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May 6, 2026

Via Electronic Mail & Hand Delivery

Mr. Brian Johnson
North Dakota Public Service Commission
600 E. Boulevard, Dept. 408
Bismarck, ND 58505-0480
ndpsc@nd.gov

In re: Minnesota Power
Longspur Wind Project - Morton County
Siting Application
Case No. PU-25-304

-and-

Minnesota Power
Longspur Wind 230-kV Transmission Line - Morton & Mercer Counties
Siting Application
Case No. PU-25-305
Our File No. 111345-000003

Dear Mr. Johnson:

Enclosed for filing in the above-referenced matter, please find eight copies of the following:

1. Pre-filed Witness Testimony Part I – Cheryl Froelich;
2. Pre-filed Witness Testimony Part II – Mitchell Bettenhausen;
3. Pre-filed Witness Testimony Part III – Alexander Luman;
4. Attachment A – Class I and II Cultural Resource Survey Addendum;
5. Attachment B – Architectural and Viewshed Report;
6. Attachment C – Grassland Addendum Memo;
7. Attachment D – Geotech Report;
8. Attachment E – Noxious Weed Management Plan;
9. Attachment F – Updated Wildlife Agency Correspondence;
10. Attachment G – Revised Project Figures;
11. Attachment H – Residence Survey Memo;
12. Attachment I – Sound Study (Revised Appendix B3);
13. Attachment J – Shadow Flicker Study (Revised Appendix B4);
14. Attachment K – Sound and Shadow Flicker Summary;
15. Attachment L – Site Plan Detail (Revised Figure 12);

16. Attachment M – Floodplains Avoidance Area Map;
17. Attachment N – Wetlands Avoidance Area Map;
18. Attachment O – Tree Clearing Overview Map;
19. Attachment P – Sound and Shadow Flicker Overview Map;
20. Attachment Q – Updated T-Line Application Table 3.2-1;
21. Hearing Display Map – T-Line; and
22. Hearing Display Map – Wind Project.

Please feel free to contact me if you have any questions. Thank you.

Sincerely,

Erik J. Edison

Erik J. Edison

EJE/lh
Enc.

cc: ALJ Hope L. Hogan (via email)
Zachary Pelham (via email)
Adam Renfandt (via email)
Jim Klempir (via email)
Alex Luman (via email)
Mitchell Bettenhausen (via email)
Casey Furey (via email)
Wade Mann (via email)

NORTH DAKOTA PUBLIC SERVICE COMMISSION

MINNESOTA POWER
LONGSPUR WIND PROJECT
APPLICATION FOR A CERTIFICATE OF SITE COMPATIBILITY
LONGSPUR 230kV TRANSMISSION LINE
CONSOLIDATED APPLICATION FOR A CERTIFICATE OF CORRIDOR COMPATIBILITY AND ROUTE PERMIT

CASE NOS. PU-25-304 AND PU-25-305

MAY 6, 2026
PART I

PREPARED TESTIMONY OF CHERYL FROELICH

I. Introduction and Background

Q1. Please state your name, by whom you are employed, and your business address.

A. My name is Cheryl Froelich. I am employed by BNI Coal. My business address is 1637 Burnt Boat Drive, Bismarck, ND 58503.

Q2. What is your position with BNI Coal?

A. I am the director of external affairs for BNI Coal and the ALLETE Sr. Government Affairs Representative.

Q3. Briefly describe your educational background and professional experience.

A. I hold business degrees from Bismarck State College, and University of Mary. I am a certified human resource professional, having spent the past 24 years working in the energy industry and more recently external affairs.

Q4. What is your role with respect to the Longspur Wind Project ("Wind Project") and the Longspur 230kV Transmission Line ("Transmission Project") (collectively, the "Projects")?

A. In my external and government affairs role, it has been my responsibility to assist the technical and operations team members in working with and educating various local and state stakeholders in North Dakota about the Projects.

Q5. Please explain the purpose of your testimony.

A. The purpose of my testimony is to provide information regarding the history of ALLETE, Inc. and Minnesota Power in the community, the Projects' background and need, and the Projects' economic benefits.

Q6. What is the relationship between ALLETE, Inc. and Minnesota Power?

A. Minnesota Power is a regulated utility company based in Duluth, Minnesota, and is a business unit of ALLETE, Inc. The Longspur Wind facility and associated transmission line will be owned and operated by Minnesota Power.

Q7. Can you please explain the history of ALLETE and its affiliates in North Dakota, and specifically in Morton and Mercer Counties and the surrounding communities?

A. ALLETE and its affiliates have been a part of the North Dakota landscape since the 1970's through agreements that utilized North Dakota's energy infrastructure to help provide electricity to Minesota Power. Minnesota Power provides electricity in an approximately 26,000-square-mile electric service territory located in northeastern Minnesota. Minnesota Power serves approximately 150,000 residents, 14 municipalities and some of the nation's largest mining and paper industries in and around northern Minnesota. BNI Coal, a lignite mine near Center, North Dakota, was acquired by ALLETE in 1988. The mine supplies coal to two electric generating cooperatives, Minnkota Power and Square Butte, which operate the Milton R. Young Station.

Development of the Bison Wind Energy Center started in 2006 in Oliver County. It was built in four phases spanning Oliver and Morton counties between 2010 and 2015. At nearly 500 megawatts (MW), Bison utilizes a dedicated High-Voltage Direct Current (HVDC) transmission line to send power directly to northern Minnesota customers. The Glen Ullin Energy Center in Morton and Mercer Counties was completed in late 2019. Both Bison and Glen Ullin are staffed by ALLETE affiliated companies with North Dakota employees.

Q8. Explain how Minnesota Power has demonstrated its commitment to being involved with the local community.

A. Through the ALLETE family of companies, we have approximately 205 current employees in North Dakota. Over the past 15 years, our companies have contributed more than $1 million in donations to local communities across the areas we live and work. We were proud to support the New Salem School digital sign and New Salem Fitness Center projects in the past, and more recently the City of Center pool project. We routinely support emergency response including fire and ambulance in New Salem, Center, Glen Ullin and beyond through monetary donations as well as sponsoring training. Several of our employees who live in these areas also serve local fire and ambulance services. We support them in doing so by participating in full-scale mock emergency response drills and allowing employees time away from work. We have also assisted in snow removal on adjacent county roads and even local high school football fields when called upon.

Minnesota Power pays about $2 million in tax to North Dakota annually. Currently all of this revenue is allocated to the counties, except for an extremely nominal slice of real property tax paid on behalf of landowners. While I am not an accountant or tax expert, I understand that tax revenue from windfarms constructed after 2020 is split with 67% going to local political subdivisions and 33% going to the state's general fund. These tax payments are in addition to tax revenue paid by other ALLETE companies such as ALLETE Clean Energy, ALLETE Renewable Resources, and BNI.

Q9. Please explain the need for the Projects.

A. In January 2023, the Minnesota Public Utility Commission ("MPUC") approved Minnesota Power's 2021 Integrated Resource Plan ("2021 IRP"). In February of 2024, Minnesota Power issued a Request for Proposals ("RFP") for up to 400MW of wind generation projects in response to its 2021 IRP. Following the RFP, Minnesota Power requested MPUC approval for the approximately 200 MW Longspur wind powered electricity generating facility in Morton County, North Dakota. In March of 2026, the MPUC approved Minnesota Power's nearly $800 million investment in the Longspur Project. Longspur will help support Minnesota Power's generation needs within Minnesota

Power's service territory while bringing extensive economic benefits to North Dakota residents.

Q10. Please describe some of the economic benefits of the proposed Projects?

A. The proposed Projects will have several positive economic impacts. Minnesota Power estimates that the Wind Project will provide approximately $33 million in state tax revenue over 35 years and pay approximately $19 million in sales tax. The Projects will also provide over $62 million in payments to participating landowners over 35 years. These revenues will not only benefit the counties and participating landowners, but also the local economy as that money is reinvested in local goods and services. This is a rare opportunity where a company with a long-term presence in North Dakota is able to make a substantial regulated utility investment in our state, while having the costs borne by Minnesota state rate payers.

Q11. Does this conclude your testimony?

A. Yes.

NORTH DAKOTA PUBLIC SERVICE COMMISSION

MINNESOTA POWER
LONGSPUR WIND PROJECT
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CASE NOS. PU-25-304 AND PU-25-305

MAY 6, 2026
PART II

PREPARED TESTIMONY OF MITCHELL BETTENHAUSEN

I. Introduction and Background

Q1. Please state your name, your employer, and your business address.

A. My name is Mitchell Bettenhausen. I am employed by Minnesota Power. My business address is 6043 30th St. SW, Glen Ullin, ND 58631.

Q2. What is your position with Minnesota Power?

A. I am a Project Manager for Minnesota Power's wind development team. In this role, I oversee the development and execution of wind energy projects, including site selection, permitting, construction, and commissioning. Additionally, I manage operations for ALLETE Clean Energy's (ACE) North Dakota and Montana wind facilities, ensuring they operate efficiently, safely, and in compliance with all regulatory requirements. My responsibilities include coordinating with internal teams, contractors, and stakeholders to support the successful operation and growth of the company's energy portfolio.

Q3. Briefly describe your educational background and professional experience.

A. I hold an Associate of Applied Science degree in Renewable Generation Technology and a Bachelor of Applied Science degree in Energy Management, both from Bismarck State College. I also earned a Master of Business with a certificate in Organization Leadership from the University of Mary.

I have been employed with ALLETE, Inc. and its subsidiaries for the past eleven years. During this time, I have worked as a wind technician, performing technical operations and maintenance at wind generation facilities. I have also assisted with safety audits at Minnesota Power's generating facilities to ensure compliance with safety standards. Additionally, I have overseen the reclamation of the Glen Ullin Energy Center and managed other construction projects for ALLETE, focusing on environmental stewardship and successful project completion.

In addition to my work in the energy sector, I farm and ranch in the Glen Ullin area. I operate several small businesses in North Dakota. I also serve on my local school board and am a member of the Bismarck State College Energy Advisory Board. Furthermore, I am an adjunct instructor at Bismarck State College, where I help educate the next generation of energy professionals.

Q4. What is your role with respect to the Longspur Wind Project ("Wind Project") and the Longspur 230kV Transmission Line ("Transmission Project") (collectively, the "Projects")?

A. In my current position with Minnesota Power, I serve as the project manager for the Longspur Wind Project and the associated Longspur 230kV Transmission Line. My responsibilities include overseeing the technical operations, maintenance, and compliance activities for these projects. I coordinate with internal teams and external stakeholders to ensure that both the Wind Project and Transmission Project are developed, constructed, and operated in accordance with regulatory requirements, safety standards, and environmental best practices.

Additionally, I am involved in project planning, permitting, and community engagement efforts to support the successful completion and integration of these projects into Minnesota Power's portfolio. My background in wind facility operations, construction management, and environmental stewardship enables me to provide effective leadership and oversight throughout all phases of the Projects.

Q5. Are you familiar with the contents of Minnesota Power's Application for a Certificate of Site Compatibility for the Wind Project, and the Consolidated Application for a Certificate of Corridor Compatibility and Route Permit for the Transmission Project, (collectively, the "Applications")?

A. Yes. I am familiar with the contents of the Applications for both Projects.

Q6. Do these Applications accurately describe the Projects?

A. Yes, along with the supplemental filings and supporting information that has been filed with the Commission.

Q7. What entities will construct, own, and operate the Projects?

A. Minnesota Power will own the Projects and is the entity responsible for construction, and operation of the Projects. Minnesota Power has engaged with M.A. Mortenson to be the construction contractor on the Longspur Project. Mortenson is headquartered in Minneapolis, MN and has locations in several states, including Fargo, ND. Mortenson has constructed about 40GW of wind in the United States and 430MW in North Dakota.

Q8. What is the purpose of your testimony?

A. My testimony provides an overview of the Projects, including development history, interconnection, site selection, layout, facility design, land acquisition, landowner coordination, and benefits.

II. <u>Description of the Projects</u>

Q9. What factors make the Project site a good site for wind development?

A. Minnesota Power selected the Wind Project Area because the site is exceptionally well-suited for wind development due to several important factors. First, the area offers a strong and consistent wind resource, which is essential for efficient and reliable energy generation. Additionally, the site benefits from favorable interconnection opportunities, with access to existing transmission infrastructure—specifically at the 230kV level—allowing efficient delivery of power to the grid. The land itself is primarily agricultural, making it highly compatible with wind energy; turbines occupy a small footprint, enabling ongoing farming and ranching activities. The region also provides a business-friendly environment that promotes business growth and land rights. Finally, there is strong support from local landowners and the community, which is critical for the successful development and long-term operation of the project. These combined factors make the Project site an ideal location for wind energy development.

Q10. Please describe the Wind Project, its general location, proposed capacity, and associated facilities.

A. The Wind Project has a planned nameplate capacity of approximately 200 MW to be located in Morton County. The Wind Project is primarily on rural and agricultural land and encompasses approximately 26,100 acres.

The Wind Project consists of 45 primary turbines and 12 alternate wind turbine locations. Minnesota Power expects to use Vestas V163 4.5 MW wind turbines, which have an approximately 370.7-foot hub height and a rotor diameter of approximately 534.8 feet. Total turbine height measured from base of tower to upright blade is approximately 638.2 feet.

The permanent impacts from wind turbine structures will occupy up to 68 acres during operation, which is less than 0.3 percent of the total participating land.

Additional facilities associated with the Wind Project include access roads to turbine locations, underground electrical collection and communication systems, a collection substation, an operations and maintenance ("O&M") building, one permanent meteorological tower ("MET"), and one permanent Aircraft Detection Lighting System ("ADLS") radar system tower.

The Wind Project's temporary facilities will include a construction laydown area, staging areas at turbine locations, intersection improvements to existing roads, and crane paths between turbines.

Q11. Describe the associated Transmission Project, its general location, facilities, and where it will interconnect to the grid.

A. In addition to the Wind Project, Minnesota Power is also seeking a Certificate of Corridor Compatibility and Route Permit for the associated Transmission Project located in Morton and Mercer Counties. The Transmission Project is an approximately 2.5-mile long, 230kV overhead transmission line, of which approximately 2.1 miles are in Morton County, and approximately 0.37 miles are in Mercer County. The Transmission Project's corridor ranges from 158 to 510-feet wide and encompasses 74 acres. The increased corridor is due to crossing requirements of existing utilities. To comply with the Dakota Access Pipeline (DAPL) requirements when crossing the pipeline, the transmission line needs to cross at a perpendicular angle which increases our corridor. When crossing the DAPL at a 90-degree angle there also is a wetland that needs to be avoided. Avoiding these constraints increases the corridor to 510 feet. The Transmission Project will convey electricity from the Wind Project to the point of interconnection at Minnesota Power's existing Tri-County Substation in Mercer County.

The Transmission Project will be constructed using 18 transmission line structure locations, consisting of 12 single-pole tangent structures and 6 single-pole dead-end structures. The average height of a single pole structure is 95 feet and will range from 85 feet to 105 feet depending on final engineering design. All structure foundations will be concrete drilled piers. Structure spans will average approximately 750 feet.

Permanent impacts from the Transmission Project will be approximately 0.02 acres. Pole foundations comprise about 50 square feet of permanent impacts per structure.

Q12. Describe the development history of the Projects.

A. Longspur has been engaged with landowners and stakeholders in this area for many years. Some of the agreements and negotiations with landowners in what is now the proposed project area date back to 2010. I joined the project team in 2023. Since then, the Longspur team has continued the project development process by conducting environmental and technical studies, advancing engineering design, and refining site layouts to optimize project performance and minimize impacts. We have regularly engaged with our landowners, members of the surrounding communities and local civic and governmental organizations. We have successfully obtained project permits from Morton and Mercer counties. All these efforts have led to the current project before the Commission.

Q13. Have there been any changes to the Wind Project's site plan since Minnesota Power filed its Application with the Commission?

A. Yes. After the Wind Application was filed, we received a request from a nonparticipating landowner to have their parcels excluded from the Wind Project boundary. In response to this request, we updated the Wind Project boundary to exclude these parcels which are reflected in the updated map is filed as Attachment L to the May 6, 2026 Filing. We have also provided supplemental filings with updated information to the Commission as studies have been completed, and additional stakeholder coordination and correspondence has taken place.

Q14. What are the Projects' estimated costs?

A. The Wind Project is estimated to cost approximately $780 million, and the Transmission Project is estimated to cost approximately $10.9 million.

Q15. What is the status of land and easement acquisition for the Projects?

A. Minnesota Power has secured all necessary land use agreements for construction and operation of the Projects. We continue to pursue efforts to optimize the Wind Project design and we are open to offering good neighbor agreements with individuals that are within or adjacent to our project, but are not current participants in the Wind Project.

Q16. Please describe the Wind Project's electrical collection system and collection substation.

A. The power from the wind turbines will be run through an underground 34.5 kV collection system consisting of various sized cables. Collection lines will be buried at least 48 inches deep and will not affect farming operations. The wind turbines will be interconnected by underground power collection cables and co-located with fiber optic communication cables. All the collection system cables will terminate at the Project collection substation. The substation will include power transformers to step up the voltage from 34.5-kV to 230-kV and provide the necessary protection and control for interconnection to the transmission grid.

Q17. Please describe the Projects' interconnection arrangements.

A. Longspur submitted generator interconnection applications to the Midcontinent Independent System Operator (MISO) in 2021, to connect 200 MW in total to the Tri-County Substation in Mercer County. Longspur wind will connect to the Minnesota Power-owned Tri-County substation with a 230 kV transmission line. The Tri-County substation is directly connected to the Bison 230 kV substation, which then connects to the Square Butte East Substation in Oliver County. The Square Butte East Substation is also the termination point of Minnesota Power's Square Butte high-voltage direct current (HVDC) line that transmits power from North Dakota to Minnesota.

As part of MISO's 2021 Definitive Planning Phase (DPP) study group, final interconnection costs will be revealed in the DPP Phase 3 results, which were expected on April 30th, 2026 per MISO's current schedule. The DPP Phase 2 results, which were published in mid-2025, included MISO system upgrades, as well as upgrades on neighboring systems: Southwest Power Pool, Minnkota Power Cooperative, Manitoba Hydro, and Saskatchewan Power. The preliminary mitigation costs allocated to Longspur Projects were $200M due to other projects on the neighboring systems. Because most of these other neighboring projects withdrew between DPP Phases 2 and 3 (9 of 13 projects), it is expected that the Projects' mitigation costs will decrease in the third and final study phase.

Q18. What is the proposed timeline for construction and operation of the Projects.

A. Subject to receipt of Commission approval, Minnesota Power currently anticipates beginning construction of the Projects as early as the summer of 2026 and placing the Projects into commercial operations by December 2027.

Q19. Provide a brief overview of the Projects' construction process.

A. Several activities must be completed prior to commercial operations. The majority of the activity relates to equipment procurement and construction of the facilities, with most of the equipment procurement already in progress. Pre-construction, construction, and post-construction activities for the Projects will include:

- Procurement of all necessary components including turbine towers, nacelles, blades, and transformers;
- Final turbine siting;
- Complete survey of site locations of permanent and temporary facilities;
- Complete soil borings, testing, and analysis for proper foundation design and materials;
- Clearing and grubbing, as necessary;
- Installation of best management practices (BMPs) for erosion and sedimentation control;
- Construction of access roads, to be used for construction and maintenance;
- Construction of underground collection lines;
- Design and construction of the Longspur Substation;
- Installation of turbine foundations;
- Installation of underground and aboveground junction boxes;
- Wind turbine erection;
- Acceptance testing of facility; and
- Commencement of commercial operation.

In addition to these construction activities, the Projects' will continue to coordinate and comply with applicable local, state, and federal agencies.

Q20. How will topsoil removal be handled during construction?

A. Minnesota Power will comply with the Commission's requirements regarding topsoil removal, segregation, and replacement in accordance with the Commission's Certifications Relating to Order Provisions.

Q21. What roads are necessary for the construction and operation of the Projects?

A. Approximately 38 acres of permanent access roads are necessary for the Wind Project. Permanent access roads will be 16 feet wide on average. No permanent access roads will be built to construct or maintain the Transmission Project.

Q22. During construction how many construction jobs are the Projects anticipated to create?

A. The Projects will create approximately 350 temporary construction jobs at the peak of construction activities and up to 11 regular full-time local operations and maintenance (O&M) jobs. The construction contractor for the Project, Mortenson, intends to hire local skilled and non-skilled labor through local Unions. Mortenson has indicated Union Labor Agreements are in place with Laborers Local 563, Operators Local 49, IBEW, UBC Carpenters and Millwrights Local 1091 and 1176 and Ironworkers Local 512. These agreements fall under the Heavy Highway, Builders, and Industrial Agreements varying by trade. Mortenson will build the Projects with a minimum of 15% of the total labor hours performed by qualified apprentices. Additional goods and services will be sourced locally to the extent possible.

Q23. How does Minnesota Power plan to mitigate impacts during construction?

A. Minnesota Power is committed to minimizing impacts on local communities and the environment during construction. We are working with Morton County to develop a road use agreement to minimize road impacts. To control dust during construction, the Projects will use water trucks for dust suppression where needed. In certain areas, where additional dust control mitigation may be needed, like haul routes in front of rural residences, the Projects will consider using additional dust suppression methods in coordination with Morton County such as magnesium chloride. Construction traffic will follow posted speed limits, yield to local vehicles, and observe 4-way stops at all intersections, regardless of existing signage. Additionally, escorts will accompany specific heavy equipment, such as Rough-Terrain cranes and rollers, when traveling on public roads to ensure safety. Any road closures will be carefully coordinated with the North Dakota Department of Transportation (NDDOT) and will follow an approved traffic control plan to minimize disruptions. Throughout the construction process, Minnesota Power will maintain open communication with local residents and stakeholders, and will implement best management practices to protect soil, water, and wildlife resources.

Q24. Does Minnesota Power have a process for coordinating with landowners if a landowner has any concerns during or after construction?

A. Prior to construction, all landowners within the Project will receive mailers that will include the Construction Manager's contact information. During construction, a mailer will be sent out containing the O&M Manager's contact information. If a landowner has concerns, they may contact the Construction Manager during construction and the O&M Manager after construction. Additionally, post-construction reclamation concerns may be directed to the local O&M Manager. The Construction Manager and O&M Manager for Minnesota Power are both local residents.

Q25. Please briefly explain Minnesota Power's desktop review and field studies of geologically unstable areas.

A. A desktop review of the Projects using the North Dakota Geological Survey ("NDGS") landslide mapping data was conducted as recommended by the NDGS. Based on data from the NDGS, several landslide deposits have been identified in the southeastern portion of the Wind Project Area, and a few have also been identified in the western portion of the Wind Project Area (Wind Application, Figure 6). No infrastructure is located in areas where landslide deposits are present. With respect to the Transmission Project, mapped landslides are not present within the Transmission Project Corridor according to the NDGS survey data.

Q26. Has Minnesota Power designed the Projects to ensure they avoid areas that are geologically unstable?

A. Yes. The Projects avoid all unstable areas identified from NDGS data. Additionally, Longspur has conducted geotechnical surveys on areas where turbine, transmission line, and other infrastructure will be placed.

III. <u>Telecommunications, Weather Radar, and Lighting</u>

Q27. Has Minnesota Power studied whether there are any possible effects from the Wind Project on microwave beam paths, telecommunications, and weather radar facilities?

A. Yes. Existing telephone and fiber optic cables within the Wind Project will be located in the field by the respective utility companies prior to construction to ensure that impacts to telephone and fiber optic cables will be avoided. Minnesota Power received a response from the National Telecommunications and Information Administration (NTIA) on October 4, 2024. NTIA completed its review and found the Project Area is 67.7 kilometers west of KBIS Bismarck, North Dakota Next Generation Weather Radar (NEXRAD) and is within the notification zone of that radar. However, NTIA concluded there will be low impact to this system. NTIA requested additional consultation only if the Project Area changes or if the turbine height increases by 10 meters or more, which has not occurred. The NTIA indicated the Department of Energy identified the Project has potential to impact Western Area Power Administration (WAPA) operations and requested the Project coordinate turbine placement with WAPA. Minnesota Power has communicated with WAPA throughout the development process on turbine size and location. WAPA expressed no concerns with the Wind Project.

Q28. Will the Wind Project comply with Federal Aviation Administration ("FAA") requirements?

A. Yes. The wind turbines and the meteorological tower (MET) must comply with FAA lighting and marking requirements. The Wind Project has received FAA Determinations of No Hazard for all of the primary and alternate wind turbine locations. The FAA's review included the evaluation of any potential interference with air traffic and concluded the proposed turbine locations do not pose a hazard.

Q29. Explain Minnesota Power's plans for use of light-mitigating technology at the Wind Project.

A. The Wind Project will have one associated Aircraft Detection Lighting System (ADLS) radar tower at the Project. The ADLS will comply with all FAA and North Dakota requirements and will be operational when the Wind Project enters commercial operations.

IV. <u>Operations and Maintenance and Project Decommissioning</u>

Q30. Discuss the personnel that will operate and maintain the Projects?

A. The Projects will be operated and maintained with up to 11 local O&M employees. The O&M staff will have full responsibility for ensuring that the Projects operate in a manner consistent with applicable permits, prudent industry practice, and equipment manufacturer recommendations.

Q31. Explain what monitoring and maintenance are required for the Projects?

A. Minnesota Power's on-site O&M staff will be responsible for maintenance of the Projects on a daily basis. O&M field duties include performing all scheduled and unscheduled maintenance, including periodic operational checks and tests, regular preventive maintenance on all turbines, related plant facilities and equipment, safety systems, controls, instruments, and machinery. In addition to the on-site O&M staff, remote staff will control, monitor, operate, and maintain the Wind Project by means of a SCADA system and can shut down turbines if necessary. Monitoring of the Project will occur 24 hours a day, 7 days a week by Minnesota Power.

Q32. Please explain what steps Minnesota Power will take to ensure the Projects' emergency preparedness.

A. Minnesota Power is committed to ensuring the Projects' emergency preparedness through a combination of proactive planning, staff training, and coordination with local emergency services. The company will develop and implement a comprehensive emergency response plan tailored to the specific risks associated with the Projects. All personnel will receive training on emergency procedures, including how to respond to medical incidents, fires, severe weather, and other potential hazards. Regular emergency drills will be conducted to ensure that everyone on site is familiar with their roles and responsibilities. Minnesota Power will also establish clear communication protocols and designate key contacts to coordinate response efforts efficiently. In addition, the company will work closely with local first responders and emergency management agencies to ensure rapid and effective assistance if needed. These steps are designed to protect the safety of workers, contractors, and the surrounding community throughout the duration of the Projects.

Q33. What is the estimated life of the Wind Project?

A. The expected life of the Wind Project is approximately 35 years. As technology continues to evolve, the life of the Wind Project may be extended with future upgrades.

Q34. What are Minnesota Power's plans regarding de-commissioning of the Wind Project?

A. Minnesota Power will develop a decommissioning plan and provide financial assurance in accordance with the Commission's decommissioning rules and regulations. In addition, Minnesota Power is contractually obligated to the landowners to remove the wind facilities, including foundations to a depth of four feet below ground, when the wind easement expires and to restore the area to the same physical condition that existed immediately before the construction of the turbines.

V. <u>Conclusion</u>

Q35. Will Minnesota Power make additional commitments to minimize adverse impacts with respect to the Projects?

A. Yes. Minnesota Power will comply with the requirements set forth in the Commission's Certifications Relating to Order Provisions for the Projects. Executed copies of the Certifications will be filed with the Commission.

Q36. Will the Projects' location and operation produce minimal adverse effects on the environment and on the citizens of North Dakota?

A. Yes. The Projects have been sited to comply with Morton and Mercer County zoning regulations and the Commission's siting criteria, as well as to minimize potential impacts to existing land uses, infrastructure, and environmental resources. Additionally, the Projects will provide significant benefits to the local community and the state. For these reasons, and as demonstrated through the Applications, supporting filings, and my testimony, the Projects will produce minimal adverse effects.

Q37. Does this conclude your testimony?

A. Yes.

NORTH DAKOTA PUBLIC SERVICE COMMISSION

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CASE NOS. PU-25-304 AND PU-25-305

MAY 6, 2026
PART III

PREPARED TESTIMONY OF ALEXANDER LUMAN

I. <u>Introduction and Background</u>

Q1. Please state your name, by whom you are employed, and your business address.

A. My name is Alexander Luman. I am employed by Minnesota Power. My business address is 30 W. Superior Street, Duluth, Minnesota 55802. I am providing this testimony on behalf of Minnesota Power, a division of ALLETE, Inc.

Q2. What is your position with ALLETE?

A. I am an environmental compliance specialist for Minnesota Power and I am responsible for permitting and environmental requirements on ALLETE Projects. It is my responsibility to provide oversight of all permitting needed to construct a project, including overseeing environmental consultants' work products.

Q3. Briefly describe your educational background and professional experience.

A. I received a Bachelor of Science in Environmental Science from Northern Michigan University in 2023. I have over two years of experience in permitting, environmental review, and regulatory compliance largely related to energy generation and transmission projects. I have managed or advised teams of consultants on federal, state, and local permitting, acoustic studies, shadow-flicker, wetland and waterbody surveys, habitat assessments, cultural resources surveys, and other related services for projects in the Midwest.

Q4. Were you involved in the preparation of Minnesota Power's siting applications for the Longspur Wind Project ("Wind Project") and the Longspur 230 kV Electrical Transmission Line ("Transmission Line") (collectively, "Longspur or Projects")?

A. Yes. I managed the consultants responsible for conducting environmental studies and preparing Longspur's applications, filed in Case Nos. PU-25-304 (Dkt. No. 1) and PU-25-305 (Dkt. No. 10). I managed the studies related to wetlands and water resources, land use and land cover, wildlife, cultural resources, architectural history, acoustic studies, and shadow flicker assessments. In addition, I managed the preparation of the Morton County Special Use Permit Application, the Mercer County Conditional Use Permit Application, the Consolidated Application for a Certificate of Corridor Compatibility and Transmission Facility Route Permit Application, and the application for a Certificate of Site Compatibility.

II. Summary of Testimony and Conclusions

Q5. Please briefly summarize the purpose of your testimony.

A. The purpose of my direct testimony is to provide information concerning existing environmental conditions in the proposed Wind Project and Transmission Line Project, Longspur's environmental studies, and to discuss how Longspur will avoid, minimize, and/or mitigate potential impacts. My testimony and supporting evidence demonstrate that Longspur will have minimal effects on human health and the environment and meet the Commission's siting criteria. In addition, my testimony will also provide information regarding agency outreach and coordination.

Q6. Do you have any updates to make to the Applications?

A. Yes. After further assessment, Longspur has updated the Grassland Assessment contained in Appendix B5 of the Wind Project Application for the Projects. *See* Attachment C to the May 6 Filing. In addition, Longspur has updated the Wind Project Site Plan at Figure 12 of the Wind Project Application to reflect a minor change in the Project Boundary and to clarify details related to a right-of-way for a collector line. *See* Attachment L to the May 6, 2026 Filing, On December 18, 2024, Longspur completed a grassland habitat assessment for the Projects. At that time, an approximately 32-acre (ac) parcel along the western portion of the Wind Project Area was classified as "unbroken" grassland based on a combination of North Dakota Game and Fish Department's (NDGFD) "Native Prairie" layer (2022), aerial imagery review, and a cursory visual review in the parcel. Since that time, Longspur conducted a more specific review of the 32-ac parcel and contacted the landowner regarding possible tilling that may have previously occurred on the parcel. On June 19, 2025, the landowner responded in writing that the parcel in question had been previously tilled. This parcel was reclassified as "broken grasslands" and updated in the Wildlife Conservation Strategy (WCS) dated January 29, 2026. Further discussions in March of 2026, with the landowner and Longspur confirmed that the parcel was designated by the Farm Service Agency (FSA) as cropland. The landowner indicated that the parcel was planted with alfalfa and actively managed as a hay field. The combination of the FSA designation and the current use of the property as actively managed hay indicates that this parcel is more accurately represented as cropland. *See* Attachment C to the May 6, 2026 Filing.

Longspur updated the Wind Project Site Plan at Figure 12. The updates to this Figure are a revision of the Wind Project boundary made in response to a request from a landowner and a change to clarify a location where Wind Project infrastructure (a collection line) is anticipated to cross from one portion of the Project Boundary to another along a public road right-of-way. The updated Figure 12 map book has been filed as Attachment L to the May 6, 2026 filing. The updated pages in Figure 12 are clearly marked at the bottom of the table section.

Longspur updated the sound and shadow flicker reports included in the Wind Project Application at Appendices B3 and B4. The updates do not change the data reported; sound and shadow flicker levels (dba/hour-per-year) remain unchanged. The changes are limited to correcting labeling of receptors. The updated sound and shadow flicker reports are filed as Attachments I and J.

Q7. Did Longspur develop the Wind Project to be consistent with recommended processes described in the United States Fish and Wildlife Service's (USFWS) voluntary Land-Based Wind Energy Guidelines ("WEGs")?

A. Yes. While the use and application of the WEGs is voluntary, Longspur incorporated the Tiered approach and recommendations set forth in the WEGs in developing the Wind Project to avoid, minimize, and mitigate potential adverse effects. In addition to following the WEGs, Longspur incorporated USFWS comments received during a December 2024 meeting to discuss the Wind Project's proposed studies.

Q8. Please briefly describe the WEGs.

A. The WEGs use a five-tiered, iterative approach for assessing potential adverse effects to species of concern and their habitats during wind project siting, construction, and operation. The first three tiers progressively guide decision making during pre-construction assessments, and the last two tiers relate to post-construction studies. In particular:

- Tier 1 is an evaluation of desktop landscape-scale data;
- Tier 2 includes a broad site characterization and reconnaissance-level site visits;
- Tier 3 includes site-specific field studies;
- Tier 4 includes post-construction studies; and,
- Tier 5 includes additional post-construction studies as needed although such studies are typically unnecessary for most projects.

The WEG provides a tiered decision-making approach to quantifying the potential risks of proposed wind projects to species of concern (SOC) and their habitats. Per the WEG, a SOC is any species that: 1) is either a) listed as an endangered, threatened, or candidate species under the Endangered Species Act (ESA), or subject to the Migratory Bird Treaty Act (MBTA) or Bald and Golden Eagle Protection Act (BGEPA); b) is designated by law, regulation, or other formal process for protection and/or management by the relevant agency or other authority; or c) has been shown to be significantly adversely affected by wind energy development; and 2) is determined to be possibly affected by the Project. Consistent with the approach set forth in the WEGs, during various stages of project development, Longspur evaluated the outcomes at each tier, and assessed whether impacts could be sufficiently avoided, minimized, or mitigated, before deciding to proceed with development. The Site Characterization Study conducted by Longspur and coordination with wildlife agencies identified additional Tier 3 field surveys in accordance with the WEGs and Eagle Conservation Plan Guidance (ECPG) to further assess the potential for impacts on wildlife and determine avoidance and minimization strategies. Based on desktop and field survey results, no federally listed endangered or threatened species have been documented within the Longspur project area; however, three species are likely to occur: whooping crane, Dakota skipper, and northern long-eared bat. Longspur is located within the 50% whooping crane migration corridor and whooping crane sightings and telemetry locations have been recorded within 1-mi of the Project Area. Dakota skipper larval habitat surveys were completed in the Wind Project Area and along the Transmission Line. No northern long-eared bats were detected during USFWS approved Presence/Probable Absence surveys or confirmed during the bat acoustic surveys. Based on surveys conducted by Longspur from September 2024 and ongoing, eagle use was limited within the Wind Project Area and no consistent eagle flight patterns were observed. No eagle nests have been identified within Longspur. No turbines are planned for construction in grasslands and other above-ground infrastructure will be sited to minimize disturbance to all grasslands.

Furthermore, Longspur will conduct one-year of post-construction mortality monitoring consistent with Tier 4 of the WEGs and implement a Wildlife Conservation Strategy ("WCS") throughout the Projects' life. The WCS is a living document memorializing measures to avoid, minimize, and mitigate potential impacts to wildlife from construction and operation. The WCS also includes an adaptive management approach, so that information gathered during post-construction monitoring can be used to inform future management decisions. Additional Tier 5 studies are not anticipated because the Wind Project has been designed to produce minimal adverse effects.

Q9. Did Longspur develop the Transmission Project consistent with practices suggested by the Avian Power Line Interaction Committee ("APLIC")?

A. Yes. Similar to the WEGs, the APLIC-suggested practices are voluntary; however, Longspur has incorporated and utilized suggested practices in developing the Transmission Line Project to reduce avian impacts such as, marking the transmission line with bird flight diverters, and spacing the conductors to reduce electrocution risk or avian interactions (*i.e.*, ensuring spacing between energized conductors and grounded hardware to prevent electrocutions) in the transmission line structure design.

Q10. Describe the environmental studies and site assessments filed as part of the Projects' Applications.

A. Longspur conducted the following studies in support of the Applications:

- Microwave Study [2024] (Wind Project)
- AM and FM Radio Report [2024] (Wind Project)
- Acoustic Assessment [2025] (Wind Project)
- Shadow Flicker Assessment [2025] (Wind Project)
- Grassland Assessment [2024] (Wind and Transmission Projects)
- Wetlands and Waterbody [2025] (Wind and Transmission Projects)
- Cultural Resources [2025] (Wind and Transmission Projects)
- Architectural Resources [2025] (Wind Project)
- Eagle and Raptor Nest Survey Reports [2024 and 2025] (Wind and Transmission Projects)
- Northern Long-eared Bat Habitat Desktop Study [2025] (Wind and Transmission Projects)
- Sharp-tailed Grouse Lek Surveys [2024 and 2025] (Wind and Transmission Projects)
- Whooping Crane Habitat Assessment [2025] (Wind and Transmission Projects)
- Northern Long-eared Bat Presence/Absence Surveys [2025] (Wind Project)
- Dakota Skipper Habitat Survey [2025] (Wind and Transmission Projects)
- Avian Use Survey [2025 and 2026] (Wind Project)
- Bat Acoustic Activity Survey [2025] (Wind Project)

Q11. Since the Applications were filed, have any additional or updated reports been completed?

A. Longspur conducted an additional Class III survey of the Wind Project area due to shifts in infrastructure during the engineering of the project in quarter four of 2025. The report has been filed with North Dakota State Historic Preservation Office (SHPO) and acceptance was received on April 17th. *See* Attachment A to the May 6, 2026 Filing.

Longspur, at the request of the State Historical Society of North Dakota (SHS), conducted an Architectural History study of the Wind Project to assess potential visual impacts from proposed turbines on historically significant architectural resources. The study was conducted in the third and fourth quarters of 2025. All areas within two miles of a proposed turbine were reviewed. Longspur recommended that no historically significant sites will be adversely affected by the Wind Project, due to existing impacts from nearby wind turbines and other existing infrastructure on the landscape. The report has been filed with SHPO and acceptance was received on April 17th. *See* Attachment B.

As discussed in my response to question 6, above, Longspur reviewed the grasslands within the Wind Project and conducted a more specific review of the 32-ac parcel. As stated, this parcel is more accurately represented as cropland and the Wind Project's Grassland Assessment has been updated accordingly. *See* Attachment C to the May 6, 2026 Filing.

Q12. Are there any additional environmental studies and/or surveys yet to be completed for the Projects?

A. Longspur has completed all preapplication and preconstruction surveys, the only remaining environmental studies and surveys for the Projects are the voluntary 2026 Avian Use Survey, raptor nesting surveys, and Post Construction Monitoring.

The Project completed its first year of voluntary Tier 3 avian use surveys in accordance with the USFWS WEGs and ECPG to characterize site-specific avian and eagle activity prior to construction. Longspur is currently conducting a second year of voluntary Tier 3 avian use surveys following the same USFWS recommendations. The survey will be completed in August of 2026. Results from the first survey year indicated relatively low avian use across seasons, with limited activity by species of concern and generally low use of the rotor-swept zone.

Based on these findings, and consistent with the WEG's risk-based, iterative approach, the Project determined that initiating construction activities during the latter portion of the second survey year would not compromise the ability to identify, avoid, or minimize impacts to avian resources. Construction activities are being scheduled to avoid sensitive seasonal periods where practicable, and avian use surveys will continue through completion of the second year.

Longspur is avoiding impacts to raptors during the breeding season by establishing seasonal constraints on construction. Longspur will conduct raptor nesting surveys in 2026 for proposed construction and surveys in 2027 to track when young has fledged and dispersed from the nest area.

Longspur will conduct one year of standardized post-construction monitoring following the completion of construction and restoration activities.

Q13. Please describe Minnesota Power's assessment regarding threatened and endangered species or designated critical habitat occurring within the Project areas.

A. Longspur used the USFWS Information for Planning and Consultation ("IPaC") tool to identify threatened or endangered species that have been previously documented within the vicinity of the Projects. This tool identified four federally threatened or endangered species and three species proposed for listing: the whooping crane (endangered), piping plover (threatened); Rufa red knot (threatened) and Dakota skipper (threatened). The northern long-eared bat (Endangered) was identified in early project coordination as possibly occurring within the Project area.

Q14. What are the results of Minnesota Power's analysis regarding Whooping Crane?

A. The Whooping Crane Habitat Assessment showed that there is a low probability of occurrence within the Project area and that the Projects are unlikely to have adverse impacts on whooping cranes. There is no federally designated whooping crane critical habitat within or near Longspur, or within the state of North Dakota, and no USFWS whooping crane sightings have been recorded within the Longspur area during the whooping crane assessment. However, Longspur is located within the western half of the 50 percent whooping crane migratory corridor, and there is a historical record of a whooping crane sighting and telemetry data within the vicinity of Longspur, although not within the Wind Project Area or Transmission Corridor, based on data from the Cooperative Whooping Crane Tracking Project and a telemetry dataset published by U.S. Geological Survey. During the 2025 avian use survey and in the ongoing 2026 avian use survey, no whooping cranes have been observed stopping over, foraging, or roosting on the ground within the Wind Project Area or Transmission Corridor, or incidentally during other biological field surveys.

In addition, Longspur will implement certain mitigation measures to minimize the likelihood of impact from Longspur to whooping cranes even further such as conducting training of construction contractors and on-site Project employees for the life of the Projects to identify and report whooping cranes and stop all construction and operation activities within one mile of any observed or reported whooping crane sightings until the birds have departed for at least 15 minutes. During construction, Longspur will perform a visual survey during spring and fall migration prior to starting work and no work will commence until cleared by the site manager. All employees and contractors working in the field will be required to participate in whooping crane trainings.

Q15. What are the results of Minnesota Power's analysis regarding Piping plover and Rufa Red Knot?

A. Longspur's analysis determined that piping plover are unlikely to occur at the Projects due to the distance from Longspur to a site of preferred habitat. Federally designated critical habitat (DCH) for the piping plover occurs throughout the shores of the Missouri River and within the Alkali Lakes Core Area. The nearest DCH is located approximately 29 miles east of the Project along the Missouri River. Longspur is within the range of the piping plover, but not within the primary range. Suitable habitat consisting of sandy, gravelly beaches, sandbars, wetlands, or lakes were not found during a desktop review.

The rufa red knot is unlikely to occur at Longspur. Federally DCH has been proposed for the rufa red knot; however, North Dakota is not a part of those proposed locations.

Although rufa red knots are found primarily in intertidal habitats, especially near coastal inlets, estuaries, and bays, they have been observed in both alkaline and freshwater lakes of North Dakota during migration as well as within the Missouri River drainage system, sewage lagoons, and large permanent freshwater wetlands. Observations have been scattered throughout the state without consistent stopover sites being observed. Suitable habitat consisting of coastal marine areas, or freshwater lakes were not found during a desktop review. With the absence of preferred nesting and foraging habitat, it is unlikely that the rufa red knot will occur at Longspur.

Q16. What are the results of Minnesota Power's analysis regarding Dakota skipper?

A. Longspur conducted a Dakota skipper habitat survey in 2025 and approximately 7,813 acres of native, unbroken grasslands were previously identified during the grassland habitat assessment. Of these, 2,965 acres were identified as potential Dakota skipper habitat that were surveyed during August and October 2025. An estimated 2,692 acres were surveyed via pedestrian surveys while 273 acres were surveyed from public roads due to access restrictions. There were 17 individual patches of suitable habitat identified resulting in approximately 21 acres in the Wind Project. Longspur is avoiding all suitable Dakota Skipper habitat.

Q17. What are the results of Minnesota Power's analysis regarding northern long-eared bat?

A. Longspur is not anticipating impacts on northern long-eared bat (NLEB). Longspur, following USFWS guidance, mapped potential NLEB habitat, completed presence/probable absence surveys following a USFWS approved Study Plan, and conducted general acoustic surveys all in 2025. Based on the habitat assessment, approximately thirteen acres of potentially suitable NLEB summer habitat were identified with the Wind Project area. No bats were identified during the presence/probable absence surveys. During the general bat acoustic surveys no northern long-eared bats were identified, and the area was deemed low general bat activity. During a coordination meeting with NDGFD Longspur proposed that no second year of general bat acoustic monitoring, based on the low bat activity throughout the surveys, would occur, and NDGFD did not provide any further recommendations for surveys.

Q18. How are bald and golden eagles treated under federal environmental law?

A. Bald and golden eagles are not considered "threatened or endangered" under the ESA. Eagles are protected under the MBTA and the BGEPA. The BGEPA does not designate critical habitat, but it does protect individual eagles and nests from disturbance. Longspur conducted eagle and raptor nest surveys to ensure the Projects do not encroach on nests.

Q19. Please describe the findings of Minnesota Power's analysis with respect to bald and golden eagles.

A. Eagle use of the Wind Project area is minimal as described in the avian use survey. Longspur's eagle and raptor nest surveys, conducted in 2024 and 2025 following USFWS Region 6 guidance, did not identify bald or golden eagle nests within the Wind Project area; however, two bald eagle nests were observed outside but within two miles of the Wind Project boundary. The closest proposed turbine is at least 1.8 miles away.

Q20. What additional activities is Minnesota Power undertaking to avoid and minimize any potential impacts to bald or golden eagles?

A. Minnesota Power will implement the following measures to avoid and minimize potential impacts to bald or golden eagles:

- mark the transmission line in accordance with APLIC requirements;
- avoid turbine placement within 660 feet from eagle nests;
- bury all collection lines;
- remove large roadkill animals or other carcasses detected by staff on or near roads in the Project to avoid attracting eagles.

Q21. Please describe any important results from other wildlife studies, including sharp-tailed grouse surveys and avian use.

A. In addition to the studies and results described above, Longspur conducted two years of sharp-tailed grouse lek surveys following NDGFD Key Wind Energy Development in North Dakota Best Management Practices to determine the locations of leks within the Wind Project boundary and a two-mile buffer of the Wind Project boundary to help inform avoidance and minimization efforts.

Q22. How has Minnesota Power avoided, minimized, and mitigated any potential impacts to sharp-tailed grouse?

A. Longspur has followed NDGFD Key Wind Energy Development in North Dakota Best Management Practices guidance, including no siting of turbines in nesting habitat, such as broken and unbroken grasslands, within a two-mile buffer from sharp-tailed grouse leks. Additionally, Longspur will avoid the installation of collection lines in nesting habitat within one mile of leks during the breeding season to minimize potential disturbance to lekking or nesting.

Q23. Have the Projects been sited to exclude critical areas where animal or plant species that are unique or rare to the state would be irreversibly damaged?

A. Yes. Consistent with the Commission's designated Exclusion Areas in its siting criteria, Longspur has designed the Projects to exclude infrastructure from areas where rare or unique animal or plant species to the state would be irreversibly damaged.

Q24. Please briefly explain the Projects' potential impacts on wetlands.

A. The Project has been sited to avoid wetland impacts to the greatest extent possible. The proposed Transmission Line will span all wetlands, therefore avoiding any impacts. Longspur's Wind Project design avoids wetlands to the extent practicable. However, approximately 1.5 acres of temporary impacts to wetlands will occur from crane paths. Several crane paths for the Wind Project will cross wetlands or waterbodies, which is unavoidable, due to site constraints. In many locations, wetlands are linear or geographically extensive, making avoidance infeasible without major reroutes that would substantially increase other disturbance, such as to croplands. In other areas, existing infrastructure such as undersized bridges, nearby transmission lines, homesteads, or adjacent streams, preclude alternate alignments. Approximately 0.27 acres of permenent impacts to wetlands are associated with access roads. Access road alignments for several turbines are constrained by existing roadways, topography, wetlands, waterbodies, and landownership limitations. In some locations, existing road curves or terrain cannot safely accommodate large construction equipment, necessitating alternate access routes. Certain access roads represent the only practical option due to the reasons listed above. Where wetlands are present, alignments have been selected to minimize impacts by using the most direct routes, staying within surveyed corridors, and crossing wetlands at their narrowest feasible points.

Q25. Please briefly explain the Projects' potential impact on woodlands.

A. The Projects lack large, contiguous woodlands, and impacts to woodlands are not anticipated.

Q26. Please briefly explain the Projects' potential impact on trees and shrubs.

A. Overall impacts to trees and shrubs are anticipated to be minimal. Longspur will submit a tree and shrub inventory and replacement plan for Commission review and approval. Adverse impacts to trees and shrubs are not anticipated and 2.14 acres of trees, mostly associated with windrows, will be cleared. Maps detailing areas where tree clearing will occur are filed as Attachment O to the May 6, 2026 filing.

Q27. Does Longspur anticipate exceeding the Commission's 50-foot-wide tree and shrub clearance limitation?

A. Yes. It is expected that clearing trees and shrubs will exceed the 50-foot-wide tree and shrub clearance limitation in the Tree and Shrub Mitigation Specifications established by the Commission. As a result, the Applicants request a modification of the 50-foot clearance limitation.

Q28. Please describe the types of grasslands located within the Projects.

A. Longspur is in rural western North Dakota in an area predominately comprised of cultivated land, hayfields, pasturelands, and grasslands. In December of 2024, Longspur conducted a desktop assessment using United States Department of Agriculture (USDA) Farm Production Conservation Business Center and NDGFD's "Native Prairie" layer and historic Unit USDA imagery. After compiling the desktop information, field surveys were conducted to verify desktop classification of unbroken and broken grasslands within Longspur. These surveys occurred from roadsides looking into the properties to record sod type, field edge changes, tree/shrub presence, rock piles, and human disturbances. Approximately 9,064 acres of grassland were identified within the Wind Project Boundary. Of that, approximately 7,800 acres were identified as unbroken grasslands and 1,250 acres as broken grasslands.

Q29. Please describe the siting efforts that Minnesota Power undertook to avoid and minimize impacts from the Projects to grasslands.

A. Longspur reviewed the NDGFD Key Wind Energy Development in North Dakota Best Management Practices and did not site turbines in broken or unbroken grasslands. The Projects also avoided placement of associated facilities in grasslands, unless alternatives would increase disturbance amount following NDGFD Best Management Practices. Longspur also executed a Memorandum of Understanding with the North Dakota Agriculture Commissioner for Longspur to provide voluntary compensatory mitigation for approximately 65 acres of grassland habitat.

Q30. What is the status of local permitting?

A. As described above, Minnesota Power has obtained an SUP and CUP from Morton and Mercer Counties, respectively for the Wind Project and Transmission Line. Remaining local permitting requirements include: Building Permits, Entrance Permits, Utility Occupancy Permits, and Road Crossing Permits. These will be obtained and filed with the Commission prior to commencing construction in areas for which said permit or authorization is required.

Q31. Please describe the local permitting efforts related to the Projects.

A. On September 29, 2025, Longspur submitted a Special Use Permit ("SUP") application to Morton County for the Wind Project located within the County. On November 25, 2025, the Morton County Board of Commissioners approved the Projects' SUP application. On August 8, 2025, Minnesota Power submitted a Conditional Use Permit ("CUP") application to Mercer County for the approximately 0.37 miles of the Transmission Project located in the County. On October 1, 2025, the Mercer County Board of Commissioners approved the Transmission Project's CUP application.

Q32. Are the Projects designed to comply with local setback requirements and the setback requirements set forth in the Commission's rules and regulations?

A. Yes.

Q33. Describe the setbacks applicable to the Wind Project.

A. The Wind Project has been designed to comply with or exceed the setbacks of the Commission and Morton County, which were provided in Section 3.6 in the Wind Project Application. The distance from the nearest participating residence to a turbine is approximately 1,600 feet, and the distance to the nearest non-participating residence to a turbine is approximately 2,100 feet.

Q34. Describe the setbacks applicable to the Transmission Project.

A. The Transmission Line also complies with or exceeds the Commission setbacks. Morton and Mercer Counties do not have specific setback requirements for transmission facilities.

Q35. How were setbacks measured for the Projects?

A. The setbacks were measured using spatial data to calculate the distance from Longspur infrastructure to Morton County Parcel GIS data and Longspur surveyed receptors, Longspur mapped out each participating parcel and selected turbine locations that comply with all applicable setbacks.

Q36. Will temporarily disturbed areas be restored?

A. Yes, Minnesota Power understands and agrees that reclamation, fertilization, and reseeding of temporarily disturbed lands is to be done according to the Natural Resources Conservation Service recommendations, unless otherwise specified by the landowner. Longspur also provided its noxious weed management plan to Mercer and Morton Counties. Longspur received approval of its noxious weed management plan from the Mercer and Morton County weed control officers. Longspur will also follow the noxious weed management plan during Project construction and restoration.

Q37. Please describe Minnesota Power's coordination with NDGFD and USFWS regarding the Projects.

A. Since 2024, Longspur has engaged in ongoing coordination with the USFWS and the NDGFD to support responsible development of the Longspur Wind Project and the associated Longspur Transmission Line. Early coordination included an introductory meeting in December 2024 with USFWS, NDGFD, and project consultants to present

Longspur and share results from completed Tier 1–3 studies conducted consistent with the USFWS WEGs. Longspur also requested and incorporated agency data, including historical eagle nest and sharp-tailed grouse lek information from NDGFD, and worked with USFWS to develop and secure approval for a northern long-eared bat presence/probable absence mist-netting study. Formal project notification letters were provided to both agencies in June 2025 in accordance with North Dakota Administrative Code requirements, and NDGFD provided early guidance on flora, fauna, and information needs well in advance of the North Dakota Public Service Commission (NDPSC) hearing schedule.

Coordination continued through regular information sharing, meetings, and iterative review of biological studies and mitigation approaches. Minnesota Power notified the NDGFD of its proposed North Dakota Department of Agriculture (NDDA) Voluntary Compensatory Mitigation Fund. Minnesota Power established a file-sharing platform for NDGFD and USFWS containing survey reports, spatial data, voluntary offsets, and a Wildlife Conservation Strategy, and held a detailed biological coordination meeting with NDGFD in February 2026 to review all wildlife studies. Although USFWS was unable to attend later meetings due to federal guidance related to wind project reviews, the Service remained informed through meeting summaries, and USFWS encouraged continued coordination with NDGFD in their absence. The information supplied on the file sharing site was confirmed to be received by NDGFD, and was provided more than 100 days prior to the NDPSC Hearing, as NDGFD requested in their response to the notification letter. Following agency feedback, Longspur provided additional analyses, including avian offset modeling, revised meeting notes, and supporting documentation, reflecting an adaptive and transparent coordination process intended to avoid, minimize, and mitigate potential wildlife impacts.

Q38. Please briefly describe the receptor survey conducted for the Wind Project.

A. Longspur conducted a receptor survey to comply with setback requirements. Longspur identified and field verified potential residential receptors within the Wind Project boundary and a one-mile buffer using desktop analysis, and onsite surveys were conducted in the fall of 2024, resulting in the evaluation of 417 receptors. Follow-up coordination by

Longspur in October 2025 clarified occupancy status for previously undetermined structures, reclassifying several as nonresidential or agricultural buildings not subject to occupied receptor criteria by site visits and discussions with the landowners. A summary of Longspur's receptor survey process is filed as Attachment H.

Q39. Please briefly describe the cultural and historic resource assessments conducted for the Projects.

A. Longspur's environmental consultant, Merjent, Inc., conducted Class I, II, and III cultural, archaeological, and architectural history surveys for the Wind Project and Transmission Line. Merjent completed the Class I literature search in late 2024 and early 2025, and conducted a Class III intensive archeological survey in March of 2025. Merjent prepared and submitted to SHPO, a survey report to document the survey methods and results. SHPO accepted the findings of the report. Longspur then modified the Project design to avoid impacts on unevaluated and potentially eligible cultural sites. After further design modifications within the Wind Project during the Summer of 2025, additional Class I and III surveys were performed to evaluate new project design areas that were not previously surveyed. More design modifications were made related to the survey findings. No additional sites were identified in the second Class III study, and an amended survey report was supplied to SHPO March 17, 2026 for review and approval. Longspur received notice from SHPO on its evaluation of the findings in the most recent amended survey report, SHPO agreed with the findings that no significant site are affected and that no further work is required for the Projects as planned.

Q40. Will the Projects impact the identified cultural and historic sites?

A. Longspur will not impact identified eligible cultural and historic resource sites. The Wind Project and Transmission Line have been designed to avoid directly impacting the known or recently identified unevaluated, eligible or potentially eligible sites. Longspur will use fencing to maintain buffers around sites that are in close proximity to Project infrastructure, and will employ cultural field monitors to ensure avoidance of sensitive areas.

Q41. Does Minnesota Power have procedures in place to address previously unidentified cultural resources encountered during construction?

A. Yes. An Unanticipated Discoveries Plan ("UDP") has been developed and will be implemented to guide activities if previously unknown cultural resources are identified during construction. The UDP establishes: the proper procedure to follow for stopping work and securing the area around an identified resource; a communications plan for the Projects' archaeologist, SHPO, and Minnesota Power; and permissions needed for work to resume.

Q42. Please describe the results of the acoustic assessment conducted for the Wind Project.

A. The acoustic modeling results indicate that the Wind Project's predicted sound limits will not exceed the Commission's current sound limit of 45 dBA within 100 feet of an inhabited residence or community building. The Wind Project will not exceed a maximum predicted sound limit at any occupied residence, the maximum sound anticipated at a residence is 44 dBA at 100 feet, and thus the Wind Project complies with the Commission's Avoidance Criteria. The study was conducted with all 45 primary turbine locations and the 12 alternate locations. The study calculated impacts assuming all 57 turbine locations would be operating; however, Longspur will have a maximum of 45 operational turbines so the predicted sound assessment is conservative. Longspur will update the study once final turbines are selected and commits to submit an updated report prior to construction.

Q43. Please describe the results of the shadow flicker assessment for the Wind Project.

A. The generally accepted Commission standard to assess shadow flicker is no more than 30 hours per year of shadow flicker at an occupied receptor. The maximum predicted shadow flicker impact at any occupied residence is 30 hours per year. Longspur modeled the study with all 45 primary turbine locations and the 12 alternate locations. The study calculated impacts assuming all 57 turbine locations would be operating; however, Longspur will install a maximum of 45 turbines, so like the acoustic assessment, the predicted shadow flicker analysis is conservative. Longspur will update the study with final selected turbine locations and commits to submit an updated report prior to construction.

Q44. Are you familiar with the Exclusion Areas, Avoidance Areas, Selection Criteria, and Policy Criteria identified in Chapter 69-06-08 of the North Dakota Administrative Code?

A. Yes. The studies and surveys conducted for the Projects included an assessment of the Commission's Siting Criteria.

Q45. Are there any Exclusion Areas located within the Projects?

A. No. There are no Exclusion Areas located within the Wind Project or the Transmission Project Corridor. Dakota Skipper habitat is present within the project area; however, all infrastructure has been sited to avoid these areas, and no permanent or temporary impacts are expected.

Q46. Are there any Avoidance Areas located within the Wind Project?

A. Yes. The following Avoidance Areas identified in N.D. Admin. Code § 69-06-08-01(3) are present within the Wind Project: 1) historical resources; 2) 100-year floodplains; 3) geologically unstable areas; and 4) wetlands.

1) Historical resources: SHPO has agreed with the Wind Project's findings in its cultural and historical resources surveys as described in the initial survey report and subsequent addendum reports, that the Project has been designed to avoid all impacts to unevaluated, eligible, or potentially eligible historic sites. Furthermore, Longspur will avoid impacts to archeological sites during construction in accordance with input from the SHSND. For instance, cultural sites recommended for avoidance by SHSND will be fenced with a buffer of at least 50 feet and occasionally monitored by a licensed archeologist to reduce the potential for inadvertent disturbance. An Unanticipated Discoveries Plan has been prepared and will be implemented in the event that unknown archaeological sites or human remains are discovered during construction.

2) 100-Year floodplain: Longspur has sited infrastructure to avoid these areas to the greatest extent practicable. Overall impacts are anticipated to be negligible. Table 1 identifies each permanent floodplain impact within the Wind Project and provides an explanation as to why there is no reasonable alternative to the proposed infrastructure's location within these areas. As discussed below, placement of infrastructure in the

locations identified results from siting constraints to avoid impacts to other avoidance or exclusion areas or sensitive features or is in response to landowner requests.

TABLE 1				
Longspur Wind – Permanent Impacts in 100-Year Floodplain Avoidance Areas				
Floodplain Grouping ID	Project Infrastructure Type	**Impact Area (Acres)**	**Map Page**	**Basis for Unavoidable Impacts**
1	Access Road to T15, T16	0.056	20, 24	Linear floodplain area 1 cannot be avoided entirely; design minimizes impacts to broken and unbroken grasslands and to wetland and floodplains; design avoids farmstead to east; road on property line minimizes impacts to each property.
2	Access Road to T17	0.015	20, 24	Floodplain 2 cannot be avoided entirely; alignment follows the section line; design minimizes farming impacts and avoids an existing well water line.
3	T5	0.073	10	Floodplain 3 cannot be avoided entirely; turbine placement reduces potential impacts to floodplains further east and meets required setback distances from the west.
7	Access Road to T16	0.018	20	Access road alignment avoids removal of trees and is responsive to landowner preference.
10	Access Road to T13	0.014	14, 20	Access road alignment avoids impacts to farming practices and is responsive to landowner preference.
11	Access Road to T12	0.039	10, 15	Access road alignment follows an existing field road and minimizes impacts to farming practices while reducing overall infrastructure impacts.
16	Access Road to T47	0.005	11	Access road alignment is responsive to landowner preference and addresses safety concerns from area topography.
19	O&M Facility	0.382	6	O&M facility has been sited to avoid wetland impacts to the northwest and to avoid existing county infrastructure to the east.
32	Project Substation	0.159	1, 6	Substation has been sited to avoid wetland and cultural resource impacts to the southwest and avoids existing county infrastructure to the east.
50	Access Road to PMM1	0.0003	2	Direct route selected at the request of the landowner and minimizes impacts to farming operations.
52	PMM1	0.042	2	Met tower placed to meet setback requirements from existing turbines; allows for collection of meteorological data for the Wind Project.
55	T61	1.271	18, 19	Turbine placement reflects landowner preference and addresses safety concerns related to site topography.
56	Access Road to T40	0.008	13	Access road alignment minimizes disturbance to farming practices; impacted floodplain is in a road ditch and the access road alignment avoids larger floodplain areas in the farm field; crosses existing infrastructure at a constrained location.
57	Access Road to T27	0.0007	4, 8	Access road alignment creates a direct route to infrastructure, thereby minimizing disturbance to farming practices. Impacted floodplain is in a road ditch.
59	Access Road to T24	0.007	3	Access road alignment creates a direct route to infrastructure, thereby minimizing disturbance to farming practices. Alignment is responsive to landowner preference.

Attachment M to the May 6, 2026 filing contains a map detailing the above described locations.

3) Geologically unstable areas: With respect to geologically unstable areas, North Dakota Geological Survey landslide deposits are present within the Wind Project; however, no

turbine locations or associated Wind Project infrastructure is sited within the landslide areas as identified by the North Dakota Geological Survey. Geotechnical studies at each turbine location have confirmed that turbine foundations will not be sited within geologically unstable areas.

4) Wetlands: The Wind Project has been designed to minimize impacts on wetlands and other waters to the extent practicable. Turbines have been sited to avoid temporary and permanent impacts on wetlands and waterbodies, all collector lines will be bored beneath wetlands, avoiding all wetland impacts, and the substation and O&M building have been sited to avoid all wetland impacts. Table 2 identifies the negligible wetland impacts within the Wind Project and provides an explanation as to why there is no reasonable alternative to the proposed infrastructure's location within these areas. As discussed below, placement of infrastructure in the locations identified results from siting constraints to avoid impacts to other avoidance or exclusion areas or sensitive features or is in response to landowner requests.

TABLE 2

Longspur Wind – Wetland Avoidance Areas

Wetland ID	Project Infrastructure Type	Impact Area (Acres)	Temporary or Permanent	Basis for Unavoidable Impacts
W002	Crane Path	0.058	Temporary	Temporary impact at W002 is unavoidable so that the crane path alignment can support avoidance and minimization of impacts at W045. W002 is a farmed wetland with regular impacts from farming activities.
W012	Access Road	0.262	Permanent	Due to higher topography north and south of access road alignment, significant grading would be required to avoid W012, resulting in greater impacts to the land. In addition, this access road alignment was requested by the landowner to minimize impacts to farming practices.
W013	Crane Path	0.070	Temporary	Linear wetland W013 extends east and west and cannot be avoided entirely. The crane path alignment avoids the farmstead to the south; avoids clearing of trees; and minimizes impacts to wetland by crossing at the narrowest point.
W015	Access Road	0.003	Permanent	W015 is a farmed / cropped wetland, usually dry and farmable but intermittently (seasonally) wet. The impact is extremely small and the access road alignment was selected at the landowner's request.
W037	Crane Path	0.968	Temporary	This crane path alignment represents the least impact to unbroken grasslands that extend north and south of the crossing location. Wetland W037 is a linear feature that continues north and south and is therefore unavoidable. The crossing location is best based on topography.

TABLE 2				
Longspur Wind – Wetland Avoidance Areas				
Wetland ID	**Project Infrastructure Type**	**Impact Area (Acres)**	**Temporary or Permanent**	**Basis for Unavoidable Impacts**
W045	Crane Path	0.045	Temporary	Wetland W045 is a linear feature that continues north and south of the crane path crossing location. The crane path alignment sets up a perpendicular crossing of W045 to minimize impacts to the wetland and unbroken grasslands and avoids DASK habitat around W045.
W047	Crane Path	0.098	Temporary	W047 is a linear wetland that can't be avoided entirely without a much longer crane path route that would increase impacts to farmlands. The crane path alignment avoids broken and unbroken grasslands to the east and west. The crane path alignment is topographically preferred for moving heavy equipment.
W050	Crane Path	0.193	Temporary	The crane path alignment follows the best topography for moving large equipment and avoids unbroken grasslands and other farm features such as stock ponds and abandoned equipment. W050 is a linear wetland that cannot be avoided. Turbine T29 is an alternate turbine location and the crane path may not be required.
W051	Crane Path	0.109	Temporary	The crane path alignment follows the best topography for moving large equipment and avoids unbroken grasslands and other farm features such as stock ponds and abandoned equipment. W051 is a farmed wetland. Turbine T29 is an alternate turbine location and the crane path may not be required.
W058	Crane Path	0.10	Temporary	Wetland W058 is a linear wetland that extends far north and south and can't be avoided entirely. The crane path alignment minimizes impacts to broken and avoids unbroken grasslands. The area’s topography favors this crane path alignment for the movement of heavy equipment.
W059	Access Road	0.08	Permanent	Wetland W058 is a linear wetland that extends far north and south and can't be avoided entirely. The straighter crossing location is least impactful to surrounding land uses for delivery of large components. The existing "road" is not an improved road and would not accommodate heavy equipment, plus the alignment of the "road" is not suitable for heavy equipment.
W063	Access Road	0.036	Permanent	Wetland W063 is a linear wetland that extends far north and south and can't be avoided entirely. The access road alignment minimizes impacts on broken and unbroken grasslands and the crossing location represents the least impacts to wetland. Road avoids the farmstead to east, while placing the road on property line minimizes additional land use impacts to each adjoining property.
W068	Access Road	0.611	Permanent	Access road alignment was requested by the landowner as the least impactful to farming practices. Wetland W068 is a farmed wetland.
W069	Access Road	0.046	Permanent	Access road alignment was requested by the landowner as the least impactful to farming practices. Wetland W069 is a farmed wetland.

TABLE 2				
Longspur Wind – Wetland Avoidance Areas				
Wetland ID	**Project Infrastructure Type**	**Impact Area (Acres)**	**Temporary or Permanent**	**Basis for Unavoidable Impacts**
W077	Crane Path	0.419	Temporary	Crane path alignment represents the least impactful route between multiple linear waterbodies and wetlands. Unbroken grasslands are extensive in this area and cannot be avoided entirely.
W089	Crane Path	0.079	Temporary	Wetland W089 is a linear wetland that extends far north and south and can't be avoided entirely. The crane path alignment minimizes impacts on unbroken grasslands and the crossing location represents the least impacts to the wetland. Alignment avoids DASK habitat to south.
W091	Crane Path	0.195	Temporary	Wetland W091 is a linear wetland that extends far north and south and can't be avoided entirely. The crane path alignment minimizes impacts on broken grasslands and the crossing location represents the least impacts to the wetland.

Attachment N to the May 6, 2026 filing contains a map detailing the above described locations.

Q47. Are there any Avoidance Areas located within the Transmission Project?

A. Yes. Historical resources which are an Avoidance Area under N.D. Admin. Code § 69-06-08-02(2) are present within the Transmission Project Corridor. Longspur has received acceptance of the reports with SHPO regarding a Class I and III survey and Class I and III addendum survey that took place. Longspur will not impact any historical resources.

No NDGS-mapped landslide deposits or geologically unstable areas are located within the Project Corridor. In the Transmission Project Application at Table 3.2-1(d), the Application states that areas which are geologically unstable are present in the transmission line corridor. To clarify, our review of NDGS data showed no mapped landslide deposits. In addition, Longspur conducted geophysical analysis for all structure locations. This analysis did not reveal any landslide deposits or geologically unstable areas at these locations. An updated Transmission Line Application Avoidance Area Table 3.2-1(d) is filed as Attachment R to the May 6, 2026 filing. An updated Wind Application Avoidance Area Table 3.2-1 was previously filed as Attachment A to the January 6, 2026 filings.

Q48. Please address the Commission's Selection Criteria.

A. Longspur does not anticipate any significant adverse impacts to the Commission's Selection Criteria in N.D. Admin. Code §§ 69-06-08-01(5) and 69-06-08-02(3). The Projects' evaluation of the Commission's selection criteria is located in Section 3.3 of both the Transmission Line and Wind Project Applications.

Q49. Please address the Commission's Policy Criteria.

A. The Projects have maximized the benefits set forth in the Commission's Policy Criteria in N.D. Admin. Code §§ 69-06-08-01 and 69-06-08-02 to the greatest extent possible. The Projects' evaluation of the Commission's selection criteria is located in Section 3.4 of both the Transmission Line and Wind Project Applications.

Q50. Are any remaining local, state, or federal permits or approvals needed for the Projects?

A. Minnesota Power still requires certain ordinary construction permits such as use of county right-of-way approvals for collection line road crossings, county driveway permits, stormwater construction permits, and building permits.

III. Conclusion

Q51. Has Minnesota Power designed the Projects to avoid, minimize, and mitigate environmental impacts to the greatest extent possible?

A. Yes.

Q52. Has Minnesota Power sited the Projects in a manner so that the location and operation will produce minimal adverse effects on the environment, wildlife, and upon the welfare of the citizens of North Dakota?

A. Yes.

Q53. Are the Projects compatible with the environmental preservation and the efficient use of resources?

A. Yes.

Q54. Does this conclude your direct testimony?

A. Yes.

AN ALLETE COMPANY

Attachment A

Class I and III Cultural Resource Survey Addendum

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30 West Superior Street | Duluth, MN 55802

Longspur conducted an additional Class III cultural resources survey of the Wind Project area in response to minor shifts in proposed infrastructure identified during project engineering in the fourth quarter of 2025. The supplemental survey effort was completed to confirm that the revised facility layout and associated improvements remained consistent with applicable cultural resource review requirements and to evaluate any newly affected areas within the Project boundary. A report documenting the methods, results, and any recommendations from this additional Class III survey was submitted to the State Historical Society on March 19, 2026. Longspur received concurrence from the State Historical Society on April 17, 2026.

MANUSCRIPT DATA RECORD FORM

1. Manuscript Number: [SHPO assigns]

2. SHPO Reference #:

3. Author(s): Damien Reinhart

4. Title: Addendum: A Class I and Class III Cultural Resources Inventory of Minnesota Power's Longspur Wind Project, Morton County, North Dakota.

5. Report Date: March 17, 2026

6. Number of Pages: 148

7. Type – I, T, E, O: I

   I=Inventory; T=Formal Testing; E=Excavation; O=Other

8. List formally tested or excavated sites (not probes):

9. Acres: 2,974.8

10. List the legal description* and study unit. For study unit assignment, use the township tables in the *State Plan*, http://history.nd.gov/hp/stateplan_arch.html.
    Study Units: LM, CB, KN, HE, SM, GA, JA, GR, NR, SR, SO, SH, YE

*For *inventory*, *formal testing,* and *excavation* projects, *list the CLASS III legal locations only*.

County	Township	Range	Section	Study Unit
Morton	139 N	87 W	4-6	HE
Morton	139N	88W	4, 5	HE
Morton	140N	87W	5-8, 17-29, 28-34	HE
Morton	140N	88W	1-3, 9-16, 18-25, 29-33	HE
Morton	140N	89W	13, 14, 23-25	HE

Minnesota Power

Addendum: A Class I and Class III Cultural Resources Inventory of Minnesota Power's Longspur Wind Project

Morton County, North Dakota

PREPARED BY

Merjent, Inc.
1 Main Street SE, Suite 300
Minneapolis, Minnesota 55414

Damien Reinhart, MA
Principal Investigator

March 2026

MANAGEMENT SUMMARY

Minnesota Power, an ALLETE company, is developing a wind energy conversion facility, known as the Longspur Wind Project, in Morton and Mercer Counties, North Dakota (Project). All Project turbines will be in Morton County, and approximately 2.5 miles of 230-kilovolt (kV) transmission generator lead line (transmission line) will be installed to connect the Project to the proposed Point of Interconnect at an existing substation in Mercer County. The Project will require a Certificate of Site Compatibility from the North Dakota Public Service Commission in accordance with the North Dakota Energy Conversion and Transmission Facility Siting Act (Siting Act; North Dakota Century Code, Chapter 49-22). Because the Project's Transmission Line will have a capacity greater than 115 kV and is longer than 1 mile, the Project will also need a Certificate of Corridor Compatibility under the Siting Act. The Project has received a Special Use Permit from Morton County, and the Transmission Line received a Conditional Use Permit from Mercer County.

A previous Class III intensive cultural resource inventory investigation was conducted by Merjent, Inc. to support the current Project, the results of which are detailed in, *A Class I and Class III Cultural Resources Inventory of the Minnesota Power Longspur Windfarm Project, Morton and Mercer Counties, North Dakota* (Reinhart and Cox 2025). The previous Class III intensive cultural resource inventory investigation of 1,478.41 acres was conducted from January 2025 to May 2025. This addendum includes the results of subsequent Class III investigations encompassing 2,974.79 additional acres within an expanded Project survey area, which was surveyed from October 21 to November 15, 2025, in Morton County. During the current survey, 19 new archaeological resources were identified, and 3 previously recorded resources (32MOX0132, 32MO0233, and 32MOX0576) were revisited. The three revisited sites consist of a historic camp site lead, a stagecoach line, and a precontact isolated find. The campsite and stagecoach line were not located in the area surveyed, and no further work is recommended. The isolated find consisted of a single flake that is recommended not eligible for listing in the North Dakota State Historic Sites Register and no further work is recommended. The 19 newly recorded resources are unevaluated and avoidance or further work is recommended. Merjent recommends the Project be granted a determination of *no significant sites affected*. No further archaeological work is recommended for the Project as planned.

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ACRONYMS AND ABBREVIATIONS

GLO	General Land Office
GSV	ground surface visibility
kV	kilovolt
Merjent	Merjent, Inc.
NDSHSR	North Dakota State Historic Sites Register
NRHP	National Register of Historic Places
Project	Minnesota Power Longspur Wind Project
Survey Area	Locations and surrounding buffer of Project structures and work areas
Siting Act	North Dakota Energy Conversion and Transmission Facility Siting Act
transmission line	230-kV transmission generator lead line
USGS	U.S. Geological Survey

1.0 PROJECT DESCRIPTION

As stated in *A Class I and Class III Cultural Resources Inventory of the Minnesota Power Longspur Windfarm Project, Morton and Mercer Counties, North Dakota* (Reinhart and Cox 2025), Minnesota Power, an ALLETE company, is developing a wind energy conversion facility, known as the Longspur Wind Project in Morton and Mercer Counties, North Dakota (Project). All Project turbines will be in Morton County and approximately 2.5 miles of 230-kilovolt (kV) transmission generator lead line (transmission line) will be installed to connect the Project to the proposed Point of Interconnect at an existing substation in Mercer County. The Project will require a Certificate of Site Compatibility from the North Dakota Public Service Commission in accordance with the North Dakota Energy Conversion and Transmission Facility Siting Act (Siting Act; North Dakota Century Code, Chapter 49-22). Because the Project's transmission line will have a capacity greater than 115 kV and is longer than 1 mile, the Project will also need a Certificate of Corridor Compatibility under the Siting Act. The Project received a Special Use Permit from Morton County, and the Transmission Line received a Conditional Use Permit from Mercer County. The Project has an anticipated commercial operation date of December 2027, with construction potentially starting in 2026.

TABLE 1.0-1

List of Township/Range/Sections within the Current Survey Areas

Township	Range	Sections
139 North	87 West	4–6
139 North	88 West	4,5
140 North	87 West	5–8, 17–29, 28–34
140 North	88 West	1–3, 9–16, 18–25, 29–33
140 North	89 West	13, 14, 23–25

For this addendum, Minnesota Power identified additional turbine locations, access road corridors, a transmission line corridor, operations and maintenance areas, crane paths, and work or staging areas. These locations and the buffers surrounding them, which make up the Project Survey Area, were inventoried to identify the presence of historic sites, structures, and archaeological sites within the Project Survey Areas and assess their eligibility to the North Dakota State Historic Sites Registry (NDSHSR).

A previous Class III intensive cultural resource inventory investigation of 1,478.41 acres was conducted by Merjent, Inc. (Merjent) to support the current Project, the results of which are detailed in Reinhart and Cox (2025). The previous survey included 23.89 linear miles for access roads and the proposed transmission line, all of which were inventoried at the Class III level, and which were conducted from January 2025 to May 2025. The following addendum includes the results of subsequent Class III investigations of additional Survey Areas encompassing 2,974.79 additional acres, which were surveyed from October 21 to November 15, 2025, in Morton County (see Figures 1 and 3 in Appendix A).

Three previously recorded resources (32MOX0132, 32MO0233, and 32MOX0576) were revisited, and 19 resources were newly recorded. The three revisited sites consist of a historic camp site lead, a stagecoach line, and a precontact isolated find. The campsite and stagecoach line were not located in the Survey Area, and no further work is recommended. The isolated find consisted of a single flake located in an area of severe ground disturbance created by the Dakota Access Pipeline, and no further artifacts were visible; the isolated find is recommended not eligible, and no further work is recommended. The 19 newly recorded resources are unevaluated, and avoidance or further work is recommended. The resources consist of 12 isolated finds and 7 sites. The isolated finds consist of precontact chipped stone artifacts. The sites consist of: five precontact resources composed of three cairns, one chipped stone scatter, and one lithic scatter; one historic cultural material scatter; and, one multicomponent farm. Merjent recommends the Project be granted a determination of *no significant sites affected*.

2.0 ENVIRONMENTAL AND CULTURAL BACKGROUND

The environmental and cultural background, including the literature reviews, for the Project was previously presented in Reinhart and Cox (2025).

3.0 FIELD METHODS

Field methods replicate those reported in the original survey (Reinhart and Cox 2025).

4.0 CLASS III SURVEY RESULTS

2,974.79 acres of additional Project space were subjected to an intensive Class III inventory between October 21, 2025, to November 15, 2025. Survey Areas included potential transmission lines, crane paths and Project workspaces. Vegetation throughout the Project varied along with the ground surface visibility (GSV). Vegetation encountered during survey included short grass prairie and agricultural fields. Crops in agricultural fields were typically harvested prior to survey. Crops included flax, canola, corn, and sunflowers. In this most recent survey, Merjent identified 19 new archaeological resources and revisited 3 previously recorded sites. During survey, no shovel tests were conducted, and no cultural material was collected.

4.1 32MOX0132 REVISIT

Site lead 32MOX132 is a historic campsite originally recorded in 1980 by Benson as "Camp 5" from archival sources. Other supporting information was lacking. Only the overlapping portion of the Survey Area was surveyed. No historic material or features were identified during the survey, and no artifacts were collected. The current Survey Area was walked on three separate occasions: October 23, November 1, and November 7, 2025, and no evidence of a campsite was identified despite GSV of 35 to 100 percent. Because of the good to excellent GSV, no shovel tests were conducted. Since no cultural materials were identified within the Survey Area, the site lead within the Survey Area does not retain any location, design, materials, workmanship, or association. Setting and feeling of any potential camp has also been impacted by agricultural activity. Any camp site is likely located to the south in a flatter plain outside of the current Survey Area. The portion of the site lead boundary within the current Survey Area consists of a well-established, east-west trending gravel county road. No evidence of a campsite exists within the Survey Area, and any historic camp site is likely located south of the Survey Area in a flat to gently rolling plain; therefore, the site remains unevaluated, and no further work is recommended for the resource in this area.

Photo 4.1-1. Overview of surveyed area in 32MOX132, facing east.

4.2 32MO233 REVISIT

Site 32MO233 is the abandoned Fort Keogh to Fort Lincoln historic stagecoach line. Only the portions of the Survey Area overlapping the site boundary were surveyed. The site visits took place on November 1, 2025, and November 12, 2025. No remnants or evidence of the stagecoach line were identified within the Survey Area. The original form indicated that the portion of the line in this area was now the improved county road located along the south edge of the site boundary. Although the stagecoach line may retain its location, it is no longer recognizable as such as its materials, workmanship, feeling, design, and association have been completely altered by the improved road. Additionally, in this location, the site's setting has been impacted by expansive agriculture and improved roadways. No shovel tests were conducted. No artifacts were observed. The site was originally recommended as unevaluated for inclusion in the National Register of Historic Places (NRHP) in 1980. At that time, the recorder recommended that any information that could be gained about the history of the stagecoach line within the current site boundary could be ascertained from review of aerial photography. A second revisit to the Survey Area in 2025 did not reveal any cultural materials or features associated with the stagecoach line. Merjent recommends that the stagecoach line no longer exists in the Survey Area, and no further work is recommended for the resource in this area. The stagecoach line may exist undisturbed in other places outside of the current Survey Area. The site is unevaluated for the NDSHSR. Merjent recommends no further work is necessary within the surveyed areas.

Photo 4.2-1. Overview of surveyed area in 32MO233, facing northeast.

4.3 32MOX576 REVISIT

Isolated find 32MOX576 is a precontact isolated find consisting of chipped stone. The isolated find is located on the top of, and side, of a hill approximately 591 feet (180 meters) north of an unnamed drainage leading into Wilson Creek. During survey, it was revisited, and no cultural materials or features were identified. The isolated find was originally identified by Gaia Ewing on May 2, 2015. Ewing recorded it as being located in a harvested agricultural field with 70 percent GSV. A limited number of prehistoric archaeological artifacts were recovered, suggesting that the ability to obtain significant information regarding the prehistoric occupation of the site was limited. The Class I file search indicated that the NRHP status of the isolated find is not eligible for listing in the NRHP. No lithic flakes or cultural materials were identified during the site revisit. As no cultural material was found, the isolated find does not retain design, materials, workmanship, or association. Field conditions indicated significant disturbance associated with the Dakota Access Pipeline, which was constructed after the isolated find was originally documented. This disturbance has likely impacted the isolated find location, and infrastructure and agriculture have impacted the isolated find setting and feeling as well. Merjent revisited 32MOX576 on November 13, 2025, during pedestrian survey for the Project. Cultivated GSV was 60 percent, and field conditions indicated the area was significantly disturbed by pipeline construction activities. No cultural material was identified. No shovel tests were conducted. Merjent does not recommend a change in the current NRHP recommendation status, and it is further recommended the isolated find is not eligible for listing in the NDSHSR. No further work is recommended.

Photo 4.3-1. IF 32MOX576 overview, facing north.

4.4 32MO1734

Site 32MO1734 is a cairn located on a ridge covered in short grass. The site was identified by Merjent staff on October 21, 2025. The cairn consists of 15 stones, both round and tabular, that were visible on the ground surface. The stones are locally sourced bedrock and cobbles. The cairn measures approximately 1 meter north-south by 1.5 meters east-west. It is a relatively low cairn, measuring less than 50 centimeters in height. GSV during survey was 50 percent. The stones exhibit lichen growth and are mostly sodded into the ground surface. The area surrounding the site has been disturbed by agricultural activities and crowned and ditched county roads to the north and east. The ridge top has not been disturbed, and the cairn retains integrity of location, design, materials, and workmanship; however, the site lacks integrity of setting, feeling, and cannot be associated with significant individuals. No shovel tests were conducted. No artifacts were collected. Some cairns are considered potential burial markers. The site appears to be undisturbed, with stones anchored on the ground surface. The site is unevaluated for eligibility for inclusion in the NDSHSR under all criteria. Under Criterion 1, stone features may be considered of a sacred nature important to Tribes (cf., Parker and King 1990). Under Criterion 2, the site does not exhibit a distinctive architectural style or type. Under Criterion 3, although the site may contain information about historic events, additional investigations are required to reify them. Under Criterion 4, the site appears to retain integrity of material, and setting. The cairn is unevaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.4-1. Site 32MO1734 overview of cairn.

4.5 32MO1735

Site 32MO1735 is a stone feature that consists of a cairn. The site was identified by Merjent staff on November 4, 2025. The cairn was identified within a cattle pasture of mixed prairie grasses and forbs with improved roads, cultivated fields, and wind turbines visible in the distance. The cairn is oval in shape, measuring 176 centimeters north-south by 149 centimeters east-west. It is a relatively dispersed cairn, measuring 34 centimeters high. Twenty-five heavily sodded cobbles were visible on the surface. The cobbles range in size from 9 centimeters to 31 centimeters in diameter. During survey, the pasture had approximately 40 percent GSV. Although the site has been impacted by cattle trampling and energy and transportation development, it maintains its overall integrity of materials, setting, location, and feeling. Workmanship and design of the cairn have likely been impacted by the passage of time and livestock trampling. Further work is necessary to fully assess the association of the cairn. No shovel tests were conducted. No artifacts were collected. Some cairns are considered potential burial markers. The site may have significance to Tribes for its potential association with significant events or individuals. As such, additional information is necessary for the site to be evaluated under all criteria. Criterion 1, stone features may be considered of a sacred nature important to Tribes (cf., Parker and King 1990). Under Criterion 2, the site does not exhibit a distinctive architectural style or type. Under Criterion 3, although the site may contain information about historic events, additional investigations are required to reify them. Under Criterion 4, the site appears to retain integrity of material, and setting. The cairn is unevaluated for the NDSHSR. The site is currently unevaluated regarding eligibility for listing in the NDSHSR. Merjent recommends avoidance or further work.

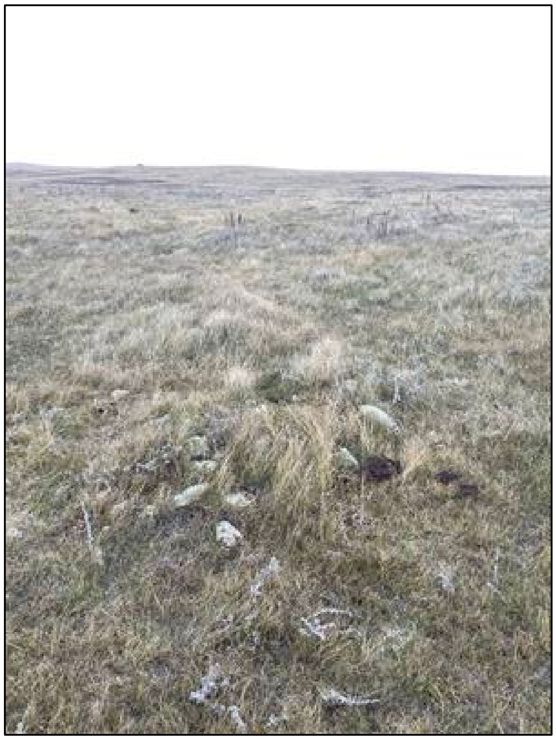


Photo 4.5-1. Site 32MO1735 overview of cairn, facing east.

4.6 32MO1736

Site 32MO1736 is a lithic scatter located in an agricultural field on the top and side of a gently sloped hill. The site was identified by Merjent staff on November 4, 2025. The site consists of two primary flakes, two secondary flakes, and two tertiary flakes made of Knife River Flint and one white chalcedony semitranslucent tertiary flake. During survey, GSV was 50 percent in a harvested canola field with some low vegetation present on the ground surface. The site and surrounding field have been subject to decades of agricultural practices including plowing and discing potentially impacting its integrity of location. Wind turbines, a power line, and the surrounding agricultural fields have impacted the field site's setting and feeling. The identified flakes cannot be associated with any specific cultural or temporal affiliation and do not exhibit any noteworthy workmanship. Subsurface testing is necessary to assess whether the location has the potential for any buried cultural deposits which could retain integrity of workmanship, materials, design, and association. No shovel tests were conducted. No artifacts were collected. Site 32MO1736 is not associated with any significant events or notable individuals in history, nor does the site embody the distinctive characteristics of a type, period, or method of construction. As such, the field site is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4),, subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.6-1. Site 32MO1736, chalcedony flake.

Photo 4.6-2. Site 32MO1736 overview, facing west.

4.7 32MO1737

Site 32MO1737 is a lithic scatter located in an agricultural field upon an upland plain southwest of Hailstone Butte, the highest point in Morton County. The site was identified by Merjent staff on November 5, 2025. The site consists of five Knife River Flint tertiary flakes with light to moderate white patina and a Knife River Flint biface fragment with very little white patina. During survey, the agricultural field had a GSV of 40 percent with remaining flax stubble as ground cover. The field site and surrounding area have been subject to decades of agricultural practices including plowing and discing potentially impacting its integrity of location. Wind turbines and the surrounding agricultural fields have impacted the site's setting and feeling. The identified flakes and biface fragment cannot be associated with any specific cultural or temporal affiliation and do not exhibit any noteworthy workmanship. Subsurface testing is necessary to assess whether the location has the potential for any buried cultural deposits which could retain aspects of workmanship, materials, design, and association. No shovel tests were conducted. No artifacts were collected. Site 32MO1737 is not associated with significant events or notable individuals in history, nor does the site embody the distinctive characteristics of a type, period, or method of construction. the field site is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.7-1. Site 32MO1737, Knife River Flint biface fragment.

Photo 4.7-2. Field site 32MO1737 overview, facing west.

4.8 32MO1738

Site 32MO1738 is a historic scatter possibly representing the remnants of a homestead occupied during the first half of the twentieth century. The site was identified by Merjent staff on November 5, 2025. The site is situated on rolling grasslands overlooking intermittent streams that empty into Wilson Creek, which is west/southwest of the site. No architectural features were recorded during the survey, but domestic artifacts are represented heavily in the cultural material scatter. All artifacts were identified on the ground surface, and GSV averaged 35 percent at the time of the survey.

During the survey, the field crew identified and recorded the following artifacts on the ground surface: four amber bottle glass shards, including two bottle bases with maker's marks; one green glass bottle neck; four aqua glass shards, including one with an embossed "CO" and one with indeterminate embossing; nine clear glass shards, including one embossed with squares, one embossed with triangles, two vessel neck fragments, one vessel handle, and one melted glass shard; one cobalt vessel glass shard; one amethyst or "solarized" glass shard; two milk glass shards, including a vessel base with a maker's mark and a tableware base; two whiteware tableware sherds, including a base fragment with a foot ring; one cream salt-glazed stoneware vessel sherd; one coarse earthenware with red slip sherd; one fire brick; three ferrous metal fragments, including a nail, a threaded hook, and a riveted T-shape piece; one miscellaneous triradiate brass piece; and, one button. This is a small sample of the total artifacts discovered. There are several hundred pieces of glass and ceramic shards spread throughout the site with the greatest artifact density 50 to75 meters from the road. No artifacts were collected.

Peter C. Redmann received a land patent on November 23, 1915, for 160 acres in the [redacted] under the authority of the 1862 Homestead Act (General Land Office [GLO] 1915). A 1912 directory of Morton County (Keiter Directory Company 1912) indicates that Peter C. Redmann had already established his homestead at this location by 1912, during the proving up period. As Peter C. Redmann was still listed as living in his father's household elsewhere in the township in the 1910 Federal Census (U.S. Census Bureau 1910a), the homestead was likely established between 1910 and 1912. A 1917 atlas shows Peter C. Redmann owning the 160 acres in the [redacted] in the extreme northeast corner of the southeast quarter of the section (Geo. A. Ogle & Co. 1917). Peter C. Redmann worked and lived on a farm in Township 140 North, Range 87 West through 1950 (U.S. Census Bureau 1950) and does not appear in a search of the North Dakota Biography Index (North Dakota State University Archives 2025).

Historical aerial imagery and maps do not show structures anywhere near the site location during the second half of the twentieth century (Directory Service Company 1969; Directory Service Company 1976; NETROnline 2025; U.S. Geological Survey [USGS] 2025). Aerial imagery suggests that by at least 1967, the entirety of the site location had been plowed and was under cultivation (NETROnline 2025).

Artifacts from the site correspond with an early- to mid-twentieth-century occupation. A solarized or "amethyst" glass shard places the occupation of the site from the mid-1870s to the 1920s or 1930s (Lockhart 2006), while an amber bottle base with an Owens-Illinois Duraglas maker's mark dates to 1948 (Lockhart and Hoening 2018). The Hazel-Atlas Glass Company maker's mark on the base of a milk glass vessel dates from 1923 to roughly 1982 (Lockhart et al. 2021). Other glass and ceramic artifacts at the site are not able to be dated to refined timeframes but are typical of what one may encounter at an early-twentieth-century homestead.

The site is located in an active agricultural field which has been cultivated for decades, and no architectural features were identified alongside the cultural material scatter. As such, the location of the artifacts may have changed slightly through time, and the setting and feeling likely have been altered. The site retains association with a specific individual and a general period of time in North Dakota history. The artifact assemblage does not indicate the presence of modern refuse at the site, so the site retains the aspect of materials. Additional research and testing are necessary to determine whether the site contains subsurface features or artifacts which can contribute to the site's integrity of association, design, and workmanship.

Although site 32MO1738 represents the material culture of an early- to mid-twentieth century homestead, it is indeterminable whether the site has any associations with significant events or trends in history and Peter C. Redmann does not appear to be a notable individual in state or local history (Criterion 1). No architectural features were recorded at the site, and the artifacts present do not exhibit any significance of design or construction, as such the site is recommended as not eligible under Criteria 2 and 4. Subsurface testing may yield features and/or additional artifacts that could contribute information important to our understanding of the past (Criterion 3). As such, site 32MO1738 is currently unevaluated regarding eligibility for listing in the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.8-1. Site 32MO1738 overview, facing west.

Photo 4.8-2. Site 32MO1738, representative glass surface artifacts.

4.9 32MO1739

Site 32MO1739 is a cairn site consisting of 17 visible stones. The site was identified by Merjent staff on November 7, 2025. The cairn is located on a hill surrounded by an agricultural field in all directions. The area surrounding the site has been disturbed by agricultural activities, a crowned and ditched county road to the west, and barbed wire fencing. The stones are mostly local tabular sandstone stacked with moderate lichen growth and a well sodded base covering a 2-meter-by-2-meter area. The hill and site are undisturbed with stones anchored on the ground surface, and the cairn retains integrity of location, design, materials, and workmanship; however, the site lacks integrity of setting, feeling, and cannot be associated with significant events or individuals. No shovel tests were conducted. No artifacts were collected. Some cairns are considered potential burial markers or indicators of an important location. The site is unevaluated for eligibility for inclusion in the NDSHSR under all criteria. Under Criterion 1, stone features may be considered of a sacred nature important to Tribes (i.e., Parker and King 1990). Under Criterion 2, the site does not exhibit a distinctive architectural style or type. Under Criterion 3, although the site may contain information about historic events, additional investigations are required to reify them. Under Criterion 4, the site appears to retain integrity of form, material, and setting. The cairn is unevaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.9-1. Site 32MO1739, cairn overview facing east.

4.10 32MO1740

32MO1740 is a historic site with multiple structures and foundations (Features 1 to 9). The site was identified by Merjent staff on November 6, 2025. The site is a historic farmstead with three standing structures and an additional six foundations located during survey. Standing structures include a red Gambrel style barn (Feature 1) dating to the early part of the twentieth century. The two-story barn is wood framed with horizontal siding. The façade of the barn faces east with a lean-to addition on the north and south sides. There is significant damage and collapse on the north side of the barn, leaving the interior exposed; the barn is overall in poor condition. The standing structures also include a twentieth-century red shed (Feature 2) with gabled metal roof and horizontal wood framing, which is deteriorating and missing some of its siding. Feature 2 likely served as a workshop or equipment shed. A more modern-looking sheet metal shed with ammonia tanks (Feature 3) is also standing and dates to approximately the 1930s or 1940s. This shed is in relatively fair condition. Five of the six foundations discovered are 10-feet-by-10-feet concrete slabs (Features 4 to 8) located west of the standing structures. The other foundation is a brick basement (Feature 9) that is beginning to collapse in on itself. It appears that Feature 9 was once associated with a house and seems to be associated with the standing structures. No shovel tests were conducted. The farmstead is littered with miscellaneous metal pieces. A notable artifact is the historic Mcormick-Deering plow that dates between 1902 and 1948 (Moore 1998). There is also a precontact lithic scatter located in a previous survey area several hundred feet northeast of the farmstead (32MO1722). The area surrounding the site has been disturbed by agricultural activities, pasture, and a farm road to the east.

A patent for 160 acres was granted in 1909 to Burt S. Kidder under the authority of the 1862 Homestead Act (GLO 1909). Under the 1910 census (U.S. Census 1910b), Mr. Kidder lived with his wife and five children. No other information could be located for Mr. Kidder. The 1958 Bismark topographic map indicates a structure located in the site area (USGS 1958). Further, the 1970 Hailstone Butte topographic map indicates two structures and a road on site (USGS 1970). Google Earth (2025) aerial imagery from 1995 to 2020 indicates the farm structures (barn and sheds) and foundation remnants in place. Aerial imagery from 2016 to 2022 indicates some type of agricultural activity taking place (possibly temporary road and temporary agricultural structures) in the vicinity of surface finds 1 and 2. The site area has not been disturbed, and the foundations, surface finds, and structures retain integrity of location, however the site lacks overall physical integrity and integrity of feeling. Integrity of materials is diminished as the structural materials that composed the farm are degraded, and the integrity of workmanship is degraded with the disuse and removal of structures. The site is an abandoned farmstead, which is left unevaluated for the NDSHSR pending further investigation. It is indeterminable whether the site has any associations with significant events or trends in history (Criterion 1). The architectural features recorded at the site do not exhibit any significance of design or construction, and the artifacts present do not exhibit any significance of design or construction, as such the site is recommended as not eligible under Criteria 2 and 4. Subsurface testing may yield features and/or additional artifacts that could contribute information important to our understanding of the past (Criterion 3). As such, site 32MO1740 is currently unevaluated regarding eligibility for listing in the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.10-1. Feature 1, Site 32MO1740 red barn, facing southwest.

Photo 4.10-2. Feature 2, Site 32MO1740 historic shed, facing northwest.

Photo 4.10-3. Feature 3, Site 32MO1740 historic shed, facing west.

Photo 4.10-4. Feature 9, Site 32MO1740 basement foundation, facing southwest.

Photo 4.10-4. Deering-McCormick Plow 32MO1740, facing south.

4.11 32MOX819

Isolated find 32MOX819 is a single utilized tertiary flake. The isolated find was identified by Merjent staff on October 30, 2025. The isolated find is located in a two-track farm road on a hill surrounded by agricultural fields. The isolated find is potentially disturbed or out of context due to its location within the ruts of a farm road. The farm road has 50 to 100 percent GSV. The flake is made from a beige opaque chert. The surrounding area has been subject to decades of agricultural practices including plowing and discing, potentially impacting its integrity of location.

The presence of nearby wind turbines, gravel county roads, Highway 49, and the surrounding agricultural fields have impacted the isolated find setting and feeling. The identified flake cannot be associated with any specific cultural or temporal affiliation and does not exhibit any noteworthy workmanship. Subsurface testing is necessary to assess whether the location has the potential for any buried cultural deposits which could retain aspects of workmanship, materials, design, and association. No shovel tests were conducted. 32MOX819 is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.11-1. Isolated find 32MOX819, utilized flake located in farm road.

Photo 4.11-2. Isolated find 32MOX819 overview, facing north.

4.12 32MOX820

Isolated find 32MOX820 consists of a Knife River Flint scraper. The isolated find was identified by Merjent staff on November 3, 2025. The isolated find was located near the top of a small hill in an agricultural field. The scraper measures 4 centimeters by 2 centimeters by 1.5 centimeters, and over 50 percent of the artifact is covered in cortex. During survey the agricultural field was covered in flax stubble and had a GSV of 25 percent. The isolated find is within an active agricultural field which has been cultivated for decades, potentially impacting its integrity of location. Modern roads and agricultural fields have impacted the isolated find setting and feeling, although the isolated find does maintain an unobstructed view of Hailstone Butte. The scraper cannot be associated with any specific cultural or temporal affiliation and does not exhibit any noteworthy workmanship. Subsurface testing is necessary to assess whether the isolated find has the potential for any buried cultural deposits which could retain aspects of workmanship, materials, design, and association. No shovel tests were conducted. 32MOX820 is not associated with any significant events or notable individuals in history, nor does the isolated find embody the distinctive characteristics of a type, period, or method of construction. As such, the isolated find is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.12-1. Isolated find 32MOX820, scraper made of Knife River Flint.

Photo 4.12-2. Isolated find 32MOX820 overview, facing north.

4.13 32MOX821

Isolated find 32MOX821 consists of two Knife River Flint artifacts, a medial fragment of a projectile point or preform, and a tertiary flake. The site was identified by Merjent staff on November 3, 2025. The isolated find is located on a small hill in a gently rolling agricultural field southwest of Hailstone Butte. The medial projectile point fragment is 2.3 centimeters wide at the proximal end and 1.4 centimeters wide at the distal end with a length of 1.9 centimeters and a thickness of 0.4 centimeters. During survey the agricultural field was covered in flax stubble and had a GSV of 25 percent. No shovel tests were conducted. The isolated find has been within an active agricultural field for decades, potentially impacting the isolated find integrity and location. Modern roads and agriculture have left an impact on the setting and feeling of the isolated find. None of the artifacts located have diagnostic features and a temporal affiliation cannot be identified. As such, the isolated find is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.13-1. Isolated find 32MOX821, medial fragment of a point.

Photo 4.13-2. Isolated find 32MOX821 overview, facing south.

4.14 32MOX822

Isolated find 32MOX822 is a single Knife River Flint primary flake (consisting of more than 50 percent cortex). The isolated find was identified by Merjent staff on November 3, 2025. The isolated find is located at the top of a hill in an agricultural field. During survey the agricultural field was covered in harvested corn chaff with 50 percent GSV. The isolated find is located within an active agricultural field which has been cultivated for decades, potentially impacting its integrity of location. Agricultural activity in all directions has impacted the setting and feeling of the isolated find. The flake cannot be associated with any specific cultural or temporal affiliation and does not exhibit any noteworthy workmanship. Subsurface testing is necessary to assess whether the isolated find has the potential for any buried cultural deposits which could retain aspects of workmanship, materials, design, and association. No shovel tests were conducted. 32MOX822 is not associated with significant events or notable individuals in history, nor does the isolated find embody the distinctive characteristics of a type, period, or method of construction. As such, the field site is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.14-1. Isolated find 32MOX822, ventral side of primary flake.

Photo 4.14-2. Isolated find 32MOX822 overview, facing southwest.

4.15 32MOX823

Isolated find 32MOX823 consists of two artifacts composed of one Knife River Flint core and one single tan opaque chert tertiary flake. The isolated find was identified by Merjent staff on November 5, 2025. The isolated find is located on an upland plain in an agricultural field. The core has at least eight visible flake scars. The tertiary flake is from a dull, tan chert with very light brown speckling and appeared to be heavily patinated Knife River Flint. During survey the field was covered in flax stubble with 25 percent GSV. The isolated find is in an active agricultural field, and the surrounding area has been subject to decades of agricultural practices including plowing and discing potentially impacting its integrity of location. Wind turbines and the surrounding agricultural fields have impacted the isolated find setting and feeling. The identified flake and core fragment cannot be associated with any specific cultural or temporal affiliation and does not exhibit any noteworthy workmanship. Subsurface testing is necessary to assess whether the location has the potential for any buried cultural deposits which could retain aspects of workmanship, materials, design, and association. No shovel tests were conducted. 32MOX823 is not associated with significant events or notable individuals in history, nor does the isolated find embody the distinctive characteristics of a type, period, or method of construction. As such, the isolated find is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.15-1. Isolated find 32MOX823, core fragment made of Knife River Flint.

Photo 4.15-2. Isolated find 32MOX823 overview, facing west.

4.16 32MOX824

Isolated find 32MOX824 consists of two Knife River Flint artifacts: a secondary flake and a primary flake with a retouched utilized edge. The isolated find was identified by Merjent staff on November 5, 2025. The isolated find is located on the slope just before the top of a hill in an agricultural field. During survey the field was covered in flax stubble resulting in 25 percent GSV. The isolated find and surrounding area have been subject to decades of agricultural practices including plowing and discing potentially impacting its integrity of location. Wind turbines, a power line, and surrounding agricultural fields have impacted the setting and feeling of the isolated find. The identified secondary flake and utilized primary flake cannot be associated with any specific cultural or temporal affiliation and does not exhibit any noteworthy workmanship. Subsurface testing is necessary to assess whether the location has the potential for any buried cultural deposits which could retain aspects of workmanship, materials, design, and association. No shovel tests were conducted. 32MOX824 is not associated with any significant events or notable individuals in history, nor does the isolated find embody the distinctive characteristics of a type, period, or method of construction. As such, the isolated find is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.16-1. Isolated find 32MOX824, secondary flake of Knife River Flint.

Photo 4.16-2. Isolated find 32MOX824 overview, facing east.

4.17 32MOX825

Isolated find 32MOX825 is a single Knife River Flint tertiary flake. The isolated find was identified by Merjent staff on November 5, 2025. The isolated find is located near the top of a hill in an agricultural field. The flake has light patina. During survey, the ground surface was covered in harvested canola resulting in 25 percent GSV. The isolated find and surrounding area have been subject to decades of agricultural practices including plowing and discing potentially impacting its integrity of location. Wind turbines, a power line, and surrounding agricultural fields have impacted the setting and feeling of the isolated find. The flake cannot be associated with any specific cultural or temporal affiliation and does not exhibit any noteworthy workmanship. Subsurface testing is necessary to assess whether the location has the potential for any buried cultural deposits which could retain aspects of workmanship, materials, design, and association. No shovel tests were conducted. 32MOX825 is not associated with significant events or notable individuals in history, nor does the isolated find embody the distinctive characteristics of a type, period, or method of construction. As such, the isolated find is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.17-1. Isolated find 32MOX825, tertiary flake with a light patina.

Photo 4.17-2. Overview of 32MOX825, facing west.

4.18 32MOX826

Isolated find 32MOX826 is a single Knife River Flint primary flake with a heavy patina. The isolated find was identified by Merjent staff on November 5, 2025. The isolated find is located in a gently rolling agricultural field. During survey, the ground surface was covered in harvested canola with 25 percent GSV. The isolated find was recorded in an active agricultural field which has been cultivated for decades, potentially impacting its integrity of location. A modern road 90 feet west of the isolated find, and the surrounding agricultural fields have impacted the setting and feeling of the isolated find. The flake cannot be associated with any specific cultural or temporal affiliation and does not exhibit any noteworthy workmanship. Subsurface testing is necessary to assess whether the location has the potential for any buried cultural deposits which could retain aspects of workmanship, materials, design, and association. No shovel tests were conducted. 32MOX826 is not associated with any significant events or notable individuals in history, nor does the isolated find embody the distinctive characteristics of a type, period, or method of construction. As such, the isolated find is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.18-1. Isolated find 32MOX826, primary flake with a heavy patina.

Photo 4.18-2. Isolated find 32MOX826 overview, facing north.

4.19 32MOX827

Isolated find 32MOX827 is a Knife River Flint utilized secondary flake with 5 percent cortex and a light patina located on a low hill in gently rolling grasslands. The isolated find was identified by Merjent staff on November 5, 2025. The artifact is situated at the edge of a minimum maintenance farm road and is potentially out of context or disturbed. During survey, the isolated find was discovered near a patch of tumbleweed with 50 to 75 percent GSV at the edge of a harvested canola field. 32MOX827 is on the edge of an active agricultural field which has been cultivated for decades, potentially impacting its integrity of location. The isolated find is immediately adjacent to the right-of-way of a modern road, construction of which may have also impacted integrity of location. The modern road and the surrounding agricultural fields have impacted the setting and feeling of the isolated find. The identified flake cannot be associated with any specific cultural or temporal affiliation and does not exhibit any noteworthy workmanship. Subsurface testing is necessary to assess whether the location has the potential for any buried cultural deposits which could retain aspects of workmanship, materials, design, and association. No shovel tests were conducted. 32MOX827 is not associated with significant events or notable individuals in history, nor does the isolated find embody the distinctive characteristics of a type, period, or method of construction. As such, the isolated find is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.19-1. Isolated find 32MOX827, utilized secondary flake with a light patina.

4.20 32MOX828

Isolated find 32MOX828 consists of two Knife River Flint flakes: one revitalization flake and one tertiary flake. The isolated find was identified by Merjent staff on November 6, 2025. The isolated find is located on a ridge that is slowly eroding into the gate to the road. A revitalization flake is defined as an irregular thinning flake from removing bulk or excess material from a tool. The revitalization flake appears to have been heat treated due to its darker color and more glass-like texture. During survey, the isolated find had 50 percent GSV and was vegetated by grass in a pasture. No shovel tests were conducted. No artifacts were collected. The area surrounding the isolated find has been disturbed by agricultural activities, pasture, and a county road to the east. The ridge has not been disturbed, and the isolated find retains integrity of location, design, materials, and workmanship; however, the isolated find lacks integrity of setting, feeling, and cannot be associated with significant events or individuals. Subsurface testing is necessary to assess whether the isolated find potentially has buried cultural deposits which could retain aspects of workmanship, materials, design, and association. 32MOX828 is not associated with significant events or notable individuals in history, nor does the isolated find embody the distinctive characteristics of a type, period, or method of construction. As such, the isolated find is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.20-1. Isolated find 32MOX828, tertiary flake.

Photo 4.20-2. Isolated find 32MOX828, revitalization flake.

Photo 4.20-3. Isolated find 32MOX828 overview, facing west.

4.21 32MOX829

Isolated find 32MOX829 consists of a single Knife River Flint secondary flake with cortex on one side and patination on both sides. The isolated find was identified by Merjent staff on November 13, 2025. The isolated find is located in a flax field on a hill overlooking a drainage. During the survey, the isolated find was situated in flax stubble with 25 percent GSV. The isolated find and surrounding area have been subject to decades of agricultural practices including plowing and discing potentially impacting its integrity of location. A transmission line west of the isolated find and the surrounding agricultural fields have impacted the setting and feeling of the isolated find. The identified flake cannot be associated with any specific cultural or temporal affiliation and does not exhibit any noteworthy workmanship. No shovel tests were conducted. 32MOX829 is not associated with significant events or notable individuals in history, nor does the isolated find embody the distinctive characteristics of a type, period, or method of construction. As such, the isolated find is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.21-1. Isolated find 32MOX829, secondary flake with cortex and patina.

Photo 4.21-2. Isolated find 32MOX829 overview, facing west.

4.22 32MOX830

Isolated find 32MOX830 consists of a single Knife River Flint secondary flake. The isolated find was identified by Merjent staff on November 15, 2025. The isolated find is located in an agricultural field on an upland plain. The flake has 5 percent cortex remaining with a possible retouch on the lateral margin. During survey, the agricultural field was harvested with flax stubble remaining, resulting in 25 percent GSV. The isolated find was identified in an active agriculture field and has been subject to decades of agricultural practices such as plowing and discing, potentially impacting its location and integrity. Modern roads, a powerline, and agricultural fields impact the setting and feeling of the isolated find. The flake cannot be associated with a specific culture or temporal affiliation and does not exhibit any noteworthy workmanship. No shovel tests were conducted. Subsurface testing is necessary to assess whether the isolated find potentially has buried cultural deposits which could retain aspects of workmanship, materials, design, and association. 32MOX830 is not associated with significant events or notable individuals in history, nor does the isolated find embody the distinctive characteristics of a type, period, or method of construction. As such, the isolated find is not recommended as eligible for the NDSHSR under Criteria 1 and 2. Since no subsurface testing was conducted, nor was there integrity of form, materials, and setting that would include physical features, location, or surroundings (Criteria 3 and 4), subsurface testing may yield additional information that could be used to determine whether the location contains significant, intact buried cultural deposits that could yield information important to our understanding of the past (Criterion 3). The site is not evaluated for the NDSHSR. Merjent recommends avoidance or further work.

Photo 4.22-1. Isolated find 32MOX830, secondary flake with possible retouch.

Photo 4.22-2. Isolated find 32MOX830 overview, facing north.

5.0 SUMMARY AND RECOMMENDATIONS

This addendum includes the results of subsequent Class III investigations encompassing 2,974.79 additional acres within an expanded Survey Area, which was surveyed from October 21 to November 15, 2025, in Morton County. During the current survey, 19 new archaeological resources were identified, and 3 previously recorded resources (32MOX0132, 32MO0233, and 32MOX0576) were revisited. The sites, NDSHSR recommendations, and treatment are summarized in Table 5.0-1.

TABLE 5.0-1

Class III Survey Results and Recommendations

Site No.	Cultural Affiliation	Resource	Site Type	NDSHSR Recommendation	Treatment
32MOX132	Historic	Site Lead	Camp Site	Unevaluated	No Further Work for the project in the surveyed area
32MO233	Historic	Site	Stagecoach Line	Unevaluated	No Further Work for the project in the surveyed area
32MOX576	Precontact	IF	Chipped Stone	Not Eligible	No Further Work
32MO1734	Precontact	Site	Cairn	Unevaluated	Avoidance or further work
32MO1735	Precontact	Site	Cairn	Unevaluated	Avoidance or further work
32MO1736	Precontact	Site	Lithic Scatter	Unevaluated	Avoidance of further work
32MO1737	Precontact	Site	Chipped Stone	Unevaluated	Avoidance or further work
32MO1738	Historic	Site	Cultural Material Scatter	Unevaluated	Avoidance of further work
32MO1739	Precontact	Site	Cairn	Unevaluated	Avoidance of further work
32MO1740	Multi-component	Site	Farm	Unevaluated	Avoidance of further work
32MOX819	Precontact	IF	Chipped Stone	Unevaluated	Avoidance or further work
32MOX820	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work
32MOX821	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work
32MOX822	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work
32MOX823	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work
32MOX824	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work
32MOX825	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work
32MOX826	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work
32MOX827	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work
32MOX828	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work
32MOX829	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work
32MOX830	Precontact	IF	Chipped Stone	Unevaluated	Avoidance of further work

During the survey, a total of 22 resources were either newly recorded or revisited. Three previously recorded resources (32MOX0132, 32MO0233, and 32MOX0576) were revisited. The three revisited sites consist of a historic camp site lead, a stagecoach line, and a precontact isolated find. The campsite and stagecoach line were not located in the Survey Area, and no further work is recommended. One isolated find (32MOX0576) is recommended as not eligible for listing in the NDSHSR, and no further work is needed. The remaining 19 resources are unevaluated for the NDSHSR, and avoidance or further work is recommended. Merjent recommends the Project be granted a determination of *no significant sites affected*. No further archaeological work is recommended for the Project as planned.

6.0 REFERENCES CITED

Directory Service Company. 1969. *Morton County, North Dakota Farm & Ranch Directory*. Directory Service Company, Algona, Iowa. Historic Map Works. https://historicmapworks.com/Map/US/666177/Page+063++F+T140N+R87W/Morton+County+1969/North+Dakota/, accessed December 10, 2025.

Directory Service Company. 1976. *Morton, North Dakota Rural Directory*. Directory Service Company, Algona, Iowa. Historic Map Works. https://historicmapworks.com/Map/US/666245/Page+063++F+T140N+R87W/Morton+County+1976/North+Dakota/, accessed December 10, 2025.

General Land Office (GLO). 1909. Serial Patent Number 03001 to Burt S. Kidder. Bureau of Land Management, General Land Office Records. https://glorecords.blm.gov/details/patent/default.aspx?accession=85478&docClass=SER&sid=rpknulfm.fbl, accessed December 22, 2025.

GLO. 1915. Serial Patent Number 03751 to Peter C. Redmann. Bureau of Land Management, General Land Office Records. https://glorecords.blm.gov/details/patent/default.aspx?accession=500374&docClass=SER&sid=yxuvr3ek.f3s#patentDetailsTabIndex=0, accessed December 11, 2025.

Geo. A. Ogle & Co. 1917. *Standard Atlas of Morton County North Dakota*. Geo. A Ogle & Co., Chicago, Illinois. Historic Map Works. https://historicmapworks.com/Map/US/501609/Township+140+North+Range+87+West++Page+063/Morton+County+1917/North+Dakota/, accessed December 10, 2025.

Google Earth. 2025. Google Earth Pro [Computer Software]. Google LLC. Available online at https://www.google.com/earth/about/versions/, accessed December 2025

Keiter Directory Company. 1912. *Mandan City and Morton County, N.D. Directory, 1912–1913.* Keiter Directory Company, St. Paul, Minnesota. Ancestry. https://www.ancestry.com/search/collections/2469/records/1045587585?tid=&pid=&queryId=e2c4b78b-9f99-4b56-ab15-698df6877d29&_phsrc=yKy56&_phstart=successSource, accessed December 10, 2025.

Lockhart, Bill. 2006. The Color Purple: Dating Solarized Amethyst Container Glass. *Historical Archaeology* 40(2):45-56.

Lockhart, Bill, and Russ Hoenig. 2018. Owens-Illinois Glass Co. – Part 2: The Bewildering Array of Owens-Illinois Glass Co. Logos and Codes. Electronic document, https://secure-sha.org/bottle/pdffiles/OwensIllinois2018Part2.pdf, accessed December 10, 2025.

Lockhart, Bill, Bill Lindsey, Carol Serr, Pete Schulz, and Beau Schriever. 2021. Glass Manufacturer's Logo Tables. Society for Historical Archaeology. Electronic document, https://secure-sha.org/bottle/makersmarks.htm#makersmarkinglogotable, accessed December 10, 2025.

Moore, Sam. 1998. Whatever Happened to McCormick-Deering? Electronic document, https://www.farmcollector.com/company-history/whatever-happened-to-mccormick-deering/. Accessed December 2025.

NETROnline. 2025. Historic Aerials. Electronic resource, https://www.historicaerials.com/viewer, accessed December 10, 2025.

North Dakota State University Archives. 2025. North Dakota Biography Index. Electronic resource, https://library.ndsu.edu/db/biography/results, accessed December 10, 2025.

Parker, Patricia L. and Thomas King. 1990. *Guidelines for Evaluating and Documenting Traditional Cultural Properties*. National Register Bulletin 38, U.S. National Park Service. Washington, D.C.

Reinhart, Damien and Matt Cox. 2025. *A Class I and Class III Cultural Resources Inventory of the Minnesota Power Longspur Windfarm Project, Morton and Mercer Counties, North Dakota*. Copies available from Merjent, Inc., Minneapolis, Minnesota.

U.S. Census Bureau. 1910a. 1910 Federal Census, Blue Grass, Morton, North Dakota, Roll T624_1144, Page 2b. Ancestry. https://www.ancestry.com/search/collections/7884/records/170267674?tid=&pid=&queryId=92979c2a-068e-42ec-aee8-be630171b223&_phsrc=VkH93&_phstart=successSource, accessed December 11, 2025.

U.S. Census Bureau. 1910b. 1910 Federal Census, Township 140, Morton, North Dakota, Roll T624_1144, Page 12a. Ancestry. https://www.ancestry.com/search/collections/7884/records/20993547?tid=&pid=&queryId=166281d0-9b19-4040-9e98-d13151f3a9cc&_phsrc=yKy60&_phstart=successSource, accessed December 22, 2025.

U.S. Census Bureau. 1950. 1950 Federal Census, Morton, North Dakota, roll 2195, Page 71. Ancestry. https://www.ancestry.com/search/collections/62308/records/7081972?tid=&pid=&queryId=b345140a-2e81-4edb-bcbe-07f0d1063610&_phsrc=VkH121&_phstart=successSource, accessed December 11, 2025.

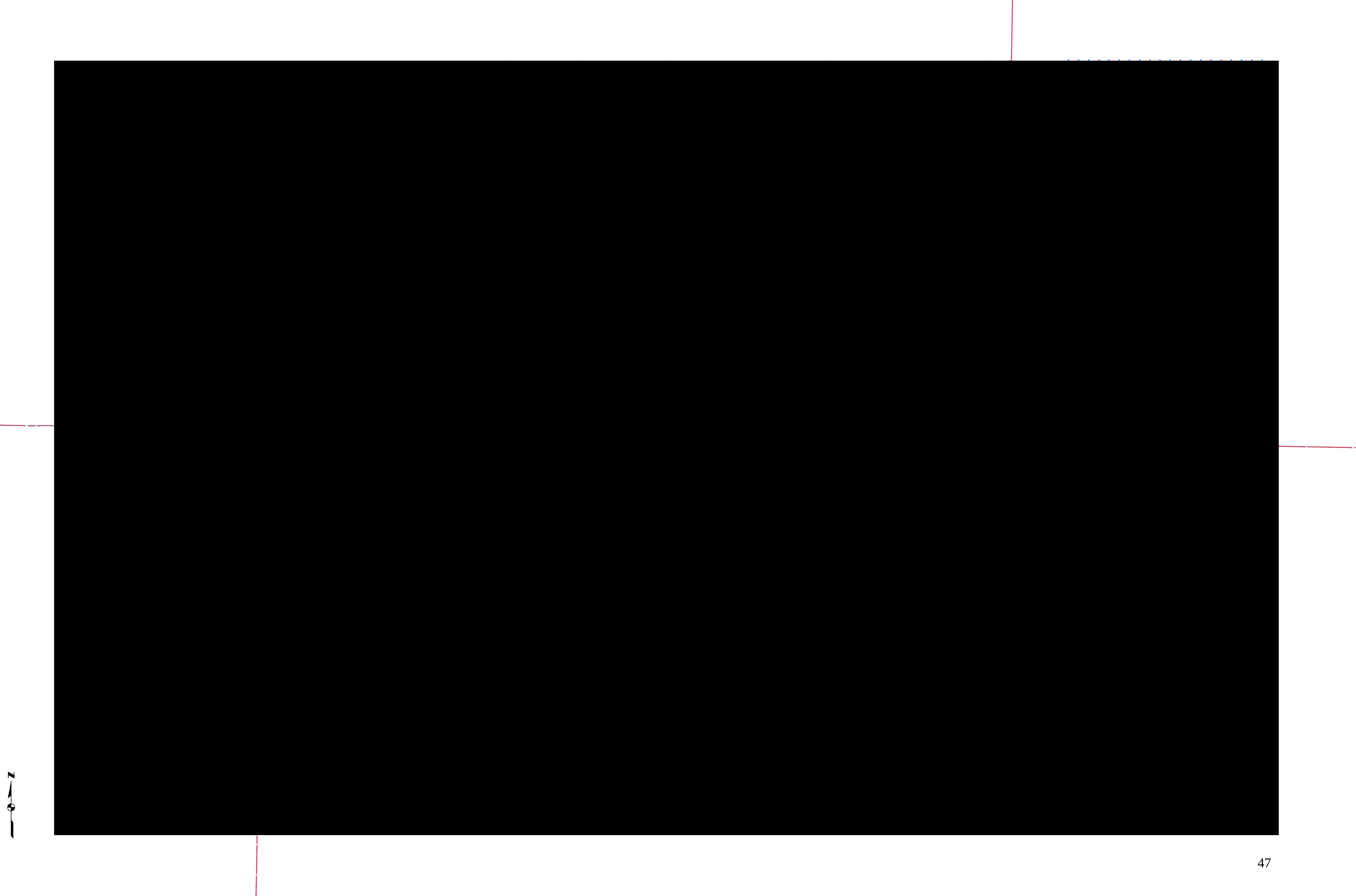
U.S. Geological Survey (USGS). 1958. *Bismarck*. 1:250,000. U.S. Geological Survey, Denver, Colorado. Electronic document, https://ngmdb.usgs.gov/topoview/, accessed December 22, 2025

USGS. 1970. *Hailstone Butte Quadrangle*. 1:24,000. U.S. Geological Survey, Denver, Colorado. Electronic document, https://ngmdb.usgs.gov/topoview/, accessed December 22, 2025

USGS. 2025. TopoView. Electronic resource, https://ngmdb.usgs.gov/topoview/viewer/#15/46.9110/-101.7068, accessed December 10, 2025.

APPENDIX A

Figures



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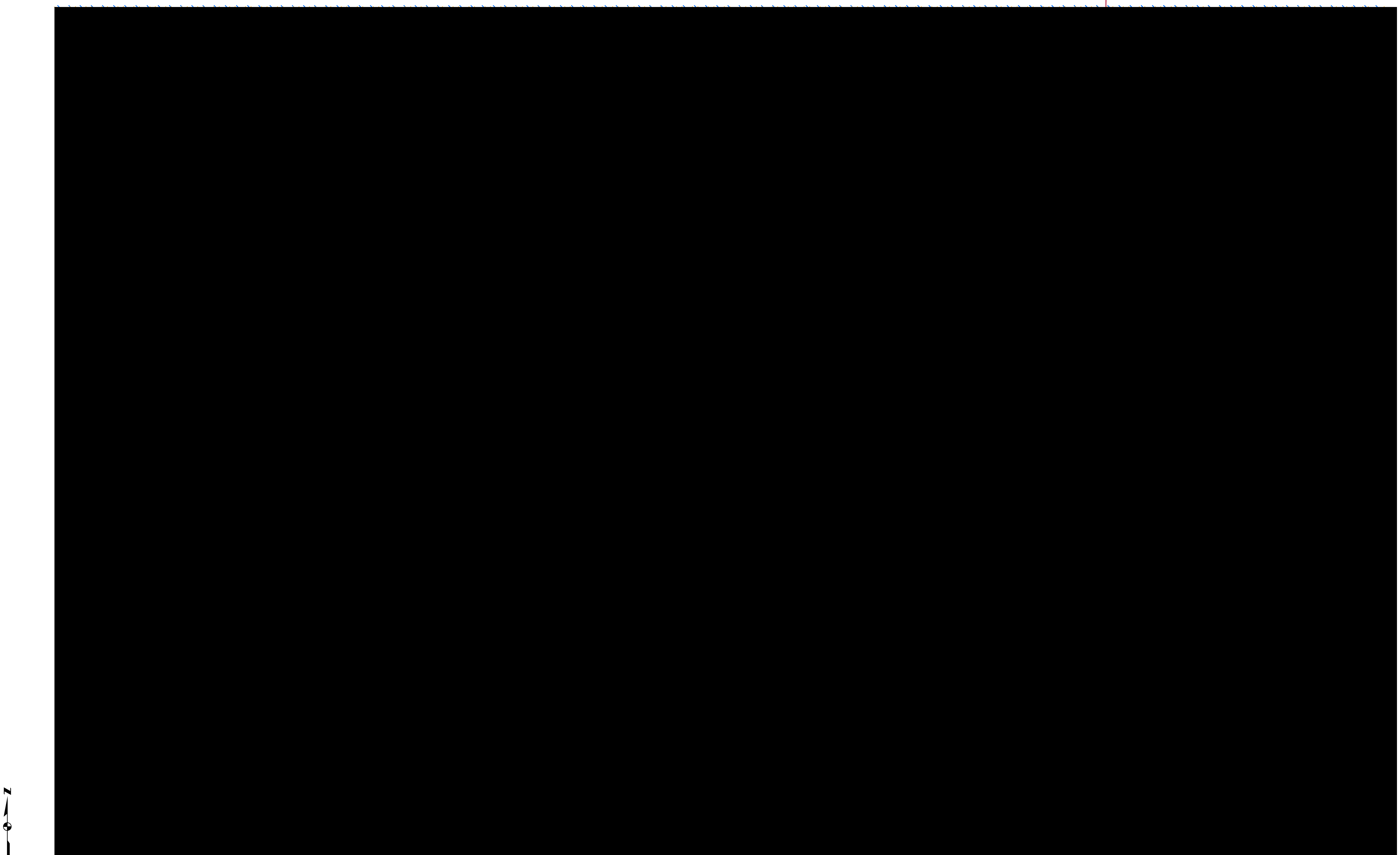

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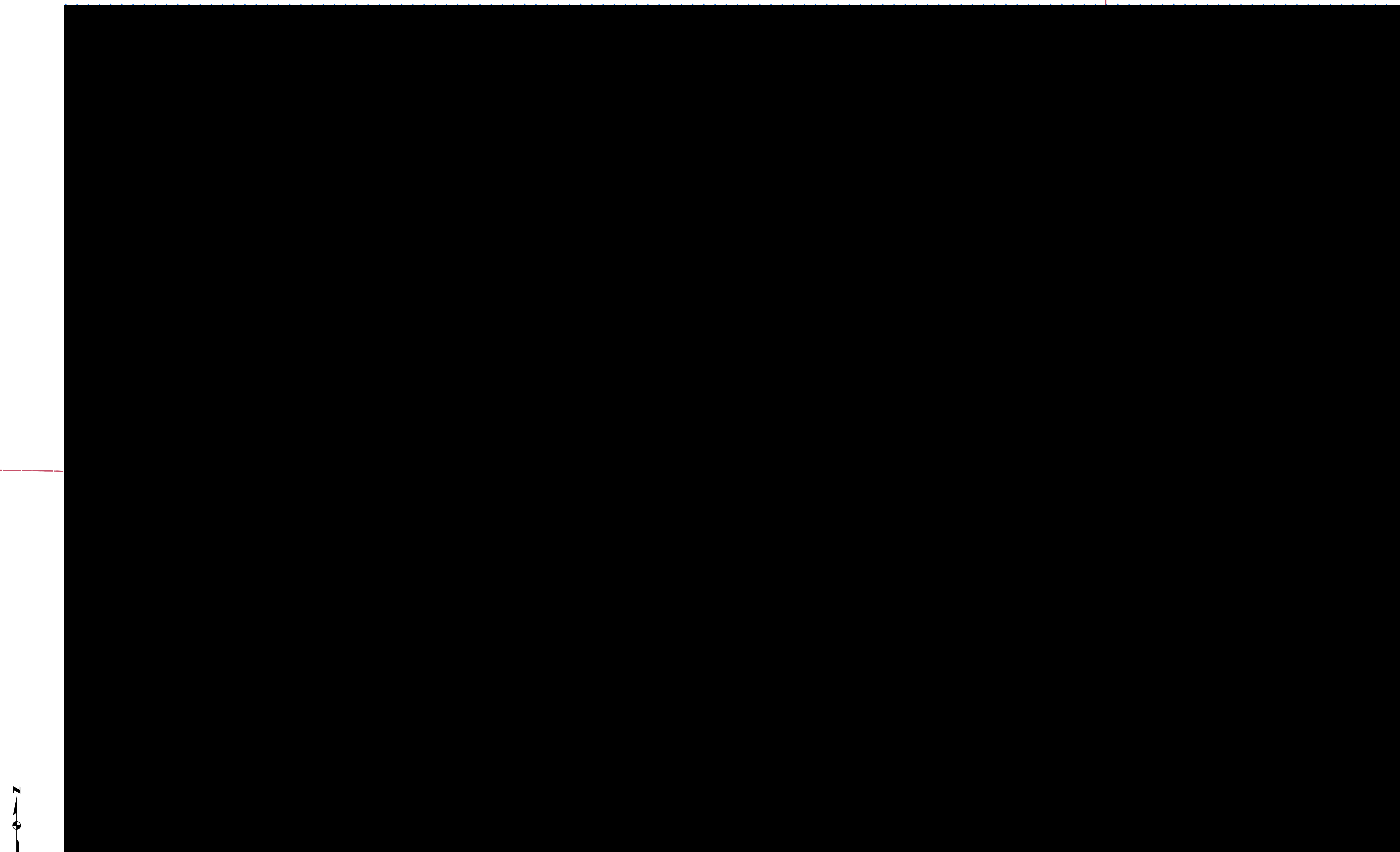

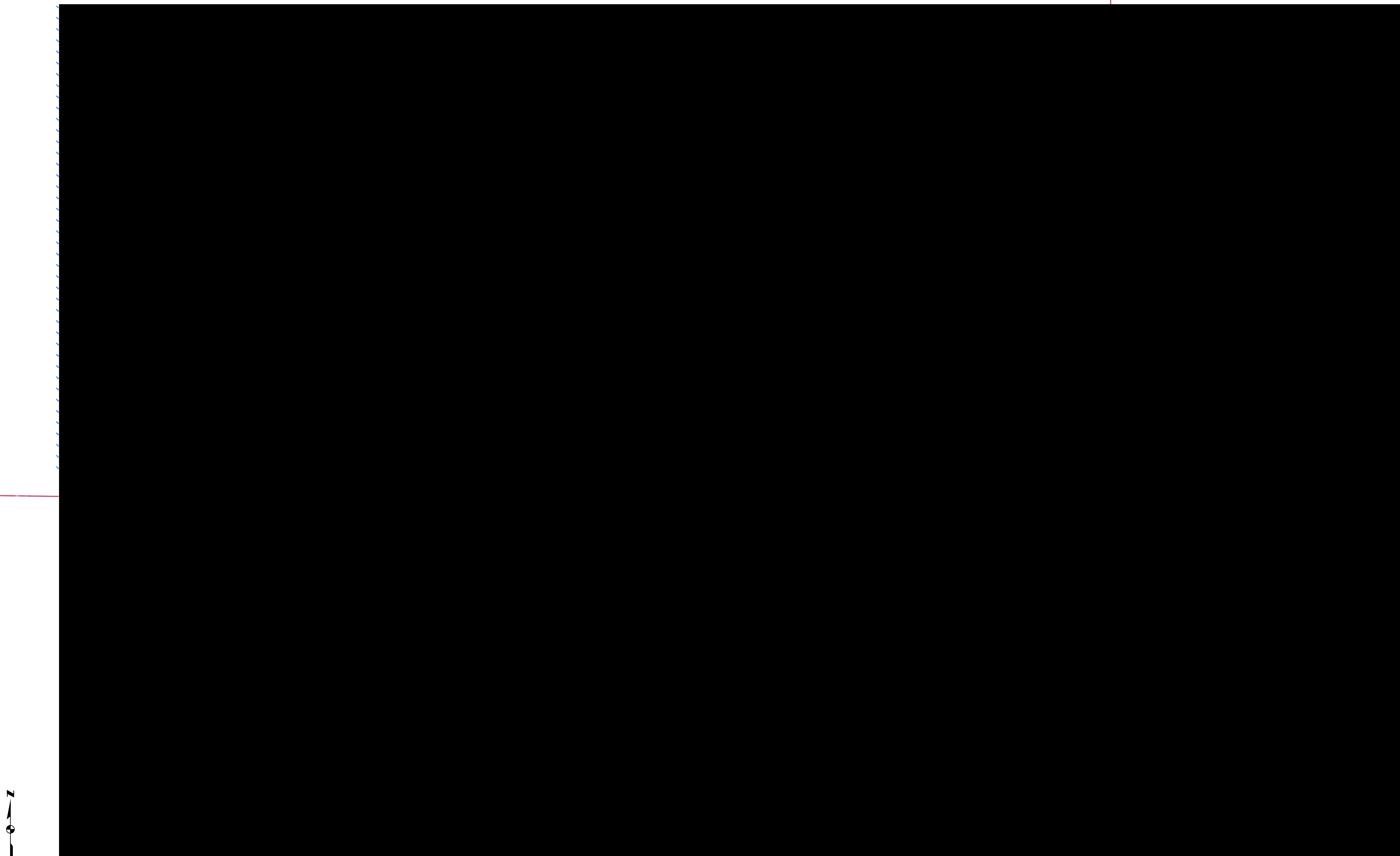

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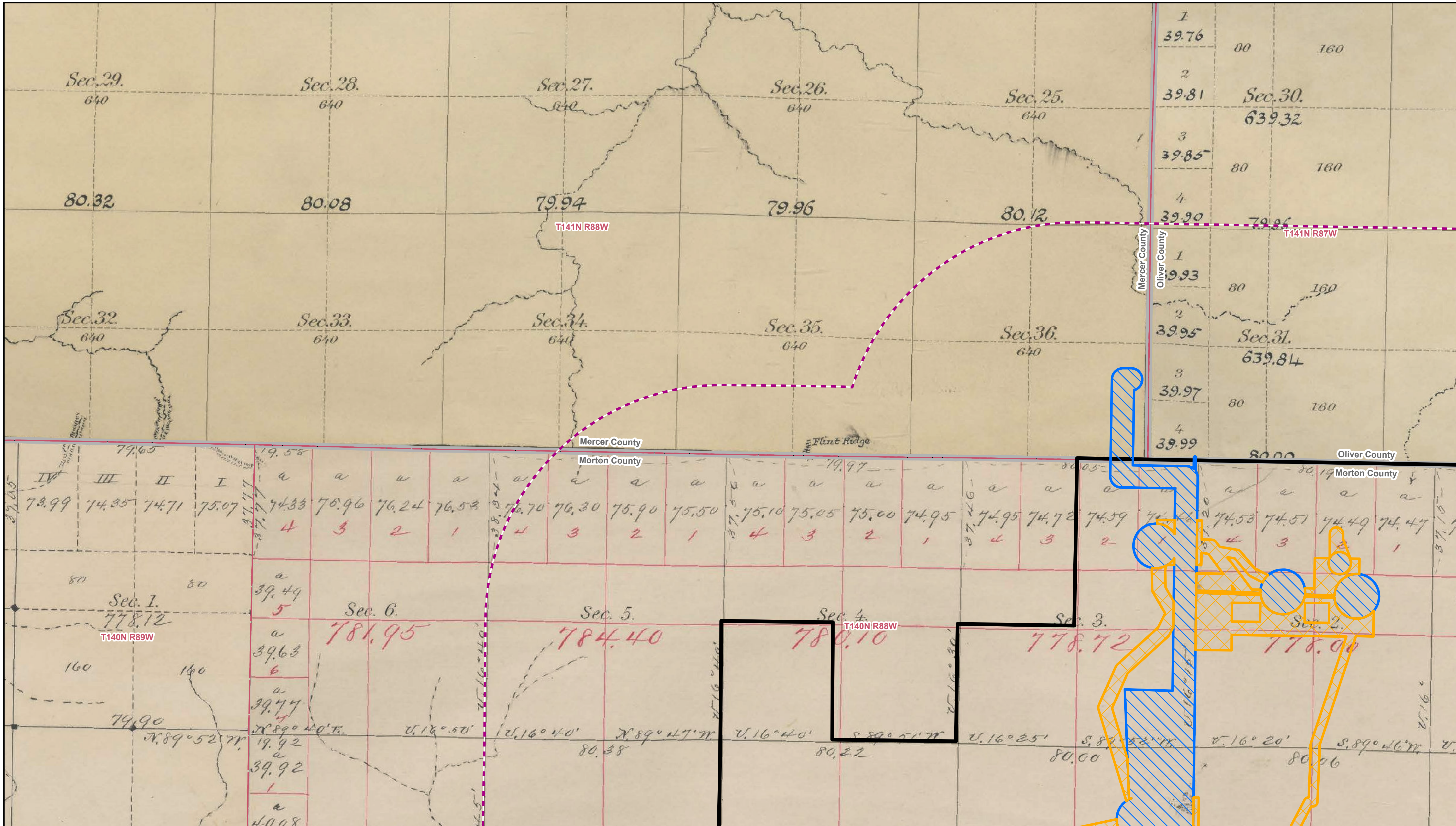

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Canada

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MT

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Figure 2.1: 1880-1883 GLO Map
Minnesota Power
Longspur Wind Project
Mercer, Morton, and Oliver Counties, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Township Boundary
County Boundary

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Do Not Distribute

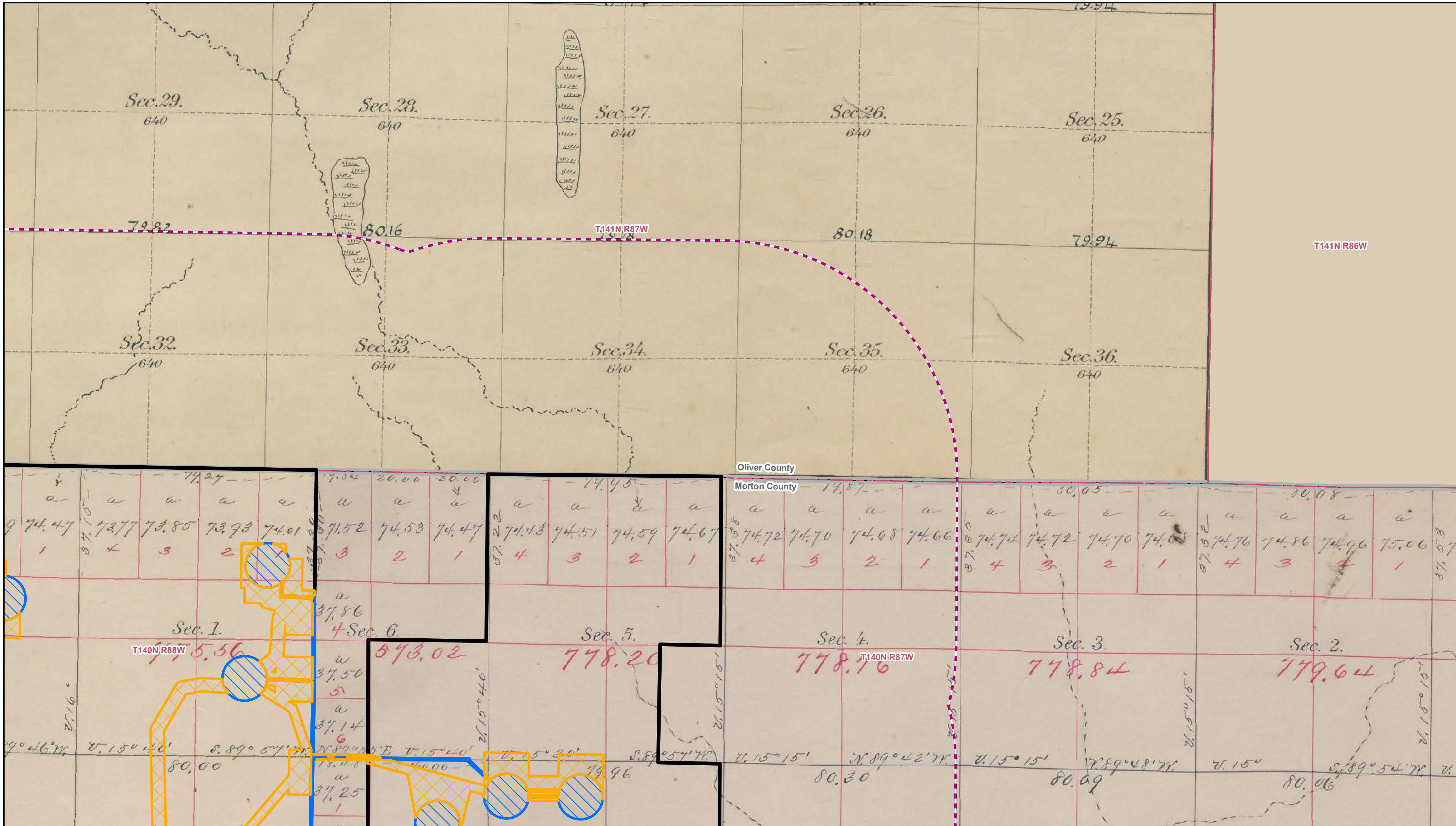

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Figure 2.2: 1880-1883 GLO Map
Minnesota Power
Longspur Wind Project
Morton and Oliver Counties, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Township Boundary
County Boundary

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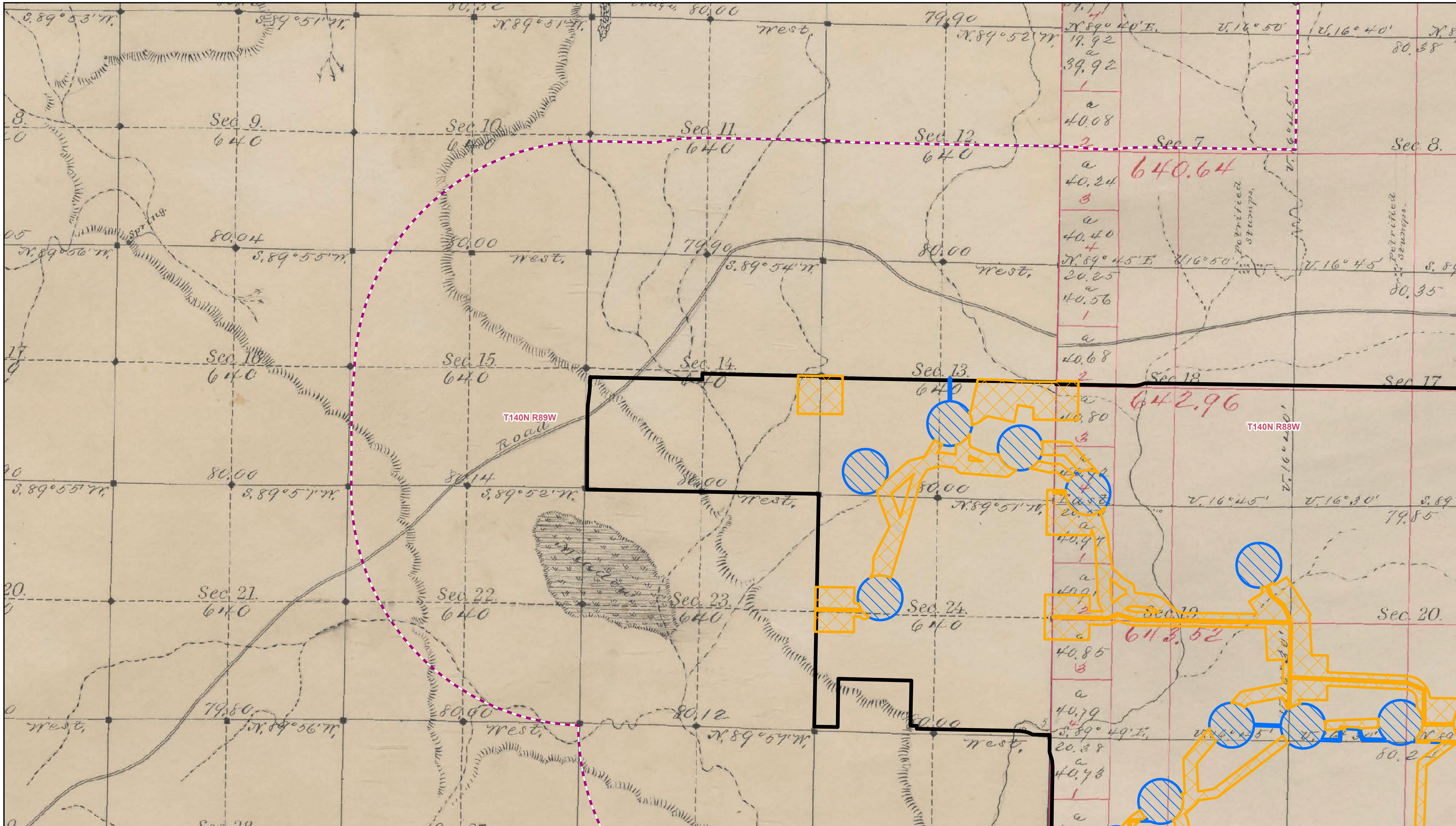

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Figure 2.3: 1880-1883 GLO Map
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

- Project Boundary
- One-Mile Buffer
- Original Merjent Class III Survey Area
- Current Merjent Class III Survey Area
- Township Boundary
- County Boundary

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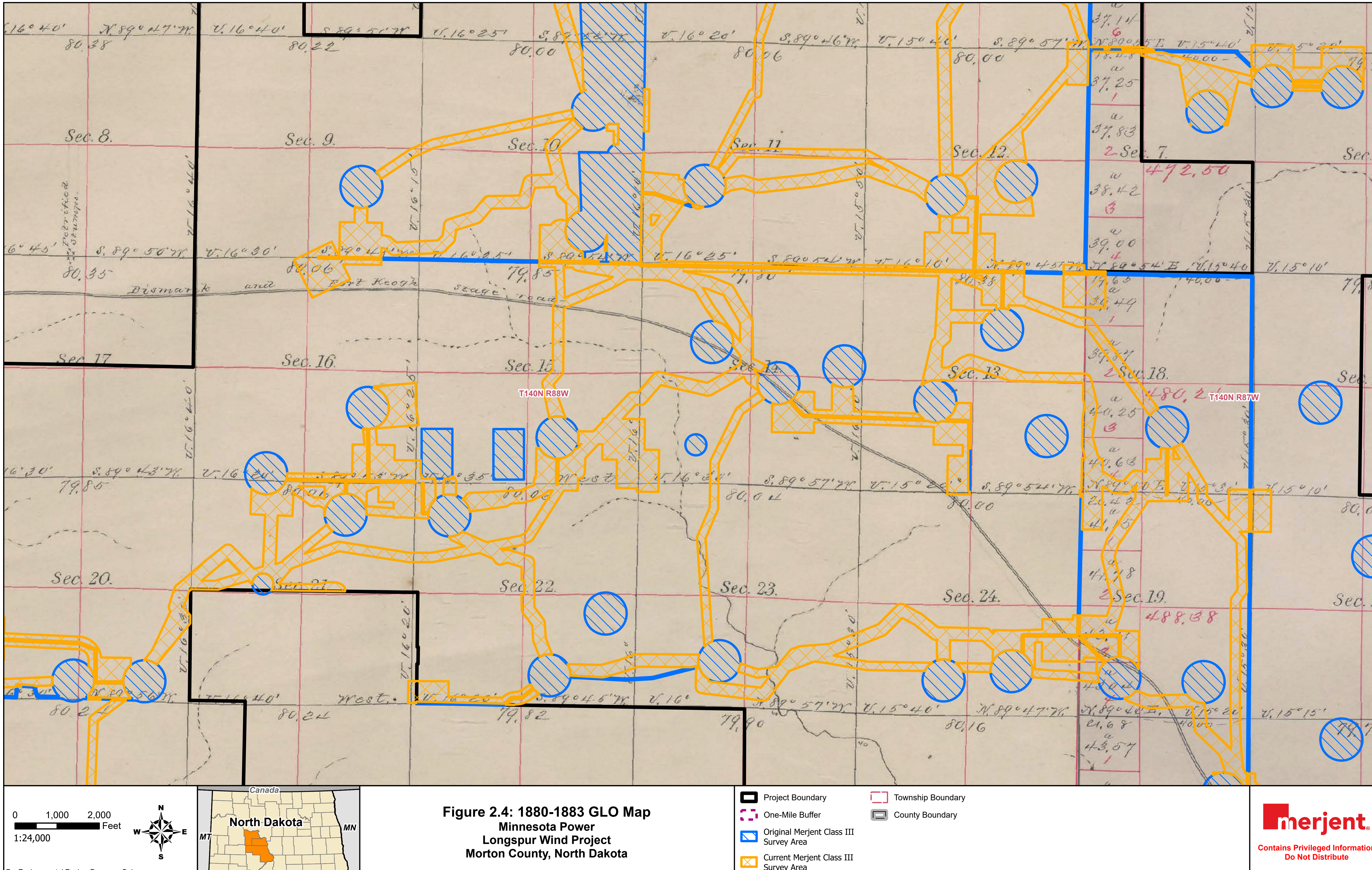

Figure 2.4: 1880-1883 GLO Map
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

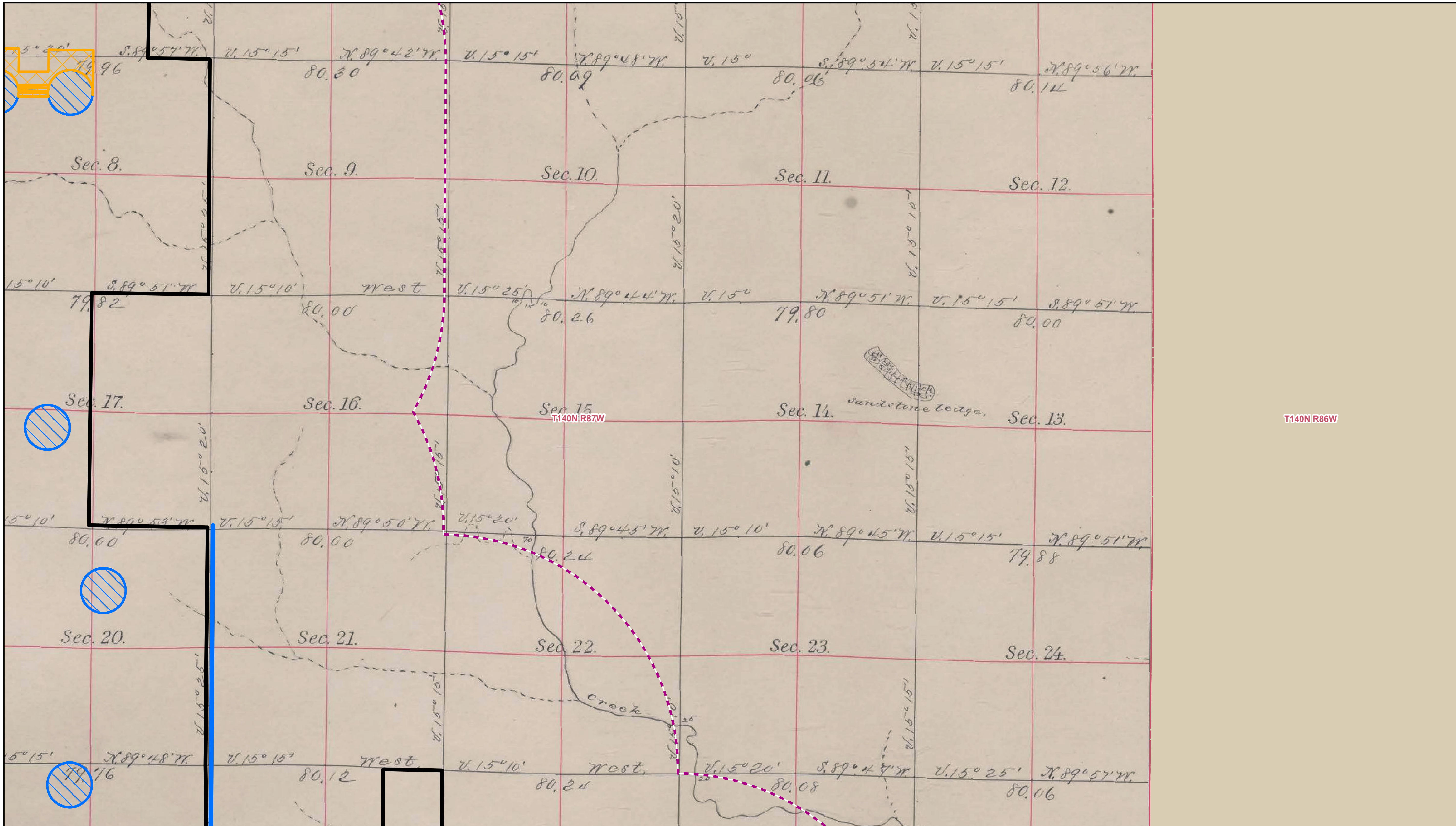

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Figure 2.5: 1880-1883 GLO Map
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Township Boundary
County Boundary

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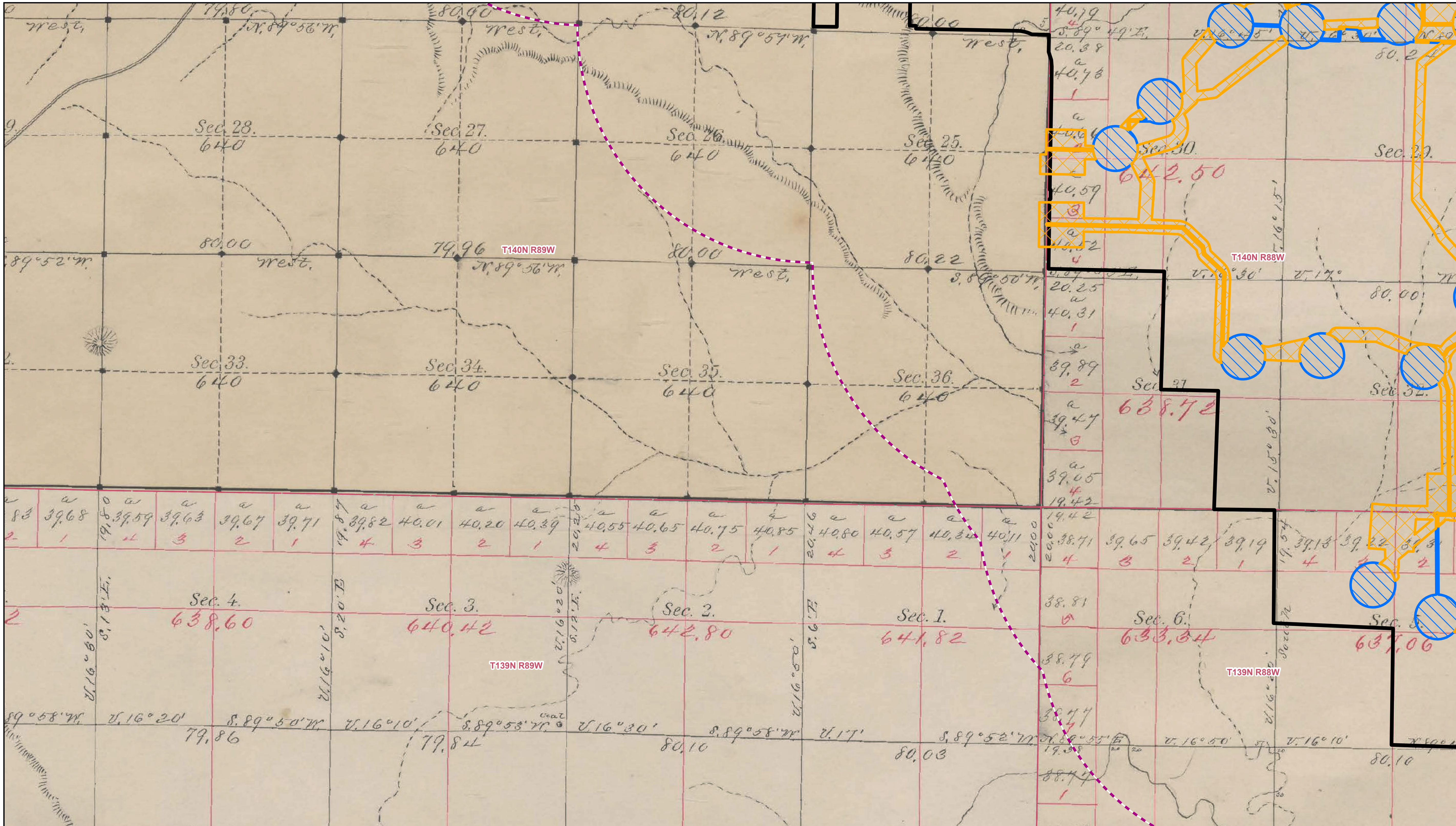

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Figure 2.6: 1880-1883 GLO Map
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Township Boundary
County Boundary

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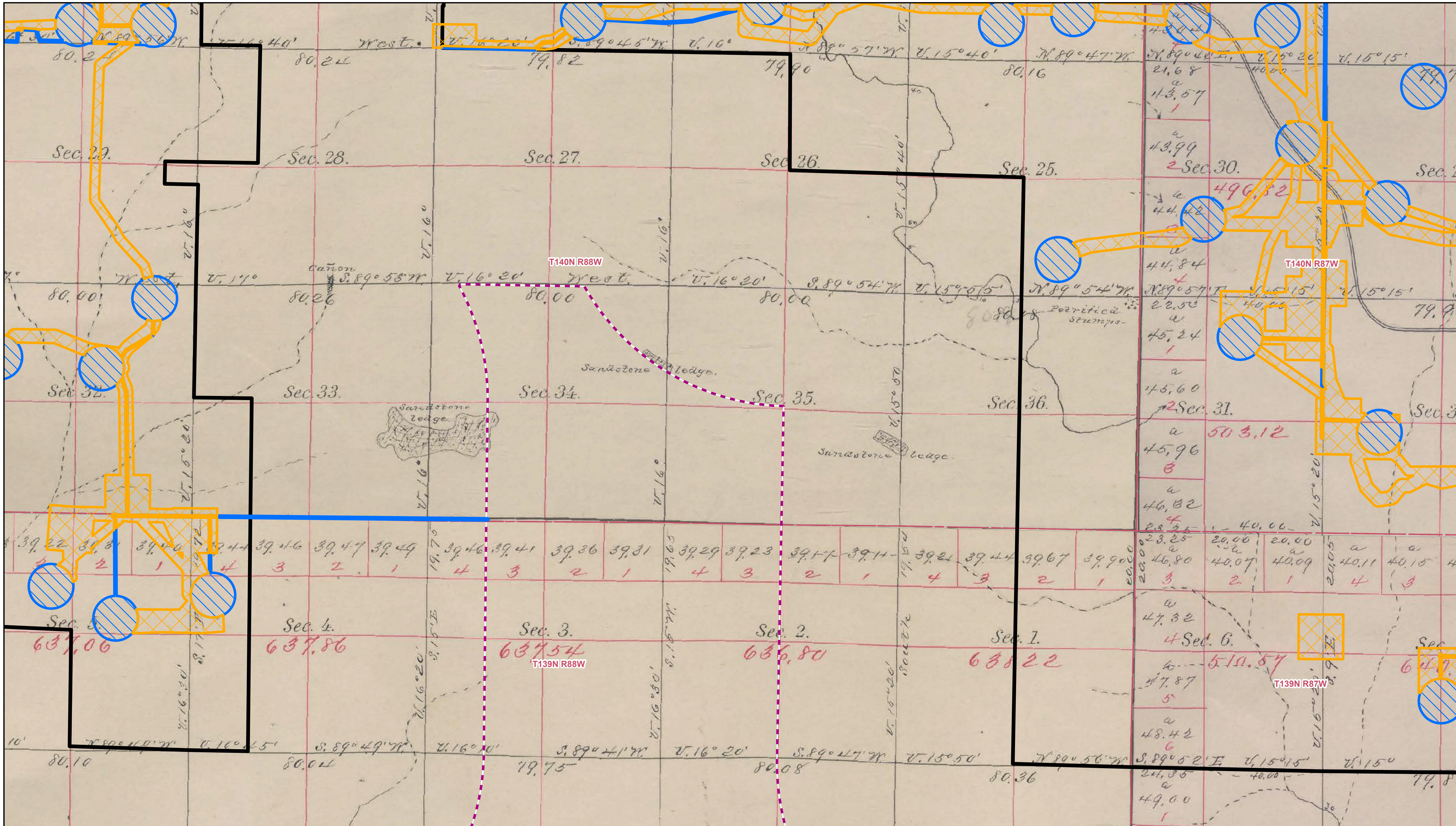

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Figure 2.7: 1880-1883 GLO Map
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Township Boundary
County Boundary

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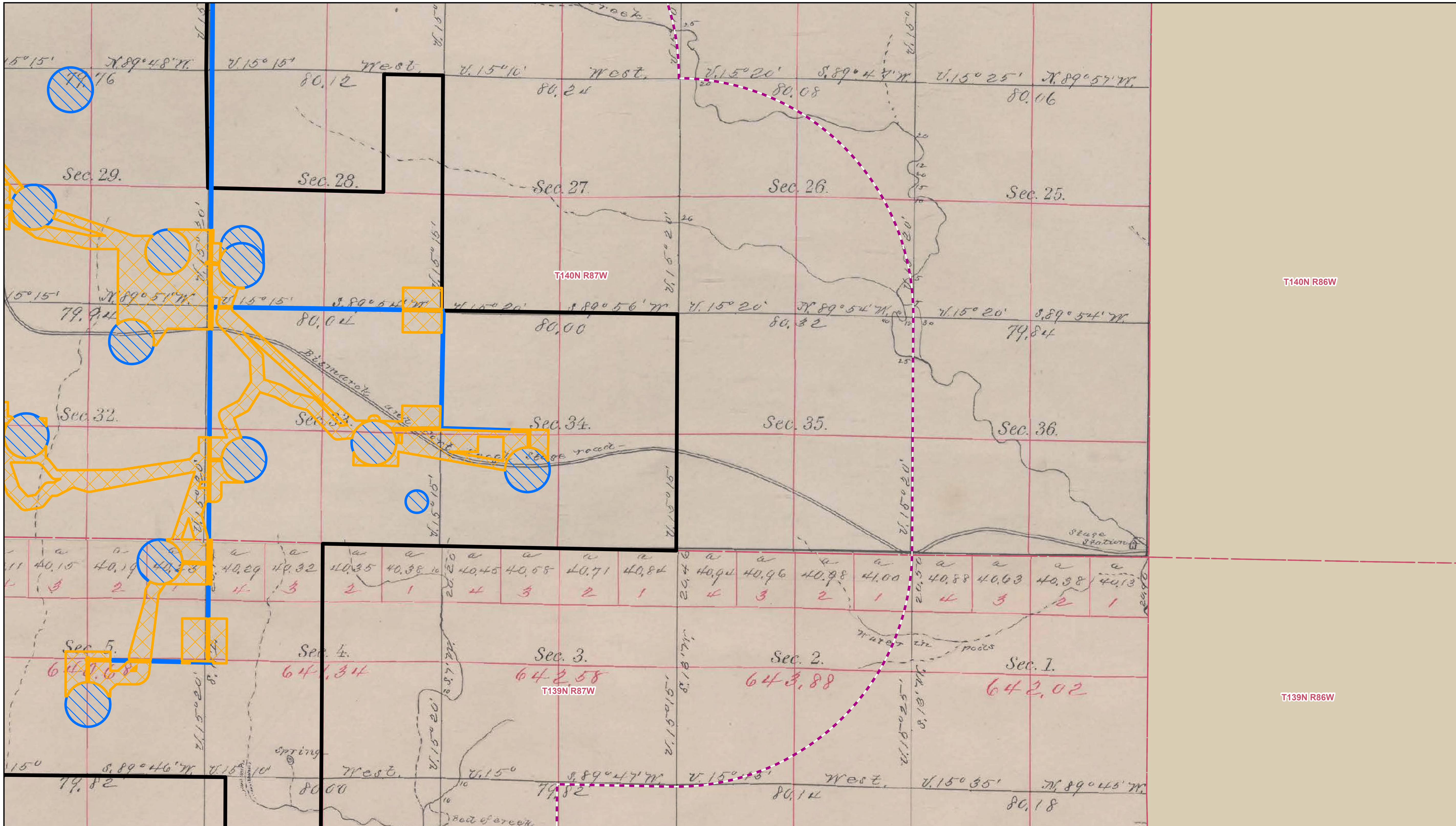

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Figure 2.8: 1880-1883 GLO Map
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Township Boundary
County Boundary

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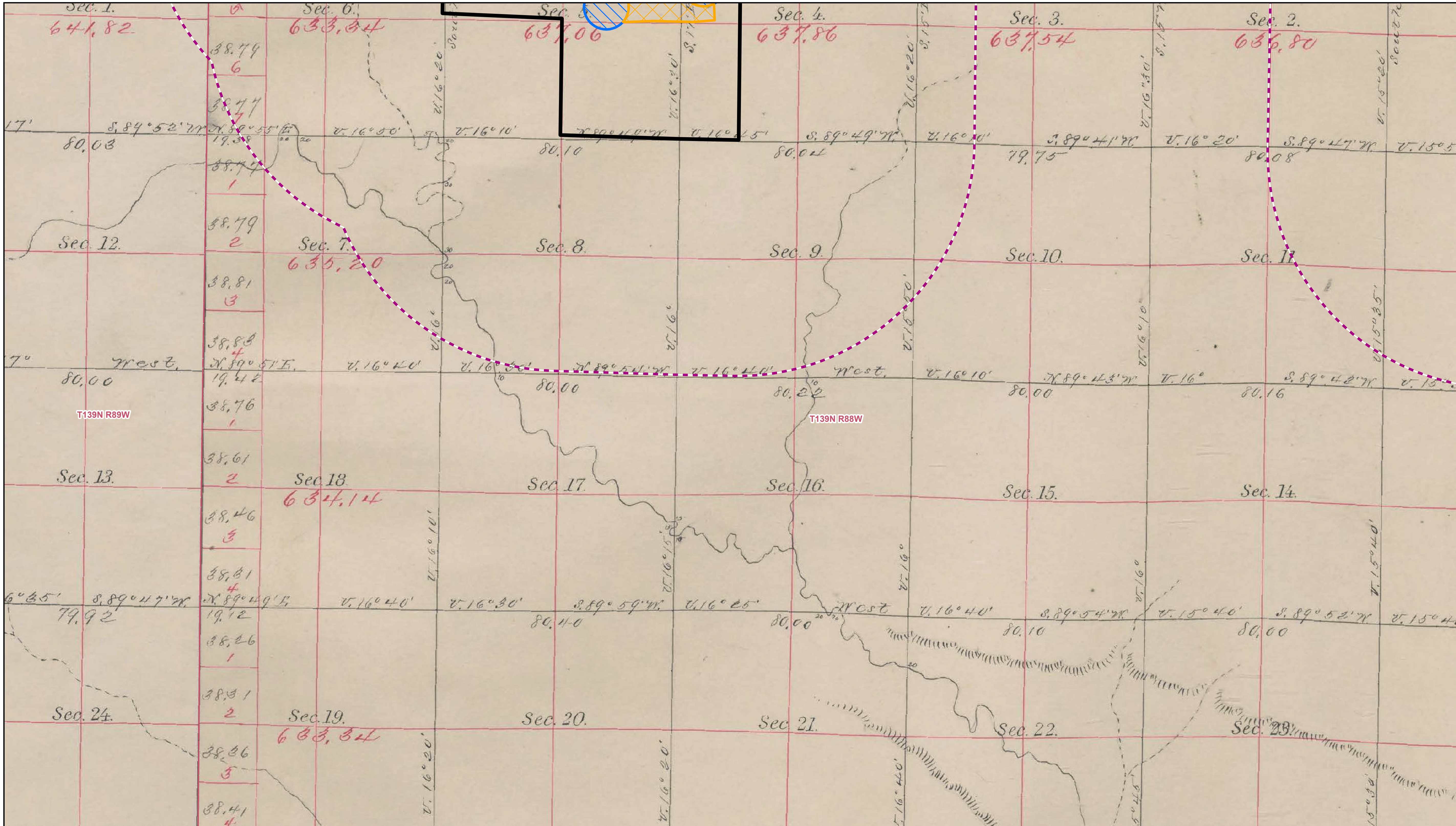

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Figure 2.9: 1880-1883 GLO Map
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Township Boundary
County Boundary

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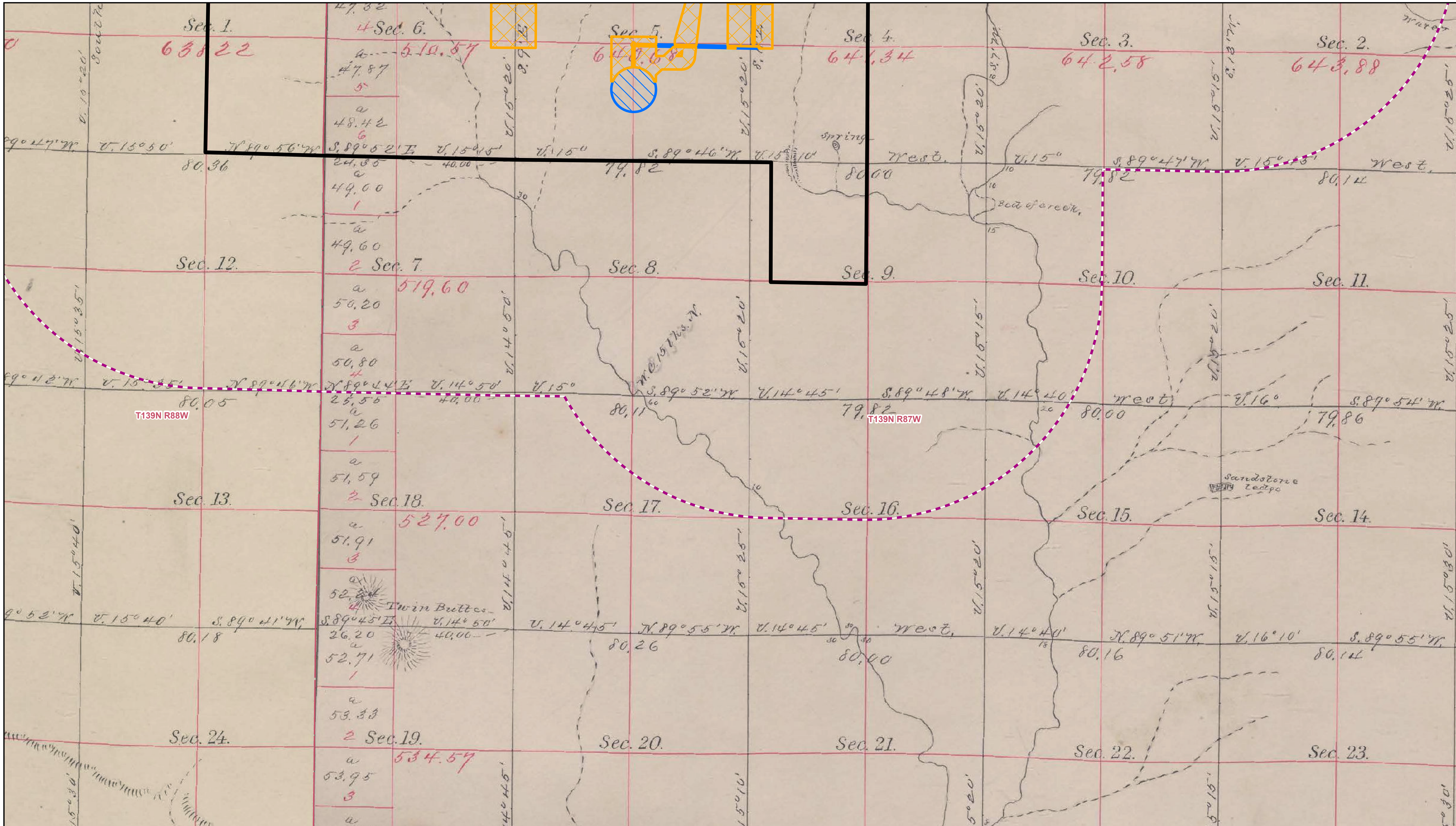

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Figure 2.10: 1880-1883 GLO Map
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

- Project Boundary
- One-Mile Buffer
- Original Merjent Class III Survey Area
- Current Merjent Class III Survey Area
- Township Boundary
- County Boundary

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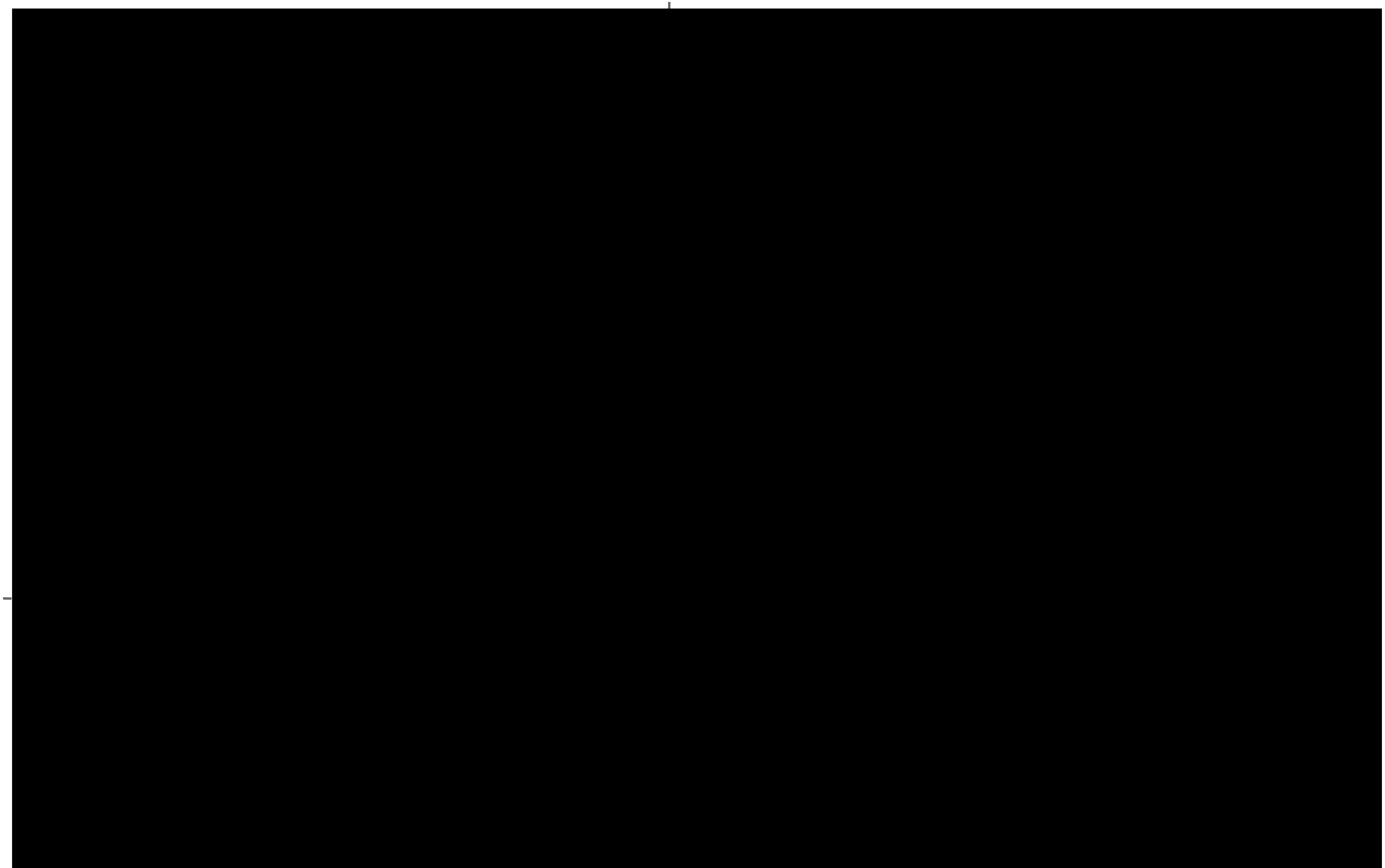

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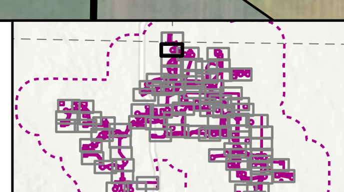

Figure 3.2: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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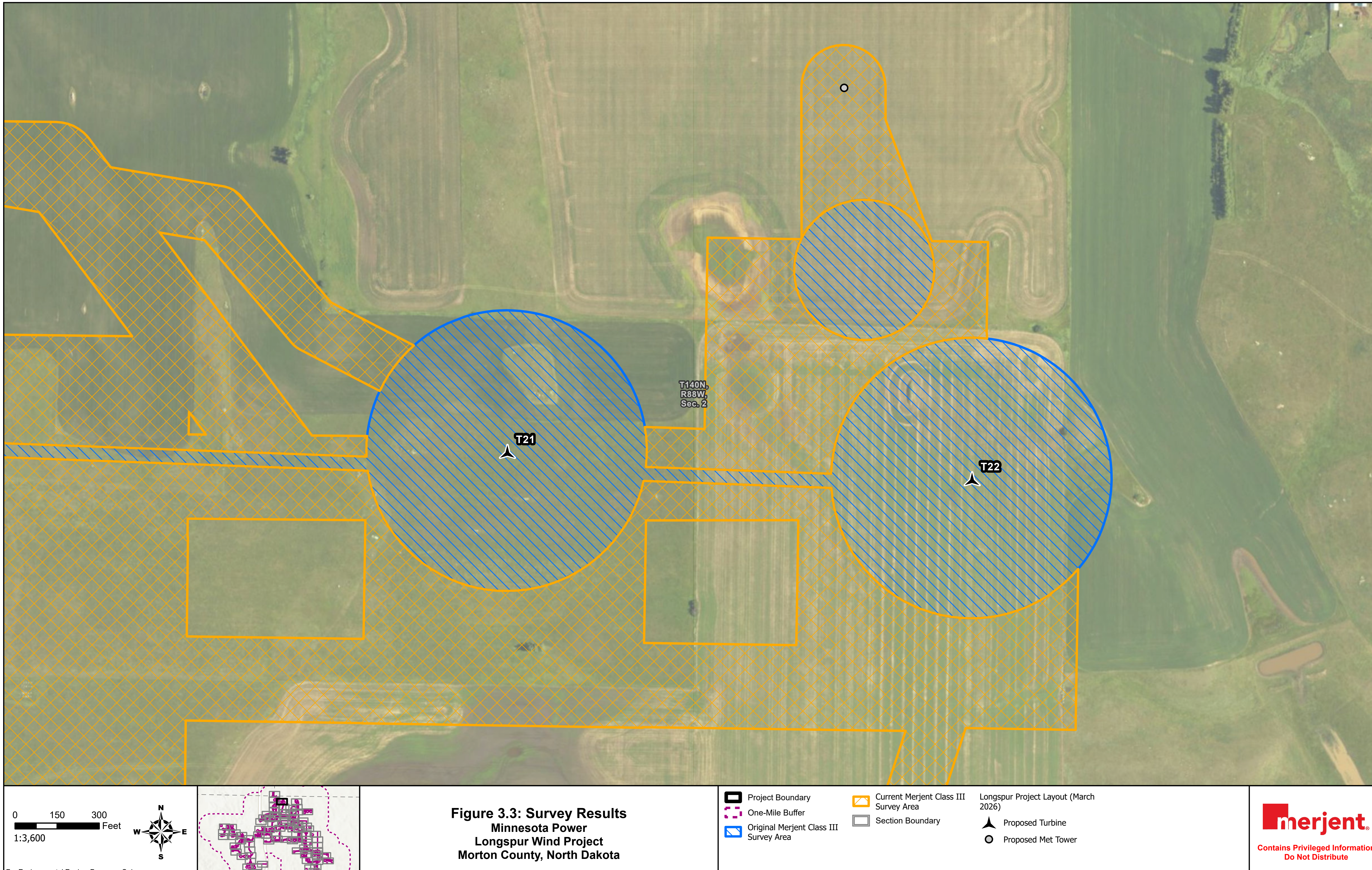

Figure 3.3: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

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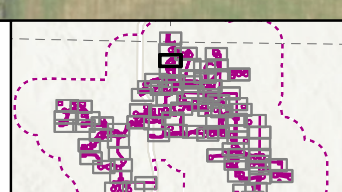

Figure 3.4: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary

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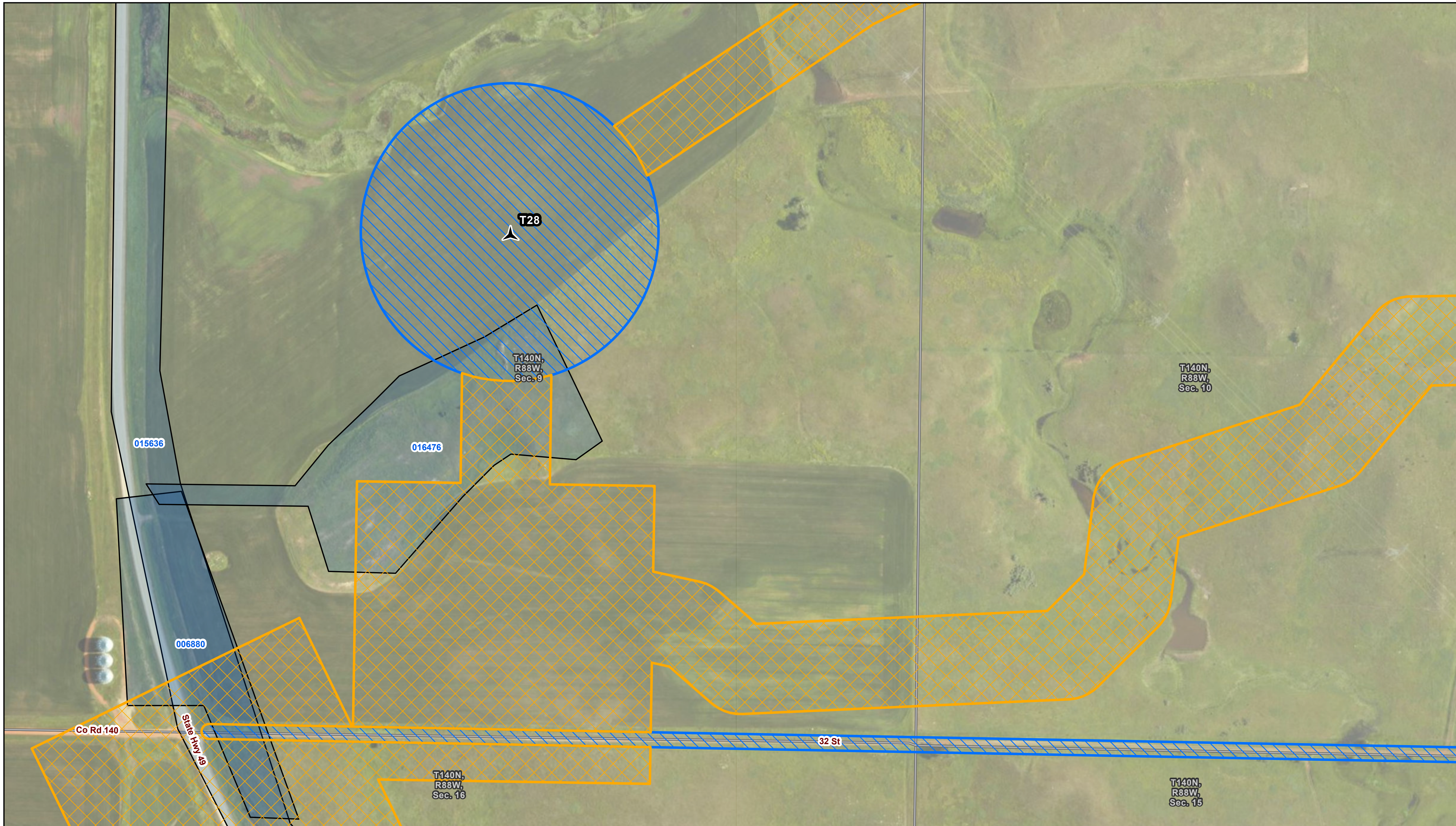

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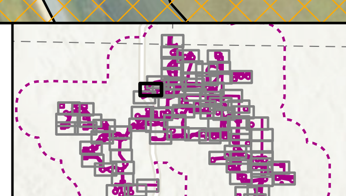

Figure 3.9: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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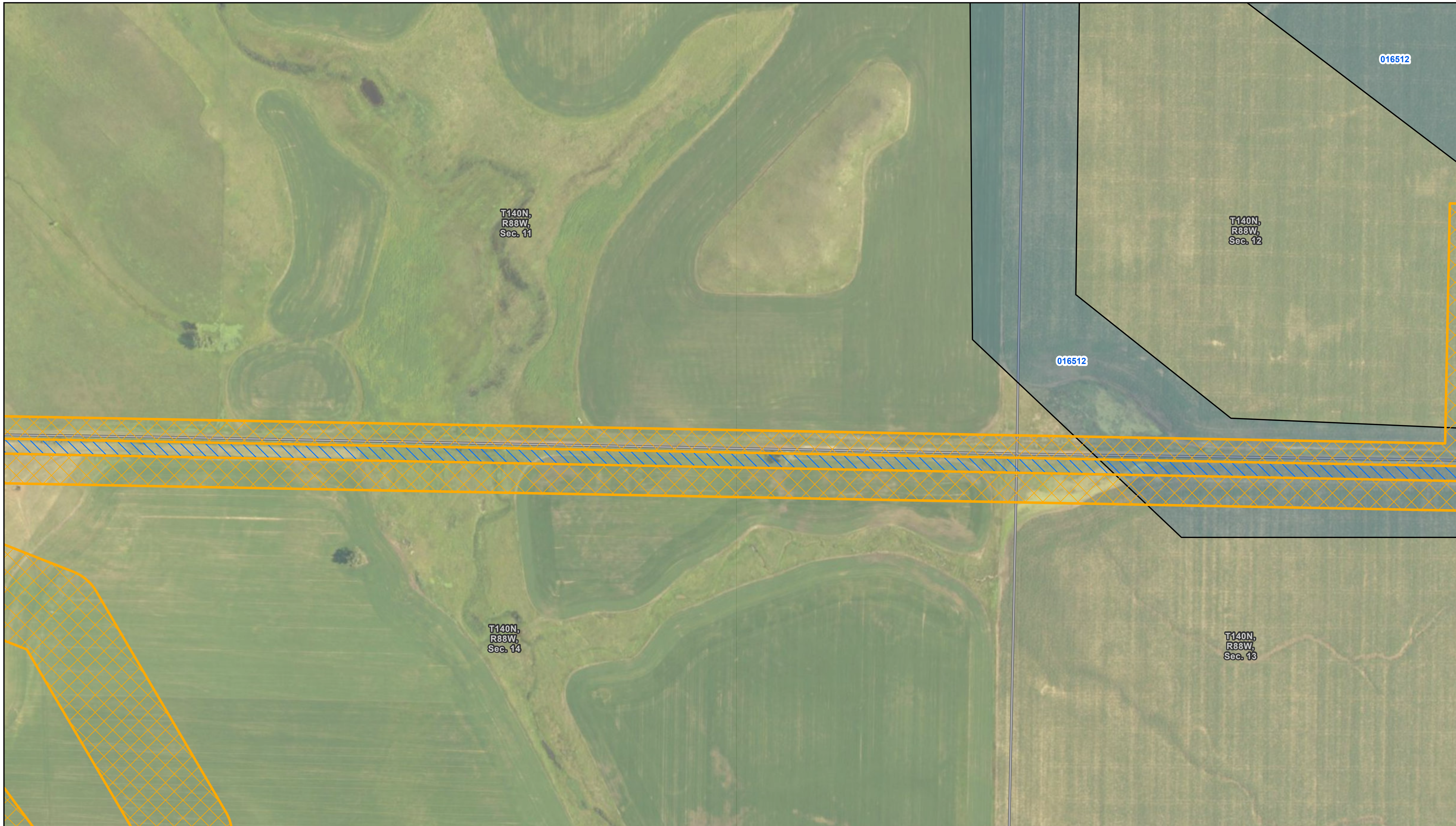

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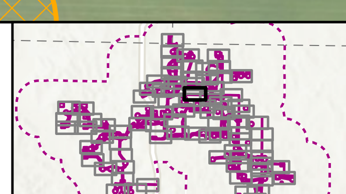

Figure 3.10: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

- Project Boundary
- One-Mile Buffer
- Original Merjent Class III Survey Area
- Current Merjent Class III Survey Area
- Previous Survey
- Section Boundary

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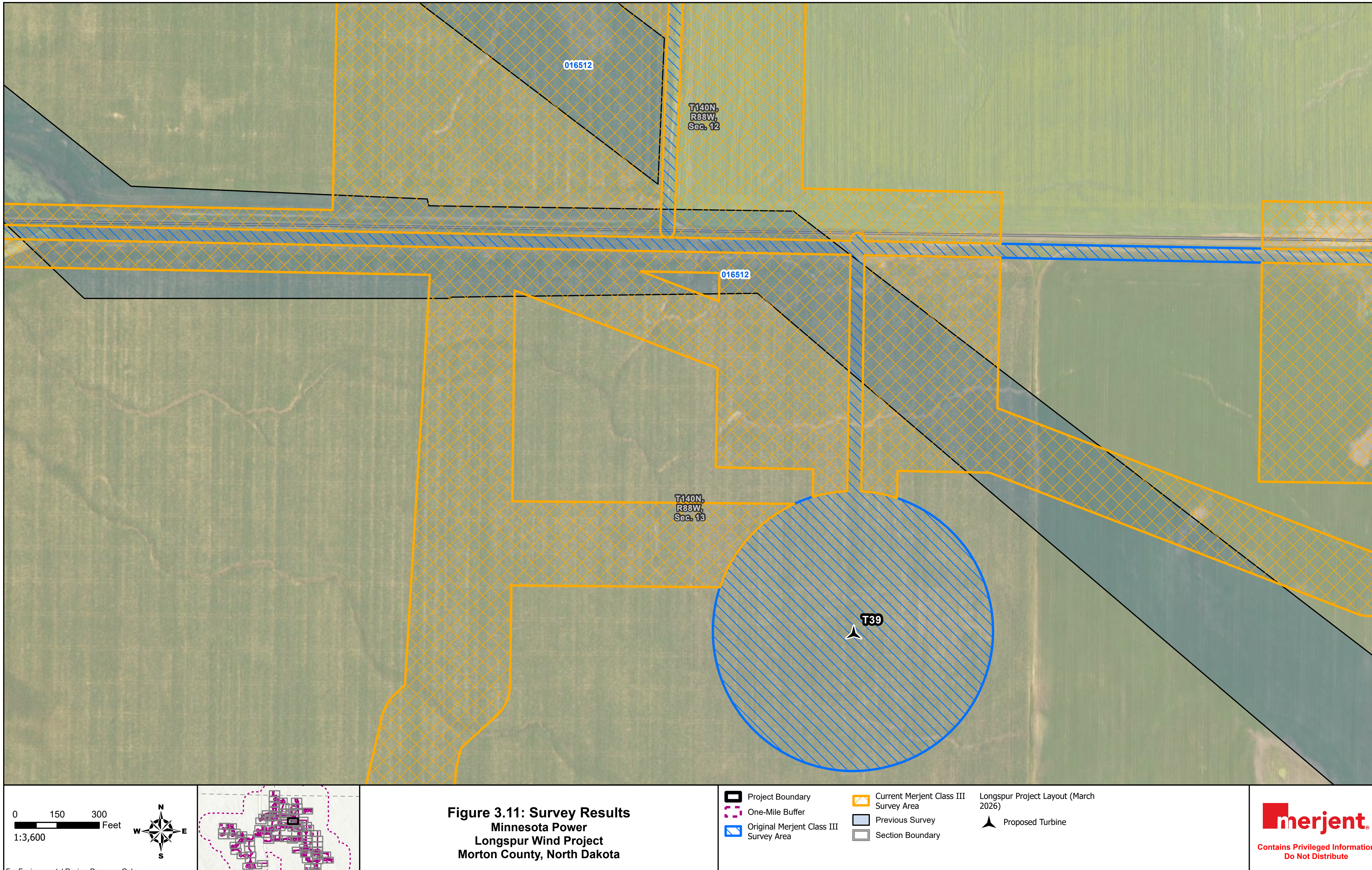

Figure 3.11: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

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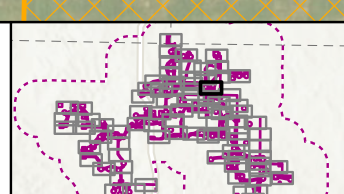

Figure 3.12: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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Figure 3.13: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary

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Figure 3.14: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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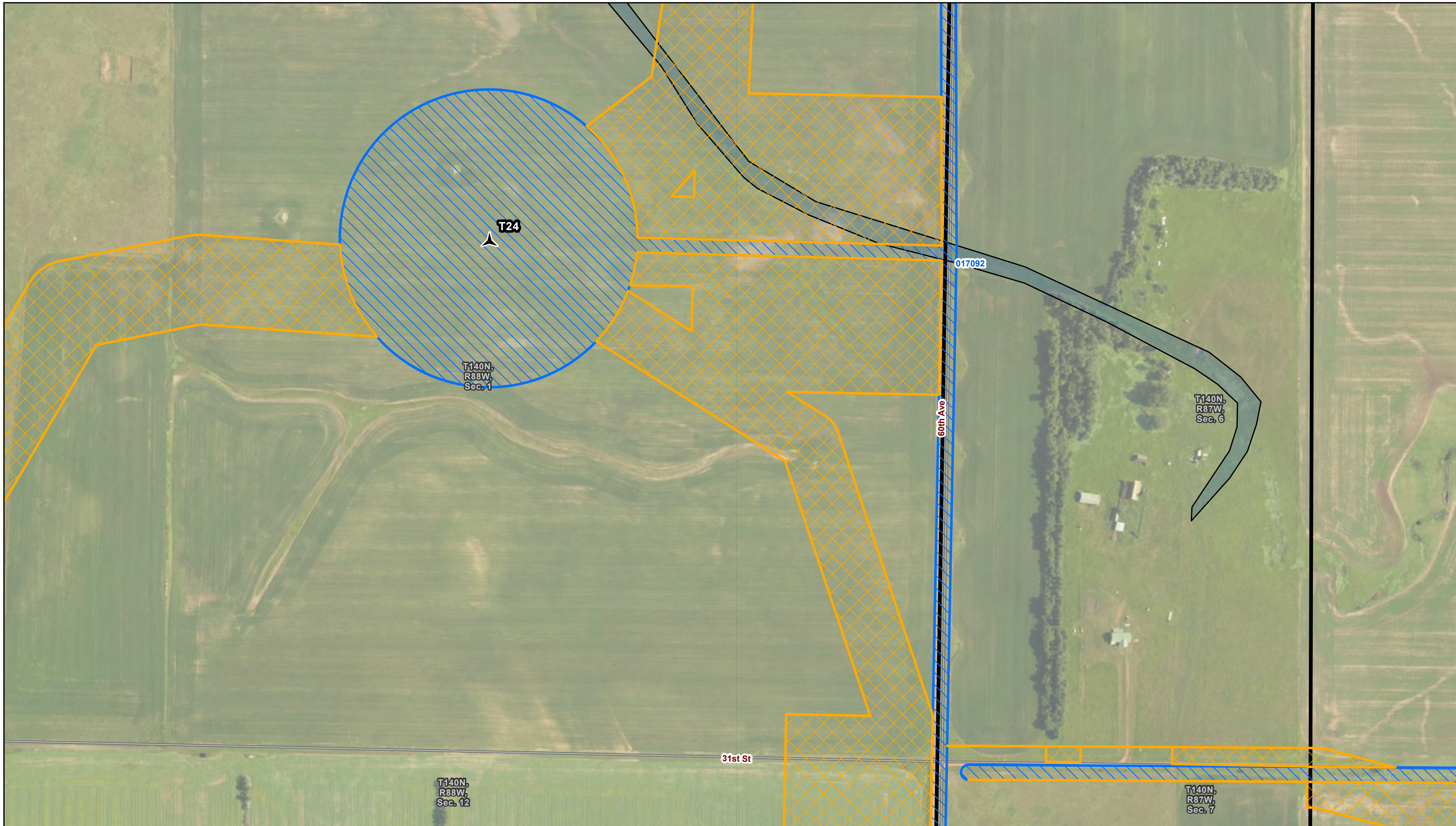

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For Environmental Review Purposes Only

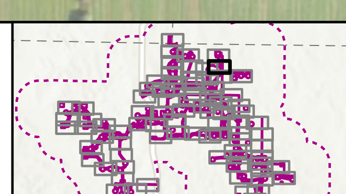

Figure 3.15: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

- Project Boundary
- One-Mile Buffer
- Original Merjent Class III Survey Area
- Current Merjent Class III Survey Area
- Previous Survey
- Section Boundary

Longspur Project Layout (March 2026)
- Proposed Turbine

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For Environmental Review Purposes Only

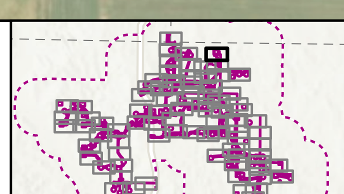

Figure 3.16: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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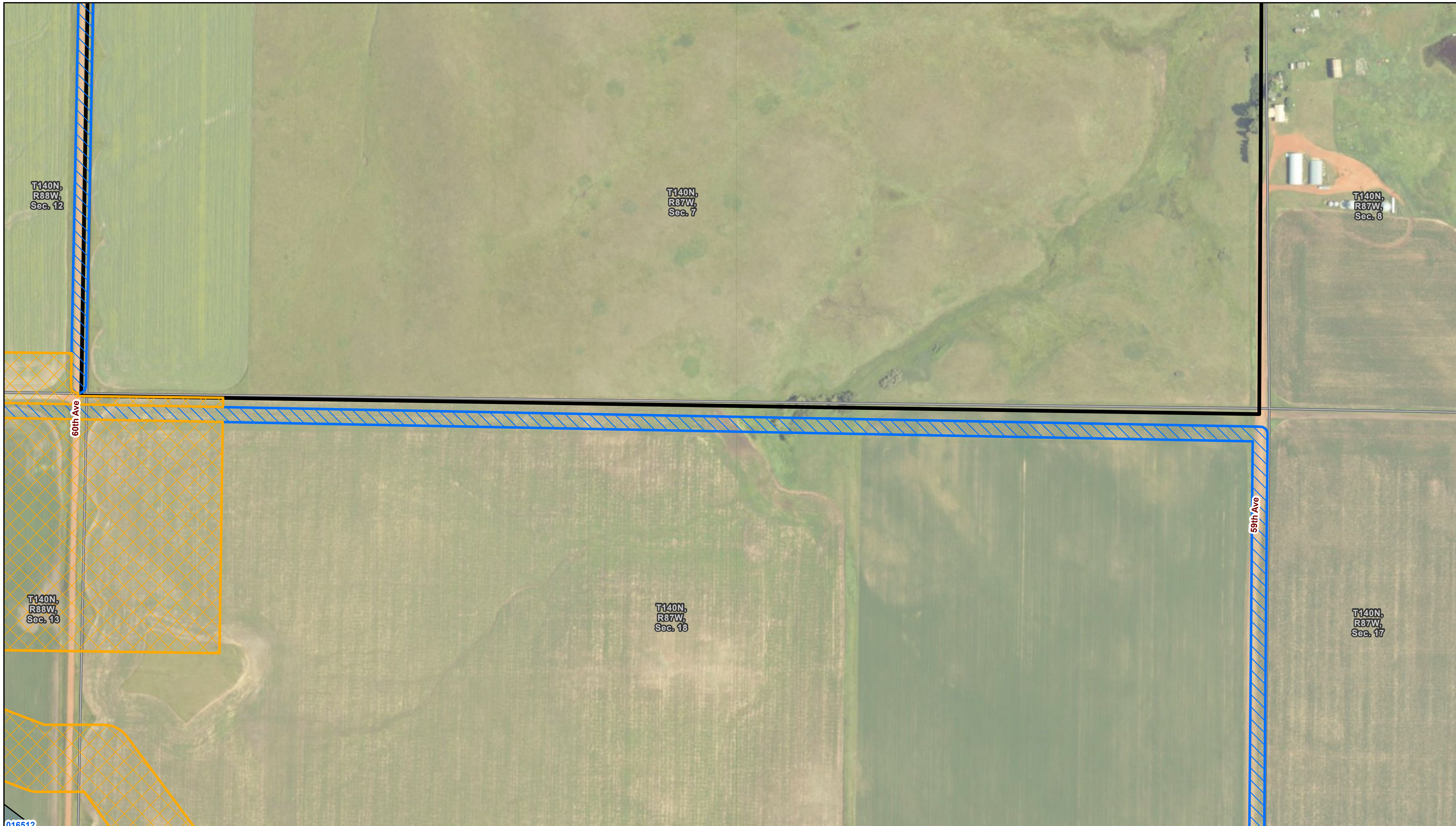

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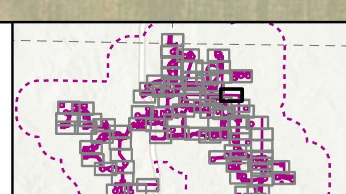

Figure 3.17: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary

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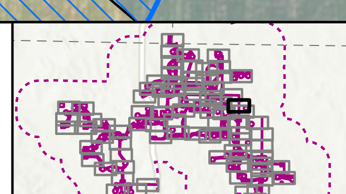

Figure 3.18: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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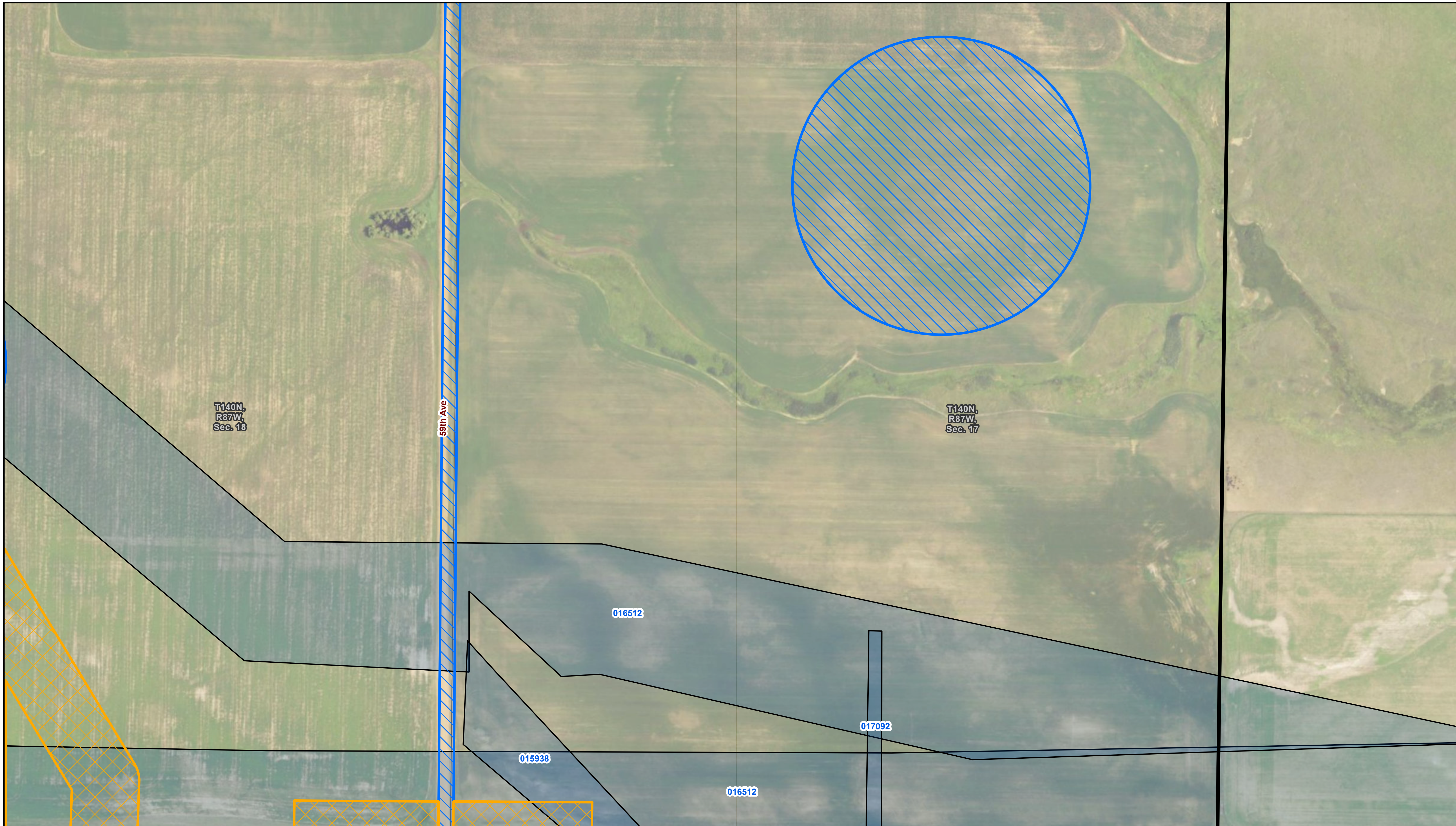

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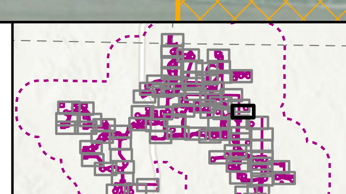

Figure 3.19: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary

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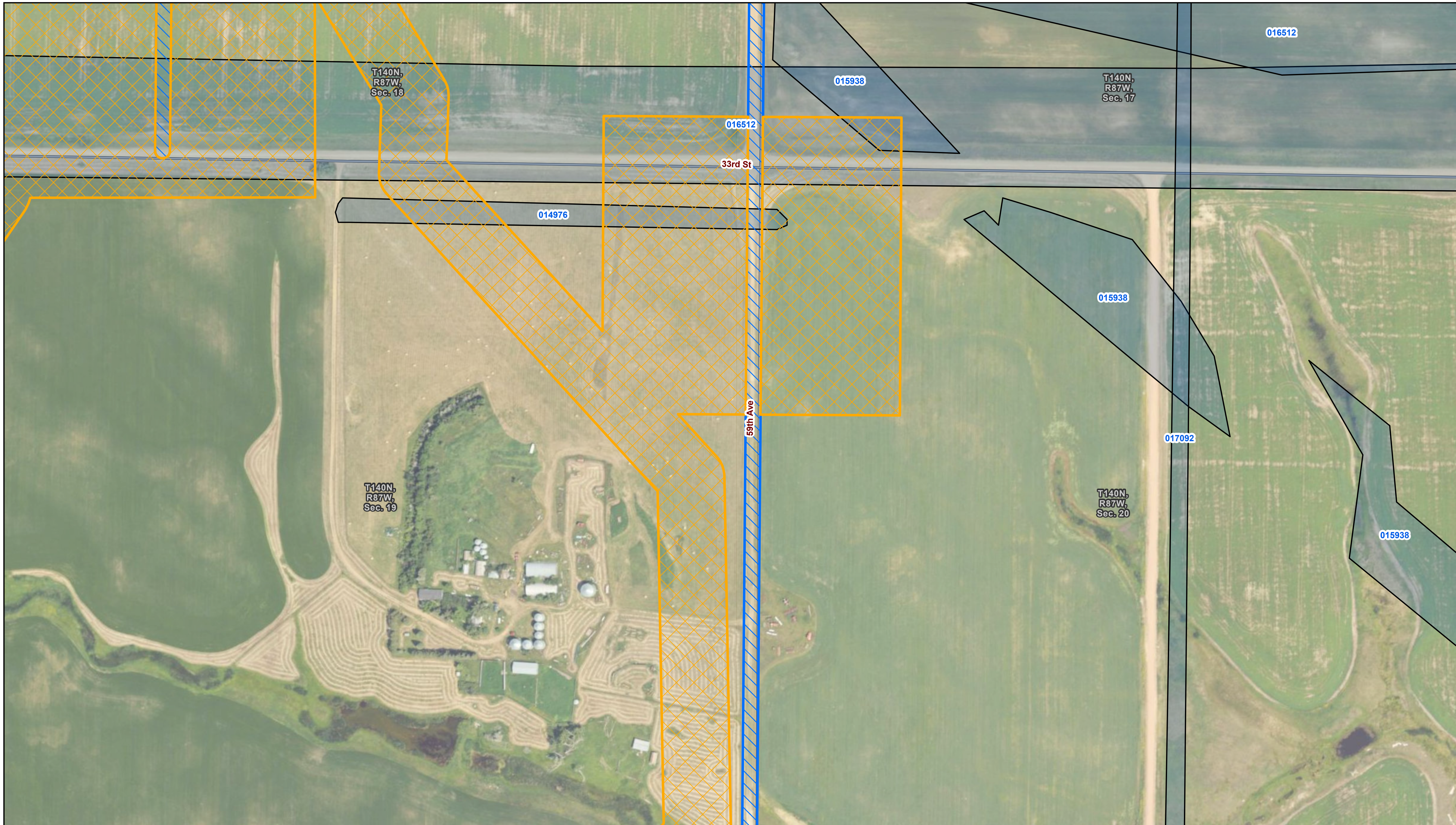

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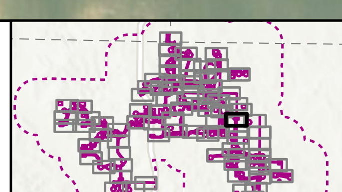

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Figure 3.20: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary

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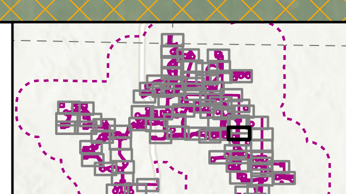

Figure 3.21: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary

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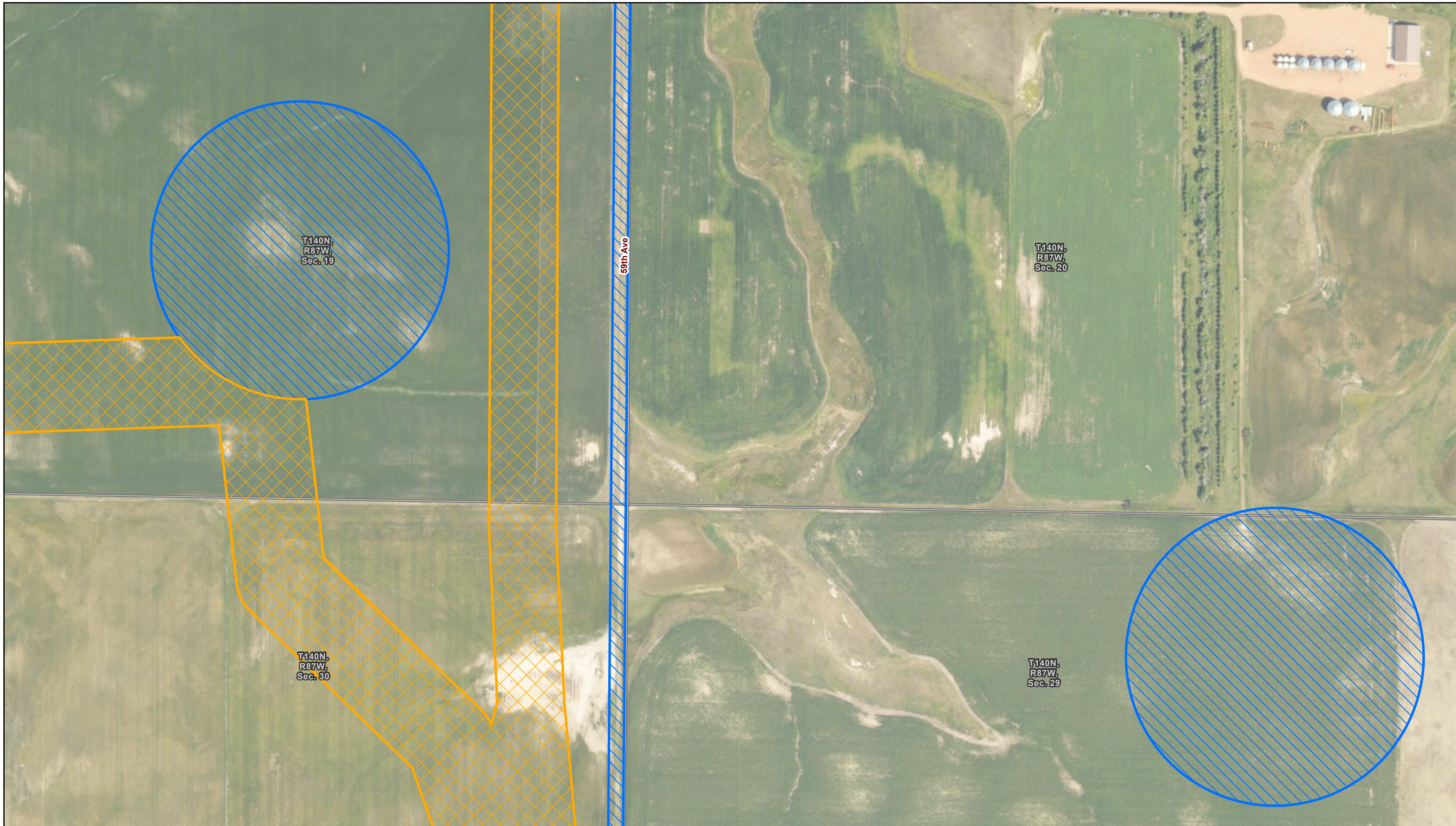

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Figure 3.22: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary

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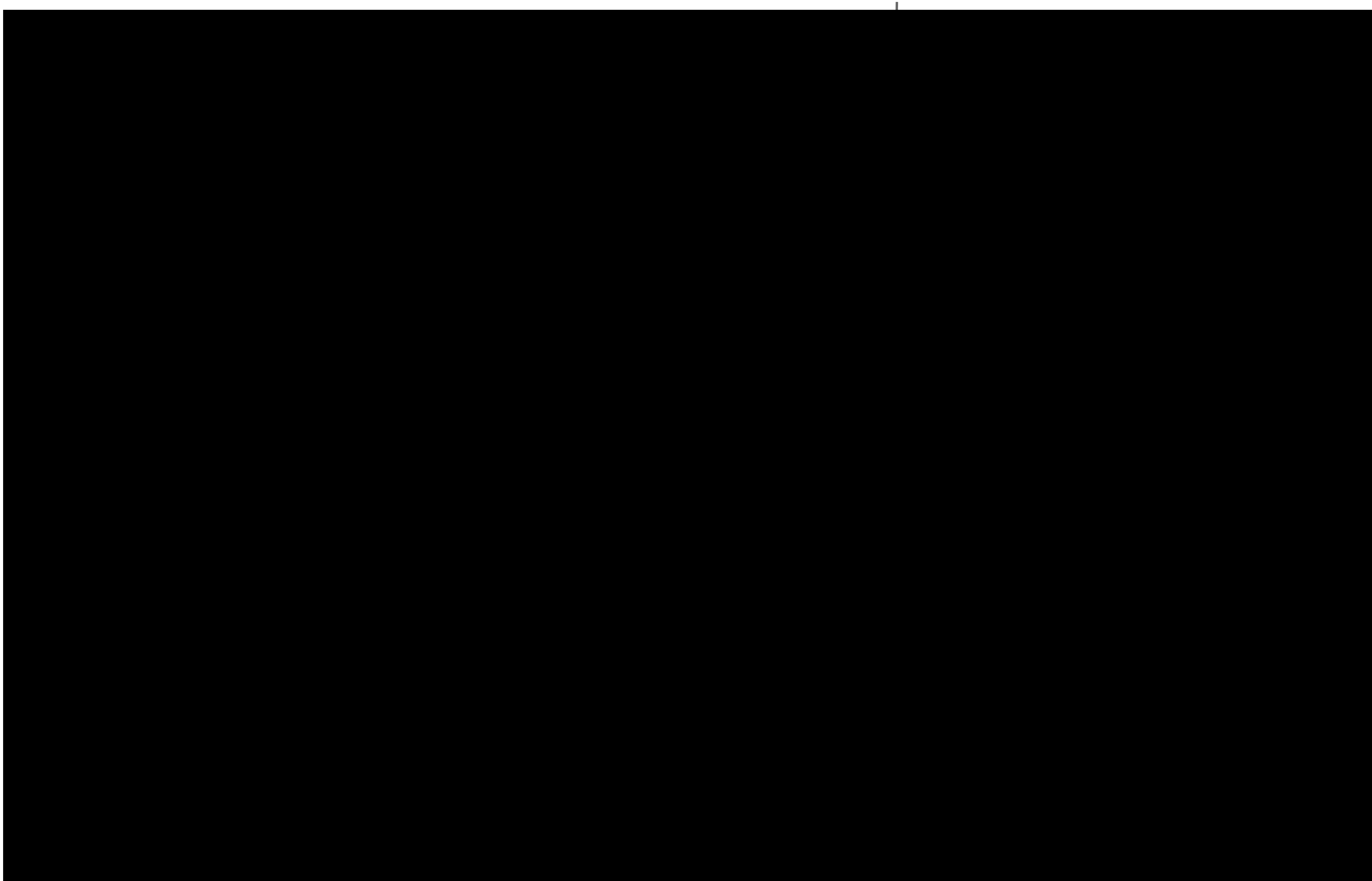

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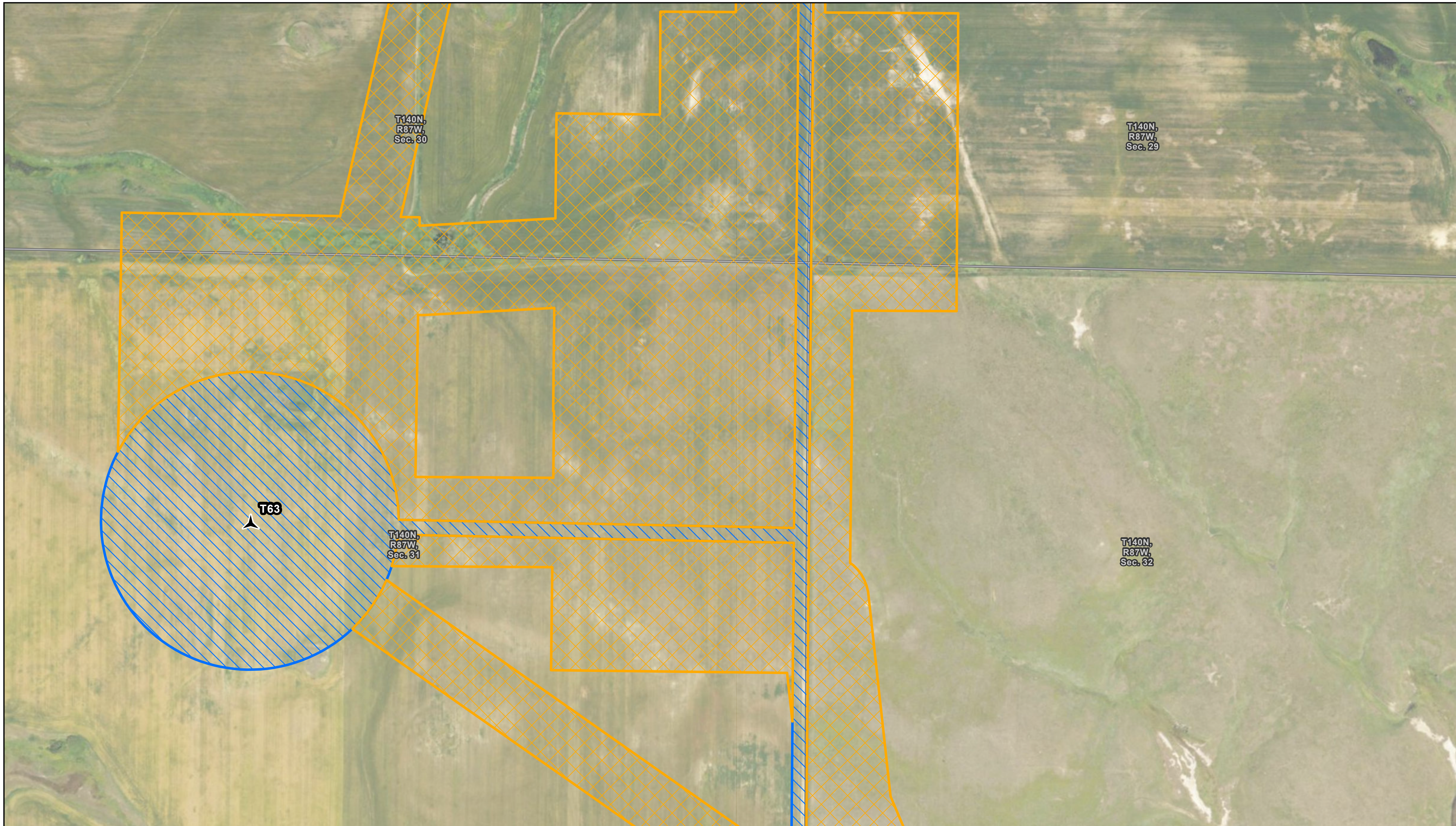

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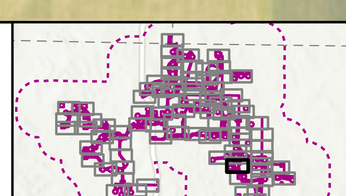

Figure 3.26: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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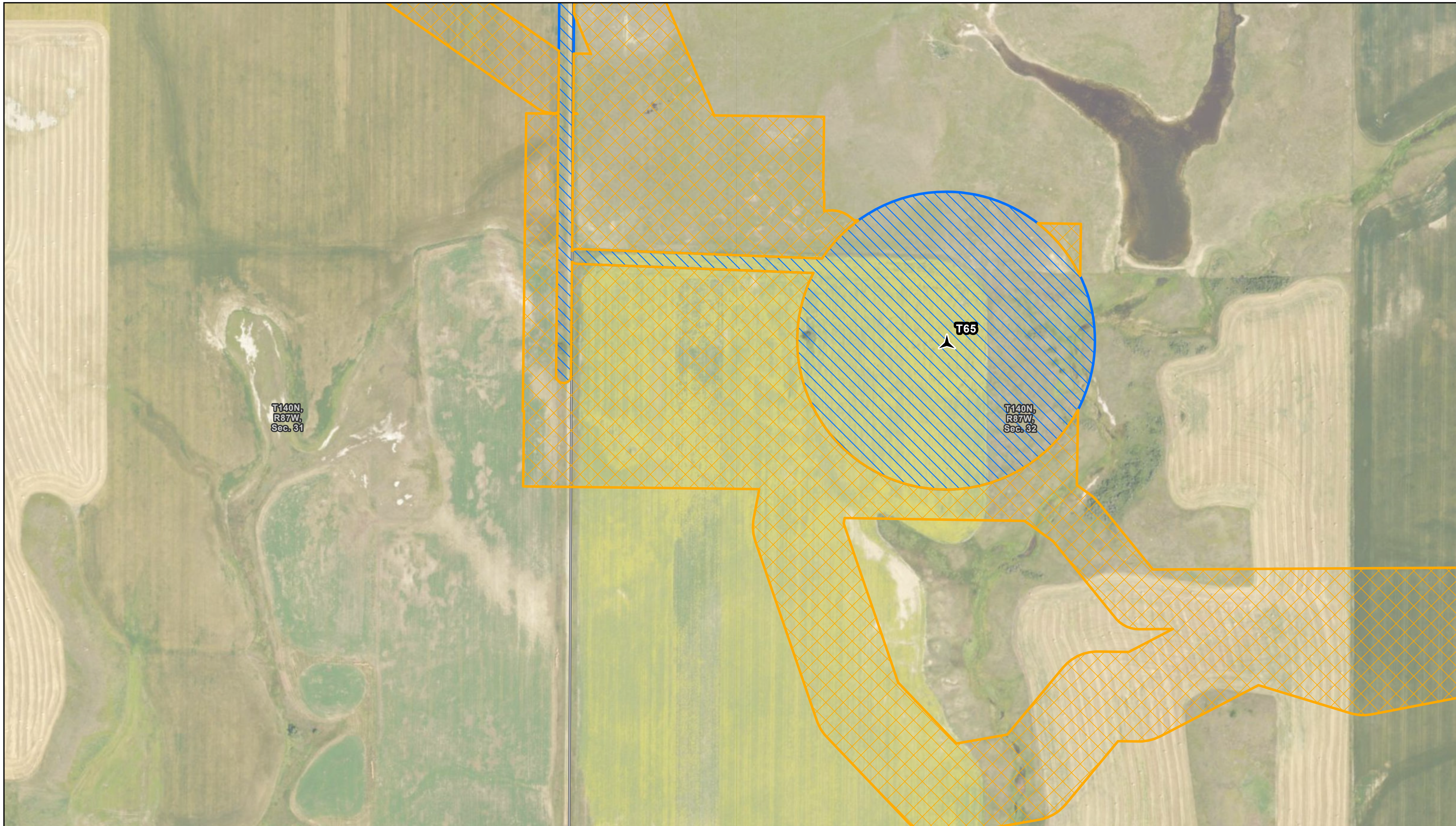

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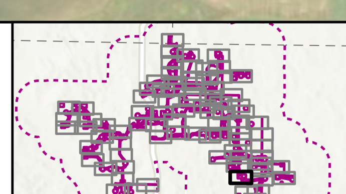

Figure 3.27: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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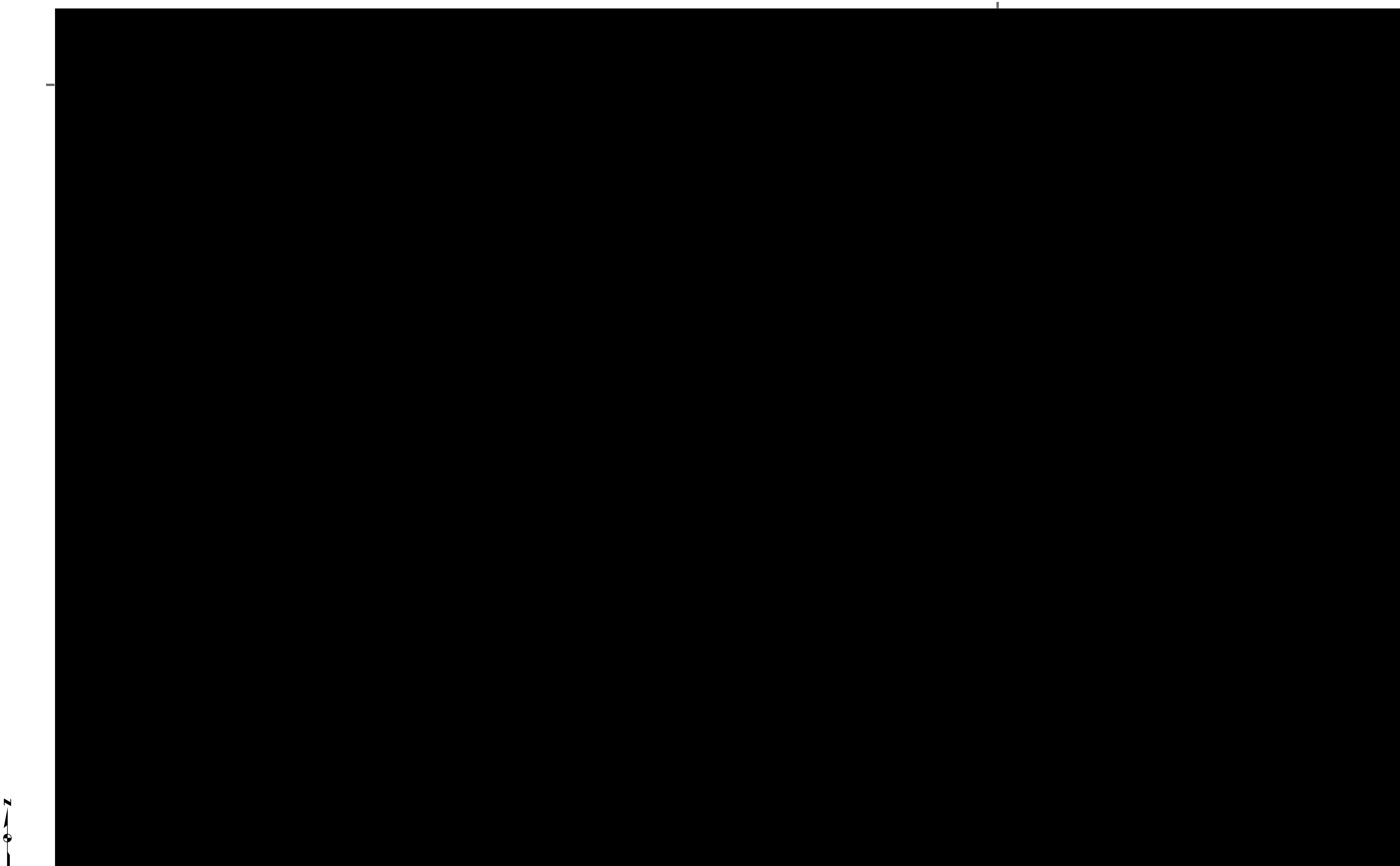

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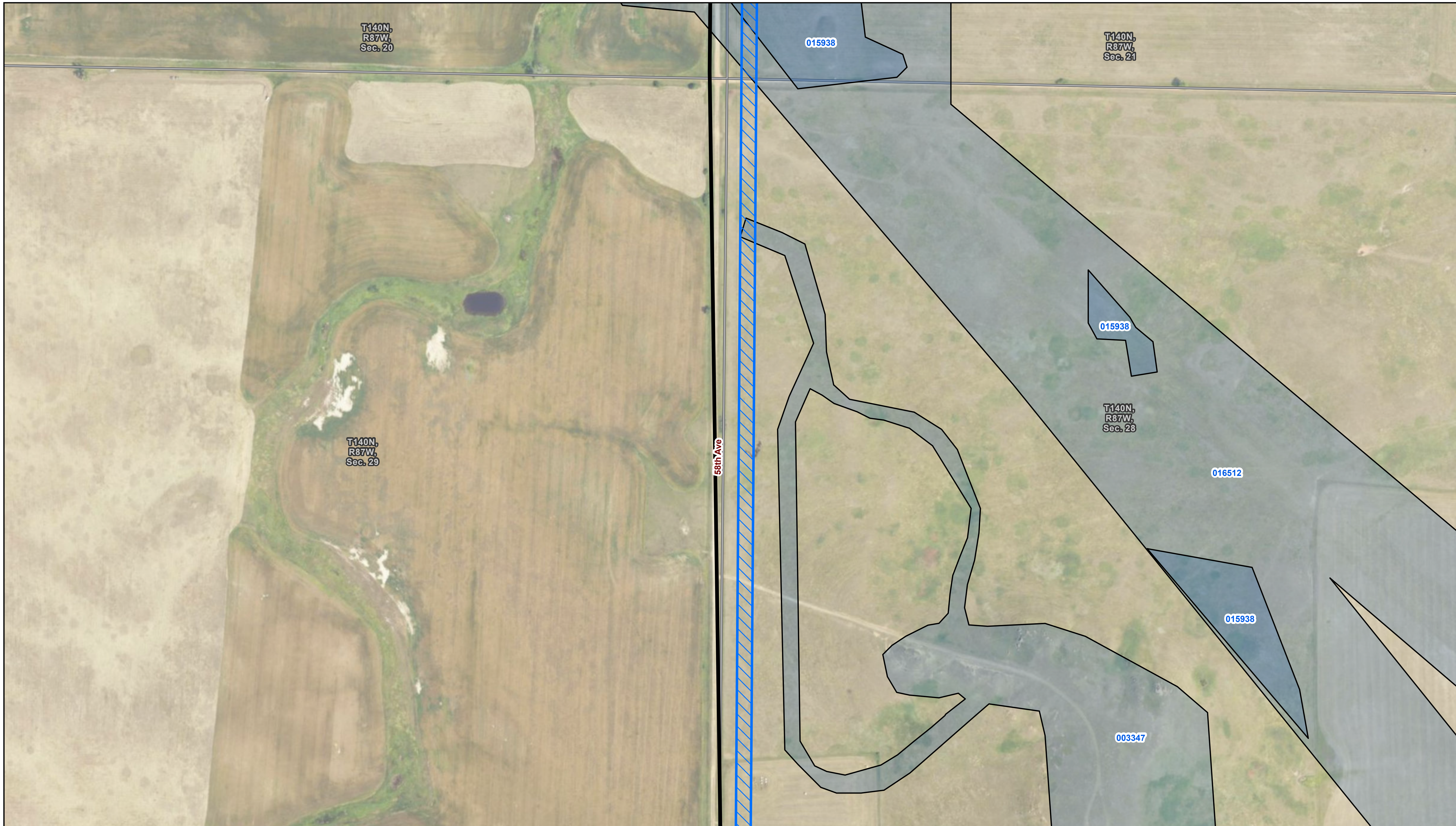

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Figure 3.30: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Previous Survey
Section Boundary

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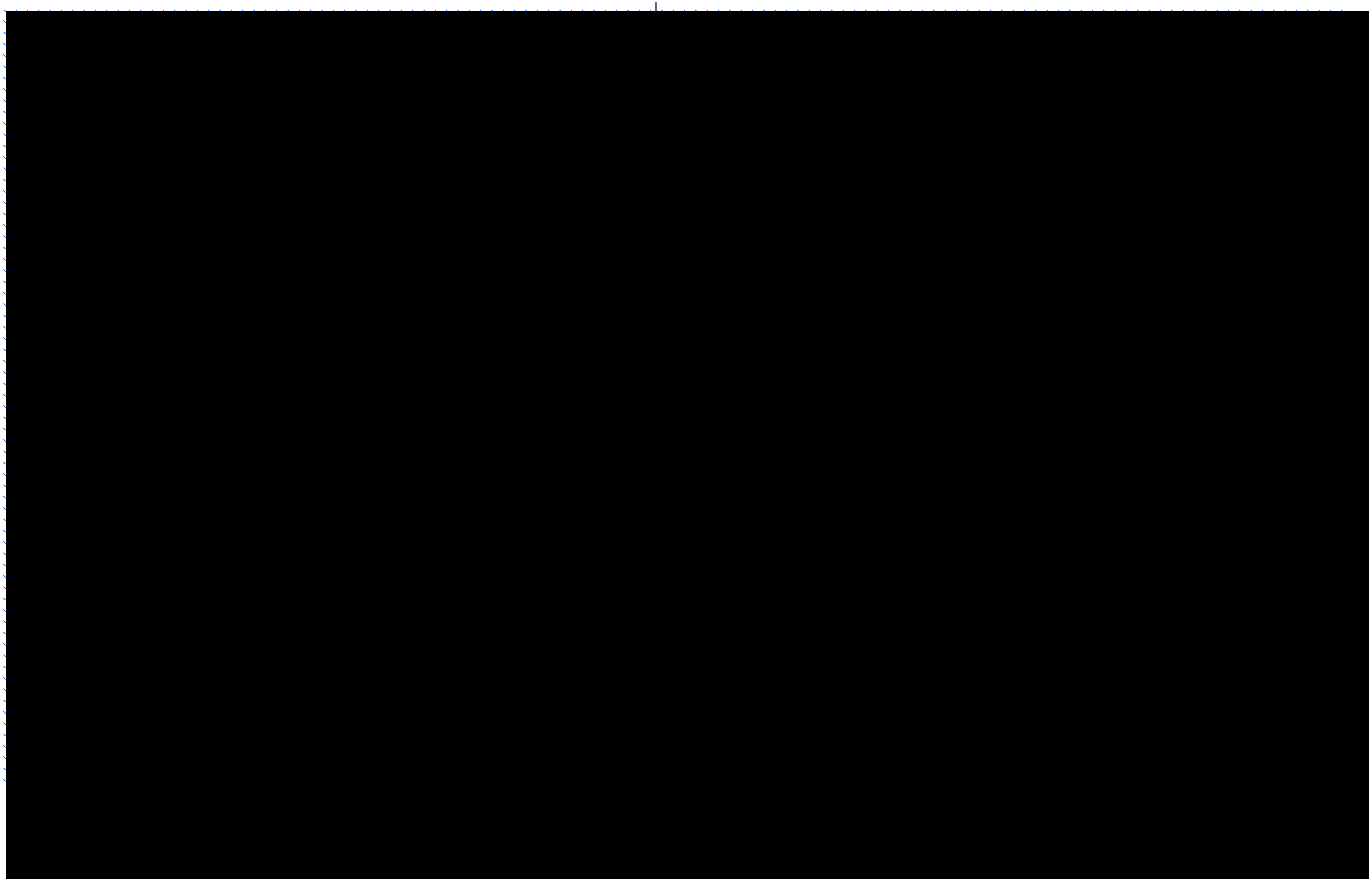

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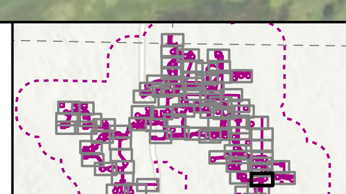

Figure 3.34: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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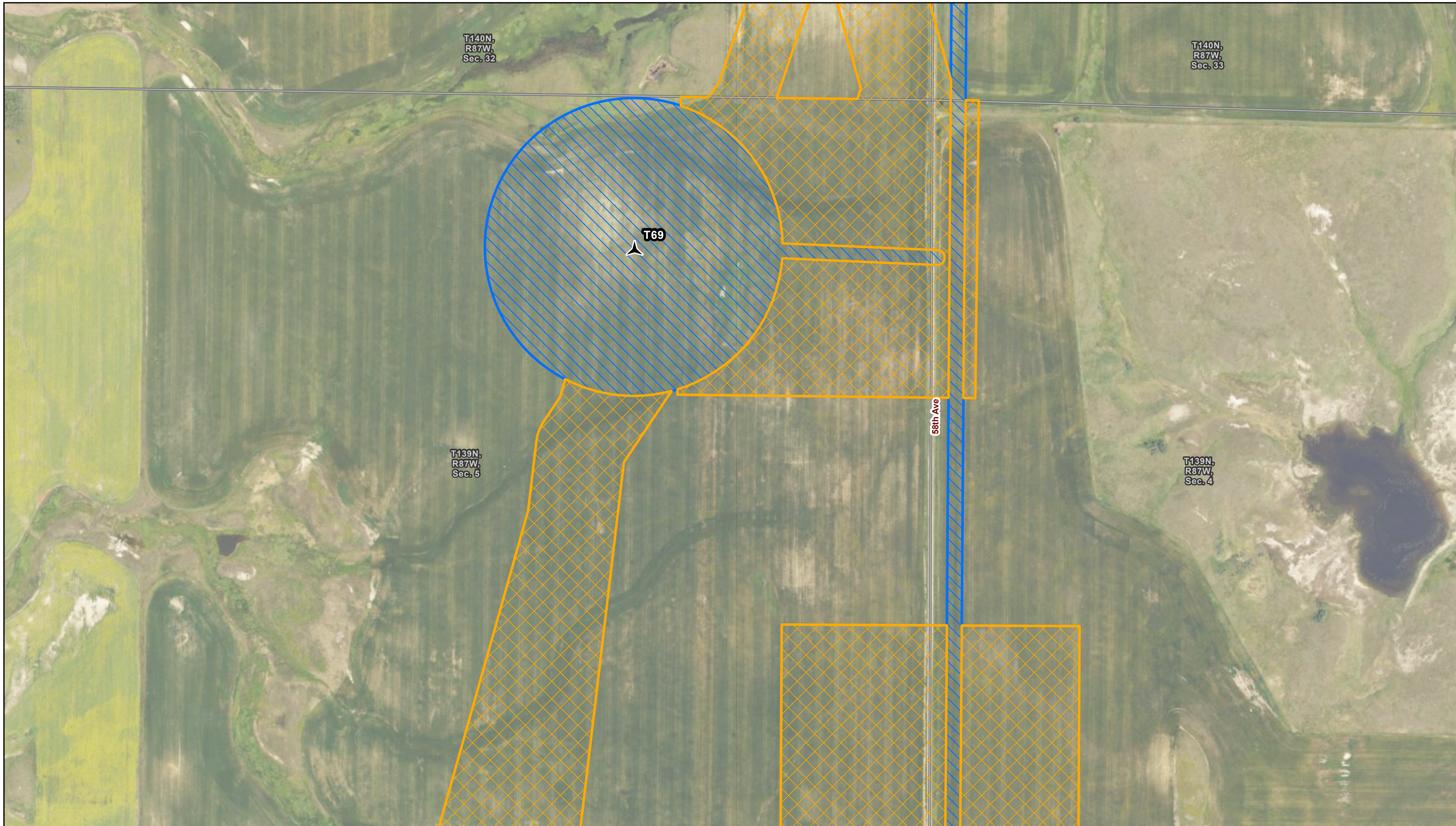

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Figure 3.35: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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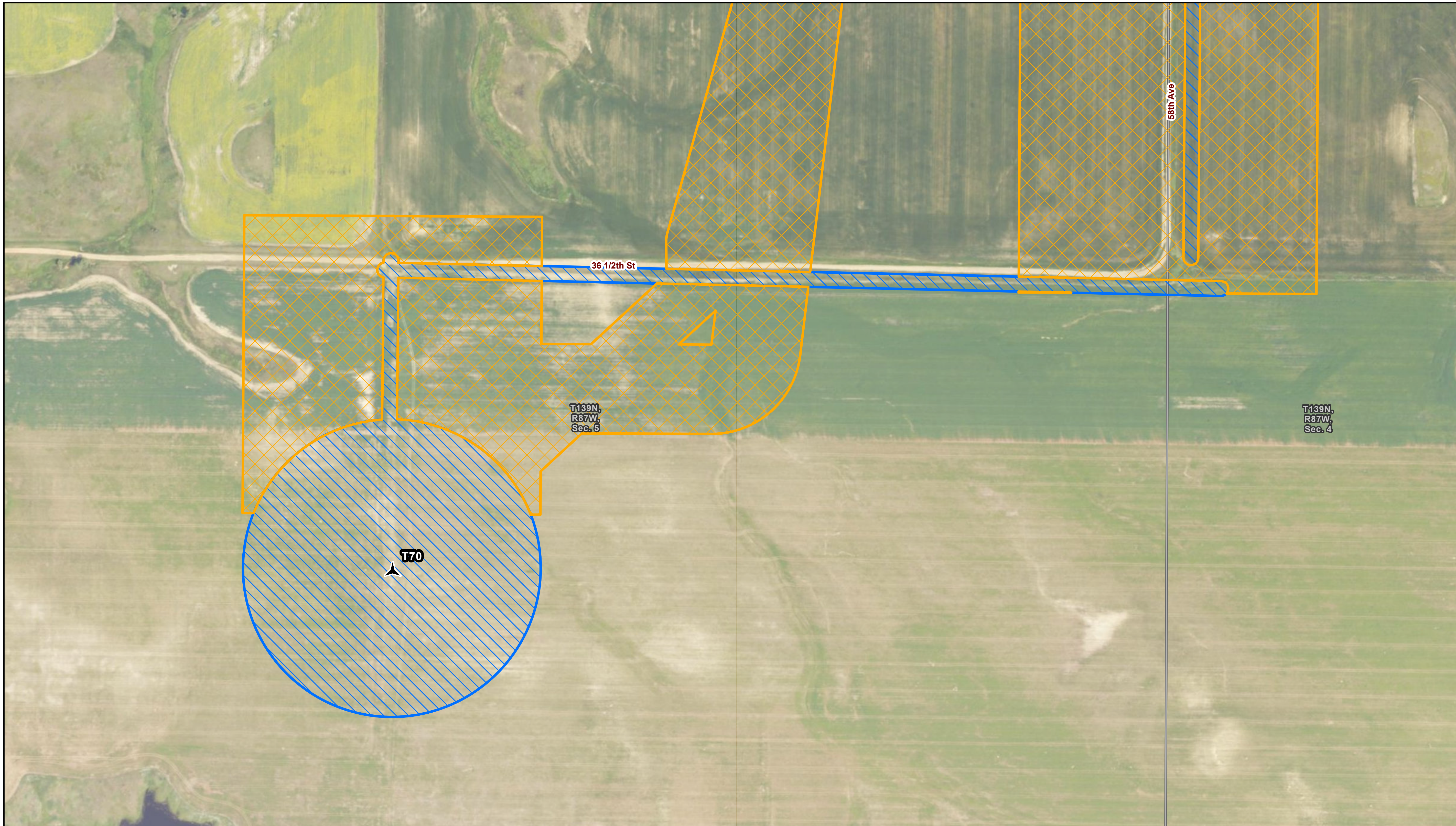

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Figure 3.36: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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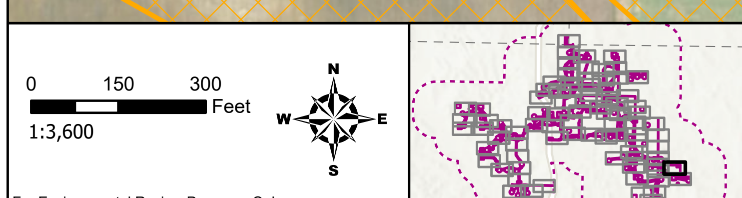

Figure 3.37: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
SHPO Archaeological Site
Previous Survey
Section Boundary

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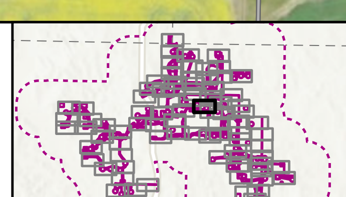

Figure 3.44: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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Figure 3.45: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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Figure 3.46: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Merjent Site Boundary
SHPO Archaeological Site
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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Figure 3.49: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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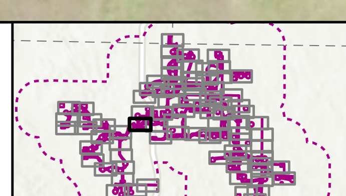

Figure 3.50: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine
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Figure 3.51: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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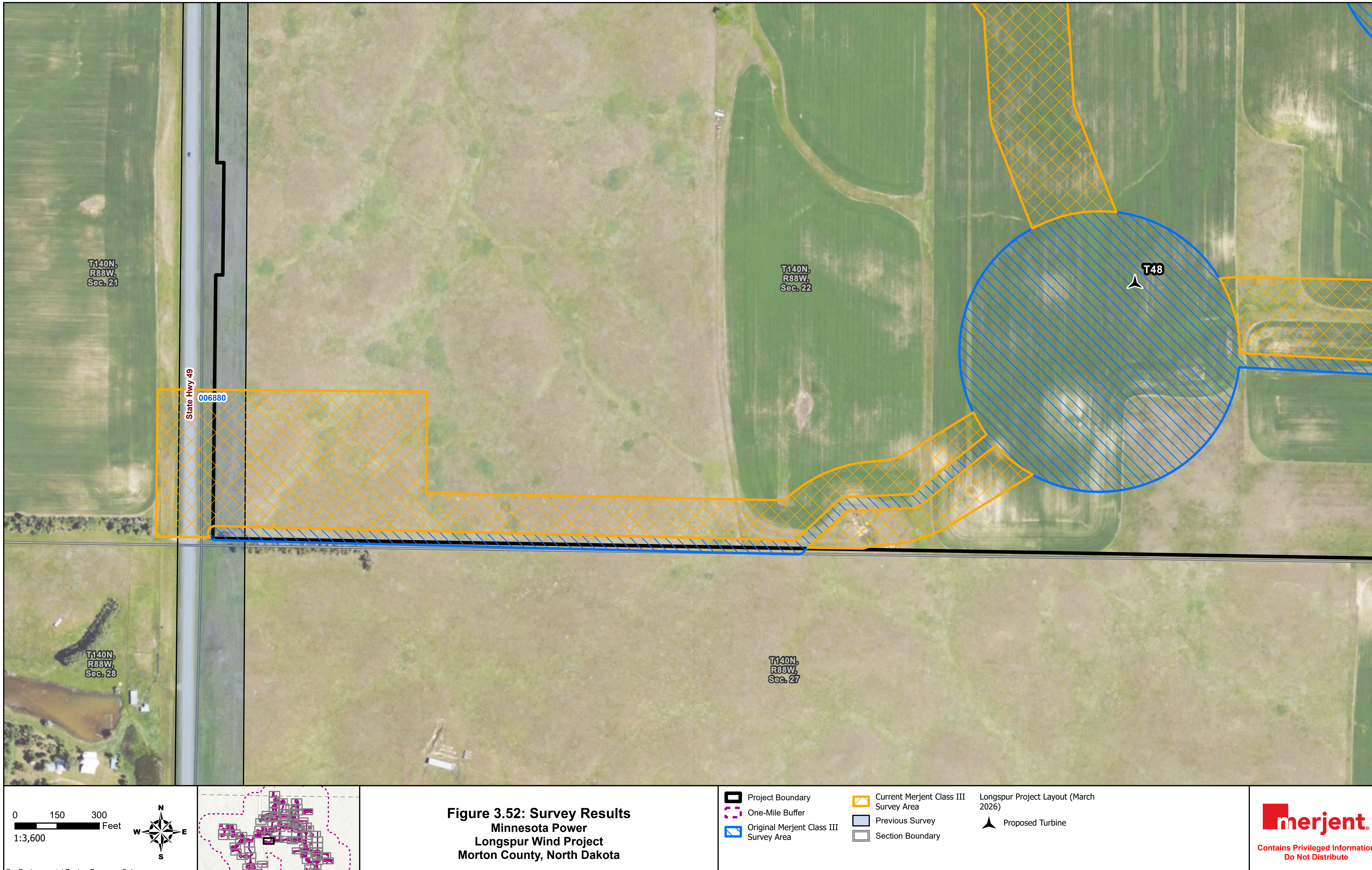

Figure 3.52: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

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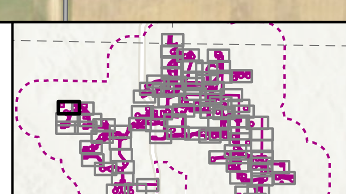

Figure 3.53: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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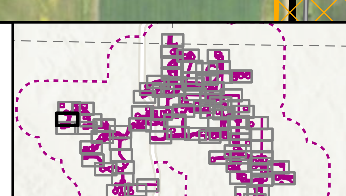

Figure 3.55: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

- Project Boundary
- One-Mile Buffer
- Original Merjent Class III Survey Area
- Current Merjent Class III Survey Area
- Section Boundary
- Longspur Project Layout (March 2026)
- Proposed Turbine

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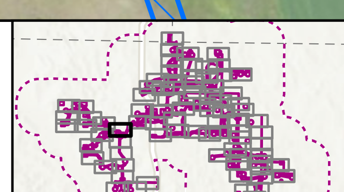

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Figure 3.58: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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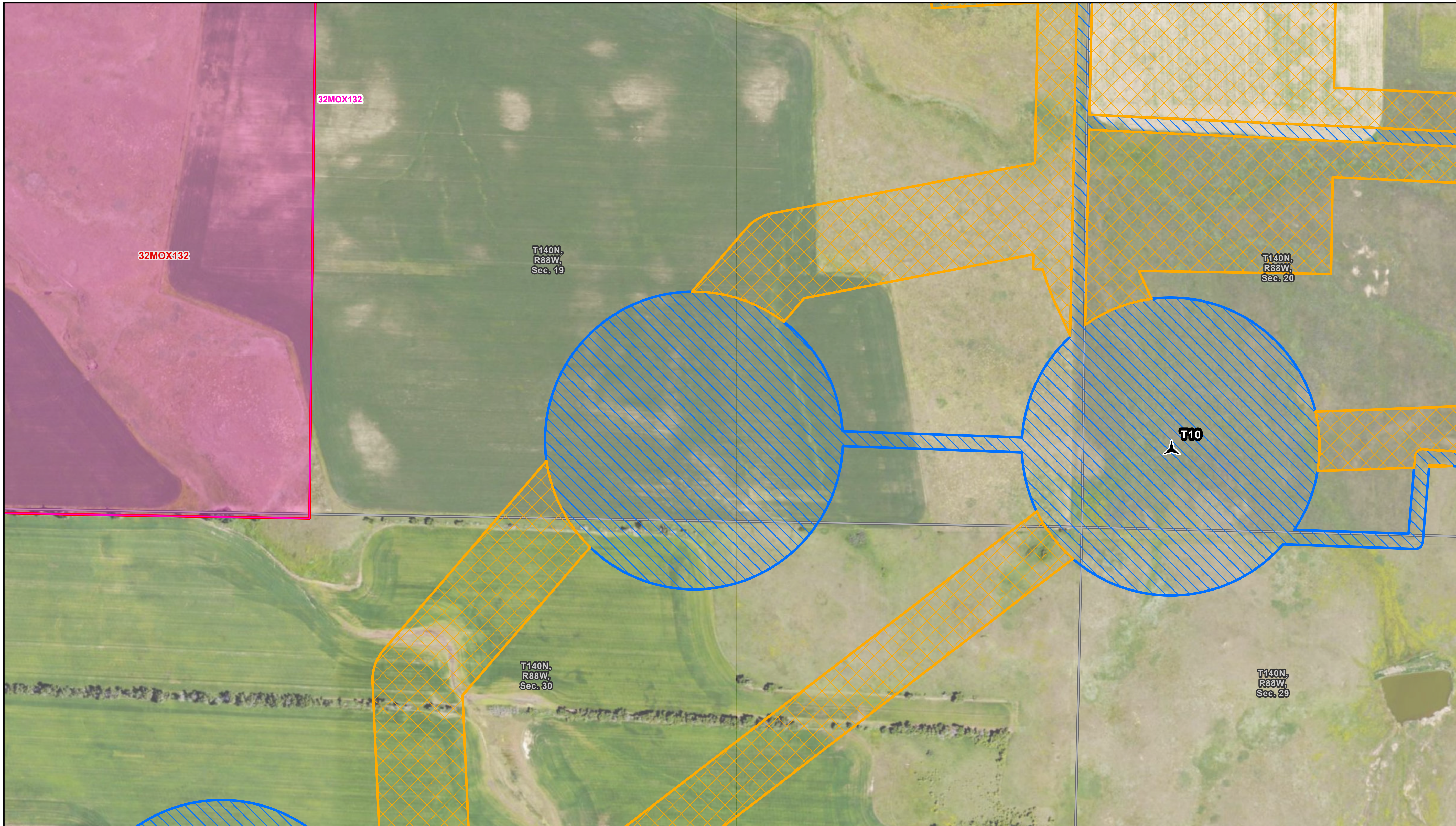

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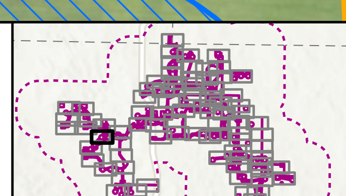

Figure 3.59: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Merjent Site Boundary
SHPO Archaeological SIte
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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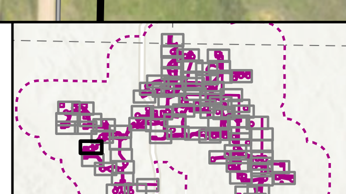

Figure 3.60: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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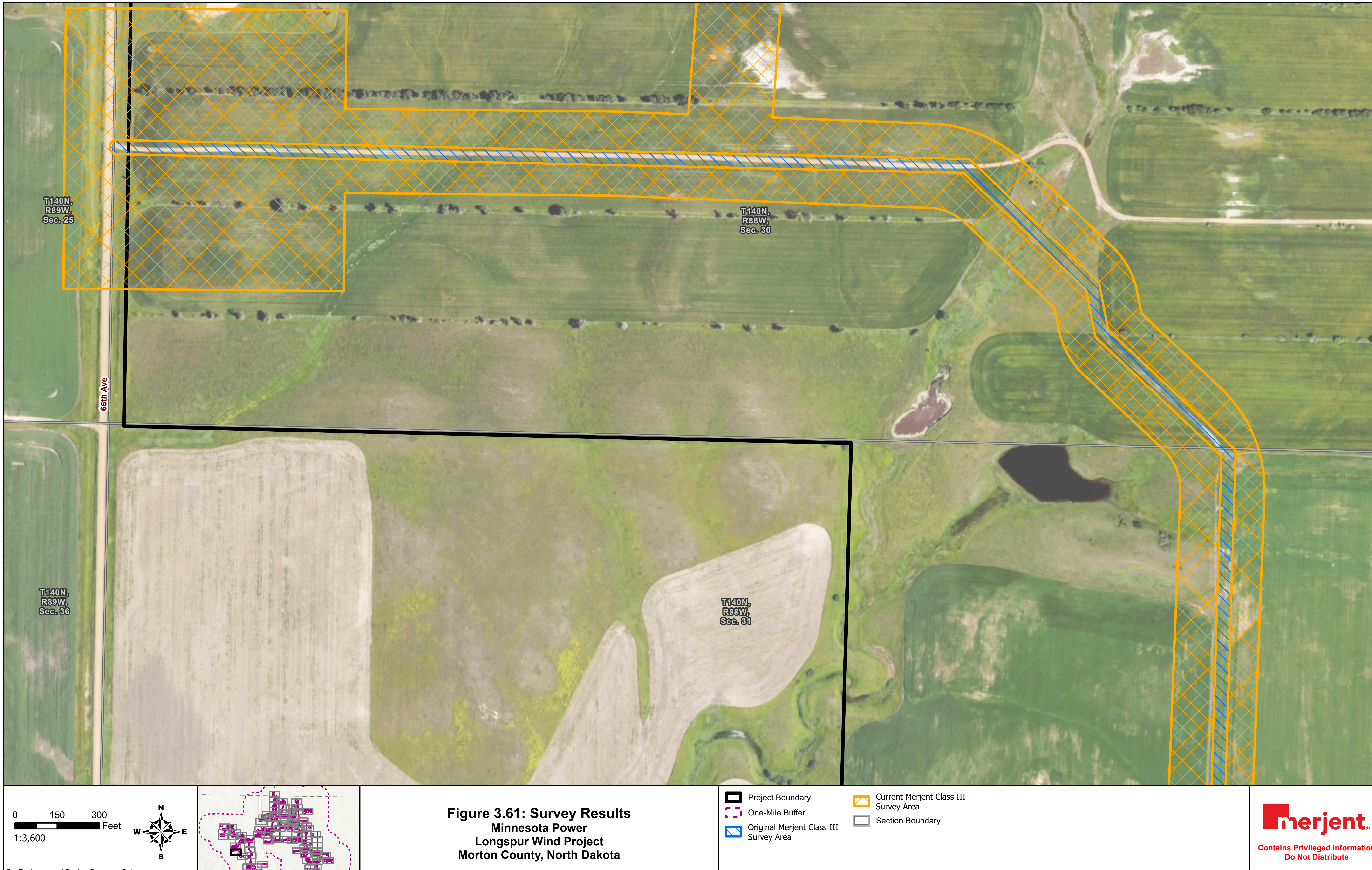

Figure 3.61: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

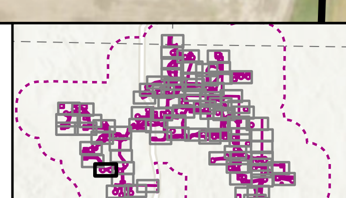

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Figure 3.62: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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Date: (3/16/2026) Source: Z:\Clients\M_P\MN_Power\Longspur_Wind\ArcGIS\Cultural\001_ArcPro\Longspur_Cultural.aprx

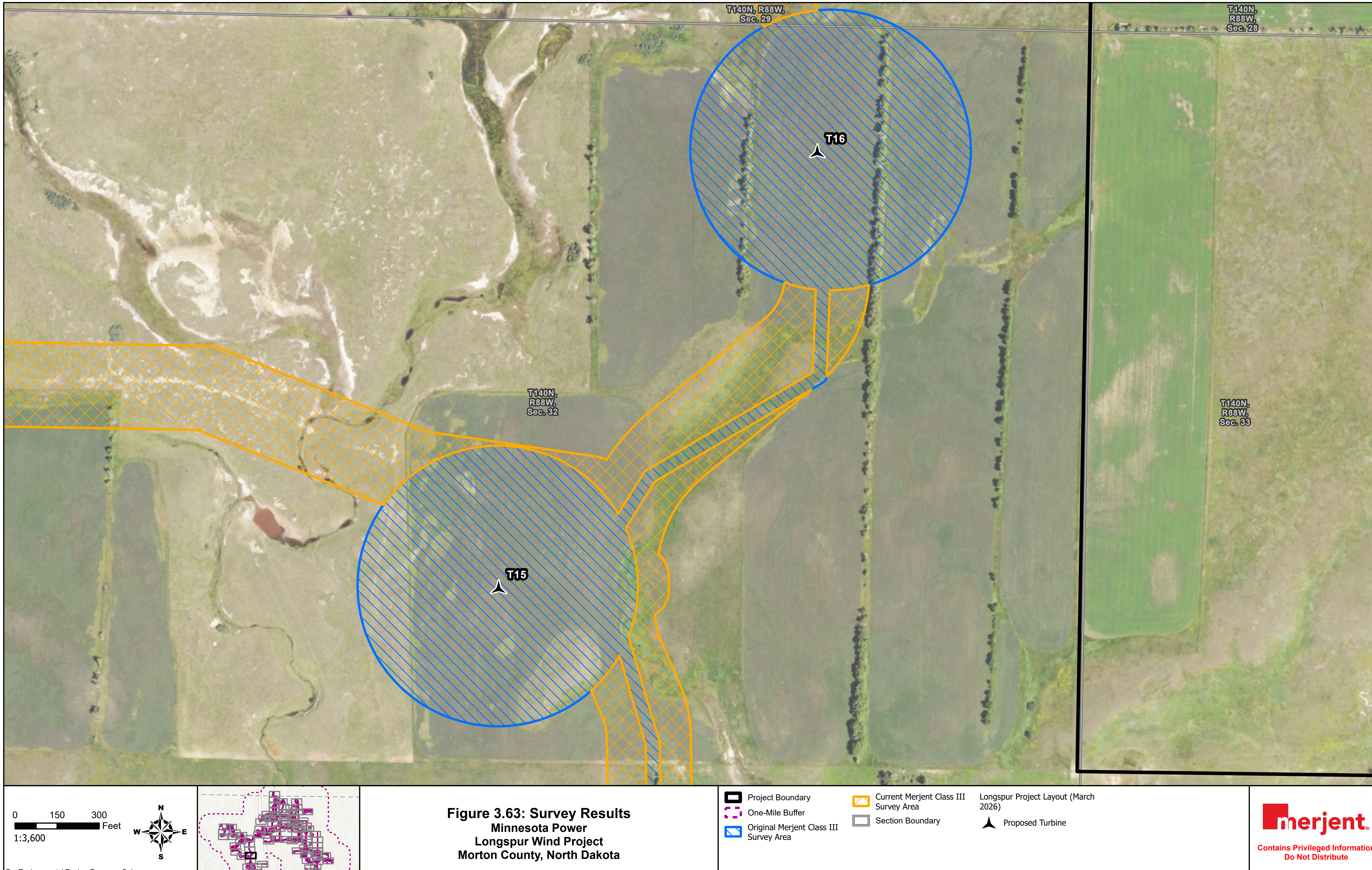
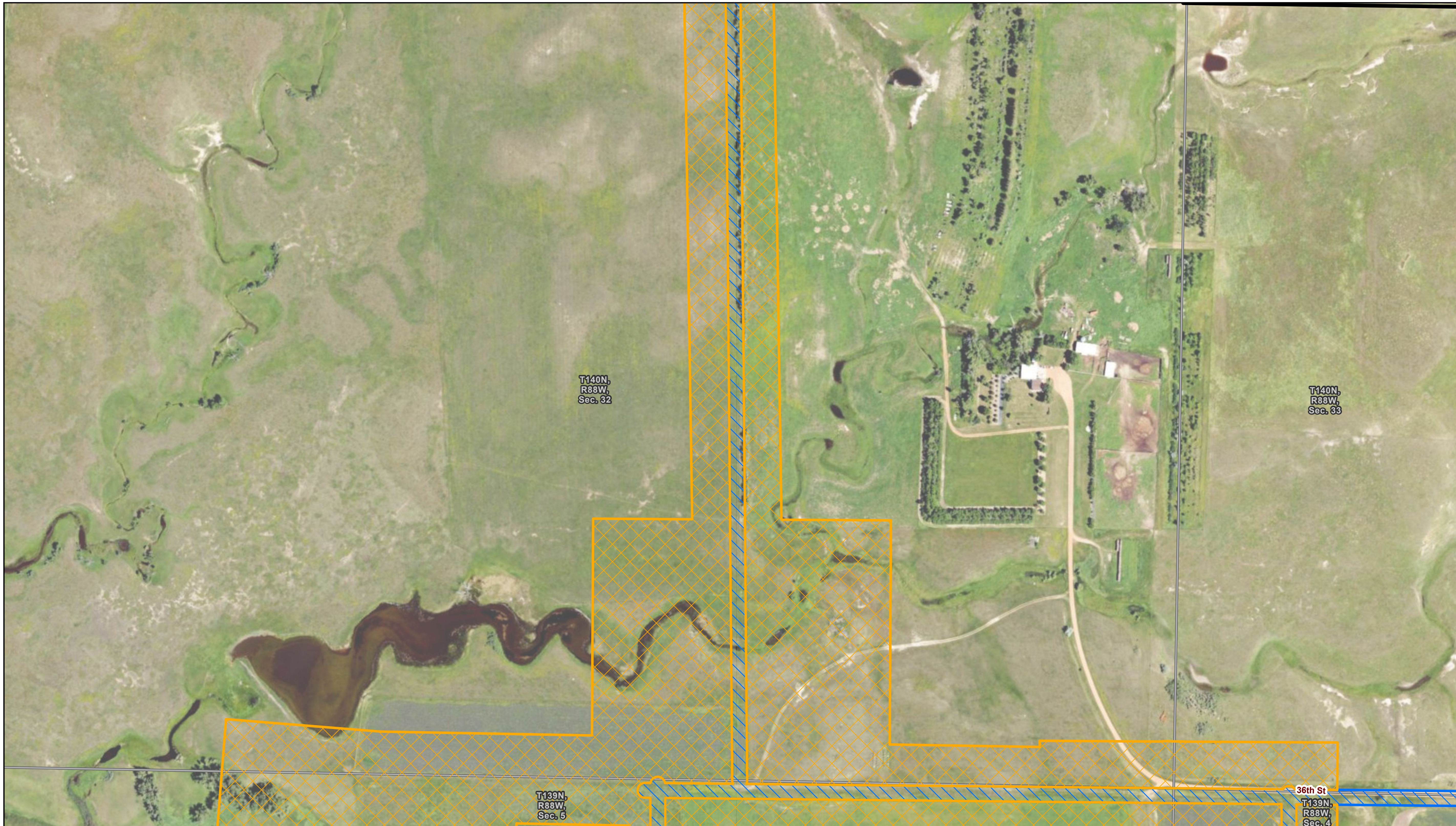


Figure 3.63: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota



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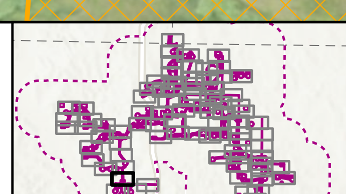

Figure 3.64: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary

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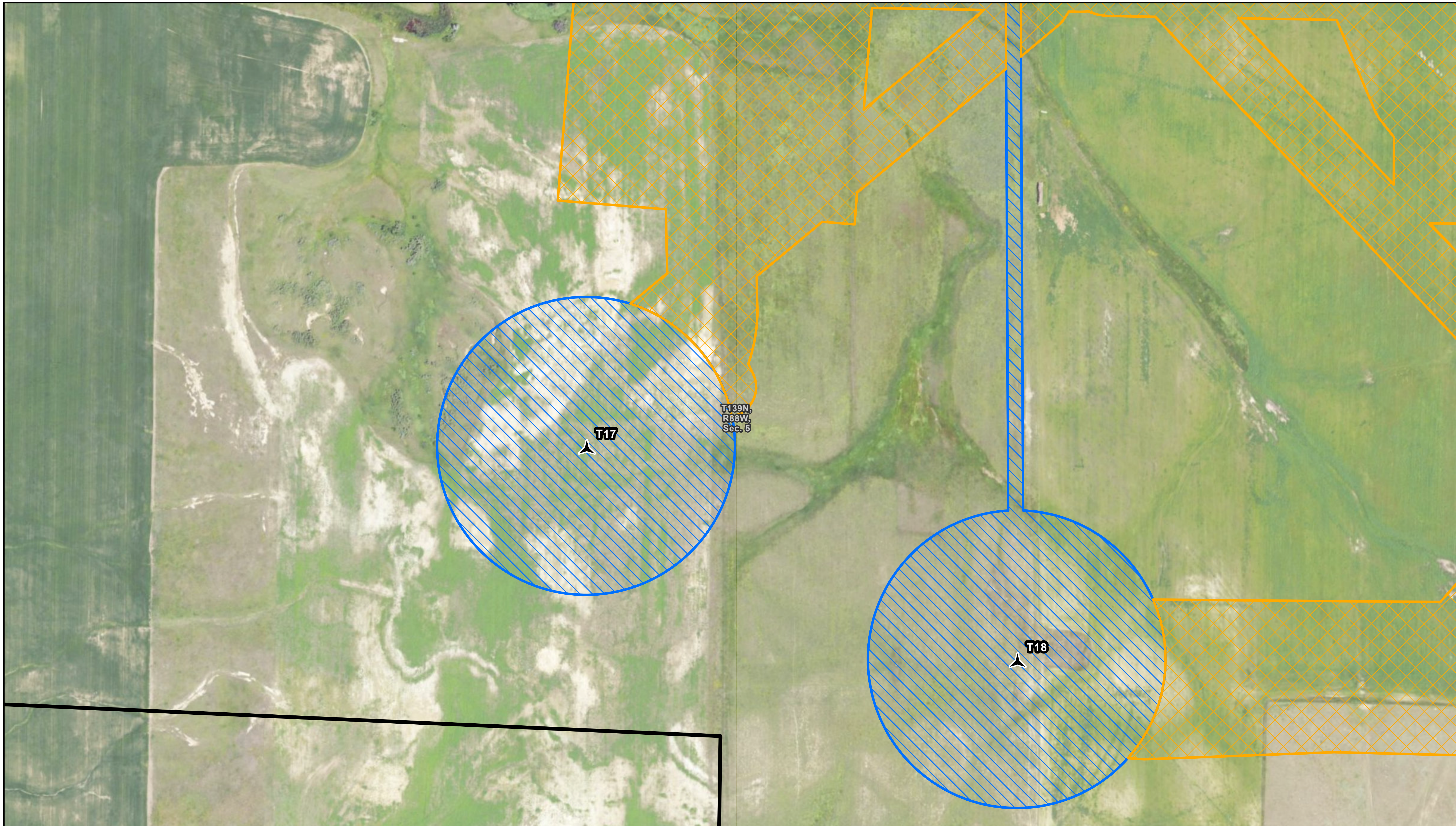

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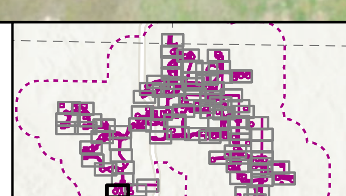

Figure 3.65: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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Figure 3.67: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

One-Mile Buffer
Original Merjent Class III Survey Area
Previous Survey
Section Boundary

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Figure 3.68: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Current Merjent Class III Survey Area
Previous Survey
Section Boundary

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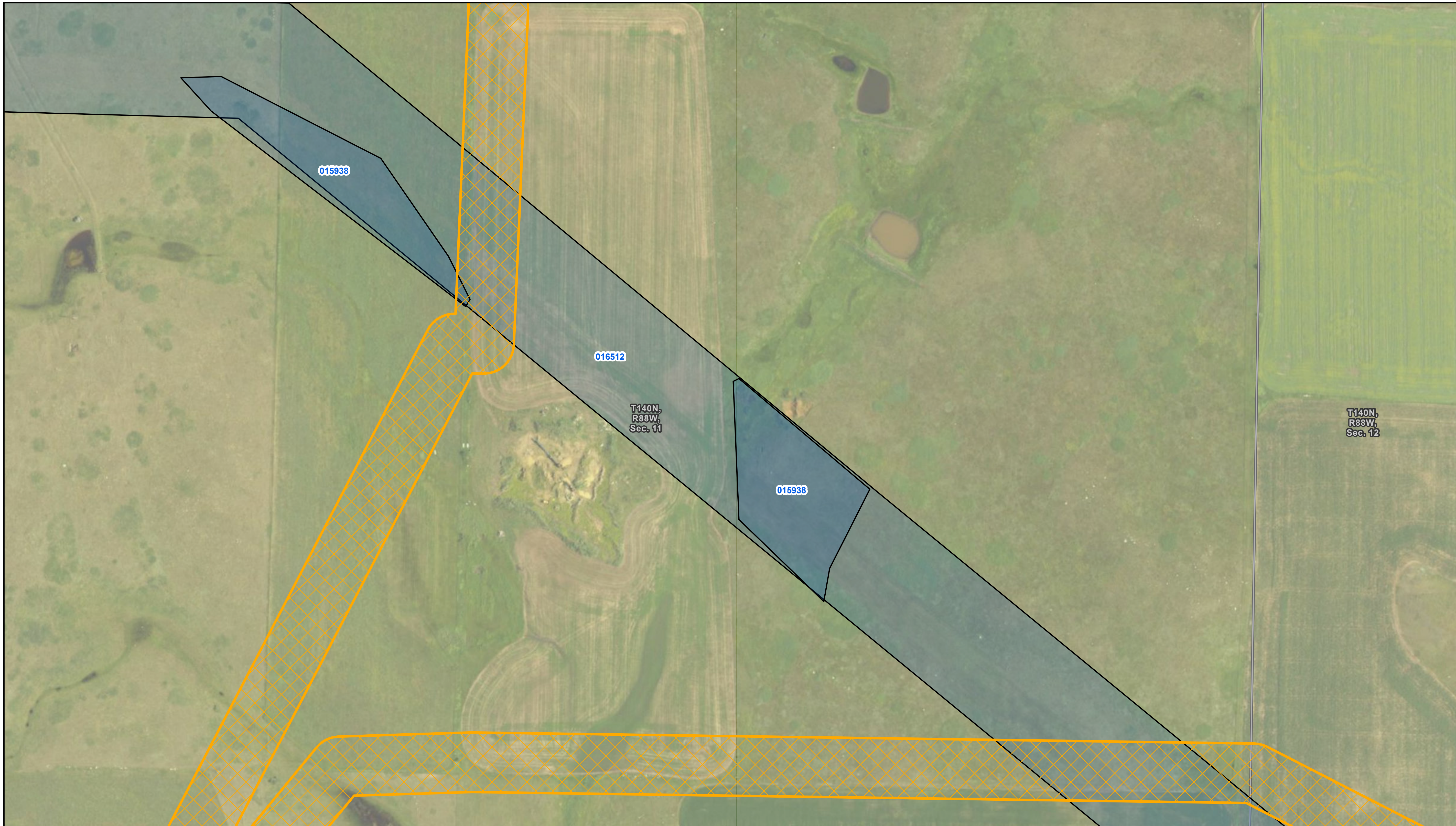

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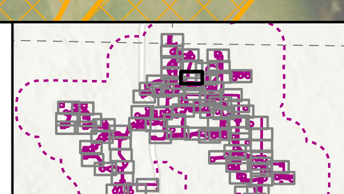

Figure 3.69: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Current Merjent Class III Survey Area
Previous Survey
Section Boundary

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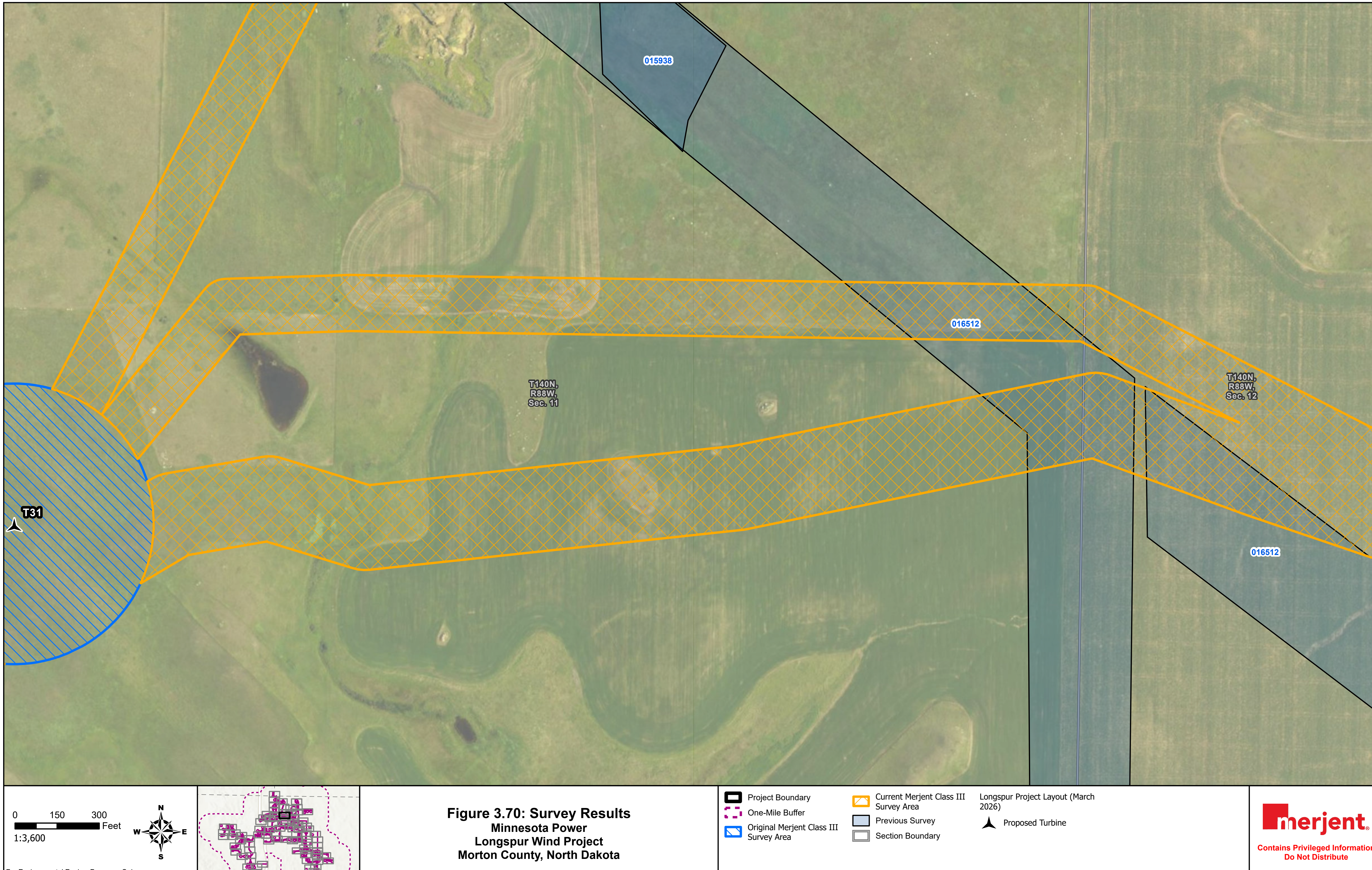

Figure 3.70: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

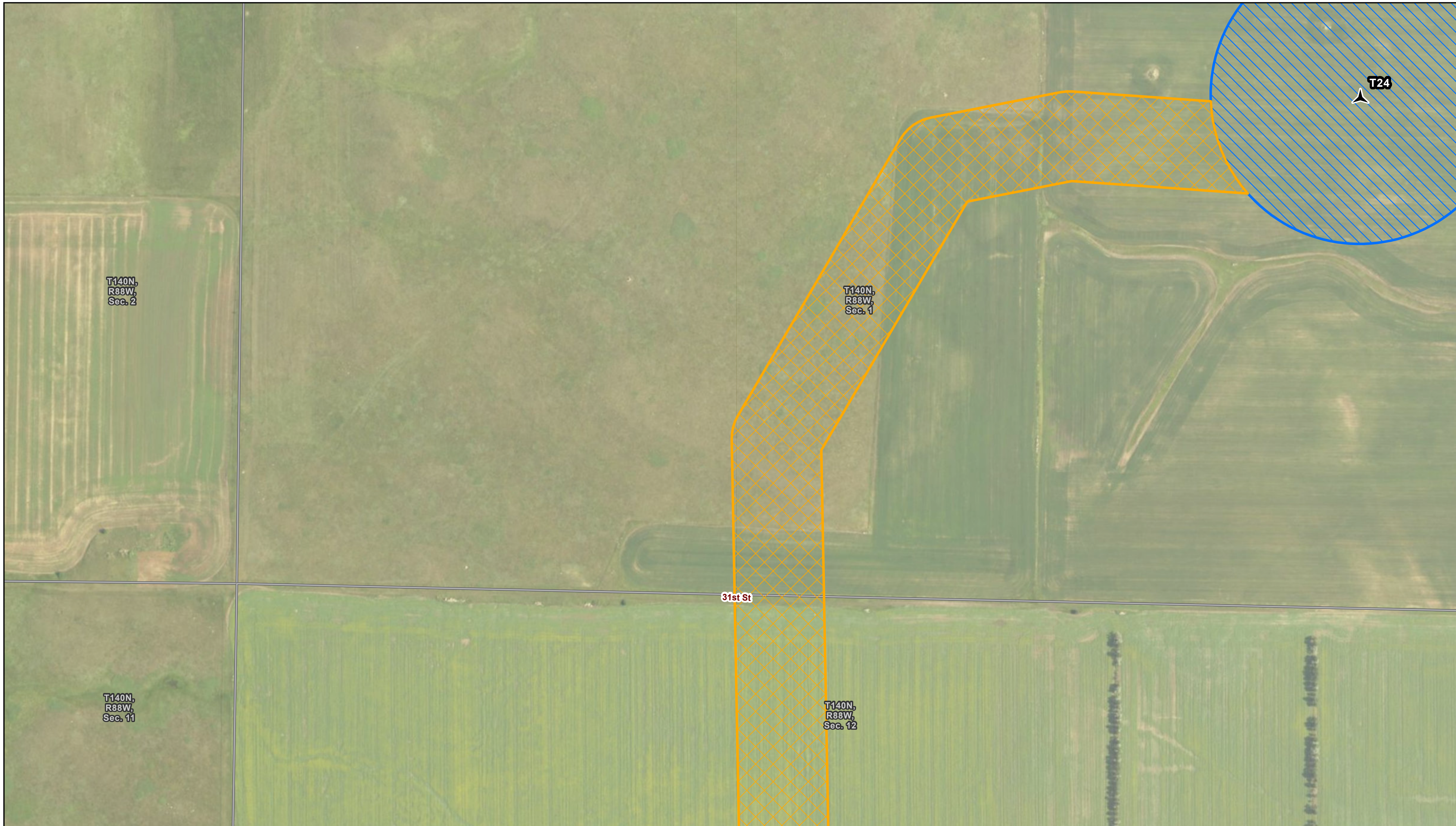

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Figure 3.71: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

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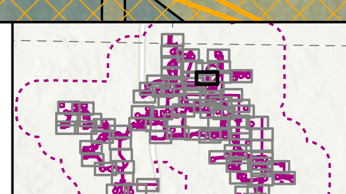

Figure 3.72: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary

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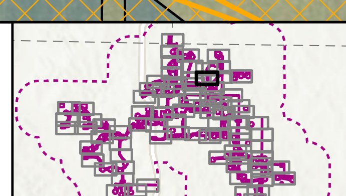

Figure 3.73: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary

merjent
Contains Privileged Information
Do Not Distribute

0 150 300 Feet
1:3,600

For Environmental Review Purposes Only

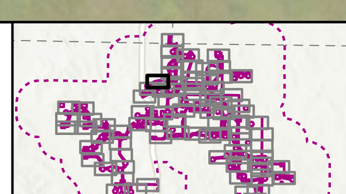

Figure 3.74: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

merjent
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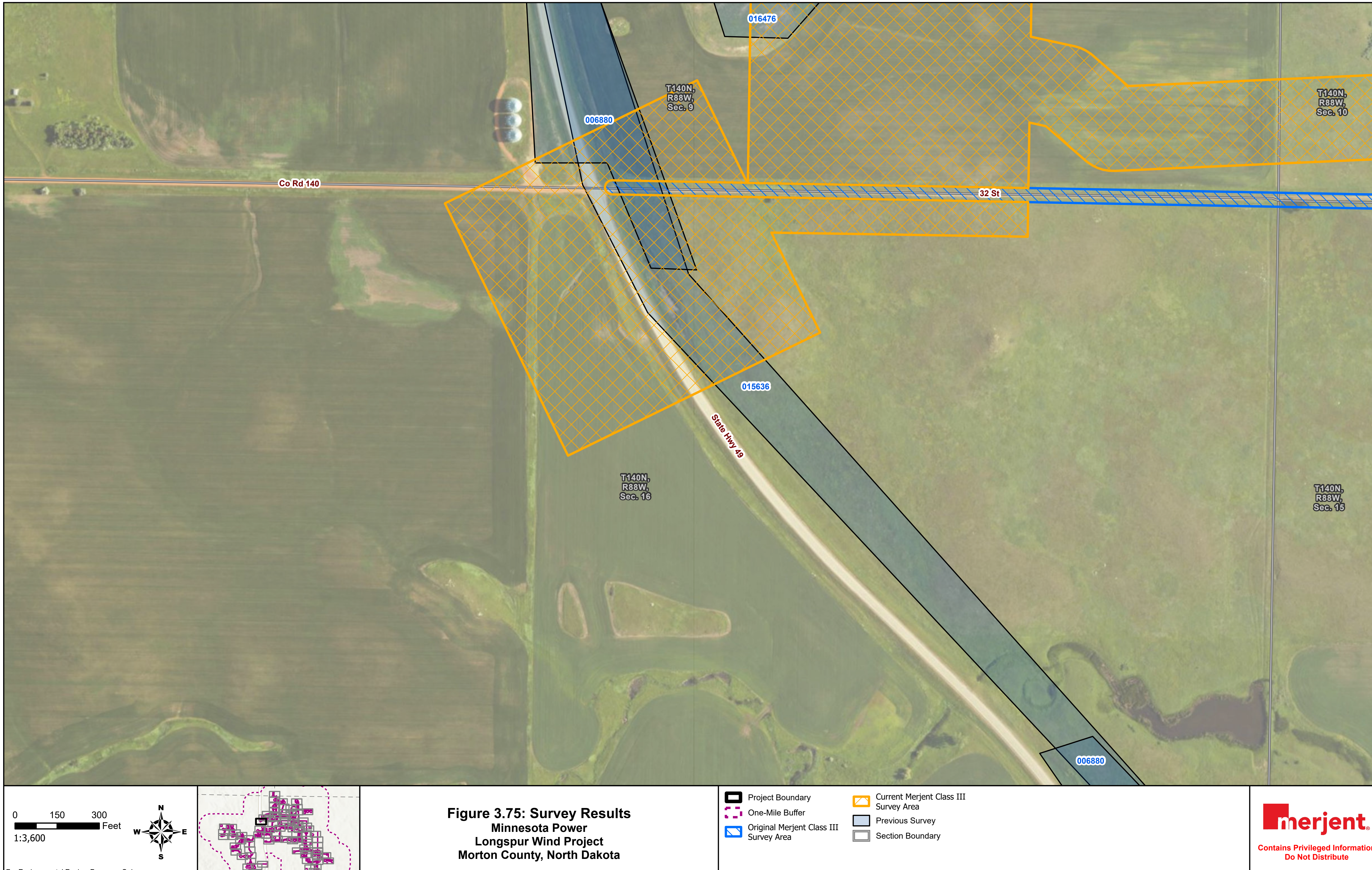


For Environmental Review Purposes Only

Figure 3.75: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

merjent

Contains Privileged Information
Do Not Distribute

[redacted]

0 150 300 Feet
1:3,600

N W E S

For Environmental Review Purposes Only

Figure 3.77: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Previous Survey
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

merjent
Contains Privileged Information
Do Not Distribute

[redacted]

0 150 300 Feet
1:3,600

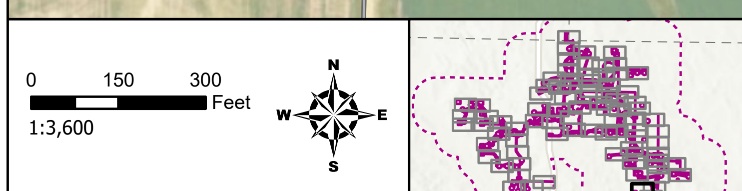
For Environmental Review Purposes Only

Figure 3.79: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary

merjent

Contains Privileged Information
Do Not Distribute



For Environmental Review Purposes Only

Figure 3.80: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

merjent
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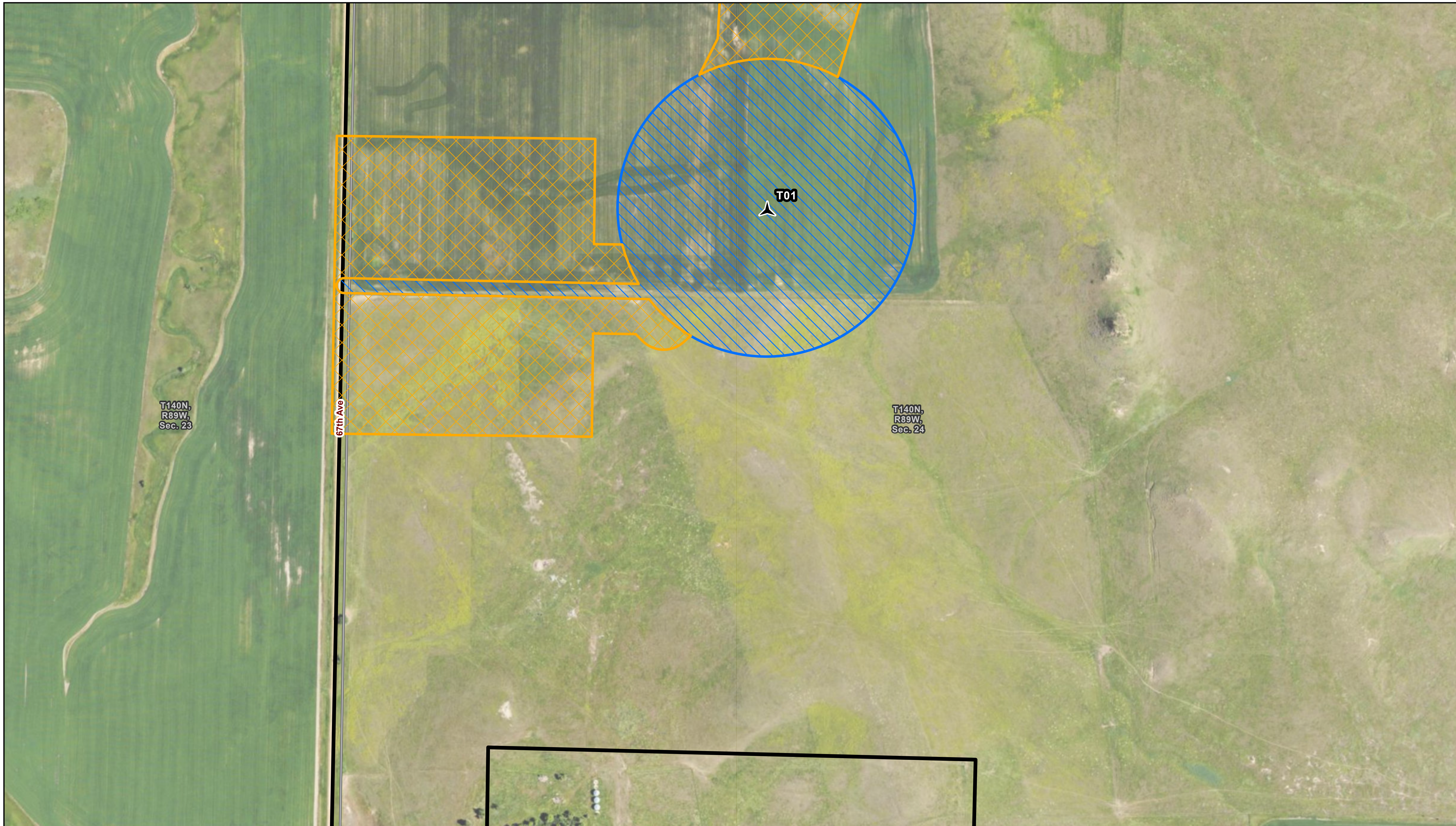
Do Not Distribute

Source: Z:\Clients\M_P\MN_Power\Longspur_Wind\ArcGIS\Cultural\001_ArcPro\Longspur_Cultural.aprx
Date: (3/16/2026)



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1:3,600

N W E S

For Environmental Review Purposes Only

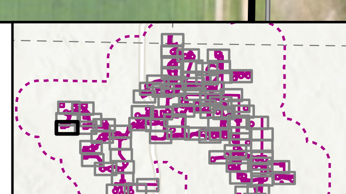

Figure 3.81: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

Project Boundary
One-Mile Buffer
Original Merjent Class III Survey Area
Current Merjent Class III Survey Area
Section Boundary
Longspur Project Layout (March 2026)
Proposed Turbine

merjent
Contains Privileged Information
Do Not Distribute

Date: (3/16/2026) Source: Z:\Clients\M_P\MN_Power\Longspur_Wind\ArcGIS\Cultural\001_ArcPro\Longspur_Cultural.aprx

Figure 3.83: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

0 150 300 Feet
1:3,600

For Environmental Review Purposes Only

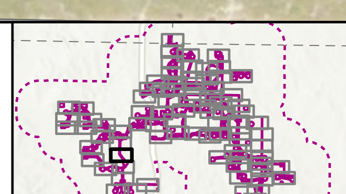

Figure 3.84: Survey Results
Minnesota Power
Longspur Wind Project
Morton County, North Dakota

- Project Boundary
- One-Mile Buffer
- Original Merjent Class III Survey Area
- Current Merjent Class III Survey Area
- Previous Survey
- Section Boundary

merjent

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Do Not Distribute

Appendix B

Site Forms (Detached)

STATE HISTORICAL SOCIETY OF NORTH DAKOTA

HISTORY FOR everyone.

April 17, 2026

Damien Reinhart
Merjent Inc.
1 Main Street SE
Suite 300
Minneapolis, MN 55414
damien.reinhart@merjent.com

SHSND Ref.: 25-9058 Longspur Wind Project

Dear Damien,

We received the report for SHSND Ref: 25-9058, titled "Addendum: A Class I and Class III Cultural Resources Inventory of Minnesota Power's Longspur Wind Project, Morton County, North Dakota" and find this Merjent report by Damien Reinhart acceptable. We will add it to our Manuscript Collection.

Thank you for the opportunity to review this report. Please be advised that acceptance of this report does not constitute concurrence with the determinations therein. If you have any questions, please Lorna Meidinger, Lead Historic Preservation Specialist, at (701) 328-2089 or lbmeidinger@nd.gov.

Sincerely,

for William D. Peterson, PhD
Director, State Historical Society of North Dakota

25-9058

Attachment B

Architectural and Viewshed Report

Longspur, at the request of the State Historical Society, conducted an Architectural History study of the project to assess potential visual impacts from proposed turbines on historically significant architectural resources. The study was conducted in the third and fourth quarters of 2025. All areas within two miles of a proposed turbine were reviewed. Longspur recommended that no historically significant sites will be adversely affected by the Wind Project, due to existing impacts from nearby wind turbines and other obstructions like power lines. The report was filed with the State Historical Society and concurrence was received on April 17, 2026.

MANUSCRIPT DATA RECORD FORM

1. Manuscript Number: [SHPO assigns]

2. SHPO Reference #:

3. Author(s): Chris Kinder and William Harding

4. Title: Addendum: An Architectural Survey and Viewshed Report for the Minnesota Power Longspur Wind Project, Morton and Mercer Counties, North Dakota.

5. Report Date: March 18, 2026

6. Number of Pages: 66

7. Type – I, T, E, O: O

   I=Inventory; T=Formal Testing; E=Excavation; O=Other

8. List formally tested or excavated sites (not probes):

9. Acres:

10. List the legal description* and study unit. For study unit assignment, use the township tables in the *State Plan*, http://history.nd.gov/hp/stateplan_arch.html.
    Study Units: LM, CB, KN, HE, SM, GA, JA, GR, NR, SR, SO, SH, YE

*For *inventory*, *formal testing,* and *excavation* projects, *list the CLASS III legal locations only*.

County	Township	Range	Section	Study Unit

Minnesota Power

An Architectural Survey and Viewshed Report for the Minnesota Power Longspur Wind Project

Morton and Mercer Counties, North Dakota

PREPARED BY

Merjent, Inc.
1 Main Street SE, Suite 300
Minneapolis, Minnesota 55414

Chris Kinder
Principal Investigator & Author

William M. Harding
Co-Author

March 2026

EXECUTIVE SUMMARY

Minnesota Power, an ALLETE company, is developing a wind energy conversion facility, known as the Longspur Wind Project in Morton and Mercer Counties, North Dakota (Project). All Project turbines will be in Morton County and approximately 2.5 miles of 230-kilovolt (kV) transmission generator lead line (Transmission Line) will be installed to connect the Project to the proposed Point of Interconnect at an existing substation in Mercer County. The Project will require a Certificate of Site Compatibility from the North Dakota Public Service Commission in accordance with the North Dakota Energy Conversion and Transmission Facility Siting Act (the Siting Act) (North Dakota Century Code [NDCC], Chapter 49-22). Because the Project's Transmission Line will have a capacity greater than 115 kV and is longer than one mile, the Project will also need a Certificate of Corridor Compatibility under the Siting Act. The Project has received a Special Use Permit from Morton County and received a Conditional Use Permit from Mercer County.

Minnesota Power contracted Merjent, Inc. (Merjent) to conduct a cultural resources inventory on their behalf. In June 2025 Merjent consulted with the State Historical Society of North Dakota (SHSND), which serves as the State Historic Preservation Office (SHPO) for the state. On July 8, 2025, the SHPO responded with a reference number to the Project, 25-9058. SHPO requested a Class II reconnaissance survey for structures 45 years or older in the visual area of the Project. A 2-mile viewshed buffer of the proposed wind turbine sites was recommended by SHPO for the survey. The SHPO also requested archaeological surveys in the Area of Potential Effect, which have been completed and have either been documented, or are in the process of being documented, in separate reports (Reinhart and Cox 2025).

In August 2025, Merjent architectural historian, Chris Kinder, conducted a desktop survey of a 2-mile viewshed radius surrounding the Project area. Within the Project area, 105 sites were identified, containing approximately 390 structures. Using aerial imagery, Mr. Kinder determined that 26 of those identified sites did not meet the 50-year threshold for National Register of Historic Places nor the North Dakota State Historic Sites Registry (NDSHSR) eligibility consideration. In September 2025, the remaining 79 sites were photographed from the public right-of-way (ROW) by Merjent staff, Damien Reinhart.

Photographs were taken from the public ROW (roads or access maintained by a state or federal agency, or county), although many buildings and structures were not visible from the ROW. Desktop review initially identified 79 properties that needed to be photographed for evaluation. After looking through imagery and completing further evaluation, several properties were eliminated. The last boundary change to the Project eliminated 9 more properties from review. In total, 58 properties were eliminated because they were too new or outside the viewshed boundaries, leaving 21 that required further analysis. Of the 21 properties, 1 of those sites was previously identified and determined to be eligible for listing on the NDSHSR (MER-441; 32MO189); and of the remaining 20 sites, several were not visible from the public ROW, not accessible because of distance from the ROW, or blocked from viewshed by mature tree growth or topography. Representative photographs were taken of those properties that were visible from the public ROW. Because of lack of access or distance, not enough data was obtained to determine eligibility for the NDSHSR. All sites were within viewshed of extant modern wind turbines. As a result of already existing visual impacts from existing modern wind turbines, other energy infrastructures, and the presence of mature trees and vegetation, Merjent recommends that the proposed Project will have no effect on historic structures. No further architectural surveys are recommended for the Project as planned.

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LIST OF ACRONYMS

kV	kilovolt
Merjent	Merjent, Inc.
NDCC	North Dakota Century Code
NDSHSR	North Dakota State Historic Sites Register
Project	Longspur Wind Project in Morton and Mercer Counties, North Dakota
ROW	right-of-way
SHPO	State Historic Preservation Office
SHSND	State Historical Society of North Dakota
Siting Act	North Dakota Energy Conversion and Transmission Facility Siting Act
Study Area	Project turbine areas and 2-mile buffer
Transmission Line	Transmission generator lead line

1.0 PROJECT DESCRIPTION

Minnesota Power, an ALLETE company, is developing a wind energy conversion facility, known as the Longspur Wind Project in Morton and Mercer Counties, North Dakota (Project). All Project turbines will be in Morton County and approximately 2.5 miles of 230-kilovolt (kV) transmission generator lead line (Transmission Line) will be installed to connect the Project to the proposed Point of Interconnect at an existing substation in Mercer County. The Project will require a Certificate of Site Compatibility from the North Dakota Public Service Commission in accordance with the North Dakota Energy Conversion and Transmission Facility Siting Act (Siting Act) (North Dakota Century Code [NDCC], Chapter 49-22). Because the Project's Transmission Line will have a capacity greater than 115 kV and is longer than one mile, the Project will also need a Certificate of Corridor Compatibility under the Siting Act. The Project received a Special Use Permit from Morton County and received a Conditional Use Permit from Mercer County. The Project has an anticipated commercial operation date of December 2027, with construction potentially starting in 2026.

Minnesota Power contracted Merjent, Inc. (Merjent) to conduct a cultural resources inventory on their behalf. In June 2025, Merjent consulted with the State Historical Society of North Dakota (SHSND), which serves as the State Historic Preservation Office (SHPO) for the state. On July 8, 2025, the SHPO responded with a reference number to the Project, 25-9058. SHPO requested a Class II reconnaissance survey for structures 45 years or older in the visual area of the Project. A 2-mile viewshed buffer of the proposed wind turbine sites was recommended by SHPO for the Class II survey. The Project area and additional 2-mile viewshed buffers surrounding the turbine sites were inventoried to identify the presence of significant properties, with the goal of avoiding adverse effects to unevaluated, potentially eligible properties, properties recommended or determined eligible, or those already listed on the North Dakota State Historic Sites Registry (NDSHSR) (*NDCC § 55-10 and NDCC § 49-22-09)*. The SHPO also requested archaeological surveys in the Area of Potential Effect (Two-mile Turbine Viewshed Buffer), which have been completed and have either been documented, or are in the process of being documented, in separate reports (Reinhart and Cox 2025).

1.1 PROJECT AREA

The proposed Project originally included a total of 45 proposed and 22 alternate turbine locations (that number has since been reduced to 45 proposed and 12 alternative turbine locations), including access roads to the proposed turbines, a gen-tie transmission line, underground electrical collection lines, project substation, a 2.5-mile-long 230-kV transmission line (application to be filed separately, substation block, two operations and maintenance facility locations, three meteorological evaluation towers, an Aircraft Detection Lighting System tower location, and associated access roads were inventoried on private lands. Photographs were taken from the public right-of-way (ROW; roads or access maintained by a state or federal agency, or county), although many buildings and structures were not visible from the ROW.

The Two-mile Turbine Viewshed Buffer for visual effects is a radius of two miles surrounding the turbine sites, which was established based on the response from SHPO.

The Project and Two-mile Turbine Viewshed Buffer intersects multiple legal townships, ranges, and sections in Morton and Mercer Counties (see Figure 1 in Appendix A, and Table 1.3-1 below).

TABLE 1.3-1

Townships, Ranges, and Sections Included in the Two-mile Turbine Viewshed Buffer

County	Township	Range	Sections
Morton	139 N	87 W	1-12, 14-22
Morton	139 N	88 W	1-18, 24
Morton	139 N	89 W	1,2,12,13
Morton	140 N	87 W	2-11, 14-36
Morton	140 N	88 W	1-36
Morton	140 N	89 W	1-4, 9-16, 21-28, 34-36
Mercer	141 N	88 W	24-27, 34-36
Oliver	141	87	19, 22-36

1.2 SURVEY SUMMARY

In August 2025, Merjent architectural historian, Chris Kinder, conducted an initial desktop survey of a 2-mile viewshed radius surrounding the Project area (see Figure 2 in Appendix A). Mr. Kinder also served as the principal investigator for architectural history. Representative photos of the previously recorded properties were taken, as well as photos taken towards the Project area. Within the viewshed radius, 105 sites were identified, containing approximately 390 structures. Using aerial imagery, Mr. Kinder determined that 26 of those identified sites did not meet the 50-year threshold for NDSHSR eligibility consideration. In September 2025, the remaining 79 sites were photographed from the public ROW by Merjent's Damien Reinhart.

A total of 21 properties, including 1 that was previously identified and determined to be eligible for listing on the NDSHSR (MER-441; 32MO189); and 20 newly identified sites, several of which were not visible from the public ROW, not accessible because of distance from the ROW, or blocked from viewshed by mature tree growth or topography were analyzed. Photographs were taken of each site that was at least partially visible, though most were at a distance from the public ROW.

2.0 LITERATURE SEARCH RESULTS

The literature review for the Project Study Area is presented in the Class I and III inventory report and is not repeated here (Reinhart and Cox 2025). On July 24, 2025, a wider file search of the expanded Project turbine areas and a 2-mile buffer (Study Area) was conducted. The original Class I file search focused on a 1-mile radius from the Project. Records in the North Dakota Archaeology and Historic Preservation Files identify 51 cultural resources in the Study Area, which is the Project turbine areas plus a 2-mile viewshed buffer around each turbine area. Additionally, nineteenth-century General Land Office maps and historical aerial photography were reviewed.

2.1 PREVIOUSLY IDENTIFIED HISTORIC PROPERTIES

Merjent identified one previously identified historic property within the 2-mile viewshed buffer of the proposed Project (see Table 2.1-1). Twenty other structures are newly identified historic age properties that have not been previously identified and are discussed in Section 4.2.

TABLE 2.1-1

Previously Identified Significant Properties Within the Two-Mile Turbine Viewshed Buffer

Historic Inventory Number	Historic Property Name	Structure Type	NDSHSR Status
32MO189	St. Clement's Church	Church	Eligible

3.0 NDSHSR EVALUATION PROCESS

For a property to be recommended eligible for the NDSHSR, it must meet one or more of the NDSHSR Criterion by being associated with an important historic context and retaining the physical integrity necessary to convey its significance. To complete the NDSHSR evaluation, properties are categorized (i.e., as a district, site, building, structure, or object), placed within their appropriate historic context, evaluated for significance under NDSHSR Criteria, and assessed for retention of physical integrity. The following are criteria set forth the NDSHSR Criteria for Evaluation (N.D.C.C. § 55-10 and N.D.C.C. § 49-22-09) state:

1) Criteria 1: Sites must have been associated with and now illustrate, recall, or characterize individuals, groups, processes, institutions, movements, lifeways, folkways, ideals, beliefs, or other patterns that had a significant influence on or are important reflections of the state's history.

2) Criteria 2: Sites must be distinctive or illustrate architectural styles, building types, vernacular, popular, or traditional building design, landscape architecture, urban design or planning, works of significant architects, designers, builders or planners, monumental sculpture, or industrial, technological, or engineering design.

3) Criteria 3: The site contain information about or evidence of one or more of the following historic or prehistoric: events, processes, institutions, designs, construction, settlement, migration, ideals, beliefs, lifeways, or folkways, or other facets of development and cultural systems that are known or established likely to be important to professional or public knowledge or understanding of earlier cultures or cultural systems or of the development of the state or of regions or communities within the state.

4) Criteria 4: The site retains integrity of form, material, and setting, generally retaining those historic characteristics such as physical features, evidence of workmanship, fabric, location, and surroundings that convey, support, represent, or contain values and qualities for which they are judged significant.

To be included in the NDSHSR, a property must meet one of the criteria for evaluation and must possess integrity. Integrity may be defined as the authenticity of a property's historic identity as demonstrated by the survival of physical characteristics that existed during the historical or precontact period of the property and is defined herein as a characteristic of a property that both renders it significant to modern cultural groups and is representative enough of its historic quality so that a person from the represented period would theoretically be able to recognize its value as it exists today. To retain historic integrity, a property will always exhibit several, if not all, of seven necessary aspects: location, design, setting, materials, workmanship, feeling, and association.

4.0 SURVEY RESULTS

Mr. Kinder conducted a visual impacts survey of architectural properties and historic-aged resources from August to September 2025. Representative photos of the previously recorded properties and unrecorded historic-aged resources were taken by Merjent staff, Damien Reinhart, as well as photos from the property/resource towards the Project area. These photos and survey field notes were used to determine if the proposed Project would have any effect on previously recorded architectural properties and unrecorded historic-aged resources.

There were 21 historic properties surveyed and analyzed within the 2-mile viewshed buffer surrounding each proposed turbine location. One historic property was previously identified, St. Clement's Church, and was determined to be eligible (MER-441; 32MO189) and the remaining 20 properties identified by Merjent were not previously identified.

Any eligibility recommendations were made through the NDSHSR and NDSHSR evaluation process described in Section 3.

4.1 PREVIOUSLY IDENTIFIED HISTORIC STRUCTURES

In August 2024, Merjent conducted a Class I file search for the proposed Project area to inform the Class II process (also used to inform the Class III intensive pedestrian inventory). Merjent reviewed architecture and history inventory forms and cultural resource reports filed at the SHSND. An expanded search was conducted in July 2025 to inform the Class II survey. Merjent identified one previously identified historic property, St. Clements Church (**described below**), within the 2-mile buffer of proposed turbine locations.

32MO189

Also known historically as St. Clement's Church, the property contains the church building and a historic age schoolhouse (see Photos 1-3 and Figure 2 in Appendix A). An associated cemetery (see Photo 3 below) is located across the road and just to the east of the church property. Based on available resources, the property was recommended as meeting all the requirements of eligibility by the SHPO at an unknown date.

The church (see Photo 1 below) was constructed in 1937 after a 1905 wood-frame church was destroyed by fire. The current church is wood frame, with a stone foundation. The church is front gabled, with the façade facing west. The door opening is located in the southwest corner of the façade. The steeple juts from the front on the southern end of the façade. There are six window openings on the façade; two on the first level are two over two double hung windows; the remaining windows are six-light arched windows. Except for the steeple, the church is rectangular in shape. The north elevation has four arched, stained-glass windows. The south elevation has 2 arched, stained-glass windows on the west end. A lean to shed or storage addition is located on the east end of the southern façade. The church appears to be little altered from its 1937 construction (see Photo 1 below).

The property also contains a brick, two-story schoolhouse (see Photo 2). The schoolhouse appears to date to the early 20th century, and most likely was built around the same time as the 1905 wood frame church that was later destroyed by fire. The schoolhouse is brick with a stone foundation. It has a pyramid shaped roof with a gabled dormer on the east façade. A brick entry way juts from the façade and was most likely added at a later date. The entry had a front gabled roof. There are multiple window openings on each side of the schoolhouse, most are covered by plywood or boarded-over. The schoolhouse is in fair condition but does show signs of deterioration.

Due to the distance from the Proposed wind turbines, and the presence of mature trees, Merjent recommends that the Project will have no effect on the property's ability to convey historic significance.

Photo 1: St. Clements Church. South elevation

Photo 2: East facade and south elevation of the St. Clements school

Photo 3: St. Clements Cemetery, view to the north

4.2 NEWLY IDENTIFIED PROPERTIES

Within the Survey Area of the proposed Project, 20 historic-aged resources were identified by Merjent within the 2-mile viewshed buffer. None of the resources were previously evaluated for the NDSHSR. As such, resources which are unevaluated are to be treated as "NDSHSR-Eligible" until a determination is made otherwise. These 20 newly identified resources were assessed to evaluate if the proposed Project would have any direct or indirect effect on the historic-aged resources' ability to portray significance for future inclusion on the NDSHSR or NDSHSR. The 20 newly identified are listed in Table 4.2-1 below. Some resources were either not visible or partially visible from the public ROW, which consists of roads constructed and maintained by the North Dakota Department of Transportation or Morton and Mercer Counties. Privately owned roads or driveways were not accessed to take photographs. However, due to the topography, vegetation, and/or presence of existing transmission line utilities and wind turbines within the viewshed, Merjent recommends a finding of no effect to these newly identified historic-aged resources. SHSND historic structure site forms have been completed for each newly identified resource, and no further investigation or mitigation is recommended.

TABLE 4.2-1

Newly Identified Properties

Site Number	Merjent Field Code	Historic Name/Address	City, County	Merjent NDSHSR-Eligibility Recommendation
32MOX831	MER-433	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX832	MER-444	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX833	MER-446	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX834	MER-448	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX835	MER-449	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX836	MER-450	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX837	MER-453	[redacted]	Glen Ullin, Morton	Unevaluated

TABLE 4.2-1

Newly Identified Properties

Site Number	Merjent Field Code	Historic Name/Address	City, County	Merjent NDSHSR-Eligibility Recommendation
32MOX838	MER-457	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX839	MER-459	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX840	MER-460	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX841	MER-462	[redacted]	Glen Ullin, Morton	Unevaluated
32ME2404	MER-468	[redacted]	Glen Ullin, Morton	Unevaluated
32OLX559	MER-478	[redacted]	New Salem, Oliver	Unevaluated
32MO1740	MER-489	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX842	MER-494	[redacted]	New Salem, Morton	Unevaluated
32MOX843	MER-495	[redacted]	New Salem, Morton	Unevaluated
32MOX844	MER-500	[redacted]	New Salem, Morton	Unevaluated
32MOX845	MER-509	[redacted]	Glen Ullin, Morton	Unevaluated
32MOX846	MER-511	[redacted]	New Salem, Morton	Unevaluated
32MOX847	MER-513	[redacted]	Glen Ullin, Morton	Unevaluated

32MOX831 (MER-433)

32MOX831 (MER-433) is the remnants of a farmstead and contains two structures (see Photo 4 below and Figure 2 in Appendix A). The first structure is a small, rectangular, utilitarian agricultural outbuilding. The structure is wood frame, with horizontal wood siding. The roof is low pitched and side gable. The facade faces south with three openings: two small windows on the east and west ends, with a centrally placed doorway. building is visible to the southeast of Feature 1. Based on view from the ROW and aerial imagery, it is unclear if the building is historic or modern. Views from the ROW of other elevations were not able to be viewed or assessed.

The structure is a rectangular, wooden storage building with a gable roof. It appears to be original, in fair condition with some dilapidation. Integrity of materials and workmanship for the structure remains intact. Other aspects of integrity, especially feeling and setting may be altered as this site was most likely part of a homestead and other buildings associated with the property are no longer extant. However, the resource is recommended as not eligible for listing on the NDSHSR under Criteria 2 and 4, because it does not appear to have significant association with an important historic building style or development, nor does it exhibit any character-defining or architectural features worthy of note. A more intensive survey would be required to determine if the site as any historic associations to events that have made significant contributions to broad patterns in American history (Criteria 1 NDSHSR), or to people significant in our past (Criteria 1 NDSHSR), so at this time the resource remains unevaluated.

Photo 4: Overview of outbuilding looking west, 32MOX831 (MER-433)

32MOX832 (MER-444)

32MOX832 (MER-444) is the remnants of a farmstead (see Photo 5 below and Figure 2 in Appendix A). One building remains on the property (Feature 1), a wooden vernacular Craftsman bungalow. The house is rectangular and side-gabled with a steeply pitched roof and a front-gabled dormer. The house is wood frame with wide overhanging eaves. Only the façade of the house was partially visible, the rest of the view was blocked by mature tree growth, vegetation, and a collection of cars. The house is in relatively poor condition as the enclosed porch and portions of the roof appear to be sagging. A garage and outbuilding are located to the north and northwest of Feature 1. It is unclear of the buildings are historic due to mature tree cover and shadows in aerial imagery.

The resource is recommended as not eligible for listing on the NDSHSR under Criteria 2 and 4, because it does not appear to have significant association with an important historic building style or development, nor does it exhibit any character-defining or architectural features worthy of note. A more intensive survey would be required to determine if the site as any historic associations to events that have made significant contributions to broad patterns in American history (Criteria 1 NDSHSR), or to people significant in our past (Criteria 1 NDSHSR), so the resource currently remains unevaluated.

Photo 5: Site overview looking west, 32MOX832 (MER-444)

32MOX833 (MER-446)

32MOX833 (MER-446) is a farmstead with a few buildings of varying age (see Photo 6 below and Figure 2 in Appendix A). There is a modern house, a mid-20th century metal barn, and a historic-age house that dates to late 19th or early 20th centuries.

The historic-age storage building is rectangular in shape with a side gabled roof. Based on aerials, it appears the residence was north of this building where the modern residence is located. The façade faces south and has four window openings: two on the west end and two on the east. The doorway was not readily visible but is most likely centrally placed between the façade windows and covered over. Only the western elevation was visible. The building is clad in wood horizontal siding.

There is a large, wood frame, metal-clad barn located to the northeast of the historical house. The barn was only partially visible from the public ROW. The building has a side gabled, metal roof and is clad in corrugated metal. There are two large visible openings on the southern elevation. One on the west end and one on the east.

The modern house was not visible from the ROW, but from aerial imagery it could be seen that the structure is rectangular in shape. An outbuilding, row of three grain bins, and several small sheds are also located at the site. The outbuilding and grain bins in the northeast portion of the site were added between 1967 and 1985. What appear to be three small sheds are located to the east of the residence.

The structures do not appear to be altered significantly and are in fair condition. However, the resource is recommended as not eligible for listing on the NDSHSR under Criteria 2 and 4, because it does not appear to have significant association with an important historic building style or development, nor does it exhibit any character-defining or architectural features worthy of note.

A more intensive survey would be required to determine if the site as any historic associations to events that have made significant contributions to broad patterns in American history (Criteria 1 NDSHSR), or to people significant in our past (Criteria 1 NDSHSR), so the resource remains unevaluated.

Photo 6: Site overview looking north, 32MOX833 (MER-446)

32MOX834 (MER-448)

32MOX834 (MER-448) is a farmstead with a house, barn, and several small outbuildings (see Photo 7 below and Figure 2 in Appendix A). A total of 11 features dating between 1945 and 2005 could be described. No characteristics of the structures could be seen from the ROW but did appear to be abandoned and no longer in use.

Feature 1 appears to be a wooden, end-gabled residence located in the southern portion of the farmstead. Feature 2 appears to be a wooden, rectangular, garage based on the surrounding vehicles and driveway. Feature 3 is a Quonset hut located near the center of the farmstead. A bay door is visible on the east end, and it is surrounded by vehicles, possibly indicating its function as a garage/workshop. Feature 4 appears to be a second wooden, gabled single dwelling with a center gable on the south side possibly indicating an entry. Feature 5 is a wooden, rectangular garage located in the northeast portion of the farmstead just south of a large metal-clad structure (Feature 6). Feature 6 is an L-shaped metal-clad gabled building that may be attached to Feature 7 to the west. The east-west trending wing has an arched roof. Feature 7 is a large T-shaped metal-clad building in the northeast portion of the farmstead. It has four additions on the east side that are adjacent to Feature 6. The southernmost addition is L-shaped and may connect with Feature 6, it is indeterminable based on the aerial imagery. Feature 8 is a Quonset hut clustered near Features 6 and 7. It is presumed to function as a shed. Feature 9 is an additional Quonset hut located near the center of the farmstead, with four vents placed in its roof. It is corrugated metal and has a corral attached to its northeast side. A road appears to enter it from the south end indication that it may be a workshop. Feature 10 is a gabled wooden shed located in the north central portion of the farmstead, northwest of Feature 9. Feature 11 is a granary located north of Feature 1.

A more intensive survey and research are needed to ascertain the accurate number of buildings, their age and any historic significance, associations, and integrity. With the property only partially visible at a distance from the ROW, no recommendation of eligibility for the NDSHSR could be made.

Photo 7: View south toward 32MOX834 (MER-448)

32MOX835 (MER-449)

32MOX835 (MER-449) is a farmstead with a house, large barn, and several outbuildings and grain bins (see Photo 8 below and Figure 2 in Appendix A). A total of 14 features could be described dating between 1930 and 1990. The farmstead was a sizeable distance from the ROW, and features and characteristics of the property and structures could not be ascertained.

Feature 1 appears to be a wood framed storage building/shed located in the north central part of the site. It has a gabled roof appears to have vertical wood siding based on the aerial. Feature 2 is a wooden barn with a gambrel roof. A large silo (Feature 13) is directly south of the barn. Two vents extend from the metal barn roof. Feature 3 appears to be a smaller barn, with a corral attached to its north and east sides. A large silo (Feature 4) is adjacent to its east side, within the corral. Feature 5 appears to be an animal shelter of unknown function attached to the same corral as Feature 4. Although not apparent, it is possible there is an opening for animals on the north end based on the configuration of the corral. Feature 6 consists of two identical, circular, granaries located in the southeast portion of the farmstead. They are metal-clad with conical roofs. Feature 7 is a wooden, gable-roofed stable, or other animal shelter, with a corral attached to the north side. Feature 8 is a wooden, gable-roofed shed in the southern portion of the farmstead. Feature 9 is a wooden gable-roofed shed near the southwest corner of the farmstead near several metal granaries. Feature 10 consists of three metal-clad granaries that are collocated in the southwest corner of the farmstead. Two are identical and the third is Feature 14. Feature 12 consists of two smaller metal-clad granaries in a row of three located north of the shed (Feature 9). The granary on the north end (Feature 11) is larger than the two described.

A more intensive survey and research are needed to ascertain the accurate number of buildings, their age and any historic significance, associations, and integrity. With the property only partially visible at a distance from the ROW, no recommendation of eligibility for NDSHSR could be made.

Photo 8: View southwest toward 32MOX835 (MER-449)

32MOX836 (MER-450)

32MOX836 (MER-450) is a collection of five grain bins of varying height and similar circumference (Features 1 to 4) (See Photo 9 below and Figure 2 in Appendix A). The grain bins date to the mid to late 20th Century. The grain bins are clad in corrugated metal and have low-pitched circular pyramidal roofs.

Feature 1 is single grain bin on the far west of the row that was added between 2003 and 2005). Feature 2 consists of two identical grain bins in the center of the row that were added between 2003 and 2005. Feature 3 is a single grain bin locate on the far east of the row and was also added between 2003 and 2005. Feature 4 is a single grain bin southeast of the row that was added between 1967 and 1985). The grain bins are clad in corrugated metal and have low-pitched conical roofs.

The resource is recommended as not eligible for listing on the NDSHSR under Criteria 2 and 4, because it does not appear to have significant association with an important historic building style or development, nor does it exhibit any character-defining or architectural features worthy of note. A more intensive survey would be required to determine if the site as any historic associations to events that have made significant contributions to broad patterns in American history (Criteria 1 NDSHSR), or to people significant in our past (Criteria 1 NDSHSR), so the resource remains unevaluated.

Photo 9: Site overview looking northeast, 32MOX836 (MER-450)

32MOX837 (MER-453)

32MOX837 (MER-453) is a large farmstead with numerous structures (see Photo 10 below and Figure 2 in Appendix A). The farmstead was at a large distance from the ROW, and few details could be ascertained. There is a modern house, a large barn, and a diverse array of historical buildings and structures that could only be seen from aerial imagery, perhaps as many as 12.

Feature 1 is a house located in the east-central portion of the farmstead. It is gabled with a small extension/addition on the southeast corner that may be a porch. The main entry appears to be on the east elevation. Feature 2 is a wooden workshop with a gable roof with shed addition on the north and south sides. The south side is adjacent to a possible gas tank and the north side is adjacent to a smaller shed (Feature 12). There is a possible addition or separate detached building to the north. Feature 3 is an animal shelter with a corral attached to its south side and appears to date between 1967 and 1985. Feature 4 appears to be a wooden, rectangular, shed or other type of storage building. It is located east of the corral attached to the animal shelter (Feature 3). Feature 4 appears to be a wooden shed or other type of storage building added between 1967 and 1985. It is located east of the corral attached to the animal shelter (Feature 3). Feature 6 is also a wooden, rectangular, animal shelter located within a series of corrals immediately northeast of Feature 5. Feature 7 appears to be a garage with a bay opening on the east elevation based on the road configuration added between 1960 and 1975. It is adjacent to the corrals associated with Features 5 and 6. Feature 8 consists of four larger, circular, metal granaries collocated in an L-shaped configuration in the northeast portion of the farmstead added between 1960 and 1975. There is a total of 6 granaries, but two are smaller (Feature 9, which were added between 1960 and 1975). The granaries are in an L-shaped configuration with the smaller ones located on the upright of the L. Feature 10 is a barn located near the center of the farmstead built between 1930 and 1945. Based on the aerial, it appears to be a Western barn style (Dennis 2014). It is attached to the corrals on its east elevation that are associated with Features 5 and 6, and has a smaller corral attached to its north elevation. Feature 11 is a small, wooden, square shed west of the barn (Feature 10) and northeast of the house (Feature 1). Feature 12 is a small, rectangular, wooden, shed immediately north of, and adjacent to, the repair/workshop (Feature 2) that first appears in aerial imagery in 2010.

A more intensive survey and research is needed to ascertain the accurate number of buildings, their age, and any historic significance, associations, and integrity. With the property only partially visible at a distance from the ROW, no recommendation of eligibility for the NDSHSR could be made.

Photo 10: View north toward 32MOX836 (MER-453)

32MOX838 (MER-457)

32MOX838 (MER-457) is a large farmstead with a historic-age house, two barns, and numerous other outbuildings (see Photo 11 below and Figure 2 in Appendix A).

Feature 1 is the house, which appears to be a gabled front American Foursquare with a gable with a shed dormer. No other characteristics could be ascertained. Feature 2 appears to be a barn with a gabled roof added between 1960 and 1975. It is directly east of the house and had an attached corral on its east side. Feature 3 appears to be a gambrel-roofed barn added between 1975 and 1990. It is northwest of the other barn (Feature 2) and northeast of the house (Feature 1). Feature 4 is a small granary immediately north of Feature 3. Feature 5 is a garage that may double as a workshop, and which has been enlarged over time. It is adjacent to house (Feature 1).

The farmstead is at a distance from the public ROW, and few distinguishing features or characteristics could be ascertained. A more intensive survey and research are needed to ascertain the accurate number of buildings, their age and any historic significance, associations, and integrity. With the property only partially visible at a distance from the ROW, no recommendation of eligibility for the NDSHSR could be made.

Photo 11: View northwest toward 32MOX838 (MER-457)

32MOX839 (MER-459)

32MOX839 (MER-459) is a large farmstead (see Photo 12 below and Figure 2 in Appendix A). There are numerous structures on the property that can only be seen from aerial imagery. The property is not visible from the public ROW. The structures include a house, garage, two sheds, several granaries, and a barn with attached corrals.

Feature 1 is a house that is located near the center of the farmstead. It is multi-gabled, possibly two stories, and appears to have a side gabled entry on the south elevation. with an attached garage on the west end. Feature 2 is a long, rectangular, metal-clad workshop west of the house. Feature 3 is a small, gable roofed shed west of the metal workshop. Feature 4 is a small, gable roofed shed north of the metal workshop and east of a row of metal granaries of various sizes. Feature 5 consists of the three larger, co-located granaries in a row of four. They are directly north of the metal workshop. Feature 6 is the smaller granary near the east end. Feature 7 are two larger, circular metal granaries north of the row of four (Features 5 and 6). Feature 8 is a metal granary east of, and across a road, from Feature 7. Feature 9 is a gambrel-roofed barn located southwest of the house. A series of corrals are attached to the east and south sides of the barn.

A more intensive survey and research are needed to ascertain the accurate number of buildings, their age and any historic significance, associations, and integrity. With the property only partially visible at a distance from the ROW, no recommendation of eligibility for the NDSHSR could be made.

Photo 12: View west toward 32MOX839 (MER-459)

32MOX840 (MER-460)

32MOX840 (MER-460) is a small farmstead composed of 7 features (see Photo 13 below and Figure 2 in Appendix A). The property contains several historic-age structures, including a house, two workshops, two barns, and several other utilitarian or agricultural buildings, some of which appear modern.

The house dates approximately to the 1920s or 1930s and is a vernacular wooden Craftsmen bungalow. The house is side gabled with a front gabled dormer on the façade. The porch is enclosed with window openings running across the façade; a centrally placed doorway between them. The house sits on a stone or brick foundation. The window openings appear to be original. Few other details could be ascertained because of distance and mature tree growth.

The two sheds are both clad in metal and located just south of the house. The furthest from the house is a late 1940s or 1950s era Quonset-style workshop (Feature 2) with a large central barn door opening and a small window opening on the north end of the façade. The other is a 1930s era metal farm equipment shed (Feature 3) with three large garage door openings across the façade.

To the north of the house are four agricultural structures. The furthest west (Feature 4) is a small, rectangular, wood frame workshop with a large central barn-style opening. Few other features could be determined from the public ROW. To the east is another 1940s-era Quonset-style workshop (Feature 5) with a centrally placed barn door opening. To the east there is a large early to mid-20th century grain bin (Feature 6), of which few details could be ascertained from the public ROW. The easternmost structure (Feature 7) on the property is a large Gambrel-style barn that dates to the early 20th Century. The barn has wood frame with wood cladding. Few features could be seen from the ROW due to mature tree growth.

The structures do not appear to be altered significantly and are in fair condition. However, the historic-aged resource is recommended as not eligible for listing on the NDSHSR under Criteria 2 and 4, because it does not appear to have significant association with an important historic building style or development, nor does it exhibit any character-defining or architectural features worthy of note. A more intensive survey would be required to determine if the site as any historic associations to events that have made significant contributions to broad patterns in American history (Criteria 1 NDSHSR), or to people significant in our past (Criteria 1 NDSHSR), so the resource remains unevaluated.

Photo 13: Overview looking west, 32MOX840 (MER-460)

32MOX841 (MER-462)

32MOX841 (MER-462) is a small farmstead composed of four features (see Photo 14 below and Figure 2 in Appendix A). MER-462 is a small farmstead composed of four features. Feature 1 appears to be an animal shelter, Feature 2 appears to be a garage/shop, Feature 3 is a silo/granary, and Feature 4 is a shed/warehouse.

Feature 1 is a rectangular, metal clad, barn with a gable roof in the northwest portion of the farmstead. A corral appears to be attached to its east end and a small addition may be present on the west end. Feature 2 is in the northwest portion of the farmstead and also appears to be metal clad. It is rectangular with a gable roof. Several vehicles are located to its west, possibly indicating its use as a garage or workshop. Feature 3 is a metal, circular, granary in the southeast portion of the farmstead with a conical roof. Feature 4 is a small, rectangular, wooden building with a gable roof in the southwest corner of the farmstead.

The farmstead can only be viewed from aerial imagery and is not visible from the public ROW. A more intensive survey and research are needed to ascertain the accurate number of buildings, their age and any historic significance, associations, and integrity. With the property not visible from the ROW, no recommendation of eligibility for the NDSHSR could be made.

Photo 14: View east toward 32MOX841 (MER-462)

32ME2404 (MER-468)

32ME2404 (Field number MER-468) updates the remnants of a small residential property with two structures (see Photo 15 below and Figure 2 in Appendix A). The first structure is a small, wood frame cabin that dates to the earliest years of the 20th Century. The structure is rectangular in shape, with a side gabled roof. The structure is clad in horizontal wood siding. No openings could be seen from the ROW. The structure is in fair condition.

The second structure is a small, wood-framed shed, possible granary, that appears to be of a style that typically dates to the early 20th Century. The structure is rectangular in shape, with a front gabled roof, with a large centrally placed opening with double wooden doors. There is a centrally placed chimney at the north end of the structure. The structure is clad in wood siding and asphalt shingle roof. The center of the garage is collapsing, and the structure is in poor condition.

The structures do not appear to be altered significantly and are in fair condition. However, the property is recommended as not eligible for listing on the NDSHSR under Criteria 2 and 4, because it does not appear to have significant association with an important historic building style or development, nor does it exhibit any character-defining or architectural features worthy of note. A more intensive survey would be required to determine if the site as any historic associations to events that have made significant contributions to broad patterns in American history (Criteria 1 NDSHSR), or to people significant in our past (Criteria 1 NDSHSR).

Photo 15: Overview looking northwest, 32ME2404 (MER-468)

32OLX559 (MER-478)

32OLX559 (MER-478) is a farmstead with three structures (see Photo 16 below and Figure 2 in Appendix A). The structures could not be viewed from the public ROW. The structures can be viewed from aerial imagery, where it appears the farmstead includes a house and two outbuildings.

Feature 1 is a Gambrel-roofed animal shelter or barn with a metal building attached to the west side. Based on aerial imagery, it appears that the original farmhouse was located northeast of this building and has been demolished. Feature 2 also appears to be an animal shelter. It is wooden and rectangular with a gable roof and was added between 1960 and 1975. Feature 3 is somewhat larger than Feature 2 and is also wooden, rectangular, and has a gable roof. It was added between 1975 and 1990. They appear to be in very poor condition.

A more intensive survey and research is needed to ascertain the accurate number of buildings, their age and any historic significance, associations, and integrity. With the property not visible from the ROW, no recommendation of eligibility for the NDSHSR could be made.

Photo 16: View northeast toward 32OLX559 (MER-478) and the Project area

32MO1740 (MER-489)

MER-489 is a farmstead with several structures (see Photo 17 below and Figure 2 in Appendix A). The structures could not be viewed from the public ROW. The structures can be viewed from aerial imagery, where it appears the farmstead includes a Gambrel-style barn and multiple outbuildings. A more intensive survey and research are needed to ascertain the accurate number of buildings, their age and any historic significance, associations, and integrity. With the resource not visible from the ROW, no recommendation of eligibility for the NDSHSR could be made. This property is being more thoroughly described in a forthcoming Class III addendum report.

Photo 17: View west toward 32MO1740 (MER-489) and the Project Area

32MOX842 (MER-494)

32MOX842 (MER-494) is a farmstead with several buildings of varying ages, sizes and condition. The property includes a house, barns, workshops, and grain bins for a total of approximately 8 features.

The house is located near the center of the property (see Photo 18 below and Figure 2 in Appendix A). The vernacular house dates to the early 20th Century. The house is rectangular in shape with a steeply pitched side-gabled roof. The house is one and a half stories with horizontal wood siding. The house is oriented east to west, with a small entry way jutting out from the front. The visible window openings appear to be original. Because the property was viewed from a distance from the ROW, few details could be ascertained.

To the south of the house is a post-1960 metal shed or garage, with a slanted shed roof. The building is rectangular in shape and constructed of metal. The garage is utilitarian in nature. There are three large garage doors, two of same size, one slightly larger, on the east facade, along with a single-entry door on the north end of the east facade.

Immediately south of the metal shed is a is a utilitarian wooden shed or residential structure with a gabled roof and a south facing facade. The structure is clad in horizontal wooden siding. There are multiple openings on the south facade, but vegetation and distance from the ROW prevented a full view of the facade. The structure is in poor condition and on the verge of collapse.

Southwest of the wooden shed or house is a collection of four small, mid-20th Century grain bins (see Photo 18 below). The grain bins are constructed with and clad in metal, with cylindrical pyramid roofs. They are utilitarian in nature and common structures for the area. Immediately south are the ruins of a wooden utilitarian agricultural structure. The facade remains standing, but very slanted. The rest of the structure has collapsed. Because of the distance from the ROW and the condition of the structure, no other details could be ascertained.

South of those structures were two wood framed agricultural buildings (see Photo 19 below). The first is a rectangular, wooden, utilitarian agricultural structure. The likely use was as a chicken coop. The structure faces east and has two openings on the facade. The structure has a side-gabled roof and horizontal wooden siding. The condition is poor, but no other details could be ascertained because of distance from the ROW. The other is a small utilitarian, wooden barn. The barn has a steeply pitched gabled roof and horizontal wooden siding. The barn is in poor condition and is slanting slightly to the north. Because of the distance from the ROW, no other details could be ascertained.

To the southernmost part of the property is a utilitarian workshop on the south end of the property (see Photo 20 below). The shop is clad in metal and has a slanted roof and faces the east. There is one door opening on the north end of the east facade. No other details could be determined from the ROW.

While the structures could be viewed from the ROW, they were at a distance, and many details and features of the structures could not be ascertained. The structures do not appear to be altered significantly and are in fair condition. However, the resource is recommended as not eligible for listing on the NDSHSR under Criteria 2 and 4, because it does not appear to have significant association with an important historic building style or development, nor does it exhibit any character-defining or architectural features worthy of note. A more intensive survey would be required to determine if the site as any historic associations to events that have made significant contributions to broad patterns in American history (Criteria 1 NDSHSR), or to people significant in our past (Criteria 1 NDSHSR), so the resource remains unevaluated.

Photo 18: 32MOX842 (MER-494), view facing west toward the house

Photo 19: 32MOX842 (MER-494), view facing west toward several agricultural structures

Photo 20: 32MOX842 (MER-494), view facing northwest

32MOX843 (MER-495)

32MOX843 (MER-495) is a farmstead with a house and several agricultural structures (Features 1 to 7; see Photo 21 below and Figure 2 in Appendix A). View of the property was at a distance from the ROW, and many features of the structures could not be ascertained.

The vernacular, L-shaped house dates to the early 20th Century. Because the property was viewed at a distance from the ROW, few details could be ascertained. To the west and southwest of the house are two rectangular outbuildings that also were only visible by aerial imagery. The southernmost structure on the property is a mid-century Quonset-style workshop. View of the workshop was limited to the eastern elevation.

Feature 2 is a Quonset style workshop southeast of the house. View of the property was from a distance along the ROW. Few details could be seen. Feature 5 is a small, wooden, rectangular, shed located southwest of the house and Feature 6 is a larger wooden, rectangular, shed located west of the house.

To the north of the house is a group of several grain bins of various sizes (Features 3 and 4) that could only be viewed with aerial imagery. Feature 3 is a relatively large silo on the east end of a line of six silos. Feature 4 consists of four smaller bins in the center of the line. Feature 7 is on the west end of the line and is relatively larger.

Feature 5 is a wood frame shed in the south center portion of the site. Feature 6 is a wood frame shed in the western portion of the site. The structures could only be viewed from aerial imagery. View of the structures from the ROW was blocked by vegetation and mature trees. A more intensive survey and research is needed to ascertain the accurate number of buildings, their age and any historic significance, associations, and integrity. With much of the property not visible from the ROW, no recommendation of eligibility for the NDSHSR could be made.

Photo 21: Overview looking northwest, 32MOX843 (MER-495)

32MOX844 (MER-500)

32MOX844 (MER-500) is a farmstead containing six structures, four of which are obscured by mature tree growth and include two Quonsets (see Photo 22 below and Figure 2 in Appendix A). The structures include a house, grain bins, and other structures of unknown function obscured by mature tree growth. The modern barn and historic period barn were the only structures visible from the ROW.

Of the two structures that could be viewed from the ROW, one is a modern Monitor-style barn that dates between 2005 and 2020 based on aerial imagery. The barn is rectangular in shape with a raised center portion with lean-tos on either side. The barn is clad in metal. There are five total openings on the western elevation; two small, evenly spaced two-light windows on the raised center portion and three openings on the ground level. The ground floor openings include two doors on the south end of west elevation and one small two-light window on the north end. A large opening, with a sliding barn door is centrally placed on the southern facade. The barn was viewed at a distance from the ROW, and no other elevations or characteristics could be seen.

The other visible structure was a historical Gambrel-style barn that dates to the mid-20th century. The barn is rectangular in shape with a large, rounded Gambrel roof. The barn is wood frame and clad in horizontal wood siding. There are multiple evenly spaced windows on the western elevation that appear to be original. The total number of windows could not be ascertained from the ROW. The southern facade has two openings. A large barn door on the ground floor and a slightly smaller opening on the second floor used to place and store hay. Because the barn was viewed at a distance from the ROW, not all characteristics could be determined.

Feature 3 is a smaller, metal, barn that dates to the mid-20th century. It is rectangular with a gable roof. Features 2 and 5 consist of a rectangular, metal, Quonset huts that are 1 story high. Feature 2 is located in the north central portion of the farmstead while Feature 5 is located more closely in the central portion. Feature 4 is a single grain bin just north of Feature 5. This bin is in this location by at least 1985 according to aerial imagery. Feature 5 was added between 1967 and 1985 based on aerial imagery. Feature 6 is a single unit dwelling. Based on aerials, the house has a cross-gable roof and attached garage at the northeast corner. No other details could be ascertained as a shelterbelt blocks the view of the feature.

Several grain bins of various sizes and ages, as well as the house and other agricultural outbuildings, were not visible from the ROW. A more intensive survey and research is needed to ascertain the accurate number of buildings, their age and any historic significance, associations, and integrity. With much of the property not visible from the ROW, no recommendation of eligibility for the NDSHSR could be made.

Photo 22: Overview looking southeast, 32MOX844 (MER-500)

32MOX845 (MER-509)

32MOX845 (MER 509) is a small farmstead with nine historic-age structures; including a house, garage, Quonset, barn, equipment shed, and grain bins.

The house is centrally located on the property (see Photo 23 below and Figure 2 in Appendix A). It is a vernacular Craftsmen bungalow that dates to the 1910s or 1920s. The rectangular house is front gabled, with a side gabled dormer on the east elevation. Few other details could be described as the view of the house was a distance from the public ROW. Just to the west of the house is small, wood-frame garage of the same age, with a double-pitched front gabled roof. Few other features could be seen because of distance.

To the north of the house is a large, rectangular, Gambrel-style barn (see Photo 23 below). The barn is wood-framed and clad in horizontal wood siding. There are lean-to additions on both the east and west elevations. Other details were obscured by mature trees or unable to be clearly seen at a distance from the ROW. Southwest of the house is a Quonset-style workshop that most likely dates between 1960 to 1975 based on aerial imagery (see Photo 24 below). Other than its arched shape and metal cladding, no other details could be ascertained from a distance. Additionally, there were several small grain bins of different sizes clustered together on the south end of the property but were not visible from the ROW.

Feature 6 is a small, modern, rectangular, utilitarian shed. The structure, viewed from a distance, does not appear to be historic in nature and most likely dates to 2021 based on aerial imagery.

Several grain bins of various sizes (Features 2, 7, 8, and 9) were also observed. Feature 2 reflects the grain bin at the far south, Feature 7 identifies the grain bin second from the south in the line, Feature 8 identifies the grain bin third from the south in the line, and Feature 9 identifies the grain bin at the north end of the line.

A more intensive survey and research are needed to ascertain any historic significance, associations, and integrity. With the property only visible at a distance from the ROW, no recommendation of eligibility for the NDSHSR could be made.

Photo 23: 32MOX845 (MER-509), view northwest of the barn, house and garage

Photo 24: 32MOX845 (MER-509), view northwest of Quonset workshop and garage

32MOX846 (MER-511)

32MOX846 (MER-511) is a farmstead comprised of a house, garage grain bins, workshops, and other utilitarian outbuildings (see Photo 25 below and Figure 2 in Appendix A). The farmstead was viewed at a distance from the public ROW, and not all distinguishing features could be seen or analyzed.

Centrally located on the farmstead is a vernacular residential structure in a rectangular shape and a gabled roof. The structure is wood frame with horizontal wood siding. The house runs north to south. An entry extends from the north gabled end. The house is an early 20th Century Craftsman Bungalow house with a double pitched front gabled roof. The facade faces south. A large dormer window is on the second floor on the east elevation. There are five, first-floor window openings on the east elevation. The siding and openings could be altered but could not be determined from a distance. Most details could not be ascertained from the ROW.

The early 20th Century Craftsman garage (Feature 5) is wooden and a gable offset roof. The facade faces south. The facade has a large bi-fold garage door that appears to be original. A small window opening is on the south end of the east facade. The structure does appear original but is in a dilapidated condition. The structure could only be viewed at a distance from the ROW and not all characteristics could be ascertained.

There are 12 grain bins on the property. All the grain bins are cylindrical with circular pyramidal roofs; all clad in metal. Six of the grain bins are identical in size. One grain bin is slightly smaller in diameter and shorter in height. Five of the grain bins are on the east side of the property, while two are located at the east end of the barn on the western edge of the property. The five grain bins on the east edge of the site were added between 1967 and 1985. No other details could be ascertained from the ROW.

A workshop or barn in a Quonset-style is situated on the north side of the property (Feature 3) and runs north to south and clad in metal. No other details could be ascertained from the ROW. Based on aerial imagery, it was added to the site between 1967 and 1985.

A mid-century metal barn with a saltbox roof (Feature 8) is situated on the north side of the property and runs north to south and is rectangular in shape. The barn runs east to west and is situated on the western edge of the property. Two grain bins are immediately adjacent on the east gabled end. Based on aerial imagery, it was added to the site between 1967 and 1985. No other details could be ascertained from the ROW.

The remaining structures are small utilitarian structures, including a wooden privy or shed northeast of the house and a wooden pump house. Features of those structures could not be viewed from the public ROW.

Feature 8 is a modern, rectangular, utilitarian shed on the west side of the farmstead, east of a row of granaries. The structure, viewed from a distance, does not appear to be historic in nature and most likely dates from the 1970s to the 1990s. The structure could only be viewed at a distance from the ROW and not all characteristics could be ascertained.

A more intensive survey and research is needed to ascertain any historic significance, associations, and integrity. With the property only visible at a distance from the ROW, no recommendation of eligibility for the NDSHSR or NDSHSR could be made.

Photo 25: Overview looking southeast, 32MOX846 (MER-511)

32MOX847 (MER-513)

32MOX847 (MER-513) is a small farmstead comprised of four visible structures: a house, barn, grain bins, and shed (see Photo 26 below and Figure 2 in Appendix A). The farmstead was viewed at a considerable distance from the ROW, and many features could not be ascertained. More buildings are visible in the aerial than could be described from public right-of-way. A building and a grain bin are visible in the northeast corner of the site boundary that appear to be modern.

The house is a small, wood frame, vernacular structure that appears to date to the early 20th century. The house is rectangular and has a side-gabled roof with a shed dormer on the south elevation. Because the house was viewed at a distance, few other details or features could be distinguished. To the southeast of the house is a large, rectangular, Gambrel-style barn of unknown age with an attached corral. It is indeterminable whether the corral is in a historic configuration as the configuration has changed over time based on aerial imagery. It is unknown if the materials or any portion of the corral are historic. A few small window openings could be seen on the west elevation and south façade, but no details could be seen at a distance from the ROW.

The remaining visible structures are a small, circular, metal grain bin and a small, rectangular, shed or chicken coop. The grain bin is cylindrical with a circular pyramidal roof that doesn't appear on aerial imagery until 2018; it may be a 1980s or 1990s grain bin moved from the northeast corner of the site. The shed has a wood frame with a slanted roof. No other details could be seen from the public ROW.

A more intensive survey and research is needed to ascertain any historic significance, associations, and integrity. With the property only visible at a distance from the ROW, no recommendation of eligibility for the NDSHSR could be made.

Photo 26: Overview looking northeast, 32MOX847 (MER-513)

5.0 SUMMARY AND RECOMMENDATIONS

A visual impacts survey of previously recorded historic properties was conducted in September 2025. Twenty-one architectural properties and historic-aged resources were surveyed and assessed for visual effects that would affect their integrity and ability to portray significance for inclusion on the NDSHSR (*N.D.C.C. § 55-10 and N.D.C.C. § 49-22-09)*. Properties and resources determined or recommended as eligible were photographed from the public ROW and assessed for visual effects with representative photos. However, due to distance from the public ROW, inaccessibility, partial or no visibility of sites, or obstructed views, some of the properties and resources could not be fully evaluated to determine NDSHSR significance. Merjent evaluated and determined whether the proposed Project would adversely affect surveyed properties. All the sites identified were within direct viewshed of modern wind turbines similar to those being proposed for this Project. Mature tree growth is also present on many of the identified properties that would minimize view of the proposed turbines. As a result, Merjent recommends the finding of **no significant sites affected**. No further work or mitigation is recommended for the Project to proceed as planned.

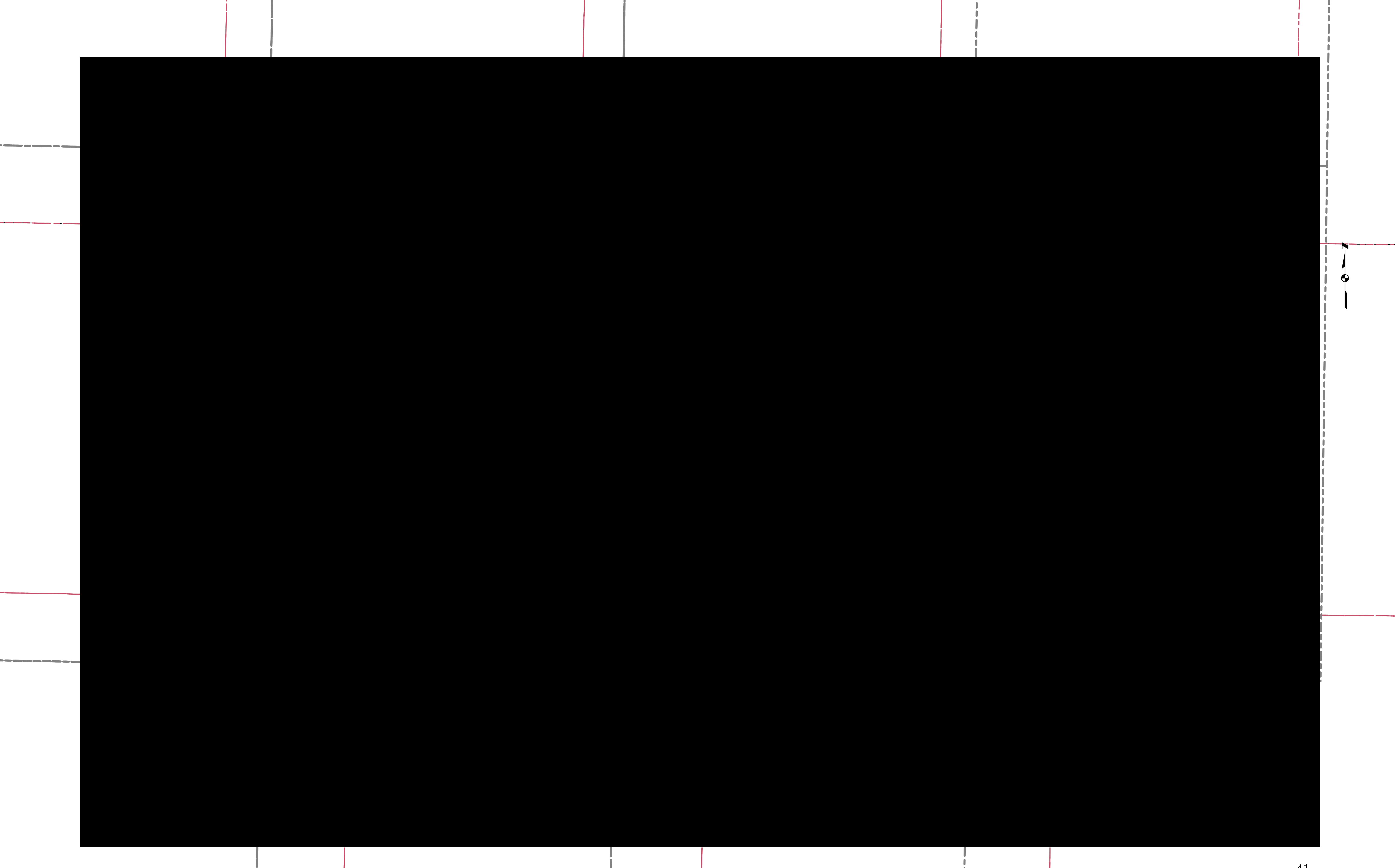
6.0 REFERENCES CITED

Reinhart, Damien and Matthew Cox. 2025. A Class I and Class III Cultural Resources Inventory of the Minnesota Power Longspur Windfarm Project, Morton and Mercer Counties, North Dakota. Report prepared for Minnesota Power and on file at the North Dakota State Historic Preservation Office.

U.S. Department of the Interior, National Park Service. 1995. How to Apply the National Register Criteria. *National Register Bulletin 15*. National Park Service, Washington, DC.

APPENDIX A

Figures



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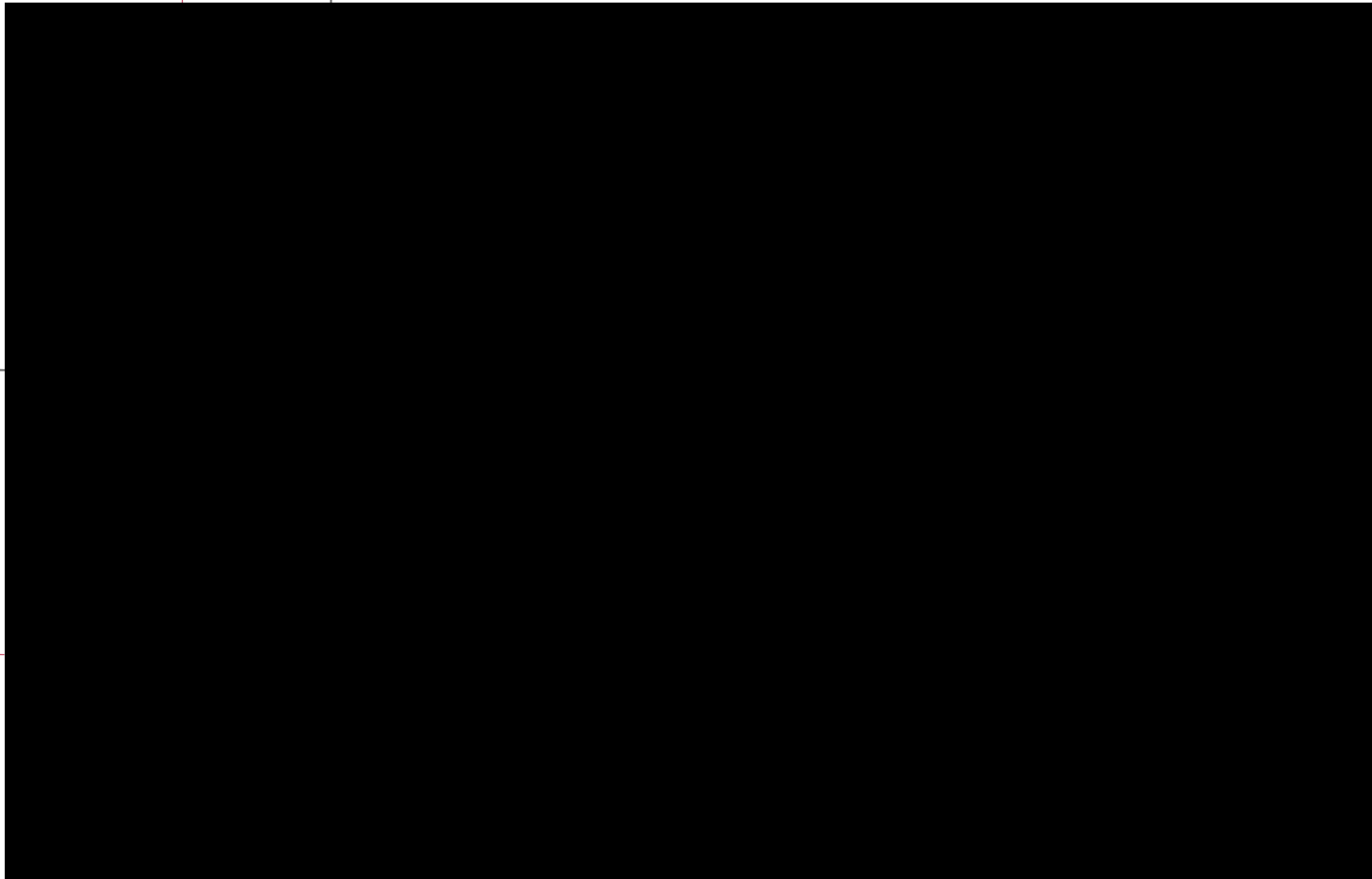

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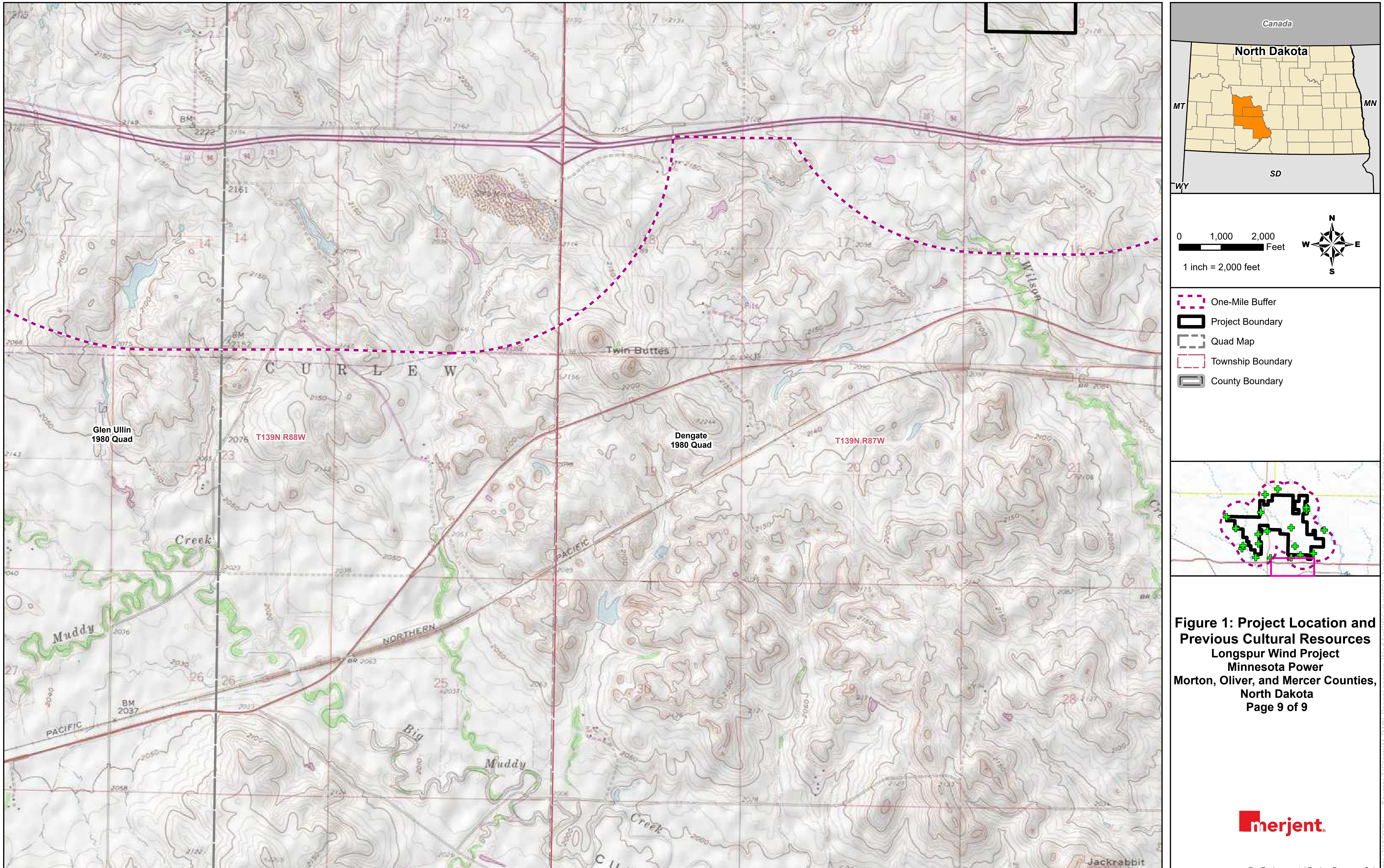

Figure 1: Project Location and Previous Cultural Resources

Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
Page 9 of 9

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For Environmental Review Purposes Only

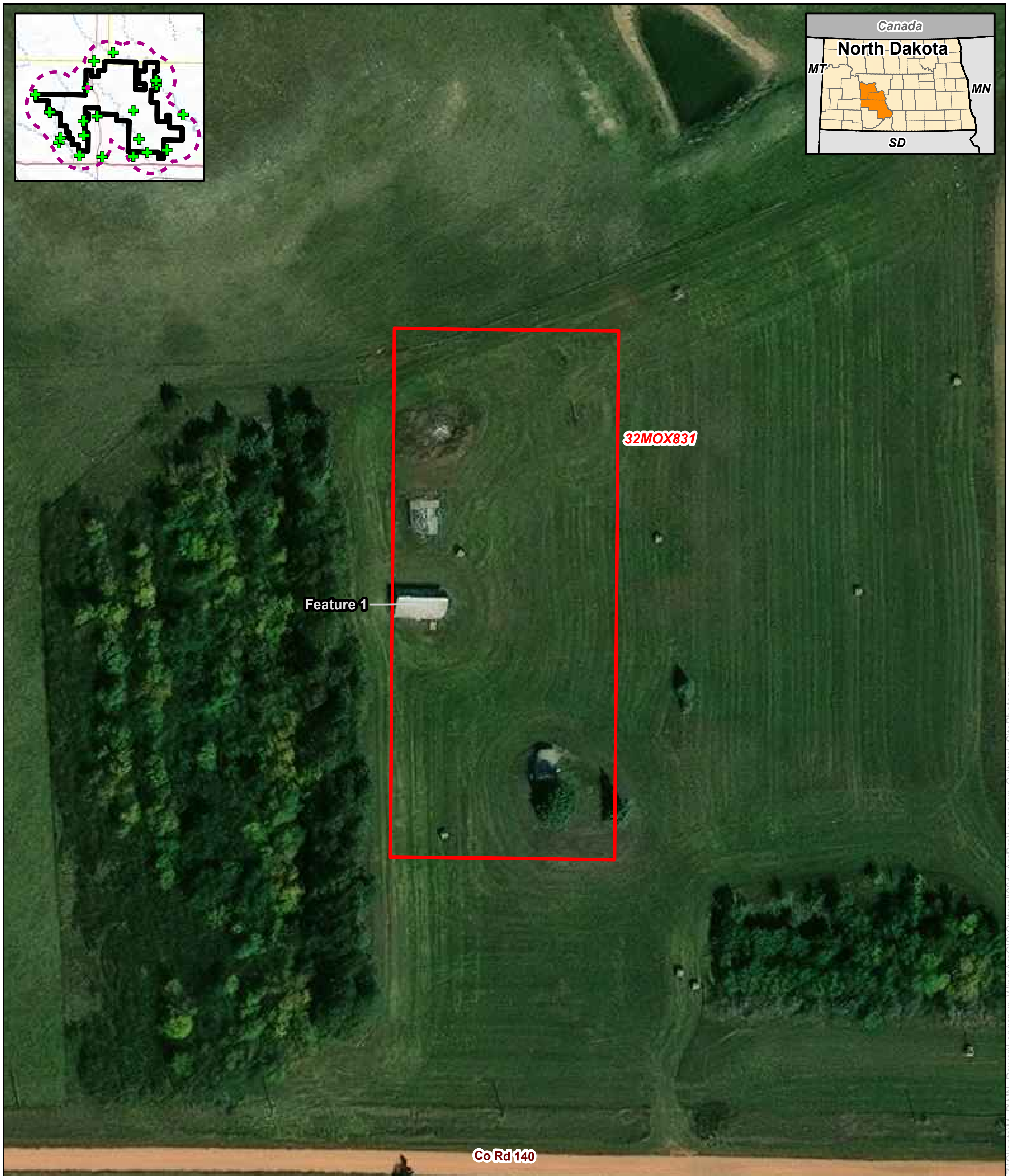

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Figure 2: Site: 32MOX831
Features

Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
Page 1 of 20

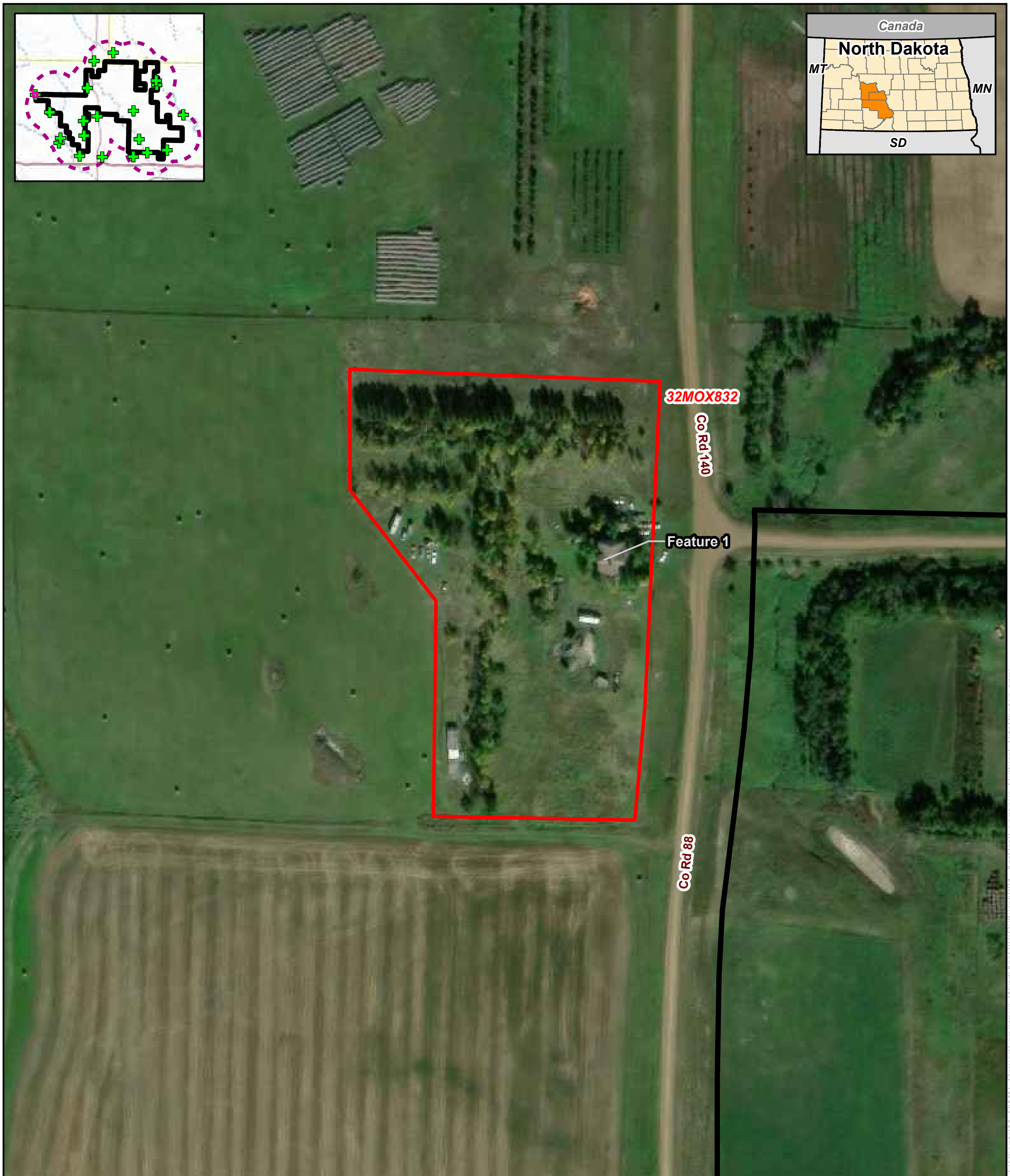
Photo Analysis Location

Project Boundary

One-Mile Buffer

Source: Z:\Clients\M_P\MN_Power\Longspur_Wind\ArcGIS\Cultural\001_ArcPro\Longspur_Cultural_SitePhotos.aprx

Date: (3/18/2026)



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Feet
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For Environmental Review Purposes Only

Figure 2: Site: 32MOX832
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
Page 2 of 20

Photo Analysis Location
Project Boundary
One-Mile Buffer

Date: (3/18/2026) Source: Z:\Clients\M_P\MN_Power\Longspur_Wind\ArcGIS\Cultural\001_ArcPro\Longspur_Cultural_SitePhotos.aprx

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N W E S

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Figure 2: Site: 32MOX833
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
Page 3 of 20

Photo Analysis Location

Project Boundary

One-Mile Buffer

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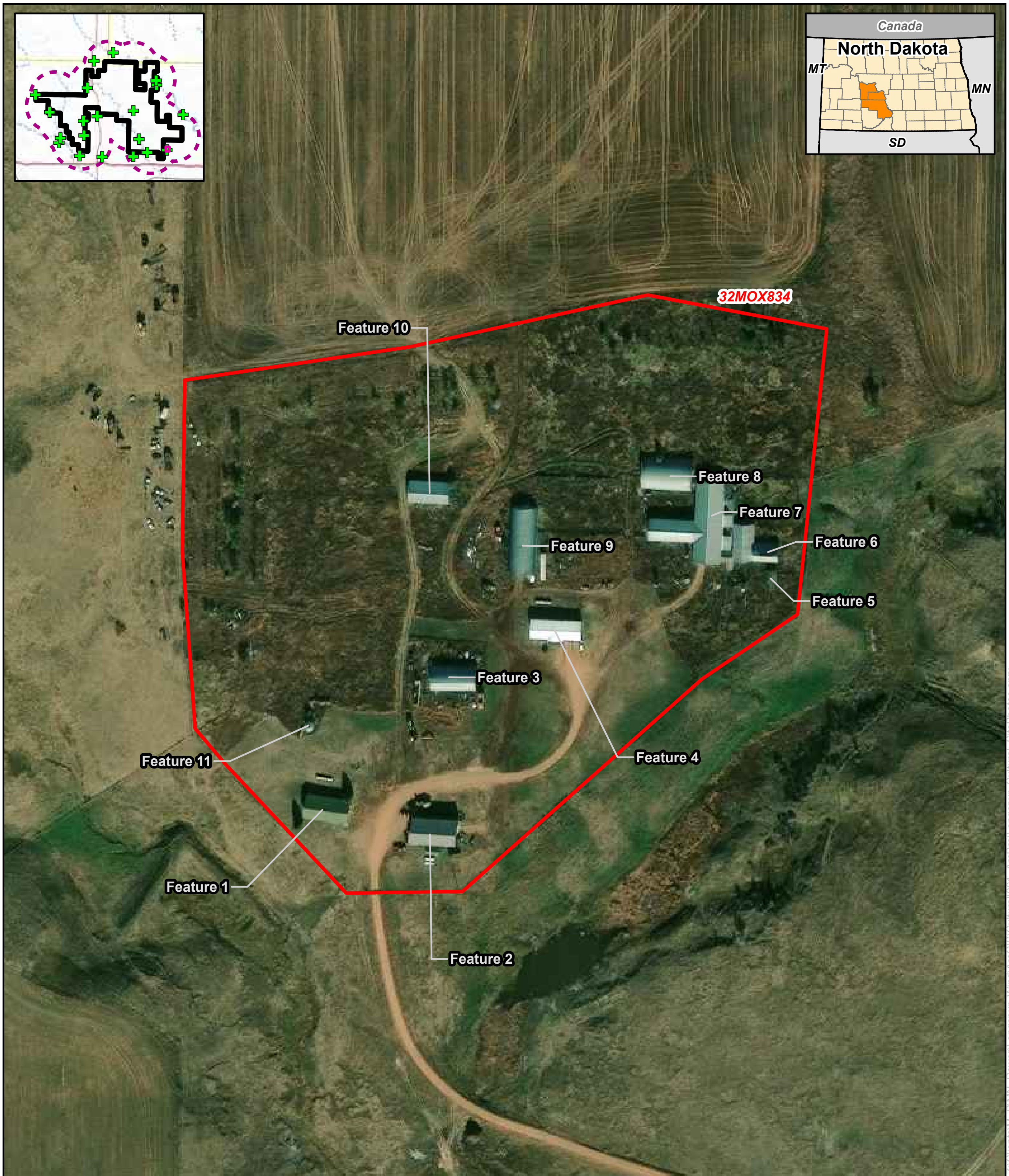

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N W E S

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Figure 2: Site: 32MOX834
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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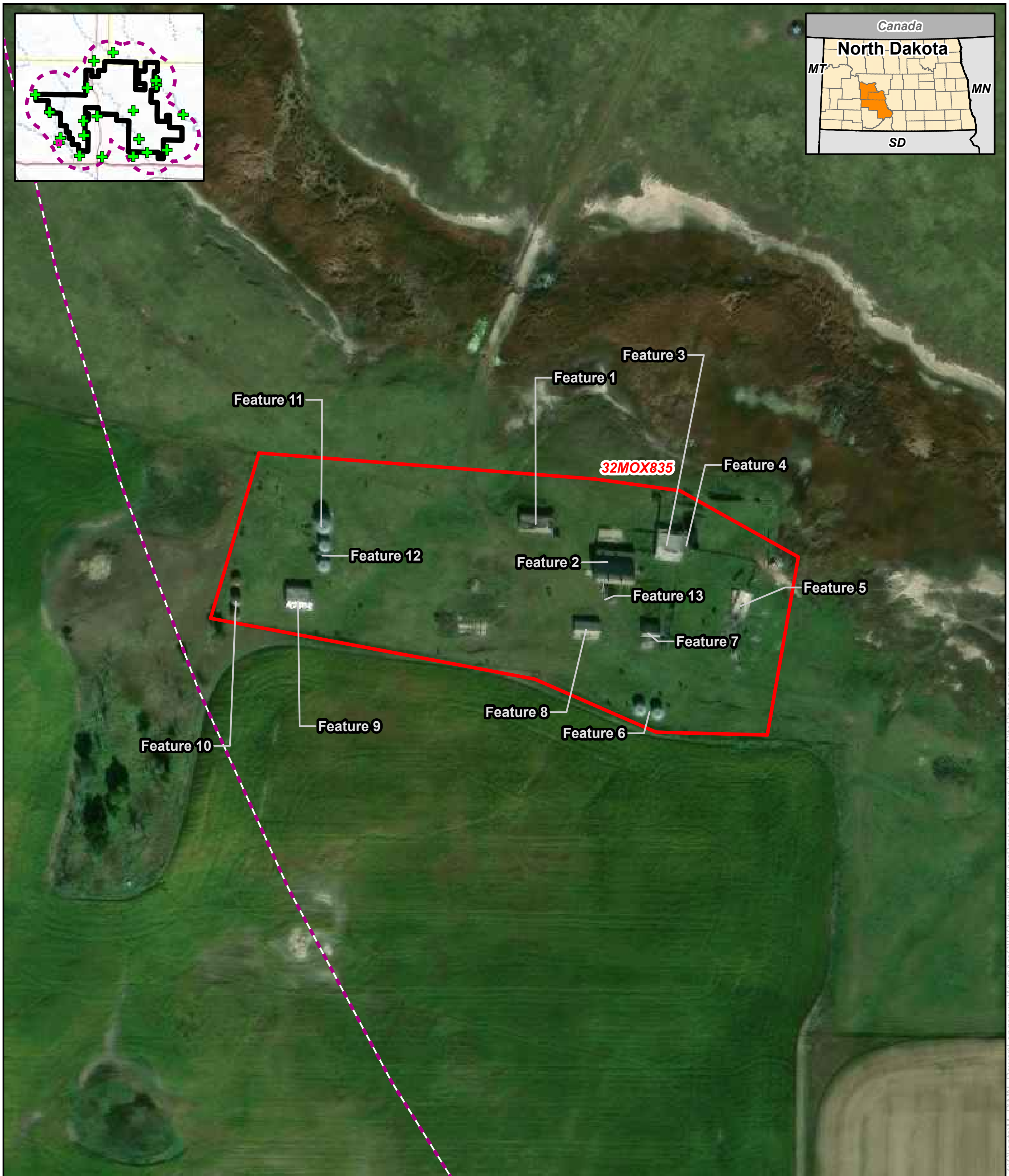
Photo Analysis Location
Project Boundary
One-Mile Buffer



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N W E S

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Figure 2: Site: 32MOX835
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Photo Analysis Location
Project Boundary
One-Mile Buffer

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Date: (3/18/2026)

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N W E S

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Figure 2: Site: 32MOX836
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Photo Analysis Location
Project Boundary
One-Mile Buffer

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N W E S

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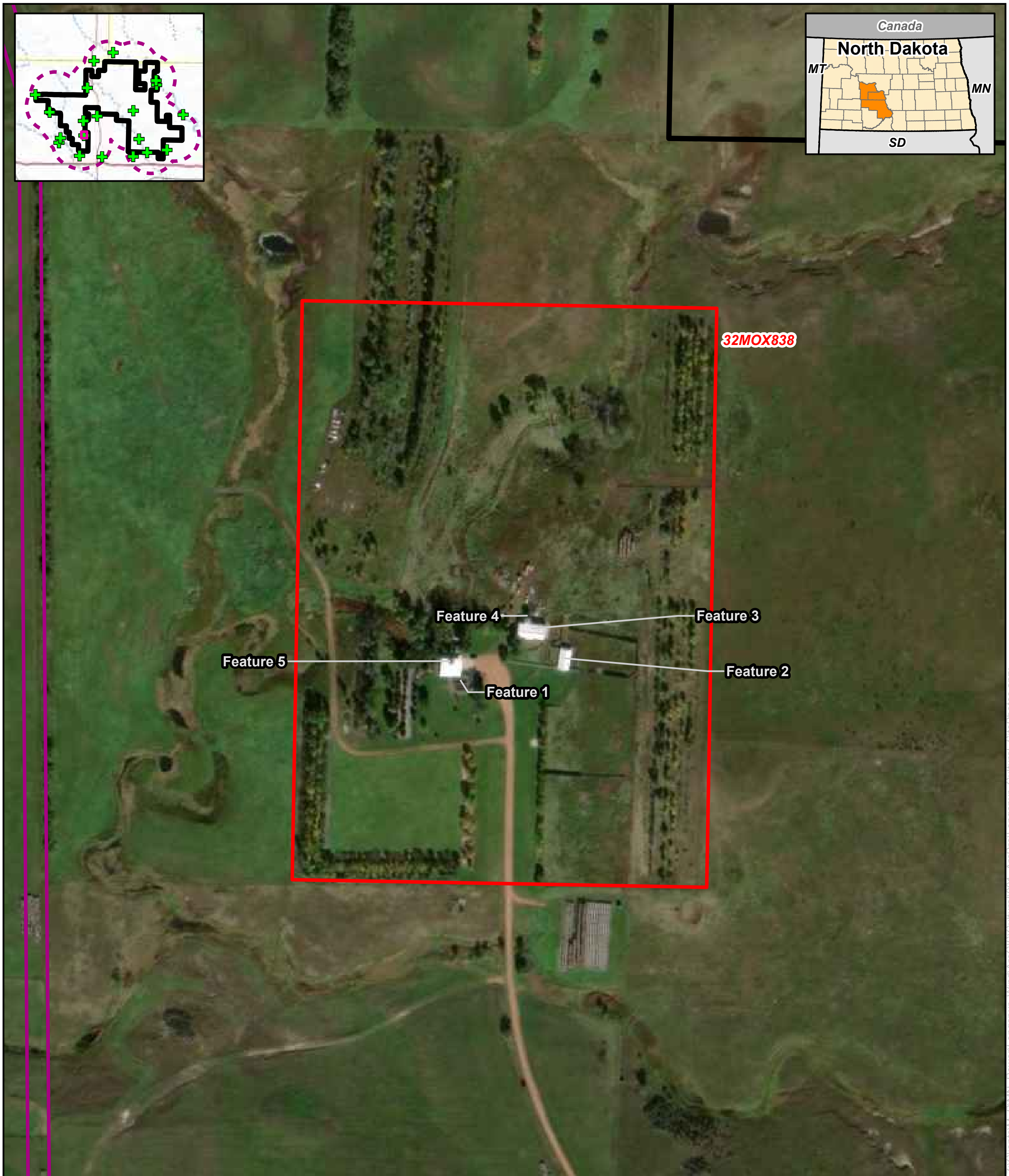
Figure 2: Site: 32MOX837
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
Page 7 of 20

Photo Analysis Location
Project Boundary
One-Mile Buffer



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N W E S

For Environmental Review Purposes Only

Figure 2: Site: 32MOX838
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Photo Analysis Location
Project Boundary
Project Area
One-Mile Buffer

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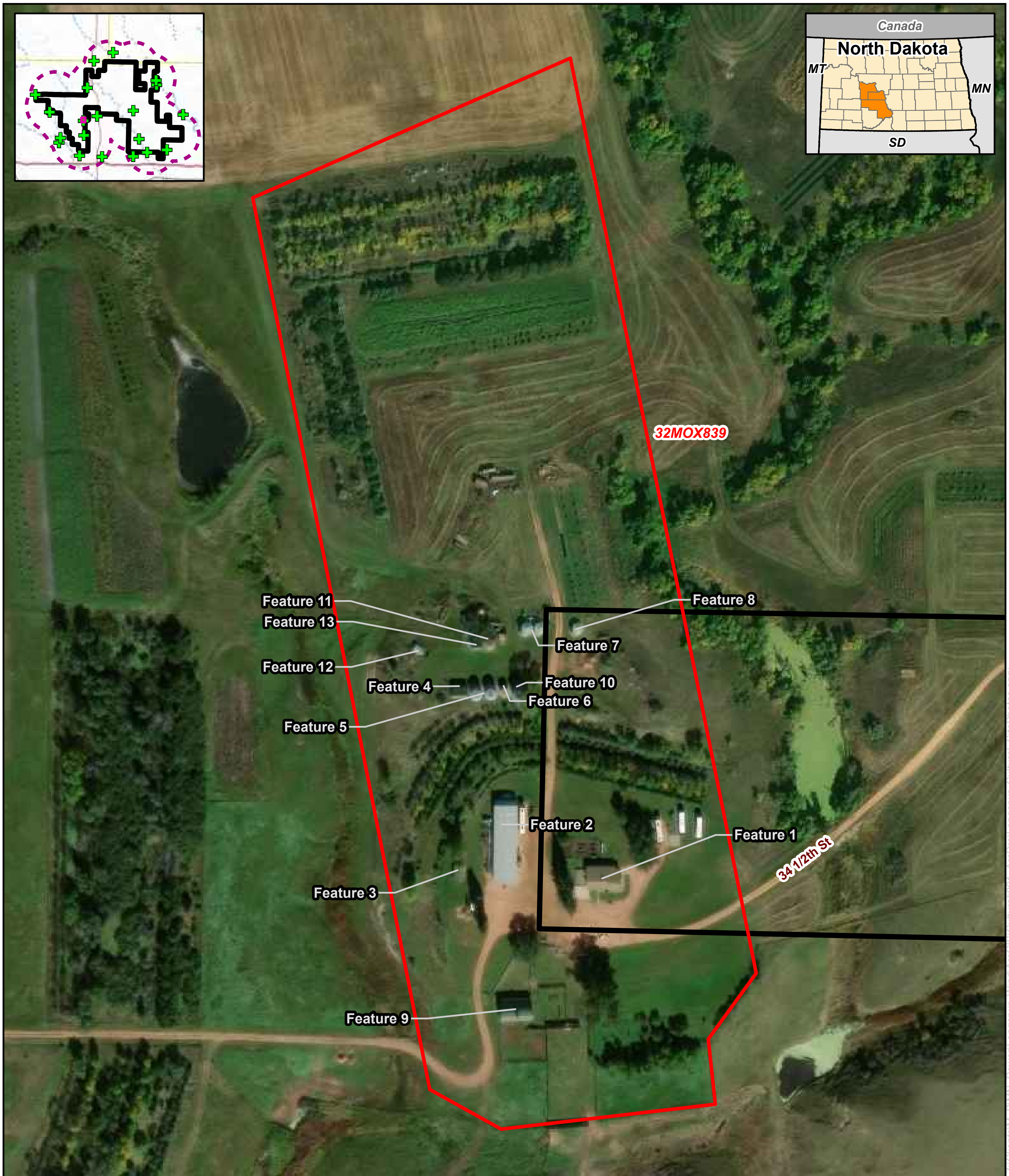

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For Environmental Review Purposes Only

Figure 2: Site: 32MOX839
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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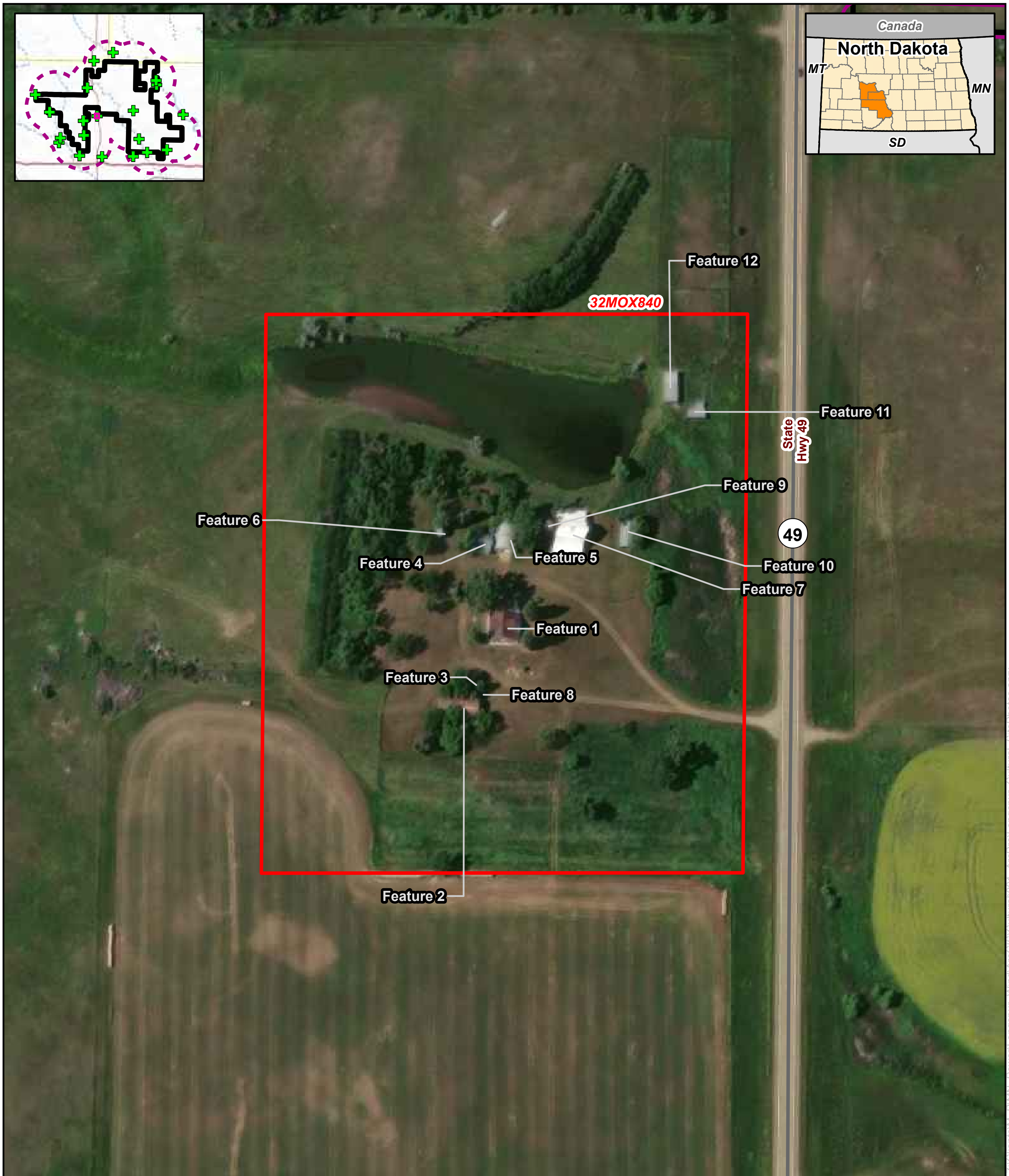
Photo Analysis Location
Project Boundary
One-Mile Buffer



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N W E S

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Figure 2: Site: 32MOX840
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Photo Analysis Location
Project Boundary
Project Area
One-Mile Buffer

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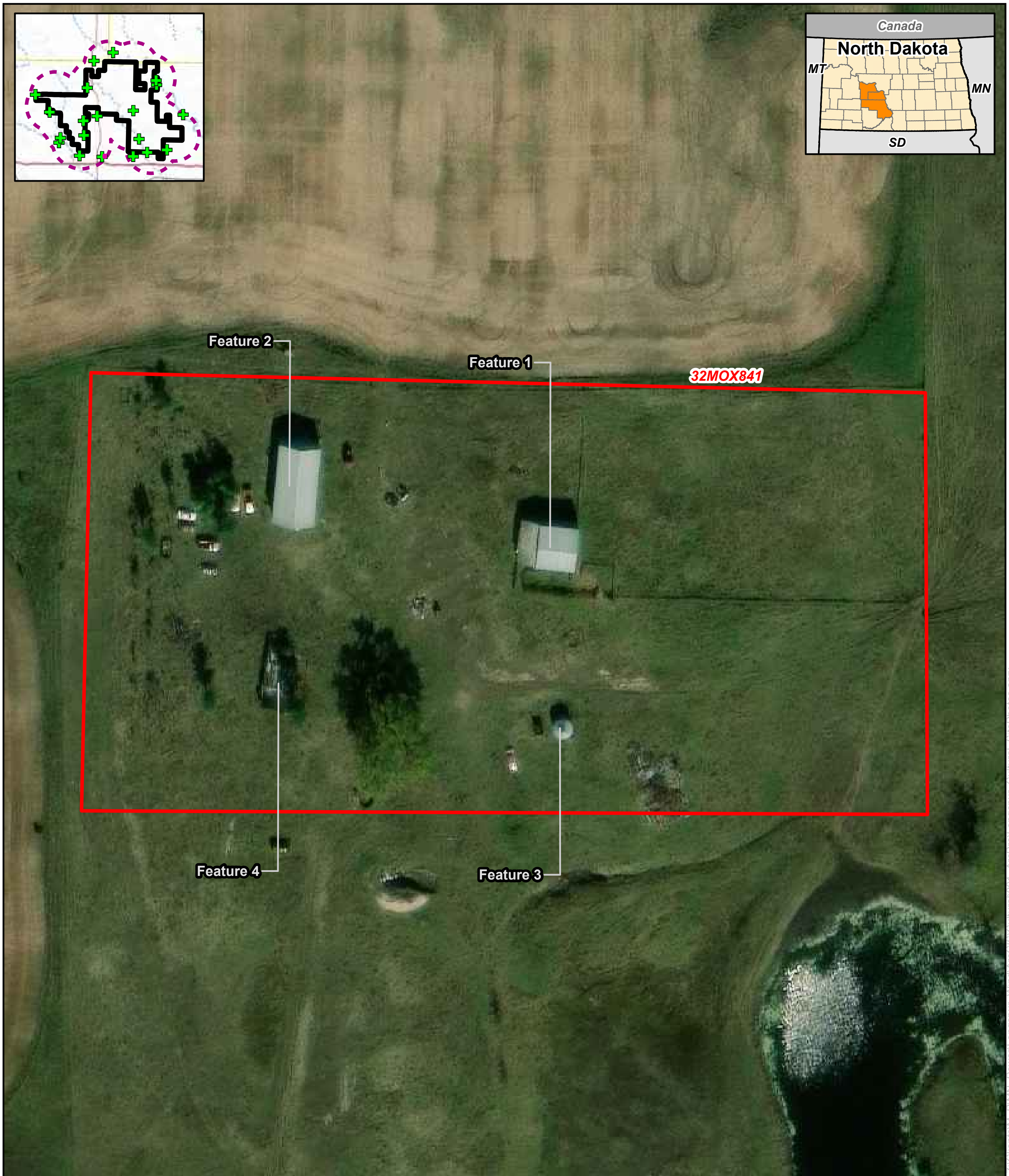

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N W E S

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Figure 2: Site: 32MOX841
Features
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Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Photo Analysis Location
Project Boundary
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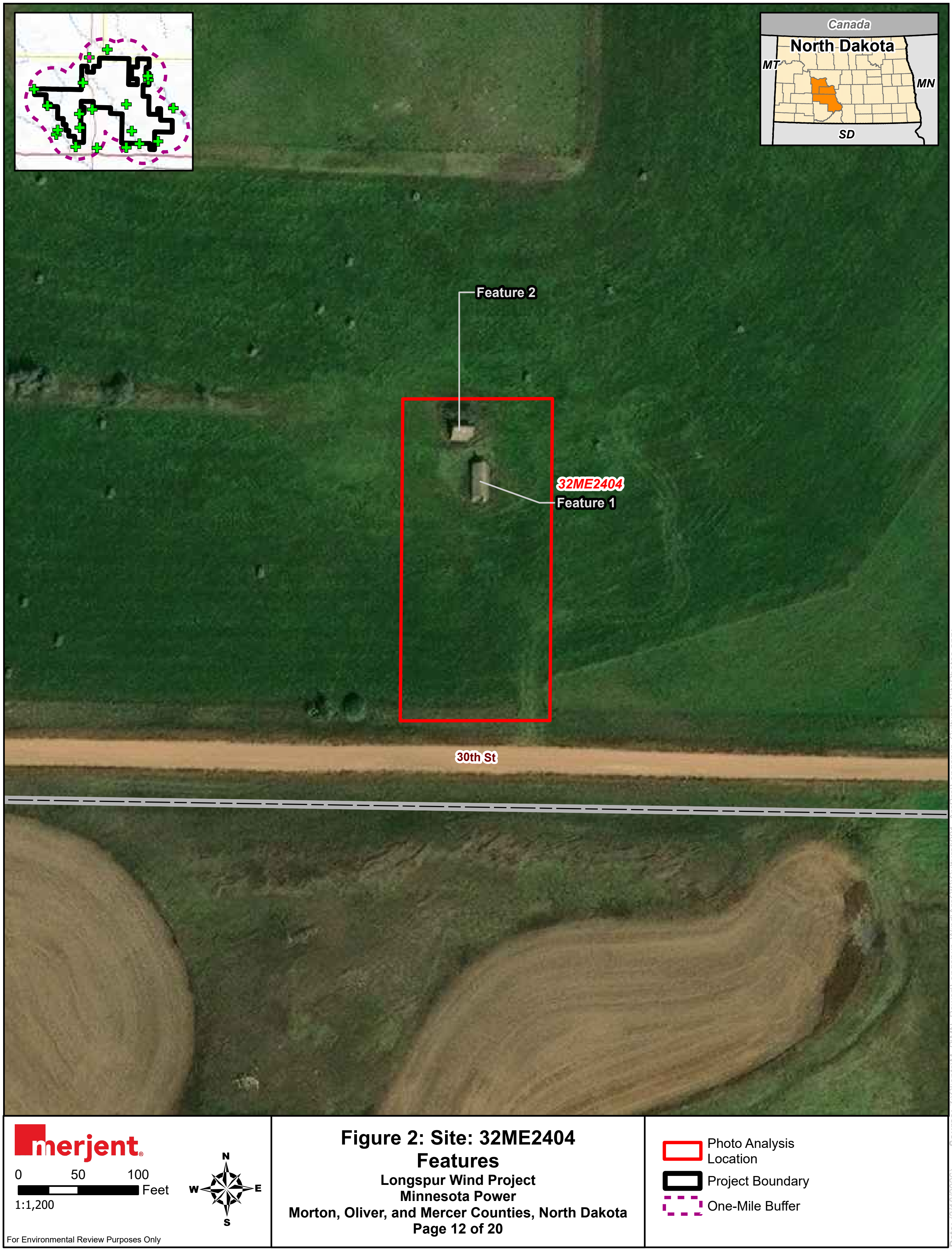

Figure 2: Site: 32ME2404
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Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Figure 2: Site: 32OLX559
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Photo Analysis Location
Project Boundary
One-Mile Buffer

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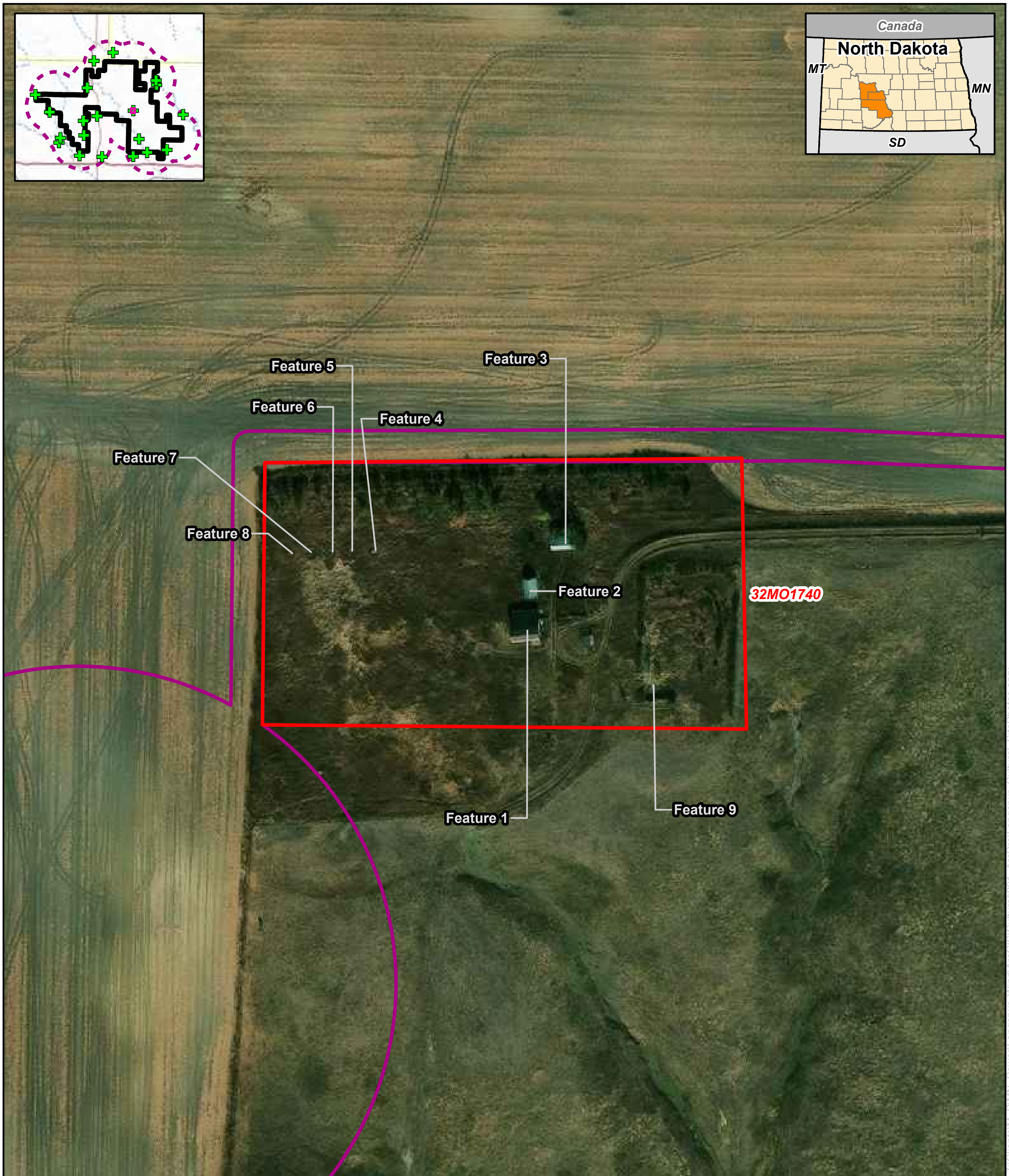

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Figure 2: Site: 32MO1740
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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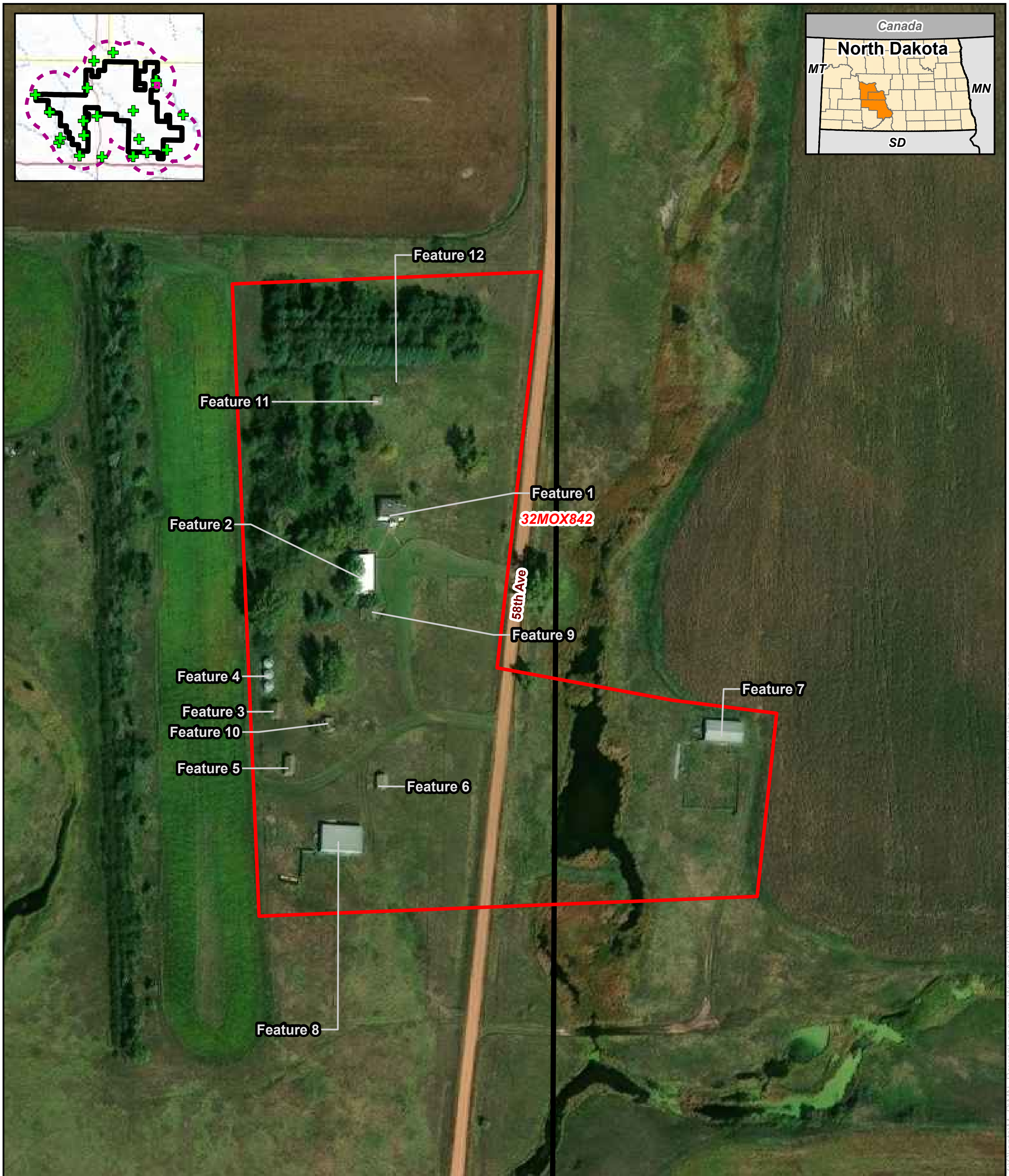
Photo Analysis Location
Project Boundary
Project Area
One-Mile Buffer



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For Environmental Review Purposes Only

Figure 2: Site: 32MOX842
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Photo Analysis Location
Project Boundary
One-Mile Buffer

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For Environmental Review Purposes Only

Figure 2: Site: 32MOX843
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Photo Analysis Location
Project Boundary
One-Mile Buffer

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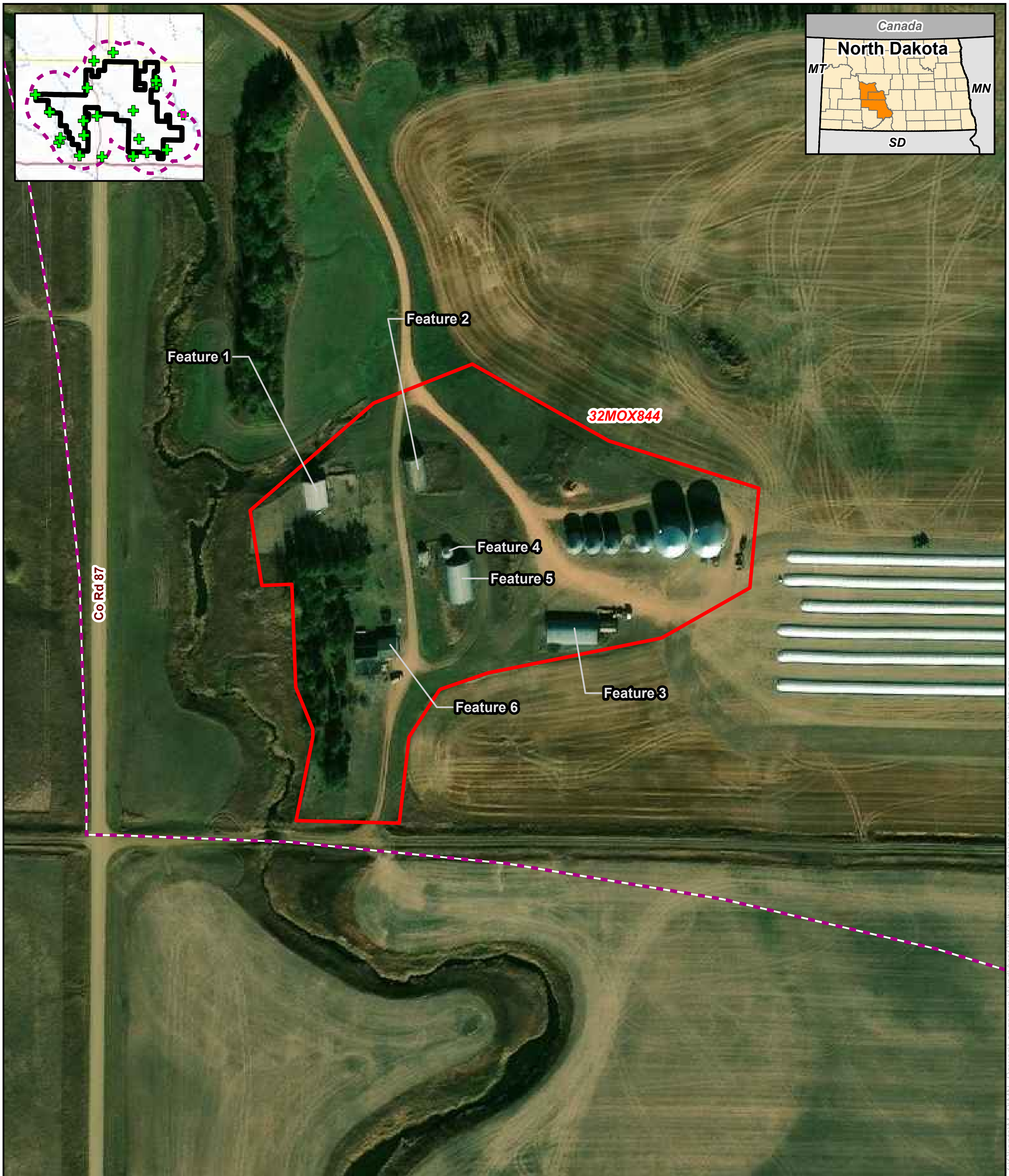

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For Environmental Review Purposes Only

Figure 2: Site: 32MOX844 Features

Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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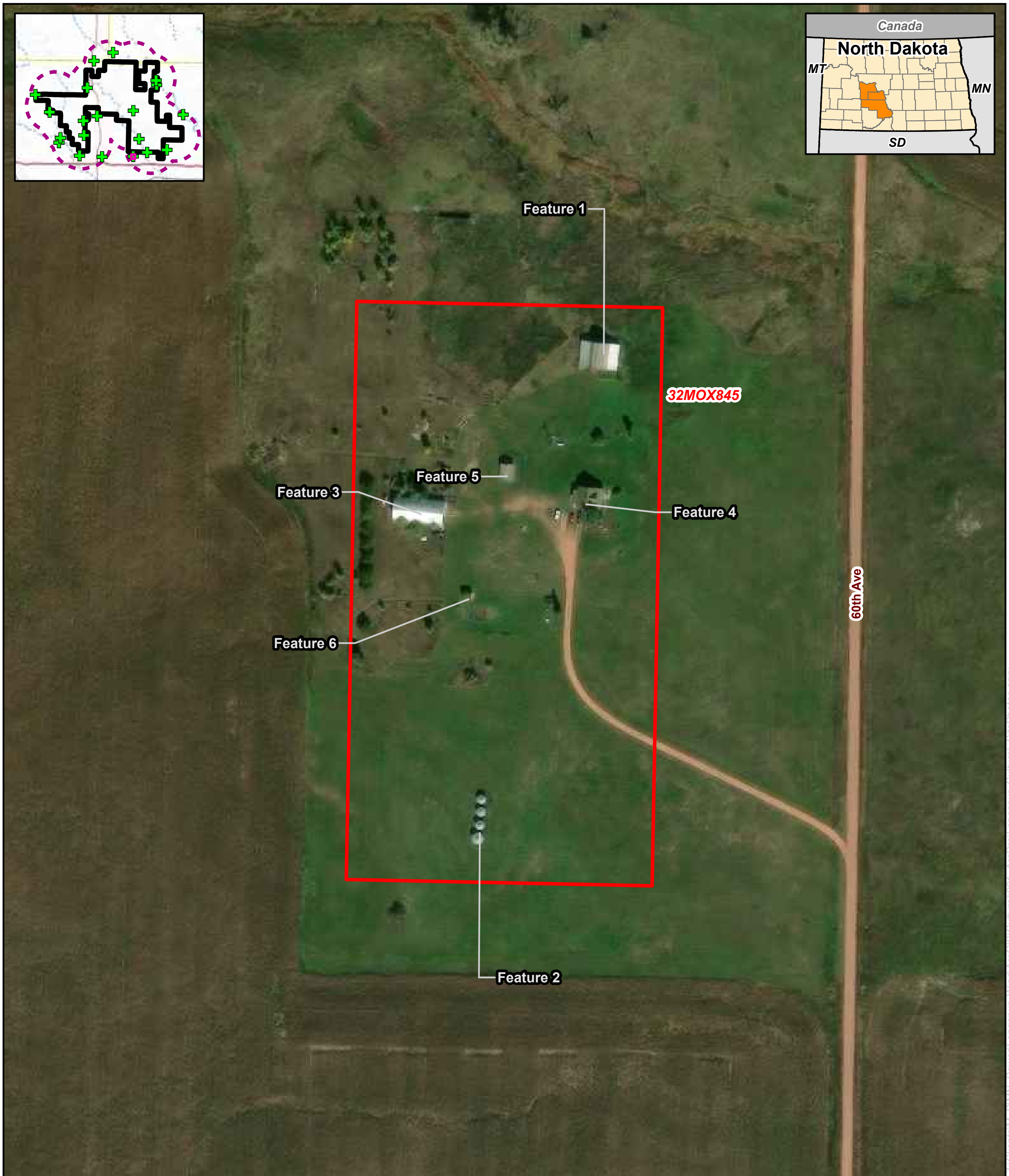
Photo Analysis Location
Project Boundary
One-Mile Buffer



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For Environmental Review Purposes Only

Figure 2: Site: 32MOX845
Features
Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Photo Analysis Location

Project Boundary

One-Mile Buffer

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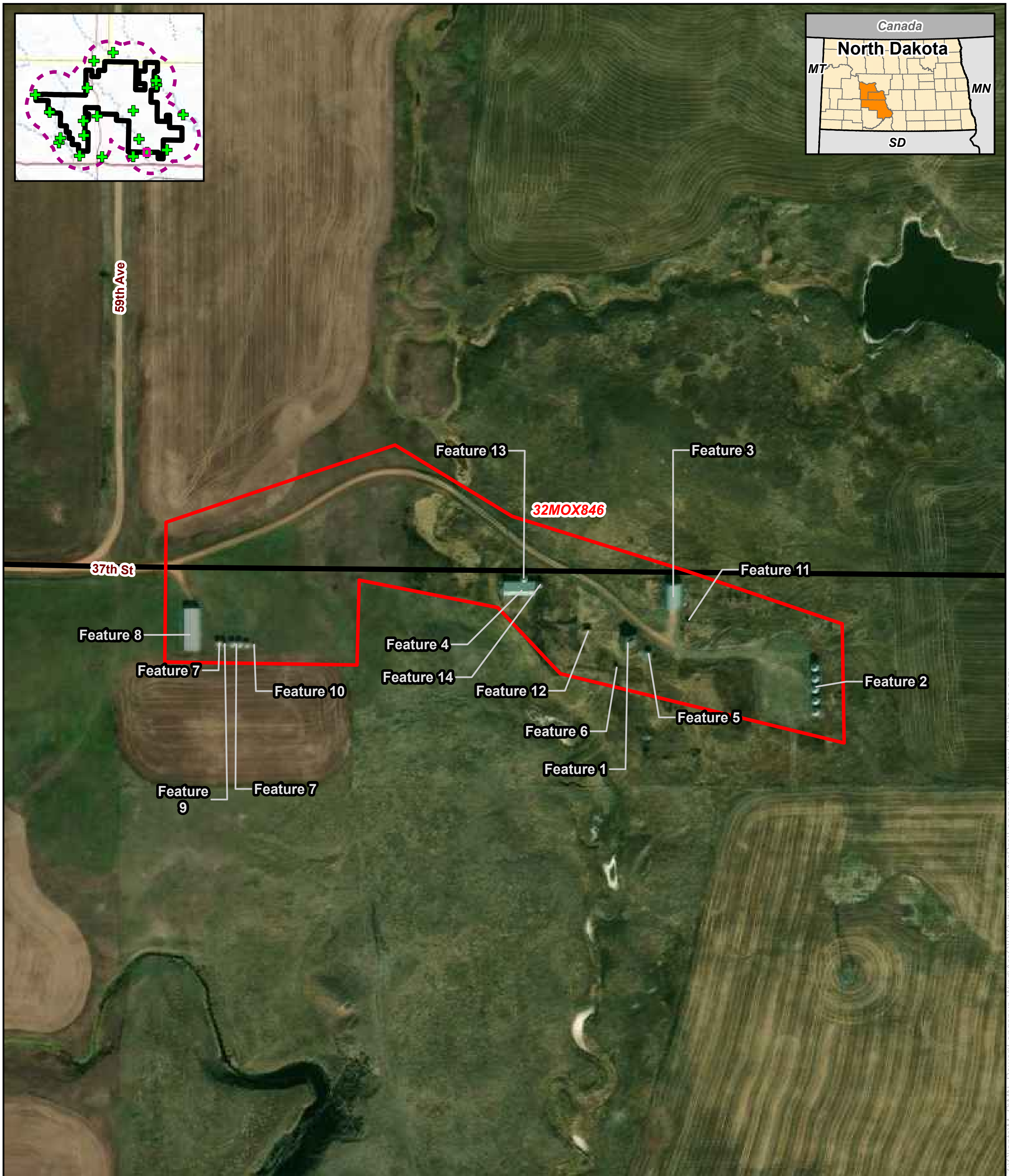

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For Environmental Review Purposes Only

Figure 2: Site: 32MOX846
Features

Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
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Photo Analysis Location
Project Boundary
One-Mile Buffer

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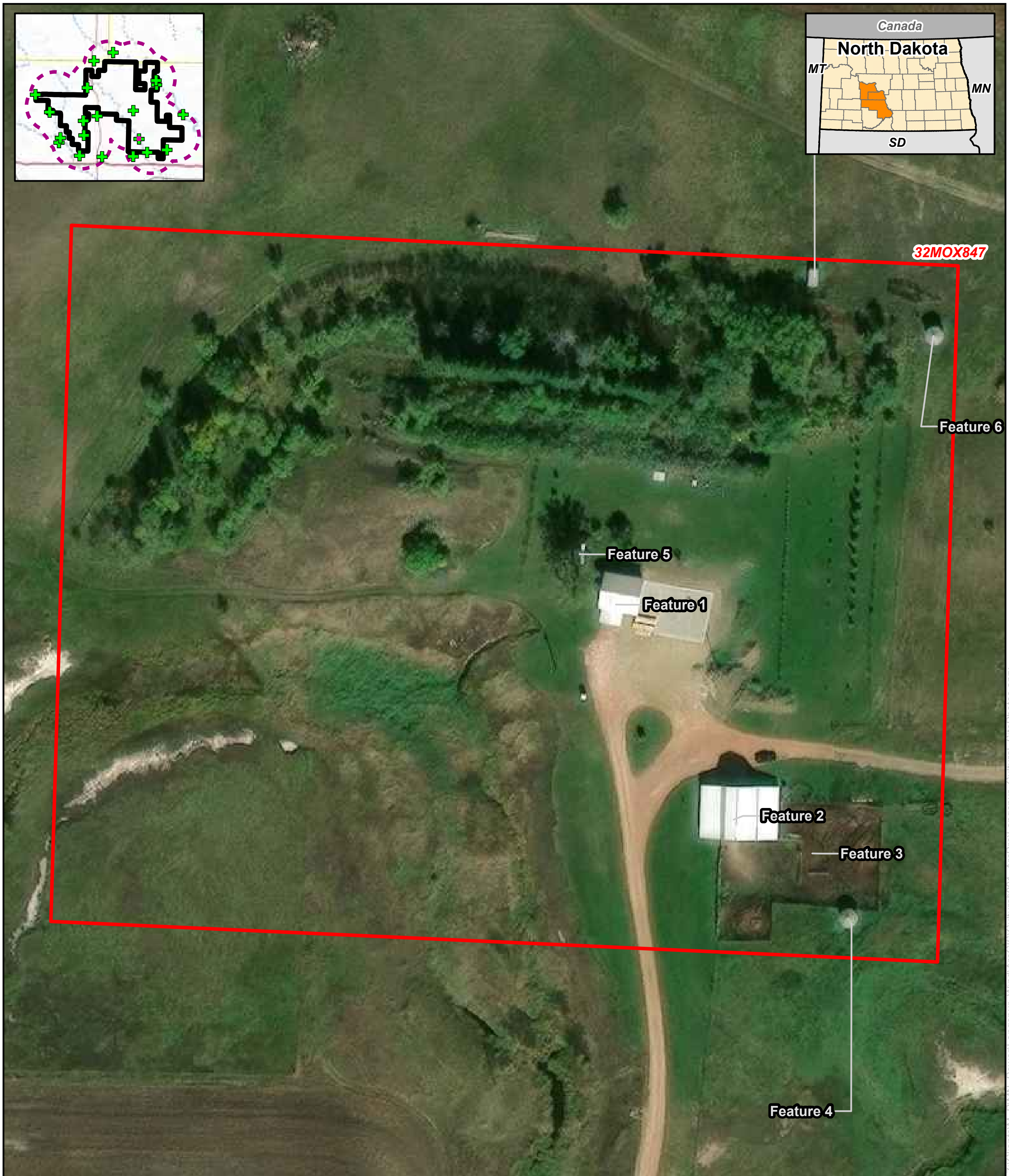

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Figure 2: Site: 32MOX847 Features

Longspur Wind Project
Minnesota Power
Morton, Oliver, and Mercer Counties, North Dakota
Page 20 of 20

Photo Analysis Location
Project Boundary
One-Mile Buffer

April 17, 2026

Damien Reinhart
Merjent Inc.
1 Main Street SE
Suite 300
Minneapolis, MN 55414
damien.reinhart@merjent.com

SHSND Ref.: 25-9058 Longspur Wind Project

Dear Damien,

We received the report for SHSND Ref: 25-9058, titled "An Architectural Survey and Viewshed Report for the Minnesota Power Longspur Wind Project, Morton and Mercer Counties, North Dakota" and find this Merjent report by Chris Kinder and William Harding on the architectural visual impacts portion of the survey acceptable. We will add it to our Manuscript Collection.

Thank you for the opportunity to review this report. Please be advised that acceptance of this report does not constitute concurrence with the determinations therein. If you have any questions, please Lorna Meidinger, Lead Historic Preservation Specialist, at (701) 328-2089 or lbmeidinger@nd.gov.

Sincerely,

for William D. Peterson, PhD
Director, State Historical Society of North Dakota

25-9058

AN ALLETE COMPANY

Attachment C

Grassland Addendum Memo

The Project conducted a more specific review of a 32-ac parcel that contained an unbroken grassland, and contacted the landowner regarding possible tilling that may have previously occurred on the parcel. On June 19, 2025, the landowner responded in writing that the parcel in question had been previously tilled. This parcel was reclassified as “broken grasslands” and updated in the Wildlife Conservation Strategy (WCS) dated January 29, 2026. Further discussions in March of 2026, with the landowner and Longspur confirmed that the parcel was designated by the Farm Service Agency (FSA) as cropland. The landowner indicated that the parcel was planted with alfalfa and actively managed as a hay field. The combination of the FSA designation and the current use of the property as actively managed hay indicates that this parcel is more accurately represented as cropland. This change reduces the Project’s impact of turbines sited on grasslands and meets North Dakota Game and Fish Department’s (NDGFD) KeyWind Energy Development in North Dakota Best Management Practices to avoid siting turbines in nesting habitat within a two mile buffer from a Sharp Tailed Grouse Lek. The Project will meet NDGFD’s recommendation in the December 2, 2024 meeting.

WESTERN ECOSYSTEMS TECHNOLOGY, INC.
4007 State Street, Suite 109 Bismarck, North Dakota 58503
Phone: 701-250-1756 ◆ www.west-inc.com

TECHNICAL MEMORANDUM

Date: March 24, 2026

To: Alex Luman; Minnesota Power

From: Western EcoSystems Technology, Inc.

Subject: Addendum to 2024 Grassland Habitat Assessment for the Longspur Wind Project

BACKGROUND

On December 18, 2024, Western EcoSystems Technology, Inc. (WEST), completed and finalized a grassland habitat assessment for the Longspur Wind Project in Morton County, North Dakota. A 32-acre (ac) parcel along the western portion of the Project Area (Figure 1) was originally classified as "unbroken" grassland based on a combination of North Dakota Game and Fish Department's "Native Prairie" layer (2022), aerial imagery review, and a cursory visual review in the parcel. Additionally, there was a slight modification of the Project Area from the 2024 report that increased the Project Area by approximately 167 ac. This was addressed in the Project's Wildlife Conservation Strategy (WCS) dated January 29, 2026.

Minnesota Power conducted a more specific review of the 32-ac parcel and contacted the landowner. On June 19, 2025, the landowner responded in writing that the parcel in question had been previously tilled. This parcel was reclassified as "broken grasslands" and updated in the WCS dated January 29, 2026. Further discussions with the landowner and Minnesota Power provided context to the parcel confirming that the parcel was designated by the Farm Service Agency (FSA) as cropland. The landowner described farming practices currently on the parcel as planted with alfalfa and actively managed as a hay field.

The combination of the FSA designation and the landowner's current management as an actively managed hay field but could be used for other crop types, confirms that this parcel is more accurately represented as cropland. This addendum reflects both the classification change to the original grassland report and the Project Area change. These updates are reflected in the WCS. Below are the updated calculations from the 2024 report of "broken" and "unbroken" grasslands along with an updated map.

UPDATED RESULTS

Within the current Project Area, approximately 1,252 ac of broken grasslands and 7,851 ac of unbroken grasslands were identified (Figure 1). Sixty-three ac of broken grassland and 110 ac of unbroken grassland habitat could not be verified in the field due to lack of access to private lands.

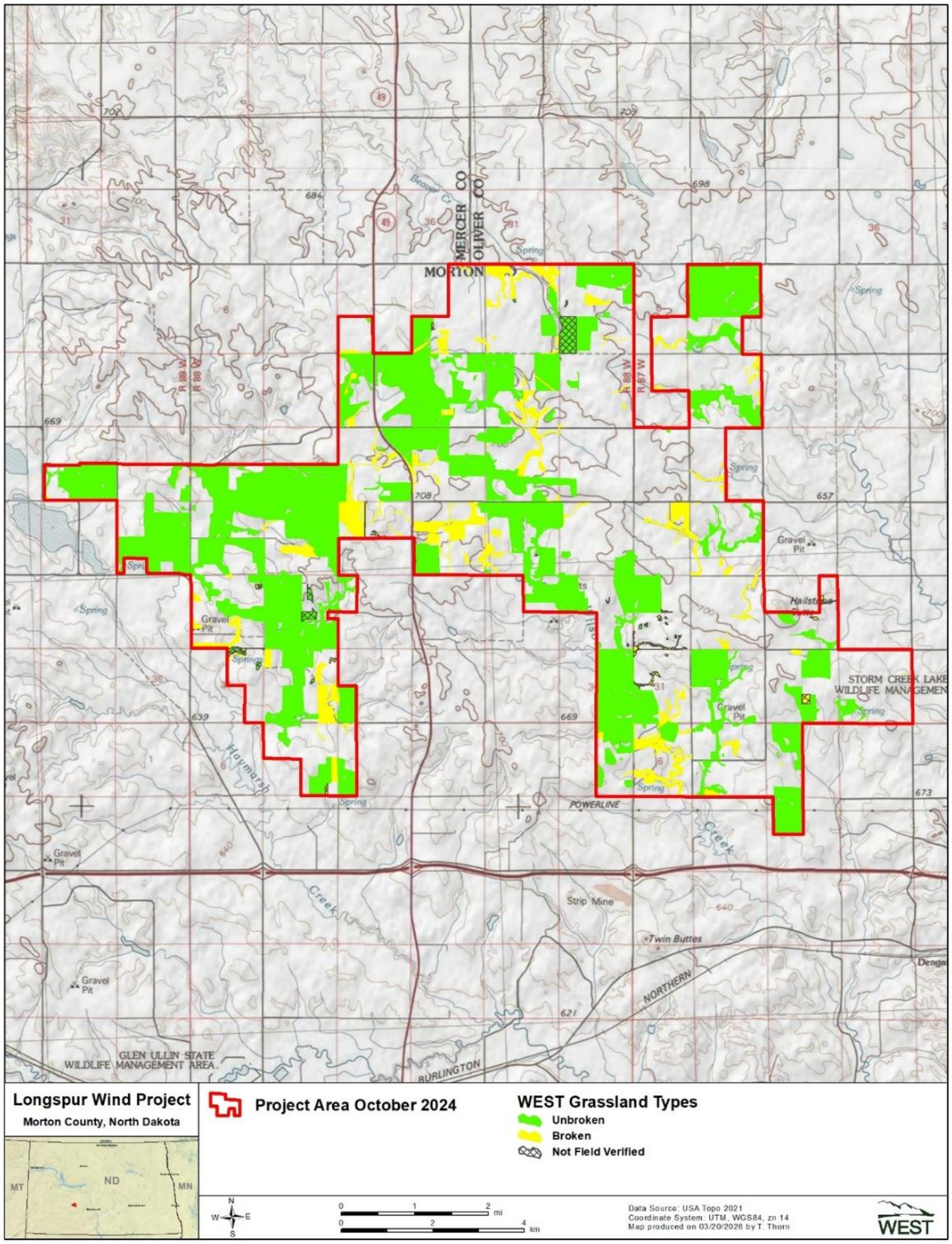


Figure 1. Grassland habitat assessment results for the Longspur Wind Project in Morton County, North Dakota.

minnesota power

AN ALLETE COMPANY

Attachment D

Geotech Report

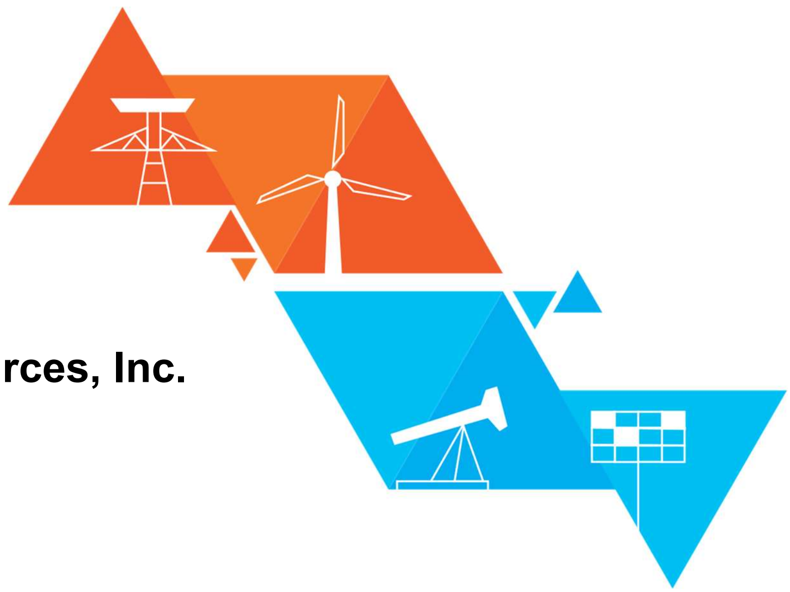
Longspur conducted an additional geotechnical survey in response to changes in the Wind Project layout during the fourth quarter of 2025. As noted in the application, the resulting report is being submitted to the North Dakota Public Service Commission.

CONFIDENTIAL

Geotechnical Report

Longspur Wind Project

Mercer and Morton Counties,
North Dakota



PREPARED FOR

Minnesota Power
c/o Allete Renewable Resources, Inc.

Prepared By:

810 Hesters Crossing Road, Suite 120
Round Rock, TX 78681
512.992.2087 | www.RRCcompanies.com

RRC Project No. GE2503026
April 22, 2026

experience matters

www.RRCcompanies.com

120 Hesters Crossing Rd
Round Rock, TX 76861
512.992.2087

April 22, 2026

Minnesota Power
c/o Allete Renewable Resources, Inc.
30 Superior Street
Duluth, MN 55802

Attn: Mitchell Bettenhausen

Re: Geotechnical Report
Longspur Wind Project
Mercer and Morton Counties, North Dakota
RRC Project No. GE2503026

RRC Power & Energy, LLC (RRC) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the proposed Longspur Wind Project. The purpose of this geotechnical engineering study was to explore and evaluate the subsurface conditions at various locations on the site and develop geotechnical design and construction recommendations for the project. The attached report contains:

- A description of our findings from the field exploration and laboratory-testing program;
- Our engineering interpretation of the results with respect to the project characteristics; and
- Geotechnical engineering parameters for the design of foundation systems and access roadways.

Should you have any questions concerning this Geotechnical Report, please do not hesitate to contact us. Your business is always appreciated.

Sincerely,

RRC Power & Energy, LLC

Manoj Keerthipati, P.E.
Geotechnical Engineer

REVISION HISTORY

Revision	Description	Performed by	Reviewed by	Issued Date
0	Draft Geotechnical Report	Manoj Keerthipati	Alfred Williams	6/19/2025
0	Final Geotechnical Report	Manoj Keerthipati	Alfred Williams	9/19/2025
1	Final Geotechnical Report	Manoj Keerthipati	Alfred Williams	4/22/2026

REGISTERED PROFESSIONAL ENGINEER
ALFRED WILLIAMS
41361
DATE 4/22/2026
NORTH DAKOTA

Prepared and Submitted by

Manoj Keerthipati, P.E.
Geotechnical Engineer

Reviewed by

Alfred Williams, P.E.
Director of Geotechnical Engineering

FIRM REGISTRATION NO. ND 1788PE

TABLE OF CONTENTS

APPENDICES

APPENDIX A

APPENDIX B

APPENDIX C – Geophysics

APPENDIX D – Deep Foundation Design

GEOTECHNICAL REPORT

1.0 INTRODUCTION

RRC Power and Energy LLC (RRC) has completed the authorized subsurface exploration and geotechnical engineering evaluation for the proposed Longspur Wind Project. This Report includes subsurface information and geotechnical design recommendations. The site is located 5 miles north of the City of Glen Ullin, in Mercer and Morton Counties, North Dakota. The approximate boundaries of the project site are shown on Figure 1, Site Location Map.

The purpose of this geotechnical investigation and report was to:

- Explore subsurface soil, bedrock, and groundwater conditions;
- Conduct field and laboratory tests to characterize the subsurface soil and bedrock properties at selected locations across the site; and
- Provide geotechnical engineering parameters for the design of foundation systems and access roadways.

2.0 PROPOSED CONSTRUCTION

It is understood that the Longspur Wind project will consist of 45 wind turbine generators (WTG). The WTGs will be comprised of Vestas 4.5 MW, 163-meter rotor diameter models with a hub height of 113 meters. The project team anticipates WTGs will be supported on gravity foundation systems with an embedment depth of about thirteen (13) feet below finished grade. RRC assumes finished turbine pad grade is at or slightly above current existing site grade.

3.0 SITE EXPLORATION

Facilities associated with the project are anticipated to include electrical collection lines, overhead transmission lines, MET tower, Permanent Meteorological Mast (PMM), substation, operations and maintenance (OM) building, and access roadways. Private-access roadways will most likely be surfaced with imported road-base materials from nearby quarry pits.

The exploration was conducted based on turbine array L015_01.13.26, which includes a total 57 turbines, primary and alternates. This an update from the previous array, L011_04.26.25, which included 67 turbines. Laboratory and geophysical data completed as part of the initial investigation is included within the appendices of this report.

RRC’s complete subsurface exploration program consisted of:

- Drilled 73 borings at WTG locations;
- Drilled 10 borings and 14 Hand Auger borings at the substation;
- Drilled 18 borings along the Transmission Line;
- Drilled 1 borings at the MET tower location;

- Drilled 3 borings at Permanent Meteorological Mast (PMM) locations;
- Drilled one boring at ADLS Tower location;
- Drilled one boring at the O&M Building;
- Installed 5 temporary piezometers at select WTG locations and 1 temporary piezometer within the substation;
- Obtained bulk samples at 14 locations for laboratory thermal resistivity (TR) testing;
- Obtained bulk samples at 2 locations for California Bearing Ratio (CBR) testing;
- Completed 18 Electrical Resistivity (ER) surveys; and
- Completed six Multi-Channel-Analysis-of-Surface-Waves (MASW) surveys.

Figures 1 to 13 in Appendix A consist of maps for the various borings relative to sample, geophysical survey and thermal resistivity test locations, site geology, and soil survey and groundwater data. A summary of subsurface exploration is provided within Table A2 within Appendix A.

3.1 Field Exploration and Testing

RRC geologists staked the boring locations using GPS coordinates provided by Allette Renewable Resources, Inc. Drill crews under RRC's direction drilled the borings within 15 feet of each staked location.

The borings were advanced with truck and track mounted drill rigs utilizing continuous flight hollow stem augers. During the field operations, the drill crew observed for groundwater levels. Following the completion of the drilling operations, the drillers backfilled each bore with soil cuttings in accordance with state regulations. At some locations, we added bentonite chips to supplement the soil cuttings.

Standard Penetration Test (SPT) samplers obtain disturbed soil samples. RRC documented each penetration resistance value in accordance with *ASTM D1586: Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*. This test consists of driving the sampler into the ground with a 140-pound hammer free-falling 30 inches. The number of blows required to advance the SPT sampler 18 inches is counted and recorded, with the sum of the blows to drive the last 12 inches referred to as the standard penetration resistance value (N-value). Results of the field tests are shown on the logs of boring under the "Field Data" column and are preceded by the letter "N." Each soil sample from the SPT samplers collected in the field were visually classified, placed in plastic bags to preserve moisture content, and labeled as to location and depth. All SPT samples were arranged in core boxes and transported to our laboratory facility in Round Rock, Texas for further analysis.

RRC's field geologist directed sampling of cohesive soils at selected depths using Shelby tube samplers. These are 3-inch (OD) diameter stainless steel, thin-walled tubes in accordance with ASTM D1587: Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes. The intent of this sampling technique is to obtain relatively undisturbed samples. Soil samples obtained using Shelby tubes were tested for consistency utilizing a pocket-sized penetrometer, with the reading included on the log of boring, as identified by the preceded letter "P." Readings in excess of 4.5 tons per square feet (tsf), if any, indicate that the capacity of the device has been exceeded. Note that the penetrometer reading is only an approximation of general cohesion. Pocket penetrometers are not a measurement for either shear strength, unconfined compressive strength, or bearing capacity.

Modified California (MC) split-spoon samplers were used to obtain relatively undisturbed samples of both cohesive and non-cohesive soils. RRC's field geologist and/or field engineer directed drill crews to obtain these samples at intermittent locations. The Modified California sampler is similar to the SPT sampler except that the Modified California sampler obtains 2.5-inch diameter samples in a steel sleeve. The Modified California sampler is driven like the SPT sampler and the blow counts are counted and recorded similarly. Results of the field tests are also shown on the Logs of Boring under the "Field Data" column and are preceded by the letter "N". When conducting an analysis of the stratum, a correlation is needed to convert the Modified California N-value to an SPT N-value. For 3-inch outside diameter MC sampler, conversion factor is in the range of 0.45 (Lacroix and Horn, 1773 method) to 0.65 (Burmister, 1948 method). Based on the experience, RRC uses a conversion factor of 0.5 when performing soil density analysis of N-values for the Modified California sampler. A plastic cap was placed on each end of the Modified California sample to seal the sample's moisture. The sample was labeled as to location and depth. All Modified California samples were arranged in core boxes and transported to our laboratory facility in Round Rock, Texas for further analysis.

RRC classifies soils in general accordance with the Unified Soil Classification System (USCS); *ASTM D2488: Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*. The soil and bedrock classification symbols appear on the logs of boring and are briefly described in Appendix A. Bedrock materials were classified in general accordance with the general notes for rock classification included as part of *ASTM D5878: Standard Guides for Using Rock-Mass Classification Systems for Engineering Purposes*.

RRC's field geologist prepared field logs for each boring. The logs of boring contain classification of the materials encountered during drilling as well as interpolation of the subsurface conditions between samples.

The project engineer/geologist reviewed all the field logs, soil samples, and lab test data to make appropriate modifications to the logs of boring, as necessary. Final Logs of Boring and laboratory testing completed to date are provided in Appendix A. The logs of boring describe the strata encountered, their approximate thickness, SPT results, soil and rock classifications, the various depths at which the samples were obtained, as well as the presence of groundwater.

Temporary piezometers were installed at five locations to allow for subsequent groundwater measurements. We installed the piezometers to an approximate depth of 18-feet below the ground surface. Each piezometer consisted of either 1 or 2-inch diameter schedule 40 PVC pipe. We situated the piezometers an offset distance of about 5 to 10 feet from the boring location. The piezometers include a bottom screen/slotted section that is 5-feet long and backfilled with sand that extends about one-foot above the screened section. The remainder of the piezometer is 15-feet of PVC that extends two-feet above ground. We used bentonite to backfill the upper portion of the piezometer. Groundwater levels measured to date within the temporary piezometers are discussed in Section 4.4 of this report. At locations where piezometers were not installed the borings were backfilled with soil cuttings in accordance with the state of North Dakota regulations. The temporary piezometer locations are mapped on Figure 13 in Appendix A.

3.2 Laboratory Tests

The soil samples were returned to the laboratory, examined by the project engineer/geologist, and applicable laboratory testing was assigned on selected soil samples. Laboratory testing was performed in general accordance with ASTM and locally accepted practices. The following laboratory methods of analyses were generally utilized, where sample quality allowed:

- Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System): ASTM D2487;
- Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass: ASTM D2216;
- Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils: ASTM D4318;
- Standard Test Methods for Amount of Material in Soils Finer than No. 200 (75-μm) Sieve: ASTM D1140;
- Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort: ASTM D698;
- Standard Test Methods for Unconfined Compressive Strength of Cohesive Soils: ASTM D2166;
- Standard Test Methods for CBR (California Bearing Ratio) of Laboratory-Compacted Soils: ASTM D1883;
- Standard Test Method for Measurement of Soil Resistivity using the Two-Electrode Soil Box Method: ASTM G187;
- Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing: ASTM G51; and
- Sulfate and Chlorides Content: EPA 300/300.1.

4.0 SUBSURFACE CONDITIONS

4.1 Geology

The geologic interpretations contained herein are based on available geological maps and literature, and review of the logs of excavation as part of this study. The Longspur Wind project site is located within the Missouri Plateau Section of the Great Plains Province, which includes western Northern Dakota, western South Dakota, northeastern Wyoming, and Montana. It is an area characterized by generally low relief with gentle slopes interrupted by low buttes and ridges.

The northern half of the site is glaciated, while the lower half of the site is unglaciated. (Reference 1).

At the project site, bedrock includes thick beds of Tertiary aged sandstone (Reference 2). The bedrock is covered by thin surficial unconsolidated sediments composed mostly of silt, clay, and sand. These are river, lake, and swamp deposits that range from 10 to 30 feet in thickness (Reference 2).

The Geologic map of North Dakota: U.S. Geological Survey, scale 1:500,000 (Reference 2) indicates the bedrock materials of the site consist of the following geologic units of the listed geologic time periods.

Quaternary Period

- **Oahe Formation River Sediment** (Qor): This unit consists of river and stream sediments made of dark clay and silt. The sediments are bedded and overlies crossbedded sand. It is on the plains of modern streams. The thickness of this unit ranges from 10 to 30 feet.

Tertiary Period

- **Golden Valley Formation** (Tg): The upper part of the unit contains yellowish brown micaceous sandstone and fluvial sediments consisting of sand, silt, and clay. The lower part of the unit consists of white or yellow clay, silt, and sand. This unit is about 265 feet.

- **Sentinel Butte Formation** (Ts): This unit consists of river, lake, and swamp sediments containing grayish brown silt, sand, clay, sandstone, and lignite. This unit is 600 feet thick.

- **Bullion Creek Formation** (Tb): This unit consists of river, lake, and swamp sediments containing yellowish brown silt, sand, clay, sandstone, and lignite. This unit is 600 feet thick.

Figure 6 and Figure 7 in Appendix A shows the geologic units within the project site.

4.2 Subsurface Stratigraphy

As indicated on the logs of boring, the soil stratigraphy at the site generally consisted of topsoil underlain by either clay or sand layers.

The soil layers can generally be described as:

- Soft to hard, Lean and Fat Clay soils with varying amounts of sand and gravel.
- Medium stiff to hard, Silt soils with varying amounts of sand and gravel.
- Dense sands with varying amounts of silt, clay and gravel.

Bedrock where encountered, consisted of sandstone, shale, and mudstone.

Lignite seams/layers were also noted in some of the borings. Approximate thickness and consistency of these seams/layers are noted on the logs of boring within Appendix A.

Detailed Logs of Boring present detailed stratum descriptions, soil classifications, types of sampling used, laboratory test data, and additional field data. Bore logs are presented in Appendix A. The lines separating stratum types on the Logs of Boring do not necessarily represent distinct lines of demarcation because transitions can be gradual. The Boring Log Key, defining the terms and descriptive symbols used on each log of boring, is also presented in Appendix A

4.3 Laboratory Test Results

RRC obtained the service of Beyond Engineering & Testing, LLC to conduct laboratory tests. Lab test results completed to date are presented below and discussed in subsequent sections.

Laboratory test results indicate the native soils possess in-situ moisture contents in the range from about 2 to 55%, with an average of 19%.

The native soils have Plasticity Indices (PI) ranging from non-plastic to 48%. Clay soils with a PI less than 15 are generally considered to exhibit a low expansive potential provided their moisture contents are stable. High plasticity clay soils with a PI greater than 25 are generally considered to exhibit a high expansive potential if their moisture contents undergo a significant moisture change

We performed 14 moisture/density relationships (proctors) to determine the maximum dry unit weight and optimum moisture content in accordance with ASTM D698 (standard method). We also conducted Atterberg Limits on these samples to assess the soil type. A summary of the test results is presented below.

Table 4.3.1 Summary of Proctors and Atterberg Test Results

Sample Location	Depth (feet)	Material Type	Liquid Limit (%)	Plasticity Index (%)	Maximum Dry Unit Weight (pcf)	Optimum Moisture Content (%)
GEO-01	2 to 4	CH	63	41	99.5	22.2
GEO-08	2 to 4	CH	57	38	107.0	18.2
GEO-10	2 to 4	CH	71	47	92.4	27.6
GEO-19	2 to 4	CL	30	12	111.8	16.3
GEO-22	2 to 4	SC-SM	22	6	115.6	12.7
GEO-33	2 to 4	CH	61	42	100.4	20.8
GEO-46	2 to 4	CL	41	23	112.1	15.4
GEO-48	2 to 4	CH	71	48	99.1	20.7
GEO-53	2 to 4	CH	54	35	103.1	19.5
GEO-59	2 to 4	CH	54	34	104.8	20.2
GEO-62	2 to 4	SC	26	8	113.9	12.3
GEO-67	2 to 4	CL	43	22	105.9	18.1
GEO-70	2 to 4	CH	61	41	100.6	20.8

Sample Location	Depth (feet)	Material Type	Liquid Limit (%)	Plasticity Index (%)	Maximum Dry Unit Weight (pcf)	Optimum Moisture Content (%)
SUB-2	2 to 4	CL	37	23	116.1	13.7

Notes: pcf = pounds per cubic foot; CL = Lean Clay; CH = Fat Clay; SC = Clayey Sand, SM = Silty Sand;

Results of Unconsolidated-Undrained Triaxial (UU) Compression testing are presented in Table 4.3.2. These tests are performed in accordance with ASTM D2166 on relatively undisturbed samples.

Table 4.3.2 Summary of UU Triaxial Test Results

Sample Location	Depth (feet)	Material Type	Confining Pressure (psi)	In-situ Dry Unit Weight (pcf)	Undrained Shear Strength, s_u (psf)
GEO-04	12	CL	10.0	103.0	1,960
GEO-07	12	CL	10.0	99.0	6,920
GEO-46	12	CL	10.0	104.0	6,210
GEO-62	12	CL	10.0	105.0	4,510
GEO-66	12	SC	10.0	104.0	6,240
GEO-77	12	CL	10.0	112.3	6,420
SUB-3	4	CL	3.0	108.0	1,620
O&M-1	7	SC	5.5	100.0	320

Notes: pcf = pounds per cubic foot; psf = pounds per square foot; CL = Lean Clay; SC = Clayey Sand.

Results of Unconfined Compressive Strength (UC) tests are presented in Table 4.3.3. These tests are performed in accordance with ASTM D2166 on relatively undisturbed samples.

Table 4.3.3 Summary of Unconfined Compressive Strength Test Results

Sample Location	Sample Type	Depth (feet)	Material Type	In-situ Dry Unit Weight (pcf)	In-situ Moisture Content (%)	Undrained Shear Strength, s_u (psf)
GEO-01	MC	14	CL	111.2	20.2	5,280
GEO-04	ST	19	CL	102.3	22.1	2,600
GEO-33	MC	17	CL	111.3	16.6	9,450
GEO-36	ST	17	CL	92.9	29.9	940
GEO-37	ST	12	CL	65.1	47.0	2,660
GEO-69	ST	12	CL	95.1	24.8	4,600

Notes: pcf = pounds per cubic foot; psf = pounds per square foot; MC = Modified California; ST = Shelby tube; CL = Lean Clay.

Results of swell test performed in accordance with ASTM D4546 are presented in Table 4.3.4.

Table 4.3.4 Summary of Swell/ Collapse Test Results

Sample Location	Depth (feet)	Material Type	Dry Density (pcf)	Moisture Content (%)	Surcharge Load (psf)	Collapse Strain (%)
SUB-6	4	SM	101.2	18.8	500	-0.8

Notes: pcf = pounds per cubic foot; SM = Silty Sand.

We performed two California Bearing Ratio (CBR) tests on select samples. The test specimens soaked for 96 hours prior to the CBR load test. A summary of the CBR test results is presented in Table 4.3.5. Design CBR values represent strength at 95% compaction relative to the maximum dry density as determined by ASTM D698. CBR increases with increased density.

Table 4.3.5 Summary of CBR Test Results

Sample Location	Depth (feet)	Material Type	Design Dry Unit Weight (pcf)	Design CBR (%)
GEO-48	1 to 4	CH	94.1	0.8
GEO-62	1 to 4	SC	108.2	8.2

Notes: pcf = pounds per cubic foot; CH = Fat Clay; SC = Clayey Sand.

Results of water-soluble sulfate and chloride testing performed on shallow soil samples are presented in Table 4.3.6.

Table 4.3.6 Summary of Sulfate and Chloride Contents

Sample Location	Depth (feet)	Material Type	Chloride Contents (% by weight)	Sulfate Contents (% by weight)
GEO-04	1 to 13	CL	0.0080	0.2220
GEO-10	1 to 13	CH	0.0080	0.0672
GEO-25	1 to 13	CL	0.0059	0.2600
GEO-50	1 to 13	CL/CH	0.0079	0.4390
GEO-64	1 to 13	CL	0.0076	0.2740
SUB-3	1 to 4	CL	0.0305	0.0240

Notes: CL = Lean Clay; CH = Fat Clay.

Results of Minimum Soil Box Resistivity and pH tests performed on shallow soil samples are summarized in Table 4.3.7.

Table 4.3.7 Summary of Minimum Soil Box Resistivity and pH Tests

Sample Location	Depth (feet)	Material Type	Minimum Resistivity (ohm-cm)	pH
GEO-04	1 to 13	CL	589	7.1
GEO-10	1 to 13	CH	746	6.6
GEO-25	1 to 13	CL	455	7.5
GEO-50	1 to 13	CL/CH	408	7.6
GEO-64	1 to 13	CL	294	7.3
SUB-3	1 to 4	CL	805	9.1

Notes: CL = Lean Clay; CH = Fat Clay.

A summary of laboratory tests is presented in Appendix B.

4.4 Groundwater Conditions

Based upon information obtained from the borings drilled to date and historical water data for the region, it is RRC's opinion static groundwater level will affect the construction and design of shallow gravity foundation systems at select locations. Groundwater was encountered at the time of drilling at depths in the range of about 7 to 49 feet below site grade in 37 of the 115 borings completed as part of this study. Groundwater observations for each WTG location are presented on Table A1 in Appendix A.

Temporary piezometers were installed within the foundation footprint of four select turbine sites and within the substation area to facilitate additional groundwater level measurements. Based on water measurements collected to date, the groundwater table (GWT) in the piezometers was found to be at depths in the range of about 1 foot to 12 feet below existing site grade. Groundwater level measurements in the piezometers were recorded immediately after installation, and approximately 24 to 72 hours after installation. A summary of the groundwater levels measured in the piezometers are presented in Table A4 within Appendix A.

RRC reviewed published water well logs for Mercer and Morton Counties, North Dakota that were available from the North Dakota Department of Water Resources. Historical water well logs surrounding the project site reported ground water levels between 1.4 and 278.8 feet below the ground surface. The shallowest groundwater level was recorded in the year 2020 at about 1.4 feet below the ground surface at Well Report No. 9006.

It is important to note that water well records may not accurately represent seasonal fluctuations in static groundwater level or perched groundwater conditions, which should be considered during WTG foundation design.

It is also imperative to note that short-term groundwater level observations presented in this study are not an accurate evaluation of the variable groundwater conditions that may be present at each of the turbine locations. This Report is not to be interpreted as a comprehensive groundwater study. Groundwater levels are highly dependent on climatic and hydrologic conditions before and after construction, and site development including irrigation demands, drainage and other factors. As such, the presence of water during construction may vary relative to this report. It is understood that the presence of groundwater may influence certain construction activities and long-term performance of foundations and pavements; if a detailed groundwater study is desired, a groundwater hydrologist should be retained to perform these services.

RRC recommends implementing a groundwater level monitoring program to assess the impact of shallow groundwater levels on foundation design and construction.

4.5 Geohazard Assessment

The following subject items represent geologic or physical hazards to the project. Within each subject, we address the level of risk associated with the particular hazard to the project.

4.5.1 Flood Hazard

The Federal Emergency Management Agency (FEMA) has not completed a study to determine the flood hazard for Mercer and Morton Counties, North Dakota.

The project civil engineer should review the structure locations within the project site, especially for those located near drainage features to verify if additional studies are needed. The design of flood-proofing as well as the need for scour/erosion protection is the responsibility of the project Civil Engineer or Hydrology Engineer.

4.5.2 Expansive Soils

Based upon review of the logs of boring, laboratory testing results, available geological maps and literature, expansive soils are anticipated to be encountered across the project site. Expansive soils have a potential to shrink or swell when the moisture content is allowed to change significantly. WTG foundations are anticipated to have an embedment depth of approximately 13 feet, which is likely beyond the depth of moisture variations for this project site. It is our opinion that expansive soil will not cause significant movement for WTG foundation systems. The potential of expansive soils negatively impacting WTG foundations can be considered as a low risk. It is imperative that the exposed subgrade is not allowed to dry out significantly prior to concrete seal slab placement.

4.5.3 Soil Collapse Due to Windblown Soils

The project site can be classified as having a low susceptibility risk of collapse prone soils. Soil collapse is a geological feature associated with windblown soils. Windblown soil particles can be angular and when deposited lightly, they can form with high void ratios. Windblown soil is also quickly deposited and may become partially cemented. Both of these factors tend to preserve the high void ratio. When wetted and loaded, these soils can then collapse. Typically, we can identify these soils by low SPT N values and low dry densities.

Based on the log of borings and publicly available geological mapping within the project area, the potential for soil collapse is considered low.

4.5.4 Frost Penetration Depth

Based on Reference 3, the average frost penetration depth for Morton County is approximately 48 inches. Therefore, we recommend that the spread or strip footings at the site should have a minimum embedment of 48 inches below finished site grade for confinement and frost penetration.

4.5.5 Corrosion Potential

Published maps indicate that surficial soils within the project site have a low to high risk for concrete corrosion. Figure 10 in Appendix A is a map that attempts to indicate concrete corrosion risk boundaries. RRC cautions that this published map only estimates the boundaries based on soil types and cannot be precise. Based on the lab testing completed, the soils within the upper 12 feet exhibit, the risk for concrete corrosion is low to moderate..

Published maps indicate that the project site has a low to high risk for steel corrosion. Refer to Figure 11 for approximate steel corrosion risk boundaries. Again, we caution that this map is not precise and are only generalizations based on soil types. Based on the lab testing completed, the soils within the upper 12 feet exhibit “Very Corrosive” electrical characteristics with regards to galvanic corrosion of steel.

Section 5.4 discusses in greater detail laboratory test results for concrete and steel corrosion.

4.5.6 Karst Potential

Water soluble rocks located near or exposed at the surface have potential for development of karst and dissolution features. Rocks or mineral deposits, such as limestone, dolomite, gypsum/anhydrite, and salt are all susceptible to dissolution when in contact with circulating water. These soluble deposits pose the greatest risk when located within 20 feet of the ground surface, and a moderate risk when located within 20 to 100 feet of the surface Based upon review of geologic maps and literature, bedrock formations of this project area predominately consist of sandstone, shale and mudstone, which are typically not subject to karst and dissolution features.

Based upon review of the logs of boring, available geological maps and literature, karst potential can be considered low.

4.5.7 Slope Stability

Within the project area, the site consists of broader flat to gently rolling plains. Where most of the site exhibits gradual to moderate slopes, occasional steeper slopes may exist near drainage features. For native slopes greater than 2.5:1 (horizontal:vertical), RRC recommends that the turbines are offset one foundation diameter or more from the slope crest; otherwise, it is recommended that a detailed slope stability analysis be performed. Based on current existing site topography and RRC’s observations during the geotechnical field exploration, slope stability is not anticipated to be a major concern for this project site, assuming minimum site grading occurs during construction phase.

4.5.8 Seismicity Hazards

North Dakota is generally a region of relatively low seismicity. At the project area, the site modified peak ground acceleration (PGA_m) was computed to be 0.039 g for Site Class D. This is based on the *Hazards Program*, a web-based program developed by the ASCE Hazard Tool (Reference 5) in accordance with ASCE 7-16. Based on the 2021 IBC (Reference 4), the Seismic Design Category for the site is anticipated to be category “A”. Therefore, the seismic hazard risk is considered very low at the project site.

4.6 Geophysical Properties

RRC performed One-Dimensional Multi-Channel Analysis of Subsurface Waves (MASW) surveys at 6 WTG locations. The purpose of MASW surveys is to obtain shear wave velocity (V_s) profiles. The MASW survey locations are mapped on Figure 5 in Appendix A. The MASW survey methodologies and results are discussed in Section 4.6.1.

RRC also completed Earth Electrical Resistivity (ER) surveys at 18 locations across the site, including five surveys within the substation area. The test locations are mapped on Figure 5 in Appendix A. RRC conducted these surveys using the Wenner four-pin method. The electrical resistivity survey methodologies are presented in Section 4.6.2.

4.6.1 MASW Survey

The Multi-Channel-Analysis-of-Surface-Waves (MASW) method is a non-intrusive/non-destructive technique which uses Rayleigh waves to evaluate the stiffness of subsurface strata. Rayleigh waves of different wavelengths (or frequencies) travel at different velocities as they propagate through different soils. The waves also bounce along the surface of different layers, called dispersion. MASW reports are presented in Appendix C.

For a 1-D MASW survey, twenty-four geophones with a 5-foot spacing are laid out in a linear array. The total length of the array is approximately 115 feet. A 16-pound sledgehammer striking a metal plate is employed as the seismic source located 10, 25 and 40 feet away from the first geophone. RRC uses SurfSeis 4.04 software to collect and process the seismic data.

The shear wave velocities are used to determine certain soil and bedrock characteristics based on simple equations. For example, the soil/bedrock shear modulus can be calculated using the following equation:

$$G = \rho V_S^2$$

Where: G = Shear Modulus (psf);
ρ = Mass density (pcf/(ft/sec.^{2})); and
V_s = Shear wave velocity (ft/sec.)

Young's Modulus, E, can also be calculated from the shear wave velocity data using the following equation:

$$E = 2G(1 + v)$$

Where: E = Young's Modulus (psf);
G= Shear Modulus (psf); and
v = Poisson's Ratio.

The weighted average is calculated based on the following formula based on the 2021 International Building Code (IBC) (reference 4):

$$\overline{V_S} = \frac{\sum_i^n d_i}{\sum_i^n \frac{d_i}{V_{si}}}$$

Where: d_i = Thickness of any layer between 0 and 100 feet; and
V_{si}= Shear wave velocity of a layer.

Note the measured shear wave velocity using MASW may not be available down to a depth of 100 feet. In the case where measured shear wave velocity is less than 100 feet, the weighted shear wave velocity is calculated based on available depths.

To determine the rotational stiffness of the underlying soil and bedrock, the parameters outlined in Table 4.6.1.1 can be used to compute the elastic and shear moduli. These values are generic values from published sources and typical for the respective soil type.

Table 4.6.1.1 Recommended Soil Parameters for Rotational Stiffness

Soil/ Material Type	Poisson's Ratio (1)	Average Total Unit Weight (pcf) (1,2)
Saturated Clay and Silt Soils	0.45	115
Unsaturated Clay and Silt Soils	0.35	105
Loose to Medium Dense Sand Soils	0.35	115
Medium Dense to Dense Sand Soils	0.30	120
Structural Fill	0.30	120
Bedrock	0.30	165

Note: (1) Based on Reference 6 (see page 123 for Poisson's ratio and page 163 for unit weight).
(2) Based on laboratory measurements (see Section 4.3).

Computed parameters from the MASW surveys represent soil behavior at small strain. The foundation designer should incorporate appropriate reduction factors to determine the rotational stiffness of the foundation system. The MASW survey results completed to date are included in Appendix C.

4.6.2 Earth Electrical Resistivity Surveys

RRC performed a total of 18 field electrical resistivity (ER) surveys using the Wenner 4-pin array method. The electrical resistivity surveys were completed at 13 WTG locations and 5 surveys within the substation. The electrical resistivity survey locations are mapped on Figure 5 included in Appendix A. Each survey consists of two perpendicular arrays, both centered at the same location. Results of electrical resistivity surveys are presented in Appendix C.

Interpretation of the electrical resistivity surveys is beyond the scope of this study and should be performed by the electrical design team.

4.6.3 Thermal Resistivity of Soils

RRC obtained bulk soil samples at 14 locations to conduct laboratory thermal resistivity (TR) tests. The samples consist of subsurface soils collected at depths of 2 to 4 feet below existing site grade. RRC obtained the services of Beyond Engineering & Testing to conduct laboratory thermal resistivity (TR) tests in accordance with IEEE 442 Method. The test locations are mapped on Figure 5 in Appendix A.

The thermal resistivity tests were performed on remolded samples targeting 92% compaction of the maximum dry density as determined by ASTM D698 at the "as-received" moisture content. Thermal resistivity samples were then tested at a series of moisture contents from "as-received" moisture content to 0% moisture content. The result is a thermal resistivity dry-out curve. Thermal resistivity test results are included in Appendix C.

Interpretation of the thermal resistivity tests results is beyond the scope of this study and should be performed by the design team.

5.0 GEOTECHNICAL RECOMMENDATIONS

It is understood the Longspur Wind Project will consist of the construction of 45 WTGs and associated facilities, including a substation, transmission line, PMM structure, MET tower and O&M building. We assume WTGs will be supported on gravity foundation systems and will bear on native soils with an embedment depth of about 13 feet below finished grade. RRC received the proposed grade changes from Client and has incorporated these into our recommendations.

The extent and location of site grading is also unknown. RRC should be retained to review the civil drawings and cross-sections for each turbine location and other critical areas along the proposed roadways. This will allow us to evaluate the need for additional studies such as slope stability analyses. If current site grade is changed at a WTG location, we can assess whether our original recommendations apply.

RRC's geotechnical recommendations presented in this report should be verified when information on the foundation design and site grading become available.

5.1 General Turbine Foundation Expectations

RRC performed bearing capacity and settlement calculations in general accordance with methodologies outlined in the 2nd Edition of *Guidelines for Design of Wind Turbines* (Reference 7). We also used generally accepted standard of care and practice along with experience with similar soil conditions in this type of geological setting. Detailed discussions of bearing capacity and settlement for WTG bearing on native soils are outlined in the following subsections. A summary of anticipated conditions that will require particular attention in the design and construction is presented below:

- RRC based our design parameters and construction recommendations to allow for foundations to bear at depths outlined in Table A1 below the existing ground surface for an allowable end bearing capacity of 2,500 psf, with a total settlement of 2.5-inches and a maximum differential settlement or tilt potential of 0.15 degree across the foundation. Table A1, *Summary of Foundation Design Net Allowable Bearing Pressure and Design Groundwater Recommendation*s in Appendix A provides net allowable end bearing capacity for each turbine site. Some locations are not capable of supporting a net allowable bearing capacity of 2,500 psf. Alternate foundation designs may be required. Otherwise, remediation of the foundation supporting soils is necessary.

- The depths of remediation required to obtain the bearing capacity and/or settlement values listed above are provided in Table A1. RRC assumes an embedment depth of 13 feet or greater. Should an embedment depth of less than 13 feet be used, RRC should be consulted to determine if additional locations require soil improvement to achieve the bearing capacity and/or settlement values listed above. These depths to remediation are based relative to naturally existing grade and foundations bearing about nine feet below grade. If final elevations result in the foundation bearing at a different depth, then adjustments should be made to the depth of remediation.

- Over-excavation and replacement with structural fill materials may be considered for soil improvement depths up to about 16 feet below existing ground surface, if feasible. For soil improvements greater than 16 feet below existing ground surface, the cost for performing over-excavation and replacement will likely be excessive; therefore, deep soil improvement measures such as Rammed Aggregate Piers (RAP), compaction grouting or other equivalent ground improvement techniques are appropriate.

- It is anticipated excavations may be advanced with conventional earth moving equipment where native soils extend below foundation bearing elevations.

- Excavation contractors and/or underground utility installers should consider performing test pits or probing tests to evaluate proper means and methods for advancing excavations. Potential caving/sloughing within narrow and shallow utility trenches may require sidewalls of trenches to be sloped in order to install utilities. Excavated trench bottoms should be thoroughly cleaned prior to cable placement and backfilling.

- It is crucial to maintain a uniform foundation subgrade support below the turbine foundation to reduce the potential of excessive differential foundation settlement. If compacted structural fill is used below the turbine foundation, the thickness of structural fill below the turbine foundation shall be a minimum of 6 inches; the structural fill thickness shall be kept as uniform as possible with no abrupt thickness change, with an overall thickness difference of 2 feet or less across the turbine foundation footprint. Either the bedrock portion of the foundation subgrade may be excavated, or the lower portion of the soil subgrade excavation may be filled with lean concrete so that the structural fill thickness difference can be kept at 2 feet or less across the foundation width.

- Turbine foundations located adjacent to natural or man-made slopes should be setback laterally from the top of the slope. The minimum setback distance should be 25 feet or one turbine foundation diameter, whichever is larger, away from the edge of foundation to the crest of any natural or man-made slopes. Proper drainage measures should be taken to reduce impacts to man-made cut and fill slopes as well as all undisturbed natural slopes.

It is imperative that a professional geotechnical engineer, or their representative, observe each foundation excavation to verify that the exposed foundation soil bearing conditions meet the intent of this Report. This observation allows the geotechnical engineer to assess the need and limits of removal and replacement. Detailed construction recommendations and/or specifications are outlined in Section 6 of this report.

5.1.1 Bearing Capacity and Settlement of Gravity Foundation System

A net allowable bearing pressure of 2,500 psf can be used for the structural design for turbine foundations bearing directly on undisturbed native soils. The allowable bearing values are based on a safety factor of three for general shear failure. These net allowable bearing pressure values may be increased by 25% when considering short duration loading conditions such as extreme wind and seismic forces. Some locations will require remedial measures outlined in Section 6 in order to achieve the full allowable bearing pressure.

The estimated total turbine foundation settlement is expected to be about 1.5 to 2.5 inches under normal operating loading conditions at the center of the foundation. The estimated differential settlement or tilt across the foundation diameter is less than 0.15 degrees under both dead load and normal operating loading conditions.

Table 5.1.1.1 Geotechnical Design Parameters for Gravity Foundation

Parameters/Soil Type*	Recommended Values
Min. Undrained Shear Strength / Very Stiff Clay	1,500 (psf)
Min. Internal Friction Angle / Sand	30 (deg.)
Min. Net Allowable Bearing Capacity (Normal Operating Load, Fs=3.0)	2,500 (psf)
Poisson's Ratio	0.35

Table 5.1.1.2 presents a summary of Modulus of Subgrade Reaction for different soil, bedrock, and structural fill materials.

Table 5.1.1.2 Recommended Soil and Structural Fill Design Parameters

Soil/ Material Type	Friction Coefficient[(1)]	Modulus of Subgrade Reaction, k_s(pci)
Firm Clay Soils	0.35	75
Stiff to Hard Clay Soils	0.35	100
Medium Dense Sand Soils	0.35	150
Dense to Very Dense Sand Soils	0.45	200
Structural Fill Materials (Min. 1-foot thick)	0.45	225

Note: [(1)] If necessary, lateral passive earth pressures can be considered to develop additional resistance. The coefficient of base friction should be reduced to 0.30 when used in conjunction with passive pressure.

To determine the rotational stiffness of the underlying soils/bedrock, the foundation designer should reference the results of the MASW testing performed as part of this study. The results of these surveys completed as part of this study are presented in Appendix C.

5.1.2 Overburden Backfill on Turbine Foundation

The use of native soil/rock as backfill materials placed above and against the side of turbine foundations is acceptable. RRC recommends the backfill materials placed over the turbine foundations be compacted to dry densities of at least 95% of the maximum dry density as determined by ASTM D698. This compaction is necessary to support a crane pad, reduce erosion and deter settlement. RRC recommends using an average long-term moisture content of 10% for native soils used as overburden. Contractor should place overburden backfill material in accordance with specifications outlined in Section 6.4.4 of this report.

Using the Standard Proctor tests listed in Table 4.3.1, the recommended overburden backfill unit weight values for turbine foundation design are presented in Table 5.1.2.1 below.

Table 5.1.2.1 Overburden Backfill Density Range Requirement

Soil/ Material Type	Dry Backfill Unit Weight Range, γ_d (pcf)	Moist Backfill Unit Weight Range, γ_{total} (pcf)
Native Soils	88-116	118-134

Note: pcf= pounds per cubic foot;

It should be noted that some turbine sites have shallow surficial soils which are classified as fat clay soils. In areas where fat clay soils are encountered within the foundation excavation zone, increased compaction efforts or mixing with heavier soil may be required to achieve the proposed turbine foundation backfill requirements.

5.2 Substation, O&M Building, MET Tower and ADLS Tower Shallow Foundation Systems

Final grade elevations for the Substation, O&M Building, ADLS, and PMM were not available. RRC has assumed the finished grade will be near or slightly above the existing ground surface. Surficial soils at these locations predominantly comprise lean and fat clay soils with varying amounts of sand. These clay soils range from medium stiff to very stiff in terms of consistency.

Shallow foundations shall bear a minimum of 48 inches below the ground surface. 48 inches was selected based on the *Building and Design Criteria* for Morton County, North Dakota. We recommend that continuous footings have a minimum width of 18-inches to allow cleaning, inspection, and placement of rebar.

Shallow foundations embedded 48 inches below the ground surface at the substation, O&M Building, ADLS, and PMM can use a net allowable bearing pressures shown in the tables below. These net allowable bearing capacities include a factor of safety of 3 for general shear failure.

For reinforced concrete slabs bearing at finished grade, we recommend over-excavation of foundation subgrade soils to a minimum of four feet below the finished grade and replacement with non-frost susceptible structural fill material or flowable fill (controlled low strength material) having compressive strength of at least 150 psi. The non-frost susceptible materials should meet the requirements of Section 6.2. The excavation should extend at least four feet beyond the perimeter of the foundation.

Table 5.2.1 Soil Parameters for Substation

Parameter	Design Value
Design Groundwater Level below ground surface (ft)	7
Average Total Unit Weight (pcf)	115
Modulus of Subgrade Reaction of Select Fill Pad (pci)	70*

Parameter	Design Value
Friction Coefficient at Foundation Base (Native Soils)	0.35
Friction Coefficient at Foundation Base (Structural Fill)	0.45
Net Allowable bearing pressure for Strip or Continuous Footings (psf) bearing 4-feet below ground surface (psf) with 0.5-inch settlement	1,500
Net Allowable bearing pressure for Strip or Continuous Footings (psf) bearing 4-feet below ground surface (psf) with 1-inch settlemment	2,000
Net Allowable Bearing Pressure for Continuous and Spread Footings (psf) bearing 4-feet below ground surface (psf) with 0.5-inch settlement	1,500
Net Allowable Bearing Pressure for Continuous and Spread Footings (psf) bearing 4-feet below ground surface (psf) with 1-inch settlement	2,000
Net Allowable bearing pressure for Mat Foundations on earthen pad to 4-feet below ground surface (psf) with 0.5-inch settlement	1,350
Net Allowable bearing pressure for Mat Foundations on earthen pad to 4-feet below ground surface (psf) with 1-inch settlement	1,800

Notes: pcf = pounds per cubic foot; psf = pounds per square foot; pci = pounds per cubic inch.
* For a 1 ft. x 1 ft. Plate.

Table 5.2.2 Soil Parameters for O&M Building

Parameter	Design Value
Design Groundwater Level below ground surface (ft)	18
Average Total Unit Weight, pcf	115
Modulus of Subgrade Reaction of Select Fill Pad, pci	70*
Friction Coefficient at Foundation Base (Native Soils)	0.35
Friction Coefficient at Foundation Base (Structural Fill)	0.45
Net Allowable bearing pressure for Strip or Continuous Footings (psf) bearing 4-feet below ground surface (psf)	2,000
Net Allowable Bearing Pressure for Continuous and Spread Footings (psf) bearing 4-feet below ground surface (psf)	2,000
Net Allowable bearing pressure for Mat Foundations on earthen pad to 4-feet below ground surface (psf)	1,500

Notes: pcf = pounds per cubic foot; psf = pounds per square foot; pci = pounds per cubic inch.
* For a 1 ft. x 1 ft. Plate.

Table 5.2.3 Soil Parameters for ADLS Locations

Parameter	Design Value
Design Groundwater Level below ground surface (ft)	20
Average Total Unit Weight, pcf	115
Modulus of Subgrade Reaction of Select Fill Pad, pci	70*
Friction Coefficient at Foundation Base (Native Soils)	0.35
Friction Coefficient at Foundation Base (Structural Fill)	0.45
Net Allowable bearing pressure for Strip or Continuous Footings (psf) bearing 4-feet below ground surface (psf)	2,500
Net Allowable Bearing Pressure for Continuous and Spread Footings (psf) bearing 4-feet below ground surface (psf)	3,000

Parameter	Design Value
Net Allowable bearing pressure for Mat Foundations on earthen pad to 4-feet below ground surface (psf)	2,500

Notes: pcf = pounds per cubic foot; psf = pounds per square foot; pci = pounds per cubic inch.
* For a 1 ft. x 1 ft. Plate.

Table 5.2.4 Soil Parameters for PMM Locations

Parameter	Design Value
Design Groundwater Level below ground surface (ft)	20
Average Total Unit Weight, pcf	115
Modulus of Subgrade Reaction of Select Fill Pad, pci	70*
Friction Coefficient at Foundation Base (Native Soils)	0.35
Friction Coefficient at Foundation Base (Structural Fill)	0.45
Net Allowable bearing pressure for Strip or Continuous Footings (psf) bearing 4-feet below ground surface (psf)	2,000
Net Allowable Bearing Pressure for Continuous and Spread Footings (psf) bearing 4-feet below ground surface (psf)	2,500
Net Allowable bearing pressure for Mat Foundations on earthen pad to 4-feet below ground surface (psf)	2,000

Notes: pcf = pounds per cubic foot; psf = pounds per square foot; pci = pounds per cubic inch.
* For a 1 ft. x 1 ft. Plate.

Site grading should ensure positive drainage away from the structures. This will prevent pooling of water near the foundations which could result in significant moisture changes of the soils beneath the foundations. Poorly graded sand (classified as SP) and gravel are highly permeable and allow water entry. These soils make poor overburden backfill. If the backfilled material around the structures consists of SP or Gravel, RRC recommends adding a 12-inch-thick clay cap. This clay cap should extend at least five feet beyond the foundation excavation.

5.3 Substation, Transmission Line, MET Tower and ADLS Tower Deep Foundation Systems

Structure elements with heavy axial loads and/or large overturning moments may utilize drilled pier foundations. Pier lengths will likely be dictated by overturning resistance. Allowable end bearing pressures and allowable skin friction values for the substation, transmission line and MET/ADLS tower structures are presented in Appendix D. Allowable end bearing pressures and allowable skin frictions utilize a factor of safety of 3 and 2.5, respectively.

Skin friction values should be reduced by 25% when calculating pull-out resistance, where applicable. Settlement associated with drilled piers is anticipated to be about ½ to 1 inch. For proper installation of steel rebar and to monitor cleanliness, drilled shafts should have a minimum diameter of 1½ feet. The structural engineer should determine the length of the drilled piers to satisfy axial, uplift, and lateral loading.

Lateral load analysis may be performed using the LPILE computer program. LPILE uses a p-y curve finite difference technique for predicting the soil-structure interaction and response. RRC provides detailed LPILE parameters within Appendix D to evaluate drilled piers under lateral loads.

Vertical steel reinforcement to resist tensile loads caused by uplift forces should extend the full length of the pier shaft. Additional reinforcement required by structural demands for axial compressive loads, lateral loads, or minimum reinforcement required by design codes should also be satisfied.

Transmission line pole foundation systems may consist of directly embedded pre-stressed concrete pole foundation systems and would likely be designed using EPRI's MFAD computer software. Compacted granular backfill material in the annulus can be assumed to exhibit the following parameters outlined in Table 5.3.1. These values assume backfill to be compacted to a relative density of 65% of greater.

Table 5.3.1 Parameters for Compacted Anulus Backfill

Parameter	Compacted Granular Aggregate
Total Unit Weight (pcf)	125
Internal Angle of Friction (degree)	35
Horizontal Modulus of Elasticity (ksi)	1.6

5.4 Corrosivity of Soils

Water-soluble sulfate and chloride test results are presented in Table. 4.3.6. The test results indicate the soils in the upper 12 feet possess a "Negligible" to "Moderate" risk for sulfate exposure and corrosion potential to concrete. Published maps indicate that in general, the area has low to moderate risk for corrosion to concrete. Foundation concrete should be designed in accordance with *ACI 318: Building Code Requirements for Structural Concrete and Commentary*.

Minimum Soil Box Electrical Resistivity and pH testing results are presented in Table 4.3.7 of this report. Soil Box Electrical Resistivity results indicate soils within the upper 12 feet exhibit "Very Corrosive" electrical characteristics with regards to galvanic corrosion of steel. Cathodic protection for buried metal pipe should be designed by a qualified corrosion engineer.

Table 5.4.1 Effect of Soil Box Electrical Resistivity on Corrosion

Aggressiveness	Resistivity in ohm-cm
Very Corrosive	< 700
Corrosive	700 – 2,000
Moderately Corrosive	2,000 – 5,000
Mildly Corrosive	5,000 – 10,000
Non-Corrosive	> 10,000

5.5 Lateral Earth Pressures

Lateral earth pressures will apply in soil strata. The WTG foundations will be designed to resist all lateral movements; therefore, the “at rest” lateral earth pressure will apply. The following “at rest” equivalent fluid pressures are recommended in Table 5.5.1. The lightweight range is more conservative and necessary for the “at rest” and “passive” condition. The heavier weights are more conservative for the “active” condition.

RRC applied unit weights listed in Table 5.2.1.3 for overburden backfill soils with minimal compaction and low moisture content. The lightweight range is more conservative and necessary for the “at rest” and “passive” condition. The heavier weights are more conservative for the “active” condition.

Table 5.5.1 Equivalent Fluid Pressures

Soil Type	Condition	Equivalent Fluid Pressure (psf/ft)
Clay Soils ϕ=20, γ_t=97 to 136 pcf	At Rest, k_o= 0.65	63 to 88
	Active, k_a= 0.49	68
	Passive, k_p= 2.0	195
Sand Soils ϕ=34, γ_t=103 to 132 pcf	At Rest, k_o= 0.44	41 to 53
	Active, k_a= 0.28	40
	Passive, k_p= 3.5	365

We note that for clay soils, the angle of internal friction is adjusted to correct for shear versus a lower friction angle. Theoretical correlations for the at-rest coefficient of clays are a property of Plasticity Index. For large variations in clay plasticity, RRC can provide alternate k_o coefficients. Because we expect that there will only be one foundation design, we expect that the lateral earth pressure will be dictated by the sandy condition.

Passive and active earth pressure resistance will only mobilize after significant movement of the foundation. The passive case occurs where a structural element tends to move into the soil mass. The active case occurs when the element tends to move away from the soil mass. Both cases are applicable for unrestrained foundation elements.

The above earth pressure values do not include safety factors. We recommend a minimum safety factor of 2.0 be applied when using passive earth pressure for lateral load resistance. Surcharge loads should also be considered where appropriate. The values apply only to cases where the ground surface is level. We should be contacted to provide suitable values for cases where the ground surface is sloped. Similarly, if a structure is submerged below water, then the earth pressures change dramatically and require a different analysis.

5.6 Seismic Design

RRC provides seismic design using 2021 International Building Code (IBC) (reference 4). Based on Logs of Boring, we recommend using a Site Class D for stiff soils. The Mapped Spectral

Response Acceleration for the 1 second (S_1) and short periods (S_S) were computed using the ASCE Hazard Tool, which is a web-based application program (reference 5). The table below summarizes recommended seismic parameters to be used in the design.

Table 5.6.1 Recommended Seismic Parameters

Parameter	Recommended Value
S_S – Mapped Spectral Response Acceleration at Short Period (0.2-Second)	0.053 g
S_1 – Mapped Spectral Response Acceleration at 1-Second Period	0.023 g
F_a (Site Coefficient) – Site Class D	1.6
F_v (Site Coefficient) – Site Class D	2.4
Site Modified Peak Ground Acceleration	0.039 g
Seismic Design Category	A

6.0 FOUNDATION CONSTRUCTION CRITERIA

6.1 Site Preparation

Prior to construction, we recommend adequate positive drainage be provided to maintain a relatively dry condition in the area of proposed construction. This will be very important if any work is attempted during periods of prolonged rainfall or heavy snow fall followed by warmer days. Ponding of water in the areas of construction should be avoided. Winter conditions can also impact the construction process. Newly placed fill should not be placed on frozen subgrade and frozen material should not be used for fill.

During excavation of the turbine foundations, every effort should be made to avoid disturbing subgrade materials at the planned foundation bearing elevation. When the subgrade is disturbed, the resulting surface should be re-compacted to achieve a minimum compaction of 98% of the maximum dry density as determined by ASTM D698 and moisture conditioned within 2% of optimum moisture content or drier. Soft lignite layers encountered at or near foundation bearing elevation shall be removed and replaced with suitable on-site soils or structural fill. A qualified representative of the geotechnical engineer should verify the stability of the subgrade prior to foundation installation.

6.2 Structural Fill Specifications

Structural fill material beneath foundations, where required, should consist of a non-expansive, well-graded material with sufficient binder for compaction purposes and should be in general accordance with the meets *North Dakota Department of Transportation, Section 816, Aggregate Class 5,* or better. RRC's intent is to make Structural Fill interchangeable with road base.

Structural fill should be compacted to a minimum of 95% of ASTM D1557. The structural fill should be moisture conditioned within 2% of optimum moisture content. Typically, 9-inch lifts are a maximum, but if a contractor can complete thicker lifts and it can be verified that full densification occurs throughout the lift, then lifts to 12-inches are possible.

6.3 Native Soils as Select Fill below Foundations

RRC understands the importance of using native soils whenever feasible. The following specifications allow reasonable native soil reuse while maintaining structural requirements for end bearing capacity and settlement. Modification of unsuitable foundation soils shall consist of over-excavation and replacement with any of the following materials:

All soils that possess the following properties qualify as Select Fill that may be used under foundations: maximum plasticity index of 15 and a maximum liquid limit of 40, and classify as SC-SM, SC, Sandy CL, well-graded GC, and well-graded GS.

Select Fill placement under turbines should be limited to two-feet thick. Deeper replacement must be approved by the Geotechnical Engineer in order to assess settlement potentials for that specific location. Otherwise, use Structural Fill.

When dealing with subgrade pumping, rutting, or moisture, and the remediation has a maximum thickness of 12-inches, then the excavated soils may be scarified and reused to complete the remediation. Deeper remediation requires either Select Fill or Structural Fill.

All reused and Select Fill soils used under foundations shall be compacted to a minimum of 98% of the maximum dry density as determined by ASTM D698 and shall be moisture conditioned within 3% of optimum moisture content.

6.4 Turbine Earthwork Requirements

RRC reviewed each log of boring for the presence of soft to medium stiff clays, loose sand layer(s) and/or non-competent materials below and near the anticipated foundation bearing elevation. In *Table A1, Summary of Foundation Design Net Allowable Bearing Pressure and Design Groundwater Recommendations* within Appendix A, we list locations that we expect will require remediation. Following are various options and methods to remediate subsurface soils to support the intended gravity foundations. We also present other earthwork requirements related to the turbines, such as overburden backfill and crane pads on overburden fill.

6.4.1 Verification of Turbine Foundation Subgrade

Prior to placing a mud mat and rebar, the bearing surface should be verified for stability. This verification applies under all soil, fill, or rock conditions. There is a preference to perform a proof-roll test using a fully loaded water truck, or similar equipment. Conduct the proof-roll test in at least two directions with a minimum of two passes per area. Proof-roll tests should not exceed 1-inch of deflection, rutting, or pumping. Areas that fail this proof-roll shall be excavated and the removed soils be recompacted or replaced.

Where the foundation design allows for relatively soft soils with a bearing capacity below 3,000 psf, or where shallow groundwater deters the proof-roll, then the Geotechnical Engineer shall consider alternate verification methods. Alternates might consist of Dynamic Cone Penetrometer for sandy/gravelly soils or Static Cone Penetrometer for clay with low sand content.

6.4.2 Subgrade Remediation Methods

A representative of the Geotechnical Engineer should observe and verify over-excavations. In some cases, additional over-excavation may be necessary. In some cases, less excavation is sufficient.

In order to disperse the foundation load over a larger area, structural fill pads should be larger than the foundation. Deeper remediation also requires a wider distance. The over-excavated areas should extend laterally a distance such that the edge is at least a distance equal to the pad thickness. Foundation stresses extend downward and outward at a 45-degree angle through the structural fill. For example, a 3-foot thick remediation will require a pad that is 3-feet beyond the edge of the foundation.

If compacted structural fill or select fill is used below the turbine foundation, the fill thickness shall be kept uniform with a maximum thickness difference of two feet across the foundation footprint. This uniform thickness is to deter differential settlement. Where subgrade is a combination of bedrock and soil, then either excavate the rock or replace the soil with lean concrete or structural fill.

It is possible to encounter suitable soils at shallower depths. It is also feasible to verify that suspect soils are suitable to support the foundation design intent. If Table A1 recommends excavation to a depth, it is because this is the anticipated bottom of the suspect stratum. Contractor may choose to conduct additional tests to verify whether the suspect soils meet strength requirements. These tests should extend through the suspect layer. For the stiff and dense soils at this site, RRC can recommend Dynamic Cone Penetrometer (DCP) tests to conduct this verification. Once a foundation design is complete, the geotechnical team can work with the quality assurance team to devise a suitable DCP test procedure and minimum DCP test values.

The stability of the subgrade at foundation bearing elevation may be affected by the proximity to shallow groundwater levels and/or “Perched” Groundwater conditions. In areas where bearing capacity and settlement are not the concern, such as a thin layer of mud, the contractor may establish a stable platform using the following options:

- Dewater the site. Means and methods for dewatering are the responsibility of the contractor.

- Use geogrid/geotextile in combination with structural fill to create a stable surface. Obtain design input from the product manufacturer.

- Use coarse rip rap to bridge wet soils. Compact rip rap to bed the aggregate within the wet soils. Cap the rip rap with compacted structural fill then verify overall stability using a proof-roll method.

It is crucial to maintain a uniform foundation subgrade support below the turbine foundation to reduce differential foundation settlement. In areas where a combination of soil and bedrock are exposed at the foundation bearing elevation, the soil portion should be over-excavated to competent bedrock and replaced with either compacted structural fill or lean concrete having a 28-day compressive strength of 1,000 psi or higher. Do not use select fill or native soils. Alternatively, the entire foundation footprint can be over-excavated for a depth of 2 feet below the foundation bearing elevation and replaced with compacted structural fill.

Should boulders be exposed at foundation bearing elevation during excavation, remove the boulder and replace with structural fill. Foundations bearing on exposed boulders have the potential to create point loads at the bottom of the foundations. This increases differential foundation stress.

6.4.3 Excavated Materials as Overburden Backfill

The use of native clay and sand soils is acceptable as overburden backfill materials placed above and against the sides of turbine foundations. All backfill should be free of significant organics, roots, and deleterious materials and should be properly processed and compacted. See specifications below.

Overburden Backfill Placement:

- The backfill materials should be placed in loose lifts not exceeding 12 inches.

- Each lift of backfill should be moisture conditioned, compacted, and tested to meet the minimum and maximum dry and moist unit weight values specified in the foundation design drawings. If not on the drawings, refer to Section 5.1.2 of this report for target overburden weights.

- Each lift of backfill materials over turbine foundations should be compacted to dry densities of at least 95% of the maximum dry density as determined by ASTM D698. Even if this level of compaction is greater than the minimum target weights from item 2 above. This compaction reduces fill settlement, erosion, and provides support for the transformer and crane pad.

Poorly graded sand (classified as SP) and gravel is highly permeable and allow water entry. These soils make poor overburden backfill. If overburden material consists of SP or Gravel, then RRC recommends adding a 12-inch thick clay cap. This clay cap should extend at least five feet beyond the turbine foundation excavation. Alternately, the contractor can consider mixing clayey soils into the overburden backfill materials in order to create a less permeable mixture. The Geotechnical Engineer should be allowed to review such mixtures.

The top surface of the backfill should have a minimum 2% drainage slope away from the turbine to allow surface water runoff.

6.4.4 Crane Pads on Overburden

In areas where crane pads extend over the overburden backfill zone, then the crane operator's bearing capacity requirements also must apply. As a general guideline, RRC suggests a minimum three feet (in thickness) of the overburden backfill below crane pads be compacted to a minimum of 98% of the maximum dry density as determined by ASTM D698 and moisture conditioned within 2% of optimum moisture content. Refer to Section 7.2 of this Report for additional recommendations related to crane pads.

6.5 Substation, Transmission Line, MET Tower, PMM, ADLS and O&M Building Structures

This section provides construction recommendations and specifications related to shallow and deep foundations for structures not consisting of turbines. This section is intended to apply for all electrical substation, switchyard, and transmission line structures. If future, more specific geotechnical studies for those facilities are conducted, then disregard this section and refer to the recommendations in those more specific studies.

6.5.1 Shallow Foundation Construction

The following construction criteria and general guidance should be observed during foundation construction:

- All foundation excavations should be observed by the engineer's qualified representative to assess proper bearing materials are present at foundation bearing elevation in accordance with the recommendations given herein, and to assess the need for densification of the subgrade materials.

- Care should be taken to protect the exposed soils from being disturbed, freezing or desiccation.

- The foundation excavation should be sloped sufficiently to create internal sumps for runoff collection and removal. Foundation excavations subject to rainfall and possible deterioration from accumulated water should be protected using a protective "mud-slab" (lean concrete). If surface runoff water or groundwater seepage accumulates at the bottom of the foundation excavation, it should be collected and removed and not allowed to adversely affect the quality of the bearing surface.

- The foundation excavations should be checked for size and cleaned prior to the placement of reinforcing steel. Take precautions during the placement of reinforcement and concrete to prevent the loose material from falling into the excavation.

6.5.2 Drilled Shaft Foundation Construction

The following items are important for the successful completion of drilled shaft foundations:

- The engineer's representative should observe all drilled shaft excavations. This inspection is to verify proper depth, bearing stratum, cleanliness, verticality (plumbness) and to record other observations regarding the drilled shaft construction.

- If water is present within the shaft, it is imperative that the contractor use proper construction methods to account for the water. Either the water must be removed, or the contractor must use tremies or pumps to allow concrete placement under water.

- Prompt placement of concrete in the excavation as it is completed, cleaned, and inspected is strongly recommended. Under no circumstances should a shaft be drilled, that cannot be filled with concrete before the end of the workday.

- The reinforcement steel cage placed in the shaft should be designed to be stable and centered during the placement of concrete.

- Varying subsurface soil conditions may be encountered. A Geotechnical Engineer or his representative should observe subsurface conditions during installation of any drilled piers to verify subsurface conditions match the design criteria.

- Drilled shaft construction should follow applicable industry standard. Means and methods of construction shall be determined by the contractor.

6.5.3 Directly Embedded Pole Construction

The following items are important for the successful completion of directly embedded foundations:

- The Geotechnical Engineer or their representative should observe all excavations. Directly embedded pole construction observations are recommended to observe proper depth, bearing stratum and to record other observations regarding the construction.

- Excavations should be checked for size, and to determine all loose material and free water has been removed prior to the placement of the poles and annulus with crushed rock. Precautions should be taken during the placement of the poles and annulus materials to prevent loose excavated material from falling into the excavation.

- Prompt placement of the pole and annulus material in the excavation as it is completed, cleaned, and inspected is strongly recommended. Under no circumstances should a shaft excavation be drilled that cannot be filled with the pole and annulus material before the end of the workday.

- The pole placed in the shaft excavation should be designed to be stable and centered during the placement of the annulus backfill materials.

- Varying subsurface soil conditions may be encountered. A Geotechnical Engineer or his representative should observe subsurface conditions during installation of any drilled piers to verify subsurface conditions match the design criteria.

6.6 Open Excavations

With all excavations in soils, sloped excavations and trench shields are required for excavations greater than four feet in depth. The contractor's "Competent Person" (as defined by OSHA) must inspect each trench wall to determine the type of bench or slope that is required. With all excavations, only a "Competent Person" shall determine whether sloped, benched, or trench shields can be used. OSHA and applicable state and local standards should be observed and followed. Site safety is the responsibility of the contractor. For general planning purposes, RRC offers the following:

- The surficial cohesive clay soils across this site are generally stiff. This soil type classifies as an OSHA Type A material that requires the excavation's sidewall be sloped at 3/4H:1V (or flatter).

- The sandy soils at the site possess low to zero cohesion. This soil type classifies as an OSHA Type B material that requires the excavation's sidewall be sloped at a 1H:1V slope (or flatter). The silt content may give the appearance of cohesion when first excavated, but this is not correct.

- The presence of water within any excavation automatically creates a Type C classification. All Type C class excavations require a 1.5H:1V slope or bench.

- Stable Rock is a natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed, such as Limestone or Sandstone.

Protect construction slopes and permanent embankment slopes from surface runoff water. Design site grading to deter surface water from flowing down unprotected slopes. The contractor should avoid surcharge loads, either static or dynamic, adjacent to an excavation slope. Prevent construction equipment from traveling along or near the top of the excavation slope. The contractor's "Competent Person" must monitor temporary slopes, trenches, and dewatering during construction in order to detect early warnings of movement. Site safety is the responsibility of the contractor.

6.7 Drainage and Construction Dewatering

Proper drainage should be provided away from the foundation elements during all phases of construction and post-construction grading. Proper drainage is essential to the long-term stability of the structures. Ponding of water near the foundation elements from improper drainage should not be permitted.

Based on the available groundwater information, shallow groundwater may be encountered and is considered a concern at some WTG foundation excavations. If rain causes perched water conditions, we anticipate the groundwater re-charge rate should be slow enough to conduct excavation dewatering with conventional sumps and pumps.

7.0 ACCESS ROADWAYS AND CRANE PADS

Private access roadways will be built for construction and maintenance purposes. Traffic volumes during construction are anticipated to be frequent with heavy equipment utilizing the access roadways. Following the construction period, the traffic volumes will be light and vehicles accessing the roadways will generally consist of pickup trucks and occasional single and multi-axle truck traffic. The section thickness design should be based upon the methodology outlined by the American Association of State Highways and Transportation Officials (AASHTO) for design of aggregate-surfaced roadways (reference 8).

Crane pads require sufficient bearing capacity to support the large cranes used to lift the turbine sections. The design intent for these crane pads is not related to regular traffic.

7.1 Pavement Section Thickness Recommendations

Based on the field exploration, lean clay, fat clay and clayey sand soils were encountered at the ground surface across the site. Clay soils are considered to be poor subgrades for roadways. The Contractor and the Civil Engineer should coordinate on traffic expectations for different roadways such as to value engineer road design for different areas of the facility.

Soaked CBR tests are compacted to 95% of the maximum dry density at optimum moisture content as determined by ASTM D698. Soaked CBR values of native soils ranged from 0.8% to 8.2%. RRC used a design CBR value of 2.0 %, which is correlated to a subgrade resilient modulus (M_R) value of 3,980 psi. It is important to understand that these CBR values are for soils without topsoil. Leaving topsoil within the road subgrade will significantly reduce the CBR values, thus negating the recommendations below.

RRC anticipates that the project team will use crushed stone for the roadways. RRC recommends using crushed limestone that meets *North Dakota Department of Transportation, Section 816, Aggregate Class 5,* or better. Aggregate base materials should be compacted to a minimum of 95% of ASTM D1557. The thickness of the crushed stone base course is dependent on the traffic loads, traffic frequency, duration, and performance expectations. Crushed stone ‘pavement’ is not an engineered pavement and can be expected to require regular maintenance regardless of thickness. This is especially true if traffic is allowed onto it when saturated.

The following section provides a summary of design recommendations for aggregate base course roadways based on the 1993 AASHTO Design Manual. We used AASHTO’s design chart for low-volume aggregate base surface roads, which designs based on acceptable rutting. Traffic 18-kip Equivalent Single-Axle Loads (ESAL) were estimated based upon our experience with similar type projects. For this project we estimate 1,000 ESAL for each turbine. AASHTO's 1993 nomograph from low-volume aggregate pavement design was utilized to calculate the required aggregate base layer thickness for the corresponding ESAL traffic load, with the following design parameters: 30,000 psi for the Modulus of Aggregate Base Layer (E_{BS}), 3,980 psi for the Resilient Modulus (M_R), and 2.0 and 3.0 inches for an Allowable Rut Depth. A summary of design parameters and recommended aggregate base course thickness are presented in Table 7.1.1.

Table 7.1.1 Summary of Aggregate Base Course Thickness

Number of WTG Sites per Private Access Roadway	ESAL	Aggregate Base Thickness (in.) - 2.0-inch Allowable Rutting	Aggregate Base Thickness (in.) - 3.0-inch Allowable Rutting
3 or less	3,000	5.0	4.0
5	5,000	5.5	4.5
10	10,000	7.5	5.5

RRC cautions that a 3-inch rut is essentially a failure for a roadway. Trucking and turbine providers typically reject this amount of rutting. We provide these values because it is part of the AASHTO method, and it provides the team with comparisons for the performance of different pavement cross-sections.

Strip and remove topsoil and vegetation prior to the placement of the aggregate base materials. Topsoil and organics could be up to about 8 inches or more in thickness in some areas and should not be allowed for use in structural areas or along roadway alignments. The exposed subgrade should then be compacted, and proof rolled to assess the presence of soft areas and the need for remedial measures, if any. Proof-roll test with at least two passes using a fully loaded water truck or similar. Maximum deflection or pumping should be less than one inch. In areas where excessive pumping of the subgrade is observed, removal unsuitable soils and re-compaction and/or replacement with road base. Aggregate base materials should be compacted to a minimum of 95% of ASTM D1557 where moisture content is not a pass/fail criteria.
As an alternative, consider placing geogrid (Tensar Biaxial Type 2 or equivalent) on top of geotextile (Mirafi HP 570 or equivalent) in areas where excessive pumping is observed. Consideration could also be given to performing a cement or lime mix design to stabilize the subgrade soils supporting pavement structures as an alternative. A formal cement or lime mix design should be performed prior to construction to determine design CBR values and aggregate base thicknesses.

7.2 Crane Pads Design and Construction Recommendations

This Section 7.2 works in conjunction with Section 6.4.3 within the turbine earthwork requirements. That previous section defines earthwork requirements for the overburden backfill. In areas where the crane pad does not overlap with the overburden backfill, then follow the subgrade requirements below.

The crane pad should extend at least two feet beyond the footprint of the crane tracks. Strip and remove topsoil, vegetation, and other deleterious materials. When the subgrade consists of soils, scarify and rework the resulting subgrade to a depth of 12 inches. Compact the reworked soils to a minimum of 98% of the maximum dry density per ASTM D698. Also, the contractor's use of mats can affect the necessary compaction requirement.

After verifying subgrade density, perform a proof-roll test using a fully loaded water truck, or similar equipment. Conduct the proof-roll in two directions and perform at least two passes per location. Maximum allowable deflection under the proof-roll is 1-inch. If higher deflections are observed, the subgrade soil should be over-excavated to suitable material and replaced with either Select Fill or Structural Fill, defined in Section 6.

Once a suitable subgrade condition has been achieved, use flexible road base aggregate materials (structural fill) to construct the crane pad. The pad should be at least 9-inches thick. The aggregate base should conform to the requirements of Section 6.2 of this report. Compact to a minimum of 95% of the maximum dry density as determined in accordance with ASTM D1557. Moisture is not a test criteria.

These recommendations are expected to provide an ultimate bearing capacity of 5,000 psf at the finished surface. This value assumes a crane track width of six feet, treated as a mat bearing on the ground surface.

For cranes that impart loads more than that provided above, alternate designs will be necessary. The crane operators can consider load distribution mats, such as timber mats or composite mats. If crane mats are to be used, RRC should be retained to review the design of the crane mats to check that bearing capacities are met. Otherwise, an alternate crane pad cross section may be necessary.

8.0 LIMITATIONS

Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory tests, and our present knowledge of the proposed construction. It is likely soil conditions will vary between or beyond the points explored. If soil conditions are encountered during construction that differ from those described herein, we should be notified immediately in order to provide supplemental recommendations (if needed). If the scope of the proposed construction, including the proposed loads or structural locations, changes from those described in this report, our data should also be reviewed.

We have prepared this report in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the site area at the time of our study. No warranty is expressed or implied. The recommendations provided in this report assume RRC will conduct an adequate program of tests and observations during the construction phase in order to evaluate compliance with our recommendations.

This report may be used only by the client and only for the purposes stated, within three years from its issuance. Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client, or the client's design team members for this project, who wishes to use this report shall notify RRC of such intended use. Based on the intended use of the report, RRC may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release RRC from any liability resulting from the use of this report by any unauthorized party.

Other standards or documents referenced in any given standard cited in this report, or otherwise relied upon by the authors of this report, are only mentioned in the given standard; they are not incorporated into it or "included by reference," as that latter term is used relative to contracts or other matters of law.

9.0 REFERENCES

1. Carlson, C., G., 1983, Geology of Morton County, North Dakota, North Dakota Geological Survey, Bulletin 72 — Part I, pp. 5-7.
2. Clayton, L., Moran, S.R., Bluemle, J.P., and Carlson, C.G., 1980, Geologic map of North Dakota: U.S. Geological Survey, scale 1:500,000
3. Department of the Army U.S. Army Corps of Engineers, EM 1110-1-1905, October 30, 1992.
4. International Building Code (IBC) 2021, International Code Council.
5. ASCE Hazard Tool, https://ascehazardtool.org/
6. Bowles, J. E. (1996), "Foundation Analysis and Design," Fifth Edition, McGraw-Hill Companies, Inc.
7. RisØ National Laboratory, Guidelines for Design of Wind Turbines, 2nd Edition, Det Norske Veritas, Copenhagen, 2002.
8. AASHTO Guide for Design of Pavement Structures, Washington, D.C., 1993.
9. U.S. Department of Transportation, Federal Highway Administration, “Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes,” Publication No. FHWA-NHI-00-044, September 2000.

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APPENDIX A

Table A1 - Summary of Foundation Design Net Allowable Bearing Pressure and Design Groundwater Recommendations

Boring No.	Latitude	Longitude	Turbine/Boring ID (L015_01.13.26)	Groundwater During Drilling (ft,begs)	Groundwater Immediately After Drilling (ft,begs)	Minimum Piezometer Groundwater Level (ft,begs)	Estimated Design Groundwater Depth (begs,ft)	Anticipated Grade Change (ft)	Anticipated Foundation Embedment Depth (ft, begs)	Net Allowable Bearing Capacity (qnet all) Under Normal Operating Load Conditions Based on Anticipated Foundation Bearing Elevation (psf)	Required Soil Improvement Depth Below Existing Ground Surface (ft,begs)	Recommended Soil Improvement to Achieve a Net Allowble Bearing Capacity of 2,500 psf (ft,begs)	Remarks
GEO-001	46.928605	-101.860052	T01	30.0	52.0	--	20.0	1.8	11.2	2,250		14	Over-excavation and Replacement w/ Structural Fill
GEO-002	46.936340	-101.861568		NE	NE	--	20.0		13.0	3,500			
GEO-003	46.939368	-101.854080	T03	NE	NE	--	20.0	-4.4	17.4	3,500			
GEO-004	46.937945	-101.847728		NE	NE	--	20.0		13.0	3,500	25		Deep Soil Improvement
GEO-005	46.935278	-101.841595	T05	34.0	48.0	--	20.0	-1.1	14.1	3,500			
GEO-006	46.930996	-101.826168	T06	NE	NE	--	20.0	0.0	13.0	3,500			
GEO-007	46.913460	-101.838517	T07	NE	NE	--	35.0	-15.1	28.1	3,500			
GEO-008	46.916400	-101.834600	T08	NE	NE	--	20.0	-0.4	13.4	3,500			
GEO-009	46.921153	-101.828370		NE	NE	--	20.0		13.0	3,500			
GEO-010	46.921172	-101.821962	T10	NE	NE	--	20.0	0.2	12.8	3,500			
GEO-011	46.921497	-101.813248		NE	NE	--	20.0		13.0	3,250			
GEO-012	46.921525	-101.806480	T12	19.0	44.0	12.0	11.0	-0.1	13.1	3,500			
GEO-013	46.900807	-101.826790	T13	NE	NE	--	20.0	-1.4	14.4	3,500			
GEO-014	46.900966	-101.819722		34.0	48.0	--	20.0		13.0	3,500			
GEO-015	46.900394	-101.810586	T15	NE	NE	--	20.0	-2.3	15.3	3,500			
GEO-016	46.904707	-101.805945	T16	NE	NE	--	20.0	-1.4	14.4	3,000			
GEO-017	46.886948	-101.814793	T17	49.0	52.0	--	20.0	0.1	12.9	3,500			
GEO-018	46.885050	-101.808962	T18	44.0	44.0	--	20.0	0.0	13.0	3,500			
GEO-019	46.886566	-101.800295	T19	NE	NE	--	20.0	-2.9	15.9	3,500			
GEO-020	46.976011	-101.763598	T20	NE	NE	--	20.0	-0.6	13.6	3,500			
GEO-021	46.973311	-101.752139	T21	39.0	23.0	--	20.0	2.5	10.5	3,500			
GEO-022	46.973116	-101.745499	T22	NE	NE	--	20.0	1.2	11.8	3,500			
GEO-023	46.975381	-101.721823	T23	NE	NE	--	20.0	-0.5	13.5	3,500			
GEO-024	46.968427	-101.723739	T24	NE	NE	--	20.0	-1.9	14.9	3,500			
GEO-025	46.959730	-101.706249	T25	NE	NE	--	20.0	0.0	13.0	3,500			
GEO-026	46.961450	-101.700128	T26	39.0	50.0	--	20.0	0.6	12.4	3,500			
GEO-027	46.961464	-101.693477	T27	NE	NE	--	20.0	0.2	12.8	3,500			
GEO-028	46.953950	-101.786611	T28	35.0	52.0	--	20.0	0.0	13.0	3,500			
GEO-029	46.959220	-101.764704	T29	9.0	55.0	12.0	11.0	0.0	13.0	3,500			
GEO-030	46.951333	-101.765145				--	--		13.0	--			Not Investigated
GEO-031	46.954390	-101.753974	T31	49.0	49.0	--	20.0	0.5	12.5	3,250			
GEO-032	46.955296	-101.743890				--	--		13.0	--			Not Investigated
GEO-033	46.954002	-101.730960	T33	NE	NE	--	20.0	-0.2	13.2	3,500	18		Deep soil improvement
GEO-034	46.954983	-101.724356	T34	NE	NE	--	20.0	0.0	13.0	3,500			
GEO-035	46.944218	-101.753027		30.0	NE	--	20.0	1.2	11.8	3,500			
GEO-036	46.941605	-101.746654	T36	12.0	47.0	0.5	0.0	0.0	13.0	3,500	20		Deep soil improvement
GEO-037	46.942772	-101.740419	T37	NE	NE	--	20.0	0.0	13.0	3,500	15		Over-Excavation and Replacement w/ Structural Fill
GEO-038	46.940588	-101.731712		NE	NE	--	20.0	0.0	13.0	3,000			
GEO-039	46.945336	-101.725459	T39	49.0	54.0	--	20.0	0.0	13.0	3,500			
GEO-040	46.939113	-101.709620	T40	NE	NE	--	20.0	-2.2	15.2	3,500			
GEO-041	46.938437	-101.721078				--	--		13.0	--			Not Investigated
GEO-042	46.940888	-101.695081		30.0	54.0	--	20.0	0.0	13.0	3,500			
GEO-043	46.939567	-101.785665	T43	NE	NE	--	20.0	-5.8	18.8	3,500			
GEO-044	46.937839	-101.767572		NE	NE	--	20.0	0.9	12.1	2,500			
GEO-045	46.935204	-101.795228	T45	NE	NE	--	20.0	-2.3	15.3	3,500			
GEO-046	46.932590	-101.787606	T46	NE	NE	--	20.0	-0.7	13.7	3,500			
GEO-047	46.932651	-101.777749	T47	45.0	48.0	--	20.0	0.2	12.8	3,500			
GEO-048	46.922343	-101.767967		NE	NA	--	20.0	0.0	13.0	3,500			
GEO-049	46.926427	-101.762739		NE	NE	--	20.0	0.0	13.0	2,500			
GEO-050	46.923447	-101.751849	T50	NE	NE	--	20.0	0.1	12.9	3,500			
GEO-051	46.922422	-101.730508	T51	NE	NE	--	20.0	0.0	13.0	3,500			
GEO-052	46.923094	-101.724068	T52	NE	NE	--	20.0	-1.1	14.1	3,500			
GEO-053	46.922764	-101.713804	T53	NE	NE	--	20.0	-4.2	17.2	2,500			
GEO-054	46.922576	-101.705791		NE	NE	--	20.0	-3.9	16.9	3,000			
GEO-055	46.930926	-101.689845				--	--		13.0	--			Not Investigated
GEO-056	46.907994	-101.725116		NE	NE	--	20.0	-2.3	15.3	3,500			
GEO-057	46.910611	-101.712133	T57	NE	NE	--	20.0	0.0	13.0	3,500			
GEO-058	46.915340	-101.703733	T58	NE	NE	--	20.0	0.5	12.5	3,500			
GEO-059	46.911737	-101.695736	T59	34.0	NA	--	20.0	-0.5	13.5	3,500			
GEO-060	46.918971	-101.692605		NE	NE	16.0	15.0	0.1	12.9	3,500			
GEO-061	46.909107	-101.683665	T61	24.0	NE	2.3	1.3	0.6	12.4	3,500			
GEO-062	46.908347	-101.677053	T62	34.0	52.0	--	20.0	-0.5	13.5	3,500			
GEO-063	46.903391	-101.708698	T63	NE	NE	--	20.0	-0.2	13.2	3,500			
GEO-064	46.903570	-101.686788	T64	NE	NE	--	20.0	0.0	13.0	3,500			
GEO-065	46.897699	-101.696096	T65	NE	NE	--	20.0	-3.7	16.7	3,500			
GEO-066	46.896434	-101.676574	T66	NE	NE	--	20.0	0.4	12.6	3,000			
GEO-067	46.897586	-101.664957	T67	45.0	NA	--	20.0	0.2	12.8	3,500			
GEO-068	46.896070	-101.651180		NE	NE	--	20.0	0.6	12.4	3,000			
GEO-069	46.890090	-101.683948	T69	NE	NE	--	20.0	-2.5	15.5	3,500			

Table A1 - Summary of Foundation Design Net Allowable Bearing Pressure and Design Groundwater Recommendations

Boring No.	Latitude	Longitude	Turbine/Boring ID (L015_01.13.26)	Groundwater During Drilling (ft,begs)	Groundwater Immediately After Drilling (ft,begs)	Minimum Piezometer Groundwater Level (ft,begs)	Estimated Design Groundwater Depth (begs,ft)	Anticipated Grade Change (ft)	Anticipated Foundation Embedment Depth (ft, begs)	Net Allowable Bearing Capacity (qnet all) Under Normal Operating Load Conditions Based on Anticipated Foundation Bearing Elevation (psf)	Required Soil Improvement Depth Below Existing Ground Surface (ft,begs)	Recommended Soil Improvement to Achieve a Net Allowble Bearing Capacity of 2,500 psf (ft,begs)	Remarks
GEO-070	46.881269	-101.690206	T70	NE	NE	--	20.0	-3.1	16.1	3,500			
GEO-071	46.951278	-101.767572		25.0	NE	--	20.0	0.0	13.0	3,500			
GEO-072	46.951464	-101.767567	T30	19.0	6.0	NE	20.0	0.9	12.1	3,500			
GEO-073	46.940581	-101.732158	T38	NE	NE	--	20.0	1.1	11.9	2,500			
GEO-074	46.937832	-101.766825	T44	NE	NA	--	20.0	-3.9	16.9	3,500			
GEO-075	46.923032	-101.767480	T48	NE	NE	--	20.0	-0.8	13.8	2,750			
GEO-076	46.907995	-101.724410	T56	NE	NE	--	20.0	0.0	13.0	3,250			
GEO-077	46.895876	-101.651185	T68	NE	NE	--	20.0	0.1	12.9	3,500			

NE = Not Encountered; begs = Below Existing Ground Surface

Table A2 - Summary of Subsurface Exploration and Geographic Coordinates

Boring No.	Latitude	Longitude	Turbine/Boring ID (L015_01.13.26)	Latitude (L015_01.13.26)	Longitude (L015_01.13.26)	Turbine/Boring ID (L011_04.26.25)	Turbine/Boring ID (L009_03.19.25)	MASW Survey	Electrical Resistivity Testing	Thermal Resistivity Samples	Piezometer Location	Piezometer Installation Date	Test/ Drilling Date	Auger (ft)	Total Depth (ft)	Groundwater During Drilling (ft.)	Groundwater Immediately After Drilling (ft.)	Groundwater 24-Hours After Drilling (ft.)	Remarks
GEO-001	46.928605	-101.860052	T01	46.928598	-101.860041	T01	T01		05/14/25	04/25/25			04/25/25	55.5	55.5	30	52	NA	
GEO-002	46.936340	-101.861568				T02	T02						04/25/25	55.0	55.0	NE	NE	NA	**Removed from L015**
GEO-003	46.939368	-101.854080	T03	46.939360	-101.854069	T03	T03						04/24/25 - 04/25/25	55.5	55.5	NE	NE	NA	
GEO-004	46.937945	-101.847728				T04	T04	05/10/25					04/25/25	55.0	55.0	NE	NE	NA	**Removed from L015**
GEO-005	46.935278	-101.841595	T05	46.935271	-101.841461	T05	T05						04/26/25	55.5	55.5	34	48	NA	**L015 relocated ~35 ft.**
GEO-006	46.930996	-101.826168	T06	46.930989	-101.826157	T06	T06						04/23/25	55.5	55.5	NE	NE	NA	
GEO-007	46.913460	-101.838517	T07	46.913388	-101.838660	T07	T07						04/23/25	55.5	55.5	NE	NE	NA	**L015 relocated ~45 ft.**
GEO-008	46.916400	-101.834600	T08	46.916479	-101.834460	T08	T08		05/14/25	04/23/25			04/23/25	55.5	55.5	NE	NE	NA	**L015 relocated ~45 ft.**
GEO-009	46.921153	-101.828370				T09	T09						05/07/25	55.5	55.5	NE	NE	NA	**Removed from L015**
GEO-010	46.921172	-101.821962	T10	46.921164	-101.821952	T10	T10		05/14/25	04/24/25			04/23/25 - 04/24/25	55.0	55.0	NE	NE	NA	
GEO-011	46.921497	-101.813248				T11	T11						04/24/25	55.5	55.5	NE	NE	NA	**Removed from L015**
GEO-012	46.921525	-101.806480	T12	46.921517	-101.806469	T12	T12				X	04/24/25	04/24/25	55.5	55.5	19	44	NA	
GEO-013	46.900807	-101.826790	T13	46.900880	-101.826716	T13	T13						04/22/25	55.5	55.5	NE	NE	NA	**L015 relocated ~30 ft.**
GEO-014	46.900966	-101.819722				T14	T14	05/10/25					04/22/25	55.5	55.5	34	48	NA	**Removed from L015**
GEO-015	46.900394	-101.810586	T15	46.900386	-101.810575	T15	T15						04/22/25	55.5	55.5	NE	NE	NA	
GEO-016	46.904707	-101.805945	T16	46.904696	-101.806135	T16	T16						04/21/25 - 04/22/25	55.5	55.5	NE	NE	NA	**L015 relocated ~45 ft.**
GEO-017	46.886948	-101.814793	T17	46.886940	-101.814783	T17	T17						04/21/25	55.5	55.5	49	52	NA	
GEO-018	46.885050	-101.808962	T18	46.885043	-101.808952	T18	T18	05/10/25					04/21/25	55.5	55.5	44	44	NA	
GEO-019	46.886566	-101.800295	T19	46.886559	-101.800285	T19	T19		05/17/25	04/21/25			04/21/25	55.5	55.5	NE	NE	NA	
GEO-020	46.976011	-101.763598	T20	46.976003	-101.763752	T20	T20						04/30/25	55.5	55.5	NE	NE	NA	**L015 relocated ~45 ft.**
GEO-021	46.973311	-101.752139	T21	46.973304	-101.752129	T21	T21						05/11/25	54.5	54.5	39	23	NA	
GEO-022	46.973116	-101.745499	T22	46.973109	-101.745488	T22	T22		05/06/25	05/09/25			05/09/25	55.5	55.5	NE	NE	NA	
GEO-023	46.975381	-101.721823	T23	46.975373	-101.721813	T23	T23						05/09/25	55.5	55.5	NE	NE	NA	
GEO-024	46.968427	-101.723739	T24	46.968420	-101.723729	T24	T24						05/09/25	55.5	55.5	NE	NE	NA	
GEO-025	46.959730	-101.706249	T25	46.959723	-101.706238	T25	T25						05/08/25	55.5	55.5	NE	NE	NA	
GEO-026	46.961450	-101.700128	T26	46.961443	-101.700118	T26	T26						05/08/25	55.5	55.5	39	50	NA	
GEO-027	46.961464	-101.693477	T27	46.961457	-101.693467	T27	T27						05/09/25	55.0	55.0	NE	NE	NA	
GEO-028	46.953950	-101.786611	T28	46.953943	-101.786601	T28	T28						04/26/25	55.5	55.5	35	52	NA	
GEO-029	46.959220	-101.764704	T29	46.959212	-101.764736	T29	T29	05/10/25			X	04/29/25	04/29/25	55.5	55.5	9	55	NA	
GEO-030	46.951333	-101.765145					T30												**Relocated ~ 600 ft. from L011, See GEO-071;**
GEO-031	46.954390	-101.753974	T31	46.954383	-101.753964	T31	T31						05/02/25	55.5	55.5	49	49	NA	
GEO-032	46.955296	-101.743890					T32												**Removed From L011**
GEO-033	46.954002	-101.730960	T33	46.953995	-101.730950	T33	T33	05/09/25	05/18/25	05/03/25			05/03/25	55.5	55.5	NE	NE	NA	
GEO-034	46.954983	-101.724356	T34	46.954976	-101.724345	T34	T34						05/04/25	55.0	55.0	NE	NE	NA	
GEO-035	46.944218	-101.753027				T35	T35						04/03/25	55.5	55.5	30	NE	NA	**Removed from L015**
GEO-036	46.941605	-101.746654	T36	46.941598	-101.746644	T36	T36				X	05/05/25	05/05/25	55.5	55.5	12	47	NA	
GEO-037	46.942772	-101.740419	T37	46.942764	-101.740409	T37	T37						05/04/25 - 04/05/25	54.5	54.5	NE	NE	NA	
GEO-038	46.940588	-101.731712				T38	T38						05/01/25	42.5	42.5	NE	NE	NA	**Relocated ~93 ft. See GEO-073**
GEO-039	46.945336	-101.725459	T39	46.945329	-101.725449	T39	T39						05/04/25	55.5	55.5	49	54	NA	
GEO-040	46.939113	-101.709620	T40	46.939105	-101.709609	T40	T40						04/27/25	55.0	55.0	NE	NE	NA	
GEO-041	46.938437	-101.721078				T41	T41												**Non Participating Landowner per email 04.04.25**
GEO-042	46.940888	-101.695081				T42	T42						05/10/25	55.5	55.5	30	54	NA	**Removed from L015**
GEO-043	46.939567	-101.785665	T43	46.939560	-101.785655	T43	T43						05/07/25	55.5	55.5	NE	NE	NA	
GEO-044	46.937839	-101.767572				T44	T44						04/27/25	55.5	55.5	NE	NE	NA	**Relocated ~160 ft. from L015, See GEO-074**
GEO-045	46.935204	-101.795228	T45	46.935196	-101.795217	T45	T45						04/27/25	55.5	55.5	NE	NE	NA	
GEO-046	46.932590	-101.787606	T46	46.932583	-101.787596	T46	T46		05/13/25	04/26/25			04/26/25	55.0	55.0	NE	NE	NA	
GEO-047	46.932651	-101.777749	T47	46.932644	-101.777739	T47	T47						04/27/25	55.5	55.5	45	48	NA	
GEO-048	46.922343	-101.767967				T48	T48		05/18/25	05/05/25			05/05/25	52.5	52.5	NE	NA	NA	**Relocated ~245 ft. from L015, See GEO-075**
GEO-049	46.926427	-101.762739				T49	T49						05/06/25	55.5	55.5	NE	NE	NA	**Removed from L015**
GEO-050	46.923447	-101.751849	T50	46.923440	-101.751839	T50	T50						05/08/25	55.5	55.5	NE	NE	NA	
GEO-051	46.922422	-101.730508	T51	46.922415	-101.730497	T51	T51						05/10/25	55.0	55.0	NE	NE	NA	
GEO-052	46.923094	-101.724068	T52	46.923086	-101.724057	T52	T52						05/08/25 - 05/09/25	55.5	55.5	NE	NE	NA	
GEO-053	46.922764	-101.713804	T53	46.922757	-101.713794	T53	T53		05/18/25	05/06/25			05/06/25	55.5	55.5	NE	NE	NA	
GEO-054	46.922576	-101.705791				T54	T54						04/27/25	55.5	55.5	NE	NE	NA	**Removed from L015**
GEO-055	46.930926	-101.689845					T55												**Removed From L011**
GEO-056	46.907994	-101.725116				T56	T56						05/08/25	55.5	55.5	NE	NE	NA	**Relocated ~160 ft. from L015, See GEO-076**
GEO-057	46.910611	-101.712133	T57	46.910604	-101.712123	T57	T57						05/07/25	55.5	55.5	NE	NE	NA	
GEO-058	46.915340	-101.703733	T58	46.915332	-101.703722	T58	T58						04/27/25 - 05/07/25	55.5	55.5	NE	NE	NA	
GEO-059	46.911737	-101.695736	T59	46.911730	-101.695726	T59	T59		05/17/25	04/26/25			04/26/25	55.5	55.5	34	NA	NA	
GEO-060	46.918971	-101.692605				T60	T60						04/25/25 - 04/26/25	55.5	55.5	NE	NE	NA	**Removed From L011**
GEO-061	46.909107	-101.683665	T61	46.909100	-101.683654	T61	T61				X	04/25/25	04/25/25	55.5	55.5	24	NE	NA	
GEO-062	46.908347	-101.677053	T62	46.908339	-101.677043	T62	T62		05/17/25	05/07/25			05/06/25	55.5	55.5	34	52	NA	
GEO-063	46.903391	-101.708698	T63	46.903383	-101.708687	T63	T63						05/07/25	55.5	55.5	NE	NE	NA	
GEO-064	46.903570	-101.686788	T64	46.903563	-101.686778	T64	T64	05/09/25					04/24/25	55.5	55.5	NE	NE	NA	
GEO-065	46.897699	-101.696096	T65	46.897692	-101.696086	T65	T65						05/08/25	55.5	55.5	NE	NE	NA	
GEO-066	46.896434	-101.676574	T66	46.896426	-101.676563	T66	T66						04/23/25	55.5	55.5	NE	NE	NA	
GEO-067	46.897586	-101.664957	T67	46.897578	-101.664946	T67	T67		05/17/25	04/26/25			04/25/25	55.5	55.5	45	NA	NA	
GEO-068	46.896070	-101.651180				T68	T68						04/23/25	54.5	54.5	NE	NE	NA	**Relocated ~63 ft. from L015, See GEO-077**
GEO-069	46.890090	-101.683948	T69	46.890082	-101.683937	T69	T69						04/24/25	55.5	55.5	NE	NE	NA	
GEO-070	46.881269	-101.690206	T70	46.881261	-101.690195	T70	T70		05/11/25	04/24/25			04/24/25	55.5	55.5	NE	NE	NA	
GEO-071	46.951278	-101.767572				T30							05/03/25	55.5	55.5	25	NE	NA	**Relocated from L015; Moved 60 ft., see GEO-072**
GEO-072	46.951464	-101.767567	T30	46.951464	-101.767567						X	03/18/26	03/18/26	55.5	55.5	19	6	NA	
GEO-073	46.940581	-101.732158	T38	46.940581	-101.732158								03/18/26	55.5	55.5	NE	NE	NA	
GEO-074	46.937832	-101.766825	T44	46.937832	-101.766825								01/30/26	54.5	54.5	NE	NA	NA	
GEO-075	46.923032	-101.767480	T48	46.923032	-101.767480								03/17/26	55.5	55.5	NE	NE	NA	
GEO-076	46.907995	-101.724410	T56	46.907995	-101.724410								03/17/26	55.5	55.5	NE	NE	NA	
GEO-077	46.895876	-101.651185	T68	46.895876	-101.651185								01/29/26	55.5	55.5	NE	NE	NA	
TL-01	46.986205	-101.766771											04/29/25	50.5	50.5	NE	NE	NA	
TL-02	46.984606	-101.766776											04/29/25	30.5	30.5	NE	NE	NA	
TL-03	46.982158	-101.766783											04/29/25	30.5	30.5	NE	NE	NA	
TL-04	46.980259	-101.766789											04/29/25	50.5	50.5	NE	NE	NA	

Table A2 - Summary of Subsurface Exploration and Geographic Coordinates

Boring No.	Latitude	Longitude	Turbine/Boring ID (L015_01.13.26)	Latitude (L015_01.13.26)	Longitude (L015_01.13.26)	Turbine/Boring ID (L011_04.26.25)	Turbine/Boring ID (L009_03.19.25)	MASW Survey	Electrical Resistivity Testing	Thermal Resistivity Samples	Piezometer Location	Piezometer Installation Date	Test/ Drilling Date	Auger (ft)	Total Depth (ft)	Groundwater During Drilling (ft.)	Groundwater Immediately After Drilling (ft.)	Groundwater 24-Hours After Drilling (ft.)	Remarks
TL-05	46.980257	-101.763791											04/29/25	30.5	30.5	NE	NE	NA	
TL-06	46.980255	-101.760946											04/30/25	50.5	50.5	NE	NE	NA	
TL-07	46.978169	-101.760927											04/30/25	30.5	30.5	NE	NE	NA	
TL-08	46.976028	-101.760909											04/30/25	30.5	30.5	NE	NE	NA	
TL-09	46.973915	-101.760890											05/01/25	30.5	30.5	NE	NE	NA	
TL-10	46.971640	-101.760870											05/01/25	30.5	30.5	24	24	NA	
TL-11	46.969358	-101.760850											05/01/25	30.5	30.5	29	28	NA	
TL-12	46.967150	-101.760831											05/02/25	30.5	30.5	7	6.5	NA	
TL-13	46.964992	-101.760811											05/02/25	50.5	50.5	NE	NE	NA	
TL-14	46.964315	-101.761887											05/02/25	50.5	50.5	NE	NE	NA	
TL-15	46.962040	-101.761888											05/06/25	30.5	30.5	24	NA	NA	
TL-16	46.960133	-101.761890											04/29/25	30.5	30.5	25	27	NA	
TL-17	46.958219	-101.761891											04/29/25	30.5	30.5	12	54	NA	
TL-18	46.956549	-101.761892											04/29/25	50.5	50.5	10	47	NA	
MET-01	46.975132	-101.747075																	**Relocated to PMM borings**
MET-02	46.937508	-101.754410																	**Relocated to PMM borings**
MET-03	46.894016	-101.661035											04/23/25	34.5	34.5	NE	NE	NA	**Relocated to PMM borings**
PMM1	46.976921	-101.747421											05/11/25	35.5	35.5	NE	NE	NA	
PMM2	46.938197	-101.755101											05/05/25	35.5	35.5	NE	NE	NA	**Moved ~120 ft. to avoid transmission line**
PMM3	46.894397	-101.662007											05/07/25	34.5	34.5	NE	NE	NA	
ADLS-01	46.927989	-101.795361																	
ADLS-02	46.927981	-101.795351											05/07/25	35.5	35.5	NE	NE	NA	
DSR-1	46.955511	-101.761935								05/12/25				05/12/25						
DSR-2	46.957204	-101.763285								05/12/25				05/12/25						
TSR-1	46.954950	-101.762055								05/13/25				05/13/25						
TSR-2	46.955006	-101.760905								05/13/25				05/13/25						
TSR-3	46.955567	-101.760980								05/12/25				05/12/25						
HA-1	46.955771	-101.762488												04/30/25	5.0	5.0	NE	NE	NA	
HA-2	46.955782	-101.761487												04/30/25	5.0	5.0	NE	NE	NA	
HA-3	46.955793	-101.760486												04/30/25	5.0	5.0	NE	NE	NA	
HA-4	46.955223	-101.762475												04/30/25	5.0	5.0	NE	NE	NA	
HA-5	46.955234	-101.761474												04/30/25	5.0	5.0	NE	NE	NA	
HA-6	46.955245	-101.760473												04/30/25	5.0	5.0	NE	NE	NA	
HA-7	46.954675	-101.762462												04/30/25	5.0	5.0	NE	NE	NA	
HA-8	46.954686	-101.761461												04/30/25	5.0	5.0	NE	NE	NA	
HA-9	46.954697	-101.760460												04/30/25	5.0	5.0	NE	NE	NA	
HA-10	46.954106	-101.761659												05/01/25	5.0	5.0	NE	NE	NA	
HA-11	46.954113	-101.760954												05/01/25	5.0	5.0	NE	NE	NA	
HA-12	46.953608	-101.761295												05/01/25	5.0	5.0	NE	NE	NA	
HA-13	46.953102	-101.761635												05/01/25	5.0	5.0	NE	NE	NA	
HA-14	46.953110	-101.760931												05/01/25	5.0	5.0	NE	NE	NA	
SB-1	46.955712	-101.761785												05/01/25	40.5	40.5	19.8	33	NA	
SB-2	46.955535	-101.762072									05/06/25			05/01/25	40.5	40.5	14	35	NA	
SB-3	46.955049	-101.762273										X	05/01/25	04/30/25	40.5	40.5	14	35	NA	
SB-4	46.955054	-101.761848												04/30/25	40.5	40.5	12	33	NA	
SB-5	46.954784	-101.761958												04/29/25	40.5	40.5	12.5	30	NA	
SB-6	46.955549	-101.760791												05/01/25	40.5	40.5	19	29	NA	
SB-7	46.955058	-101.761344												04/30/25	40.5	40.5	13	34	NA	
SB-8	46.954797	-101.760801												04/30/25	40.5	40.5	19	35	NA	
SB-9	46.953917	-101.761302												05/01/25	15.5	15.5	NE	NE	NA	
SB-10	46.953298	-101.761288												05/01/25	15.5	15.5	NE	NE	NA	
O&M -1	46.950414	-101.762334												05/03/25	35.0	35.0	18	25	NA	

NE = Not Encounter, NA = Not Available

Table A3: Well Log Information Obtained from the North Dakota Department of Water Resources

Well Report No. (NDDWR)	**Latitude**	**Longitude**	**Well Depth** (feet below land surface)	**Water Level Record** (feet below land surface)	**Date of Record** (YYYY/MM/DD)
9060	46.944751	-101.785024	890	278.8	1978/07/24
20703	46.944751	-101.785024	400	225.9	1977/10/12
9064	46.935761	-101.896039	380	13.4	1978/07/07
9066	46.899611	-101.845919	400	42.7	1993/12/07
8467	46.982237	-101.897894	380	27.7	1978/06/30
9056	46.954666	-101.699212	N/D	20.0	1967/06/20
9046	46.94992	-101.577623	N/D	10.0	1967/05/15
9049	46.954421	-101.542125	154.0	84.0	1967/06/04
9006	46.863352	-101.932869	380.0	1.4	2020/05/29
9009	46.861534	-101.930243	N/D	1.9	1973/10/24
8985	46.846777	-101.635774	360.0	104.3	1994/05/04
8988	46.878104	-101.827556	N/D	39.7	1975/08/05
8989	46.848936	-101.779908	360.0	42.6	1973/08/24

N/D = No Data Available

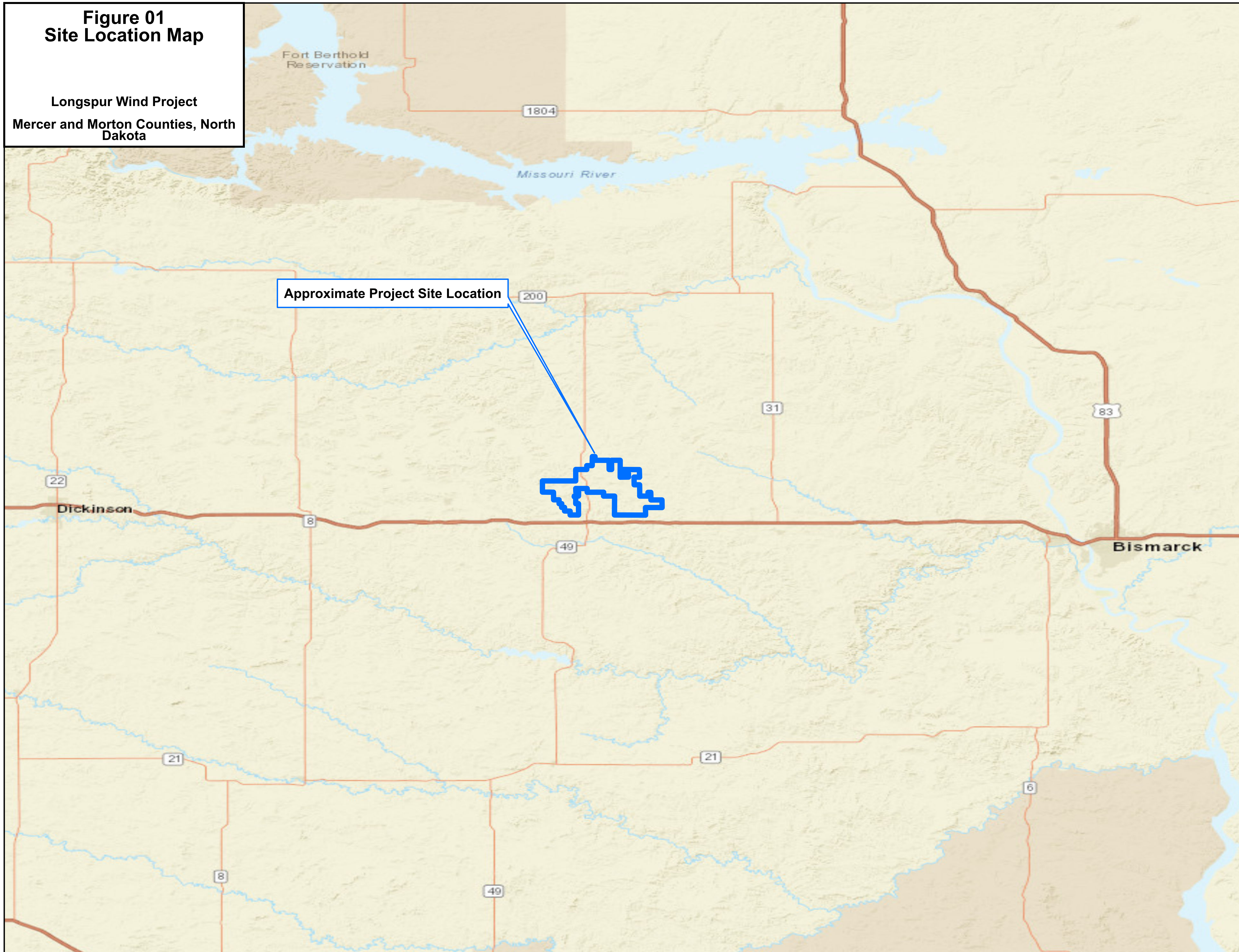
Table A4 - Summary of Measured Groundwater Levels in Temporary Piezometers Installed at Selected WTG Sites

Temp Piezometer No.	Latitude	Longitude	Date Installed	Total Depth of Temporary Piezometer (ft.) Below Existing Ground Surface	Height of Temp Piezometer Stick-up (ft.) Above Existing Site Grade	GWL (ft.) After Installation	GWL (ft.) 24 hrs after Installation	GWL (ft.) 48 hrs after Installation	GWL (ft.) 72 hrs after Installation	GWL (ft.) (05/18/25)	GWL (ft.) (10/06/25)	GWL (ft.) (03/18/26)	Minimum GWL (ft.)
GEO-012	46.921525	-101.806480	04/24/2025	18.00	2.00	NE	15.25	15.42	14.00	12.00	12.92		12.00
GEO-029	46.959220	-101.764704	04/29/2025	18.00	2.00	15.80	14.20	13.70	13.00	12.00	12.92	12.00	12.00
GEO-036	46.941605	-101.746654	05/05/2025	18.00	2.00	3.50	1.25	1.92	2.00	2.00	2.50	0.50	0.50
GEO-061	46.909107	-101.683665	04/25/2025	18.00	2.00	7.30		2.33		3.00	3.00	2.75	2.33
GEO-072	46.951494	-101.767567	03/18/2026	13.00	2.00	NE							NE
SB-4	46.955049	-101.762273	05/01/2025	18.00	2.00	7.00	7.50	9.33	9.42	7.00	8.50	7.50	7.00

Figure 01
Site Location Map

Longspur Wind Project

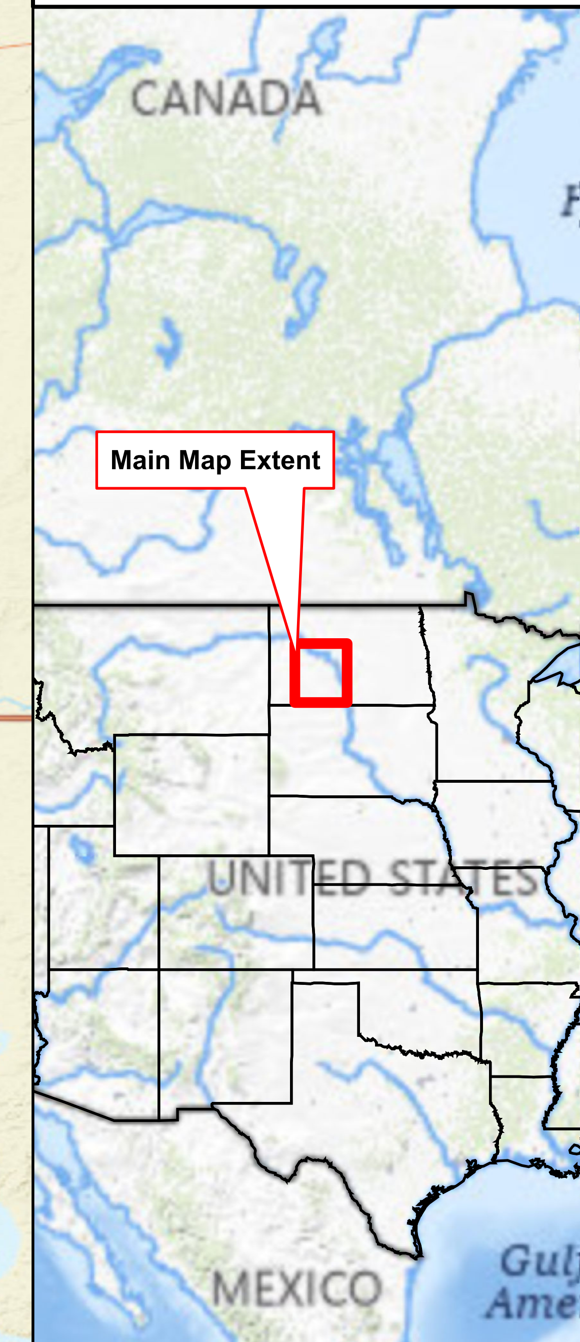
Mercer and Morton Counties, North Dakota



0 5 10 15 20 25 Miles
N

Legend

Project Boundary



RRC Power & Energy, LLC

810 Hesters Crossing Rd
Suite 120
Round Rock, TX 78681

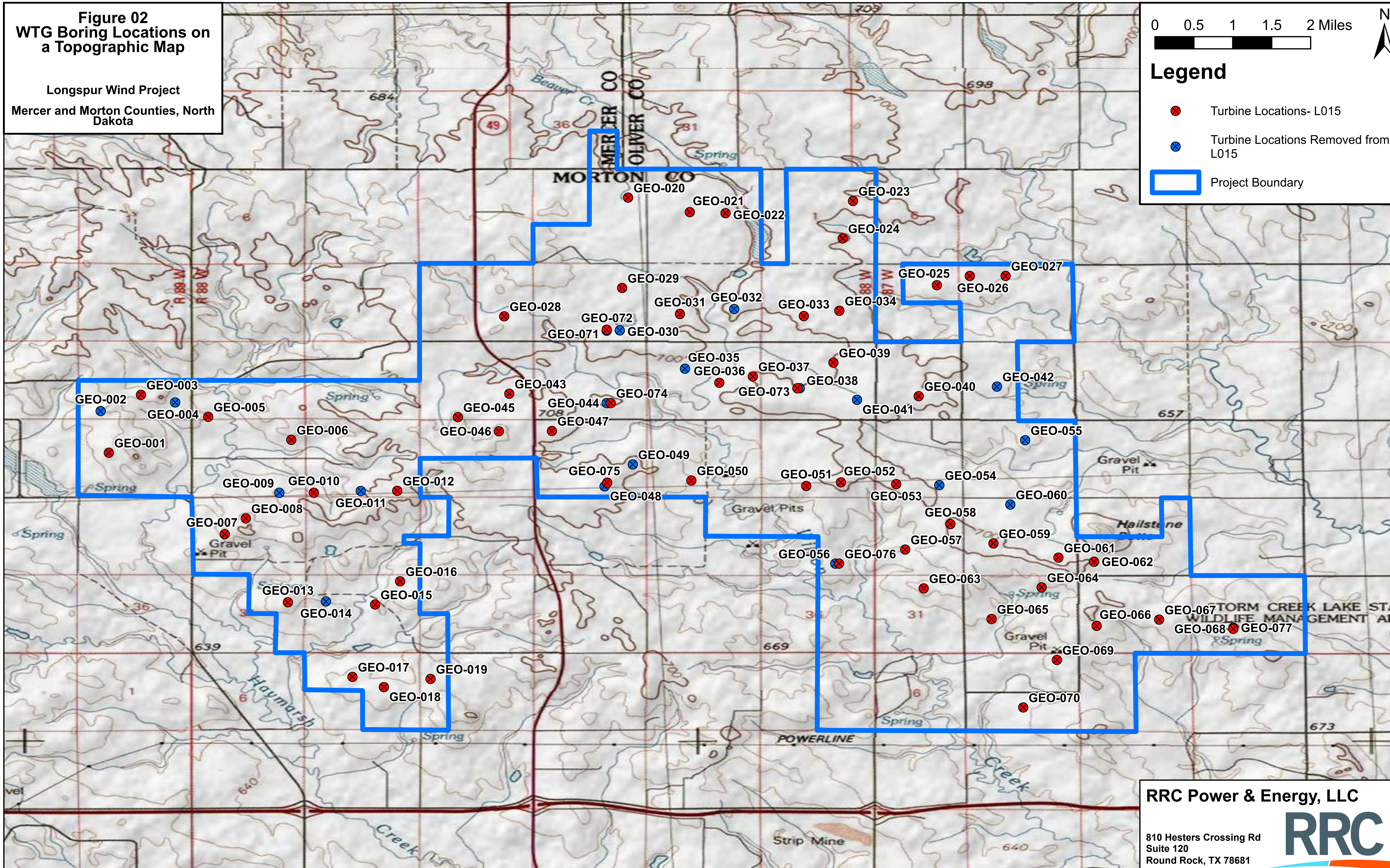


Figure 02
WTG Boring Locations on a Topographic Map
Longspur Wind Project
Mercer and Morton Counties, North Dakota
0 0.5 1 1.5 2 Miles
N
Legend
Turbine Locations- L015
Turbine Locations Removed from L015
Project Boundary
RRC Power & Energy, LLC
810 Hesters Crossing Rd
Suite 120
Round Rock, TX 78681
MORTON CO
MERCER CO
OLIVER CO
GEO-001
GEO-002
GEO-003
GEO-004
GEO-005
GEO-006
GEO-007
GEO-008
GEO-009
GEO-010
GEO-011
GEO-012
GEO-013
GEO-014
GEO-015
GEO-016
GEO-017
GEO-018
GEO-019
GEO-020
GEO-021
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GEO-026
GEO-027
GEO-028
GEO-029
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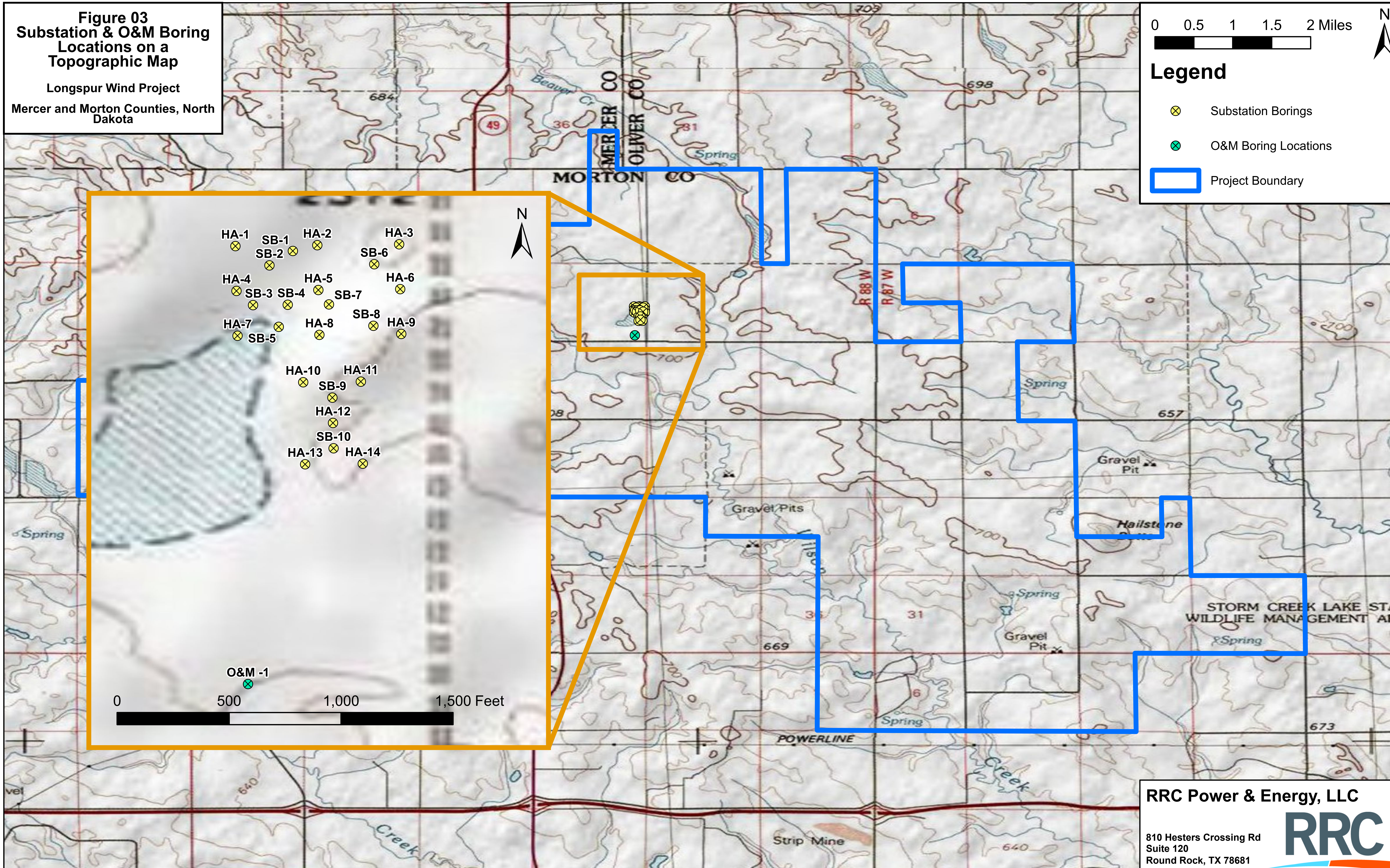
GEO-071
GEO-072
GEO-073
GEO-074
GEO-075
GEO-076
GEO-077
Beaver Cr
Spring
Gravel Pit
Gravel Pits
Hailstone Butte
STORM CREEK LAKE STATE WILDLIFE MANAGEMENT AREA
POWERLINE
Haymarsh
Creek
Strip Mine

Figure 03
Substation & O&M Boring Locations on a Topographic Map

Longspur Wind Project

Mercer and Morton Counties, North Dakota



RRC Power & Energy, LLC

810 Hesters Crossing Rd
Suite 120
Round Rock, TX 78681

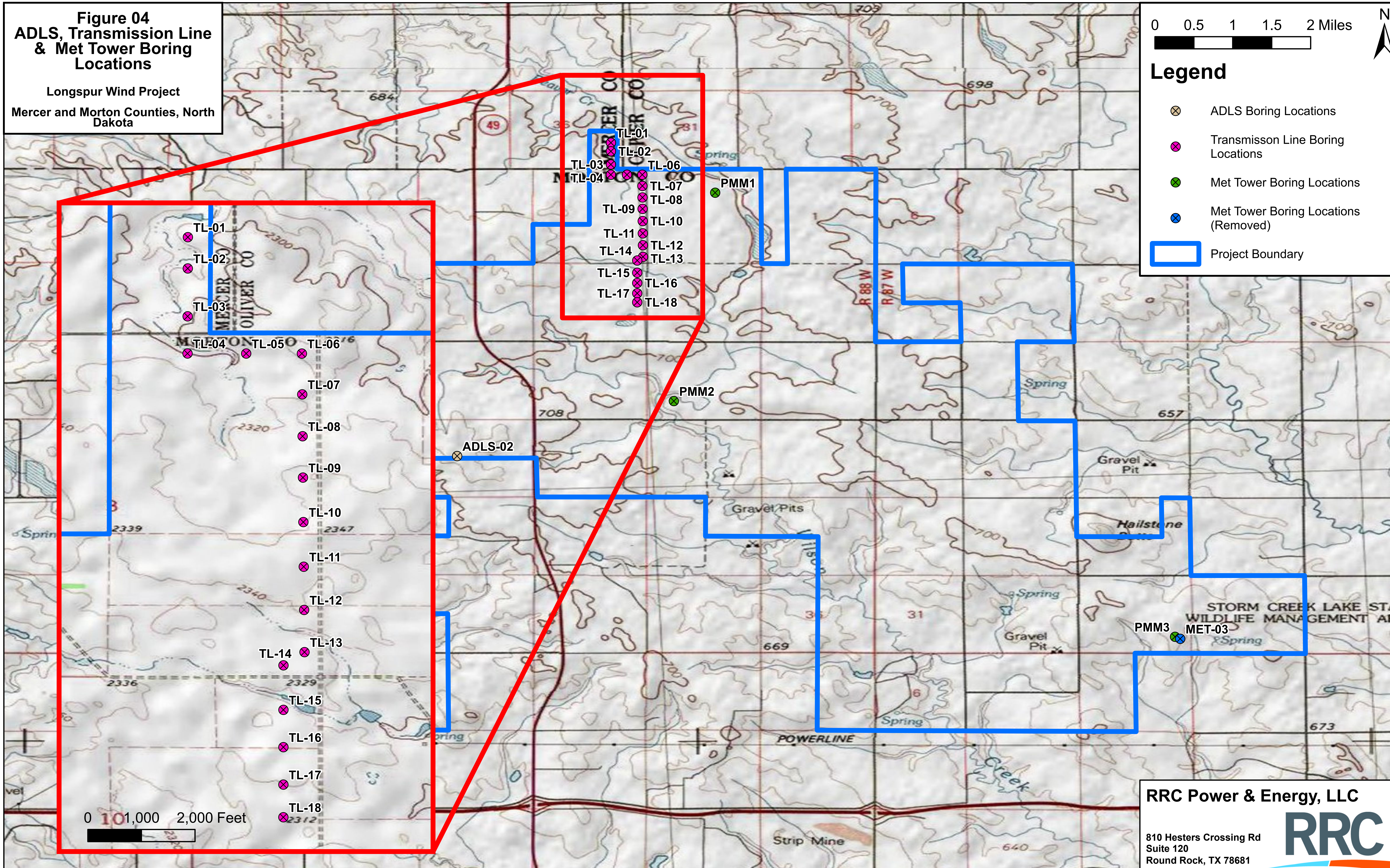


Figure 04
ADLS, Transmission Line & Met Tower Boring Locations

Longspur Wind Project

Mercer and Morton Counties, North Dakota

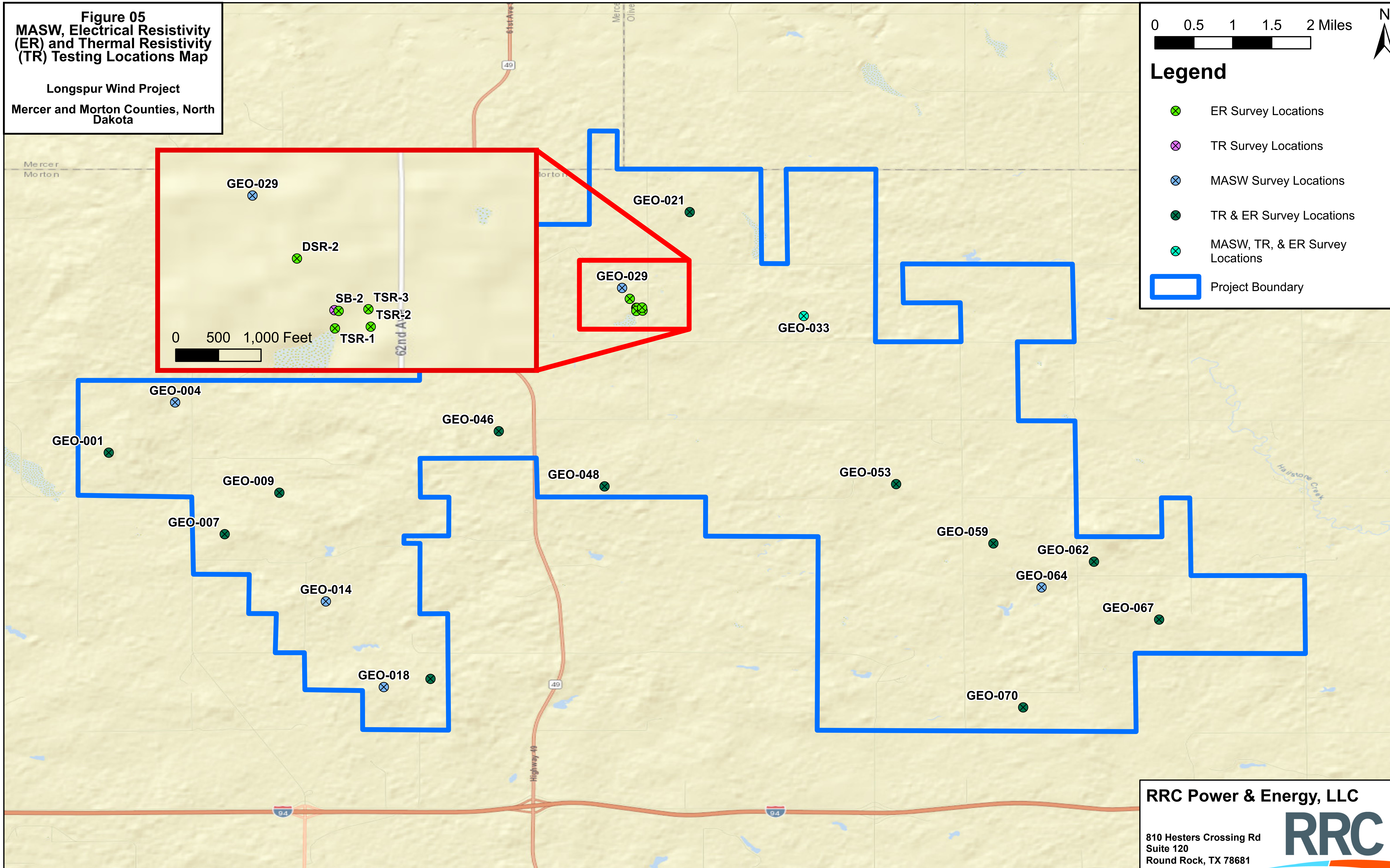


Figure 05
MASW, Electrical Resistivity (ER) and Thermal Resistivity (TR) Testing Locations Map
Longspur Wind Project
Mercer and Morton Counties, North Dakota
0 0.5 1 1.5 2 Miles
N
Legend
ER Survey Locations
TR Survey Locations
MASW Survey Locations
TR & ER Survey Locations
MASW, TR, & ER Survey Locations
Project Boundary
GEO-029
DSR-2
SB-2
TSR-3
TSR-2
TSR-1
0 500 1,000 Feet
62nd Av
Mercer
Morton
GEO-021
GEO-029
GEO-033
GEO-004
GEO-001
GEO-046
GEO-009
GEO-048
GEO-053
GEO-007
GEO-059
GEO-062
GEO-064
GEO-014
GEO-067
GEO-018
GEO-070
Highway 49
RRC Power & Energy, LLC
810 Hesters Crossing Rd
Suite 120
Round Rock, TX 78681
RRC

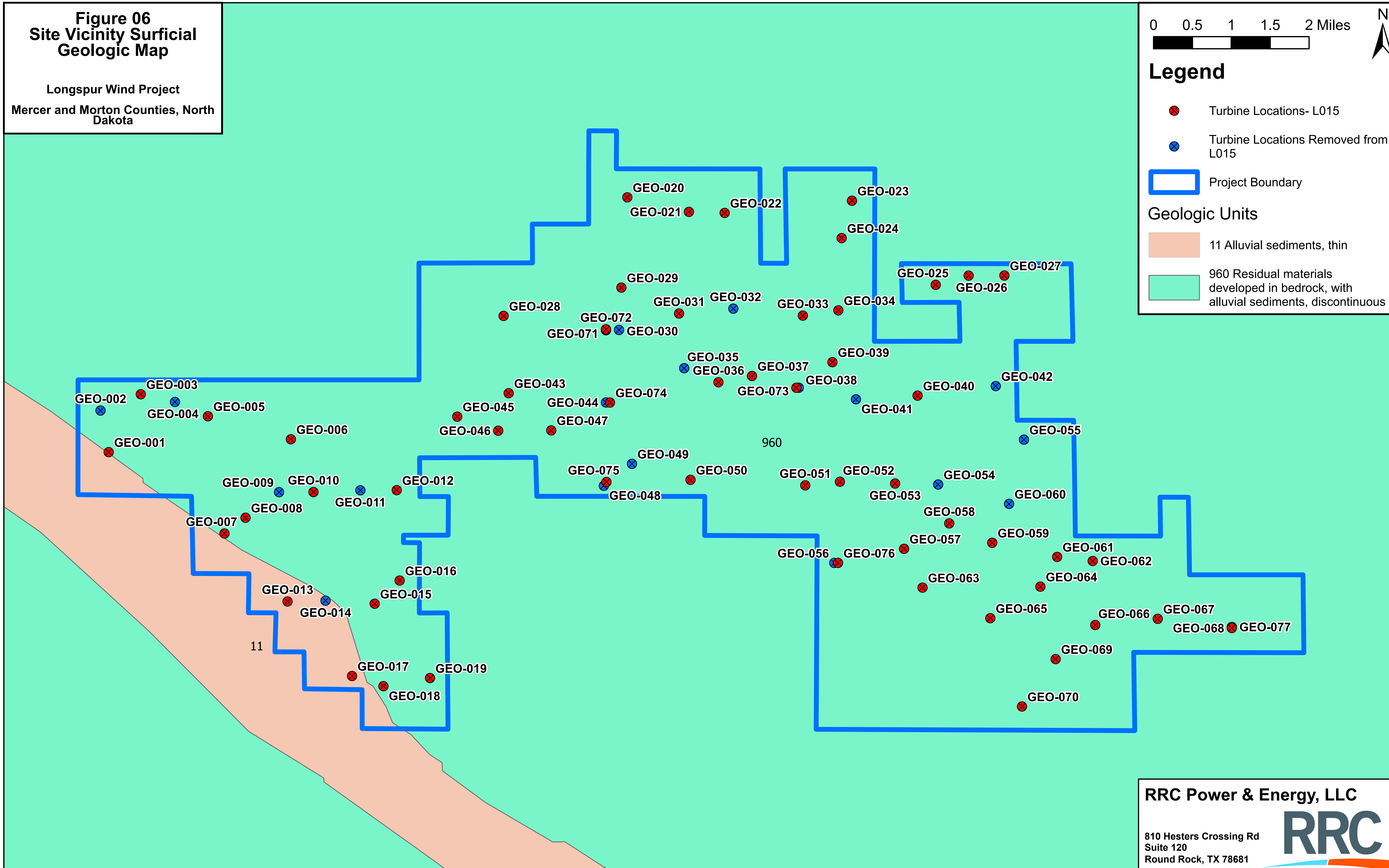


Figure 06
Site Vicinity Surficial Geologic Map
Longspur Wind Project
Mercer and Morton Counties, North Dakota
0 0.5 1 1.5 2 Miles
N
Legend
Turbine Locations- L015
Turbine Locations Removed from L015
Project Boundary
Geologic Units
11 Alluvial sediments, thin
960 Residual materials developed in bedrock, with alluvial sediments, discontinuous
GEO-001
GEO-002
GEO-003
GEO-004
GEO-005
GEO-006
GEO-007
GEO-008
GEO-009
GEO-010
GEO-011
GEO-012
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GEO-075
GEO-076
GEO-077
960
11
RRC Power & Energy, LLC
810 Hesters Crossing Rd
Suite 120
Round Rock, TX 78681

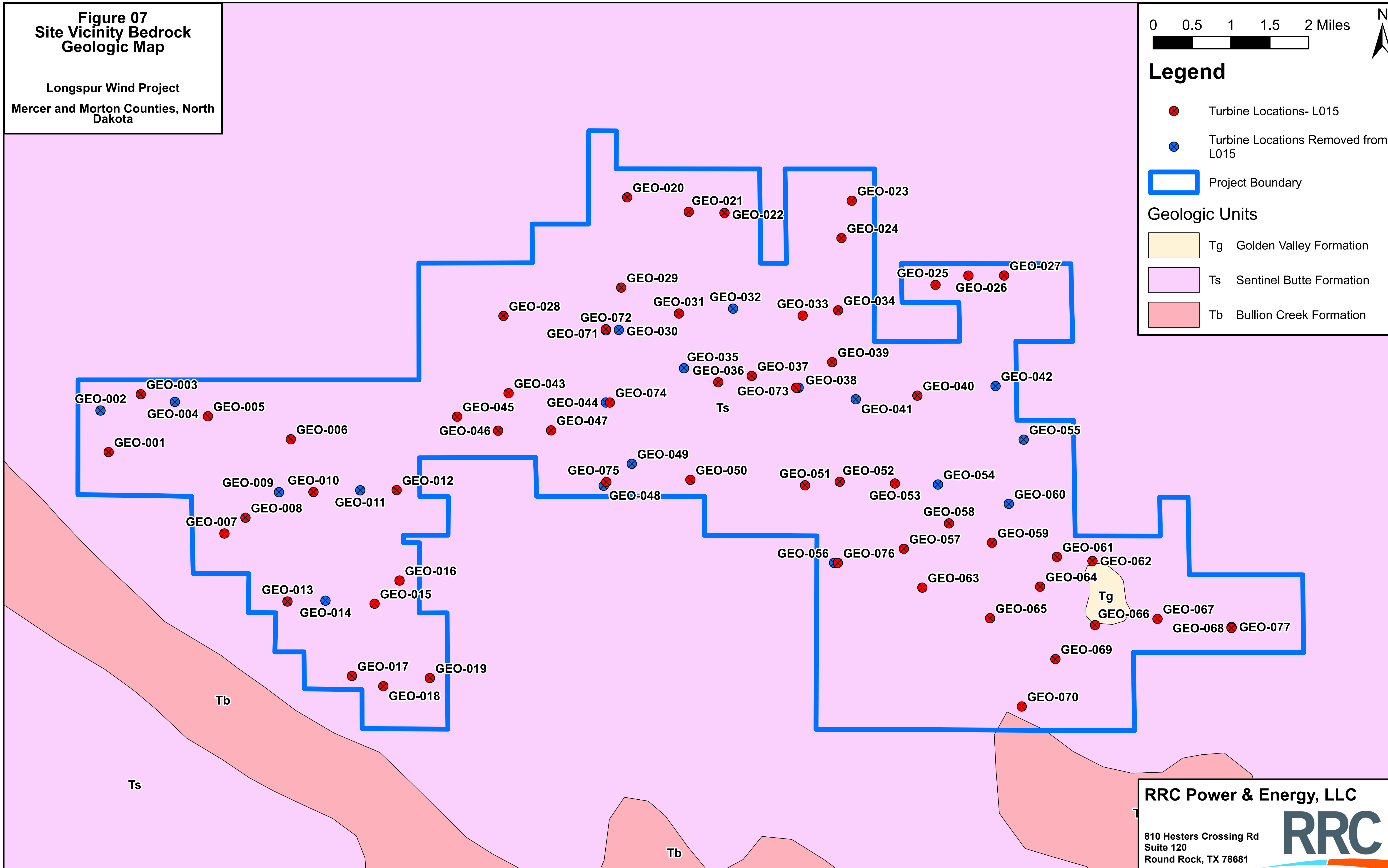

Figure 07
Site Vicinity Bedrock Geologic Map
Longspur Wind Project
Mercer and Morton Counties, North Dakota
0 0.5 1 1.5 2 Miles
N
Legend
Turbine Locations- L015
Turbine Locations Removed from L015
Project Boundary
Geologic Units
Tg Golden Valley Formation
Ts Sentinel Butte Formation
Tb Bullion Creek Formation
GEO-001
GEO-002
GEO-003
GEO-004
GEO-005
GEO-006
GEO-007
GEO-008
GEO-009
GEO-010
GEO-011
GEO-012
GEO-013
GEO-014
GEO-015
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GEO-069
GEO-070
GEO-071
GEO-072
GEO-073
GEO-074
GEO-075
GEO-076
GEO-077
Ts
Tg
Tb
Ts
Tb
RRC Power & Energy, LLC
810 Hesters Crossing Rd
Suite 120
Round Rock, TX 78681

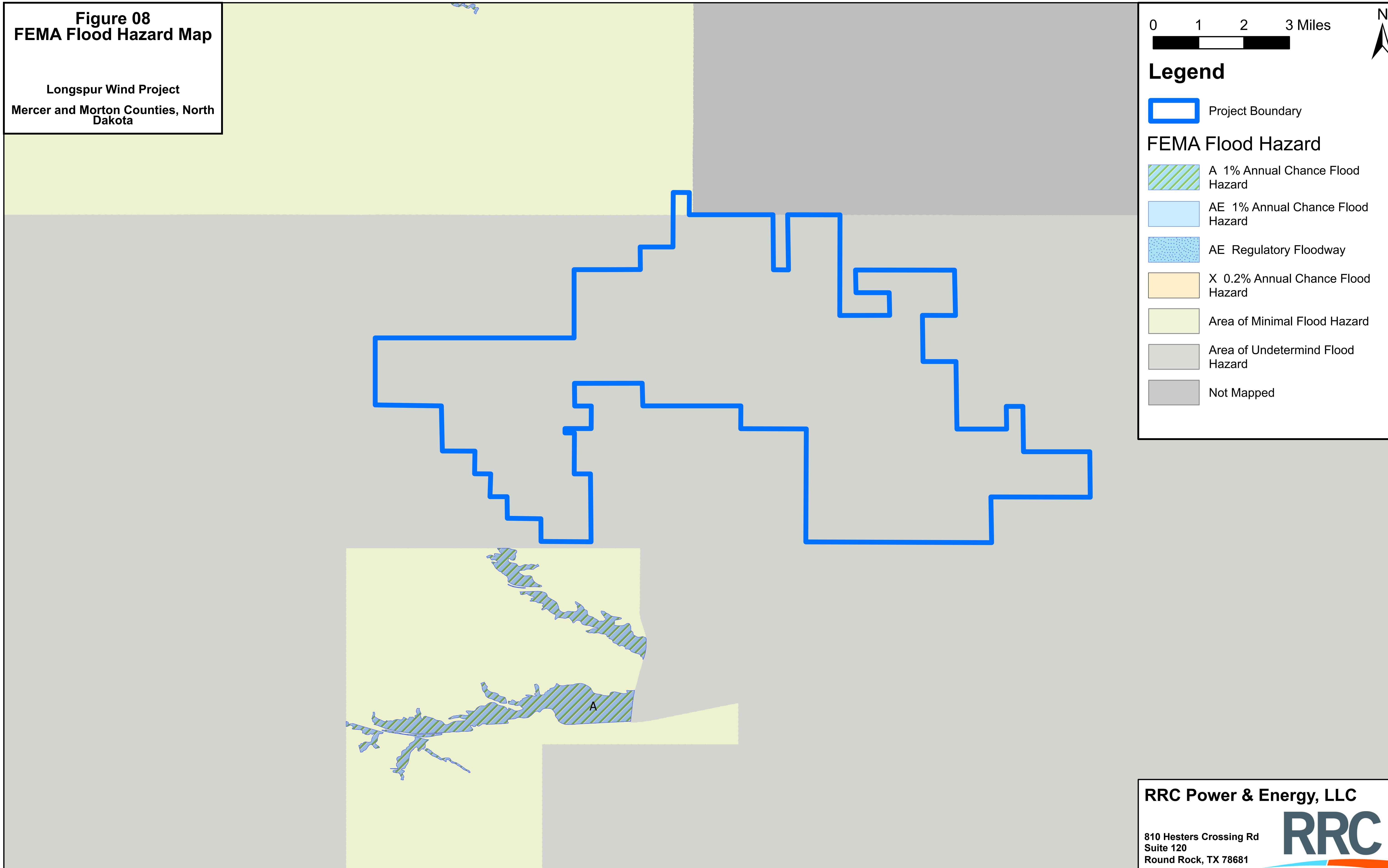
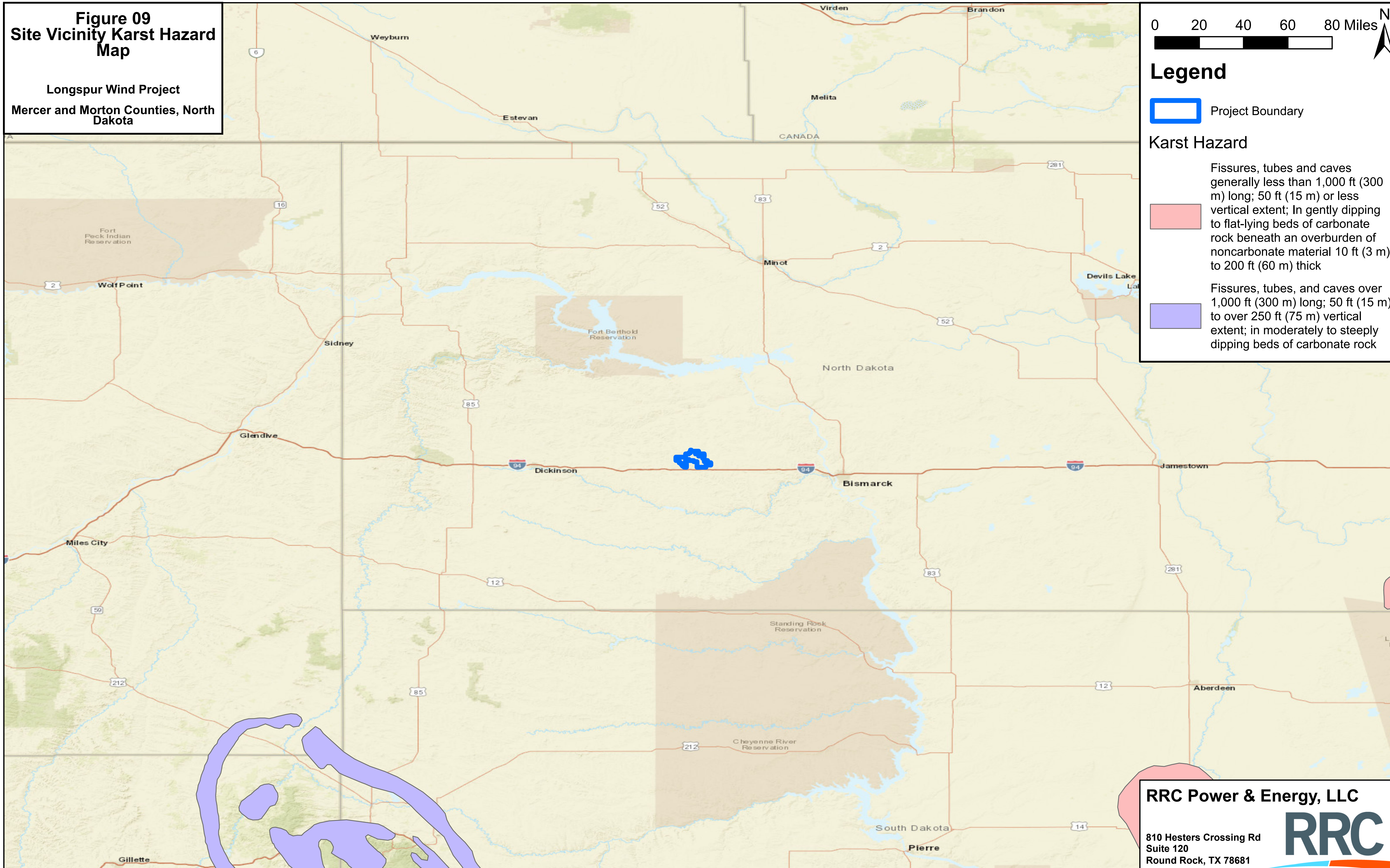


Figure 08
FEMA Flood Hazard Map
Longspur Wind Project
Mercer and Morton Counties, North Dakota
0
1
2
3 Miles
N
Legend
Project Boundary
FEMA Flood Hazard
A 1% Annual Chance Flood Hazard
AE 1% Annual Chance Flood Hazard
AE Regulatory Floodway
X 0.2% Annual Chance Flood Hazard
Area of Minimal Flood Hazard
Area of Undetermind Flood Hazard
Not Mapped
A
RRC Power & Energy, LLC
810 Hesters Crossing Rd
Suite 120
Round Rock, TX 78681

Figure 09
Site Vicinity Karst Hazard Map

Longspur Wind Project

Mercer and Morton Counties, North Dakota



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810 Hesters Crossing Rd
Suite 120
Round Rock, TX 78681

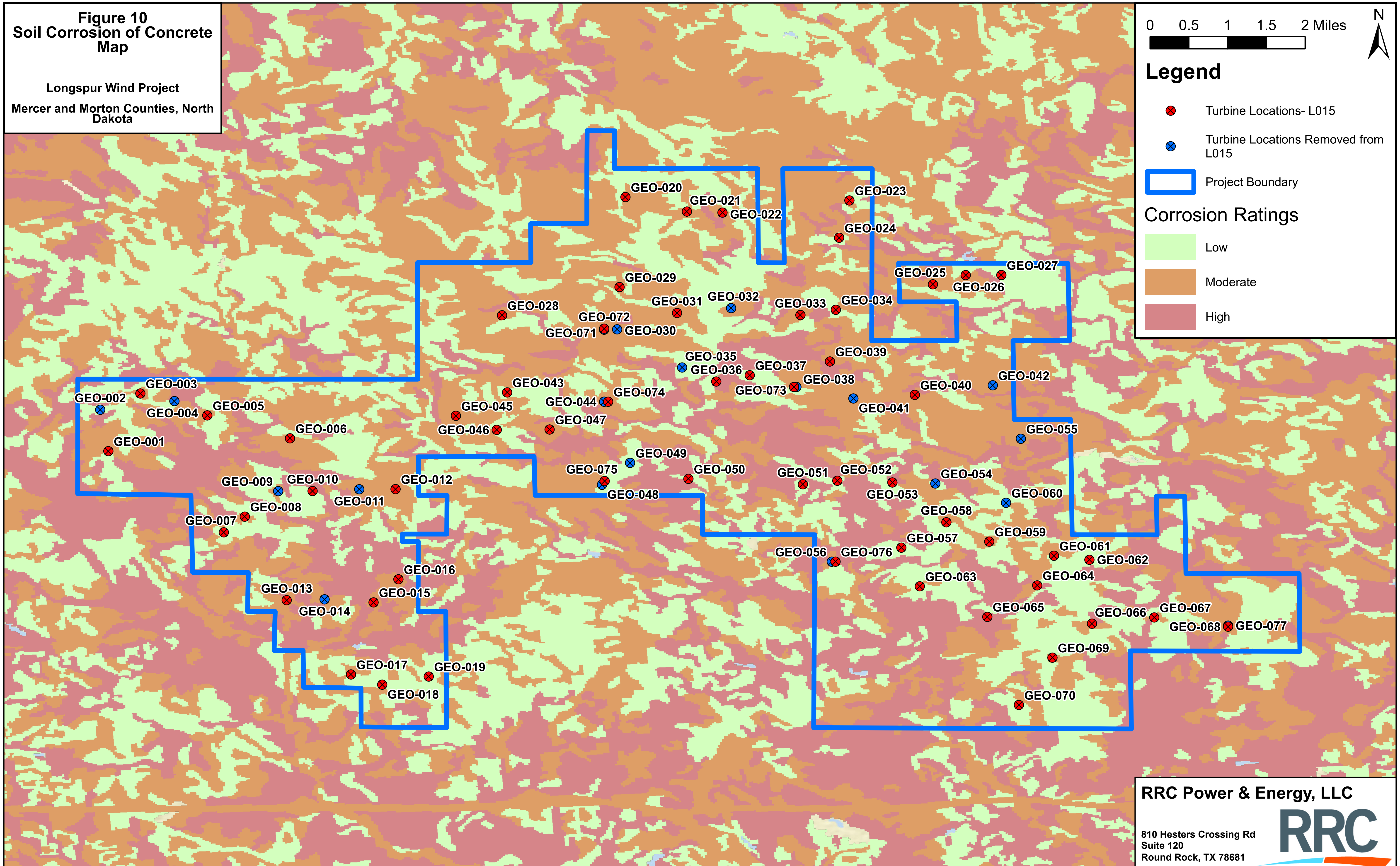


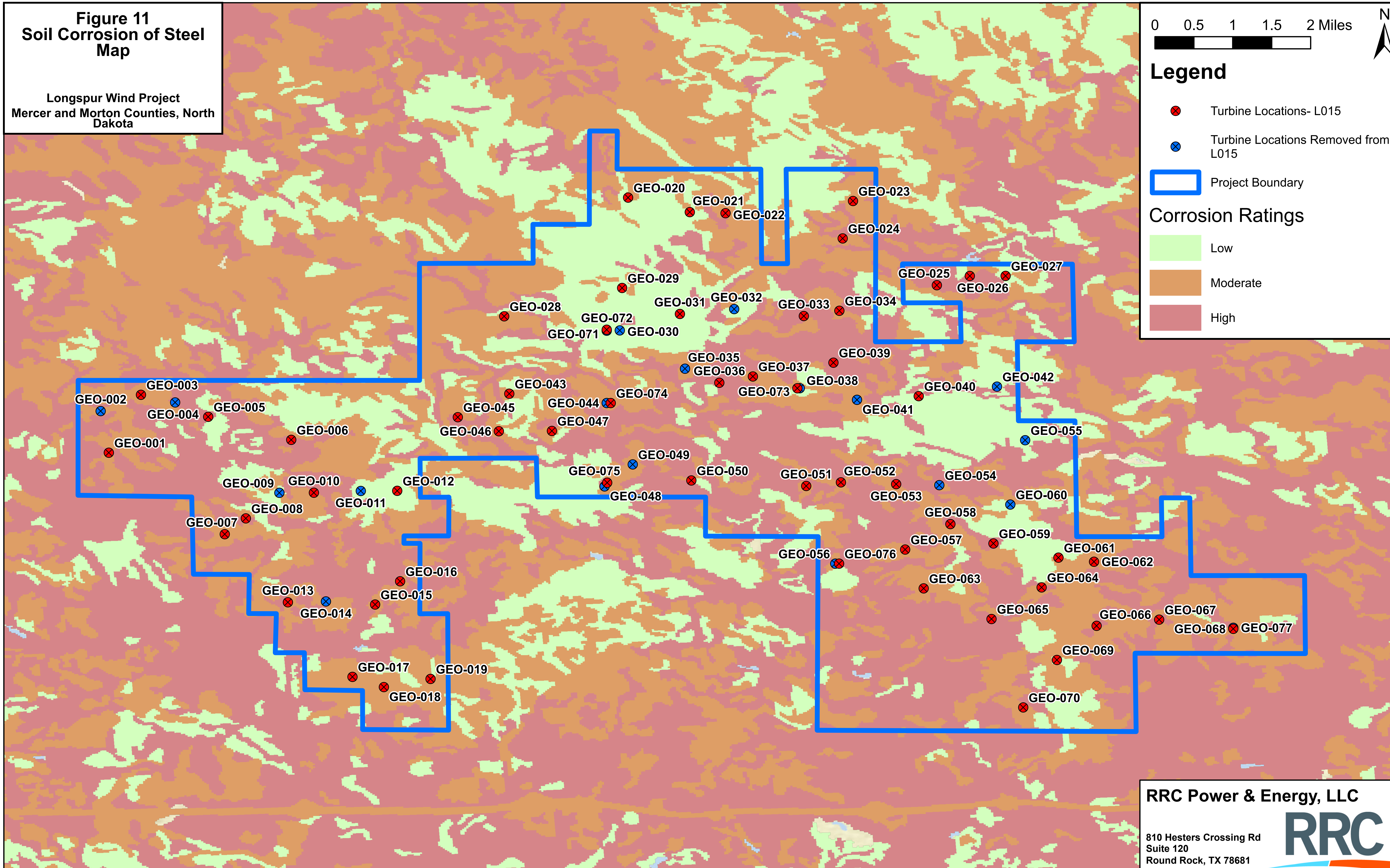
Figure 10
Soil Corrosion of Concrete Map

Longspur Wind Project

Mercer and Morton Counties, North Dakota

Figure 11
Soil Corrosion of Steel Map

Longspur Wind Project
Mercer and Morton Counties, North Dakota

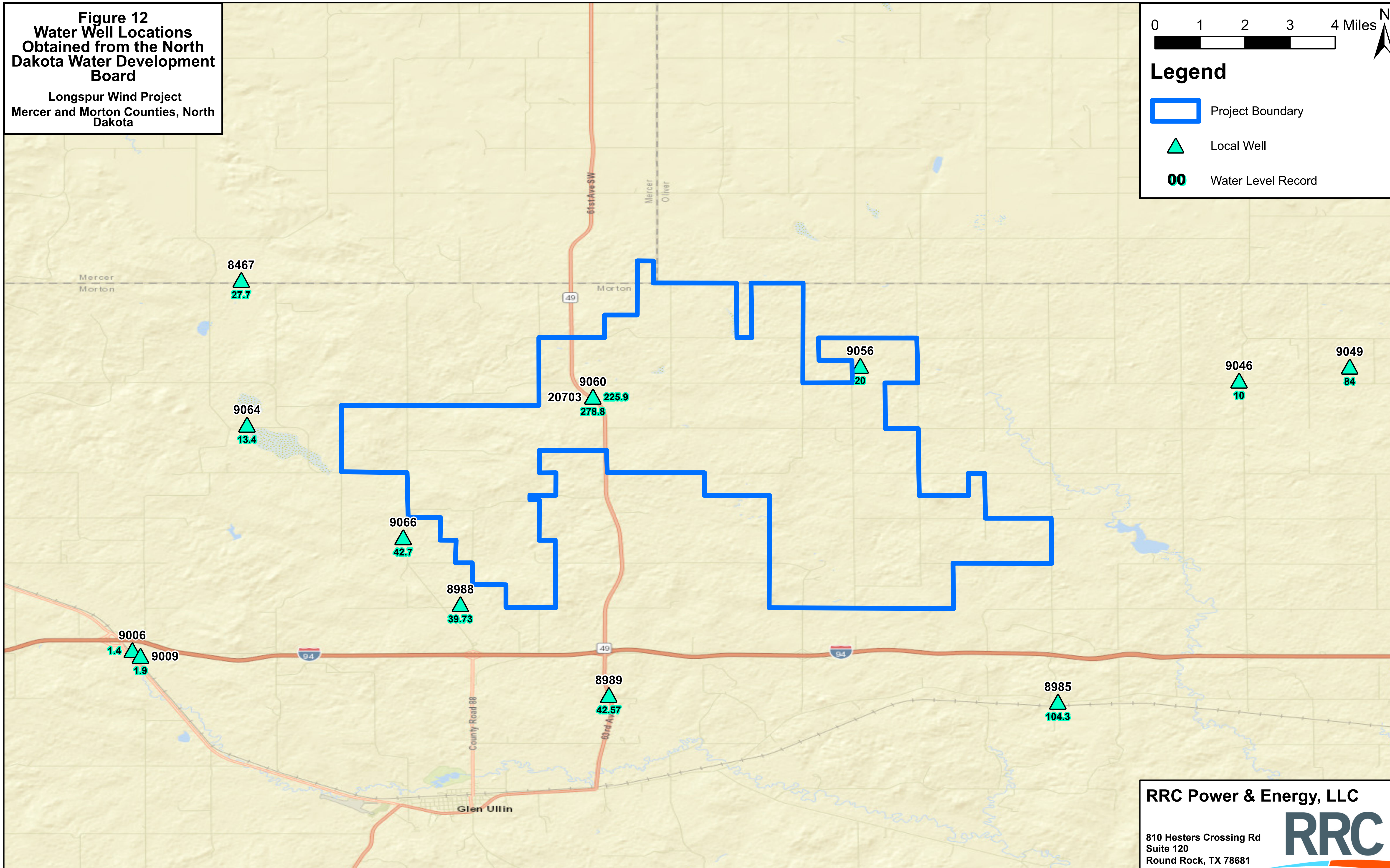


RRC Power & Energy, LLC

810 Hesters Crossing Rd
Suite 120
Round Rock, TX 78681

Figure 12
Water Well Locations Obtained from the North Dakota Water Development Board

Longspur Wind Project
Mercer and Morton Counties, North Dakota



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Suite 120
Round Rock, TX 78681

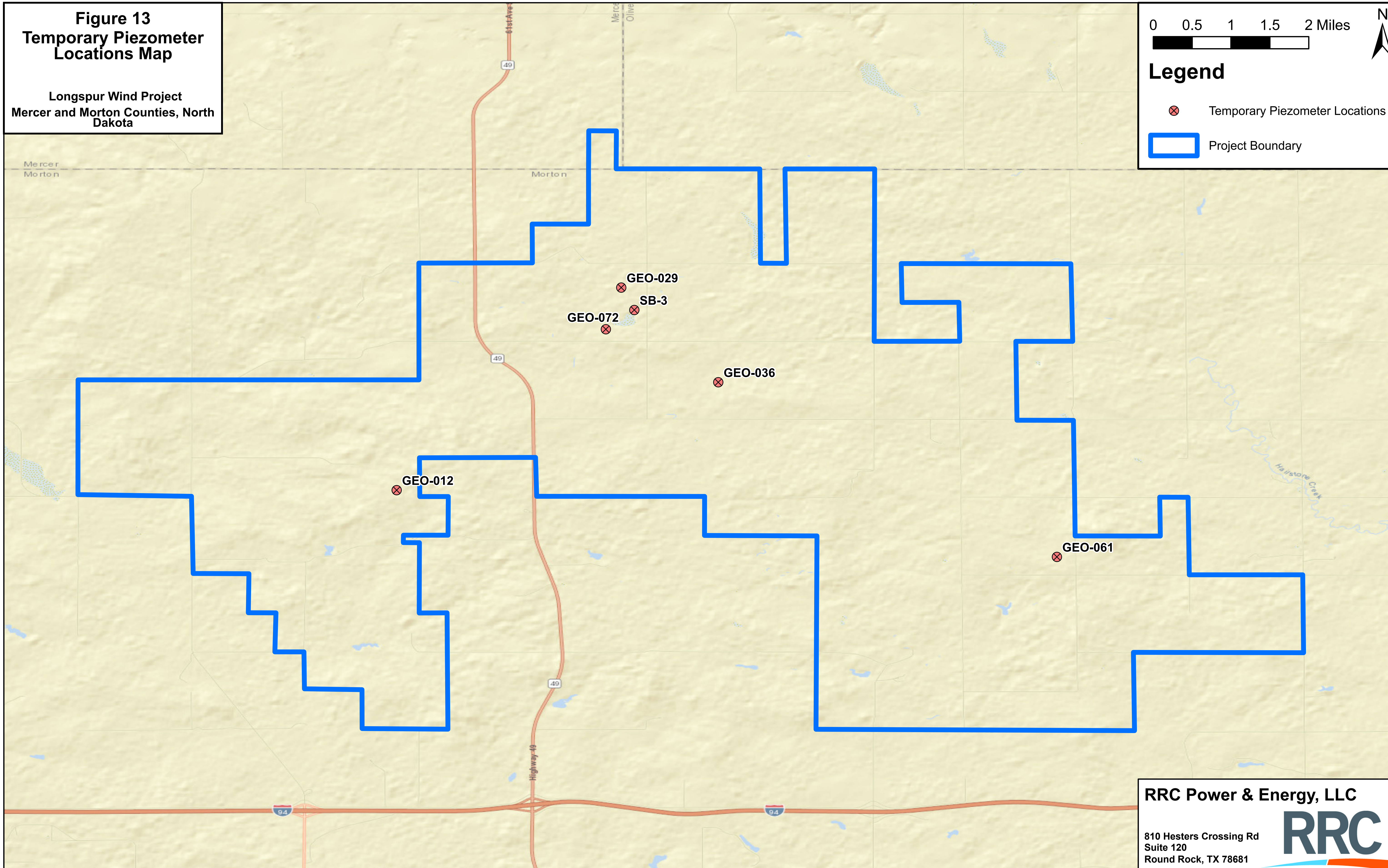
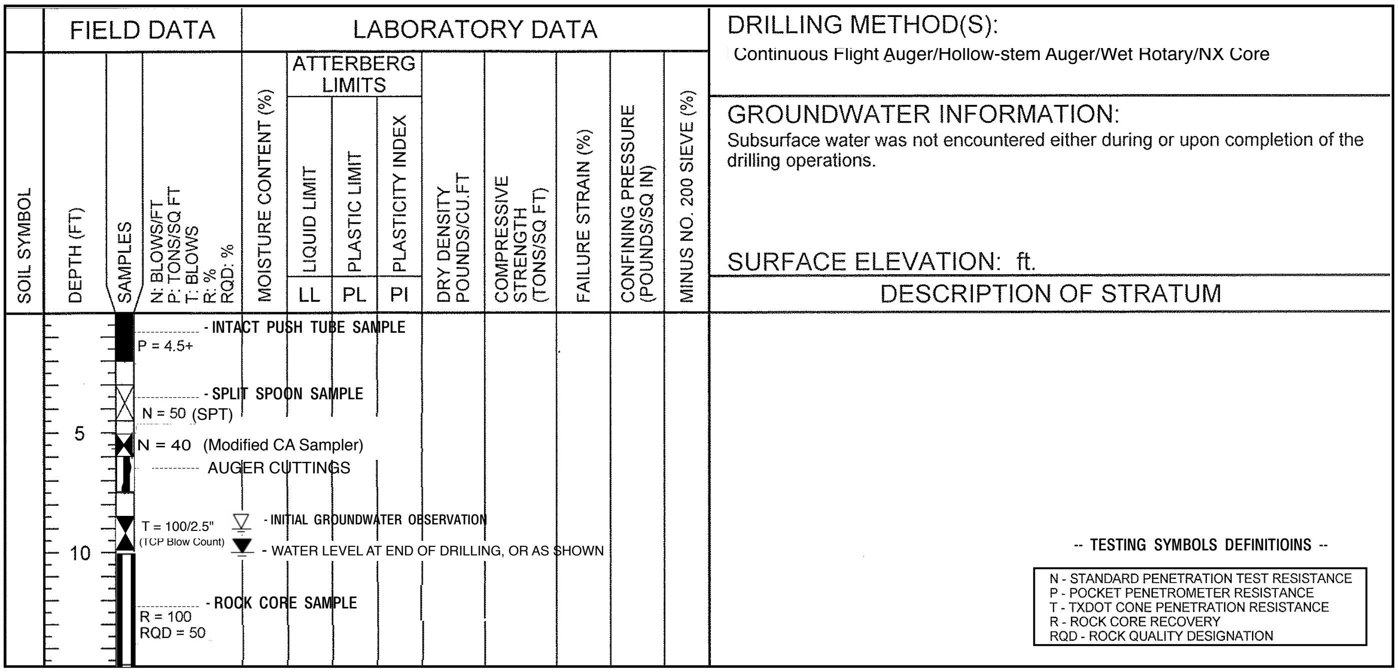
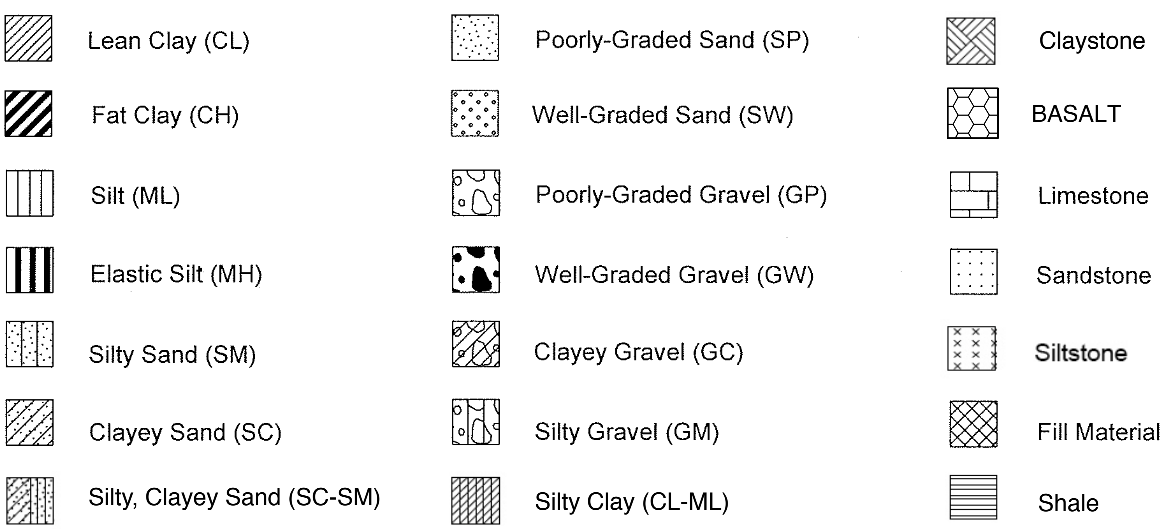


Figure 13
Temporary Piezometer Locations Map
Longspur Wind Project
Mercer and Morton Counties, North Dakota
0 0.5 1 1.5 2 Miles
N
Legend
Temporary Piezometer Locations
Project Boundary
Mercer
Morton
GEO-029
SB-3
GEO-072
GEO-036
GEO-012
GEO-061
49
94
Highway 49
RRC Power & Energy, LLC
810 Hesters Crossing Rd
Suite 120
Round Rock, TX 78681

BORING LOG KEY



TYPICAL SOIL AND ROCK SYMBOLS (USCS CLASSIFICATION)



DEGREE OF WEATHERING

1) Unweathered: No evidence of any chemical or mechanical alteration.
2) Slightly weathered: Slight discoloration on surface, slight alteration along discontinuities, less than 10% of the rock volume altered.
3) Moderately weathered: Discoloring evident, surface pitted and altered with alteration penetrating well below rock surfaces, weathering "halos" evident, 10% to 50% of the rock volume altered.
4) Highly weathered: Entire mass discolored, alteration pervading nearly all of the rock with some pockets of slightly weathered rock noticeable, some minerals leached away.
5) Decomposed: rock reduced to a soil with relicit rock texture, generally molded and crumbled by hand.

SOIL STRUCTURE

Calcareous.......... Containing calcium carbonate

Slickensided........ The presence of planes of weakness having a slick and glossy appearance

Interbedded......... Alternating layers of varying material

LOG OF BORING GEO-01

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/25/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 30 ft. during drilling and measured at 52 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											4 in. Topsoil
	N = 12	23									FAT CLAY (CH), trace Sand, brown to light gray, stiff to hard, moist
		24	63	22	41					100	
5	N = 16	19									
	N = 15	28									Grading light brown, iron stained
10	N = 30	29									Grading dark brown to brown, with organics
	N = 9	47									Grading with Lignite
15	N = 50	20	52	20	32	111	5.28	7.3	0.0	81	Grading with Sand Grading brown to gray
20	N = 35										CLAYEY SAND (SC), light gray to gray, dense, dry to moist, fine grained
25	N = 16										LEAN CLAY (CL), trace Sand, dark gray to gray, very stiff to hard, dry to moist
30	N = 32										Grading trace Lignite and organics Grading wet
35	N = 32										
40	N = 50/3"										SHALE, dark brown, hard to very hard, moist to wet, with Lignite
45	N = 50/6"										
50	N = 64										Grading gray
55	N = 42										MUDSTONE, light gray to gray, medium hard, moist to wet, trace organics
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.928605, Long. -101.860051

LOG OF BORING GEO-02

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/25/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											3 in. Topsoil
	N = 10	18									SANDY LEAN CLAY (CL), gray, stiff to very stiff, moist, calcareous
5	N = 16	22									
	N = 21	20									CLAYEY SAND (SC), light brown to gray, medium dense, moist, fine grained, iron stained, trace organics
10	N = 30	19									
	N = 22	22									
15	N = 32										LEAN CLAY (CL), with Sand, gray, hard, dry to moist, trace Lignite
20	N = 50/3"										
25	N = 47										
30	N = 36										Grading trace Sand
35	N = 46										
40	N = 67										
45	N = 81/11"										SILTSTONE, gray to light brown, very hard, dry to moist, with Shale interbeddings, trace Lignite
50	N = 50/6"										Shale interbedding grades out
55	N = 50/6"										
											Total Depth = 55 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.936340, Long. -101.861568

LOG OF BORING GEO-03

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/24/2025 - 4/25/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	N = 24	11									LEAN CLAY (CL), trace Sand, brown, very stiff, dry to moist, calcareous
5	N = 15	16									SANDY LEAN CLAY (CL), brown, stiff to very stiff, moist, iron stained
	N = 19	16									Grading trace organics
10	N = 15	19									Grading dark brown, trace Lignite
	N = 38	16				96					
15	N = 42										LEAN CLAY (CL), trace Sand, dark brown, hard, dry to moist, iron stained, calcareous
20	N = 62										
25	N = 36										Grading trace organics
30	N = 27										LIGNITE, black, very stiff, dry to moist
35	N = 79										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist
40	N = 43										
45	N = 49										
50	N = 50/3"										LIGNITE, black, hard, dry to moist
55	N = 92										SANDSTONE, gray, very hard, dry to moist, fine grained

Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.939368, Long. -101.854080

RENEWABLE LOG - LOG A GNNL01.GDT - 4/22/26 14:49 - C:\USERS\JOHNVILLARINO\RRC COMPANIES\GEOTECHNICAL ENGINEERING - DATABASES\03.GINT\PROJECTS\2025\LONGSPUR WIND PROJECT-GE2503026\LONGSPUR WIND PROJECT-GE2503026.GPJ

LOG OF BORING GEO-04

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/25/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											4 in. Topsoil
	N = 15	14									LEAN CLAY (CL), with Sand, light brown, soft to very stiff, dry to moist, calcareous
5	N = 9	19									
	N = 5	23 22									
10	N = 4	23									
	P = 2.5	23	47	18	29	103	1.96	14.8	10.0	85	
15	N = 5										
20	P = 2.5	22				102	2.59	7.8	0.0		
25	N = 13										
30	N = 10										SANDY LEAN CLAY (CL), light brown, stiff, dry to moist, calcareous
35	N = 29										SILTY SAND (SM), light brown to gray, medium dense to dense, dry to moist, fine grained
40	N = 35										
45	N = 50/6"										SANDSTONE, light brown to gray, very hard, dry to moist, fine grained
50	N = 50/5"										
55	N = 50/6"										
											Total Depth = 55 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.937945, Long. -101.847728

LOG OF BORING GEO-05

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/26/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 34 ft. during drilling and measured at 48 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
			N = 21	16									3 in. Topsoil CLAYEY SAND (SC), brown, medium dense to dense, dry to moist, fine grained, iron stained
	5		N = 27	15									
			N = 25	17									Grading trace organics
	10		N = 28	19									
			N = 34	17									
	15		N = 32										
	20		N = 33										
	25		N = 46										
	30		N = 42										
	35		N = 42										Grading wet
	40		N = 32										LIGNITE, dark brown, hard, moist to wet
	45		N = 38										SILT (ML), trace Sand, gray, hard, moist to wet
	50		N = 60										LEAN CLAY (CL), with Sand, gray, hard, moist, trace organics
	55		N = 82										Grading gray to brown
													Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.935278, Long. -101.841595

LOG OF BORING GEO-06

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/23/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
			N = 11	14									LEAN CLAY (CL), with Sand, brown, stiff to hard, dry to moist, calcareous
	5		N = 9	30									Grading iron stained, trace organics
			N = 13	27									Grading trace Sand, gray
	10		N = 11	30									Grading with Lignite interbeddings
			N = 33										
	15		N = 31										
	20		N = 39										
	25		N = 51										
	30		N = 41										
	35		N = 44										POORLY-GRADED SAND (SP), light brown to gray, dense, dry to moist, fine grained
	40		N = 57										LEAN CLAY (CL), trace Sand, gray to brown, hard, dry to moist
	45		N = 83										
	50		N = 59										
	55		N = 75										
													Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.930996, Long. -101.826168

LOG OF BORING GEO-07

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/23/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											4 in. Topsoil
	N = 11	25									SANDY LEAN CLAY (CL), light brown, stiff, moist, iron stained, calcareous
5	N = 14	22									FAT CLAY (CL), with Sand, light brown, stiff to hard, dry to moist, trace organics
	N = 14	26									Grading trace Sand, gray
10	N = 18	27									
	N = 28	27	64	23	41	99	6.92	6.3	10.0	100	
15	N = 20										
20	N = 45										
25	N = 50/1"										Grading with Gravel
30	N = 36										
35	N = 27										Organic grades out; grading gray
40	N = 41										
45	N = 38										
50	N = 77										LIGNITE, dark gray to dark brown, hard, dry to moist
55	N = 84										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.913460, Long. -101.838517

LOG OF BORING GEO-08

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/23/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 9	25									FAT CLAY (CH), trace Sand, light brown to brown, stiff to very stiff, dry to moist, trace roots
		22	57	19	38					99	
5	N = 15	22									Grading brown, iron stained
	N = 19	24									
10	N = 22	23									
	N = 38										
15	N = 27										CLAYEY SAND (SC), light brown to brown, medium dense, dry to moist, fine grained
20	N = 26										LEAN CLAY (CL), trace Sand, gray to bluish gray, very stiff to hard, dry to moist
25	N = 37										
30	N = 27										
35	N = 50/4"										LIGNITE, black, hard, dry to moist
40	N = 37										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist
45	N = 41										SILT (ML), trace Sand, gray to dark gray, hard, dry to moist
50	N = 64										LIGNITE, black, hard, dry to moist
55	N = 43										SILT (ML), trace Sand, gray to light gray, hard, dry to moist

Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.916400, Long. -101.834600

LOG OF BORING GEO-09

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/7/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
												8 in. Topsoil
		N = 9	16									LEAN CLAY (CL), with Sand, light brown, stiff to hard, dry to moist
5		N = 17	23									Grading light brown, iron stained
		N = 20	25									Grading trace Sand
10												
		N = 50/6"										
15		N = 26										Grading dark gray to gray
20		N = 28										
25		N = 35										Iron stain grades out
30		N = 50/6"										Grading dark brown to brown
35		N = 38										SANDY LEAN CLAY (CL), light gray to dark gray, hard, dry to moist, trace Lignite
40		N = 50/6"										LIGNITE, dark brown to black, hard, dry to moist
45		N = 56										LEAN CLAY (CL), with Sand, light gray to gray, hard, dry to moist, with Lignite
50		N = 52										Lignite grades out
55		N = 71										Grading trace Sand
												Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.921153, Long. -101.828369

LOG OF BORING GEO-10

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/23/2025 - 4/24/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											3 in. Topsoil
	N = 21	14									FAT CLAY (CH), trace Sand, light brown to brown, very stiff to hard, moist
		16	71	24	47					91	
5	N = 40	15									Grading with Sand, yellowish brown to brown, calcareous, trace roots
		17									
	N = 26	16									
10	N = 26	17									Grading trace Sand, dark gray to gray, iron stained
	N = 32	41									Grading with Lignite interbeddings
15	N = 50/6"										LIGNITE, black, hard, dry to moist
20	N = 38										LEAN CLAY (CL), trace Sand, light gray to dark brown, hard, dry to moist
25	N = 40										Grading trace Lignite
30	N = 40										
35	N = 73										Grading with Sand, light gray to brown
40	N = 50/6"										SANDY LEAN CLAY (CL), light brown to light gray, hard, dry to moist
45	N = 88/9"										CLAYEY SAND (SC), light brown to gray, very dense, dry to moist, fine grained
50	N = 50/6"										
55	N = 50/6"										
											Total Depth = 55 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.921172, Long. -101.821962

LOG OF BORING GEO-11

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/24/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											3 in. Topsoil
	N = 5	13									LEAN CLAY (CL), with Sand, light brown, medium stiff, moist, trace roots
5	N = 12	12									CLAYEY SAND (SC), light brown, medium dense to very dense, dry to moist, fine to medium grained
	N = 18	7									Grading light gray
10	N = 50/4"	4									Grading light brown to gray
	N = 35	13									
15	N = 13										LEAN CLAY (CL), trace Sand, light brown, stiff to very stiff, dry to moist, calcareous
20	N = 37										Grading trace organics
25	N = 37										SANDY LEAN CLAY (CL), light brown to gray, hard, dry to moist, iron stained
30	N = 31										CLAYEY SAND (SC), dark gray to light gray, dense to very dense, dry to moist, fine grained, trace organics
35	N = 51										Organic grades out; grading brown, iron stained
40	N = 46										LEAN CLAY (CL), with Sand, gray, hard, dry to moist, with Lignite interbeddings
45	N = 34										Lignite interbedding grades out; grading Lignite beddings
50	N = 50/1"										SILTSTONE, gray, very hard, dry to moist, calcareous
55	N = 35										SANDY CLAYSTONE, light gray, medium hard, dry to moist
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.921497, Long. -101.813248

LOG OF BORING GEO-12

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/24/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 19 ft. during drilling and measured at 44 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	N = 4	12									SANDY LEAN CLAY (CL), dark brown, soft, dry to moist
5	N = 9	11									CLAYEY SAND (SC), trace Gravel, dark brown to gray, loose to medium dense, dry to moist, fine to coarse grained, calcareous
	N = 11	9									Calcareous feature grades out
10	N = 29	16									Grading iron stained
	N = 37	16									SILTY SAND (SM), gray to brown, dense, dry to moist, fine grained
15	N = 40										
20	N = 37										Grading trace Gravel, wet, fine to coarse grained
25	N = 29										LEAN CLAY (CL), with Sand, gray to brown, very stiff to hard, moist to wet
30	N = 33										Grading calcareous
35	N = 60/9"										Grading iron stained, with Lignite interbeddings
40	N = 50/3"										LIGNITE, black, hard, moist
45	N = 40										LEAN CLAY (CL), trace Sand, gray, hard, moist
50	N = 36										
55	N = 59										POORLY-GRADED SAND (SP), gray, very dense, moist, fine to medium grained
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.921525, Long. -101.806480

LOG OF BORING GEO-13

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/22/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
												3 in. Topsoil
	X	N = 4	20									SANDY LEAN CLAY (CL), light brown, soft, moist
5	X	N = 8	26									CLAYEY SAND (SC), light brown, loose, moist, fine grained, iron stained
	X	N = 15	21									LEAN CLAY (CL), trace Sand, light brown, stiff to hard, dry to moist, iron stained
10	X	N = 17	24									Grading with Sand, trace organics
	X	N = 18	30									Grading trace Sand, gray to dark brown
15	X	N = 30										
20	X	N = 42										Grading light brown
25	X	N = 35										SANDY LEAN CLAY (CL), light brown to brown, hard, dry to moist
30	X	N = 58										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist, iron stained
35	X	N = 48										Grading brown, trace organics
40	X	N = 66										Grading light gray
45	X	N = 58										Grading gray to dark gray
50	X	N = 81										SILTSTONE, light gray to gray, very hard, dry to moist
55	X	N = 90/11"										
												Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.900807, Long. -101.826790

LOG OF BORING GEO-14

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/22/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 34 ft. during drilling and measured at 48 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													5 in. Topsoil
			N = 6	19									LEAN CLAY (CL), trace Sand, light brown, medium stiff to very stiff, moist
	5		N = 20	22									
			N = 21	23									Grading with Sand, light brown to gray, calcareous, trace organics
	10		N = 23	22									Organic grades out
			N = 28	18									SANDY LEAN CLAY (CL), light gray, very stiff, moist
	15		N = 21										CLAYEY SAND (SC), light gray, medium dense, dry to moist, fine grained
	20		N = 16										LEAN CLAY (CL), trace Sand, dark brown, very stiff to hard, dry to moist, with Lignite interbeddings
	25		N = 42										Grading with Sand, brown to light brown, iron stained, trace organics
	30		N = 50										Grading trace Sand, light gray
	35		N = 49										Grading with Sand, wet
	40		N = 34										Grading gray to dark gray
	45		N = 39										
	50		N = 37										
	55		N = 37										
													Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.900966, Long. -101.819722

LOG OF BORING GEO-15

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/22/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											4 in. Topsoil
	N = 22	7									SILT (ML), trace Sand, light brown, very stiff, dry to moist, calcareous
5	N = 52	11									LEAN CLAY (CL), trace Sand, light brown, stiff to hard, dry to moist
	N = 12	24									Grading light gray, with Lignite interbeddings
10	N = 20	23									Grading calcareous, trace organics
	N = 36	19									Grading light brown to brown, iron stained
15	N = 34										CLAYEY SAND (SC), light gray to brown, dense, dry to moist, fine grained
20	N = 29										LEAN CLAY (CL), trace Sand, dark brown to black, very stiff to hard, dry to moist, with Lignite interbeddings, trace organics
25	N = 72/11"										
30	N = 48										CLAYEY SAND (SC), light gray to gray, dense, dry to moist, fine grained, trace organics
35	N = 48										
40	N = 35										LEAN CLAY (CL), with Sand, light brown to gray, very stiff to hard, dry to moist
45	N = 28										
50	N = 36										Grading calcareous
55	N = 30										CLAYEY SAND (SC), dark gray to light gray, medium dense, dry to moist, fine grained
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.900394, Long. -101.810586

LOG OF BORING GEO-16

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/21/2025 - 4/22/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

Depth (ft)	N: Blows/ft	Moisture Content (%)	LL	PL	PI	Dry Density (pcf)	Compressive Strength (tons/sq ft)	Strain at Failure (%)	Confining Pressure (psi)	Minus No. 200 Sieve (%)	Description of Stratum
											5 in. Topsoil
	N = 69	3									SILT (ML), trace Sand, light brown, hard, dry to moist, calcareous
5	N = 12	36									CLAYEY SAND (SC), dark brown, medium dense, moist, fine grained, trace organics
	N = 28	23									Grading brown
10	N = 31	23									SANDY ELASTIC SILT (MH), dark brown to brown, stiff to hard, dry to moist
	N = 12	31	76	46	30					56	Grading with Lignite interbeddings
15	N = 23										Grading with Shale beddings, trace organics
20	N = 78/10"										
25	N = 47										LEAN CLAY (CL), with Sand, gray, hard, dry to moist
30	N = 34										Grading light gray
35	N = 38										
40	N = 43										
45	N = 69										CLAYSTONE, dark brown to black, hard, dry to moist, trace organics
50	N = 89										SILTSTONE, light gray to gray, very hard, dry to moist
55	N = 81/11"										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.904707, Long. -101.805945

LOG OF BORING GEO-17

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/21/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 49 ft. during drilling and measured at 52 ft. immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													4 in. Topsoil
			N = 11	13									SILT (ML), trace Sand, light brown, medium stiff to stiff, dry to moist, calcareous
	5		N = 7	12									Grading trace organics
			N = 4	14									LEAN CLAY (CL), trace Sand, dark brown, soft to hard, dry to moist, calcareous, trace organics
	10		P = +4.5										
			N = 16	17									Grading light brown
	15		N = 50/1"										Grading with Sand
	20		N = 37										Grading trace Sand
	25		N = 45										
	30		N = 42										Grading with Sand
	35		N = 33										
	40		N = 36										
	45		N = 36										
	50		N = 43										Grading trace Sand, gray, wet
	55		N = 37										
													Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.886948, Long. -101.814793

LOG OF BORING GEO-18

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/21/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 44 ft. during drilling and measured at 44 ft. immediately after drilling

SURFACE ELEVATION (FT):

Soil Symbol	Depth (ft)	Samples	N: Blows/ft; P: Tons/sq ft; T: Blows; R: %; RQD: %	Moisture Content (%)	LL	PL	PI	Dry Density Pounds/cu.ft	Compressive Strength (Tons/sq. ft)	Strain at Failure (%)	Confining Pressure (Pounds/sq in)	Minus No. 200 Sieve (%)	Description of Stratum
													3 in. Topsoil
SC		X	N = 24	7									CLAYEY SAND (SC), light brown to brown, medium dense to very dense, dry to moist, fine grained
	5	X	N = 39	9									
		X	N = 51	9									
	10	X	N = 72	10									
		X	N = 86	6									
	15	X	N = 39										
	20	X	N = 50/6"										
	25	X	N = 93/11"										
	30	X	N = 71										
CL	35	X	N = 56										SANDY LEAN CLAY (CL), dark brown to brown, hard, dry to moist, iron stained
	40	X	N = 36										Grading trace organics
SC	45	X	N = 45										CLAYEY SAND (SC), dark brown to brown, dense, wet, fine grained, iron stained
	50	X	N = 42										
CL	55	X	N = 32										LEAN CLAY (CL), with Sand, gray to brown, hard, moist
													Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.885050, Long. -101.808962

RENEWABLE LOG - LOG A GNNL01.GDT - 4/22/26 14:49 - C:\USERS\JOHNVILLARINO\RRC COMPANIES\GEOTECHNICAL ENGINEERING - DATABASES\03.GINT\PROJECTS\2025\LONGSPUR WIND PROJECT-GE2503026\LONGSPUR WIND PROJECT-GE2503026.GPJ

LOG OF BORING GEO-19

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/21/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											4 in. Topsoil
	N = 30	8									LEAN CLAY (CL), trace Sand, light brown, very stiff, dry to moist
		6	30	18	12					97	
5	N = 26	20									Grading with Sand, light brown to brown, iron stained
	N = 24	29									Grading trace Sand, gray to brown, with Lignite interbeddings
10	N = 25	21									
	N = 36	19									SANDY LEAN CLAY (CL), light gray, very stiff to hard, dry to moist
15	N = 25										
20	N = 28										Grading iron stained, trace organics
25	N = 24										LEAN CLAY (CL), trace Sand, gray to light gray, very stiff to hard, dry to moist, iron stained, trace organics
30	N = 50/1"										Grading with Sand, brown, with occasional Sandstone fragments
35	N = 37										Grading trace Sand, gray to brown
40	N = 33										Grading dark brown to black
45	N = 39										Organic grades out; grading light gray to gray
50	N = 39										Grading dark brown to black, trace organics
55	N = 50										Grading gray to light gray
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.886567, Long. -101.800295

LOG OF BORING GEO-20

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											3 in. Topsoil
	N = 5	21									CLAYEY SAND (SC), light brown, loose, moist, fine grained
											SILT (ML), trace Sand, light brown, dry to moist
5	N = 15	22									CLAYEY SAND (SC), light brown to brown, medium dense, moist, fine grained
	N = 20	22									LEAN CLAY (CL), with Sand, brown to gray, very stiff to hard, dry to moist, iron stained
10	N = 21	22									
	P = +4.5										
15	N = 29										
20	N = 33										CLAYEY SAND (SC), gray, dense to very dense, dry to moist, fine grained
25	N = 35										Grading light gray
30	N = 41										
35	N = 58										Grading fine to medium grained
40	N = 40										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist
45	N = 47										SILT (ML), trace Sand, gray, hard, dry to moist
50	N = 55										
55	N = 36										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.976011, Long. -101.763598

LOG OF BORING GEO-21

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/11/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 39 ft. during drilling and measured at 23 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													6 in. Topsoil
			N = 9	8									SANDY LEAN CLAY (CL), brown, stiff, dry to moist, trace roots
	5		N = 10	7									CLAYEY SAND (SC), light brown to brown, loose, dry to moist, fine grained, iron stained
			N = 10	6									POORLY-GRADED SAND (SP), brown, loose to dense, dry to moist, fine to medium grained, iron stained
	10		N = 35	7									
			N = 65										
	15		N = 43										Grading light brown
	20		N = 47										CLAYEY SAND (SC), light brown to brown, dense to very dense, dry to moist, fine to medium grained, iron stained
													Grading wet
	25		N = 42										
	30		N = 50										
	35		N = 48										Grading gray to brown
	40		N = 64										Grading dark gray
	45		N = 58										Iron stain grades out; grading gray
	50		N = 79										
			N = 50/5"										Grading gray to brown, fine to coarse grained, trace organics
													Total Depth = 54.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.973311, Long. -101.752139

LOG OF BORING GEO-22

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/9/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 17	10									SILTY, CLAYEY SAND (SC-SM), light brown, medium dense, dry to moist, fine grained
		17	22	16	6					37	
5	N = 17	23									Grading trace Sand, light gray, iron stained, calcareous
	N = 15	22									SANDY SILT (ML), light brown, medium dense, moist, calcareous
10	N = 18	21									SANDY LEAN CLAY (CL), brown, very stiff, moist, iron stained
	N = 37										SILTY SAND (SM), light brown, medium dense, dry to moist, fine grained, iron stained, trace organics
15	N = 30										LEAN CLAY (CL), trace Sand, brown, very stiff to hard, dry to moist, iron stained
20	P = +4.5										
25	N = 34										CLAYEY SAND (SC), brown, dense, dry to moist, fine grained, trace organics
30	N = 50/3"										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist, calcareous, trace organics
35	N = 36										Grading with Lignite beddings
40	N = 44										SANDY SILT (ML), gray, dense, dry to moist
45	N = 53										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist
50	N = 55										Grading with Shale beddings
55	N = 49										SANDY LEAN CLAY (CL), gray, hard, dry to moist, trace organics
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.973116, Long. -101.745499

LOG OF BORING GEO-23

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/9/2025

DRILLING METHOD(S): Solid Stem Auger

GROUNDWATER INFORMATION: Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											5 in. Topsoil
	N = 8	13									LEAN CLAY (CL), with Sand, light brown, medium stiff to hard, dry to moist, calcareous
5	N = 9	21									
	N = 19	20									Grading trace Sand, yellowish brown, iron stained
10	N = 23	21									Grading trace organics
	P = +4.5										
15	N = 22										Grading with Sand, light brown
20	N = 45										CLAYEY SAND (SC), light brown to brown, medium dense to very dense, dry to moist, fine grained, iron stained
25	N = 79/9"										
30	N = 37										LEAN CLAY (CL), trace Sand, gray to bluish gray, hard, dry to moist
35	N = 78										
40	N = 51										Grading gray to black, with Lignite interbeddings
45	N = 75/8"										Grading light gray to gray
50	N = 95/10"										Grading with Sand, calcareous
55	N = 62										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.975381, Long. -101.721823

LOG OF BORING GEO-24

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/9/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 9	21									SANDY LEAN CLAY (CL), light brown to gray, stiff to very stiff, moist
5	N = 21	19									Grading iron stained
	N = 17	21									LEAN CLAY (CL), trace Sand, gray to brown, very stiff to hard, dry to moist, iron stained, trace organics
10	N = 23	21									Grading light brown to yellowish brown, calcareous
	P = +4.5										Grading with Sand
15	N = 28										Grading trace Sand, light brown to gray
20	N = 22										Grading with Lignite
25	N = 41										Grading dark brown
30	N = 52										Grading gray to dark gray, with Lignite interbeddings
35	N = 54										Organic grades out; grading light gray
40	N = 61										SANDY LEAN CLAY (CL), light gray, hard, dry to moist
45	N = 62										LEAN CLAY (CL), with Sand, dark gray, hard, dry to moist, trace organics
50	N = 78/10"										CLAYEY SAND (SC), light gray to gray, very dense, dry to moist, fine grained
55	N = 55										LEAN CLAY (CL), trace Sand, dark gray to gray, hard, dry to moist
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.968427, Long. -101.723739

LOG OF BORING GEO-25

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/8/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											3 in. Topsoil
	N = 10	19									LEAN CLAY (CL), with Sand, light brown, stiff to hard, dry to moist, calcareous
5	N = 14	21									Grading trace Sand, trace organics
	N = 15	16 20									Grading iron stained
10	N = 19	21									
	P = +4.5										
15	N = 33										
20	N = 46										Organic grades out
25	N = 56										SILT (ML), trace Sand, light brown, hard, dry to moist
30	N = 43										LEAN CLAY (CL), trace Sand, brown to gray, hard, dry to moist, iron stained
35	N = 48										SILT (ML), with Sand, light brown, hard, dry to moist, calcareous
40	N = 43										LEAN CLAY (CL), trace Sand, dark brown, hard, dry to moist, trace organics
45	N = 72/9"										
50	N = 36										CLAYEY SAND (SC), gray, dense, dry to moist, fine grained
55	N = 47										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.959730, Long. -101.706249

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LOG OF BORING GEO-26

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/8/2025

DRILLING METHOD(S): Solid Stem Auger

GROUNDWATER INFORMATION: Groundwater encountered at 39 ft. during drilling and measured at 50 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 13	18									LEAN CLAY (CL), with Sand, light brown, stiff, moist
5	N = 22	16									SANDY LEAN CLAY (CL), light brown to brown, very stiff, moist, iron stained
	N = 16	18									LEAN CLAY (CL), trace Sand, light gray to brown, very stiff to hard, dry to moist, iron stained
10	N = 20	21									Grading with Sand, trace organics
	N = 62										Grading trace Sand, gray to light gray
15	N = 28										Grading with Sand, gray to brown, with Lignite interbeddings
20	N = 55										CLAYEY SAND (SC), light gray, very dense, dry to moist, fine grained
25	N = 50/1"										Grading light brown to gray, calcareous
30	N = 82/11"										
35	N = 78										Grading light brown to yellowish brown, with Lignite
40	N = 58										LEAN CLAY (CL), trace Sand, dark brown to black, hard, wet, with Lignite interbeddings
45	N = 75/9"										Grading dark gray to black
50	N = 59										Grading light gray to black, trace organics
55	N = 68										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.961450, Long. -101.700128

LOG OF BORING GEO-27

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/9/2025

DRILLING METHOD(S): Solid Stem Auger

GROUNDWATER INFORMATION: Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0–0.5											6 in. Topsoil
	N = 11	16									LEAN CLAY (CL), with Sand, light brown, stiff, moist, calcareous
5	N = 10	15									SANDY LEAN CLAY (CL), dark brown, stiff, moist, iron stained, trace organics
	N = 25	15									CLAYEY SAND (SC), light brown, medium dense to dense, moist, fine grained, trace organics
10	N = 42	14									Grading light brown to brown, iron stained
	N = 33	15									Grading light brown to gray
15	N = 32										LEAN CLAY (CL), trace Sand, brown, hard, dry to moist, iron stained, trace organics
20	N = 39										
25	N = 55										Grading dark brown, with Lignite
30	N = 65										CLAYEY SAND (SC), gray, very dense, dry to moist, fine grained
35	N = 74										
40	N = 78										
45	N = 50/6"										LIGNITE, black to dark brown, hard, dry to moist, trace organics
50	N = 70										
55	N = 50/6"										
											Total Depth = 55 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.961464, Long. -101.693477

LOG OF BORING GEO-28

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/26/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 35 ft. during drilling and measured at 52 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 6	15									LEAN CLAY (CL), with Sand, light brown, medium stiff to hard, dry to moist
5	N = 7	20									Grading iron stained, calcareous
	N = 10	22									Grading trace organics
10	N = 32	20									
	N = 50/5"	7									
15	N = 62										SANDY LEAN CLAY (CL), light brown to brown, hard, dry to moist, iron stained
20	N = 41										CLAYEY SAND (SC), light gray to brown, dense, dry to moist, fine grained
25	N = 35										Grading iron stained
30	N = 40										Grading trace Lignite
35	N = 43										Organic grade out; grading dark gray Grading wet
40	N = 33										LEAN CLAY (CL), trace Sand, gray, hard, moist to wet
45	N = 35										
50	N = 47										Grading calcareous
55	N = 73										SILTSTONE, gray to light gray, hard, moist
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.953950, Long. -101.786611

LOG OF BORING GEO-29

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/29/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 9 ft. during drilling and measured at 55 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											4 in. Topsoil
	N = 2	19									CLAYEY SAND (SC), light brown, very loose to dense, dry to moist, fine grained
5	N = 2	21									
	P = 2.5										
10											Grading wet
	N = 31	19									Grading brown to gray, iron stained
	N = 36	20									
15	N = 42										Grading light brown to gray
20	N = 34										Grading dark gray to gray
25	N = 22										LEAN CLAY (CL), with Sand, light brown to gray, very stiff to hard, moist to wet
30	N = 39										
35	N = 50/6"										CLAYEY SAND (SC), gray to bluish gray, very dense, moist to wet, fine grained
40	N = 35										LEAN CLAY (CL), trace Sand, dark gray to gray, hard, moist to wet
45	N = 51										Grading with organics
50	N = 45										Organic grades out
55	N = 67/11"										Grading with Lignite interbeddings
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.959220, Long. -101.764704

LOG OF BORING GEO-31

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/2/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 49 ft. during drilling and measured at 49 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											6 in. Topsoil
	N = 8	7									CLAYEY SAND (SC), light brown to brown, loose to medium dense, dry to moist, fine grained
5	N = 7	7									
	N = 21	7									Grading iron stained
10	N = 15	15									LEAN CLAY (CL), trace Sand, gray to light brown, very stiff to hard, dry to moist
	P = 4.5										
15	N = 20										
20	P = +4.5										
25	N = 31										Grading with Sand
30	N = 32										
35	N = 55										Grading trace Sand, dark gray
40	N = 38										Grading gray
45	N = 50/5"										Grading dark brown, trace organics
50	N = 40										Grading gray, wet
55	N = 41										SILT (ML), trace Sand, gray, hard, moist
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.954390, Long. -101.753974

LOG OF BORING GEO-33

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/3/2025

DRILLING METHOD(S): Solid Stem Auger

GROUNDWATER INFORMATION: Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 14	14									FAT CLAY (CH), trace Sand, gray to brown, stiff to hard, moist, iron stained
		17	61	19	42					98	
5	N = 14	25									Grading trace organics
	N = 16	21									
10	N = 52/8"	23									
	N = 21	19									SANDY LEAN CLAY (CL), light brown, medium stiff to hard, dry to moist
15	N = 6										Grading dark brown to black, with Lignite interbeddings and organics
	N = 80/9"	17				111	9.45	2.9	0.0		Grading brown to gray, iron stained
20	N = 33										LEAN CLAY (CL), with Sand, light brown, hard, dry to moist
25	N = 58										Grading trace Sand, brown, trace Lignite and organics
30	N = 35										Grading with Sand, dark gray to gray
35	N = 42										
40	N = 82/11"										SANDSTONE, gray to dark gray, very hard, dry to moist, fine grained
45	N = 50/5"										
50	N = 93/8"										
55	N = 50/6"										
											Total Depth = 55 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.954002, Long. -101.730960

LOG OF BORING GEO-34

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/4/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 14	15									CLAYEY SAND (SC), light brown, medium dense, dry to moist, fine grained, calcareous
5	N = 17	12									Grading brown, iron stained
	N = 11	32									LEAN CLAY (CL), trace Sand, light brown to gray, stiff, moist
10	N = 23	22									CLAYEY SAND (SC), light brown to gray, medium dense, moist, fine grained
	N = 32	24									LEAN CLAY (CL), with Sand, brown, hard, moist, iron stained
15	N = 33										CLAYEY SAND (SC), light brown to brown, dense, dry to moist, fine grained
20	N = 23										LEAN CLAY (CL), trace Sand, dark brown to brown, very stiff, dry to moist, iron stained, trace organics
25	N = 27										Grading light brown, with Lignite interbeddings
30	N = 61										SILT (ML), trace Sand, gray to light gray, hard, dry to moist
35	N = 78/9"										SHALE, dark brown to black, very hard, dry to moist, with Lignite interbeddings
40	N = 56										SILTSTONE, dark brown, medium hard to hard, dry to moist, trace organics
45	N = 48										Organic grades out; grading gray to light gray
50	N = 90/8"										CLAYSTONE, dark gray to gray, very hard, dry to moist, trace Lignite
55	N = 50/6"										
											Total Depth = 55 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.954983, Long. -101.724356

LOG OF BORING GEO-35

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/3/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 30 ft. during drilling and not measured immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 5	30									LEAN CLAY (CL), trace Sand, dark brown, medium stiff, moist, trace organics
5	N = 8	24									SANDY LEAN CLAY (CL), dark brown, medium stiff, moist, iron stained, trace organics
	N = 7	51									LEAN CLAY (CL), with Sand, brown, medium stiff to very stiff, dry to moist, iron stained, with Lignite interbeddings, trace organics
10	N = 29	26									Grading gray
	N = 27	23									
15	N = 24										
20	N = 35										POORLY-GRADED SAND (SP), dark brown, dense, dry to moist, fine grained
25	N = 44										Grading iron stained
30	N = 21	▽									LEAN CLAY (CL), trace Sand, gray, very stiff to hard, moist to wet, trace organics
35	N = 26										
40	N = 24										
45	N = 46										
50	N = 31										
55	N = 37										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.944218, Long. -101.753027

LOG OF BORING GEO-36

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/5/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 12 ft. during drilling and measured at 47 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
			N = 18	14									6 in. Topsoil LEAN CLAY (CL), with Sand, brown to dark gray, very stiff, moist, iron stained, trace organics
	5		N = 6	16									CLAYEY SAND (SC), brown to gray, very loose to very dense, dry to moist, fine grained
			N = 9	21									
	10		N = 50/2"	6									
			N = 50/2"	10									Grading wet
	15		N = WOH										Grading trace organics
			P = 4.0	30	63	26	37	93	0.93	4.1	0.0	100	FAT CLAY (CH), trace Sand, gray, medium stiff to hard, moist to wet, trace organics
	20		N = 24										Grading with Sand, brown
	25		N = 21										
	30		N = 25										
	35		N = 21										
	40		N = 32										
	45		N = 35										Grading dark gray
	50		N = 29										Grading dark brown
	55		N = 34										
													Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.941605, Long. -101.746654

LOG OF BORING GEO-37

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/4/2025 - 5/5/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA			LABORATORY DATA									
DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
												5 in. Topsoil
	X	N = 13	21									LEAN CLAY (CL), trace Sand, light brown, stiff to very stiff, moist, iron stained
5	X	N = 20	22									
	X	N = 17	24									
10	X	N = 5	97									LIGNITE, black, medium stiff to very stiff, moist, trace organics
	X	N = 43	47				65	2.66	3.5	0.0		
15	X	N = 17										LEAN CLAY (CL), trace Sand, gray, very stiff, dry to moist
20	X	N = 49										
25	X	N = 33										POORLY-GRADED SAND (SP), gray, dense, dry to moist, fine grained
30	X	N = 50/6"										LIGNITE, black, hard, dry to moist
35	X	N = 50/6"										
40	X	N = 43										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist
45	X	N = 43										SILT (ML), trace Sand, gray, hard, dry to moist
50	X	N = 42										
	X	N = 50/2"										
												Total Depth = 54.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.942772, Long. -101.740419

LOG OF BORING GEO-38

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/4/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

Depth (ft)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											6 in. Topsoil
	N = 13	12									LEAN CLAY (CL), with Sand, light brown to brown, soft to hard, dry to moist, trace roots
5	N = 5	15									Grading dark brown
	N = 4	23									Grading brown
10	P = +4.5										Grading light brown
	N = 14	21	38	17	21					85	Grading trace Sand, brown, iron stained
15	N = 26										Grading light brown to brown
20	N = 22										CLAYEY SAND (SC), brown, medium dense to very dense, dry to moist, fine grained, iron stained
25	N = 38										
30	N = 53										
35	N = 68/10"										
40	N = 71/9"										SANDSTONE, gray, very hard, dry to moist, fine grained
	N = 50/2"										
											Total Depth = 42.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.940587, Long. -101.731712

LOG OF BORING GEO-39

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/4/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 49 ft. during drilling and measured at 54 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 7	19									LEAN CLAY (CL), with Sand, dark brown to brown, medium stiff, moist
5	N = 13	20									SILT (ML), trace Sand, light gray, stiff, moist
	N = 18	20									LEAN CLAY (CL), trace Sand, brown to light gray, very stiff to hard, dry to moist
10	N = 19	21									
	N = 56										
15	N = 25										Grading with Sand, dark brown to brown
20	N = 46										CLAYEY SAND (SC), brown, dense to very dense, dry to moist, fine grained
25	N = 67										Grading trace Gravel, fine to coarse grained
30	N = 79/11"										SANDSTONE, brown to light brown, very hard, dry to moist, fine grained, iron stained
35	N = 75/10"										Grading dark gray to brown
											SANDY CLAYSTONE, gray, medium hard, dry to moist
40	N = 48										SANDSTONE, gray, medium hard to very hard, fine grained
45	N = 81/8"										
50	N = 68										Grading wet
55	N = 79/8"										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.945336, Long. -101.725459

LOG OF BORING GEO-40

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/27/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)
	N = 9	9								
5	N = 7	15								
	N = 13	17								
10	N = 17	16								
	N = 67									
15	N = 49									
20	N = 42									
25	N = 57									
30	N = 33									
35	N = 50/6"									
40	N = 95									
45	N = 87									
50	N = 50/6"									
55	N = 50/5"									

DESCRIPTION OF STRATUM

- 6 in. Topsoil
- SANDY SILT (ML), light brown, loose, dry to moist
- SILTY SAND (SM), light brown, dry to moist, fine grained
- LEAN CLAY (CL), with Sand, brown to light brown, medium stiff, moist
- CLAYEY SAND (SC), brown, medium dense to dense, dry to moist, fine to medium grained, iron stained
- POORLY-GRADED SAND (SP), light brown to yellowish brown, dense to very dense, dry to moist, fine grained

Total depth = 55 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.939113, Long. -101.709620

LOG OF BORING GEO-42

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/10/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 30 ft. during drilling and measured at 54 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											5 in. Topsoil
	N = 12	18									LEAN CLAY (CL), trace Sand, brown, stiff, moist, iron stained, calcareous
5	N = 11	22									SANDY LEAN CLAY (CL), brown, stiff to hard, dry to moist, calcareous
	N = 17	22									Grading iron stained
10	N = 21	21									
	P = +4.5										
15	N = 23										
	N = 28										
20	N = 38										CLAYEY SAND (SC), brown, dense to very dense, dry to moist, fine grained
25	N = 37										
30	N = 47										Grading gray, trace organics Grading wet
35	N = 76/11"										
40	N = 75/11"										
45	N = 44										
50	N = 46										
55	N = 48										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.940888, Long. -101.695081

LOG OF BORING GEO-43

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/7/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 11	13									CLAYEY SAND (SC), light brown, medium dense to very dense, dry to moist, fine grained, calcareous
5	N = 29	14									Grading brown, iron stained
	N = 33	13									
10											
	N = 35	12									Grading gray to brown
	N = 80										
15	N = 44										
20	N = 52										Grading light brown to brown
25	N = 69										
30	N = 62										
35	N = 92										
40	N = 80										Grading gray to brown
45	N = 85/10"										
50	N = 81/10"										
55	N = 71										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.939567, Long. -101.785665

LOG OF BORING GEO-44

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/27/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA: DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0	N = 14	15									3 in. Topsoil LEAN CLAY (CL), with Sand, light brown, stiff to very stiff, moist, calcareous
5	N = 19	22									Grading trace organics
	N = 93/9"	19									CLAYEY SAND (SC), brown, very dense, dry to moist, fine grained, iron stained
10	N = 50/5"	2									
	N = 27	21									SANDY LEAN CLAY (CL), brown to gray, very stiff, dry to moist, iron stained, trace organics
15	N = 23										
20	N = 53										LEAN CLAY (CL), trace Sand, brown to light brown, hard, dry to moist
25	N = 9										LIGNITE, black, stiff to hard, dry to moist
	N = 80/11"										
30	N = 29										SILT (ML), trace Sand, gray, stiff to hard, dry to moist, trace Lignite
35	N = 35										
40	N = 34										
45	N = 34										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist
50	N = 64										Grading with Sand
55	N = 83										Grading Lignite beddings
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.937839, Long. -101.767572

LOG OF BORING GEO-45

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/27/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0	N = 20	16									3 in. Topsoil; CLAYEY SAND (SC), light brown, medium dense, moist, fine grained, calcareous
5	N = 22	20									SANDY LEAN CLAY (CL), light brown to brown, very stiff, moist, iron stained, calcareous, trace organics
	N = 17	23									LEAN CLAY (CL), trace Sand, light brown, very stiff, moist, iron stained, calcareous, trace organics
10	N = 18	18									SANDY LEAN CLAY (CL), light brown to gray, very stiff to hard, dry to moist, iron stained
	N = 38										
15	N = 34										CLAYEY SAND (SC), gray to brown, dense, dry to moist, fine grained, iron stained
20	N = 23										LEAN CLAY (CL), trace Sand, brown, very stiff to hard, dry to moist, iron stained, trace organics
25	N = 59										Grading gray
30	N = 56										
35	N = 58										
40	N = 83/11"										SANDSTONE, light brown, very hard, dry to moist, fine grained
45	N = 84/9"										
50	N = 93/10"										
55	N = 88/10"										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.935204, Long. -101.795228

LOG OF BORING GEO-46

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/26/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	N = 14	12									LEAN CLAY (CL), with Sand, light brown, stiff to very stiff, moist, trace Lignite
		16	41	18	23					84	
5	N = 29	19									Grading light brown to brown, iron stained
	N = 15	31									Grading trace Sand, gray to brown, trace organics
10	N = 17	19									
	N = 34	23	69	18	51	104	6.21	10.1	10.0	82	FAT CLAY (CH), with Sand, gray to brown, hard, moist
15	N = 30										SANDY LEAN CLAY (CL), light gray to brown, very stiff, dry to moist
20	N = 18										LEAN CLAY (CL), trace Sand, light gray to dark brown, very stiff to hard, dry to moist, trace organics
25	N = 38										Grading with Sand
30	N = 47										SANDY LEAN CLAY (CL), light brown to brown, hard, dry to moist, iron stained
35	N = 65										Grading light gray
40	N = 78/10"										SANDY CLAYSTONE, light gray to brown, very hard, dry to moist
45	N = 50/5"										SANDSTONE, light gray to brown, very hard, dry to moist, fine to medium grained, weakly cemented
50	N = 50/6"										
55	N = 50/4"										Total Depth = 55 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.93259, Long. -101.787606

LOG OF BORING GEO-47

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/27/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 45 ft. during drilling and measured at 48 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											2 in. Topsoil
	N = 18	8									CLAYEY SAND (SC), light brown, medium dense to very dense, dry to moist, fine grained, calcareous
5	N = 74	7									
	N = 58	11									SANDY LEAN CLAY (CL), light brown, hard, dry to moist
10	N = 51	14									
	N = 49	13									CLAYEY SAND (SC), light brown, dense, dry to moist, fine grained
15	N = 39										SANDY LEAN CLAY (CL), light brown, hard, dry to moist
20	N = 50										CLAYEY SAND (SC), light brown, dense to very dense, dry to moist, fine grained
25	N = 52										Grading gray
30	N = 47										
35	N = 45										
40	N = 58										
45	N = 56										Grading wet
50	N = 66										LIGNITE, dark brown, hard, moist
55	N = 36										LEAN CLAY (CL), with Sand, gray, hard, moist, calcareous
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.932651, Long. -101.777749

LOG OF BORING GEO-48

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/5/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

Depth (ft)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	Moisture Content (%)	LL	PL	PI	Dry Density Pounds/Cu.Ft	Compressive Strength (Tons/Sq. Ft)	Strain at Failure (%)	Confining Pressure (Pounds/Sq In)	Minus No. 200 Sieve (%)	Description of Stratum
											6 in. Topsoil
	N = 13	20									FAT CLAY (CH), trace Sand, brown to gray, stiff to hard, moist
		23	71	23	48					96	
5	N = 15	22									Grading with Sand, iron stained
	N = 19	22									
10	N = 31	17									CLAYEY SAND (SC), brown to gray, dense, dry to moist, fine grained, iron stained
	N = 37	19									Grading yellowish brown
15	N = 42										
20	N = 55										LEAN CLAY (CL), trace Sand, brown to dark brown, hard, dry to moist, with Lignite, trace organics
25	N = 33										Grading gray
30	N = 83										POORLY-GRADED SAND (SP-SM), with Silt, yellowish brown, very dense, dry to moist, fine grained
35	N = 50/1"										LIMESTONE, light yellowish brown, very hard, dry to moist, calcareous
40	N = 67										SANDSTONE, yellowish brown, hard to very hard, dry to moist, fine grained, weakly to moderately cemented
45	N = 93/11"										
50	N = 91/7"										
	N = 25/0"										Refusal at 52 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.922342, Long. -101.767967

LOG OF BORING GEO-49

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/6/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 18	12									LEAN CLAY (CL), with Sand, light brown, very stiff, dry to moist, calcareous
5	N = 6	22									SANDY LEAN CLAY (CL), light brown to yellowish brown, medium stiff to stiff, moist
	N = 14	21									Grading brown to gray
10	N = 14	22									LEAN CLAY (CL), with Sand, brown to gray, stiff to hard, dry to moist, iron stained
	N = 55										Grading trace organics
15	N = 34										SANDY ELASTIC SILT (MH), brown to gray, medium stiff to hard, dry to moist, iron stained, calcareous
20	N = 28										Grading trace organics
25	N = 40										Calcareous feature and organic grades out; grading with Lignite
30	N = 6	81	88	69	19					62	
	N = 50/4"										Grading dark brown
35	N = 32										LEAN CLAY (CL), trace Sand, dark brown to gray, very stiff to hard, dry to moist, iron stained, trace Lignite and organics
40	N = 30										Organic grades out; grading with Sand, calcareous
45	N = 31										
50	N = 33										SANDY LEAN CLAY (CL), gray, hard, dry to moist, calcareous
55	N = 32										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.926427, Long. -101.762738

LOG OF BORING GEO-50

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/8/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

Depth (ft)	Field Data (N: blows/ft; P: tons/sq ft; T: blows; R: %; RQD: %)	Moisture Content (%)	LL	PL	PI	Dry Density (pounds/cu.ft)	Compressive Strength (tons/sq. ft)	Strain at Failure (%)	Confining Pressure (pounds/sq in)	Minus No. 200 Sieve (%)	Description of Stratum
0–0.5											6 in. Topsoil
0.5–7	N = 9	19									LEAN CLAY (CL), trace Sand, brown to gray, stiff, moist, calcareous
	N = 12	22									Grading iron stained
7–29	N = 7	26 37									FAT CLAY (CH), trace Sand, dark brown to gray, medium stiff to hard, dry to moist, calcareous, with Lignite
	N = 16	23									Grading brown
	P = +4.5										Grading with Shale
	N = 39	20	52	20	32	107				99	
	N = 29										
	N = 34										Grading brown to gray
29–34	N = 86										SANDY LEAN CLAY (CL), dark brown to gray, hard, dry to moist, trace Lignite
34–44	N = 46										LEAN CLAY (CL), trace Sand, dark brown to gray, hard, dry to moist, trace Lignite
	N = 41										
44–49	N = 40										SANDY LEAN CLAY (CL), gray, hard, dry to moist
49–55.5	N = 57										CLAYEY SAND (SC), gray, dense to very dense, dry to moist, fine grained
	N = 36										

Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.923447, Long. -101.751849

LOG OF BORING GEO-51

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/10/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											5 in. Topsoil
	N = 9	12									SANDY LEAN CLAY (CL), light brown, stiff, dry to moist, iron stained, calcareous
5	N = 13	26									LEAN CLAY (CL), with Sand, gray to brown, stiff to hard, dry to moist, iron stained
	N = 19	23									Grading trace Sand, light brown to yellowish brown, trace organics
10	N = 16	22									Grading light brown to brown
	P = +4.5										
15	N = 18										
20	N = 72/7"										
25	N = 30										Grading light gray
30	N = 42										Grading with Sand, light brown to gray
35	N = 40										Grading trace Sand, gray to dark gray
40	N = 40										
45	N = 44										
50	N = 59										Grading with Lignite interbeddings
55	N = 50/6"										
											Total Depth = 55 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.922422, Long. -101.730508

LOG OF BORING GEO-52

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/8/2025 - 5/10/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 15	16									SANDY LEAN CLAY (CL), brown to gray, stiff, moist, calcareous
5	N = 21	17									LEAN CLAY (CL), with Sand, brown to gray, stiff to very stiff, moist
	N = 14	20									Grading trace Sand, light brown to light gray, trace organics
10	N = 22	48									Grading dark brown, with Lignite
	N = 50	19									CLAYEY SAND (SC), light brown, dense, moist, fine grained, trace organics
15	N = 32										LEAN CLAY (CL), trace Sand, brown, hard, dry to moist, iron stained
20	N = 50/6"										SILTY SAND (SM), brown, very dense, dry to moist, fine grained, trace organics
25	N = 43										LEAN CLAY (CL), trace Sand, dark brown, hard, dry to moist, with Lignite, trace organics
30	N = 36										SANDY LEAN CLAY (CL), brown, hard, dry to moist, iron stained
35	N = 81										CLAYEY SAND (SC), light brown, dense to very dense, dry to moist, fine grained
40	N = 69										Grading brown to gray
45	N = 42										
50	N = 37										Grading light brown to gray
55	N = 56										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.923094, Long. -101.724068

LOG OF BORING GEO-53

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/6/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											5 in. Topsoil
	N = 11	16									FAT CLAY (CH), trace Sand, light brown, medium stiff to stiff, moist, calcareous
		17	54	19	35					93	
5	N = 7	22									Calcareous feature grades out; grading with Sand, iron stained
	N = 6	23									Grading trace organics
10	P = +4.5										SANDY SILT (ML), black, loose, dry to moist, trace organics
	N = 13	98	NP	NP	NP	34				66	
15	N = 34										LEAN CLAY (CL), trace Sand, gray to brown, stiff to hard, dry to moist, iron stained, with Lignite
20	N = 9										Grading dark brown, with Lignite interbeddings
	P = +4.5	26				94					
25	N = 35										Grading gray, calcareous
30	N = 28										Grading dark gray
35	N = 35										Lignite grades out
40	N = 42										
45	N = 33										
50	N = 51										Grading with Lignite interbeddings
55	N = 59										CLAYEY SAND (SC), gray, very dense, dry to moist, fine grained
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.922764, Long. -101.713804

LOG OF BORING GEO-54

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/27/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 21	22									LEAN CLAY (CL), with Sand, yellowish brown, very stiff, moist, iron stained
											SILTY SAND (SM), light brown, dry to moist, fine grained
5	N = 20	22									LEAN CLAY (CL), with Sand, light brown, very stiff, moist
	N = 34	18									CLAYEY SAND (SC), light brown to brown, medium dense to dense, moist, fine grained, iron stained
10	N = 25	21									
	N = 15	56									LEAN CLAY (CL), trace Sand, dark brown to black, stiff, moist, with Lignite interbeddings
15	N = 89										SANDY LEAN CLAY (CL), light brown, hard, dry to moist, with Lignite beddings
20	N = 21										CLAYEY SAND (SC), brown to gray, medium dense, dry to moist, fine grained
25	N = 50										LEAN CLAY (CL), trace Sand, light gray, hard, dry to moist, trace organics
30	N = 54										Grading light gray to dark gray
35	N = 45										Organic grades out
40	N = 37										
45	N = 55										
50	N = 40										
55	N = 40										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.922576, Long. -101.705791

RENEWABLE LOG - LOG A GNNL01.GDT - 4/22/26 14:50 - C:\USERS\JOHNVILLARINO\RRC COMPANIES\GEOTECHNICAL ENGINEERING - DATABASES\03.GINT\PROJECTS\2025\LONGSPUR WIND PROJECT-GE2503026\LONGSPUR WIND PROJECT-GE2503026.GPJ

LOG OF BORING GEO-56

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/8/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											6 in. Topsoil
	N = 18	16									LEAN CLAY (CL), trace Sand, light brown, very stiff to hard, dry to moist
5	N = 20	19									
	N = 27	26									Grading dark brown, with occasional Shale fragments, trace organics
10	N = 18	42									Grading gray to dark brown
	P = +4.5										
15	N = 39										Grading with Sand, brown to gray, iron stained
20	N = 84/10"										
25	N = 57										Grading trace Sand, dark gray to gray, with Lignite interbeddings
30	N = 72										
35	N = 47										SANDY LEAN CLAY (CL), light gray to gray, hard, dry to moist, trace organics
40	N = 34										LEAN CLAY (CL), trace Sand, light gray to gray, hard, dry to moist
45	N = 41										Grading light gray to black, with Lignite interbeddings
50	N = 54										Grading with Sand, trace organics
55	N = 35										SANDY LEAN CLAY (CL), dark gray to gray, hard, dry to moist, trace organics
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.907994, Long. -101.725116

LOG OF BORING GEO-57

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/7/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											4 in. Topsoil
	N = 19	11									LEAN CLAY (CL), with Sand, light brown, very stiff to hard, dry to moist, calcareous
5	N = 50/2"	14									
	N = 29	20									Grading trace Sand, light brown
10	N = 24	20									
	N = 29	19									Grading light brown to gray
15	N = 33										
											LIGNITE, black, hard, dry to moist
20	N = 74/9"										LEAN CLAY (CL), trace Sand, light gray to gray, hard, dry to moist, trace organics
25	N = 38										Grading dark gray to gray, with Lignite interbeddings
30	N = 50/4"										Grading gray to black
35	N = 40										Grading light gray
40	N = 42										
45	N = 50/3"										Grading gray
50	N = 39										
55	N = 47										Lignite and organic grades out
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.910611, Long. -101.712133

LOG OF BORING GEO-58

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/27/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											6 in. Topsoil
	N = 11	21									LEAN CLAY (CL), with Sand, light brown, stiff, moist
5	N = 10	24									
	N = 38	13									CLAYEY SAND (SC), light brown, medium dense to dense, dry to moist, fine grained
10	N = 25	10									
	N = 37	24									SANDY LEAN CLAY (CL), brown to gray, hard, dry to moist
15	N = 50/1"										
	N = 33										
20	N = 35										LEAN CLAY (CL), trace Sand, gray to brown, hard, dry to moist, iron stained, trace Lignite
25	N = 43										SANDY LEAN CLAY (CL), brown, very stiff to hard, dry to moist, iron stained
30	N = 27										Grading dark brown, trace organics
35	N = 41										LEAN CLAY (CL), trace Sand, dark brown to black, hard, dry to moist, with Lignite bedding
40	N = 44										CLAYEY SAND (SC), light gray to gray, dense, dry to moist, fine grained
45	N = 39										LEAN CLAY (CL), trace Sand, light gray to gray, hard, dry to moist
50	N = 59										
55	N = 42										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.915340, Long. -101.703733

LOG OF BORING GEO-59

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/26/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 34 ft. during drilling and not measured immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	FIELD DATA: N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 11	17									FAT CLAY (CH), trace Sand, light brown, stiff to very stiff, moist
		21	54	20	34					98	
5	N = 17	20									LEAN CLAY (CL), trace Sand, light brown to gray, very stiff, moist, iron stained
	N = 20	22									Grading with Sand, trace calcite
10	N = 25	13									SANDY SILT (ML), light brown, medium dense to dense, dry to moist
	N = 65										
15	N = 49										SILTY SAND (SM), light brown, dense, dry to moist, fine grained
20	N = 56										LEAN CLAY (CL), trace Sand, light brown, hard, dry to moist
25	N = 72										SILTY SAND (SM), light brown to gray, very dense, dry to moist, fine to medium grained
30	N = 60										
											POORLY-GRADED SAND (SP), light brown, very dense, moist to wet, fine grained
35	N = 59										Grading brown
40	N = 68										Grading Lignite and Shale bedding
45	N = 55										
50	N = 23										LEAN CLAY (CL), with Sand, gray, very stiff to hard, moist, with Lignite bedding
55	N = 35										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.911737, Long. -101.695736

LOG OF BORING GEO-60

RRC
RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/25/2025 - 4/26/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)
	N = 5	9								
5	N = 15	21								
	N = 24	25								
10	N = 19	25								
	N = 49									
15	N = 24									
20	N = 30									
25	N = 37									
30	N = 36									
35	N = 60									
40	N = 42									
45	N = 50/5"									
50	N = 46									
55	N = 42									

DESCRIPTION OF STRATUM

6 in. Topsoil

SILTY SAND (SM), light brown, loose to medium dense, dry to moist, fine grained

SANDY LEAN CLAY(CL), light brown, very stiff, dry to moist

Grading calcareous

Grading brown to dark brown

Grading brown to gray

LEAN CLAY (CL), trace Sand, gray to brown, hard, dry to moist

Grading gray to light gray, trace organics

SILT (ML), trace Sand, gray, hard, dry to moist, with Lignite and Sandstone interbeddings

LEAN CLAY (CL), with Sand, gray, hard, dry to moist

Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.918971, Long. -101.692604

LOG OF BORING GEO-61

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/25/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 24 ft. during drilling and not measured immediately after drilling

SURFACE ELEVATION (FT):

Depth (ft)	N: BLOWS/FT / P: TONS/SQ FT / T: BLOWS / R: % / RQD: %	Moisture Content (%)	LL	PL	PI	Dry Density (pounds/cu.ft)	Compressive Strength (tons/sq. ft)	Strain at Failure (%)	Confining Pressure (pounds/sq in)	Minus No. 200 Sieve (%)	Description of Stratum
0–0.5											6 in. Topsoil
0.5–4	N = 8	19									SANDY LEAN CLAY (CL), dark brown to brown, medium stiff, moist
4–39	N = 22	15									CLAYEY SAND (SC), light brown, medium dense to very dense, dry to moist, fine grained, iron stained Grading light brown to brown
	N = 26	14									
	N = 23	27									
	N = 54										
	N = 40										Grading dark brown to brown
	N = 42										
	N = 70										Grading wet
	N = 42										
	N = 79										Grading gray to brown
39–45	N = 58										SANDY LEAN CLAY (CL), gray to light gray, hard, moist
	N = 67/11"										
45–55.5	N = 52										LEAN CLAY (CL), trace Sand, gray to light gray, hard, moist, with Lignite interbeddings Grading dark brown, with Lignite beddings Grading light gray
	N = 44										

Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.909107, Long. -101.683665

LOG OF BORING GEO-62

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/6/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 34 ft. during drilling and measured at 52 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											3 in. Topsoil
	N = 4	13									CLAYEY SAND (SC), light brown, loose, dry to moist, fine grained, calcareous
		8	26	18	8					49	
5	N = 9	12									
	N = 4	27									SANDY LEAN CLAY (CL), brown, soft, moist
10	N = 19	22									FAT CLAY (CH), trace Sand, brown, very stiff to hard, dry to moist
	N = 29	21	56	23	33	105	4.51	6.6	10.0	91	Grading dark brown to gray
15	N = 39										Grading light gray
20	N = 21										Grading iron stained
25	P = +4.5	25				101					
30	N = 34										
35	N = 32										Grading wet
40	N = 47										
45	N = 39										
50	N = 70/7"										Grading gray
55	N = 35										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.908346, Long. -101.677053

LOG OF BORING GEO-63

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/7/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 19	9									LEAN CLAY (CL), with Sand, light brown, stiff to hard, dry to moist, calcareous
5	N = 11	28									Grading light brown to yellowish brown, iron stained
	N = 17	21									Grading trace Sand
10	N = 22	20									
	N = 16	23									Grading with Sand, brown
15	N = 35										
20	N = 21										Grading trace Sand, gray to dark brown, with Lignite interbedding
25	N = 36										
30	N = 32										Grading dark brown to light brown
35	N = 31										Grading brown
40	N = 34										
45	N = 28										CLAYEY SAND (SC), gray to brown, medium dense, dry to moist, fine grained
50	N = 47										SANDY LEAN CLAY (CL), light gray, hard, dry to moist
55	N = 42										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.903390, Long. -101.708697

LOG OF BORING GEO-64

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/24/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0–0.5											6 in. Topsoil
0.5–7	N = 9	17									SANDY LEAN CLAY (CL), light brown, stiff to very stiff, moist
5	N = 27	21									
7–24	N = 28	22 23									LEAN CLAY (CL), with Sand, light brown, very stiff to hard, dry to moist, iron stained
10	N = 27	23									Grading trace Sand, with Lignite seems
	N = 28	26									Grading dark gray to gray
15	N = 34										Grading dark brown, with Lignite bedding
20	N = 31										
24–25	N = 50/4"										LIGNITE, dark brown, hard, dry to moist
25–29											SILT (ML), with Sand, gray, hard, dry to moist
30	N = 42										SANDY LEAN CLAY (CL), gray to dark gray, hard, dry to moist
35	N = 36										
40	N = 39										
45	N = 96/10"										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist, with Lignite bedding
50	N = 44										
55	N = 41										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.903570, Long. -101.686788

LOG OF BORING GEO-65

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/8/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 11	11									SANDY LEAN CLAY (CL), light brown, medium stiff to stiff, dry to moist, calcareous
5	N = 8	27									Grading trace organics
	N = 6	33									CLAYEY SAND (SC), brown, loose, moist, fine grained, trace organics
10	N = 31	25									LEAN CLAY (CL), with Sand, brown to gray, very stiff to hard, dry to moist
	N = 32	25									Grading light brown
15	N = 16										Grading trace Sand
20	N = 48										
25	N = 22										Grading dark gray, iron stained
30	N = 34										
35	N = 27										
40	N = 34										
45	N = 69/10"										
50	N = 50/5"										
55	N = 33										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.897699, Long. -101.696096

RENEWABLE LOG - LOG A GNNL01.GDT - 4/22/26 14:50 - C:\USERS\JOHNVILLARINO\RRC COMPANIES\GEOTECHNICAL ENGINEERING - DATABASES\03.GINT\PROJECTS\2025\LONGSPUR WIND PROJECT-GE2503026\LONGSPUR WIND PROJECT-GE2503026.GPJ

LOG OF BORING GEO-66

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/23/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA			LABORATORY DATA									
SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													9 in. Topsoil
			N = 5	15									SANDY LEAN CLAY (CL), light brown, medium stiff to stiff, moist, calcareous, trace roots
	5		N = 6	20									
			N = 14	17									Grading light brown to gray
	10		N = 11	28									FAT CLAY (CH), trace Sand, light gray to brown, stiff to hard, dry to moist, iron stained
			P = 4.5	22	52	22	30	104	6.24	5.8	10.0	100	
	15		N = 25										
	20		N = 26										SANDY LEAN CLAY (CL), light gray to brown, very stiff, dry to moist, iron stained
	25		N = 37										LEAN CLAY (CL), trace Sand, light gray to brown, hard, dry to moist, iron stained
	30		N = 48										SANDY LEAN CLAY (CL), light gray to brown, hard, dry to moist, iron stained
	35		N = 56										LEAN CLAY (CL), with Sand, light brown, hard, dry to moist, iron stained
	40		N = 55										
	45		N = 58										
	50		N = 35										SILT (ML), trace Sand, dark gray to gray, hard, dry to moist
	55		N = 54										
													Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.896434, Long. -101.676574

LOG OF BORING GEO-67

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/25/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 45 ft. during drilling and not measured immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 13	14									LEAN CLAY (CL), trace Sand, light brown to brown, stiff to very stiff, dry to moist, calcareous
		14	43	21	22					97	
5	N = 26	20									
	N = 26	20									Grading iron stained
10	N = 25	18									
	N = 48										
15	N = 23										SANDY LEAN CLAY (CL), brown, very stiff, dry to moist, iron stained
20	N = 32										LEAN CLAY (CL), with Sand, light brown to brown, hard, dry to moist
25	N = 38										Grading trace Sand, iron stained
30	N = 46										Grading light gray to brown
35	N = 41										Iron stain grades out; grading dark gray to gray
40	N = 72/11"										
45	N = 60										SANDY LEAN CLAY (CL), light brown to brown, hard, dry to moist, trace organics Grading wet
50	N = 34										LEAN CLAY (CL), with Sand, bluish gray to gray, hard, moist
55	N = 40										SANDY LEAN CLAY (CL), bluish gray to gray, hard, moist
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.897586, Long. -101.664957

LOG OF BORING GEO-68

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/23/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0–0.75											9 in. Topsoil
	N = 19	15									LEAN CLAY (CL), with Sand, light brown, very stiff, moist, iron stained, calcareous
5	N = 26	20									
	N = 35	20									SANDY LEAN CLAY (CL), brown to gray, hard, moist, iron stained
10	N = 32	19									LEAN CLAY (CL), with Sand, brown to gray, very stiff to hard, dry to moist, iron stained, with Lignite
	N = 25	22									Grading trace Sand, calcareous, trace Lignite
15	N = 54										
20	N = 28										Lignite grades out; grading trace Calcite
25	N = 39										
30	N = 42										Calcite grades out
35	N = 46										Grading light brown to gray
40	N = 81/11"										
45	N = 50										Grading with Sand
50	N = 73										
	N = 50/4"										
											Total Depth = 54.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.896070, Long. -101.651180

LOG OF BORING GEO-69

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/24/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	N = 20	24									6 in. Topsoil SILTY SAND (SM), light brown, medium dense, moist, fine grained
5	N = 25	17									Grading dark brown, with Lignite seams LEAN CLAY (CL), with Sand, light gray to brown, very stiff to hard, moist, iron stained, trace Calcite
	N = 18	23									
10	N = 18	25									Grading trace Sand
	P = N/A	25				95	4.60	3.5	0.0		
15	N = 22										SANDY LEAN CLAY (CL), light brown, very stiff, dry to moist
20	N = 68										SILT (ML), trace Sand, light brown, hard, dry to moist Grading dark brown, with Lignite beddings
25	N = 26										LEAN CLAY (CL), with Sand, dark brown, very stiff, dry to moist, with Lignite beddings
30	N = 32										SILTY SAND (SM), gray, dense, dry to moist, fine grained
35	N = 39										LEAN CLAY (CL), trace Sand, light gray to gray, very stiff to hard, dry to moist, with Lignite seams
40	N = 41										
45	N = 30										
50	N = 39										
55	N = 40										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.890090, Long. -101.683948

LOG OF BORING GEO-70

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/24/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 34 ft. during drilling and not measured immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 22	14									FAT CLAY (CH), trace Sand, light brown, very stiff, moist, calcareous
		16	61	20	41					99	
5	N = 20	19									
											SANDY SILT (ML), light brown, medium dense, dry to moist
	N = 22	11									SANDY LEAN CLAY (CL), light brown to gray, very stiff, dry to moist, calcareous
10	N = 18	15									
											LEAN CLAY (CL), trace Sand, light brown to gray, stiff to very stiff, dry to moist
	N = 34	26									
15	N = 14										Grading dark brown, trace Lignite bedding
20	N = 26										SANDY LEAN CLAY (CL), light brown to gray, very stiff to hard, dry to moist
25	N = 33										Grading brown
30	N = 43										
35	N = 50/4"										LIGNITE, dark brown, hard, moist to wet
											SILT (ML), trace Sand, gray, hard, moist to wet
40	N = 37										
45	N = 35										SANDY LEAN CLAY (CL), gray, hard, moist
50	N = 49										LEAN CLAY (CL), trace Sand, dark gray to light gray, hard, moist
55	N = 51										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.881269, Long. -101.690206

LOG OF BORING GEO-71

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/3/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 25 ft. during drilling and not measured immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											4 in. Topsoil
	N = 7	14									CLAYEY SAND (SC), brown, loose to very dense, dry to moist, fine grained, iron stained
5	N = 8	11									Grading light brown
	N = 50/3"	12									
10	N = 34	14									SANDY LEAN CLAY (CL), light brown to gray, hard, moist, trace organics
	N = 30										CLAYEY SAND (SC), gray, medium dense, dry to moist, fine grained
15	N = 17										LEAN CLAY (CL), with Sand, gray to brown, very stiff, dry to moist, trace organics
20	N = 25										Organic grades out; grading iron stained
	N = 41										
25	N = 28										Grading trace Sand, dark gray to light gray, trace organics; Grading wet
30	N = 38										CLAYEY SAND (SC), light gray to gray, dense, moist, fine grained
35	N = 30										LEAN CLAY (CL), with Sand, light gray, very stiff to hard, moist
40	N = 36										Grading light gray to gray, trace organics
45	N = 61										Grading trace Sand, gray to dark gray
50	N = 44										Grading light gray to gray
55	N = 38										Organic grades out
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.951278, Long. -101.767572

LOG OF BORING GEO-72

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 3/18/2026

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 19 ft. during drilling and measured at 6 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 6										CLAYEY SAND (SC), brown to reddish brown, loose to medium dense, dry to moist, fine to medium grained, iron stained
5	N = 5										Grading gray
	N = 11										
10	N = 18										
	N = 35										
15	N = 19										
20	N = 15										LEAN CLAY (CL), with Sand, dark gray to gray, stiff to hard, moist to wet
25	N = 33										
30	N = 45										
35	N = 24										Grading trace Sand, trace Lignite
40	N = 40										
45	N = 23										
50	N = 39										
55	N = 70/10"										Grading with Lignite
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.951464, Long. -101.767567

LOG OF BORING GEO-73

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 3/18/2026

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0–7		N = 7										6 in. Topsoil
		N = 4										LEAN CLAY (CL), trace Sand, brown to dark brown, soft to medium stiff, dry to moist
7–15		N = 6										SANDY LEAN CLAY (CL), olive to gray, medium stiff to very stiff, dry to moist
		N = 10										Grading iron stained
		P = 4.0										
15–29		N = 14										LEAN CLAY (CL), trace Sand, light brown to brown, stiff to very stiff, dry to moist
		N = 22										
		N = 27										Grading with Sand
29–39		N = 33										SANDY LEAN CLAY (CL), light gray to brown, hard, dry to moist
		N = 36										
39–55.5		N = 50/3"										SANDSTONE, gray to brown, medium hard to very hard, dry to moist, fine to medium grained, weakly cemented
		N = 42										
		N = 45										
		N = 57										
												Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.940581, Long. -101.732158

RENEWABLE LOG - LOG A GNNL01.GDT - 4/22/26 14:50 - C:\USERS\JOHNVILLARINO\RRC COMPANIES\GEOTECHNICAL ENGINEERING - DATABASES\03.GINT\PROJECTS\2025\LONGSPUR WIND PROJECT-GE2503026\LONGSPUR WIND PROJECT-GE2503026.GPJ

LOG OF BORING GEO-74

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 1/30/2026

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													6 in. Topsoil
		X	N = 50/2"	22									SILT (ML), with Sand, brown, very stiff to hard, dry to moist
	5	X	N = 19	23									Grading trace Lignite
		X	N = 25	22									Grading calcareous
	10	X	N = 31	21									
		X	N = 30	16									LEAN CLAY (CL), trace Sand, brown to gray, hard, dry to moist, iron stained, calcareous, trace Lignite
	15	X	N = 35										
	20	X	N = 35										
	25	X	N = 52										Grading dark brown to black
	30	X	N = 36										Grading dark gray to gray
	35	X	N = 36										
	40	X	N = 43										
	45	X	N = 39										SILTSTONE, gray, medium hard to very hard, dry to moist, calcareous
	50	X	N = 75/7"										Grading trace Lignite
		X	N = 50/5"										Grading dark brown to black
													Total Depth = 54.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.937832, Long. -101.766825

LOG OF BORING GEO-75

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 3/17/2026

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 18										LEAN CLAY (CL), trace Sand, brown to gray, stiff to very stiff, dry to moist
5	N = 24										Grading yellowish brown to gray, trace organics
	N = 23										Grading Lignite interlayers
10	N = 27										Grading with Sand, light brown to gray
	N = 30										
15	N = 11										Grading trace Sand, brown to dark brown
20	N = 30										SILTSTONE, light gray to gray, medium hard to hard, dry to moist
25	N = 72										
30	N = 70										
35	N = 52										
40	N = 68										
45	N = 74										
50	N = 68										
55	N = 52										Grading with Lignite interlayers
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.923032, Long. -101.767480

LOG OF BORING GEO-76

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 3/17/2026

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											5 in. Topsoil
	N = 10										LEAN CLAY (CL), trace Sand, brown to dark brown, stiff to hard, dry to moist, trace organics
5	N = 10										Grading yellowish brown, with Coal
	N = 29										Grading with Lignite interlayers
10	N = 18										Grading brown to dark gray, trace Coal
	N = 27										Grading with Sand
15	N = 39										Grading trace Sand, brown to dark brown
20	N = 50/2"										SILTSTONE, gray, medium hard to very hard, dry to moist
25	N = 34										Grading light gray
30	N = 34										
35	N = 36										
40	N = 48										CLAYSTONE, light gray, medium hard to hard, dry to moist, trace Lignite
45	N = 54										Grading light gray to gray
50	N = 41										
55	N = 42										Grading with Lignite
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.907995, Long. -101.724410

LOG OF BORING GEO-77

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 1/29/2026
DRILLING METHOD(S): Hollow Stem Auger
GROUNDWATER INFORMATION: Groundwater not encountered during or immediately after drilling
SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											8 in. Topsoil
	N = 20	25									LEAN CLAY (CL), with Sand, light brown, medium stiff to hard, dry to moist
5	N = 8	19									
	N = 16	23									Grading gray, iron stained, calcareous
10	N = 12	25									
	N = 31	17	37	18	19	112	6.42	12.5	10.0	89	Grading trace Sand
15	N = 43										Grading dark brown, trace Lignite
20	N = 36										Grading light brown
25	N = 36										Grading gray to brown
30	N = 44										
35	N = 55										
40	N = 62										
45	N = 69										
50	N = 62										
55	N = 99/9"										
											Total Depth = 55.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.895876, Long. -101.651185

LOG OF BORING PMM-1

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/11/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											6 in. Topsoil
											LEAN CLAY (CL), with Sand, dark brown, stiff to very stiff, dry to moist
	N = 14										
5	N = 10										Grading trace Sand, gray to brown, calcareous
	N = 31										Grading iron stained
10	N = 23										SANDY LEAN CLAY (CL), light brown to brown, very stiff, dry to moist, iron stained
	N = 32										CLAYEY SAND (SC), light brown to brown, medium dense to dense, dry to moist, fine grained, iron stained
15	N = 21										
20	N = 26										Grading gray to brown
25	N = 29										
30	N = 27										LEAN CLAY (CL), trace Sand, gray to dark gray, very stiff to hard, dry to moist, with Lignite
35	N = 38										Grading light gray
											Total Depth = 35.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.976921, Long. -101.747421

LOG OF BORING PMM-2

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/5/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											6 in. Topsoil
	N = 18										SANDY LEAN CLAY (CL), with Gravel, brown to light brown, very stiff, dry to moist, iron stained, calcareous
5	N = 8	25	77	22	55					100	FAT CLAY (CH), trace Sand, light brown to gray, medium stiff to hard, dry to moist
	P = 3.0										
10	N = 14										Grading with Sand
	N = 17										Grading trace Sand, iron stained
15	N = 18										
20	N = 20										
25	N = 22										Grading calcareous, trace organics
30	N = 34										
35	N = 50/5"										Grading dark brown, with Lignite
											Total Depth = 35 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.938197, Long. -101.755101

LOG OF BORING PMM-3

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/7/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													4 in. Topsoil
			N = 19										SANDY SILT (ML), light brown, medium dense, dry to moist, calcareous
	5		N = 19										LEAN CLAY (CL), with Sand, brown to gray, very stiff to hard, dry to moist, iron stained
			N = 65										Grading trace Sand, dark brown
	10		N = 34										
			N = 47										
	15		N = 47										Grading trace organic
	20		N = 43										
	25		N = 40										
	30		N = 52										Grading dark brown to gray
			N = 50/6"										LIGNITE, black, hard, dry to moist, trace organics
													Total Depth = 34.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.894397, Long. -101.662007

LOG OF BORING ADLS-2

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/7/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 13										SILTY SAND (SM), light brown, medium dense to dense, dry to moist, fine grained
5	N = 32										
	N = 36										
10	N = 56										
	N = 22										LEAN CLAY (CL), trace Sand, gray, very stiff, dry to moist, iron stained, trace organics
15	N = 37										SILTY SAND (SM), light brown, dense, dry to moist, fine grained
20	N = 39										CLAYEY SAND (SC), light brown, dense, dry to moist, fine grained
25	N = 36										LEAN CLAY (CL), trace Sand, dark gray to gray, hard, dry to moist, iron stained, calcareous
30	N = 37										SILT (ML), trace Sand, gray, hard, dry to moist, iron stained, calcareous
35	N = 43										LEAN CLAY (CL), trace Sand, dark gray, hard, dry to moist
											Total Depth = 35.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.927981, Long. -101.795351

LOG OF BORING MET-3

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/23/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													9 in. Topsoil
			N = 11										SANDY LEAN CLAY (CL), light brown, stiff to hard, dry to moist, iron stained, calcareous
	5		P = 4.5										
			N = 26										SANDY SILT (ML), light brown to light gray, medium dense, dry to moist, iron stained
	10		N = 21										LEAN CLAY (CL), trace Sand, brown to gray, very stiff, dry to moist, iron stained, trace organics
			N = 21										LIGNITE, dark brown, very stiff, dry to moist
	15		N = 27										LEAN CLAY (CL), trace Sand, gray to brown, very stiff, dry to moist, iron stained, trace Lignite
	20		N = 39										SANDY LEAN CLAY (CL), light brown to gray, hard, dry to moist, iron stained
	25		N = 65										Grading with Sandstone beddings
	30		N = 43										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist, trace Lignite
			N = 50/4"										LIGNITE, dark brown, hard, dry to moist, iron stained, trace organics
													Total Depth = 34.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.894016, Long. -101.661035

LOG OF BORING O&M-1

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/3/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 18 ft. during drilling and measured at 25 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											4 in. Topsoil
	N = 6	17									CLAYEY SAND (SC), dark brown, loose to medium dense, dry to moist, fine grained, calcareous
5	N = 17	10									Grading brown, iron stained
	N = 9	19				100	0.32	1.8	5.5		
10	N = 23										Calcareous feature grades out; grading gray to light brown
	N = 50/3"										POORLY-GRADED SAND (SP-SM), with Silt, gray to light brown, very dense, dry to moist, fine grained
15	N = 30										CLAYEY SAND (SC), light brown, medium dense to dense, dry to moist, fine grained
											Grading wet
20	N = 42										Grading light brown to brown, iron stained
25	N = 20										LEAN CLAY (CL), with Sand, dark gray, very stiff, moist to wet
30	N = 21										Grading gray, trace organics
35	N = 50/5"										SANDY CLAYSTONE, gray, very hard, moist
											Total Depth = 35 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.950414, Long. -101.762334

LOG OF BORING SUB-1

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S): Solid Stem Auger

GROUNDWATER INFORMATION: Groundwater encountered at 19.5 ft. during drilling and measured at 33 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													3 in. Topsoil
			N = 6	11									SILTY SAND (SM), light brown, loose, dry to moist, fine grained
	5		N = 30	14									POORLY-GRADED SAND (SP), light brown to dark brown, medium dense, dry to moist, fine to medium grained
			N = 16										Grading iron stained
	10		N = 49										
			N = 30										CLAYEY SAND (SC), light gray to brown, medium dense to dense, dry to moist, fine to medium grained
	15		N = 40										
	20		N = 38										Grading gray Grading wet
	25		N = 73										LIGNITE, gray, hard, moist to wet
	30		N = 26										LEAN CLAY (CL), trace Sand, light gray to dark brown, very stiff to hard, moist to wet
	35		N = 38										
	40		N = 41										
													Total Depth = 40.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955712, Long. -101.761785

LOG OF BORING SUB-2

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 14 ft. during drilling and measured at 35 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											2 in. Topsoil
	N = 7	7									SANDY LEAN CLAY (CL), dark brown, medium stiff, dry to moist
		14	37	14	23					51	
5	N = 9	14	NP	NP	NP					20	SILTY SAND (SM), light brown, loose, moist, fine grained
	N = 32										POORLY-GRADED SAND (SP), brown, medium dense, dry to moist, fine to medium grained, iron stained
10	N = 27										CLAYEY SAND (SC), light gray to brown, medium dense to dense, dry to moist, fine to medium grained
	N = 52										Grading dark brown
15	N = 39										Grading wet
20	N = 40										POORLY-GRADED SAND (SP), dark brown, dense, moist to wet, fine grained, trace Lignite and organics
25	N = 85										CLAYEY SAND (SC), dark brown to brown, very dense, moist to wet, fine to medium grained, with Lignite interbeddings
30	N = 41										LEAN CLAY (CL), trace Sand, dark brown to brown, hard, moist to wet
35	N = 51										CLAYEY SAND (SC), light gray, dense to very dense, moist to wet, fine grained
40	N = 45										
											Total Depth = 40.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955535, Long. -101.762072

LOG OF BORING SUB-3

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 14 ft. during drilling and measured at 36 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											2 in. Topsoil
	N = 6										SILTY, CLAYEY SAND (SC-SM), dark brown to brown, loose, dry to moist, fine grained
5	P = 1.5	15	21	16	5	108	1.62	14.3	3.0	20	Grading light brown
	N = 14										CLAYEY SAND (SC), dark brown to brown, medium dense to dense, dry to moist, fine to medium grained, iron stained
10	N = 28										
	N = 33										
15	N = 42										Grading gray, wet
20	N = 44										Grading light gray
25	N = 29										LEAN CLAY (CL), trace Sand, light gray to gray, very stiff to hard, moist to wet
30	N = 33										
35	N = 50										SANDY LEAN CLAY (CL), light gray to gray, hard, moist to wet
40	N = 79										
											Total Depth = 40.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955049, Long. -101.762273

LOG OF BORING SUB-4

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 12 ft. during drilling and measured at 33 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											2 in. Topsoil
0–4	N = 5										SANDY LEAN CLAY (CL), dark brown to brown, medium stiff, dry to moist, trace roots
4–34	N = 5										CLAYEY SAND (SC), light brown to gray, loose to dense, dry to moist, fine grained
	N = 22										
	N = 23										
	N = 37										Grading wet
	N = 46										
	N = 33										
	N = 39										Grading dark gray, fine to medium grained
	N = 46										Grading trace organics
34–40.5	N = 38										LEAN CLAY (CL), trace Sand, dark gray to gray, very stiff to hard, moist
	N = 30										
											Total Depth = 40.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955054, Long. -101.761848

LOG OF BORING SUB-5

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/29/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 12.5 ft. during drilling and measured at 30 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											3 in. Topsoil
	N = 5										SANDY LEAN CLAY (CL), light gray to gray, medium stiff, dry to moist
5	N = 6										CLAYEY SAND (SC), dark brown to light gray, loose to dense, dry to moist, fine grained, iron stained
	N = 14										
10	N = 9										
	N = 30										Grading wet
15	N = 36										Grading dark gray
20	N = 31										
25	N = 44										LEAN CLAY (CL), trace Sand, dark brown, hard, moist to wet
30	N = 41										Grading light gray
35	N = 35										
40	N = 42										
											Total Depth = 40.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.954784, Long. -101.761958

LOG OF BORING SUB-6

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 19 ft. during drilling and measured at 29 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	FIELD DATA: N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											3 in. Topsoil
											SILTY SAND (SM), light brown, medium dense to dense, dry to moist, fine grained, iron stained
	N = 11										
5	P = 2.5	6	NP	NP	NP	101				27	
	N = 12										
10	N = 30										
	N = 31										
15	N = 50/6"										LEAN CLAY (CL), with Sand, brown, hard, dry to moist
20	N = 50										CLAYEY SAND (SC), light brown to dark brown, dense to very dense, moist to wet, fine to medium grained, iron stained
25	N = 59										Iron stain grades out; grading gray
30	N = 59										
35	N = 24										LEAN CLAY (CL), trace Sand, gray, very stiff to hard, moist
40	N = 44										Grading with Sand, trace organics
											Total Depth = 40.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955549, Long. -101.760791

LOG OF BORING SUB-7

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 13 ft. during drilling and measured at 34 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											2 in. Topsoil
	N = 3										SANDY LEAN CLAY (CL), brown, soft, dry to moist, trace roots
5	N = 14										CLAYEY SAND (SC), light brown to brown, medium dense to very dense, dry to moist, fine to medium grained
	N = 26										
10	N = 28										Grading dark brown
	N = 31										Grading wet
15	N = 70/10"										Grading trace organics
20	N = 62										Grading gray
25	N = 68										
30	N = 58										LEAN CLAY (CL), trace Sand, dark brown to gray, hard, moist to wet, with Lignite interbeddings
35	N = 44										Grading with Sand, light gray
40	N = 46										
											Total Depth = 40.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.9550580, Long. -101.761344

LOG OF BORING SUB-8

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 19 ft. during drilling and measured at 35 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (LL)	ATTERBERG LIMITS: PLASTIC LIMIT (PL)	ATTERBERG LIMITS: PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0												3 in. Topsoil
		X	N = 12										CLAYEY SAND (SC), brown, medium dense, dry to moist, fine grained, iron stained
	5	■	P = 3.0										
		X	N = 30										POORLY-GRADED SAND (SP), light brown to dark brown, medium dense to dense, dry to moist, fine grained
	10	X	N = 32										
		X	N = 35										CLAYEY SAND (SC), brown, dense to very dense, moist, fine to medium grained, iron stained
	15	X	N = 35										
	20	X	N = 40	▽									Grading wet
	25	X	N = 47										Grading light brown to gray
	30	X	N = 64										
	35	X	N = 36	▼									LEAN CLAY (CL), with Sand, dark gray to dark brown, hard, moist to wet, with Lignite interbeddings
	40	X	N = 36										Grading trace organics
													Total Depth = 40.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.954797, Long. -101.760801

LOG OF BORING SUB-9

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													2 in. Topsoil
			N = 11	6									CLAYEY SAND (SC), light brown to brown, loose to dense, dry to moist, fine grained, iron stained
	5		N = 8	6	24	16	8					23	Grading dark brown, trace roots
			N = 28										
	10		N = 27										Grading light brown, fine to medium grained
			N = 30										
	15		N = 49										
													Total Depth = 15.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.953917, Long. -101.761302

LOG OF BORING SUB-10

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													3 in. Topsoil
		X	N = 11										CLAYEY SAND (SC), light brown, medium dense to dense, dry to moist, fine grained
	5	X	N = 20										Grading brown
		X	N = 28										
	10	X	N = 33										Grading dark brown
		X	N = 42										
	15	X	N = 39										
													Total Depth = 15.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.953298, Long. -101.761288

LOG OF BORING HA-1

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													2 in. Topsoil
													SILTY SAND (SM), light brown, dry to moist, fine grained
	1												
	2												
	3												
	4												
	5												
													Total Depth = 5 ft.

(FIELD DATA: Soil Symbol through N/P/T/R/RQD; LABORATORY DATA: Moisture Content through Minus No. 200 Sieve; ATTERBERG LIMITS: LL, PL, PI)

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955771, Long. -101.762488

LOG OF BORING HA-2

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0												2 in. Topsoil
	0.2–5												SILTY SAND (SM), light brown, dry to moist, fine grained
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955782, Long. -101.761487

LOG OF BORING HA-3

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													4 in. Topsoil
													SILT (ML), trace Sand, reddish brown, dry to moist
	1												
													Grading light brown
	2												
	3												SILTY SAND (SM), light brown, dry to moist, fine grained
	4												
	5												
													Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955793, Long. -101.760486

LOG OF BORING HA-4

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0												2 in. Topsoil
													LEAN CLAY (CL), trace Sand, dark brown, dry to moist
	1												
	2												
	3												CLAYEY SAND (SC), light brown, dry to moist, fine grained
	4												
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955223, Long. -101.762475

LOG OF BORING HA-5

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													3 in. Topsoil
													SILT (ML), trace Sand, dark brown, dry to moist
	1												
	2												
	3												SILTY SAND (SM), light brown, dry to moist, fine grained
	4												
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955234, Long. -101.761474

LOG OF BORING HA-6

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													3 in. Topsoil
	1, 2, 3, 4												SILT (ML), trace Sand, light brown, dry to moist
	5												Total Depth = 5 ft.

FIELD DATA / LABORATORY DATA

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.955245, Long. -101.760473

LOG OF BORING HA-7

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0–0.25												3 in. Topsoil
	0.25–5												CLAYEY SAND (SC), light brown, dry to moist, fine grained
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.954675, Long. -101.762462

LOG OF BORING HA-8

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0												2 in. Topsoil
													SILTY SAND (SM), dark brown, dry to moist, fine grained
	1												
	2												
	3												CLAYEY SAND (SC), light brown, dry to moist, fine grained
	4												
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.954686, Long. -101.761461

LOG OF BORING HA-9

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0–0.25												3 in. Topsoil
	0.25–5												SILT (ML), trace Sand, light brown, dry to moist
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.954697, Long. -101.760460

LOG OF BORING HA-10

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0												SILTY SAND (SM), light brown, dry to moist, fine grained
	1												
	2												
	3												
	4												
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.954105, Long. -101.761659

LOG OF BORING HA-11

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0–5												SILTY SAND (SM), light brown, dry to moist, fine grained
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.954113, Long. -101.760954

LOG OF BORING HA-12

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0–5												SILTY SAND (SM), dark brown, dry to moist, fine grained
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.953607, Long. -101.761294

LOG OF BORING HA-13

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0–5												SILTY SAND (SM), light brown, dry to moist, fine grained
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.953102, Long. -101.761635

RENEWABLE LOG - LOG A GNNL01.GDT - 4/22/26 11:39 - C:\USERS\JOHNVILLARINO\RRC COMPANIES\GEOTECHNICAL ENGINEERING - DATABASES\03.GINT\PROJECTS\2025\LONGSPUR WIND PROJECT-GE2503026\LONGSPUR WIND PROJECT-GE2503026.GPJ

LOG OF BORING HA-14

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0–5												SILTY SAND (SM), dark brown, dry to moist, fine grained
	5												Total Depth = 5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.953109, Long. -101.760930

LOG OF BORING TL-1

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/29/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
			N = 23										3 in. Topsoil SANDY LEAN CLAY (CL), light brown, very stiff, dry to moist
	5		N = 42										CLAYEY SAND (SC), light brown, medium dense to very dense, dry to moist, fine grained
			N = 50/3"										
	10		N = 29										
			N = 20										
	15		N = 23										LEAN CLAY (CL), with Sand, light brown, very stiff to hard, dry to moist, iron stained
	20		N = 31										Grading trace Sand, dark brown to brown, trace organics
	25		N = 36										Grading gray to dark gray
	30		N = 48										
	35		N = 35										
	40		N = 50/4"										MUDSTONE, dark gray to gray, hard to very hard, dry to moist, trace organics
	45		N = 58										
	50		N = 67										
													Total Depth = 50.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.986205, Long. -101.766771

RENEWABLE LOG - LOG A GNNL01.GDT - 4/22/26 11:39 - C:\USERS\JOHNVILLARINO\RRC COMPANIES\GEOTECHNICAL ENGINEERING - DATABASES\03.GINT\PROJECTS\2025\LONGSPUR WIND PROJECT-GE2503026\LONGSPUR WIND PROJECT-GE2503026.GPJ

LOG OF BORING TL-2

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/29/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	SAMPLES / N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											3 in. Topsoil
	N = 5										FAT CLAY (CH), with Sand, light brown to gray, medium stiff to hard, dry to moist
5	P = 4.5										
	N = 24										LEAN CLAY (CL), with Sand, brown to light brown, very stiff, dry to moist, iron stained
10	N = 22										
	N = 30										
15	N = 26										Grading trace Sand, light gray to gray
20	N = 41										LIGNITE, dark brown to black, hard, dry to moist
25	N = 74										LEAN CLAY (CL), with Sand, gray, hard, dry to moist
30	N = 61										
											Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.984606, Long. -101.766776

LOG OF BORING TL-3

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/29/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											3 in. Topsoil
	N = 9										CLAYEY SAND (SC), brown, loose, dry to moist, fine grained
5	N = 18										FAT CLAY (CH), trace Sand, light brown to gray, stiff to hard, dry to moist
	N = 20										
10	P = 4.5										SILT (ML), with Sand, light brown to gray, hard, dry to moist
	N = 26										LEAN CLAY (CL), trace Sand, brown, very stiff to hard, dry to moist
15	N = 30										
20	N = 23										Grading iron stained, trace calcite and Lignite bedding
25	N = 33										Iron stained and Lignite grade out; grading calcareous
30	N = 26										LIGNITE, dark brown to black, very stiff, dry to moist
											Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.982158, Long. -101.766783

LOG OF BORING TL-4

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/29/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											3 in. Topsoil
	N = 6										LEAN CLAY (CL), with Sand, light brown to gray, medium stiff to hard, dry to moist
5	P = 0.75										
	N = 8										Grading trace Sand, light gray
10	P = 2.0										
	N = 24										Grading with Sand, gray to brown
15	N = 33										
20	N = 39										
25	N = 48										
30	N = 44										SANDY LEAN CLAY (CL), gray to dark gray, hard, dry to moist
35	N = 55										Grading dark gray
40	N = 60										Grading with organics
45	N = 54										CLAYEY SAND (SC), dark gray, very dense, dry to moist, fine grained, with organics
50	N = 54										Organic grades out
											Total Depth = 50.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.980259, Long. -101.766789

LOG OF BORING TL-5

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/29/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											3 in. Topsoil
	N = 12										LEAN CLAY (CL), trace Sand, light brown, stiff to very stiff, dry to moist, trace calcium
5	N = 9										Grading with Sand
	P = 2.75										
10	N = 13										Grading trace Sand
	N = 14										Grading iron stained
15	N = 26										SANDY LEAN CLAY (CL), light brown, very stiff, dry to moist
20	N = 51										CLAYEY SAND (SC), light brown, very dense, dry to moist, fine grained
25	N = 78										SILT (ML), with Sand, light brown to gray, hard, dry to moist
30	N = 34										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist

Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.980257, Long. -101.763791

LOG OF BORING TL-6

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													3 in. Topsoil
			N = 8										CLAYEY SAND (SC), light brown, loose to medium dense, dry to moist, fine grained
	5		N = 30										
			N = 8										LEAN CLAY (CL), with Sand, light brown to gray, medium stiff to hard, dry to moist, trace Lignite
	10		P = 4.5										
			N = 14										
	15		N = 39										Lignite grades out
	20		N = 23										
	25		N = 36										CLAYEY SAND (SC), light brown, dense, dry to moist, fine grained
	30		N = 33										
	35		N = 37										Grading gray
	40		N = 40										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist
	45		N = 41										SILT (ML), trace Sand, gray, hard, dry to moist
	50		N = 84/10"										
													Total Depth = 50.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.980255, Long. -101.760946

LOG OF BORING TL-7

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	SAMPLES / N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											6 in. Topsoil
	N = 5										SANDY FAT CLAY (CH), light brown, medium stiff, dry to moist
5	P = 3.5										LEAN CLAY (CL), with Sand, light brown, very stiff, dry to moist
	N = 16										Grading trace Sand
10	N = 20										
	N = 27										CLAYEY SAND (SC), light brown, medium dense to dense, dry to moist, fine grained
15	N = 24										
20	N = 43										
25	N = 41										LEAN CLAY (CL), trace Sand, gray, hard, dry to moist
30	N = 36										SILT (ML), trace Sand, gray, hard, dry to moist
											Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.978169, Long. -101.760927

LOG OF BORING TL-8

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 4/30/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
			N = 7										6 in. Topsoil SILTY SAND (SM), light brown, loose, dry to moist, fine grained
	5		N = 5										CLAYEY SAND (SC), light brown, loose to medium dense, dry to moist, fine grained
			N = 43										
	10		N = 36										
			N = 3										LEAN CLAY (CL), trace Sand, dark brown, soft to very stiff, dry to moist, trace organics Grading with Sand, light brown
	15		N = 16										
	20		N = 38										CLAYEY SAND (SC), light brown to light gray, dense, dry to moist, fine to medium grained, iron stained
	25		N = 42										LEAN CLAY (CL), trace Sand, gray to dark gray, hard, dry to moist
	30		N = 40										
													Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.976028, Long. -101.760909

LOG OF BORING TL-9

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	SAMPLES / N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											6 in. Topsoil
	N = 15										CLAYEY SAND (SC), light brown, medium dense, dry to moist, fine grained, iron stained
5	N = 14										
	P = +4.5										SANDY LEAN CLAY (CL), brown to gray, very stiff to hard, dry to moist
10	N = 24										CLAYEY SAND (SC), gray, medium dense to dense, dry to moist, fine grained
	N = 32										
15	N = 30										
20	N = 44										
25	N = 43										Grading light brown to brown, trace organics
30	N = 26										Grading light brown to gray
											Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.973915, Long. -101.760890

LOG OF BORING TL-10

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 24 ft. during drilling and measured at 24 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	0												6 in. Topsoil
		X	N = 7										CLAYEY SAND (SC), light brown, very loose to very dense, dry to moist, fine grained
	5	X	N = 2										
		X	N = 47										Grading iron stained
	10	X	N = 32										
		X	N = 23										
	15	X	N = 32										
	20	X	N = 51										
	25	X	N = 44	▼ (24 ft)									Grading wet
	30	X	N = 59										
													Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.971640, Long. -101.760870

LOG OF BORING TL-11

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/1/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 29 ft. during drilling and measured at 28 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	SAMPLES / N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											6 in. Topsoil
	N = 18										CLAYEY SAND (SC), light brown, loose to very dense, dry to moist, fine grained
5	N = 8										
	N = 17										
10	N = 33										
	N = 29										Grading iron stained
15	N = 28										
20	N = 31										Grading brown
25	N = 61										Grading gray to light brown
30	N = 58										Grading wet
											Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.969358, Long. -101.760850

LOG OF BORING TL-12

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/2/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 7 ft. during drilling and measured at 6.5 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0–0.5											6 in. Topsoil
0.5–7	N = 8										CLAYEY SAND (SC), light brown, loose, moist, fine grained
5	N = 6										Grading brown
7–9	N = 8										SANDY LEAN CLAY (CL), light brown, medium stiff, moist to wet, iron stained
9–12	N = 18										POORLY-GRADED SAND (SP-SC), with Clay, brown, medium dense, moist, fine to medium grained
12–24	N = 27 N = 33 N = 31										CLAYEY SAND (SC), brown to light brown, medium dense to dense, moist, fine to medium grained
24–29	N = 15										SILT (ML), trace Sand, dark gray, stiff, moist
29–30.5	N = 42										CLAYEY SAND (SC), trace Gravel, gray, dense, moist, fine to coarse grained
											Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.967150, Long. -101.760831

LOG OF BORING TL-13

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/2/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
0											6 in. Topsoil
	N = 13										CLAYEY SAND (SC), brown, medium dense, dry to moist, fine grained, iron stained, trace roots
5	N = 19										SANDY LEAN CLAY (CL), light brown, stiff, dry to moist, iron stained
	N = 22										CLAYEY SAND (SC), light brown, medium dense, dry to moist, fine grained
10	N = 13										FAT CLAY (CH), trace Sand, brown, stiff to hard, dry to moist, trace organics
	P = 4.5										
15	N = 17										LEAN CLAY (CL), trace Sand, gray to dark gray, very stiff, dry to moist
20	N = 27										Grading with Sand
25	N = 50/5"										CLAYSTONE, gray, medium hard to very hard, dry to moist
30	N = 68										Grading dark gray
35	N = 36										
40	N = 77/11"										LIGNITIC SHALE, dark brown, medium hard to very hard, dry to moist
45	N = 57										Grading gray to dark gray
50	N = 34										
											Total Depth = 50.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.964992, Long. -101.760812

LOG OF BORING TL-14

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026
DATE(S) DRILLED: 5/2/2025

DRILLING METHOD(S): Hollow Stem Auger

GROUNDWATER INFORMATION: Groundwater not encountered during or immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											6 in. Topsoil
	N = 8										CLAYEY SAND (SC), brown, loose to medium dense, dry to moist, fine grained, iron stained, trace roots
5	N = 5										Grading light brown, fine to medium grained, micaceous
	N = 21										
10	N = 25										
	N = 25										
15	N = 15										LEAN CLAY (CL), with Sand, gray to light brown, stiff to hard, dry to moist, iron stained
	P = 4.5										Grading trace Sand
20	N = 27										
25	N = 26										Grading with Sand
30	N = 23										Grading trace Sand
35	N = 31										
40	N = 50/2"										LIGNITIC SHALE, dark brown, medium hard to very hard, dry to moist
45	N = 49										Grading gray to dark gray
50	N = 48										Grading light gray
											Total Depth = 50.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.964315, Long. -101.761880

LOG OF BORING TL-15

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 5/6/2025

DRILLING METHOD(S):
Hollow Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 24 ft. during drilling and not measured immediately after drilling

SURFACE ELEVATION (FT):

SOIL SYMBOL	DEPTH (FT)	SAMPLES	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
													6 in. Topsoil
			N = 13										SILTY SAND (SM), brown, medium dense, dry to moist, fine grained
	5		N = 16										CLAYEY SAND (SC), light brown, loose, dry to moist, fine grained, iron stained
			N = 10										
	10		N = 45										SANDY LEAN CLAY (CL), brown, hard, dry to moist, iron stained
													Grading trace Sandstone fragments
			N = 50/6"										SILT (ML), trace Sand, light brown, hard, dry to moist
	15		N = 53										POORLY-GRADED SAND (SP), light brown, dense to very dense, dry to moist, fine grained, iron stained, micaceous
	20		N = 50										
	25		N = 55										Grading wet
	30		N = 32										Grading dark gray
													Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.962040, Long. -101.761888

LOG OF BORING TL-16

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/29/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 25 ft. during drilling and measured at 27 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA / LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											2 in. Topsoil
	N = 14										CLAYEY SAND (SC), light brown to brown, medium dense to dense, dry to moist, fine grained, iron stained, trace roots
5	N = 14										Grading light gray
	N = 49										Grading brown to dark brown
10	N = 43										
	N = 42										
15	N = 45										
20	N = 47										
25	N = 50										Grading wet
30	N = 91/10"										SANDSTONE, brown, very hard, moist, fine grained, weakly cemented
											Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.960133, Long. -101.761890

LOG OF BORING TL-17

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/29/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 12 ft. during drilling and measured at 24 ft. immediately after drilling

SURFACE ELEVATION (FT):

DEPTH (FT)	N: BLOWS/FT, P: TONS/SQ FT, T: BLOWS, R: %, RQD: %	MOISTURE CONTENT (%)	LL	PL	PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											3 in. Topsoil
	N = 6										LEAN CLAY (CL), with Sand, dark brown, medium stiff, dry to moist
5	N = 4										CLAYEY SAND (SC), light brown to light gray, loose to dense, dry to moist, fine to medium grained
	N = 8										Grading gray
10	N = 19										Grading brown, iron stained
	N = 59										Grading dark gray, wet
15	N = 30										
20	N = 33										
25	N = 35										LEAN CLAY (CL), with Sand, dark brown to gray, hard, moist to wet, trace organics
30	N = 35										Grading trace Sand, dark gray
											Total Depth = 30.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.958219, Long. -101.761891

LOG OF BORING TL-18

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

DATE(S) DRILLED: 4/29/2025

DRILLING METHOD(S):
Solid Stem Auger

GROUNDWATER INFORMATION:
Groundwater encountered at 10 ft. during drilling and measured at 47 ft. immediately after drilling

SURFACE ELEVATION (FT):

FIELD DATA | LABORATORY DATA

DEPTH (FT)	N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI	DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
											3 in. Topsoil
	N = 4										CLAYEY SAND (SC), light brown, very loose to very dense, dry to moist, fine grained
5	N = 3										Grading gray
	N = 12										
10	N = 27										Grading wet
	N = 36										
15	N = 49										Grading trace Lignite
20	N = 50/6"										Grading gray
25	N = 41										LIGNITE, dark brown, hard, moist to wet
30	N = 50										LEAN CLAY (CL), with Sand, gray, hard, moist to wet
35	N = 38										
40	N = 51										SILT (ML), trace Sand, gray, hard, moist to wet
45	N = 37										LEAN CLAY (CL), with Sand, gray, hard, moist to wet
50	N = 41										Grading trace Lignite
											Total Depth = 50.5 ft.

N - STANDARD PENETRATION TEST RESISTANCE
P - POCKET PENETROMETER RESISTANCE
T - TXDOT CONE PENETRATION RESISTANCE
R - ROCK CORE RECOVERY
RQD - ROCK QUALITY DESIGNATION

REMARKS:
GPS COORDINATES: Lat. 46.956549, Long. -101.761892

www.RRCcompanies.com

810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78661
512.992.2087

APPENDIX B

MOISTURE-DENSITY RELATIONSHIP

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026

Sample ID: **GEO-01 at 2.0 to 4.0 ft.**
Description of Material: **BROWN FAT CLAY(CH)**

Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **99.5 PCF**
Optimum Water Content **22.2 %**

ATTERBERG LIMITS

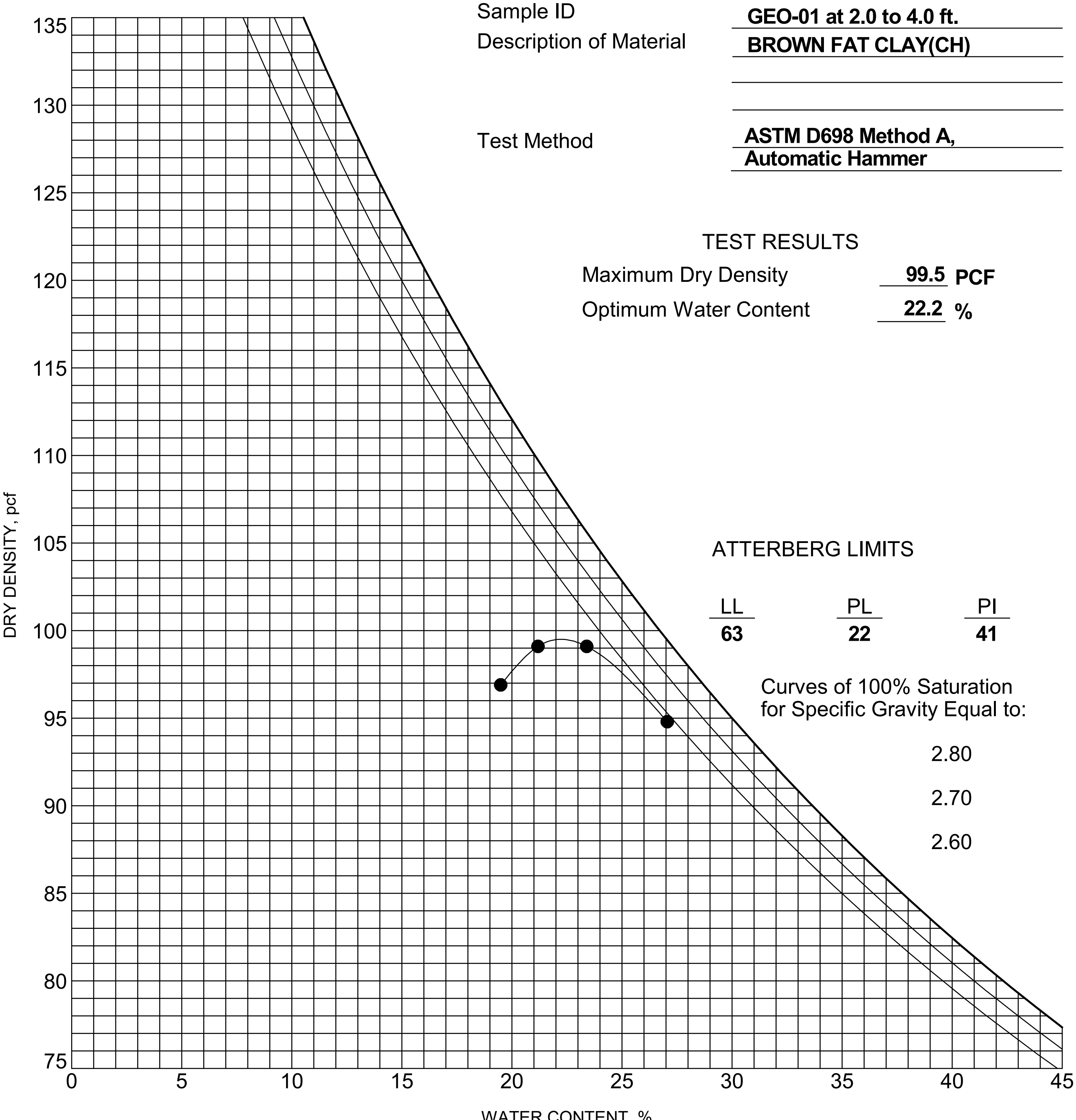
LL	PL	PI
63	**22**	**41**

Curves of 100% Saturation
for Specific Gravity Equal to:

2.80

2.70

2.60



Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

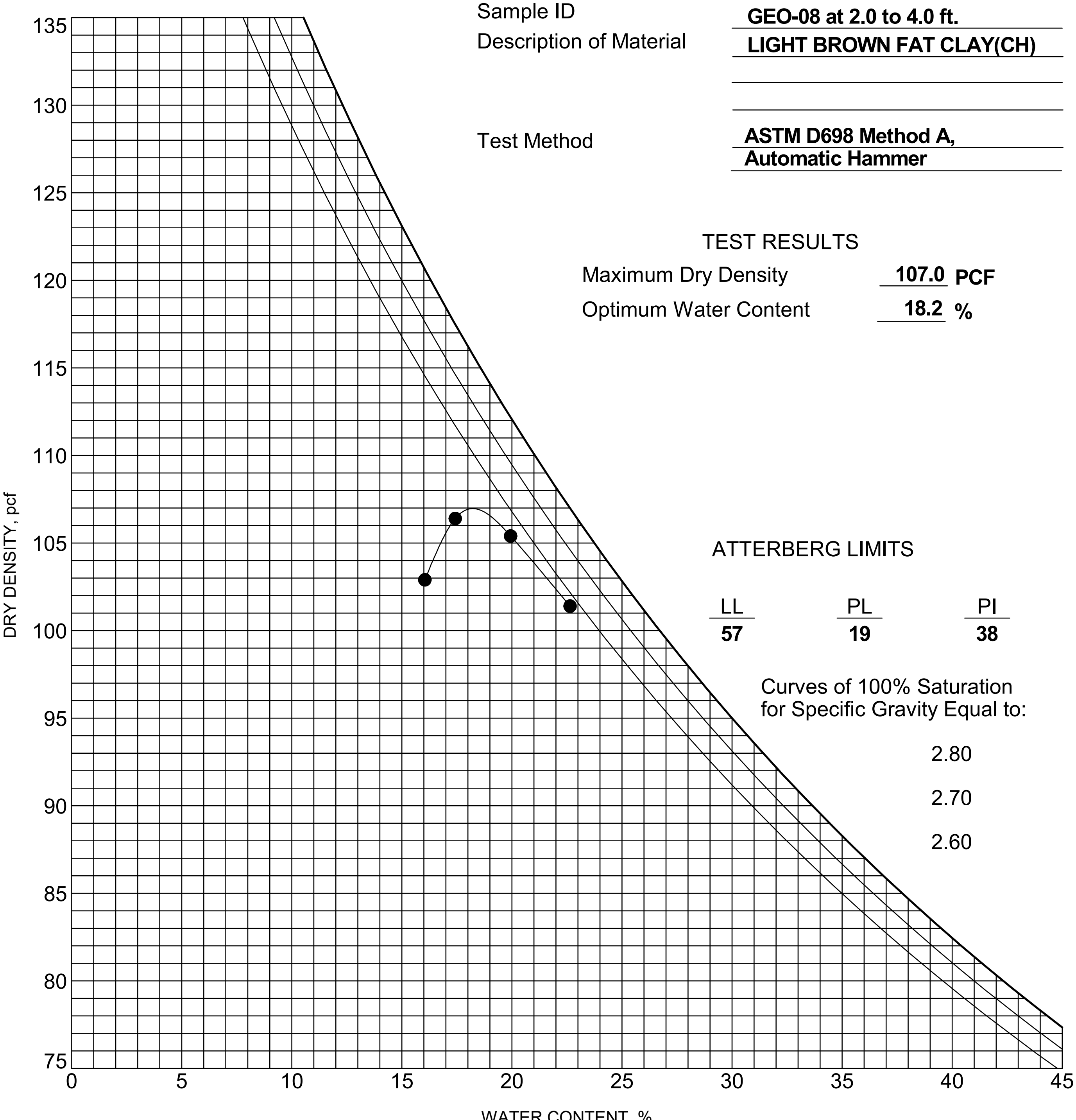
Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

BEYOND Engineering & Testing

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026



Sample ID **GEO-08 at 2.0 to 4.0 ft.**

Description of Material **LIGHT BROWN FAT CLAY(CH)**

Test Method **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **107.0** **PCF**

Optimum Water Content **18.2** **%**

ATTERBERG LIMITS

LL	PL	PI
57	**19**	**38**

Curves of 100% Saturation
for Specific Gravity Equal to:

2.80

2.70

2.60

Te-An Wang, 05/27/2025

Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026

Sample ID: **GEO-10 at 2.0 to 4.0 ft.**
Description of Material: **LIGHT BROWN FAT CLAY(CH)**

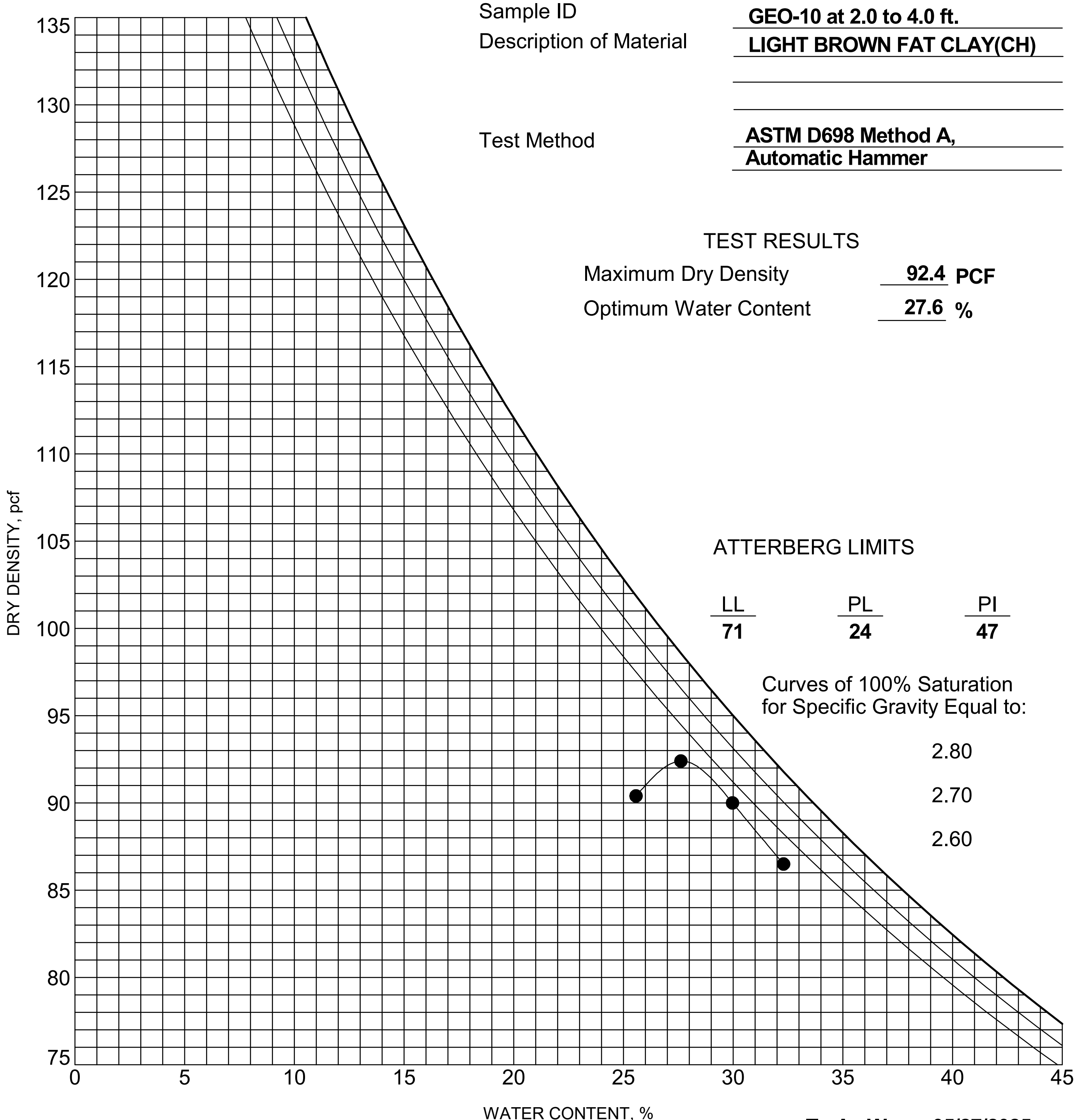
Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **92.4** **PCF**
Optimum Water Content **27.6** **%**

ATTERBERG LIMITS

LL	PL	PI
71	**24**	**47**



Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

BEYOND Engineering & Testing

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026

Sample ID: **GEO-19 at 2.0 to 4.0 ft.**

Description of Material: **LIGHT BROWN LEAN CLAY(CL)**

Test Method: **ASTM D698 Method A, Automatic Hammer**

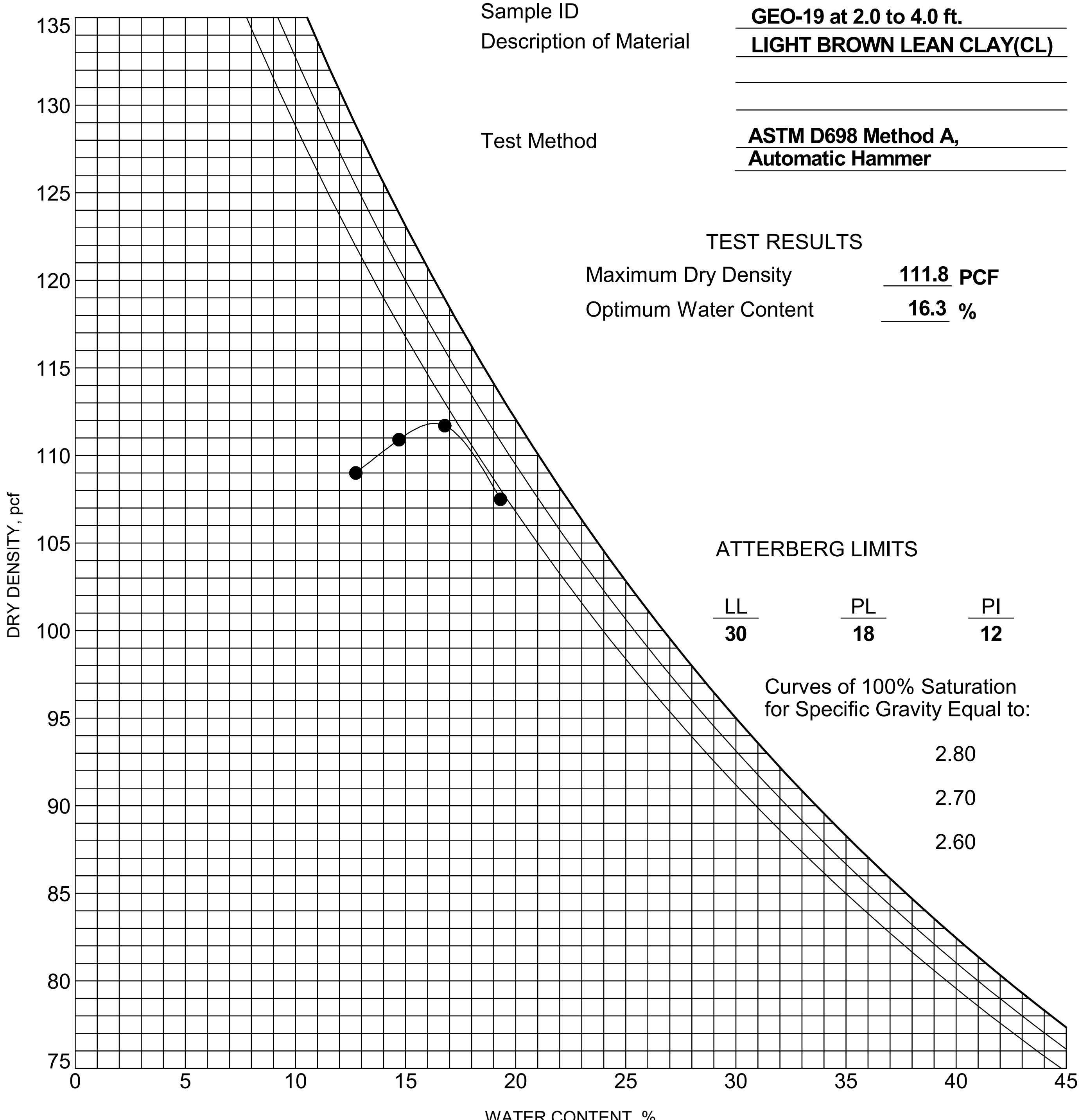
TEST RESULTS

Maximum Dry Density **111.8** **PCF**

Optimum Water Content **16.3** **%**

ATTERBERG LIMITS

LL	PL	PI
30	**18**	**12**



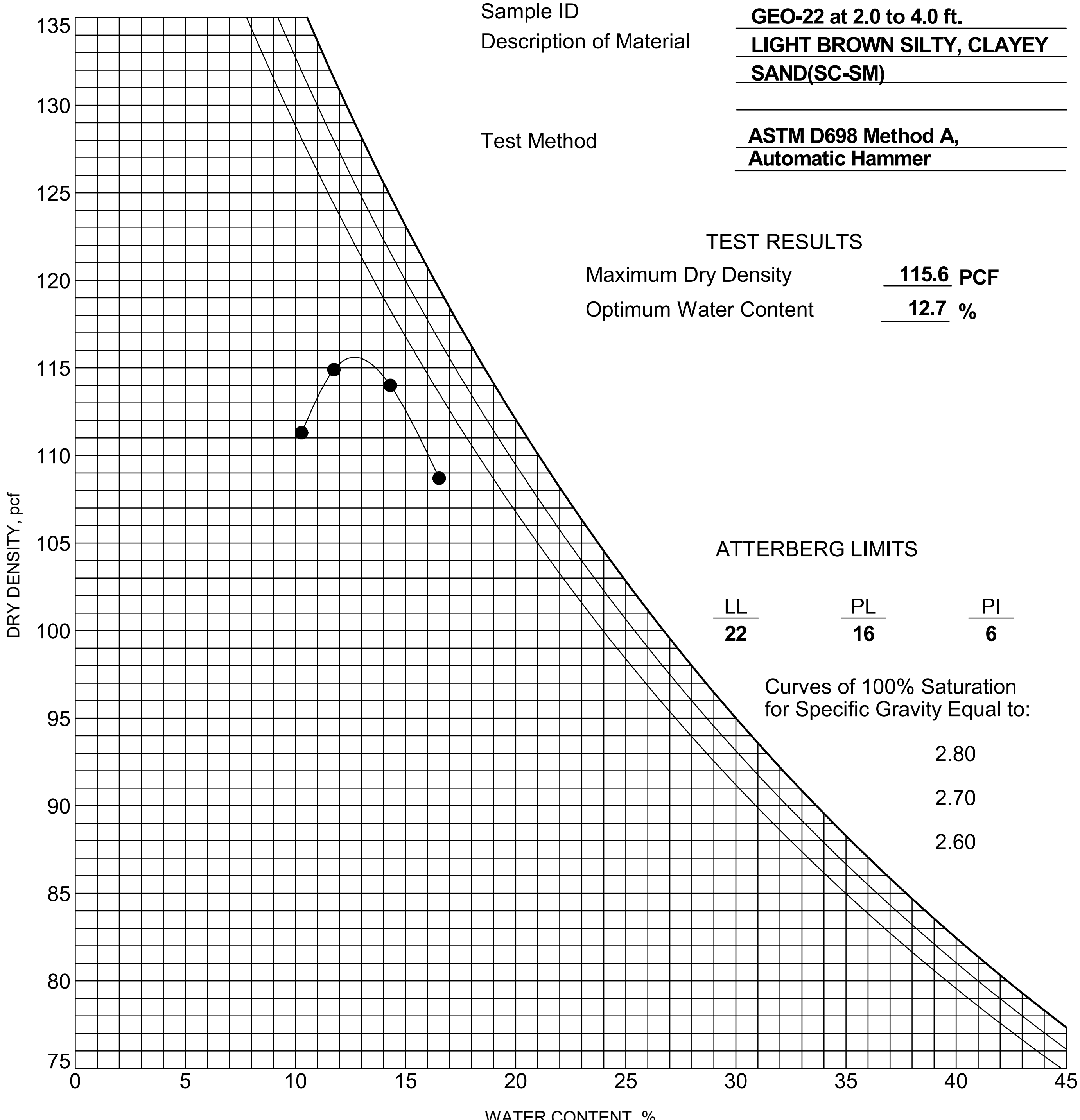
Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026



Sample ID: **GEO-22 at 2.0 to 4.0 ft.**

Description of Material: **LIGHT BROWN SILTY, CLAYEY SAND(SC-SM)**

Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **115.6 PCF**

Optimum Water Content **12.7 %**

ATTERBERG LIMITS

LL	PL	PI
22	**16**	**6**

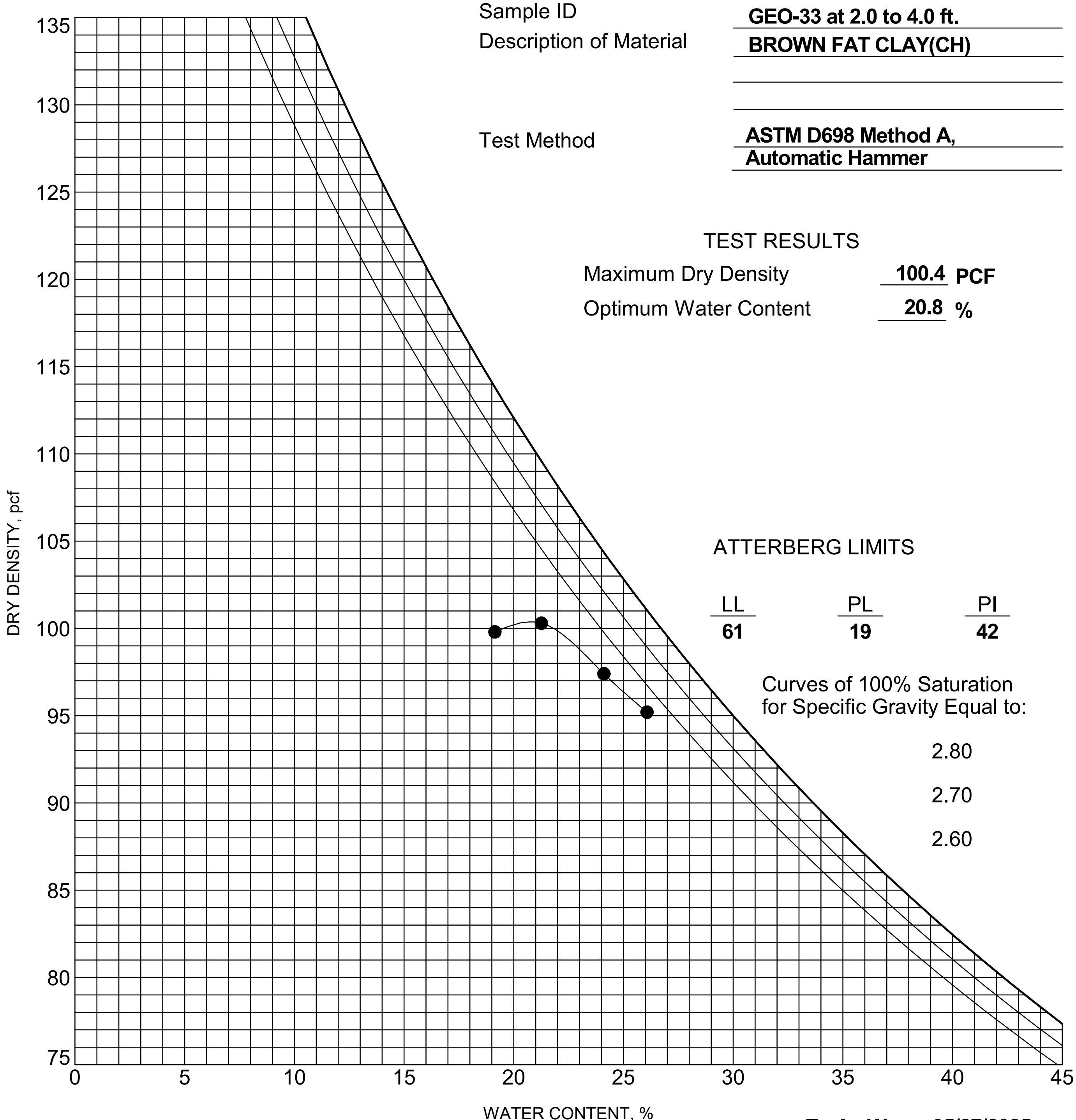
Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

BEYOND Engineering & Testing
Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026



Sample ID: **GEO-33 at 2.0 to 4.0 ft.**
Description of Material: **BROWN FAT CLAY(CH)**

Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **100.4** **PCF**
Optimum Water Content **20.8** **%**

ATTERBERG LIMITS

LL	PL	PI
61	**19**	**42**

Curves of 100% Saturation
for Specific Gravity Equal to:

2.80

2.70

2.60

Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

BEYOND Engineering & Testing

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026

Sample ID: **GEO-46 at 2.0 to 4.0 ft.**

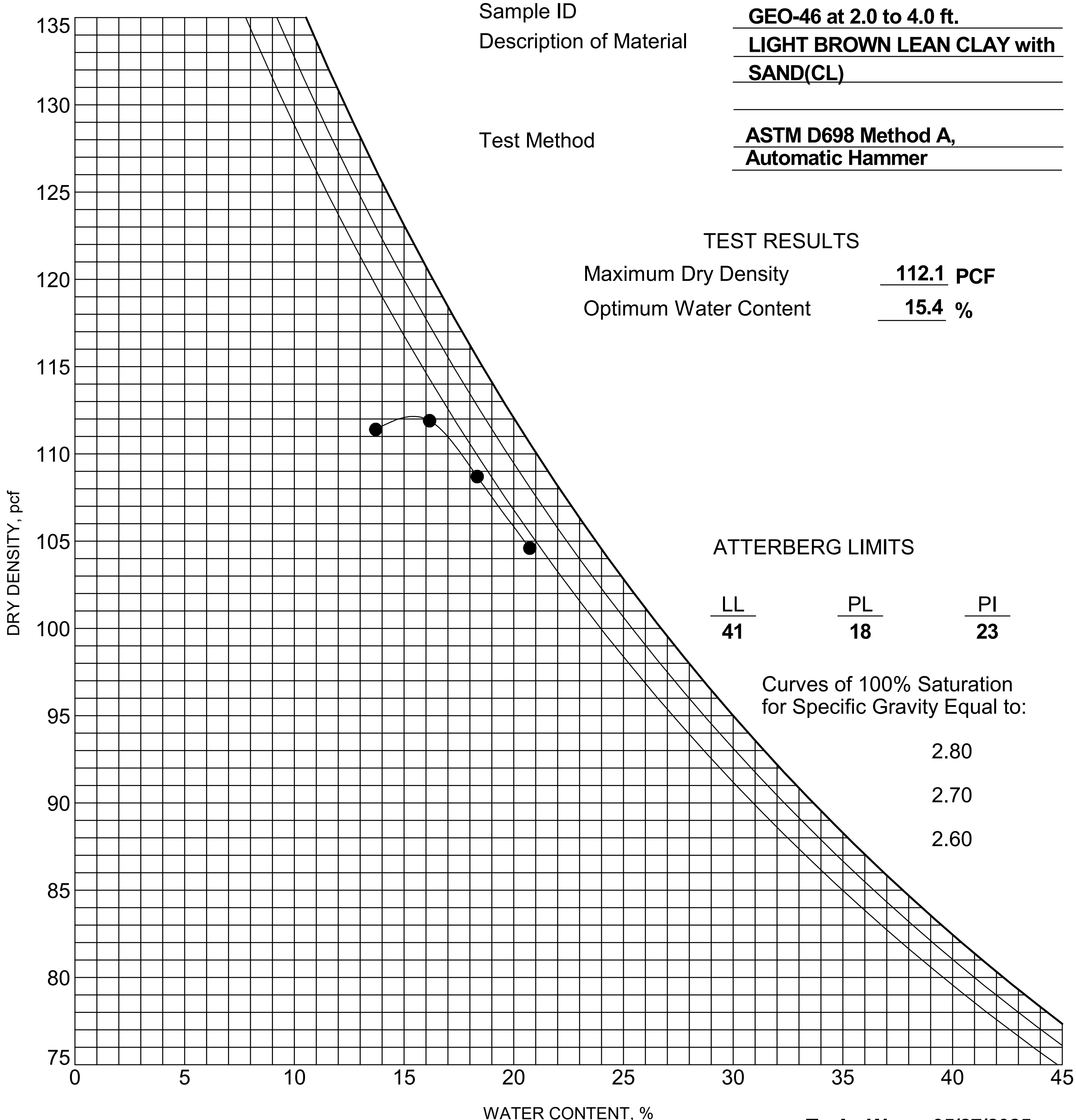
Description of Material: **LIGHT BROWN LEAN CLAY with SAND(CL)**

Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **112.1** **PCF**

Optimum Water Content **15.4** **%**



ATTERBERG LIMITS

LL	PL	PI
41	**18**	**23**

Curves of 100% Saturation
for Specific Gravity Equal to:

2.80

2.70

2.60

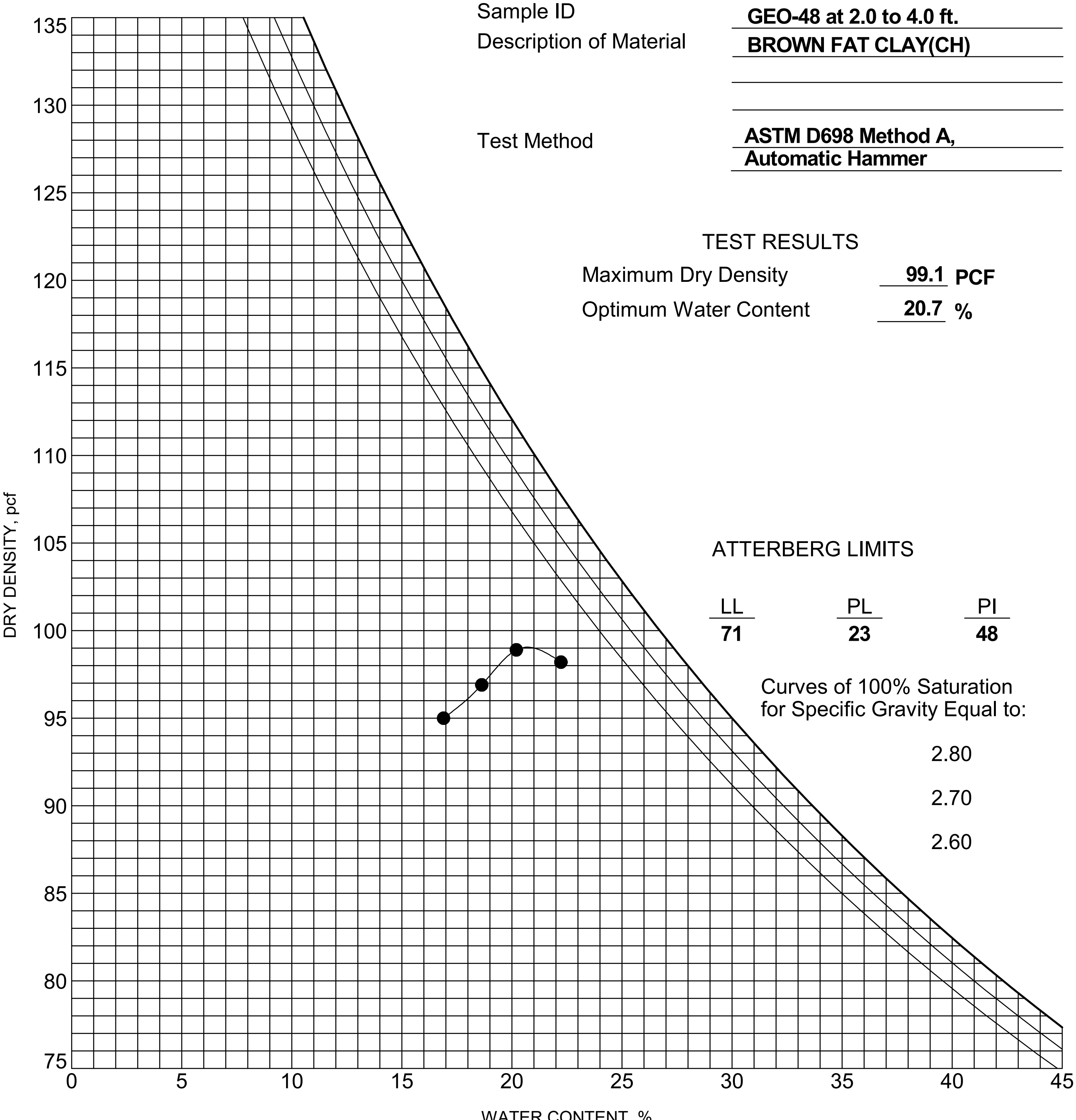
Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026



Sample ID: **GEO-48 at 2.0 to 4.0 ft.**
Description of Material: **BROWN FAT CLAY(CH)**

Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **99.1 PCF**
Optimum Water Content **20.7 %**

ATTERBERG LIMITS

LL	PL	PI
71	**23**	**48**

Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

BEYOND Engineering & Testing

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026

Sample ID: **GEO-53 at 2.0 to 4.0 ft.**
Description of Material: **LIGHT BROWN FAT CLAY(CH)**

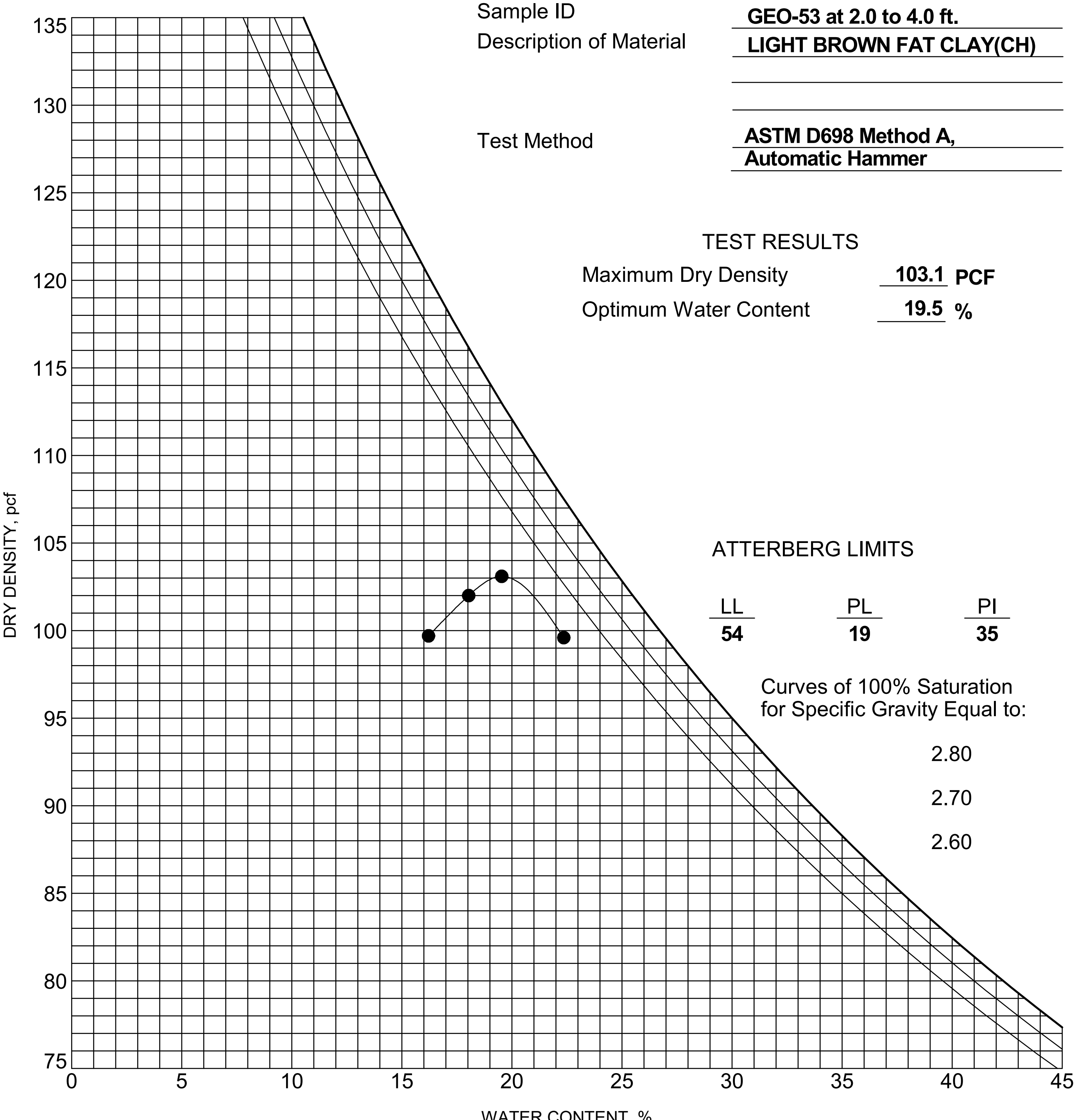
Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **103.1 PCF**
Optimum Water Content **19.5 %**

ATTERBERG LIMITS

LL	PL	PI
54	**19**	**35**



Curves of 100% Saturation
for Specific Gravity Equal to:

2.80

2.70

2.60

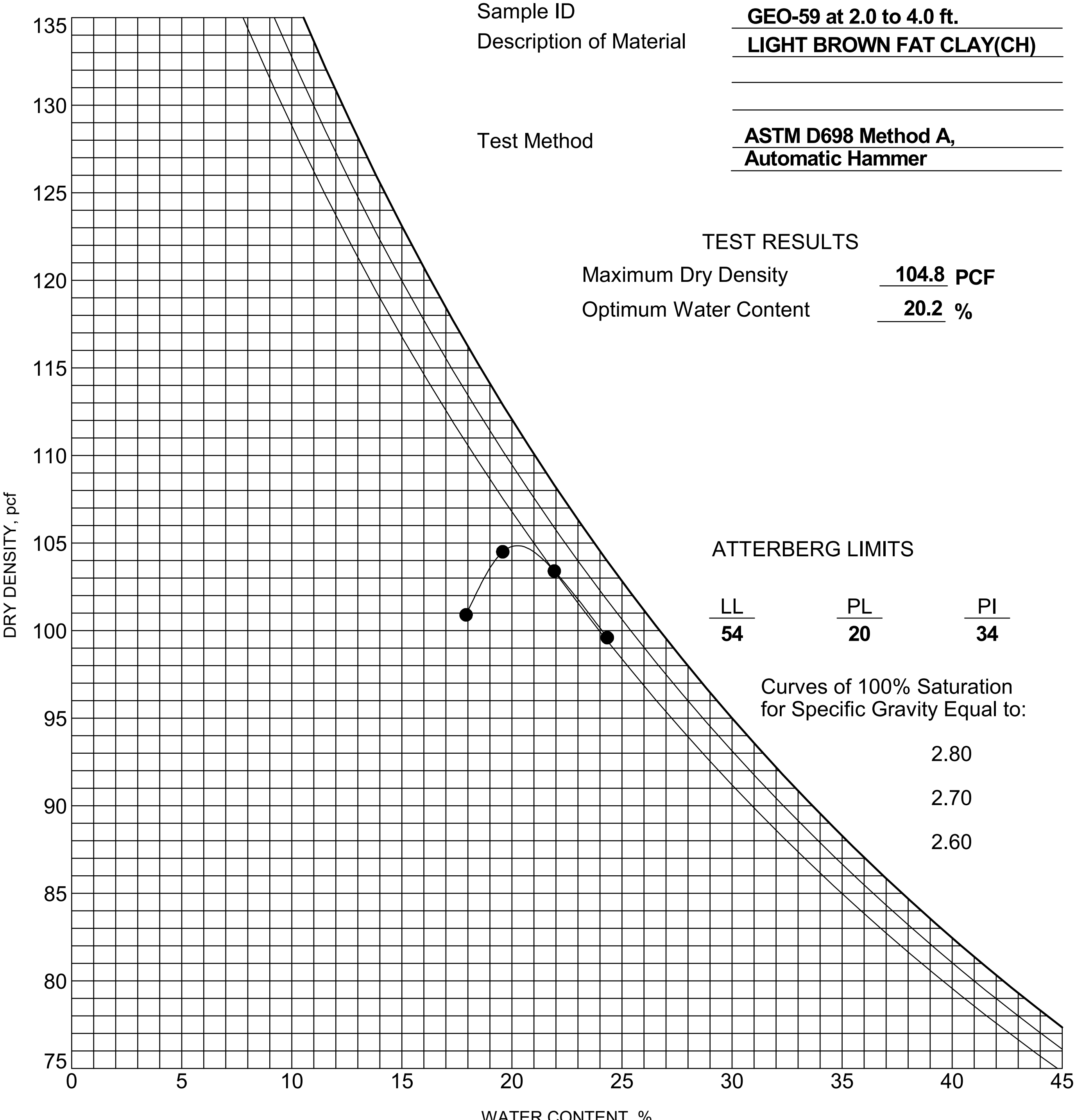
Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026



Sample ID: **GEO-59 at 2.0 to 4.0 ft.**

Description of Material: **LIGHT BROWN FAT CLAY(CH)**

Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **104.8** **PCF**

Optimum Water Content **20.2** **%**

ATTERBERG LIMITS

LL	PL	PI
54	**20**	**34**

Curves of 100% Saturation
for Specific Gravity Equal to:

2.80

2.70

2.60

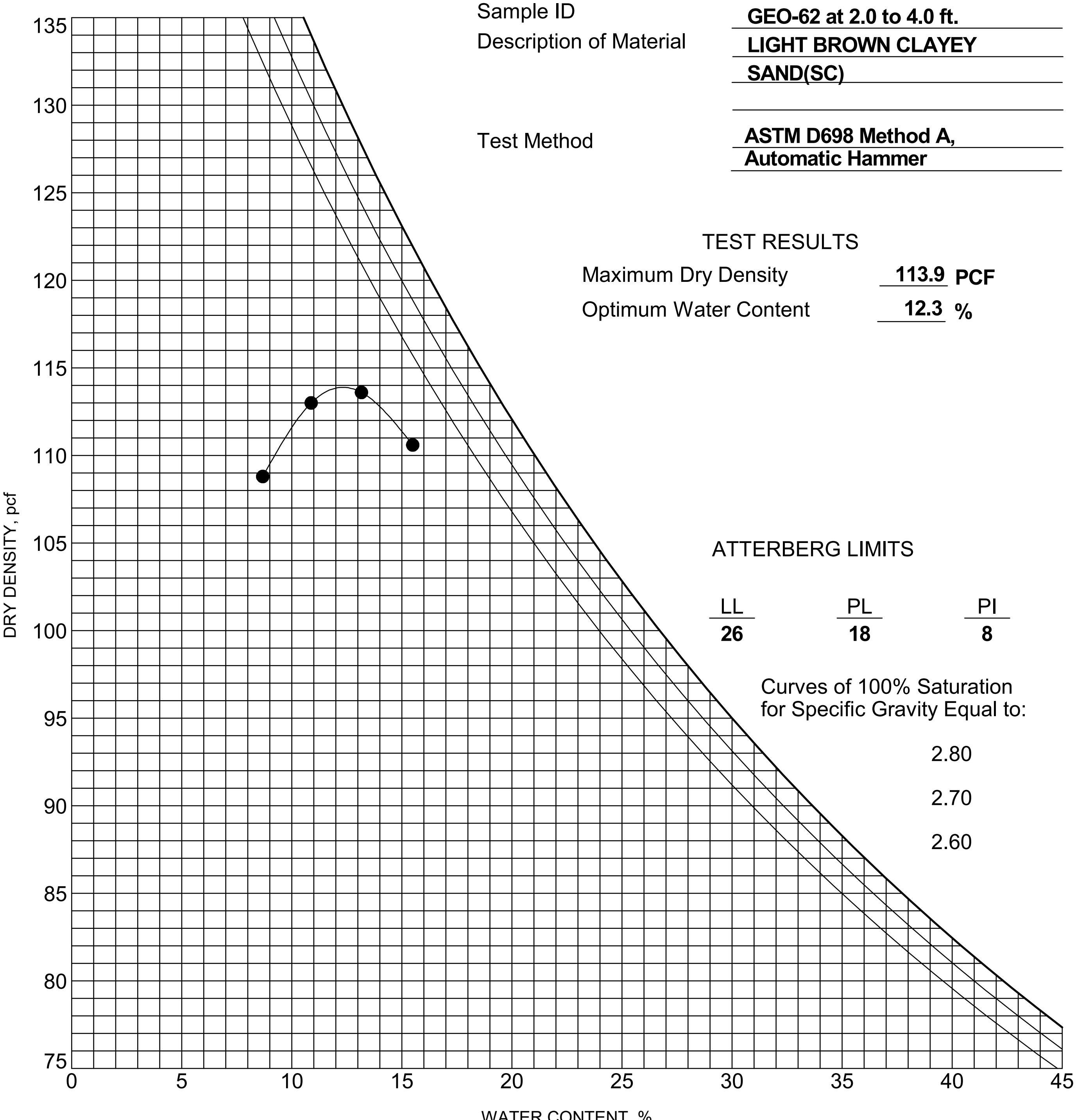
Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026



Sample ID: **GEO-62 at 2.0 to 4.0 ft.**

Description of Material: **LIGHT BROWN CLAYEY SAND(SC)**

Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **113.9 PCF**

Optimum Water Content **12.3 %**

ATTERBERG LIMITS

LL	PL	PI
26	**18**	**8**

Curves of 100% Saturation
for Specific Gravity Equal to:

2.80

2.70

2.60

Te-An Wang, 05/27/2025

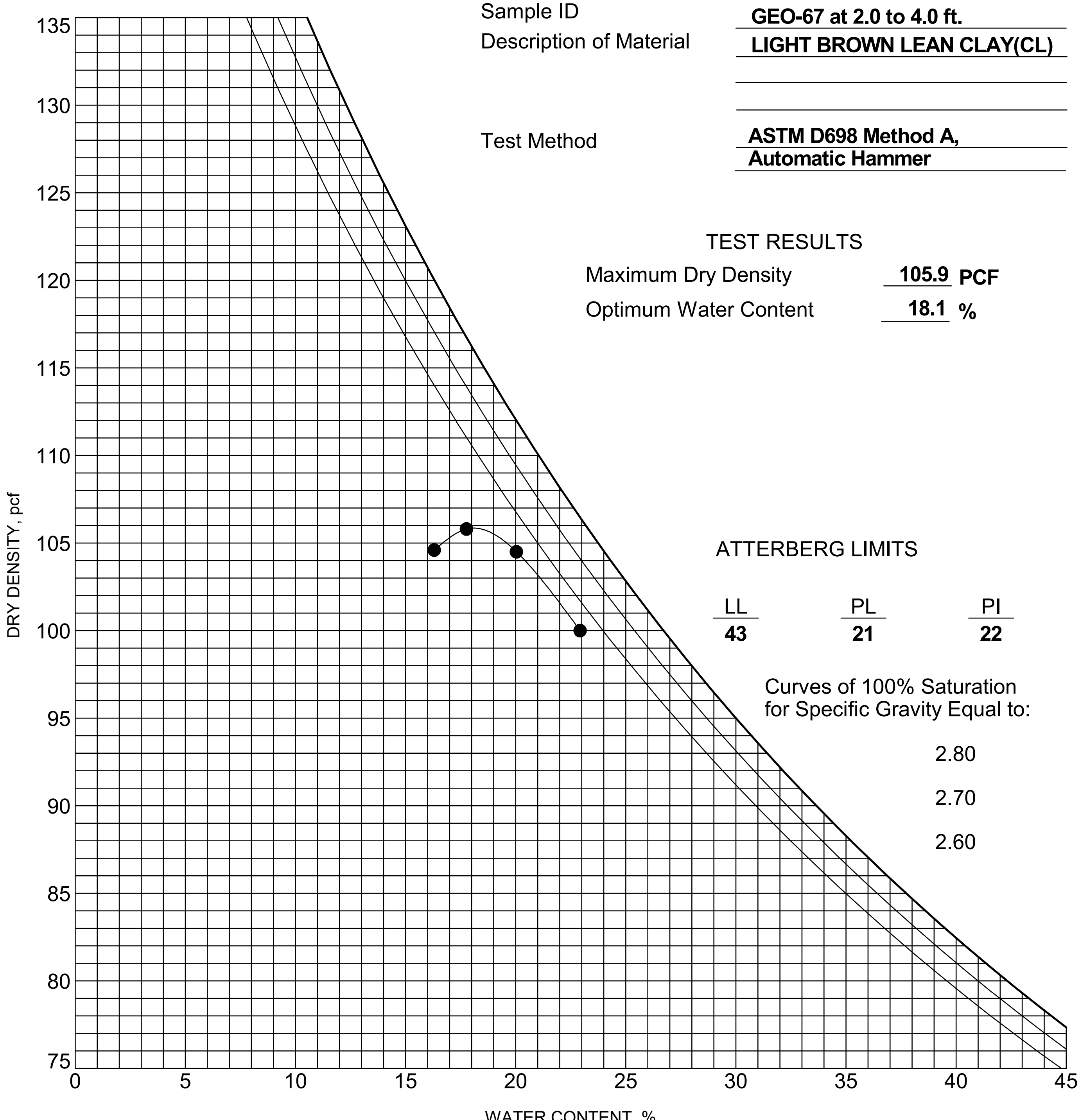
Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026



Sample ID: **GEO-67 at 2.0 to 4.0 ft.**

Description of Material: **LIGHT BROWN LEAN CLAY(CL)**

Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **105.9** **PCF**

Optimum Water Content **18.1** **%**

ATTERBERG LIMITS

LL	PL	PI
43	**21**	**22**

Curves of 100% Saturation
for Specific Gravity Equal to:

2.80

2.70

2.60

Te-An Wang, 05/27/2025

Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

BEYOND Engineering & Testing

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

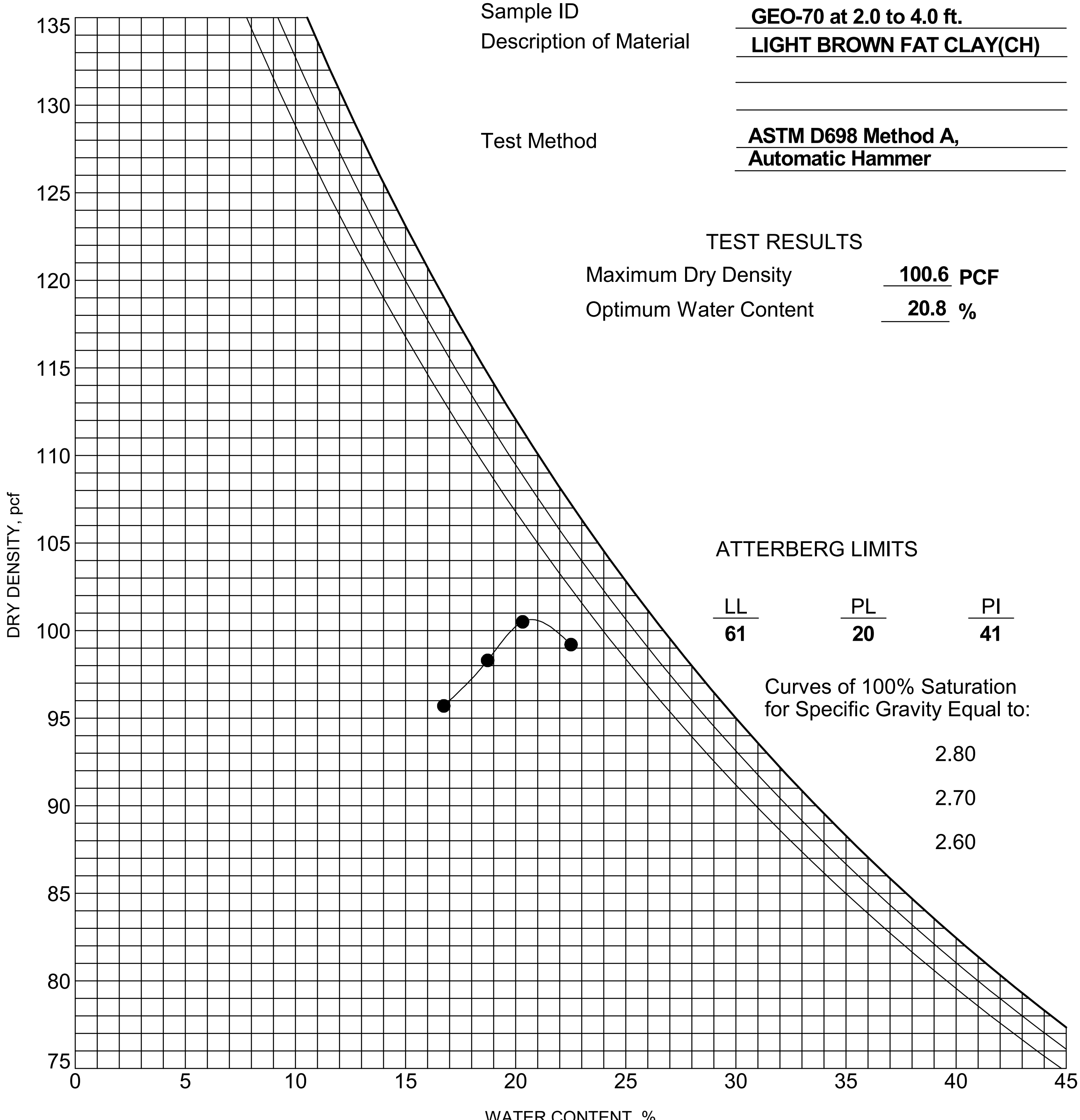
CLIENT: RRC Power & Energy, LLC
PROJECT: Longspur Wind Project
LOCATION: Morton County, ND
NUMBER: GE2503026

Sample ID: **GEO-70 at 2.0 to 4.0 ft.**
Description of Material: **LIGHT BROWN FAT CLAY(CH)**

Test Method: **ASTM D698 Method A, Automatic Hammer**

TEST RESULTS

Maximum Dry Density **100.6** **PCF**
Optimum Water Content **20.8** **%**



ATTERBERG LIMITS

LL	PL	PI
61	**20**	**41**

Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

Specimens prepared by: T.W.

MOISTURE-DENSITY RELATIONSHIP

BEYOND Engineering & Testing

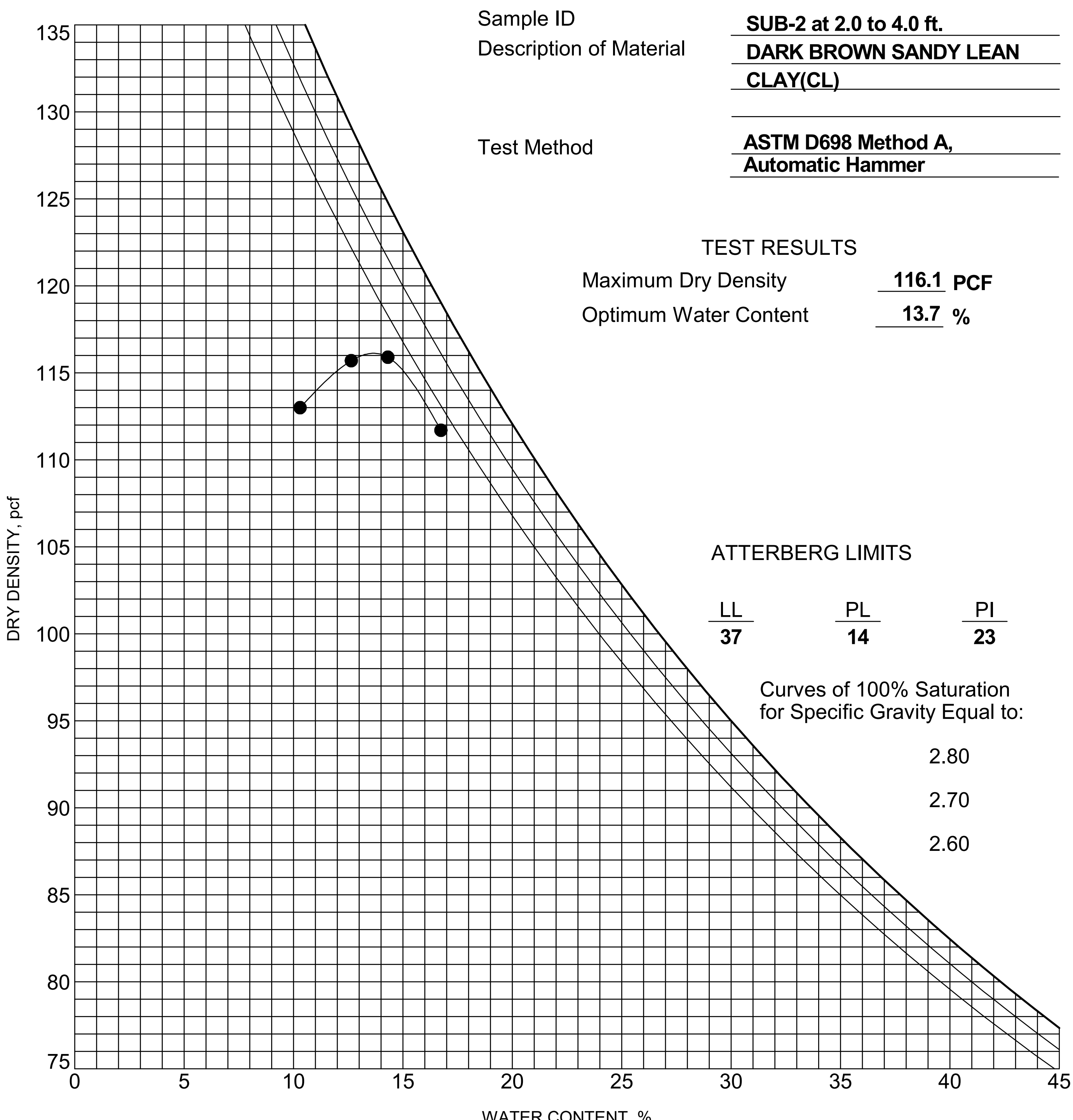
Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
Telephone: (512) 358-6048

CLIENT:	RRC Power & Energy, LLC
PROJECT:	Longspur Wind Project
LOCATION:	Morton County, ND
NUMBER:	GE2503026

Sample ID: **SUB-2 at 2.0 to 4.0 ft.**

Description of Material: **DARK BROWN SANDY LEAN CLAY(CL)**

Test Method: **ASTM D698 Method A, Automatic Hammer**



TEST RESULTS

Maximum Dry Density	**116.1**	**PCF**
Optimum Water Content	**13.7**	**%**

ATTERBERG LIMITS

LL	PL	PI
37	**14**	**23**

Te-An Wang, 05/27/2025
Analysis & Quality Review/Date

Specimens prepared by: T.W.

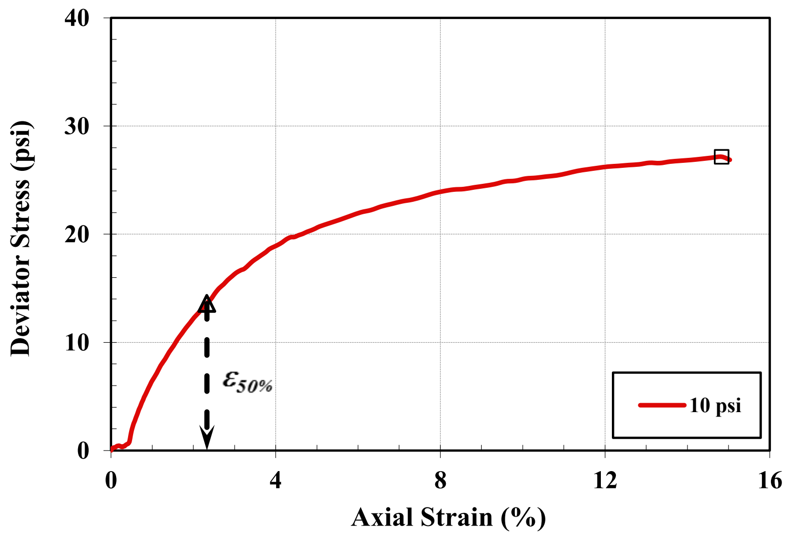
Unconsolidated-Undrained Triaxial Compression Test

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample No.: GEO-04 at 12 ft

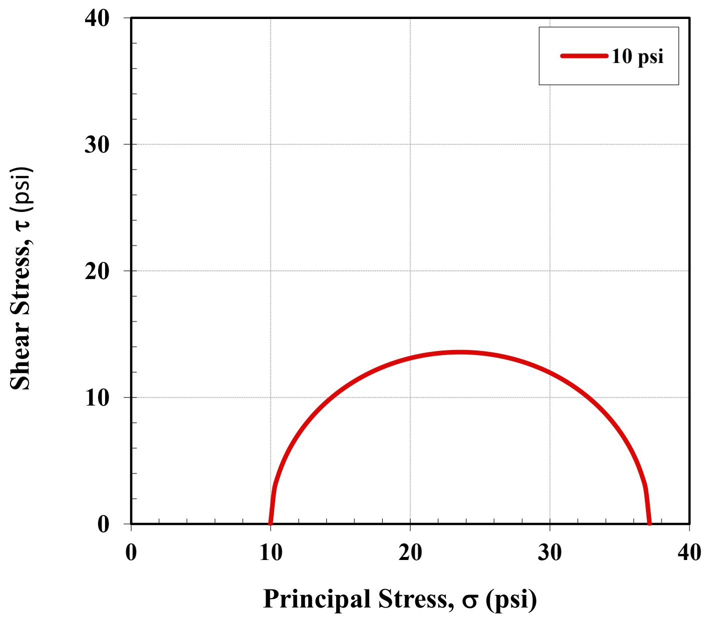
Project No.: GE2503026
Type of Test: Q-Test
Test Date: 6/3/2025

Type of Specimen: Shelby Tube
Strain Rate: 1.0 %/min
Test Method: ASTM D2850

Principal Stress Difference vs. Axial Strain



Mohr Circles (Total Stress) for Peak Stress at Failure



Initial Specimen Conditions		
Confining Pressure (psi)		10.0
Avg. Diameter (in)	D_o	2.86
Avg. Height (in)	H_o	5.55
In-situ Water Content (%)	w_o	23.0
Total Unit Weight (pcf)	γ_{total}	126.7
Dry Unit Weight (pcf)	γ_{dry}	103.0
Saturation (%)	S_r	97.6
Void Ratio	e_o	0.64
Specific Gravity (Assumed)	G_s	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	27.2
Axial Strain at Failure (%)	14.8
Axial Strain at 50% of q_u , ε_{50} (%)	2.3
Total Stresses at Failure	
Major Principal Stress Corrected, σ_{1C} (psi)	37.1
Minor Principal Stress, σ_3 (psi)	10.0

Test Results	
Unconsolidated-Undrained Compressive Strength at Failure, $\sigma_{1C} - \sigma_3$ **(tsf)**	1.96

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Kainat Batool, 06/04/25
Analysis & Quality Review/Date
Specimen Prepared by: A.B.

Unconsolidated-Undrained Triaxial Compression Test Appendix

Client:	RRC Power & Energy, LLC	Project No.:	GE2503026
Project:	Longspur Wind Project	Test Method:	ASTM D2850
Specimen:	GEO-04 at 12 ft	Test Date:	06/03/25

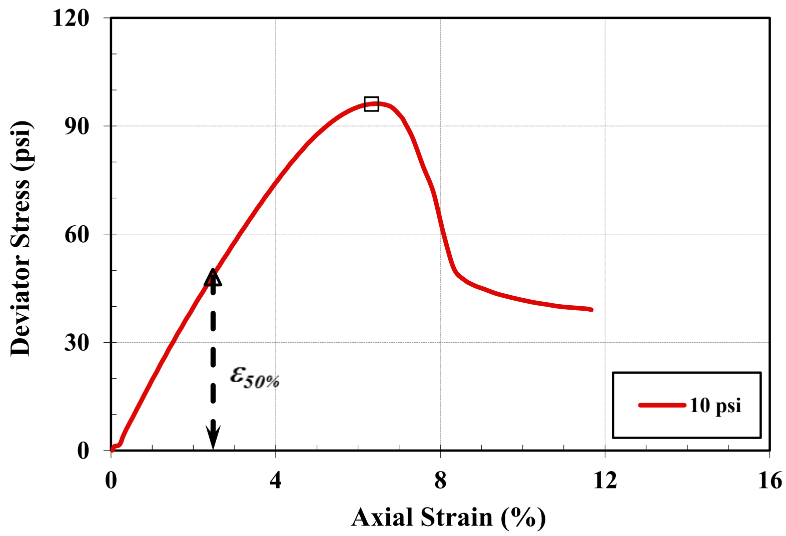
Unconsolidated-Undrained Triaxial Compression Test

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample No.: GEO-07 at 12 ft

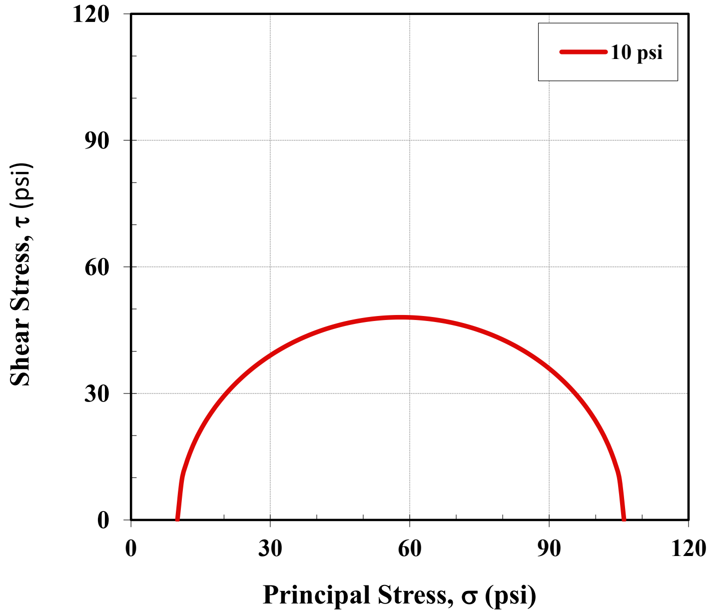
Project No.: GE2503026
Type of Test: Q-Test
Test Date: 6/3/2025

Type of Specimen: Modified CA Tube
Strain Rate: 1.0 %/min
Test Method: ASTM D2850

Principal Stress Difference vs. Axial Strain



Mohr Circles (Total Stress) for Peak Stress at Failure



Initial Specimen Conditions		
Confining Pressure (psi)		10.0
Avg. Diameter (in)	D_o	2.40
Avg. Height (in)	H_o	4.87
In-situ Water Content (%)	w_o	27.2
Total Unit Weight (pcf)	γ_{total}	125.9
Dry Unit Weight (pcf)	γ_{dry}	98.9
Saturation (%)	S_r	100.0
Void Ratio	e_o	0.70
Specific Gravity (Assumed)	G_s	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	96.1
Axial Strain at Failure (%)	6.3
Axial Strain at 50% of q_u , ε_{50} (%)	2.5
Total Stresses at Failure	
Major Principal Stress Corrected, σ_{1C} (psi)	106.1
Minor Principal Stress, σ_3 (psi)	10.0

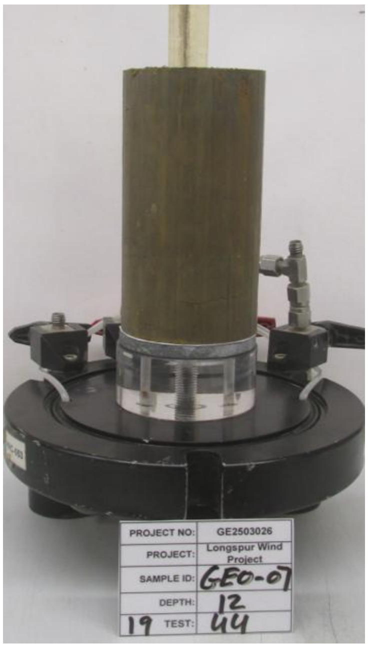
Test Results	
Unconsolidated-Undrained Compressive Strength at Failure, σ_{1C} - σ_3 **(tsf)**	6.92

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Kainat Batool, 06/04/25
Analysis & Quality Review/Date
Specimen Prepared by: A.B.

Unconsolidated-Undrained Triaxial Compression Test Appendix

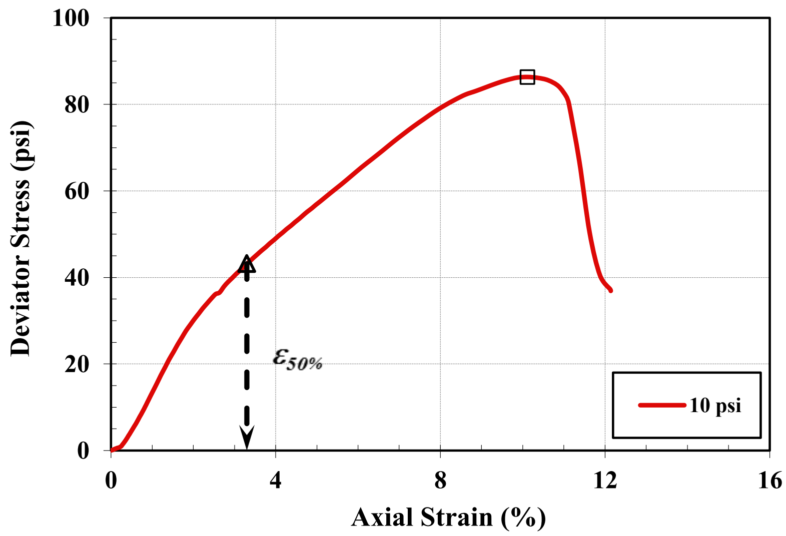
Client:	RRC Power & Energy, LLC	Project No.:	GE2503026
Project:	Longspur Wind Project	Test Method:	ASTM D2850
Specimen:	GEO-07 at 12 ft	Test Date:	06/03/25



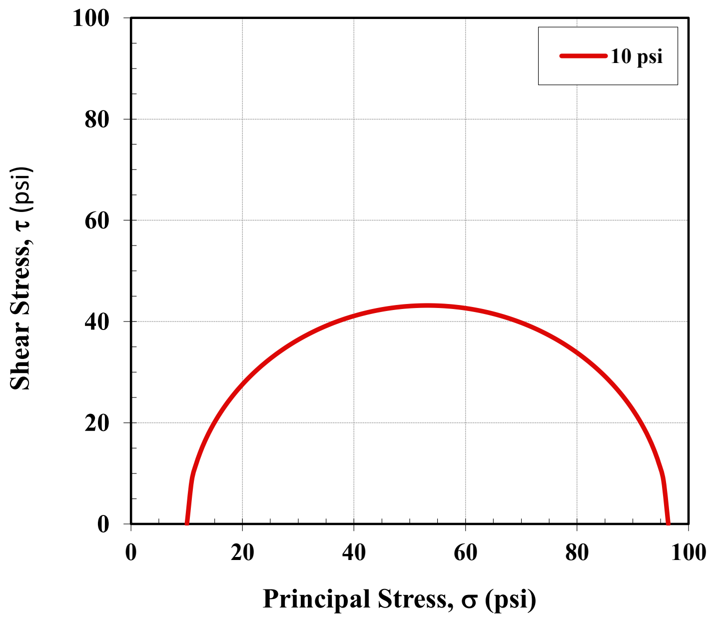
Unconsolidated-Undrained Triaxial Compression Test

Client: RRC Power & Energy, LLC
Project No.: GE2503026
Type of Specimen: Modified CA Tube
Type of Test: Q-Test
Strain Rate: 1.0 %/min
Project: Longspur Wind Project
Test Date: 6/5/2025
Test Method: ASTM D2850
Sample No.: GEO-46 at 12 ft

Principal Stress Difference vs. Axial Strain



Mohr Circles (Total Stress) for Peak Stress at Failure



Initial Specimen Conditions		
Confining Pressure (psi)		10.0
Avg. Diameter (in)	D_o	2.40
Avg. Height (in)	H_o	4.84
In-situ Water Content (%)	w_o	22.6
Total Unit Weight (pcf)	γ_{total}	127.8
Dry Unit Weight (pcf)	γ_{dry}	104.3
Saturation (%)	S_r	99.0
Void Ratio	e_o	0.62
Specific Gravity (Assumed)	G_s	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	86.3
Axial Strain at Failure (%)	10.1
Axial Strain at 50% of q_u , ε_{50} (%)	3.3
Total Stresses at Failure	
Major Principal Stress Corrected, σ_{1C} (psi)	96.4
Minor Principal Stress, σ_3 (psi)	10.0

Test Results	
Unconsolidated-Undrained Compressive Strength at Failure, σ_{1C} - σ_3 **(tsf)**	6.22

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Te-An Wang, EIT, 06/09/25
Analysis & Quality Review/Date
Specimen Prepared by: A.B.

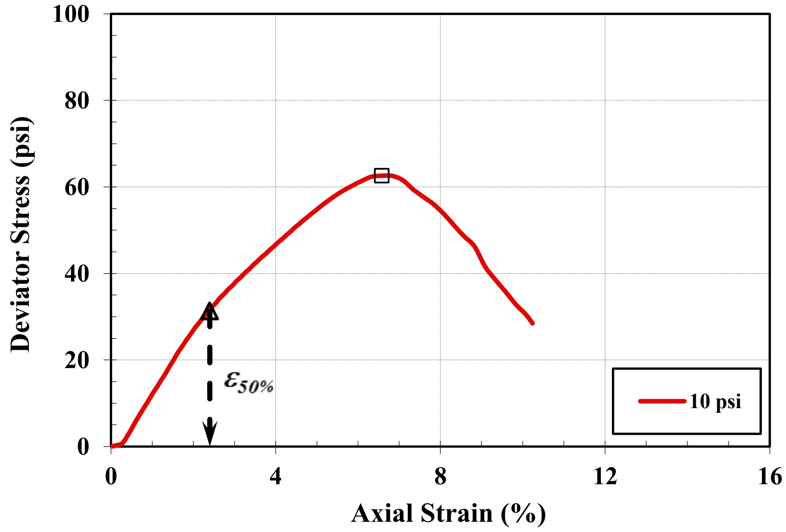
Unconsolidated-Undrained Triaxial Compression Test Appendix

Client:	RRC Power & Energy, LLC	Project No.:	GE2503026
Project:	Longspur Wind Project	Test Method:	ASTM D2850
Specimen:	GEO-46 at 12 ft	Test Date:	06/05/25

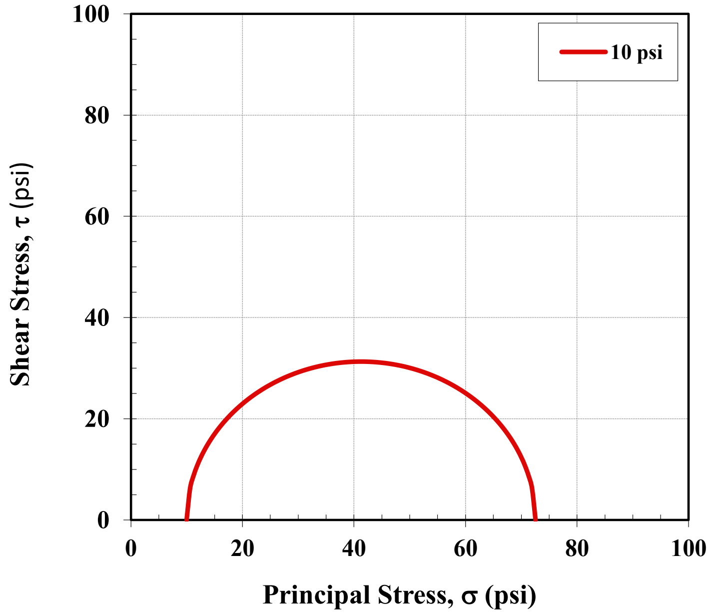
Unconsolidated-Undrained Triaxial Compression Test

Client:	RRC Power & Energy, LLC	Project No.:	GE2503026	Type of Specimen:	Modified CA Tube
		Type of Test:	Q-Test	Strain Rate:	1.0 %/min
Project:	Longspur Wind Project	Test Date:	6/6/2025	Test Method:	ASTM D2850
Sample No.:	GEO-62 at 12 ft				

Principal Stress Difference vs. Axial Strain



Mohr Circles (Total Stress) for Peak Stress at Failure



Initial Specimen Conditions		
Confining Pressure (psi)		10.0
Avg. Diameter (in)	D_o	2.40
Avg. Height (in)	H_o	4.81
In-situ Water Content (%)	w_o	21.3
Total Unit Weight (pcf)	γ_{total}	127.5
Dry Unit Weight (pcf)	γ_{dry}	105.1
Saturation (%)	S_r	95.3
Void Ratio	e_o	0.60
Specific Gravity (Assumed)	G_s	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	62.6
Axial Strain at Failure (%)	6.6
Axial Strain at 50% of q_u , ε_{50} (%)	2.4
Total Stresses at Failure	
Major Principal Stress Corrected, σ_{1C} (psi)	72.6
Minor Principal Stress, σ_3 (psi)	10.0

Test Results	
Unconsolidated-Undrained Compressive Strength at Failure, σ_{1C} - σ_3 **(tsf)**	4.51

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Te-An Wang, EIT, 06/09/25

Analysis & Quality Review/Date

Specimen Prepared by: A.B.

Unconsolidated-Undrained Triaxial Compression Test Appendix

Client:	RRC Power & Energy, LLC	Project No.:	GE2503026
Project:	Longspur Wind Project	Test Method:	ASTM D2850
Specimen:	GEO-62 at 12 ft	Test Date:	06/06/25

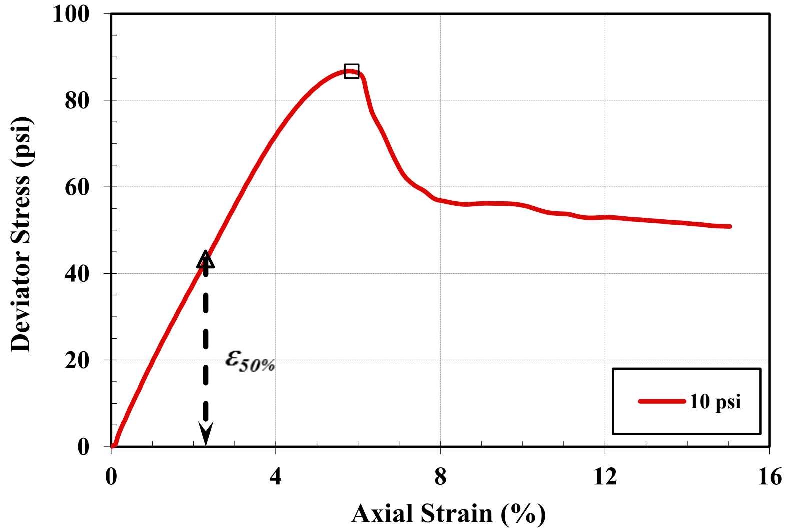
Unconsolidated-Undrained Triaxial Compression Test

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample No.: GEO-66 at 12 ft

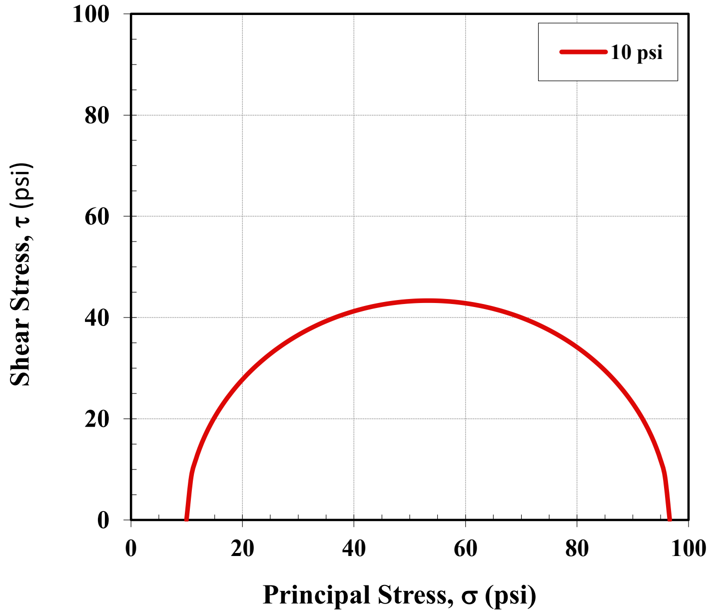
Project No.: GE2503026
Type of Test: Q-Test
Test Date: 6/6/2025

Type of Specimen: Shelby Tube
Strain Rate: 1.0 %/min
Test Method: ASTM D2850

Principal Stress Difference vs. Axial Strain



Mohr Circles (Total Stress) for Peak Stress at Failure



Initial Specimen Conditions		
Confining Pressure (psi)		10.0
Avg. Diameter (in)	D_o	2.86
Avg. Height (in)	H_o	5.64
In-situ Water Content (%)	w_o	21.5
Total Unit Weight (pcf)	γ_{total}	126.6
Dry Unit Weight (pcf)	γ_{dry}	104.2
Saturation (%)	S_r	93.9
Void Ratio	e_o	0.62
Specific Gravity (Assumed)	G_s	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	86.7
Axial Strain at Failure (%)	5.8
Axial Strain at 50% of q_u , ε_{50} (%)	2.3
Total Stresses at Failure	
Major Principal Stress Corrected, σ_{1C} (psi)	96.6
Minor Principal Stress, σ_3 (psi)	10.0

Test Results	
Unconsolidated-Undrained Compressive Strength at Failure, σ_{1C} - σ_3 **(tsf)**	6.24

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Te-An Wang, EIT, 06/09/25
Analysis & Quality Review/Date
Specimen Prepared by: A.B.

Unconsolidated-Undrained Triaxial Compression Test Appendix

Client:	RRC Power & Energy, LLC	Project No.:	GE2503026
Project:	Longspur Wind Project	Test Method:	ASTM D2850
Specimen:	GEO-66 at 12 ft	Test Date:	06/06/25

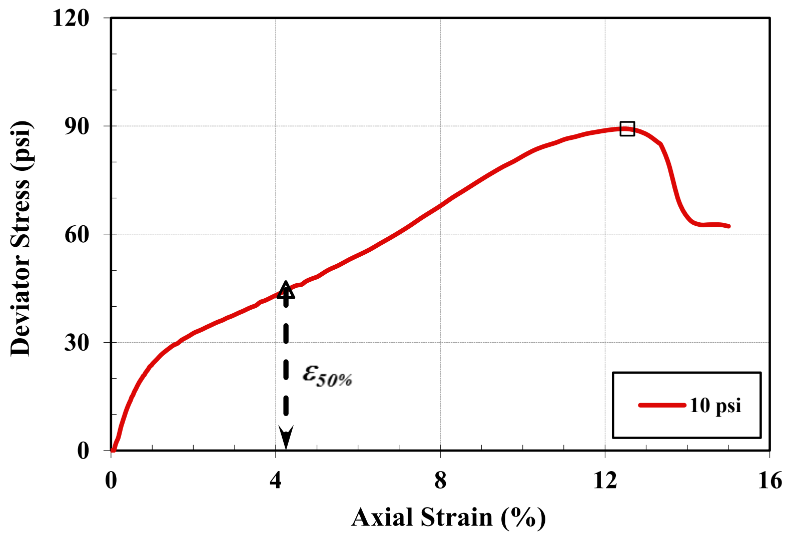
Unconsolidated-Undrained Triaxial Compression Test

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample No.: GEO-077 at 12 ft

Project No.: GE2603026
Type of Test: Q-Test
Test Date: 3/20/2026

Type of Specimen: Modified CA Tube
Strain Rate: 1.0 %/min
Test Method: ASTM D2850

Principal Stress Difference vs. Axial Strain



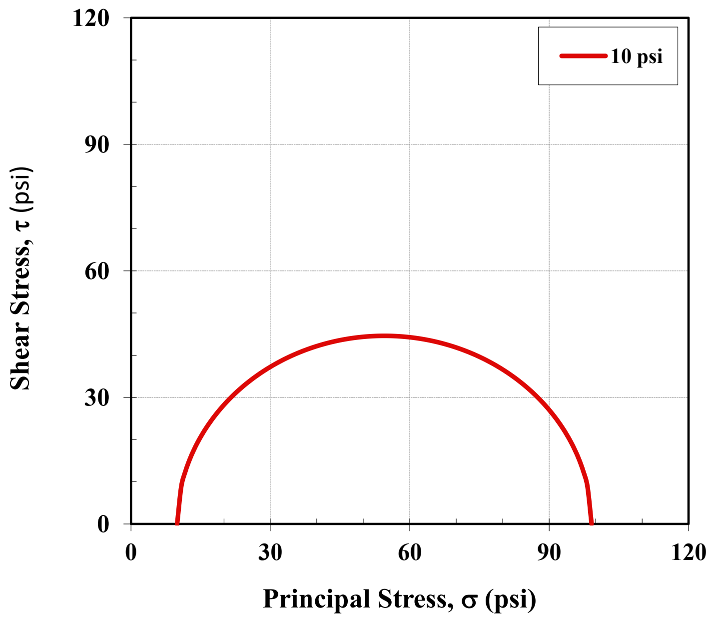
Initial Specimen Conditions		
Confining Pressure (psi)		10.0
Avg. Diameter (in)	D_o	1.90
Avg. Height (in)	H_o	3.68
In-situ Water Content (%)	w_o	17.3
Total Unit Weight (pcf)	γ_{total}	131.7
Dry Unit Weight (pcf)	γ_{dry}	112.3
Saturation (%)	S_r	93.2
Void Ratio	e_o	0.50
Specific Gravity (Assumed)	G_s	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	89.2
Axial Strain at Failure (%)	12.5
Axial Strain at 50% of q_u, ε_{50} (%)	4.3
Total Stresses at Failure	
Major Principal Stress Corrected, σ_{1C} (psi)	99.1
Minor Principal Stress, σ_3 (psi)	9.9

Test Results	
Unconsolidated-Undrained Compressive Strength at Failure, $\sigma_{1C} - \sigma_3$ **(tsf)**	6.42

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

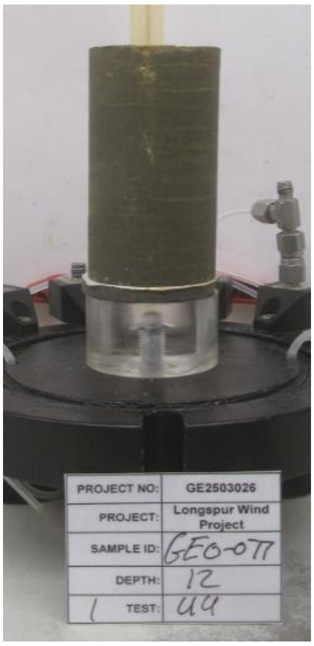
Mohr Circles (Total Stress) for Peak Stress at Failure

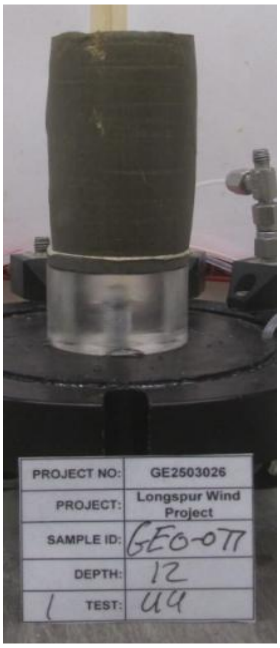


Te-An Wang, EIT, 3/24/2026
Analysis & Quality Review/Date
Specimen Prepared by: A.B.

Unconsolidated-Undrained Triaxial Compression Test Appendix

Client:	RRC Power & Energy, LLC	Project No.:	GE2603026
Project:	Longspur Wind Project	Test Method:	ASTM D2850
Specimen:	GEO-077 at 12 ft	Test Date:	3/20/2026





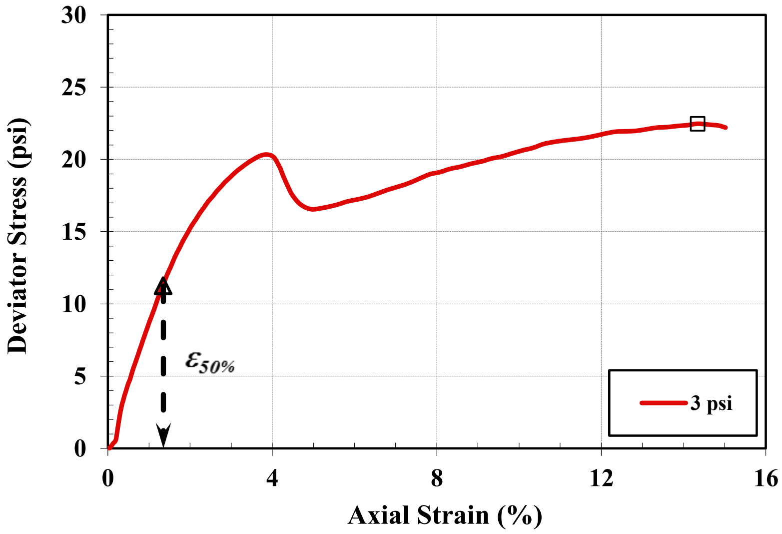
Unconsolidated-Undrained Triaxial Compression Test

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample No.: SUB-3 at 4 ft

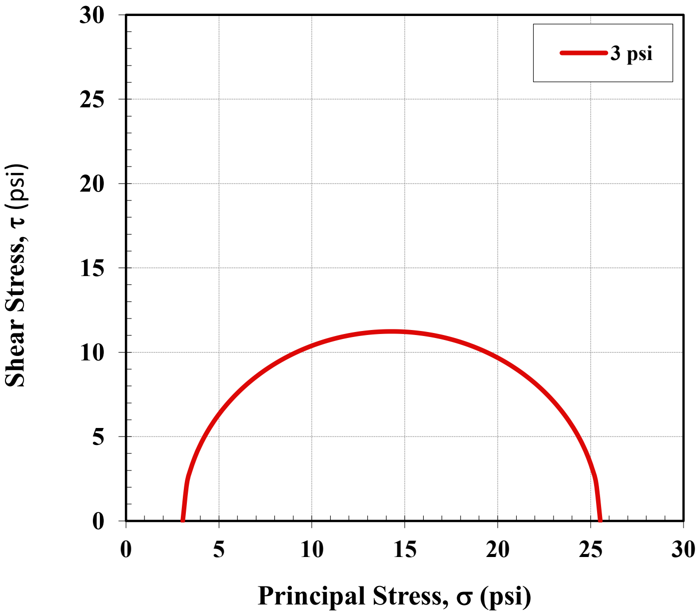
Project No.: GE2503026
Type of Test: Q-Test
Test Date: 6/6/2025

Type of Specimen: Shelby Tube
Strain Rate: 1.0 %/min
Test Method: ASTM D2850

Principal Stress Difference vs. Axial Strain



Mohr Circles (Total Stress) for Peak Stress at Failure



Initial Specimen Conditions		
Confining Pressure (psi)		3.0
Avg. Diameter (in)	D_o	2.89
Avg. Height (in)	H_o	5.64
In-situ Water Content (%)	w_o	14.8
Total Unit Weight (pcf)	γ_{total}	123.7
Dry Unit Weight (pcf)	γ_{dry}	107.7
Saturation (%)	S_r	70.9
Void Ratio	e_o	0.56
Specific Gravity (Assumed)	G_s	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	22.5
Axial Strain at Failure (%)	14.3
Axial Strain at 50% of q_u, ε_{50} (%)	1.4
Total Stresses at Failure	
Major Principal Stress Corrected, σ_{1C} (psi)	25.5
Minor Principal Stress, σ_3 (psi)	3.1

Test Results	
Unconsolidated-Undrained Compressive Strength at Failure, $\sigma_{1C} - \sigma_3$ **(tsf)**	1.62

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Te-An Wang, EIT, 06/09/25
Analysis & Quality Review/Date
Specimen Prepared by: A.B.

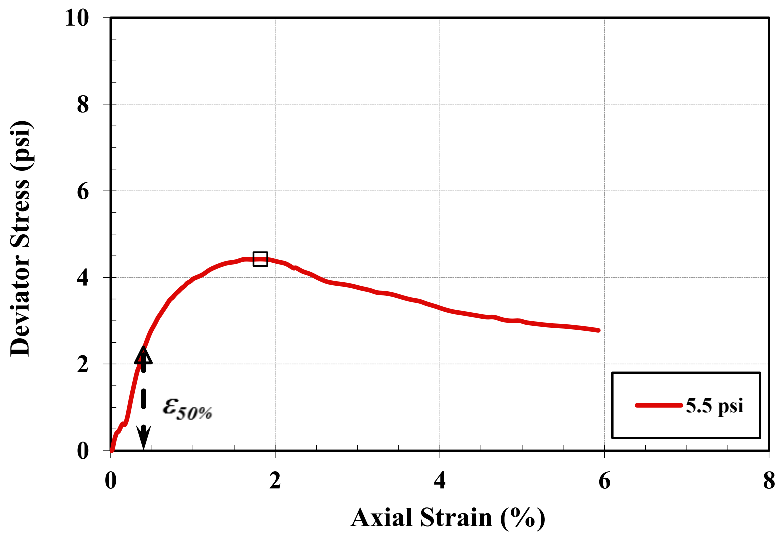
Unconsolidated-Undrained Triaxial Compression Test Appendix

Client:	RRC Power & Energy, LLC	Project No.:	GE2503026
Project:	Longspur Wind Project	Test Method:	ASTM D2850
Specimen:	SUB-3 at 4 ft	Test Date:	06/06/25

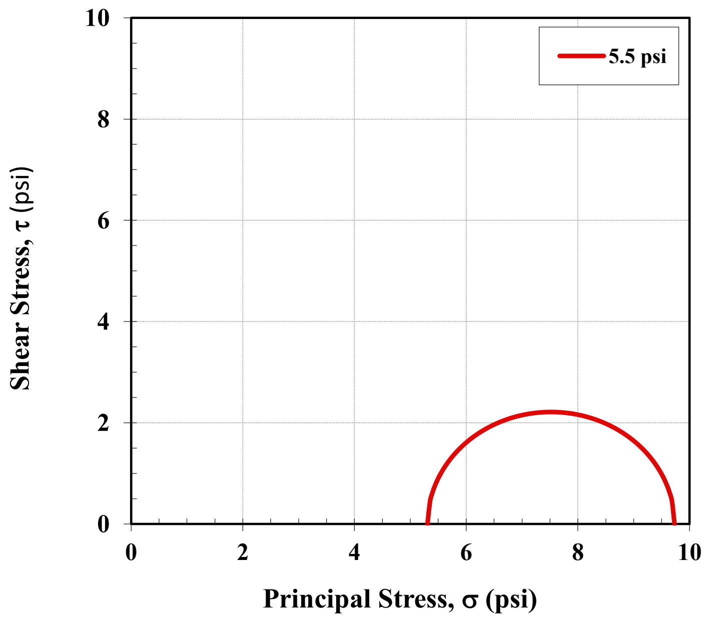
Unconsolidated-Undrained Triaxial Compression Test

Client:	RRC Power & Energy, LLC	Project No.:	GE2503026	Type of Specimen:	Modified CA Tube
		Type of Test:	Q-Test	Strain Rate:	1.0 %/min
Project:	Longspur Wind Project	Test Date:	6/6/2025	Test Method:	ASTM D2850
Sample No.:	O&M-1 at 7 ft				

Principal Stress Difference vs. Axial Strain



Mohr Circles (Total Stress) for Peak Stress at Failure



Initial Specimen Conditions		
Confining Pressure (psi)		5.5
Avg. Diameter (in)	D_o	2.40
Avg. Height (in)	H_o	4.83
In-situ Water Content (%)	w_o	18.9
Total Unit Weight (pcf)	γ_{total}	119.3
Dry Unit Weight (pcf)	γ_{dry}	100.3
Saturation (%)	S_r	75.2
Void Ratio	e_o	0.68
Specific Gravity (Assumed)	G_s	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	4.4
Axial Strain at Failure (%)	1.8
Axial Strain at 50% of q_u , ε_{50} (%)	0.4
Total Stresses at Failure	
Major Principal Stress Corrected, σ_{1C} (psi)	9.7
Minor Principal Stress, σ_3 (psi)	5.3

Test Results	
Unconsolidated-Undrained Compressive Strength at Failure, σ_{1C} - σ_3 **(tsf)**	0.32

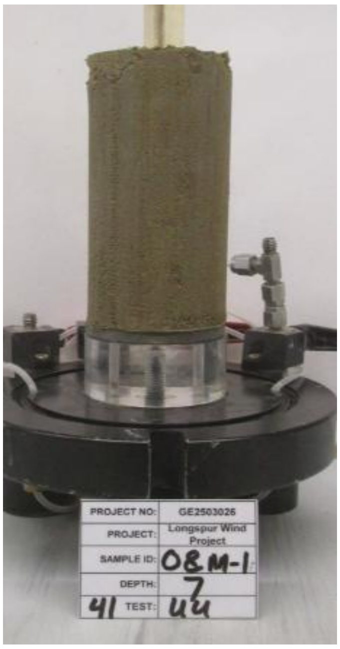
Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

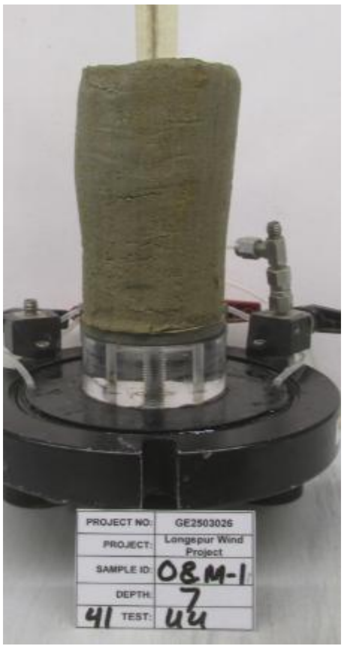
Te-An Wang, EIT, 06/09/25
Analysis & Quality Review/Date
Specimen Prepared by: A.B.

Unconsolidated-Undrained Triaxial Compression Test Appendix

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Specimen: O&M-1 at 7 ft

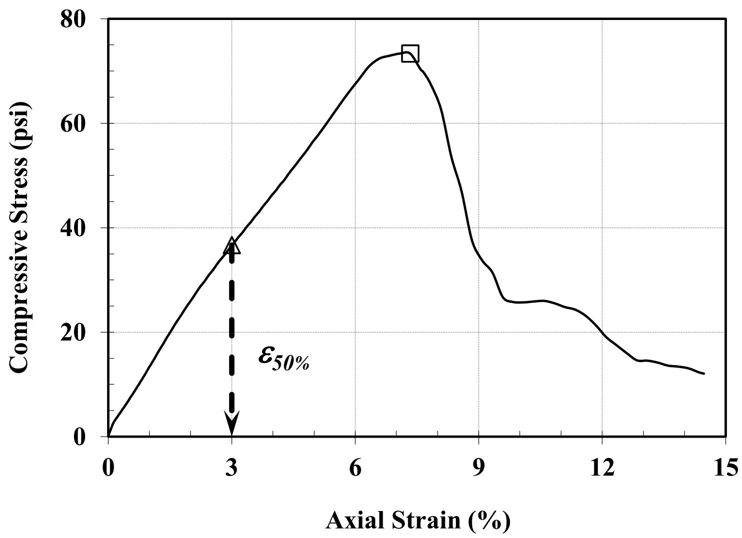
Project No.: GE2503026
Test Method: ASTM D2850
Test Date: 06/06/25





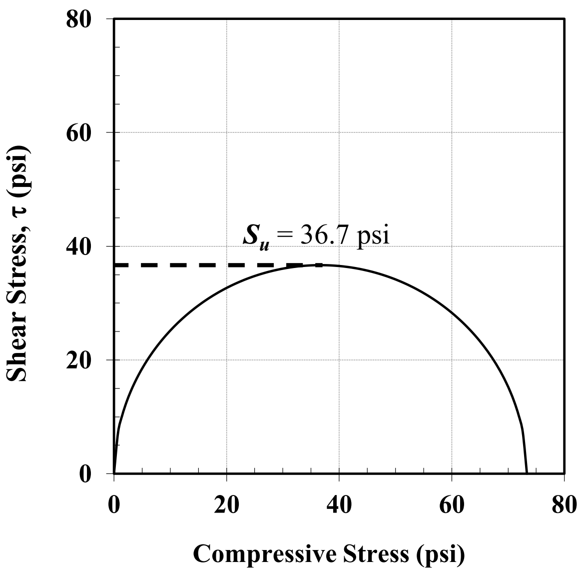
Unconfined Compression Test Report

Client: RRC Power & Energy, LLC	Project No.: GE2503026	Type of Specimen: Modified CA Tube
Project: Longspur Wind Project	Test Method: ASTM D2166	Strain Rate: 1.0 %/min
Sample I.D.: GEO-01 at 14 ft	Test Date: 6/4/2025	



Initial Specimen Conditions		
Avg. Diameter (in)	D_o	2.41
Avg. Height (in)	H_o	4.84
In-situ Moisture Content (%)	w_o	20.2
Total Unit Weight (pcf)	γ_{total}	133.6
Dry Unit Weight (pcf)	γ_{dry}	111.2
Saturation (%)	S_r	100.0
Void Ratio	e_o	0.52
Specific Gravity (Assumed)	G_s	2.70

Mohr Circles for Peak Stress at Failure



Stresses at Failure	
Unconfined Compressive Strength, q_u (psi)	73.3
Axial Strain at Failure (%)	7.3
Axial Strain at 50 % of q_u (%)	3.0
Total Stresses at Failure	
Major Principal Stress, σ_1 (psi)	73.3
Minor Principal Stress, σ_3 (psi)	0
Undrained Shear Strength, S_u (tsf)	2.64

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Kainat Batool, 06/06/25

Quality Review/Date

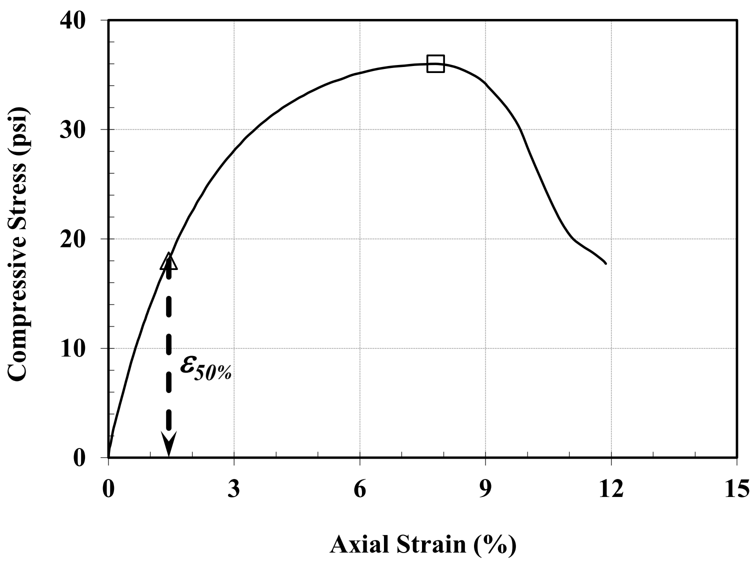
Specimen prepared & tested by: A.B.

Unconfined Compression Test Report

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample I.D.: GEO-04 at 19 ft

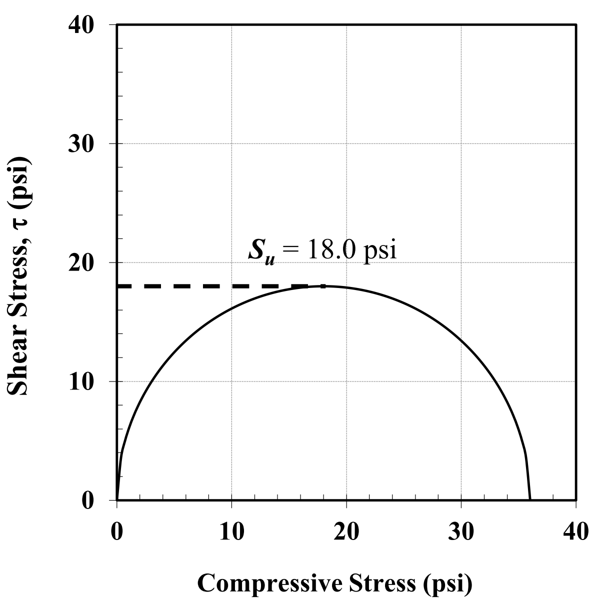
Project No.: GE2503026
Test Method: ASTM D2166
Test Date: 6/10/2025

Type of Specimen: Shelby Tube
Strain Rate: 1.0 %/min



Initial Specimen Conditions		
Avg. Diameter (in)	D_o	2.87
Avg. Height (in)	H_o	5.62
In-situ Moisture Content (%)	w_o	22.1
Total Unit Weight (pcf)	γ_{total}	124.9
Dry Unit Weight (pcf)	γ_{dry}	102.3
Saturation (%)	S_r	92.0
Void Ratio	e_o	0.65
Specific Gravity (Assumed)	G_s	2.70

Mohr Circles for Peak Stress at Failure



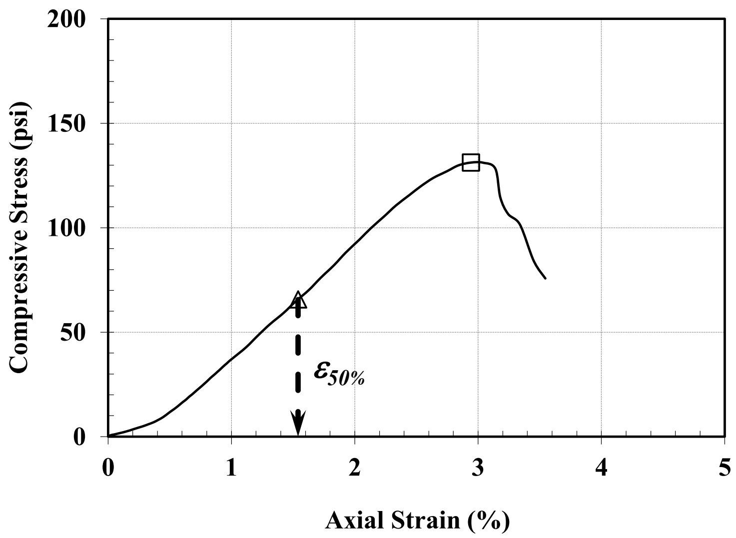
Stresses at Failure	
Unconfined Compressive Strength, q_u (psi)	36.0
Axial Strain at Failure (%)	7.8
Axial Strain at 50 % of q_u (%)	1.4
Total Stresses at Failure	
Major Principal Stress, σ_1 (psi)	36.0
Minor Principal Stress, σ_3 (psi)	0
Undrained Shear Strength, S_u (tsf)	1.30

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Kainat Batool, 06/10/25
Quality Review/Date
Specimen prepared & tested by: A.B.

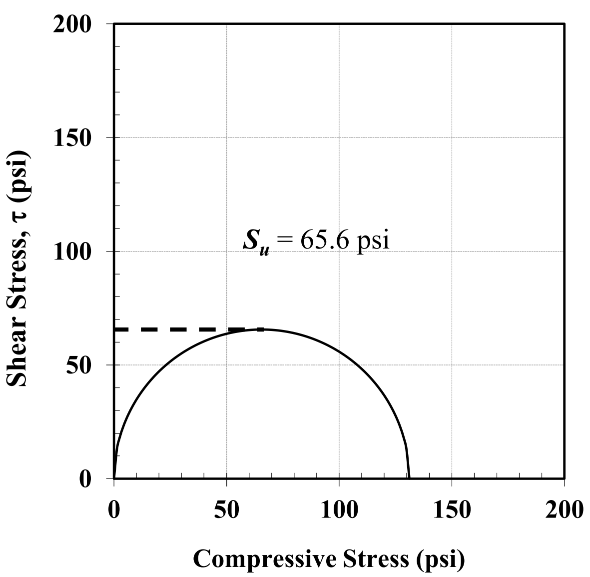
Unconfined Compression Test Report

Client: RRC Power & Energy, LLC	Project No.: GE2503026	Type of Specimen: Modified CA Tube
Project: Longspur Wind Project	Test Method: ASTM D2166	Strain Rate: 1.0 %/min
Sample I.D.: GEO-33 at 17 ft	Test Date: 6/4/2025	



Initial Specimen Conditions		
Avg. Diameter (in)	D_o	2.40
Avg. Height (in)	H_o	4.85
In-situ Moisture Content (%)	w_o	16.9
Total Unit Weight (pcf)	γ_{total}	130.0
Dry Unit Weight (pcf)	γ_{dry}	111.3
Saturation (%)	S_r	88.4
Void Ratio	e_o	0.51
Specific Gravity (Assumed)	G_s	2.70

Mohr Circles for Peak Stress at Failure



Stresses at Failure	
Unconfined Compressive Strength, q_u (psi)	131.2
Axial Strain at Failure (%)	2.9
Axial Strain at 50 % of q_u (%)	1.5
Total Stresses at Failure	
Major Principal Stress, σ_1 (psi)	131.2
Minor Principal Stress, σ_3 (psi)	0
Undrained Shear Strength, S_u (tsf)	4.72

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

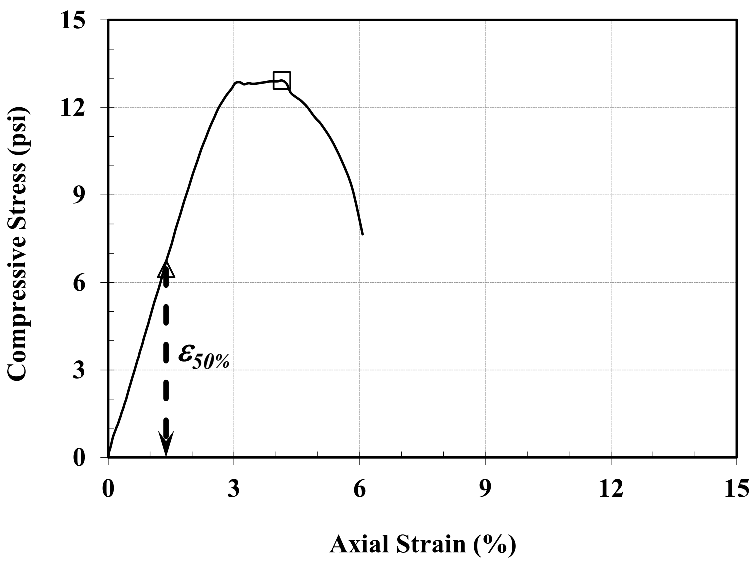
Kainat Batool, 06/06/25
Quality Review/Date
Specimen prepared & tested by: A.B.

Unconfined Compression Test Report

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample I.D.: GEO-036 at 17 ft

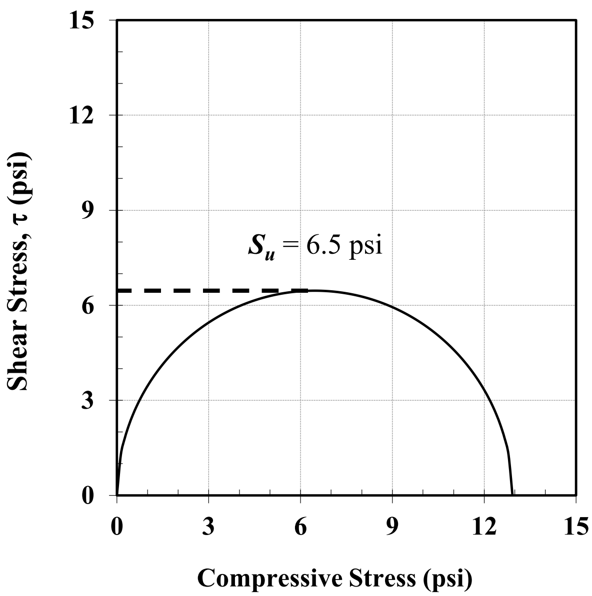
Project No.: GE2503026
Test Method: ASTM D2166
Test Date: 6/10/2025

Type of Specimen: Shelby Tube
Strain Rate: 1.0 %/min



Initial Specimen Conditions		
Avg. Diameter (in)	D_o	2.87
Avg. Height (in)	H_o	5.63
In-situ Moisture Content (%)	w_o	29.9
Total Unit Weight (pcf)	γ_{total}	120.7
Dry Unit Weight (pcf)	γ_{dry}	92.9
Saturation (%)	S_r	99.2
Void Ratio	e_o	0.81
Specific Gravity (Assumed)	G_s	2.70

Mohr Circles for Peak Stress at Failure



Stresses at Failure	
Unconfined Compressive Strength, q_u (psi)	12.9
Axial Strain at Failure (%)	4.1
Axial Strain at 50 % of q_u (%)	1.4
Total Stresses at Failure	
Major Principal Stress, σ_1 (psi)	12.9
Minor Principal Stress, σ_3 (psi)	0
Undrained Shear Strength, S_u (tsf)	0.47

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

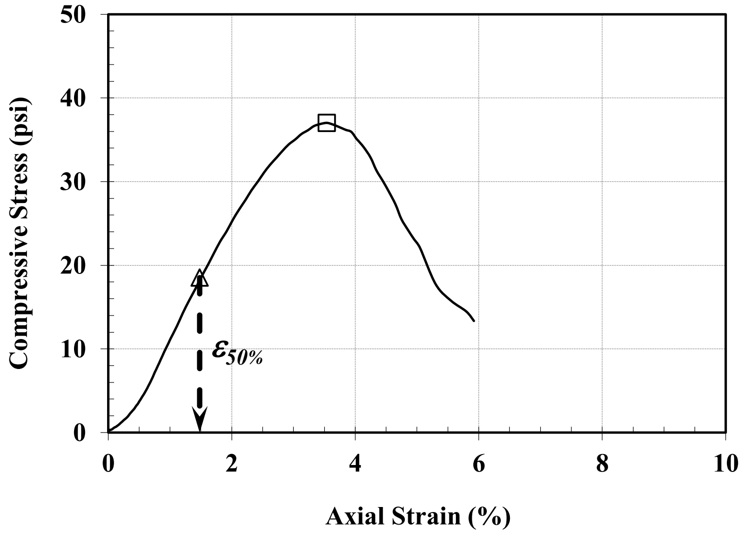
Kainat Batool, 06/10/25
Quality Review/Date
Specimen prepared & tested by: A.B.

Unconfined Compression Test Report

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample I.D.: GEO-37 at 12 ft

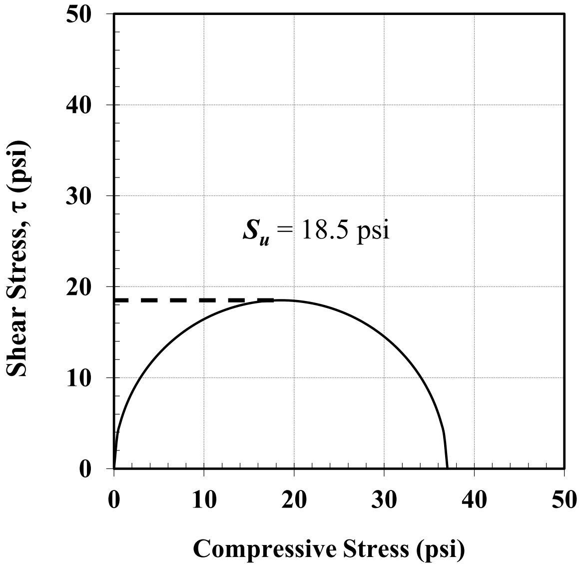
Project No.: GE2503026
Test Method: ASTM D2166
Test Date: 6/4/2025

Type of Specimen: Modified CA Tube
Strain Rate: 1.0 %/min



Initial Specimen Conditions		
Avg. Diameter (in)	D_o	2.40
Avg. Height (in)	H_o	4.85
In-situ Moisture Content (%)	w_o	47.0
Total Unit Weight (pcf)	γ_{total}	95.8
Dry Unit Weight (pcf)	γ_{dry}	65.1
Saturation (%)	S_r	80.0
Void Ratio	e_o	1.59
Specific Gravity (Assumed)	G_s	2.70

Mohr Circles for Peak Stress at Failure



Stresses at Failure	
Unconfined Compressive Strength, q_u (psi)	37.0
Axial Strain at Failure (%)	3.5
Axial Strain at 50 % of q_u (%)	1.5
Total Stresses at Failure	
Major Principal Stress, σ_1 (psi)	37.0
Minor Principal Stress, σ_3 (psi)	0
Undrained Shear Strength, S_u (tsf)	1.33

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

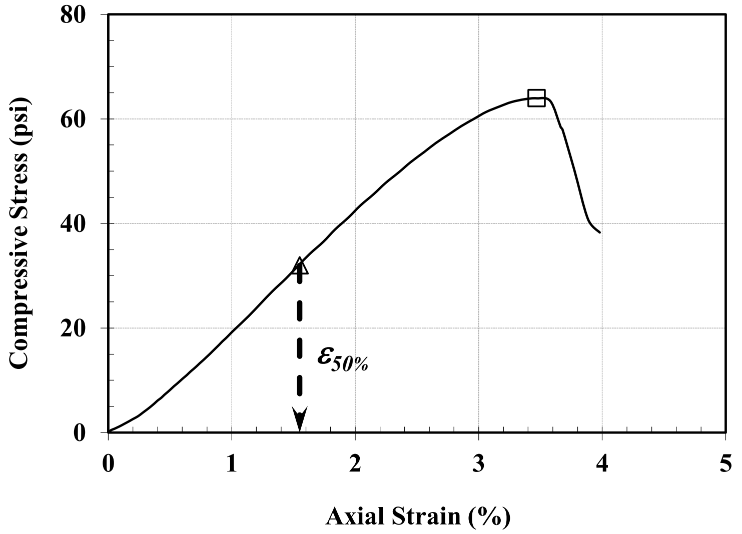
Kainat Batool, 06/09/25
Quality Review/Date
Specimen prepared & tested by: A.B.

Unconfined Compression Test Report

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample I.D.: GEO-69 at 12 ft

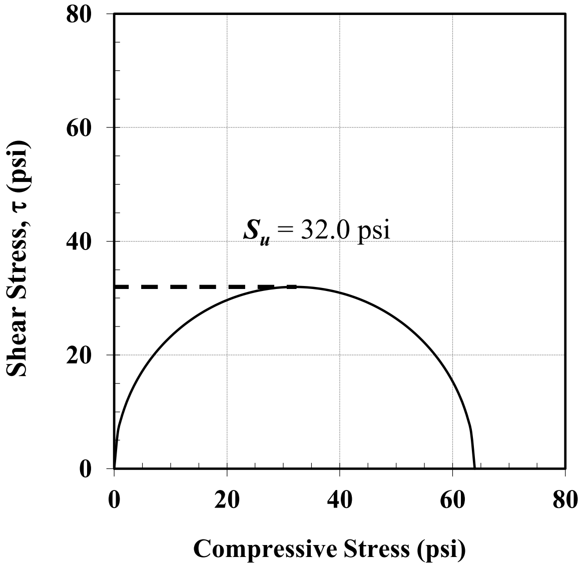
Project No.: GE2503026
Test Method: ASTM D2166
Test Date: 6/6/2025

Type of Specimen: Shelby Tube
Strain Rate: 1.0 %/min



Initial Specimen Conditions		
Avg. Diameter (in)	D_o	2.89
Avg. Height (in)	H_o	5.63
In-situ Moisture Content (%)	w_o	24.8
Total Unit Weight (pcf)	γ_{total}	118.8
Dry Unit Weight (pcf)	γ_{dry}	95.1
Saturation (%)	S_r	86.9
Void Ratio	e_o	0.77
Specific Gravity (Assumed)	G_s	2.70

Mohr Circles for Peak Stress at Failure



Stresses at Failure	
Unconfined Compressive Strength, q_u (psi)	63.9
Axial Strain at Failure (%)	3.5
Axial Strain at 50 % of q_u (%)	1.6
Total Stresses at Failure	
Major Principal Stress, σ_1 (psi)	63.9
Minor Principal Stress, σ_3 (psi)	0
Undrained Shear Strength, S_u (tsf)	2.30

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Kainat Batool, 06/09/25
Quality Review/Date
Specimen prepared & tested by: A.B.

Beyond Engineering Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
(512) 358-6048

One-Dimensional Swell or Collapse of Soils

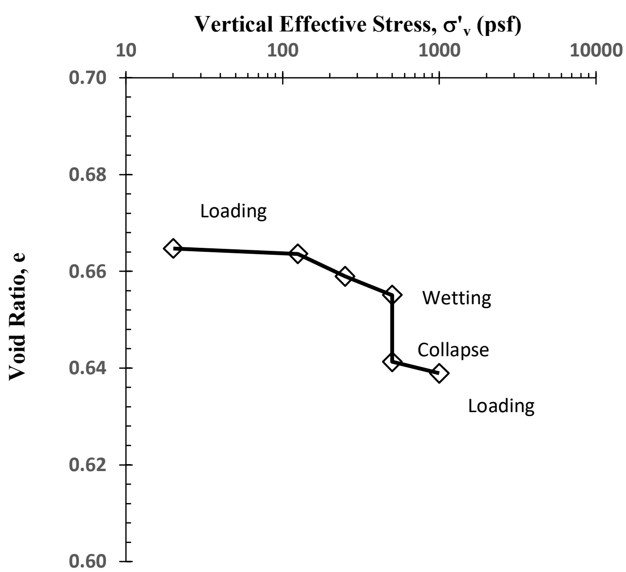
Client:	RRC Power & Energy, LLC	**Beyond Project No.:**	GE2503026
Project Name:	Longspur Wind Project	**Test Method:**	ASTM D4546, Method C
Sample ID:	SUB-6 at 4 ft	**Test Date:**	9/13/25-9/15/25

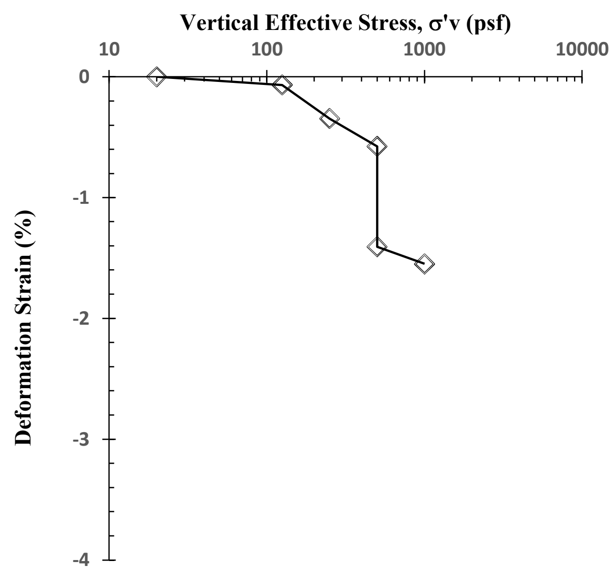
Specimen Conditions	
Avg. Water Content of Trimmings (%)	5.6
Final Specimen Water Content (%)	18.8
Initial Specimen Height (in)	0.798
Final Specimen Height (in)	0.785
Initial Dry Unit Weight, γ_o (pcf)	101.2
Final Dry Unit Weight, γ_f (pcf)	102.8
Initial Void Ratio, e_o	0.665
Final Void Ratio, e_f	0.639
Initial Degree of Saturation (%)	22.8
Final Degree of Saturation (%)	79.4
Collapse Strain (%)	-0.8

Specimen was inundated with tap water during testing. Loading increment duration was minimum 24 hours. . The calculation included the machine deflections that measured in each loading steps.

Gs assumed to be 2.70

Specimen Diameter: 2.493 inches





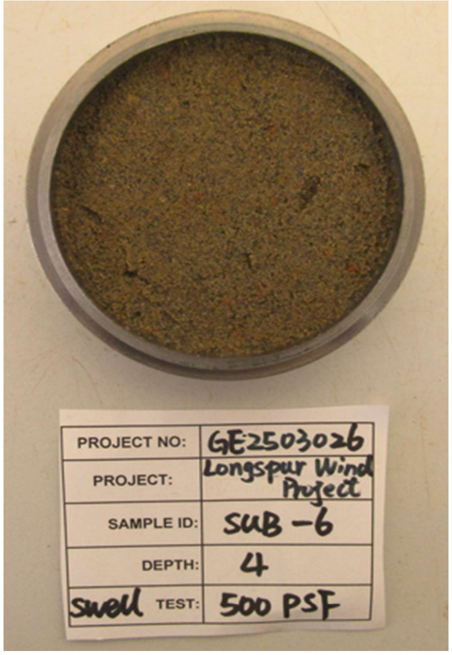
	Dry				Inundated	
Stage No.	1	2	3	4	5	6
σ'$_v$ (psf)	20	125	250	500	500	1000
Height (inch)	0.798	0.797	0.795	0.793	0.787	0.785
Void Ratio, e	0.665	0.664	0.659	0.655	0.641	0.639
Axial Strain (%)	0.00	-0.07	-0.35	-0.58	-1.41	-1.55

Huamiao Cao, P.E. 09/16/25
Analysis & Quality Review/Date
Specimen prepared and tested by: J.Z.

Beyond Engineering Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
(512) 358-6048

One-Dimensional Swell or Collapse of Soils

Client:	RRC Power & Energy, LLC	**Beyond Project No.:**	GE2503026
Project Name:	Longspur Wind Project	**Test Method:**	ASTM D4546, Method C
Sample ID:	SUB-6 at 4 ft	**Test Date:**	9/13/25-9/15/25

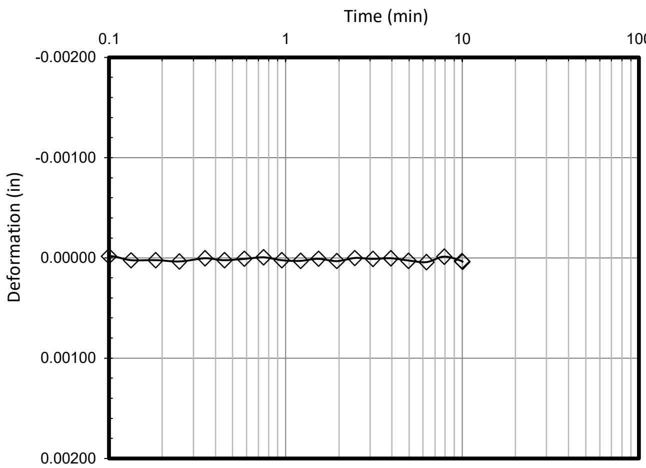


Beyond Engineering Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
(512) 358-6048

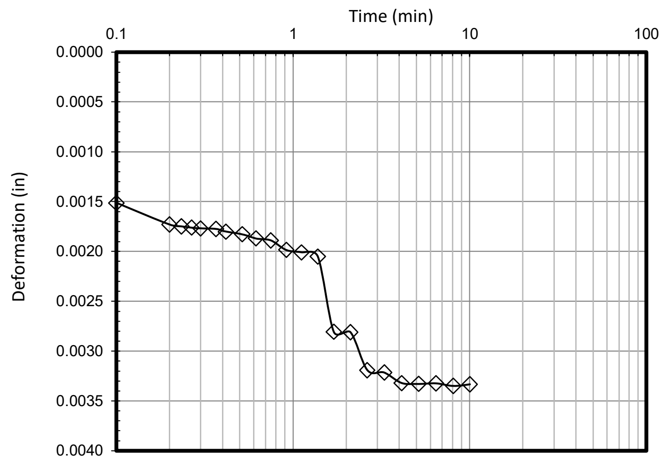
One-Dimensional Swell or Collapse of Soils

Client:	RRC Power & Energy, LLC	**Beyond Project No.:**	GE2503026
Project Name:	Longspur Wind Project	**Test Method:**	ASTM D4546, Method C
Sample ID:	SUB-6 at 4 ft	**Test Date:**	9/13/25-9/15/25

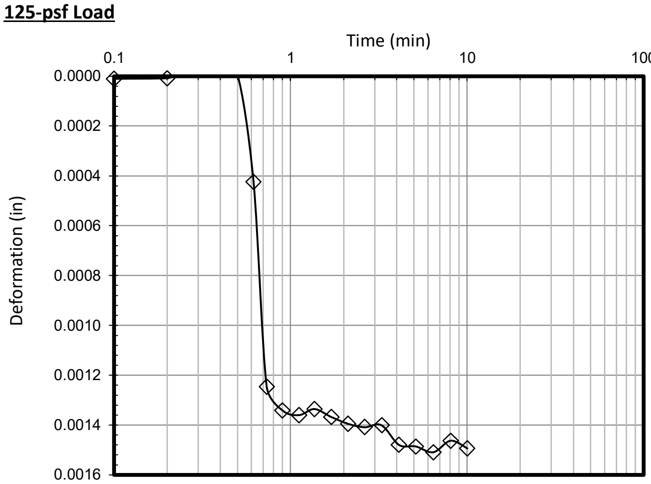
20-psf Load (Seating Load)



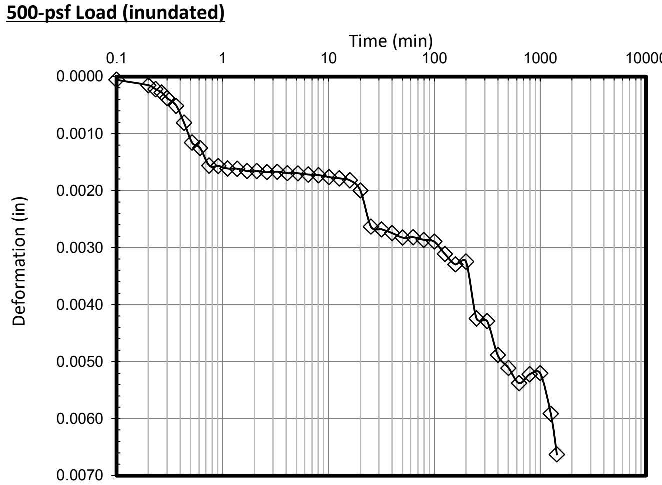
500-psf Load



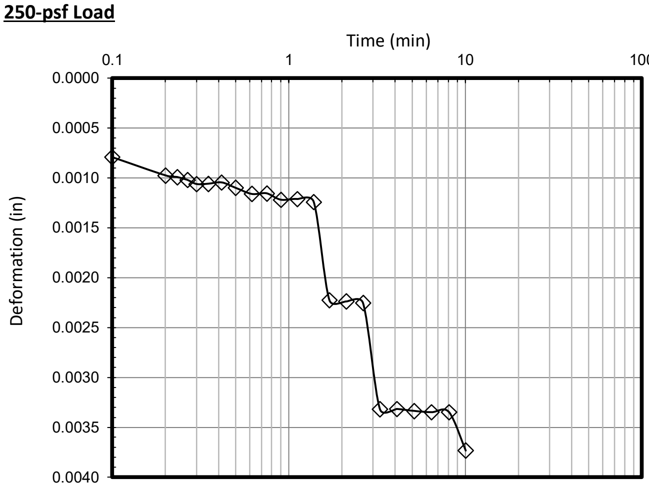
125-psf Load



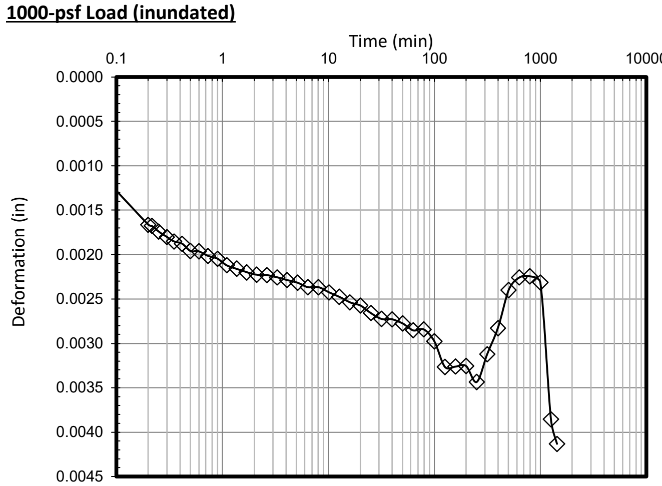
500-psf Load (inundated)



250-psf Load



1000-psf Load (inundated)



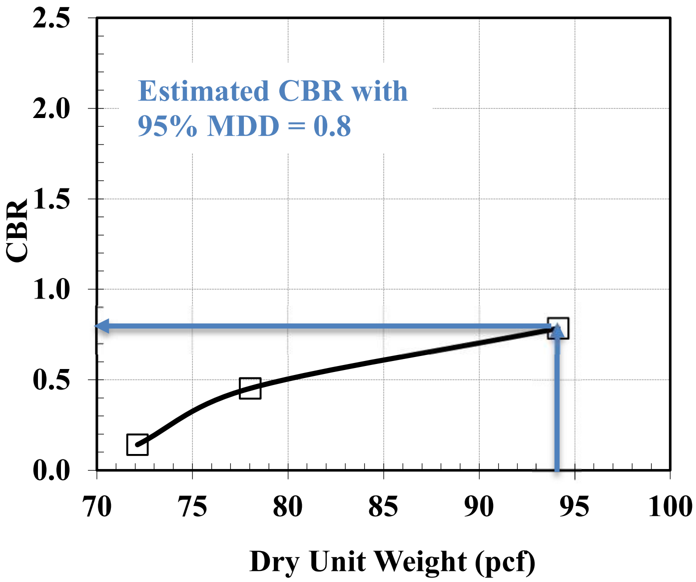
Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
(512) 358-6048

CBR (California Bearing Ratio) Test

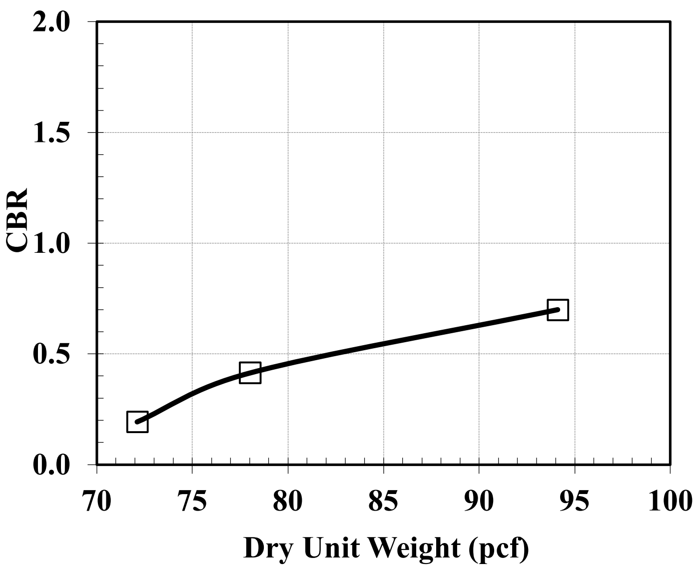
Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample No: GEO-048 at 1-4 ft

Beyond Project No.: GE2503026
Test Method: ASTM D1883
Test Date: 6/17/2025
Rate of Penetration: 0.05 in/min

CBR for 0.100-in Penetration



CBR for 0.200-in Penetration



Initial Conditions			
Specimen No.	1	2	3
Blows per Layer	15	30	60
Surcharge Weight (lbs)	10	10	10
Water Content (%)	20.6	20.9	21.3
Dry Unit Weight (pcf)	72.1	78.0	94.1
Percent Compaction (%)	72.8	78.7	95.0
Final Conditions (soaked)			
Water Content (%) at top 1-in layer after soaking	40.9	47.0	37.3
Swell (% of initial height)	4.1	6.4	5.1
Bearing Ratio of Sample at 0.100 in penetration	0.1	0.5	0.8
Bearing Ratio of Sample at 0.200 in penetration	0.2	0.4	0.7

Note: Soil specimens were molded to a range of densities using 15, 30 and 60 blows at optimum moisture content as per ASTM D 1883 to develop the CBR versus dry density curve. It was allowed the specimens to soak for 96 hrs prior bearing test. Removed the free water and allow the specimens to drain out for 15 min. The 10-lbs surcharge load was placed during bearing test.

HuaMiao Cao, P.E., 6/18/25

Analysis & Quality Review/Date
Specimens prepared and tested by: A.S.

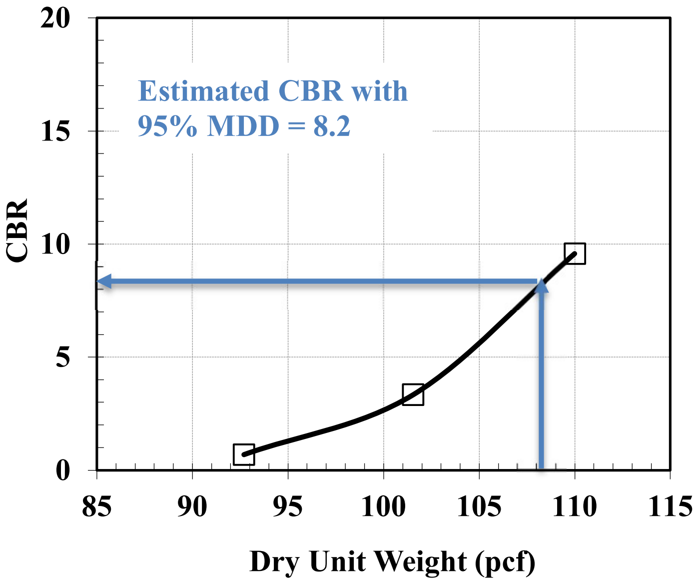
Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
(512) 358-6048

CBR (California Bearing Ratio) Test

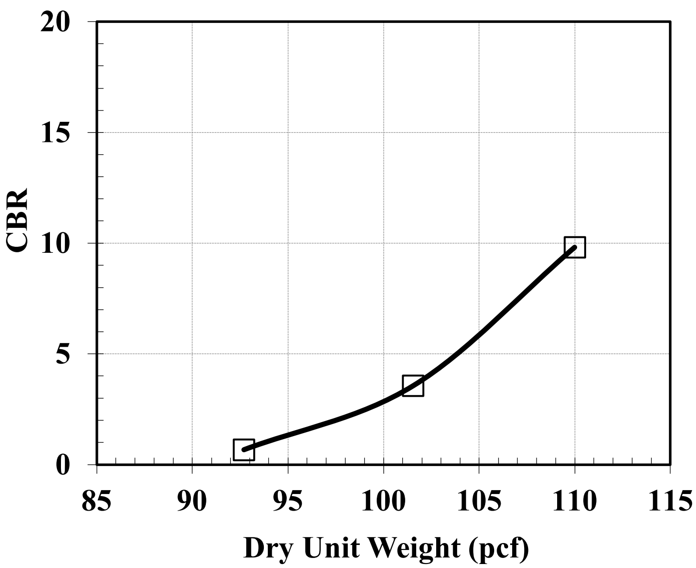
Client: RRC Power & Energy, LLC
Project: Longspur Wind Project
Sample No: GEO-062 at 1-4 ft

Beyond Project No.: GE2503026
Test Method: ASTM D1883
Test Date: 6/17/2025
Rate of Penetration: 0.05 in/min

CBR for 0.100-in Penetration



CBR for 0.200-in Penetration



Initial Conditions			
Specimen No.	1	2	3
Blows per Layer	10	25	60
Surcharge Weight (lbs)	10	10	10
Water Content (%)	12.2	12.0	12.4
Dry Unit Weight (pcf)	92.7	101.5	110.0
Percent Compaction (%)	81.4	89.2	96.6
Final Conditions (soaked)			
Water Content (%) at top 1-in layer after soaking	25.1	21.8	19.3
Swell (% of initial height)	0.5	0.8	0.5
Bearing Ratio of Sample at 0.100 in penetration	0.7	3.3	9.6
Bearing Ratio of Sample at 0.200 in penetration	0.7	3.6	9.8

Note: Soil specimens were molded to a range of densities using 10, 25 and 60 blows at optimum moisture content as per ASTM D 1883 to develop the CBR versus dry density curve. It was allowed the specimens to soak for 96 hrs prior bearing test. Removed the free water and allow the specimens to drain out for 15 min. The 10-lbs surcharge load was placed during bearing test.

HuaMiao Cao, P.E., 6/18/25

Analysis & Quality Review/Date
Specimens prepared and tested by: A.S.

Beyond Engineering & Testing, LLC
3801 Doris Lane, Suite B
Round Rock, TX 78664
(512) 358-6048

Client: RRC Power & Energy, LLC
Project: Longspur Wind Project

RRC Project No.: GE2503026
Testing Method: EPA 300/300.1
Test Date: 6/9/2025

No.	Sample ID & Depth	Sulfate Content (mg SO_4/kg)	Chloride Content (mg/kg)
1	GEO-04 at 1-13 ft	2,220	79.9
2	GEO-10 at 1-13 ft	672	82.8
3	GEO-25 at 1-13 ft	2,600	59.3
4	GEO-50 at 1-13 ft	4,390	78.6
5	GEO-64 at 1-13 ft	2,740	76.4
6	SUB-3 at 1-4 ft	240	305
7			
8			
9			
10			

HuaMiao Cao, 6/10/25

Quality Review/Date

Tested by: XENCO

SUMMARY OF LABORATORY RESULTS

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-01	1.0		23												
GEO-01	2.0	CH	24		100	63	22	41							
GEO-01	4.0		19												
GEO-01	7.0		28												
GEO-01	10.0		29												
GEO-01	12.0		47												
GEO-01	14.0	CH	20	111	81	52	20	32	5.28	7.3	0.0				
GEO-02	1.0		18												
GEO-02	4.0		22												
GEO-02	7.0		20												
GEO-02	10.0		19												
GEO-02	12.0		22												
GEO-03	1.0		11												
GEO-03	4.0		16												
GEO-03	7.0		16												
GEO-03	10.0		19												
GEO-03	12.0		16	96											
GEO-04	1.0		14												
GEO-04	1.0		23									0.0080	0.2220	7.1	589
GEO-04	4.0		19												
GEO-04	7.0		22												
GEO-04	10.0		23												
GEO-04	12.0	CL	23	103	85	47	18	29	1.96	14.8	10.0				
GEO-04	19.0		22	102					2.59	7.8	0.0				
GEO-05	1.0		16												
GEO-05	4.0		15												
GEO-05	7.0		17												
GEO-05	10.0		19												
GEO-05	12.0		17												
GEO-06	1.0		14												
GEO-06	4.0		30												

ND Not Detected; **D** Diluted;
*Denotes Total Unit Weight

SUMMARY OF LABORATORY RESULTS

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-06	7.0		27												
GEO-06	10.0		30												
GEO-07	1.0		25												
GEO-07	4.0		22												
GEO-07	7.0		26												
GEO-07	10.0		27												
GEO-07	12.0	CH	27	99	100	64	23	41	6.92	6.3	10.0				
GEO-08	1.0		25												
GEO-08	2.0	CH	22		99	57	19	38							
GEO-08	4.0		22												
GEO-08	7.0		24												
GEO-08	10.0		23												
GEO-09	1.0		16												
GEO-09	4.0		23												
GEO-09	7.0		25												
GEO-10	1.0		14												
GEO-10	1.0		17									0.0083	0.0672	6.6	746
GEO-10	2.0	CH	16		91	71	24	47							
GEO-10	4.0		15												
GEO-10	7.0		16												
GEO-10	10.0		17												
GEO-10	12.0		41												
GEO-11	1.0		13												
GEO-11	4.0		12												
GEO-11	7.0		7												
GEO-11	10.0		4												
GEO-11	12.0		13												
GEO-12	1.0		12												
GEO-12	4.0		11												
GEO-12	7.0		9												
GEO-12	10.0		16												

ND Not Detected; **D** Diluted;
*Denotes Total Unit Weight

SUMMARY OF LABORATORY RESULTS

RRC Power & Energy, LLC
810 Hesters Crossing Rd, Suite 120
Round Rock, TX 78681
Telephone: (512) 992-2087

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-12	12.0		16												
GEO-13	1.0		20												
GEO-13	4.0		26												
GEO-13	7.0		21												
GEO-13	10.0		24												
GEO-13	12.0		30												
GEO-14	1.0		19												
GEO-14	4.0		22												
GEO-14	7.0		23												
GEO-14	10.0		22												
GEO-14	12.0		18												
GEO-15	1.0		7												
GEO-15	4.0		11												
GEO-15	7.0		24												
GEO-15	10.0		23												
GEO-15	12.0		19												
GEO-16	1.0		3												
GEO-16	4.0		36												
GEO-16	7.0		23												
GEO-16	10.0		23												
GEO-16	12.0	MH	31		56	76	46	30							
GEO-17	1.0		13												
GEO-17	4.0		12												
GEO-17	7.0		14												
GEO-17	12.0		17												
GEO-18	1.0		7												
GEO-18	4.0		9												
GEO-18	7.0		9												
GEO-18	9.0		10												
GEO-18	12.0		6												
GEO-19	1.0		8												

ND Not Detected; **D** Diluted;
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SUMMARY OF LABORATORY RESULTS

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-19	2.0	CL	6		97	30	18	12							
GEO-19	4.0		20												
GEO-19	7.0		29												
GEO-19	9.0		21												
GEO-19	12.0		19												
GEO-20	1.0		21												
GEO-20	4.0		22												
GEO-20	7.0		22												
GEO-20	9.0		22												
GEO-21	1.0		8												
GEO-21	4.0		7												
GEO-21	7.0		6												
GEO-21	9.0		7												
GEO-22	1.0		10												
GEO-22	2.0	SC-SM	17		37	22	16	6							
GEO-22	4.0		23												
GEO-22	7.0		22												
GEO-22	10.0		21												
GEO-23	1.0		13												
GEO-23	4.0		21												
GEO-23	7.0		20												
GEO-23	10.0		21												
GEO-24	1.0		21												
GEO-24	4.0		19												
GEO-24	7.0		21												
GEO-24	10.0		21												
GEO-25	1.0		19												
GEO-25	1.0		16									0.0059	0.2600	7.5	455
GEO-25	4.0		21												
GEO-25	7.0		20												
GEO-25	10.0		21												

ND Not Detected; **D** Diluted;
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SUMMARY OF LABORATORY RESULTS

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-26	1.0		18												
GEO-26	4.0		16												
GEO-26	7.0		18												
GEO-26	10.0		21												
GEO-27	1.0		16												
GEO-27	4.0		15												
GEO-27	7.0		15												
GEO-27	10.0		14												
GEO-27	12.0		15												
GEO-28	1.0		15												
GEO-28	4.0		20												
GEO-28	7.0		22												
GEO-28	10.0		20												
GEO-28	12.0		7												
GEO-29	1.0		19												
GEO-29	4.0		21												
GEO-29	10.0		19												
GEO-29	12.0		20												
GEO-31	1.0		7												
GEO-31	4.0		7												
GEO-31	7.0		7												
GEO-31	10.0		15												
GEO-33	1.0		14												
GEO-33	2.0	CH	17		98	61	19	42							
GEO-33	4.0		25												
GEO-33	7.0		21												
GEO-33	10.0		23												
GEO-33	12.0		19												
GEO-33	17.0		17	111					9.45	2.9	0.0				
GEO-34	1.0		15												
GEO-34	4.0		12												

ND Not Detected; **D** Diluted;
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Telephone: (512) 992-2087

SUMMARY OF LABORATORY RESULTS

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-34	7.0		32												
GEO-34	10.0		22												
GEO-34	12.0		24												
GEO-35	1.0		30												
GEO-35	4.0		24												
GEO-35	7.0		51												
GEO-35	10.0		26												
GEO-35	12.0		23												
GEO-36	1.0		14												
GEO-36	4.0		16												
GEO-36	7.0		21												
GEO-36	10.0		6												
GEO-36	12.0		10												
GEO-36	17.0	CH	30	93	100	63	26	37	0.93	4.1	0.0				
GEO-37	1.0		21												
GEO-37	4.0		22												
GEO-37	7.0		24												
GEO-37	10.0		97												
GEO-37	12.0		47	65					2.66	3.5	0.0				
GEO-38	1.0		12												
GEO-38	4.0		15												
GEO-38	7.0		23												
GEO-38	12.0	CL	21		85	38	17	21							
GEO-39	1.0		19												
GEO-39	4.0		20												
GEO-39	7.0		20												
GEO-39	10.0		21												
GEO-40	1.0		9												
GEO-40	4.0		15												
GEO-40	7.0		17												
GEO-40	9.0		16												

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SUMMARY OF LABORATORY RESULTS

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-42	1.0		18												
GEO-42	4.0		22												
GEO-42	7.0		22												
GEO-42	10.0		21												
GEO-43	1.0		13												
GEO-43	4.0		14												
GEO-43	7.0		13												
GEO-43	12.0		12												
GEO-44	1.0		15												
GEO-44	4.0		22												
GEO-44	7.0		19												
GEO-44	10.0		2												
GEO-44	12.0		21												
GEO-45	1.0		16												
GEO-45	4.0		20												
GEO-45	7.0		23												
GEO-45	10.0		18												
GEO-46	1.0		12												
GEO-46	2.0	CL	16		84	41	18	23							
GEO-46	4.0		19												
GEO-46	7.0		31												
GEO-46	10.0		19												
GEO-46	12.0	CH	23	104	82	69	18	51	6.21	10.1	10.0				
GEO-47	1.0		8												
GEO-47	4.0		7												
GEO-47	7.0		11												
GEO-47	10.0		14												
GEO-47	12.0		13												
GEO-48	1.0		20												
GEO-48	2.0	CH	23		96	71	23	48							
GEO-48	4.0		22												

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SUMMARY OF LABORATORY RESULTS

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-48	7.0		22												
GEO-48	9.0		17												
GEO-48	12.0		19												
GEO-49	1.0		12												
GEO-49	4.0		22												
GEO-49	7.0		21												
GEO-49	10.0		22												
GEO-49	29.0	MH	81		62	88	69	19							
GEO-50	1.0		19												
GEO-50	1.0		26									0.0079	0.4390	7.6	408
GEO-50	4.0		22												
GEO-50	7.0		37												
GEO-50	9.0		23												
GEO-50	14.0	CH	20	107	99	52	20	32							
GEO-51	1.0		12												
GEO-51	4.0		26												
GEO-51	7.0		23												
GEO-51	10.0		22												
GEO-52	1.0		16												
GEO-52	4.0		17												
GEO-52	7.0		20												
GEO-52	10.0		48												
GEO-52	12.0		19												
GEO-53	1.0		16												
GEO-53	2.0	CH	17		93	54	19	35							
GEO-53	4.0		22												
GEO-53	7.0		23												
GEO-53	12.0	ML	98	34	66	NP	NP	NP							
GEO-53	22.0		26	94											
GEO-54	1.0		22												
GEO-54	4.0		22												

ND Not Detected; **D** Diluted;
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RRC Power & Energy, LLC
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SUMMARY OF LABORATORY RESULTS

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-54	7.0		18												
GEO-54	9.0		21												
GEO-54	12.0		56												
GEO-56	1.0		16												
GEO-56	4.0		19												
GEO-56	7.0		26												
GEO-56	9.0		42												
GEO-57	1.0		11												
GEO-57	4.0		14												
GEO-57	7.0		20												
GEO-57	10.0		20												
GEO-57	12.0		19												
GEO-58	1.0		21												
GEO-58	4.0		24												
GEO-58	7.0		13												
GEO-58	9.0		10												
GEO-58	12.0		24												
GEO-59	1.0		17												
GEO-59	2.0	CH	21		98	54	20	34							
GEO-59	4.0		20												
GEO-59	7.0		22												
GEO-59	9.0		13												
GEO-60	1.0		9												
GEO-60	4.0		21												
GEO-60	7.0		25												
GEO-60	9.0		25												
GEO-61	1.0		19												
GEO-61	4.0		15												
GEO-61	7.0		14												
GEO-61	9.0		27												
GEO-62	1.0		13												

ND Not Detected; **D** Diluted;
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SUMMARY OF LABORATORY RESULTS

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-62	2.0	SC	8		49	26	18	8							
GEO-62	4.0		12												
GEO-62	7.0		27												
GEO-62	10.0		22												
GEO-62	12.0	CH	21	105	91	56	23	33	4.51	6.6	10.0				
GEO-62	24.0		25	101											
GEO-63	1.0		9												
GEO-63	4.0		28												
GEO-63	7.0		21												
GEO-63	10.0		20												
GEO-63	12.0		23												
GEO-64	1.0		17												
GEO-64	1.0		22									0.0076	0.2740	7.3	294
GEO-64	4.0		21												
GEO-64	7.0		23												
GEO-64	9.0		23												
GEO-64	12.0		26												
GEO-65	1.0		11												
GEO-65	4.0		27												
GEO-65	7.0		33												
GEO-65	10.0		25												
GEO-65	12.0		25												
GEO-66	1.0		15												
GEO-66	4.0		20												
GEO-66	7.0		17												
GEO-66	9.0		28												
GEO-66	12.0	CH	22	104	100	52	22	30	6.24	5.8	10.0				
GEO-67	1.0		14												
GEO-67	2.0	CL	14		97	43	21	22							
GEO-67	4.0		20												
GEO-67	7.0		20												

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SUMMARY OF LABORATORY RESULTS

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
GEO-67	9.0		18												
GEO-68	1.0		15												
GEO-68	4.0		20												
GEO-68	7.0		20												
GEO-68	9.0		19												
GEO-68	12.0		22												
GEO-69	1.0		24												
GEO-69	4.0		17												
GEO-69	7.0		23												
GEO-69	9.0		25												
GEO-69	12.0		25	95					4.60	3.5	0.0				
GEO-70	1.0		14												
GEO-70	2.0	CH	16		99	61	20	41							
GEO-70	4.0		19												
GEO-70	7.0		11												
GEO-70	9.0		15												
GEO-70	12.0		26												
GEO-71	1.0		14												
GEO-71	4.0		11												
GEO-71	7.0		12												
GEO-71	10.0		14												
GEO-74	1.0		22												
GEO-74	4.0		23												
GEO-74	7.0		22												
GEO-74	9.0		21												
GEO-74	12.0		16												
GEO-77	1.0		25												
GEO-77	4.0		19												
GEO-77	7.0		23												
GEO-77	9.0		25												
GEO-77	12.0	CL	17	112	89	37	18	19	6.42	12.5	10.0				

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SUMMARY OF LABORATORY RESULTS

CLIENT: ALLETE Renewable Resources, Inc.
PROJECT: Longspur Wind Project
LOCATION: Mercer and Morton County, ND
NUMBER: GE2503026

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200 (%)	LL	PL	PI	Compressive Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (%/weight)	Sulfates (%/weight)	pH	Minimum Resistivity (ohm-cm)
SUB-1	1.0		11												
SUB-1	4.0		14												
SUB-2	1.0		7												
SUB-2	2.0	CL	14		51	37	14	23							
SUB-2	4.0	SM	14		20	NP	NP	NP							
SUB-3	1.0											0.0305	0.0240	9.1	805
SUB-3	4.0	SC-SM	15	108	20	21	16	5	1.62	14.3	3.0				
SUB-6	4.0	SM	6	101	27	NP	NP	NP							
SUB-9	1.0		6												
SUB-9	4.0	SC	6		23	24	16	8							
PMM-2	4.0	CH	25		100	77	22	55							
O&M-1	1.0		17												
O&M-1	4.0		10												
O&M-1	7.0		19	100					0.32	1.8	5.5				

ND Not Detected; **D** Diluted;
*Denotes Total Unit Weight

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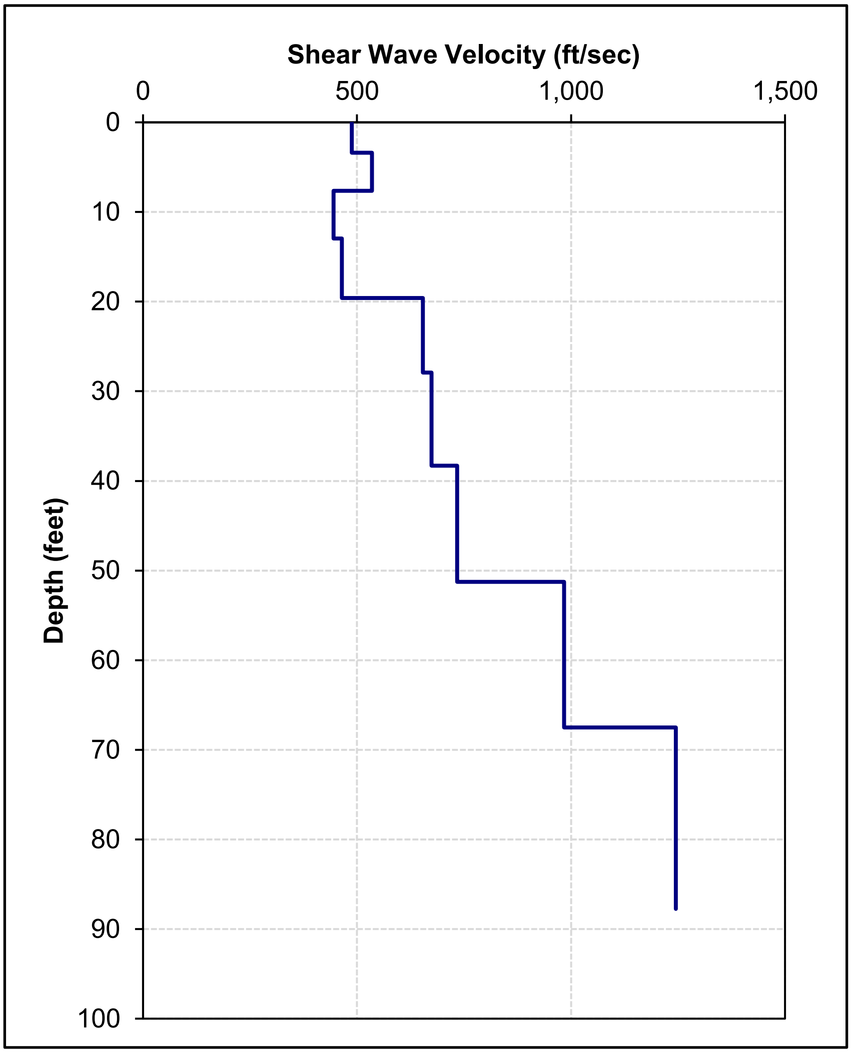
APPENDIX C

Multi-Channel Analysis of Surface Waves (MASW) Survey Results for WTG No. GEO-004

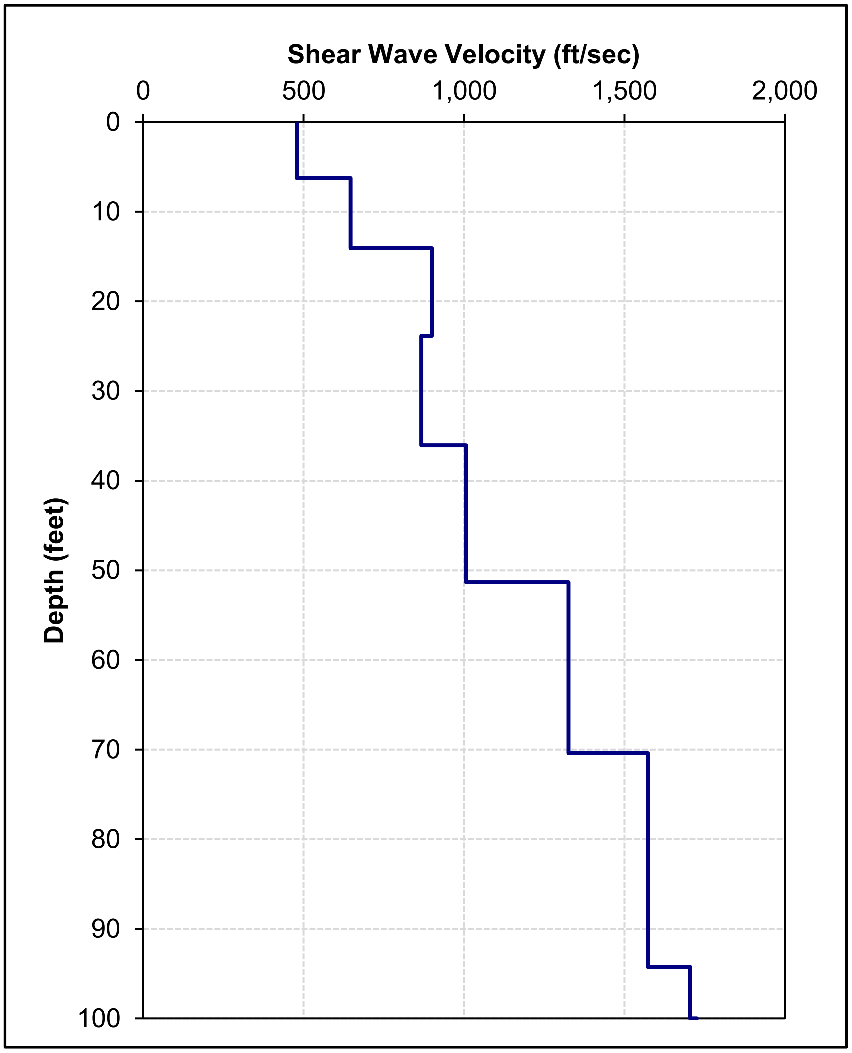
Depth (ft)	Shear Wave Velocity (ft/sec)
3.4	488
7.7	535
13.0	445
19.6	465
27.9	654
38.3	674
51.3	734
67.5	984
87.8	1,245



Note:
1. Data collected on May 09, 2025
2. SurfSeis v. 4.2.4.5 computer software developed by Kansas Geological Survey was used to process the field data.

Multi-Channel Analysis of Surface Waves (MASW) Survey Results for WTG No. GEO-014

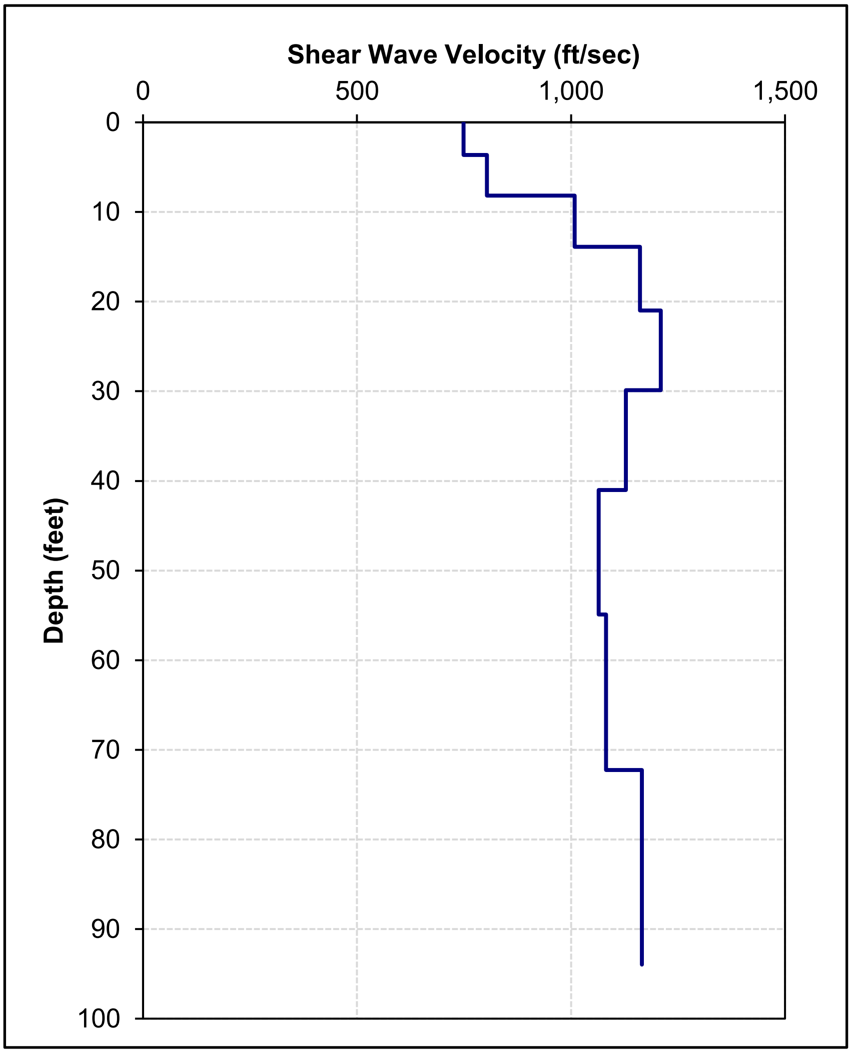
Depth (ft)	Shear Wave Velocity (ft/sec)
6.3	479
14.1	646
23.8	900
36.1	867
51.3	1,007
70.4	1,326
94.3	1,573
100.0	1,705



Note:
1. Data collected on May 09, 2025
2. SurfSeis v. 4.2.4.5 computer software developed by Kansas Geological Survey was used to process the field data.

Multi-Channel Analysis of Surface Waves (MASW) Survey Results for WTG No. GEO-018

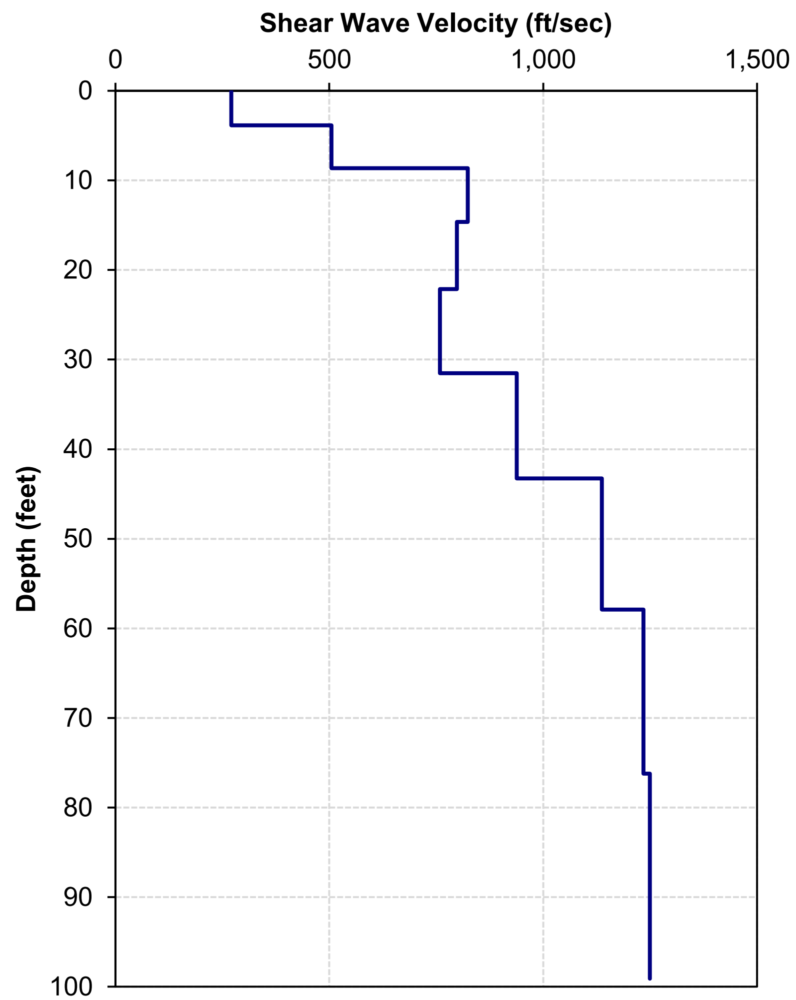
Depth (ft)	Shear Wave Velocity (ft/sec)
3.6	749
8.2	803
13.9	1,009
21.0	1,161
29.9	1,210
41.0	1,128
54.9	1,064
72.3	1,082
94.0	1,166



Note:
1. Data collected on May 09, 2025
2. SurfSeis v. 4.2.4.5 computer software developed by Kansas Geological Survey was used to process the field data.

Multi-Channel Analysis of Surface Waves (MASW) Survey Results for WTG No. GEO-029

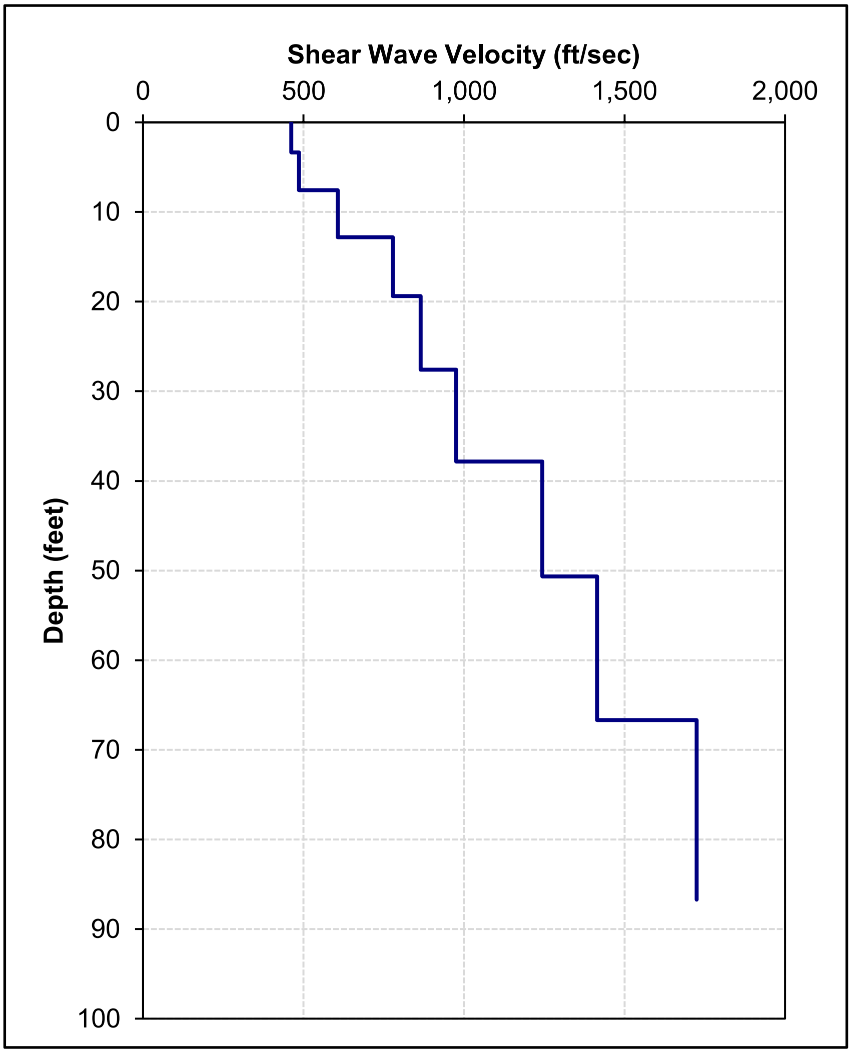
Depth (ft)	Shear Wave Velocity (ft/sec)
3.8	271
8.6	505
14.7	824
22.2	798
31.5	759
43.3	938
57.9	1,137
76.2	1,234
99.1	1,250



Note:
1. Data collected on May 09, 2025
2. SurfSeis v. 4.2.4.5 computer software developed by Kansas Geological Survey was used to process the field data.

Multi-Channel Analysis of Surface Waves (MASW) Survey Results for WTG No. GEO-033

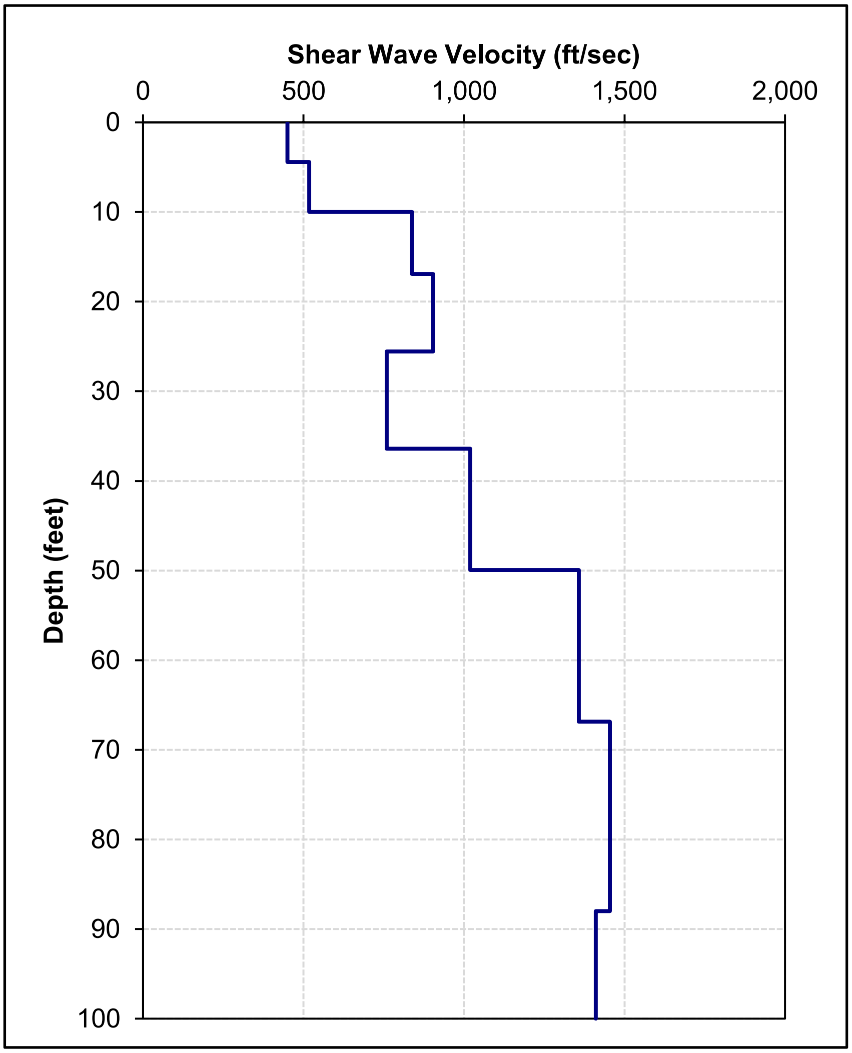
Depth (ft)	Shear Wave Velocity (ft/sec)
3.4	462
7.6	486
12.8	607
19.4	778
27.6	865
37.8	976
50.7	1,244
66.7	1,414
86.7	1,725



Note:
1. Data collected on May 09, 2025
2. SurfSeis v. 4.2.4.5 computer software developed by Kansas Geological Survey was used to process the field data.

Multi-Channel Analysis of Surface Waves (MASW) Survey Results for WTG No. GEO-064

Depth (ft)	Shear Wave Velocity (ft/sec)
4.4	450
10.0	518
16.9	838
25.6	904
36.4	760
49.9	1,020
66.9	1,357
88.0	1,455
100.0	1,411



Note:
1. Data collected on May 09, 2025
2. SurfSeis v. 4.2.4.5 computer software developed by Kansas Geological Survey was used to process the field data.

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name:	Minnesota Power - Longspur
Black & Veatch Project No.:	
Supplier Name & Operator	RRC Power & Energy; Ashutosh Shrivastava
Project Location:	West Morton, ND (46.955518, -101.761945)
Date:	5/12/2025
Measurement No. & Orientation:	DSR-1 / NE-SW
Description of Terrain & Probe Insertion:	Silt, Brown, Dry, Flat Topography; Probe insertion required some force
Weather (Present and Recent):	Sunny, 84° F
Meter Model Type:	Supersting; R8
Serial No. & Calibration Date:	SS2106234, 1/28/26

Notes: 1. Fence Lines is at approximately 500 feet East running N-S and 350 feet South running E-W.

Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration					Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-m)
			A (ft)	M (ft)	0	N (ft)	B (ft)						
1	1	2	1.5	0.5		0.5	1.5			9.996	0.2	126.6	242.33
2	2	2	3	1		1	3			135.9	0.1	27.75	106.23
3	4	2	4.5	1.5		1.5	4.5			158.3	0.2	10.83	62.19
6	6	4	9	3		3	9			134.6	0	3.401	39.06
10	6	4	15	5		5	15			147.0	0	1.809	34.63
20	12	6	30	10		10	30			186.3	0.1	0.832	31.85
30	12	6	45	15		15	45			135.0	0.2	0.553	31.76
60	12	12	90	30		30	90			169.0	0.2	0.214	24.58
100	12	12	150	50		50	150			213.2	0	0.0979	18.74
200	12	12	300	100		100	300			280.2	0.1	0.038	14.55
300	12	12	450	150		150	450			125.8	0.1	0.0219	12.58

[1] Not required if using AGI meters.

Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of “a” spacing.

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name:	Minnesota Power - Longspur
Black & Veatch Project No.:	
Supplier Name & Operator	RRC Power & Energy; Ashutosh Shrivastava
Project Location:	West Morton, ND (46.955518, -101.761945)
Date:	5/12/2025
Measurement No. & Orientation:	DSR-1 NW-SE
Description of Terrain & Probe Insertion:	Silt, Brown, Dry, Flat Topography; Probe insertion required some force
Weather (Present and Recent):	Sunny, 88° F
Meter Model Type:	Supersting; R8
Serial No. & Calibration Date:	SS2106234, 1/28/26

Notes: Fence Line is at approximately 500 feet East running N-S and 350 feet South running E-W.

Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration					Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-m)
			A (ft)	M (ft)	0	N (ft)	B (ft)						
1	1	1	1.5	0.5		0.5	1.5			9.979	0	112.5	215.34
2	2	2	3	1		1	3			102.1	0.1	30.88	118.22
3	4	4	4.5	1.5		1.5	4.5			100.4	0.1	9.618	55.23
6	6	6	9	3		3	9			115.9	0	3.383	38.85
10	6	6	15	5		5	15			163.5	0.1	1.812	34.68
20	12	12	30	10		10	30			148.2	0.1	0.908	34.76
30	12	12	45	15		15	45			144.5	0.1	0.574	32.96
60	12	12	90	30		30	90			135.7	0.1	0.206	23.66
100	12	12	150	50		50	150			175.6	0.1	0.095	18.18
200	12	12	300	100		100	300			210	0	0.037	14.16
300	12	12	450	150		150	450			135.2	0.1	0.022	12.63

[1] Not required if using AGI meters.

Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of “a” spacing.

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name:	Minnesota Power - Longspur
Black & Veatch Project No.:	
Supplier Name & Operator	RRC Power & Energy; Ashutosh Shrivastava
Project Location:	West Morton, ND (46.957200, -101.763272)
Date:	5/12/2025
Measurement No. & Orientation:	DSR-2 NE-SW
Description of Terrain & Probe Insertion:	Silt, Brown, Dry, Flat Topography; Probe insertion required some force
Weather (Present and Recent):	Sunny, 89° F
Meter Model Type:	Supersting; R8
Serial No. & Calibration Date:	SS2106234, 1/28/26

Notes: Fence Line is at approximately 150 feet East running NE-SW.

Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration					Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-m)
			A (ft)	M (ft)	0	N (ft)	B (ft)						
1	1	1	1.5	0.5		0.5	1.5			15.2	0	39.61	75.82
2	2	2	3	1		1	3			132.5	0	13.94	53.37
3	4	4	4.5	1.5		1.5	4.5			135.9	0.1	4.626	26.56
6	6	6	9	3		3	9			183.1	0	2.136	24.53
10	6	6	15	5		5	15			160.5	0.1	1.524	29.17
20	12	12	30	10		10	30			190.0	0.1	0.92	35.22
30	12	12	45	15		15	45			177.1	0.1	0.607	34.86
60	12	12	90	30		30	90			176.2	0.3	0.221	25.38
100	12	12	150	50		50	150			221.7	0.1	0.104	19.91
200	12	12	300	100		100	300			208.5	0.1	0.037	14.16
300	12	12	450	150		150	450			163.3	0.1	0.0225	12.92
600	12	12	900	300		300	900			115.4	0	0.0092	10.57

[1] Not required if using AGI meters.

Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of “a” spacing.

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name:	Minnesota Power - Longspur
Black & Veatch Project No.:	
Supplier Name & Operator	RRC Power & Energy; Ashutosh Shrivastava
Project Location:	West Morton, ND (46.954955, -101.762062)
Date:	5/13/2025
Measurement No. & Orientation:	TSR-1 E-W
Description of Terrain & Probe Insertion:	Silt, Brown, Dry, Flat Topography; Probe insertion required some force
Weather (Present and Recent):	Sunny, 91° F
Meter Model Type:	Supersting; R8
Serial No. & Calibration Date:	SS2106234, 1/28/26

Notes: Fence Line is at approximately 150 feet South running E-W and 500 feet East running N-S.

Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration					Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-m)
			A (ft)	M (ft)	0	N (ft)	B (ft)						
1	1	1	1.5	0.5		0.5	1.5			21.3	0	62.18	119.02
2	2	2	3	1		1	3			23.2	0	36.14	138.35
3	4	4	4.5	1.5		1.5	4.5			108.6	0.1	19.43	111.58
6	6	6	9	3		3	9			201.7	0	7.044	80.90
10	6	6	15	5		5	15			193.8	0	2.964	56.74
20	12	12	30	10		10	30			218.7	0.1	1.075	41.15
30	12	12	45	15		15	45			215.4	0.1	0.553	31.76

[1] Not required if using AGI meters.

Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of “a” spacing.

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name:	Minnesota Power - Longspur
Black & Veatch Project No.:	
Supplier Name & Operator	RRC Power & Energy; Ashutosh Shrivastava
Project Location:	West Morton, ND (46.954955, -101.762062)
Date:	5/13/2025
Measurement No. & Orientation:	TSR-1 N-S
Description of Terrain & Probe Insertion:	Silt, Brown, Dry, Flat Topography; Probe insertion required some force
Weather (Present and Recent):	Sunny, 90 ° F
Meter Model Type:	Supersting; R8
Serial No. & Calibration Date:	SS2106234, 1/28/26

Notes: Fence Line is at approximately 150 feet South running E-W and 500 feet East running N-S.

Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration					Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-m)
			A (ft)	M (ft)	0	N (ft)	B (ft)						
1	1	1	1.5	0.5		0.5	1.5			19.3	0	58.45	111.88
2	2	2	3	1		1	3			26.2	0.1	34.48	132.00
3	4	4	4.5	1.5		1.5	4.5			131.8	0.1	20.53	117.89
6	6	6	9	3		3	9			192.3	0	6.835	78.50
10	6	6	15	5		5	15			181.6	0	2.754	52.72
20	12	12	30	10		10	30			201.3	0	0.954	36.52
30	12	12	45	15		15	45			191.2	0.1	0.494	28.37

[1] Not required if using AGI meters.

Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of “a” spacing.

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name:	Minnesota Power - Longspur
Black & Veatch Project No.:	
Supplier Name & Operator	RRC Power & Energy; Ashutosh Shrivastava
Project Location:	West Morton, ND (46.955010, -101.760918)
Date:	5/13/2025
Measurement No. & Orientation:	TSR-2 NE-SW
Description of Terrain & Probe Insertion:	Silt, Brown, Dry, Flat Topography; Probe insertion required some force
Weather (Present and Recent):	Sunny, 88 ° F
Meter Model Type:	Supersting; R8
Serial No. & Calibration Date:	SS2106234, 1/28/26

Notes: Fence Line is at approximately 150 feet South running E-W and 225 feet East running N-S.

Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration					Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-m)
			A (ft)	M (ft)	0	N (ft)	B (ft)						
1	1	1	1.5	0.5		0.5	1.5			21.5	0	46.63	89.26
2	2	2	3	1		1	3			20.4	0	31.86	121.97
3	4	3	4.5	1.5		1.5	4.5			19.7	0	22.31	128.11
6	6	5	9	3		3	9			243.2	0.1	7.38	84.76
10	6	6	15	5		5	15			238.2	0.1	3.189	61.04
20	12	10	30	10		10	30			209.8	0.1	1.053	40.31
30	12	12	45	15		15	45			135.1	0.1	0.559	32.10

[1] Not required if using AGI meters.

Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of “a” spacing.

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name: Minnesota Power - Longspur

Black & Veatch Project No.:

Supplier Name & Operator: RRC Power & Energy; Ashutosh Shrivastava

Project Location: West Morton, ND (46.955010, -101.760918)

Date: 5/13/2025

Measurement No. & Orientation: TSR-2 NW-SE

Description of Terrain & Probe Insertion: Silt, Brown, Dry, Flat Topography; Probe insertion required some force

Weather (Present and Recent): Sunny, 88 ° F

Meter Model Type: Supersting; R8

Serial No. & Calibration Date: SS2106234, 1/28/26

Notes: Fence Line is at approximately 150 feet South running E-W and 225 feet East running N-S.

Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration					Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-m)
			A (ft)	M (ft)	0	N (ft)	B (ft)						
1	1	1	1.5	0.5		0.5	1.5			18.6	0	48.33	92.51
2	2	2	3	1		1	3			16.2	0.1	32.62	124.88
3	4	4	4.5	1.5		1.5	4.5			81.3	0	21.38	122.77
6	6	6	9	3		3	9			221.8	0	6.332	72.72
10	6	6	15	5		5	15			196.3	0.1	3.018	57.77
20	12	12	30	10		10	30			201.4	0.1	0.958	36.67
30	12	12	45	15		15	45			162.3	0.1	0.545	31.30

[1] Not required if using AGI meters.

Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of "a" spacing.

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name:	Minnesota Power - Longspur
Black & Veatch Project No.:	
Supplier Name & Operator	RRC Power & Energy; Ashutosh Shrivastava
Project Location:	West Morton, ND (46.955574, -101.760990)
Date:	5/12/2025
Measurement No. & Orientation:	TSR-3 E-W
Description of Terrain & Probe Insertion:	Silt, Brown, Dry, Flat Topography; Probe insertion required some force
Weather (Present and Recent):	Sunny, 87 ° F
Meter Model Type:	Supersting; R8
Serial No. & Calibration Date:	SS2106234, 1/28/26

Notes: Fence Line is at approximately 350 feet South running E-W and 250 feet East running N-S.

Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration					Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-m)
			A (ft)	M (ft)	0	N (ft)	B (ft)						
1	1	1	1.5	0.5		0.5	1.5			9.6	0	81.62	156.23
2	2	2	3	1		1	3			9.8	0	42.57	162.97
3	4	4	4.5	1.5		1.5	4.5			103.8	0	21.94	125.99
6	6	6	9	3		3	9			163.4	0.1	6.88	79.02
10	6	6	15	5		5	15			124.9	0	2.963	56.72
20	12	12	30	10		10	30			83.9	0.2	0.897	34.34
30	12	12	45	15		15	45			95.9	0.3	0.433	24.86

[1] Not required if using AGI meters.

Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of “a” spacing.

In Situ Electrical Soil Resistivity Measurement Data Form

Revision 0

Wenner Array

Project Name:	Minnesota Power - Longspur
Black & Veatch Project No.:	
Supplier Name & Operator	RRC Power & Energy; Ashutosh Shrivastava
Project Location:	West Morton, ND (46.955574, -101.760990)
Date:	5/12/2025
Measurement No. & Orientation:	TSR-3 N-S
Description of Terrain & Probe Insertion:	Silt, Brown, Dry, Flat Topography; Probe insertion required some force
Weather (Present and Recent):	Sunny, 91 ° F
Meter Model Type:	Supersting; R8
Serial No. & Calibration Date:	SS2106234, 1/28/26

Notes: Fence Line is at approximately 350 feet South running E-W and 250 feet East running N-S.

Electrode "a" Spacing (ft)	Preferred Electrode Depth (in)	Actual Electrode Depth (in)	Electrode Configuration					Source Voltage (V)	V_{M-N} (mV) [1]	Current Injected, I (mA)	Standard deviation (%)	Apparent Resistance (Ohm)	Apparent Resistivity (Ohm-m)
			A (ft)	M (ft)	0	N (ft)	B (ft)						
1	1	1	1.5	0.5		0.5	1.5			4.8	0	78.86	150.95
2	2	2	3	1		1	3			9.6	0	45.07	172.54
3	4	4	4.5	1.5		1.5	4.5			83.9	0.1	18.06	103.71
6	6	6	9	3		3	9			137.8	0	5.179	59.48
10	6	6	15	5		5	15			91.6	0.1	2.185	41.82
20	12	12	30	10		10	30			103.5	0	0.947	36.25
30	12	12	45	15		15	45			123.9	0.1	0.545	31.30

[1] Not required if using AGI meters.

Note: Due to soil conductivity, the electrode depth may have to be increased. However, electrode depth shall not exceed 10% of “a” spacing.

Project Name: Longspur Wind Project
Black & Veatch Project No.:
Supplier Name: RRC Power & Energy LLC

In Situ Electrical Soil Resistivity Summary Data Form

Revision 0

Instructions:
1. Enter resistance and resistivity values of all traverse locations listed below.
2. Submit this completed spreadsheet with the final report.

Apparent Resistance (ohm)

Electrode "a" spacing (ft)	DSR-1 NE-SW	DSR-1 NW-SE	TSR-1 N-S	TSR-1 E-W	TSR-2 NE-SW	TSR-2 NW-SE	TSR-3 N-S	TSR-3 E-W	DSR-2 NE-SW
1	126.600	112.500	58.450	62.180	46.630	48.330	78.860	81.620	39.610
2	27.750	30.880	34.480	36.140	31.860	32.620	45.070	42.570	13.940
3	10.830	9.618	20.530	19.430	22.310	21.380	18.060	21.940	4.626
6	3.401	3.383	6.835	7.044	7.380	6.332	5.179	6.880	2.136
10	1.809	1.812	2.754	2.964	3.189	3.018	2.185	2.963	1.524
20	0.832	0.908	0.954	1.075	1.053	0.958	0.947	0.897	0.920
30	0.553	0.574	0.494	0.553	0.559	0.545	0.545	0.433	0.607
60	0.214	0.206							0.221
100	0.098	0.095							0.104
200	0.038	0.037							0.037
300	0.022	0.022							0.023
600									0.009

Apparent Resistivity (ohm-m)

Electrode "a" spacing (ft)	DSR-1 NE-SW	DSR-1 NW-SE	TSR-1 N-S	TSR-1 E-W	TSR-2 NE-SW	TSR-2 NW-SE	TSR-3 N-S	TSR-3 E-W	DSR-2 NE-SW
1	242.331	215.341	111.882	119.021	89.257	92.511	150.949	156.232	75.82
2	106.235	118.218	131.999	138.354	121.969	124.879	172.541	162.970	53.37
3	62.191	55.231	117.892	111.575	128.114	122.773	103.708	125.989	26.56
6	39.060	38.853	78.499	80.899	84.758	72.722	59.480	79.016	24.53
10	34.627	34.684	52.716	56.735	61.042	57.769	41.824	56.716	29.17
20	31.851	34.761	36.522	41.154	40.312	36.675	36.254	34.340	35.22
30	31.756	32.962	28.368	31.756	32.100	31.296	31.296	24.865	34.86
60	24.578	23.659							25.38
100	18.739	18.184							19.91
200	14.547	14.165							14.16
300	12.576	12.633							12.92

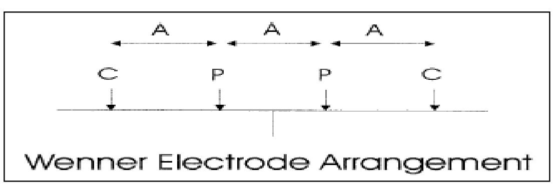
SOIL RESISTIVITY MEASURMENT DATA SHEET

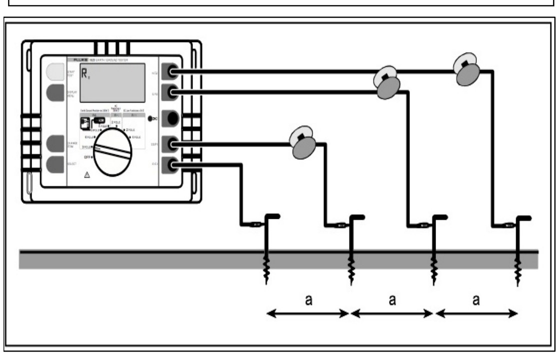
Survey ID GEO-001
DATE 5/14/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind
Project No. GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.928622
LONGITUDE : -101.860048
WEATHER: Sunny
Temp. (°F) 69°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

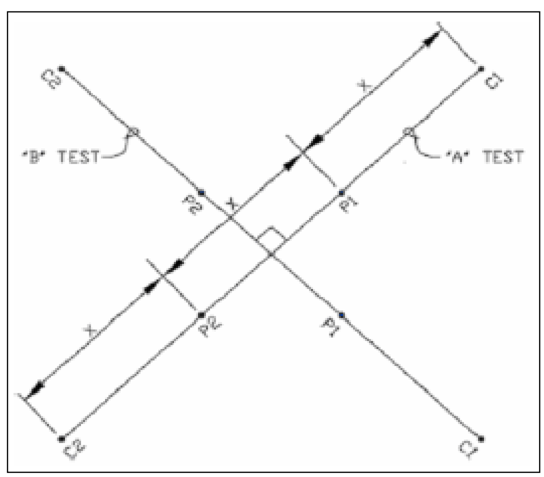
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				Average Soil Resistivity (Ωm)
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	
0.5	4	2	4.452	4.26	4.628	4.43			4.35
1	4	2	3.531	6.76	3.318	6.35			6.55
1.5	4	2	2.343	6.73	2.331	6.69			6.71
2.5	4	2	1.297	6.21	1.362	6.52			6.36
3	4	2	0.824	4.73	0.816	4.69			4.71
5	4	2	0.384	3.68	0.399	3.81			3.75
7	4	2	0.201	2.70	0.194	2.60			2.65
10	12	6	0.113	2.17	0.121	2.32			2.24
15	12	6	0.068	1.95	0.067	1.92			1.93
20	12	6	0.054	2.06	0.052	1.99			2.03
30	12	6	0.044	2.54	0.043	2.49			2.51
45	12+	6+	0.037	3.16	0.037	3.20			3.18
70	12+	6+	0.029	3.86	0.030	4.05			3.96
100	12+	6+	0.021	4.01	0.020	3.76			3.88

Notes: Fence line at ~300 ft south of the profile center, going E-W.

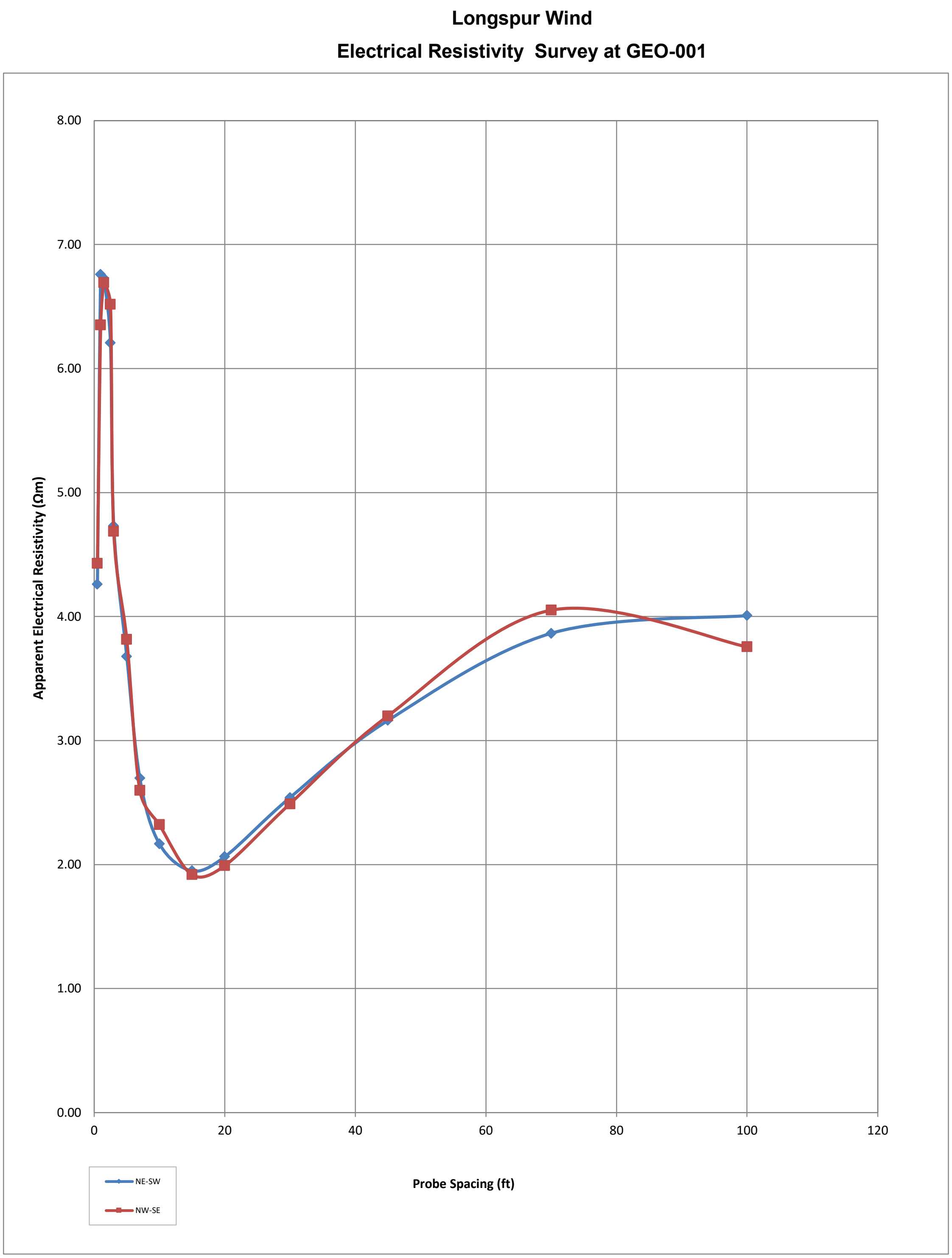






General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.


Longspur Wind
Electrical Resistivity Survey at GEO-001
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Apparent Electrical Resistivity (Ωm)
0
20
40
60
80
100
120
Probe Spacing (ft)
NE-SW
NW-SE

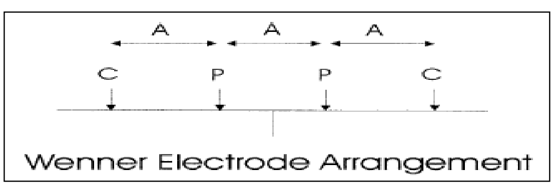
SOIL RESISTIVITY MEASURMENT DATA SHEET

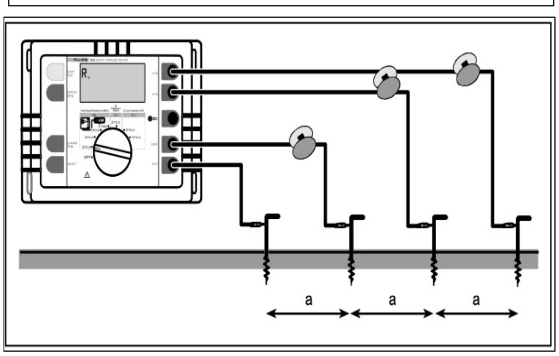
Survey ID GEO-008
DATE 5/14/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind — **Project No.** GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.916389
LONGITUDE : -101.834616
WEATHER: Sunny — **Temp. (°F)** 72°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

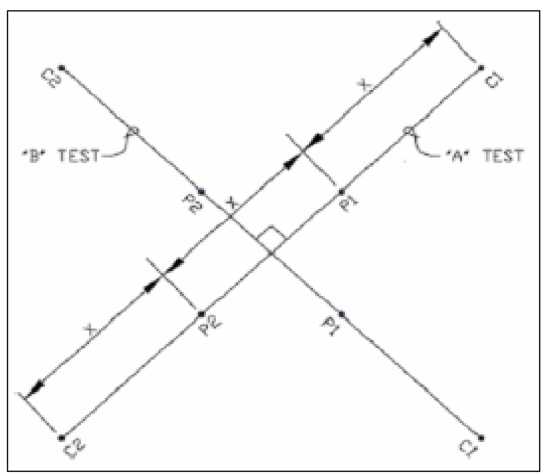
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Average Soil Resistivity (Ωm)
0.5	4	2	9.113	8.72	8.884	8.50			8.61
1	4	2	7.573	14.50	7.424	14.21			14.35
1.5	4	2	5.115	14.69	5.230	15.02			14.85
2.5	4	2	3.235	15.48	3.122	14.94			15.21
3	4	2	2.342	13.45	2.456	14.10			13.78
5	4	2	1.265	12.11	1.315	12.59			12.35
7	4	2	0.858	11.50	0.856	11.47			11.49
10	12	6	0.497	9.50	0.504	9.65			9.58
15	12	6	0.295	8.48	0.310	8.89			8.69
20	12	6	0.203	7.78	0.202	7.72			7.75
30	12	6	0.142	8.15	0.141	8.11			8.13
45	12+	6+	0.097	8.32	0.093	7.97			8.14
70	12+	6+	0.063	8.47	0.064	8.58			8.53
100	12+	6+	0.048	9.10	0.048	9.14			9.12

Notes:



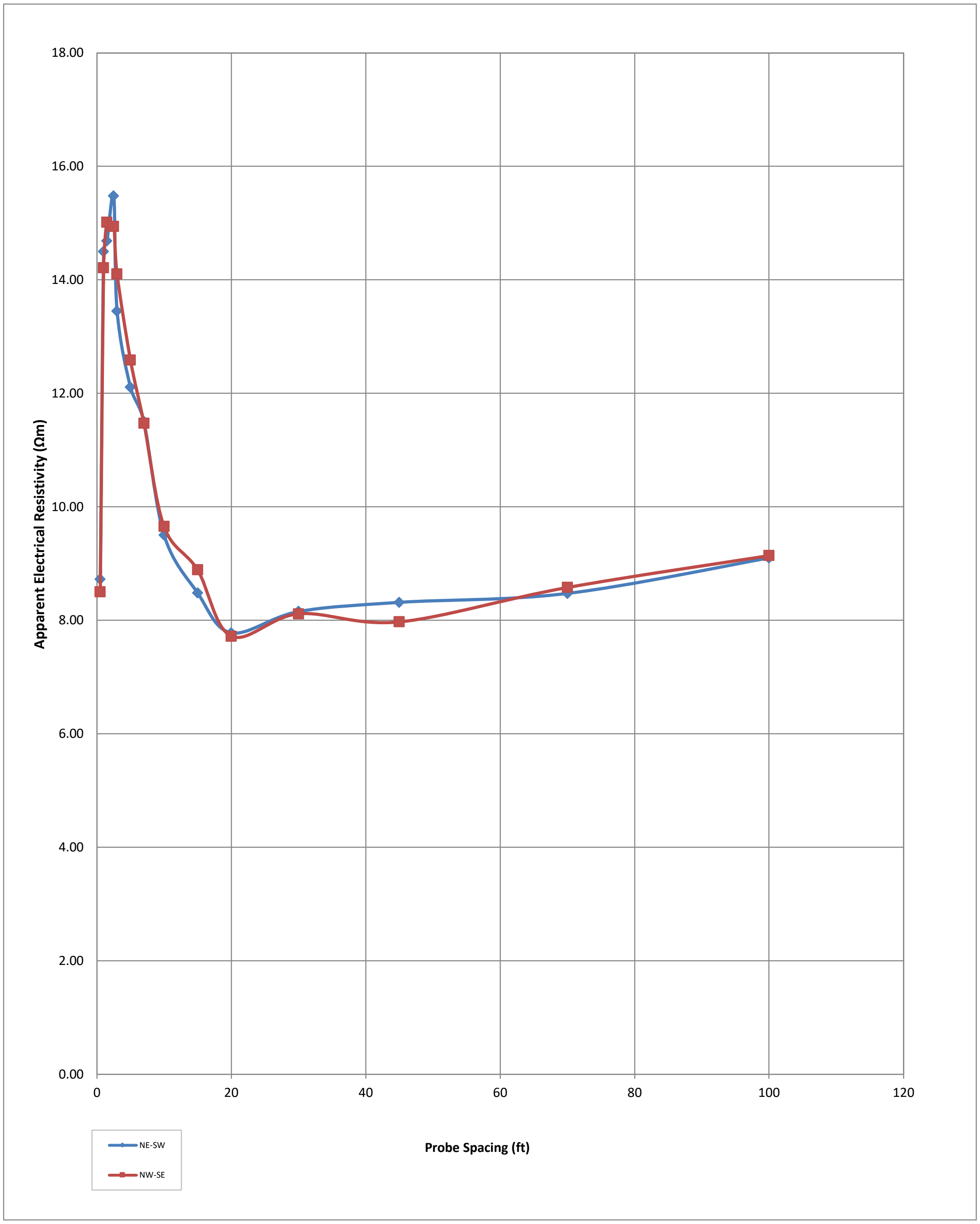




General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.

Longspur Wind
Electrical Resistivity Survey at GEO-008



SOIL RESISTIVITY MEASURMENT DATA SHEET

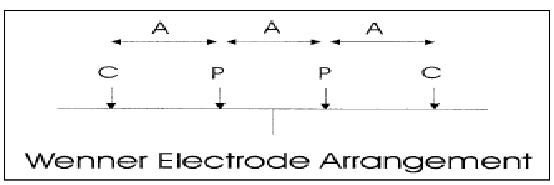
0 GEO-010

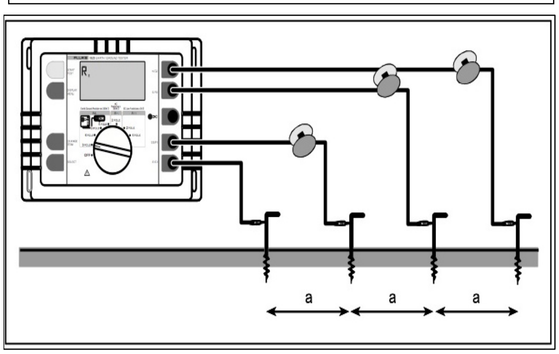
DATE 5/14/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind
Project No. GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.921177
LONGITUDE : -101.821968
WEATHER: Partly Cloudy
Temp. (°F) 69°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

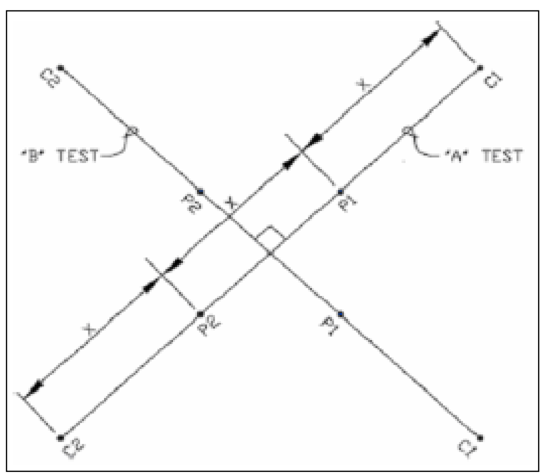
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Average Soil Resistivity (Ωm)
0.5	4	2	12.540	12.00	13.430	12.85			12.43
1	4	2	9.440	18.07	9.272	17.75			17.91
1.5	4	2	7.432	21.34	7.343	21.08			21.21
2.5	4	2	5.435	26.01	5.453	26.09			26.05
3	4	2	4.692	26.94	4.529	26.01			26.48
5	4	2	3.356	32.12	3.524	33.73			32.92
7	4	2	2.536	33.98	2.426	32.51			33.24
10	12	6	1.675	32.06	1.623	31.07			31.56
15	12	6	1.056	30.32	1.032	29.63			29.98
20	12	6	0.743	28.44	0.734	28.11			28.28
30	12	6	0.455	26.11	0.452	25.95			26.03
45	12+	6+	0.279	24.06	0.297	25.62			24.84
70	12+	6+	0.159	21.26	0.153	20.45			20.86
100	12+	6+	0.103	19.75	0.092	17.69			18.72

Notes: Fence line at ~300 ft west of the profile center, going N-S.



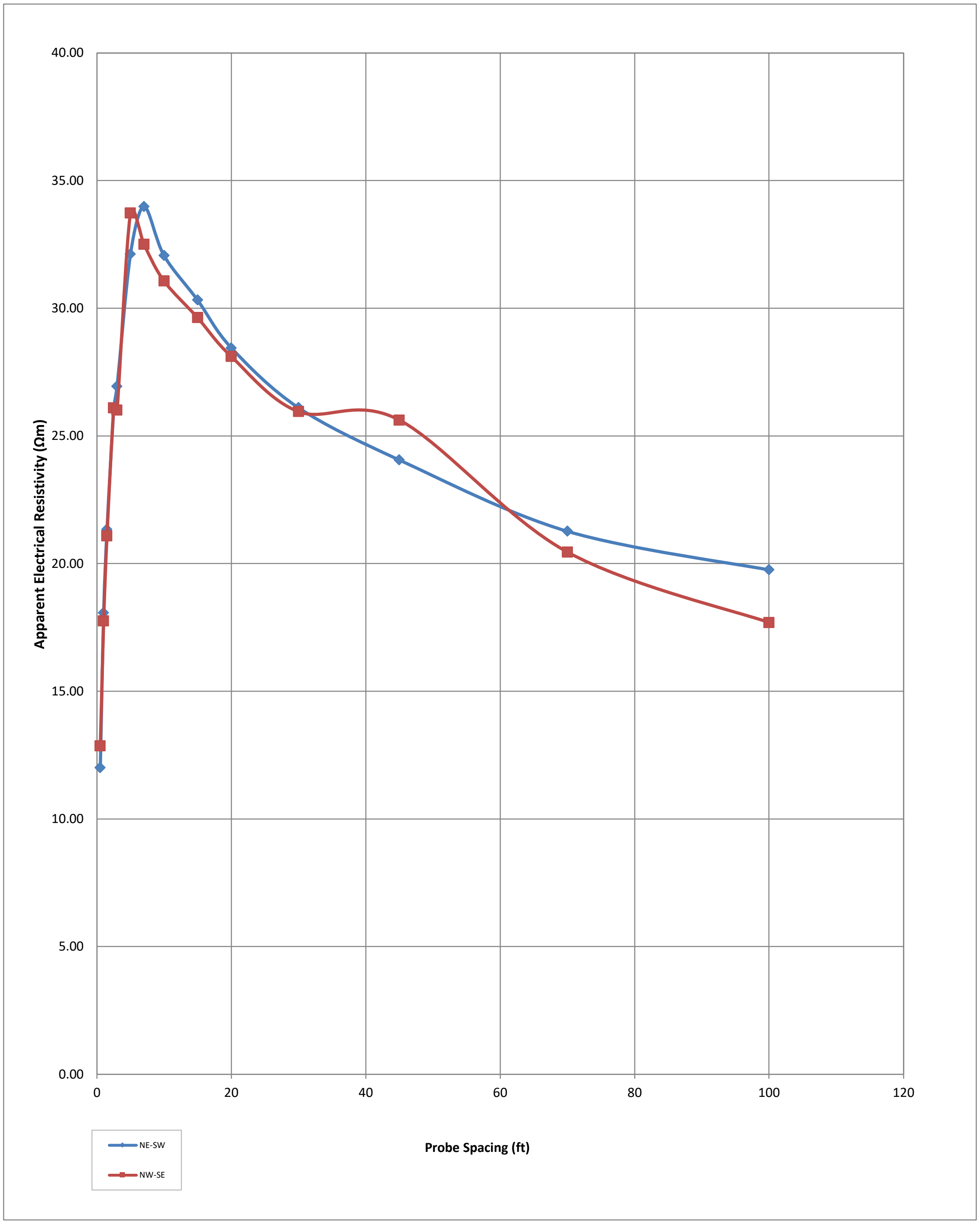




General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.

Longspur Wind
Electrical Resistivity Survey at GEO-010



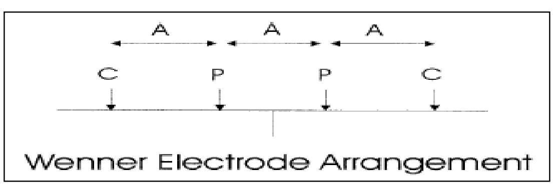
SOIL RESISTIVITY MEASURMENT DATA SHEET

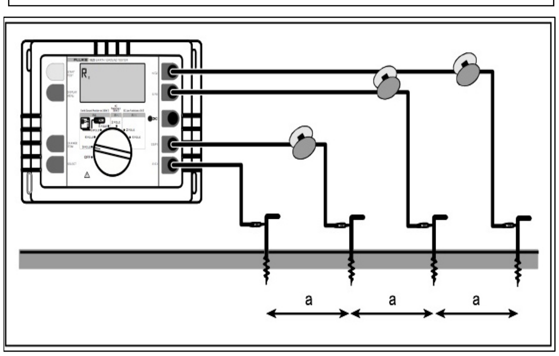
Survey ID GEO-019
DATE 5/17/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind **Project No.** GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.886393
LONGITUDE : -101.800325
WEATHER: Sunny **Temp. (°F)** 49°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

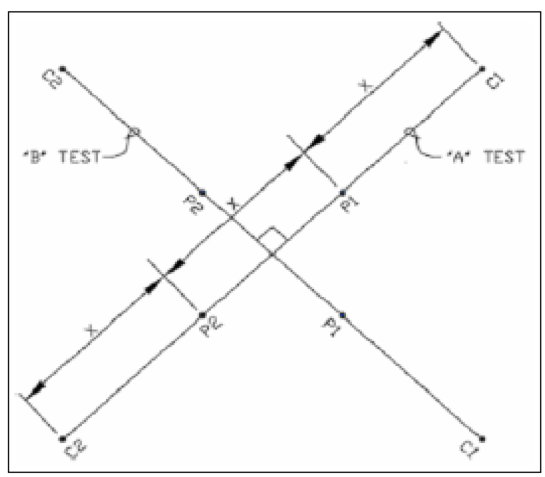
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Average Soil Resistivity (Ωm)
0.5	4	2	15.320	14.66	17.250	16.51			15.59
1	4	2	8.679	16.61	9.245	17.70			17.15
1.5	4	2	6.246	17.93	6.645	19.08			18.51
2.5	4	2	5.136	24.58	5.235	25.05			24.81
3	4	2	4.964	28.51	4.883	28.04			28.27
5	4	2	4.053	38.79	3.769	36.07			37.43
7	4	2	2.735	36.65	2.756	36.93			36.79
10	12	6	1.618	30.97	1.542	29.52			30.24
15	12	6	0.854	24.53	0.853	24.48			24.50
20	12	6	0.525	20.08	0.572	21.91			20.99
30	12	6	0.301	17.31	0.299	17.16			17.24
45	12+	6+	0.125	10.80	0.117	10.11			10.46
70	12+	6+	0.060	7.99	0.058	7.75			7.87
100	12+	6+	0.039	7.56	0.041	7.91			7.73

Notes: Powerlines at ~1800 ft north of the profile center, going E-W.

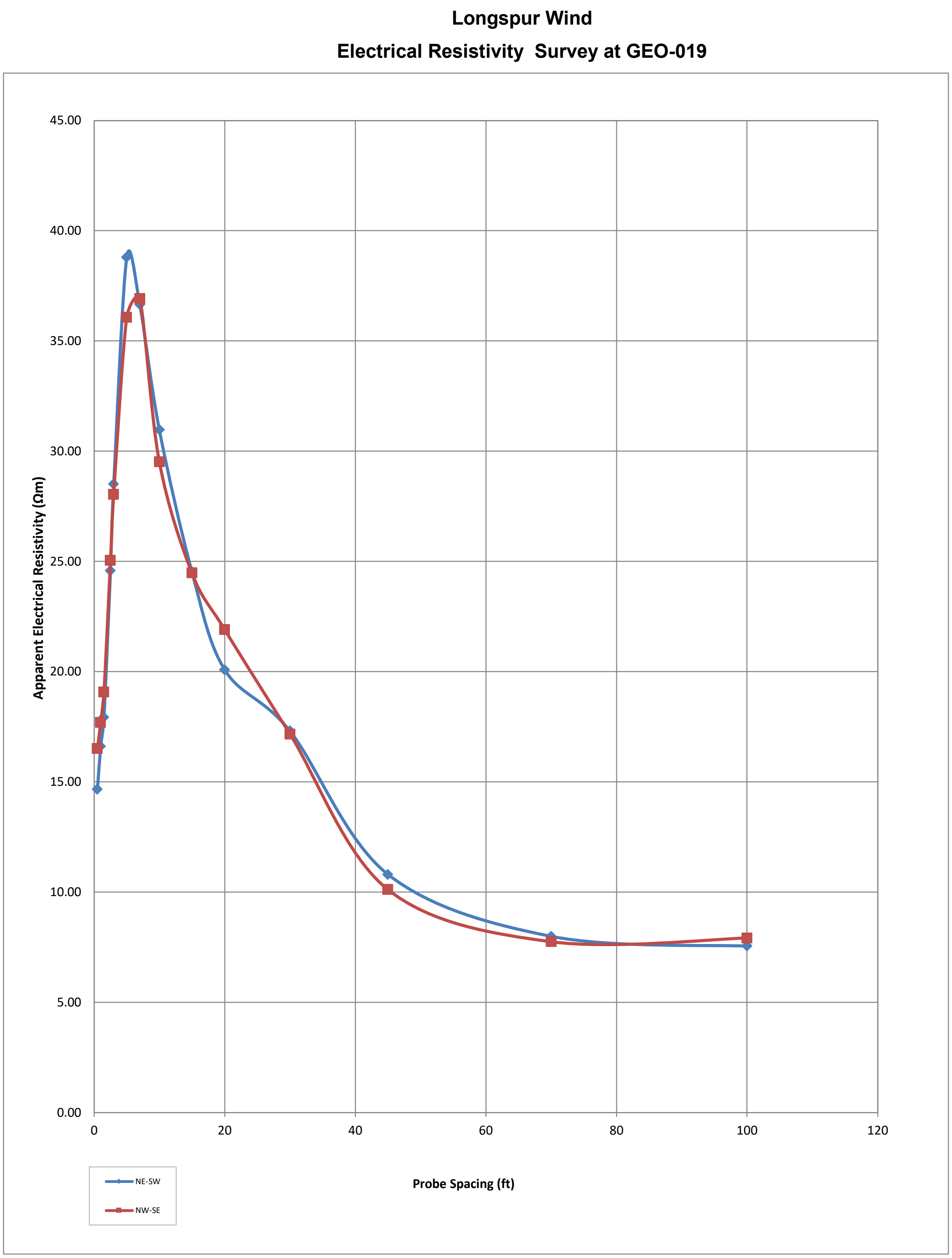






General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.


Longspur Wind
Electrical Resistivity Survey at GEO-019
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Apparent Electrical Resistivity (Ωm)
0
20
40
60
80
100
120
Probe Spacing (ft)
NE-SW
NW-SE

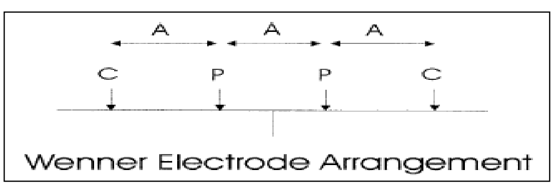
SOIL RESISTIVITY MEASURMENT DATA SHEET

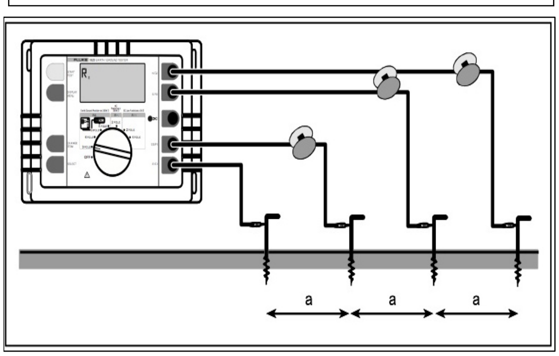
Survey ID GEO-022
DATE 5/6/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind **Project No.** GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.973121
LONGITUDE : -101.745487
WEATHER: Sunny **Temp. (°F)** 65°F
TOP SOIL: Silty Clay, Brown, Dry-Moist
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

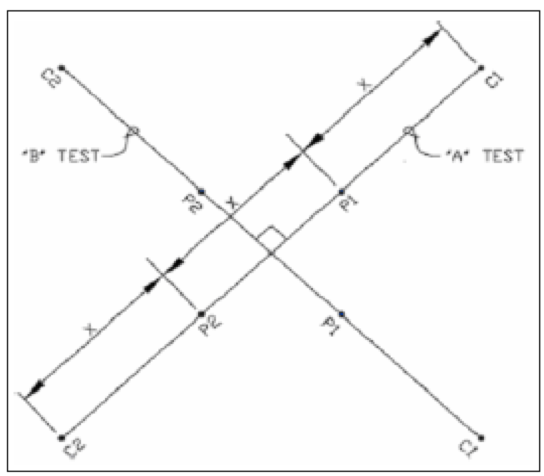
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Average Soil Resistivity (Ωm)
0.5	4	2	35.280	33.77	38.660	37.00			35.38
1	4	2	26.240	50.23	27.740	53.10			51.66
1.5	4	2	21.300	61.16	20.910	60.04			60.60
2.5	4	2	12.010	57.47	11.440	54.74			56.11
3	4	2	9.882	56.75	10.330	59.32			58.03
5	4	2	4.090	39.14	4.210	40.29			39.72
7	4	2	1.980	26.53	1.998	26.77			26.65
10	12	6	0.938	17.95	0.922	17.65			17.80
15	12	6	0.502	14.40	0.489	14.05			14.23
20	12	6	0.331	12.69	0.326	12.49			12.59
30	12	6	0.219	12.55	0.210	12.07			12.31
45	12+	6+	0.135	11.62	0.139	11.95			11.78
70	12+	6+	0.088	11.83	0.088	11.77			11.80
100	12+	6+	0.063	12.02	0.062	11.80			11.91

Notes: Fence line at ~300 ft east of the profile center, going N-S.



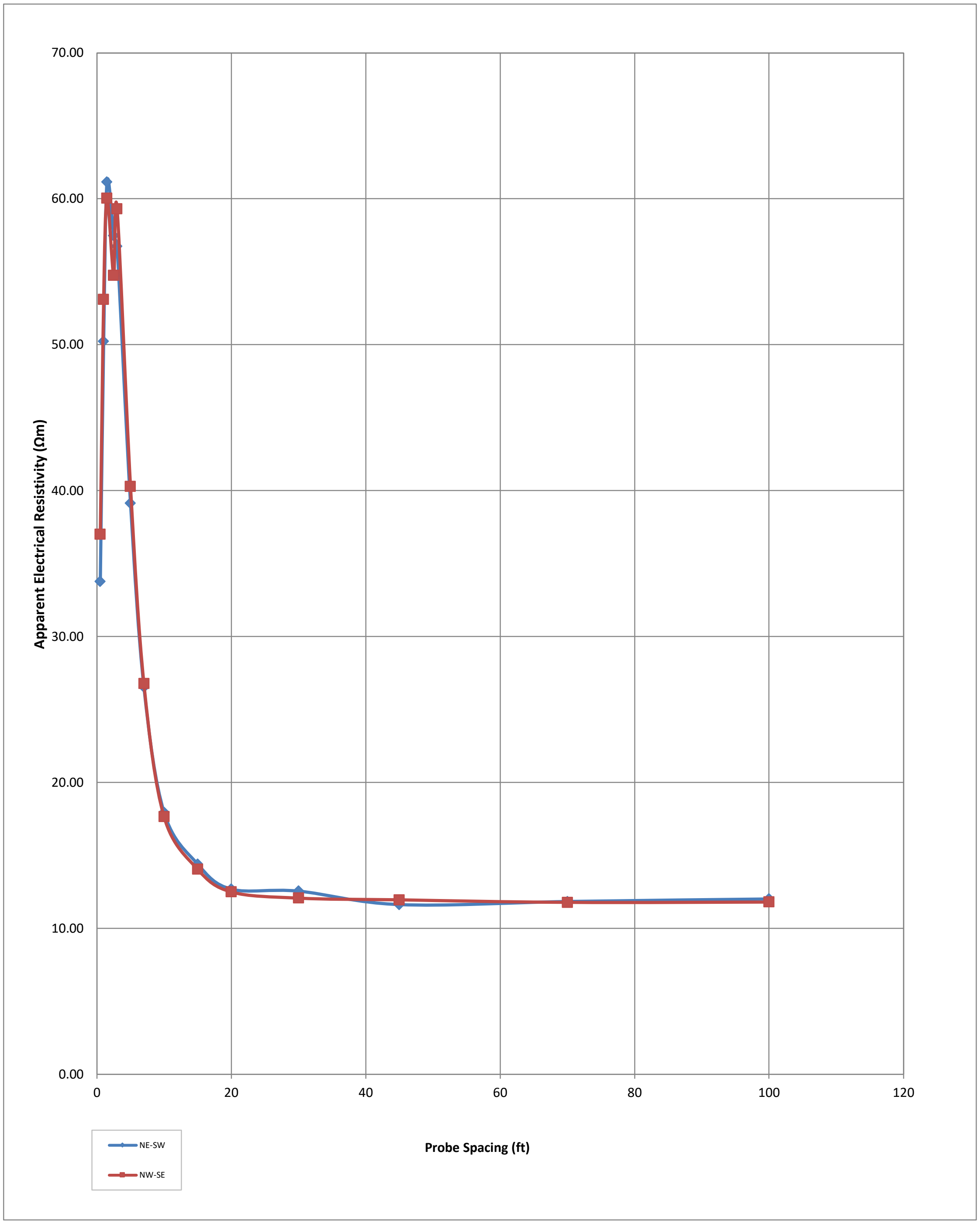




General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.

Longspur Wind
Electrical Resistivity Survey at GEO-022



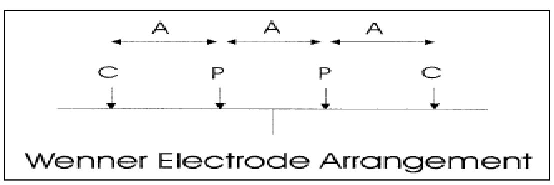
SOIL RESISTIVITY MEASURMENT DATA SHEET

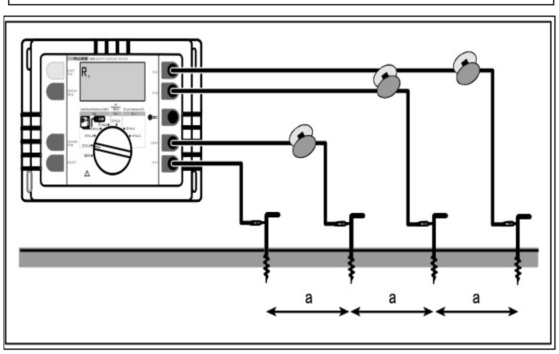
Survey ID GEO-033
DATE 5/13/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind
Project No. GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.95389
LONGITUDE : -101.730973
WEATHER: Partly Cloudy
Temp. (°F) 42°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

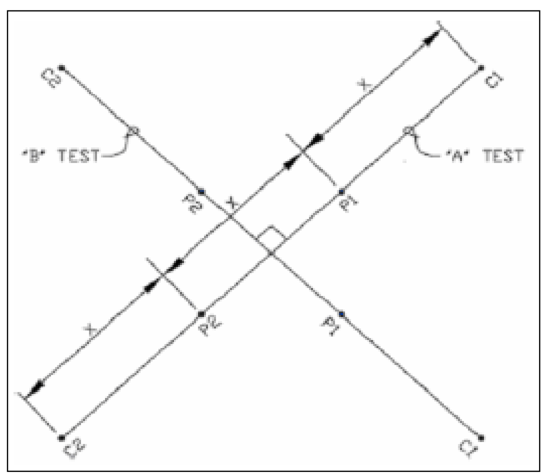
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Average Soil Resistivity (Ωm)
0.5	4	2	28.530	27.31	31.560	30.21			28.76
1	4	2	19.530	37.38	20.380	39.01			38.20
1.5	4	2	14.270	40.97	15.240	43.76			42.36
2.5	4	2	8.028	38.42	8.383	40.12			39.27
3	4	2	6.249	35.88	6.862	39.40			37.64
5	4	2	2.749	26.31	2.934	28.08			27.20
7	4	2	1.592	21.33	1.574	21.09			21.21
10	12	6	0.876	16.78	0.902	17.27			17.02
15	12	6	0.498	14.30	0.501	14.40			14.35
20	12	6	0.297	11.39	0.297	11.35			11.37
30	12	6	0.172	9.90	0.177	10.19			10.04
45	12+	6+	0.104	8.98	0.118	10.12			9.55
70	12+	6+	0.063	8.49	0.065	8.74			8.61
100	12+	6+	0.041	7.83	0.044	8.39			8.11

Notes:



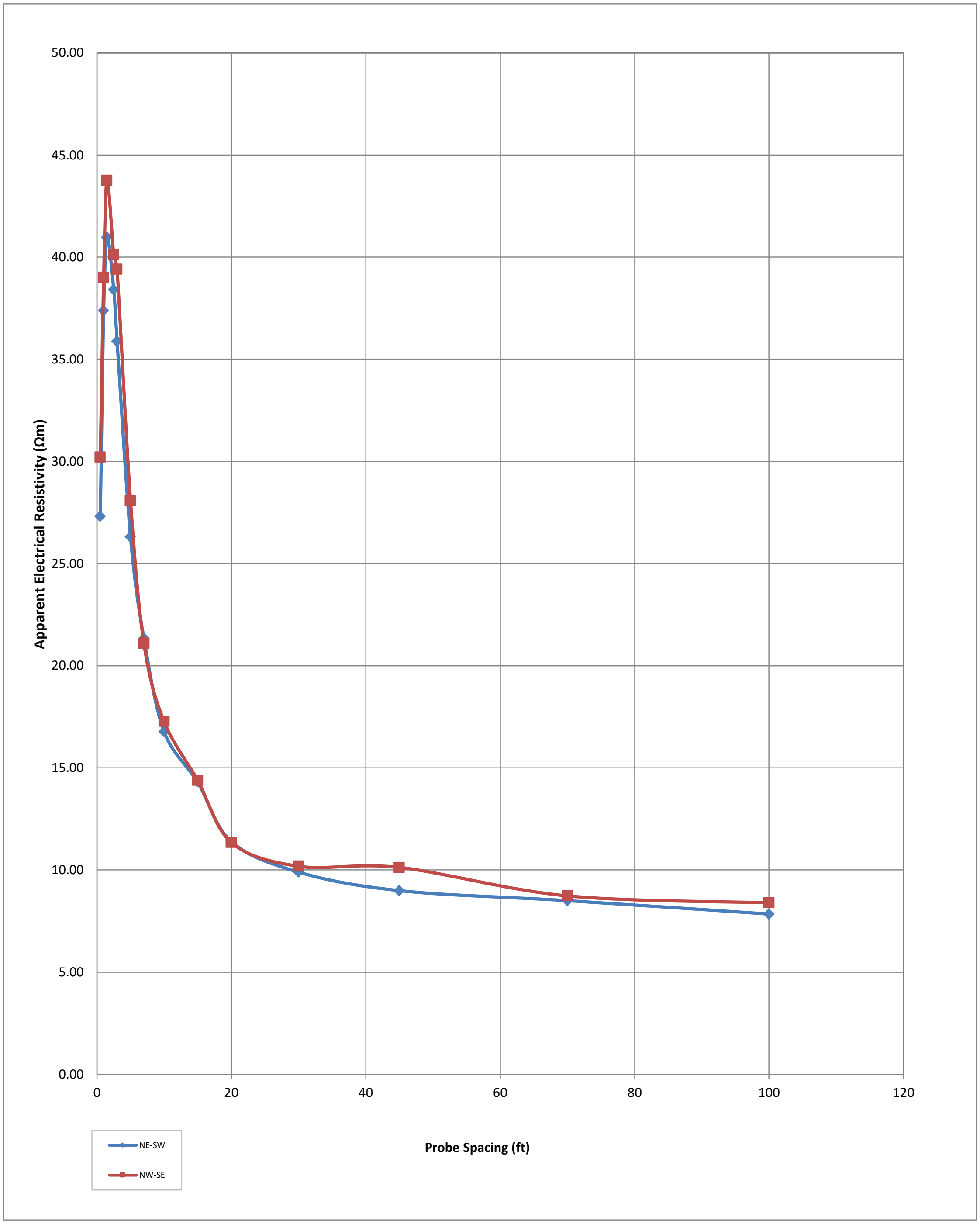




General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.

Longspur Wind
Electrical Resistivity Survey at GEO-033



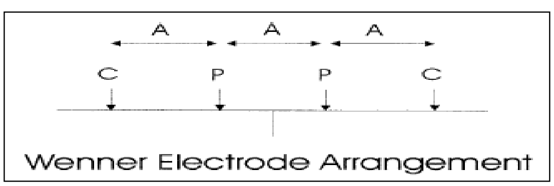
SOIL RESISTIVITY MEASURMENT DATA SHEET

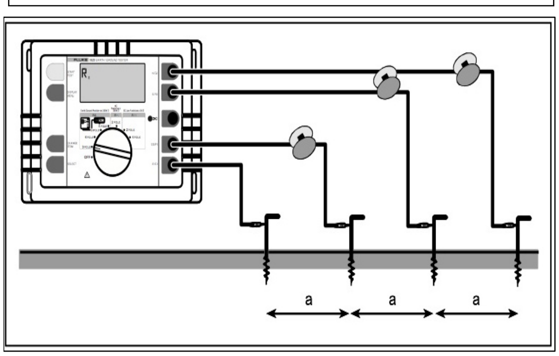
Survey ID GEO-046
DATE 5/13/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind **Project No.** GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.932595
LONGITUDE : -101.787575
WEATHER: Sunny **Temp. (°F)** 82°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

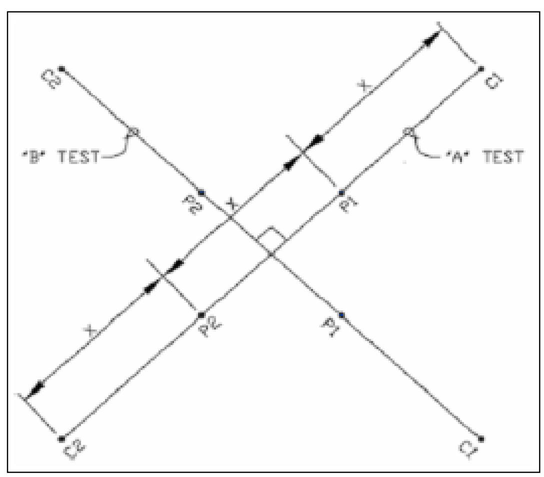
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				Average Soil Resistivity (Ωm)
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	
0.5	4	2	18.890	18.08	19.150	18.33			18.20
1	4	2	17.440	33.38	17.530	33.55			33.47
1.5	4	2	15.840	45.48	15.620	44.85			45.16
2.5	4	2	11.160	53.40	11.280	53.98			53.69
3	4	2	8.551	49.10	8.769	50.36			49.73
5	4	2	4.140	39.62	4.261	40.78			40.20
7	4	2	2.556	34.25	2.433	32.60			33.42
10	12	6	1.345	25.75	1.421	27.20			26.47
15	12	6	0.581	16.69	0.559	16.05			16.37
20	12	6	0.314	12.01	0.325	12.43			12.22
30	12	6	0.191	10.99	0.178	10.23			10.61
45	12+	6+	0.123	10.61	0.130	11.23			10.92
70	12+	6+	0.091	12.14	0.095	12.77			12.46
100	12+	6+	0.076	14.46	0.073	13.88			14.17

Notes:

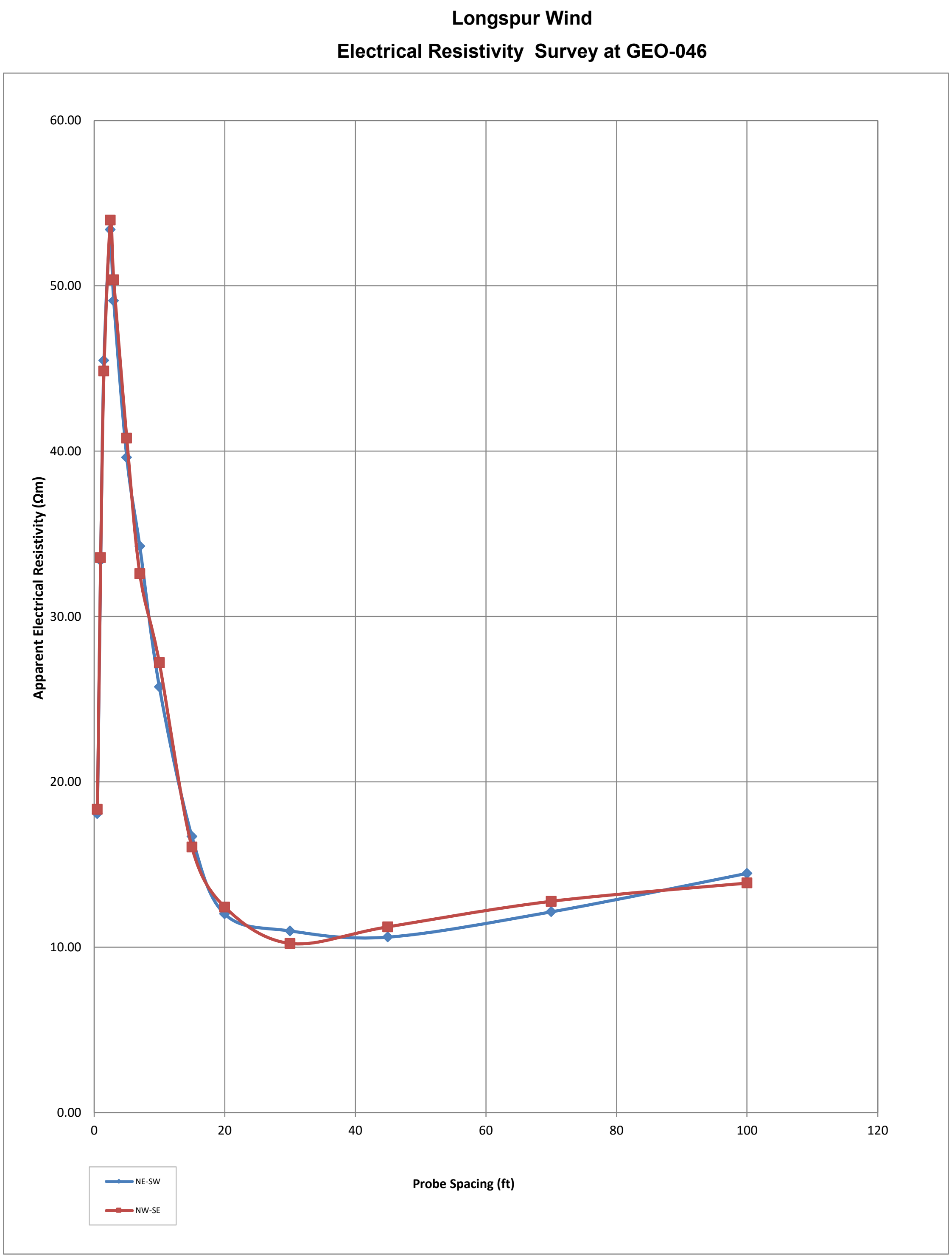






General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.


Longspur Wind
Electrical Resistivity Survey at GEO-046
Apparent Electrical Resistivity (Ωm)
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0
20
40
60
80
100
120
Probe Spacing (ft)
NE-SW
NW-SE

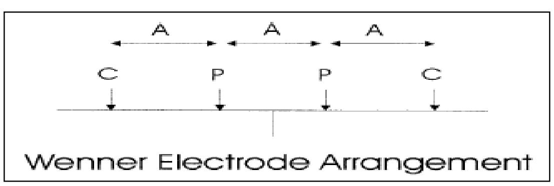
SOIL RESISTIVITY MEASURMENT DATA SHEET

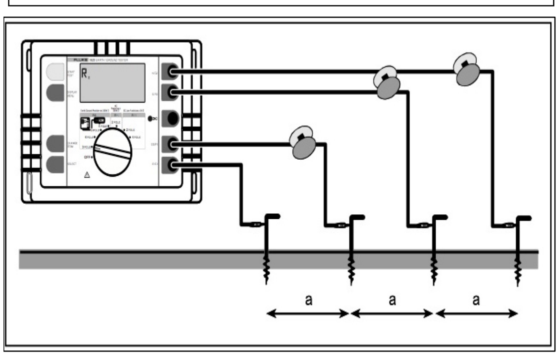
Survey ID GEO-048
DATE 5/13/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind **Project No.** GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.932595
LONGITUDE : -101.787575
WEATHER: Partly Cloudy **Temp. (°F)** 82°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

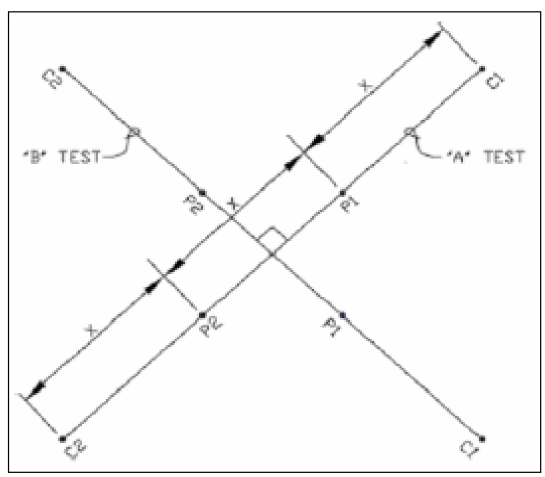
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				Average Soil Resistivity (Ωm)
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	
0.5	4	2	29.850	28.57	33.930	32.47			30.52
1	4	2	20.640	39.51	22.710	43.47			41.49
1.5	4	2	16.060	46.11	16.390	47.06			46.59
2.5	4	2	12.670	60.63	12.320	58.96			59.79
3	4	2	9.053	51.99	10.050	57.71			54.85
5	4	2	4.188	40.08	4.260	40.77			40.43
7	4	2	2.257	30.24	2.292	30.71			30.48
10	12	6	1.253	23.98	1.347	25.78			24.88
15	12	6	0.592	17.01	0.605	17.36			17.18
20	12	6	0.364	13.92	0.404	15.45			14.69
30	12	6	0.176	10.08	0.194	11.16			10.62
45	12+	6+	0.102	8.82	0.119	10.28			9.55
70	12+	6+	0.075	10.09	0.078	10.46			10.27
100	12+	6+	0.055	10.60	0.057	10.97			10.78

Notes:



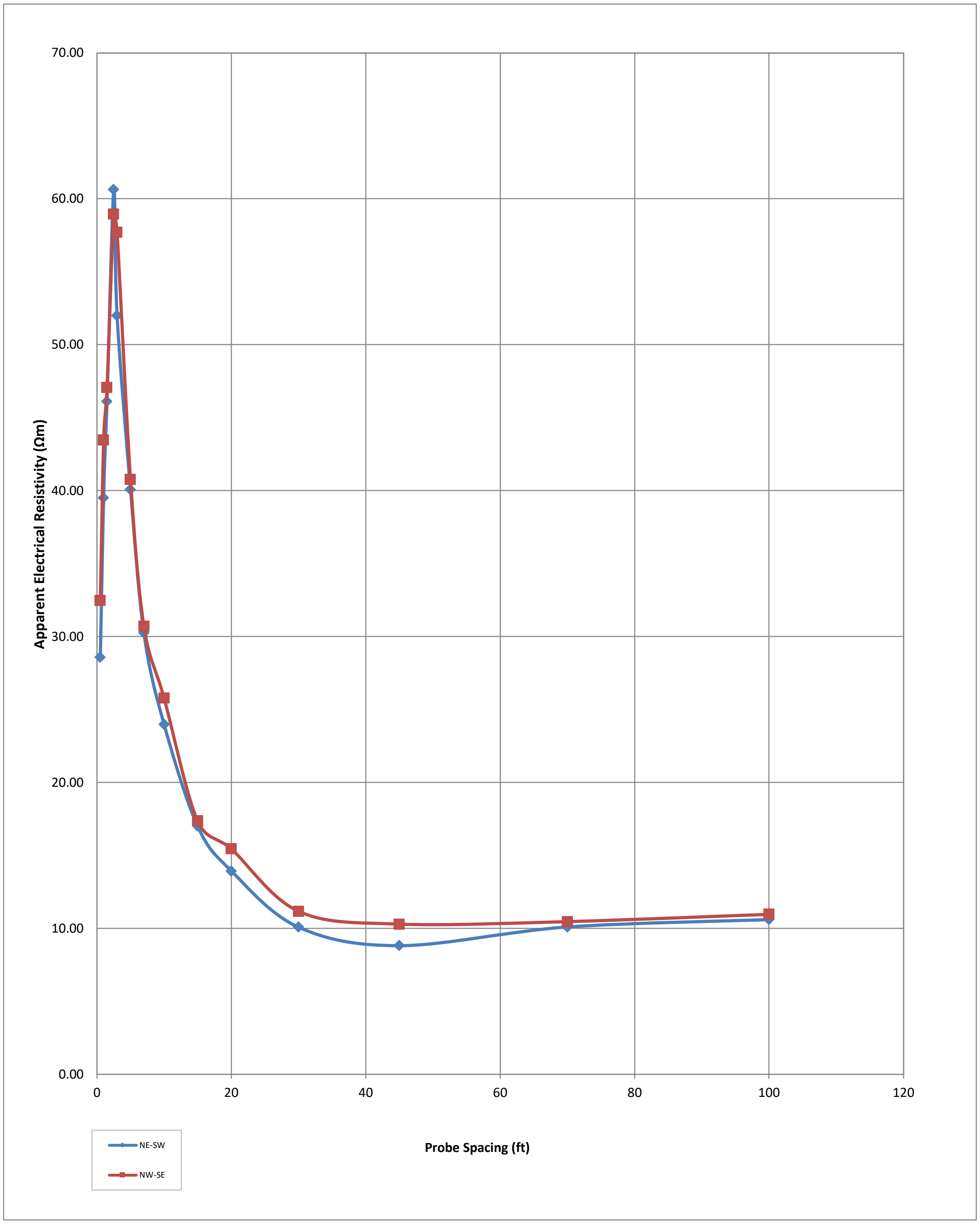




General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.

Longspur Wind
Electrical Resistivity Survey at GEO-048



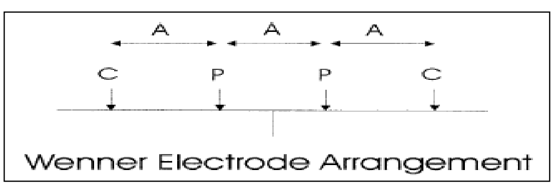
SOIL RESISTIVITY MEASURMENT DATA SHEET

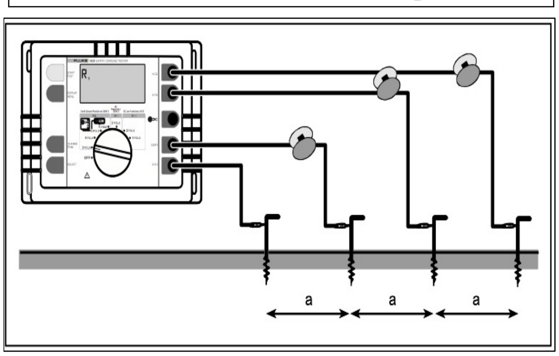
Survey ID GEO-053
DATE 5/13/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind **Project No.** GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.932595
LONGITUDE : -101.787575
WEATHER: Partly Cloudy **Temp. (°F)** 82°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

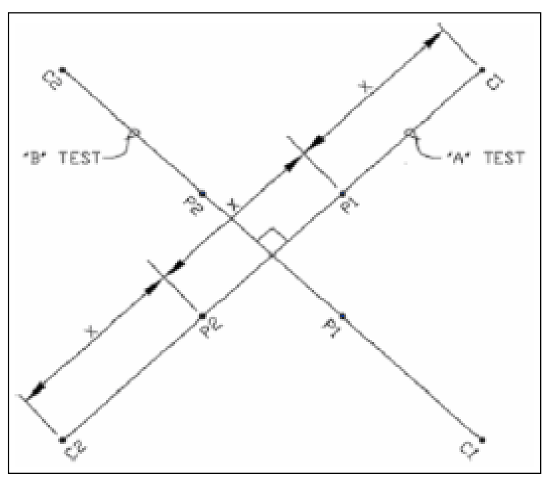
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				Average Soil Resistivity (Ωm)
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	
0.5	4	2	26.490	25.35	28.720	27.49			26.42
1	4	2	18.470	35.35	20.820	39.85			37.60
1.5	4	2	13.850	39.77	14.580	41.86			40.81
2.5	4	2	8.474	40.55	9.034	43.23			41.89
3	4	2	6.437	36.96	6.734	38.67			37.82
5	4	2	3.309	31.67	3.573	34.20			32.93
7	4	2	2.184	29.26	2.257	30.24			29.75
10	12	6	1.376	26.34	1.357	25.97			26.16
15	12	6	0.733	21.04	0.775	22.25			21.64
20	12	6	0.387	14.80	0.397	15.21			15.00
30	12	6	0.201	11.57	0.226	12.97			12.27
45	12+	6+	0.128	11.06	0.129	11.07			11.06
70	12+	6+	0.079	10.63	0.078	10.44			10.54
100	12+	6+	0.052	9.89	0.054	10.39			10.14

Notes: Powerlines at ~900 ft west of the profile center, going N-S.



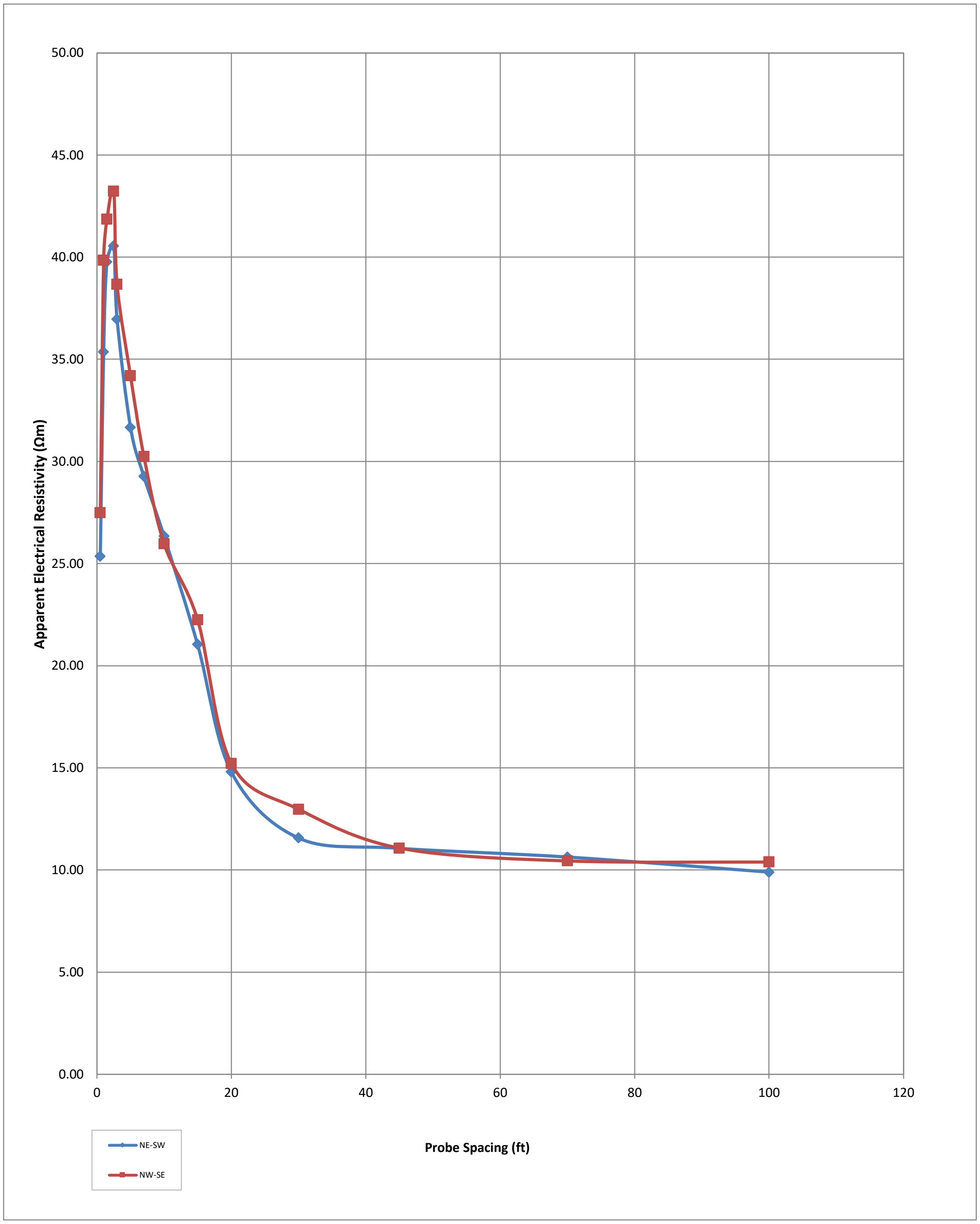




General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.

Longspur Wind
Electrical Resistivity Survey at GEO-053



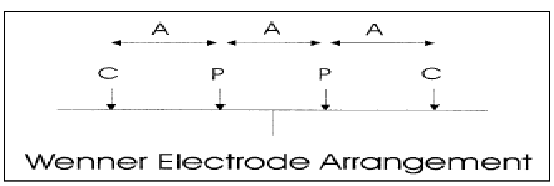
SOIL RESISTIVITY MEASURMENT DATA SHEET

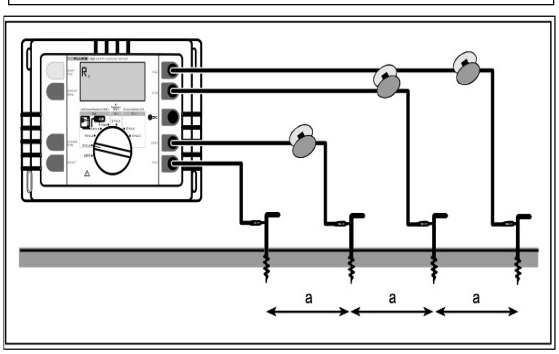
Survey ID GEO-059
DATE 5/13/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind **Project No.** GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.911622
LONGITUDE : -101.695731
WEATHER: Sunny **Temp. (°F)** 61°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

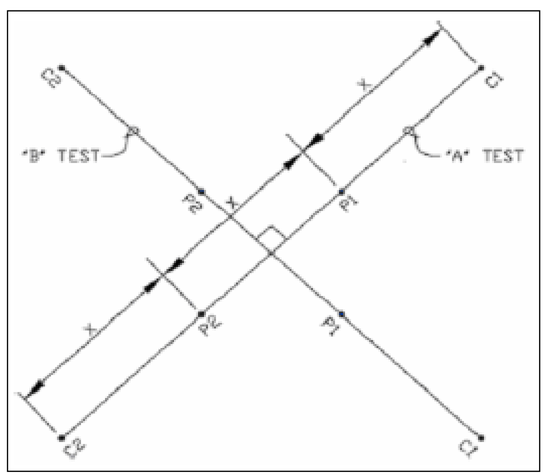
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Average Soil Resistivity (Ωm)
0.5	4	2	44.240	42.34	41.830	40.03			41.19
1	4	2	29.240	55.97	27.810	53.23			54.60
1.5	4	2	20.530	58.95	19.770	56.76			57.86
2.5	4	2	15.570	74.51	15.730	75.27			74.89
3	4	2	9.345	53.66	10.030	57.60			55.63
5	4	2	4.532	43.37	5.024	48.08			45.73
7	4	2	2.935	39.33	2.738	36.69			38.01
10	12	6	1.635	31.30	1.536	29.40			30.35
15	12	6	0.835	23.98	0.853	24.50			24.24
20	12	6	0.413	15.82	0.473	18.12			16.97
30	12	6	0.194	11.15	0.208	11.92			11.54
45	12+	6+	0.093	8.05	0.114	9.81			8.93
70	12+	6+	0.065	8.77	0.068	9.14			8.96
100	12+	6+	0.041	7.92	0.047	9.05			8.49

Notes:

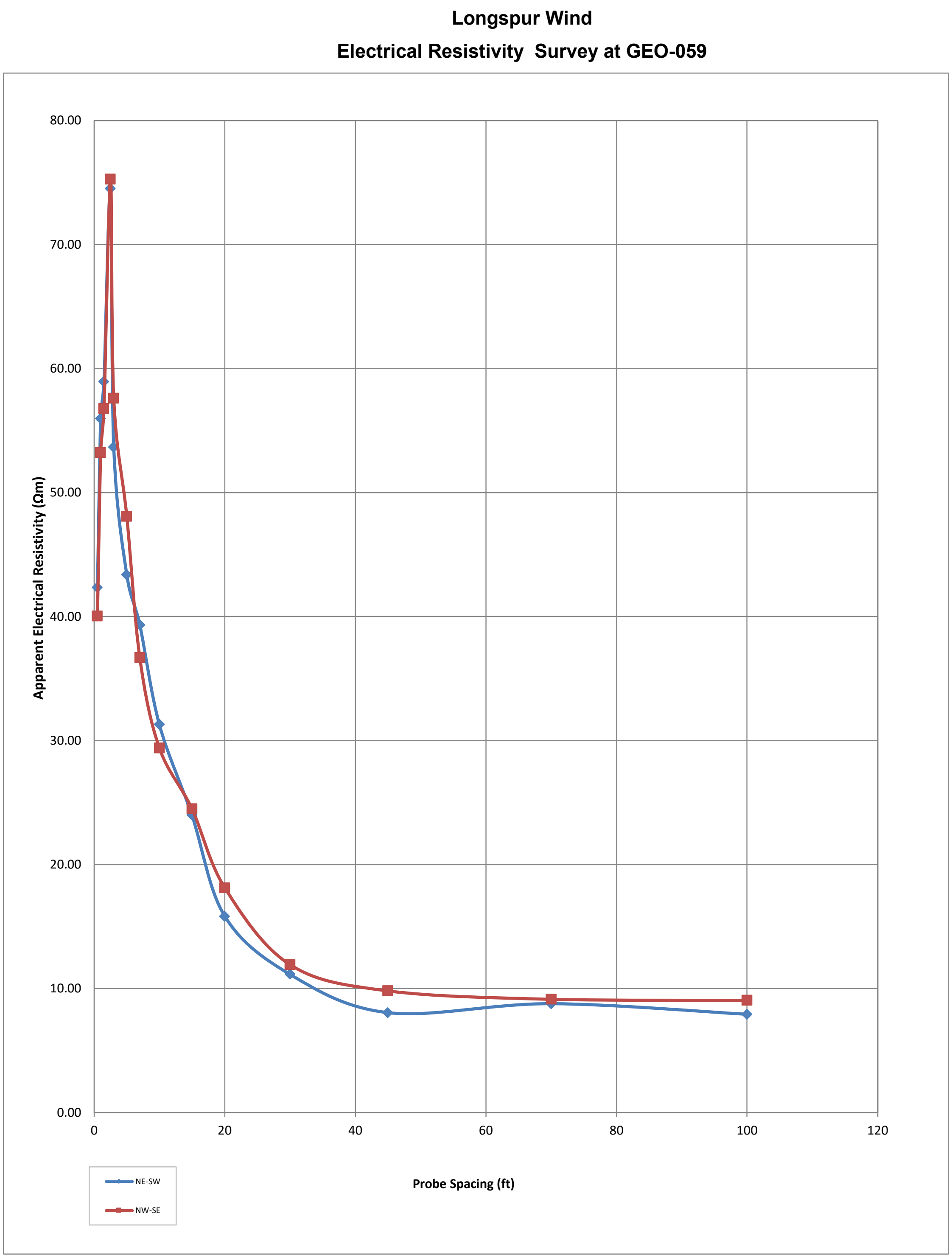






General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.



Longspur Wind
Electrical Resistivity Survey at GEO-059
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Apparent Electrical Resistivity (Ωm)
0
20
40
60
80
100
120
Probe Spacing (ft)
NE-SW
NW-SE

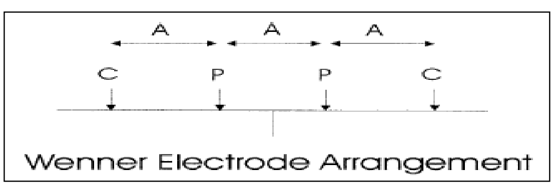
SOIL RESISTIVITY MEASURMENT DATA SHEET

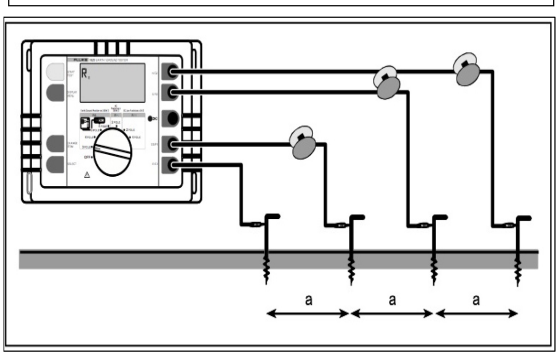
Survey ID GEO-062
DATE 5/13/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind **Project No.** GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.908306
LONGITUDE : -101.677064
WEATHER: Sunny **Temp. (°F)** 59°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

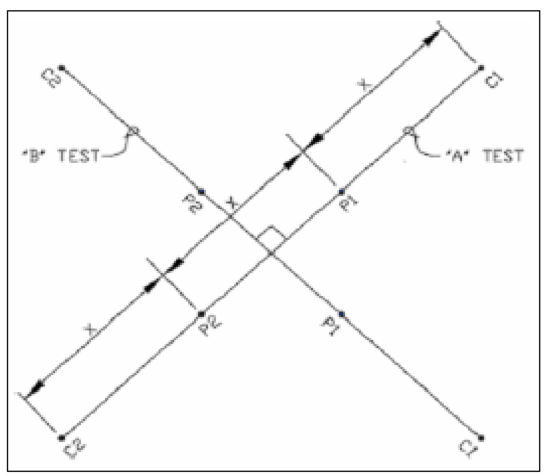
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Average Soil Resistivity (Ωm)
0.5	4	2	28.230	27.02	27.420	26.24			26.63
1	4	2	19.110	36.58	21.530	41.21			38.90
1.5	4	2	13.720	39.39	14.560	41.80			40.60
2.5	4	2	8.244	39.45	8.424	40.31			39.88
3	4	2	5.124	29.42	5.066	29.09			29.26
5	4	2	2.734	26.17	2.623	25.10			25.64
7	4	2	1.582	21.20	1.613	21.61			21.40
10	12	6	1.042	19.95	0.957	18.33			19.14
15	12	6	0.614	17.63	0.592	17.01			17.32
20	12	6	0.413	15.81	0.422	16.17			15.99
30	12	6	0.201	11.51	0.213	12.20			11.86
45	12+	6+	0.109	9.41	0.114	9.81			9.61
70	12+	6+	0.065	8.68	0.068	9.14			8.91
100	12+	6+	0.048	9.23	0.044	8.48			8.85

Notes: Powerlines at ~950 ft south of the profile center, going E-W.



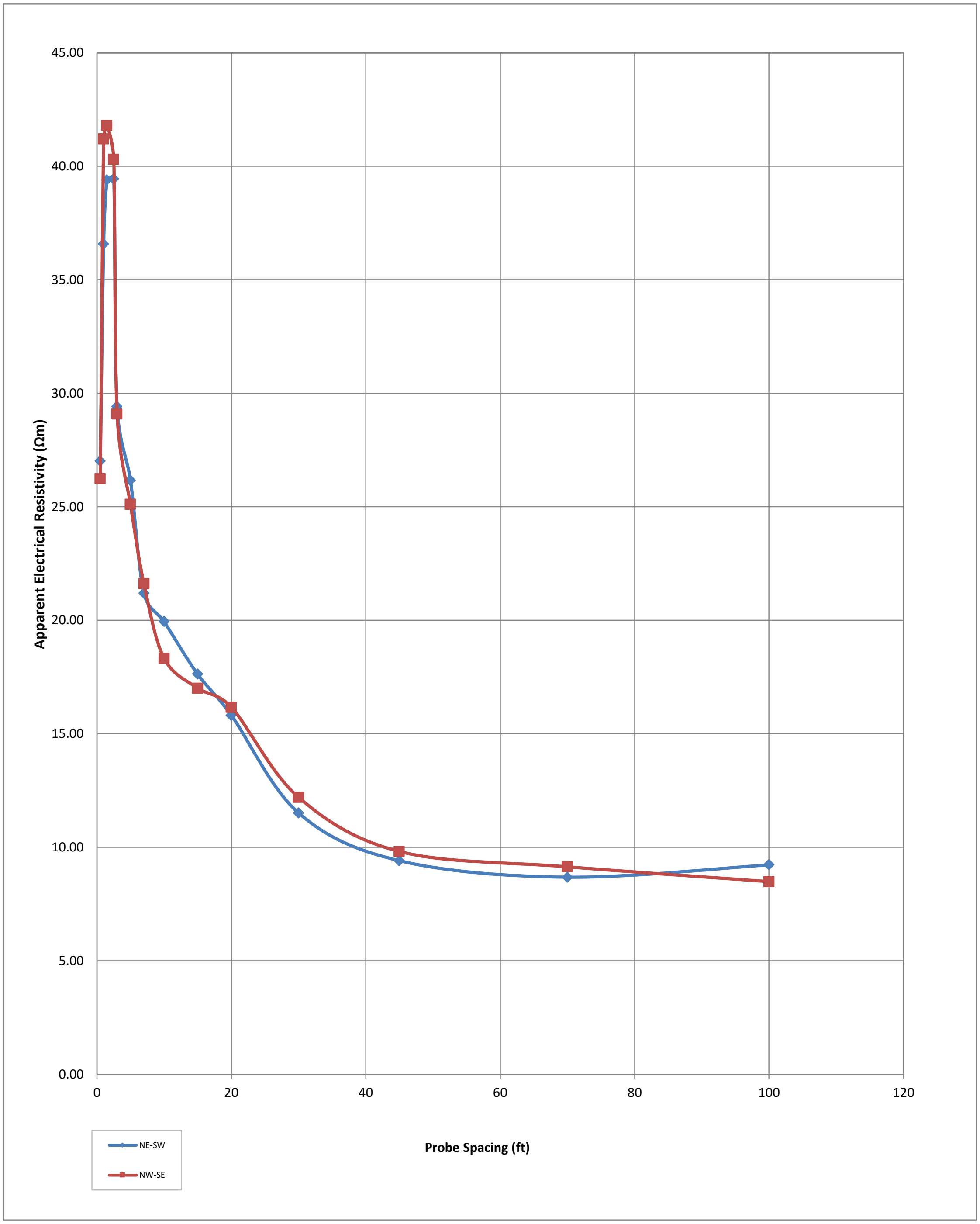




General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.

Longspur Wind
Electrical Resistivity Survey at GEO-062



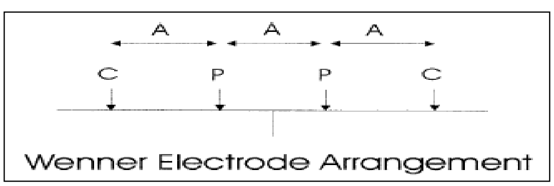
SOIL RESISTIVITY MEASURMENT DATA SHEET

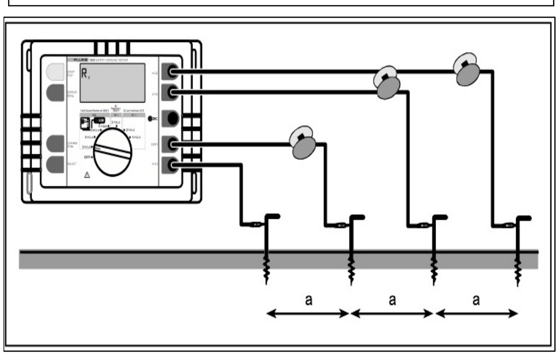
Survey ID GEO-067
DATE 5/17/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind **Project No.** GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.897545
LONGITUDE : -101.664921
WEATHER: Sunny **Temp. (°F)** 55°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

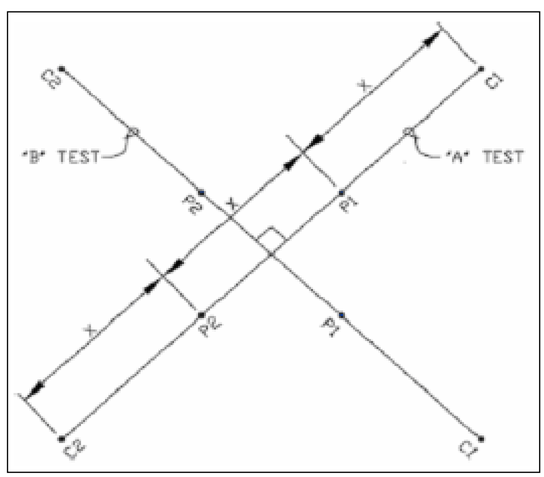
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Average Soil Resistivity (Ωm)
0.5	4	2	38.270	36.63	41.030	39.27			37.95
1	4	2	27.540	52.72	26.580	50.88			51.80
1.5	4	2	21.570	61.93	20.230	58.08			60.01
2.5	4	2	16.730	80.06	15.340	73.41			76.73
3	4	2	10.000	57.42	10.850	62.31			59.86
5	4	2	5.253	50.27	5.248	50.23			50.25
7	4	2	3.475	46.56	3.549	47.55			47.06
10	12	6	1.815	34.74	1.793	34.32			34.53
15	12	6	0.923	26.51	1.063	30.52			28.52
20	12	6	0.514	19.69	0.542	20.76			20.22
30	12	6	0.214	12.30	0.205	11.75			12.02
45	12+	6+	0.111	9.59	0.103	8.91			9.25
70	12+	6+	0.064	8.55	0.062	8.37			8.46
100	12+	6+	0.047	8.94	0.044	8.34			8.64

Notes: Fence line at ~350 ft north of the profile center, going E-W.



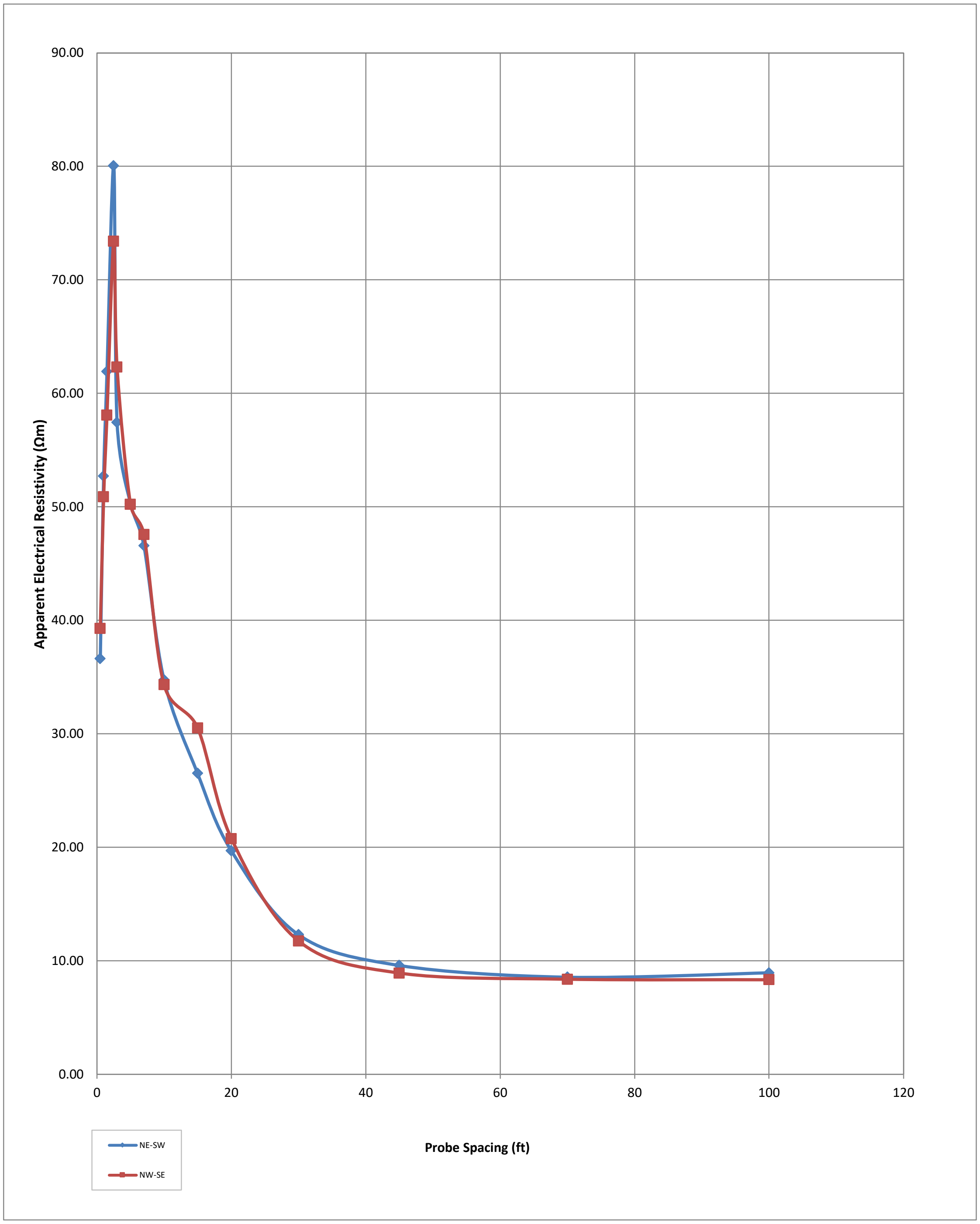




General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.

Longspur Wind
Electrical Resistivity Survey at GEO-067



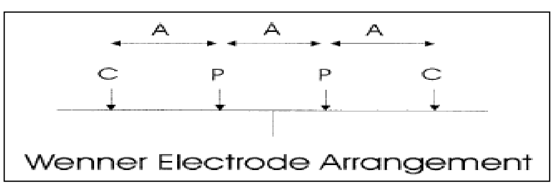
SOIL RESISTIVITY MEASURMENT DATA SHEET

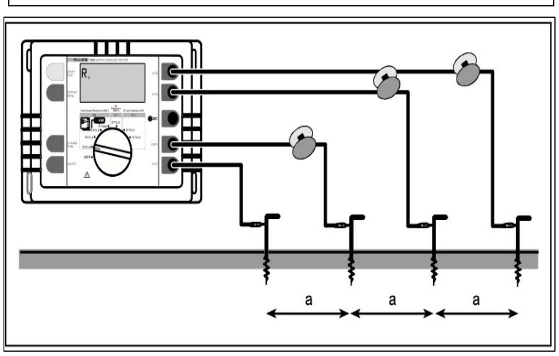
Survey ID GEO-070
DATE 5/11/2025
CLIENT ALLETE Renewable Resources, Inc.
PROJECT Longspur Wind
Project No. GE2503026
LOCATION: Morton County, ND
LATITUDE : 46.881276
LONGITUDE : -101.690209
WEATHER: Sunny
Temp. (°F) 97°F
TOP SOIL: Silt (ML), Brown, Dry
TYPE OF TEST : Wenner 4-Pin Method
EQUIPMENT: SuperSting
SERIAL NO. SS2106234
MODEL: R8
CALIBRATION DUE DATE: 1/28/2026
TEST PERFORMED BY : RRC

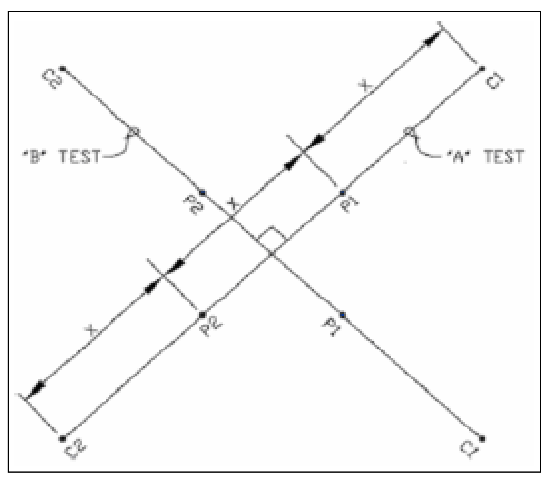
TEST SET RANGE
Meter Current: 1mA - 2000mA
Meter Resistance: 0.01Ohm - 19.99kOhom

PROB Spacing (ft)	PROBE C DEPTH (Inches)	PROBE P DEPTH (Inches)	APPARENT ELECTRICAL RESISTIVITY						
			NE-SW		NW-SE				
			Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Meter reading (Ω)	Soil Resistivity (Ωm)	Average Soil Resistivity (Ωm)
0.5	4	2	8.899	8.52	9.018	8.63			8.57
1	4	2	7.183	13.75	7.281	13.94			13.84
1.5	4	2	5.038	14.47	5.162	14.82			14.64
2.5	4	2	2.963	14.18	3.010	14.40			14.29
3	4	2	2.246	12.90	2.307	13.25			13.07
5	4	2	1.250	11.96	1.382	13.23			12.60
7	4	2	0.843	11.29	0.812	10.87			11.08
10	12	6	0.537	10.28	0.544	10.42			10.35
15	12	6	0.337	9.66	0.311	8.93			9.30
20	12	6	0.215	8.25	0.211	8.09			8.17
30	12	6	0.135	7.76	0.138	7.94			7.85
45	12+	6+	0.093	8.03	0.095	8.20			8.12
70	12+	6+	0.060	8.06	0.059	7.91			7.98
100	12+	6+	0.042	8.11	0.042	7.97			8.04

Notes: Powerlines at ~2500 ft south of the profile center, going E-W.





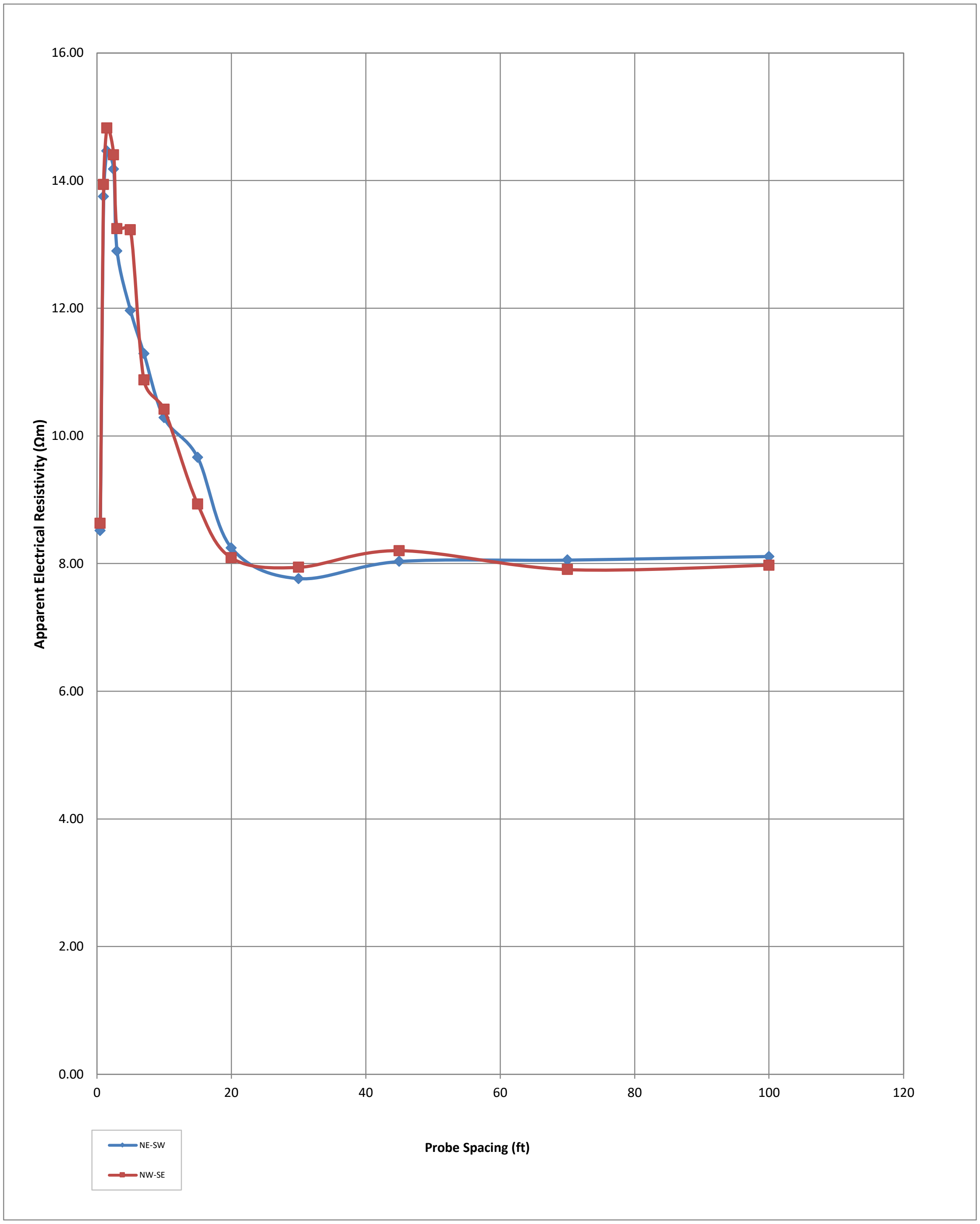


General Sketch of the test set up.

Total Array length is 3 times the probe spacing. The Apparent resistivity is calculated using the following equation: r=2*p*R*spacing*0.3048, where last item converts feet to meters. Wenner Array surveys were performed generally in accordance with IEEE std 81-2012 "IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System." and ASTM G-57.

Longspur Wind

Electrical Resistivity Survey at GEO-070



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Soil Thermal Resistivity Sample & Testing Summary
Longspur Wind Project (PN: GE2503026)

Boring	*Depth*	*Percent Passing #200 Sieve*	*Maximum Dry Density (ASTM D698)*	*Optimum Water Content (ASTM D698)*	*LL*	*PL*	*PI*
	ft	*%*	*pcf*	*%*			
GEO-001	2-4	99.5	99.5	22.2	63	22	41
GEO-008	2-4	98.8	107.0	18.2	57	19	38
GEO-010	2-4	90.7	92.4	27.6	71	24	47
GEO-019	2-4	96.5	111.8	16.3	30	18	12
GEO-022	2-4	36.8	115.6	12.7	22	16	6
GEO-033	2-4	97.7	100.4	20.8	61	19	42
GEO-046	2-4	84.0	112.1	15.4	41	18	23
GEO-048	2-4	96.2	99.1	20.7	71	23	48
GEO-053	2-4	93.2	103.1	19.5	54	19	35
GEO-059	2-4	97.9	104.8	20.2	54	20	34
GEO-062	2-4	49.0	113.9	12.3	26	18	8
GEO-067	2-4	97.4	105.9	18.1	43	21	22
GEO-070	2-4	98.7	100.6	20.8	61	20	41
SUB-2	2-4	51.2	116.1	13.7	37	14	23

Boring	*Depth*	*Soil Type (USCS)*
GEO-001	2-4	Fat Clay (CH)
GEO-008	2-4	Fat Clay (CH)
GEO-010	2-4	Fat Clay (CH)
GEO-019	2-4	Lean Clay (CL)
GEO-022	2-4	Silty, Clayey Sand (SC-SM)
GEO-033	2-4	Fat Clay (CH)
GEO-046	2-4	Lean Clay with Sand (CL)
GEO-048	2-4	Fat Clay (CH)
GEO-053	2-4	Fat Clay (CH)
GEO-059	2-4	Fat Clay (CH)
GEO-062	2-4	Clayey Sand (SC)
GEO-067	2-4	Lean Clay (CL)
GEO-070	2-4	Fat Clay (CH)
SUB-2	2-4	Sandy Lean Clay (CL)

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Soil Thermal Resistivity Sample & Testing Summary
Longspur Wind Project (PN: GE2503026)

Remolded Samples						
Boring	*Remold Water Content*	*Percent Compaction*	*Target Remold Dry Density*	*Actual Remold Dry Density*	*Thermal Resistivity at Wet (IEEE 442)*	*Thermal Resistivity at Dry (IEEE 442)*
	%	*%*	*pcf*	*pcf*	*°C-cm/W*	*°C-cm/W*
GEO-001	23.6	92	91.5	92.2	85	185
GEO-008	22.1		98.4	100.0	70	140
GEO-010	28.1		85.0	85.2	94	215
GEO-019	16.6		102.9	103.2	66	162
GEO-022	16.6		106.4	106.9	48	126
GEO-033	20.3		92.4	93.3	83	165
GEO-046	15.8		103.1	103.8	64	136
GEO-048	22.4		91.2	92.2	84	172
GEO-053	19.7		94.9	95.6	85	168
GEO-059	21.0		96.4	97.1	76	145
GEO-062	12.7		104.8	105.0	62	162
GEO-067	18.1		97.4	98.1	73	158
GEO-070	20.6		92.6	93.9	79	169
SUB-2	14.0		106.8	107.5	58	125

HuaMiao Cao, P.E., 6/3/25

Analysis & Quality Review/Date

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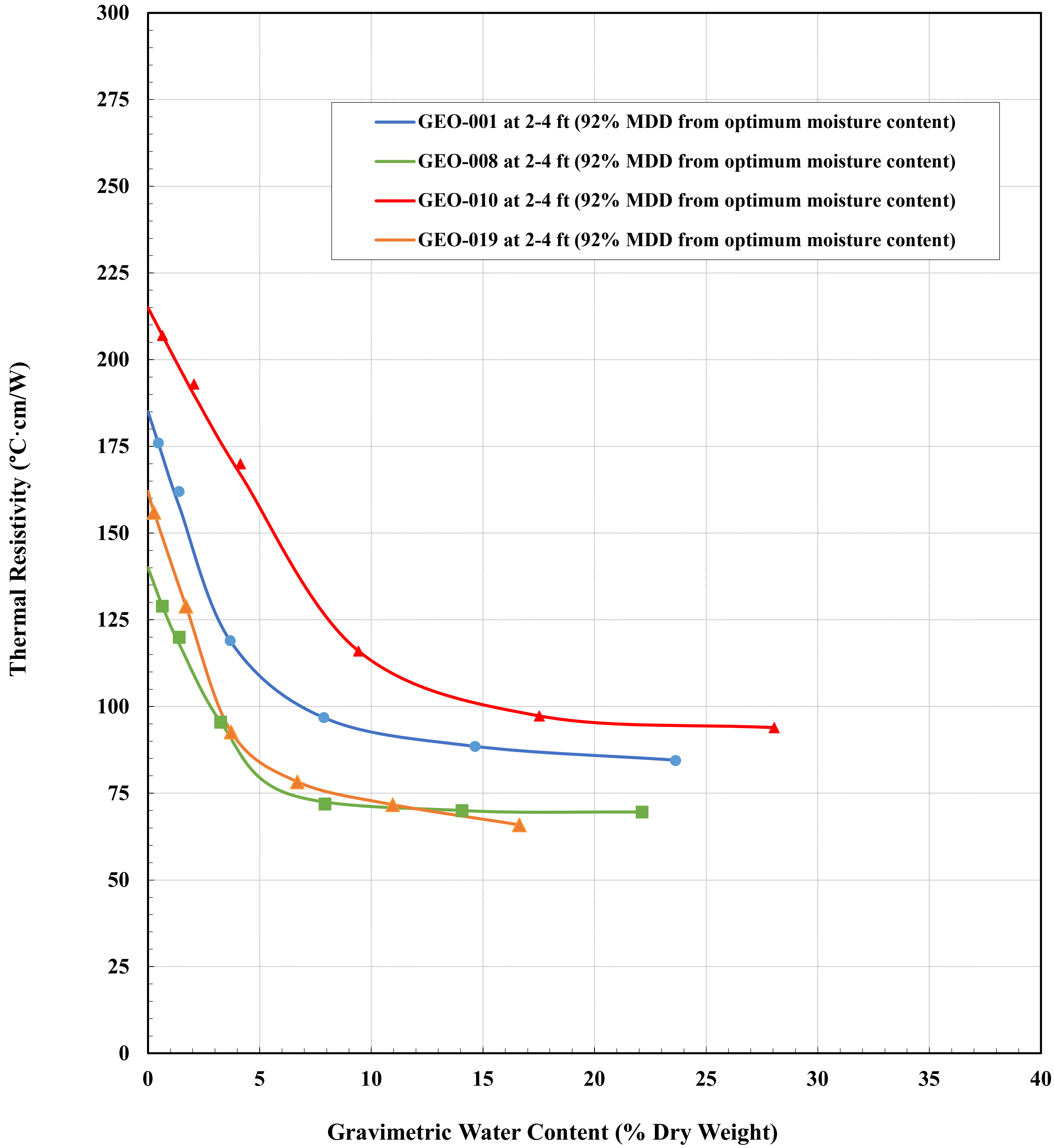
Soil Thermal Resistivity Testing Dryout Curves
Longspur Wind Project (PN: GE2503026)



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Soil Thermal Resistivity Testing Dryout Curves
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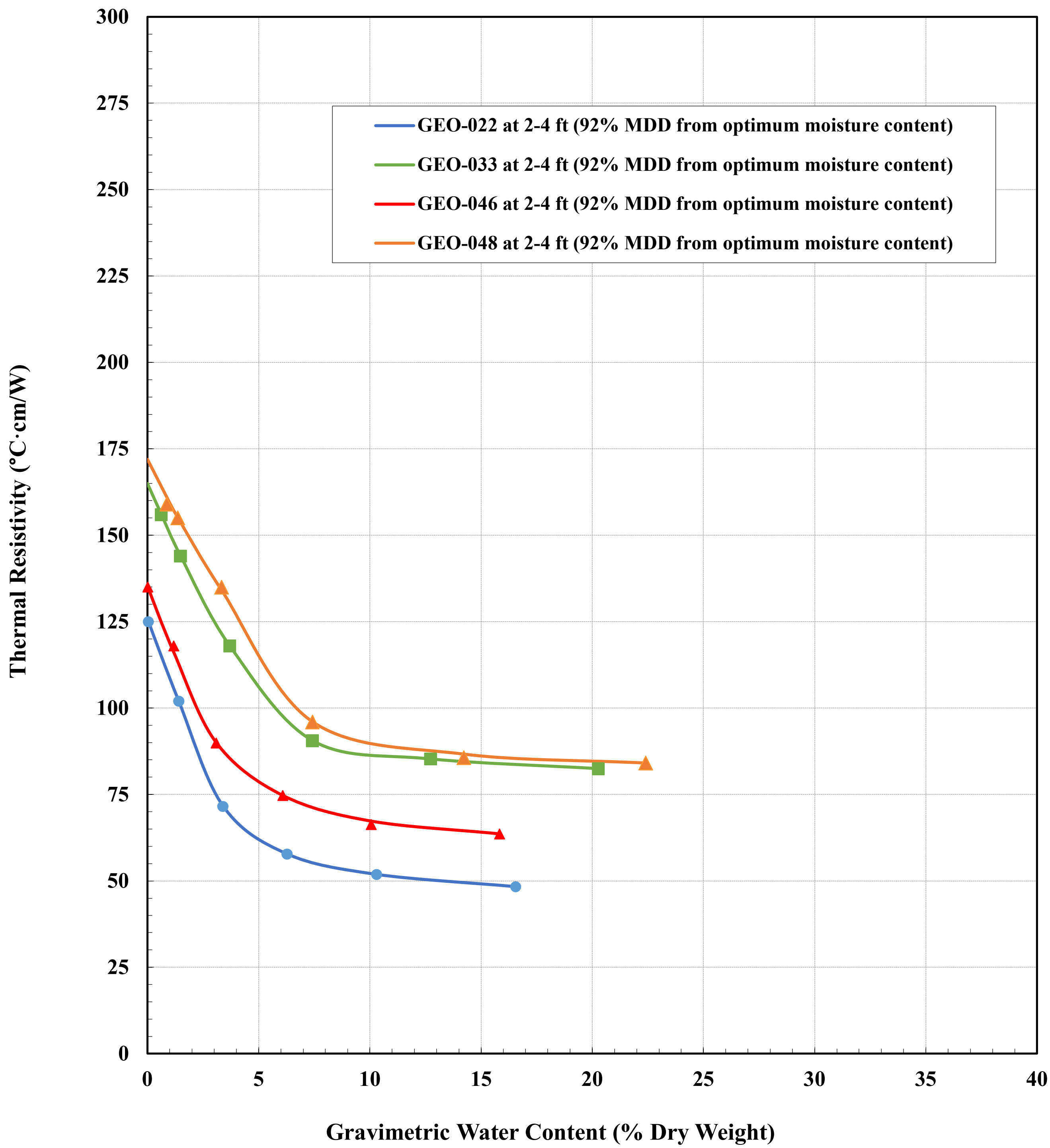

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Soil Thermal Resistivity Testing Dryout Curves
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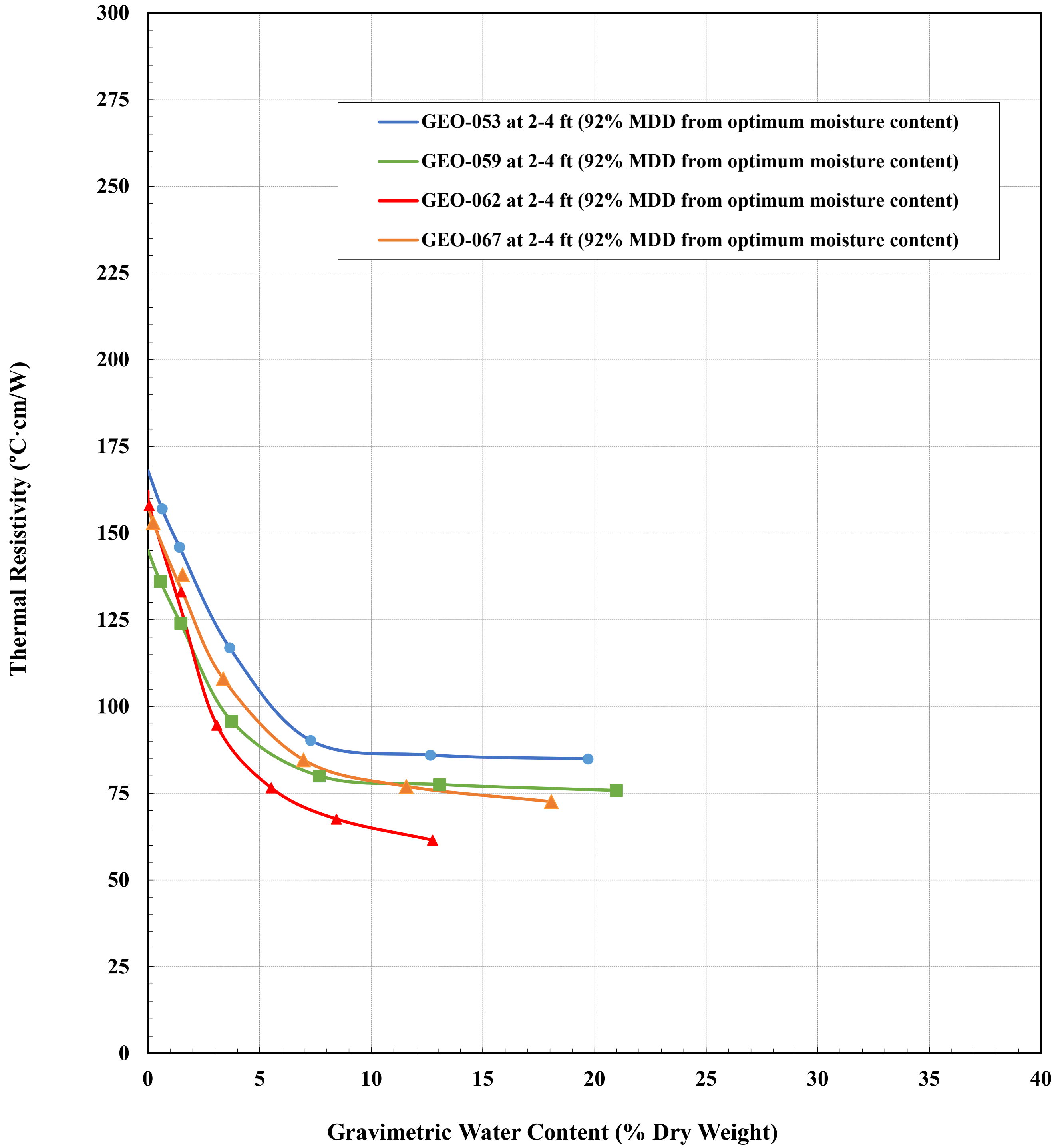

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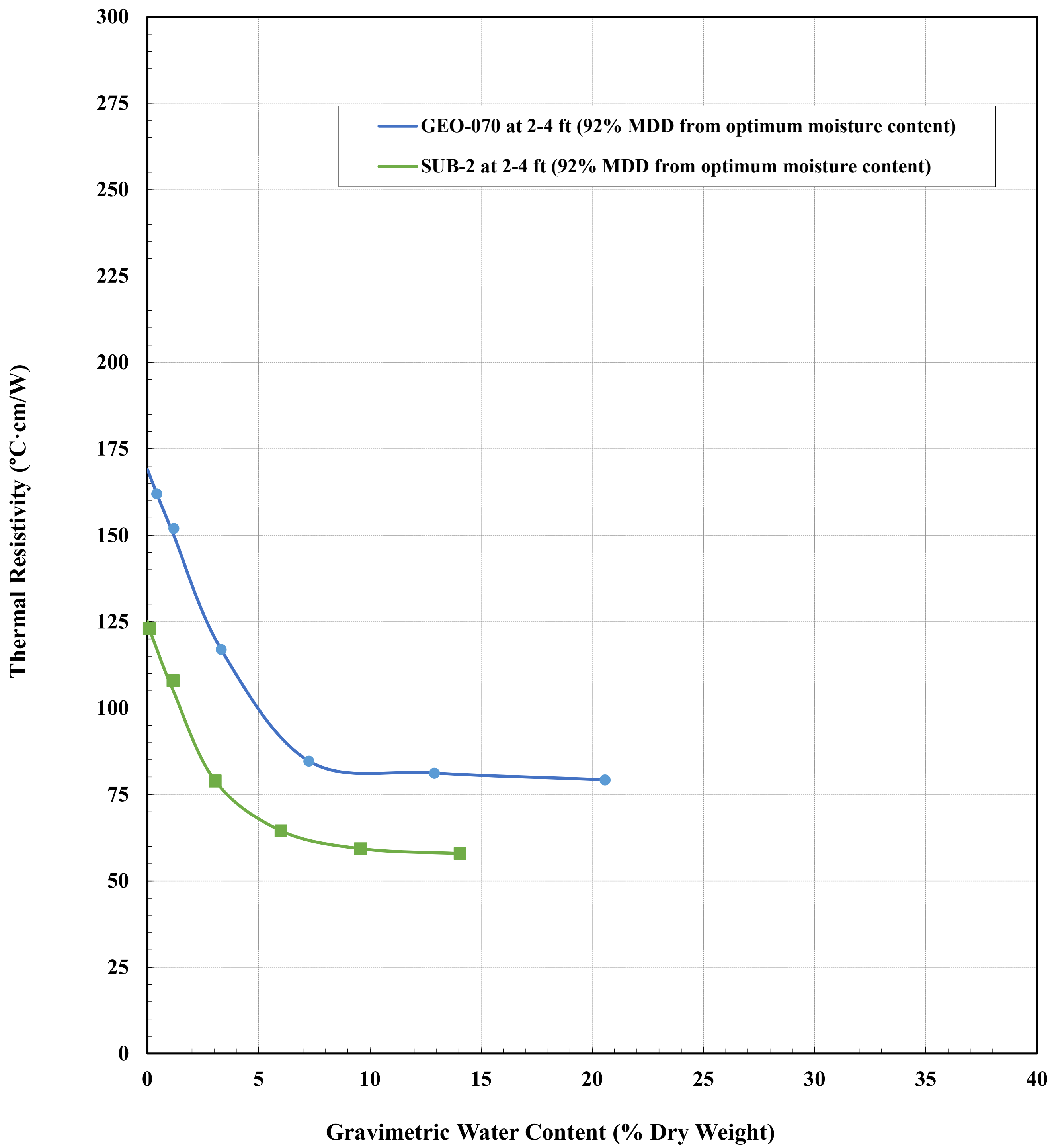
Soil Thermal Resistivity Testing Dryout Curves
Longspur Wind Project (PN: GE2503026)



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APPENDIX D

Table D1.1 – LPILE Computer Program Parameters for Lateral Load Analysis for SUB-1

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	790	--	0.01	--	--	--	--
2	3 to 4	Sand (Reese)	25	--	110	--	31	--	--	--	--	--
3	4 to 7	Sand (Reese)	90	--	110	--	35	--	--	--	--	--
4	7 to 12	Sand (Reese)	60	--	58	--	33	--	--	--	--	--
5	12 to 14	Sand (Reese)	60	--	63	--	35	--	--	--	--	--
6	14 to 19	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
7	19 to 24	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
8	24 to 29	Stiff Clay w/o Free Water	--	--	68	5,980	--	0.004	--	--	--	--
9	29 to 34	Stiff Clay w/o Free Water	--	--	67.6	3,450	--	0.005	--	--	--	--
10	34 to 40	Stiff Clay w/o Free Water	--	--	67.6	5,050	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D1.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for SUB-1

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	790	--	3.04	6	--	0	1,700
2	3 to 4	SM	110	31	--	--	3.12	6	0.6	90	2,400
3	4 to 7	SP	110	35	--	--	3.69	30	2.9	350	6,400
4	7 to 12	SP	58	33	--	--	3.39	16	1.5	370	6,400
5	12 to 14	SC	63	35	--	--	3.69	30	2.9	590	10,300
6	14 to 19	SC	63	35	--	--	3.69	40	3.9	720	10,300
7	19 to 24	SC	63	35	--	--	3.69	38	3.7	770	10,300
8	24 to 29	CL	68	--	5,980	--	3.04	73	4.2	1,070	10,300
9	29 to 34	CL	68	--	3,450	--	3.04	26	2.2	740	10,300
10	34 to 40	CL	68	--	5,050	--	3.04	38	2.8	930	15,100

Table D1.3 – Grout Anchor Design Parameters for SUB-1

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	CL	--
2	3 to 4	SM	9
3	4 to 7	SP	15
4	7 to 12	SP	12
5	12 to 14	SC	15
6	14 to 19	SC	18
7	19 to 24	SC	17
8	24 to 29	CL	21
9	29 to 34	CL	12
10	34 to 40	CL	18

Notes: Design depth to groundwater is 7 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma' = \gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D2.1 – LPILE Computer Program Parameters for Lateral Load Analysis for SUB-2

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci)		γ'	C	ϕ	ε_{50}	E_{rm}	UCS	RQD	K_{rm}
			Static	Cyclic	(pcf)	(psf)	(degree)		(psi)	(psi)	(%)	
1*	0 to 3	Soft Clay (1)	--	--	105	920	--	0.01	--	--	--	--
2	3 to 7	Stiff Clay w/o Free Water	--	--	120	920	--	0.010	--	--	--	--
3	7 to 9	Sand (Reese)	60	--	58	--	33	--	--	--	--	--
4	9 to 14	Sand (Reese)	60	--	63	--	35	--	--	--	--	--
5	14 to 19	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
6	19 to 24	Sand (Reese)	125	--	58	--	35	--	--	--	--	--
7	24 to 29	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
8	29 to 34	Stiff Clay w/o Free Water	--	--	68	5,450	--	0.005	--	--	--	--
9	34 to 39	Sand (Reese)	125	--	62.6	--	35	--	--	--	--	--
10	39 to 40	Sand (Reese)	125	--	62.6	--	35	--	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D2.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for SUB-2

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	920	--	3.04	7	--	0	2,000
2	3 to 7	CL	120	--	920	--	3.04	7	1.0	200	2,000
3	7 to 9	SP	58	33	--	--	3.39	16	1.5	350	6,400
4	9 to 14	SC	63	35	--	--	3.69	27	2.6	550	10,800
5	14 to 19	SC	63	35	--	--	3.69	39	3.8	730	15,600
6	19 to 24	SP	58	35	--	--	3.69	40	3.9	800	16,000
7	24 to 29	SC	63	35	--	--	3.69	85	8.3	1,220	16,300
8	29 to 34	CL	68	--	5,450	--	3.04	41	2.9	980	16,300
9	34 to 39	SC	63	35	--	--	3.69	51	5.0	1,090	18,000
10	39 to 40	SC	63	35	--	--	3.69	45	4.4	1,060	18,000

Table D2.3 – Grout Anchor Design Parameters for SUB-2

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	CL	--
2	3 to 7	CL	3
3	7 to 9	SP	12
4	9 to 14	SC	14
5	14 to 19	SC	17
6	19 to 24	SP	18
7	24 to 29	SC	29
8	29 to 34	CL	19
9	34 to 39	SC	20
10	39 to 40	SC	19

Notes: Design depth to groundwater is 7 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D3.1 – LPILE Computer Program Parameters for Lateral Load Analysis for SUB-3

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	790	--	0.01	--	--	--	--
2	3 to 7	Stiff Clay w/o Free Water	--	--	120	790	--	0.010	--	--	--	--
3	7 to 9	Sand (Reese)	60	--	63	--	33	--	--	--	--	--
4	9 to 14	Sand (Reese)	60	--	63	--	35	--	--	--	--	--
5	14 to 19	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
6	19 to 24	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
7	24 to 29	Stiff Clay w/o Free Water	--	--	68	3,850	--	0.005	--	--	--	--
8	29 to 34	Stiff Clay w/o Free Water	--	--	68	4,390	--	0.005	--	--	--	--
9	34 to 39	Stiff Clay w/o Free Water	--	--	67.6	5,980	--	0.004	--	--	--	--
10	39 to 40	Stiff Clay w/o Free Water	--	--	67.6	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D3.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for SUB-3

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	790	--	3.04	6	--	0	1,700
2	3 to 7	CL	120	--	790	--	3.04	6	0.9	170	1,700
3	7 to 9	SC	63	33	--	--	3.39	14	1.3	330	5,600
4	9 to 14	SC	63	35	--	--	3.69	28	2.7	560	11,200
5	14 to 19	SC	63	35	--	--	3.69	33	3.2	680	11,500
6	19 to 24	SC	63	35	--	--	3.69	44	4.3	840	11,500
7	24 to 29	CL	68	--	3,850	--	3.04	29	2.4	790	11,500
8	29 to 34	CL	68	--	4,390	--	3.04	33	2.6	860	13,100
9	34 to 39	CL	68	--	5,980	--	3.04	50	3.3	1,070	17,900
10	39 to 40	CL	68	--	5,980	--	3.04	79	4.4	1,070	17,900

Table D3.3 – Grout Anchor Design Parameters for SUB-3

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	CL	--
2	3 to 7	CL	3
3	7 to 9	SC	11
4	9 to 14	SC	15
5	14 to 19	SC	16
6	19 to 24	SC	19
7	24 to 29	CL	13
8	29 to 34	CL	15
9	34 to 39	CL	21
10	39 to 40	CL	21

Notes: Design depth to groundwater is 7 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D4.1 – LPILE Computer Program Parameters for Lateral Load Analysis for SUB-4

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	650	--	0.01	--	--	--	--
2	3 to 7	Stiff Clay w/o Free Water	--	--	125	650	--	0.010	--	--	--	--
3	7 to 9	Sand (Reese)	60	--	63	--	32	--	--	--	--	--
4	9 to 14	Sand (Reese)	60	--	63	--	34	--	--	--	--	--
5	14 to 19	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
6	19 to 24	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
7	24 to 29	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
8	29 to 34	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
9	34 to 39	Stiff Clay w/o Free Water	--	--	67.6	5,050	--	0.005	--	--	--	--
10	39 to 40	Stiff Clay w/o Free Water	--	--	67.6	3,990	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D4.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for SUB-4

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	650	--	3.04	5	--	0	1,400
2	3 to 7	CL	125	--	650	--	3.04	5	0.8	140	1,400
3	7 to 9	SC	63	32	--	--	3.25	11	1.1	300	4,400
4	9 to 14	SC	63	34	--	--	3.54	23	2.2	500	9,200
5	14 to 19	SC	63	35	--	--	3.69	46	4.5	790	11,900
6	19 to 24	SC	63	35	--	--	3.69	33	3.2	740	11,900
7	24 to 29	SC	63	35	--	--	3.69	39	3.8	860	11,900
8	29 to 34	SC	63	35	--	--	3.69	46	4.5	990	11,900
9	34 to 39	CL	68	--	5,050	--	3.04	38	2.8	930	11,900
10	39 to 40	CL	68	--	3,990	--	3.04	30	2.4	810	11,900

Table D4.3 – Grout Anchor Design Parameters for SUB-4

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	CL	--
2	3 to 7	CL	2
3	7 to 9	SC	10
4	9 to 14	SC	13
5	14 to 19	SC	19
6	19 to 24	SC	16
7	24 to 29	SC	17
8	29 to 34	SC	19
9	34 to 39	CL	18
10	39 to 40	CL	14

Notes: Design depth to groundwater is 7 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

[1] For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

[2] A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D5.1 – LPILE Computer Program Parameters for Lateral Load Analysis for SUB-5

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci)		γ'	C	ϕ	ε_{50}	E_{rm}	UCS	RQD	K_{rm}
			Static	Cyclic	(pcf)	(psf)	(degree)		(psi)	(psi)	(%)	
1*	0 to 3	Soft Clay (1)	--	--	105	650	--	0.01	--	--	--	--
2	3 to 4	Stiff Clay w/o Free Water	--	--	120	650	--	0.010	--	--	--	--
3	4 to 7	Sand (Reese)	25	--	125	--	30	--	--	--	--	--
4	7 to 14	Sand (Reese)	20	--	63	--	31	--	--	--	--	--
5	14 to 19	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
6	19 to 24	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
7	24 to 29	Stiff Clay w/o Free Water	--	--	68	5,850	--	0.004	--	--	--	--
8	29 to 34	Stiff Clay w/o Free Water	--	--	68	5,450	--	0.005	--	--	--	--
9	34 to 39	Stiff Clay w/o Free Water	--	--	67.6	4,650	--	0.005	--	--	--	--
10	39 to 40	Stiff Clay w/o Free Water	--	--	67.6	5,590	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D5.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for SUB-5

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	650	--	3.04	5	--	0	1,400
2	3 to 4	CL	120	--	650	--	3.04	5	0.8	140	1,400
3	4 to 7	SC	125	30	--	--	3.00	6	0.6	150	2,400
4	7 to 14	SC	63	31	--	--	3.12	9	0.9	290	3,600
5	14 to 19	SC	63	35	--	--	3.69	36	3.5	710	12,400
6	19 to 24	SC	63	35	--	--	3.69	31	3.0	720	12,400
7	24 to 29	CL	68	--	5,850	--	3.04	44	3.1	1,050	13,900
8	29 to 34	CL	68	--	5,450	--	3.04	41	2.9	980	13,900
9	34 to 39	CL	68	--	4,650	--	3.04	35	2.7	890	13,900
10	39 to 40	CL	68	--	5,590	--	3.04	42	3.0	1,000	16,700

Table D5.3 – Grout Anchor Design Parameters for SUB-5

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	CL	--
2	3 to 4	CL	2
3	4 to 7	SC	9
4	7 to 14	SC	10
5	14 to 19	SC	17
6	19 to 24	SC	15
7	24 to 29	CL	20
8	29 to 34	CL	19
9	34 to 39	CL	16
10	39 to 40	CL	19

Notes: Design depth to groundwater is 7 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

[1] For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

[2] A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D6.1 – LPILE Computer Program Parameters for Lateral Load Analysis for SUB-6

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,450	--	0.007	--	--	--	--
2	3 to 7	Sand (Reese)	90	--	120	--	33	--	--	--	--	--
3	7 to 9	Sand (Reese)	60	--	63	--	32	--	--	--	--	--
4	9 to 14	Sand (Reese)	60	--	63	--	35	--	--	--	--	--
5	14 to 19	Stiff Clay w/o Free Water	--	--	68	5,980	--	0.004	--	--	--	--
6	19 to 24	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
7	24 to 29	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
8	29 to 34	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
9	34 to 39	Sand (Reese)	60	--	62.6	--	33	--	--	--	--	--
10	39 to 40	Sand (Reese)	125	--	62.6	--	35	--	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D6.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for SUB-6

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	1,450	--	3.04	11	--	0	3,800
2	3 to 7	SC	120	33	--	--	3.39	12	1.2	200	4,800
3	7 to 9	SC	63	32	--	--	3.25	12	1.2	300	4,800
4	9 to 14	SC	63	35	--	--	3.69	30	2.9	580	9,600
5	14 to 19	CL	68	--	5,980	--	3.04	100	5.2	1,070	9,600
6	19 to 24	SC	63	35	--	--	3.69	50	4.9	900	9,600
7	24 to 29	SC	63	35	--	--	3.69	59	5.8	1,040	9,600
8	29 to 34	SC	63	35	--	--	3.69	59	5.8	1,110	9,600
9	34 to 39	SC	63	33	--	--	3.39	24	2.3	730	9,600
10	39 to 40	SC	63	35	--	--	3.69	44	4.3	1,050	17,600

Table D6.3 – Grout Anchor Design Parameters for SUB-6

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	CL	--
2	3 to 7	SC	11
3	7 to 9	SC	11
4	9 to 14	SC	15
5	14 to 19	CL	21
6	19 to 24	SC	20
7	24 to 29	SC	22
8	29 to 34	SC	22
9	34 to 39	SC	14
10	39 to 40	SC	19

Notes: Design depth to groundwater is 7 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D7.1 – LPILE Computer Program Parameters for Lateral Load Analysis for SUB-7

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	390	--	0.02	--	--	--	--
2	3 to 4	Stiff Clay w/o Free Water	--	--	115	390	--	0.020	--	--	--	--
3	4 to 7	Sand (Reese)	90	--	120	--	33	--	--	--	--	--
4	7 to 14	Sand (Reese)	60	--	63	--	35	--	--	--	--	--
5	14 to 19	Stiff Clay w/o Free Water	--	--	63	5,980	--	0.004	--	--	--	--
6	19 to 24	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
7	24 to 29	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
8	29 to 34	Stiff Clay w/o Free Water	--	--	68	5,980	--	0.004	--	--	--	--
9	34 to 39	Stiff Clay w/o Free Water	--	--	67.6	5,850	--	0.004	--	--	--	--
10	39 to 40	Stiff Clay w/o Free Water	--	--	67.6	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D7.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for SUB-7

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	390	--	3.04	3	--	0	800
2	3 to 4	CL	115	--	390	--	3.04	3	0.6	80	800
3	4 to 7	SC	120	33	--	--	3.39	14	1.3	240	5,600
4	7 to 14	SC	63	35	--	--	3.69	28	2.7	550	11,200
5	14 to 19	SC	63	--	5,980	--	3.04	85	4.7	1,070	17,500
6	19 to 24	SC	63	35	--	--	3.69	62	6.1	990	17,500
7	24 to 29	SC	63	35	--	--	3.69	68	6.6	1,110	17,500
8	29 to 34	CL	68	--	5,980	--	3.04	58	3.7	1,070	17,500
9	34 to 39	CL	68	--	5,850	--	3.04	44	3.1	1,050	17,500
10	39 to 40	CL	68	--	5,980	--	3.04	46	3.2	1,070	17,900

Table D7.3 – Grout Anchor Design Parameters for SUB-7

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	CL	--
2	3 to 4	CL	1
3	4 to 7	SC	11
4	7 to 14	SC	15
5	14 to 19	SC	29
6	19 to 24	SC	23
7	24 to 29	SC	25
8	29 to 34	CL	21
9	34 to 39	CL	20
10	39 to 40	CL	21

Notes: Design depth to groundwater is 7 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D8.1 – LPILE Computer Program Parameters for Lateral Load Analysis for SUB-8

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,590	--	0.007	--	--	--	--
2	3 to 7	Sand (Reese)	90	--	120	--	33	--	--	--	--	--
3	7 to 9	Sand (Reese)	60	--	58	--	35	--	--	--	--	--
4	9 to 12	Sand (Reese)	125	--	58	--	35	--	--	--	--	--
5	12 to 19	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
6	19 to 24	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
7	24 to 29	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
8	29 to 34	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
9	34 to 40	Stiff Clay w/o Free Water	--	--	67.6	4,790	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D8.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for SUB-8

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	1,590	--	3.04	12	--	0	4,200
2	3 to 7	SC	120	33	--	--	3.39	12	1.2	200	4,800
3	7 to 9	SP	58	35	--	--	3.69	30	2.9	510	12,000
4	9 to 12	SP	58	35	--	--	3.69	32	3.1	580	12,800
5	12 to 19	SC	63	35	--	--	3.69	35	3.4	680	14,000
6	19 to 24	SC	63	35	--	--	3.69	40	3.9	800	14,300
7	24 to 29	SC	63	35	--	--	3.69	47	4.6	930	14,300
8	29 to 34	SC	63	35	--	--	3.69	64	6.3	1,140	14,300
9	34 to 40	CL	68	--	4,790	--	3.04	36	2.7	900	14,300

Table D8.3 – Grout Anchor Design Parameters for SUB-8

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	CL	--
2	3 to 7	SC	11
3	7 to 9	SP	15
4	9 to 12	SP	16
5	12 to 19	SC	16
6	19 to 24	SC	18
7	24 to 29	SC	19
8	29 to 34	SC	24
9	34 to 40	CL	17

Notes: Design depth to groundwater is 7 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D9.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-1 (POI)

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	3,060	--	0.005	--	--	--	--
2	3 to 4	Stiff Clay w/o Free Water	--	--	125	3,060	--	0.005	--	--	--	--
3	4 to 9	Sand (Reese)	225	--	120	--	35	--	--	--	--	--
4	9 to 14	Sand (Reese)	90	--	120	--	35	--	--	--	--	--
5	14 to 19	Stiff Clay w/o Free Water	--	--	125	3,060	--	0.005	--	--	--	--
6	19 to 29	Stiff Clay w/o Free Water	--	--	125	4,120	--	0.005	--	--	--	--
7	29 to 34	Stiff Clay w/o Free Water	--	--	125	5,980	--	0.004	--	--	--	--
8	34 to 39	Stiff Clay w/o Free Water	--	--	125	4,650	--	0.005	--	--	--	--
9	39 to 44	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--
10	44 to 50	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D9.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-1 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	3,060	--	3.04	23	--	0	9,100
2	3 to 4	CL	125	--	3,060	--	3.04	23	2.0	670	9,100
3	4 to 9	SC	120	35	--	--	3.69	42	4.1	520	9,100
4	9 to 14	SC	120	35	--	--	3.69	29	2.8	630	9,100
5	14 to 19	CL	125	--	3,060	--	3.04	23	2.0	670	9,100
6	19 to 29	CL	125	--	4,120	--	3.04	31	2.5	830	12,300
7	29 to 34	CL	125	--	5,980	--	3.04	48	3.3	1,070	13,900
8	34 to 39	CL	125	--	4,650	--	3.04	35	2.7	890	13,900
9	39 to 44	CL	130	--	5,980	--	3.04	75	4.3	1,070	17,900
10	44 to 50	CL	130	--	5,980	--	3.04	67	4.0	1,070	17,900

Table D9.3 – Grout Anchor Design Parameters for TL-1 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	CL	--
2	3 to 4	CL	11
3	4 to 9	SC	18
4	9 to 14	SC	15
5	14 to 19	CL	11
6	19 to 29	CL	14
7	29 to 34	CL	21
8	34 to 39	CL	16
9	39 to 44	CL	21
10	44 to 50	CL	21

Notes: Design depth to groundwater is 50 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D10.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-2

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci)		γ'	C	ϕ	ε_{50}	E_{rm}	UCS	RQD	K_{rm}
			Static	Cyclic	(pcf)	(psf)	(degree)		(psi)	(psi)	(%)	
1*	0 to 3	Soft Clay (1)	--	--	105	650	--	0.01	--	--	--	--
2	3 to 7	Stiff Clay w/o Free Water	--	--	125	650	--	0.010	--	--	--	--
3	7 to 9	Stiff Clay w/o Free Water	--	--	125	3,190	--	0.005	--	--	--	--
4	9 to 12	Stiff Clay w/o Free Water	--	--	125	2,920	--	0.005	--	--	--	--
5	12 to 14	Stiff Clay w/o Free Water	--	--	125	3,990	--	0.005	--	--	--	--
6	14 to 19	Stiff Clay w/o Free Water	--	--	125	3,450	--	0.005	--	--	--	--
7	19 to 24	Stiff Clay w/o Free Water	--	--	125	5,450	--	0.005	--	--	--	--
8	24 to 29	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--
9	29 to 30	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D10.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-2

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CH	105	--	650	--	3.04	5	--	0	1,400
2	3 to 7	CH	125	--	650	--	3.04	5	0.8	140	1,400
3	7 to 9	CL	125	--	3,190	--	3.04	24	2.1	700	8,700
4	9 to 12	CL	125	--	2,920	--	3.04	22	2.0	640	8,700
5	12 to 14	CL	125	--	3,990	--	3.04	30	2.4	810	10,300
6	14 to 19	CL	125	--	3,450	--	3.04	26	2.2	740	10,300
7	19 to 24	CL	125	--	5,450	--	3.04	41	2.9	980	16,300
8	24 to 29	CL	130	--	5,980	--	3.04	74	4.3	1,070	17,900
9	29 to 30	CL	130	--	5,980	--	3.04	61	3.8	1,070	17,900

Table D10.3 – Grout Anchor Design Parameters for TL-2

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	CH	--
2	3 to 7	CH	2
3	7 to 9	CL	11
4	9 to 12	CL	10
5	12 to 14	CL	14
6	14 to 19	CL	12
7	19 to 24	CL	19
8	24 to 29	CL	21
9	29 to 30	CL	21

Notes: Design depth to groundwater is 30 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D11.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-3

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,190	--	0.007	--	--	--	--
2	3 to 4	Sand (Reese)	25	--	120	--	32	--	--	--	--	--
3	4 to 7	Stiff Clay w/o Free Water	--	--	125	1,190	--	0.007	--	--	--	--
4	7 to 12	Stiff Clay w/o Free Water	--	--	130	2,650	--	0.005	--	--	--	--
5	12 to 14	Stiff Clay w/o Free Water	--	--	125	3,450	--	0.005	--	--	--	--
6	14 to 19	Stiff Clay w/o Free Water	--	--	125	3,990	--	0.005	--	--	--	--
7	19 to 24	Stiff Clay w/o Free Water	--	--	125	3,060	--	0.005	--	--	--	--
8	24 to 29	Stiff Clay w/o Free Water	--	--	125	4,390	--	0.005	--	--	--	--
9	29 to 30	Stiff Clay w/o Free Water	--	--	125	3,450	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D11.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-3

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SC	105	--	1,190	--	3.04	9	--	0	3,100
2	3 to 4	SC	120	32	--	--	3.25	9	0.9	110	3,100
3	4 to 7	CH	125	--	1,190	--	3.04	9	1.1	260	3,100
4	7 to 12	CH	130	--	2,650	--	3.04	20	1.9	580	7,900
5	12 to 14	CL	125	--	3,450	--	3.04	26	2.2	740	9,100
6	14 to 19	CL	125	--	3,990	--	3.04	30	2.4	810	9,100
7	19 to 24	CL	125	--	3,060	--	3.04	23	2.0	670	9,100
8	24 to 29	CL	125	--	4,390	--	3.04	33	2.6	860	10,300
9	29 to 30	CL	125	--	3,450	--	3.04	26	2.2	740	10,300

Table D11.3 – Grout Anchor Design Parameters for TL-3

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	SC	--
2	3 to 4	SC	10
3	4 to 7	CH	4
4	7 to 12	CH	9
5	12 to 14	CL	12
6	14 to 19	CL	14
7	19 to 24	CL	11
8	24 to 29	CL	15
9	29 to 30	CL	12

Notes: Design depth to groundwater is 50 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma' = \gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D12.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-4 (POI)

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci)		γ'	C	ϕ	ε_{50}	E_{rm}	UCS	RQD	K_{rm}
			Static	Cyclic	(pcf)	(psf)	(degree)		(psi)	(psi)	(%)	
1*	0 to 3	Soft Clay (1)	--	--	105	790	--	0.01	--	--	--	--
2	3 to 7	Stiff Clay w/o Free Water	--	--	120	790	--	0.010	--	--	--	--
3	7 to 12	Stiff Clay w/o Free Water	--	--	120	1,050	--	0.007	--	--	--	--
4	12 to 14	Stiff Clay w/o Free Water	--	--	125	3,190	--	0.005	--	--	--	--
5	14 to 19	Stiff Clay w/o Free Water	--	--	125	4,390	--	0.005	--	--	--	--
6	19 to 24	Stiff Clay w/o Free Water	--	--	125	5,190	--	0.005	--	--	--	--
7	24 to 34	Stiff Clay w/o Free Water	--	--	125	5,850	--	0.004	--	--	--	--
8	34 to 39	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--
9	39 to 44	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--
10	44 to 50	Sand (Reese)	225	--	125	--	34	--	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D12.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-4 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	790	--	3.04	6	--	0	1,700
2	3 to 7	CL	120	--	790	--	3.04	6	0.9	170	1,700
3	7 to 12	CL	120	--	1,050	--	3.04	8	1.1	230	2,800
4	12 to 14	CL	125	--	3,190	--	3.04	24	2.1	700	9,500
5	14 to 19	CL	125	--	4,390	--	3.04	33	2.6	860	13,100
6	19 to 24	CL	125	--	5,190	--	3.04	39	2.9	940	15,500
7	24 to 34	CL	125	--	5,850	--	3.04	44	3.1	1,050	17,500
8	34 to 39	CL	130	--	5,980	--	3.04	55	3.5	1,070	17,900
9	39 to 44	CL	130	--	5,980	--	3.04	60	3.7	1,070	17,900
10	44 to 50	SC	125	34	--	--	3.54	54	5.3	1,530	20,000

Table D12.3 – Grout Anchor Design Parameters for TL-4 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	CL	--
2	3 to 7	CL	3
3	7 to 12	CL	4
4	12 to 14	CL	11
5	14 to 19	CL	15
6	19 to 24	CL	18
7	24 to 34	CL	20
8	34 to 39	CL	21
9	39 to 44	CL	21
10	44 to 50	SC	21

Notes: Design depth to groundwater is 50 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D13.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-5

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,590	--	0.007	--	--	--	--
2	3 to 9	Stiff Clay w/o Free Water	--	--	120	1,190	--	0.007	--	--	--	--
3	9 to 14	Stiff Clay w/o Free Water	--	--	125	1,720	--	0.007	--	--	--	--
4	14 to 19	Stiff Clay w/o Free Water	--	--	125	3,450	--	0.005	--	--	--	--
5	19 to 24	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
6	24 to 29	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--
7	29 to 30	Stiff Clay w/o Free Water	--	--	125	4,520	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D13.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-5

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	1,590	--	3.04	12	--	0	3,100
2	3 to 9	CL	120	--	1,190	--	3.04	9	1.1	260	3,100
3	9 to 14	CL	125	--	1,720	--	3.04	13	1.4	380	4,600
4	14 to 19	CL	125	--	3,450	--	3.04	26	2.2	740	10,300
5	19 to 24	SC	125	35	--	--	3.69	51	5.0	1,080	13,500
6	24 to 29	ML	130	--	5,980	--	3.04	78	4.4	1,070	13,500
7	29 to 30	CL	125	--	4,520	--	3.04	34	2.6	880	13,500

Table D13.3 – Grout Anchor Design Parameters for TL-5

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	CL	--
2	3 to 9	CL	4
3	9 to 14	CL	6
4	14 to 19	CL	12
5	19 to 24	SC	20
6	24 to 29	ML	21
7	29 to 30	CL	16

Notes: Design depth to groundwater is 30 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D14.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-6 (POI)

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci)		γ'	C	ϕ	ε_{50}	E_{rm}	UCS	RQD	K_{rm}
			Static	Cyclic	(pcf)	(psf)	(degree)		(psi)	(psi)	(%)	
1*	0 to 3	Soft Clay (1)	--	--	105	1,050	--	0.007	--	--	--	--
2	3 to 7	Stiff Clay w/o Free Water	--	--	120	3,990	--	0.005	--	--	--	--
3	7 to 12	Stiff Clay w/o Free Water	--	--	125	1,050	--	0.007	--	--	--	--
4	12 to 14	Stiff Clay w/o Free Water	--	--	125	1,850	--	0.007	--	--	--	--
5	14 to 19	Stiff Clay w/o Free Water	--	--	125	5,190	--	0.005	--	--	--	--
6	19 to 24	Stiff Clay w/o Free Water	--	--	125	3,060	--	0.005	--	--	--	--
7	24 to 39	Sand (Reese)	225	--	120	--	33	--	--	--	--	--
8	39 to 44	Stiff Clay w/o Free Water	--	--	130	5,320	--	0.005	--	--	--	--
9	44 to 49	Stiff Clay w/o Free Water	--	--	130	5,450	--	0.005	--	--	--	--
10	49 to 50	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D14.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-6 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SC	105	--	1,050	--	3.04	8	--	0	2,800
2	3 to 7	SC	120	--	3,990	--	3.04	30	2.4	810	2,800
3	7 to 12	CL	125	--	1,050	--	3.04	8	1.1	230	2,800
4	12 to 14	CL	125	--	1,850	--	3.04	14	1.5	400	4,900
5	14 to 19	CL	125	--	5,190	--	3.04	39	2.9	940	9,100
6	19 to 24	CL	125	--	3,060	--	3.04	23	2.0	670	9,100
7	24 to 39	SC	120	33	--	--	3.39	36	3.5	1,030	14,400
8	39 to 44	CL	130	--	5,320	--	3.04	40	2.9	950	15,900
9	44 to 49	CL	130	--	5,450	--	3.04	41	2.9	980	16,300
10	49 to 50	CL	130	--	5,980	--	3.04	100	5.2	1,070	17,900

Table D14.3 – Grout Anchor Design Parameters for TL-6 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	SC	--
2	3 to 7	SC	15
3	7 to 12	CL	4
4	12 to 14	CL	6
5	14 to 19	CL	18
6	19 to 24	CL	11
7	24 to 39	SC	17
8	39 to 44	CL	18
9	44 to 49	CL	19
10	49 to 50	CL	21

Notes: Design depth to groundwater is 50 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D15.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-7

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	650	--	0.01	--	--	--	--
2	3 to 4	Stiff Clay w/o Free Water	--	--	125	650	--	0.010	--	--	--	--
3	4 to 9	Stiff Clay w/o Free Water	--	--	125	2,120	--	0.007	--	--	--	--
4	9 to 12	Stiff Clay w/o Free Water	--	--	125	2,650	--	0.005	--	--	--	--
5	12 to 19	Sand (Reese)	90	--	120	--	34	--	--	--	--	--
6	19 to 24	Sand (Reese)	225	--	120	--	35	--	--	--	--	--
7	24 to 29	Stiff Clay w/o Free Water	--	--	130	5,450	--	0.005	--	--	--	--
8	29 to 30	Stiff Clay w/o Free Water	--	--	130	4,790	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D15.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-7

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CH	105	--	650	--	3.04	5	--	0	1,400
2	3 to 4	CH	125	--	650	--	3.04	5	0.8	140	1,400
3	4 to 9	CL	125	--	2,120	--	3.04	16	1.6	460	6,300
4	9 to 12	CL	125	--	2,650	--	3.04	20	1.9	580	7,900
5	12 to 19	SC	120	34	--	--	3.54	27	2.6	680	10,800
6	19 to 24	SC	120	35	--	--	3.69	43	4.2	1,000	14,300
7	24 to 29	CL	130	--	5,450	--	3.04	41	2.9	980	14,300
8	29 to 30	CL	130	--	4,790	--	3.04	36	2.7	900	14,300

Table D15.3 – Grout Anchor Design Parameters for TL-7

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	CH	--
2	3 to 4	CH	2
3	4 to 9	CL	7
4	9 to 12	CL	9
5	12 to 19	SC	14
6	19 to 24	SC	18
7	24 to 29	CL	19
8	29 to 30	CL	17

Notes: Design depth to groundwater is 30 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D16.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-8

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	920	--	0.01	--	--	--	--
2	3 to 7	Sand (Reese)	25	--	120	--	30	--	--	--	--	--
3	7 to 9	Sand (Reese)	90	--	125	--	34	--	--	--	--	--
4	9 to 12	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
5	12 to 14	Stiff Clay w/o Free Water	--	--	115	390	--	0.020	--	--	--	--
6	14 to 19	Stiff Clay w/o Free Water	--	--	125	2,120	--	0.007	--	--	--	--
7	19 to 24	Sand (Reese)	225	--	125	--	34	--	--	--	--	--
8	24 to 30	Stiff Clay w/o Free Water	--	--	130	5,590	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D16.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-8

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SM	105	--	920	--	3.04	7	--	0	800
2	3 to 7	SC	120	30	--	--	3.00	5	0.5	120	800
3	7 to 9	SC	125	34	--	--	3.54	21	2.0	440	800
4	9 to 12	SC	125	35	--	--	3.69	36	3.5	670	800
5	12 to 14	CL	115	--	390	--	3.04	3	0.6	80	800
6	14 to 19	CL	125	--	2,120	--	3.04	16	1.6	460	6,300
7	19 to 24	SC	125	34	--	--	3.54	38	3.7	910	15,200
8	24 to 30	CL	130	--	5,590	--	3.04	42	3.0	1,000	16,700

Table D16.3 – Grout Anchor Design Parameters for TL-8

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	SM	--
2	3 to 7	SC	9
3	7 to 9	SC	13
4	9 to 12	SC	17
5	12 to 14	CL	1
6	14 to 19	CL	7
7	19 to 24	SC	17
8	24 to 30	CL	19

Notes: Design depth to groundwater is 30 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

[1] For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

[2] A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D17.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-9

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,990	--	0.007	--	--	--	--
2	3 to 7	Sand (Reese)	90	--	120	--	33	--	--	--	--	--
3	7 to 12	Sand (Reese)	90	--	120	--	34	--	--	--	--	--
4	12 to 14	Stiff Clay w/o Free Water	--	--	125	4,250	--	0.005	--	--	--	--
5	14 to 19	Sand (Reese)	90	--	125	--	34	--	--	--	--	--
6	19 to 24	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
7	24 to 29	Sand (Reese)	225	--	125	--	34	--	--	--	--	--
8	29 to 30	Sand (Reese)	90	--	125	--	32	--	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D17.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-9

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SC	105	--	1,990	--	3.04	15	--	0	5,300
2	3 to 7	SC	120	33	--	--	3.39	14	1.3	210	5,600
3	7 to 12	SC	120	34	--	--	3.54	24	2.3	510	9,600
4	12 to 14	CL	125	--	4,250	--	3.04	32	2.5	840	10,400
5	14 to 19	SC	125	34	--	--	3.54	30	2.9	720	10,400
6	19 to 24	SC	125	35	--	--	3.69	44	4.3	1,010	10,400
7	24 to 29	SC	125	34	--	--	3.54	43	4.2	1,060	10,400
8	29 to 30	SC	125	32	--	--	3.25	26	2.5	840	10,400

Table D17.3 – Grout Anchor Design Parameters for TL-9

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	SC	--
2	3 to 7	SC	11
3	7 to 12	SC	14
4	12 to 14	CL	15
5	14 to 19	SC	15
6	19 to 24	SC	19
7	24 to 29	SC	18
8	29 to 30	SC	14

Notes: Design depth to groundwater is 30 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma' = \gamma_{Total} - 62.4$ pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D18.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-10

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci)		γ'	C	ϕ	ε_{50}	E_{rm}	UCS	RQD	K_{rm}
			Static	Cyclic	(pcf)	(psf)	(degree)		(psi)	(psi)	(%)	
1*	0 to 3	Soft Clay (1)	--	--	105	920	--	0.01	--	--	--	--
2	3 to 7	Sand (Reese)	25	--	115	--	26	--	--	--	--	--
3	7 to 9	Sand (Reese)	90	--	120	--	35	--	--	--	--	--
4	9 to 12	Sand (Reese)	225	--	120	--	35	--	--	--	--	--
5	12 to 14	Sand (Reese)	90	--	120	--	34	--	--	--	--	--
6	14 to 19	Sand (Reese)	225	--	125	--	34	--	--	--	--	--
7	19 to 24	Sand (Reese)	225	--	130	--	35	--	--	--	--	--
8	24 to 30	Sand (Reese)	125	--	68	--	35	--	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D18.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-10

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SC	105	--	920	--	3.04	7	--	0	800
2	3 to 7	SC	115	26	--	--	2.52	2	0.2	70	800
3	7 to 9	SC	120	35	--	--	3.69	24	2.3	480	9,200
4	9 to 12	SC	120	35	--	--	3.69	32	3.1	630	9,200
5	12 to 14	SC	120	34	--	--	3.54	23	2.2	570	9,200
6	14 to 19	SC	125	34	--	--	3.54	32	3.1	740	12,800
7	19 to 24	SC	130	35	--	--	3.69	51	5.0	1,080	17,600
8	24 to 30	SC	68	35	--	--	3.69	44	4.3	1,090	17,600

Table D18.3 – Grout Anchor Design Parameters for TL-10

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	SC	--
2	3 to 7	SC	8
3	7 to 9	SC	14
4	9 to 12	SC	16
5	12 to 14	SC	13
6	14 to 19	SC	16
7	19 to 24	SC	20
8	24 to 30	SC	19

Notes: Design depth to groundwater is 24 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

[1] For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

[2] A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D19.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-11

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci)		γ'	C	ϕ	ε_{50}	E_{rm}	UCS	RQD	K_{rm}
			Static	Cyclic	(pcf)	(psf)	(degree)		(psi)	(psi)	(%)	
1*	0 to 3	Soft Clay (1)	--	--	105	2,390	--	0.005	--	--	--	--
2	3 to 7	Sand (Reese)	25	--	120	--	31	--	--	--	--	--
3	7 to 9	Sand (Reese)	90	--	120	--	33	--	--	--	--	--
4	9 to 12	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
5	12 to 19	Sand (Reese)	90	--	125	--	34	--	--	--	--	--
6	19 to 24	Sand (Reese)	225	--	125	--	34	--	--	--	--	--
7	24 to 28	Sand (Reese)	225	--	130	--	35	--	--	--	--	--
8	28 to 30	Sand (Reese)	125	--	68	--	35	--	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D19.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-11

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SC	105	--	2,390	--	3.04	18	--	0	3,200
2	3 to 7	SC	120	31	--	--	3.12	8	0.8	160	3,200
3	7 to 9	SC	120	33	--	--	3.39	17	1.6	380	6,800
4	9 to 12	SC	125	35	--	--	3.69	33	3.2	640	11,600
5	12 to 19	SC	125	34	--	--	3.54	29	2.8	700	11,600
6	19 to 24	SC	125	34	--	--	3.54	31	3.0	830	12,400
7	24 to 28	SC	130	35	--	--	3.69	61	6.0	1,280	20,000
8	28 to 30	SC	68	35	--	--	3.69	58	5.7	1,300	20,000

Table D19.3 – Grout Anchor Design Parameters for TL-11

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	SC	--
2	3 to 7	SC	10
3	7 to 9	SC	12
4	9 to 12	SC	16
5	12 to 19	SC	15
6	19 to 24	SC	15
7	24 to 28	SC	23
8	28 to 30	SC	22

Notes: Design depth to groundwater is 28 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma' = \gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

[1] For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

[2] A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D20.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-12

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,050	--	0.007	--	--	--	--
2	3 to 7	Sand (Reese)	25	--	115	--	31	--	--	--	--	--
3	7 to 9	Stiff Clay w/o Free Water	--	--	63	1,050	--	0.007	--	--	--	--
4	9 to 12	Sand (Reese)	60	--	63	--	33	--	--	--	--	--
5	12 to 19	Sand (Reese)	125	--	68	--	35	--	--	--	--	--
6	19 to 24	Sand (Reese)	125	--	68	--	35	--	--	--	--	--
7	24 to 29	Stiff Clay w/o Free Water	--	--	63	1,990	--	0.007	--	--	--	--
8	29 to 30	Sand (Reese)	125	--	68	--	35	--	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D20.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-12

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SC	105	--	1,050	--	3.04	8	--	0	2,400
2	3 to 7	SC	115	31	--	--	3.12	6	0.6	130	2,400
3	7 to 9	CL	63	--	1,050	--	3.04	8	1.1	230	2,800
4	9 to 12	SP	63	33	--	--	3.39	18	1.7	410	5,300
5	12 to 19	SC	68	35	--	--	3.69	33	3.2	660	5,300
6	19 to 24	SC	68	35	--	--	3.69	31	3.0	720	5,300
7	24 to 29	ML	63	--	1,990	--	3.04	15	1.6	430	5,300
8	29 to 30	SC	68	35	--	--	3.69	42	4.1	930	16,800

Table D20.3 – Grout Anchor Design Parameters for TL-12

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	SC	--
2	3 to 7	SC	9
3	7 to 9	CL	4
4	9 to 12	SP	12
5	12 to 19	SC	16
6	19 to 24	SC	15
7	24 to 29	ML	7
8	29 to 30	SC	18

Notes: Design depth to groundwater is 7 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

[1] For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

[2] A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D21.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-13 (POI)

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 4	Soft Clay (1)	--	--	105	1,720	--	0.007	--	--	--	--
2	4 to 6	Stiff Clay w/o Free Water	--	--	120	1,320	--	0.007	--	--	--	--
3	6 to 9	Sand (Reese)	90	--	120	--	34	--	--	--	--	--
4	9 to 14	Stiff Clay w/o Free Water	--	--	125	1,720	--	0.007	--	--	--	--
5	14 to 19	Stiff Clay w/o Free Water	--	--	125	2,250	--	0.005	--	--	--	--
6	19 to 24	Stiff Clay w/o Free Water	--	--	125	3,600	--	0.005	--	--	--	--
7	24 to 34	Stiff Clay w/o Free Water	--	--	133	5,980	--	0.004	--	--	--	--
8	34 to 39	Stiff Clay w/o Free Water	--	--	130	4,790	--	0.005	--	--	--	--
9	39 to 44	Stiff Clay w/o Free Water	--	--	133	5,980	--	0.004	--	--	--	--
10	44 to 50	Stiff Clay w/o Free Water	--	--	133	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D21.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-13 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 4	SC	105	--	1,720	--	3.04	13	--	380	3,500
2	4 to 6	CL	120	--	1,320	--	3.04	10	1.2	290	3,500
3	6 to 9	SC	120	34	--	--	3.54	22	2.1	420	4,600
4	9 to 14	CH	125	--	1,720	--	3.04	13	1.4	380	4,600
5	14 to 19	CL	125	--	2,250	--	3.04	17	1.7	490	6,700
6	19 to 24	CL	125	--	3,600	--	3.04	27	2.3	760	10,800
7	24 to 34	CL	133	--	5,980	--	3.04	68	4.0	1,070	14,300
8	34 to 39	CL	130	--	4,790	--	3.04	36	2.7	900	14,300
9	39 to 44	CL	133	--	5,980	--	3.04	77	4.4	1,070	17,900
10	44 to 50	CL	133	--	5,980	--	3.04	57	3.6	1,070	17,900

Table D21.3 – Grout Anchor Design Parameters for TL-13 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 4	SC	--
2	4 to 6	CL	5
3	6 to 9	SC	13
4	9 to 14	CH	6
5	14 to 19	CL	8
6	19 to 24	CL	13
7	24 to 34	CL	21
8	34 to 39	CL	17
9	39 to 44	CL	21
10	44 to 50	CL	21

Notes: Design depth to groundwater is 50 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D22.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-14 (POI)

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci)		γ'	C	ϕ	ε_{50}	E_{rm}	UCS	RQD	K_{rm}
			Static	Cyclic	(pcf)	(psf)	(degree)		(psi)	(psi)	(%)	
1*	0 to 3	Soft Clay (1)	--	--	105	1,050	--	0.007	--	--	--	--
2	3 to 7	Sand (Reese)	25	--	115	--	30	--	--	--	--	--
3	7 to 9	Sand (Reese)	90	--	115	--	32	--	--	--	--	--
4	9 to 14	Stiff Clay w/o Free Water	--	--	125	3,320	--	0.005	--	--	--	--
5	14 to 19	Stiff Clay w/o Free Water	--	--	125	1,990	--	0.007	--	--	--	--
6	19 to 29	Stiff Clay w/o Free Water	--	--	125	3,600	--	0.005	--	--	--	--
7	29 to 34	Stiff Clay w/o Free Water	--	--	125	3,060	--	0.005	--	--	--	--
8	34 to 39	Stiff Clay w/o Free Water	--	--	125	4,120	--	0.005	--	--	--	--
9	39 to 44	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--
10	44 to 50	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D22.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-14 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SC	105	--	1,050	--	3.04	8	--	0	2,000
2	3 to 7	SC	115	30	--	--	3.00	5	0.5	120	2,000
3	7 to 9	SC	115	32	--	--	3.25	11	1.1	300	4,400
4	9 to 14	CL	125	--	3,320	--	3.04	25	2.2	720	5,300
5	14 to 19	CL	125	--	1,990	--	3.04	15	1.6	430	5,300
6	19 to 29	CL	125	--	3,600	--	3.04	27	2.3	760	9,100
7	29 to 34	CL	125	--	3,060	--	3.04	23	2.0	670	9,100
8	34 to 39	CL	125	--	4,120	--	3.04	31	2.5	830	12,300
9	39 to 44	CL	130	--	5,980	--	3.04	50	3.3	1,070	17,900
10	44 to 50	CL	130	--	5,980	--	3.04	49	3.3	1,070	17,900

Table D22.3 – Grout Anchor Design Parameters for TL-14 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	SC	--
2	3 to 7	SC	9
3	7 to 9	SC	10
4	9 to 14	CL	12
5	14 to 19	CL	7
6	19 to 29	CL	13
7	29 to 34	CL	11
8	34 to 39	CL	14
9	39 to 44	CL	21
10	44 to 50	CL	21

Notes: Design depth to groundwater is 50 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma' = \gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D23.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-15

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,720	--	0.007	--	--	--	--
2	3 to 7	Sand (Reese)	25	--	115	--	32	--	--	--	--	--
3	7 to 9	Sand (Reese)	25	--	120	--	32	--	--	--	--	--
4	9 to 14	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
5	14 to 19	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
6	19 to 24	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
7	24 to 29	Stiff Clay w/o Free Water	--	--	68	5,980	--	0.004	--	--	--	--
8	29 to 30	Sand (Reese)	125	--	73	--	33	--	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D23.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-15

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SM	105	--	1,720	--	3.04	13	--	0	3,200
2	3 to 7	SC	115	32	--	--	3.25	8	0.8	160	3,200
3	7 to 9	SC	120	32	--	--	3.25	10	1.0	290	4,000
4	9 to 14	SC	125	35	--	--	3.69	45	4.4	770	12,800
5	14 to 19	SC	125	35	--	--	3.69	53	5.2	970	12,800
6	19 to 24	SC	125	35	--	--	3.69	50	4.9	1,070	12,800
7	24 to 29	ML	68	--	5,980	--	3.04	55	3.5	1,070	12,800
8	29 to 30	SC	73	33	--	--	3.39	32	3.1	910	12,800

Table D23.3 – Grout Anchor Design Parameters for TL-15

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	SM	--
2	3 to 7	SC	10
3	7 to 9	SC	10
4	9 to 14	SC	19
5	14 to 19	SC	21
6	19 to 24	SC	20
7	24 to 29	ML	21
8	29 to 30	SC	16

Notes: Design depth to groundwater is 24 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D24.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-16

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,850	--	0.007	--	--	--	--
2	3 to 7	Sand (Reese)	90	--	120	--	33	--	--	--	--	--
3	7 to 9	Sand (Reese)	90	--	125	--	35	--	--	--	--	--
4	9 to 14	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
5	14 to 19	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
6	19 to 25	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
7	25 to 29	Sand (Reese)	125	--	68	--	35	--	--	--	--	--
8	29 to 30	Sand (Reese)	125	--	63	--	35	--	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D24.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-16

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SC	105	--	1,850	--	3.04	14	--	0	4,900
2	3 to 7	SC	120	33	--	--	3.39	14	1.3	210	5,600
3	7 to 9	SC	125	35	--	--	3.69	25	2.4	500	10,000
4	9 to 14	SC	125	35	--	--	3.69	43	4.2	760	17,200
5	14 to 19	SC	125	35	--	--	3.69	45	4.4	910	18,000
6	19 to 25	SC	125	35	--	--	3.69	47	4.6	1,050	18,800
7	25 to 29	SC	68	35	--	--	3.69	50	4.9	1,170	20,000
8	29 to 30	SP	63	35	--	--	3.69	100	9.8	1,640	20,000

Table D24.3 – Grout Anchor Design Parameters for TL-16

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	SC	--
2	3 to 7	SC	11
3	7 to 9	SC	14
4	9 to 14	SC	18
5	14 to 19	SC	19
6	19 to 25	SC	19
7	25 to 29	SC	20
8	29 to 30	SP	33

Notes: Design depth to groundwater is 25 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

[1] For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

[2] A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D25.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-17

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	790	--	0.01	--	--	--	--
2	3 to 4	Stiff Clay w/o Free Water	--	--	115	790	--	0.010	--	--	--	--
3	4 to 9	Sand (Reese)	25	--	115	--	30	--	--	--	--	--
4	9 to 12	Sand (Reese)	25	--	120	--	31	--	--	--	--	--
5	12 to 14	Sand (Reese)	60	--	68	--	35	--	--	--	--	--
6	14 to 19	Sand (Reese)	60	--	68	--	34	--	--	--	--	--
7	19 to 24	Sand (Reese)	125	--	68	--	34	--	--	--	--	--
8	24 to 30	Stiff Clay w/o Free Water	--	--	71	4,650	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D25.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-17

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	790	--	3.04	6	--	0	1,600
2	3 to 4	CL	115	--	790	--	3.04	6	0.9	170	1,600
3	4 to 9	SC	115	30	--	--	3.00	4	0.4	150	1,600
4	9 to 12	SC	120	31	--	--	3.12	9	0.9	310	3,600
5	12 to 14	SC	68	35	--	--	3.69	30	2.9	660	12,000
6	14 to 19	SC	68	34	--	--	3.54	30	2.9	680	12,000
7	19 to 24	SC	68	34	--	--	3.54	33	3.2	770	13,200
8	24 to 30	CL	71	--	4,650	--	3.04	35	2.7	890	13,900

Table D25.3 – Grout Anchor Design Parameters for TL-17

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	CL	--
2	3 to 4	CL	3
3	4 to 9	SC	9
4	9 to 12	SC	10
5	12 to 14	SC	15
6	14 to 19	SC	15
7	19 to 24	SC	16
8	24 to 30	CL	16

Notes: Design depth to groundwater is 12 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D26.1 – LPILE Computer Program Parameters for Lateral Load Analysis for TL-18 (POI)

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	520	--	0.01	--	--	--	--
2	3 to 7	Sand (Reese)	25	--	120	--	28	--	--	--	--	--
3	7 to 9	Sand (Reese)	25	--	120	--	30	--	--	--	--	--
4	9 to 14	Sand (Reese)	60	--	63	--	35	--	--	--	--	--
5	14 to 24	Sand (Reese)	125	--	68	--	35	--	--	--	--	--
6	24 to 29	Sand (Reese)	125	--	68	--	35	--	--	--	--	--
7	29 to 34	Stiff Clay w/o Free Water	--	--	71	5,980	--	0.004	--	--	--	--
8	34 to 39	Stiff Clay w/o Free Water	--	--	71	5,050	--	0.005	--	--	--	--
9	39 to 44	Stiff Clay w/o Free Water	--	--	70.6	5,980	--	0.004	--	--	--	--
10	44 to 50	Stiff Clay w/o Free Water	--	--	70.6	5,450	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D26.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for TL-18 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SC	105	--	520	--	3.04	4	--	0	1,100
2	3 to 7	SC	120	28	--	--	2.77	3	0.3	90	1,200
3	7 to 9	SC	120	30	--	--	3.00	6	0.6	220	2,400
4	9 to 14	SC	63	35	--	--	3.69	27	2.6	580	10,800
5	14 to 24	SC	68	35	--	--	3.69	49	4.8	880	15,100
6	24 to 29	SC	68	35	--	--	3.69	41	4.0	910	15,100
7	29 to 34	CL	71	--	5,980	--	3.04	50	3.3	1,070	15,100
8	34 to 39	CL	71	--	5,050	--	3.04	38	2.8	930	15,100
9	39 to 44	CL	71	--	5,980	--	3.04	51	3.4	1,070	16,300
10	44 to 50	CL	71	--	5,450	--	3.04	41	2.9	980	16,300

Table D26.3 – Grout Anchor Design Parameters for TL-18 (POI)

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	SC	--
2	3 to 7	SC	8
3	7 to 9	SC	9
4	9 to 14	SC	14
5	14 to 24	SC	20
6	24 to 29	SC	18
7	29 to 34	CL	21
8	34 to 39	CL	18
9	39 to 44	CL	21
10	44 to 50	CL	19

Notes: Design depth to groundwater is 9 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D27.1 – LPILE Computer Program Parameters for Lateral Load Analysis for MET-3

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,450	--	0.007	--	--	--	--
2	3 to 7	Stiff Clay w/o Free Water	--	--	125	1,450	--	0.007	--	--	--	--
3	7 to 9	Stiff Clay w/o Free Water	--	--	125	3,450	--	0.005	--	--	--	--
4	9 to 12	Stiff Clay w/o Free Water	--	--	125	2,790	--	0.005	--	--	--	--
5	12 to 14	Stiff Clay w/o Free Water	--	--	125	2,790	--	0.005	--	--	--	--
6	14 to 19	Stiff Clay w/o Free Water	--	--	125	3,600	--	0.005	--	--	--	--
7	19 to 24	Stiff Clay w/o Free Water	--	--	130	5,190	--	0.005	--	--	--	--
8	24 to 29	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--
9	29 to 34	Stiff Clay w/o Free Water	--	--	130	5,720	--	0.005	--	--	--	--
10	34 to 35	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D27.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for MET-3

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	1,450	--	3.04	11	--	0	3,800
2	3 to 7	CL	125	--	1,450	--	3.04	11	1.3	320	3,800
3	7 to 9	ML	125	--	3,450	--	3.04	26	2.2	740	8,300
4	9 to 12	CL	125	--	2,790	--	3.04	21	1.9	610	8,300
5	12 to 14	CL	125	--	2,790	--	3.04	21	1.9	610	8,300
6	14 to 19	CL	125	--	3,600	--	3.04	27	2.3	760	10,800
7	19 to 24	CL	130	--	5,190	--	3.04	39	2.9	940	15,500
8	24 to 29	CL	130	--	5,980	--	3.04	65	3.9	1,070	17,100
9	29 to 34	CL	130	--	5,720	--	3.04	43	3.0	1,030	17,100
10	34 to 35	CL	130	--	5,980	--	3.04	50	3.3	1,070	17,900

Table D27.3 – Grout Anchor Design Parameters for MET-3

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	CL	--
2	3 to 7	CL	5
3	7 to 9	ML	12
4	9 to 12	CL	10
5	12 to 14	CL	10
6	14 to 19	CL	13
7	19 to 24	CL	18
8	24 to 29	CL	21
9	29 to 34	CL	20
10	34 to 35	CL	21

Notes: Design depth to groundwater is 35 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D28.1 – LPILE Computer Program Parameters for Lateral Load Analysis for PMM-1

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,850	--	0.007	--	--	--	--
2	3 to 7	Stiff Clay w/o Free Water	--	--	125	1,320	--	0.007	--	--	--	--
3	7 to 9	Stiff Clay w/o Free Water	--	--	125	2,120	--	0.007	--	--	--	--
4	9 to 12	Stiff Clay w/o Free Water	--	--	125	3,060	--	0.005	--	--	--	--
5	12 to 14	Sand (Reese)	225	--	125	--	35	--	--	--	--	--
6	14 to 19	Sand (Reese)	90	--	125	--	33	--	--	--	--	--
7	19 to 24	Sand (Reese)	90	--	125	--	33	--	--	--	--	--
8	24 to 29	Sand (Reese)	90	--	125	--	33	--	--	--	--	--
9	29 to 34	Stiff Clay w/o Free Water	--	--	130	3,600	--	0.005	--	--	--	--
10	34 to 35	Stiff Clay w/o Free Water	--	--	130	5,050	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D28.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for PMM-1

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	1,850	--	3.04	14	--	0	3,500
2	3 to 7	CL	125	--	1,320	--	3.04	10	1.2	290	3,500
3	7 to 9	CL	125	--	2,120	--	3.04	16	1.6	460	6,300
4	9 to 12	CL	125	--	3,060	--	3.04	23	2.0	670	8,400
5	12 to 14	SC	125	35	--	--	3.69	32	3.1	700	8,400
6	14 to 19	SC	125	33	--	--	3.39	21	2.0	600	8,400
7	19 to 24	SC	125	33	--	--	3.39	26	2.5	750	10,400
8	24 to 29	SC	125	33	--	--	3.39	29	2.8	870	10,800
9	29 to 34	CL	130	--	3,600	--	3.04	27	2.3	760	10,800
10	34 to 35	CL	130	--	5,050	--	3.04	38	2.8	930	15,100

Table D28.3 – Grout Anchor Design Parameters for PMM-1

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	CL	--
2	3 to 7	CL	5
3	7 to 9	CL	7
4	9 to 12	CL	11
5	12 to 14	SC	16
6	14 to 19	SC	13
7	19 to 24	SC	14
8	24 to 29	SC	15
9	29 to 34	CL	13
10	34 to 35	CL	18

Notes: Design depth to groundwater is 35 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

[1] For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

[2] A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D29.1 – LPILE Computer Program Parameters for Lateral Load Analysis for PMM-2

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	2,390	--	0.005	--	--	--	--
2	3 to 4	Stiff Clay w/o Free Water	--	--	125	2,390	--	0.005	--	--	--	--
3	4 to 9	Stiff Clay w/o Free Water	--	--	120	1,050	--	0.007	--	--	--	--
4	9 to 12	Stiff Clay w/o Free Water	--	--	125	1,850	--	0.007	--	--	--	--
5	12 to 14	Stiff Clay w/o Free Water	--	--	125	2,250	--	0.005	--	--	--	--
6	14 to 19	Stiff Clay w/o Free Water	--	--	125	2,390	--	0.005	--	--	--	--
7	19 to 24	Stiff Clay w/o Free Water	--	--	125	2,650	--	0.005	--	--	--	--
8	24 to 29	Stiff Clay w/o Free Water	--	--	125	2,920	--	0.005	--	--	--	--
9	29 to 34	Stiff Clay w/o Free Water	--	--	130	4,520	--	0.005	--	--	--	--
10	34 to 35	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D29.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for PMM-2

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	2,390	--	3.04	18	--	0	2,800
2	3 to 4	CL	125	--	2,390	--	3.04	18	1.8	520	2,800
3	4 to 9	CL	120	--	1,050	--	3.04	8	1.1	230	2,800
4	9 to 12	CL	125	--	1,850	--	3.04	14	1.5	400	4,900
5	12 to 14	CL	125	--	2,250	--	3.04	17	1.7	490	6,700
6	14 to 19	CL	125	--	2,390	--	3.04	18	1.8	520	7,100
7	19 to 24	CL	125	--	2,650	--	3.04	20	1.9	580	7,900
8	24 to 29	CL	125	--	2,920	--	3.04	22	2.0	640	8,700
9	29 to 34	CL	130	--	4,520	--	3.04	34	2.6	880	13,500
10	34 to 35	CL	130	--	5,980	--	3.04	100	5.2	1,070	17,900

Table D29.3 – Grout Anchor Design Parameters for PMM-2

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	CL	--
2	3 to 4	CL	8
3	4 to 9	CL	4
4	9 to 12	CL	6
5	12 to 14	CL	8
6	14 to 19	CL	8
7	19 to 24	CL	9
8	24 to 29	CL	10
9	29 to 34	CL	16
10	34 to 35	CL	21

Notes: Design depth to groundwater is 35 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D30.1 – LPILE Computer Program Parameters for Lateral Load Analysis for PMM-3

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	2,520	--	0.005	--	--	--	--
2	3 to 7	Stiff Clay w/o Free Water	--	--	125	2,520	--	0.005	--	--	--	--
3	7 to 9	Stiff Clay w/o Free Water	--	--	125	4,250	--	0.005	--	--	--	--
4	9 to 12	Stiff Clay w/o Free Water	--	--	125	4,520	--	0.005	--	--	--	--
5	12 to 14	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--
6	14 to 19	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--
7	19 to 24	Stiff Clay w/o Free Water	--	--	130	5,720	--	0.005	--	--	--	--
8	24 to 29	Stiff Clay w/o Free Water	--	--	130	5,320	--	0.005	--	--	--	--
9	29 to 34	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--
10	34 to 35	Stiff Clay w/o Free Water	--	--	130	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D30.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for PMM-3

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)[1] (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	CL	105	--	2,520	--	3.04	19	--	0	7,500
2	3 to 7	CL	125	--	2,520	--	3.04	19	1.8	550	7,500
3	7 to 9	CL	125	--	4,250	--	3.04	32	2.5	840	12,700
4	9 to 12	CL	125	--	4,520	--	3.04	34	2.6	880	13,500
5	12 to 14	CL	130	--	5,980	--	3.04	47	3.2	1,070	15,900
6	14 to 19	CL	130	--	5,980	--	3.04	47	3.2	1,070	15,900
7	19 to 24	CL	130	--	5,720	--	3.04	43	3.0	1,030	15,900
8	24 to 29	CL	130	--	5,320	--	3.04	40	2.9	950	15,900
9	29 to 34	CL	130	--	5,980	--	3.04	52	3.4	1,070	17,900
10	34 to 35	CL	130	--	5,980	--	3.04	100	5.2	1,070	17,900

Table D30.3 – Grout Anchor Design Parameters for PMM-3

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength[2] (psi)
1*	0 to 3	CL	--
2	3 to 7	CL	9
3	7 to 9	CL	15
4	9 to 12	CL	16
5	12 to 14	CL	21
6	14 to 19	CL	21
7	19 to 24	CL	20
8	24 to 29	CL	18
9	29 to 34	CL	21
10	34 to 35	CL	21

Notes: Design depth to groundwater is 35 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

[1] For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

[2] A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D31.1 – LPILE Computer Program Parameters for Lateral Load Analysis for ADLS-2

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	1,720	--	0.007	--	--	--	--
2	3 to 7	Sand (Reese)	225	--	128	--	35	--	--	--	--	--
3	7 to 9	Sand (Reese)	225	--	128	--	35	--	--	--	--	--
4	9 to 12	Sand (Reese)	90	--	128	--	35	--	--	--	--	--
5	12 to 14	Stiff Clay w/o Free Water	--	--	125	2,920	--	0.005	--	--	--	--
6	14 to 19	Sand (Reese)	225	--	130	--	35	--	--	--	--	--
7	19 to 24	Sand (Reese)	225	--	125	--	34	--	--	--	--	--
8	24 to 29	Stiff Clay w/o Free Water	--	--	130	4,790	--	0.005	--	--	--	--
9	29 to 34	Stiff Clay w/o Free Water	--	--	130	4,920	--	0.005	--	--	--	--
10	34 to 35	Stiff Clay w/o Free Water	--	--	130	5,720	--	0.005	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D31.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for ADLS-2

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SM	105	--	1,720	--	3.04	13	--	0	4,600
2	3 to 7	SM	128	35	--	--	3.69	32	3.1	350	8,700
3	7 to 9	SM	128	35	--	--	3.69	36	3.5	600	8,700
4	9 to 12	SM	128	35	--	--	3.69	28	2.7	600	8,700
5	12 to 14	CL	125	--	2,920	--	3.04	22	2.0	640	8,700
6	14 to 19	SM	130	35	--	--	3.69	37	3.6	840	14,300
7	19 to 24	SC	125	34	--	--	3.54	39	3.8	940	14,300
8	24 to 29	CL	130	--	4,790	--	3.04	36	2.7	900	14,300
9	29 to 34	ML	130	--	4,920	--	3.04	37	2.8	920	14,700
10	34 to 35	CL	130	--	5,720	--	3.04	43	3.0	1,030	17,100

Table D31.3 – Grout Anchor Design Parameters for ADLS-2

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	SM	--
2	3 to 7	SM	16
3	7 to 9	SM	17
4	9 to 12	SM	15
5	12 to 14	CL	10
6	14 to 19	SM	17
7	19 to 24	SC	17
8	24 to 29	CL	17
9	29 to 34	ML	17
10	34 to 35	CL	20

Notes: Design depth to groundwater is 35 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Table D32.1 – LPILE Computer Program Parameters for Lateral Load Analysis for O&M-1 Building

Soil Layer	Depth (feet)	LPILE Soil Type	K (pci) Static	K (pci) Cyclic	γ' (pcf)	C (psf)	ϕ (degree)	ε_{50}	E_{rm} (psi)	UCS (psi)	RQD (%)	K_{rm}
1*	0 to 3	Soft Clay (1)	--	--	105	790	--	0.01	--	--	--	--
2	3 to 7	Sand (Reese)	90	--	125	--	34	--	--	--	--	--
3	7 to 9	Sand (Reese)	25	--	120	--	30	--	--	--	--	--
4	9 to 12	Sand (Reese)	90	--	125	--	34	--	--	--	--	--
5	12 to 14	Sand (Reese)	225	--	120	--	35	--	--	--	--	--
6	14 to 18	Sand (Reese)	90	--	125	--	34	--	--	--	--	--
7	18 to 24	Sand (Reese)	125	--	63	--	35	--	--	--	--	--
8	24 to 29	Stiff Clay w/o Free Water	--	--	68	2,650	--	0.005	--	--	--	--
9	29 to 34	Stiff Clay w/o Free Water	--	--	67.6	2,790	--	0.005	--	--	--	--
10	34 to 35	Stiff Clay w/o Free Water	--	--	67.6	5,980	--	0.004	--	--	--	--

Notes: *Upper 3 feet of soil should be neglected due to seasonal moisture change.

Table D32.2 – Direct Embedment/Drilled Pier Foundation Design Parameters for O&M-1 Building

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	γ' (pcf)	ϕ (degree)	C (psf)	C'_{Rock} (psf)	K_p	SPT N-Value (blows/ft)	Deformation Modulus (ksi)	Allowable Unit Skin Friction (FS=2.5)(1) (psf)	Allowable Bearing Pressure (FS=3) (psf)
1*	0 to 3	SC	105	--	790	--	3.04	6	--	0	1,700
2	3 to 7	SC	125	34	--	--	3.54	17	1.6	250	2,000
3	7 to 9	SC	120	30	--	--	3.00	5	0.5	210	2,000
4	9 to 12	SC	125	34	--	--	3.54	23	2.2	530	7,900
5	12 to 14	SP	120	35	--	--	3.69	50	4.9	860	7,900
6	14 to 18	SC	125	34	--	--	3.54	30	2.9	720	7,900
7	18 to 24	SC	63	35	--	--	3.69	42	4.1	950	7,900
8	24 to 29	CL	68	--	2,650	--	3.04	20	1.9	580	7,900
9	29 to 34	CL	67.6	--	2,790	--	3.04	21	1.9	610	8,300
10	34 to 35	CL	67.6	--	5,980	--	3.04	100	5.2	1,070	17,900

Table D32.3 – Grout Anchor Design Parameters for O&M-1 Building

Soil Layer	Depth (feet)	USCS Soil & Rock Classification	Ultimate Grout Bond Strength(2) (psi)
1*	0 to 3	SC	--
2	3 to 7	SC	12
3	7 to 9	SC	9
4	9 to 12	SC	13
5	12 to 14	SP	20
6	14 to 18	SC	15
7	18 to 24	SC	18
8	24 to 29	CL	9
9	29 to 34	CL	10
10	34 to 35	CL	21

Notes: Design depth to groundwater is 18 feet.

*Upper 3 feet of soils should be neglected due to seasonal moisture change; Kp: Rankine Passive Earth Pressure Coefficient; γ': Effective Unit Weight ($\gamma'=\gamma_{Total}$-62.4 pcf); ϕ: Angle of Internal Friction.

(1) For uplift resistance, the allowable skin friction provided in table above should be reduced by 25 percent.

(2) A minimum bond length of 10 feet in bedrock and 15 feet in soils is recommended. Estimated bond strength are for gravity grout anchors. RRC recommends grout anchor capacities be verified by pull-out test.

Attachment E

Noxious Weed Management Plan

Longspur provided its noxious weed management plan to Mercer and Morton counties. Longspur received approval of its noxious weed management plan from the Mercer and Morton County weed control officers.. Longspur will also follow the noxious weed management plan during Project construction and restoration.

Weed Management Plan

Longspur Wind Project

Morton and Mercer Counties, North Dakota

Prepared for:

Minnesota Power

30 West Superior Street
Duluth, Minnesota 55802

Prepared by:

Western EcoSystems Technology, Inc.

4007 State Street, Suite 109
Bismarck, North Dakota

January 8, 2026

REPORT PARTICIPANTS

Martin Piorkowski	Project Manager
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Michael Van Laeken	Senior Reviewer
Carla DeMasters	Technical Reviewer
Andy Valencia	Technical Editor

REPORT REFERENCE

Western EcoSystems Technology, Inc. (WEST). 2026. Weed Management Plan, Longspur Wind Project, Morton and Mercer Counties, North Dakota. Prepared for Minnesota Power, Duluth, Minnesota. Prepared by WEST, Bismarck, North Dakota. January 8, 2026.

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1 INTRODUCTION

Minnesota Power is considering the development of the Longspur Wind Project (Project) in Morton County, North Dakota (Figure 1) with additional transmission line development in Mercer County. At the request of Minnesota Power, Western EcoSystems Technology, Inc. (WEST), prepared the following Weed Management Plan (Plan) as part of the conditions of the Wildlife Conservation Strategy, to provide guidance for preventing and controlling the spread of state- and/or county-listed noxious weeds on lands owned, leased, and managed by the Project, while complying with state and local noxious weed management regulations, as applicable.

Noxious weeds are spread by a variety of means including vehicles, construction equipment, livestock, and wildlife. Physical disturbance and chemical alterations of the soil create opportunities for the introduction, infestation, and spread of noxious weeds. Implementation of preventative measures is the most cost-effective management approach to control the spread of noxious weeds. This Plan has been developed using information and guidance from several State resources, as well as existing noxious weed management plans and experience gained from other noxious weed control programs in Wyoming, Colorado, South Dakota, and North Dakota. Monitoring and treatment of weeds both prior to construction and during the operational phase, as applicable, will ensure that goals to achieve the Project's vegetation performance standards by reducing and controlling weeds. Noxious weed control measures will be established during Project development, implemented during construction and operation of the Project, and refined through adaptive management.

2 PROJECT DESCRIPTION

The Project is anticipated to consist of 45 4.5-megawatt (MW) turbines, with a nameplate generation capacity of approximately 202.5 MW, and a planned commercial operation date of 2027. Additional infrastructure at the Project will include 19.5 miles (mi) of new access roads, 52.1 mi of underground electrical collector lines and cables, 5.1 acres (ac) of facility substations, an interconnection substation, a 2.7-mi 230-kilovolt transmission line interconnecting to the Tri County Substation, one permanent meteorological tower, and one operations and maintenance facility.

The Project Area encompasses 25,933 ac in southwestern North Dakota, approximately four mi north of Glen Ullin in Morton County, along with the transmission line that extends north of the Project Area approximately 0.3 mi into Mercer County (Figure 1). This Plan applies to all areas of the Project footprint that are anticipated or have been disturbed with the focus being weed management.

The Project Area is within the Missouri Plateau Level IV Ecoregion, which consists of semi-arid rolling plains punctuated by buttes and badlands (US Environmental Protection Agency [USEPA] 2012, 2013). The Missouri Plateau Ecoregion's rolling to somewhat flat topography was mostly unaffected by glaciation, with natural vegetation primarily consisting of semiarid grasses, including western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), and buffalograss (*B. dactyloides*; Bryce et al. 1998). Although large areas of the Missouri Plateau Ecoregion have been converted to agricultural crop production, areas of unbroken native grasslands remain, which are typically used for livestock grazing (USEPA 2012, 2013).

Topography within the Project Area is gently rolling to flat (USA Topo 2021). Cultivated crops and grassland/herbaceous make up approximately 89% of the Project Area (National Land Cover Database [NLCD] 2024). Shrub/scrub, hay/pasture, developed land cover types make up approximately 10% of the Project Area; wooded areas and wetlands compose the remainder cover within the Project Area (NLCD 2024).

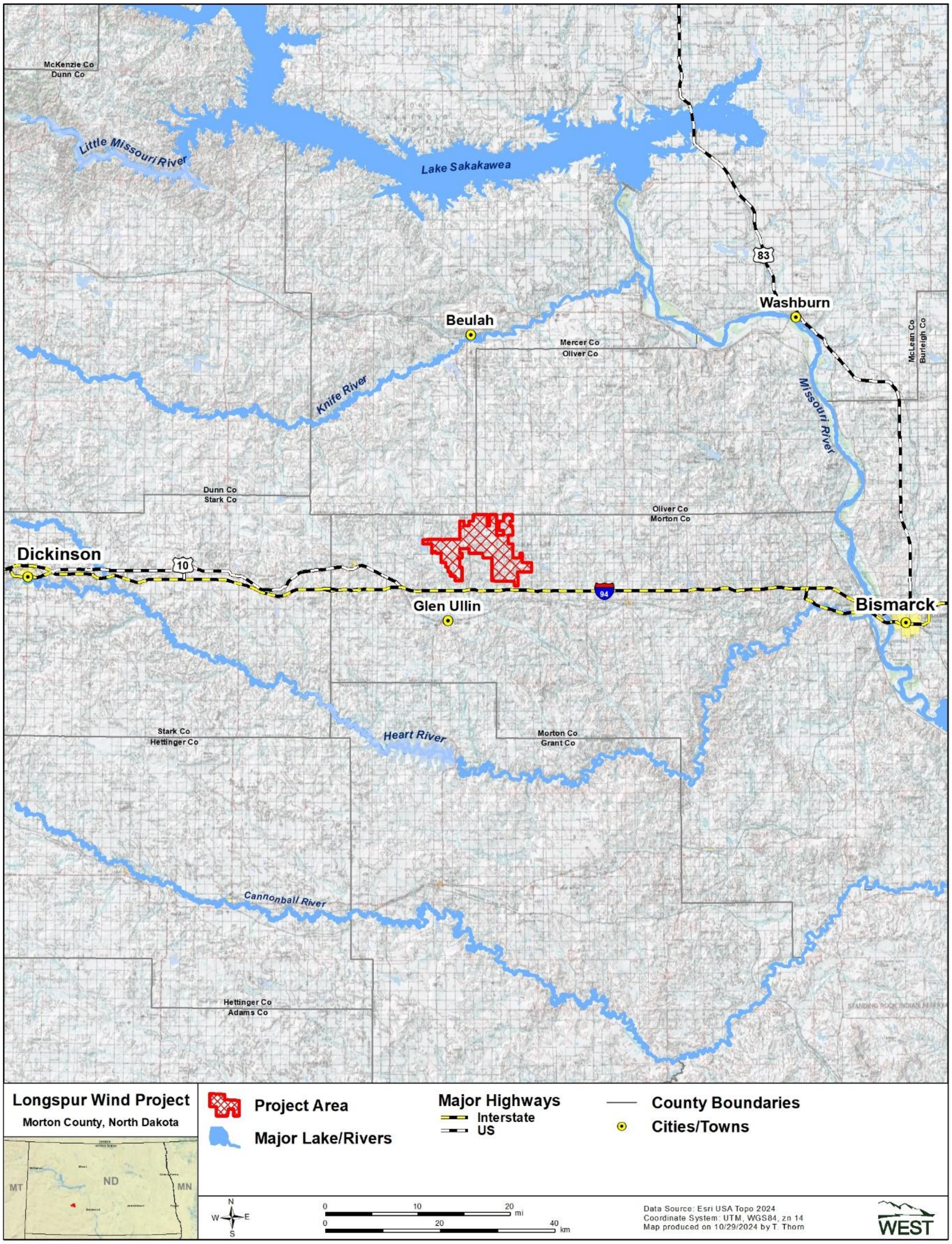

Figure 1. Location of the Longspur Wind Project Area in Morton County, North Dakota.

3 STATE AND LOCAL REGULATIONS

North Dakota Century Code (NDCC) §4.1-47, *Noxious Weed Control*, defines noxious weed as "*a plant propagated by either seed or vegetative parts and determined to be injurious to public health, crops, livestock, land, or other property*" by the North Dakota Agriculture Commissioner or by a county or city weed board (NDCC §4.1-47-01). The North Dakota Department of Agriculture (NDDA) also identifies the following 13 species as state-declared noxious weeds: absinth wormwood (*Artemisia absinthium*), Canada thistle (*Cirsium arvense*), dalmatian toadflax (*Linaria genistifolia* subsp*. dalmatica*), diffuse knapweed (*Centaurea diffusa*), houndstongue (*Cynoglossum officinale*), leafy spurge (*Euphorbia esula*), musk thistle (*Carduus nutans*), Palmer amaranth (*Amaranthus palmeri*), purple loosestrife (*Lythrum salicaria and L. virgatum*), Russian knapweed (*C. repens*), saltcedar (*Tamarisk* spp.), spotted knapweed (*C. maculosa*), and yellow toadflax (*Linaria vulgaris*; NDDA 2021).

Under North Dakota law (NDCC §4.1-47-02) every person is required to "*do all things necessary and proper to control the spread of noxious weeds*" and the NDDA coordinates with county and city weed boards for weed control programs (NDDA 2021). State law also allows counties and cities to adopt additional noxious weed species if they are approved through the statutory process. Morton and Mercer counties maintain active county weed boards responsible for implementing and enforcing the state noxious weed law but based on the most recent *County and City Listed Noxious Weed* (NDDA 2023), neither county has adopted any additional noxious weed species beyond the 13 species designated at the state level. Morton County incorporates noxious weed control into its zoning requirements, including a provision that noxious weeds on certain properties must be maintained at a maximum of 10 inches high; Mercer County does not have expanded ordinances beyond state requirements.

4 WEED MANAGEMENT

Noxious Weed field surveys for the Project have not been conducted; however, any of the 13 state-listed noxious weed species have the potential to be present within the Project Area and, therefore, are included in this Plan. Characteristics relevant for control and treatment options for each of these 13 noxious weeds are presented in Table 1; species characteristics and recommendations are based on information from *Invasive and Troublesome Weeds in North Dakota* (North Dakota State University [NDSU] and NDDA 2023), supplemented when applicable by the *North Dakota Weed Control Guide* (NDSU and NDDA 2025).

Herbicides should be used only in accordance with their registered use and shall be used or applied only by appropriately certified applicators according to federal and state laws and regulations. The treatment recommendations presented in Table 1 are not the direct recommendations of WEST but are based on information from sources including NDSU and NDDA.

Table 1. State-listed noxious weeds likely to be present within the Longspur Project Area in Morton and Mercer counties, North Dakota, and treatment methods.*

Common Name	Species Name	Life Form[1]	Treatment Method[2]	Management Notes
Absinth wormwood	*Artemisia absinthium*	IPF	CH, MD	• Apply herbicides when plants are at least 10 inches tall and actively growing. • Herbicides can be used in fall, but plants should be mowed in early to mid-summer first to promote active regrowth before using herbicide. • The following herbicides are effective for controlling this species: clopyralid, dicamba, aminopyralid, 2,4-D, picloram, and glyphosate. • Small infestations can be controlled by digging up plants.
Canada thistle	*Cirsium arvense*	IPF	CH, MD, MM, BI, CU	• The following herbicides are effective for controlling this species: glyphosate, clopyralid, picloram, dicamba, aminocyclopyrachlor, and aminopyralid. Herbicide application in the early bud growth stage (early summer) or to rosettes in the fall is most effective. Multiple years of treatment are recommended for control of this species. • Cultivation in winter when temperatures are below 20 degrees Fahrenheit can be effective. Cultivate before plants are three inches tall and repeat after regrowth is less than three inches before the soil freezes. • Repeated mowing can be effective at controlling this species. Mow several times per year before plants flower and as close to the ground as possible. Mowing for multiple years is recommended, along with following up with an herbicide application. • There are biological control agents available for this species, but none of them are effective at reducing infestations on a large scale.
Dalmatian toadflax	*Linaria genistifolia* subsp. *dalmatica*	IPF	CH, BI	• The following herbicides are effective for controlling this species when applied during flowering or late fall: picloram, imazapic, and chlorsulfuron. • Maintain proper livestock stocking rates and do not overgraze to maintain competitive forage and reduce the spread of this species. • Two biological control insects have been successful at reducing infestations of this species.
Diffuse knapweed	*Centaurea diffusa*	IPF	MD, CH, BI	• Small infestations can be controlled by hand pulling (wear gloves) or by digging. • Effective herbicides include: aminopyralid, picloram, and dicamba. • Treat an additional area 10–15 feet around knapweed patches to control missed seedlings. • Follow up treatments are essential for successful eradication. • There are several biological control agents permitted for use on knapweed species and consultation with the North Dakota Department of Agriculture is recommended.

Table 1. State-listed noxious weeds likely to be present within the Longspur Project Area in Morton and Mercer counties, North Dakota, and treatment methods.*

Common Name	Species Name	Life Form[1]	Treatment Method[2]	Management Notes
Houndstongue	*Cynoglossum officinale*	BF	CH, MD	• Products containing the active ingredient metsulfuron can be applied throughout the growing season. First-year plants can be treated with 2,4-D from late May to mid-June. Imazapic at high rates can be used for pre- and post-emergent treatments. • A root weevil has been released for control in Canada but has not been approved for release in the United States. • Small infestations can be controlled by digging up plants.
Leafy spurge	*Euphorbia esula*	IPF	CH, BG, BI, MM	• A combination of control methods is most effective for managing this plant. • Mowing or grazing followed by herbicide treatment can be effective at controlling this species • The following herbicides are effective for controlling this species: dicamba, quinclorac, aminocyclopyrachlor, and picloram. There are several herbicide combinations that have also shown effective control. • Glyphosate can be effective when applied after seed-filling in mid-summer or after fall regrowth but before a killing frost. • Grazing with sheep or goats can control top growth in pasture and rangeland areas; however, grazing alone will not eradicate this species. • Many species of biological control are available for this species, and six species are established within North Dakota.
Musk thistle	*Carduus nutans*	BF	CH, MM, BI	• Controlling plants prior to flowering is essential for successful management of this species. • Apply the following herbicides to rosettes in fall or spring for best results: aminopyralid, clopyralid, picloram, aminocyclopyrachlor, or dicamba. Metsulfuron is effective when applied in spring and can be applied when plants are bolting or budding. • Mowing can be effective if done repeatedly before plants are flowering. • There are two biological control insects and one rust fungus that provide control of this species; however, interstate transport of the insect species is not permitted.
Palmer amaranth	*Amaranthus palmeri*	IAF(W)	MP, CH	• This species is resistant to multiple classes of herbicides and modes of action. • Use preemergent herbicide. • The following herbicides are effective for controlling this species applied when growth reaches 2–3 inches in height: 2,4-D, atrazine, chloroacetamide, dicamba, diphenylethers, glufosinate, and glyphosate. • Pulling plants can also be effective if the infestation is small. • Mowing is not recommended.

Table 1. State-listed noxious weeds likely to be present within the Longspur Project Area in Morton and Mercer counties, North Dakota, and treatment methods.*

Common Name	Species Name	Life Form[1]	Treatment Method[2]	Management Notes
Purple loosestrife	*Lythrum salicaria, Lythrum virgatum,* and all cultivars	IPF	MD, CH, BI	• Small infestations and younger plants can be controlled by digging up plants. • If plants are in or near water, use herbicides approved and labeled for aquatic use. • Apply glyphosate from July-September. • Triclopyr, aminopyralid and a combination of triclopyr and aminopyralid also provide effective control of this species. • There are three biological control insects that are effective at controlling purple loosestrife.
Russian knapweed	*Centaurea repens*	IPF	CH, BI	• Apply picloram following several hard frosts (mid-October). Application in mid-September or during flowering in midsummer provides shorter-term control than late applications. • Metsulfuron and aminopyralid are also effective. • Mowing and cultivation are not recommended. • There are two biological control insects available for control of Russian knapweed.
Saltcedar	*Tamarisk* spp.	T/B	CH	• Imazapyr is the most widely used herbicide for this species. Imazapyr can also be used in combination with glyphosate. Triclopyr applied in spring or late fall is also effective. • If plants are in or near water, use herbicides approved and labeled for aquatic use. • Do not remove top growth for three years following herbicide application to prevent resprouting. • Biological control of this species is not recommended in North Dakota.
Spotted knapweed	*Centaurea maculosa*	IPF	See diffuse knapweed	See diffuse knapweed.
Yellow toadflax	*Linaria vulgaris*	IPF	Not Applicable	• The following herbicides are effective for controlling this species: metsulfuron-methyl and picloram. • Planting competitive vegetation can help stop yellow toadflax from spreading in grazing lands. • Biological controls have not been effective in North Dakota.

[1] IAF(W) = introduced warm season annual forb; N/IPF = native/introduced perennial forb; BF = biennial forb; T/B = tree/bush.

[2] Mechanical methods: MM = Mowing; MP = Pulling; MC = Cutting; MD = Digging/Tilling.
Biological methods: BI = Insects; BG = Grazing Animals.
Chemical methods: CH = Herbicides.
Cultural methods: CU = Cultivate (uprooting young weeds and incorporating them into the soil).

* The North Dakota Department of Agriculture identifies the 13 species listed in this table as state-declared noxious weeds.

Source: North Dakota State University and North Dakota Department of Agriculture (2023, 2025), Agri Care Hub 2025.

4.1 General Weed Management Practices

Weed management is a long-term iterative process that considers site-specific physical, biological, and land use characteristics. Weed management must be accomplished through several integrated practices that include prevention, monitoring, and treatment to address noxious weed incidence, occurrence, and control (DiTomaso et al. 2013). The following best management practices are recommended to limit opportunities for weeds to enter the Project, get established, and/or spread during Project construction and operation:

- Follow all label instructions for recommended grazing practices following vegetation treatment and application of any herbicide.
- Delineate a “baseline” of large noxious weed infestations within construction areas that will need to be treated prior to disturbance.
- Minimize soil disturbance as much as possible and revegetate disturbed areas when possible.
- Excavations, placement of fill soil, or other areas of surface disturbance will be revegetated with appropriate site seed mix within 14 days of completion of the disturbance.
- Avoid driving through or over any untreated and marked noxious weed areas.
- Avoid noxious plant areas until after treated with the appropriate herbicides.
- A weed-resistant seed mix for restoration of temporarily disturbed areas consisting of a combination of competitive native grass and forb species (including pollinator plant species) will be used, to the extent possible.
- Soil from areas with noxious weed populations will not be removed or introduced to the construction site, to avoid transport of weed seeds or other propagules.
- All seed, soil, and mulch imported onto the Project site will be certified as weed-free.
- Preferentially salvage topsoil only for locations dominated by native vegetation; avoid known noxious weed infestation areas when salvaging topsoil to the maximum extent practicable.
- Store salvaged topsoil in a manner to discourage weed establishment, (e.g., by covering, mulching, or stabilizing with weed-free seed).
- Where practicable, use locally sourced topsoil if additional topsoil is needed.
- Train on site staff to identify noxious weed species for successful long-term vegetation management.
- Discourage weed establishment during construction through regular site inspections and targeted herbicide application as needed.
- Herbicide application will be by qualified applicators using approved herbicides.
- Herbicide applications will follow all instructions on the label including application rates and preparation and application requirements.

- Minnesota Power will require its contractors to:
  - Inspect vehicles and equipment undercarriages and tires for mud, dirt, plant materials, and seeds before entering work areas.
  - If vehicle or equipment is not clean, it must be cleaned with high-pressure washer equipment before entering the Project.
  - Use only designated cleaning station locations or commercial car wash facilities.
  - Soil from areas with noxious weed populations will not be removed or introduced to the construction site, to avoid transport of weed seeds or other propagules.
  - Where practicable, avoid or minimize travel through or parking in areas infested with noxious weeds to avoid spreading seeds or plant parts.

Minnesota Power will provide training to its contractors to maintain compliance with the weed management plan.

4.2 Post-construction Noxious Weed Monitoring

Monitoring noxious weed populations in impacted areas within the Project Area for up to three years post-construction is recommended to compare baseline and post-construction weed populations. A memorandum, reporting management actions and monitoring results, should be prepared each year when surveys occur and adaptive management implemented as necessary to control noxious weeds. Additional noxious weed treatment and monitoring may be required if eradication of noxious weeds is not successful. Consultation with the Morton and Mercer county weed boards are being performed to determine appropriate noxious weed control measures.

5 REFERENCES

Agri Care Hub. 2025. Enhancing Soil Health: Integrating a Field Cultivator into Sustainable Crop Rotation Strategies. Agri Care Hub, Khulna, Bangladesh. Accessed November 2025. Available online: https://agricarehub.com/field-cultivator/

Bryce, S., J. M. Omernick, D. E. Pater, M. Ulmer, J. Schaar, J. Freeouf, R. Johnson, P. Kuck, and S. H. Azevedo. 1998. Ecoregions of North Dakota and South Dakota. Color poster with map, descriptive text, summary tables, and photographs. Map scale 1:1,500,000. US Geological Survey, Reston, Virginia. Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-39

DiTomaso, J. M., G. B. Kyser, S. R. Oneto, R. G. Wilson, S. B. Orloff, L. W. Anderon, S. D. Wright, J. A. Roncoroni, T. L. Miller, T. S. Prather, C. Ransom, K. G. Beck, C. Duncan, K. A. Wilson, and J. J. Mann. 2013. Weed Control in Natural Areas in the Western U.S. Weed Research and Information Center, University of California. 544 pp.

National Land Cover Database (NLCD). 2024. Annual National Land Cover Database: Annual NLCD Collection 1.0: 2023 Land Cover of Conus. US Geological Survey, Sioux Falls, South Dakota. Released October 2024. doi: 10.5066/P94UXNTS. Available online: https://www.sciencebase.gov/catalog/item/655ceb8ad34ee4b6e05cc51a

North Dakota Department of Agriculture (NDDA). 2021. North Dakota's Noxious Weed Law and Regulations. Last Updated July 2025. Accessed November 2025. Available online: https://www.ndda.nd.gov/sites/www/files/documents/files/2025%20Noxious%20Weeds%20Book.pdf

North Dakota Department of Agriculture (NDDA). 2023. North Dakota County and City Listed Noxious Weeds. Revised August 2023. Accessed November 2025. Available online: https://www.ndda.nd.gov/sites/www/files/documents/files/2023%20August%20-%20City%20County%20Noxious%20Weeds%20List.pdf

North Dakota State University (NDSU) and North Dakota Department of Agriculture (NDDA). 2023. Identification and Control of Invasive and Troublesome Weeds in North Dakota. NDSU Extension Publication W1411. Prepared by NDSU, Fargo, North Dakota, and NDDA, Bismark, North Dakota. May 2023. Available online: https://www.ndsu.edu/agriculture/sites/default/files/2023-05/w1411.pdf

North Dakota State University (NDSU) and North Dakota Department of Agriculture (NDDA). 2025. 2025 North Dakota Weed Control Guide. NDSU Extension Publication W253-25. Prepared by NDSU, Fargo, North Dakota, and NDDA, Bismark, North Dakota. Available online: https://www.ndsu.edu/agriculture/sites/default/files/2024-12/2025%20ND%20Weed%20Guide%20Final_With%20Color%20Covers.pdf

US Environmental Protection Agency (USEPA). 2012. Level III and Level IV Ecoregions of North Dakota. Ecoregions of the United States. USEPA Office of Research and Development - National Health and Environmental Effects Research Laboratory, Corvallis, Oregon. May 8, 2012. Accessed November 2025. Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-32

US Environmental Protection Agency (USEPA). 2013. Level III and Level IV Ecoregions of the Continental United States. Ecosystems Research, USEPA. April 16, 2013. Accessed November 2025. Available online: https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states

USA Topo. 2021. USA Topo Maps. US Geological Survey (USGS) topographical maps for the United States. ArcGIS. Environmental Systems Research Institute (Esri), producers of ArcGIS software, Redlands, California. February 10, 2012. Updated June 24, 2021. Accessed October 2024. Available online: https://www.arcgis.com/home/item.html?id=931d892ac7a843d7ba29d085e0433465

AN ALLETE COMPANY

AFFIDAVIT OF MAILING

State of Minnesota)

) SS.

County of St. Louis)

I, Alexander Luman, Herby certify that on the 13th day of April 2026, I directed to be sent Via U.S. Mail a true and correct copy of the Noxious Weed Management Plan for the Longspur Project attached hereto as Exhibit 1 to the Mercer County Weed Control Officer.

Alexander Luman

Alexander Luman
ALLETE/Minnesota Power

Subscribed and sworn to before me
this 13th day of April 2026.

Donnalee Laurie
,Notary Public

DONNALEE LINDA LAURIE
Notary Public
State of Minnesota
My Commission Expires
January 31, 2029

minnesota power

AN ALLETE COMPANY

April 13, 2025

Brad Seifert
Weed Control Officer
Mercer County
PO Box 550
Beulah, ND 58523

Hello Brad,

Minnesota Power respectfully submits the attached Noxious Weed Management Plan for Mercer County's records. Minnesota Power is proposing to construct an approximately 0.3-mile-long, 230-kilovolt Transmission Infrastructure Project (Project) within Mercer County. The entire transmission Line is approximately 2.7 miles. The Project will begin at the existing Tri County 230 kV Substation in Mercer County and extend south into Morton County.

Minnesota Power provided a draft Noxious Weed Management Plan for review on January 15. Based on phone conversations with you in late March, the Mercer County Weed Board reviewed the plan at its February meeting and had no comments or edits and considered the plan to be finalized.

Please let me know if you have any questions at aluman@mnpower.com or 218.481.2796

Thank you,

Alexander Luman

Alexander Luman
Environmental Compliance Specialist
ALLETE/Minnesota Power
30 W Superior St
Duluth, MN 55802

Attachments
Noxious Weed Management Plan

Alex Luman (MP)

From:	Alex Luman (MP)
Sent:	Monday, April 13, 2026 3:51 PM
To:	'Cody Schnabel'
Subject:	RE: [EXTERNAL MAIL] RE: Minnesota Power Longspur Wind Noxious Weed Management Plan Review
Attachments:	LongspurWind_Noxious WMP_FINAL.pdf

Hello Cody,

Sorry for the delay in this I wanted to see if Mercer County had any comments and they did not please see the attached final Noxious Weed Management Plan for Longspur. Please feel free to let me know if you have any questions.

Thanks,

Alexander Luman
Environmental Compliance Specialist
Minnesota Power/ALLETE Inc.
30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Cody Schnabel <cody.schnabel@mortonnd.gov>
Sent: Tuesday, January 27, 2026 3:21 PM
To: Alex Luman (MP) <aluman@mnpower.com>
Subject: RE: [EXTERNAL MAIL] RE: Minnesota Power Longspur Wind Noxious Weed Management Plan Review

Looks great to me Alex,
Thanks!

CODY SCHNABEL
MORTON COUNTY WEED CONTROL OFFICER & PARKS DIRECTOR
2916 37th St NW, Mandan, ND 58554
Cody.Schnabel@mortonnd.gov
701.391.8006
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From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Tuesday, January 27, 2026 2:29 PM

To: Cody Schnabel <cody.schnabel@mortonnd.gov>
Subject: RE: [EXTERNAL MAIL] RE: Minnesota Power Longspur Wind Noxious Weed Management Plan Review

Hello Cody,

Apologies for the delay, I was reviewing the plan and wanting to get you the best response. Please see the attached plan for items in red that are additions and items highlighted that I think cover your comment. I have provided screenshots below. I didn't want to leave out other methods of weed reduction so left it broad incase there are changes throughout the life of the project.

On page four I added the following text regarding combat of noxious weeds and certifications.

4 WEED MANAGEMENT

Noxious Weed field surveys for the Project have not been conducted; however, any of the 13 state-listed noxious weed species have the potential to be present within the Project Area and, therefore, are included in this Plan. Characteristics relevant for control and treatment options for each of these 13 noxious weeds are presented in Table 1; species characteristics and recommendations are based on information from *Invasive and Troublesome Weeds in North Dakota* (North Dakota State University [NDSU] and NDDA 2023), supplemented when applicable by the *North Dakota Weed Control Guide* (NDSU and NDDA 2025). When noxious weeds are discovered within the project area, an applicator with correct certifications will be used to combat noxious weeds

On page eight I have added the red text and highlighted some text that states of qualifications of applicators.

4.1 General Weed Management Practices

Weed management is a long-term iterative process that considers site-specific physical, biological, and land use characteristics. Weed management must be accomplished through several integrated practices that include prevention, monitoring, and treatment to address noxious weed incidence, occurrence, and control (DiTomaso et al. 2013). The following best management practices are recommended to limit opportunities for weeds to enter the Project, get established, and/or spread during Project construction and operation:

- Use internal or contracted labor that has correct certifications for noxious weed management practice.
- Follow all label instructions for recommended grazing practices following vegetation treatment and application of any herbicide.
- Delineate a "baseline" of large noxious weed infestations within construction areas that will need to be treated prior to disturbance.
- Minimize soil disturbance as much as possible and revegetate disturbed areas when possible.
- Excavations, placement of fill soil, or other areas of surface disturbance will be revegetated with appropriate site seed mix within 14 days of completion of the disturbance.
- Avoid driving through or over any untreated and marked noxious weed areas.
- Avoid noxious plant areas until after treated with the appropriate herbicides.
- A weed-resistant seed mix for restoration of temporarily disturbed areas consisting of a combination of competitive native grass and forb species (including pollinator plant species) will be used, to the extent possible.
- Soil from areas with noxious weed populations will not be removed or introduced to the construction site, to avoid transport of weed seeds or other propagules.
- All seed, soil, and mulch imported onto the Project site will be certified as weed-free.
- Preferentially salvage topsoil only for locations dominated by native vegetation; avoid known noxious weed infestation areas when salvaging topsoil to the maximum extent practicable.
- Store salvaged topsoil in a manner to discourage weed establishment, (e.g., by covering, mulching, or stabilizing with weed-free seed).
- Where practicable, use locally sourced topsoil if additional topsoil is needed.
- Train on site staff to identify noxious weed species for successful long-term vegetation management.
- Discourage weed establishment during construction through regular site inspections and targeted herbicide application as needed.
- Herbicide application will be by qualified applicators using approved herbicides.
- Herbicide applications will follow all instructions on the label including application rates and preparation and application requirements.

Please let me know if you have any other comments thank you for the catch on the who piece.

Thanks,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Cody Schnabel <cody.schnabel@mortonnd.gov>
Sent: Tuesday, January 20, 2026 11:45 AM
To: Alex Luman (MP) <aluman@mnpower.com>
Subject: [EXTERNAL MAIL] RE: Minnesota Power Longspur Wind Noxious Weed Management Plan Review

Hi Alex,
I have reviewed the plan, and it looks pretty good so far. It lays out that the weeds will be monitored, and how to control each one of them, but I didn't see if it specifies who will be enforcing the policy, who will be doing the monitoring or who will be making herbicide applications where they are needed. A statement could be added for each of these steps such as, "When noxious weeds are discovered in the project area, a certified applicator / contractor will be hired to make herbicide applications."

Thanks.

CODY SCHNABEL
MORTON COUNTY WEED CONTROL OFFICER & PARKS DIRECTOR
2916 37th St NW, Mandan, ND 58554
Cody.Schnabel@mortonnd.gov
701.391.8006
www.mortonnd.gov

From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Monday, January 19, 2026 3:32 PM
To: Cody Schnabel <cody.schnabel@mortonnd.gov>
Subject: Minnesota Power Longspur Wind Noxious Weed Management Plan Review

Hello Cody,

My name is Alex Luman I am with Minnesota Power on the Longspur Wind Project in Morton County. I'm following up on the voicemail I left on January 8.

I've attached our draft Noxious Weed Management Plan, Minnesota Power would like to ensure that its plan for controlling noxious weeds aligns with Morton County's goals and expectations. If you could review the plan and provide any feedback, that would be greatly appreciated.

Please let me know if you have any additional questions.

Thank you,

Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

AN ALLETE COMPANY

Attachment F

Updated Wildlife Agency Correspondence

Minnesota Power Longspur Wind Agency Coordination

5/4/2026

Since 2024 Minnesota Power has engaged with United States Fish and Wildlife Service (USFWS), and North Dakota Game and Fish Department for the Longspur Wind Project and associated Longspur Transmission Line Project (Projects). Minnesota Power also coordinated with the North Dakota Department of Agriculture (NDDA). These discussions were to advance the avoidance, minimization, mitigation and voluntary offset measures for the Projects to ensure minimal environmental impact. Furthermore, Minnesota Power and NDDA have executed a Memorandum of understanding to address the possibility of potential indirect adverse impacts that may result from the contraction or operation of Longspur.

Wildlife and Mitigation Correspondence

The following table summarized the correspondence between Minnesota Power and USFWS, NDGFD, and NDDA as well as Western Ecosystems Technology, Inc (WEST). Minnesota Power provided records of correspondence within the Application under section 7 and Appendix C.

Correspondence Date	Summary of correspondence
12/4/24	A meeting between Minnesota Power, USFWS, NDGFD, WEST, Merjent occurred to introduce the Longspur Wind Project and to provide survey results from completed effort addressing Tiers 1-3 of the wind energy guidelines. This meeting was also to gain feedback on proposed studies and next steps.
12/11/24	WEST requested historical eagle nest and sharp-tailed grouse lek data from NDGFD for the Project Area.
5/7/25	WEST and Minnesota Power provided northern long-eared bat presence/ probable absence mist-netting Study Plan for the Project to USFWS for approval.
6/3/25	USFWS approved the northern long-eared bat presence/ probable absence Study Plan for the Project.
6/18/25	Minnesota Power mailed the Project notification letters to the NDGFD, NDDA, and USFWS per Section 69-06-01-05 of the North Dakota Administrative Code.
6/26/25	Minnesota Power receives the response to the Notification Letter from NDDA.

6/29/25	Minnesota Power received the response to the Notification Letter from NDGFD and included early guidance recommendations of flora and fauna and information requests 100 days prior to the NDPSC hearing date.
10/27/25	Minnesota Power reached out to NDDA regarding voluntary compensatory mitigation strategies for impacts associated with wind infrastructure. Discussions involving timelines to meet and documents to review were discussed over email and over the phone.
10/31/25	Minnesota Power, NDDA, and WEST meet to discuss voluntary compensatory mitigation for Longspur. Minnesota Power was to review voluntary donation and provide a redlined version of the Memorandum of Understanding back to NDDA.
12/9/25	Minnesota Power emailed NDGFD to propose a meeting focused on the current status of surveys, provide an update on the Project, and review any additional requirements.. In a follow up email, Minnesota Power described that a file sharing site will be established, and the site would contain survey reports, spatial files, voluntary offsets, and a Wildlife Conservation Strategy. Minnesota Power also described the proposed contribution to NDDA's compensatory mitigation fund.
12/10/25	Minnesota Power returned the revised MOU to NDDA with an increase in the voluntary donation amount.
1/5/26	After phone calls between Minnesota Power and NDDA, NDDA would provide the MOU and mitigation amount to the Agriculture Commissioner for review.
1/16/25	NDDA provided a revised MOU with minor edits and Minnesota Power returned the file with an edit for signatory.
1/20/25	NDDA provided the MOU with Agriculture Commissioner Goehring's signature for Minnesota Power execution. Minnesota Power returned the fully executed copy.
1/20/2025- 1/21/2025	Discussion regarding the MOU filings the NDDA may provide to the NDPSC and intent of the MOU.
1/23/26	Minnesota Power provided NDGFD with the file sharing site, with all files requested, Minnesota Power also provide times for a coordination meeting.
1/29/26	Minnesota Power reached out to USFWS to share biological studies and to invite to a coordination meeting to discuss the studies. USFWS responded letting Minnesota Power know that they could not attend but would like to be on the meeting invite in case federal actions changed and that they would like Minnesota Power to work with North Dakota counterparts (i.e., NDGFD).
1/30/25	Minnesota Power emailed NDDA after discussion over the phone for a wildlife survey update meeting. Minnesota Power could not reschedule the meeting due to conflicts and informed the NDDA a meeting summary will be provided to all invitees.

2/2/26	Minnesota Power met with NDGFD to reintroduce the Project, provide an overview of all biological studies following the USFWS WEG tiered approach and NDGFD Wind BMPs guidelines. NDDA was invited but could not attend due to scheduling conflicts, and Minnesota Power could not reschedule due to conflicts. USFWS was also invited but could not attend due to federal and Secretary of the Interior guidance and regulations on reviewing wind energy projects.
2/9/26	Minnesota Power provided NDDA, NDGFD and USFWS with meeting notes and presentation.
2/9/2026-2/13/2026	Minnesota Power provided files to NDGFD that were requested at the meeting February 2, 2026 and worked through revision and clarifications of the meeting notes.
2/16/26	Minnesota Power provided the NDGFD an avian offset model for their review based on communication during the February 2, 2026 meeting. Minnesota Power also included the decision analysis tool used for voluntary mitigation offset developed by NDDA. NDDA was included on this email to support a collaborative approach and transparency for effective mitigation and advance the Longspur Wind Project in a way that respects the goals of each agency.
2/19/26	Minnesota Power provided updated meeting minutes based on discussions with NDGFD. Minnesota Power provided all NDGFD requested files or follow ups. NDGFD did not provide any further questions or concerns.
3/13/26	Minnesota Power provided NDGFD an update regarding a removed grassland within the previously provided grassland GIS file, and if NDGFD had any questions or concerns.
3/17/26	Minnesota Power provided the NDDA with an update on the Longspur NDPSC hearing and with an update on grasslands. This update reduced the acres of grasslands potentially impacted by the Project and that Minnesota Power would not alter the previously agreed to offsets described in the MOU.
3/30/26	Minnesota Power provided NDGFD an updated Avian offset calculation due to a reduction in grassland acres, updated meeting notes due to landcover reclassification that conflated with NDGFD Wind BMPs, and the WEST grassland addendum.
4/13/2026	Minnesota Power provided NDGFD with a shapefile containing the updated grassland files.
4/16/2026	Minnesota Power reached out to NDGFD to ensure that they have received the previous emails for the grassland updates.
4/16/2026	NDGFD provided the NDPSC a letter regarding their concerns on the project and a note about the meeting on the 30th of April.

4/16/2026	An email describing the concerns GFD stated in the letter was provided to Minnesota Power.
4/16/2026	Minnesota Power thanked the GFD for the confirmation on receival of the grassland files and asked if the GFD required a new link to the spatial data, studies, and WCS that was provided in January.
4/16/2026	Minnesota Power provided a response to the concerns the GFD provided. No further questions or comments were provided by the NDGFD.
4/30/2026	The April 30, 2026 meeting between NDDA, NDGFD, WEST, and Minnesota Power focused on whether the mitigation proposed for the Longspur Wind Project in Morton County is acceptable given potential wildlife impacts. NDGFD emphasized concerns about how mitigation offsets were calculated, data gaps, and limited access to the WCS, which they view as the most critical document for review, while NDDA expressed confidence that mitigation is generally sufficient and stressed the need for better interagency coordination and a shared understanding of direct and indirect impacts. Discussion centered on improving communication pathways, potentially routing NDGFD comments through NDDA rather than directly to the PSC, clarifying agency roles, ensuring timely notification of project changes, and balancing conservation goals with maintaining working lands. NDGFD ultimately confirmed that the BMPs were met, and did not request any additional information to address its prior PSC letter. Both agencies agreed to continue improving coordination moving forward.

Avoidance and Minimization, and Mitigation Measures

1) Conservation Measures Implemented During Site Selection and Project Design.
   a) Use available data from state and federal agencies, Tier 2 and Tier 3 study results, and other resources to avoid and minimize impacts to wildlife.
   b) Minimize construction footprints and surface disturbance to reduce wildlife habitat disturbance.
   c) Use existing county and state rights-of-way for infrastructure whenever possible rather than constructing new roads to minimize disturbance and habitat fragmentation.
   d) Locate T-Line, to the extent possible, in areas where previous disturbance has occurred, thereby minimizing impacts to trees and associated wildlife.
   e) Avoid turbine siting and minimize infrastructure within wooded patches.
   f) Avoid physical disturbance to wooded draws and shelterbelts, to the extent practicable, and minimize tree removal to reduce impacts to bat roosting habitat.
   g) Avoid USFWS wetland and grassland conservation easements.

h) Site turbines outside of unbroken grasslands (i.e., native prairie) and, to the extent practicable, design infrastructure to avoid and minimize impacts on these grasslands and wildlife dependent on them, including STGR and other grassland-related SHFC.

i) Avoid fatalities associated with overhead power lines by burying collection lines.

j) Minimize potential impacts to DASK and monarch butterflies by siting turbines outside of unbroken grasslands (i.e., native prairie) and designing access roads and other infrastructure to avoid these grasslands, to the extent possible.

k) Locate access roads and turbines away from wetlands and waterbodies, to the extent possible, and to minimize impacts on aquatic and semiaquatic wildlife species and their habitat.

l) Minimize bird strikes and impacts to species of federal or state relevance, such as WHCR, by constructing and marking T-Line in accordance with the APLIC's *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* and *Reducing Avian Collisions with Power Lines: The State of the Art in 2012*

m) Construct un-guyed permanent MET towers to minimize the potential for avian collisions.

n) Avoid turbine placement within 660 ft from previously identified bald eagle nests based on information gathered from Tier 1–3 studies.

o) Follow USFWS Region 6 recommended no disturbance buffers, to the extent practicable, for previously identified non-eagle raptor nests.

p) Develop and implement a Storm Water Pollution Prevention Plan (SWPPP) to prevent contamination of natural water resources, minimize erosion, storm water runoff, and transport of sediment and other contaminants.

q) Comply with Federal Aviation Administration (FAA) hazard lighting standards (2020) and North Dakota Century Code 49-22-16.4 with respect to turbine lighting. Minnesota Power will install a radar-activated Aircraft Detection Lighting System (ADLS), which will minimize the illumination of obstruction lighting.

r) Control and monitor the Project using Supervisory Control and Data Acquisition communications technology.

s) Prepare a WCS in accordance with the WEG that will be implemented to minimize impacts to avian and bat species during construction and operation of the Project.

2) Conservation Measures to be Implemented during Construction.

Construction of the Project is expected to begin as early as 2026 and occur over a period of approximately 15 months (excluding times when the weather prevents construction activities). The following conservation measures will be implemented to avoid or minimize environmental risk, especially focused on avian and bat species during construction:

a) Use appropriate erosion control measures during construction and operation to minimize and eliminate runoff into waterbodies.

b) Minimize equipment and vehicle travel on roads or specific construction pathways during construction to reduce wildlife and habitat disturbance.

c) Limit construction traffic, parking, and laydown areas to previously disturbed lands, to the extent feasible.

d) Identify and flag areas of native vegetation for construction crews to minimize disturbance in those areas.

e) Minimize disturbance to STGR by following the BMPs and avoiding installation of collection lines in nesting habitat within one mi of leks during the lekking and nesting season (March 15 – July 15).

f) Conduct a raptor nest survey prior to the start of construction to identify active raptor nests, and implement no disturbance buffers, to the extent practicable, following USFWS Region 6 guidance while the nest is active.

g) Develop and implement a site-specific worker training plan during construction to inform workers of the suite of biological resources present on site, including specific protocols for WHCR.

    i) Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons.

    ii) Include instruction on identification (ID) and values of plant and wildlife species, significant natural plant community habitats, the issue of micro-trash and its effects, fire protection, and noxious weed control during construction.

    iii) Conduct WHCR training for the life of the Project that consists of WHCR ID. Any WHCR sitings must be reported to the site manager immediately. All employees and contractors working in the field will be required to participate in WHCR monitoring prior to working on site. In the event a WHCR is observed or reported within one mi of active construction, all construction activities within 1-mi of the reported WHCR will halt until the bird(s) have departed for at least 15 minutes.

iv) Include an overview of the distribution, general behavior, and ecology of golden and bald eagles. Employees will be informed that they are not authorized to approach, handle, or otherwise move any eagles (or their parts, such as feathers) that might be encountered during construction or operation, whether alive, injured, or deceased. The site manager will be instructed to report any finding of an injured or deceased eagle to Minnesota Power Environmental Staff in order to confirm and report the finding to the USFWS within 24 hours of positive ID.

h) Perform a visual survey prior to starting work at a location. Any WHCR sitings will be reported to the site manager, who will then report to Minnesota Power environmental staff. No work will commence until cleared by the site manager.

i) All spills will be reported to Minnesota Power Environmental Staff.

j) Prevent the spread of noxious weeds during construction and ongoing operations to minimize impacts of natural habitats by implementing the noxious weed management plan appropriately. Any use of pesticides, herbicides, fertilizers, and other chemicals will be in accordance with federal and state laws to minimize drift and other impacts on native habitat.

k) Limit vehicular speed to 25 mi per hour (mph) on non-public access roads to minimize vehicle collisions with wildlife.

l) Implement BMPs for fire prevention during construction to minimize wildfire potential.

m) Develop "good housekeeping" procedures to prohibit scrap heaps and dumps, minimize storage yards, and keep the site clean of debris, garbage, carrion, fugitive trash, or waste.

n) Coordinate removal of large road-killed animals or other carcasses (e.g., livestock or deer) detected by personnel on or near roads in the Project promptly to avoid attracting eagles or other raptors.

o) Reclaim disturbed vegetation consistent with the surrounding vegetation types, including a seed mixture approved by the US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) and the landowner.

p) Mitigate tree impacts in-kind, as approved by the landowner and consistent with the Public Service Commission (PSC) tree and shrub mitigation specifications.

q) Conduct tree clearing, if needed, outside of the North Dakota bat active season (November 1 – April 14) to minimize impacts to tree roosting bats.

r) Identify and avoid spraying areas with high abundance of milkweed that may provide potential suitable habitat for monarch butterflies. Pending upcoming listing decisions for monarch butterflies, contingencies may be necessary to minimize potential impacts to this species.

3) Conservation Measures to be Implemented during Operations

a) Report any environmental event, such as a wildlife fatality or spill, through Minnesota Power's Wildlife Incident Reporting System.

b) Feather turbines below the manufacturer's cut-in speeds (wind speeds less than three m/s) from sunset to sunrise during periods when bats are most likely to be present (April 15 – October 31).

c) Utilize an ADLS that keeps all external lights off at turbines unless aircraft approach the Project. Additionally, the Project will use lighting that has shown to be minimally attractive to birds at night, including use of red, or dual red-and-white, strobe-like or flashing lights with long duration flash intervals that will meet FAA requirements (2020).

d) Install motion-activated lighting on all buildings and Project infrastructure wherever allowed by safety and/or utility requirements. Lights will be shielded downward to minimize skyward illumination.

e) Limit vehicle speeds on private roads to 25 mph to avoid wildlife collisions.

f) Reduce fire hazards from vehicles and human activities (e.g., use of spark arrestors on power equipment, avoid driving vehicles off roads, allow smoking in designated areas only).

g) Implement a noxious weed control plan in accordance with wind lease agreements.

h) Implement pest and weed control measures as specified by county, state, and federal requirements.

i) Conduct one year of PCM for birds and bats at Project.

j) Do not store parts and equipment that may be used as cover for prey at the base of wind turbines while a turbine is operational.

k) Coordinate with landowners on a carcass removal program to minimize potential attractants for carrion-feeding raptors.

l) Report any sitings of WHCR to the operations manager and coordinate with Minnesota Power and follow Minnesota Power reporting requirements for any WHCR observed within one mile of operating turbines.

m) Provide worker awareness training to all Project employees and contractors working on site for identifying and responding to encounters with sensitive biological resources, including avian and bat species. The training will:

i) Be conducted by Minnesota Power or their designee

ii) Instruct employees, contractors, and site visitors to avoid harassment and disturbance of wildlife, especially during reproductive (e.g., courtship and nesting) seasons

iii) Include instruction on identification and values of plant and wildlife species, significant natural plant community habitats, the issue of micro-trash and its effects, fire protection, measures to minimize the spread of weeds during construction, as well as hazardous material spill and containment measures

iv) Provide information to contractors and employees on the Project detailing information on potential state and federal special-status animal and plant species that might be discovered at the Project

v) Provide WHCR training for the life of the Project; any WHCR sitings within one mi must be reported to the site manager immediately who will implement a shutdown protocol of all turbines within 1-mi of the WHCR sighting. All employees and contractors working in the field will be required to participate in the plan prior to working on site.

vi) Include an overview of the distribution, general behavior, and ecology of golden and bald eagles; employees will be informed that they are not authorized to approach, handle, or otherwise move any eagles that might be encountered during construction or operation, whether alive, injured, or deceased; operations personnel will be instructed to report any findings of an injured or deceased eagle to the operations manager, and Minnesota Power will report any injured or deceased eagles to the USFWS within 24 hours of positive ID

4) Conservation Measures to be Implemented during Decommissioning.

The lifetime of the Project is expected to be up to 30–35 years, after which it will likely be decommissioned and existing equipment removed. Minnesota Power will file a decommissioning plan, remove foundations and facilities from the landscape, and restore the area to the same physical condition of the area before construction occurred, through the implementation of measures such as:

a) Explore other alternatives to decommissioning, such as upgrading with new technology to allow the wind energy facility to continue producing energy for many more years.

b) Remove foundations to a minimum of three ft below grade and cover with soil.

c) Restore and reclaim disturbed areas to the approximate original topography.

d) Introduction and spread of invasive species shall be prevented, to the greatest extent practicable.

e) Spread topsoil over the disturbed areas at a depth similar to that in existence prior to the disturbance.

f) Reseed disturbed areas according to USDA NRCS guidelines, unless the PSC approves otherwise.

g) Decommissioning shall follow the BMPs of a SWPPP for the protection of water resources and prevention of erosion.

h) Overhead transmission line no longer necessary should be removed.

i) If applicable, petroleum products and chemical releases or leaks shall be remediated

Additional Voluntary Offset Methods

Minnesota Power minimized impacts from the Projects through siting and mitigation measures outlined above. However, Minnesota Power and NDDA executed a Memorandum of Understanding to provide voluntary offsets for potential indirect adverse impacts that may result from the contraction or operation of Longspur.

Enclosed:

Exhibit 1. Longspur Minnesota Power – North Dakota Department of Agriculture MOU

Exhibit 2. Records of Correspondence

Exhibit 1

MOU Minnesota Power and NDDA

Memorandum of Understanding

between

Minnesota Power

and

The North Dakota Agriculture Commissioner

1. This Memorandum of Understanding ("**MOU**"), dated January 20, 2026, is between Minnesota Power, a division of ALLETE, Inc. (**Minnesota Power**), a Minnesota corporation authorized to do business in North Dakota and as the owner of the Longspur Wind Project (**Longspur Wind**), and the North Dakota Agriculture Commissioner (Agriculture Commissioner), acting on behalf of the State of North Dakota. The Agriculture Commissioner and Minnesota Power are jointly referred to as the "**Parties**".

2. Since 2023, Minnesota Power has been proactively considering voluntary potential environmental mitigation offsets related to the Longspur Wind Project (**Project**) in coordination with the North Dakota Game and Fish (**NDGFD**) and the Agriculture Commissioner.

3. The Project is an approximate 202.5-megawatt wind energy conversion facility located in Morton County, North Dakota, with a short transmission line in Mercer County. Minnesota Power plans to own, construct, and operate the Project.

4. Longspur Wind has sited the proposed turbine locations of the Project off of unbroken (i.e., native) grasslands, consistent with the recommendations of the NDGFD.

5. By implementing proper siting practices, Longspur Wind represents that the Project will have minimal adverse environmental impacts in accordance with North Dakota Century Code section 49-22-02. However, to address the possibility of potential indirect adverse impacts that may result from the construction or operation of the Project, Longspur Wind has proposed in good faith to provide voluntary compensatory mitigation offsets.

6. Longspur Wind has elected to make a voluntary contribution to the Environmental Impact Mitigation Fund (**Fund**) administered by the Agriculture Commissioner under North Dakota Century Code section 4.1-01-21.1 so that the Agriculture Commissioner can develop and implement mitigation offsets on behalf of Longspur Wind in relation to the Project.

7. Accordingly, Longspur Wind will voluntarily:

   Contribute to the Fund pursuant to North Dakota Century Code section 49-22-09.2.

   This contribution shall be used by the Agriculture Commissioner for the purposes provided in North Dakota Century Code section 4.1-01-21.1 and for the purpose of the protection and/or restoration of grasslands, wetlands, and other habitats as deemed appropriate. This dollar amount **($230,000)** is voluntarily contributed by Longspur Wind as an environmental mitigation offset for potential displacement within 64.8 acres of grassland habitat, as determined in coordination with the Agriculture Commissioner.

8. The Agriculture Commissioner recognizes Longspur Wind's efforts to avoid and minimize adverse environmental impacts through strategic and ecologically responsible Project and turbine siting as well as through its voluntary mitigation offsets for residual potential indirect environmental impacts.

9. This MOU, and all voluntary commitments made, are contingent upon two milestones:

Milestone 1: Longspur Wind filing a Notice of Intent to Start Construction of the Project with the North Dakota Public Service Commission (PSC), and

Milestone 2: The Project becoming commercially operational.

10. Within thirty (30) days of the Milestone 1, the Parties will determine the financial mechanism for Longspur Wind to transfer the voluntary offset dollars into the Fund and consequently Longspur Wind will transfer to the Fund a minimum of 50% of the total voluntary contribution as stated in paragraph 7 (Seventy-five thousand dollars **($115,000).**

11. At Milestone 2, Longspur Wind will make the final financial voluntary contribution to the Fund, comprising the remainder of its voluntary contribution as stated in paragraph 7. Longspur Wind, in its discretion, may make other payments of its voluntary contribution at other times between Milestone 1 and Milestone 2.

12. After Milestone 1, the Agriculture Commissioner will engage with a mitigation provider(s) to develop mitigation offset plans as to where and what offset mitigation actions will take place. Prior to Milestone 1, the Agriculture Commissioner may, as appropriate, proactively engage in preliminary exploratory discussions with a mitigation provider(s).

13. The Agriculture Commissioner will notify Longspur Wind of the use of the funds that were contributed by Longspur Wind under this MOU. The Agriculture Commissioner will use the contributed funds for the purposes provided in North Dakota Century Code section 4.1-01-21.1. In general, the Agriculture Commissioner will use the contributed funds to:

- Establish, restore, enhance, and/or preserve grassland habitat;
- Enter into non-perpetual, *e.g.*, 35-year, easements/agreements for appropriate acreages on working lands, that are limited in time to the operational life of the Project;
- Purchase proper seed mixes (such as diverse, native perennial grass/forb mix suited for site), and conduct proper restoration/protection measures, management, and maintenance of mitigation offset areas; or
- As practicable, conduct mitigation offsets within the general vicinity of the area, county, or region affected by the Project or within another suitable area of similar habitat within the State as approved by the Agriculture Commissioner. No mitigation offsets may take place outside the State.

14. The Parties recognize that time is of the essence to implement the terms of this MOU. All mitigation offsets are expected to be delivered by the Agriculture Commissioner within 5 years after Milestone 2, following the payment schedule described in paragraphs 10 and 11. Mitigation offset efforts will be prioritized to take place on private land acreage with willing landowners who, as appropriate, will be compensated financially for the initial habitat establishment and for subsequent transition into appropriate conservation use within their respective operations.

15. Longspur Wind may reasonably modify financial mitigation offset estimates if unforeseen circumstances during construction result in significant Project changes (*e.g.*, reduction or increase in turbine

number or change in turbine locations). The Parties will coordinate together as to any substantial estimate modifications.

16. The Agriculture Commissioner will notify the PSC of mitigation efforts made by or on behalf of Longspur Wind under this MOU.

17. It fully is the intent of the Parties to work together in good faith to implement the terms of this MOU so that voluntary environmental mitigation offsets pertinent to this MOU can be established and maintained in a timely, efficient, transparent, cost-effective, and equitable manner. This MOU is effective on the date that it has been signed by both Parties.

MOU acknowledged and entered into on this 20th day of January 2026

Minnesota Power, a division of ALLETE, Inc.

Kurt Anderson
Director – Environmental & Land Management
ALLETE/Minnesota Power

MOU acknowledged and entered into on this 20th day of January 2026

State of North Dakota

Doug Goehring
Agriculture Commissioner

AN ALLETE COMPANY

Exhibit 2

Records of Correspondence

USFWS, NDGFD, WEST, and Minnesota Power – Longspur Wind Project Introduction

Attendees:

USFWS:	Hanna Edens
NDGFD:	Bruce Kreft, Elisha Mueller
WEST:	Martin Piorkowski, Nicholas O'Neil
Merjent:	Dan Flo, Mandy Bohnenblust
MN Power/ALLETE:	Ben Reister, Scott Monroe, Mitchell Bettenhausen, John Hollingsworth Chris Aepelbacher, Mike French, Drew Janke, Alex Luman

Location: NDGFD Conference Room & Teams Meeting (Virtual)
Date/Time: December 4, 2024; 10:00 – 11:00 AM (CST)

Summary of Meeting:

Minnesota Power (MN Power) requested a wildlife agency meeting with US Fish and Wildlife Service (USFWS) and North Dakota Game and Fish Department (NDGFD) on December 4, 2024. The objectives of this meeting were to introduce the Longspur Wind Project (Project) in Morton County, North Dakota to the wildlife agencies and to provide survey results from completed studies and to propose upcoming surveys and studies at the Project. Western EcoSystems Technology, Inc. (WEST) added that a secondary objective of this meeting was to gain any feedback on proposed studies and their designs. A PowerPoint presentation accompanied this meeting for visualization of data and proposed survey efforts.

<u>Project Overview and Timeline</u>

- MN Power Introduced the Project to the USFWS and NDGFD and explained that the Project had been under development over the last decade under different Project names. Project development resumed in early 2024 with the intention to file for permits in 2025 with Public Service Commission (PSC) permitting in mid-late 2025. Targeted construction is anticipated in Q2 of 2026 with commercial operations beginning in Q4 2027.

- WEST explained that although there had been wildlife and habitat work completed at the Project previously, these studies were getting older, and that proposed work would use previously collected information to inform new and updated studies at the Project to provide current data within the new Longspur Wind Project area.

- NDGFD asked if MN Power/ALLETE were aware of any impending changes to wind development with changing of federal administration. MN Power/ALLETE could not say for certain but discussed only small changes were observed in 2017 during similar administration changes.

Previous Study Review

- WEST discussed studies conducted at the Project in 2024 including aerial eagle nest surveys and sharp-tailed grouse lek surveys. Avian use surveys started in September 2024, but no results were discussed during this meeting.

- One aerial survey was conducted within the Project area and a 2-mile buffer of the Project area focused specifically on eagle nests. Two occupied and active bald eagle nests were observed within the 2-mi buffer surrounding the Project but not within the Project area.

- Three rounds of sharp-tailed grouse surveys were conducted following NDGFD Best Management Practices. Thirteen 13 active leks were identified of which six were historic leks from previous survey efforts and seven were new leks. Of the historic leks, none had moved significantly from their originally documented locations.

Proposed Studies with Discussion

- WEST discussed ten proposed and ongoing studies at the Project and a Wildlife Conservation Strategy through early 2026.

    - Following the Wind Energy Guidance (2012), A Tier 2 Site Characterization Study (SCS) is currently in development. NDGFD emphasized that North Dakota's Species of Conservation Priority (SCP) is a tiered level based on funding. WEST indicated that for the SCS the draft Species of Greatest Conservation Need (SGCN; available on the NDGFD website) would be used, and all species of greatest conservation need should be considered when reporting on this analysis. NDGFD stated that the updated State Wildlife Action Plan (SWAP) with the SGCN is expected to be released sometime in mid- to late-2025.

    - Grassland assessment is in development and expands and updates data collected and field verified in 2020. NDFGD was interested in seeing if WEST could discuss grassland conversion rate within the Project using data gathered in 2020 and 2024.

    - The whooping crane habitat assessment will include a more comprehensive approach using the Niemuth Model data layers and an additional Project buffer based on recent literature and to align with habitat stopover assessments in other regions of the migration corridor.

    - Eagle and raptor nest surveys are planned in 2025 following USFWS Region 6 guidance.

    - A second year of sharp-tailed grouse lek surveys are planned in 2025 following NDGFD BMP's using the same design as 2024 surveys.

    - Avian use surveys are ongoing and expected to occur through 2026 for two years of data collection. These surveys cover approximately 36% of the current Project area and include both a 10-minute small bird surveys and 60-minute eagle and large bird survey at each survey location. Eagle data will be collected using the data standards described in the Eagle Conservation Plan Guidance.

- General bat activity acoustic surveys are planned for 2025. These will occur using two acoustic units with two microphones each at up to two MET towers. Qualitative review for northern long-eared bat and little brown bat calls are planned. USFWS briefly discussed the intended study design for bat activity surveys with WEST and asked if detectors could be placed lower than 3 meters and if there was a measurable difference between 1.5 and 3 meters. WEST did not know if there were differences between the two heights but indicated that 1.5 meter was typical as it is generally a height that is high enough above grass or crop height to avoid significant insect noise.

- A northern long-eared bat habitat assessment planned for 2025 following current USFWS survey guidance. WEST requested information from USFWS on what habitat features the assessment should include for northern long-eared bat habitat. WEST explained that the Project is on the western edge of the northern long-eared bat range and the previously used 10-acre minimum patch size for habitat may not be the best starting point considering the recently finalized USFWS guidance. USFWS recommended starting with an assessment of where trees are located within the Project and what species/size of tree looked like in these features for further discussion with the USFWS. USFWS referenced a Montana graduate student that had found northern long-eared bats roosting in eight cm willows, which smaller than what is typical for the species. NDGFD acknowledged there is less data on the North Dakota populations compared to the eastern populations.

- Northern long-eared presence/probable absence surveys are planned for 2025 following current survey guidance and results from the NLEB habitat assessment. Study plan will be provided to USFWS prior to survey for approval and authorization.

- Dakota skipper larval habitat surveys are planned for 2025, if infrastructure is proposed within 250m of unbroken grassland, and will follow USFWS 2024 guidance. NDGFD asked what steps WEST and MN Power/ALLETE were taking with siting should critical habitat be found late into construction planning/development. WEST emphasized to the service that the intention of the surveys was to inform avoidance of habitat rather than necessitate presence/absence surveys.

- A Wildlife Conservation Strategy (WCS) is proposed to be developed in mid- to late-2025 and updated with completion of wildlife studies and site development. NDGFD asked that information from wildlife studies be provided to them as soon as possible so that they can submit their comments 30 days prior to the PSC permit hearing. USFWS echoed the same request. WEST plans to have a draft WCS 100 days prior to the PSC permit hearing, which should provide adequate time for NDGFD to review and submit their comments. WEST additionally stated that individual reports can be provided as well, if needed.

Timeline and Next Steps

- WEST showed a proposed timeline for studies at the Project as well as next steps to prepare for siting and permitting.

  - WEST proposed upcoming meetings (annual) with the agencies to discuss survey results and avoidance and minimization measures being implemented at the Project. NDGFD asked that the Project's turbine layout be provided once available as well to inform impact avoidance taken by the Project.

  - MN Power/WEST also plans to set up a meeting with the ND Department of Agriculture (NDDA) to introduce the Project and discuss implementation of a voluntary offset strategy.

Additional Discussions

- NDGFD followed up after the presentation to see if the Project is considering mitigation funds with the NDDA or if they would pursue independent mitigation funding. MN Power is waiting to see what guidance is provided by the NDDA before committing to mitigation funding/plans.

- NDGFD asked about considering cumulative impacts going forward. PCM data is dated on existing infrastructure near the Project so effects could be difficult to assess. NDGFD clarified this question was not intended to be addressed or investigated by MN Power, but the Agency is considering if cumulative impacts analysis is warranted or if further investigation is needed.

- USFWS reminded WEST and MN Power that the regal fritillary is proposed for listing through the Endangered Species Act and should be considered when conducting grassland and DASK assessments.

- NDFGD emphasized that they are most interested in the habitat and impacts analysis outlined in their BMPs for permit review/comments. NDGFD suggested that WEST/MN Power complete the avian habitat offset analysis described in those BMPs using site collected data. NDGFD would likely defer to the site-specific data, focused on unbroken grasslands, even if their analysis only included the modeled grassland data.

- NDGFD confirmed that turbine placement should avoid any grasslands within a 2-mile buffer of grouse leks. The goal is to conserve grasslands (i.e., nesting habitat) within 2-miles of leks over concerns of disturbing leks in crop fields as most grouse nest within 2-mile of a lek location. However, NDGFD would prefer avoidance of grasslands wherever possible though they provided the opportunity to discuss other options if this was not feasible.

Schedule/Action Items

- WEST and MN Power will be scheduling a meeting with NDDA for discussion of voluntary offsets in the near future (likely before the end of January 2025).

- A copy of the meeting's notes will be provided for review with the wildlife agencies. Additionally, a PDF of the PowerPoint presentation will accompany these meeting notes for reference.

NORTH
Dakota | Game and Fish
Be Legendary.

June 29, 2025

Drew Janke
Environmental Compliance Specialist II
Minnesota Power | ALLETE Inc.
20 West Superior Street
Duluth, Minnesota 55802-2093

RE: Proposed Longspur Wind Project, Morton and Mercer County, ND

Dear Drew:

Thank you for reaching out to the North Dakota Game and Fish Department (Department) in request of agency input on the proposed Longspur Wind Project. We would like to use this opportunity to provide some early guidance recommendations and to encourage continued coordination as the project progresses.

First and foremost, native prairie (prairie that has not been plowed or broken in any way) is the most endangered ecosystem in North Dakota and one of the most endangered ecosystems worldwide. As a prairie state, the majority of our native species are linked to and dependent on healthy grasslands. Disturbance, fragmentation, and loss of native prairie have adversely impacted a wide variety of species and these negative impacts only continue to compound as more development takes place across the landscape.

Many of North Dakota's declining resident and migratory species are becoming more and more dependent on the remaining tracts of unbroken prairie. This habitat supports 62 Species of Greatest Conservation Need and 55 Species of Greatest Information Need identified in the Draft North Dakota State Wildlife Action Plan (North Dakota Game and Fish Department, 2025). Grassland dependent species have experienced drastic declines, such as the state bird of North Dakota, the Western Meadowlark, whichh has decreased by approximately 48% globally and the monarch butterfly which has declined by over 80% since the 1990s. The loss and fragmentation of native prairie in the project area may further negatively impact these declining species, making avoidance and minimization efforts a necessary priority.

Wetlands are another productive wildlife habitat in North Dakota, supporting 39 Species of Greatest Conservation Need and 18 Species of Greatest Information Need, as well as a considerable number of waterfowl, shorebirds and cranes throughout the year. The grassland-wetland mosaic of North Dakota is often referred to as the "Duck Factory" for its high-quality nesting habitat and the vast number of ducks produced. Therefore, it's important to prioritize protecting this productive habitat for both its local and national importance.

Governor
Kelly Armstrong

Director
Jeb Williams

Deputy Director
Casey Anderson

100 North Bismarck Expressway | Bismarck ND, 58501-5095 | 701-328-6300 | gf.nd.gov

Finally, though the Department believes the best way to protect our species of conservation priority is by taking a habitat-focused approach, we would also like to reiterate the following species-specific concerns.

- Nearly 31% of the entire Sharp-tailed Grouse population falls within North Dakota and declines to the state's population will likely lead to range-wide population declines. Sharp-tailed Grouse are a high-valued upland game bird, and because research indicates that prairie grouse may be adversely affected by energy development, it is vital that lek surveys be conducted to understand the risk associated with development.
- Bats are long-lived, reproduce slowly, and migrate long distances, making them particularly susceptible to wind development. Acoustic surveys should begin at a minimum of two years pre-construction to assess the risk the project poses to local and migrating bat populations.
- The Whooping Crane's migration corridor centers along the east side of the Missouri River. The project falls within the 50% core migration corridor and there is core stopover habitat to the east and south. The U.S. Fish and Wildlife Habitat and Population Evaluation Team's (HAPET) Whooping Crane model should be used to evaluate risk associated with development to migrating Whooping Cranes.
- The Bald Eagle population and number of nest sites is increasing significantly in North Dakota. The number of nest sites has increased from 10 known sites in the year 2000 to more than 350 in the year 2023. Due to the continual increase and selection of non-traditional nest sites, it is possible that Bald Eagle nests may be found anywhere across the state where large trees are present. Therefore, it is recommended that searches for raptor nests be conducted during the breeding season to understand the risk associated with development.

The Department has a number of resources available for the benefit of the developer and consultant, including Best Management Practices (BMPs) (https://gf.nd.gov/sites/default/files/publications/wind-energy-development-bmp.pdf) . These BMPS include recommendations for responsible development of both turbines and transmission lines, as well as pre and post construction monitoring recommendations. The Department also has available maps and information on native habitats, priority areas, and sensitive species. Geospatial data can be found here https://gf.nd.gov/wildlife/data . Finally, the Department also recommends working with the U.S. Fish and Wildlife Service, as any state recommendations do not relieve the developer of its obligations to comply with any applicable federal regulations.

As we continue to address the challenges of stemming the decline of our state's most sensitive species, we cannot endorse the disturbance, fragmentation, and loss of the remaining high value habitats essential to Species of Greatest Conservation Need without recommending that suitable replacement or offsets be applied back onto the landscape. Ensuring these habitats remain on the landscape is the only way to stem the decline of these species and prevent listings through the Endangered Species Act, which could impact both the state and its citizens. The Department has stressed the importance of following the best available science in determining impacts and voluntary offsets. The best science addressing North Dakota resources are Loesch et al. 2013, Shaffer and Buhl 2016, and Shaffer et al. 2019; these papers should be used to help guide ALLETE in understanding impacts and developing a voluntary offset package, if one is deemed appropriate. For Further guidance on estimating grassland impacts, there are also resources on the NDGFD website, which can be found at: https://gf.nd.gov/sites/default/files/publications/ndgf-desktop-approach-grasslands-2021.pdf .

As ALLETE moves forward with this project, the Department requests to remain informed. To accurately analyze the project and provide valuable feedback to the PSC, it is important that the Department receives all documents, including wildlife surveys, spatial data, a Wildlife Conservation Strategy (WCS or BBCS), and any voluntary offsets being proposed 100 days prior to the hearing date.

Thank you for the opportunity to provide input. We hope to remain informed as the project moves forward.

Sincerely,

Bruce Kreft
Chief, Conservation and Communications Division

CC. Luke Toso, USFWS
Steven Kahl, ND PSC

Alex Luman (MP)

From: Alex Luman (MP)
Sent: Thursday, January 29, 2026 11:09 AM
To: 'Mueller, Elisha K.'; Martin Piorkowski
Cc: Nick O'Neil
Subject: RE: [EXTERNAL MAIL] RE: Minnesota Power Longspur North Dakota Game and Fish
Attachments: Longspur_WCS_V1_01.29.2026_NoAppendices.pdf; Longspur_WCS_V1_01.29.2026_NoAppendices.docx

Hello Elisha,

Thank you for your patience please see the attached WCS documents without the Appendices. The full WCS is too large to send through email and is in the WEST file Sharing Website you accessed last week, I have attached a direct link. Please let me know if you have any questions on these files or issues accessing the site.

https://clientcloud.west-inc.com/index.php/s/xSixkwAyFpcL69s

Thank you,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Mueller, Elisha K. <ekmueller@nd.gov>
Sent: Friday, January 23, 2026 2:12 PM
To: Martin Piorkowski <mpiorkowski@west-inc.com>; Alex Luman (MP) <aluman@mnpower.com>
Cc: Nick O'Neil <noneil@west-inc.com>
Subject: [EXTERNAL MAIL] RE: Minnesota Power Longspur North Dakota Game and Fish

It came through… I will let you know if I have any issues accessing the documents next week. Thanks!

From: Martin Piorkowski <mpiorkowski@west-inc.com>
Sent: Friday, January 23, 2026 1:49 PM
To: Mueller, Elisha K. <ekmueller@nd.gov>; Alex Luman (MP) <aluman@mnpower.com>
Cc: Nick O'Neil <noneil@west-inc.com>
Subject: Re: Minnesota Power Longspur North Dakota Game and Fish

Elisha,

Please check any junk or trash folder as it sometimes get picked up a spam depending on firewall sensitivity; otherwise please give it 30-60 minutes and see if it comes in. If not please let me know and I'll pull IT directly in to make sure you have access.

Thanks,
Marty

WEST
Innovative Solutions Through Applied Science

Martin Piorkowski
Senior Biologist, Project Manager

Western EcoSystems Technology, Inc.
w: 307-365-3361 **e:** mpiorkowski@west-inc.com
a: 4007 State Street, Suite 109, Bismarck, ND 58503

From: Mueller, Elisha K. <ekmueller@nd.gov>
Sent: Friday, January 23, 2026 1:29 PM
To: Alex Luman (MP) <aluman@mnpower.com>
Cc: Martin Piorkowski <mpiorkowski@west-inc.com>; Nick O'Neil <noneil@west-inc.com>
Subject: RE: Minnesota Power Longspur North Dakota Game and Fish

The 2nd would work best. And I have still not received an email to access the file sharing site, just fyi.

Thanks.

From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Friday, January 23, 2026 1:09 PM
To: Mueller, Elisha K. <ekmueller@nd.gov>
Cc: 'Martin Piorkowski' <mpiorkowski@west-inc.com>; 'Nick O'Neil' <noneil@west-inc.com>
Subject: RE: Minnesota Power Longspur North Dakota Game and Fish

Good afternoon Elisha,

Thank you for your patience it took a minute to get it setup and the studies submitted. The file sharing site from WEST was recently sent or is still on its way through email. The Wildlife Conservation Strategy is still being developed and are finalizing that early next week. I will send that separately when it is available. On the file site is eagle nest studies, bat acoustic, habitat, and presence absence surveys, Dakota skipper habitat, grassland, sharp-tailed grouse lek surveys, and whooping crane habitat assessment and associated GIS data. As stated before I would like to have a meeting to go over the previous letter in 2025 and see if you have any questions on the studies or files we provided. If you have any issues accessing the site please let us know and we can assist.

Please see the below dates for a meeting, please let me know what will work best for you:

Thursday 29th of January: 11am-1pm
Friday 30th: 8:30am-12pm
Monday 2nd of February: 2-4pm
Tuesday 3rd: 10-11am
Wednesday 4th: 8-10am, 1-3pm
Thursday 5th: 8-9:30am, 11am-1pm, 3-4pm

Thank you,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Alex Luman (MP)
Sent: Friday, January 9, 2026 3:06 PM
To: 'ekmueller@nd.gov' <ekmueller@nd.gov>
Cc: 'Martin Piorkowski' <mpiorkowski@west-inc.com>; 'Nick O'Neil' <noneil@west-inc.com>
Subject: RE: Minnesota Power Longspur North Dakota Game and Fish

Good afternoon Elisha,

Thank you for the phone call, as discussed Minnesota Power is finalizing its surveys, and I wanted to be able to share all data requested in the letter from Bruce Kreft on 6-29. This will contain wildlife surveys, spatial data, voluntary offsets, and a Wildlife Conservation Strategy. We are setting up a file sharing site for ease of transfer. Additionally, after receival of these files I was hoping to schedule a meeting to review. We are anticipating the site to be ready next week and I will supply times we are able to meet for your selection.

Minnesota Power has also proposed to contribute $230,000 dollars to the North Dakota Department of Agriculture's Grassland Compensatory mitigation for the Longspur Wind Project. This proposal is still pending approval from the NDDA.

Thank you,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Alex Luman (MP)
Sent: Tuesday, December 9, 2025 1:02 PM
To: 'Bkreft@nd.gov' <Bkreft@nd.gov>; 'ekmueller@nd.gov' <ekmueller@nd.gov>
Cc: Martin Piorkowski <mpiorkowski@west-inc.com>; Nick O'Neil <noneil@west-inc.com>
Subject: Minnesota Power Longspur North Dakota Game and Fish

Good afternoon,

My name is Alexander Luman, and I am with Minnesota Power. I am currently working on the Longspur Wind Project, for which you previously attended meetings and responded to our project introduction letter.

Minnesota Power would like to schedule a meeting with the North Dakota Game and Fish Department to share the current status of our environmental surveys, provide an update on the project, and review any additional requirements.

I will follow up with proposed dates for a meeting.

Thank you for your time and assistance. Please feel free to reach out with any questions

Have a great rest of your day,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796
Office 218-355-3029

Alex Luman (MP)

From: Alex Luman (MP)
Sent: Monday, February 16, 2026 10:03 AM
To: Mueller, Elisha K.; Bialke, Joseph P.
Cc: Miller, Adam M.; Martin Piorkowski; Mitchell Bettenhausen (ACE); John Hollingsworth (ACE)
Subject: Longspur Wind Avian Impact Offset Model
Attachments: Longspur Wind Summary Report.xlsx; Longspur_Avian_Offset_Model_2.12.2026.pdf

Good morning Elisha,

Thank you again for meeting with us on February 2. As discussed, I'm sharing the requested Longspur Wind Avian Offset Model for your review.
Minnesota Power sited the Longspur Wind turbines in areas identified as having low to medium wildlife impact according to the NDGFD Wind Energy Development BMPs. As such, we are providing this memo that outlines the BMPs framework approach and resulting analysis for grassland breeding birds.

I have also included the summary of the Decision Analysis Tool (DAT). This tool was used collaboratively by Minnesota Power, NDDA, and the Agriculture Commissioner to identify voluntary offset mitigation consistent with North Dakota Century Code 49-22-09.2 Mitigating environmental impacts - energy conversion facilities. Minnesota Power executed a memorandum of understanding for this mitigation with the Agriculture Commissioner in January for approximately 64 acres of offset.

There were a few questions during our meeting on February 2, and we wanted to provide additional context. Including NDDA on this communication is intended to support transparent information-sharing and ensure both agencies have visibility into the materials and process.

Minnesota Power remains committed to working collaboratively with both NDDA and NDGFD to support effective mitigation and advance the Longspur Wind Project in a way that respects the goals of each agency.

Please let me know if there are additional questions or if a follow-up discussion would be helpful.

Thank you,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

Alex Luman (MP)

From: Alex Luman (MP)
Sent: Thursday, February 19, 2026 2:15 PM
To: 'ekmueller@nd.gov'; 'pisakson@nd.gov'; 'bkreft@nd.gov'; 'Bialke, Joseph P.'; 'Miller, Adam M.'
Cc: Martin Piorkowski
Subject: RE: Longspur Wind Biological Studies Meeting Notes
Attachments: Longspur agency meeting notes_20260202_Correction.pdf

Good afternoon all,

I wanted to provide an update based on a discrepancy Elisha identified in the meeting notes. In the *Additional Discussions* section on page three, the notes incorrectly stated that the project was submitted to the PSC on January 30, 2026. Earlier in the document, we correctly noted the submission date as December 30, 2025. I have updated the meeting notes to reflect the correct date, and the revised version is attached.

Additionally, Minnesota Power has provided the Memorandum on grassland impacts along with the requested Avian Impact Offset Model. Minnesota Power is also providing information for the final outstanding action item regarding Bird Flight Diverters. For clarification, Minnesota Power is installing spiral-type Swan Flight Diverters on its 2.5-mile 230 kV transmission line.

Please let me know if you have any questions.

Thank you,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Alex Luman (MP)
Sent: Monday, February 9, 2026 8:44 AM
To: ekmueller@nd.gov; pisakson@nd.gov; bkreft@nd.gov; Bialke, Joseph P. <bialkej@nd.gov>; Miller, Adam M. <admmiller@nd.gov>
Subject: FW: Longspur Wind Biological Studies Meeting Notes

Good morning all,

I am retrying this email since I received an undeliverable notification the first time. I removed the zip file containing shapefiles for the turbine locations and if this works I will work directly with Elisha so she can receive those.

Please let me know if you have any questions.

Thanks,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Alex Luman (MP)
Sent: Monday, February 9, 2026 8:32 AM
To: ekmueller@nd.gov; Bialke, Joseph P. <bialkej@nd.gov>; Miller, Adam M. <admmiller@nd.gov>; hanna_edens@fws.gov; Toso, Luke B <luke_toso@fws.gov>; 'pisakson@nd.gov' <pisakson@nd.gov>; Bkreft@nd.gov
Cc: Martin Piorkowski <mpiorkowski@west-inc.com>; Mandy Bohnenblust <mandy.bohnenblust@merjent.com>; Nick O'Neil <noneil@west-inc.com>; Mitchell Bettenhausen (ACE) <mbettenhausen@alletecleanenergy.com>; John Hollingsworth (ACE) <jhollingsworth@alletecleanenergy.com>
Subject: Longspur Wind Biological Studies Meeting Notes

Good morning all,

Thank you for your patience. Please see the attached meeting notes, presentation, and the Longspur Wind Project turbine GIS files.

I also want to note one correction from last week's discussion: for the single turbine sited within unbroken grassland, there are five leks within two miles. Two of those leks fall within the project boundary.

Elisha, An impact analysis for the Longspur Wind Project will be provided later this week. This will follow the KeyWind Energy Development in North Dakota BMPs avian offset model results using Project-specific, field validated grassland data. Please let me know if you have any questions.

Thank you,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

Alex Luman (MP)

From:	Alex Luman (MP)
Sent:	Friday, April 17, 2026 10:07 AM
To:	'Mueller, Elisha K.'; Isakson, Patrick T.; Kreft, Bruce L.
Cc:	Martin Piorkowski; Mitchell Bettenhausen (ACE)
Subject:	RE: [EXTERNAL MAIL] RE: Minnesota Power Longspur Wind Grassland Shift
Attachments:	Fig3_Longspur_MortonCo_SUP_Preliminary Layout - Topo.pdf; Longspur PSC Figure 12 Page 14 Map.png

Hello Elisha,

Thank you for including the clarification response in this email chain, please see the comments in blue below. There was a bit of history I was providing to the original email regarding your questions on Leks that doesn't quite match your additional text but provided it before your update for additional context.

Would a meeting prior to the 30th be beneficial to the group to discuss any remaining clarifications?

Thank you,
Alexander Luman
Environmental Compliance Specialist
Minnesota Power/ALLETE Inc.
30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Mueller, Elisha K. <ekmueller@nd.gov>
Sent: Friday, April 17, 2026 8:20 AM
To: Alex Luman (MP) <aluman@mnpower.com>; Isakson, Patrick T. <pisakson@nd.gov>; Kreft, Bruce L. <bkreft@nd.gov>
Cc: Martin Piorkowski <mpiorkowski@west-inc.com>
Subject: RE: [EXTERNAL MAIL] RE: Minnesota Power Longspur Wind Grassland Shift

Alex,

Below is the email I sent earlier. Any additions to help clarify further in response to your email are in red...

Thanks again for the call and pointing me to where I could find the WCS. Several concerns from reviewing the permit still stand, but I think some clarity within the WCS would be helpful.

Of course, please let me know if you have any questions. Please also let me know if you have any questions for the studies that were supplied in January on the WEST file sharing site.

First, both the Department and FWS highly value the WCS, and because it stands as a commitment to minimization and mitigation efforts, we highly recommend it be a part of the permit application. We request this because, for example, if a minimization effort (like marking the T line) is put in the WCS, but the WCS is not a part of the official application, it is difficult to guarantee that commitment is official. This makes evaluation of a project and determining if impacts have in fact been minimized, avoided or offset very difficult.

Fully understood we also value the importance, that is why we supplied the WCS to NDGFD and USFWS at least 100 days prior to the PSC hearing and had a meeting with NDGFD and USFWS to discuss the surveys and WCS. Sadly, USFWS could not join or get into the file-sharing site to obtain the survey information due to federal actions but did state the importance of working with your department and we stay committed to supply documents when they are able to receive them.

The conservation methods listed in the application are a few of the ones proposed in the WCS. Longspur plans on submitting the avoidance measures that are listed in the WCS to the PSC but wanted to provide the NDGFD and USFWS with plenty of time to review provide comments; so changes with the document did not confuse staff or the public. The WCS is a living document and should be updated to reflect changes during the course of construction and operations. With no comments, Minnesota Power assumed that the department appreciated the extensive list of avoidance measures and did not have any edits.

Regarding sharp-tailed grouse: the following sentence is from the 2024 final report *"Additionally, surveys followed NDGFD guidance by conducting a survey approximately every 0.5 mi but were constrained to publicly accessible roads and section line roads. However, this left survey gaps primarily within the central portion of the Project area as shown in Figure 3. WEST suggest if lek surveys are completed in subsequent years, additional access may need to be granted or an alternative survey strategy may need to be discussed with NDGFD for more complete coverage of the Study Area"*. Comparing it to the 2025 report, I did not see any significant changes to account for these data gaps. If there is information I am missing, please let me know.

The 2024 survey efforts were conducted to the extent possible given non-participating landowner status, limited public access, and road conditions during spring surveys.
The most significant change between the 2024 and 2025 survey efforts is that the entire southern-central portion of the 2024 surveyed area was removed from the Project boundary. No project infrastructure is proposed in that area.

It was only after a thorough review of the permit application and reviewing both 2024 and 2025 surveys side by side that I understood this gap in the data. This was never indicated to us in any meeting or correspondence, and there were no discussions on how to address this gap prior to the 2025 survey year. Therefore, I did not realize until, again, I began a thorough review of the permit application.

Given the extensive suite of surveys, meetings did not focus exclusively on lek surveys. However, lek survey strategies and results were discussed during the 2024 meeting using Figure 3 from the 2024 report, and results were again reviewed during the 2025 meeting. The intent was to provide an overview of all survey efforts to support a thorough and informed review of the submitted reports.

We also have concerns about the risk to Whooping Cranes. I couldn't seem to find anything in the permit application about marking the T line. I see in the WCS it is noted that *"The above-ground T-Line will meet all Avian Power Line Interaction Committee (APLIC) practices (2006, 2012), as practicable."* Can you clarify if you plan to mark the line? Based on location and analysis, both FWS and the Department would recommend the line be marked.

Yes that was a question you asked in our February meeting, which I thought was from your review of the WCS on an item that states we will mark the transmission line. As documented in our February 19th email, the Project still remains committed to installing yellow spiral-type Swan Flight Diverters on the 2.5-mile 230-kV transmission line. That correspondence also included the corrected meeting notes addressing the application filing date discrepancy.

Regarding avoiding unbroken grasslands – the commitment to avoid this habitat is made several times in the WCS "to the extent possible". Can you provide clarity on this. Will there be infrastructure, turbines or otherwise, that will be placed in unbroken grasslands? We can also discuss this further at the meeting, as our last remaining concern regards the impact calculation discrepancies and how these impacts are to be offset.

As stated when providing the update to the grasslands in an earlier email no turbines are sited in grasslands. Associated facilities are proposed in both unbroken and broken grasslands; however, construction timing restrictions during sharp-tailed grouse nesting season, as outlined in the WCS, are proposed for collection lines. Siting of associated facilities considers multiple factors, including wetland delineations, cultural resources, biological surveys, setbacks, and landowner preferences. Landowners are involved in siting decisions to accommodate agricultural operations and other site-specific considerations.

Longspur has taken measurable steps to reduce impacts to unbroken grasslands. For example, during county-level permitting an access road between Turbines 7 and 8 was proposed in unbroken grassland(Attached map); subsequent siting refinements shifted this access to follow a collection line, significantly reducing impacts. This change is reflected in Figure 12, page 14 of the PSC application (Attached map)

Apologies for the long email, but I figured sending this will help facilitate meaningful discussion on the 30th.
No worries, I always welcome questions on the surveys and the project.

From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Thursday, April 16, 2026 6:15 PM
To: Mueller, Elisha K. <ekmueller@nd.gov>; Isakson, Patrick T. <pisakson@nd.gov>; Kreft, Bruce L. <bkreft@nd.gov>
Cc: Martin Piorkowski <mpiorkowski@west-inc.com>
Subject: RE: [EXTERNAL MAIL] RE: Minnesota Power Longspur Wind Grassland Shift

Hello Elisha,

Thank you for confirming receipt of the materials. Please let me know if you have any questions, or if you would like a new link to the file-sharing site that contains all studies, the WCS, and the spatial data. The original link sent in January should still be accessible for downloading. You previously indicated that the link was working back in January, but I would be more than happy to provide it again for the larger group if helpful.

Based on the letter submitted to the NDPSC today, it appears there may be concerns regarding preconstruction surveys. Since providing the data, and meeting with the department in February, we have not received any additional communication identifying specific issues with the surveys. Could you please elaborate on the concerns so we can better understand them? The items that were requested in the February meeting were supplied within the month, and no concerns were raised.

Minnesota Power remains committed to working collaboratively with the department and would like the opportunity to acknowledge and address any concerns. As noted, the WCS provided in January included several mitigation measures intended to address potential impacts. I did receive your email based on our phone call this morning and will provide a response.

I look forward to our meeting on April 30 and please let me know if you have any questions in the meantime regarding the Longspur project.

Thanks,

Alexander Luman
Environmental Compliance Specialist
Minnesota Power/ALLETE Inc.
30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Mueller, Elisha K. <ekmueller@nd.gov>
Sent: Thursday, April 16, 2026 9:54 AM
To: Alex Luman (MP) <aluman@mnpower.com>; Isakson, Patrick T. <pisakson@nd.gov>; Kreft, Bruce L. <bkreft@nd.gov>
Cc: Martin Piorkowski <mpiorkowski@west-inc.com>
Subject: [EXTERNAL MAIL] RE: Minnesota Power Longspur Wind Grassland Shift

Hi Alex,

Thank you for the follow up email. I have received the documents and have been going through everything, as well as the permit application. The Department has several concerns and has been trying to coordinate with the Department of Agriculture. It sounds like a meeting has now been set for April 30th, so we look forward to discussing these concerns then.

Elisha

From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Thursday, April 16, 2026 7:32 AM
To: Mueller, Elisha K. <ekmueller@nd.gov>
Cc: Martin Piorkowski <mpiorkowski@west-inc.com>
Subject: Re: Minnesota Power Longspur Wind Grassland Shift

Good morning Elisha,

I am writing to confirm receipt of my previous communication regarding the grasslands information and the avian offset model. Please let me know whether you received these documents and if you have any questions.

Have a great rest of your day,

Alexander Luman

Environmental Compliance Specialist

Minnesota Power/ALLETE Inc.

30 West Superior Street

Duluth, MN 55802

Cell 218-481-2796

From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Tuesday, April 7, 2026 9:04 PM
To: 'Mueller, Elisha K.' <ekmueller@nd.gov>
Cc: mpiorkowski <mpiorkowski@west-inc.com>
Subject: Re: Minnesota Power Longspur Wind Grassland Shift

Hello Elisha,

Sorry for the delay, Zip files cannot be sent forward to you and the previous internal link to send files to you expired I have attached the newest grassland layer. Nothing has changed with the layout, the one broken grassland under turbine three has changed to cropland.

Please let me know if you have any questions.

Have a great day,

Alexander Luman

Environmental Compliance Specialist

Minnesota Power/ALLETE Inc.

30 West Superior Street

Duluth, MN 55802

Cell 218-481-2796

From: Alex Luman (MP)
Sent: Monday, March 30, 2026 11:41 AM
To: 'Mueller, Elisha K.' <ekmueller@nd.gov>
Cc: 'Martin Piorkowski' <mpiorkowski@west-inc.com>
Subject: RE: Minnesota Power Longspur Wind Grassland Shift

Hello Elisha,

Please see the attached updated Avian Offset Model. With this change, the grassland impact is eliminated, removing the only turbine previously affecting grassland habitat. This modification also eliminates any turbine sited on habitat within two miles of a Sharp-tailed Grouse lek. Previously, this turbine was located within two miles of five known leks, which was noted in the meeting summary that has been updated. Finally sharing the addendum for the grassland assessment. A shapefile will be sent forward through the previous method we have been using.

Please let me know if you have any questions.

Thank you,

Alexander Luman
Environmental Compliance Specialist
Minnesota Power/ALLETE Inc.
30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Alex Luman (MP)
Sent: Friday, March 13, 2026 11:44 AM
To: Mueller, Elisha K. <ekmueller@nd.gov>
Cc: Martin Piorkowski <mpiorkowski@west-inc.com>
Subject: Minnesota Power Longspur Wind Grassland Shift

Hello Elisha,

I wanted to share an update on grasslands for the Longspur Project. As we discussed earlier this year, one turbine location had been identified on what initially appeared to be broken grassland. After further coordination with the project team and the landowner, we confirmed that this area is planted with alfalfa and is regularly hayed.

Based on this management history, nesting habitat does not appear to be present. We plan to provide you with an updated Impact Analysis and shapefile. I've attached the 2025 USDA report from the landowner showing the area classified as cropland and regularly hayed for your reference. Any comments or questions?

Please let me know if you need anything additional.

Thanks,
Alexander Luman
Environmental Compliance Specialist
Minnesota Power/ALLETE Inc.
30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

Alex Luman (MP)

From: Alex Luman (MP)
Sent: Thursday, April 16, 2026 1:18 PM
To: 'Mueller, Elisha K.'
Subject: RE: [EXTERNAL MAIL] PSC letter

Hello Elisha,

I wanted to thank you for this, and let you know that I am working on a reply to the most recent email you sent.

Thanks
Alexander Luman
Environmental Compliance Specialist
Minnesota Power/ALLETE Inc.
30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

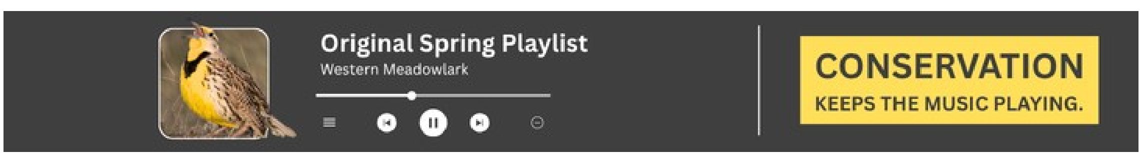
From: Mueller, Elisha K. <ekmueller@nd.gov>
Sent: Thursday, April 16, 2026 10:53 AM
To: Alex Luman (MP) <aluman@mnpower.com>
Subject: [EXTERNAL MAIL] PSC letter

Hi Alex,

Here is the letter that was submitted to the PSC. Let me know if there is anything else I can provide that might be helpful prior to the meeting on the 30th.

Elisha Mueller
Conservation Biologist

(701) 328-6348 • ekmueller@nd.gov • gf.nd.gov



NORTH Dakota | Game and Fish
Be Legendary.

USFWS, NDGFD, NDDA, WEST, and Minnesota Power – Longspur Wind Project Introduction

Attendees:

NDGFD:	Bruce Kreft, Elisha Mueller, Patrick Isakson
WEST:	Martin Piorkowski, Nicholas O'Neil
Merjent:	Mandy Bohnenblust
MN Power/ALLETE:	Alex Luman, Mitchell Bettenhausen, John Hollingsworth

Location: Teams Meeting (Virtual)
Date/Time: February 2, 2026; 2:30 – 3:30 PM (CST)

Summary of Meeting:

Reintroducing the Project. An invitation was sent to US Fish and Wildlife Service (USFWS) but they were unable to attend due to new guidance/regulations on reviewing Wind Projects. Additionally, an invitation was extended to North Dakota Department of Agriculture (NDDA); however, there were scheduling conflicts that prohibited their attendance and Minnesota Power could not reschedule due to internal scheduling conflicts.

The objectives of this meeting were to reintroduce the Longspur Wind Project (Project) in Morton County, North Dakota to the wildlife agencies and to provide a review of the Project following the USFWS tiered approach (Tiers 1-4) described in the Wind Energy Guidelines including: survey result summaries from completed studies, best management practices and implementation of conservation measures at Project, and a post-construction monitoring study in anticipation to site permitting.

Project Overview and Timeline (A. Luman)

- MN Power provided an overview of their existing presence with Bison Wind. MN Power also provided details for the currently proposed Longspur Wind Project including number of turbines, collection design, and transmission line location that the Project proposes. MN Power provided an overview of the Project timeline with NDGFD and explained that the Project received permits from the Mercer and Morton counties in late 2025 and filed for permitting with the North Dakota Public Service Commission (NDPSC) on December 30th, 2025 and into early 2026. Targeted construction is anticipated in Q2 of 2026 with commercial operations beginning in Q4 2027.

Previous Study Review (M. Piorkowski)

- WEST acknowledged the USFWS Wind Energy Guidance Framework and the NDGFD Wind Energy Development Best Management Practices (BMPs) and how it has been applied to the Project through the various wildlife studies.

- Tier 1/Tier 2 surveys – Landcover/land use types, land ownership, species of concern (Federal and North Dakota SGCN).

- Tier 3 studies – Whooping crane stopover habitat assessment, avian use surveys (results from Year 1; Year 2 in progress), raptor nest surveys (2 years of surveys following USFWS Region 6 guidance for eagles; no development within USFWS recommended buffers of eagle nests), grassland habitat assessment (no proposed turbines on unbroken grassland), sharp-tailed grouse surveys following guidance from NDGFD (no leks within 1-mi), Dakota skipper larval habitat assessment (no Project infrastructure intersecting DASK larval habitat), northern long-eared bat habitat assessment (13 acres of potentially suitable habitat within the Project Area), NLEB presence, probable absence surveys (USFWS-approved study design; no NLEB captured), bat acoustic activity surveys (no NLEB passes confirmed, relatively low activity observed),

- Wildlife Conservation Strategy – draft is complete and will be updated with wildlife agency input or as additional information becomes available. Conservation measures discussed as described in WCS.

- NDDA Voluntary Conservation Offsets – NDDA signed MOU January 20, 2026, for approximately 64.8 acres of permanently impacted habitat for a 35-year easement.

<u>Future Studies (M. Piorkowski)</u>

- Tier 4: Post-construction Study – Impacts to birds and bats at the Project are expected to be similar to other projects in the area. Twelve months of PCM will occur at the Project to document species composition and estimate avian and bat fatality ranges.

<u>NDGFD Pre-Project Letter (A. Luman)</u>

- A. Luman reviewed the major topics relayed in a letter provided by NDGFD and included sharp-tailed grouse, bat acoustic surveys, whooping crane stopover habitat assessment, and eagle nest surveys. A. Luman mentioned that MN Power proposes not to have a second year of bat acoustical surveys due to the limited NLEB habitat, low activity during acoustical survey and that no bats were captured during presence/absence survey. No other discussion was had on these topics.

<u>Timeline and Next Steps (A. Luman)</u>

- Working with NDGFD on WCS strategies
- Complete avian use study
- Finalize noxious weed management plan with Morton/Mercer counties
- Complete NDPSC permitting

<u>Additional Discussions</u>

- E. Muller asked if an impact assessment (avian offset model) was done for the Project or would be provided as outlined in the NDGFD BMPs and Shaffer and Buhl 2016. Indicated they would still be running the grassland impact analysis to be included in their letter to

PSC site permitting. E. Muller requested a Project layout for their purpose of running the impact analysis. A. Luman and M. Piorkowski responded that the avian offset analysis was not intended to be formalized at this time as the Project used the NDDA Decision Analysis Tool (DAT) to discuss voluntary environmental offset contributions with NDDA. MN Power will provide a Project layout with the meeting notes. MN Power will also provide the NDGFD with a memorandum outlining the avian offset model results using Project-specific, field validated grassland data.

- E. Muller asked for clarification on 64.8 acres of permanently impacted habitat despite no turbines on grassland habitats (one turbine is located on broken grasslands). P. Isakson asked for a brief summary of the NDDA model and M. Piorkowski provided a brief description of the inputs used in the NDDA DAT including number of turbines, location within the State, distribution within the NDGFD “key native wildlife and habitat areas”.
- E. Muller identified that they recommended turbines in nesting habitat be sited two miles or further away from leks and asked how many leks were within two miles of the one turbine in the broken grassland habitat. M. Piorkowski stated that no other leks were within two miles. **(CORRECTED from previous notes)** A shift in the grassland status removed the only turbine sited within nesting habitat. This change in status ensures that no turbines are sited in nesting habitat within two miles of a Lek. After further coordination with the project team and the landowner, we confirmed that this area is planted with alfalfa and is regularly hayed.
- E. Muller asked if project would be using a buffer to avoid DASK habitat and possible distance of infrastructure to nearest potentially suitable DASK habitat. M. Piorkowski discussed previous USFWS guidance, requesting avoiding habitat, not requiring a specific buffer.
- E. Muller asked for a reminder on proposed infrastructure being developed and whether transmission line being developed would be marked with bird flight diverters. A. Luman stated that they would follow all APLIC standards but would need to follow-up on the installation of bird flight diverters specifically.
- E. Muller asked for reminder on when project was submitted to NDPSC for permitting (January 30, 2026) **(Corrected from previous notes)** The Project submitted it’s application on December 30, 2025.

Schedule/Action Items

- MN Power to send Project layout to NDGFD. - Completed
- MN Power to provide meeting notes to all attendees. - Completed
- MN Power to review APLIC Standards on including Bird Flight Diverters. - Completed
- MN Power to provide a memorandum on grasslands. - Completed

Alex Luman (MP)

From:	Bialke, Joseph P. <bialkej@nd.gov>
Sent:	Thursday, October 30, 2025 2:25 PM
To:	Alex Luman (MP)
Cc:	Miller, Adam M.; Mitchell Bettenhausen (ACE); Drew Janke (MP); Kevin Shelley
Subject:	[EXTERNAL MAIL] Grassland Compensatory Mitigation for Longspur Wind Project - Teams call tomorrow afternoon (Friday) at 2:00 pm - October 31
Attachments:	Mitigation Progam Statutes (effective March 27, 2025).pdf; mitigation fund admin rules - eff 7.1.24.pdf; NDDA working lands mitigation program conservation easement_deed (8.21.2025).pdf; BADGER - ND Dept of Ag MOU (Grassland and Wetland Impact).docx; Letter to PSC.pdf; NDDA - Badger Wind MOU dtd 2.29.24_MDC_Final.pdf; Letter to PSC Commissioner Christmann, dtd 12.29.23 re Oliver Wind IV Project.pdf; NDDA-Oliver Wind IV MOU (Final).pdf; Longspur Wind Project Notice - North Dakota Department of Agriculture Mitigation Program
Importance:	High
Follow Up Flag:	Follow up
Flag Status:	Completed

Alex

Thanks for the below email and our congenial phone conversation this morning.

As discussed, we welcome your interest in the North Dakota Department of Agriculture (NDDA) Working Lands Mitigation Program.

Additionally, thank you for your verbal open public records request to the NDDA. I am responding back to you on behalf of NDDA.

In your open public records request, you requested, in summary:

- a template document/MoU examples related to recent program participation of wind power energy companies in the NDDA Working Lands Mitigation Program

Attached are documents responsive to your request. Any charges or fees associated with NDDA responding to this request for open public records are waived.

For your additional reference, I have also attached corresponding letters from Agriculture Commissioner Goehring to the ND Public Service Commission in relation to the Badger and Oliver Wind Projects, as well as relevant ND statutes and administrative rules. I also attached a word document of a previous finalized MOU.

Moreover, earlier this year the Legislature granted the Agriculture Commissioner the authority to purchase and hold easements on behalf the State (see attached applicable mitigation program ND statutes). Additionally, we are in the process of amending our administration rules accordingly. We'd be happy to discuss these potential administrative rule amendments with you.

We have also created a sample draft conservation easement template (attached). We strived to make it concise, straightforward, and easy to understand – with an emphasis on continuing working lands.

Additionally, we extended our consulting services contract with West Eco Systems Technology through current fiscal biennium. West will be able to provide us technical expertise as we continue to develop and implement our program. I've cc'ed Kevin Shelly from West on this email. We hope he can be on the call tomorrow afternoon.

Now that the Agriculture Commissioner has statutory authority to purchase and hold conservation easements, beginning in the Spring, 2026, we intend to locate, negotiate, and purchase a number of long-term conservation easements in and around North Dakota (using funds from the Mitigation fund you have indicated you wish to contribute to). As you know, these conservation easements are to be limited in duration to the life of the energy facility, as close to the energy facility as feasibly possible, be working lands conservation easements, and, as appropriate, be similar habitat (i.e., grasslands to grasslands, wetlands to wetlands).

In relation to your specific project, if you happen to know of any landowners in the areas of Morton and Mercer counties who might have land suitable for a working lands conservation easement, we are absolutely open to making contact with them – either later on this winter or early next spring.

Thank you and I look forward to chatting with you tomorrow (Friday) afternoon at 2:00 pm.

All the best,

Dutch

J.P. "Dutch" Bialke
General Counsel/Senior Policy Advisor
Special Assistant Attorney General
ND Department of Agriculture
600 E. Boulevard Ave. Dept. 602 | Bismarck, ND 58505
P: 701.328.1496 | F: 701.328.4567
bialkej@nd.gov | www.ndda.nd.gov

From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Wednesday, October 29, 2025 8:35 PM
To: Bialke, Joseph P. <bialkej@nd.gov>
Cc: Miller, Adam M. <admmiller@nd.gov>; -Info-DOA Energy Reclamation <energyreclamation@nd.gov>; Mitchell Bettenhausen (ACE) <mbettenhausen@alletecleanenergy.com>
Subject: RE: [EXTERNAL MAIL] RE: Request for Meeting ? Grassland Compensatory Mitigation for Longspur Wind Project

Hello Dutch,

Apologies I was away from the office and have been having issues with my cell phone so your call might have not gone through.

I think teams would be the best option for this. I have provided times for the next week. Please let me know if any of these times work.

Thursday 30th: 2pm-2:30
Friday 31st: 2pm-2:30
Monday 3rd 11am-12, 3:30-4
Tuesday 4th: 9:30am-10, 3:30-4
Thursday 6th : 11am-12, 3:30-4

Thank you,
Alexander Luman
Environmental Compliance Specialist I
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796
Office 218-355-3029

From: Bialke, Joseph P. <bialkej@nd.gov>
Sent: Tuesday, October 28, 2025 3:01 PM
To: Alex Luman (MP) <aluman@mnpower.com>
Cc: Miller, Adam M. <admmiller@nd.gov>; -Info-DOA Energy Reclamation <energyreclamation@nd.gov>; Mitchell Bettenhausen (ACE) <mbettenhausen@alletecleanenergy.com>
Subject: [EXTERNAL MAIL] RE: Request for Meeting ? Grassland Compensatory Mitigation for Longspur Wind Project

Happy Cyber Security Awareness Month! Continue to be 'Cyber Smart' by thinking twice before you click links, download attachments, or reply with personal information unless you recognize the sender and know the content is safe.

Alex

I tried calling you on your provided phone numbers, but was only able to leave you a quick voice message.

Thank you for your detailed email. Yes, we'd like to work with you.

Please let me know a time to call, or feel free to call me at my below phone number.

Also, if you wish, we could meet on teams or in person.

All the best,

Dutch

J.P. "Dutch" Bialke
General Counsel/Senior Policy Advisor
Special Assistant Attorney General
ND Department of Agriculture
600 E. Boulevard Ave. Dept. 602 | Bismarck, ND 58505
P: 701.328.1496 | F: 701.328.4567
bialkej@nd.gov | www.ndda.nd.gov

From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Monday, October 27, 2025 2:51 PM
To: -Info-DOA Energy Reclamation <energyreclamation@nd.gov>
Cc: Mitchell Bettenhausen (ACE) <mbettenhausen@alletecleanenergy.com>
Subject: Request for Meeting ? Grassland Compensatory Mitigation for Longspur Wind Project

You don't often get email from aluman@mnpower.com. Learn why this is important

***** **CAUTION:** This email originated from an outside source. Do not click links or open attachments unless you know they are safe. *****

Good morning to Whom it May Concern,

My name is Alex Luman, and I'm an Environmental Compliance Specialist with ALLETE, Inc. We are currently working on the Longspur Wind project located in Morton County, North Dakota. As part of our commitment to responsible development and habitat stewardship, we are seeking to engage with the North Dakota Department of Agriculture to discuss compensatory mitigation strategies for impacts associated with wind infrastructure. We have finalized expected turbine impacts and have provided below our summary of mitigation.

Project Summary Report

Wind Project Design & Compensatory Mitigation Cost

North Dakota Working Lands Mitigation Fund

Wind Project Name:	Longspur Wind	Report Date:	
Developer:	Minnesota Power	Expected PSC Filing Date:	
Company PM:	Alex Luman, Mitchell Bettenhausen	Consultant PM:	

PROJECT DESIGN & SITING SUMMARY

Item		Item	
County/Counties	Morton	# Turbines: Developed	
ND Region	SW	#Turbines: Mixed	
Project Capacity	202.5	# Turbines: Natural	
# Turbines	45	# Turbines: Unbroken	
MW per Turbine	4.50		

WIND PROJECT IMPACTS & COMPENSATORY MITIGATION PROJECT(S) DESIGN

Wind Project Impacts		Compensatory Mitigation Des	
Total Footprint: ac	64.80	Land Cover Cost Basis	
Footprint: ac/turbine	1.44	Easement % Cost Basis	
Footprint: ac/mw	0.32	Mitigation Method	
Environmental Debits	83.52	Habitat Mitigation Goal*	

SUGGESTED CONTRIBUTION TO COVER PROJECTED COST OF COMPENSATORY MITIGATION

Item		Item	
Mitigation of Similar Habitat		Mitigation of Dissimilar Habit	
Projected Cost :	$146,678	Projected Cost:	

*Cost increase associated with dissimilar, low
habitat

We would appreciate the opportunity to meet with a member of your team to explore mitigation options and ensure alignment with state expectations and best practices. To support this discussion, we've attached maps outlining the current and proposed infrastructure for the Longspur Project.

Please let us know your availability for a meeting in the coming weeks. We are happy to accommodate your schedule and can meet virtually or in person as appropriate.

Thank you for your time and consideration. We look forward to collaborating with you on this important matter.

Thank you,

Alexander Luman
Environmental Compliance Specialist I
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796
Office 218-355-3029

Alex Luman (MP)

From: Alex Luman (MP)
Sent: Monday, March 16, 2026 3:42 PM
To: 'Bialke, Joseph P.'
Cc: Miller, Adam M.; Mitchell Bettenhausen (ACE)
Subject: RE: [EXTERNAL MAIL] MOU signed by ND Agriculture Commissioner Goehring - Grassland Compensatory Mitigation for Longspur Wind Project
Attachments: Notice of Filing and Notice of Hearing.pdf; T-3 Grassland Shift.pdf

Hello Dutch,

I wanted to update you on the Longspur Project. The PSC finalized our hearing date and that will be on the 18th of May, please see the attachment for more details. One additional detail for the project is a change in one grassland status. Previously the project had sited one turbine on broken grassland, after further coordination with the project team and the landowner, we confirmed that this area is planted with alfalfa and is regularly hayed, we are reclassifying this grassland as cropland.

I've attached the 2025 USDA report from the landowner showing the area classified as cropland and regularly hayed for your reference. Any comments or questions? We are not looking to change the mitigation just wanted to share this update of reducing environmental impact.

Thank you,
Alexander Luman
Environmental Compliance Specialist
Minnesota Power/ALLETE Inc.
30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Bialke, Joseph P. <bialkej@nd.gov>
Sent: Wednesday, January 21, 2026 2:56 PM
To: Alex Luman (MP) <aluman@mnpower.com>
Cc: Miller, Adam M. <admmiller@nd.gov>; Mitchell Bettenhausen (ACE) <mbettenhausen@alletecleanenergy.com>
Subject: RE: [EXTERNAL MAIL] MOU signed by ND Agriculture Commissioner Goehring - Grassland Compensatory Mitigation for Longspur Wind Project

Alex

Thanks for our congenial and professional conversation this afternoon. Always great to talk with you.

As we discussed, at the end of paragraph 10 of the MOU, it has a typo in which it says both "(Seventy-five thousand dollars" and "**($115,000)**". As we further discussed, it was intended to read "(one hundred fifteen thousand dollars **($115,000)**)"

Given that paragraph 10 earlier says that Longspur will transfer to the fund a minimum of 50% of the total voluntary contribution as stated in para 7 (total of which is $230,000 – 50% of which would be $115,000), and that in paragraph 11, it says that Longspur may make other payments as voluntary contributions at other times, the typo does not appear to change the intent or overall import of the MOU, as per the mutual understanding of the parties.

Please email me back and confirm that you concur with the above understanding that, pursuant to the MOU, Longspur will still make two contributions to the fund, $115K at milestone 1 and $115K at milestone 2, totaling $230K. Upon your email concurrence, no further action would be required.

Many thanks and I look forward to hearing from you.

All the best,

Dutch

J.P. "Dutch" Bialke
General Counsel/Senior Policy Advisor
Special Assistant Attorney General
ND Department of Agriculture
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P: 701.328.1496 | F: 701.328.4567
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From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Tuesday, January 20, 2026 4:33 PM
To: Bialke, Joseph P. <bialkej@nd.gov>
Cc: Miller, Adam M. <admmiller@nd.gov>; Kevin Shelley <kshelley@west-inc.com>; Mitchell Bettenhausen (ACE) <mbettenhausen@alletecleanenergy.com>
Subject: RE: [EXTERNAL MAIL] MOU signed by ND Agriculture Commissioner Goehring - Grassland Compensatory Mitigation for Longspur Wind Project

Hello Dutch,

Thank you very much for your help throughout this process. Minnesota Power appreciates the opportunity to be able to support North Dakota in addition to providing excellent projects. Milestone one, which will be the first payment Minnesota Power estimates to be at the end of quarter two and possibly into quarter three of 2026. As we get closer to that time period I will reach out to connect on the payment process, confirm status of project, and simply connect.

Please see the attached signed MOU from Minnesota Power. Is there any formal letter or document that comes out of this for state filing?

Have a great rest of your day,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Bialke, Joseph P. <bialkej@nd.gov>
Sent: Tuesday, January 20, 2026 3:52 PM
To: Alex Luman (MP) <aluman@mnpower.com>
Cc: Miller, Adam M. <admmiller@nd.gov>; Kevin Shelley <kshelley@west-inc.com>; Mitchell Bettenhausen (ACE) <mbettenhausen@alletecleanenergy.com>
Subject: [EXTERNAL MAIL] MOU signed by ND Agriculture Commissioner Goehring - Grassland Compensatory Mitigation for Longspur Wind Project
Importance: High

Alex

Thanks for your patience!

Commissioner Goehring approved and signed the MOU this afternoon, without any further changes. Attached is the signed MOU.

Please have Director Anderson (or someone else authorized by Minnesota Power) sign the attached MOU. Then return the MOU, now signed by both parties, back to me.

The MOU is effective once signed by both parties.

Thank you for your professional collaboration on this mitigation agreement. Looking forward to continuing to work with you as the Longspur Wind Project progresses.

All the best,

Dutch

J.P. "Dutch" Bialke
General Counsel/Senior Policy Advisor
Special Assistant Attorney General
ND Department of Agriculture
600 E. Boulevard Ave. Dept. 602 | Bismarck, ND 58505
P: 701.328.1496 | F: 701.328.4567
bialkej@nd.gov | www.ndda.nd.gov

From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Friday, January 16, 2026 12:35 PM
To: Bialke, Joseph P. <bialkej@nd.gov>
Cc: Miller, Adam M. <admmiller@nd.gov>; Kevin Shelley <kshelley@west-inc.com>; Mitchell Bettenhausen (ACE) <mbettenhausen@alletecleanenergy.com>
Subject: RE: [EXTERNAL MAIL] FW: Grassland Compensatory Mitigation for Longspur Wind Project

***** **CAUTION:** This email originated from an outside source. Do not click links or open attachments unless you know they are safe. *****

Hello Dutch,

Thank you for providing the updated MOU, as discussed over the phone the only revision is the signatory from Minnesota Power. Please let me know if you have any questions.

Have a great rest of your day and weekend,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Bialke, Joseph P. <bialkej@nd.gov>
Sent: Friday, January 16, 2026 10:32 AM
To: Alex Luman (MP) <aluman@mnpower.com>
Cc: Miller, Adam M. <admmiller@nd.gov>; Kevin Shelley <kshelley@west-inc.com>; Mitchell Bettenhausen (ACE) <mbettenhausen@alletecleanenergy.com>
Subject: [EXTERNAL MAIL] FW: Grassland Compensatory Mitigation for Longspur Wind Project

Alex

Good talking with you this morning. Attached is the updated draft proposed MOU, with minor edits we discussed.

Please give it a final review before I present it to Agriculture Commissioner Goehring.

All the best,

Dutch

J.P. "Dutch" Bialke
General Counsel/Senior Policy Advisor
Special Assistant Attorney General
ND Department of Agriculture
600 E. Boulevard Ave. Dept. 602 | Bismarck, ND 58505
P: 701.328.1496 | F: 701.328.4567
bialkej@nd.gov | www.ndda.nd.gov

From: Alex Luman (MP) <aluman@mnpower.com>
Sent: Wednesday, December 10, 2025 9:47 AM
To: Bialke, Joseph P. <bialkej@nd.gov>
Cc: Miller, Adam M. <admmiller@nd.gov>; Kevin Shelley <kshelley@west-inc.com>; Mitchell Bettenhausen (ACE) <mbettenhausen@alletecleanenergy.com>
Subject: Grassland Compensatory Mitigation for Longspur Wind Project

***** **CAUTION:** This email originated from an outside source. Do not click links or open attachments unless you know they are safe. *****

Good morning Dutch,

Minnesota Power has been reevaluating its donation, last time we talked it was going to be an approximate $150,000 donation through the conserve method, now Minnesota Power is looking to donate approximately $230,000 through the enhance measure. We have been updating our Memorandum of Understanding to reflect the change and wanted to provide it to you for any final edits you may have. Please see the attached MOU for your review.

Thank you,
Alexander Luman
Environmental Compliance Specialist
ALLETE Inc. 30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796
Office 218-355-3029

Alex Luman (MP)

From:	Bialke, Joseph P. <bialkej@nd.gov>
Sent:	Thursday, April 2, 2026 4:05 PM
To:	Kreft, Bruce L.
Cc:	Goehring, Doug C.; Williams, Jeb R.; Bodine, Thomas H.; Miller, Adam M.; Alex Luman (MP); Kevin Shelley; Reinke, Jody L.
Subject:	[EXTERNAL MAIL] RE: Longspur Impact Analysis
Attachments:	Notice of Filing and Notice of Hearing.pdf; Longspur_Avian_Offset_Model_2.12.2026.pdf; Longspur Wind Summary Report.xlsx
Importance:	High
Follow Up Flag:	Follow up
Flag Status:	Completed

Bruce

I spoke with Commissioner Goehring. He'll meet with you in relation to Longspur mitigation.

It may be beneficial for representatives from Longspur and West to also attend the meeting, to provide input as necessary.

The meeting probably won't occur until towards the end of the month though, due to the Commissioner's schedule and given that the PSC hearing isn't until May 18.

I understand that Longspur has already provided you their offset model and wind summary report – but I've attached them again, just in case you don't have copies.

Please let me know if you need anything else.

All the best,

Dutch

J.P. "Dutch" Bialke
General Counsel/Senior Policy Advisor
Special Assistant Attorney General
ND Department of Agriculture

600 E. Boulevard Ave. Dept. 602 | Bismarck, ND 58505
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bialkej@nd.gov | www.ndda.nd.gov

Alex Luman (MP)

From: Alex Luman (MP)
Sent: Tuesday, April 14, 2026 4:37 PM
To: 'Bialke, Joseph P.'; Kreft, Bruce L.; Kevin Shelley
Cc: Goehring, Doug C.; Williams, Jeb R.; Bodine, Thomas H.; Miller, Adam M.; Reinke, Jody L.; Mitchell Bettenhausen (ACE); Martin Piorkowski
Subject: RE: [EXTERNAL MAIL] Longspur Wind mitigation mtg - Thurs, April 30, 2026, at 11:00 am, Capitol Building, 6th Floor Conf Rm

Hello Dutch,

Thank you for confirming the meeting date, time, and location. Minnesota Power will attend in person.

At this time, I believe all materials relevant to the Longspur Wind mitigation discussion have been provided to the participating departments. However, if there are any documents the group would like reviewed in advance of the meeting, please let me know and I would be happy to circulate them.

We appreciate the coordination and look forward to the discussion.

Have a great rest of your day,
Alexander Luman
Environmental Compliance Specialist
Minnesota Power/ALLETE Inc.
30 West Superior Street
Duluth, MN 55802
Cell 218-481-2796

From: Bialke, Joseph P. <bialkej@nd.gov>
Sent: Tuesday, April 14, 2026 10:45 AM
To: Kreft, Bruce L. <bkreft@nd.gov>; Alex Luman (MP) <aluman@mnpower.com>; Kevin Shelley <kshelley@west-inc.com>
Cc: Goehring, Doug C. <goehring@nd.gov>; Williams, Jeb R. <jwilliam@nd.gov>; Bodine, Thomas H. <tbodine@nd.gov>; Miller, Adam M. <admmiller@nd.gov>; Reinke, Jody L. <jodyreinke@nd.gov>
Subject: [EXTERNAL MAIL] Longspur Wind mitigation mtg - Thurs, April 30, 2026, at 11:00 am, Capitol Building, 6th Floor Conf Rm

Bruce/Alex/Kevin

The meeting regarding mitigation relating to the Longspur Wind Energy Project is scheduled for Thursday, April 30, 2026, at 11:00 am, Capitol Building, 6th Floor Conference Room.

Thank you for your patience. I'll be sending out a calendar invite later today.

Please let me know if you have any questions or need any further information.

All the best,

Dutch

J.P. "Dutch" Bialke
General Counsel/Senior Policy Advisor
Special Assistant Attorney General
ND Department of Agriculture
600 E. Boulevard Ave. Dept. 602 | Bismarck, ND 58505
P: 701.328.1496 | F: 701.328.4567
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From: Bialke, Joseph P.
Sent: Thursday, April 2, 2026 4:05 PM
To: Kreft, Bruce L. <bkreft@nd.gov>
Cc: Goehring, Doug C. <goehring@nd.gov>; Williams, Jeb R. <jwilliam@nd.gov>; Bodine, Thomas H. <tbodine@nd.gov>; Miller, Adam M. <admmiller@nd.gov>; Alex Luman (MP) <aluman@mnpower.com>; Kevin Shelley <kshelley@west-inc.com>; Reinke, Jody L. <jodyreinke@nd.gov>
Subject: RE: Longspur Impact Analysis
Importance: High

Bruce

I spoke with Commissioner Goehring. He'll meet with you in relation to Longspur mitigation.

It may be beneficial for representatives from Longspur and West to also attend the meeting, to provide input as necessary.

The meeting probably won't occur until towards the end of the month though, due to the Commissioner's schedule and given that the PSC hearing isn't until May 18.

I understand that Longspur has already provided you their offset model and wind summary report – but I've attached them again, just in case you don't have copies.

Please let me know if you need anything else.

All the best,

Dutch

J.P. "Dutch" Bialke
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bialkej@nd.gov | www.ndda.nd.gov

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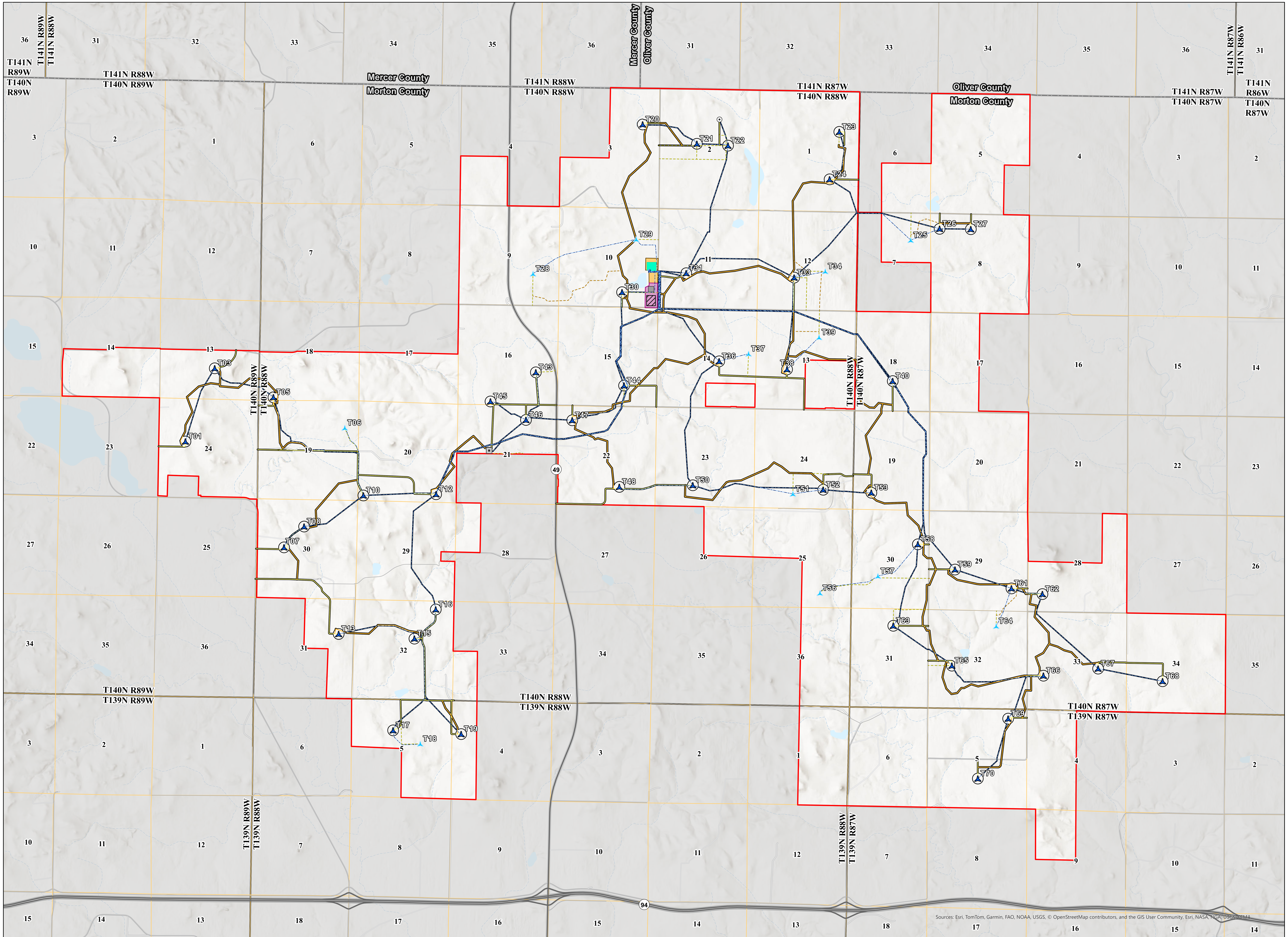
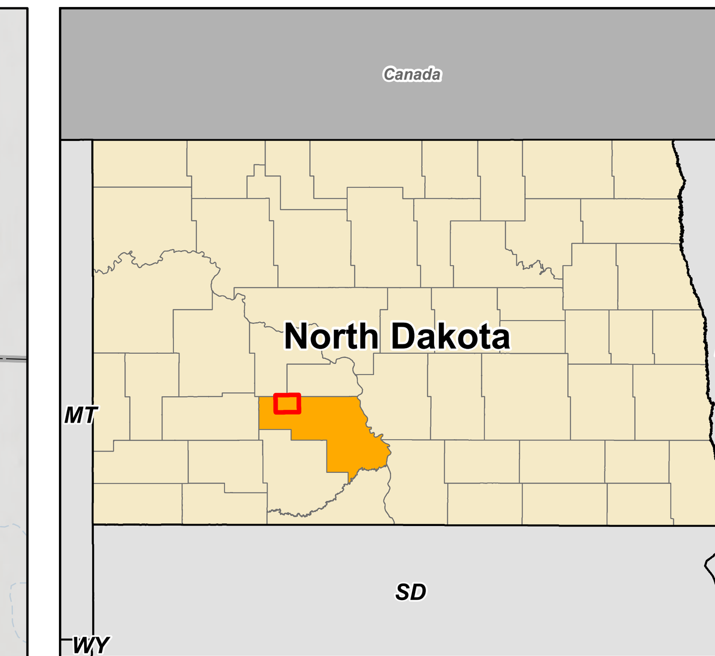
Attachment G

Revised Project Figures

The updates to this Figure are a revision of the Wind Project boundary made in response to a request from a landowner and a change to clarify a location where Wind Project infrastructure (a collection line) is anticipated to cross from one portion of the Project Boundary to another along a public road right-of-way.





0 2,000 4,000 Feet

N E S W

- Met Tower
- Primary Turbine
- Alternate Turbine
- ADLS Radar Tower
- Collection Line
- Primary Crane Path
- Alternate Crane Path
- Primary Access Road
- Alternate Access Road
- Construction Laydown Yard
- O&M Building
- O&M Yard
- Substation Yard
- Substation Facility
- Construction Easement
- Project Area
- PLSS Section Boundary
- PLSS Township Boundary
- County Boundary

Longspur Wind Energy Center

Morton County, North Dakota

minnesota power
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merjent
For Environmental Review Purposes Only

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Attachment H

Residence Survey Memo

AN ALLETE COMPANY

Longspur conducted a receptor survey for adhering to setbacks and requirements. Longspur is providing the strategy, methods, and reasoning for the determinations.

merjent.

MEMO

Date:

January 28, 2026

To:

Alex Luman, Minnesota Power

From:

Mandy Bohnenblust, Merjent, Inc.

Subject:

Residence Survey Memo
Longspur Wind Energy Project

Minnesota Power is proposing the Longspur Wind Project in Morton and Mercer Counties, North Dakota (Project).

The North Dakota Public Service Commission (ND PSC) requires distance and sound-level setbacks from occupied residences. To identify occupied residences within one-mile of the Project Boundary, Merjent Inc. (Merjent) used a variety of desktop review methods to analyze potential receptors within the Project boundary plus a one-mile buffer (Survey Area). Each receptor was identified initially via a desktop review using aerial imagery, Google Street View (if available), Google Earth, USA Structures Database (FEMA) and any other available sources such as plats or county parcel data. The desktop assessment identified 409 receptors, which were field verified.

Following the desktop review, Merjent conducted a field survey in September and October 2024 to document potential receptors within the Survey Area. The field survey included a visit to each potential receptor identified during the desktop analysis and included a review of roads within the Survey Area for potential receptors not identified during the desktop analysis. The visit to each potential receptor was conducted via public roads using a variety of tools to view the structure or site including the use of binoculars and different vantage points. Receptor data was reviewed and collected using a handheld GPS device to record and document receptor data including notes on if the receptor is "occupied," "unoccupied," or "undetermined." Notes were collected for receptors that were documented as "occupied" and "undetermined" to indicate if the structure is a one-story or two-story building. Structures were further categorized as residences, schools, church, or other.

Of the 417 receptors, 36 were occupied, 243 were unoccupied, and 93 were presumed occupied. 28 receptors with an undetermined occupancy status, land agents assisted with occupancy determination. Merjent did not contact any landowners as part of this task. Seventeen receptors had limited visibility due to obstructions such as trees, barns, or topography and were assumed to be potentially occupied.

Minnesota Power staff conducted a follow-up review of receptors with an "undetermined" occupancy status during October 2025. This review included direct communication with landowners to clarify whether structures were occupied or unoccupied. Landowners confirmed the use of each building, and Minnesota Power staff documented and signed off on the updated occupancy status. Several receptors were reclassified after determining that the structures were agricultural buildings, such as grain bins, or other outbuildings located at a substantial distance from any residence and therefore did not meet the criteria for an occupied receptor.

AN ALLETE COMPANY

Attachment I

Sound Study

minnesota power
AN ALLETE COMPANY

Longspur updated the sound report included in the Wind Project Application at Appendixes B3. The updates do not change the data reported; sound (dba) remain unchanged. The changes are limited to correcting labeling of receptors.

BURNS McDONNELL

MINNESOTA POWER

Sound Study

Longspur Wind

PROJECT NO. 154125

REVISION 3

APRIL 30, 2026

Contents

Tables

List of Abbreviations

Abbreviation	Term/Phrase/Name
ACP	American Clean Power Association
ANSI	American National Standards Institute
CadnaA	Computer Aided Noise Abatement
dB	decibel
dBA	A-weighted decibels
DEM	Digital Elevation Model
Developer	Minnesota Power
Hz	hertz
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
L_{90}	90th-percentile exceedance sound level
L_{eq}	equivalent-continuous sound level
MW	megawatt
Project	Longspur Wind Project
PWL	sound power level
SO	Sound Optimized
SPL	sound pressure level
Study	sound study for the proposed Longspur Wind Project
USGS	U.S. Geological Survey
WTG	Wind Turbine Generator

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1.0 Introduction

1.1 Study Overview

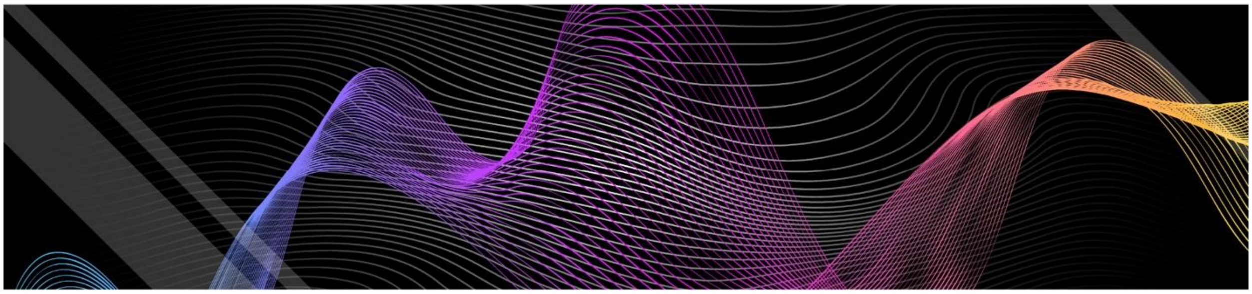
Burns & McDonnell was retained by Minnesota Power, a division of ALLETE, Inc. ("Minnesota Power") to conduct a sound study (the "Study") for the proposed Longspur Wind Project (the "Project"). The objectives of the Study were to identify applicable sound regulations and model Project-generated sound level impacts on neighboring occupied residences.

1.2 Project Overview

The proposed Project will be located in Morton County, North Dakota, approximately five (5) miles north of the city of Glen Ullin. The Project will include a quantity of up to 45 Vestas V163-4.5 wind turbine generators ("WTG") at a 113-meter hub height with an aggregate nameplate capacity of approximately 202.5 megawatts ("MW").

For purposes of this Study, a total of 57 turbine positions were evaluated (including 12 alternates), although only up to 45 turbines are expected to be installed. All 12 alternate turbines were modeled as the V163-4.5 turbine model. Some of the turbines were applied sound optimized ("SO") modes to limit noise impacts to residences near the Project. This mitigation strategy shows the Project would be able to meet the limits with any configuration of 45 WTGs at the 57 potential WTG positions. It should be noted that the SO mitigation may not be necessary for the final layout based on which turbine locations are ultimately selected to be built. A final noise model will be completed for the final layout to confirm compliance and the need for SO modes, if any.

Longspur Wind Project			
LOCATION	GENERATION	WIND TURBINES UP TO	TURBINE MODEL(S)
Morton County, North Dakota	**202.5 MW**	**45**	**V163-4.5**



2.0 Acoustic Terminology

The term “sound level” is often used to describe two different sound characteristics: sound power and sound pressure. Every source that produces sound has a sound power level (“PWL”). The PWL is the acoustic energy emitted by a sound source and is an absolute number that is not affected by the surrounding environment. The acoustic energy produced by a source propagates through media as pressure fluctuations. These pressure fluctuations, also called sound pressure levels (“SPL”), are what human ears hear and microphones measure.

Sound is physically characterized by amplitude and frequency. The amplitude of sound is measured in decibels (“dB”) as the logarithmic ratio of a sound pressure to a reference sound pressure (20 micropascals). The reference sound pressure corresponds to the typical threshold of human hearing. To the average listener, a 3-dB change in a continuous broadband sound is generally considered “just barely perceptible”; a 5-dB change is generally considered “clearly noticeable”; and a 10-dB change is generally considered a doubling (or halving, if the sound is decreasing) of the apparent loudness.

Sound waves can occur at many different wavelengths, also known as the frequency. Frequency is measured in hertz (“Hz”) and is the number of wave cycles per second that occur. The typical human ear can hear frequencies ranging from approximately 20 to 20,000 Hz. Normally, the human ear is most sensitive to sounds in the middle frequencies (1,000 to 8,000 Hz) and is less sensitive to sounds in the lower and higher frequencies. As such, the A-weighting scale was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighting scale emphasizes sounds in the middle frequencies and de-emphasizes sounds in the low and high frequencies. Any sound level to which the A-weighting scale has been applied is expressed in A-weighted decibels, or dBA. For reference, the A-weighted sound pressure level and subjective loudness associated with some common sound sources are listed in Table 2-1.

Sound in the environment is constantly fluctuating, as when a car drives by, a dog barks, or a plane passes overhead. Therefore, sound metrics have been developed to quantify fluctuating environmental sound levels. These metrics include the exceedance sound level. The exceedance sound level is the sound level exceeded during “x” percent of the sampling period and is also referred to as a statistical sound level. Common exceedance sound level values are the 10-, 50-,90-percentile exceedance sound levels, denoted by L_{10}, L_{50}, and L_{90}. The equivalent-continuous sound level (“L_{eq}”) is the arithmetic average of the varying sound over a given time period and is the most common metric used to describe sound.

Table 2-1: Typical Sound Pressure Levels Associated with Common Sound Sources

Sound Pressure Level (dBA)	Subjective Evaluation	Environment
140	Deafening	Jet aircraft at 75 feet
130	Threshold of pain	Jet aircraft during takeoff at a distance of 300 feet
120	Threshold of feeling	Elevated train
110	Very loud	Jet flyover at 1,000 feet
100		Motorcycle at 25 feet
90	Moderately loud	Propeller plane flyover at 1,000 feet
80		Diesel truck (40 mph) at 50 feet
70	Loud	B-757 cabin during flight
60	Moderate	Air-conditioner condenser at 15 feet
50	Quiet	Private Office
40		Farm field with light breeze, birdcalls
30	Very quiet	Quiet residential neighborhood
20		Rustling leaves
10	Just audible	--
0	Threshold of hearing	--

Sources:
(1) Adapted from *Architectural Acoustics*, *M. David Egan, 1988*
(2) *Architectural Graphic Standards*, Ramsey and Sleeper, 1994

3.0 Applicable Regulations

Federal, State, and county regulations and guidelines were reviewed to determine the applicable overall sound level limits for the Project.

3.1 State of North Dakota

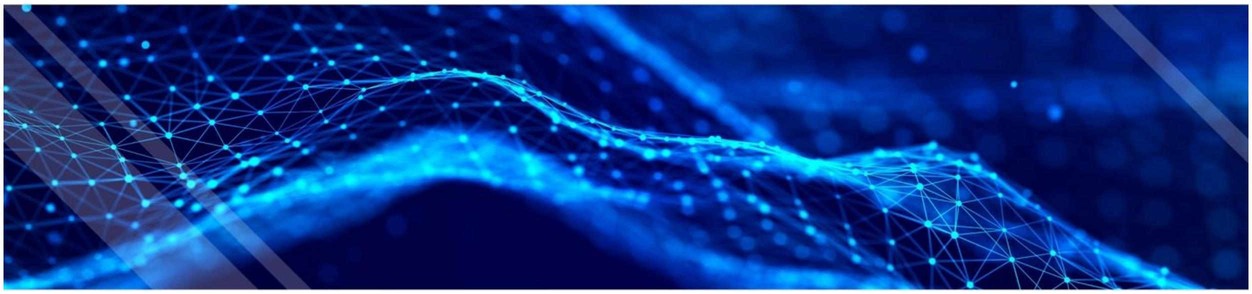
Chapter 69-06-08-01 in the North Dakota Public Service Commissions states, “A wind energy conversion facility site must not include a geographic area where, due to operation of the facility, the sound levels within one hundred feet of an inhabited residence or a community building will exceed forty-five dBA. The sound level avoidance area criteria may be waived in writing by the owner of the occupied residence or the community building”.

3.2 Morton County

Morton County Land Use Code Section 2-100(d)(6) states, “With the exception of temporary construction equipment, noises produced shall neither exceed 65 decibels between the hours of 7:00 am and 11:00 pm nor 60 decibels between the hours of 11:00 pm and 7:00 am, as measured at or beyond any of the property lines from which the noise is emanating.”.

3.3 Regulation Summary

The North Dakota Public Service Commissions are more restrictive than the county limits. Therefore, the Project will be compared to the State of North Dakota 45-dBA sound level limit at locations within one hundred feet of an inhabited residence. If sound levels are predicted to exceed the sound level limit, the sound level avoidance area criteria may be waived in writing by the owner of the occupied residence.



4.0 Modeling Parameters and Inputs

Industry-accepted sound modeling software, CadnaA (Version 2026, published by DataKustik, Ltd., Munich, Germany) was used to estimate expected sound levels from the Project. The model inputs and assumptions are described in this section.

4.1 Wind Turbine Sound Characteristics

The sound commonly associated with a wind turbine is described as a rhythmic "whoosh" caused by aerodynamic processes. This sound is created as air flow interacts with the surface of rotor blades. As air flows over the rotor blade, turbulent eddies form in the surface boundary layer and wake of the blade. These eddies are where most of the "whooshing" sound is formed. Additional sound is generated from vortex shedding produced by the tip of the rotor blade. Air flowing past the rotor tip creates alternating low-pressure vortices on the downstream side of the tip causing sound generation to occur. Older wind turbines, built with rotors which operate downwind of the tower (downwind turbines), often have higher aerodynamic impulse sound levels. This is caused by the interaction between the aerodynamic lift created on the rotor blades and the turbulent wake vortices produced by the tower. Modern wind turbine rotors are mostly built to operate upwind of the tower (upwind turbines). Upwind turbines are not impacted by wake vortices generated by the tower and, therefore, overall sound levels can be as much as 10 dBA less for similarly sized turbines. The rhythmic fluctuations of the overall sound level are less perceivable farther from the turbine. Additionally, multiple turbines operating at the same time will create the whooshing sound at different times. These non-synchronized sounds will blend together to create a more constant sound to an observer at most distances from the turbines. Another phenomenon that reduces perceivable noise from turbines is the wind itself. Higher wind speed produces noise that tends to mask (or drown out) the sounds created by wind turbines.

Advancement in wind turbine technology has reduced pure tonal emissions of modern wind turbines. Manufacturers have reduced distinct tonal sounds by reshaping turbine blades and adjusting the angle at which air contacts the blade. Pitching technology allows the angle of the blade to adjust when the maximum rotational speed is achieved, which allows the turbine to maintain a constant rotational velocity. Therefore, sound emission levels remain constant as the velocity remains the same.

Wind turbines can create noise in other ways as well. Wind turbines have a nacelle where the mechanical portions of the turbine are housed. The current generation of wind turbines use multiple techniques to reduce the noise from this portion of the turbine: vibration isolating mounts, special gears, and acoustic insulation. In general, all moving parts and the housing of the current generation wind turbines have been designed to minimize the noise they generate.

4.2 Model Inputs and Settings

The CadnaA program is a scaled, three-dimensional program that takes into account air absorption, terrain, ground absorption, and ground reflection for each piece of noise-emitting equipment and predicts downwind sound pressure levels. The model calculates sound propagation based on International Organization for Standardization ("ISO") 9613-2:2024, General Method of Calculation. ISO 9613, and therefore CadnaA, assesses the sound pressure levels based on the octave-band center-frequency range from 31.5 to 8,000 Hz. Predicted compliance with the regulations for all turbines operating implies predicted compliance for any combination of the turbines operating.

4.2.1 Project Layout

The Project layout includes up to 57 potential WTG locations. The predictive models for the Vestas V163-4.5 WTGs were completed using the proposed layout with all 57 WTGs modeled shown in Figure A-1 of Appendix A. The WTGs were modeled at a hub height of 113 meters with each serrated trailing edge blades included on each WTG. The turbine coordinates, turbine type, and hub height for each modeled WTG are listed in the tables provided in Appendix A.

4.2.2 Receptors

A quantity of 61 receptors were modeled surrounding the Project. The Developer-provided coordinates of each receptor are provided in Appendix B. Burns & McDonnell did not provide an independent verification of the location or occupied status of these receptors.

4.2.3 ANSI / ACP 111-1 (2022)

In an effort to standardize the calculation methodology for wind turbine sound levels, the American Clean Power Association ("ACP") developed a standard, recognized by the American National Standards Institute ("ANSI"), which outlines preferred modeling methods for predicting future sound levels from wind turbine generating projects. These methods, along with the wind turbine model-specific sound power levels (determined in accordance with International Electrotechnical Commission, IEC 61400-11), are to be used with ISO 9613 calculations and are expected to yield a conservative, worst-case condition with wind turbines operating at their highest rated sound power levels.

The standard, ACP 111-1-2022, provides two options for modeling parameters which are to be implemented into the modeling software/calculations. Both options are expected to yield nearly identical results, per the standard. The Option 1 modeling parameters were selected for this study and are shown in Table 4-1 below.

Table 4-1: ANSI / ACP 111-1 (2022) Modeling Parameters

Model Parameter	Value
Ground Factor (G)	0
Receptor Height	1.5 meters
Turbine Source Height	Vendor Provided Hub-height
Model Adjustments	None
Temperature	50 °F
Humidity	70%

4.2.4 Terrain and Vegetation

Terrain and attenuation from ground absorption and scattering can have a significant impact on sound transmission. U.S. Geological Survey ("USGS") Digital Elevation Model ("DEM") contours were imported into the model to account for topographic variations around the Project. The terrain around the proposed Project is mostly rural with minor changes in elevation.

4.2.5 Sound Propagation and Directivity

CadnaA calculates downwind sound propagation using ISO 9613 standards, which use omni-directional downwind sound propagation and worst-case directivity factors. In other words, the model assumes that each turbine propagates its maximum sound level in all directions at all times. This will likely over-predict upwind sound levels.

4.2.6 Sound Emission Data

Acoustic modeling was conducted for the Project using the expected loudest sound power levels for the Vestas V163-4.5 with serrated trailing edge blades. The sound emissions data was developed using the International Electrotechnical Commission ("IEC") 61400-11 acoustic measurement standards. IEC 61400-11 is used to determine the max sound power level of the overall turbine assembly. Overall sound power levels were provided by the manufacturer at various wind speeds. The expected sound power levels for the Vestas V163-4.5 are displayed in Table 4-2.

Table 4-2: Maximum Sound Power Levels

WTG Model	Octave Band Frequency (Hz) Sound Pressure Level (dBA)									Total Sound Level (dBA)
	31.5	63	125	250	500	1000	2000	4000	8000	
V163-4.5	76	88	96	100	101	100	96	90	81	106.3
V163-4.5 SO1	75	87	95	99	99	98	95	89	80	105.0
V163-4.5 SO2	73	85	93	97	98	97	94	87	78	103.5

(a) Overall sound levels are based on vendor-provided turbine data for the turbine. These levels are A-weighted octave-band sound levels with the inclusion of serrated trailing edge blades.

A point source located at the specific hub height of each proposed turbine location was used to model sound emissions from each of the wind turbines, per direction of ANSI / ACP 111-1. The sound levels shown in the table above were applied, as appropriate, to each point source. The proposed Project layout figure is provided in Appendix A, including the identified neighboring residences. Each residence was modeled as a receiver at a height of 1.5 meters (5.0 feet) above ground level.

4.3 Acoustic Modeling Results

Project-generated sound pressure levels were calculated for the identified receivers in the CadnaA noise modeling program using the manufacturer-specified sound power levels at each octave-band frequency and the assumptions listed above. Noise modeling results have been demonstrated in previous studies to conservatively approximate real-life measured noise from a source when extraneous noises are not present.

Sound level inputs and results at the nearest identified residential receptors are provided in tabular form in Appendix B. Any receptor within 1 dBA of the limit (45 dBA), was further analyzed to determine if sound levels at any location within 100 feet of the residence exceeded 45 dBA. The sound level contours for the Project WTGs are shown in Appendix C.

There were several residences identified that were predicted to exceed the 45-dBA limit within 100 feet of an inhabited residence with the standard turbine sound levels. In order to bring the Project into compliance with the North Dakota limits for the 57-turbine layout, SO operating modes were implemented on specific turbines to reduce noise impacts to these residential receptors. The turbines with SO operating modes are listed in Appendix A.

This mitigation strategy ensures the Project would be able to meet the sound level limits. However, mitigation may not be necessary for the final layout based on which turbines are ultimately selected to be built. A final noise model will be completed to demonstrate compliance for the final layout.

5.0 Conclusions

Burns & McDonnell conducted a sound study for the Longspur Wind Project. The sound study included identification of applicable sound regulations and predictive modeling to estimate sound levels in the surrounding community. A comparison to the North Dakota noise levels limit of 45 dBA was performed for compliance at the neighboring residential structures and within 100 feet of the residential structures.

The Project was modeled for Vestas V163-4.5 turbines. The Vestas turbines were modeled at a hub height of 113 meters for the 57 WTGs that could be installed. Sound pressure levels were predicted for the Project area using manufacturer-specified overall sound power levels for the wind turbines and guidance from the ANSI ACP 111-1 wind turbine modeling standard to provide the loudest predicted sound pressure levels from the modeled turbines to the neighboring identified residences.

The modeling results show the Project sound levels would meet North Dakota's requirement of 45 dBA within one hundred feet of an inhabited residence or community building for the Vestas V163-4.5 through the use of low-noise operating modes on two (2) WTGs. However, this mitigation may not be necessary for the final layout based on which turbines are ultimately selected to be built. A final noise model will be completed to demonstrate compliance for the final layout.

Appendix A – Project Layout

WIND TURBINE COORDINATES (V163)

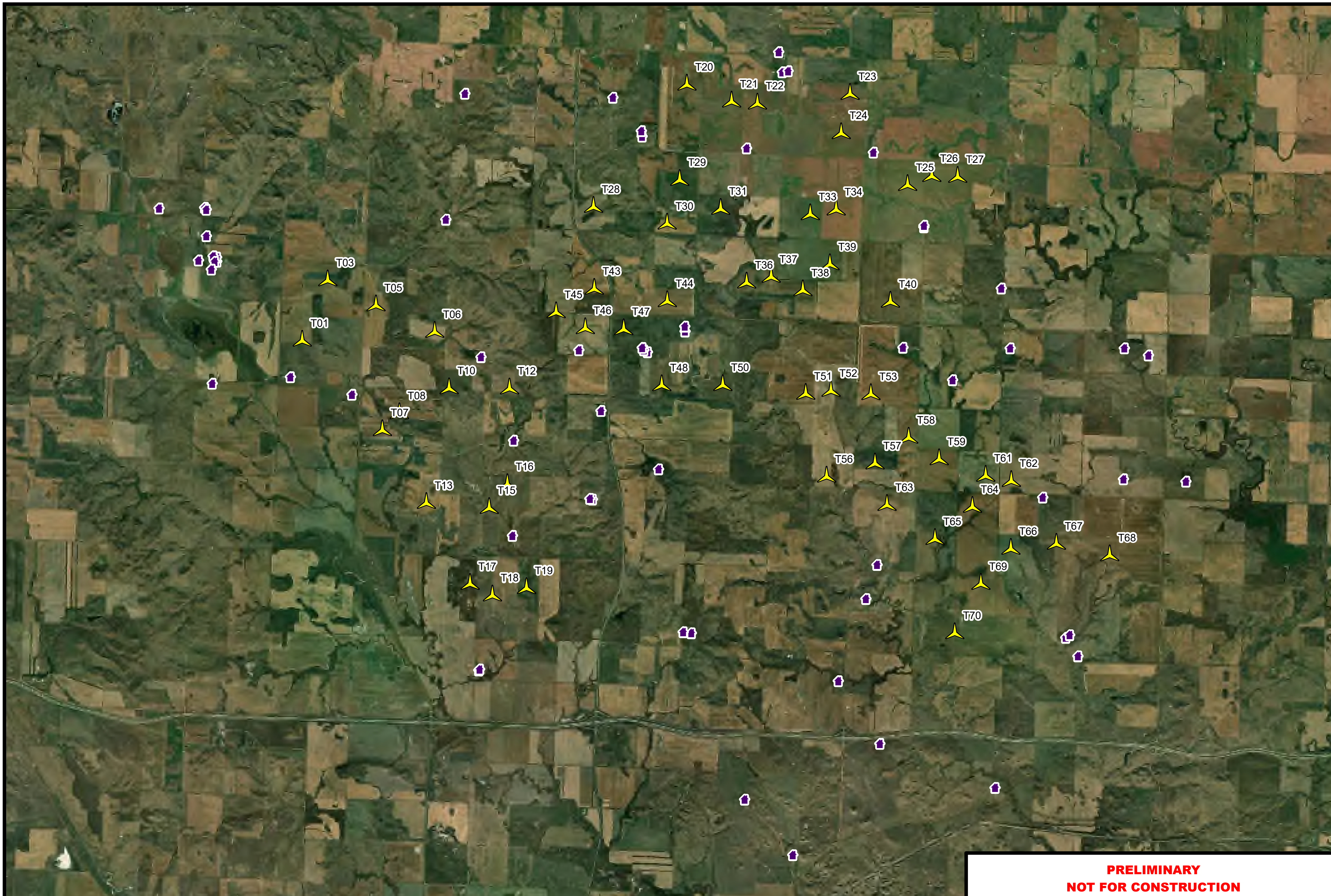
Turbine Name	Easting [m]	Northing [m]	Turbine Model	Hub Height [m]	Sound Power Level [dBA]
T01	282,280	5,201,201	V163-4.5MW	113	106.3
T03	282,778	5,202,380	V163-4.5MW	113	106.3
T05	283,721	5,201,891	V163-4.5MW	113	106.3
T06	284,869	5,201,373	V163-4.5MW	113	106.3
T07	283,847	5,199,451	V163-4.5MW	113	106.3
T08	284,179	5,199,783	V163-4.5MW	113	106.3
T10	285,150	5,200,270	V163-4.5MW	113	106.3
T12	286,330	5,200,266	V163-4.5MW	113	106.3
T13	284,706	5,198,029	V163-4.5MW	113	106.3
T15	285,933	5,197,930	V163-4.5MW	113	106.3
T16	286,289	5,198,396	V163-4.5MW	113	106.3
T17	285,559	5,196,447	V163-4.5MW	113	106.3
T18	285,996	5,196,220	V163-4.5MW	113	106.3
T19	286,662	5,196,365	V163-4.5MW	113	106.3
T20	289,796	5,206,205	V163-4.5MW	113	106.3
T21	290,669	5,205,874	V163-4.5MW	113	106.3
T22	291,173	5,205,835	V163-4.5MW	113	106.3
T23	292,983	5,206,023	V163-4.5MW	113	106.3
T24	292,810	5,205,256	V163-4.5MW	113	106.3
T25	294,107	5,204,243	V163-4.5MW	113	106.3
T26	294,579	5,204,418	V163-4.5MW	113	106.3
T27	295,086	5,204,403	V163-4.5MW	113	106.3
T28	287,971	5,203,815	V163-4.5MW	113	106.3
T29	289,655	5,204,342	V163-4.5MW	113	106.3
T30	289,409	5,203,489	V163-4.5MW	113	106.3
T31	290,456	5,203,777	V163-4.5MW	113	106.3
T33	292,205	5,203,672	V163-4.5MW	113	106.3
T34	292,711	5,203,764	V163-4.5MW	113	106.3
T36	290,963	5,202,336	V163-4.5MW	113	106.3
T37	291,442	5,202,449	V163-4.5MW	113	106.3
T38	292,061	5,202,185	V163-4.5MW	113	106.3
T39	292,590	5,202,695	V163-4.5MW	113	106.3
T40	293,772	5,201,961	V163-4.5MW	113	106.3
T43	287,986	5,202,215	V163-4.5MW	113	106.3
T44	289,412	5,201,972	V163-4.5MW	113	106.3
T45	287,241	5,201,756	V163-4.5MW	113	106.3
T46	287,811	5,201,445	V163-4.5MW SO2	113	103.5
T47	288,561	5,201,425	V163-4.5MW SO2	113	103.5
T48	289,304	5,200,329	V163-4.5MW	113	106.3
T50	290,497	5,200,333	V163-4.5MW	113	106.3
T51	292,117	5,200,162	V163-4.5MW	113	106.3
T52	292,610	5,200,219	V163-4.5MW	113	106.3
T53	293,390	5,200,156	V163-4.5MW	113	106.3
T56	292,525	5,198,543	V163-4.5MW	113	106.3
T57	293,471	5,198,801	V163-4.5MW	113	106.3
T58	294,128	5,199,304	V163-4.5MW	113	106.3
T59	294,724	5,198,883	V163-4.5MW	113	106.3
T61	295,633	5,198,559	V163-4.5MW	113	106.3
T62	296,133	5,198,457	V163-4.5MW	113	106.3
T63	293,705	5,197,990	V163-4.5MW	113	106.3
T64	295,374	5,197,952	V163-4.5MW	113	106.3
T65	294,643	5,197,324	V163-4.5MW	113	106.3
T66	296,125	5,197,133	V163-4.5MW	113	106.3
T67	297,014	5,197,230	V163-4.5MW	113	106.3
T68	298,056	5,197,006	V163-4.5MW	113	106.3
T69	295,539	5,196,447	V163-4.5MW	113	106.3
T70	295,029	5,195,483	V163-4.5MW	113	106.3

Notes:

[1] Coordinates presented in UTM NAD 83 Zone 14N (meters)

[2] Coordinates provided in "Longspur_MNPower_L013_202p5MW_45xV163-4p5_113mHH_20250807_WithAlt.shp"

[3] "SO2" identifies sound optimized mode applied to limit noise below 45 dBA limit



PRELIMINARY
NOT FOR CONSTRUCTION

LEGEND

Residential Receiver

WTG

REFERENCE

0 1 2
MILES

0 1 2
KILOMETERS

N

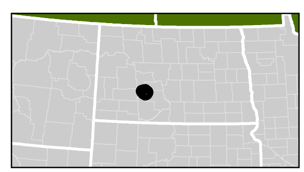


Figure A-1
Longspur Wind Project - Project Layout

LOCATION:	North Dakota
CLIENT:	Longspur Wind
PROJ. NO.:	154125
CREATED:	12/15/2025

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Appendix B – Modeled Impacts

NOISE MODEL RESULTS (V163)

Receptor Name	Easting [m]	Northing [m]	Residence Status	Project Sound Level [dBA]
REC-001	299,548	5,198,403	Non-Participating	33
REC-002	298,328	5,198,450	Non-Participating	37
REC-003	298,817	5,200,869	Non-Participating	32
REC-004	298,346	5,201,009	Non-Participating	33
REC-005	283,255	5,200,102	Non-Participating	42
REC-006	280,525	5,200,317	Non-Participating	33
REC-007	282,053	5,200,445	Non-Participating	40
REC-008	280,615	5,202,703	Non-Participating	33
REC-009	280,257	5,202,726	Non-Participating	31
REC-010	280,612	5,202,784	Non-Participating	32
REC-011	280,543	5,202,808	Non-Participating	32
REC-012	280,411	5,203,201	Non-Participating	31
REC-013	285,089	5,203,522	Non-Participating	36
REC-014	279,487	5,203,743	Non-Participating	27
REC-015	280,378	5,203,755	Non-Participating	30
REC-016	293,514	5,196,773	Participating	40
REC-017	286,391	5,197,343	Participating	44
REC-018	287,953	5,198,053	Non-Participating	38
REC-019	287,904	5,198,066	Non-Participating	38
REC-020	296,751	5,198,091	Participating	44
REC-021	289,246	5,198,642	Participating	38
REC-022	286,413	5,199,204	Participating	42
REC-023	288,121	5,199,785	Non-Participating	40
REC-024	294,990	5,200,386	Non-Participating	40
REC-025	285,777	5,200,835	Participating	43
REC-026	287,689	5,200,972	Participating	44
REC-027	289,028	5,200,932	Non-Participating	44
REC-028	288,957	5,200,970	Participating	44
REC-029	288,926	5,201,017	Participating	44
REC-030	294,020	5,201,020	Participating	42
REC-031	296,115	5,201,008	Non-Participating	37
REC-032	289,764	5,201,336	Participating	44
REC-033	289,758	5,201,432	Non-Participating	44
REC-034	295,942	5,202,178	Non-Participating	36
REC-035	294,429	5,203,374	Non-Participating	42
REC-036	294,431	5,203,404	Non-Participating	43
REC-037	290,927	5,192,186	Non-Participating	27
REC-038	293,570	5,193,278	Non-Participating	31
REC-039	285,734	5,194,712	Non-Participating	36
REC-040	285,749	5,194,731	Non-Participating	36
REC-041	292,757	5,194,503	Non-Participating	33
REC-042	297,438	5,194,987	Non-Participating	35
REC-043	289,886	5,195,439	Non-Participating	33
REC-044	289,728	5,195,460	Non-Participating	33
REC-045	297,201	5,195,350	Non-Participating	37
REC-046	297,277	5,195,400	Non-Participating	37
REC-047	293,296	5,196,108	Participating	38
REC-048	285,462	5,205,985	Non-Participating	32
REC-049	293,442	5,204,835	Non-Participating	44
REC-050	288,924	5,205,147	Participating	41
REC-051	288,909	5,205,254	Participating	40
REC-052	288,354	5,205,907	Participating	38
REC-053	291,663	5,206,405	Participating	42
REC-054	291,777	5,206,426	Participating	42
REC-055	291,592	5,206,798	Non-Participating	40
REC-056	290,965	5,204,916	Participating	43
REC-057	280,409	5,203,718	Non-Participating	30
REC-058	280,572	5,202,698	Non-Participating	32
REC-059	280,509	5,202,548	Non-Participating	32
REC-060	291,869	5,191,101	Non-Participating	24
REC-061	295,820	5,192,415	Non-Participating	29

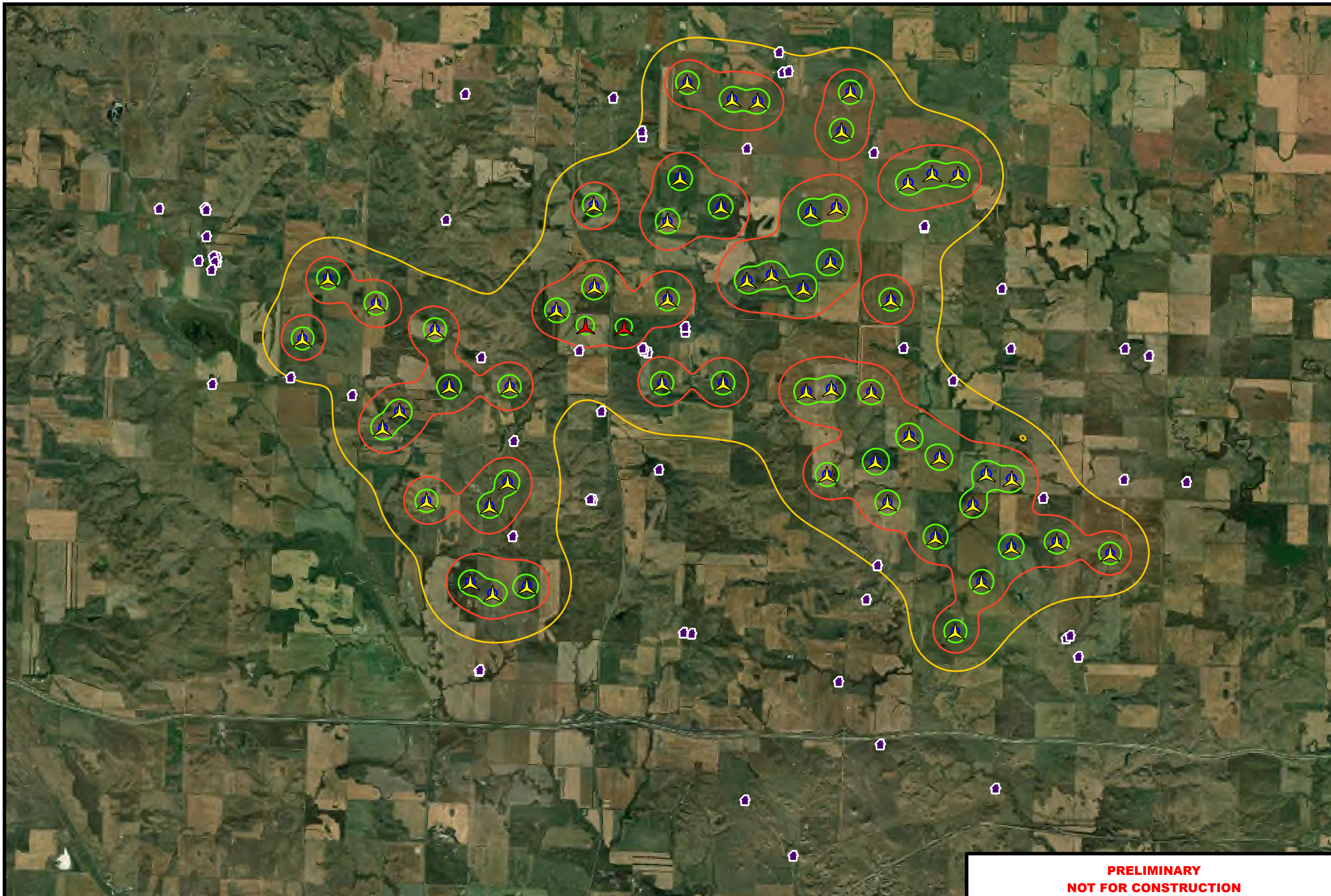
Notes:

[1] Coordinates presented in UTM NAD 83 Zone 14N (meters)

[2] Receptor coordinates provided by Client via "*Longspur_Wind_Receptor_Survey_Results - MB confirmed.xlsx*" on October 20, 2025

[3] Participating status provided by Client via *"Residence Status_ARL.shp"* on April 28, 2026.

Appendix C – Sound Level Contours



LEGEND

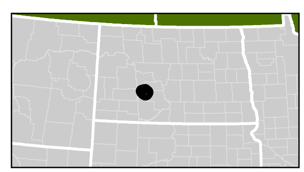
- Residential Receiver
- V163 4.5 STE
- V163 4.5 STE SO2
- 40 dBA
- 45 dBA
- 50 dBA
- 55 dBA

REFERENCE

0 1 2
MILES

0 1 2
KILOMETERS

N



PRELIMINARY
NOT FOR CONSTRUCTION

Figure C-1
Longspur Wind Project - Sound Level Contours

LOCATION:	North Dakota
CLIENT:	Longspur Wind
PROJ. NO.:	154125
CREATED:	12/15/2025

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Attachment J

Shadow Flicker

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Longspur updated the shadow flicker report included in the Wind Project Application at Appendixes B4. The updates do not change the data reported; shadow flicker levels (hour-per-year) remain unchanged. The changes are limited to correcting labeling of receptors.

MINNESOTA POWER

Shadow Flicker Analysis

Longspur Wind

PROJECT NO. 154125
REVISION 3
APRIL 30, 2026

Contents

Figures

Tables

List of Abbreviations

Abbreviation	Term/Phrase/Name
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc.
hr	Hour
kg/m3	Kilograms per cubic meter
m	Meter
m/s	Meters per second
Minnesota Power	Minnesota Power, a division of ALLETE, Inc.
MW	Megawatt
Project	Longspur Wind Project
Project Site	Location of Project in Morton County, North Dakota
Study	Shadow Flicker Analysis
yr	Year

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1.0 Introduction

1.1 Study Overview

Burns & McDonnell Engineering Company, Inc. ("Burns & McDonnell") was retained by Minnesota Power, a division of ALLETE, Inc. ("Minnesota Power") to conduct a shadow flicker analysis (the "Study") for the proposed Longspur Wind Project (the "Project"). The objective of the Study was to estimate the annual frequency of shadow flicker on occupied residences caused by Project wind turbines.

1.2 Project Overview

The proposed Project will be located in Morton County, North Dakota, approximately five (5) miles north of the city of Glen Ullin. The Project will include a quantity of up to 45 x Vestas V163-4.5 wind turbine generators at a 113-meter hub height with an aggregate nameplate capacity of approximately 202.5 megawatts ("MW"), as summarized in Section 2.2 below.

For purposes of this Study, a total of 57 turbine positions were evaluated (including 12 alternates), although only up to 45 turbines are expected to be installed. All 12 alternate turbines were modeled as the V163-4.5 turbine model.

Longspur Wind Project			
LOCATION	GENERATION	WIND TURBINES UP TO	TURBINE MODEL(S)
Morton County North Dakota	**202.5 MW**	**45**	**V163-4.5**

1.3 Shadow Flicker Overview

Shadow flicker occurs when wind turbine blades pass in front of the sun to create recurring shadows on an object. Such shadows occur only under very specific conditions, including sun position, wind direction, time of day, and other similar factors.

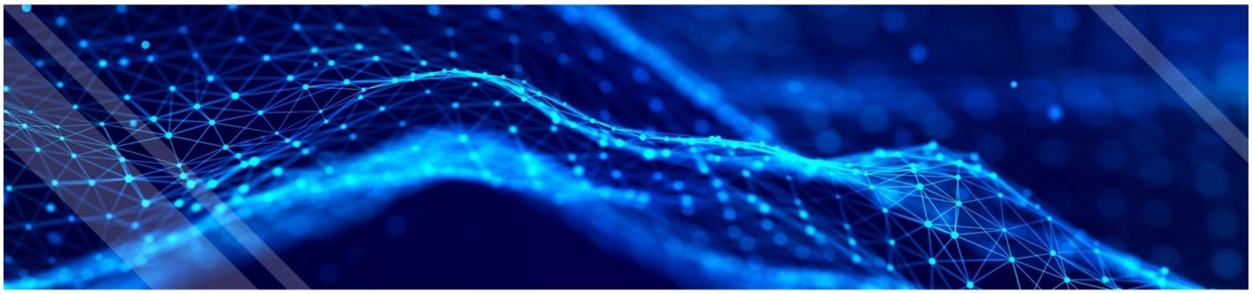
The intensity of shadow flicker varies significantly with distance, and as separation between a turbine and receptor increases, shadow flicker intensity correspondingly diminishes. Shadow flicker intensity for distances greater than 10 rotor diameters is generally considered imperceptible. At such distances, shadow flicker most commonly occurs at sunrise or sunset, when cast shadows are sufficiently long.

1.4 Applicable Regulations

Shadow flicker impacts are not currently regulated in applicable state or federal law, nor are there requirements in the current Morton County, North Dakota ordinances with regard to limitations on shadow flicker durations. This report identifies those receptors that may experience shadow flicker more than 30 hours per year, although it is noted that this threshold is presented as a typical industry benchmark for similar studies and not as a suggested limitation.

1.5 Site Visit

Burns & McDonnell did not visit the Project Site as part of this Study. The contents of this evaluation are based exclusively upon desktop analysis by Burns & McDonnell.



2.0 Modeling Parameters and Inputs

2.1 Modeling Overview

Shadow flicker was modeled for the Project Site using WindPRO, an industry-leading software package for the design and planning of wind energy projects. This package models the sun's path with respect to every turbine location during every minute over a complete year. Any shadow flicker caused by each turbine is then aggregated for each receptor for the entire year.

The following sections are summaries of the inputs utilized in the WindPRO model for this Study.

2.2 Wind Turbines

The Project will include up to 45 wind turbines when constructed, although for purposes of this Study, a total of 57 turbine positions were evaluated (including 12 alternates) to provide a conservative estimate of estimated flicker durations. A summary of the turbine model and its respective dimensions that were modeled as part of this Study is included Table 2-1.

Table 2-1: Turbine Model Dimensions

Turbine Model	Quantity	Hub Height [m]	Rotor Diameter [m]
V163-4.5	57	113	163

Shadow flicker intensity is partially dependent upon the distance from a receptor to the turbine causing the shadow. The Minnesota Power-provided coordinates of each wind turbine are presented in Appendix A and the location of each wind turbine is presented graphically in Appendix D.

2.3 Receptors

A receptor is used to designate a specific location, such as a residence or public building, where the impact of shadow flicker is assessed. A quantity of 61 receptors were modeled at the Project Site. The Minnesota Power-provided coordinates of each receptor are presented in Appendix C and the location of each receptor is presented graphically in Appendix D. Burns & McDonnell did not provide an independent verification of the location or occupied status of these receptors.

Each receptor was modeled in "green house" mode within the WindPRO model. This approach provides a conservative estimate of the amount of time when shadow flicker could occur by modeling each receptor as having windows on all sides and effectively causing the home to be susceptible to flicker effects in all directions.

2.4 Terrain

The WindPRO model utilizes topography data to place turbines and receptors at the proper elevations. This information is also used by the model to consider any natural land features between a turbine and a receptor that may block shadows from being seen at a receptor.

Publicly-available terrain data was downloaded from the National Elevation Dataset, a product of the United States Geological Survey. The 10-meter resolution digital elevation model was exported at 10-foot intervals for use in the WindPRO model. The WindPRO model uses the provided elevation data to determine the elevation of each turbine and receptor.

2.5 Obstacles

Obstacles located between a receptor and a turbine, such as trees or buildings, may significantly reduce or eliminate the duration and/or intensity of shadow flicker. However, to provide the most conservative estimate of the amount of time when shadow flicker could occur, no attempt was made to model the presence of potential obstacles.

2.6 Turbine Operation

Shadow flicker is contingent upon the movement of the turbine blades. Shadow flicker can only occur when the turbine is in operation (i.e., when the turbine blades are rotating). Moreover, shadow flicker is generally most notable when a turbine is facing a receptor, as this results in the widest-possible shadow being cast. To more accurately reflect the periods of operation of each Project wind turbine, on-site hub-height wind data was provided by Minnesota Power and used to indicate the periods when the turbines are inactive due to wind speeds below the turbine cut-in speed or above the turbine cut-out speed, at which time the turbine rotor is not in motion and no shadow flicker will occur.

Project Site-specific wind data was also utilized to model the orientation of the turbines relative to each receptor. The Minnesota Power-provided wind data includes data collected by an on-site meteorological mast.

Power curves for the proposed turbines were provided by Minnesota Power. These power curves were added to the WindPRO model to more accurately reflect the turbine's operational characteristics. The assumed cut-in wind speed of the proposed turbines was 3.0 m/s and the assumed cut-out wind speed was 24.0 m/s.

2.7 Flicker Relevance

At distances beyond 10 rotor diameters, shadow flicker effects are generally considered low, as shadows diffuse and become imperceptible. Thus, a distance equal to 10 times the rotor diameter of each turbine (i.e., 1,630 meters) was modeled as the maximum distance at which shadow flicker was considered relevant; receptors greater than this distance from a given turbine were not evaluated. The proximity of this buffer relative to each receptor is presented graphically in Appendix D.

2.8 Sun Angle

The sun's path with respect to each turbine location is calculated by the WindPRO model to determine the cast shadow paths during every minute over a complete year. However, at very low sun angles, the light must pass through more atmosphere and becomes too diffused to form a coherent shadow. Thus, a value of three (3) degrees or less was utilized for the height at which the sun would not cause noticeable flicker.

2.9 Sunshine Probability

Shadow flicker is only caused when the sun is shining. Sunshine probability data was obtained by Burns & McDonnell, as shown in Appendix B. This data represents the percentage of hours each month that the sun is expected to be shining during daylight hours, with consideration given for cloud cover, rainy days, fog, or other similar occurrences that may diminish the potential occurrence or severity of shadow flicker. In WindPRO, calculations initially consider a worst-case scenario for shadow flicker, assuming continuous sunshine and wind, which is then statistically reduced by accounting for factors such as the probability of sunshine.

3.0 Results

Using the inputs and parameters defined in Section 2.0, the WindPRO model was used to calculate shadow flicker for the identified receptors at the Project Site. Table 3-1 presents a summary of these results, while detailed tables are included within Appendix C that present shadow flicker durations by receptor, including estimated hours per year. Additionally, maps are provided in Appendix D that illustrate the shadow flicker vectors (in hours per year) caused by each Project turbine.

Table 3-1: Summary of Results

Turbine Layout	No. of Turbines	No. of Receptors	No. of Receptors, Flicker ≥ 30 hr/yr	No. of Receptors, Flicker ≥ 30 hr/yr After Mitigation
V163-4.5	57	61	4	0, See Bullet Below

The following is a set of key observations from the results of the Study:

- With the current layout, 4 of the 61 known receptors exceed 30 hours per year of shadow flicker for estimated sunshine conditions. However, mitigation techniques will be utilized to reduce the shadow flicker on the residences with more than 30 hours per year, indicated with the asterisk in Appendix C. Common techniques include planting vegetation, awning installation, and/or reduced turbine operation via curtailment. For a participating residence, a landowner may also sign an acknowledgement letter for the exceedance. Refer to Appendix C for a complete listing of results.
- The mitigation strategies ensure the Project would be able to meet the shadow flicker limits. However, mitigation may not be necessary for the final layout based on which turbines are ultimately selected to be built. A final shadow flicker model will be completed to demonstrate compliance for the final layout.
- The majority of observed shadow flicker on each receptor occurs during early morning and/or late afternoon and evening hours, as shown in Appendix E.
- For purposes of this Study, a total of 57 turbine positions were evaluated, although Burns & McDonnell understands that only up to 45 turbines are expected to be installed. Depending on the turbine location(s) that are eliminated, flicker durations at impacted receptors are likely to decrease from those presented herein.
- The Study was performed using a conservative modeling approach with Project Site-specific conditions. For example, the Study modeled each receptor as a “green house”, meaning each

receptor was modeled as having windows on all sides and effectively causing the home to be susceptible to flicker effects in all directions. Further, the Project Site was modeled as if no obstacles were present, including trees or buildings, which may significantly reduce or eliminate the duration and/or intensity of shadow flicker at a receptor. Due to the conservative approach of the Study, the actual duration and intensity of shadow flicker experienced at each receptor is expected to be less than those reported in the Study.

Appendix A – Wind Turbine Coordinates

Table A-1: Wind Turbine Coordinates

Turbine ID	Easting [m]	Northing [m]	Wind Turbine Model
T01	282,280	5,201,201	V163-4.5MW
T03	282,778	5,202,380	V163-4.5MW
T05	283,721	5,201,891	V163-4.5MW
T06	284,869	5,201,373	V163-4.5MW
T07	283,847	5,199,451	V163-4.5MW
T08	284,179	5,199,783	V163-4.5MW
T10	285,150	5,200,270	V163-4.5MW
T12	286,330	5,200,266	V163-4.5MW
T13	284,706	5,198,029	V163-4.5MW
T15	285,933	5,197,930	V163-4.5MW
T16	286,289	5,198,396	V163-4.5MW
T17	285,559	5,196,447	V163-4.5MW
T18	285,996	5,196,220	V163-4.5MW
T19	286,662	5,196,365	V163-4.5MW
T20	289,796	5,206,205	V163-4.5MW
T21	290,669	5,205,874	V163-4.5MW
T22	291,173	5,205,835	V163-4.5MW
T23	292,983	5,206,023	V163-4.5MW
T24	292,810	5,205,256	V163-4.5MW
T25	294,107	5,204,243	V163-4.5MW
T26	294,579	5,204,418	V163-4.5MW
T27	295,086	5,204,403	V163-4.5MW
T28	287,971	5,203,815	V163-4.5MW
T29	289,655	5,204,342	V163-4.5MW
T30	289,409	5,203,489	V163-4.5MW
T31	290,456	5,203,777	V163-4.5MW
T33	292,205	5,203,672	V163-4.5MW
T34	292,711	5,203,764	V163-4.5MW
T36	290,963	5,202,336	V163-4.5MW
T37	291,442	5,202,449	V163-4.5MW
T38	292,061	5,202,185	V163-4.5MW
T39	292,590	5,202,695	V163-4.5MW
T40	293,772	5,201,961	V163-4.5MW
T43	287,986	5,202,215	V163-4.5MW
T44	289,412	5,201,972	V163-4.5MW
T45	287,241	5,201,756	V163-4.5MW
T46	287,811	5,201,445	V163-4.5MW

Turbine ID	Easting [m]	Northing [m]	Wind Turbine Model
T47	288,561	5,201,425	V163-4.5MW
T48	289,304	5,200,329	V163-4.5MW
T50	290,497	5,200,333	V163-4.5MW
T51	292,117	5,200,162	V163-4.5MW
T52	292,610	5,200,219	V163-4.5MW
T53	293,390	5,200,156	V163-4.5MW
T56	292,525	5,198,543	V163-4.5MW
T57	293,471	5,198,801	V163-4.5MW
T58	294,128	5,199,304	V163-4.5MW
T59	294,724	5,198,883	V163-4.5MW
T61	295,633	5,198,559	V163-4.5MW
T62	296,133	5,198,457	V163-4.5MW
T63	293,705	5,197,990	V163-4.5MW
T64	295,374	5,197,952	V163-4.5MW
T65	294,643	5,197,324	V163-4.5MW
T66	296,125	5,197,132	V163-4.5MW
T67	297,014	5,197,230	V163-4.5MW
T68	298,056	5,197,006	V163-4.5MW
T69	295,539	5,196,447	V163-4.5MW
T70	295,029	5,195,483	V163-4.5MW

Notes:
[1] Coordinates presented in UTM NAD83 Zone 14 (meters)
[2] Coordinates via "*Longspur_MNPower_L013_202p5MW_45xV163-4p5_113mHH_20250922_WithAlt*"

Appendix B – Modeling Inputs

Table B-1: Monthly Sunshine Probability for Bismarck, North Dakota

Month	Sunshine Probability
January	54%
February	52%
March	61%
April	58%
May	64%
June	67%
July	75%
August	72%
September	67%
October	53%
November	42%
December	45%

Notes:
[1] Data source: NOAA 11-2024 - Sunshine Probability Hours by City
[2] Data location: Bismarck, North Dakota

Appendix C – Flicker Results by Receptor

Table C-1: Flicker Results by Receptor

Receptor ID	Easting [m]	Northing [m]	Participating Status	Flicker Duration [hours/year]	Mitigated Flicker Duration
REC-001	299,548	5,198,403	Non Participating	0.00	-
REC-002	298,328	5,198,450	Non Participating	0.00	-
REC-003	298,817	5,200,869	Non Participating	0.00	-
REC-004	298,346	5,201,009	Non Participating	0.00	-
REC-005	283,255	5,200,102	Non Participating	31.22	30.00*
REC-006	280,525	5,200,317	Non Participating	0.00	-
REC-007	282,053	5,200,445	Non Participating	0.00	-
REC-008	280,615	5,202,703	Non Participating	0.00	-
REC-009	280,257	5,202,726	Non Participating	0.00	-
REC-010	280,612	5,202,784	Non Participating	0.00	-
REC-011	280,543	5,202,808	Non Participating	0.00	-
REC-012	280,411	5,203,201	Non Participating	0.00	-
REC-013	285,089	5,203,522	Non Participating	0.00	-
REC-014	279,487	5,203,743	Non Participating	0.00	-
REC-015	280,378	5,203,755	Non Participating	0.00	-
REC-016	293,514	5,196,773	Participating	12.25	-
REC-017	286,391	5,197,343	Participating	3.20	-
REC-018	287,953	5,198,053	Non Participating	0.00	-
REC-019	287,904	5,198,066	Non Participating	0.00	-
REC-020	296,751	5,198,091	Participating	35.37	30.00*
REC-021	289,246	5,198,642	Participating	0.00	-
REC-022	286,413	5,199,204	Participating	0.00	-
REC-023	288,121	5,199,785	Non Participating	13.12	-
REC-024	294,990	5,200,386	Non Participating	3.08	-
REC-025	285,777	5,200,835	Participating	56.90	30.00*
REC-026	287,689	5,200,972	Participating	14.03	-
REC-027	289,028	5,200,932	Non Participating	24.77	-
REC-028	288,957	5,200,970	Participating	23.65	-
REC-029	288,926	5,201,017	Participating	19.65	-
REC-030	294,020	5,201,020	Participating	2.70	-
REC-031	296,115	5,201,008	Non Participating	0.00	-
REC-032	289,764	5,201,336	Participating	6.75	-
REC-033	289,758	5,201,432	Non Participating	6.68	-
REC-034	295,942	5,202,178	Non Participating	0.00	-
REC-035	294,429	5,203,374	Non Participating	0.00	-
REC-036	294,431	5,203,404	Non Participating	0.00	-

Receptor ID	Easting [m]	Northing [m]	Participating Status	Flicker Duration [hours/year]	Mitigated Flicker Duration
REC-037	290,927	5,192,186	Non Participating	0.00	-
REC-038	293,570	5,193,278	Non Participating	0.00	-
REC-039	285,734	5,194,712	Non Participating	0.00	-
REC-040	285,749	5,194,731	Non Participating	0.00	-
REC-041	292,757	5,194,503	Non Participating	0.00	-
REC-042	297,438	5,194,987	Non Participating	0.00	-
REC-043	289,886	5,195,439	Non Participating	0.00	-
REC-044	289,728	5,195,460	Non Participating	0.00	-
REC-045	297,201	5,195,350	Non Participating	0.00	-
REC-046	297,277	5,195,400	Non Participating	0.00	-
REC-047	293,296	5,196,108	Participating	0.00	-
REC-048	285,462	5,205,985	Non Participating	0.00	-
REC-049	293,442	5,204,835	Non Participating	36.12	30.00*
REC-050	288,924	5,205,147	Participating	9.53	-
REC-051	288,909	5,205,254	Participating	2.65	-
REC-052	288,354	5,205,907	Participating	3.67	-
REC-053	291,663	5,206,405	Participating	25.52	-
REC-054	291,777	5,206,426	Participating	21.68	-
REC-055	291,592	5,206,798	Non Participating	4.47	-
REC-056	290,965	5,204,916	Participating	3.28	-
REC-057	280,409	5,203,718	Non Participating	0.00	-
REC-058	280,572	5,202,698	Non Participating	0.00	-
REC-059	280,509	5,202,548	Non Participating	0.00	-
REC-060	291,869	5,191,101	Non Participating	0.00	-
REC-061	295,820	5,192,415	Non Participating	0.00	-

Notes:

[1] Coordinates presented in UTM NAD83 Zone 14 (meters)

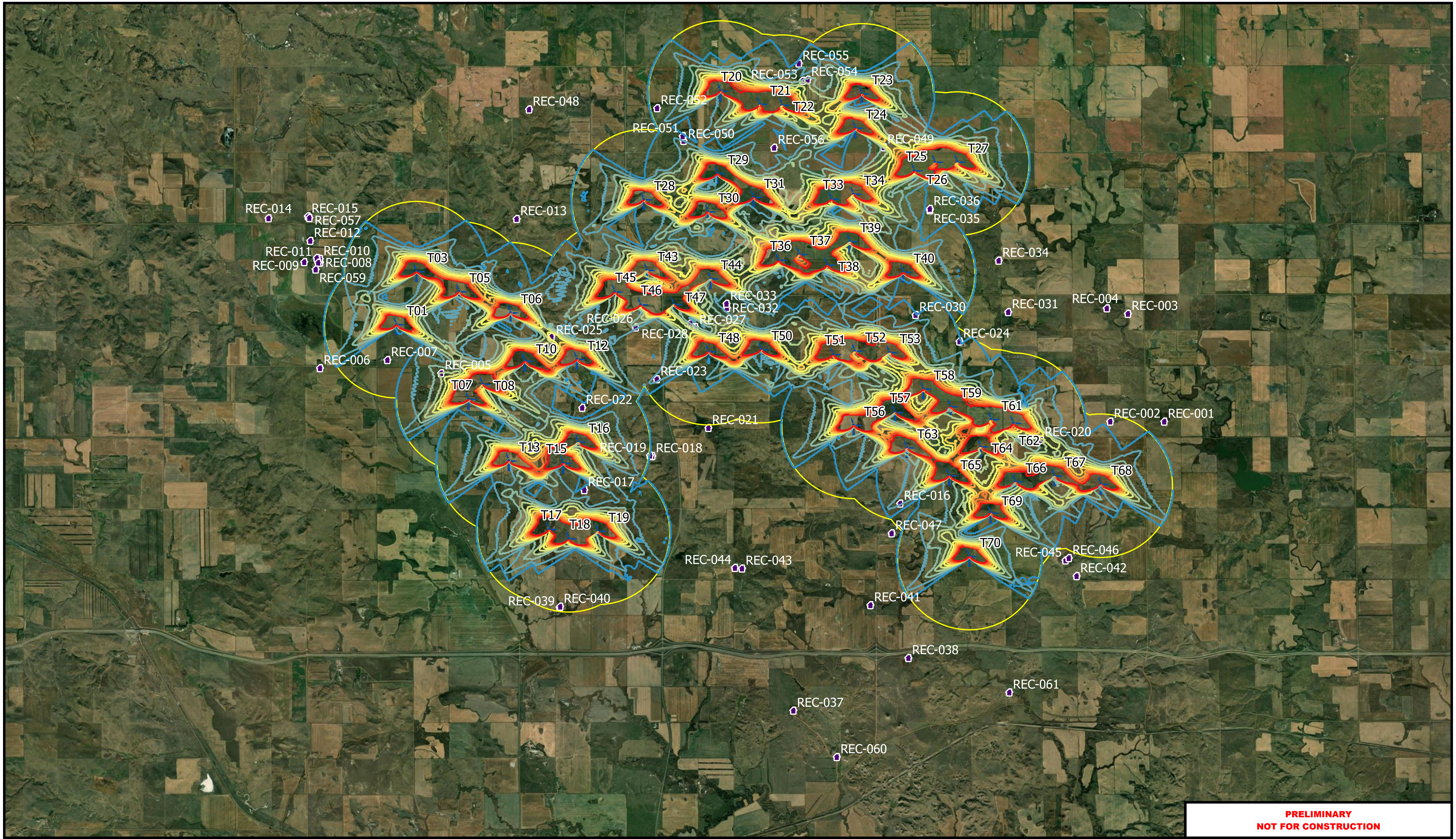
[2] Receptor coordinates provided by Client via "*Longspur_Wind_Receptor_Survey_Results - MB confirmed.xlsx*" on October 20, 2025

[3] Participating status provided by Client via “*Residence Status_ARL.shp*” on April 28, 2026.

[4] Results based on turbine layout in Table A-1

[5] Mitigation techniques will be utilized to reduce the shadow flicker on residences with more than 30 hours per year, indicated with the asterisk. Common techniques include planting vegetation, awning installation, and/or reduced turbine operation via curtailment. The mitigation strategies ensure the Project would be able to meet the shadow flicker limits. However, mitigation may not be necessary for the final layout based on which turbines are ultimately selected to be built. A final shadow flicker model will be completed to demonstrate compliance for the final layout.

Appendix D – Shadow Flicker Duration Map



LEGEND

Turbine Buffer (10 x RD - 1630m)

Receptors

Turbines

Shadow Flicker Vectors [hours per year]

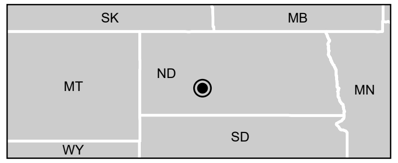
0 10 20 30 40 50 60 70 80 90 100

REFERENCE

0 1 2
MILES

0 1 2
KILOMETERS

N



PRELIMINARY
NOT FOR CONSTRUCTION

LONGSPUR WIND
Shadow Flicker Duration [Hr/Yr]

LOCATION:	MORTON COUNTY, NORTH DAKOTA
CLIENT:	MINNESOTA POWER
PROJ. NO.:	154125
CREATED:	11/05/2025

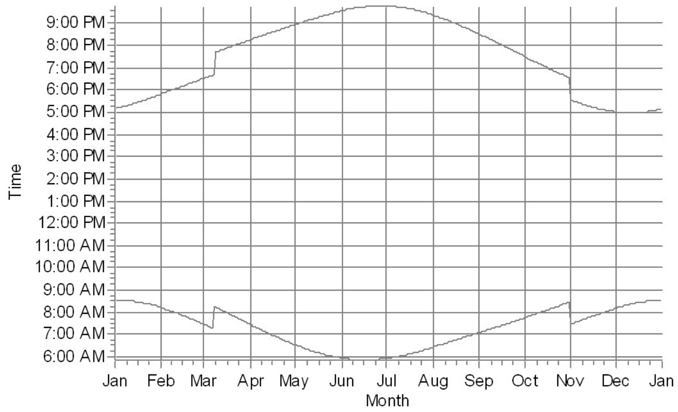
BURNS McDONNELL
www.burnsmcd.com

Appendix E – Shadow Flicker Calendar

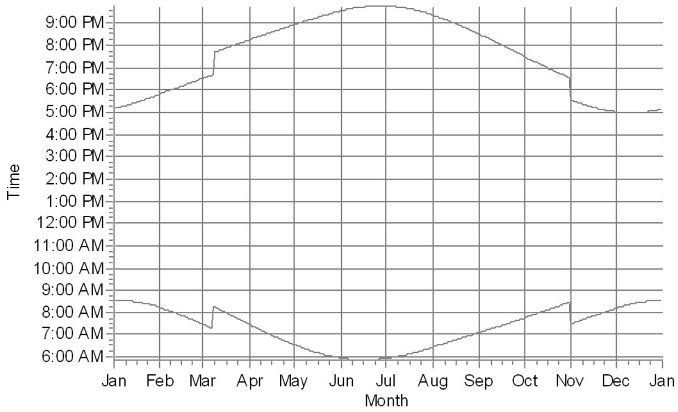
SHADOW - Calendar, graphical

Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc

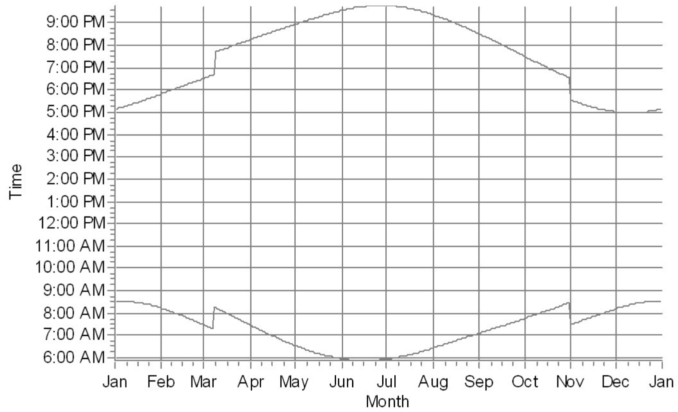
REC-001: Occupied



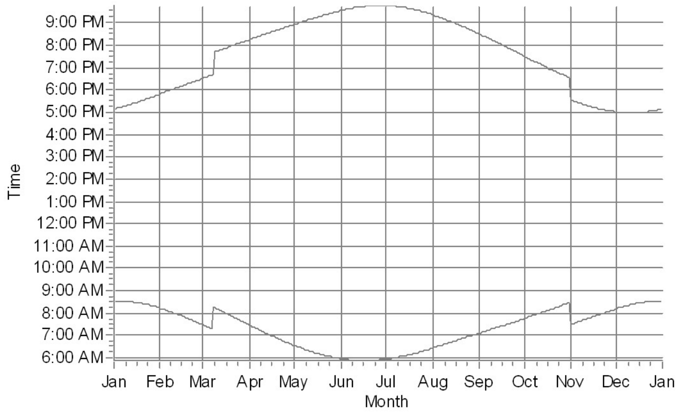
REC-002: Occupied



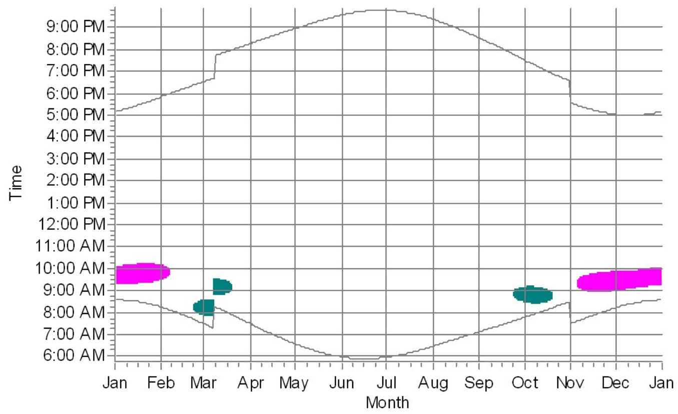
REC-003: Occupied



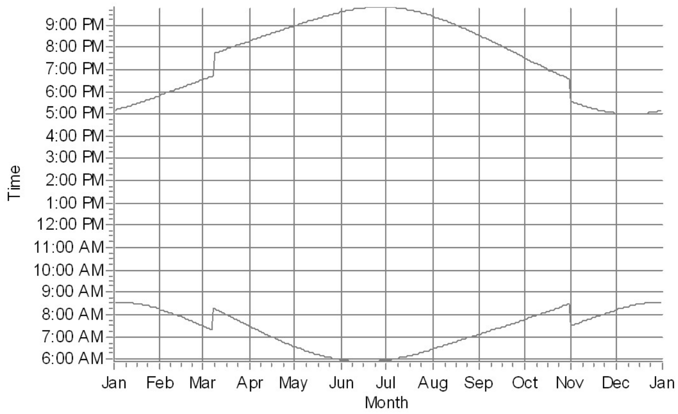
REC-004: Occupied



REC-005: Occupied



REC-006: Occupied



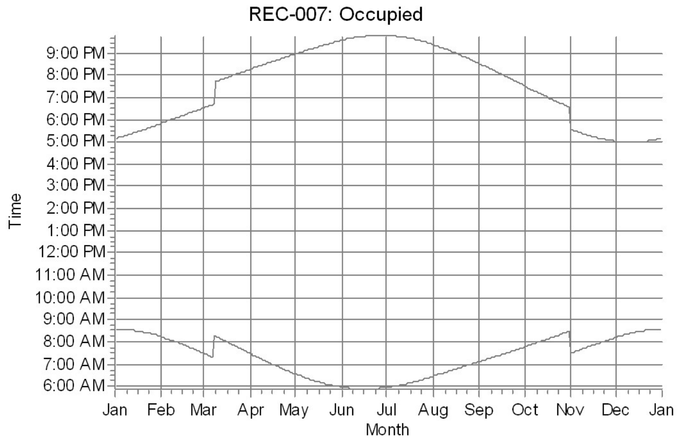
WTGs

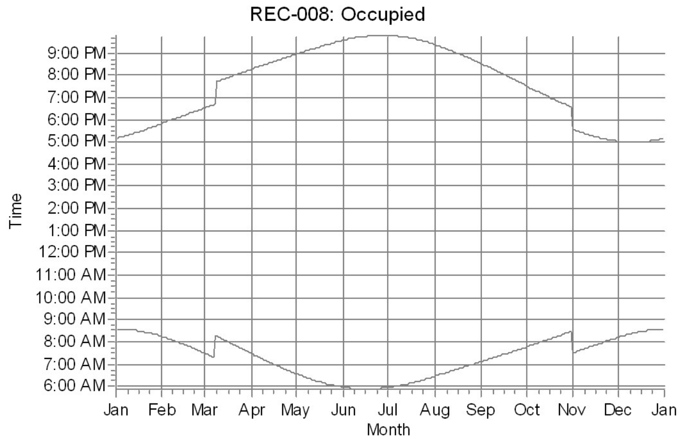
T07: Primary

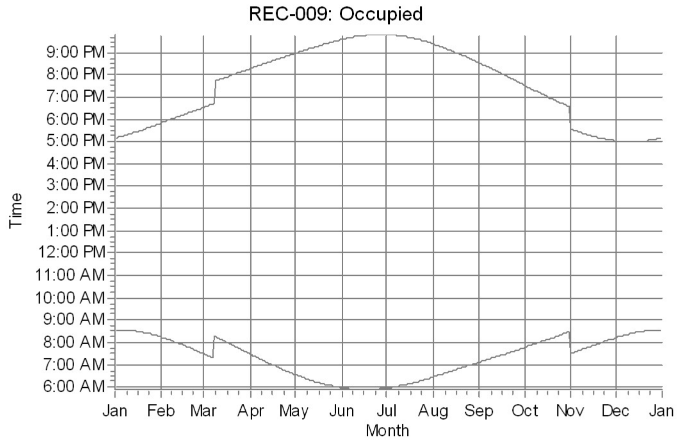
T08: Primary

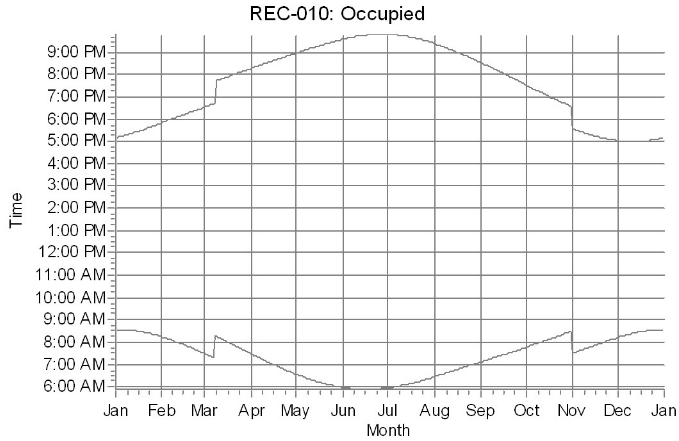
SHADOW - Calendar, graphical

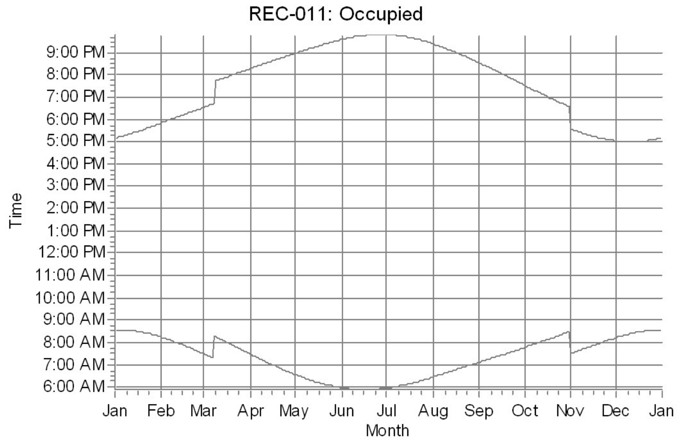
Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc

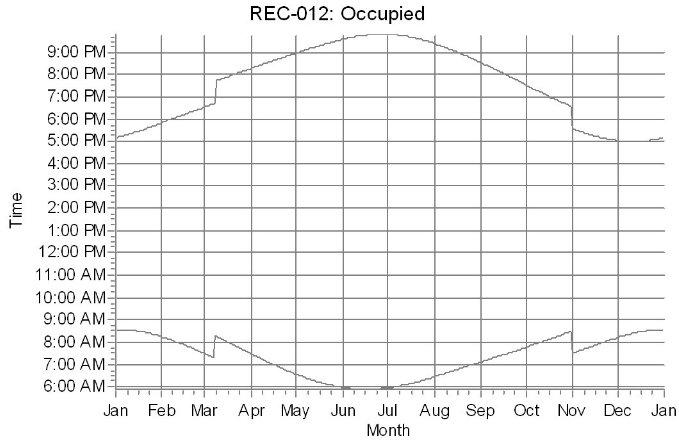










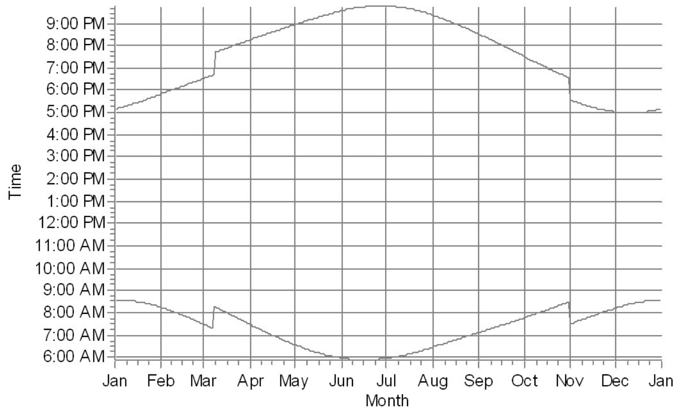


WTGs

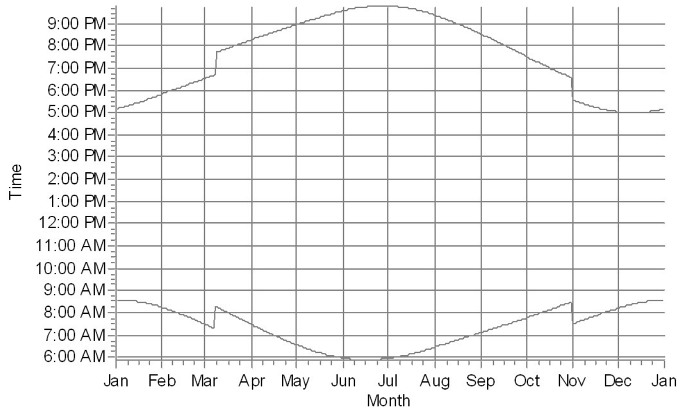
SHADOW - Calendar, graphical

Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc

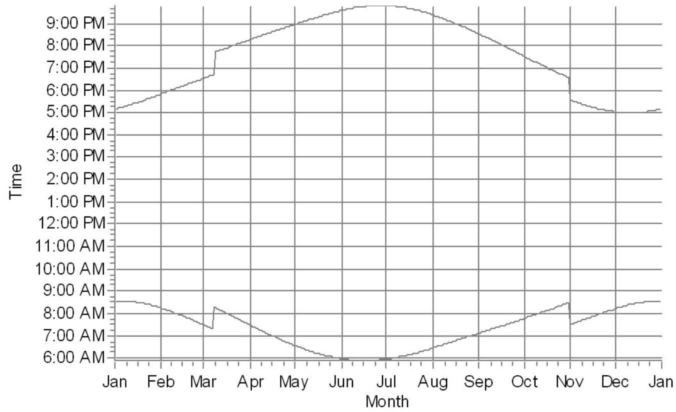
REC-013: Occupied



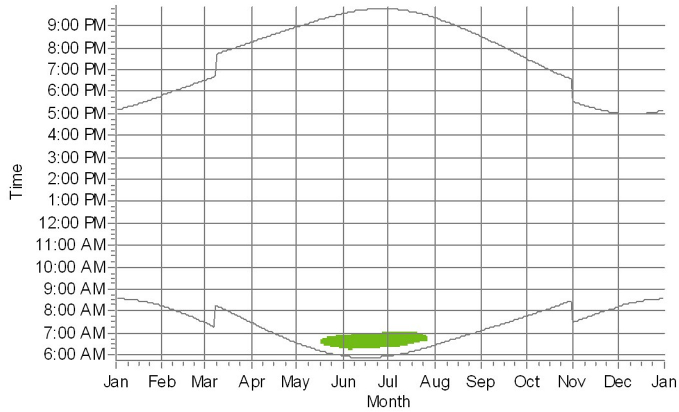
REC-014: Occupied



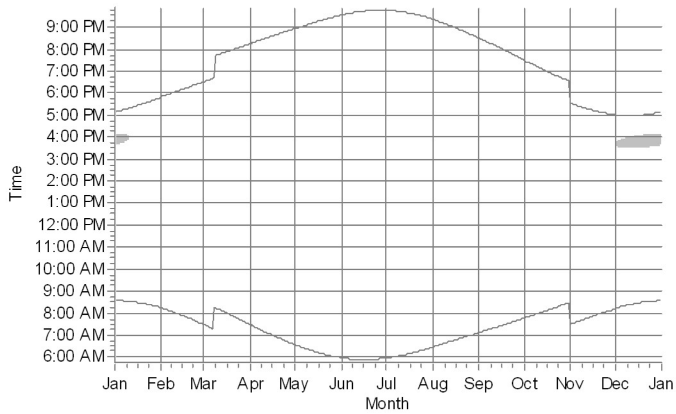
REC-015: Occupied



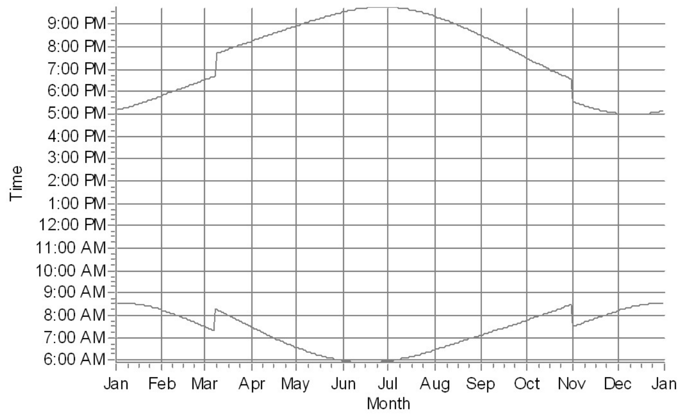
REC-016: Occupied



REC-017: Occupied



REC-018: Occupied



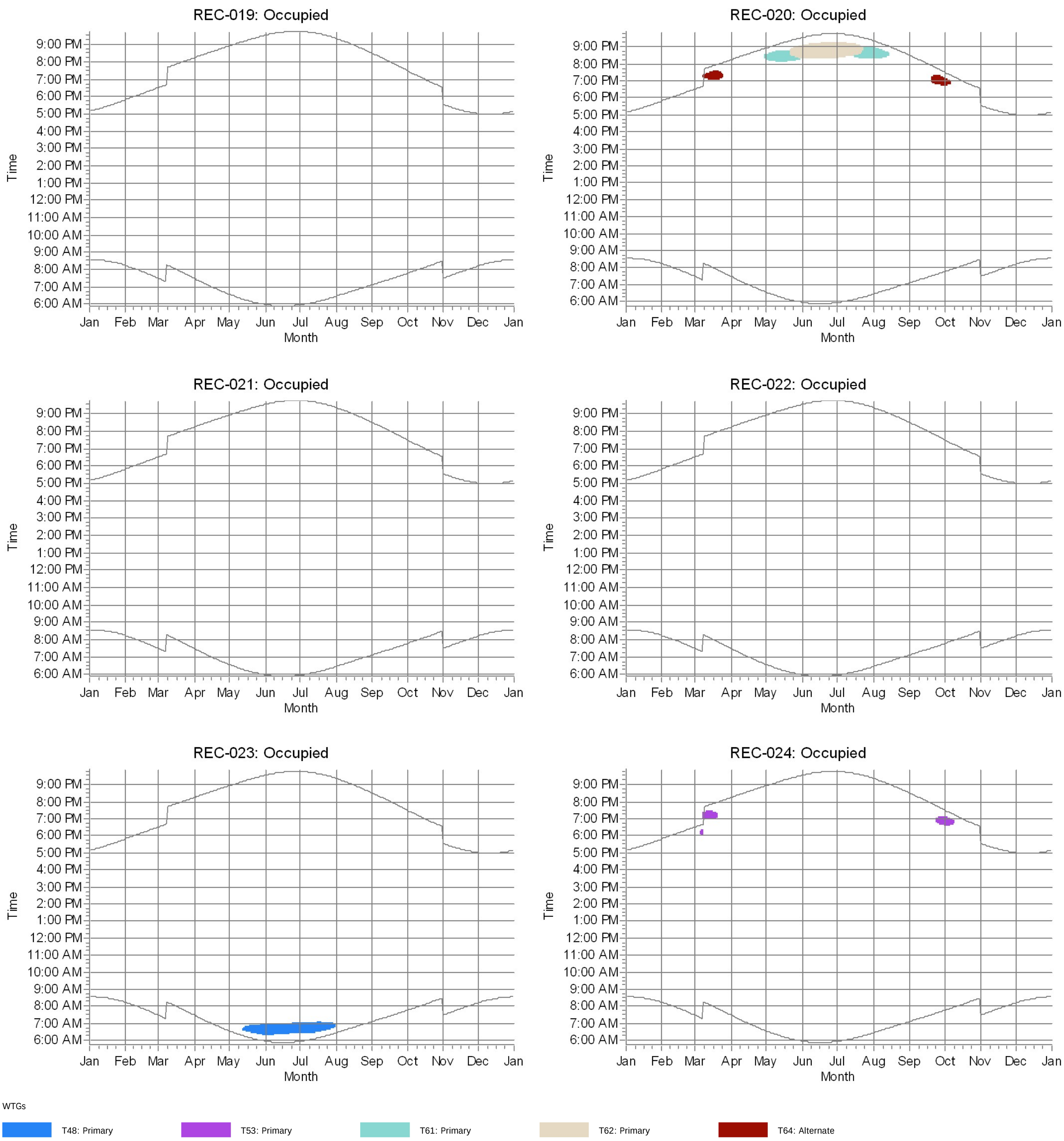
WTGs

T17: Primary

T65: Primary

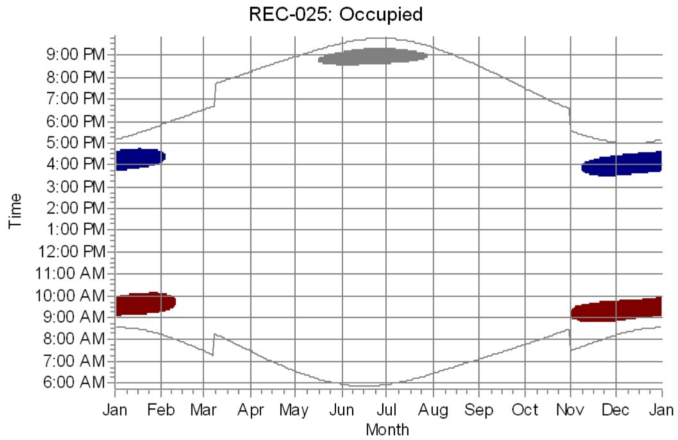
SHADOW - Calendar, graphical

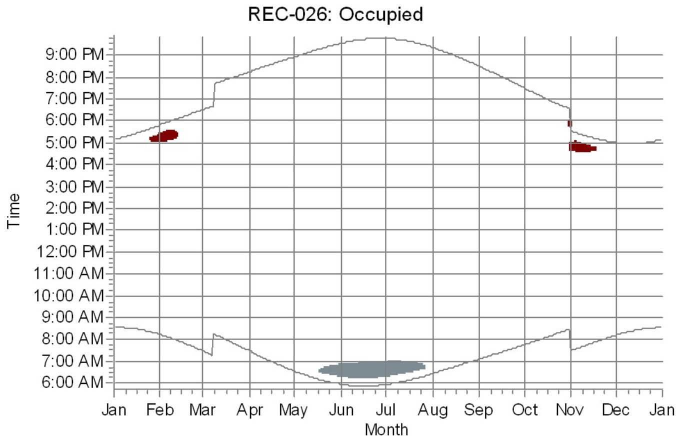
Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc

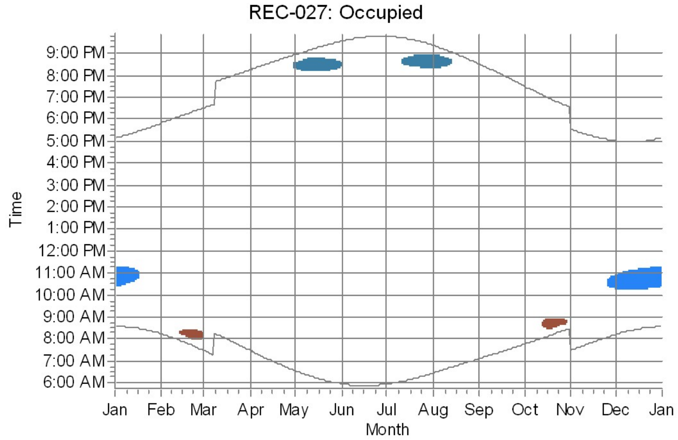


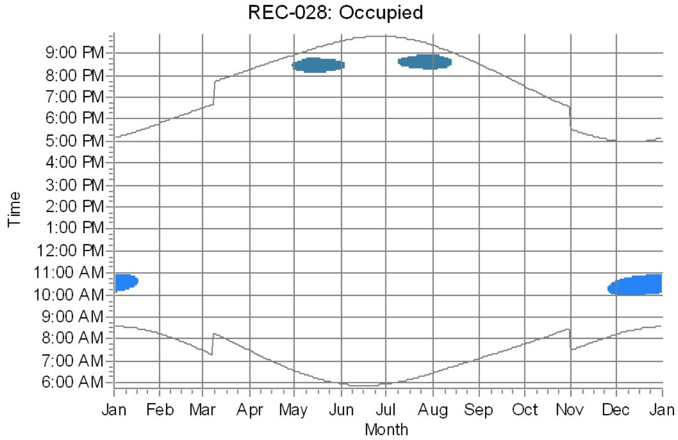
SHADOW - Calendar, graphical

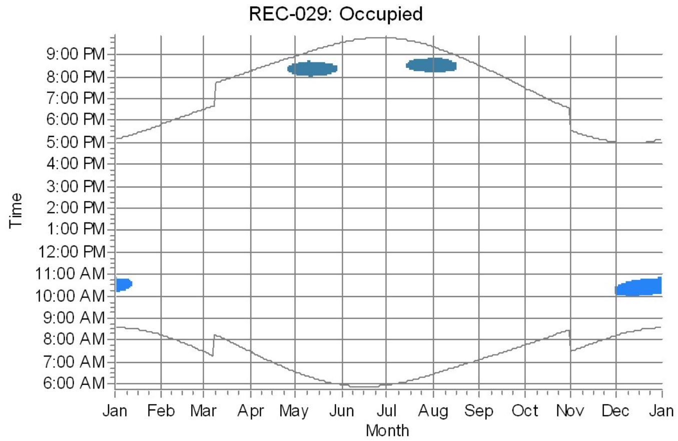
Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc

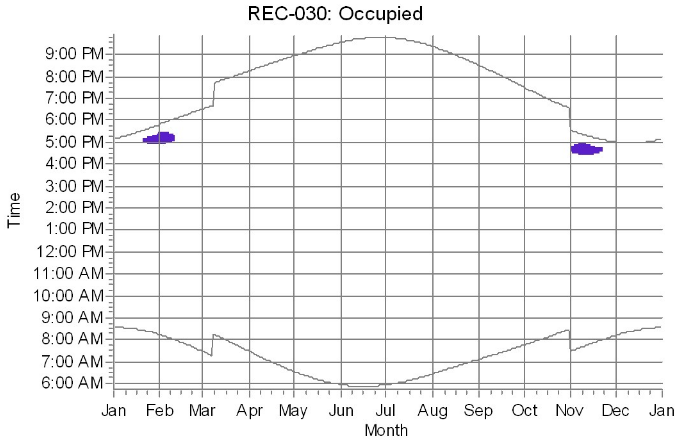












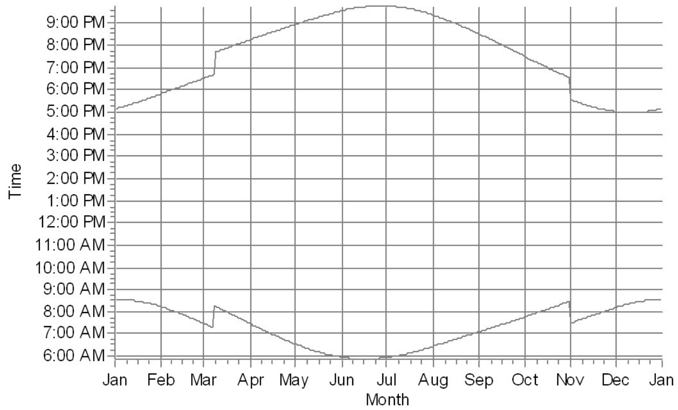
WTGs

T06: Overbuild / Alternate
T10: Primary
T12: Primary
T46: Primary
T47: Primary
T48: Primary
T50: Primary
T52: Primary

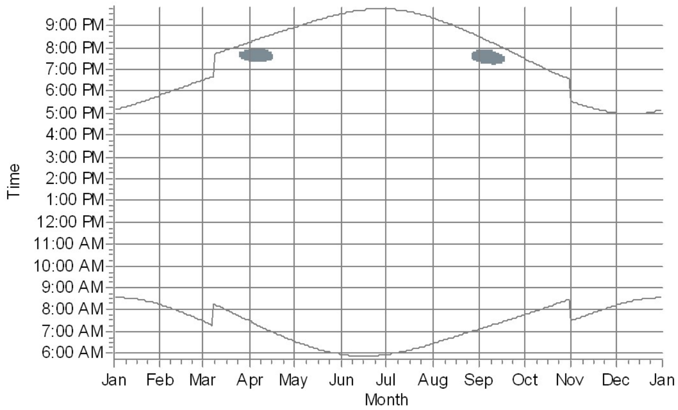
SHADOW - Calendar, graphical

Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc

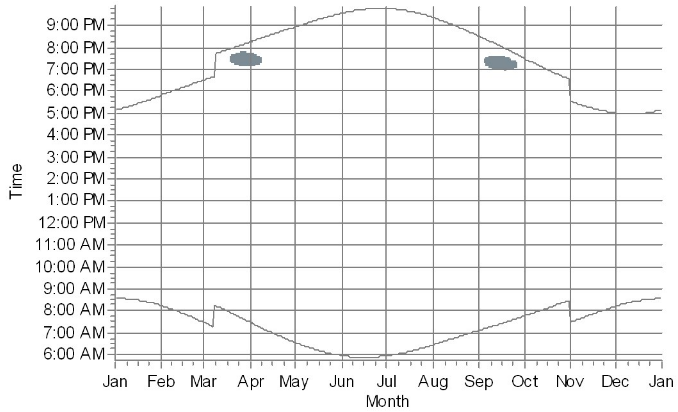
REC-031: Occupied



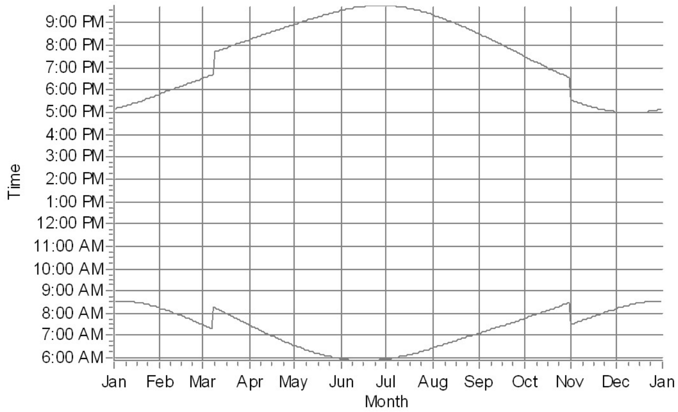
REC-032: Occupied



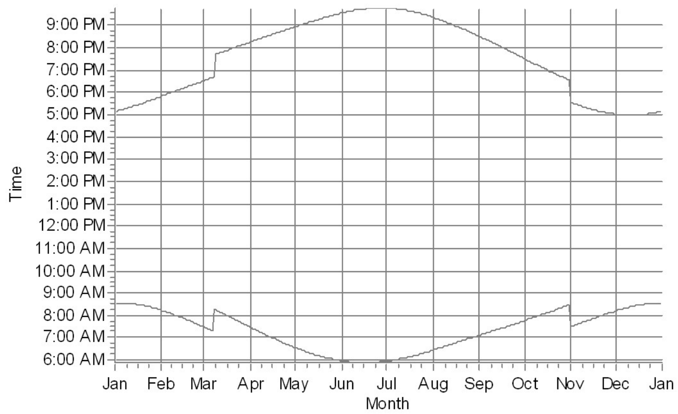
REC-033: Occupied



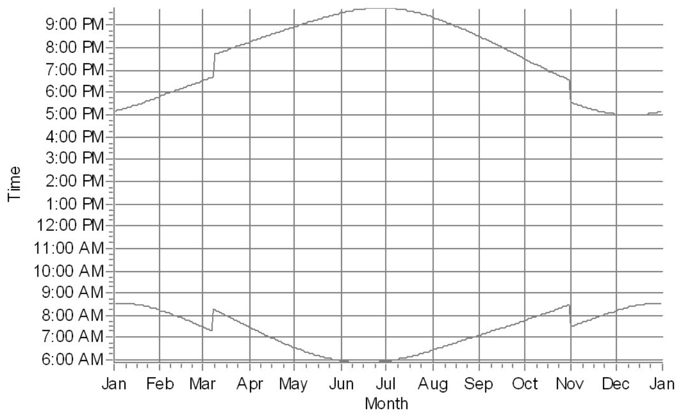
REC-034: Occupied



REC-035: Occupied



REC-036: Occupied



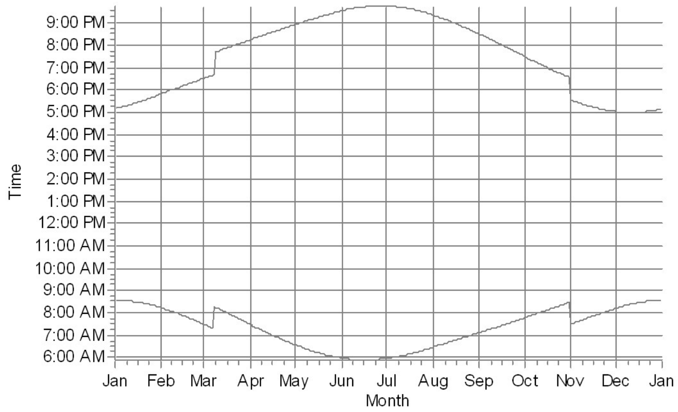
WTGs

T47: Primary

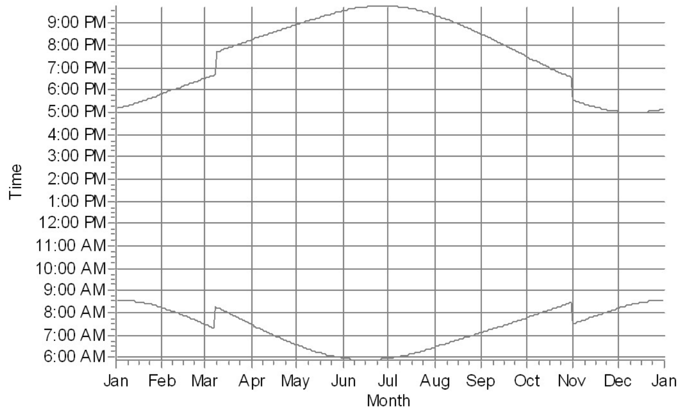
SHADOW - Calendar, graphical

Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc

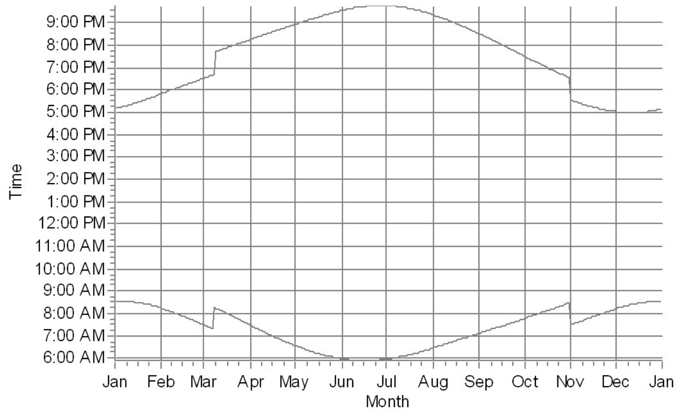
REC-037: Occupied



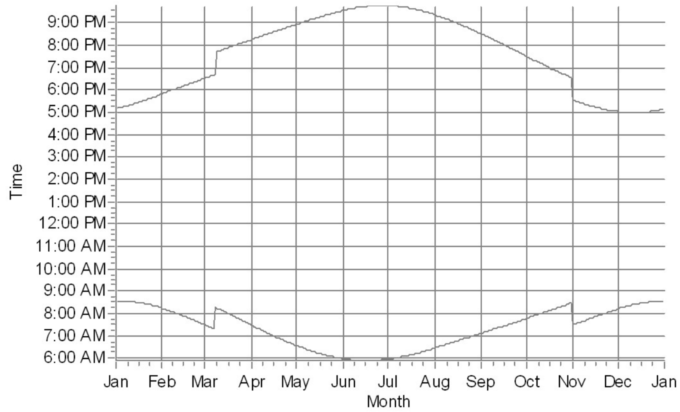
REC-038: Occupied



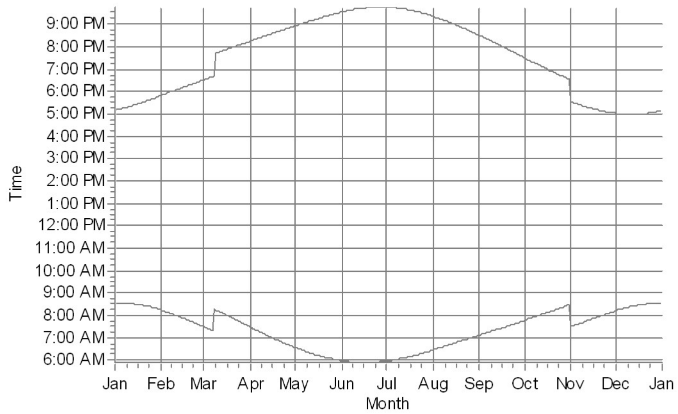
REC-039: Occupied



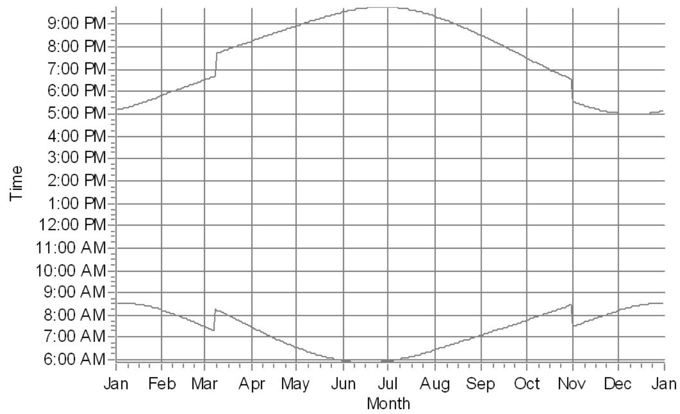
REC-040: Occupied



REC-041: Occupied



REC-042: Occupied



WTGs

SHADOW - Calendar, graphical

Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc

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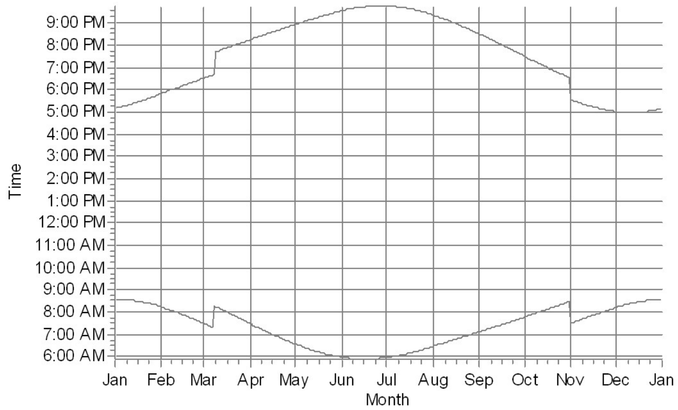

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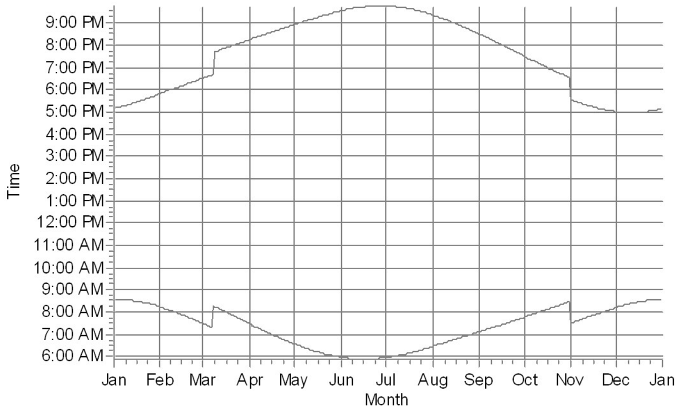

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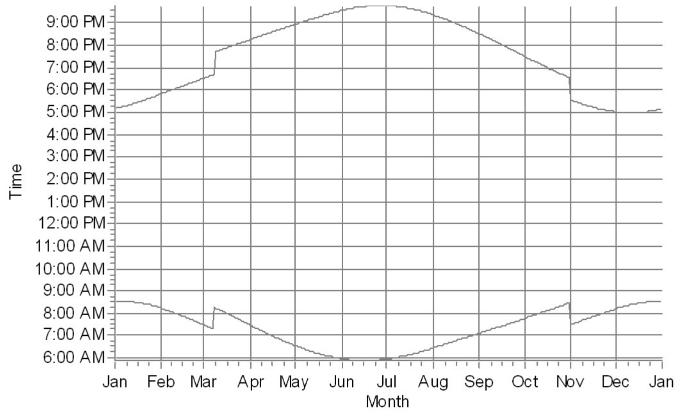

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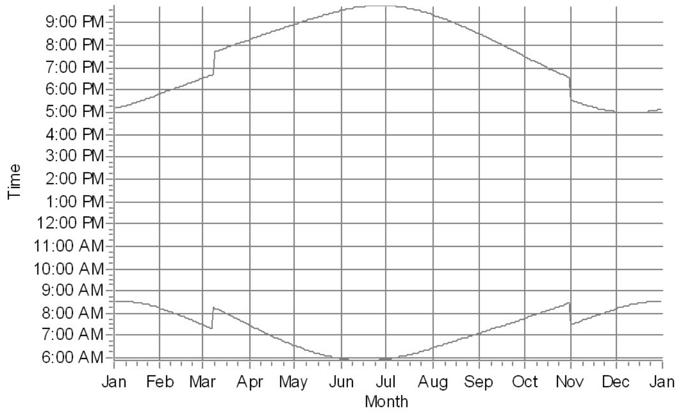

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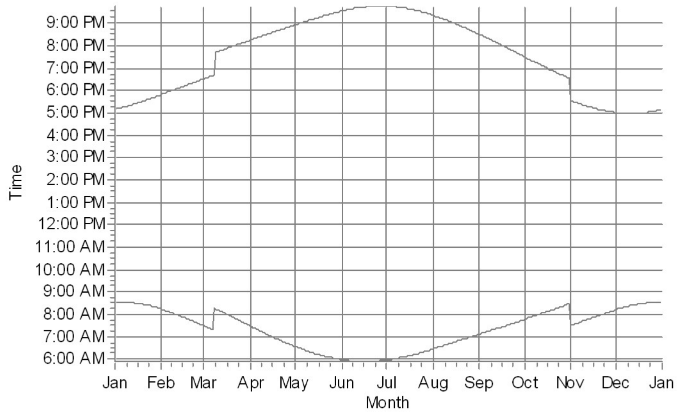

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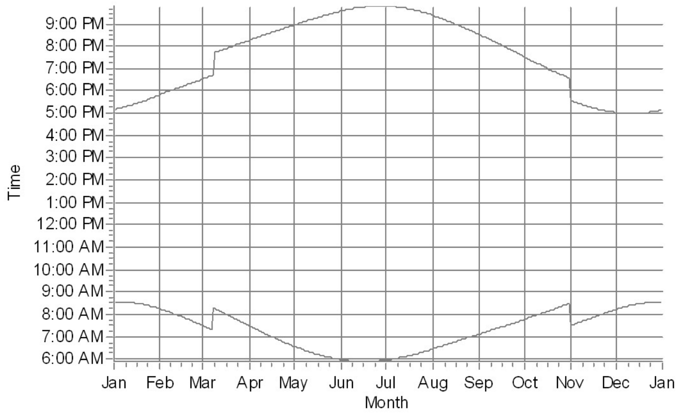


WTGs

Project:
Longspur_MNpower

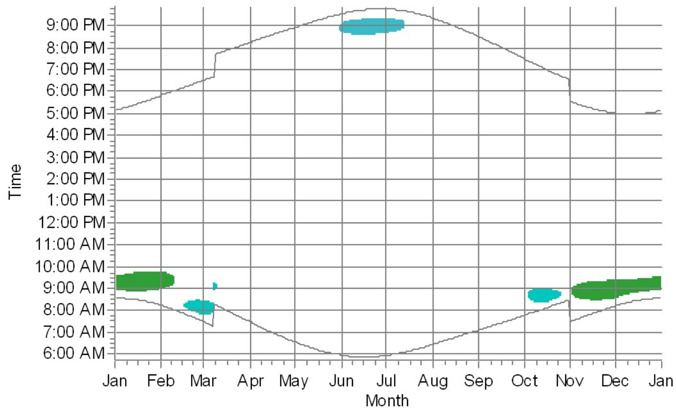
Description:
Burns & McDonnell has relied upon information provided by third-party sources to complete this study. While there is no reason to believe that the information provided is inaccurate or incomplete in any material respect, Burns & McDonnell has not independently verified such information and cannot guarantee or warranty its accuracy or completeness.

Licensed user:
1898 & Co., Part of Burns & McDonnell
9400 Ward Parkway
US-KANSAS CITY, MO 64114
816 448 7338
Tirthesh / tmshah@burnsmcd.com
Calculated:
10/24/2025 12:31 PM/4.1.273

SHADOW - Calendar, graphical

Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc

REC-049: Occupied



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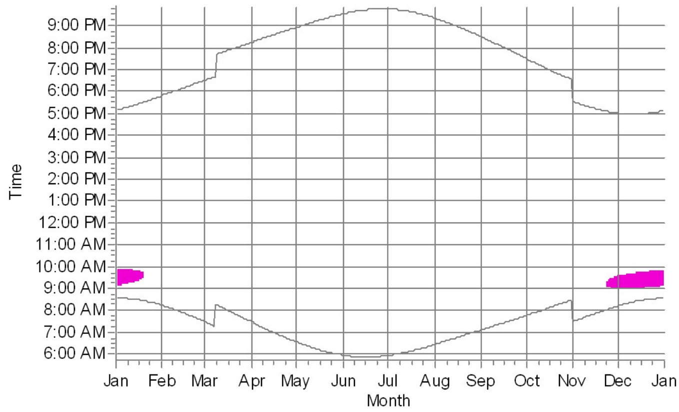

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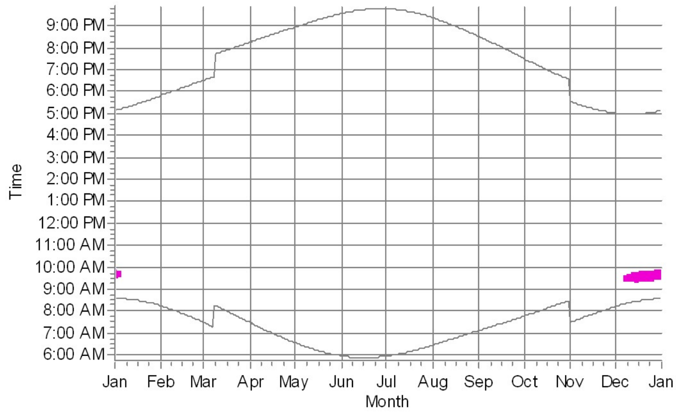

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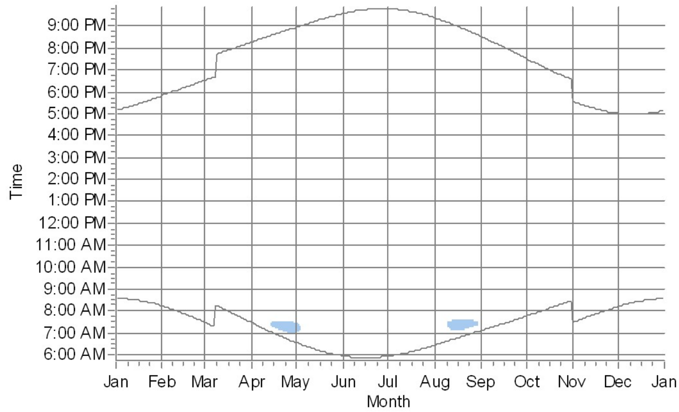

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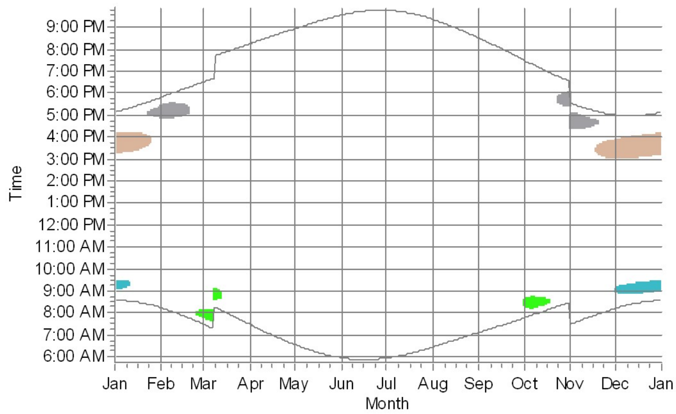

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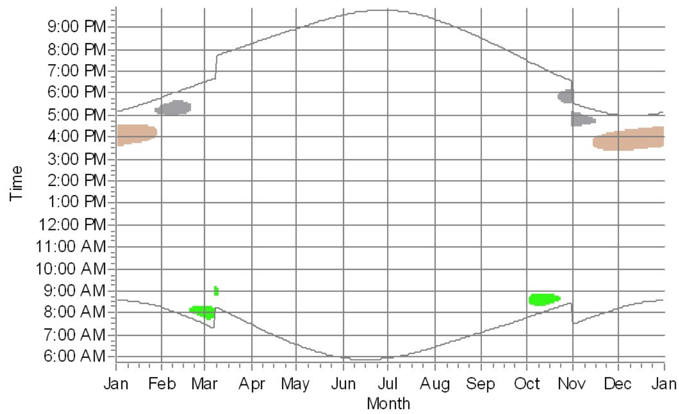

WTGs

T20: Primary
T21: Primary
T22: Primary
T23: Primary
T24: Primary
T25: Alternate
T26: Primary
T29: Overbuild / Alternate

Project:
Longspur_MNpower

Description:
Burns & McDonnell has relied upon information provided by third-party sources to complete this study. While there is no reason to believe that the information provided is inaccurate or incomplete in any material respect, Burns & McDonnell has not independently verified such information and cannot guarantee or warranty its accuracy or completeness.

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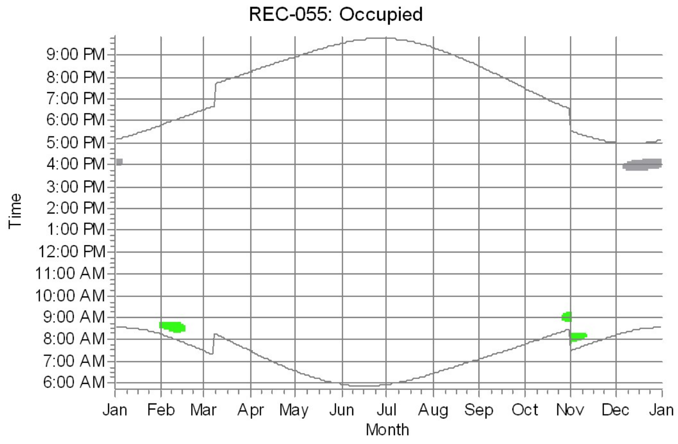
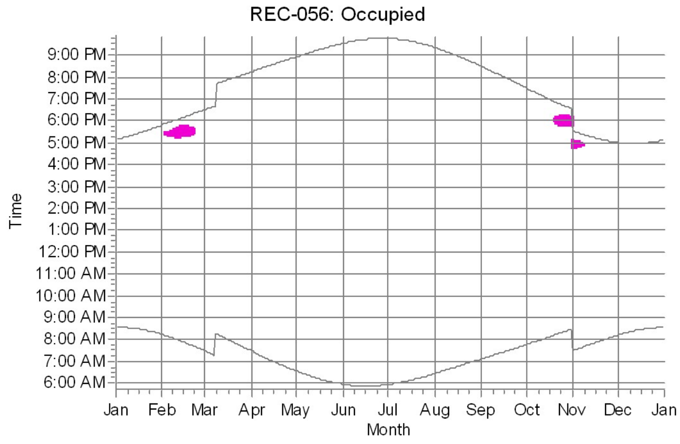
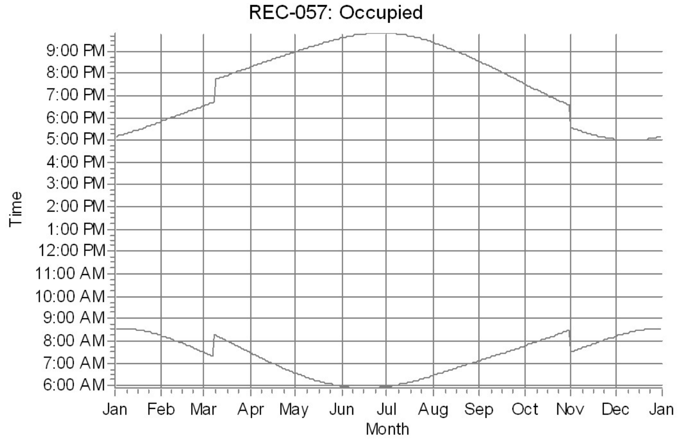
816 448 7338
Tirthesh / tmshah@burnsmcd.com
Calculated:
10/24/2025 12:31 PM/4.1.273

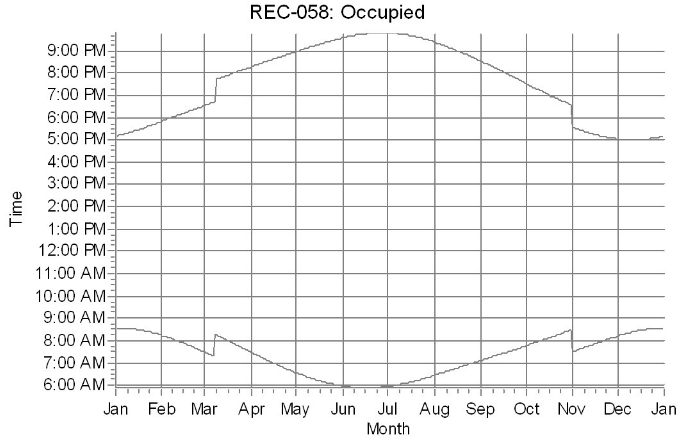
SHADOW - Calendar, graphical

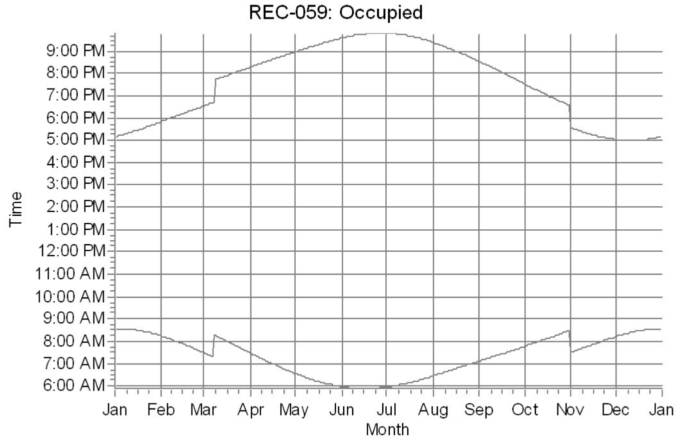
Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc

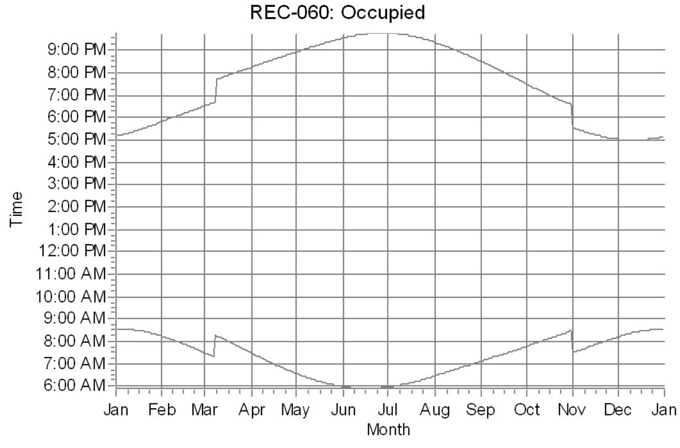










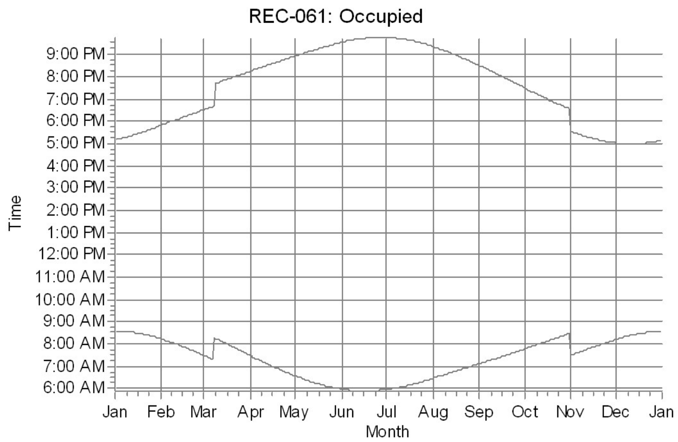


WTGs

T21: Primary   T23: Primary   T29: Overbuild / Alternate

SHADOW - Calendar, graphical

Calculation: Client Freq data_ShadowFlicker_Analysis_L013_Layout_57loc



WTGs

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Attachment K

Sound and Shadow Table

Longspur updated the sound and shadow flicker table included in the Wind Project Response for Information. The updates do not change the data reported; sound and shadow flicker levels (dba/hour-per-year) remain unchanged. The changes are limited to correcting labeling of receptors.

SOUND AND SHADOW FLICKER RESULTS						
Receptor ID	Participating Status	Sound Level [dBA]	Flicker Duration [hours/year]	Mitigated Flicker Duration [hours/year]	Nearest Turbine ID	Distance to Nearest Turbine ID [ft]
REC-001	Non-Participating	33	0.00	-	T68	6,707
REC-002	Non-Participating	37	0.00	-	T68	4,820
REC-003	Non-Participating	32	0.00	-	T62	11,835
REC-004	Non-Participating	33	0.00	-	T62	11,078
REC-005	Non-Participating	42	31.22	30.00*	T07	2,883
REC-006	Non-Participating	33	0.00	-	T01	6,445
REC-007	Non-Participating	40	0.00	-	T01	2,588
REC-008	Non-Participating	33	0.00	-	T03	7,173
REC-009	Non-Participating	31	0.00	-	T01	8,311
REC-010	Non-Participating	32	0.00	-	T03	7,229
REC-011	Non-Participating	32	0.00	-	T03	7,465
REC-012	Non-Participating	31	0.00	-	T03	8,217
REC-013	Non-Participating	36	0.00	-	T05	6,984
REC-014	Non-Participating	27	0.00	-	T03	11,683
REC-015	Non-Participating	30	0.00	-	T03	9,073
REC-016	Participating	40	12.25	-	T63	4,038
REC-017	Participating	44	3.20	-	T15	2,441
REC-018	Non-Participating	38	0.00	-	T16	5,574
REC-019	Non-Participating	38	0.00	-	T16	5,410
REC-020	Participating	44	35.37	30.00*	T62	2,356
REC-021	Participating	38	0.00	-	T48	5,538
REC-022	Participating	42	0.00	-	T16	2,681
REC-023	Non-Participating	40	13.12	-	T48	4,272
REC-024	Non-Participating	40	3.08	-	T58	4,534
REC-025	Participating	43	56.90	30.00*	T12	2,601
REC-026	Participating	44	14.03	-	T46	1,602
REC-027	Non-Participating	44	24.77	-	T48	2,174
REC-028	Participating	44	23.65	-	T47	1,980
REC-029	Participating	44	19.65	-	T47	1,795
REC-030	Participating	42	2.70	-	T40	3,194
REC-031	Non-Participating	37	0.00	-	T61	8,186
REC-032	Participating	44	6.75	-	T44	2,383
REC-033	Non-Participating	44	6.68	-	T44	2,102
REC-034	Non-Participating	36	0.00	-	T40	7,154
REC-035	Non-Participating	42	0.00	-	T25	3,040
REC-036	Non-Participating	43	0.00	-	T25	2,950
REC-037	Non-Participating	27	0.00	-	T70	17,260
REC-038	Non-Participating	31	0.00	-	T70	8,673
REC-039	Non-Participating	36	0.00	-	T18	5,021
REC-040	Non-Participating	36	0.00	-	T18	4,952
REC-041	Non-Participating	33	0.00	-	T70	8,115
REC-042	Non-Participating	35	0.00	-	T68	6,923
REC-043	Non-Participating	33	0.00	-	T19	11,002
REC-044	Non-Participating	33	0.00	-	T19	10,485
REC-045	Non-Participating	37	0.00	-	T68	6,113
REC-046	Non-Participating	37	0.00	-	T68	5,853
REC-047	Participating	38	0.00	-	T65	5,950
REC-048	Non-Participating	32	0.00	-	T28	10,878

SOUND AND SHADOW FLICKER RESULTS						
REC-049	Non-Participating	44	36.12	30.00*	T24	2,490
REC-050	Participating	41	9.53	-	T29	3,566
REC-051	Participating	40	2.65	-	T29	3,865
REC-052	Participating	38	3.67	-	T20	4,831
REC-053	Participating	42	25.52	-	T22	2,464
REC-054	Participating	42	21.68	-	T22	2,771
REC-055	Non-Participating	40	4.47	-	T22	3,446
REC-056	Participating	43	3.28	-	T22	3,091
REC-057	Non-Participating	30	0.00	-	T03	8,924
REC-058	Non-Participating	32	0.00	-	T03	7,310
REC-059	Non-Participating	32	0.00	-	T01	7,301
REC-060	Non-Participating	24	0.00	-	T70	17,720
REC-061	Non-Participating	29	0.00	-	T70	10,393

Notes:

[1] Coordinates presented in UTM North, NAD 83 Zone 14 (meters)

[2] Participating status provided by Client via *"Residence Status_ARL.shp"* on April 28, 2026.

[3] All results based on turbine layout coordinates via *"Longspur_MNPower_L013_202p5MW_45xV163-4p5_113mHH_20250922_WithAlt"*

[4] Mitigation techniques will be utilized to reduce the shadow flicker on residences with more than 30 hours per year, indicated with the asterisk. Common techniques include planting vegetation, awning installation, and/or reduced turbine operation via curtailment. The mitigation strategies ensure the Project would be able to meet the shadow flicker limits. However, mitigation may not be necessary for the final layout based on which turbines are ultimately selected to be built. A final shadow flicker model will be completed to demonstrate compliance for the final layout.

minnesota power

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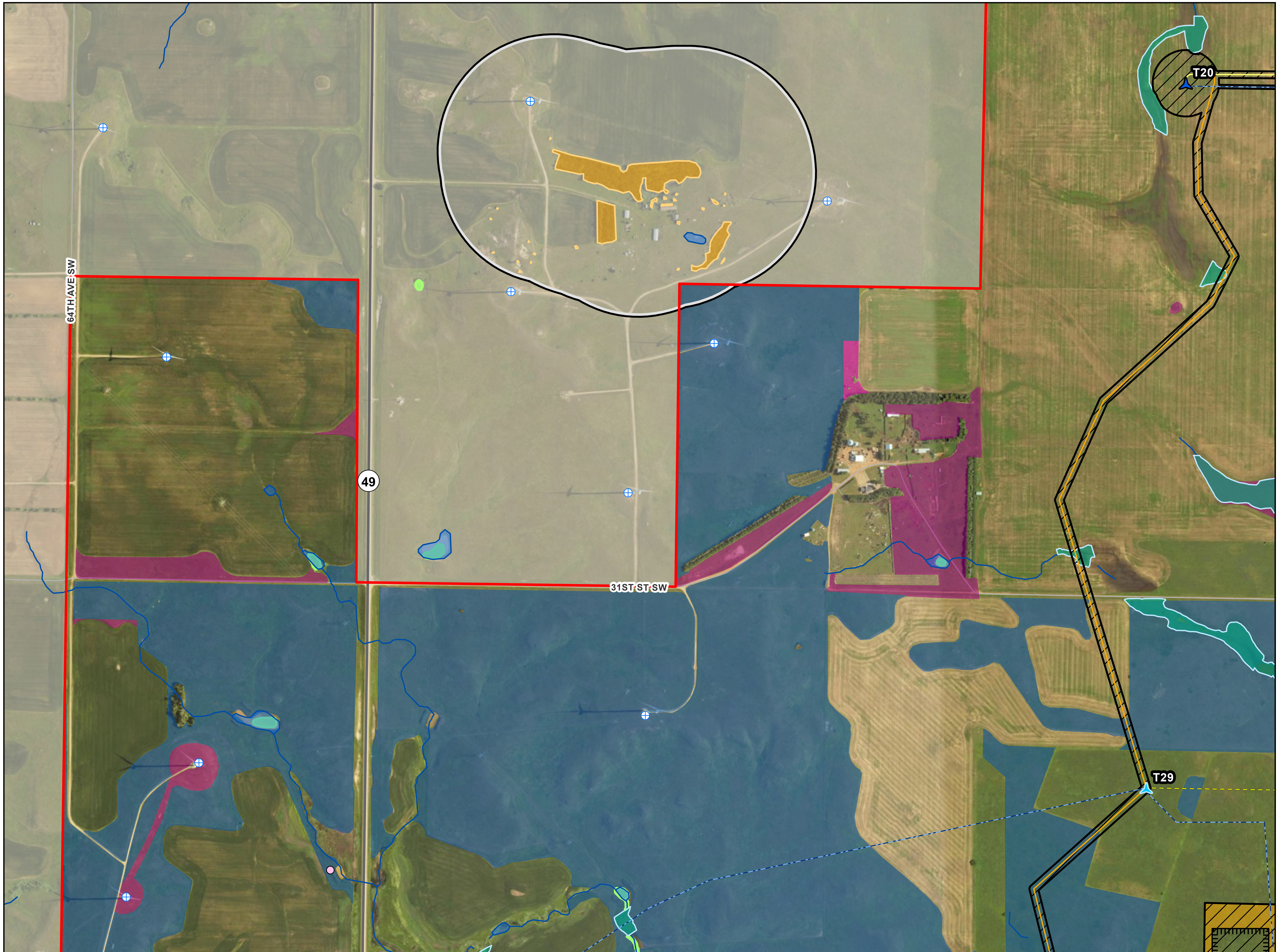
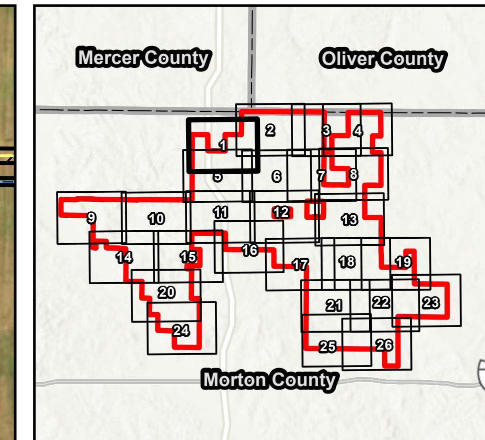
Attachment L

Site Plan Detail





0 450 900 Feet
1:9,600

N
W E
S

Project Area
Substation Yard
Substation Facility
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line

Existing Wind Turbine
Abandoned Mine
Potential Northern Long-Eared Bat Habitat
1,000ft Connected Habitat Buffer

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Desktop)
Unbroken Grassland

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

Page 1 of 26

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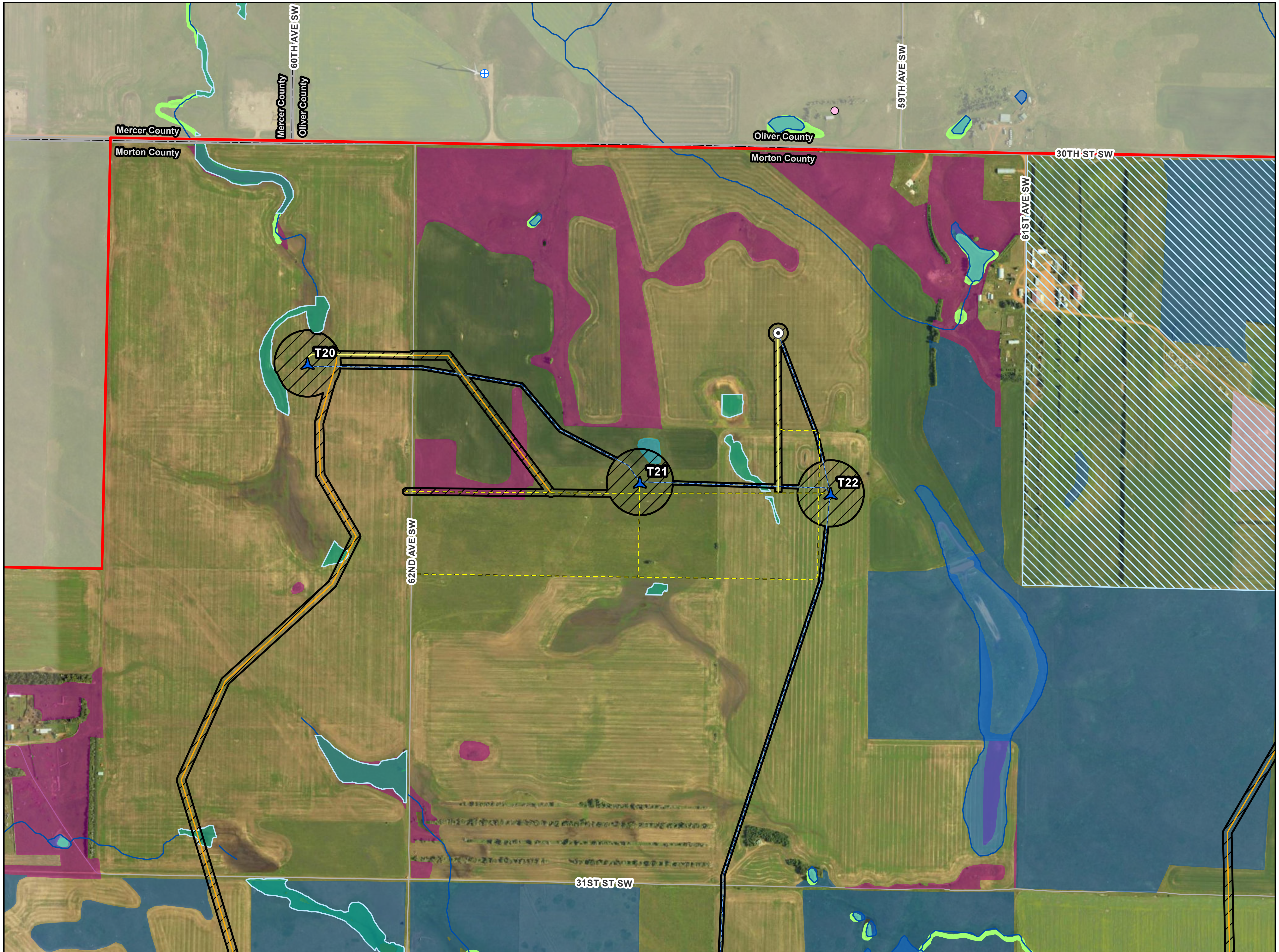
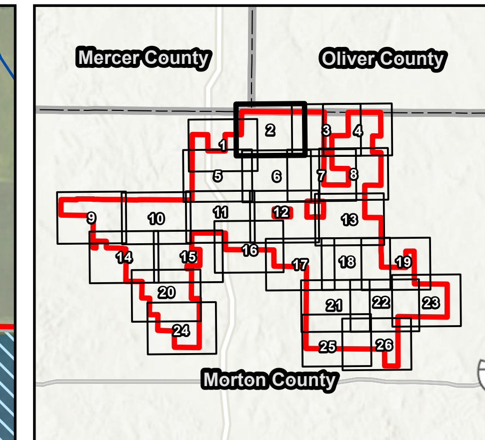
For Environmental Review Purposes Only





0 450 900 Feet

1:9,600

N
W E
S

Project Area
Construction Easement
Primary Turbine
Met Tower
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line

Existing Wind Turbine
Abandoned Mine
Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Desktop)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

Updated Page 2 of 26

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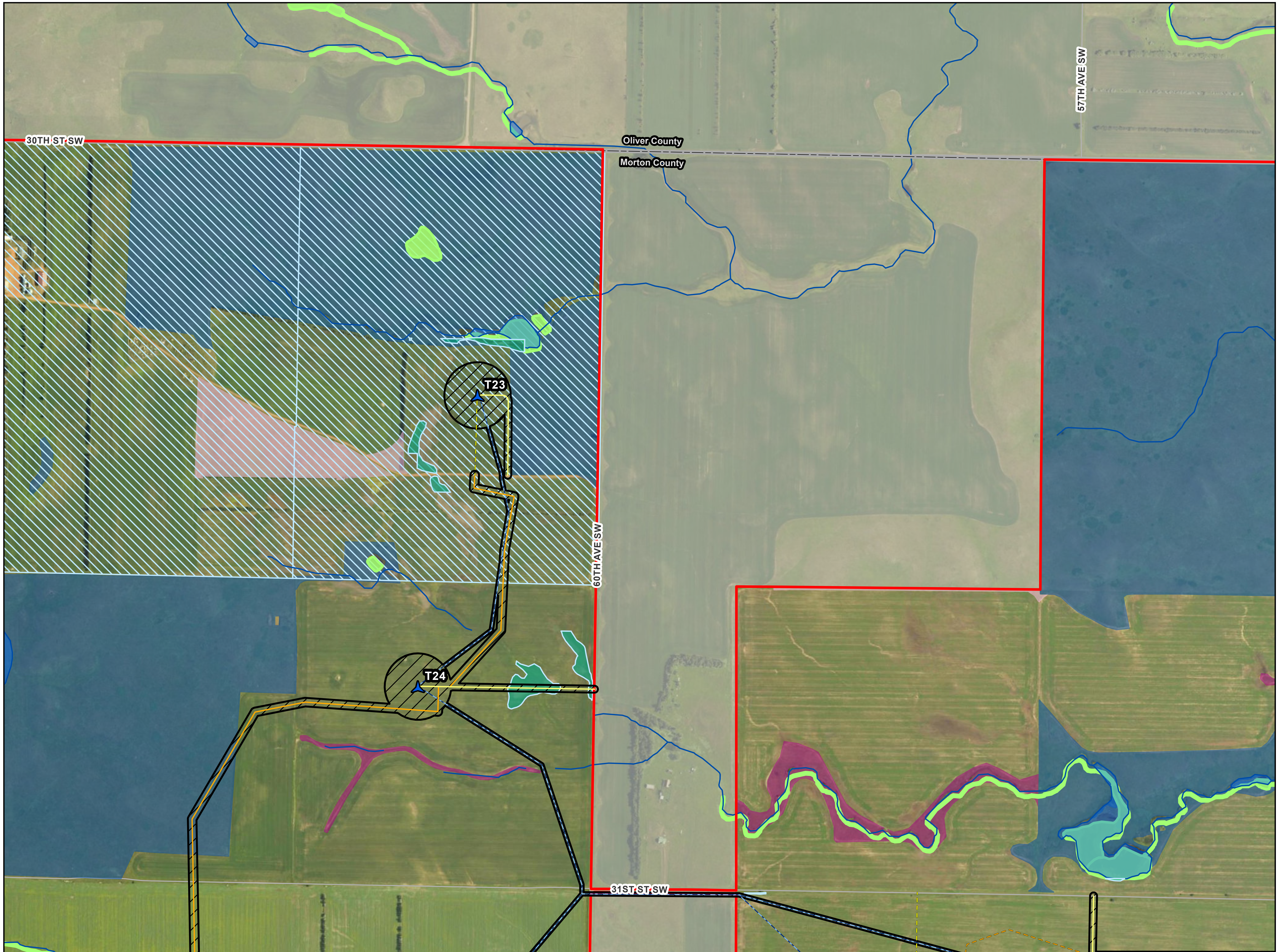

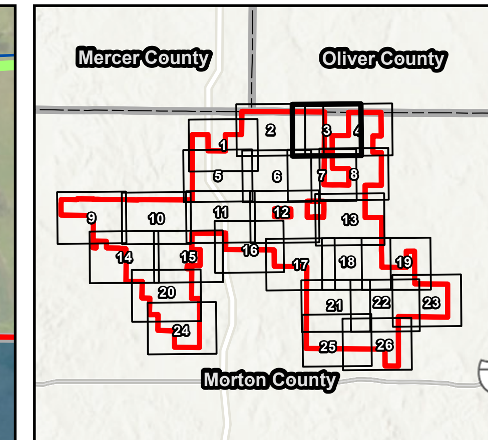

0 450 900 Feet

1:9,600

N S E W

Project Area
Construction Easement
Primary Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line

Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

Updated Page 3 of 26

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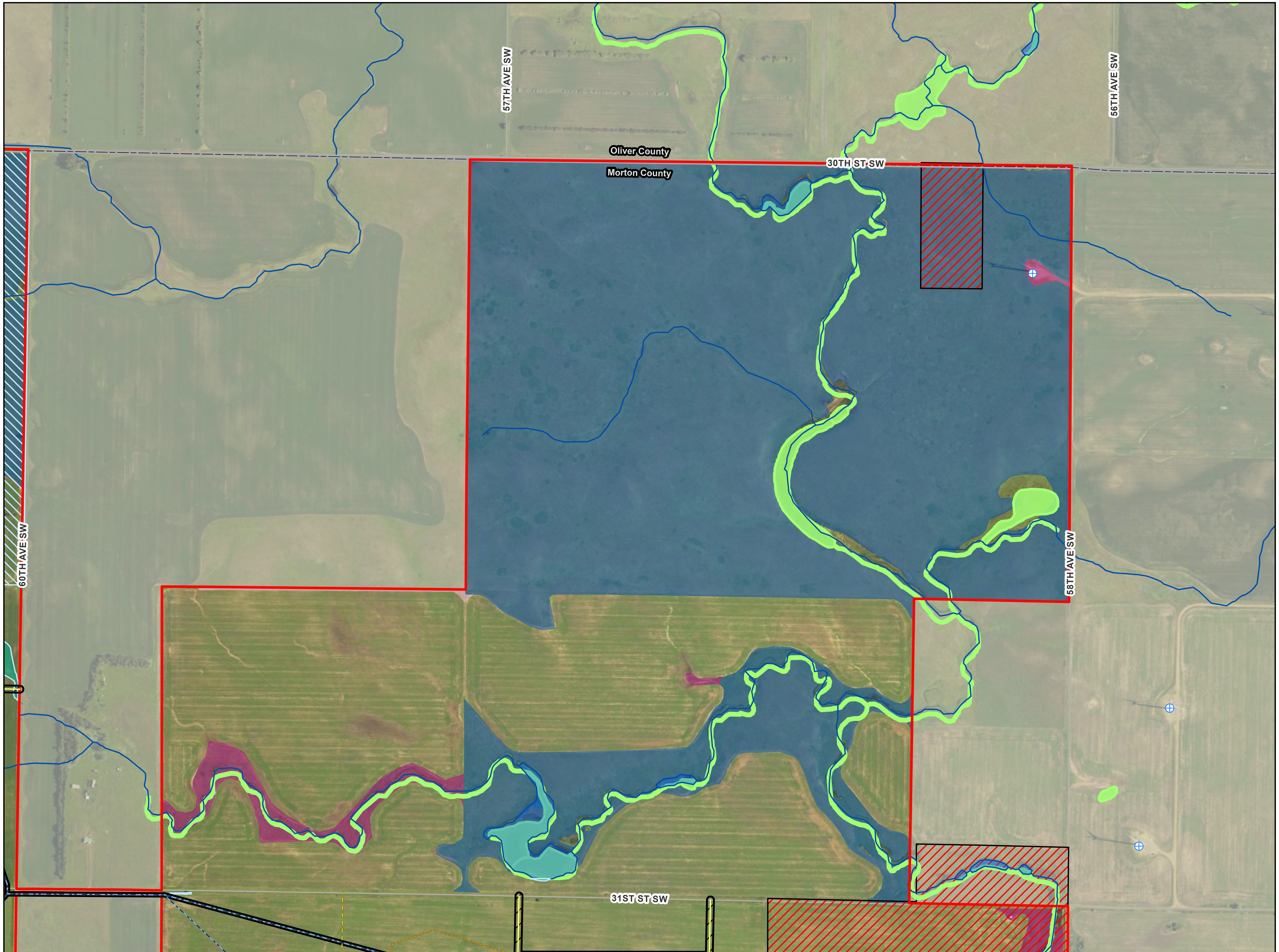

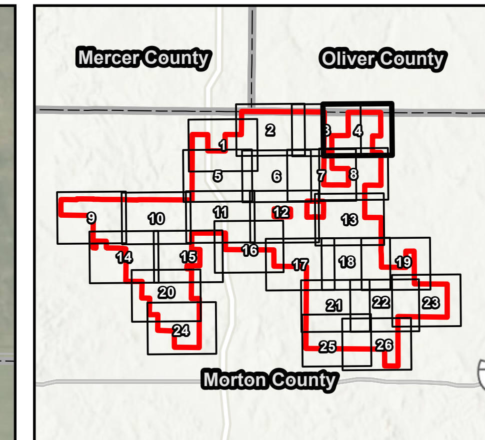

0 450 900 Feet
1:9,600

N W E S

Project Area
Construction Easement
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line

Existing Wind Turbine
USFWS Conservation Easement (Closed Access)
Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

Updated Page 4 of 26

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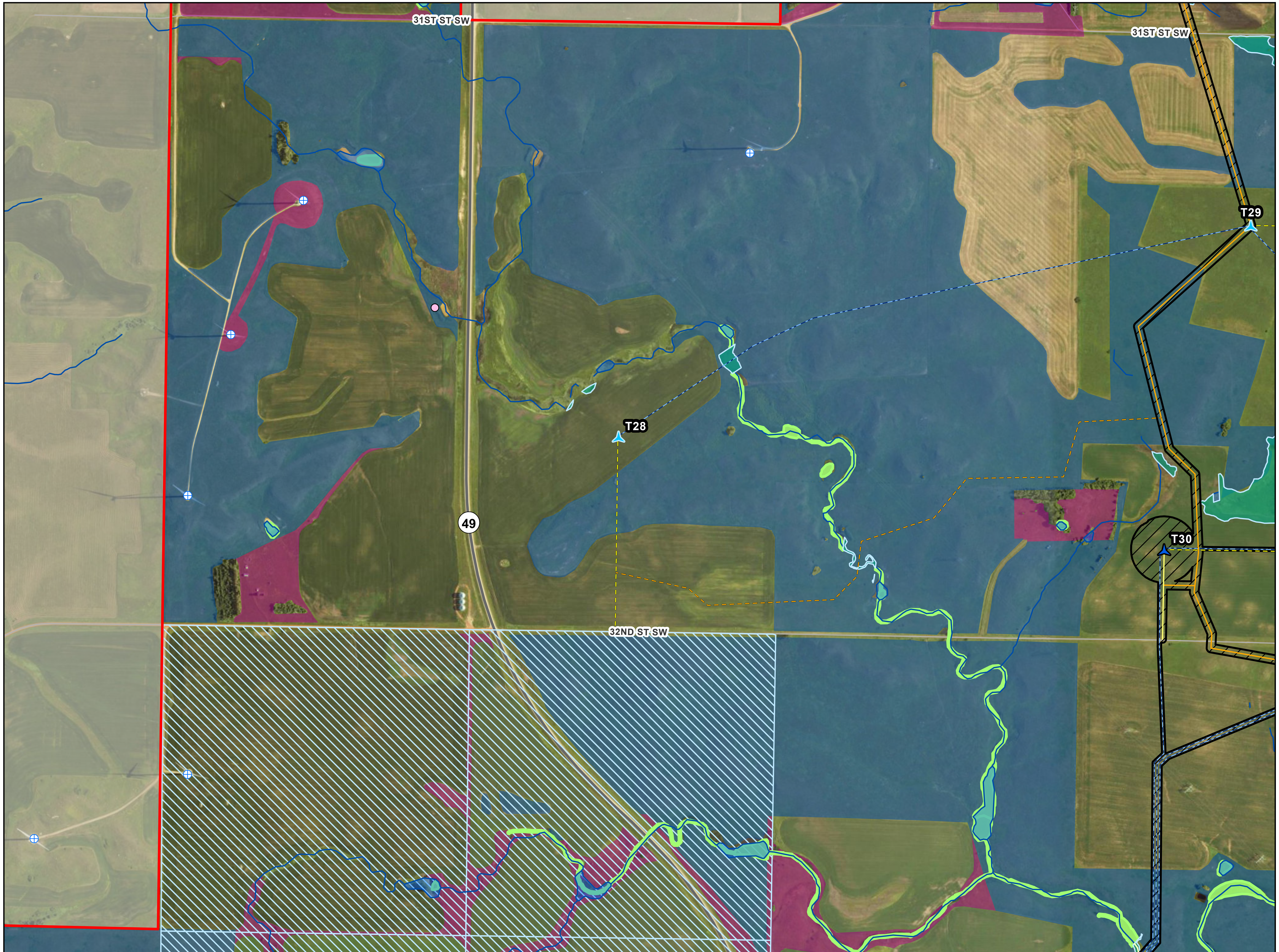

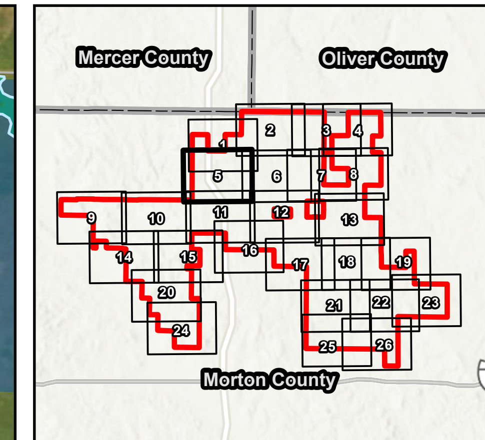

0 450 900 Feet
1:9,600

N
W E
S

Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line

Existing Wind Turbine
Abandoned Mine
Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Unbroken Grassland

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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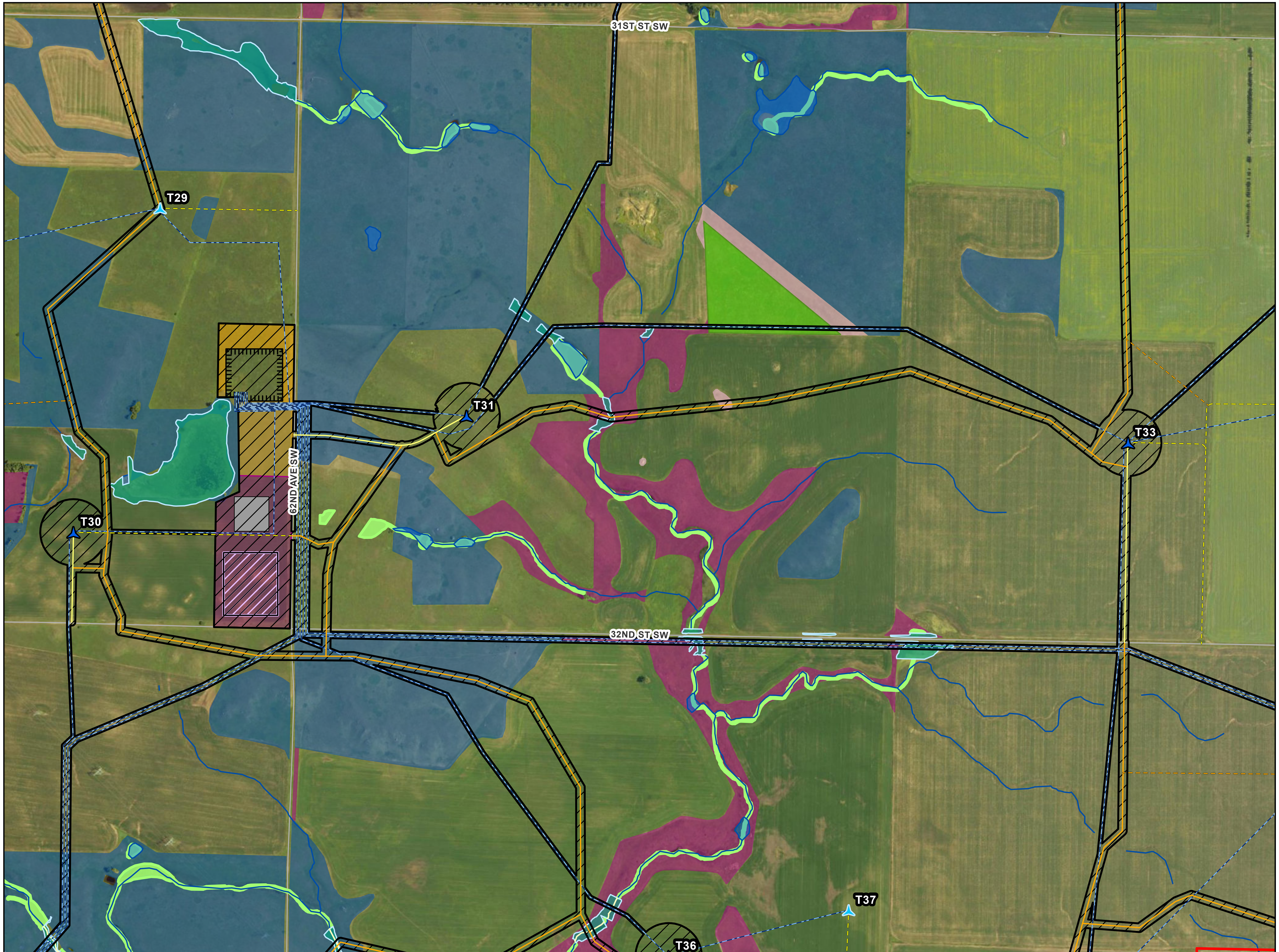
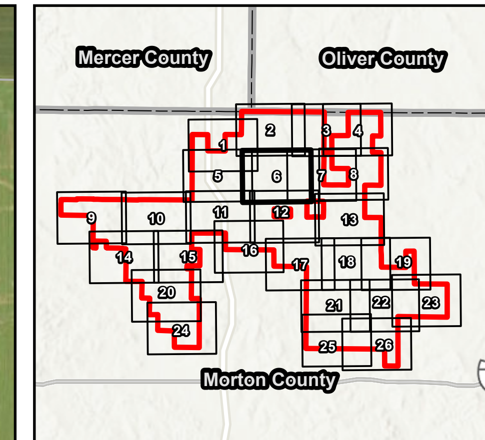
Date: (4/28/2026) Source: Z:\Clients\M_P\MN_Power\Longspur_Wind\ArcGIS\Permitting\PSC\Longspur_Wind_PSC_Application.aprx





0 450 900 Feet
1:9,600

N W E S

Project Area
Substation Yard
Substation Facility
Construction Laydown Yard
O&M Building
O&M Yard
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Previous Survey)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

Updated Page 6 of 26

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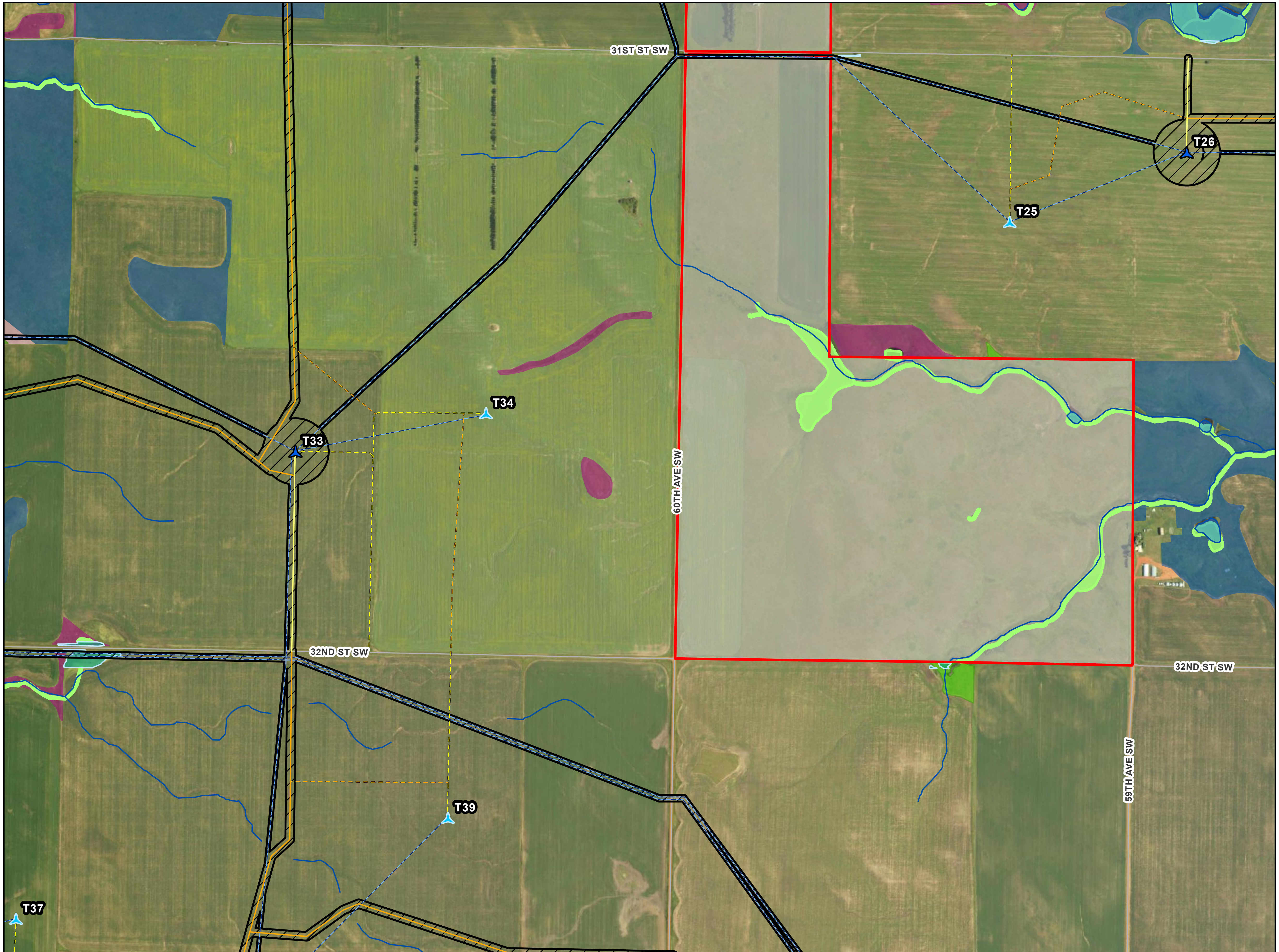
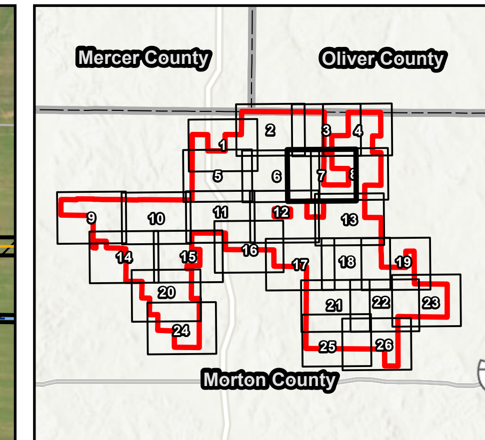
For Environmental Review Purposes Only

Date: (4/28/2026) **Source:** Z:\Clients\M_P\MN_Power\Longspur_Wind\ArcGIS\Permitting\PSC\Longspur_Wind_PSC_Application.aprx





0 450 900 Feet
1:9,600

N
W E
S

Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Previous Survey)

Figure 12:
Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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For Environmental Review Purposes Only

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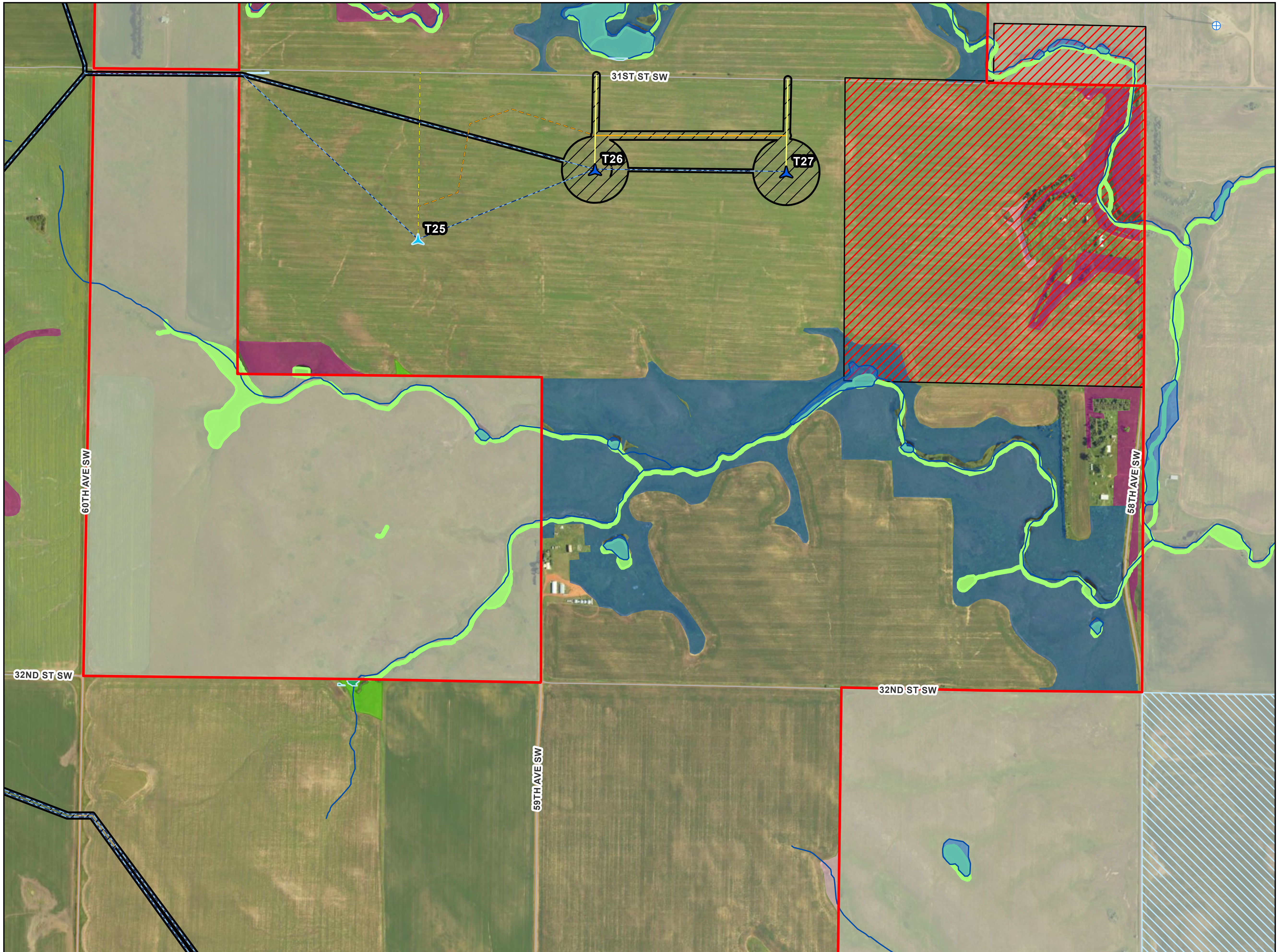

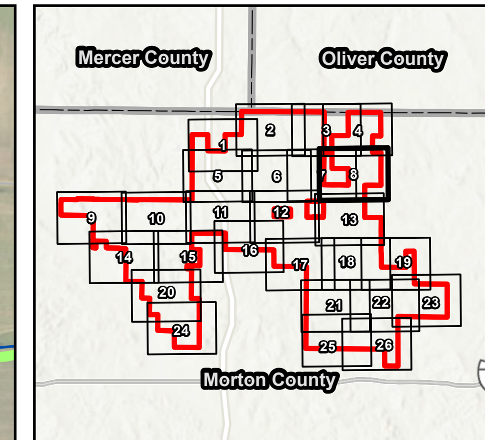

0 450 900 Feet

1:9,600

N E S W

- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Alternate Crane Path
- Collection Line
- Existing Wind Turbine
- USFWS Conservation Easement (Closed Access)
- Mineral Trust Land

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NWI Wetland
- NHD Waterway
- NHD Waterbody

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Previous Survey)
- Unbroken Grassland
- Unbroken Grassland (Previous Survey)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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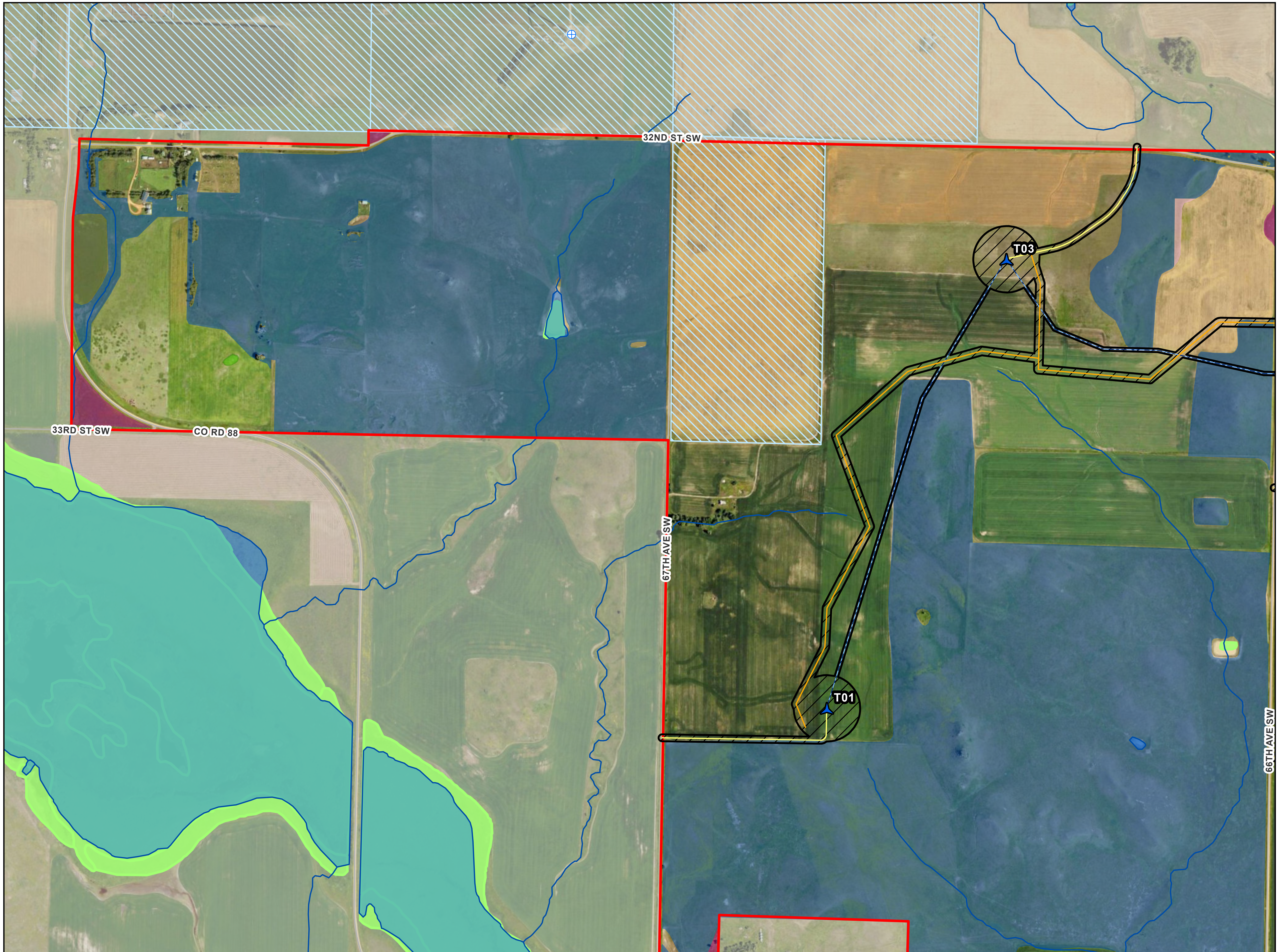

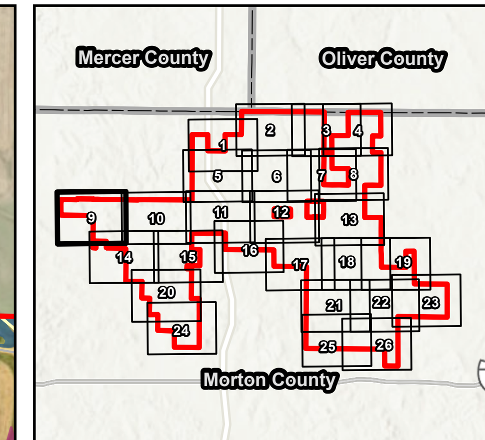

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Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line

Existing Wind Turbine
Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Previous Survey)

Figure 12:
Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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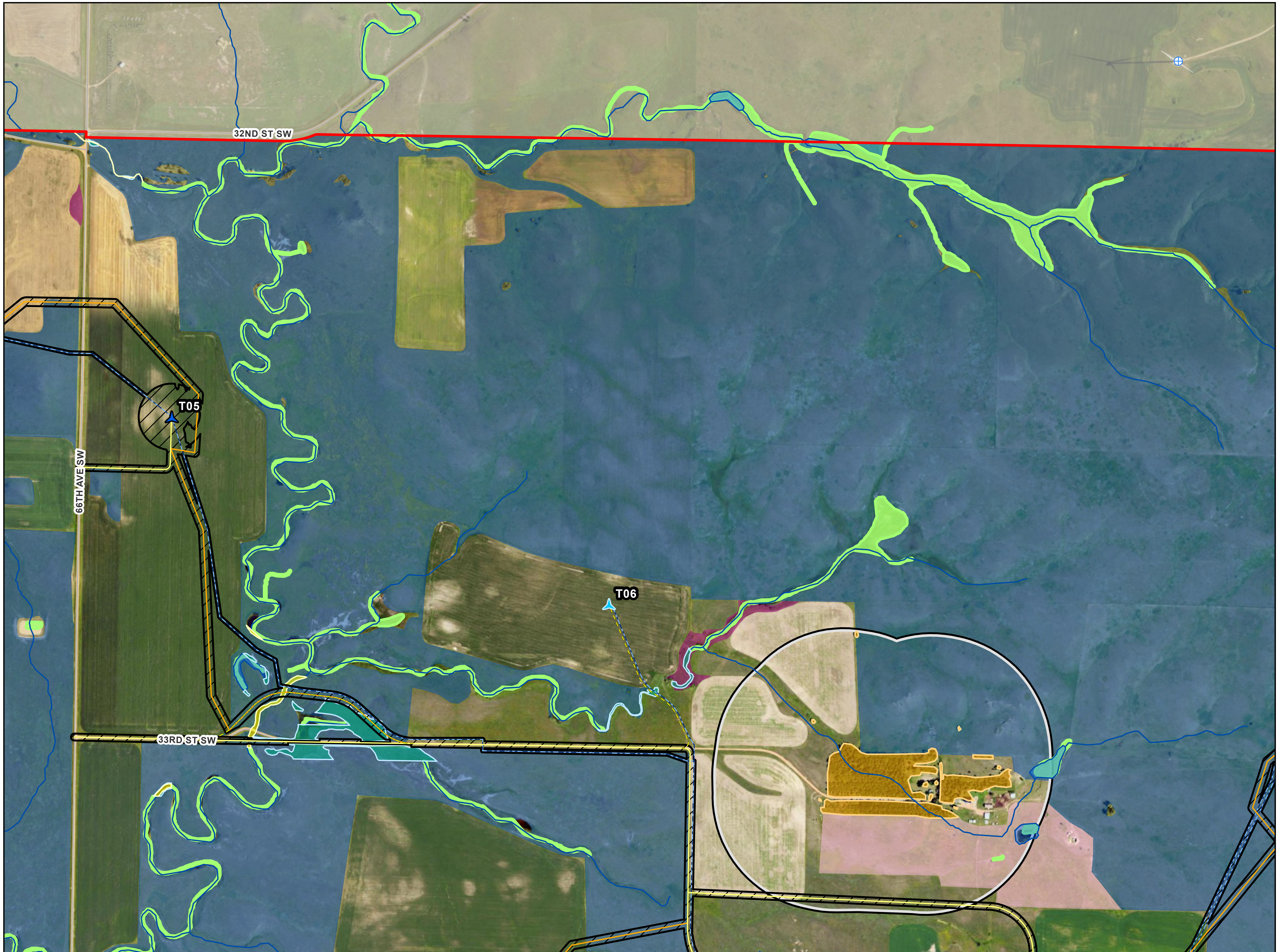

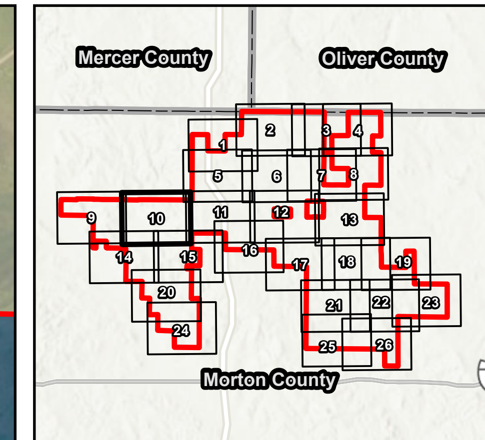

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Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line

Existing Wind Turbine
Potential Northern Long-Eared Bat Habitat
1,000ft Connected Habitat Buffer

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Desktop)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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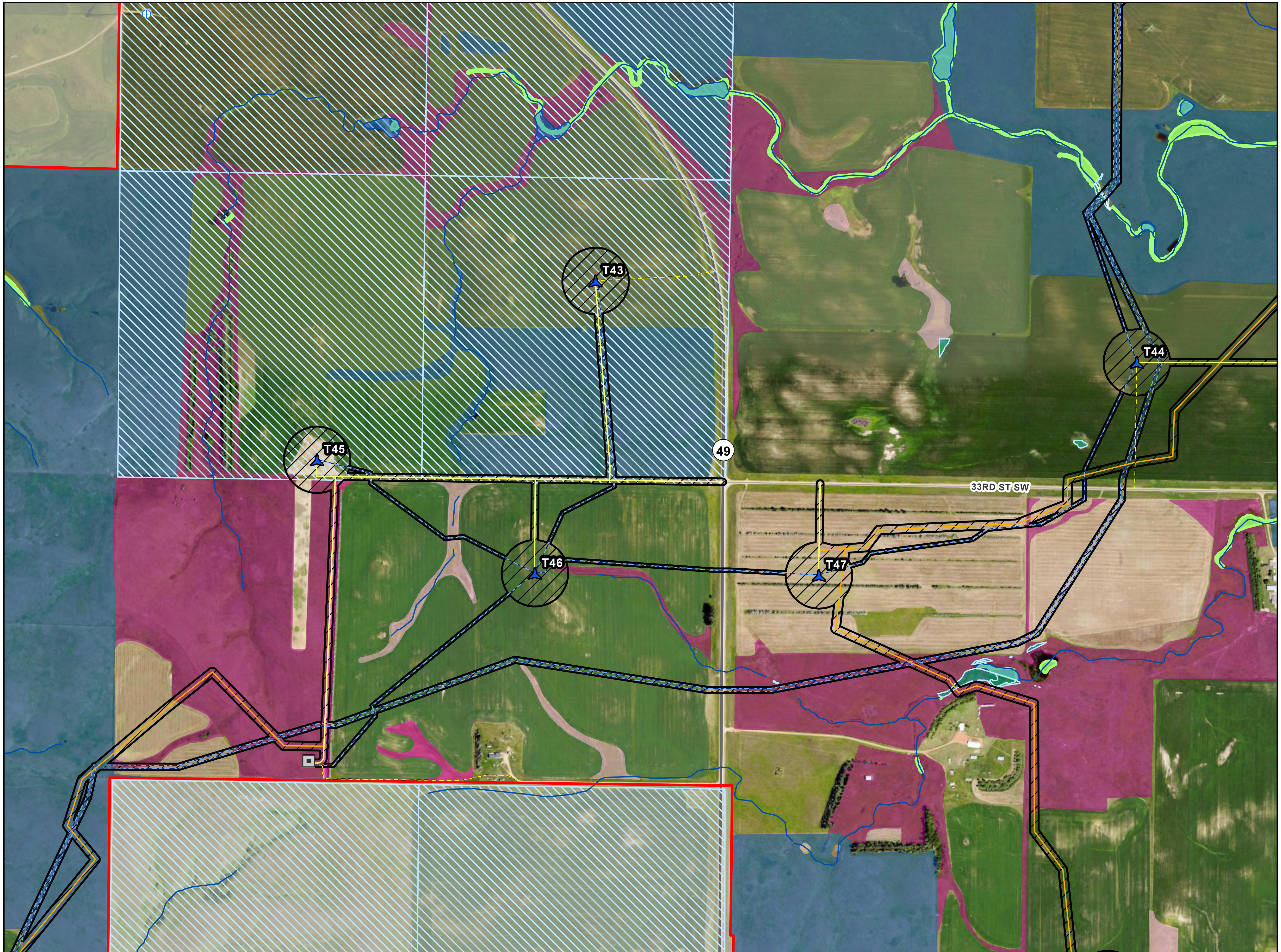

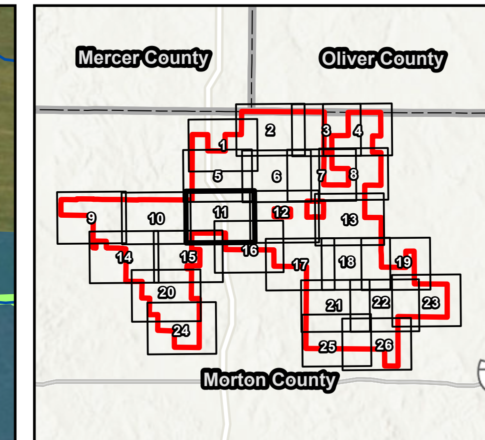

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N W E S

- Project Area
- Construction Easement
- Primary Turbine
- ADLS Radar Tower
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line
- Existing Wind Turbine
- Mineral Trust Land

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NWI Wetland
- NHD Waterway
- NHD Waterbody

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Desktop)
- Broken Grassland (Previous Survey)
- Unbroken Grassland
- Unbroken Grassland (Desktop)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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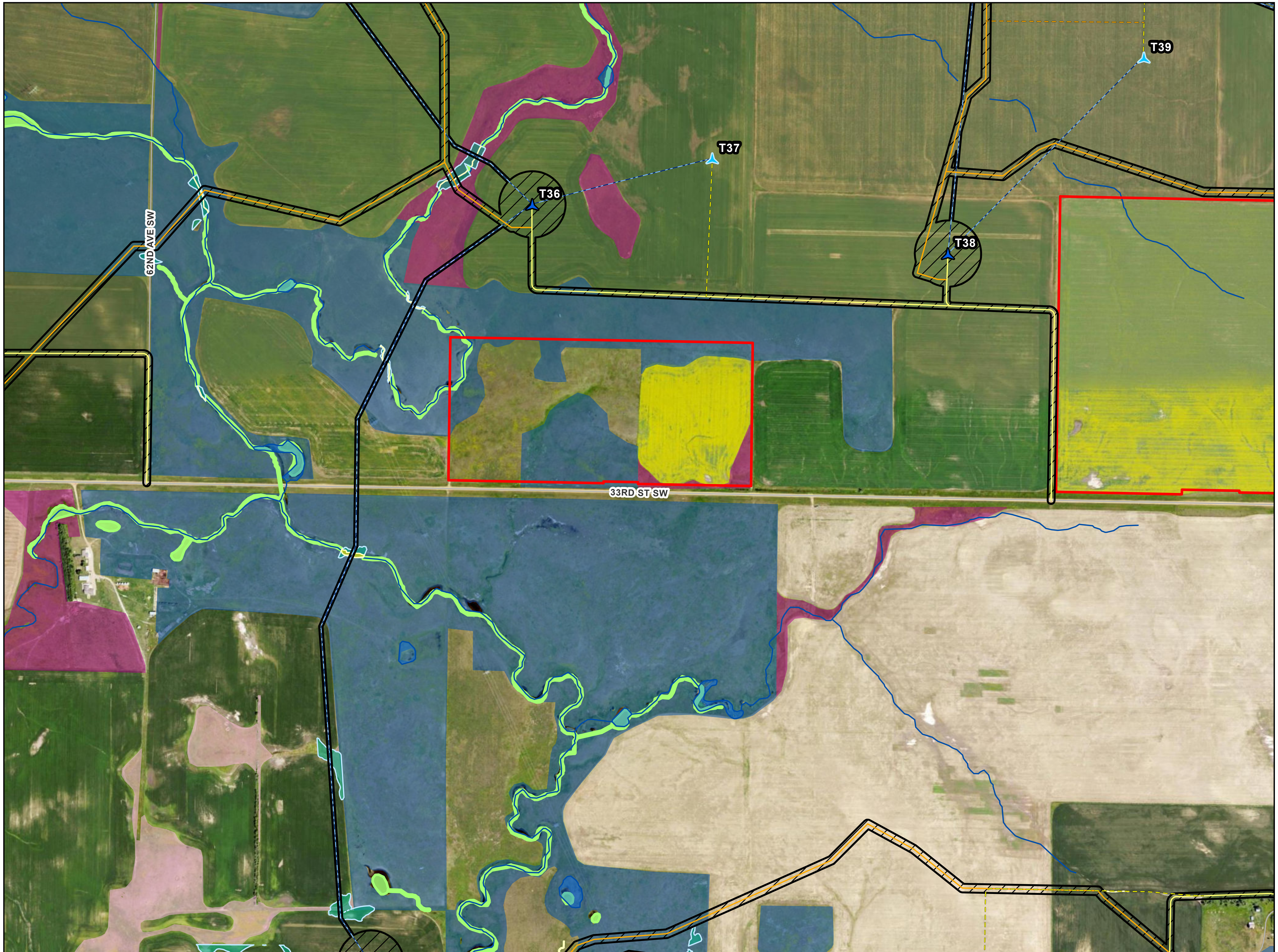

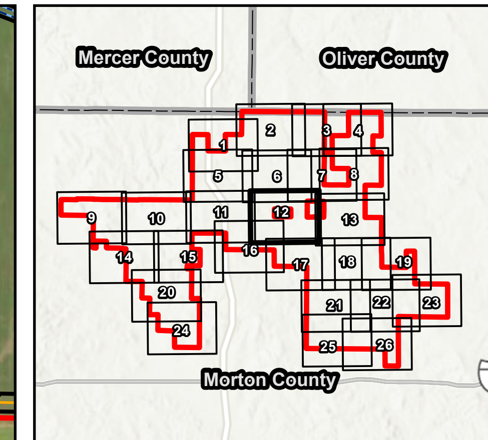

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Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Previous Survey)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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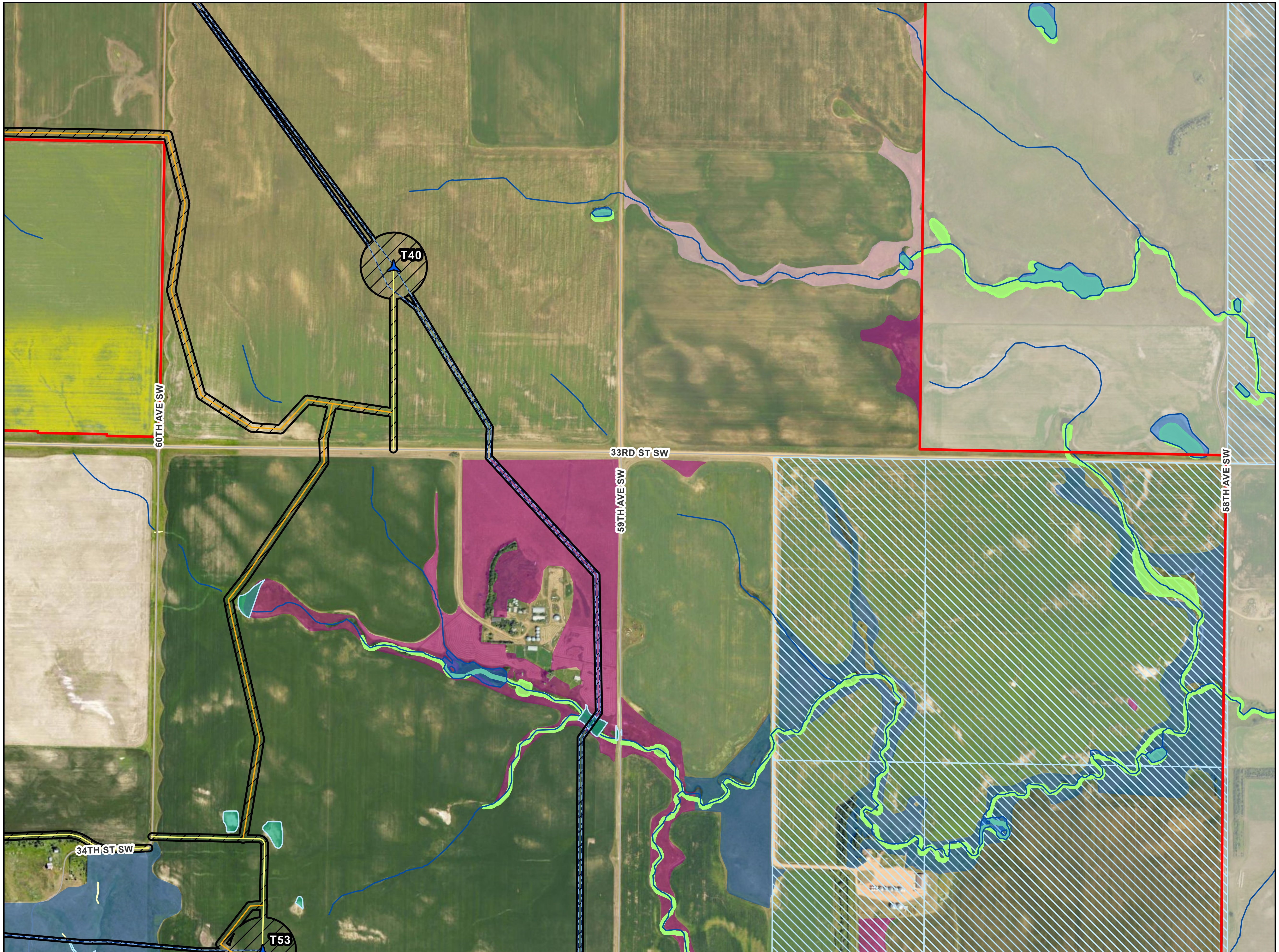

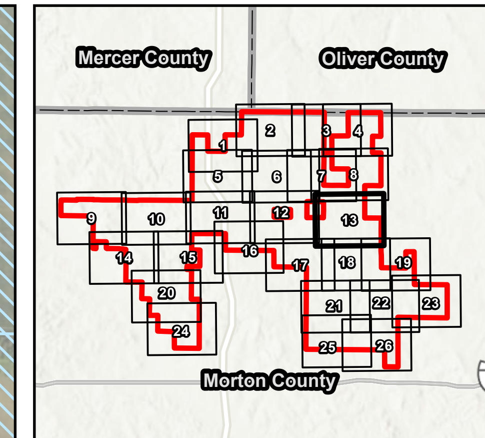

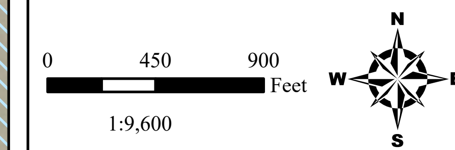

Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line

Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland

Figure 12:
Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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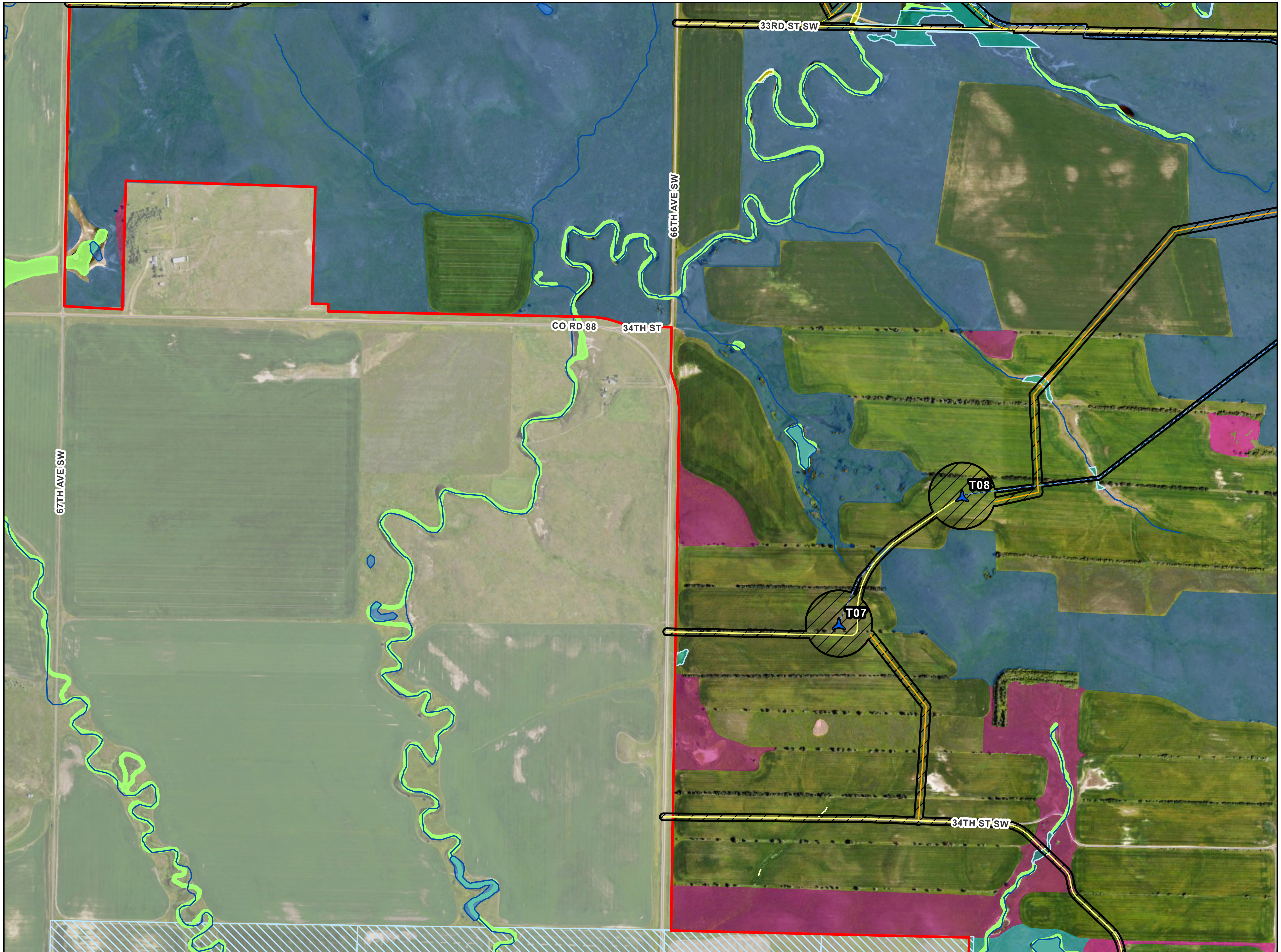

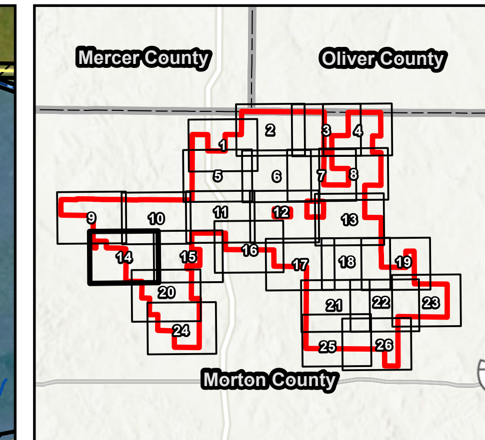

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N W E S

Project Area
Construction Easement
Primary Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line

Abandoned Mine
Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Desktop)
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Desktop)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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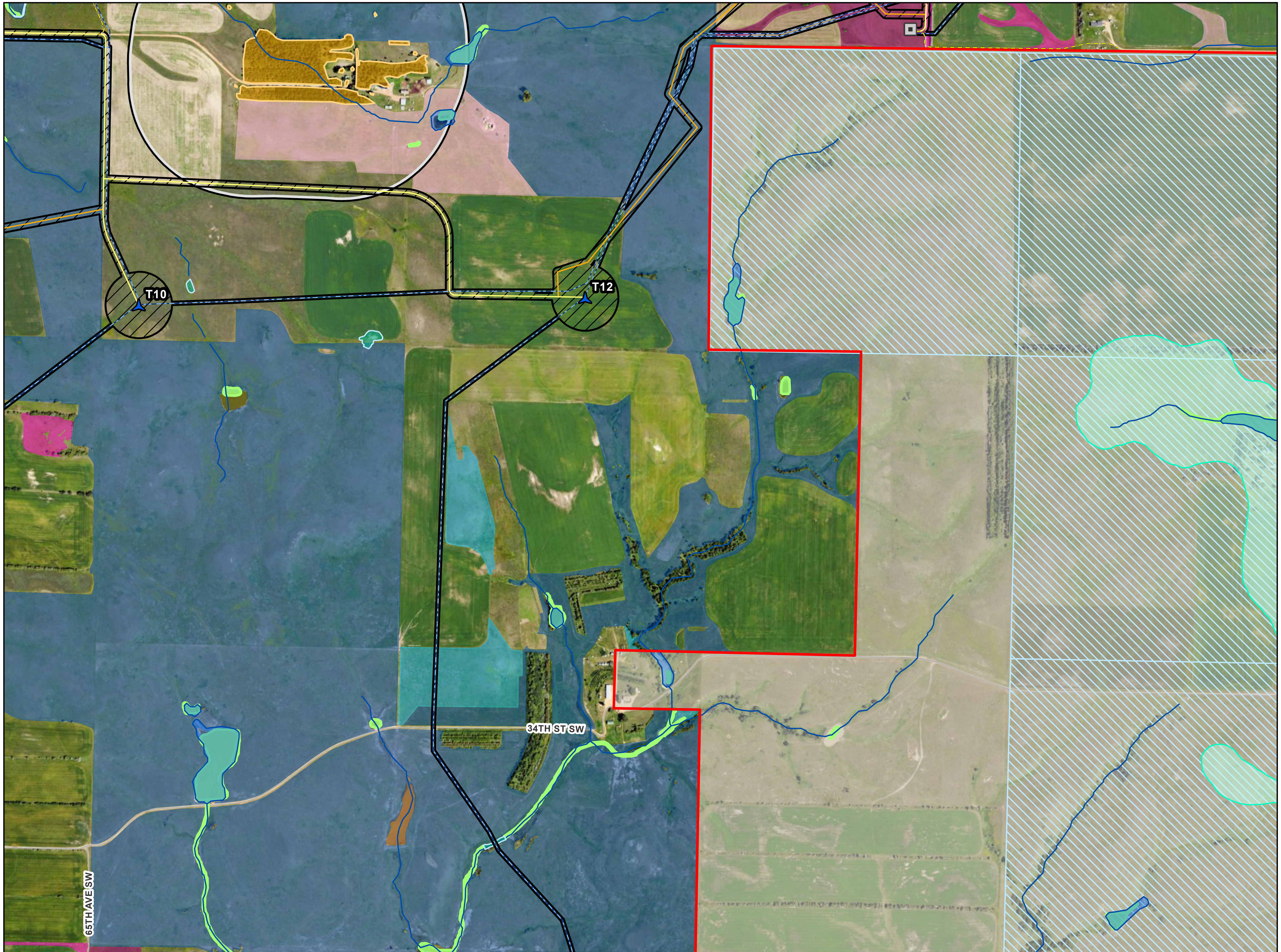

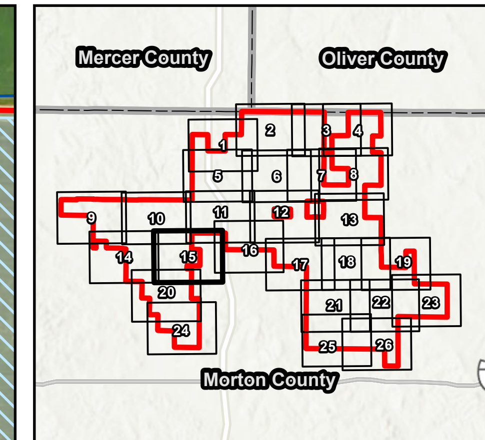

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- Project Area
- Construction Easement
- Primary Turbine
- ADLS Radar Tower
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line
- Lignite Reserve
- Potential Northern Long-Eared Bat Habitat
- 1,000ft Connected Habitat Buffer
- Mineral Trust Land

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NWI Wetland
- NHD Waterway
- NHD Waterbody

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Desktop)
- Broken Grassland (Previous Survey)
- Unbroken Grassland
- Unbroken Grassland (Desktop)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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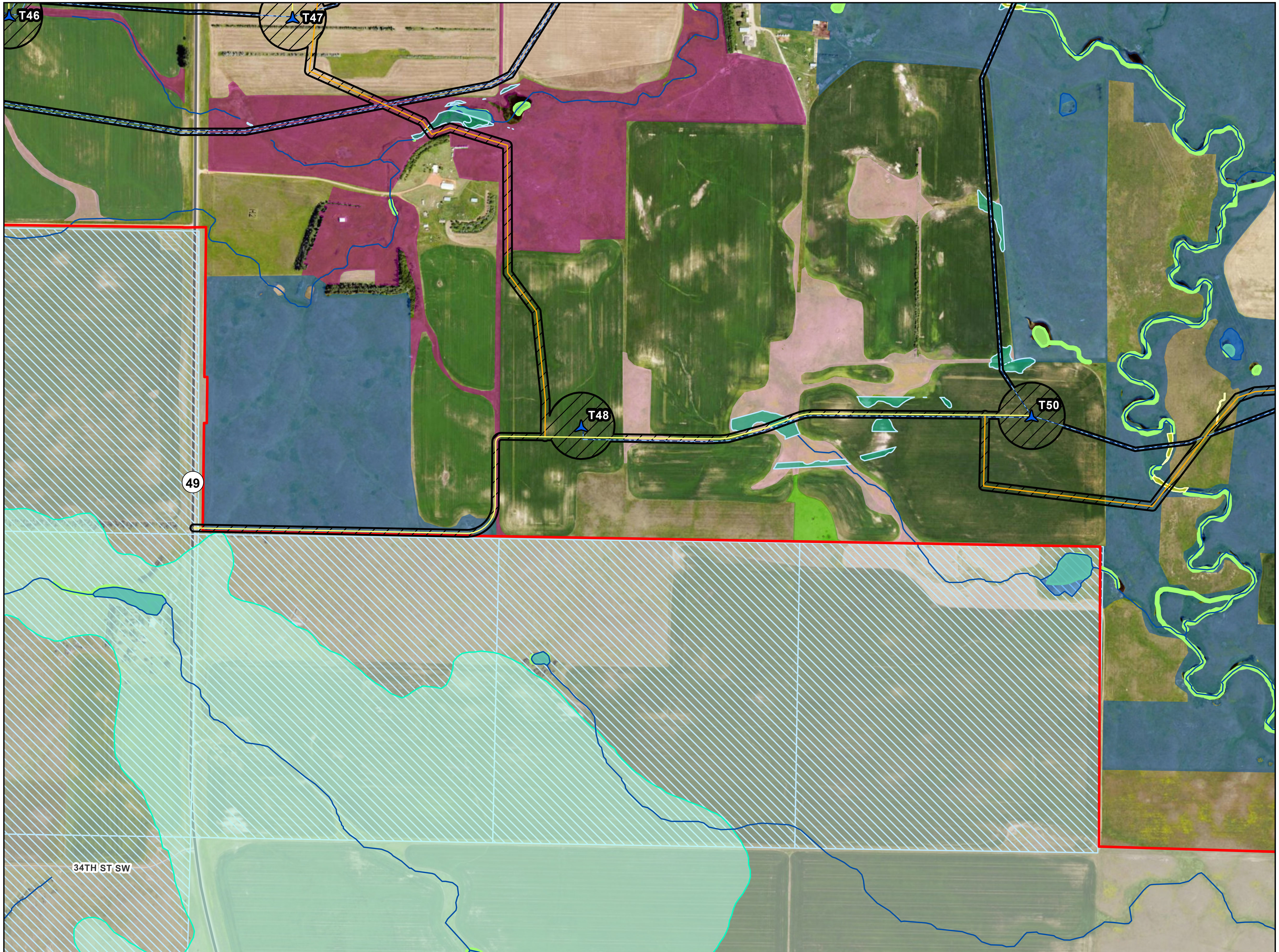

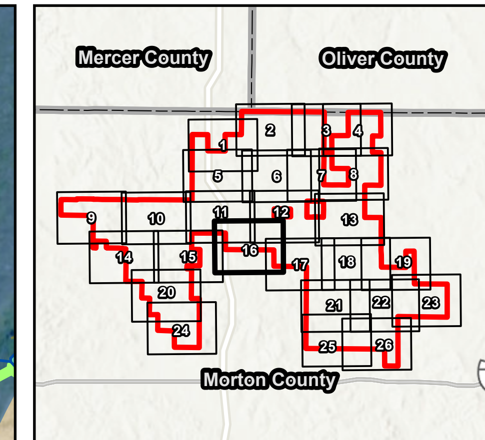

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N
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Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line

Lignite Reserve
Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Previous Survey)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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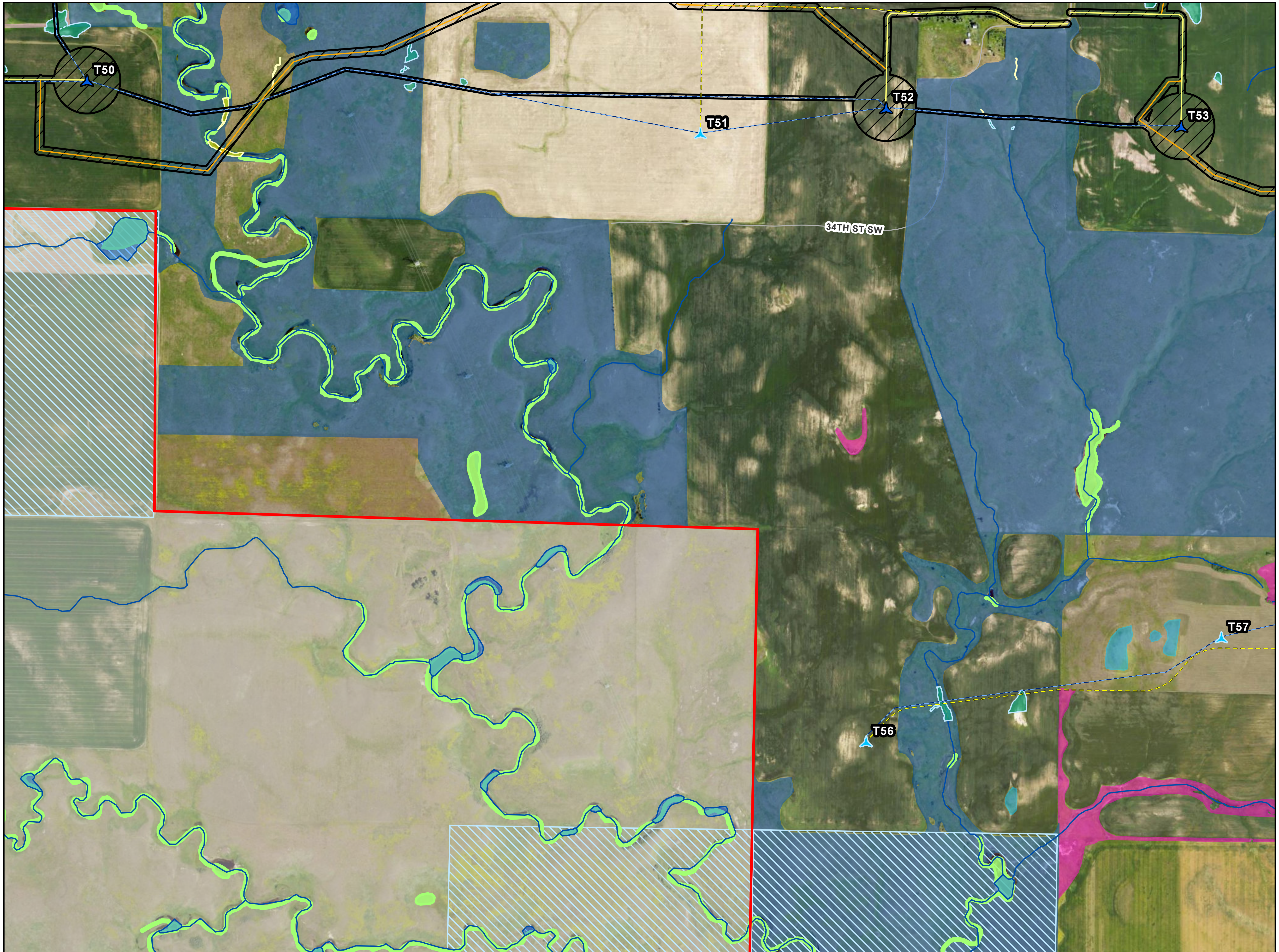

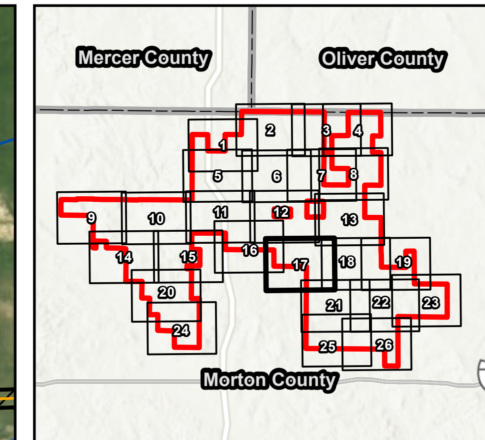

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N S E W

Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line

Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland (Desktop)
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Desktop)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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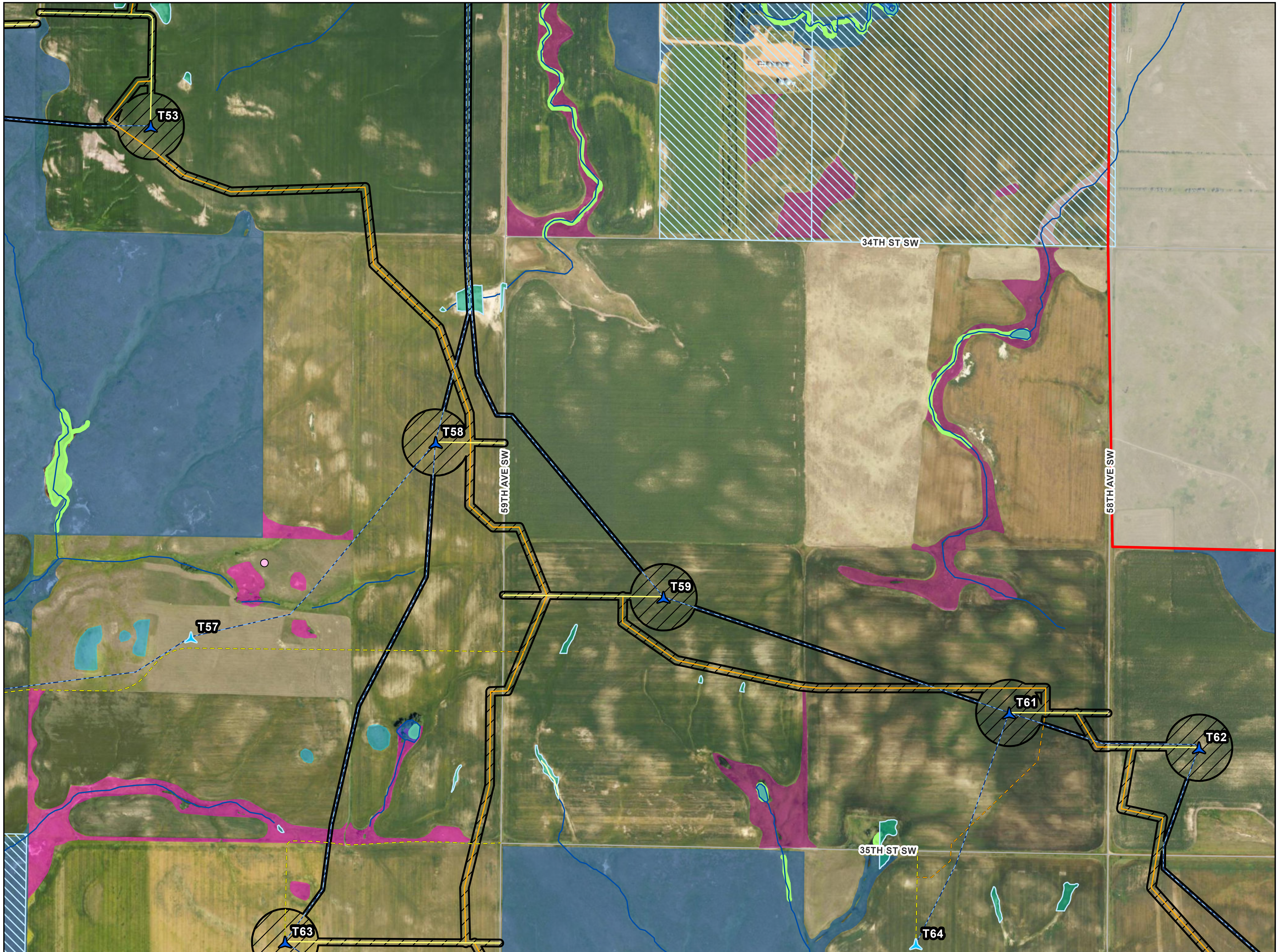

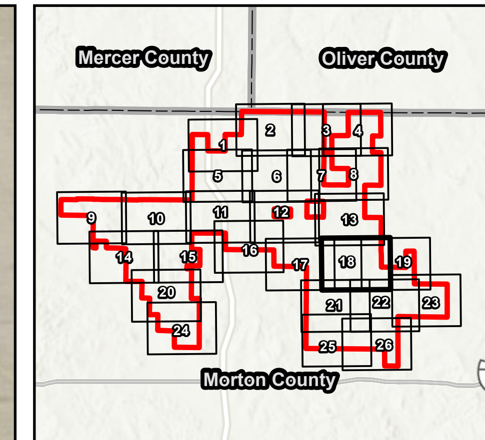

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- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Alternate Crane Path
- Collection Line
- Abandoned Mine
- Mineral Trust Land

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NWI Wetland
- NHD Waterway
- NHD Waterbody

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Desktop)
- Broken Grassland (Previous Survey)
- Unbroken Grassland
- Unbroken Grassland (Desktop)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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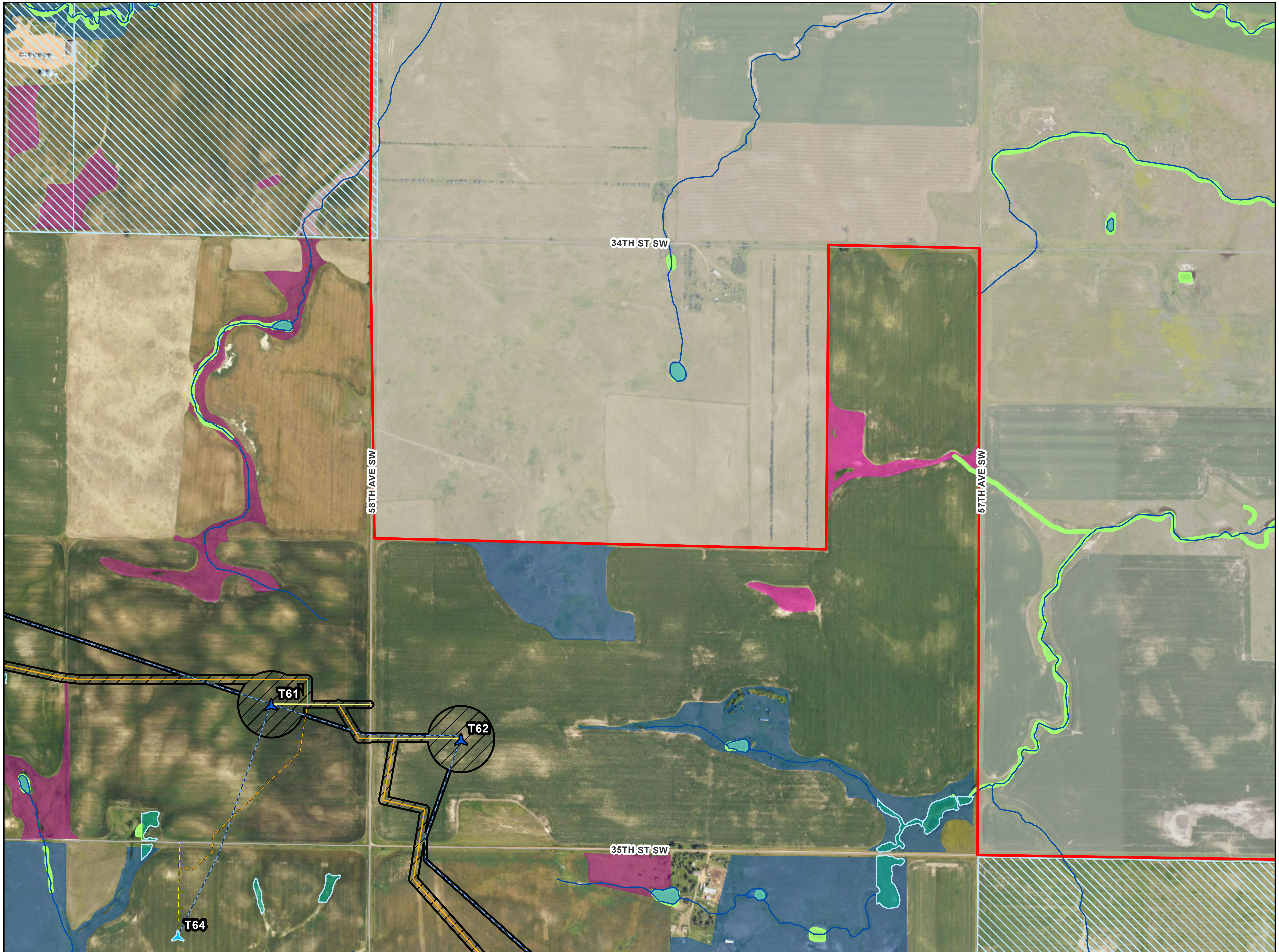

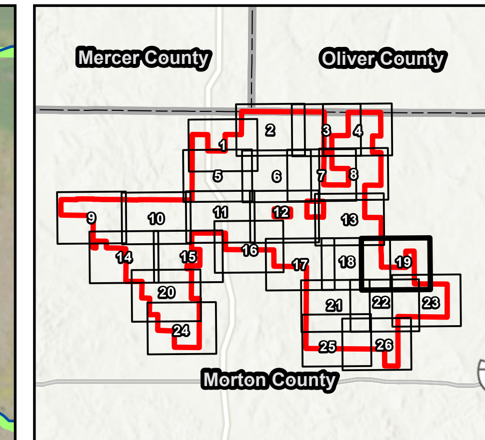

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N S W E

Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line

Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Desktop)
Broken Grassland (Previous Survey)
Unbroken Grassland

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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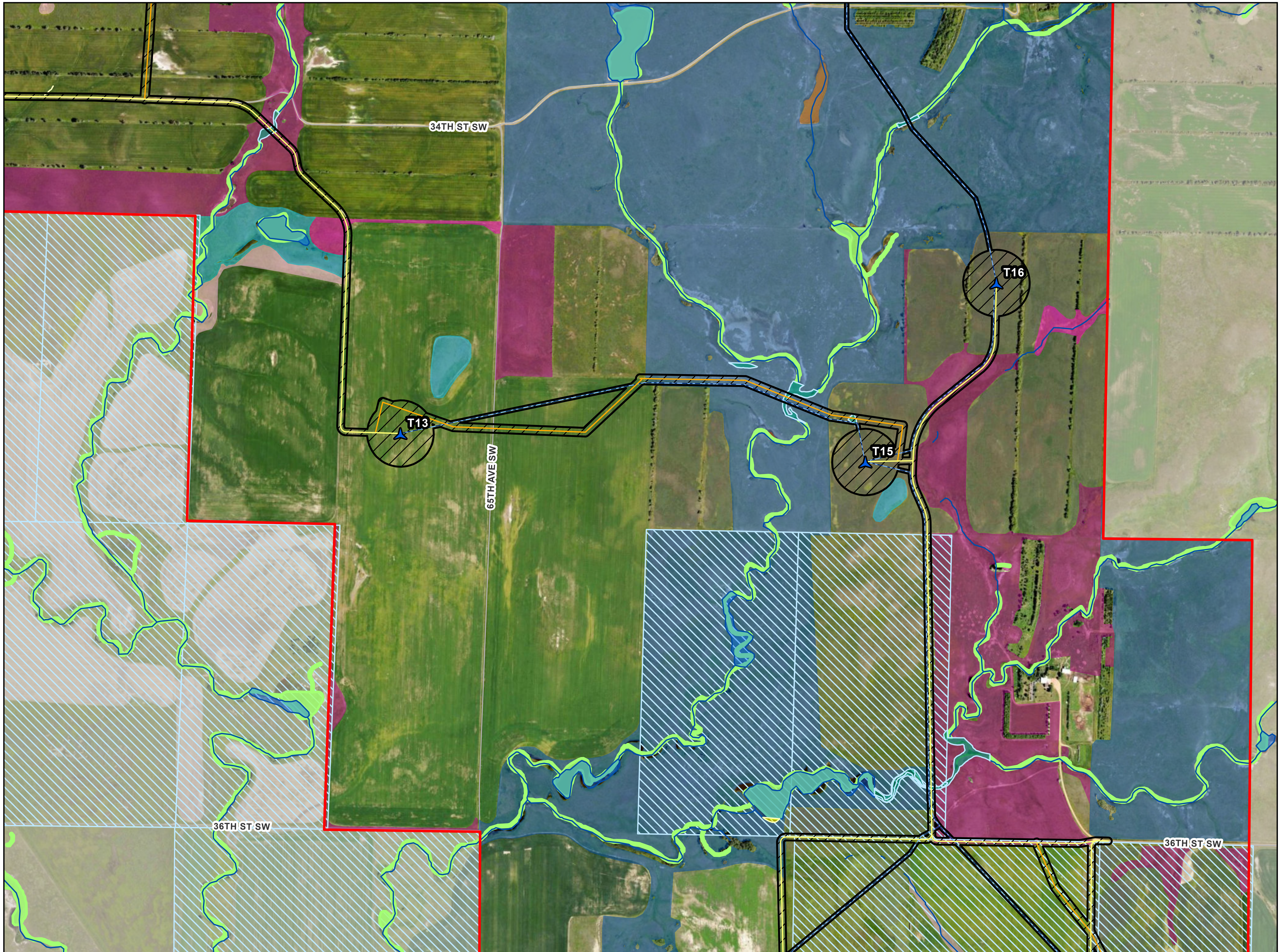

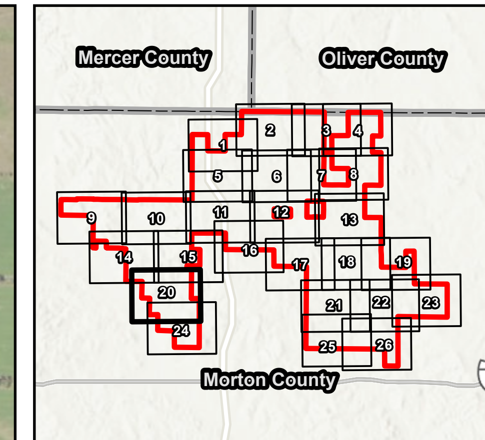

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N S W E

Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line

Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Desktop)
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Desktop)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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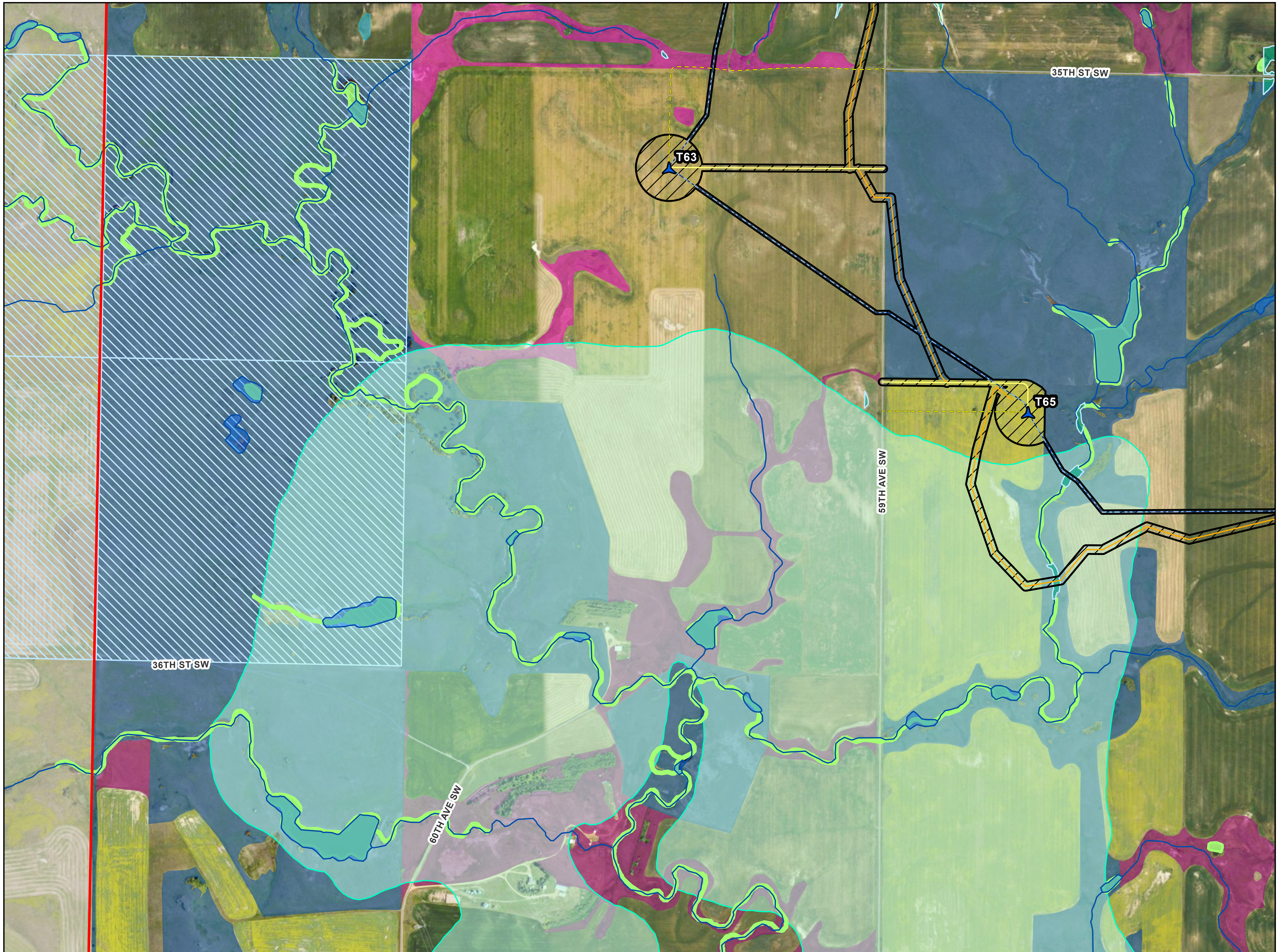

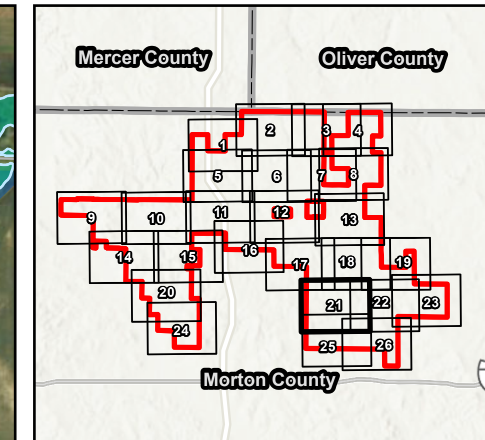

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N S E W

- Project Area
- Construction Easement
- Primary Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line
- Lignite Reserve
- Mineral Trust Land

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NWI Wetland
- NHD Waterway
- NHD Waterbody

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Desktop)
- Unbroken Grassland
- Unbroken Grassland (Desktop)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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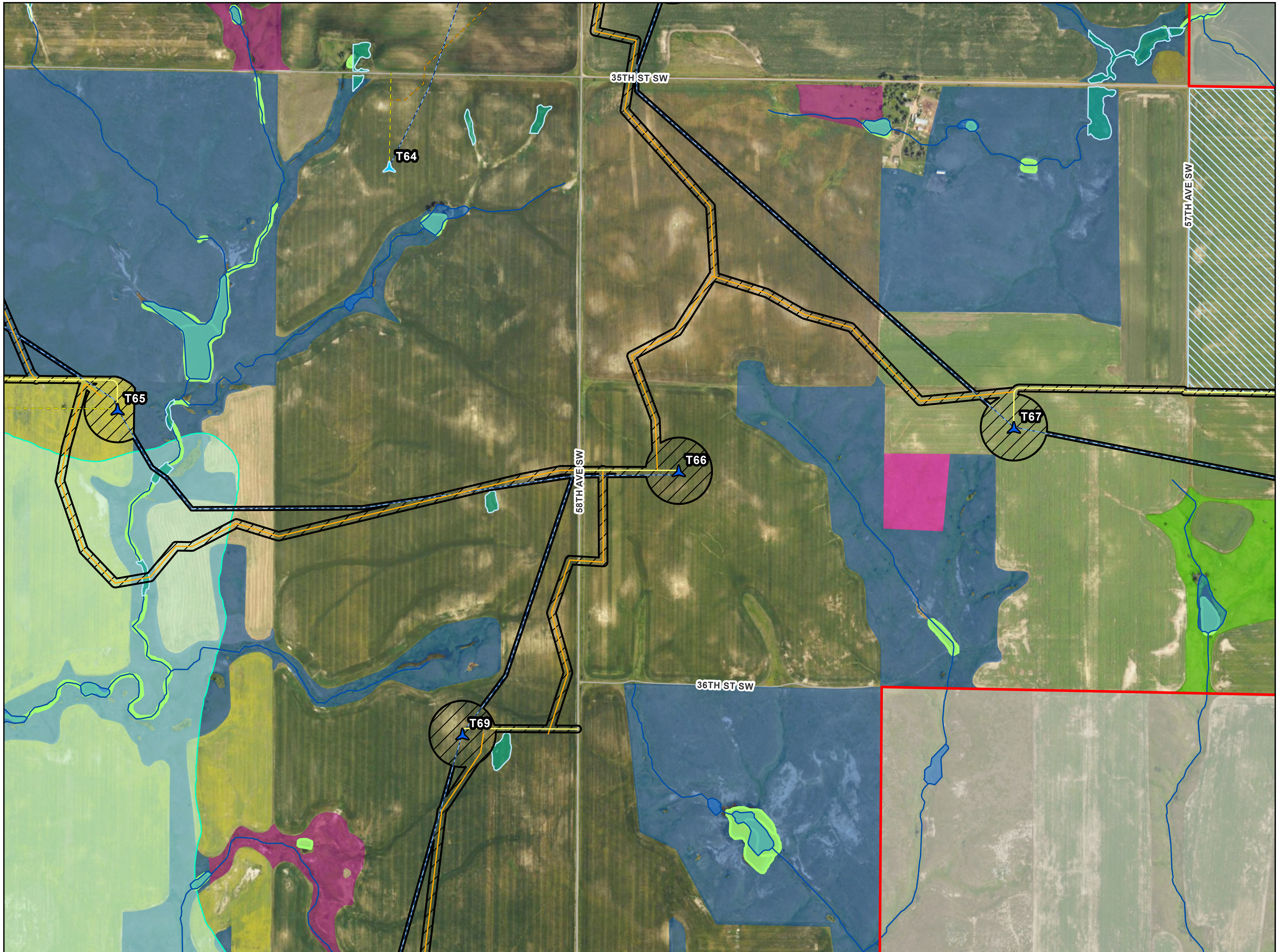

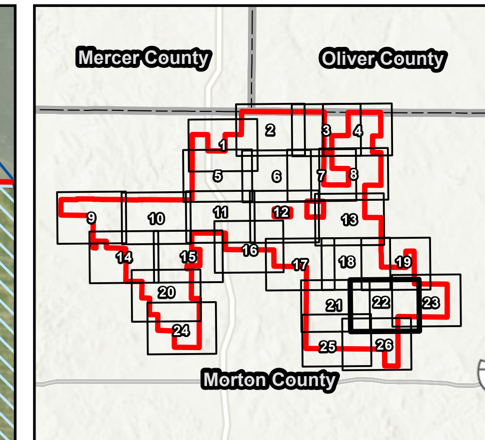

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N S E W

- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Alternate Crane Path
- Collection Line
- Lignite Reserve
- Mineral Trust Land

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NWI Wetland
- NHD Waterway
- NHD Waterbody

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Desktop)
- Unbroken Grassland
- Unbroken Grassland (Previous Survey)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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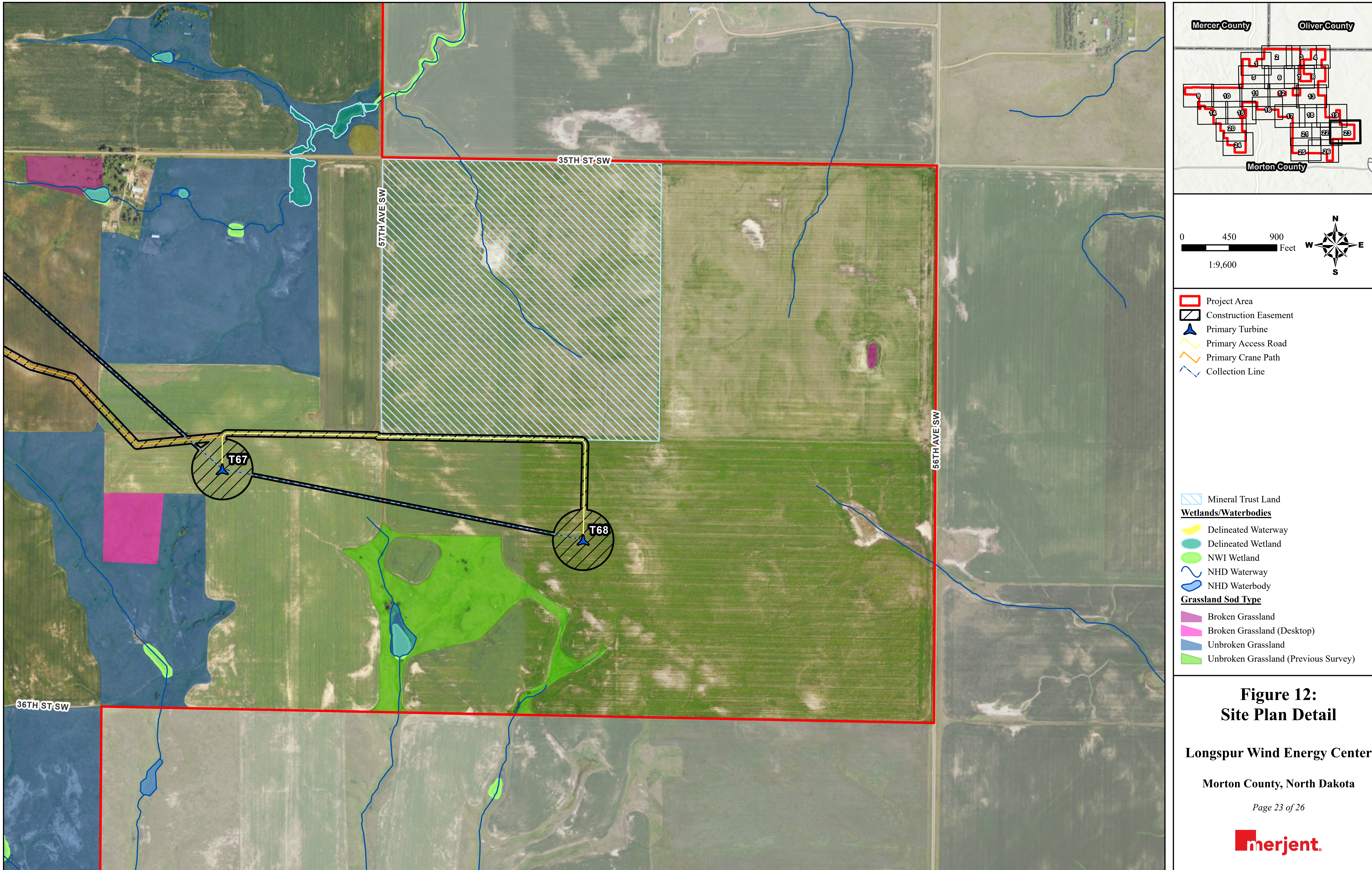

Figure 12:
Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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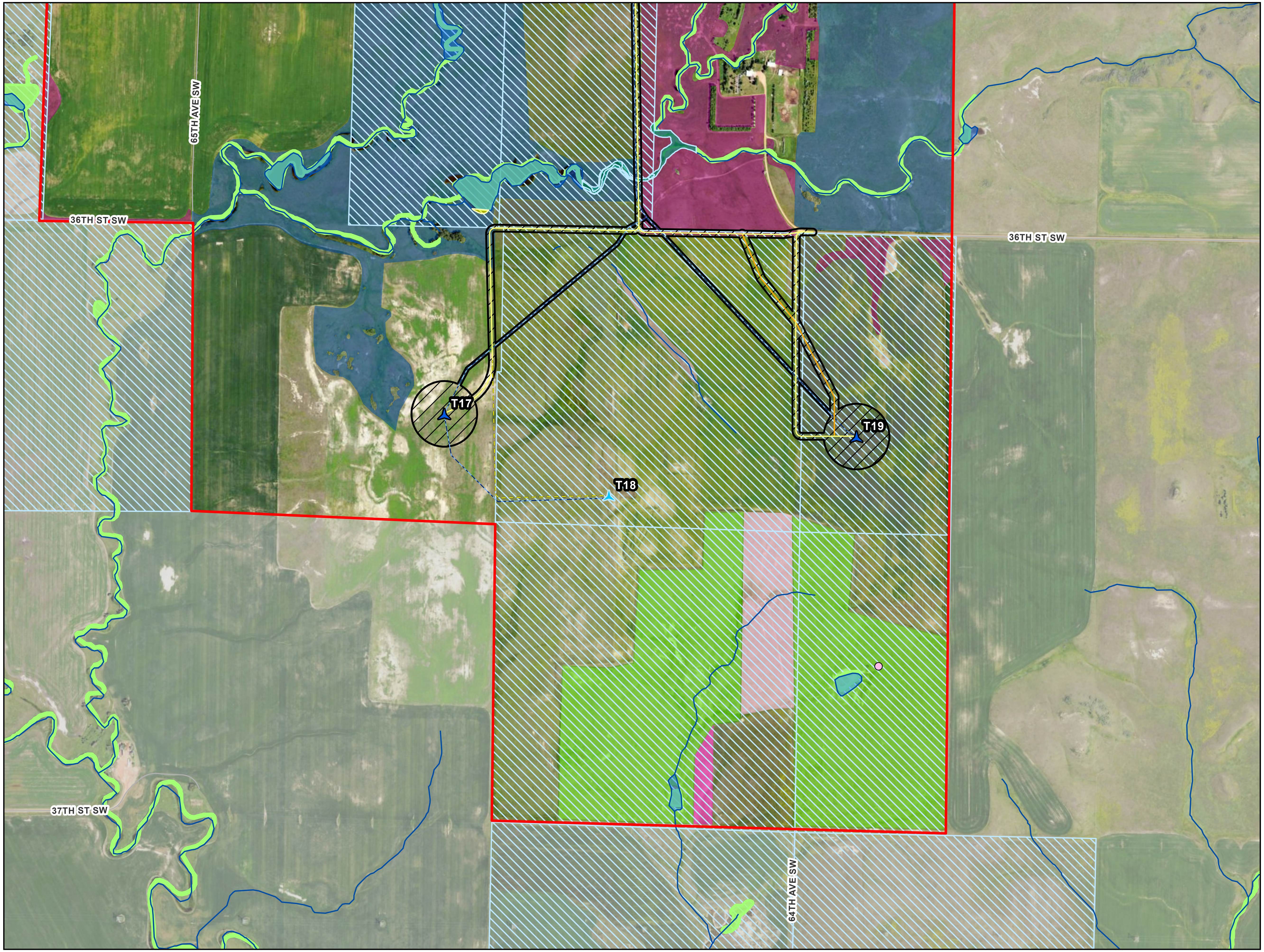

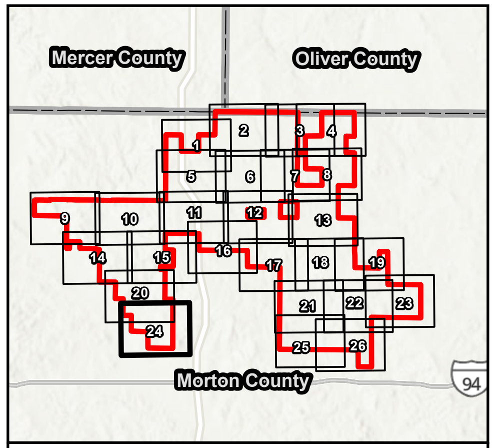

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Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line

Abandoned Mine
Mineral Trust Land

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NWI Wetland
NHD Waterway
NHD Waterbody

Grassland Sod Type

Broken Grassland
Broken Grassland (Desktop)
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Previous Survey)

Figure 12:
Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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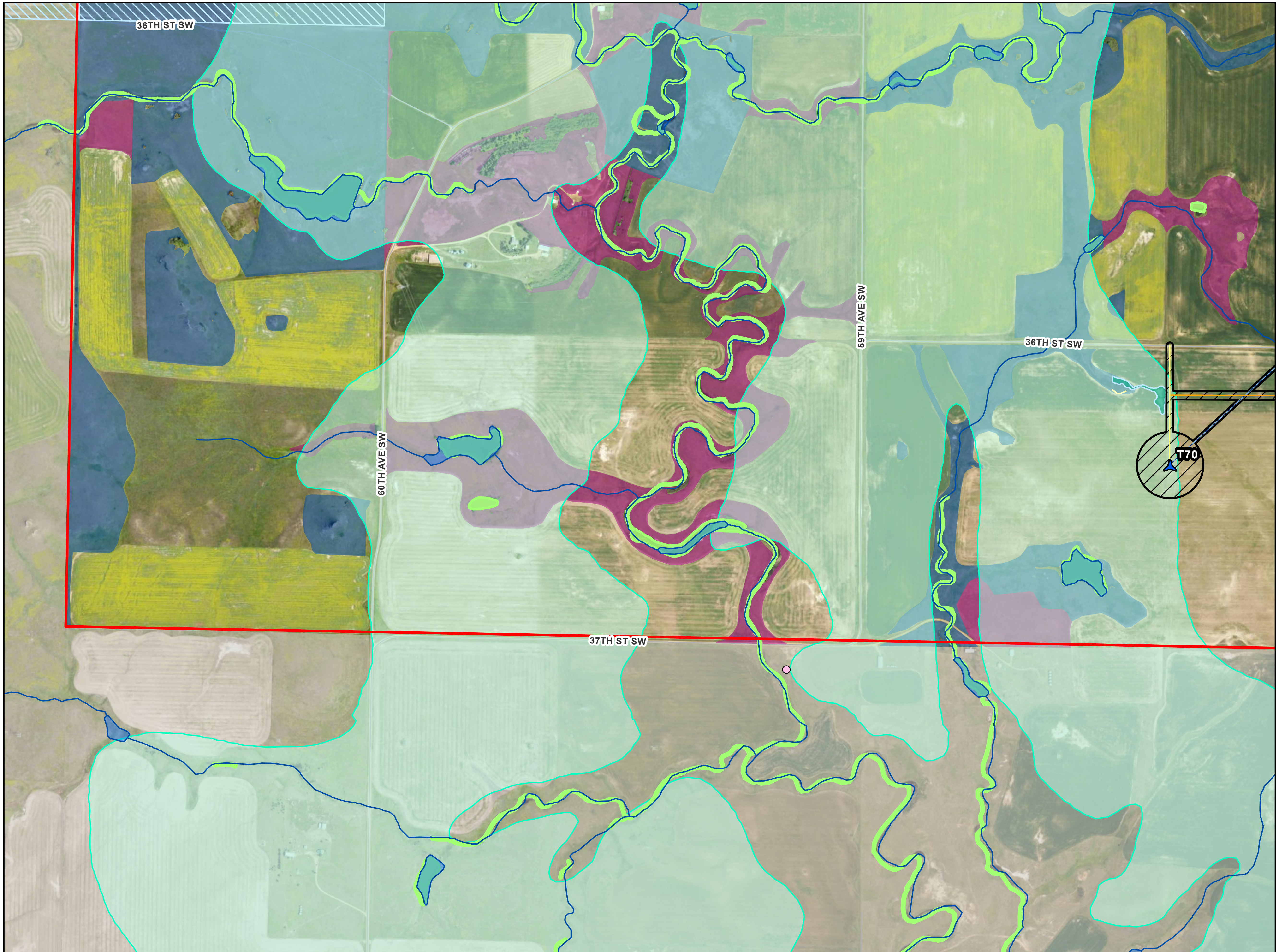

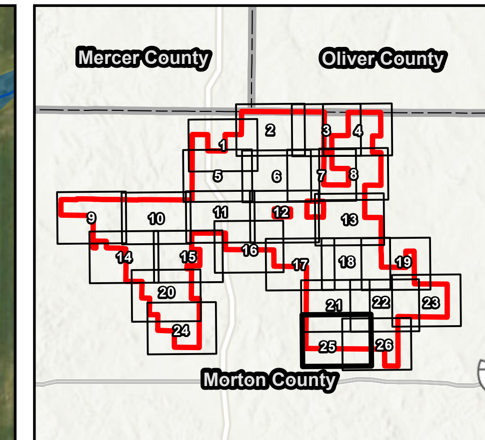

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N S E W

- Project Area
- Construction Easement
- Primary Turbine
- Primary Access Road
- Primary Crane Path
- Collection Line
- Abandoned Mine
- Lignite Reserve
- Mineral Trust Land

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NWI Wetland
- NHD Waterway
- NHD Waterbody

Grassland Sod Type

- Broken Grassland
- Unbroken Grassland

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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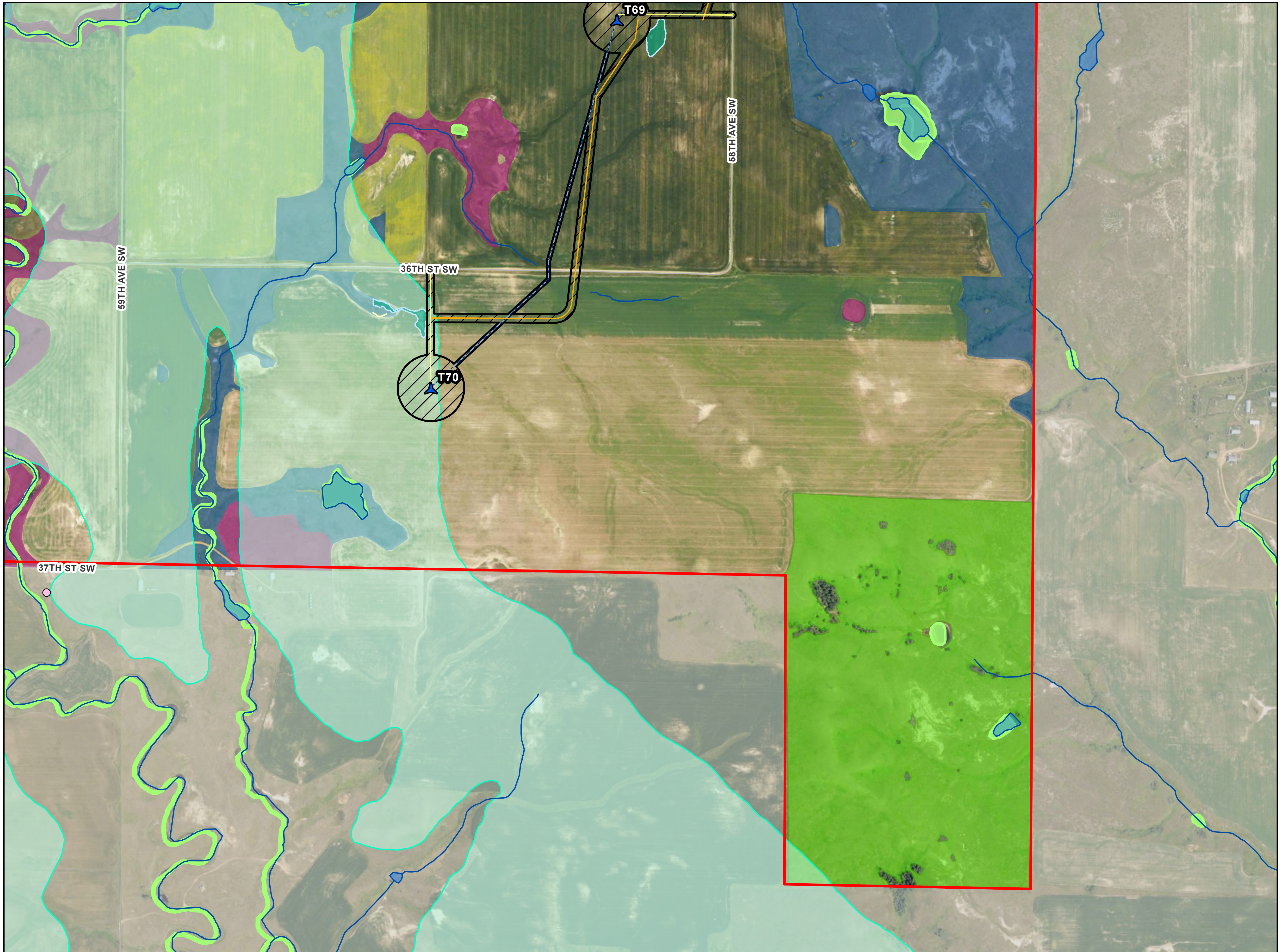

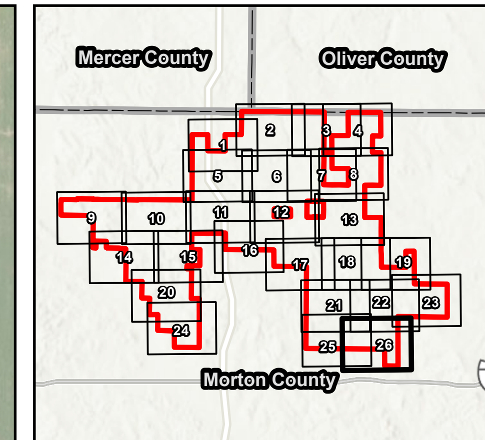

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N W E S

- Project Area
- Construction Easement
- Primary Turbine
- Primary Access Road
- Primary Crane Path
- Collection Line
- Abandoned Mine
- Lignite Reserve

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NWI Wetland
- NHD Waterway
- NHD Waterbody

Grassland Sod Type

- Broken Grassland
- Unbroken Grassland
- Unbroken Grassland (Previous Survey)

Figure 12: Site Plan Detail

Longspur Wind Energy Center

Morton County, North Dakota

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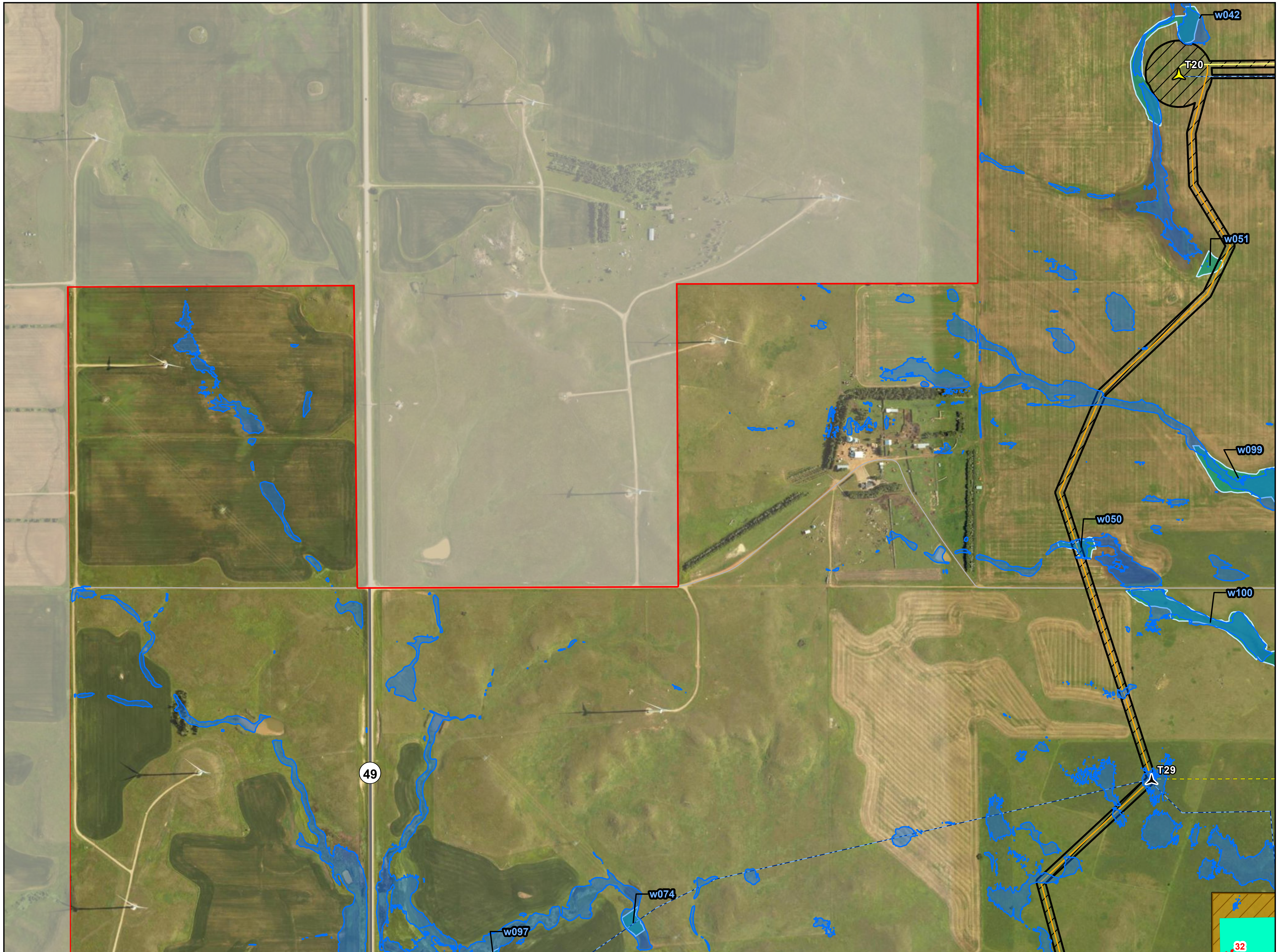
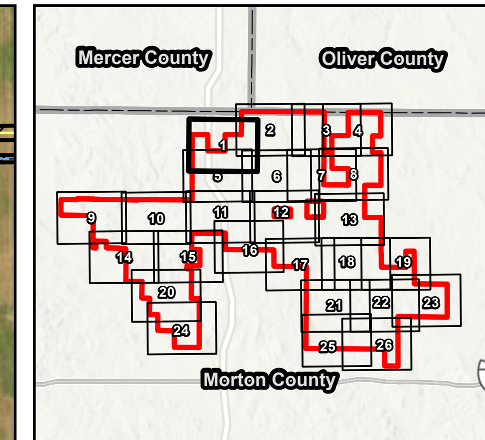
Attachment M

Floodplains Avoidance Area Map





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N W E S

- Project Area
- Construction Easement
- Substation Yard
- Substation Facility
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line
- Delineated Wetland

NDRAM BLE Floodplain Impact Type

- Permanent

NDRAM BLE Floodplain

- 100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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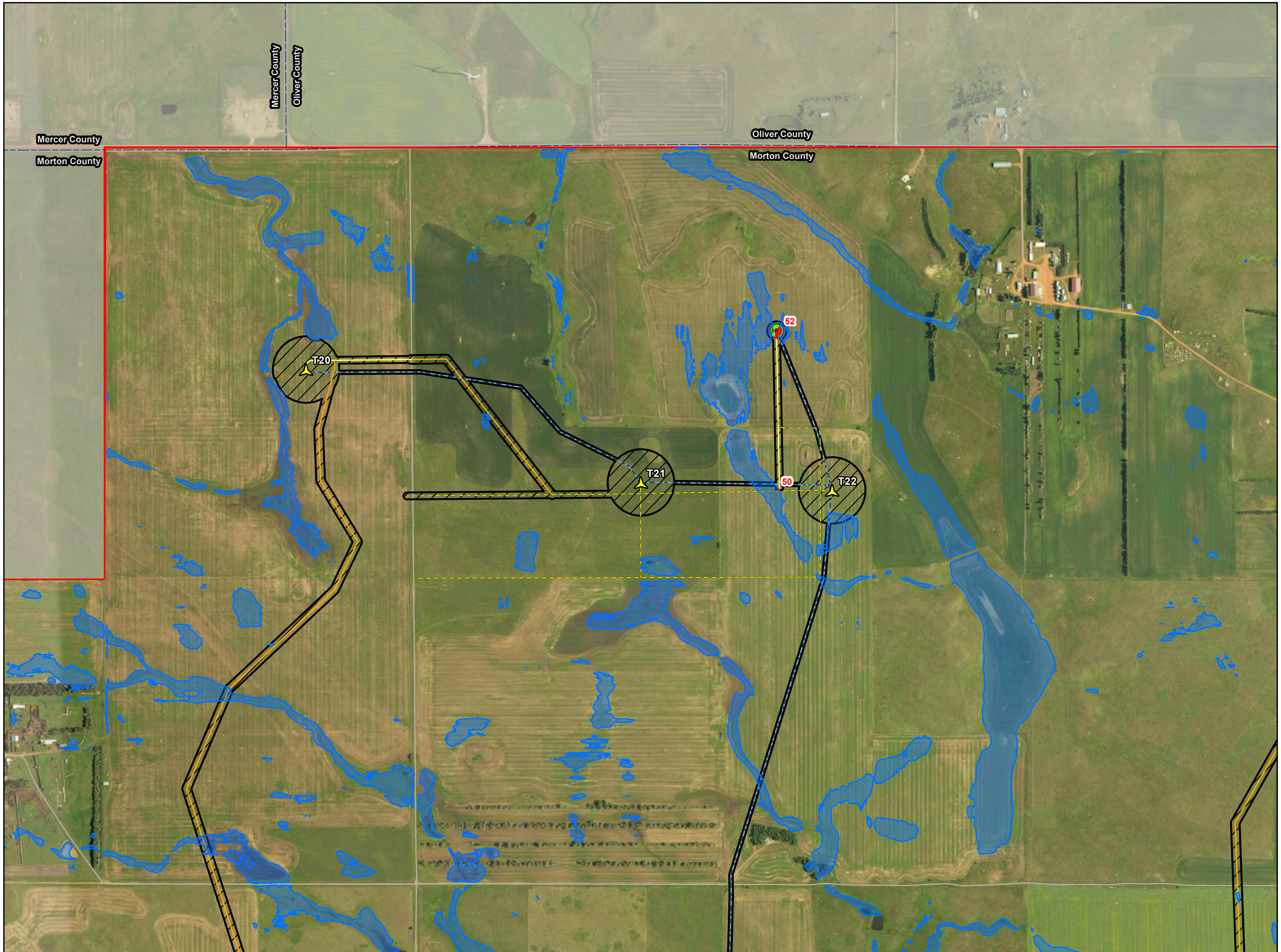

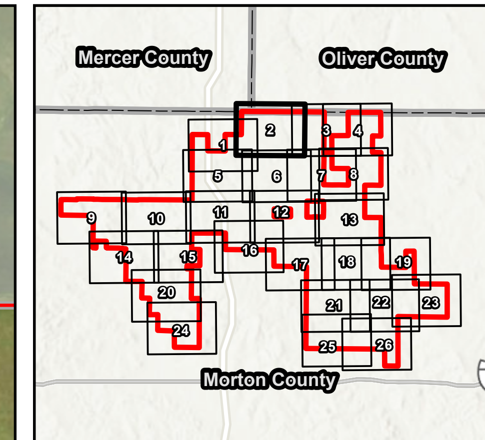

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N S E W

- Project Area
- Construction Easement
- Primary Turbine
- Met Tower
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line

NDRAM BLE Floodplain Impact Type

- Permanent

NDRAM BLE Floodplain

- 100 Year

Floodplains

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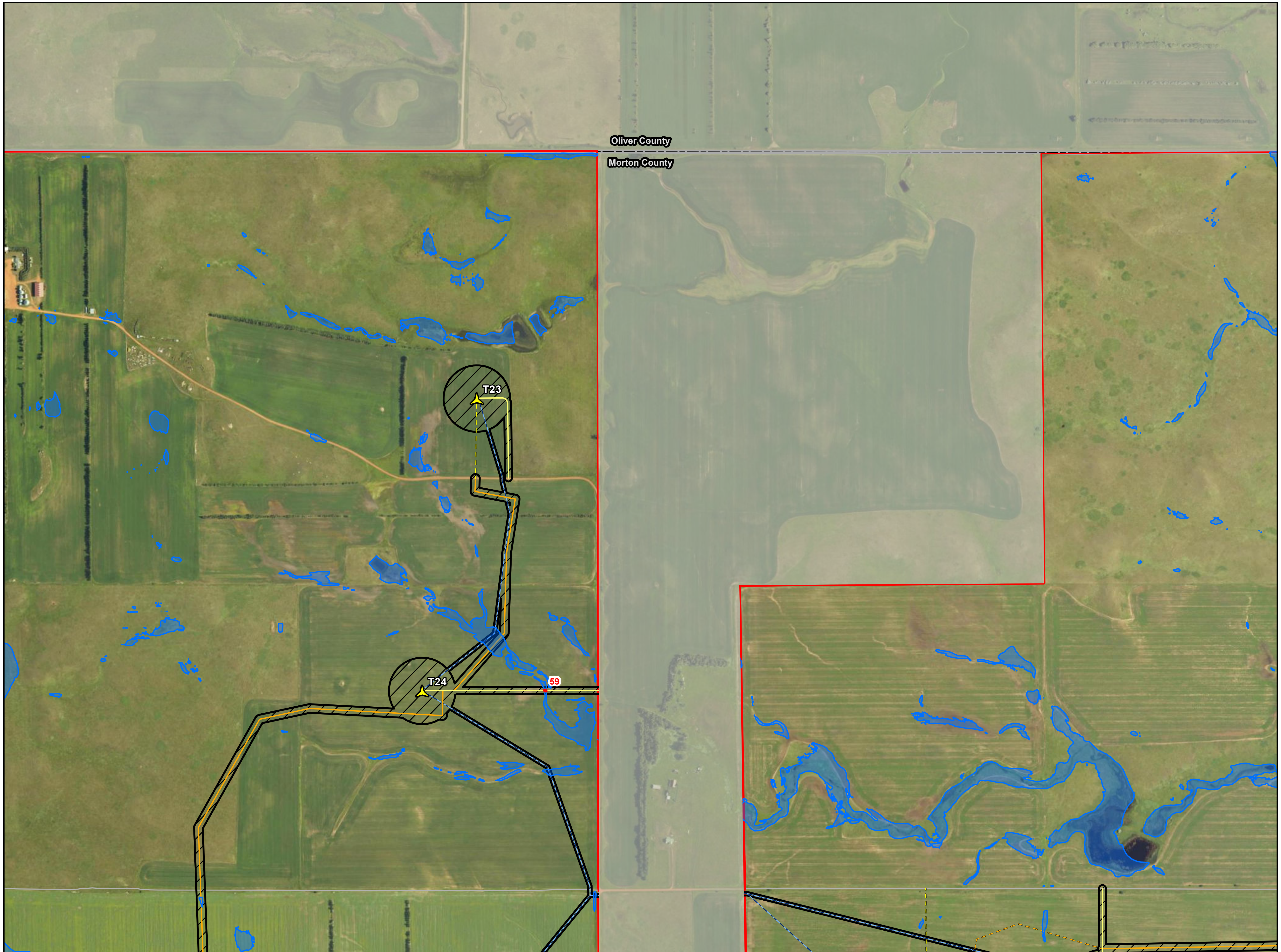

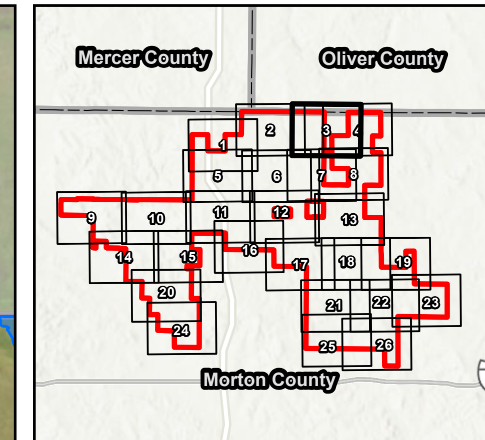

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Project Area
Construction Easement
Primary Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line
NDRAM BLE Floodplain Impact Type
Permanent
NDRAM BLE Floodplain
100 Year

Floodplains

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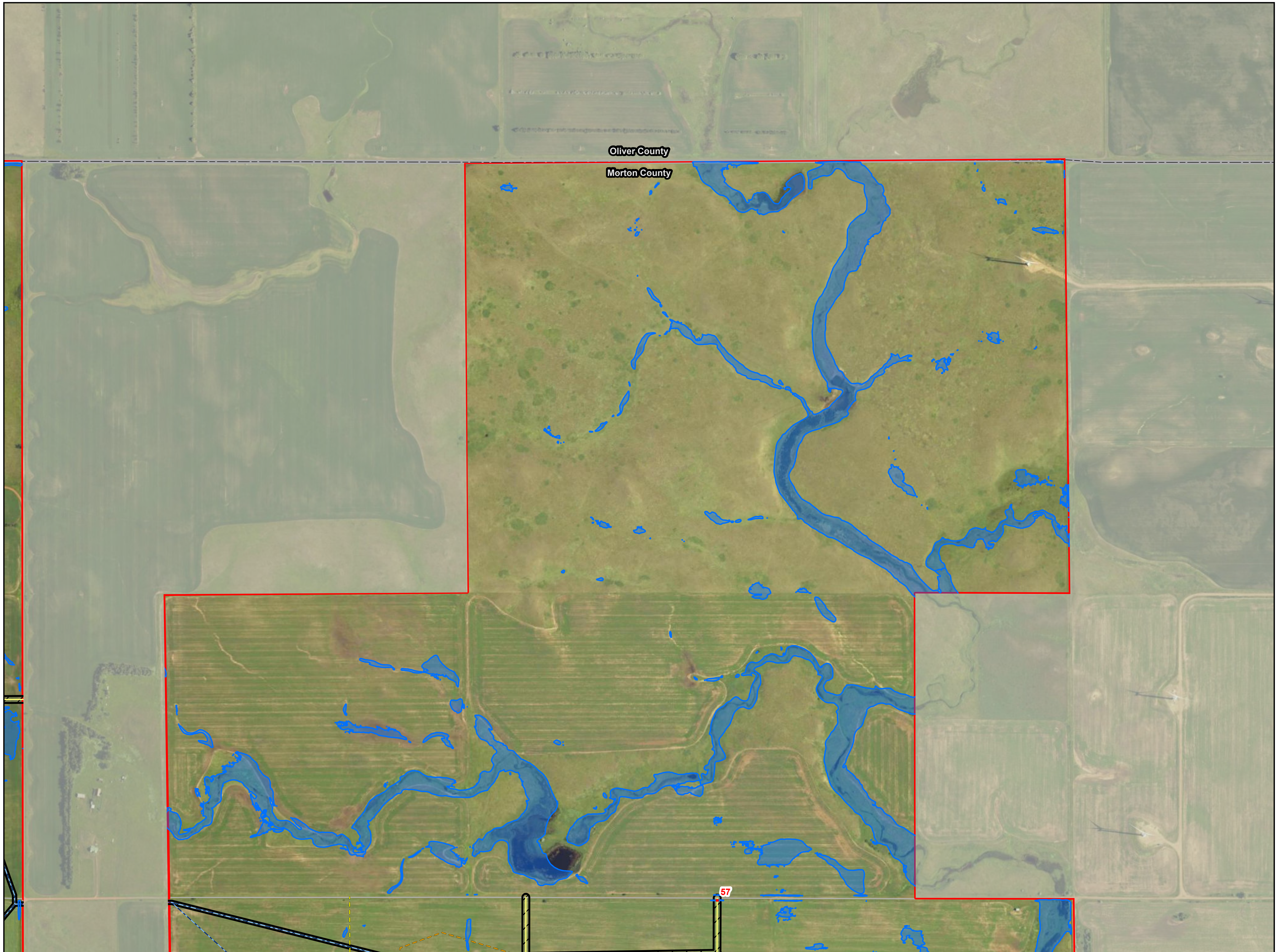

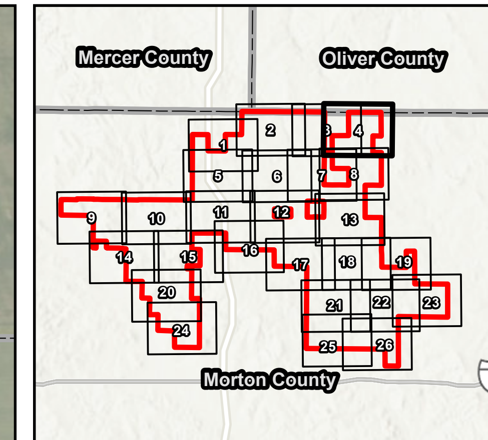

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Project Area
Construction Easement
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line
NDRAM BLE Floodplain Impact Type
Permanent
NDRAM BLE Floodplain
100 Year

Floodplains

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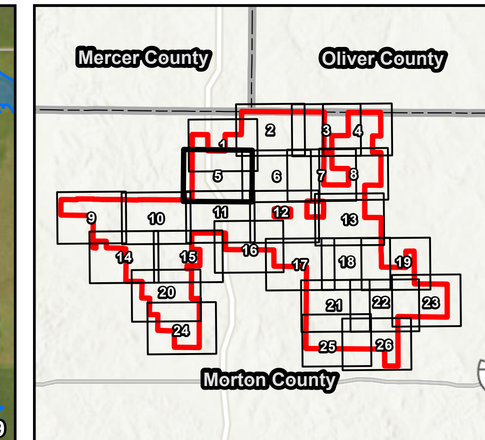

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N
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- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Alternate Crane Path
- Collection Line

NDRAM BLE Floodplain

- 100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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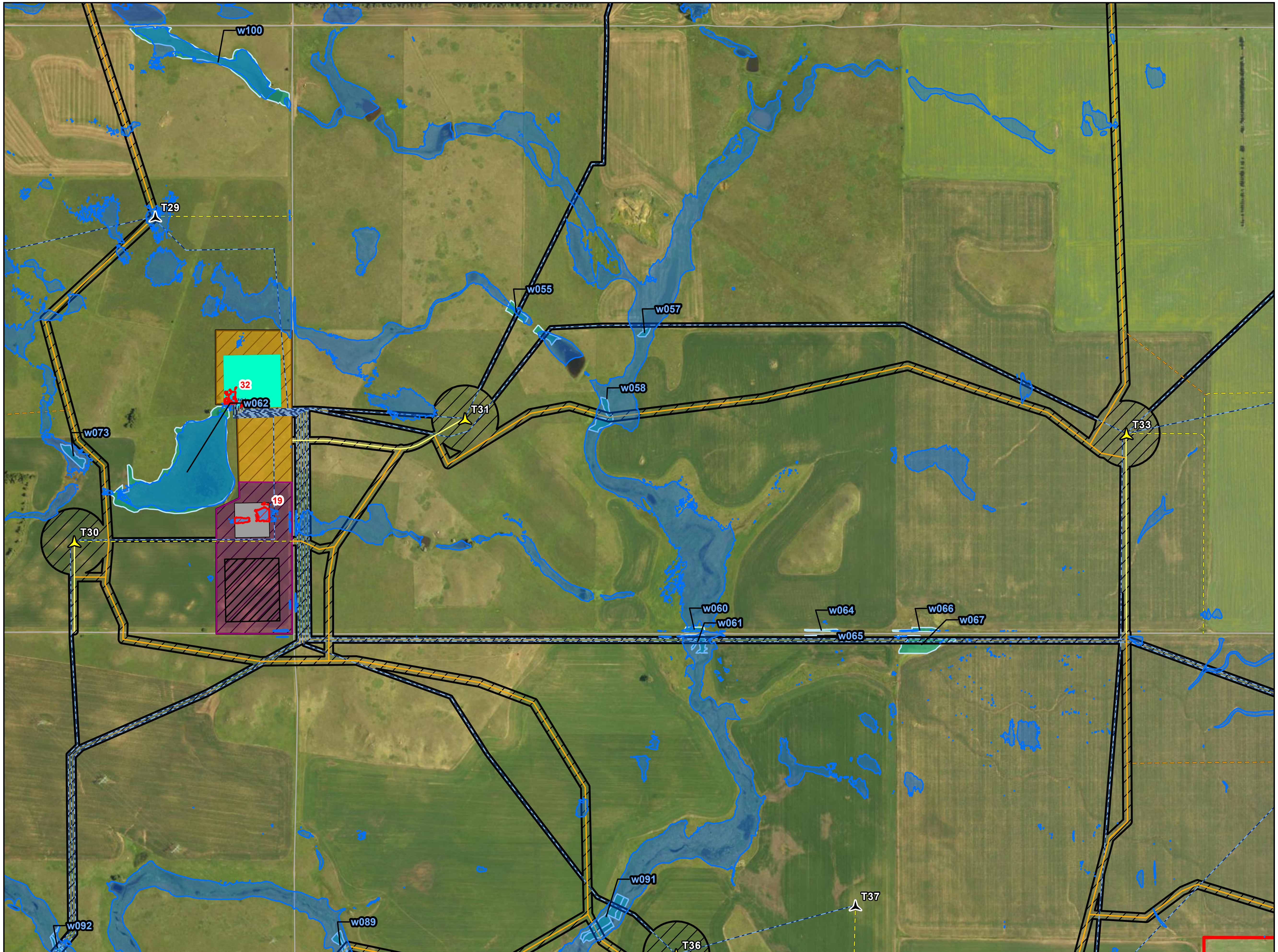

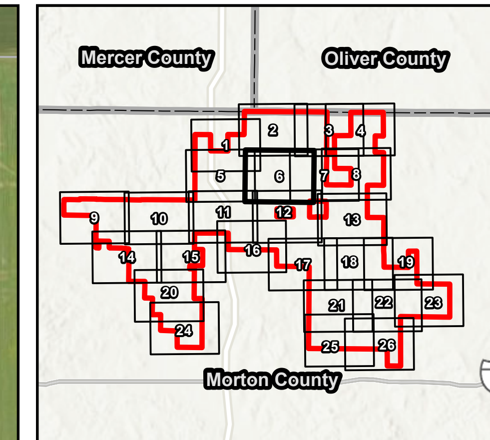

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N S E W

Project Area
Construction Easement
Substation Yard
Substation Facility
O&M Yard
O&M Building
Construction Laydown Yard
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line
Delineated Wetland

NDRAM BLE Floodplain Impact Type

Permanent

NDRAM BLE Floodplain

100 Year

Floodplains

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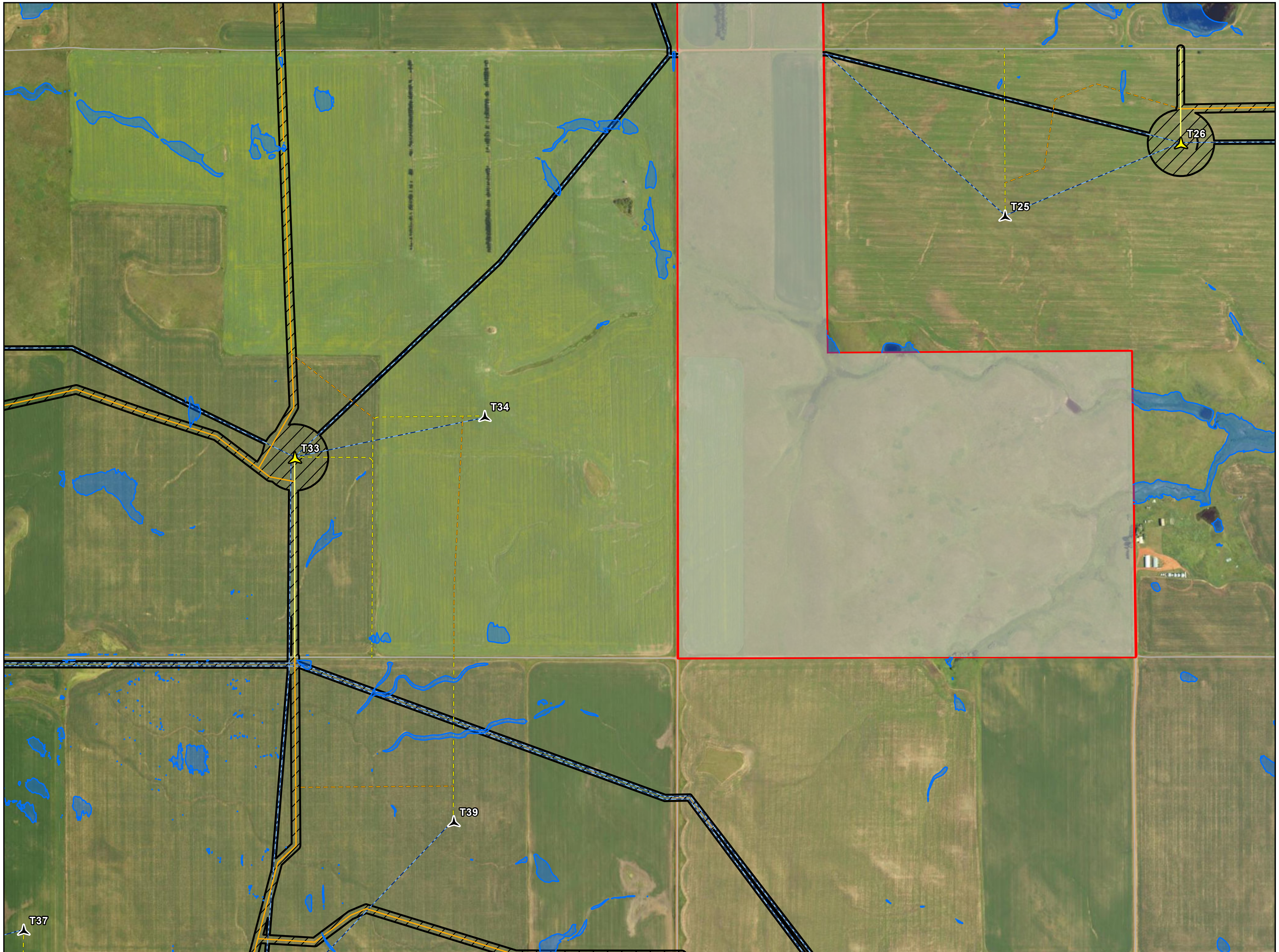

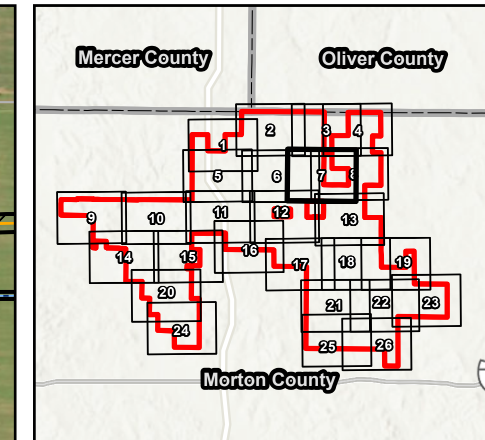

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N
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- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Alternate Crane Path
- Collection Line

NDRAM BLE Floodplain

- 100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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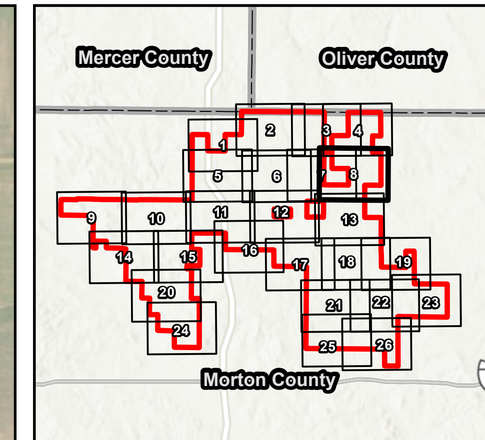

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N E S W

- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Alternate Crane Path
- Collection Line

NDRAM BLE Floodplain Impact Type

- Permanent

NDRAM BLE Floodplain

- 100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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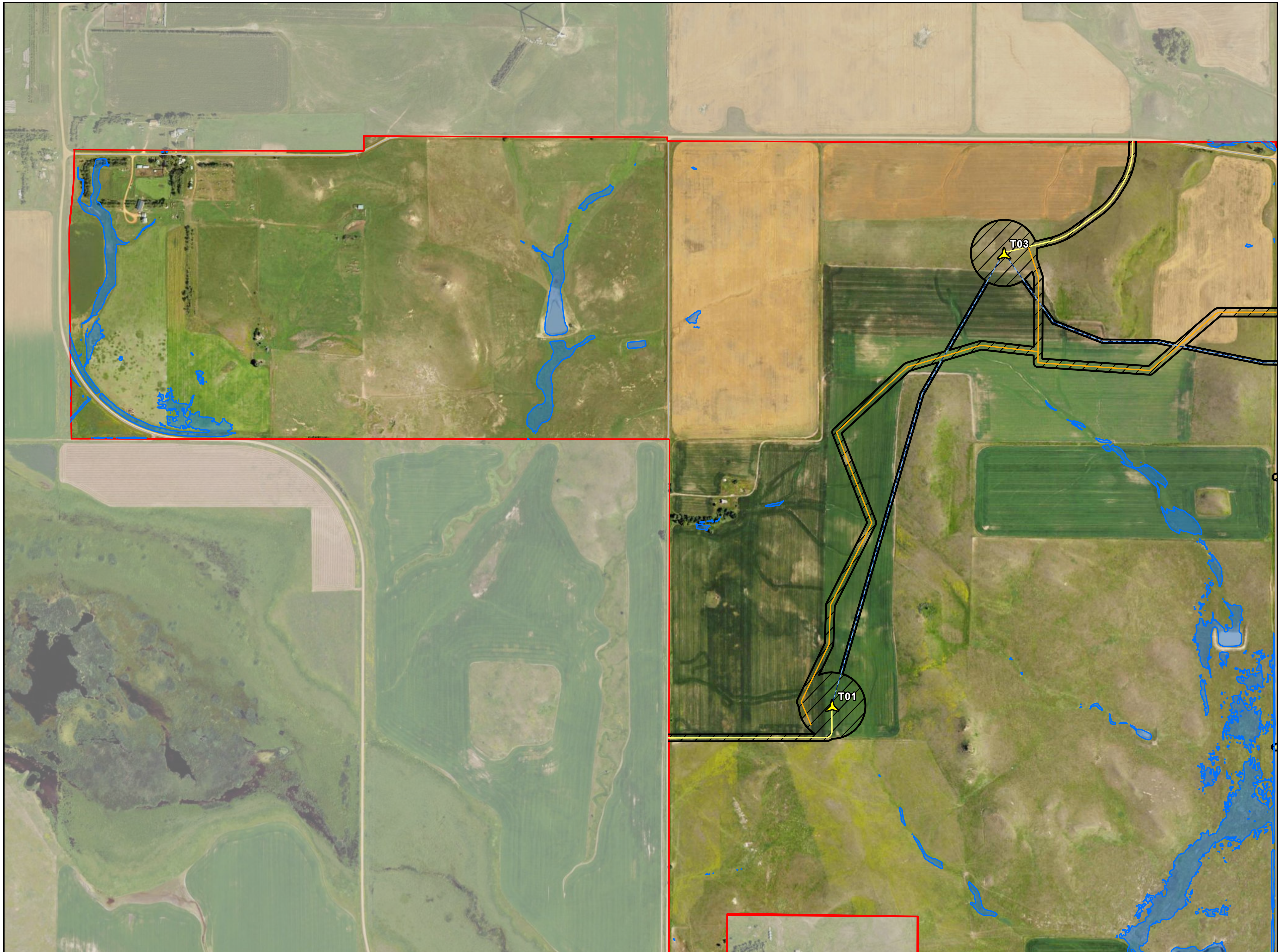

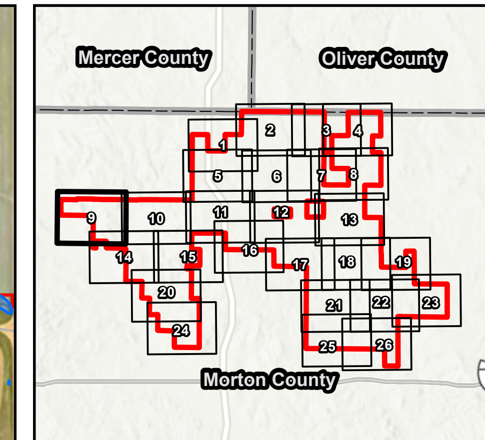

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US Feet
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N
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Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line
NDRAM BLE Floodplain
100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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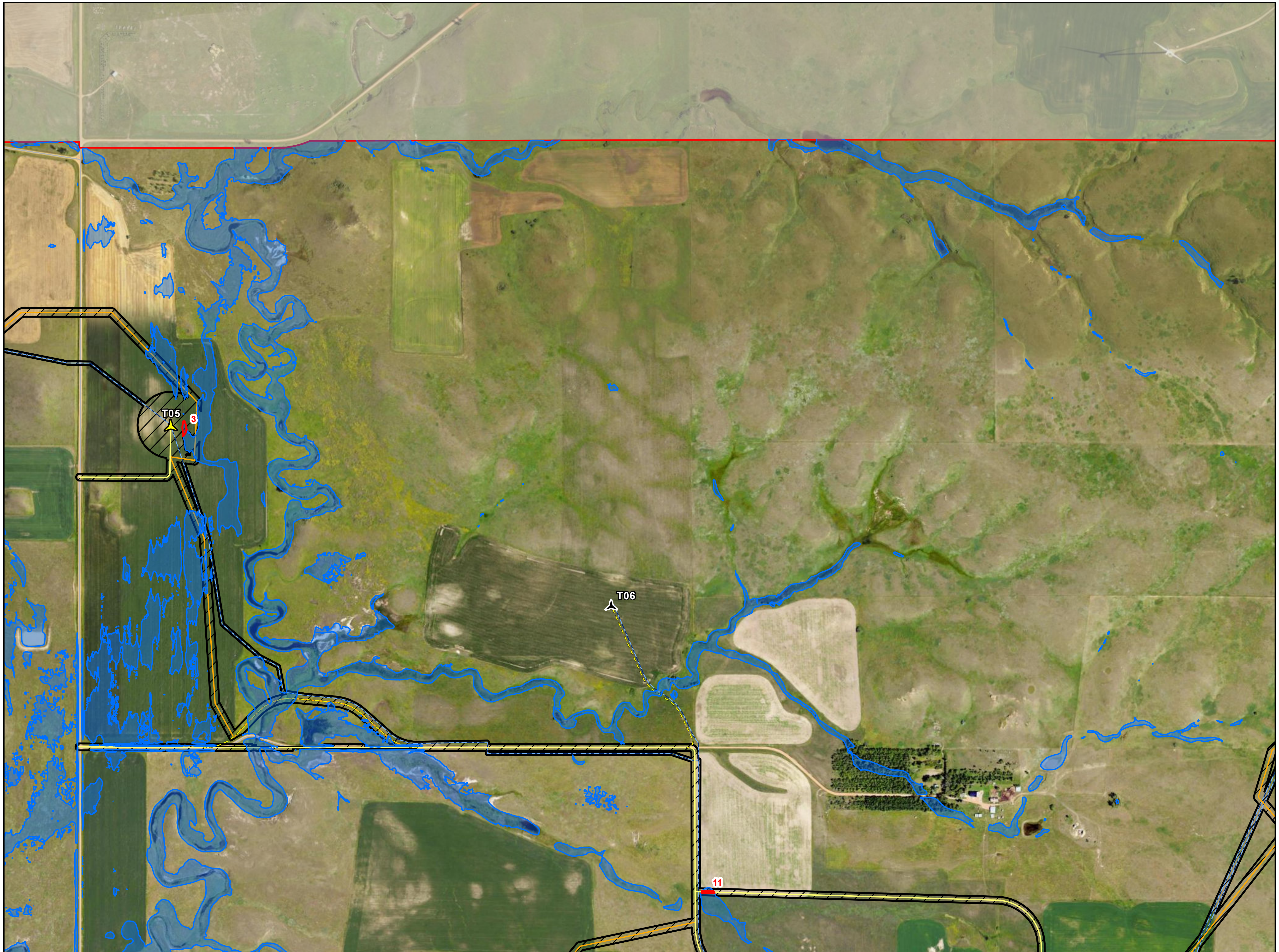

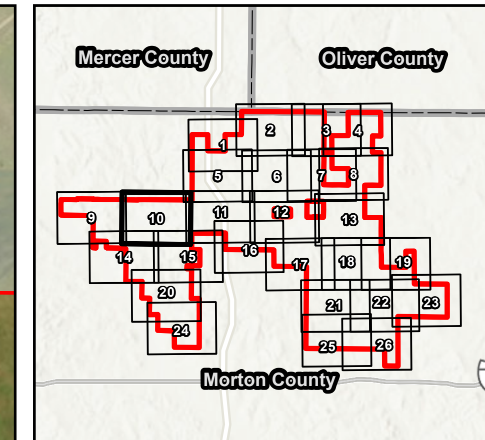

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N E S W

Project Area

Construction Easement

Primary Turbine

Alternate Turbine

Primary Access Road

Alternate Access Road

Primary Crane Path

Collection Line

NDRAM BLE Floodplain Impact Type

Permanent

NDRAM BLE Floodplain

100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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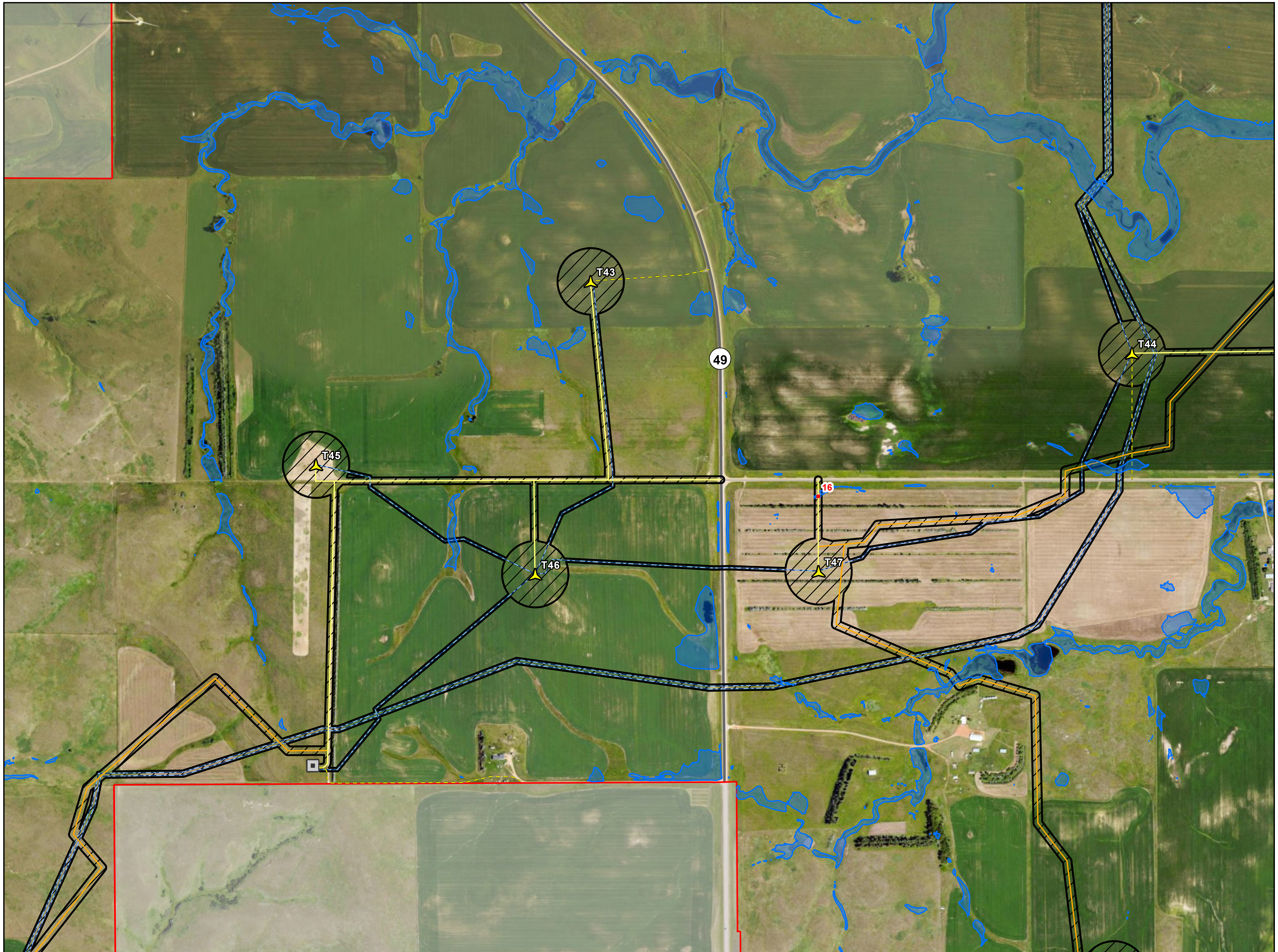

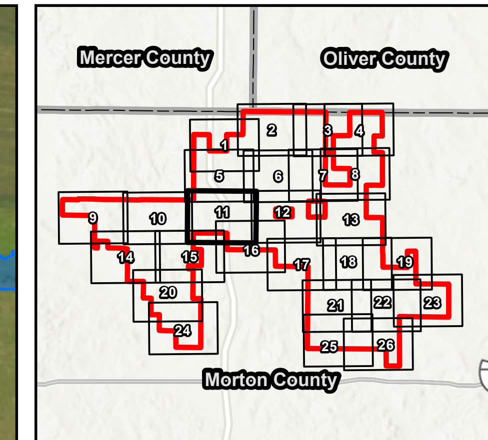

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N S E W

Project Area
Construction Easement
Primary Turbine
ADLS Radar Tower
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line
NDRAM BLE Floodplain Impact Type
Permanent
NDRAM BLE Floodplain
100 Year

Floodplains

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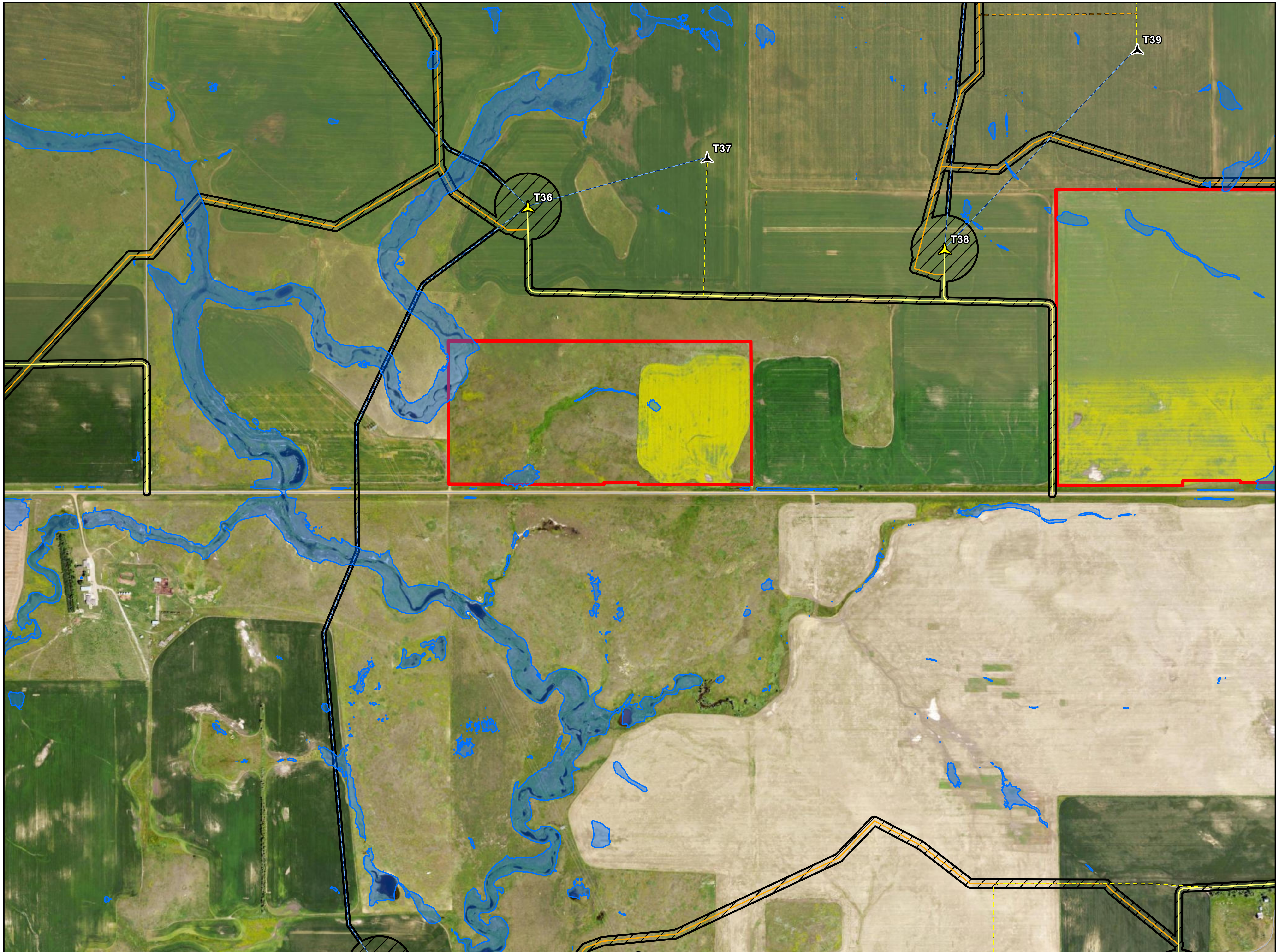

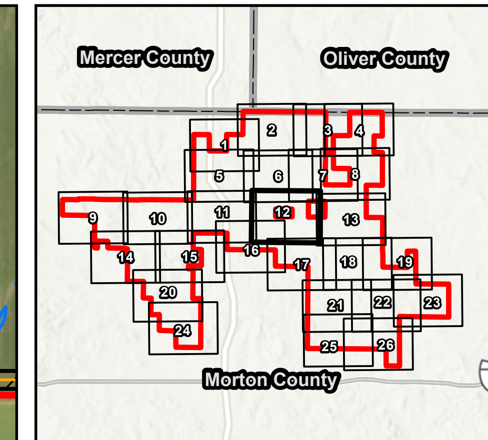

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N W E S

Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line
NDRAM BLE Floodplain
100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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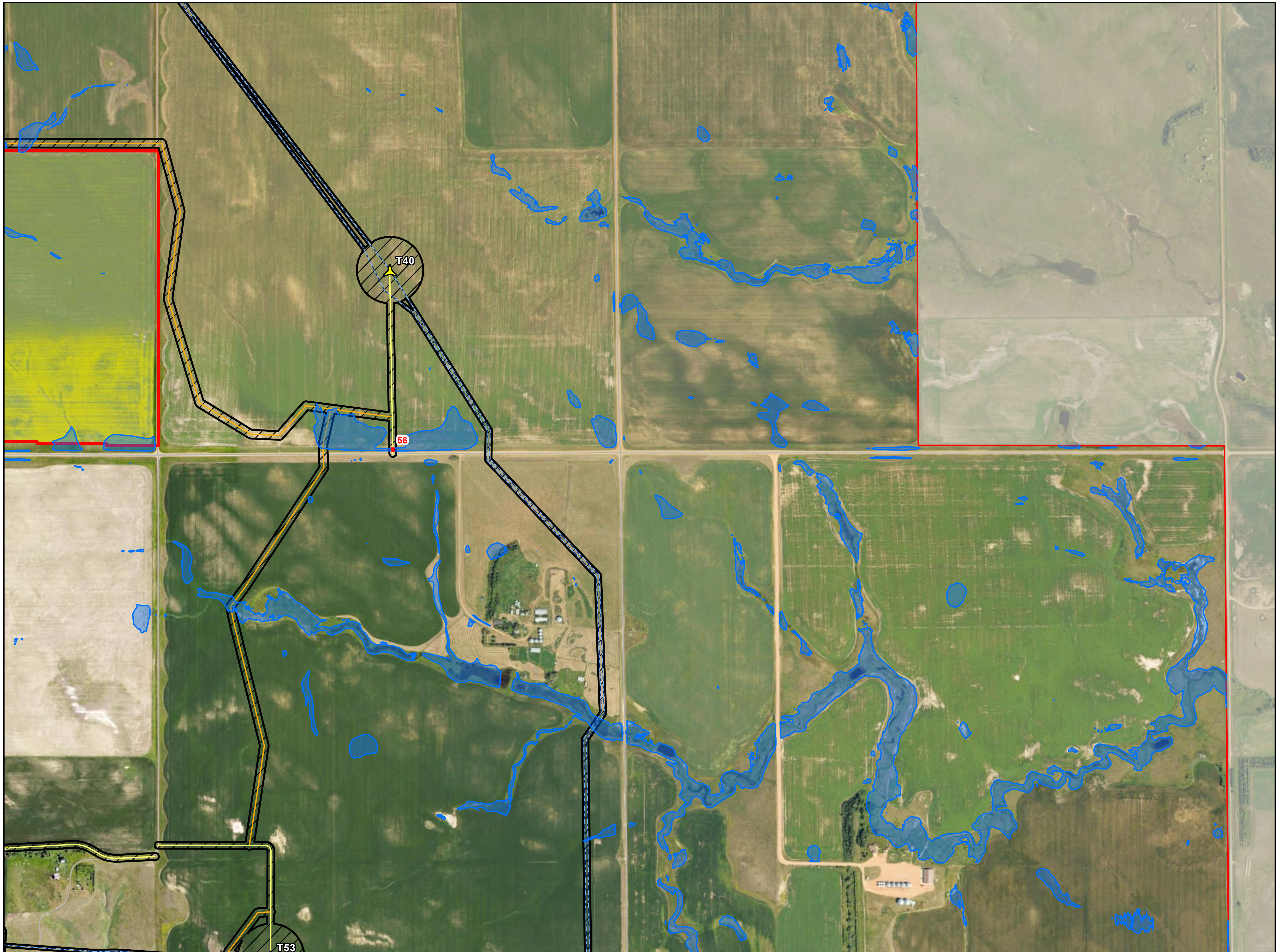

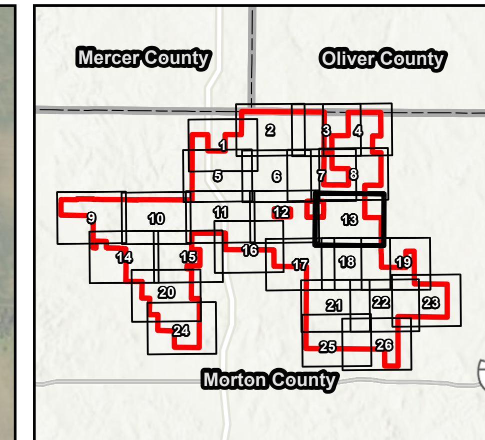

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N
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- Project Area
- Construction Easement
- Primary Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line

NDRAM BLE Floodplain Impact Type

- Permanent

NDRAM BLE Floodplain

- 100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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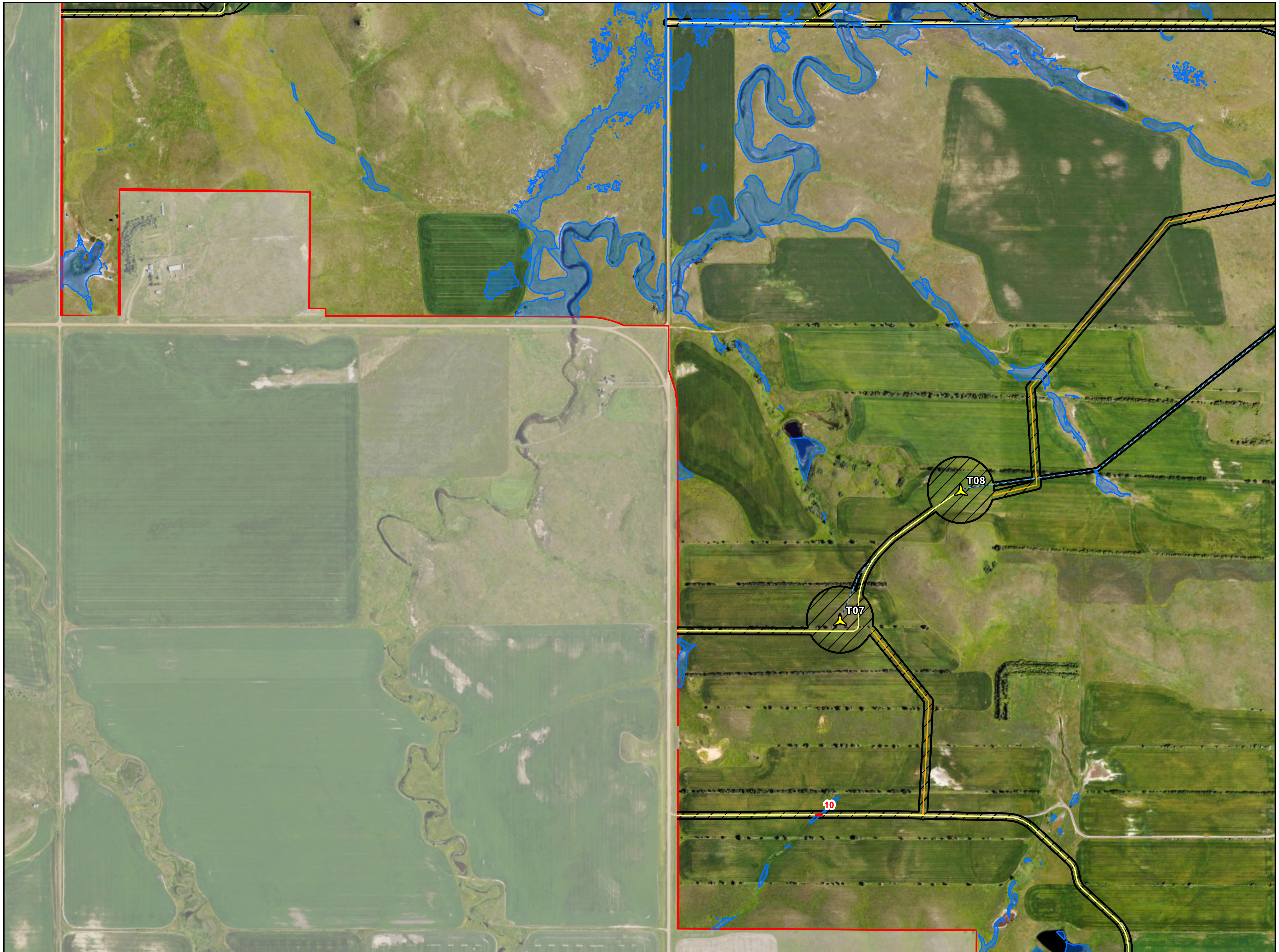

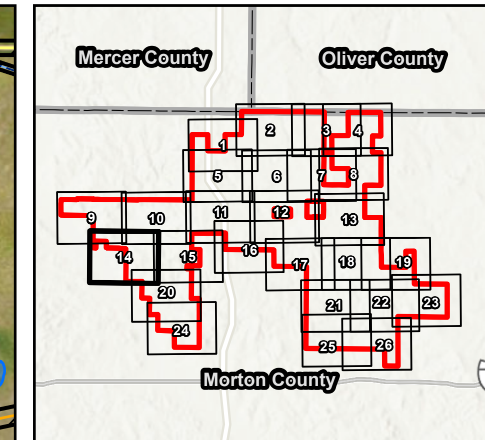

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N W E S

- Project Area
- Construction Easement
- Primary Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line

NDRAM BLE Floodplain Impact Type

- Permanent

NDRAM BLE Floodplain

- 100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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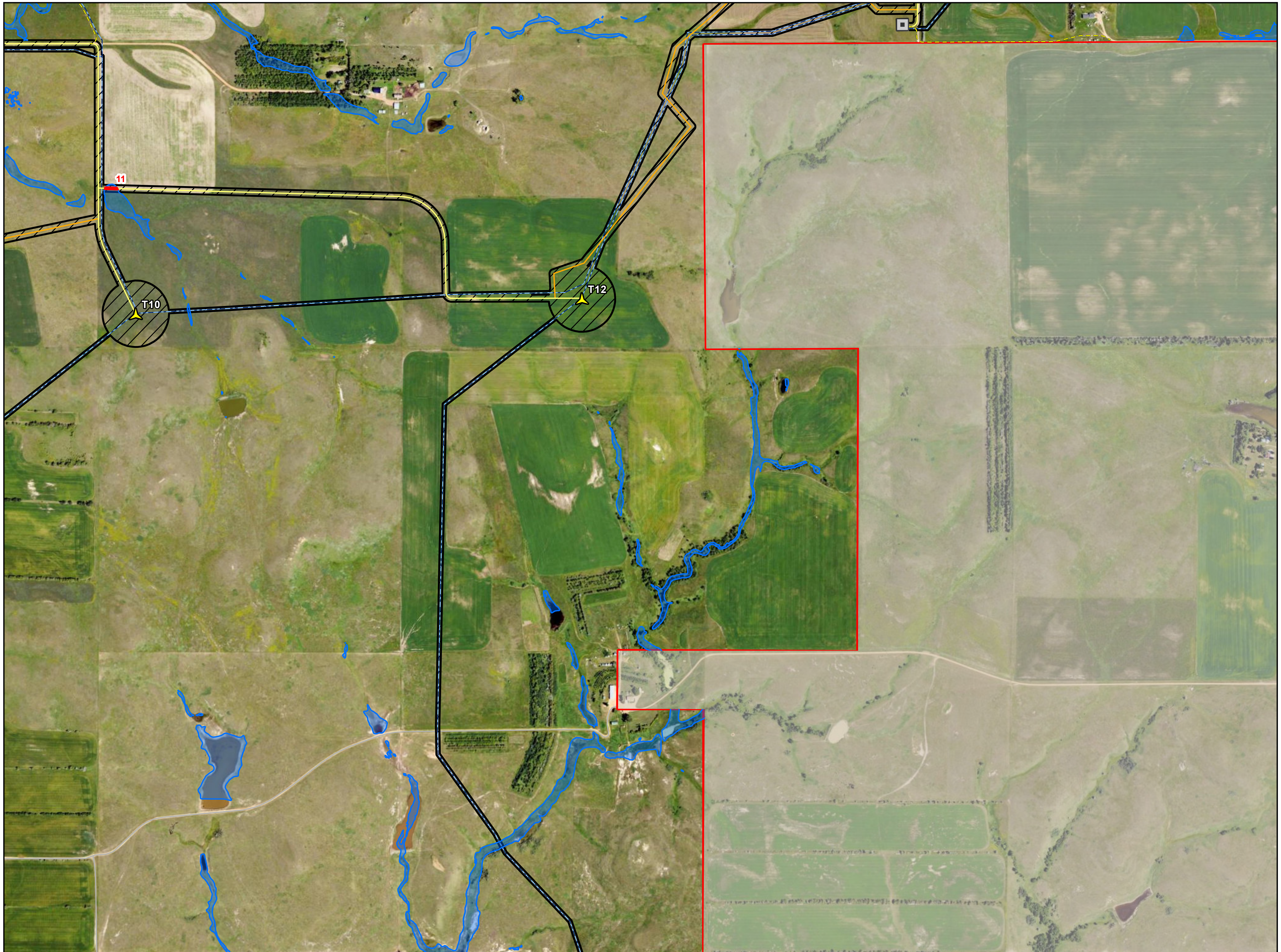

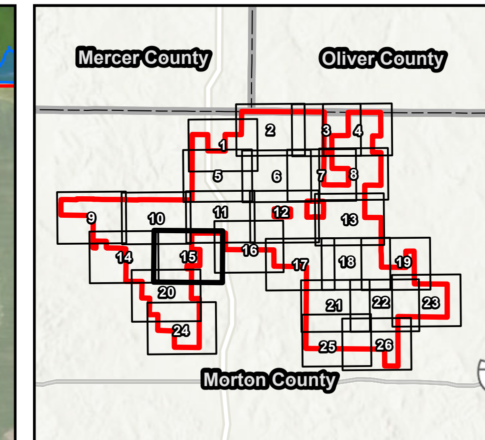

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N S W E

- Project Area
- Construction Easement
- Primary Turbine
- ADLS Radar Tower
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line

NDRAM BLE Floodplain Impact Type

- Permanent

NDRAM BLE Floodplain

- 100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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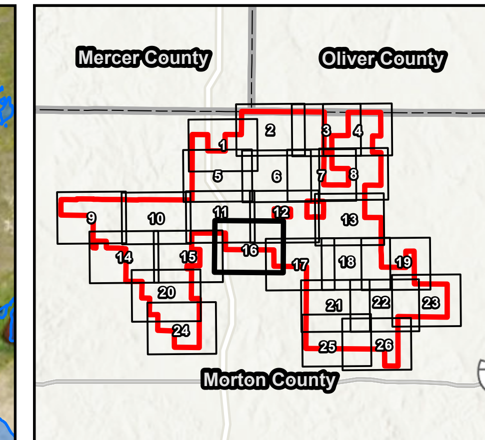

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Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line
NDRAM BLE Floodplain
100 Year

Floodplains

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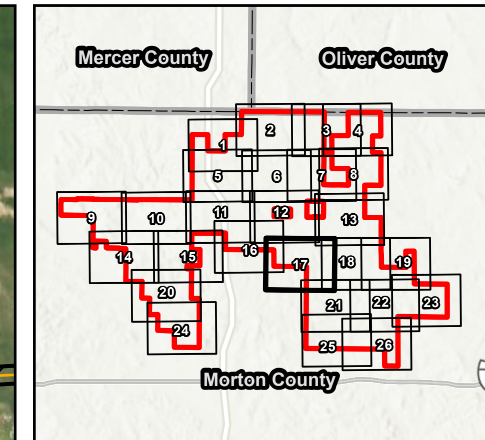

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N
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- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line

NDRAM BLE Floodplain

- 100 Year

Floodplains

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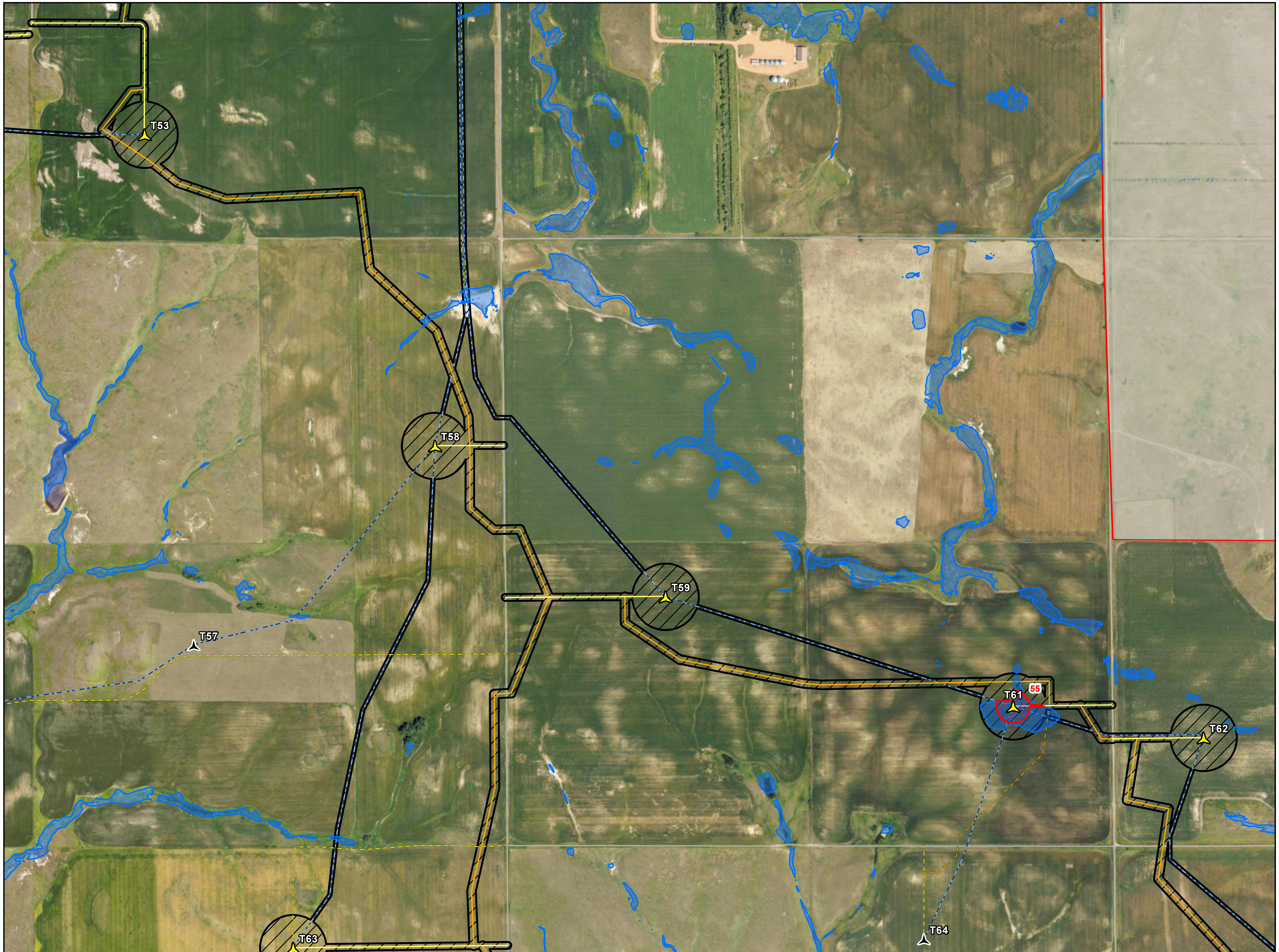

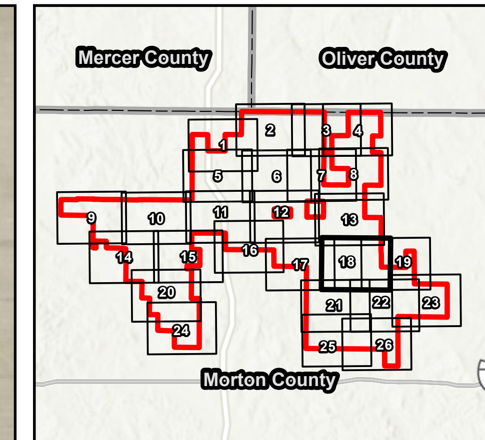

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1:9,600
N W E S

- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Alternate Crane Path
- Collection Line

NDRAM BLE Floodplain Impact Type
- Permanent

NDRAM BLE Floodplain
- 100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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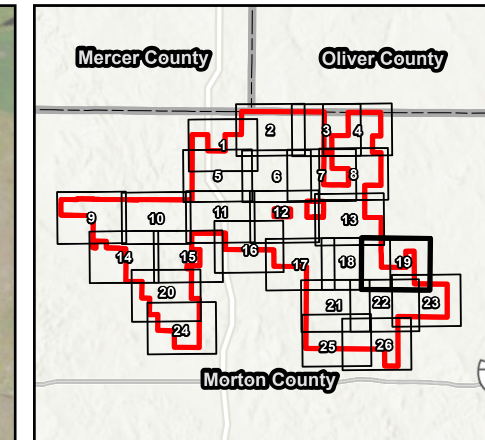

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N E S W

- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Alternate Crane Path
- Collection Line

NDRAM BLE Floodplain Impact Type

- Permanent

NDRAM BLE Floodplain

- 100 Year

Floodplains

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Morton County, North Dakota

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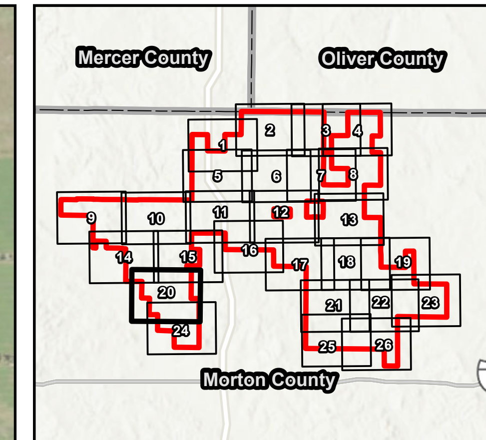

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N W E S

Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line
Delineated Wetland
NDRAM BLE Floodplain Impact Type
Permanent
NDRAM BLE Floodplain
100 Year

Floodplains

Longspur Wind Energy Center

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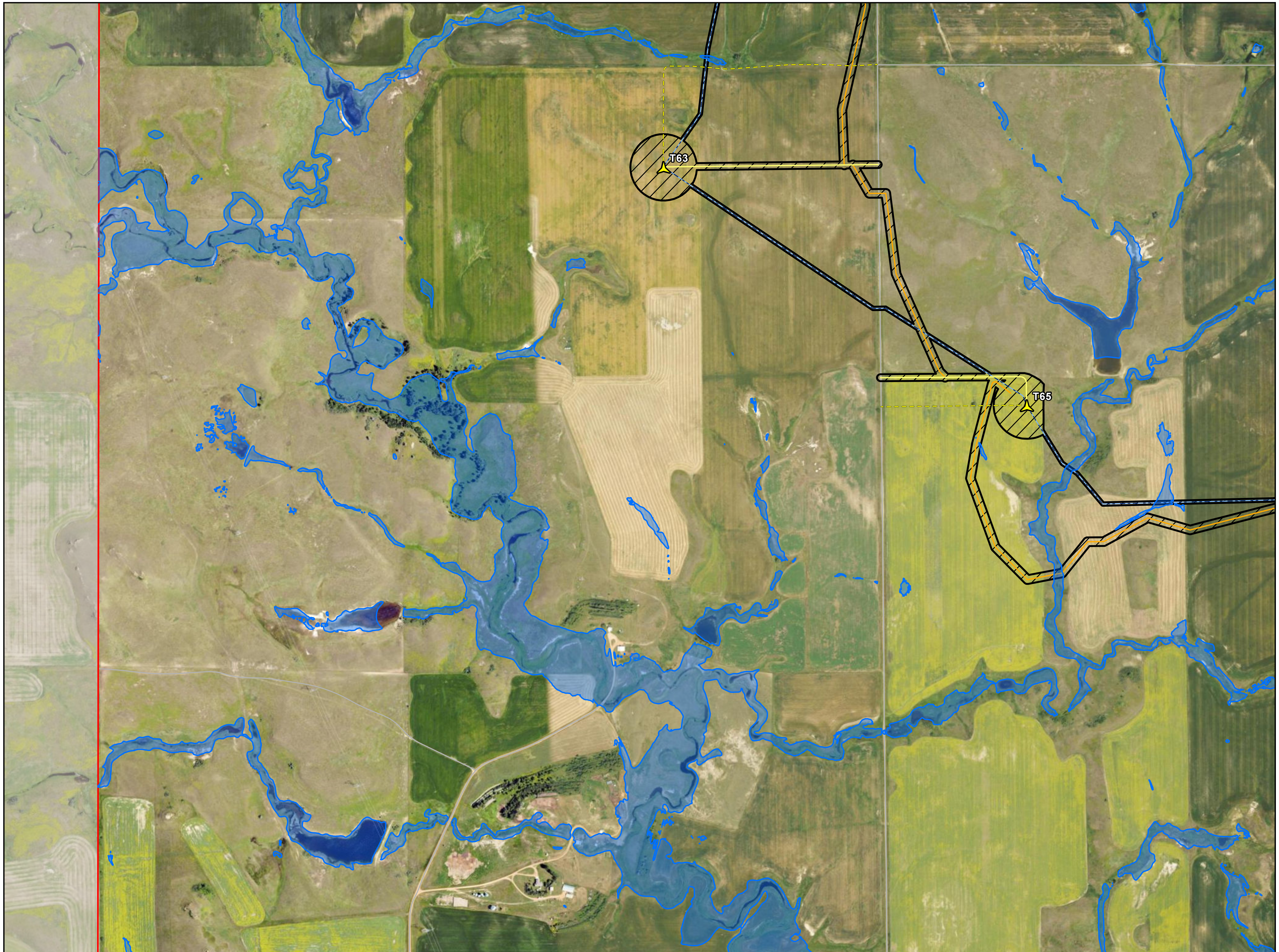

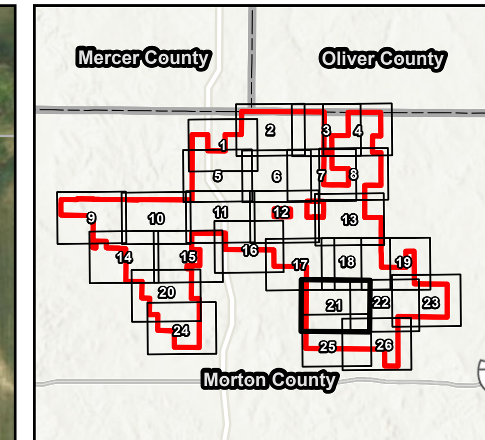

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N W E S

Project Area
Construction Easement
Primary Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line
NDRAM BLE Floodplain
100 Year

Floodplains

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Morton County, North Dakota

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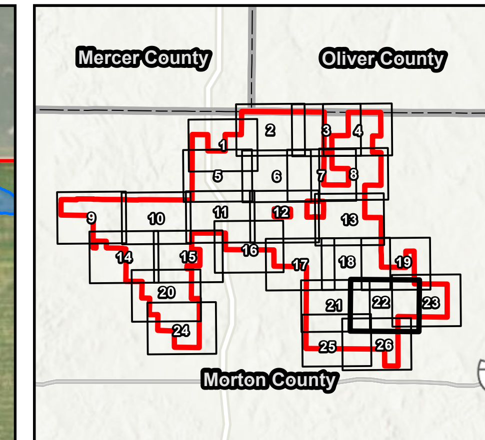

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N
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Project Area

Construction Easement

Primary Turbine

Alternate Turbine

Primary Access Road

Alternate Access Road

Primary Crane Path

Alternate Crane Path

Collection Line

NDRAM BLE Floodplain

100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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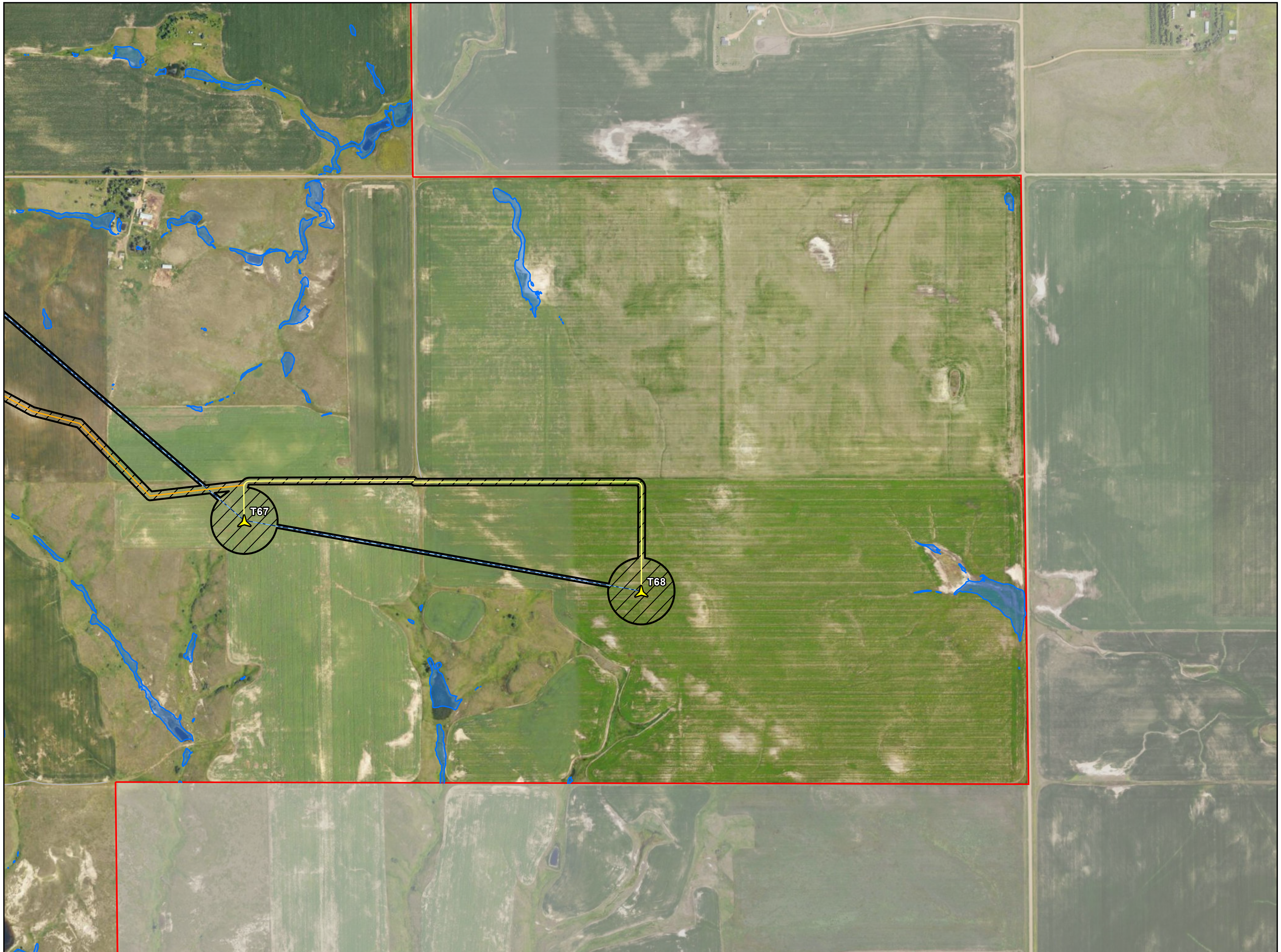

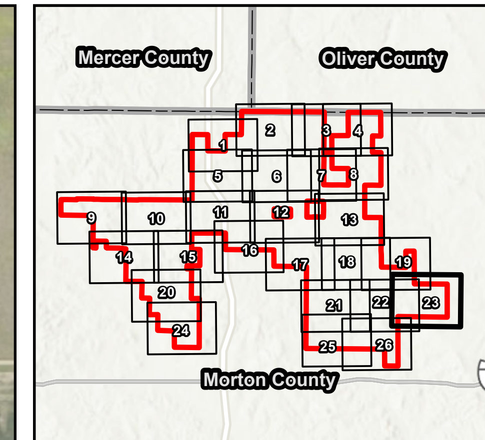

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N S E W

- Project Area
- Construction Easement
- Primary Turbine
- Primary Access Road
- Primary Crane Path
- Collection Line

NDRAM BLE Floodplain

- 100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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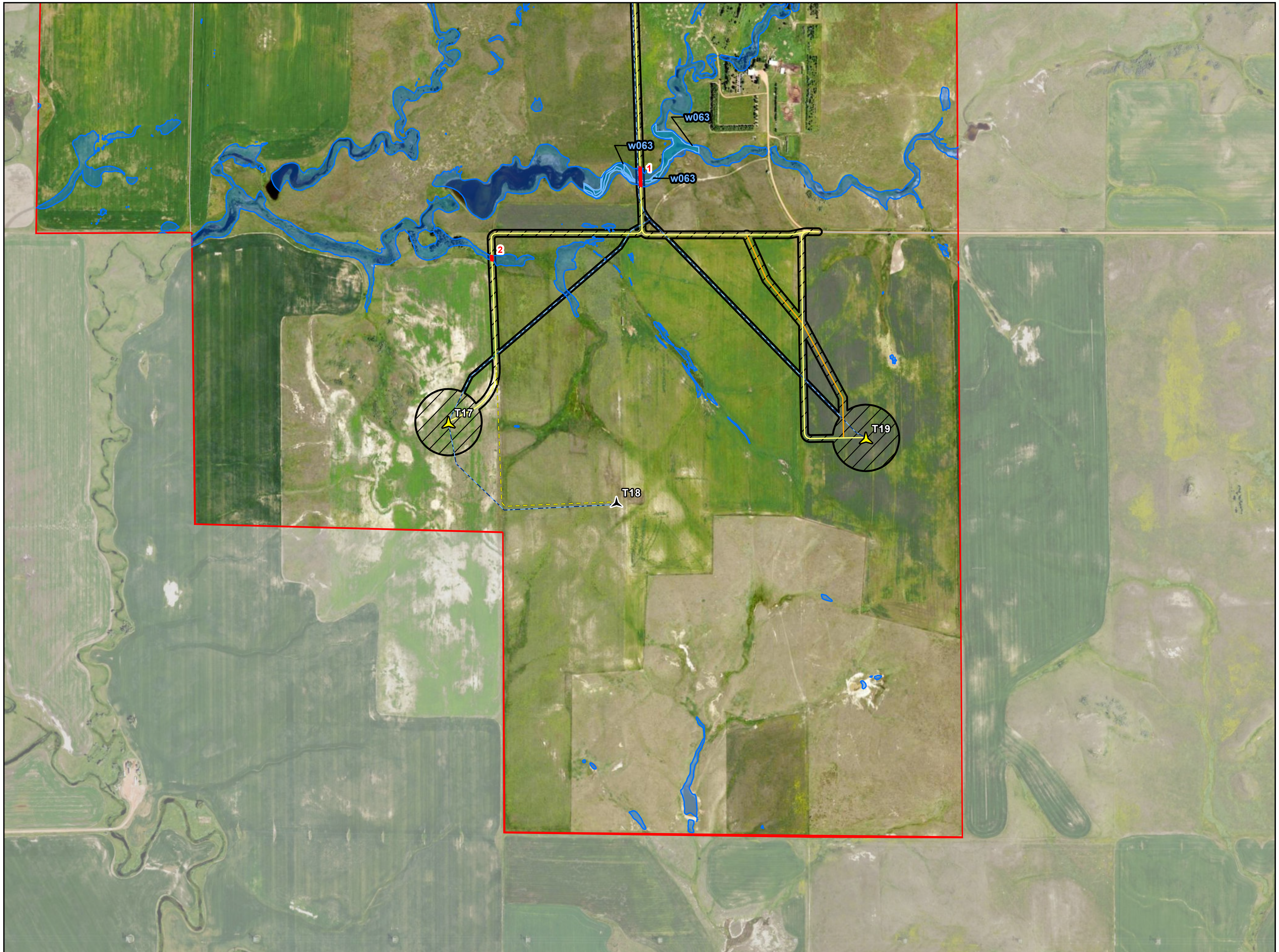

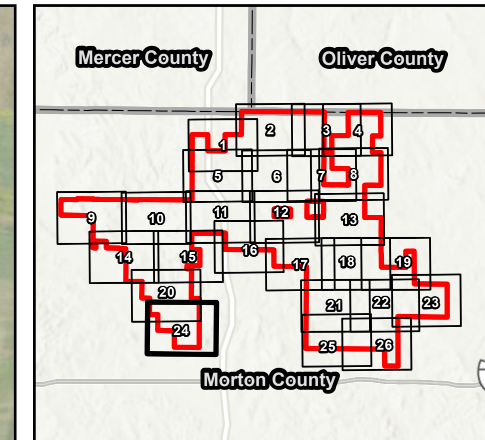

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N
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- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line
- Delineated Wetland

NDRAM BLE Floodplain Impact Type

- Permanent

NDRAM BLE Floodplain

- 100 Year

Floodplains

Longspur Wind Energy Center

Morton County, North Dakota

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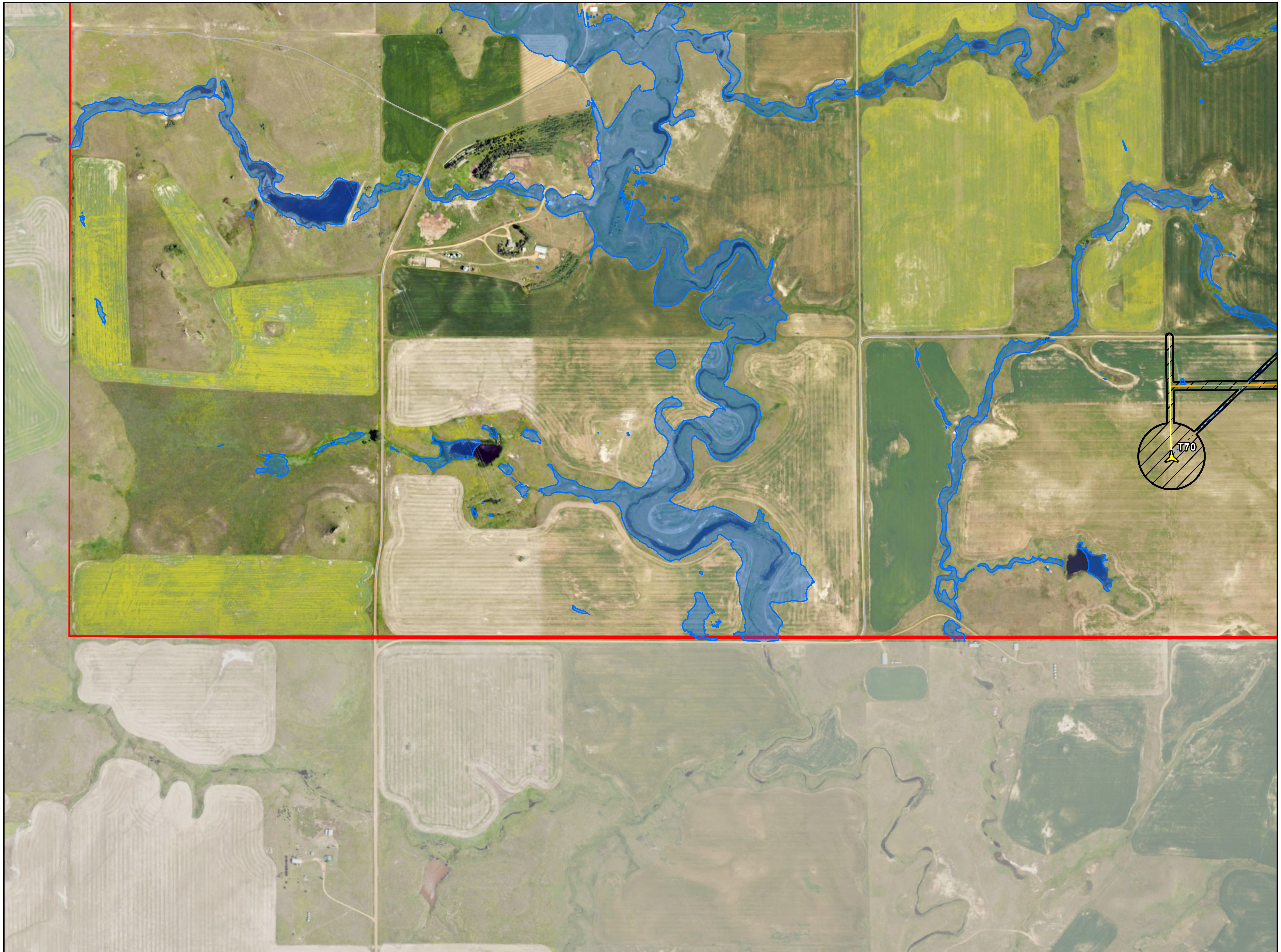

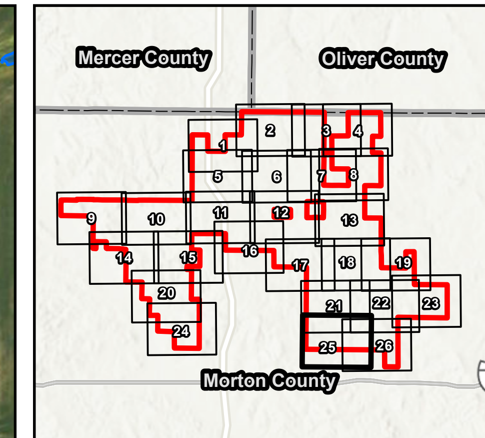

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N S E W

- Project Area
- Construction Easement
- Primary Turbine
- Primary Access Road
- Primary Crane Path
- Collection Line

NDRAM BLE Floodplain

- 100 Year

Floodplains

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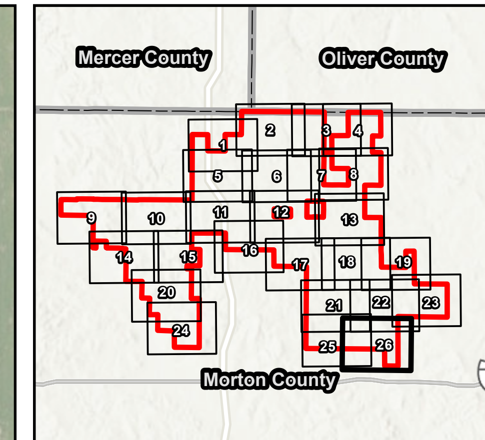

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N W E S

Project Area

Construction Easement

Primary Turbine

Primary Access Road

Primary Crane Path

Collection Line

NDRAM BLE Floodplain

100 Year

Floodplains

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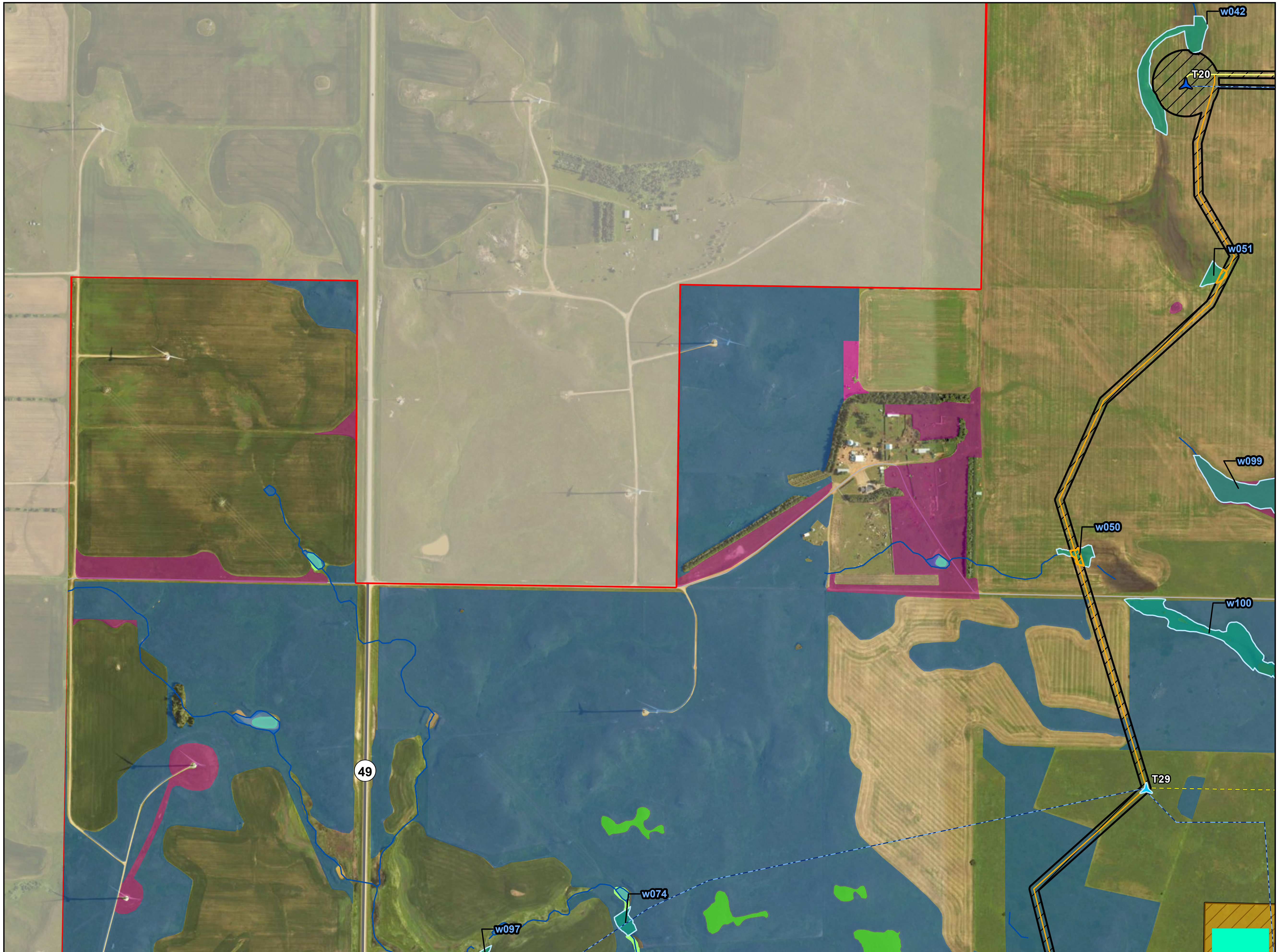
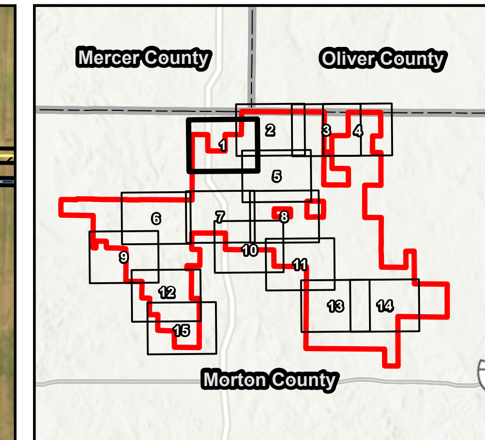
Attachment N

Wetland Avoidance Area Map





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N W E S

- Project Area
- Construction Easement
- Substation Yard
- Substation Facility
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line
- DASK Habitat
- County Boundary

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NHD Waterbody
- NHD Waterway
- NWI Wetland

Wetland Impact

- Temporary

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Desktop)
- Unbroken Grassland

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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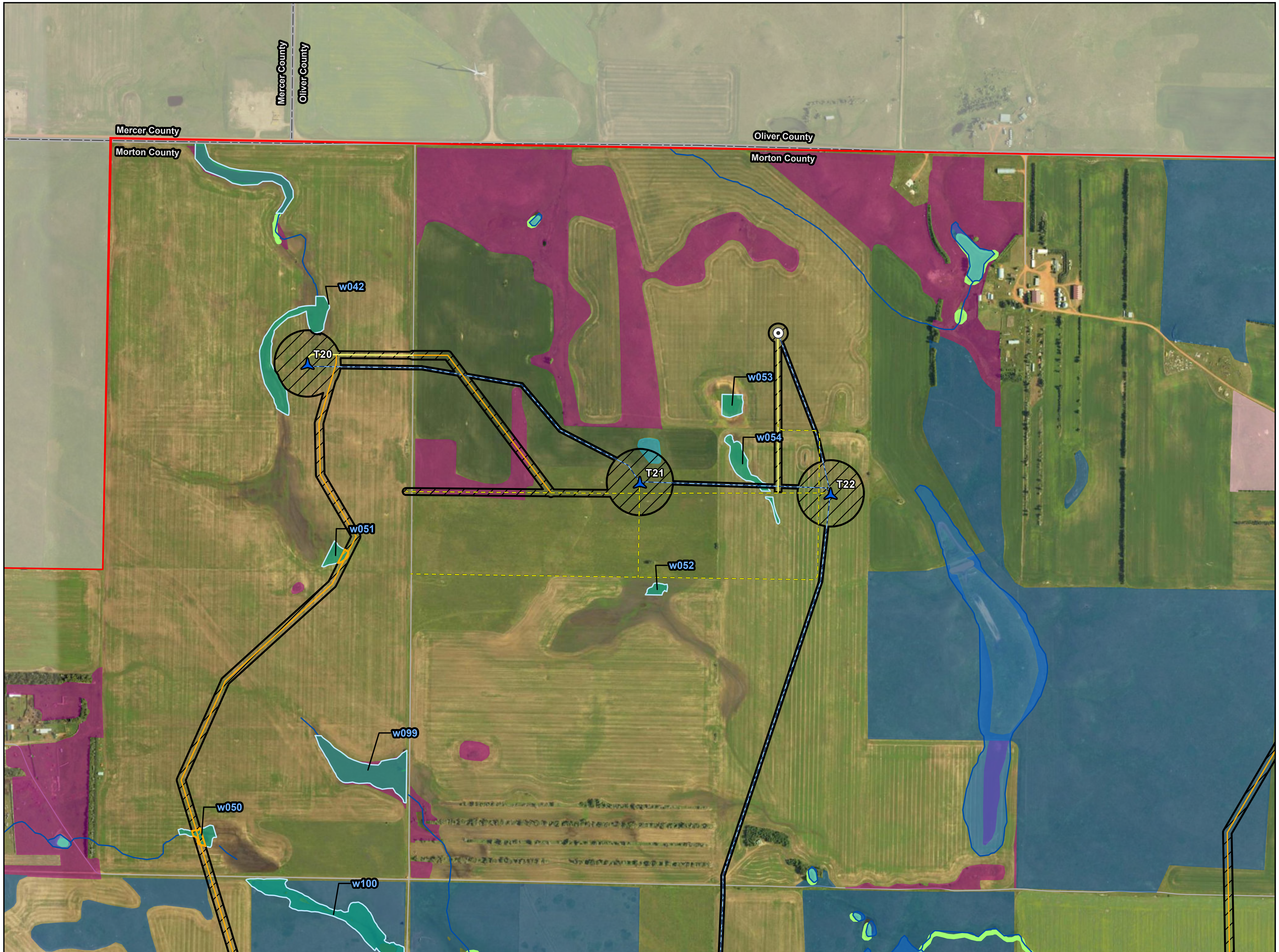

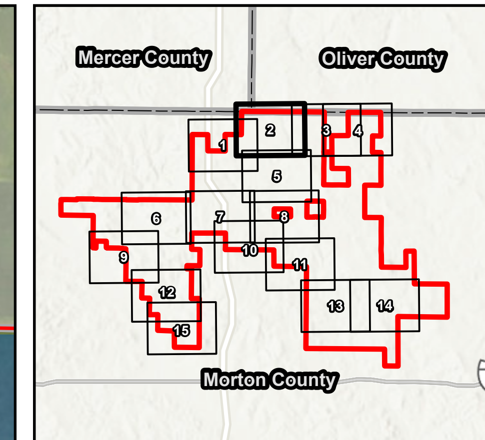

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N W E S

- Project Area
- Construction Easement
- Primary Turbine
- Met Tower
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line
- DASK Habitat
- County Boundary

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NHD Waterbody
- NHD Waterway
- NWI Wetland

Wetland Impact

- Temporary

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Previous Survey)
- Unbroken Grassland
- Unbroken Grassland (Desktop)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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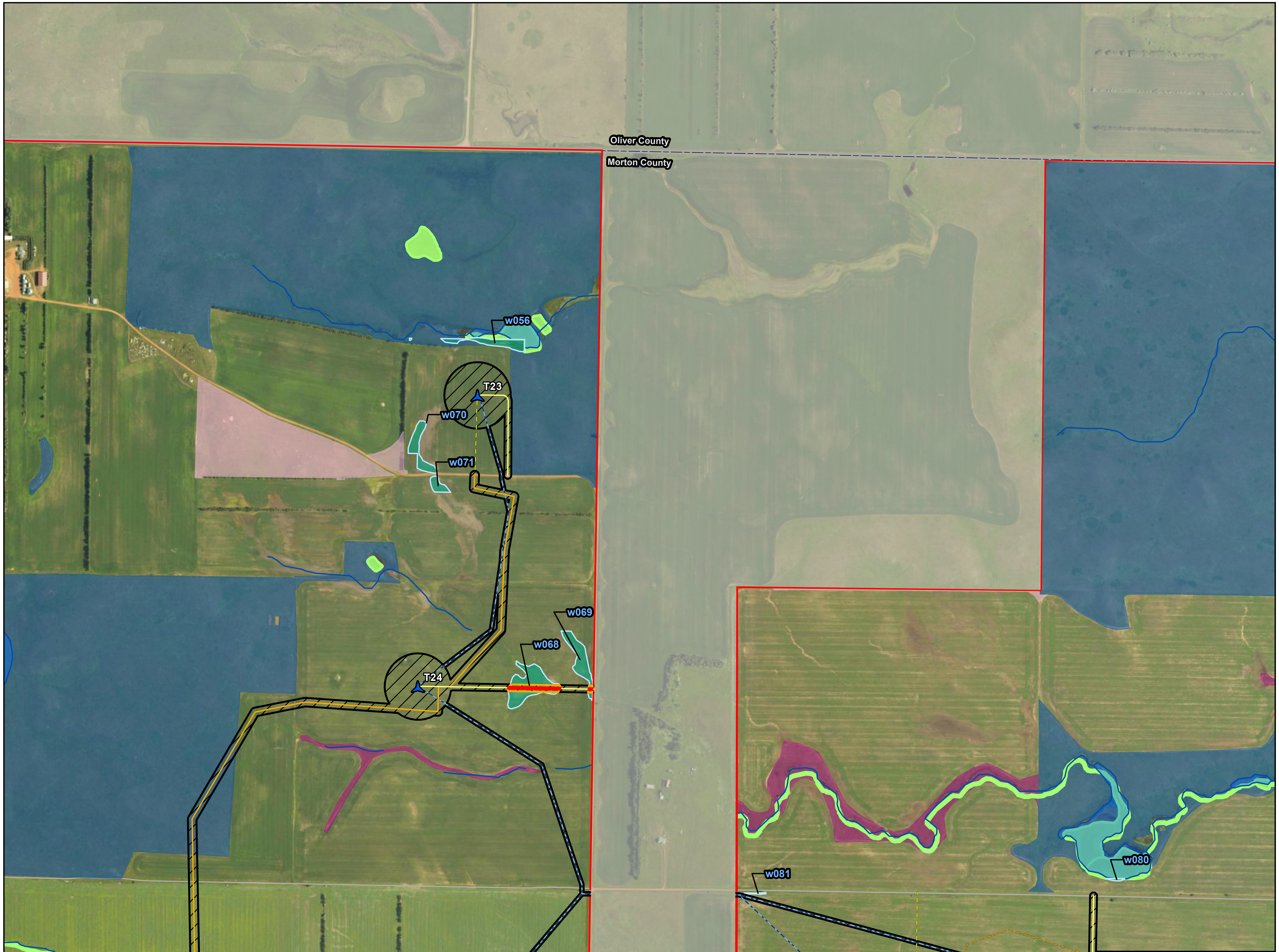

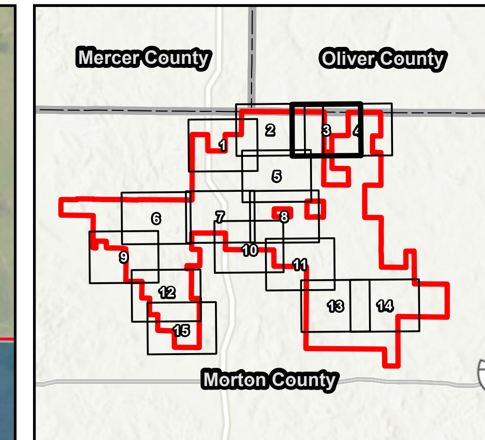

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N W E S

Project Area
Construction Easement
Primary Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line
DASK Habitat
County Boundary

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NHD Waterbody
NHD Waterway
NWI Wetland

Wetland Impact

Temporary
Permanent

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland

Wetlands/Waterbodies

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Morton County, North Dakota

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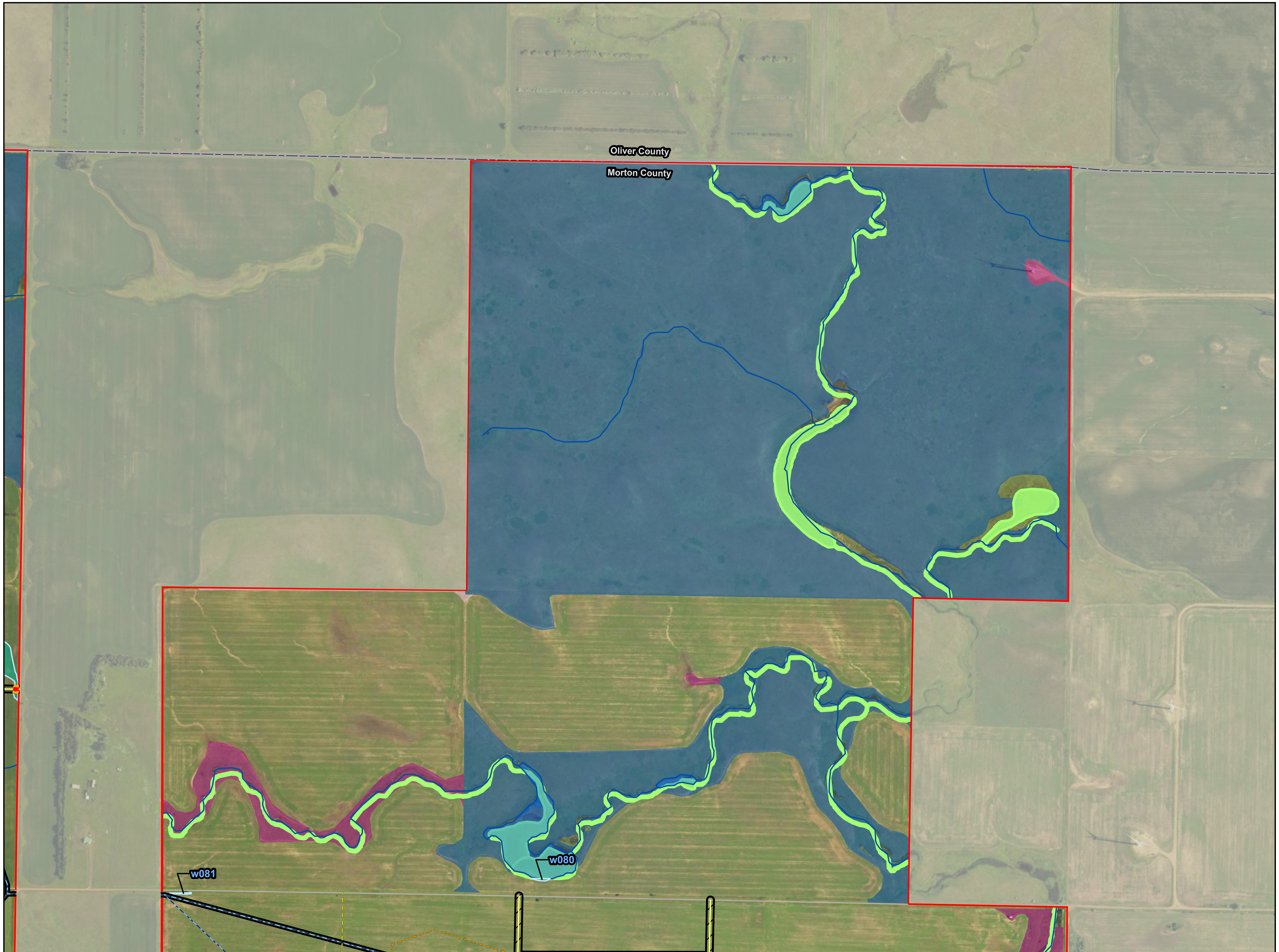

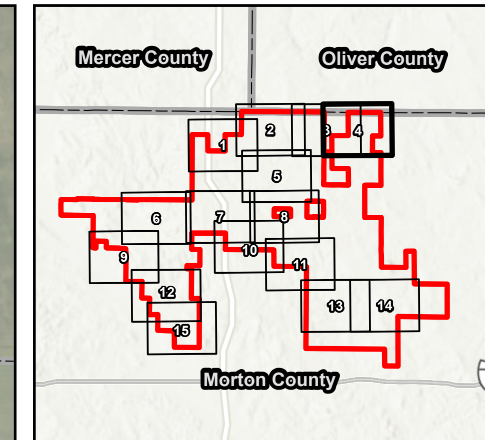

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N S W E

Project Area
Construction Easement
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line
DASK Habitat
County Boundary

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NHD Waterbody
NHD Waterway
NWI Wetland

Wetland Impact

Temporary
Permanent

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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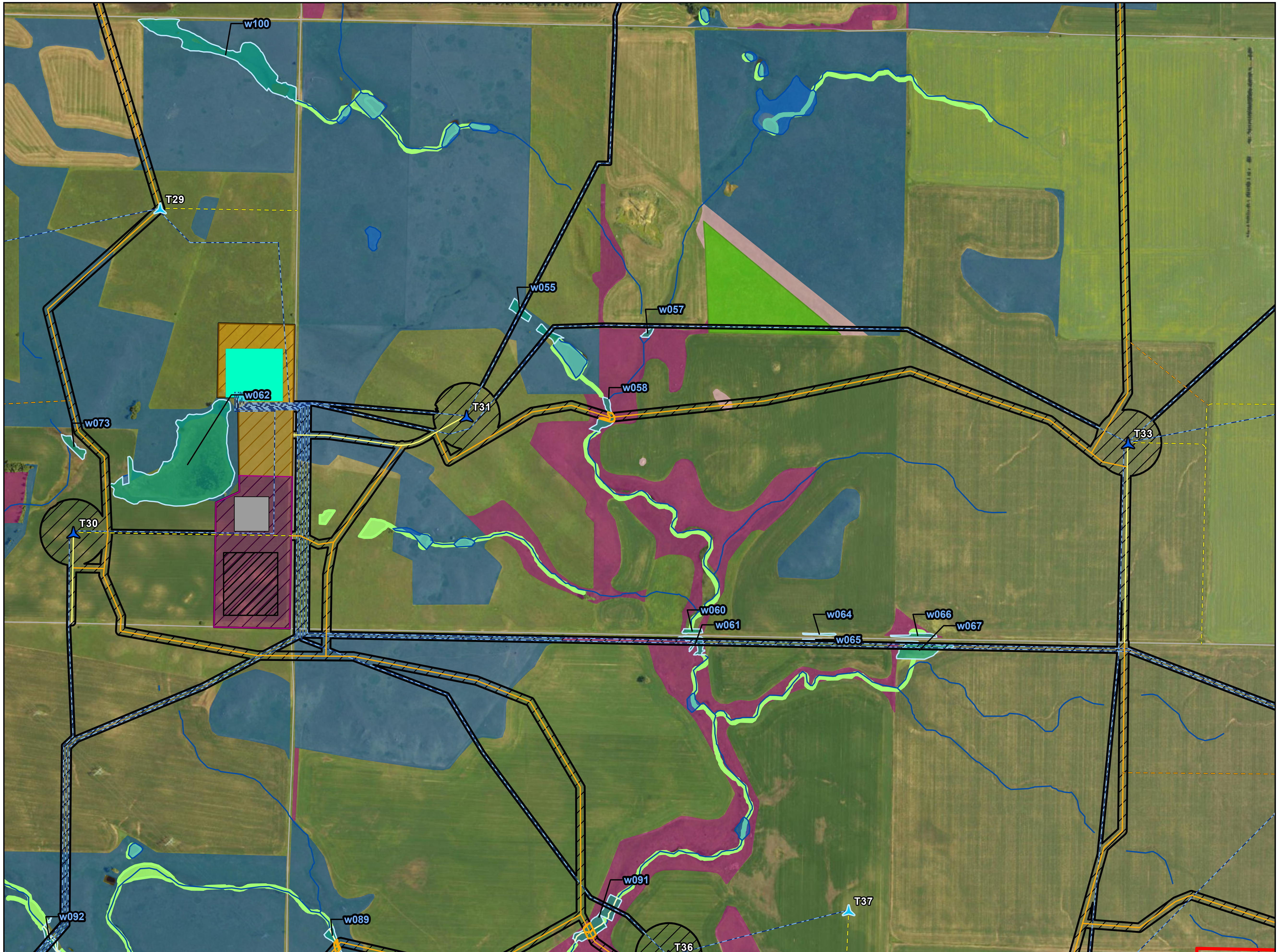

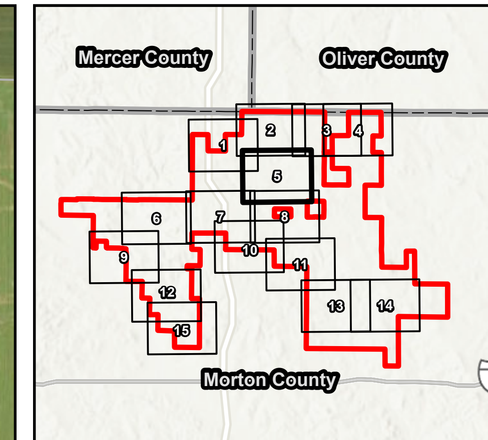

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N W E S

- Project Area
- Construction Easement
- Substation Yard
- Substation Facility
- O&M Yard
- O&M Building
- Construction Laydown Yard
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Alternate Crane Path
- Collection Line
- County Boundary

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NHD Waterbody
- NHD Waterway
- NWI Wetland

Wetland Impact

- Temporary

Waterbody Impact

- Temporary

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Previous Survey)
- Unbroken Grassland
- Unbroken Grassland (Previous Survey)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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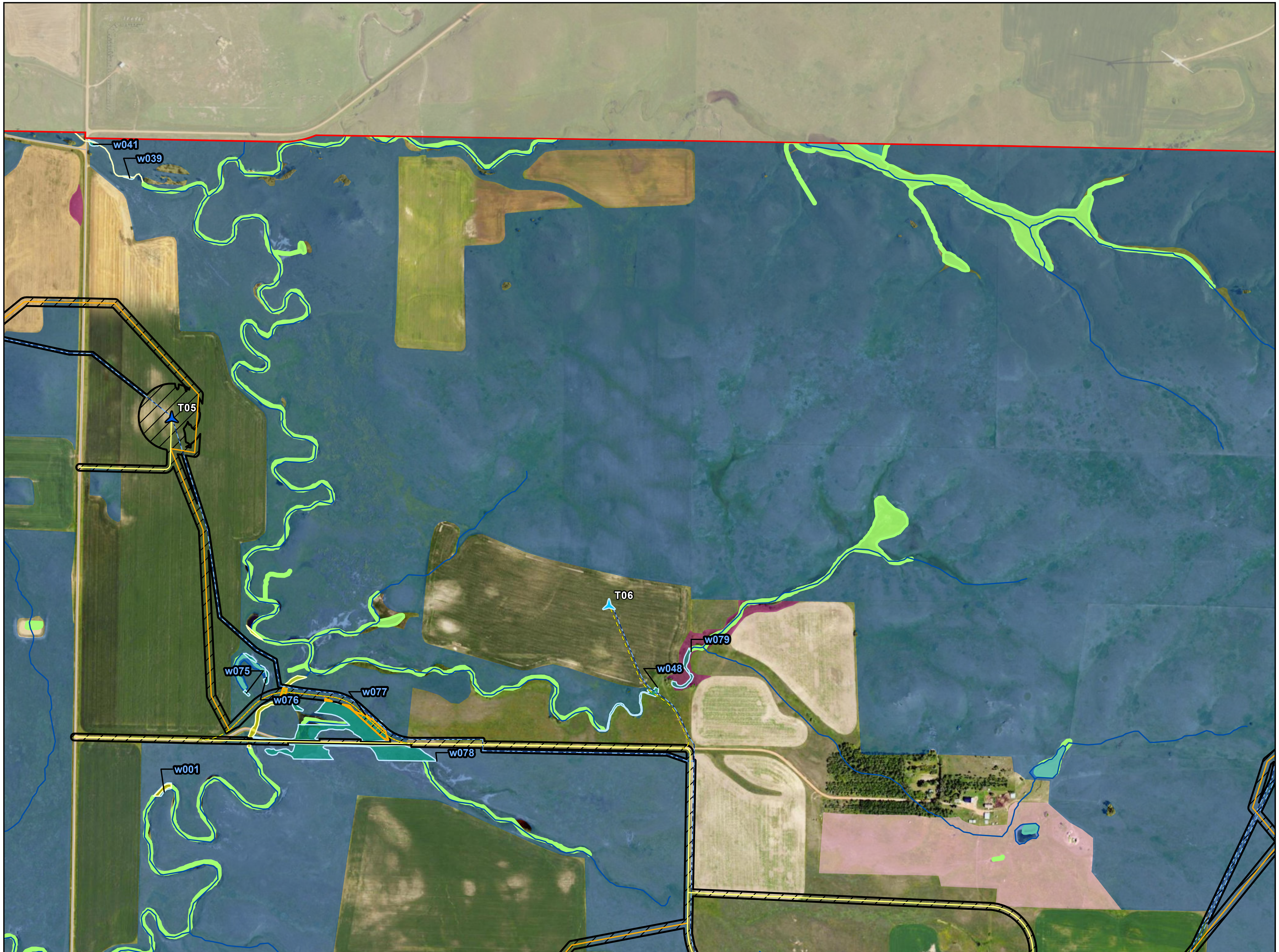

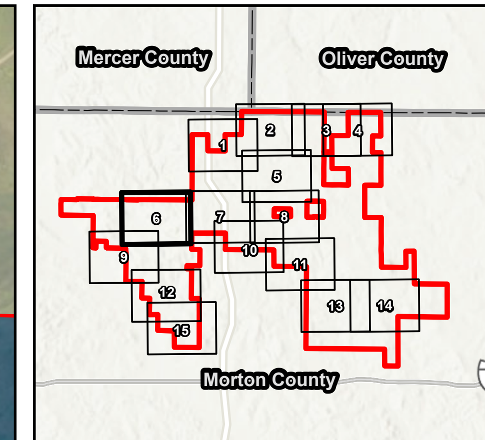

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N W E S

Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line
DASK Habitat
County Boundary

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NHD Waterbody
NHD Waterway
NWI Wetland

Wetland Impact

Temporary

Waterbody Impact

Temporary

Grassland Sod Type

Broken Grassland
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Desktop)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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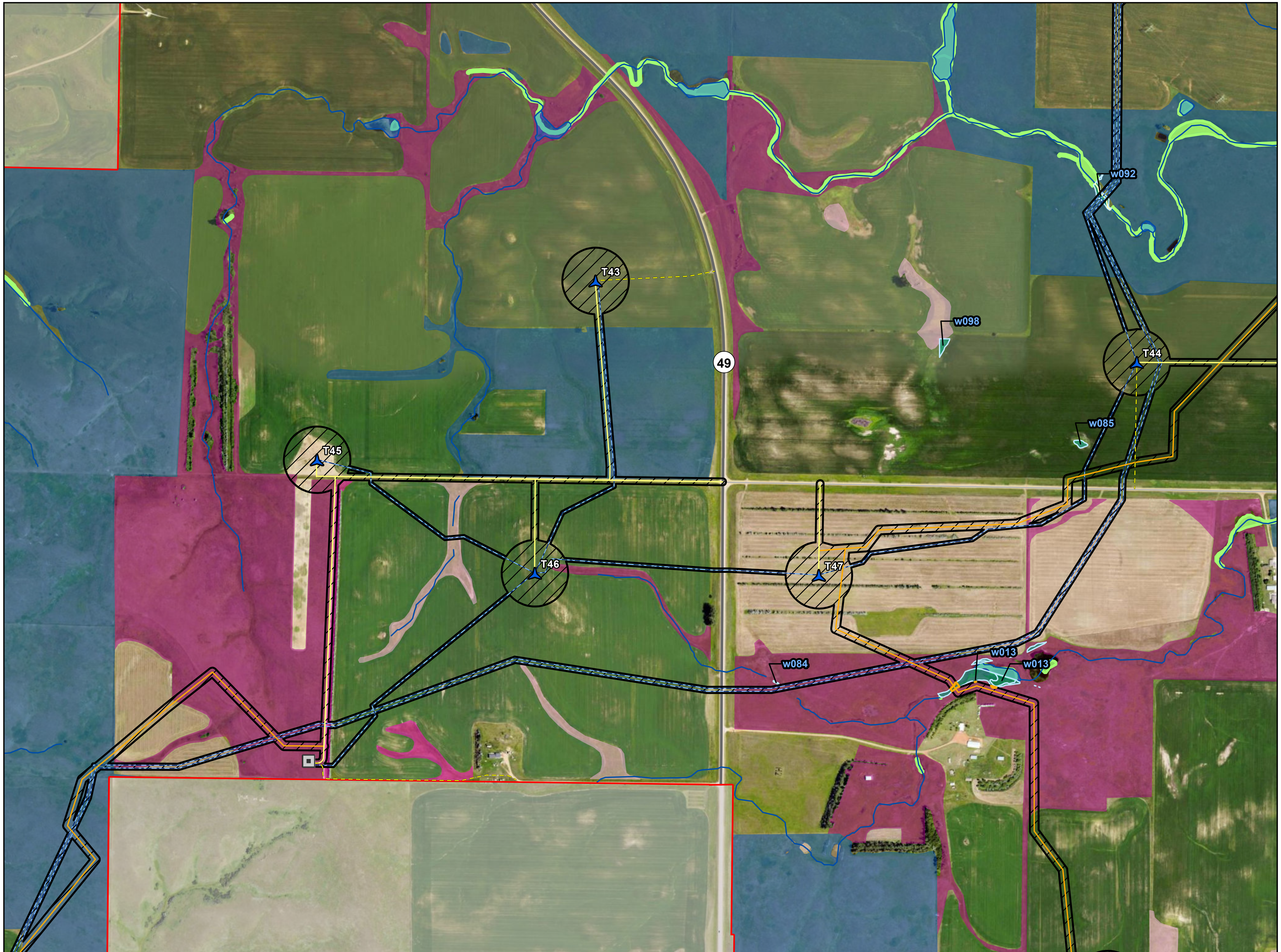

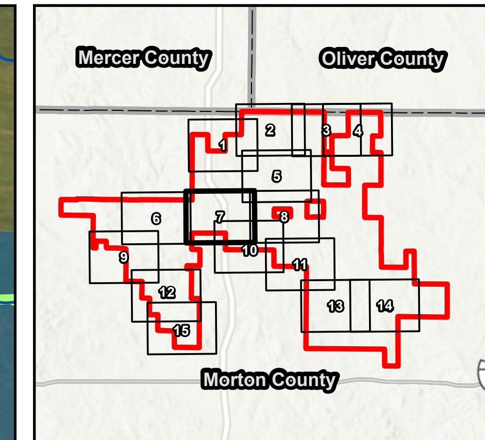

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N E S W

- Project Area
- Construction Easement
- Primary Turbine
- ADLS Radar Tower
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line
- DASK Habitat
- County Boundary

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NHD Waterbody
- NHD Waterway
- NWI Wetland

Wetland Impact

- Temporary

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Desktop)
- Broken Grassland (Previous Survey)
- Unbroken Grassland
- Unbroken Grassland (Desktop)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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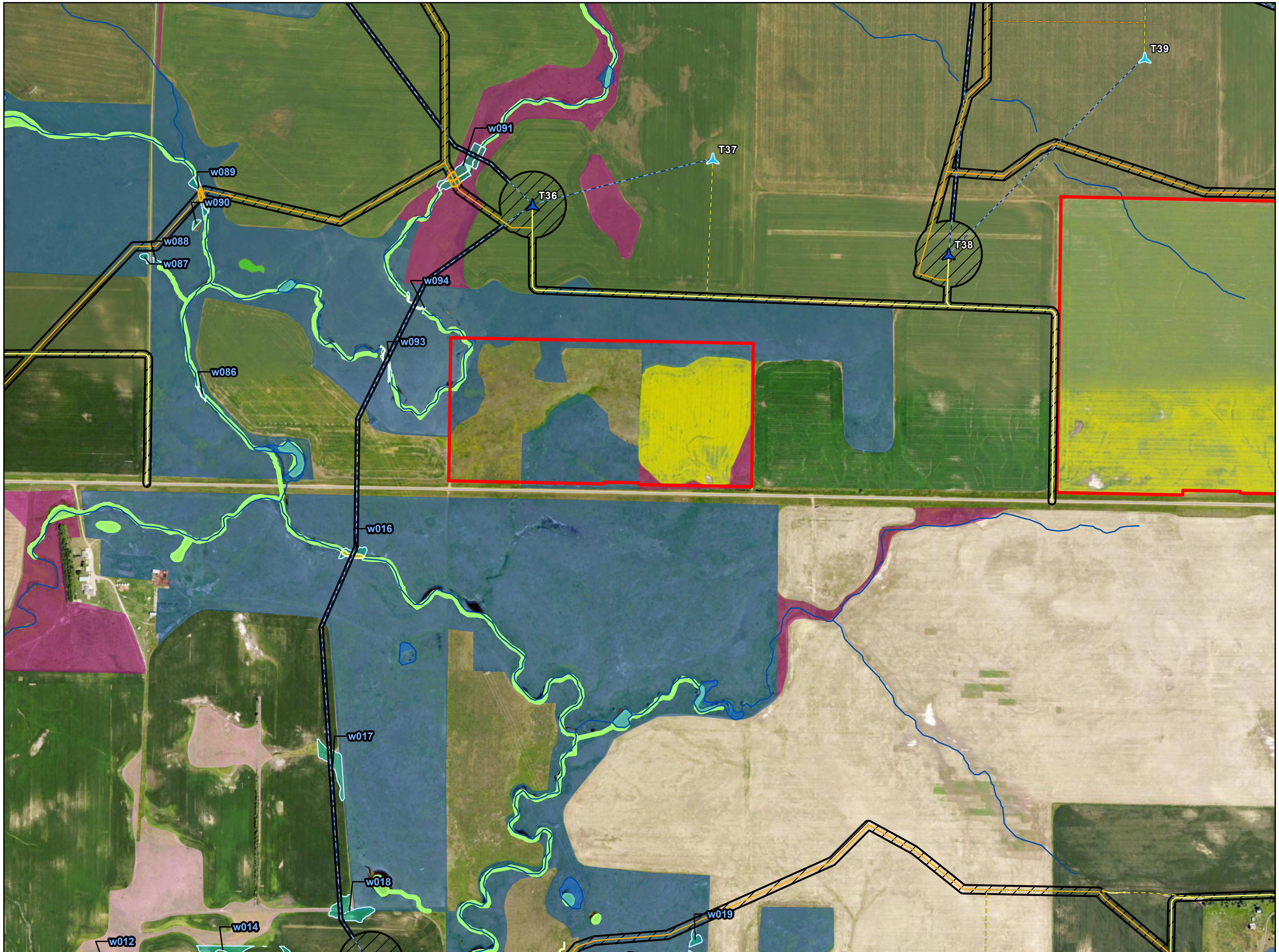

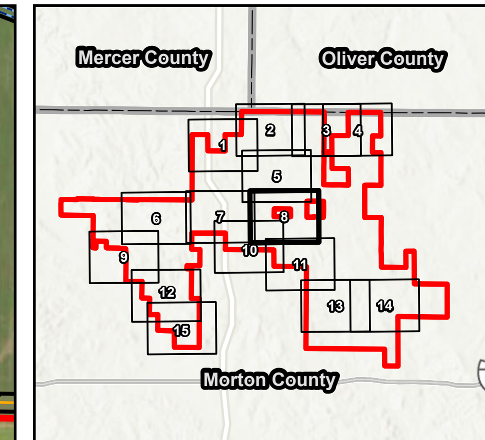

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N E S W

- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Alternate Crane Path
- Collection Line
- DASK Habitat
- County Boundary

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NHD Waterbody
- NHD Waterway
- NWI Wetland

Wetland Impact

- Temporary

Waterbody Impact

- Temporary

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Previous Survey)
- Unbroken Grassland
- Unbroken Grassland (Previous Survey)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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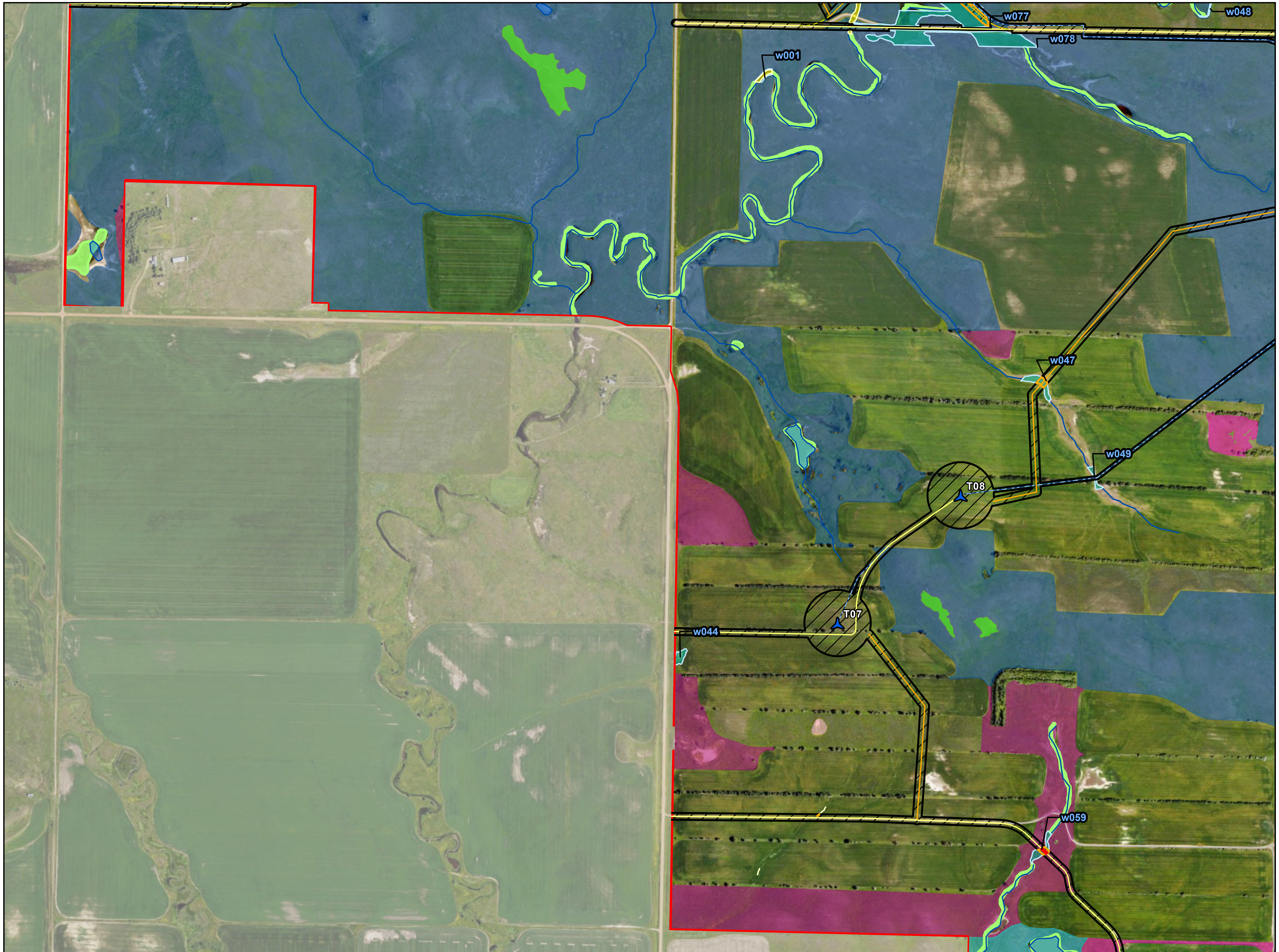

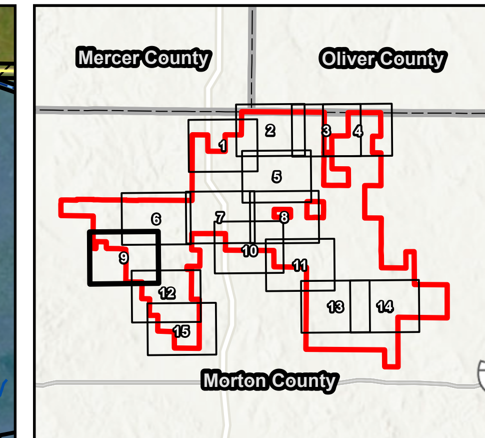

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Project Area
Construction Easement
Primary Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line
DASK Habitat
County Boundary

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NHD Waterbody
NHD Waterway
NWI Wetland

Wetland Impact

Temporary
Permanent

Waterbody Impact

Temporary

Grassland Sod Type

Broken Grassland
Broken Grassland (Desktop)
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Desktop)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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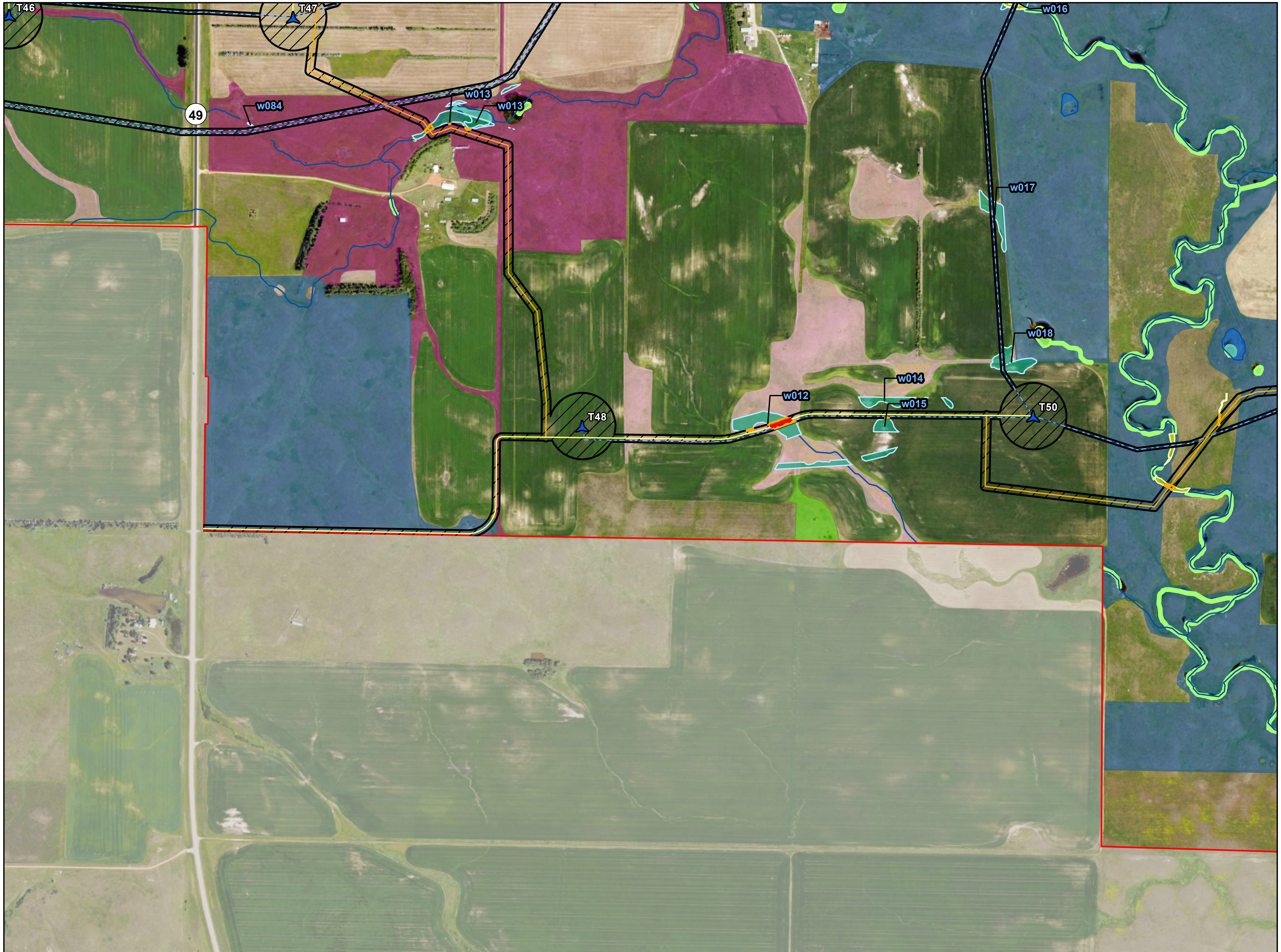

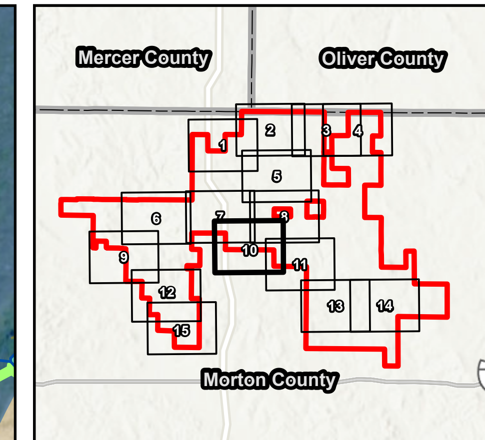

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N S E W

- Project Area
- Construction Easement
- Primary Turbine
- Primary Access Road
- Primary Crane Path
- Collection Line
- DASK Habitat
- County Boundary

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NHD Waterbody
- NHD Waterway
- NWI Wetland

Wetland Impact

- Temporary
- Permanent

Waterbody Impact

- Temporary

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Previous Survey)
- Unbroken Grassland
- Unbroken Grassland (Previous Survey)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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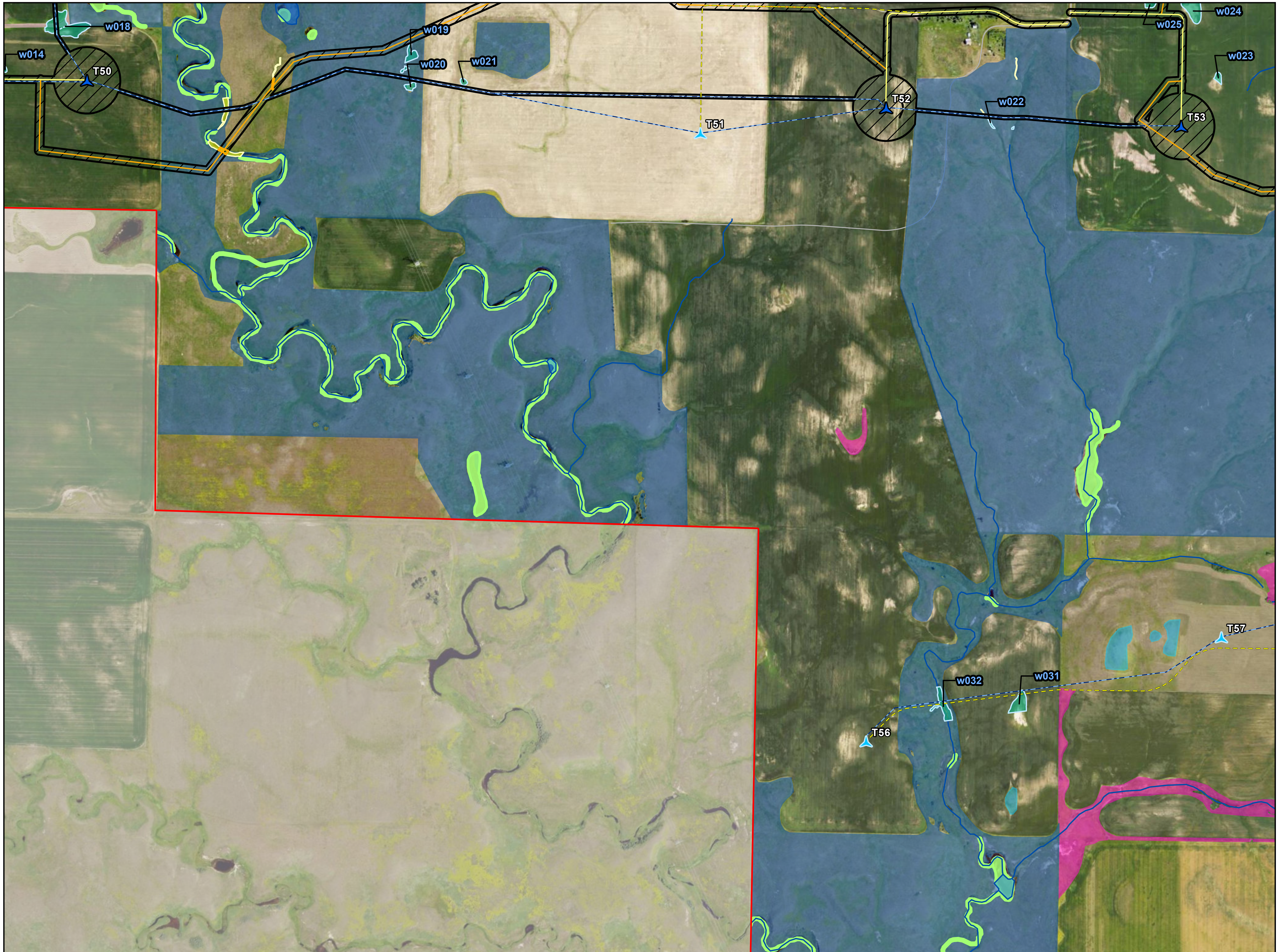

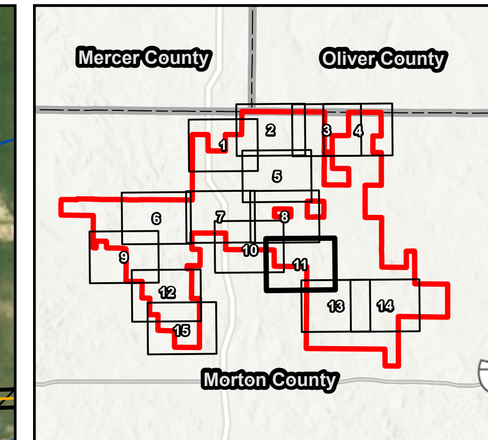

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N
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- Project Area
- Construction Easement
- Primary Turbine
- Alternate Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line
- DASK Habitat
- County Boundary

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NHD Waterbody
- NHD Waterway
- NWI Wetland

Waterbody Impact

- Temporary

Grassland Sod Type

- Broken Grassland (Desktop)
- Broken Grassland (Previous Survey)
- Unbroken Grassland
- Unbroken Grassland (Desktop)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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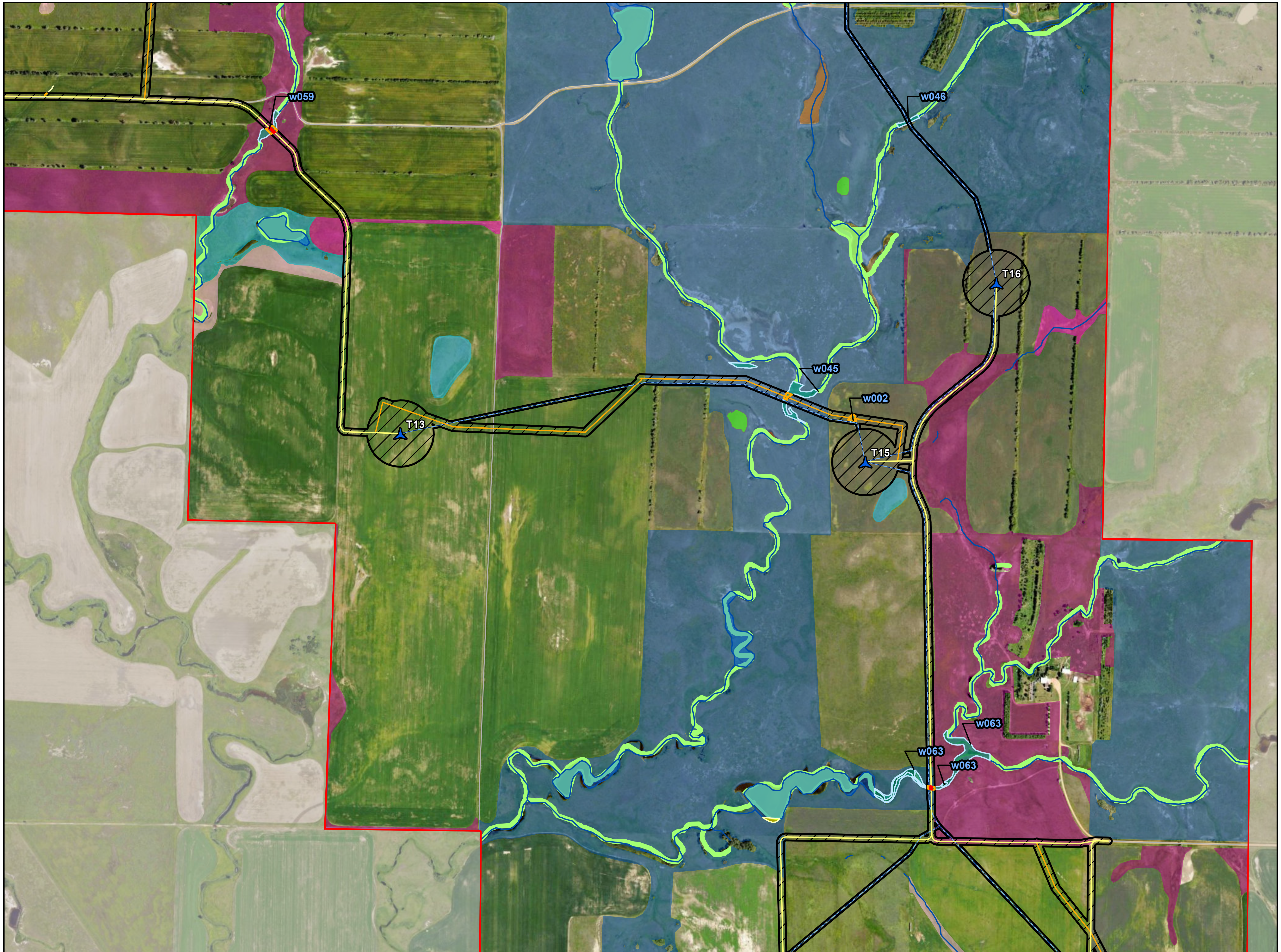

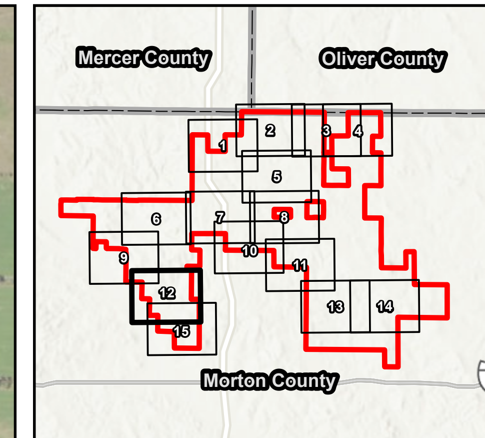

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N S E W

Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line
DASK Habitat
County Boundary

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NHD Waterbody
NHD Waterway
NWI Wetland

Wetland Impact

Temporary
Permanent

Waterbody Impact

Temporary

Grassland Sod Type

Broken Grassland
Broken Grassland (Desktop)
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Desktop)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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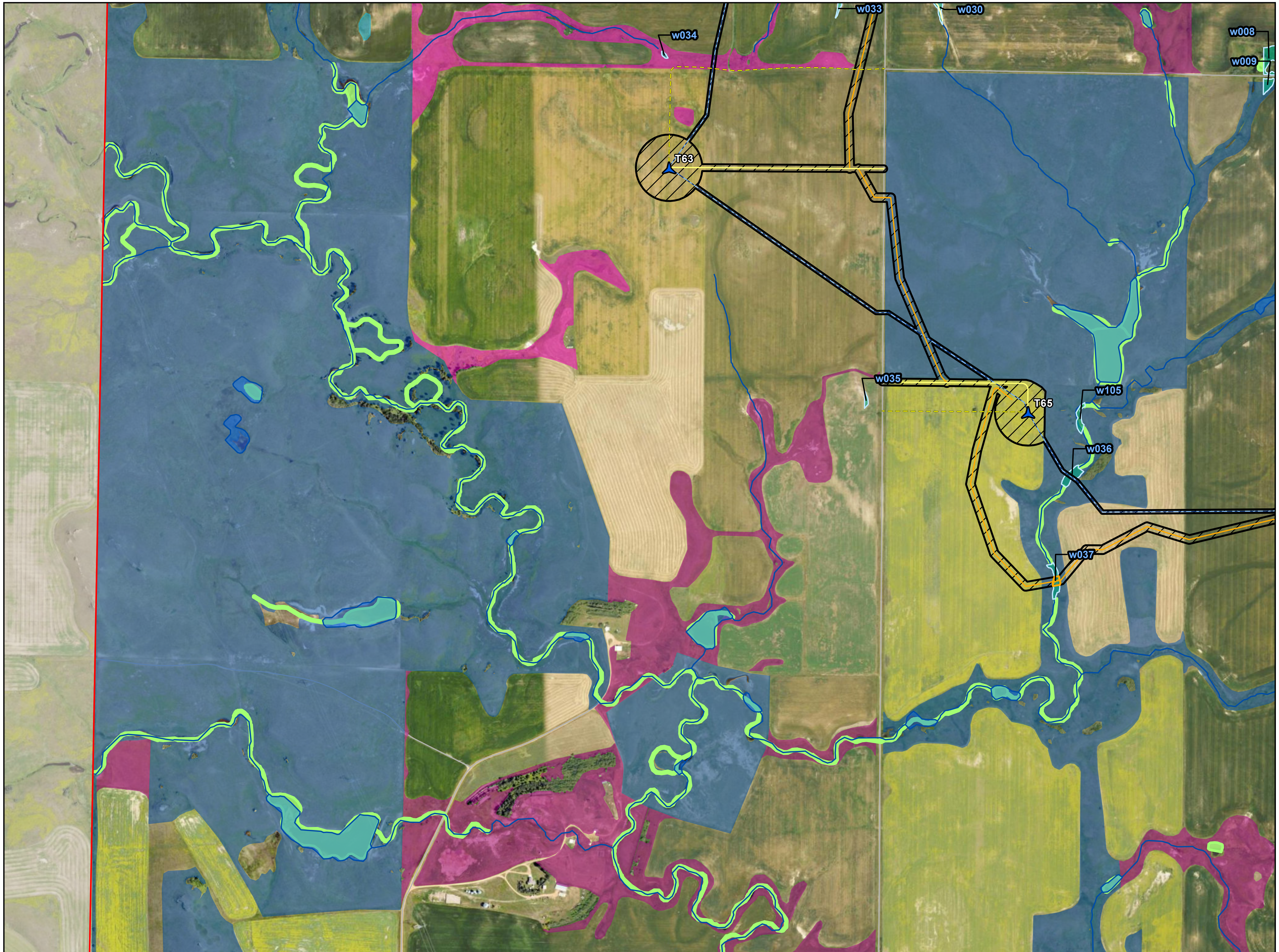

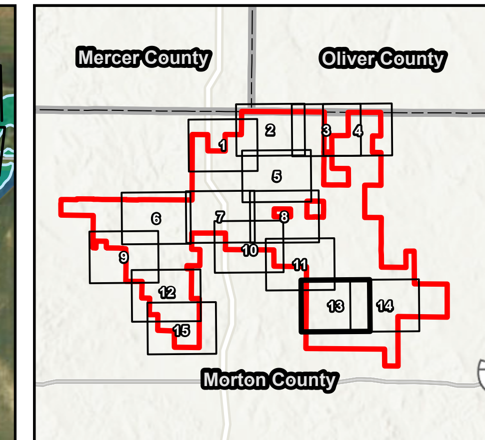

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N W E S

- Project Area
- Construction Easement
- Primary Turbine
- Primary Access Road
- Alternate Access Road
- Primary Crane Path
- Collection Line
- DASK Habitat
- County Boundary

Wetlands/Waterbodies

- Delineated Waterway
- Delineated Wetland
- NHD Waterbody
- NHD Waterway
- NWI Wetland

Wetland Impact

- Temporary

Grassland Sod Type

- Broken Grassland
- Broken Grassland (Desktop)
- Unbroken Grassland
- Unbroken Grassland (Desktop)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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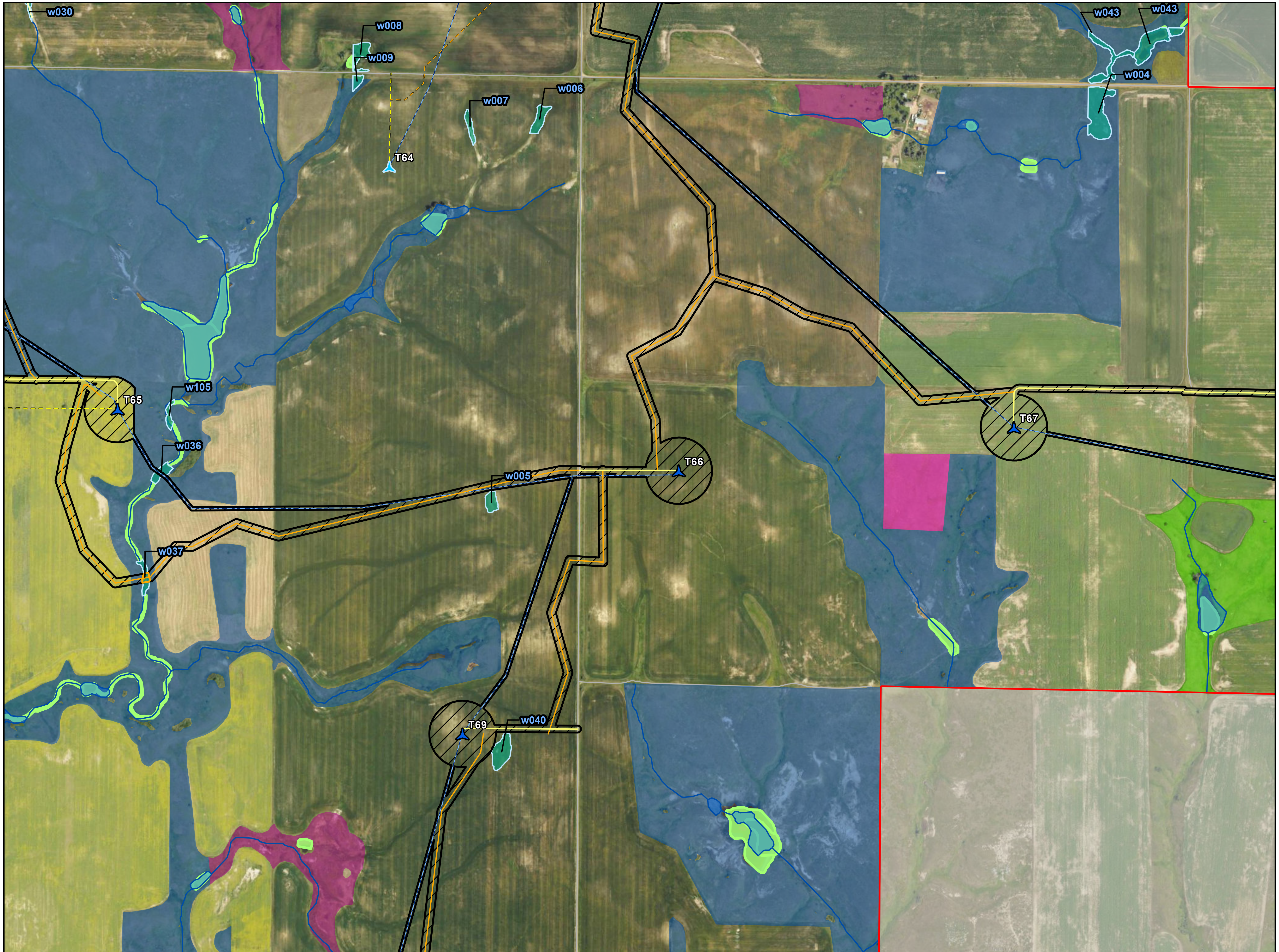

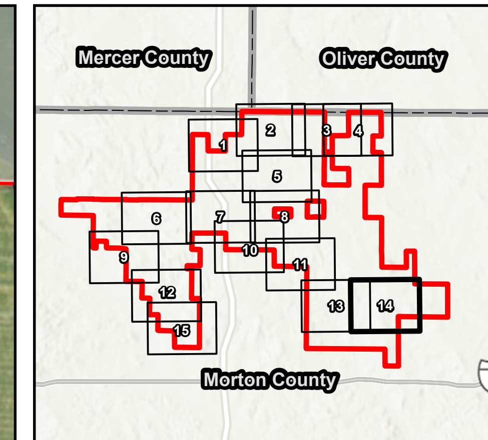

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Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Alternate Crane Path
Collection Line
DASK Habitat
County Boundary

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NHD Waterbody
NHD Waterway
NWI Wetland

Wetland Impact

Temporary

Grassland Sod Type

Broken Grassland
Broken Grassland (Desktop)
Unbroken Grassland
Unbroken Grassland (Previous Survey)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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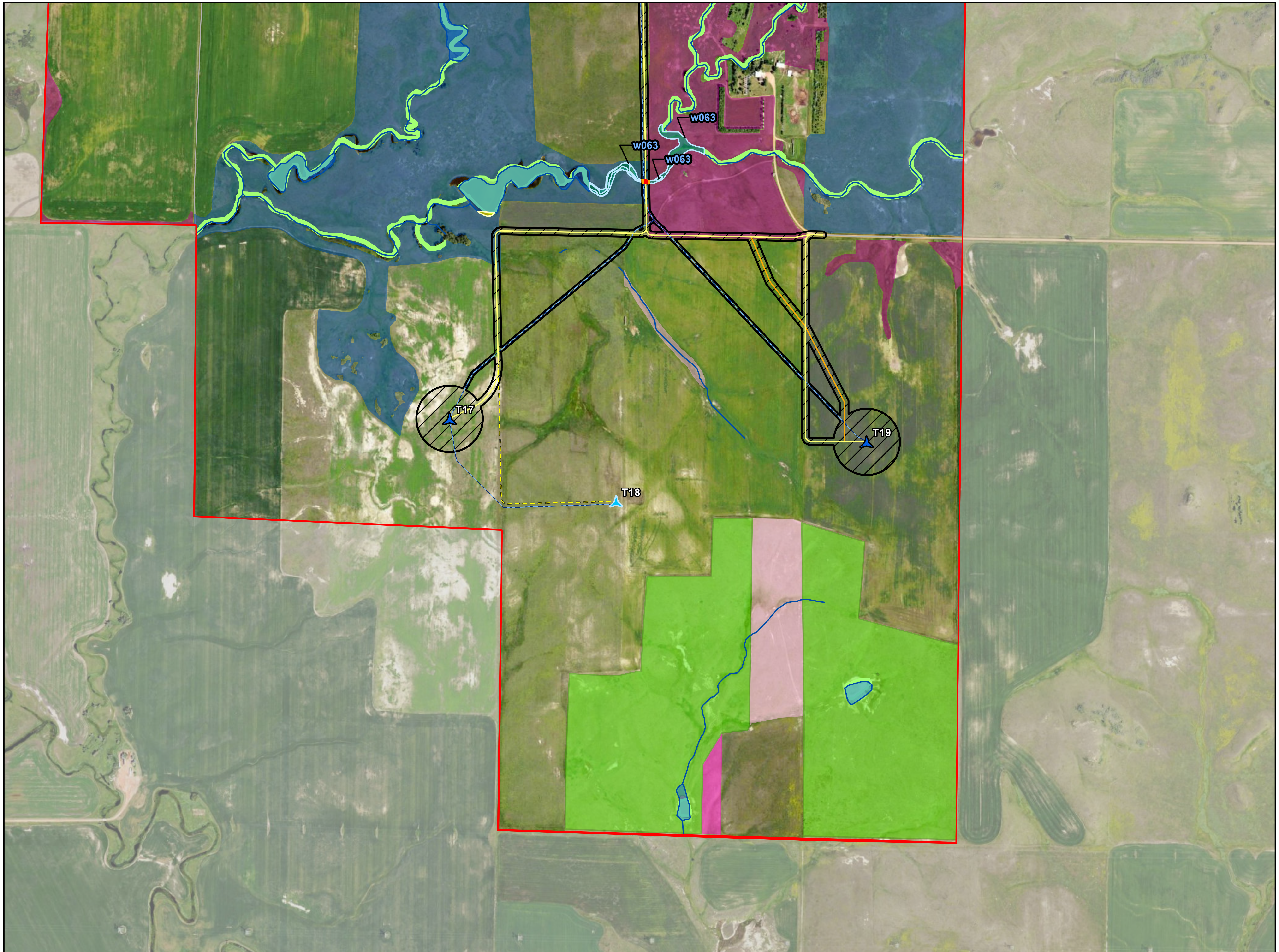

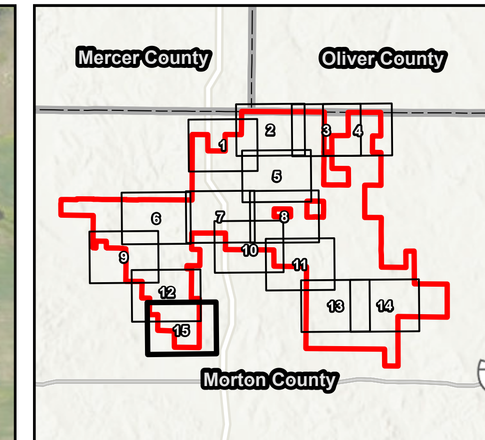

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N
W E
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Project Area
Construction Easement
Primary Turbine
Alternate Turbine
Primary Access Road
Alternate Access Road
Primary Crane Path
Collection Line
DASK Habitat
County Boundary

Wetlands/Waterbodies

Delineated Waterway
Delineated Wetland
NHD Waterbody
NHD Waterway
NWI Wetland

Wetland Impact

Temporary
Permanent

Grassland Sod Type

Broken Grassland
Broken Grassland (Desktop)
Broken Grassland (Previous Survey)
Unbroken Grassland
Unbroken Grassland (Previous Survey)

Wetlands/Waterbodies

Longspur Wind Energy Center

Morton County, North Dakota

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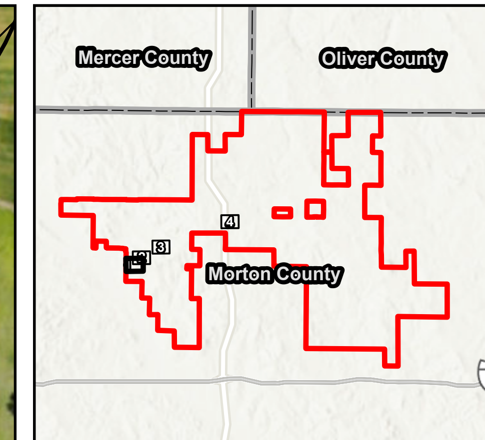
Attachment O

Tree Clearing Avoidance Area Map



0 75 150 US Feet

1:2,400

N
W E
S

Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line
Tree and Shrub Clearing
County Boundary

Tree and Shrub Clearing

Longspur Wind Energy Center

Morton County, North Dakota

Page 1 of 4

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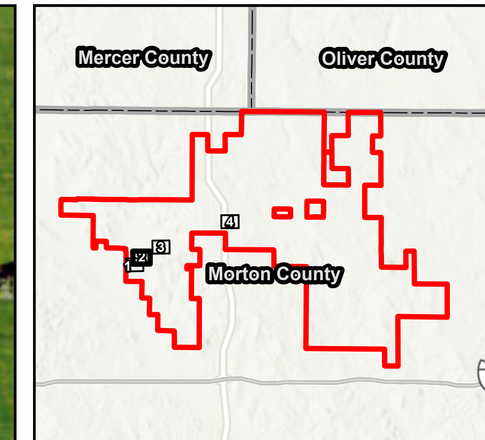
For Environmental Review Purposes Only

Date: (4/22/2026) **Source:** Z:\Clients\M_P\MN_Power\Longspur_Wind\ArcGIS\Permitting\PSC\PSC_Testimony\Longspur_Wind_PSC_Testimony.aprx



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US Feet
1:2,400

N
W E
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Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line
Tree and Shrub Clearing
County Boundary

Tree and Shrub Clearing

Longspur Wind Energy Center

Morton County, North Dakota

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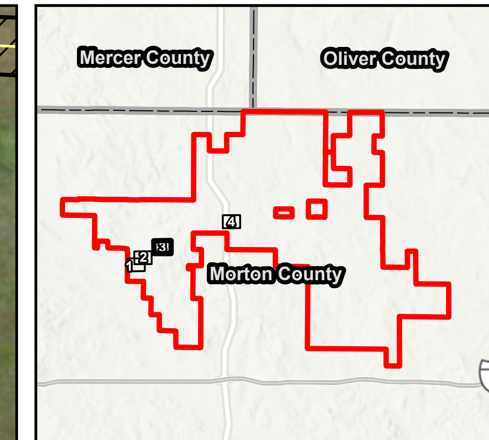

0 75 150
US Feet
1:2,400

N
W E
S

- Project Area
- Construction Easement
- Primary Turbine
- Primary Access Road
- Primary Crane Path
- Collection Line
- Tree and Shrub Clearing
- County Boundary

Tree and Shrub Clearing

Longspur Wind Energy Center

Morton County, North Dakota

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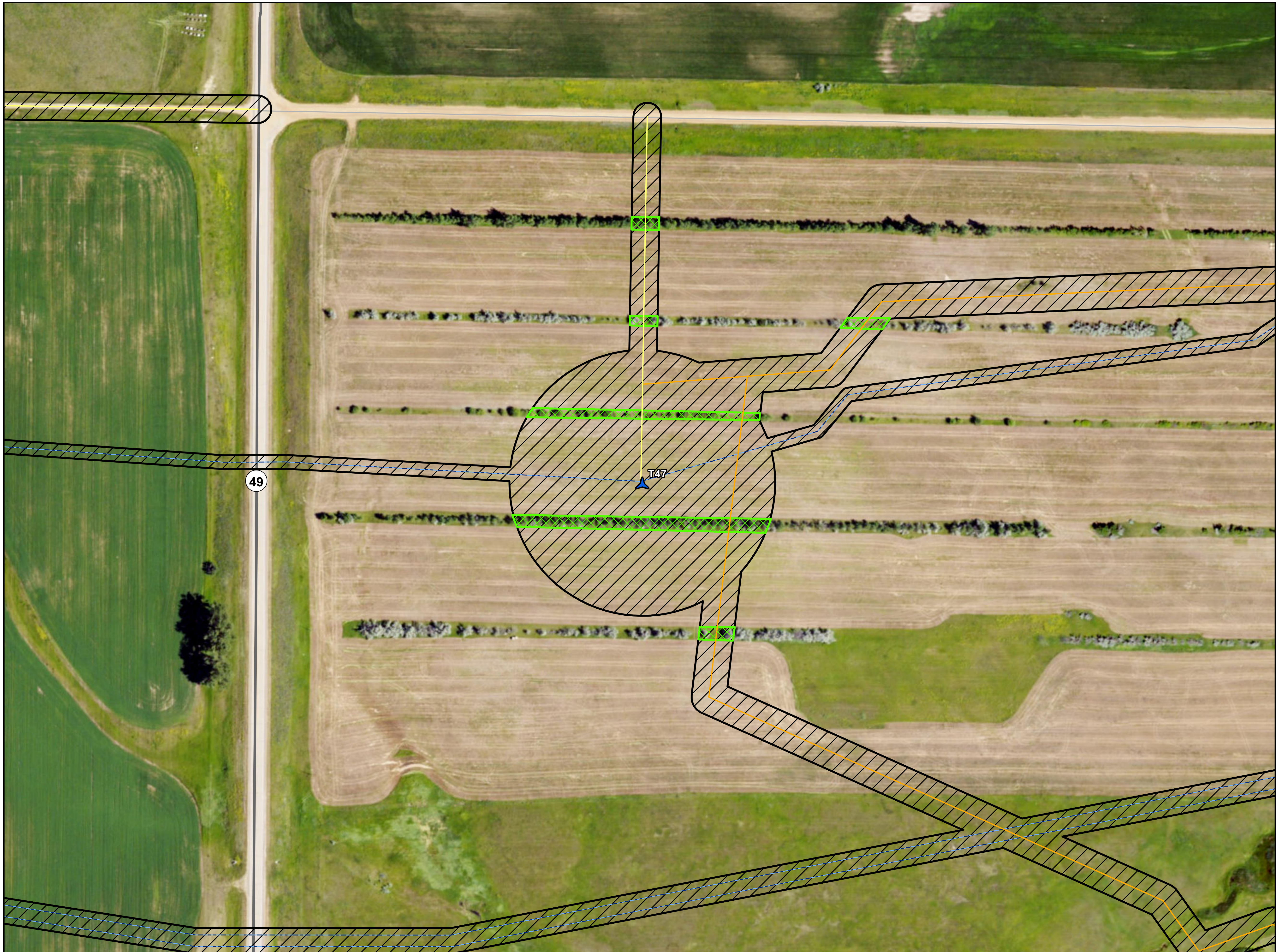

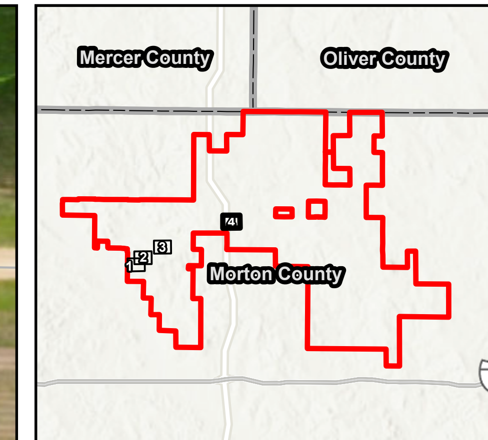

0 75 150
US Feet
1:2,400

N
W
E
S

Project Area
Construction Easement
Primary Turbine
Primary Access Road
Primary Crane Path
Collection Line
Tree and Shrub Clearing
County Boundary

Tree and Shrub Clearing

Longspur Wind Energy Center

Morton County, North Dakota

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Date: (4/22/2026) Source: Z:\Clients\M_P\MN_Power\Longspur_Wind\ArcGIS\Permitting\PSC\PSC_Testimony\Longspur_Wind_PSC_Testimony.aprx

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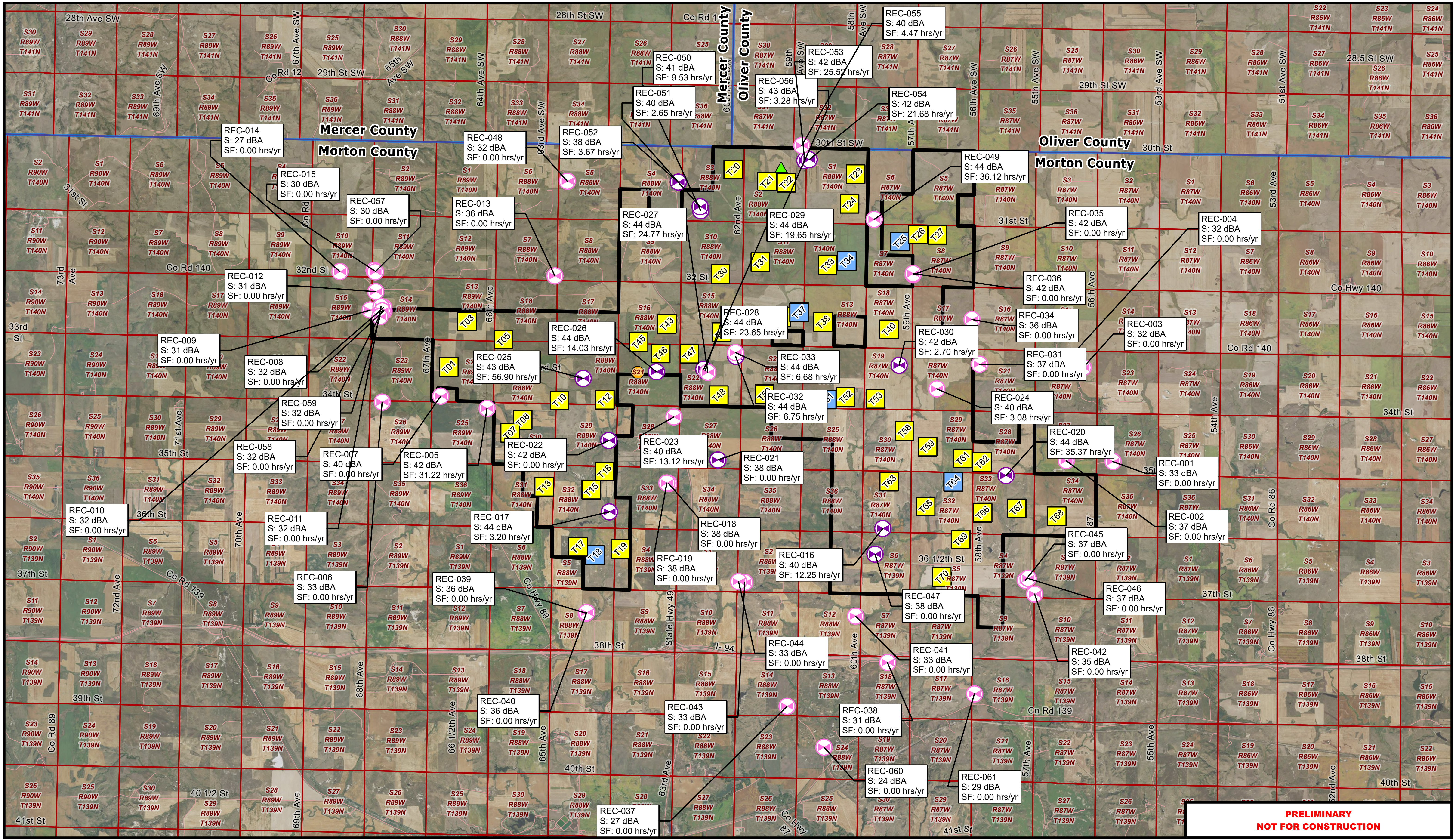
Attachment P

Sound and Shadow Flicker Overview Map



PRELIMINARY
NOT FOR CONSTRUCTION

LEGEND

- Road
- Project Area
- County Boundary
- Section Lines

Turbine

- Project Turbine
- Project Turbine - Alternate

Receptor

- Receptor, Participating
- Receptor, Non Participating

- ADLS
- Met Tower

NOTES

Definitions:

S = Sound Study Result

SF = Shadow Flicker Result

Values presented herein reflect the modeled results in Appendix B of the Sound Study (at the point 100' from the structures as further described in the study) and the modeled results in Appendix C of the Shadow Flicker Study.

REFERENCE

0 1 2 MILES

0 1 2 KILOMETERS

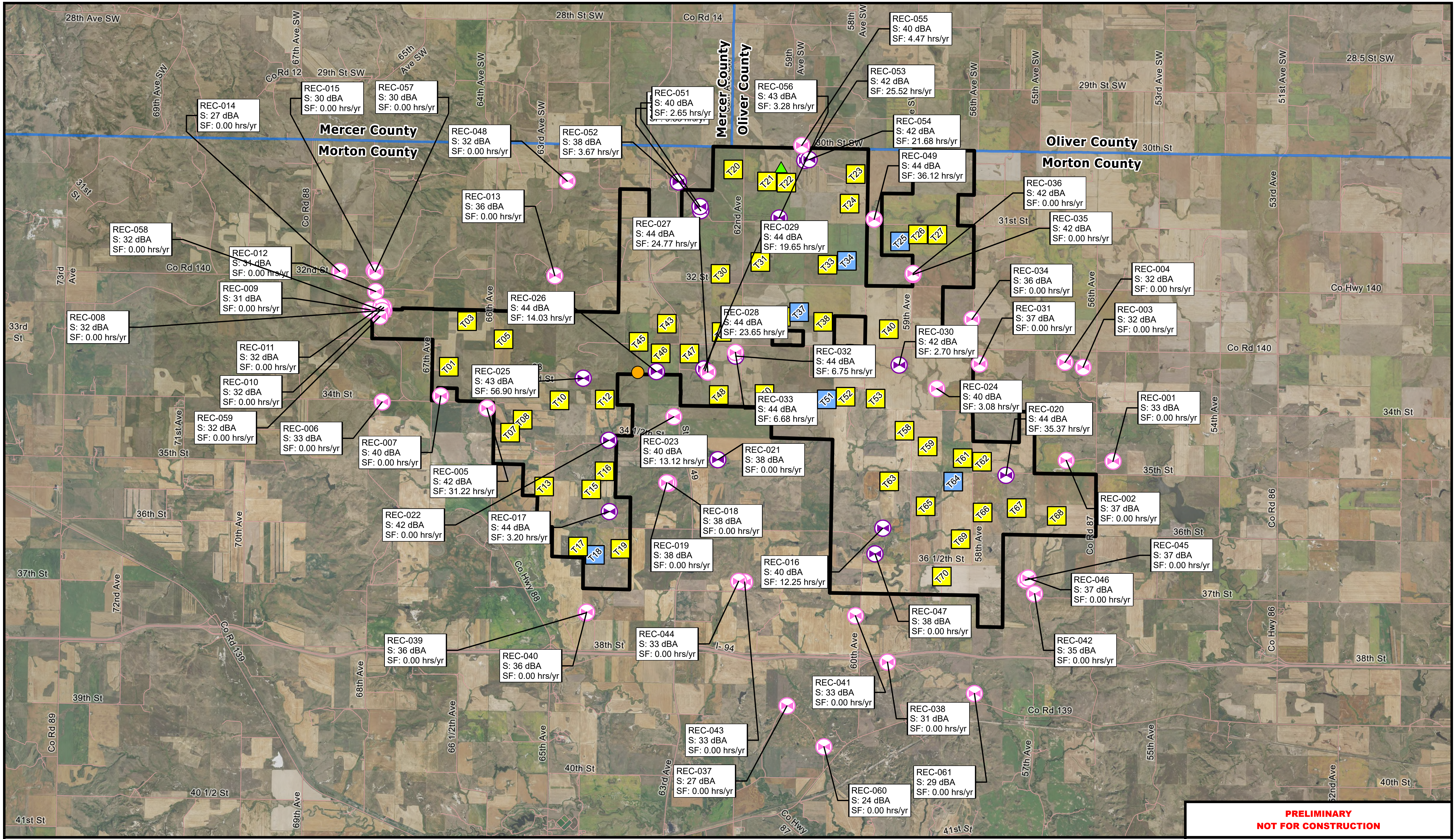
N

MT ND MN SD

LONGSPUR WIND
Shadow Flicker and Sound Study

LOCATION: MORTON COUNTY, NORTH DAKOTA
CLIENT: Minnesota Power
PROJ. NO.: 154125
CREATED: 5/1/2026

BURNS & McDONNELL
www.burnsmcd.com



PRELIMINARY
NOT FOR CONSTRUCTION

LEGEND

- Road
- Project Area
- County Boundary

Turbine

- Project Turbine
- Project Turbine - Alternate

Receptor

- Receptor, Participating
- Receptor, Non Participating
- ADLS
- Met Tower

NOTES

Definitions:

S = Sound Study Result

SF = Shadow Flicker Result

Values presented herein reflect the modeled results in Appendix B of the Sound Study (at the point 100' from the structures as further described in the study) and the modeled results in Appendix C of the Shadow Flicker Study.

REFERENCE

0 1 2 MILES

0 1 2 KILOMETERS

N

MT ND MN SD

LONGSPUR WIND
Shadow Flicker and Sound Study

LOCATION:	MORTON COUNTY, NORTH DAKOTA
CLIENT:	Minnesota Power
PROJ. NO.:	154125
CREATED:	5/1/2026

BURNS McDONNELL
www.burnsmcd.com

Attachment Q

Updated T-Line Application Table 3.2-1

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Minnesota Power is providing an update to the Transmission Line application. Minnesota Power incorrectly stated that there were unstable areas present within the corridor. Minnesota Power meant to state that there may be unstable areas present within the corridor. Minnesota preformed geotechnical analysis on the structure locations for the project, unstable areas may be present within the corridor, but they will be spanned. There are still no identified landslide deposits as indicated by the North Dakota Geological survey. The below Avoidance area table has been updated.

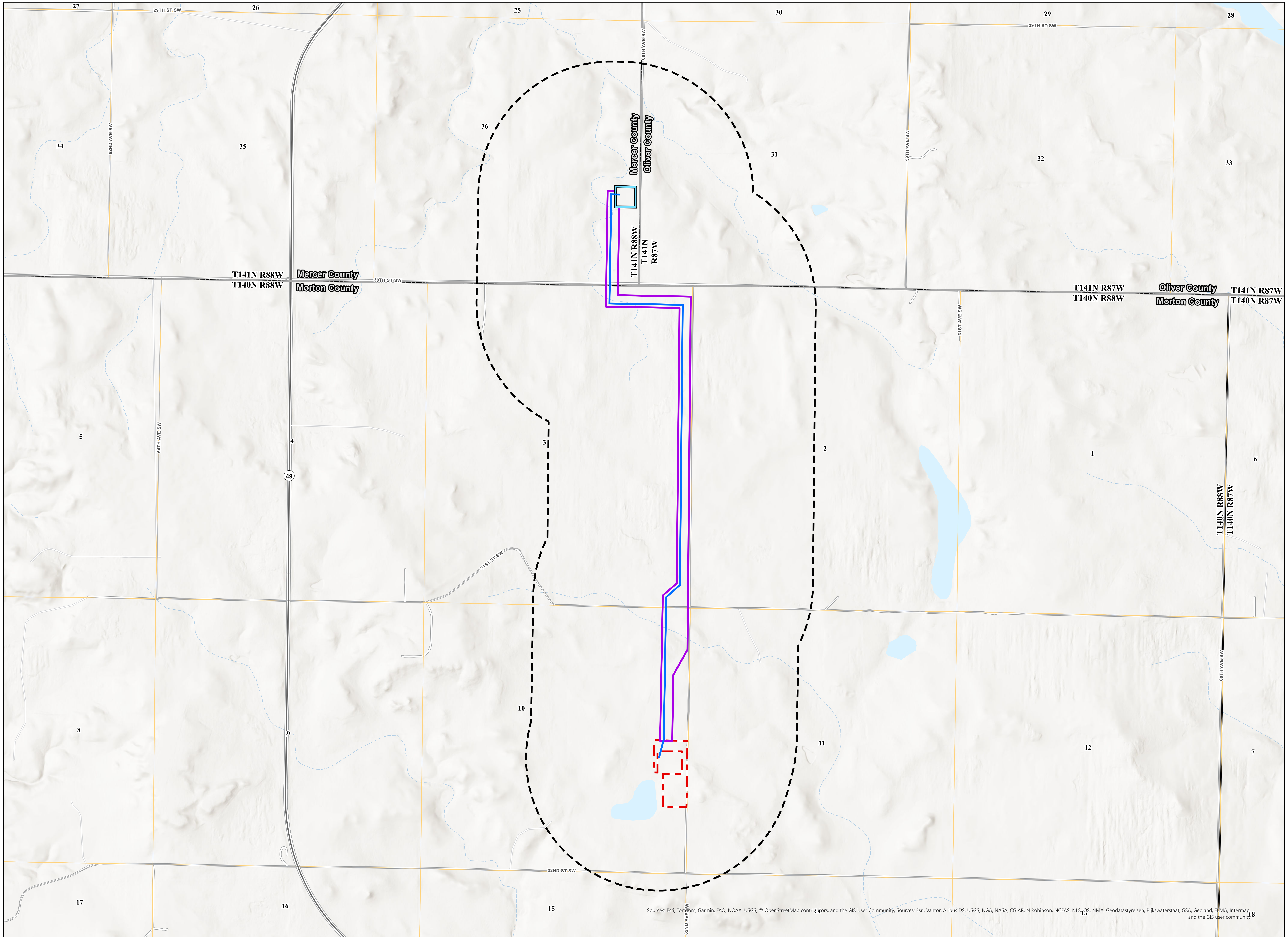
TABLE 3.2-1

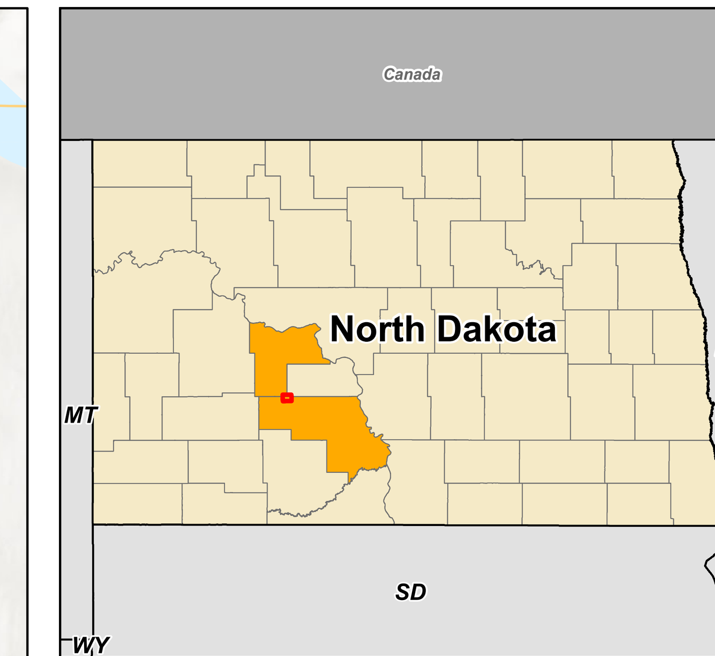
Avoidance Areas

Transmission Facility Corridor and Route Criteria			Description if Present in or Applicable to the Project	Proposed Buffer	Section Addressed
2.	**Avoidance areas**				
	a.	Designated or registered national: historic districts; wildlife areas; wild, scenic, or recreational rivers; wildlife refuges; and grasslands.	Not present within Corridor or Route	No impacts are anticipated, and no buffer is proposed.	6.5
	b.	Designated or registered state: wild, scenic, or recreational rivers; game refuges; game management areas; management areas; forests; forest management lands; and grasslands.	Not present within Corridor or Route	No impacts are anticipated, and no buffer is proposed.	6.5, Figure 7
	c.	Historical resources which are not specifically designated as exclusion or avoidance areas.	Not present within Corridor or Route	No impacts are anticipated, and no buffer is proposed.	6.4, Figure 7[a]
	d.	Areas which are geologically unstable.	May be present in Corridor. A geotechnical and	No impacts are anticipated,	6.6, Figure 7

		geophysical analysis has been performed and areas which may be geologically unstable are avoided and spanned as necessary. No transmission line structure locations will be located within a landslide deposit, as indicated by the North Dakota Geological Survey landslide mapping program.	and no buffer is proposed.	
e.	Within 500 feet of a residence, school, or place of business.	No residences, schools, or businesses are located within 500 feet of the Corridor.	No impacts are anticipated, and no buffer is proposed.	3.6, Figure 7
f.	Reservoirs and municipal water supplies.	Not present within Corridor or Route	No impacts are anticipated, and no buffer is proposed.	6.7
g.	Water sources for organized rural water districts.	Not present within Corridor or Route	No impacts are anticipated, and no buffer is proposed.	6.7
h.	Irrigated land (note this is no longer part of the siting criteria (NDCC Sec. 49-22-05.1(2))).	Not applicable.	Not applicable.	Not applicable
i.	Areas of recreational significance which are not designated as exclusion areas.	Not present within Corridor or Route	No impacts are anticipated, and no buffer is proposed.	6.5, 7.0

[a] Known archaeological sites are not depicted due to confidentiality.





0 1,000 2,000 Feet

N W E S

- Project Route
- Existing Tri-County Substation
- Project Corridor
- Study Area
- Longspur Substation
- PLSS Section Boundary
- PLSS Township Boundary
- County Boundary

Minnesota Power Longspur Wind 230-kV Transmission Line

Mercer and Morton Counties, North Dakota

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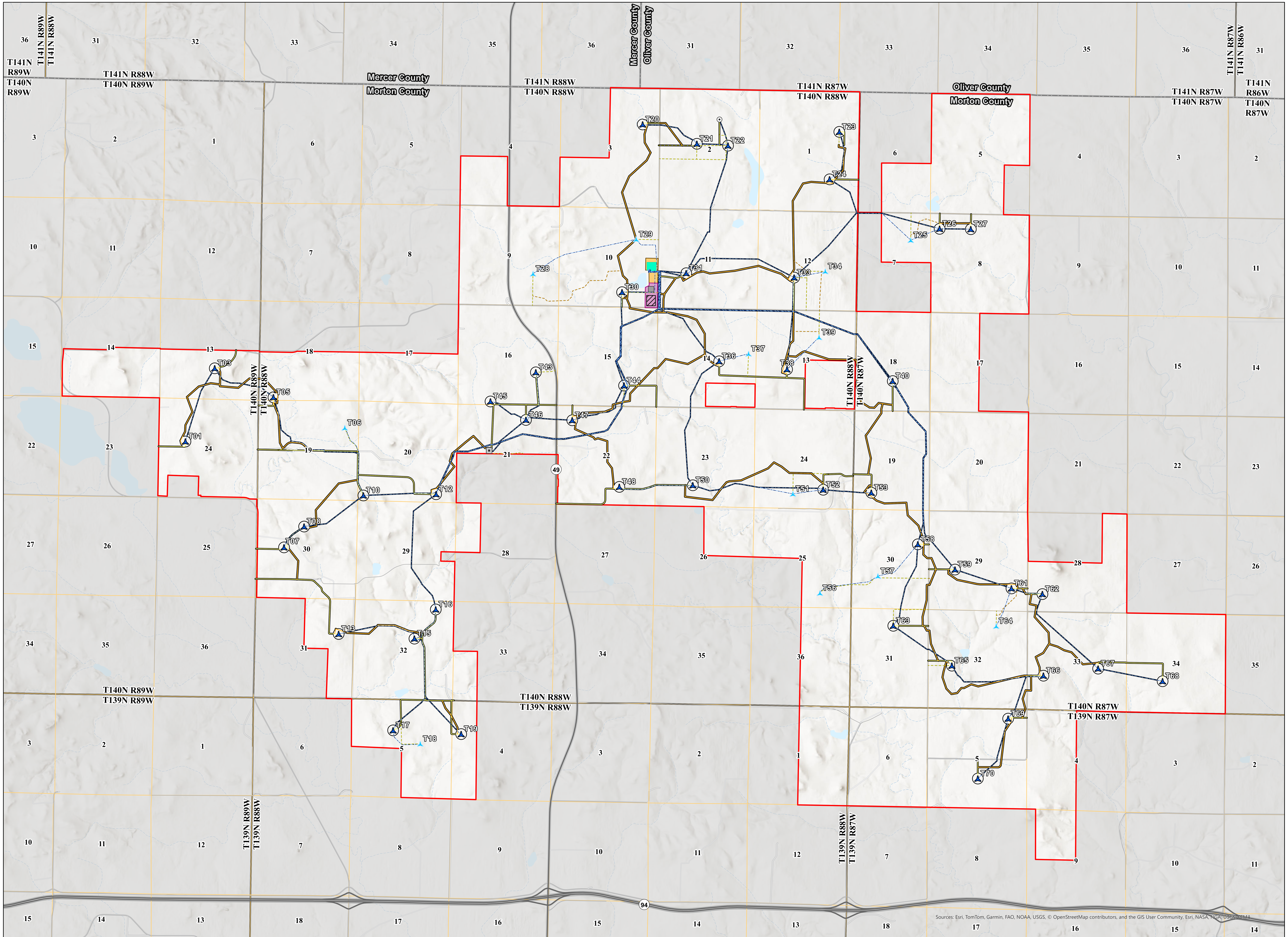

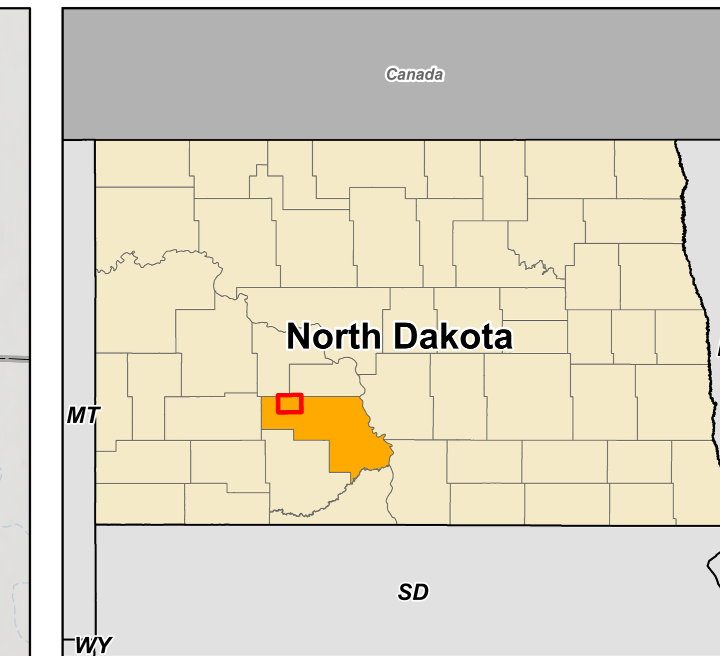

0 2,000 4,000 Feet

- Met Tower
- Primary Turbine
- Alternate Turbine
- ADLS Radar Tower
- Collection Line
- Primary Crane Path
- Alternate Crane Path
- Primary Access Road
- Alternate Access Road
- Construction Laydown Yard
- O&M Building
- O&M Yard
- Substation Yard
- Substation Facility
- Construction Easement
- Project Area
- PLSS Section Boundary
- PLSS Township Boundary
- County Boundary

Longspur Wind Energy Center

Morton County, North Dakota

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