Appendix D

Agricultural Impact Mitigation Plan (AIMP)

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Agricultural Impact Mitigation Plan

Iron Pine Solar Project

Pine County, Minnesota

Stantec Project #:193708962

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Table of Contents

LIST OF TABLES

LIST OF APPENDICES

APPENDIX A

Abbreviations

AC	Alternating current
AIMP	Agricultural Impact Mitigation Plan
BMP	best management practices
DC	direct current
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Risk Map
EPC	engineering, procurement, and construction contractor
GIS	Geographic Information System
LCC	Land Capability Class
MPCA	Minnesota Pollution Control Agency
MNBWSR	Minnesota Board of Soil and Water Resources
MNDPH	Minnesota Department of Public Health
MNDNR	Minnesota Department of Natural Resources
MV	medium voltage
Mw	Megawatt
NEC	National Electric Code
NESC	National Electric Safety Code
NRCS	Natural Resources Conservation Service
POI	point of interconnection
Project	Iron Pine Solar Project
PV	photovoltaic
Stantec	Stantec Consulting Services Inc.

Stormwater General Permit	General Permit to Discharge under a National Pollutant Discharge Elimination System (NPDES) Permit
SSURGO	Soil Survey Geographic Database
Iron Pine Solar	Iron Pine Solar Energy
UDO	Unified Development Ordinance
VMP	Vegetation Management Plan

1.0 PURPOSE AND APPLICABILITY OF PLAN

The objective of this Agricultural Impact Mitigation Plan (AIMP) is to identify measures that Iron Pine Solar Power, LLC (Iron Pine Solar) and its contractors will take to avoid, mitigate, repair, and/or compensate for potential agricultural impacts that may result from the construction, operation, and eventual decommissioning of the Iron Pine Solar (Project). A 2,296-acre Project Area was analyzed for this AIMP as shown on Figure 1, Site Location Map (Appendix A). Although agricultural operations would temporarily cease on most of the land on which the Project is constructed during the life of the Project, this Plan outlines measures to ensure the land may be returned to future agricultural use following decommissioning of the Project. This AIMP describes the Best Management Practices (BMPs) that will be used during construction, operation, and decommissioning to minimize long-term impacts to soil.

Iron Pine Solar will obtain authorization under the Minnesota Pollution Control Agency (MPCA) Construction Stormwater General Permit under a National Pollutant Discharge Elimination System (NIPDES) Permit (MNR100001) prior to the commencement of construction. The NPDES permit will be provided to Pine County prior to any ground disturbance. Temporary stormwater BMPs will be used during Project construction, and construction will be completed in accordance with the MPCA General Permit and a site-specific Erosion Control and Storm Water Management Plan to be developed for the Project.

The site-specific Vegetation Management Plan (VMP) developed for the Project describes the vegetation management practices, including seed mixtures, planting plans and methodologies, and maintenance practices to be conducted during the construction and operational phases of the Project. Permanent perennial vegetative cover will be established throughout the Project Area to manage erosion and increase stormwater infiltration within the Project Area.

This AIMP is separated into six sections: Section 2 provides an overview of the proposed Project and its components. Section 3 identifies soil limitations and suitability within the Project Area; Section 4 describes the BMPs that will be used during construction and operation of the Project; Section 5 summarizes key components of the Vegetative Management Plan in relation to agricultural impact mitigation; Section 6 describes Project Decommissioning and restoration/reclamation of the site.

2.0 PROJECT OVERVIEW

The Iron Pine Solar Project ("the Project") consists of a 325-megawatt (MW) photovoltaic (PV)) solar power generating facility and a 230 kilovolt (kV) high voltage transmission line ("Gen-Tie Line". The Gen-Tie Line will connect the Project collector substation to a switchyard located at the point of interconnection (POI) to the Minnesota Power Arrowhead-Bear Creek 230 kV transmission line. The Project is sited on approximately 2,296 acres of primarily agricultural land located approximately 0.5 miles south of the Town of Willow River, Pine County, Minnesota.

Iron Pine Solar selected this site due to land use and availability, capacity at the point of interconnection ("POI"), existing transmission facilities, existing road infrastructure, environmental considerations, and constructability (i.e., restrictions due to slopes, soils, wetlands, and waterways).

Iron Pine Solar is responsible for all land acquisition, lease agreements, and easements required to build the Project facilities within the Project Area.

2.1 PROJECT COMPONENTS

Table 1 summarizes the major components' acreages within the Project Area.

Table 1. Major Project Components and Associated Acreages

Component	Acreage
Solar Project	
Solar Arrays (fenced area)	1,526.0
Access Roads	24.0
Buried Electrical Collection Lines	5.6
Inverters	0.3
O&M Facility	0.1
Project Substation	6.4
Laydown Yard	19.6
Developed Solar Area Total[1]	**1,536.7**
Undeveloped Solar Array Area[2]	**670.1**
Solar Area Total	**2,206.8**
Transmission Line Right-of-Way[3]	19.4
Switch Yard	3.9
Access Road to Switchyard	0.8

Developed Gen-Tie Line Area Total	**24.1**
Undeveloped Gen-Tie Line Area	**64.7**
Gen-Tie Line Area Total	**88.8**
Project Total	**2,295.6**

[1] The Solar Project Development Area includes the area within the Solar Project that is hosting solar equipment and will be surrounded by a fence. The Development Area includes access roads and buried electrical collection lines (including those extending beyond the Solar Project boundary), inverters, an O&M Facility, Project Substation, and temporary laydown yards for a total of 1,536.7 acres.
[2] The Undeveloped Area includes all areas outside the fenced area but within the Solar Project.
[3]The Gen-Tie Line ROW acreage reflects a 160-foot ROW.

2.1.1 Solar Panels, Arrays, and Racking

The PV module selected for the Project will have crystalline modules and will be a plate glass module with an aluminum frame with approximate dimensions of 3.9 feet by 7.5 feet (1.2 meters by 2.3 meters), or thin-film technology (cadmium telluride [CdTe]). A total of approximately 570,622 modules are estimated for the basis of design for this application. This estimated number of modules is approximate and is subject to change based on the final design for construction.

The PV modules will be connected in series for up to 1500V operation and will be mounted on a tracker system in-line and oriented such that the long side of the module is facing adjacent modules on racking which tracks east to west to follow the sun throughout the day. The final selection of the PV module and inverters will be made at a future date based on the available market offering. The Canadian Solar 690W module and the SUNGROW 4400kVA central inverter used as the basis of the preliminary Project design.

The trackers are arranged in circuits and blocks, that are separated by roads or AC collection system corridors. The piles will run north to south along the row of modules that are mounted on rails affixed to torque tubes mounted on the piles and this steel structure will likely include an integrated cable management solution in order to support the insulated copper DC string wire which interconnects each of the PV modules.

The PV modules will be installed using industry standard, best practices. Upon completion of the final site design, pile lengths will be specified to allow the PV module racking system and tracker to be constructed at a minimum height above surrounding grade in order to account for average snow accumulation at the Project area.

Foundations or supports will be installed to an appropriate depth following a field investigation and delineation of soil types to minimize impacts from freezing and thawing conditions. Exact embedment depth for the driven pile on which the solar panels are mounted will be determined with final engineering.

2.1.2 Electrical Collection System

The current configuration for the collector system contains a bulk total of approximately thirty-five miles of cables consisting of three single conductor cables running in a bundle (one circuit) or a single cable containing all three conductors.

The collector circuits are planned as an underground system with direct buried cables or cables installed in direct buried ducts. The preliminary design assumes the conductor will be aluminum. The collection system will either be buried at a depth of at least 36 inches to the top of the cables or will be enclosed within a conduit and buried at a depth of at least 24 inches. These depths meet minimum cover requirements as specified in table 300.5 of National Electric Code (NEC) 2017, Chapter 3 “Wiring Methods and Materials.” The trench for a single cable will be eighteen inches wide. Where multiple cables are installed parallel to each other, the cable separation will be up to eight feet apart, therefore the width of the trench will vary depending on the number of circuits within the trench.

Installation of the collection system will be by use of a vibratory plow or trenching method in upland areas. The vibratory plow directly impacts an area approximately 12 inches wide and a trench method impacts an area approximately 18 inches wide. Underground horizontal directional drilling (HDD) will be utilized in environmentally sensitive areas, such as nonfarmed wetlands and natural waterways, to avoid impacts to these resources. Trenching methods will be used for installation of the collection system through farmed wetlands and the agricultural drainage ditches within the Project. There are several underground HDD drilling areas that will be used to cross culverts.

2.1.3 Gen-Tie Line

The Applicant proposes the construction of approximate one-mile long single circuit 230 kV (AC) Gen-Tie Line using weathering steel monopoles (poles or structures). The poles will be installed to facilitate the connection between the Project Substation and the to-be-built switchyard to tie-in to the Minnesota Power Arrowhead to Bear Creek 230 kV line.

2.1.4 Access Roads

Gravel access roads will connect the facility to existing public roads and provide access to Project equipment during facility operations and maintenance as well as to accommodate emergency access. Permanent internal access roads within the Project Area are expected to be approximately 16.3 miles (86,197 feet) in total length and are approximately 12 feet wide. These roads may temporarily be wider during construction to accommodate construction equipment access where necessary. Aggregate materials will be used to develop the access roads. In these areas, topsoil will be stripped and stored for use during reclamation. Geotextile matting will be installed prior to placement of aggregate to prevent mixing with native subsoil. The aggregate would be maintained for the life of the Project. During decommissioning at the end of the Project’s life, these areas may be restored unless the host landowner requests that they remain in place. Restoration activities typically include removing the aggregate, decompacting the soil if required, restoring the topsoil and either seeding to permanent perennial vegetation or returning the area to agricultural production.

2.1.5 Switchyard, Inverters, Substation

Approximately 82 inverters will be installed throughout the Project area. The final number of inverters for the Solar Project will depend on the inverter size, inverter and module availability, as well as the final array configuration. The inverters are typically part of a skid assembly with the inverter and the assembly being mounted on a driven pile foundation and associated concrete pads. These concreted pads provide the foundation for the inverter, transformer, and the SCADA system. The concrete pads will be poured onsite or precast and assembled off-site. Each inverter pad includes one transformer to which the inverters will feed electricity.

The Project Substation will be located outside the fenced solar arrays and is estimated to occupy approximately 6.4 acres. In addition, a storm water detention facility approximately 0.78 acre in size will be located adjacent to the Project substation. The Project Substation location will be graded and overlain with crushed rock to minimize vegetation growth in the area and reduce fire risk.

A typical construction sequence for the Project Substation involves, in order: site grading work, below-grade foundation installation, above-grade physical construction of buswork and installation of major electrical equipment, wiring and completion of all terminations, followed by testing, commissioning, and ultimately energization. A site-specific construction specification and schedule will be developed closer to the start of construction. All contractors will be required to follow the Storm Water Pollution Prevention Plan, as well as adhere to any site-specific environmental requirements including erosion and dust control.

The switchyard is currently forested and covers approximately 3.9 acres. The location and footprint of these facilities within the Project Area for the preliminary design is shown in Figure 1.

2.1.6 Security Fencing

Iron Pine Solar will utilize fencing around the PV solar arrays that is consistent with all applicable codes, including NEC and North American Electric Reliability Council Critical Infrastructure Protection requirements. Fencing is required to safeguard the public health. Array fencing will consist of seven- to eight-foot-high woven-wire exclusion fence with wood fenceposts. The Project Substation will require a seven to eight-foot-high chain link fence, which may include three strands of barb wire at the top. Fenceposts will be driven into the ground. No concrete foundations will be used for the fenceposts.

2.2 CONSTRUCTION

The Project will be designed in conformance with the version of the International Building Code as required by the authority having jurisdiction, state, and local requirements. The Project will select an engineering, procurement, and construction contractor (EPC) to manage engineering, procurement, and construction of the Project; subcontractors will be selected to perform all necessary work to construct the Project. Project construction follows a construction sequence in accordance with a construction plan, which will be developed and finalized prior to the start of construction, in conjunction with the selected contractors. The construction plan will be submitted to Pine County prior to commencement of construction. The following provides a general description of the staging and construction sequence for the Project:

- Tracking pads at construction entry and exit points, and erosion control and stormwater best management practices (BMPs) will be installed as outlined in the SWPPP prepared for the Project.
- Vegetation removal (crop removal) will start in areas where initial staging and lay-down areas will be located. Vegetation removal will continue across the site, sequenced to proceed in an organized and cost-efficient manner. Limited brush clearing will commence in a similar fashion. Bare ground will be re-seeded, if necessary, in accordance with the VMP and SWPPP prepared for the Project and MPCA requirements.
- Staging and lay-down areas will be developed to receive and store construction materials and equipment. The lay-down areas will also house trailers and parking for personnel and construction-related vehicles.
- Installation of access roads to facilitate continued clearing operations and construction of the facility (limited grading is anticipated as roads will be constructed at grade when possible).
- Delivery of equipment, including piles, aluminum supports/mounting structures, tracking systems, and inverters. The Project will be constructed in blocks and multiple blocks will be constructed simultaneously over time. Deliveries will continue over time in advance of construction of the blocks.
- Solar block construction in sequence, starting with driving pile foundations, then installing aluminum supports/mounting structures onto the piles.
- Delivery of collection system equipment and installation via trenching and directional drilling.
- Delivery and installation of solar PV modules.
- Stabilization and revegetation of disturbed areas will occur in stages as construction of the solar blocks and collection trenches are completed. Bare ground will be re-seeded, if necessary, in accordance with the SWPPP and MPCA requirements.
- Connect Project Switchgear and Metering and Lone Tree substation and transmission infrastructure.
- Conduct interconnection inspections and testing and Project commissioning.

Site access will be controlled for personnel and vehicles. Permanent security fencing will be installed in advance of or in conjunction with site preparation activities (e.g., grading, mowing, etc.) in advance of large component deliveries. All temporary disturbance areas will be restored in accordance with the Project specific Vegetation Management Plan.

During construction, temporary utilities will serve the construction offices, laydown area, and Project Area. Temporary construction power before the construction of permanent distribution power will either be provided via a local distribution line extended to the Project Area or by temporary diesel generators. Temporary area lighting will be provided and strategically located for safety and security.

The Project on-site workforce will consist of laborers, craftsmen, supervisory personnel, support personnel, and construction management personnel. The construction crews will have approximately 200 to 375 direct workers for the Project. Construction of the Project will generally occur between 7:00 a.m. and 5:00 p.m., Monday through Friday. Additional hours may be necessary to make up schedule deficiencies or to complete critical construction activities. During the start-up phase of the Project, some activities (such as equipment and system testing) may continue 24 hours per day, 7 days per week. Construction hours will comply with local permit requirements.

Construction of the Project is currently expected to require approximately 14-18 months, which includes mobilization, construction/installation, and commissioning/testing to achieve the targeted commercial operations date of Q1 2027.

The Project will require different equipment types depending on the phase of construction. The first phase consisting of civil work and road building will require dozers, motor graders, and rollers. The pile-driving phase will utilize pile drivers. After pile driving, the installation of racking and panels will be supported mainly by skid steers and telehandlers. Directional drilling equipment, vibratory plows, or trenching equipment for installation of the collection line will be mobilized to the site on low-profile flatbed trailers. For other Project components including the transformers, and inverters; small cranes, bucket trucks, and forklifts will be used to place equipment. Other support equipment such as skid steers, ATVs, and forklifts will also be used.

Delivery trucks will consist of standard, legal load (88,000 pounds or less) over-the-road flatbed and box trucks and will have standard turning radii. Vehicles used inside the arrays will be suitable for the engineered internal access roads and turn-arounds. Equipment typically used in construction and operation of utility scale solar facilities are generally similar in weight or less than equipment typically used in annual agricultural operations. Construction equipment distributes loads widely resulting in similar tire pressure distribution and contact pressures. During construction of a solar facility, the number of vehicle passes in the same wheel tracks is limited, with the exception of vehicles on internal access roads. During construction there will be a concentration of vehicle passes near the site entrances.

2.2.1 Site Preparation and Clearing

The Solar Development Area refers to the portion of the Solar Project on which the solar equipment will be located and constitutes a total of 1,537 acres within the proposed fence and access roads and underground cables located outside the fence. The remaining 670 acres will not be developed for the Project and will remain in their current land use of primarily cultivated cropland and woodland. The Solar Development Area include the panels and associated facilities such as inverters, access roads, and underground collector lines. The portion of the Gen-Tie Line extending from the Project Substation that is on the west is of Interstate 35 is included in this area. The portion of the Gen-Tie Line and Switchyard located on the east side of I-35 is not within agricultural land and consists of woodland and wetland and a small amount of developed land

Under existing conditions, the Solar Development Area consists of primarily of active agriculture under row crop production as well as hay/pasture land, woodland and emergent herbaceous wetlands. Prior to the commencement of construction, site vegetation will be evaluated to determine which areas will be mowed, left undisturbed or will require pre-seeding. Areas with limited vegetation due to past farming operations or disruption of vegetation due to civil construction activities will be seeded and stabilized in a timely manner. Portions of the site not utilized for the Project facilities or not impacted during construction will remain vegetated however may be overseeded to promote additional vegetation as described in the VMP.

Anti-tracking pads will be installed at the construction exits. Temporary perimeter sediment controls and diversions will be installed concurrent with the progress of land clearing and grubbing activities. Prior to any clearing, the limit of disturbance will be surveyed and marked in the field. This limit constitutes the limit of soil disturbance. Work will not be conducted within the stream corridor, the wetland, or their buffers unless authorized by Pine County and by permit from the MN Department of Natural Resources (MNDNR), Minnesota Wetland Conservation Act (WCA) Local Government Unit (LGU), which for this Project is Pine County, and U.S. Army Corps of Engineers, as applicable. Based on the preliminary design, the wetland and the stream corridor within the Project Area have been avoided and no impacts to wetlands or waterways or their buffers are proposed or authorized.

A land surveyor will obtain or calculate Project benchmark, grades, elevations and alignment data from final design plans and detail drawings which inform control staking to establish the Project alignments in advance of construction commencement. During construction, these alignment control points will be reestablished as needed.

2.2.2 Grading

Site grading activities will only occur in select areas where elevations need to be modified to accommodate tracker/racking system slope tolerances, site drainage, access roads, laydown areas; and foundations for the inverters, Project Substation, and Switchyard. This approach to grading minimizes impacts and/or preserves existing soil and root structures, topsoil nutrients, seed base, and pre-construction site hydrology.

Grading consists of excavation and soil stabilization of earth as required to meet solar array design load requirements. Grading within the solar array area will match existing grades as closely as possible, however some existing contours may require smoothing for access purposes. To the extent practical, grading of an area will take place shortly before trenching and then again post installation of Project components to minimize the area of open, uncovered ground present at all times during construction. The portions of the Project Area that need to be graded are expected to result in a balanced cut-and-fill quantity of grading to maintain the existing conditions to the extent practical for the protection of the equipment and facilities. Where grading occurs on site, topsoil will be salvaged in areas where cut will be greater than the topsoil depths and those areas where subsoil fill will be placed. Once all cut/fill is completed the topsoil will be replaced.

Materials suitable for soil stabilization and backfill will be stockpiled at designated locations using appropriate segregation and erosion control methods. Materials unsuitable for compaction, such as debris and large rocks, will be stockpiled at designated locations for disposal at an acceptable off-site location. Contaminated materials are not anticipated, but if any are encountered during excavation, they will be disposed of in accordance with applicable laws, ordinances, regulations, and standards.

2.2.3 Access Road Construction

Permanent access roads will consist of an improved aggregate base. Roads will be constructed as close to existing grade as possible so that existing sheet flow and drainage patterns are maintained. Erosion control devices will be maintained throughout grading and stabilization according to the SWPPP. Permanent access roads will be maintained for the life of the Project.

Permanent aggregate base access roads will be constructed by first removing the topsoil and organic material, compacting the subgrade, and constructing the road according to civil design requirements. Topsoil will be windrowed to the edges of the road area and distributed along the roadway edge after fill and aggregate installation. Geotextile matting will be installed prior to placement of aggregate to prevent mixing with native subsoil. A layer of road base will then be added and compacted. Road aggregate or fill will be a local pit run aggregate material. Upon completion of detailed engineering, the aggregate specifications will be available for construction quality assurance.

2.2.4 Solar Array Construction

Once grading activities are complete, the racking system supports will be constructed using steel piles driven into the ground. Driven steel pile foundations are typically used where high load bearing capacities are required. The pile is driven using a pile driver (hydraulic ram), which requires two workers. Soil disturbance would be restricted to the hydraulic ram machinery, about the size of a small tractor, temporarily disturbing soil at each pile insertion location.

Tracker mounting assemblies may be assembled at the Project laydown yard and transported to the array blocks prepared for installation; they can also be assembled at the point of installation. Tracker mounts are then fixed to prepared support foundations using forklifts and tractors. During array and racking assembly, multiple crews and various types of vehicles will be working within the Project Area.

These vehicles include flatbed trucks for transporting array components, small all-terrain vehicles, and pick-up trucks used to transport equipment and workers throughout the Project Area. Modules will be staged in advance throughout the Project Area and be brought to specific work areas for installation by wagon-type trailers pulled by skid steers. The Solar modules will be installed by multiple crews using hand tools.

2.2.5 Electrical Collection System

Collection system cabling will be installed in upland areas using one of three methods as needed: a chain-driven trenching machine, excavator, cable laying plow, MV cable trailer, or plow equipment pulled by a bulldozer. The trencher will cut an exposed trench approximately 1 foot wide by 3 to 4 feet deep depending on the type of cable installation. Soil disturbance from the trenching machines would be restricted to the trenching machine tracks. Once cables are installed, the trenches would be backfilled using a grader or small bulldozer and a compaction machine. See Section 4.6 for further description of BMP measures to be implemented during trenching activities.

The horizontal directional drill method will be used to install collection system and will not cross any public roads, as described in Section 4.7.

2.2.6 Inverter, Switchyard, Substation

The inverters, Switchyard, Project Substation, will be placed on footers with gravel pad foundations that will be designed to specifications necessary to meet the local geotechnical conditions. Each component will sit on top of a slab foundation with rebar on center in each direction. A pull box for cable penetrations will be located directly under the inverter to facilitate through-floor cable connections. After the collection system is installed and foundations are poured, the inverters will be installed into position and will be lifted by crane and set directly onto the pre-poured foundation.

The Contractor will use an appropriately sized rough-terrain crane to lift and set each unit. After the unit is properly set and anchored, the Contractor will feed the collection cabling previously installed in the adjacent trenches to the unit.

2.2.7 Project Security Fencing

Array fencing will consist of seven- to eight-foot-high woven-wire exclusion fence with wood fenceposts. The Project Substation will require a seven to eight-foot-high chain link fence, which may include three strands of barb wire at the top. Fenceposts will be driven into the ground. No concrete foundations will be used for the fenceposts. Final fence and post specifications will be determined by the EPC.

3.0 SOIL LIMITATIONS AND SUITABILITY WITHIN THE SITE

Soil varies considerably in its physical and chemical characteristics that strongly influence the suitability and limitations that soil has for construction, reclamation, and restoration. Major soil properties include:

- soil texture;
- soil slope;
- drainage and wetness;
- fertility and topsoil characteristics; and
- presence of stones, rocks, and shallow bedrock.

Interpretative limitations and hazards for construction and reclamation are based to a large degree on the dominant soil properties, and include:

- prime farmland status;
- hydric soil status;
- compaction and rutting potential;
- susceptibility to wind and water erosion;
- susceptibility to compaction;
- fertility and plant nutrition; and
- drought susceptibility and revegetation potential.

3.1 IMPORTANT SOIL CHARACTERISTICS

The Soil Survey Geographic Database (SSURGO) is the digitized county soil survey and provides a Geographic Information System (GIS) relating soil map unit polygons to component soil characteristics and interpretations. Generally, soil map unit polygons in the SSURGO database are clipped to the Project Area and major Project components including:

- Solar Array Area
- Electrical Collection Line
- Generator Tie Line
- Access Roads
- Switchyard and Metering
- Inverters, Switchyard, and Substation

Modern SSURGO datasets for the Project Area are not publicly available because of denied access from the landowner of the proposed Iron Pine Solar facility. One 1935 Pine Couty soil map is available and included in Appendix A, but was not used in quantifying soil impacts or limitations as there has been numerous soil survey recorrelations over the past 89 years that has resulted in non-existent soil series, soil series that still exist but are no longer found in or around the Project Area, and improved organic soil classification methods. Because of obsolete historic data, and unavailable modern soil spatial data, the acreage of major Project components could not be determined by spatial query of SSURGO to make soil property interpretations important for construction, use, revegetation, and reclamation. Instead, soil types mapped in the proximity of and adjacent to the Project Area were analyzed and assumed to be present in the Project Area for the purpose of this report. Notes from the 1935 County Soil Survey were included for discussion where suitable.

This report utilized abutting and adjacent soil map units due to expected similar characteristics of the soils within and outside of the Project Area. Soil genesis theories generally suggest soils that formed on similar landscape positions and climates with similar vegetation and parent material will often have similar characteristics (i.e. be the same). On-site investigations noted landscape positions, vegetation, hydrologic regimes, and parent material within the Project Area that extended beyond the proposed Project boundaries. Soil borings conducted during the field wetland delineations showed similar soil types were consistent to NRCS soil mapping of the surrounding landscape. Limitations of the soils anticipated in the Project Area are explored in the following sections since specific NRCS map unit limitations and acreages couldn't be quantified. A Custom Soil Resource Report for the Project Area which includes a SSURGO Map and descriptions of each map unit is provided Appendix A. Future soil investigations are planned to better classify the soil to provide geotechnical information for site design and construction methods.

3.1.1 Physical Characteristics

Selected physical characteristics of adjacent soils that are anticipated to be within the Project Area are shown in Table 1.

Soil texture affects water infiltration and percolation, drought tolerance, compaction, rutting, and revegetation among other things. Soil texture is described by the soil textural family which indicates the range of soil particle sizes averaged for the whole soil. According to the 1935 soil survey, 1,141.8 acres of the Project Area were classified as Peat and indicate soils dominated by organic material rather than mineral particles. The NRCS soil survey and on-site soil borings also suggest most of the soils anticipated within the Project Area are classified as muck or peat (organic soils). These soils likely reside on the central flat, open, poorly drained extents of the Project Area. Soils are expected to transition to sand and loamy sands as elevation increases on the eastern and western portions of the Project Area near the Kettle River.

Slope affects constructability, water erosion, revegetation, compaction and rutting, among other properties. Soils within the majority of the solar array footprint are anticipated to be within the 0 to 5 percent slope range, based off the surrounding soils on similar landforms. However, steeper slopes are anticipated to occur on the southwest and southeastern portions of the Project Area due to elevation increases and surrounding map units that contain greater slope ranges.

Soil drainage indicates the wetness in the soil profile along with the speed at which internal water moves. Soil Drainage affects constructability, erosion by wind and water, and revegetation success. A majority of the soils observed during on-site soil borings noted organic soils which develop in very poorly drained areas with hydric moisture regimes. The poorly drained designation reflects the flat topography on the site that inhibits water drainage either laterally or vertically. A minor extent of the Project Area is anticipated to be well to excessively well drained and is likely to be in sand-dominated soils such as the Mahtomedi and Grayling sands. Field investigations revealed extensive constructed surface drains throughout the Project Area that has likely altered natural soil drainage properties to support conventional crop production.

Topsoil depth affects soil plant nutrition and surface soil structure. To maintain soil productivity, soils with thick topsoil will require larger areas for storage of larger volume of topsoil stripped from permanent infrastructure footprints such as permanent access roads, inverters and the Project Substation. According to SSURGO mapping, approximately eight soil map units occurring adjacent to the Project Area contains topsoil 0 to 6 inches deep and include the Mahtomedi and Grayling soils. The Greenwood map unit is anticipated to have topsoil ranging from 6 to 12 inches. Lastly, the organic Bowstring, Lougee, and Rifle soils are designated as contain deep O and A horizons that extend beyond the 12 to 18 inches range. Topsoil depth is also correlated to soil order. The most abundant soil order within the Project Area are Histosols and are organic soil that lack mineral soil particles and is consistent with the 1935 Pine County soil survey map. Histosols are typically deep, dark, and contain hydric conditions in undisturbed conditions.

The presence of bedrock near the soil surface and rocks and stones in the soil profile affects constructability and revegetation. No soils in the Project Area are anticipated to be shallow to bedrock but gravel and/or rocks may be common in the profile.

Table 2. Soil Physical Characteristics by Adjacent Soil Map Units

Soil Map Unit	Textural Class[1]	Slope Range (%)[2]	Drainage Class[3]							Topsoil Thickness[4]
			E	SE	W	MW	SP	P	VP	
Bowstring and Fluvaquents, 0 to 2 percent slopes	Mucky	0 – 2							X	>12 – 18
Grayling sand	Muck over Sand	0 – 3 0 – 7 2 – 17 17 – 35	X							0 – 6
Greenwood peat, 0 to 1 percent slopes	Mucky peat	0 - 1							X	6 – 12
Lougee peat, 0 to 1 percent slopes	Sandy or Sandy-Skeletal	0 – 1							X	>12 – 18
Mahtomedi sand	Sandy	0 – 2 0 – 7 2 – 17 17 – 35	X							0 – 6
Rifle mucky peat, 0 to 1 percent slopes, occasionally ponded	Mucky peat	0 - 1							X	>12 - 18
Udifluvents, loamy, 0 to 2 percent slopes, occasionally flooded	undesignated	0 – 2								0 – 6

1 Total acres of Project features that are anticipated to be disturbed by supporting construction equipment traffic, excavation, and grading. Data obtained by merging project facility polygons with the SSURGO spatial data in ArcGIS.

2 Data available directly from the Natural Resources Conservation Service SSURGO2 spatial or attribute database via geospatial query of the spatial or attribute data.

3 Representative slope values are taken directly from the SSURGO database. The SSURGO2 database provides representative slope values for all component soil series. Slope classes represent the slope class grouping in percent that contains the representative slope value for a major component soil series. For example, a soil mapped in the 2-6% slope class has an average slope of 4%, which is within the 0-5% slope range.

4 Drainage class as taken directly from the SSURGO database: “E” Excessively drained; “SE” Somewhat excessively drained; “W” Well drained, “MW” Moderately well drained; “VP” Very poorly drained; “P” Poorly drained; “SP” Somewhat poorly drained.

5 Topsoil thickness is the aggregate thickness of the A horizons (in inches) described in the SSURGO database.

3.1.2 Selected Soil Classification

Selected classification information for soils with the vicinity of the Project Area is presented in Table 2. Natural Resources Conservation Service (NRCS)-designated prime farmland soils have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. No soil within or adjacent to the Project Area is designated as Prime farmland.

The NRCS also recognizes farmlands of statewide importance, which are defined as lands other than prime farmland that are used for production of specific high-value food and fiber crops (e.g., citrus, tree nuts, olives, fruits, and vegetables). Farmlands of statewide importance have the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods. Farmland of statewide importance is similar to prime farmland but with minor shortcomings such as greater slopes or less ability to store soil moisture. The methods for defining and listing farmland of statewide importance are determined by the appropriate State agencies, typically in association with local soil conservation districts or other local agencies. One adjacent soil map unit was designated as Farmland of Statewide Importance, but the soil resides on the floodplains of a stream and is not anticipated within the Project Area.

Land Capability Class (LCC) is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time. Capability classes are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

- Class 1 soils have slight limitations that restrict their use.
- Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.
- Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.
- Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.
- Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

- Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are designated by adding a letter, e, w, s, or c, to the class numeral. The letter e shows the risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation; s shows limitation due to shallow, droughty, or stony soil; and c, shows limitation due to climate that is very cold or very dry. In class 1 there are no subclasses because the soils of this class have few limitations.

Soils surrounding and adjacent to the Project Area are in LCC 2w, 4s, 7s, and 7w. The soil type anticipated to be predominant in the Project Area are Histosols and they contain the greatest limitations with LCC values of 7w and 8w. These limited soils include the Bowstring, Greenweed, Lougee, and Rifle series and they are anticipated to occur on the flatter areas of the Project Area. The Mahtomedi and Grayling soil series contain LCC ratings of 4s but LCC values increase to 7s in the steeper sloped map units and likely occur in the western and eastern portions of the Project Area.

Soil map units are rated based on the proportion that meets the criteria for a hydric soil and the ratings include hydric, predominantly hydric, partially hydric, predominantly non-hydric, and non-hydric. Hydric soils also generally correspond to soil map units with in poorly drained to very poorly drained drainage classes. Hydric soils are a component of regulated wetlands and can be used to indicate areas with potential jurisdictional wetlands. There is a high concentration of hydric soils along the south and north Project Area extents and suggest a high potential of hydric soil within the Project Area. Field investigations that examined hydric soils as part of a wetland delineation revealed there is at least 290 acres of functioning hydric soil present. However, the presence of constructed field drains throughout the site suggests natural hydrological regimes have been altered resulting in soils that should be rated as hydric no longer functioning as such.

Table 3. Selected Soil Classifications

Soil Map Unit	Prime Farmland[1]	Farmland of Statewide Importance	Land Capability Class[3]					Hydric Soil[4]
			2w	4s	7s	7w	8w	
Bowstring and Fluvaquents, 0 to 2 percent slopes	Not Prime Farmland	Not Farmland of Statewide Importance					X	Yes
Grayling sand	Not Prime Farmland	Not Farmland of Statewide Importance		X	X			No
Greenwood peat, 0 to 1 percent slopes	Not Prime Farmland	Not Farmland of Statewide Importance				X		Yes
Lougee peat, 0 to 1 percent slopes	Not Prime Farmland	Not Farmland of Statewide Importance				X		Yes
Mahtomedi sand	Not Prime Farmland	Not Farmland of Statewide Importance		X	X			No
Rifle mucky peat, 0 to 1 percent slopes, occasionally ponded	Not Prime Farmland	Not Farmland of Statewide Importance					X	Yes
Udifluvents, loamy, 0 to 2 percent slopes, occasionally flooded	Not Prime Farmland	Farmland of Statewide Importance	X					No

1 Data available directly from the NRCS SSURGO2 spatial or attribute database via geospatial query of the spatial or attribute data. Includes all areas Prime Farmland and Prime farmland if drained or irrigated.

2 Capability subclasses are designated by adding a letter, e, w, s, or c, to the class numeral. The letter e shows the risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation; s shows limitation due to shallow, droughty, or stony soil; and c, shows limitation due to climate that is very cold or very dry.

3 Data available directly from the NRCS SSURGO2 spatial or attribute database via geospatial query of the spatial or attribute data. Includes Hydric, Predominantly hydric, and Partially hydric soil.

3.1.3 Construction-Related Interpretations

Selected construction-related interpretative data for site soils are broken down by acreage within the Project Area in Table 3.

For the purposes of this report, a highly erodible rating consists of soils with an NRCS Soil Erodibility Factor (Kw) rating of 0.4 to 0.69. Soil Erodibility Factor (Kw) describes the susceptibility of soil detachment by water runoff or raindrop impact and predicts long-term average soil loss from sheet and rill erosion. The Kw is affected by soil texture, organic matter content, size and stability of soil aggregates, permeability, and depth to a restrictive layer. Soil erosion potential is also influenced by slope and exposure to erosion mechanisms. Soil erosion increases in inverse proportion to the effectiveness of vegetation cover (i.e., soils with denser vegetation cover are less susceptible to erosion). Removal of vegetation associated with construction activities, whether by direct stripping or by other mechanical means, greatly increases erosion potential. The soil types existing around and likely throughout the Project Area are not anticipated to be severely susceptible to water erosion.

Wind erosion was evaluated using the wind erodibility group. Highly wind erodible soils are medium textured, relatively well drained soils with poor soil aggregation, resulting in soils with soil surfaces dominated by particles that can be dislodged and carried by the wind. Three soil types identified as adjacent to the Project Area are designated as highly wind erodible and are the Mahtomedi sands, Grayling sands, and Bowstring and Fluvaquents soils.

Soils prone to compaction and rutting are subject to adverse changes in soil porosity and structure as a result of mechanical deformation caused by loading by equipment during construction. Factors considered are soil texture, soil organic matter content, soil structure, rock fragment content, and the existing bulk density. Each of these factors contributes to the soil's ability to resist compaction and rutting. Only the Udifluvent soils (if present) are anticipated to be susceptible to compaction. Organic soils that are likely extensive are not as compressible as a typical mineral soil. Despite low compaction risks, all of the soil anticipated to be within the Project Area is severely susceptible to rutting.

Two basic methods for installing ground-based solar array systems are installation via pilings or anchoring via precast footing or ballasted trays. The penetrating method includes driven piles, screw augers, or concrete piers to provide a stable foundation. The ease of installation and general site suitability of soil-penetrating anchoring systems depends on soil characteristics such as rock fragment content, soil depth, soil strength, soil corrosivity, shrink-swell tendencies, and drainage. The anchoring system utilizes precast ballasted footings or ballasted trays on the soil surface to make the arrays too heavy to move. The site considerations that impact both basic systems are slope, slope aspect, wind speed, land surface shape, flooding, and ponding. Project Area site conditions and cost dictate which method is employed. Installation of these systems requires some power equipment for hauling components and either driving piles, turning helices, or boring holes to install the anchoring apparatus. As described in Section 2.1.1 and Section 2.2.4, driven steel piles are planned to be used for installation of the racking system for the Project.

SSURGO provides interpretive rating classes for soil suitability ratings for "Ground-based Solar Panel Arrays." SSURGO soil suitability ratings for both Ground-based Solar Panel Arrays include “Not Limited”, “Somewhat Limited”, or “Very Limited”, depending on the type of solar array construction methods. Overall, all adjacent soil map units are rated as “Very Limited” and suggest the anticipated solar panel array suitability in the Project Area will be “Very Limited”. The limitations are due low soil strength, a shallow depth to a saturated zone, frost action, and ponding. A geotechnical or high-intensity soil survey conducted by a qualified firm can determine the most suitable installation method.

The final analyzed soil limitation is drought susceptibility. Even under relatively normal precipitation, some soils are prone to having drought stress occur in the plants growing on them. Soil may have an inherently low ability to store water which is typical of sandy or shallow soils or soils having a high content of rock fragments. Drought ratings include severely drought vulnerable, drought vulnerable, moderately drought vulnerable, somewhat drought vulnerable, and slightly drought vulnerable.

In the severely drought vulnerable rating, the soil and site properties are such that the plants growing on the soil must be very drought tolerant even in years with normal amounts of rainfall. The soil may have very low water storage capacity. In the drought vulnerable rating, drought conditions generally occur every year and the soil may have low water storage capacity. Under moderately drought vulnerable soils, annual precipitation is generally adequate for plant growth. In dry years some water stress may occur. Slightly drought vulnerable soils are either in low-lying parts of the landscape where plant roots may exploit near-surface ground water or are in areas where precipitation is much higher than potential evapotranspiration. In an extremely dry year plants may be water stressed on these soils.

Soils susceptible to drought include coarse textured soils in moderately well to excessive drainage classes. Revegetation during seed germination and early seedling growth is severely compromised during dry periods on droughty soils. Most of the surrounding soils were slightly drought vulnerable, with only the sand-dominated Mahtomedi and Grayling soils being rated as drought vulnerable.

Table 4. Soils in Selected Construction-related Interpretations

Project Facility	Kw[1]	Wind Erodibility[2]	Compaction Prone[3]	Rutting Hazard[4]		Solar Array[5]	Drought Vulnerable[6]		
	Moderate	High		Moderate	Severe	Very Limited	Slightly Vulnerable	Moderately Vulnerable	Drought Vulnerable
Bowstring and Fluvaquents, 0 to 2 percent slopes		X			X	X	X		
Grayling sand		X		X		X			X
Greenwood peat, 0 to 1 percent slopes					X	X	X		
Lougee peat, 0 to 1 percent slopes					X	X	X		
Mahtomedi sand		X		X		X			X
Rifle mucky peat, 0 to 1 percent slopes, occasionally ponded					X	X	X		
Udifluvents, loamy, 0 to 2 percent slopes, occasionally flooded	X		X		X	X		X	

1 Erosion Factor Kw indicates the susceptibility of a whole soil to sheet and rill erosion by water, and is a function of percent silt, sand, organic matter, soil structure, and hydraulic conductivity (Ksat). For the purposes of this report, values range from 0.02 and 0.69. A rating of 0.0-0.24 is Low, a rating of 0.25-0.40 is Moderate, and a rating of 0.40-0.69 is High.

2 Highly Erodible Wind Includes soils in wind erodibility groups 1 and 2.

3 Soils are rated Low, Medium, or High based on their susceptibility to compaction from the operation of ground-based equipment for planting, harvesting, and site preparation activities when soils are moist. For soils with a Low rating, the potential for compaction is insignificant. For soil with a Medium rating, the potential for compaction is significant and the growth rate of seedlings may be reduced following compaction. For soil with a High rating, the potential for compaction is significant and the growth rate of seedlings will be reduced following compaction. Soils with a Medium or High rating are represented in this table.

4 Rutting potential hazard based on the soil strength as indicated by engineering texture classification, drainage class, and slope. In general, soils on low slopes in wetter drainage classes, and comprised of sediments with low strength will have potential rutting hazards.

5 Soils are placed into interpretive rating classes of Not limited, Somewhat limited, or Very limited.

6 Soils are rated Slightly vulnerable, Somewhat drought vulnerable, Moderately drought vulnerable, Drought vulnerable, and Severely drought vulnerable. Soils rated as Somewhat drought vulnerable and Moderately drought vulnerable are represented in this table. No soils within the Project Area are rated as Drought vulnerable, and Severely drought vulnerable.

3.1.4 Summary of Major Soil Limitations

3.1.4.1 Wind Erodibility

The predominant rating for soil susceptibility to wind erosion was severe and is a result of organic soils and fine sand textured soils. These soils may have low vegetative cover, an expansive area, or lower particle cohesive forces that detach and erode easily with wind. Exposed topsoil, whether on stockpiles, nearby areas, or slopes, may be lost and transported into waterways or wetlands furthering potential environmental impairment. Therefore, protecting the soil surface via plant residues, perennial plant cover, soil binding agents, or soil wetting must be implemented. Soil erosion and other BMPs that can mitigate impacts to wind (and water) erodible soils are described in Section 4.10 and the Project-specific SWPPP. Initial post-construction revegetation efforts and maintenance of vegetation during operations and maintenance will need to consider selecting appropriate vegetation to grow quickly and include regular inspections of erosion controls after precipitation events as described in the VMP.

3.1.4.2 Land Capability Classification

The predominant LCC surrounding the Project Area is 7w-8w, suggesting potentially severe limitations to land use and conservation practices and an added susceptibility to excess water below and above the ground, agreeing with Section 3.1.4.3. These soil interpretations underline the importance of utilizing suitable revegetation and soil conservation methods as described in the VMP.

3.1.4.3 Solar Arrays

The predominant anticipated soil texture/type in the Project Area is muck or peat, followed by sands. The primary limitations for these soil types during construction, operations and maintenance, and decommissioning include low soil strength, saturated soil, frost action, and ponding. A geotechnical and soils investigation would identify appropriate methods required for installation of the racking systems and foundations within these soil types. As described in Section 2.1.1, the racking system supports will be determined following an on-site soil survey and will depend on delineated soil types.

3.1.4.4 Compaction & Rutting

Iron Pine Solar will design construction access and manage construction passes to minimize the number of trips occurring on a given soil and will implement wet weather procedures any time that rutting is observed. Deep compaction is not anticipated to be a significant problem as the number of construction equipment passes over a given area is limited, and construction equipment consists of smaller, low-ground- pressure tracked vehicles. Practices to be implement to decompact soils are described in Section 4.2 and the project specific VMP. Factors to be considered regarding wet weather conditions are described in Section 4.3. Rutting will be avoided by use of temporary construction matting as described in Section 4.9. No rutting will occur within the wetland as impact to the wetland has not been proposed or authorized by the USACE or Pine County. Based on the preliminary design, the wetland and one stream within the Project Area have been avoided and no impacts to wetlands are proposed.

4.0 BMPS DURING CONSTRUCTION AND OPERATION

The Project will be constructed and operated on property leased by Iron Pine Solar. No direct impacts to adjacent land are expected. The Project is located on farmland occupying a flat to gently sloping floodplain/wetland complex on the east side of Kettle River. Most of the farmland has been drained via constructed ditches to support crop production prior to 1985. The farmland is not designated as prime farmland or farmland of statewide importance.

The prevailing topography of the Project Area will not be substantially changed by construction activities, including installation of the foundations for the tracking systems and trenching for the collection system. It is anticipated that panel arrays will be designed and constructed to conform to the existing flat topography to minimize the need for significant grading. However, some localized grading may be necessary to meet racking tolerances and to construct other project facilities such as the transformer, switchgear, MV power station, and metering. Access roads will be constructed as close to existing grade as possible, maintaining preconstruction hydrologic flow patterns. Upon completion of construction activities, the areas temporarily impacted due to construction activities will be returned to their pre-construction topography.

A final grading plan will be submitted to the MPCA as part of the Stormwater Polluction Prevention Plan (SWPPP) submitted for closer to construction, but prior to site disturbance. The final grading plan will show existing and proposed contours for any areas that will require grading. The final grading plan will show the location of perimeter erosion control measures to be used throughout construction, location of stockpiles, location of bore pits, and location and dimensions of road drainage ditches, if proposed.

The sections below describe the best management practices that Iron Pine Solar will implement to maintain soil health, slope stabilization, and infiltration and avoid sedimentation, erosion, spill-related impacts, and encroachment of noxious weeds within the Project Area due to construction and operation of the Project.

4.1 ENVIRONMENTAL MONITOR

Iron Pine Solar will engage a weekly inspection onsite to monitor earthmoving activities during the initial phase of Project construction to ensure appropriate measures are taken to properly segregate and handle the topsoils. The Monitor will have a variety of duties, including but not limited to:

- Perform regular inspections during the major earthmoving phases of Project construction, including trenching, and during activities in the below bullets;
- Observe construction crews and activities to ensure that topsoil is being segregated and managed appropriately;

- Monitor the site for areas of potential soil compaction (except within access roads) and make specific recommendations for decompaction;
- Make recommendations to Iron Pine Solar's construction manager;
- Assist in determining if weather events have created "wet weather" conditions and provide recommendations to the construction manager on the ability to proceed with construction; and
- Submit reports of Iron Pine Solar's adherence to soil BMPs during the major earthmoving phase of Project construction and upon completion of earthmoving activities to document SWPPP compliance.

Potential issues with BMPs will be reported directly to Iron Pine Solar's construction manager who will use discretion to either correct the activity or stop work.

4.2 SOIL SEGREGATION AND DECOMPACTION

During construction, Iron Pine Solar will work to protect and preserve topsoil within the Project Area. Site preparation will include clearing and grubbing, where needed, prior to any topsoil stripping. Topsoil will be separated from subgrade/subsoil materials when earthmoving activities or excavation are conducted during grading, road construction, cable installation, and foundation installation. The depth of the topsoil to be stripped will be a maximum depth of 12 inches or actual depth of topsoil if less than 12 inches or as agreed upon with the landowner.

The stored topsoil and subsoil will have sufficient separation to prevent mixing during the storage period. A thin straw mulch layer or geotextile fabric may be used as a buffer between the subsoil and topsoil to facilitate separation of the subsoil and topsoil during the excavation backfill process. Topsoil will not be used to construct field entrances or drives, will not be stored or stockpiled at locations that will be used as a traveled way by construction, or be removed from the property.

During the activities that require temporary excavations and backfilling (i.e., trenching activities) the subgrade material will be replaced into the excavations first and compacted as necessary, followed by replacement of topsoil to the approximate locations from which it was removed. Topsoil will then be graded to the approximate pre-construction contour. Iron Pine Solar will avoid compaction in other areas where it is not required by the design.

Following grading activities that require segregation of topsoils/subsoils, topsoil materials will be re-spread on top of the backfilled and disturbed areas to maintain the overall integrity and character of the pre-construction farmland. Any excess topsoil material would be re-spread within the Project Area at pre-established locations and not relocated off-site. The location and amount of topsoil will be documented to facilitate re-spreading of topsoil after decommissioning.

Stripped topsoil and subsoil that will be necessary for future reclamation for components such as access road installation and the transformer, switchgear, MV power station, and metering will be removed to suitable locations near the site of removal and spread across existing topsoil for storage.

4.3 WET WEATHER CONDITIONS

Construction in wet soil conditions will not commence or continue at times when or locations where the passage of heavy construction equipment may cause rutting to the extent that the topsoil and subsoil are mixed, or underground drainage structures may be damaged.

During construction, certain activities may be suspended in wet soil conditions, based on consideration of the following factors:

- extent of surface ponding;
- extent and depth of soil erosion, rutting, compaction, and mixing of soil horizons;
- areal extent and location of potential rutting and compaction (i.e., can traffic be rerouted around wet area);
- damage to drain tiles if present; and
- type of equipment and nature of the construction operations proposed for that day.

If adverse wet weather construction impacts cannot be minimized to the satisfaction of Iron Pine Solar, the EPC will cease work in the applicable area until Iron Pine Solar determines that site conditions are such that work may continue.

4.4 INITIAL GRADING/ROAD CONSTRUCTION/ARRAY CONSTRUCTION

A final grading plan will be developed closer to construction, but prior to site disturbance. The final grading plan will show existing and proposed contours for any areas that will require grading. The final grading plan will show the location of perimeter erosion control measures to be used throughout construction, location of stockpiles, location of bore pits, and location and dimensions of road drainage ditches, if proposed.

Micro-grading or site leveling will likely be necessary prior to array installation to accommodate slope tolerances allowed for by the solar array design. The appropriate depth of topsoil that should be stripped and segregated from other materials during initial grading activities is described in Section 4.2.

During civil work, topsoil will be removed from the cut/fill areas and stored in designated locations for later use. Once topsoil is removed from the cut/fill areas, the sub-grade materials will be removed as required from higher ground elevations and relocated on-site at lower elevations. Prior to relocating sub-grade materials to the lower elevations, topsoil in the low areas will be stripped and set aside before the fill is added, then respread over the new fill. The stored topsoil will be re-spread over the reconditioned sub-grade areas. Newly spread topsoil will be loosely compacted and/or “tracked” and the erosion and sedimentation prevention BMPs will be implemented as described in Section 4.10 and in accordance with the Project SWPPP.

After the majority of the micro-grading activities have been completed, internal access roads will be constructed. Topsoil will be stripped from the roadbeds to a depth of at least 12 inches and will be windrowed to the edges of the roadbed. Windrowing will consist of pushing materials into rows of spoil piles adjacent to the road which will be loosely compacted and/or “tracked” with stormwater and wind erosion BMPs in place. The sub-grade materials will then be compacted. Roads shall be constructed at grade to allow for existing sheet flow so that existing drainage patterns are maintained. Previously windrowed topsoil material will be respread around the new gravel material along the road shoulders.

Once grading and road construction is complete, the Contractor can begin the installation of foundation piles for the PV array racking system as described in Section 2.1.1 and 2.2.4. This work will consist of directly driving the pile into the soil with pile drivers. These vehicles would operate on the existing surface of the ground and impacts would be limited to what is typical when vehicles drive over the soil surface. Very little soil disturbance is expected from this activity.

Dust abatement measures may include restriction of vehicle speeds, watering of active areas, watering of stockpiles, watering on public roadways, the application of calcium chloride (or other similarly approved product), track-out control at site exits, and other measures.

4.5 FOUNDATIONS

The skids for the inverters will likely be installed on driven pier foundations but could be placed on concrete foundations if required by soil and geotechnical conditions as described in Section 2.1.4. The Contractor will strip topsoil off the area for the foundation, install the pier-type foundations, compact sub-grade materials, re-grade spoils around the foundation area, and then install clean washed rock on the surface. All topsoil stripped from these areas will be pushed outside of the work area and collected into designated spots for later use. These topsoil piles will be windrowed or piled and loosely compacted and/or “tracked” with stormwater and wind erosion BMPs in place. Once construction is advanced, the topsoil piles would be distributed in a thin layer adjacent to the foundation area.

If concrete foundations are used, the foundations will be dug using a rubber-tire backhoe and then rebar and concrete installed and left to cure. After cure and testing of concrete strength is completed, the subgrade spoils will be compacted around the foundations. After the solar equipment is set, the adjacent topsoil will be re-spread around the foundation.

4.6 TRENCHING

Construction of the Project may require trenching for the installation of both DC and AC collection lines. The typical burial depth for collector circuits is 36 inches. The trench for a single cable will be eighteen inches wide. Where multiple cables are installed parallel to each other, the cable separation will be up to eight feet apart, therefore the width of the trench will vary depending on the number of circuits within the trench.

During trenching, topsoil and subgrade materials would be excavated from the trench using typical excavating equipment or backhoes and segregated as described in Section 4.2. The bottom of each trench may be lined with clean fill to surround the cables. Iron Pine Solar anticipates that native subsoil will be rock free, and that no foreign fill will be necessary. After cables have been installed on top of bedding materials in the trench, 1 foot of screened, native backfill will be placed on the cables followed by additional 2 feet of unscreened native backfill trench spoil. This material would be compacted as necessary. The last 1 foot of each trench will then be backfilled with topsoil material only to return the surface to its finished grade.

4.7 HORIZONTAL DIRECTIONAL DRILL

Underground horizontal directional drilling (HDD) will be utilized in environmentally sensitive areas, such as nonfarmed wetlands and natural waterways, to avoid impacts to these resources. Bore pits will be setback at least 10 feet from stream corridor and wetland buffer boundaries. Based on the preliminary design, the non-farmed wetlands within the Project Area have been avoided and no impacts to wetlands are proposed. One MDNR Public Watercourse, which has been previously altered from its natural course where it crosses through the Development Area will be crossed via collection line cable in two locations based on the current design. These crossings will be conducted via HDD and will not impact the waterway. Proper sediment, erosion control, and invasive species control Best Management Practices (BMPs) will be installed/utilized prior to and during construction activities.

Horizontal directional drill boring equipment will be stored either in the Project laydown yard or near the location of the proposed boring. If the boring cannot be completed in one day, overnight storage of equipment will be in upland agricultural areas within 50 feet of the bore pits. Appropriate BMPs and contaminant management (oil absorbent booms, etc.) materials will be put in place prior to leaving the boring area for the day.

A typical bore pit is approximately 10 feet by 20 feet by 6 feet deep. Approximately 1,200 cubic feet (45 cubic yards) of material may be excavated for each pit. The boring will require two bore pits, one on each side of the road being crossed. All materials removed from bore pits will be stored adjacent to the boring with appropriate BMPs installed. Once the boring is completed, the excavated material will be reused as backfill of the pit. Once a final grade is reached, the area will be seeded with a cover crop and permanent seed mixture with appropriate erosion control devices installed (silt fence, erosion matting, etc.), if necessary.

4.8 DEWATERING

Dewatering may be required for excavations such as bore pits. Iron Pine Solar will develop a Dewatering Plan and provide training to personnel directly involved with discharge activities. Iron Pine Solar shall ensure that on-site personnel directly involved with discharge activities have access to the Dewatering Plan at all times while at the discharge location(s). Dewatering will be performed in accordance with applicable appropriation and discharge permits, and at a minimum, will comply with the following procedures:

- Floats will be placed on pump intakes.

- The excavation will be dewatered into a well-vegetated upland area with an appropriate energy-dissipation device. Whenever possible, the slope at the point of discharge will be away from any streams or wetlands. Soils in the vicinity of the discharge point will be assessed before discharge. Topography between the discharge point and the nearest receiving waters will be evaluated for erosion potential.
- If the flow of a discharge cannot be kept out of streams, wetlands, drainage ditches, etc., the discharge shall be filtered by one of the methods described below. Dewatering discharge will be directed into a sediment filter bag or a straw bale/silt fence dewatering structure which discharges into a vegetated area to prevent heavily silt-laden water from flowing into wetlands and waterbodies.
- Only non-woven fabric filter bags will be used for dewatering.
- Filter bags and dewatering structures must be maintained in a functional condition throughout dewatering activity (e.g., clogged or ripped bags must be replaced) and will be attended at all times during active pumping. Accumulated sediment from the filter bags shall be spread in an approved upland location.
- Iron Pine Solar will comply with applicable permit requirements, including tracking volumes of water pumped, obtaining water samples (if needed) for testing, and taking necessary measures to meet effluent limitations.

4.9 TEMPORARY EROSION AND SEDIMENT CONTROL

Iron Pine Solar will prevent excessive soil erosion on lands disturbed by construction by adhering to an SWPPP required under the NPDES permitting requirement that will be administered by the MPCA. Prior to construction, the Project’s Engineer of Record will outline the reasonable methods for erosion control and prepare the SWPPP.

These measures would primarily include silt fencing on the downside of all hills and near wetlands and surface drains. This silt fencing would control soil erosion via stormwater. Check dams and straw waddles will also be used to slow water during rain events in areas that have the potential for high volume flow. In addition, the Contractor can use erosion control blankets on any steep slopes, although given the site topography, this BMP will not likely be required. Lastly, as outlined above, topsoil and sub-grade material will be piled and loosely compacted and / or “tracked” while stored. The BMPs employed to mitigate wind and stormwater erosion on these soil stockpiles will include installing silt fence on the downward side of the piles as needed and installation of straw waddles if these spoil piles are located near waterways.

The SWPPP will designate onsite SWPPP inspectors to be employed by the Contractor for routine inspections as well as for inspections after storm events per the plan outlined in the SWPPP. The SWPPP will consider wind erodibility and best practices as such including methods such as wetting exposed soils to minimize dust during construction activity and maintaining good vegetative cover (both cover crops and permanent vegetation).

The SWPPP will be submitted to the MPCA prior to construction start and designated onsite SWPPP inspectors will be employed by the Contractor for routine inspections as well as for inspections after storm events per the plan outlined in the SWPPP.

4.10 DRAIN TILE IDENTIFICATION, AVOIDANCE AND REPAIR

Iron Pine Solar or its EPC contractor will work to identify any existing non-abandoned drain tile systems within the Project Area and may include the use of local drain tile contractor. Existing non-abandoned tile will be located by analyzing existing documentation, reviewing aerial photography, and interviewing Project participating landowners and adjacent landowners to identify approximate or expected locations of the tile lines. If the location of the existing tile system is not accurately determined, a physical tile location effort may be undertaken. Physical location of tile may be attempted using ground penetrating radar in the areas of suspected tile locations, or GPS-enabled line scope. If visible surface inlets are identified, a tile probe may be used to locate the tile line and determine its direction from the inlet. The tile line will then be mapped with a GPS locator so it can be avoided during construction.

Care will be taken during construction to: a) avoid drain tile locations within the Project Area, b) re-route drain tile away from locations which could be damaged during construction, or c) in the case of fields with pattern tile networks, work with applicable landowners to establish acceptable criteria for rerouting, replacing or abandoning in place drain tile that is within a photovoltaic (PV) array.

If non-abandoned drain tile is damaged, the damaged segment will be repaired in place or, if necessary, relocated as required by the condition and location of the damaged tile. In the event drain tile damage becomes apparent after commercial operation of the Project, the drain tile will be repaired in a manner that restores the operating condition of the tile at the point of repair and will have the capacity, depth, and appropriate slope to ensure the new tile line performs adequately for the line it is replacing. All repair, relocation, or rerouting referenced above will be consistent with these policies: a) materials will be of equal or better quality to those removed or damaged; b) work will be completed as soon as practicable, taking into consideration weather and soil conditions; c) work will be performed in accordance with industry-accepted, modern methods; and d) in the event water is flowing through a tile when damage occurs, temporary repairs will be promptly installed and maintained until such time that permanent repairs can be made. Iron Pine Solar will minimize interruption of any drainage on site or on any neighboring farms that may drain through the property.

Repairs or rerouting will be performed using a small to mid-sized excavator. Laser equipment will be used to ensure proper grading of the tile. In the event a line of significant size and length needs to be rerouted or installed; a commercial drainage plow could be used. The drainage plow typically utilizes GPS-grade control to ensure tile is installed to specified slopes. The following considerations will also apply:

- Tiles will be repaired with materials of the same or better quality as that which was damaged.
- Tiles repairs will be conducted in a manner consistent with industry-accepted methods.

- Before completing permanent tile repairs, tiles will be examined within the work area to check for tile that might have been damaged by construction equipment. If tiles are found to be damaged, they will be repaired so they operate as well after construction as before construction began.
- Iron Pine Solar will make efforts to complete permanent tile repairs within a reasonable timeframe, considering weather and soil conditions.

4.11 CENTER-PIVOT IRRIGATION WELL IDENTIFICATION AND AVOIDANCE

Where center-pivot irrigation systems are present within the Project Area, the systems and the water/utility lines servicing them within the Project Area will be decommissioned and left in place. If wells are located within the solar array area, they will either be marked with flagging and a five-foot buffer around them will be fenced to protect these structures, or fully decommissioned. If Iron Pine Solar identifies a need for wells during operations, these wells may be uncapped or new wells may be installed. Any new wells will be permitted in accordance with Pine County and/or MN Department of Health standards.

5.0 VEGETATIVE MANAGEMENT PLAN

Iron Pine Solar is committed to minimizing impacts to soil within the Project Area so that the site may be returned to active agricultural production upon decommissioning. In accordance with the VMP, Iron Pine Solar will establish a permanent vegetative cover throughout the Project Area including areas beneath and around arrays. This will manage erosion by increasing stormwater infiltration and reducing runoff. Stormwater infiltrates soil at a higher rate on perennially vegetated ground cover than on cultivated cropland. The transition to permanent perennial vegetation will manage additional runoff resulting from the solar modules and access roads. Permanent perennial vegetative cover also provides connectivity to existing adjacent wildlife habitats.

6.0 CONTROLLING SPREAD OF UNDESIRABLE SPECIES

During construction and operation, appropriate BMPs will be used to manage and limit the spread of invasive and noxious weed species. Invasive and noxious weed control practices to be conducted during pre-construction, construction and operation of the project, soil handling, and equipment cleaning are described in the VMP.

Equipment will be cleaned before mobilization to the site to prevent introduction of invasive species from off-site sources. The equipment will be manually cleaned of plant materials between work zones within the Project Site. Project Plan details can be found in the Vegetation Management Plan developed for the Project.

7.0 DECOMMISSIONING

The Project will operate for at least 30 years and the useful life of the Project may be 35 or 40 years based on current forecasts for modern equipment. At the end of the useful life of the Project, Iron Pine Solar will be responsible for removing all of the solar arrays and other associated facilities and restoring the site to its prior use. At the end of the anticipated Site Permit, the Applicant reserves the right to extend operations of the Project by applying for an extension of the permit to continue operation. Should the Applicant decide to continue operation, a decision would be made as to whether the Project would continue with the existing equipment or to upgrade the facilities with newer technologies. In general, the majority of decommissioned equipment and materials will be recycled. Materials that cannot be recycled with be disposed of at approved facilities.

At the end of the Project's useful life, the Project would cease operation. At that time, the facilities would be decommissioned and dismantled and the site restored in accordance with the Decommissioning Plan developed for the Project.

7.1 RESTORATION/RECLAMATION OF FACILITY SITE

Once the solar facilities are removed, the site would be restored to agricultural use or to another use if the economic conditions and landowner intentions at that time indicate another use is appropriate for the site. Restoration activities will be conducted in accordance with the Decommissioning Plan and VMP.

After steel pier foundations, fence posts, concrete foundations, re-claimed access road corridors and other equipment are removed the site will be returned to original the original topography to the extent practicable and will be restored with either stockpiled soil or by supplemental soil. Soils will be decompacted if necessary. The method of decompaction will depend on how compacted the soil has become. Soils will be de-compacted by using a tractor and disc to a 12-inch depth or a tractor and a deep subsoiler, if necessary. Grading and other soil disturbance activities conducted during decommissioning will be minimized to the extent necessary to effectively decommission the site and to maintain the soil benefits realized during the long-term operation of the Project.

APPENDIX A

Appendix A

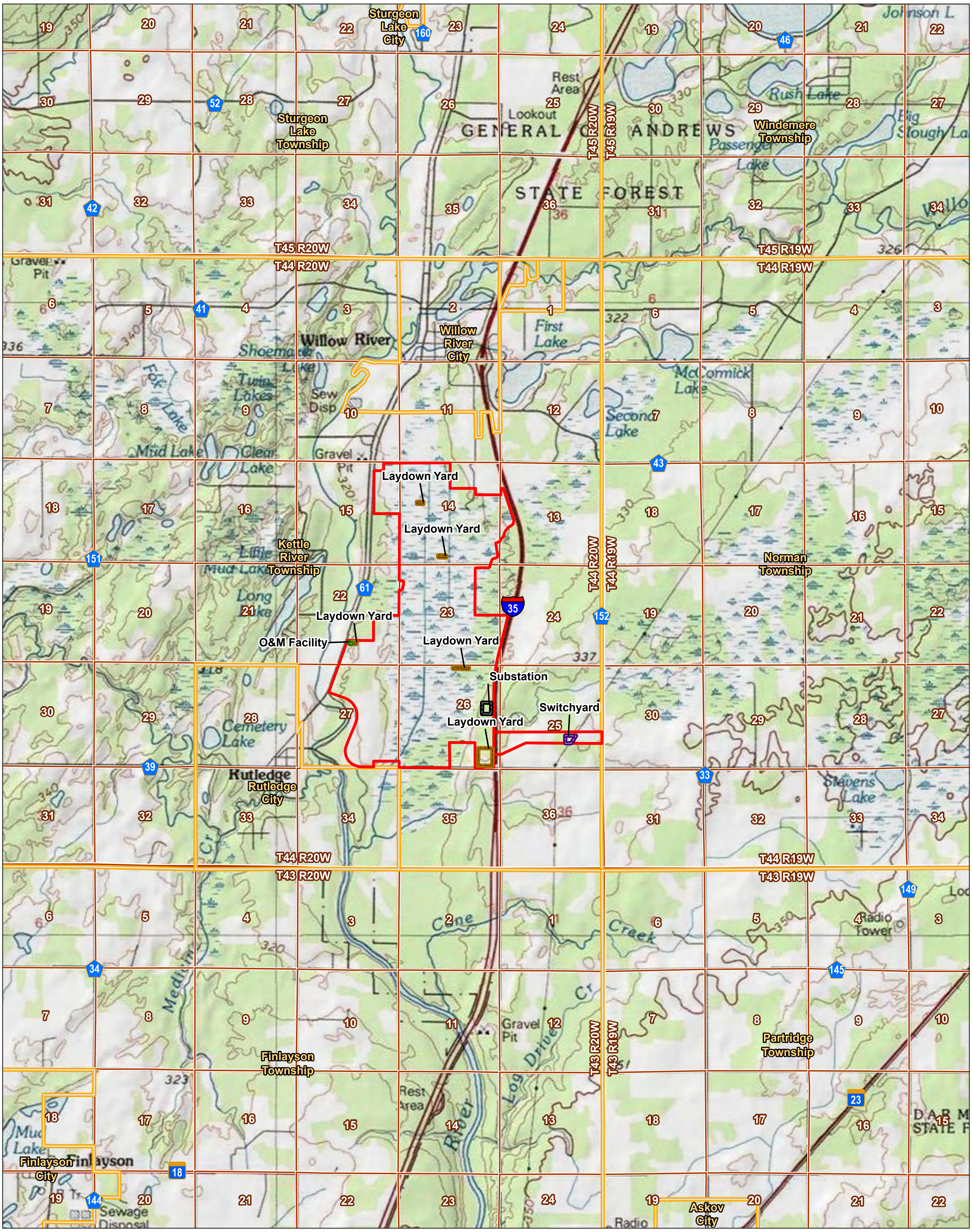
A.1 SITE LOCATION MAP

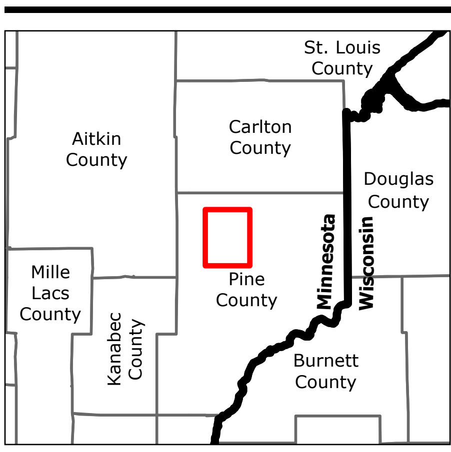
A.2 USDA NRCS SOIL SURVEY MAP

A.3 GRADING PLAN (To be inserted based on final design)

A.4 SITE PLAN (To be inserted based on final design)

A.5 1935 PINE COUNTY SOIL SURVEY MAP





Legend

- Project Area Boundary
- Proposed Laydown Yard
- Proposed O&M Facility
- Proposed Substation
- Proposed Switchyard
- County Subdivision
- Township, Range & Section Boundary

0 0.5 1 Miles

(At original document size of 11x17)
1:63,360

N

Stantec

Project Location
Kettle River Township
Pine County, Minnesota

Prepared by KJM on 2024-02-21

Client/Project
193708962
Iron Pine Solar, LLC
Iron Pine Solar Project
MnPUC Site Permit Application

Map No.
A.1

Title
Project Location

Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Swift Current Energy, Stantec, MnGeo, MnDOT
3. Background: USGS Quadrangle

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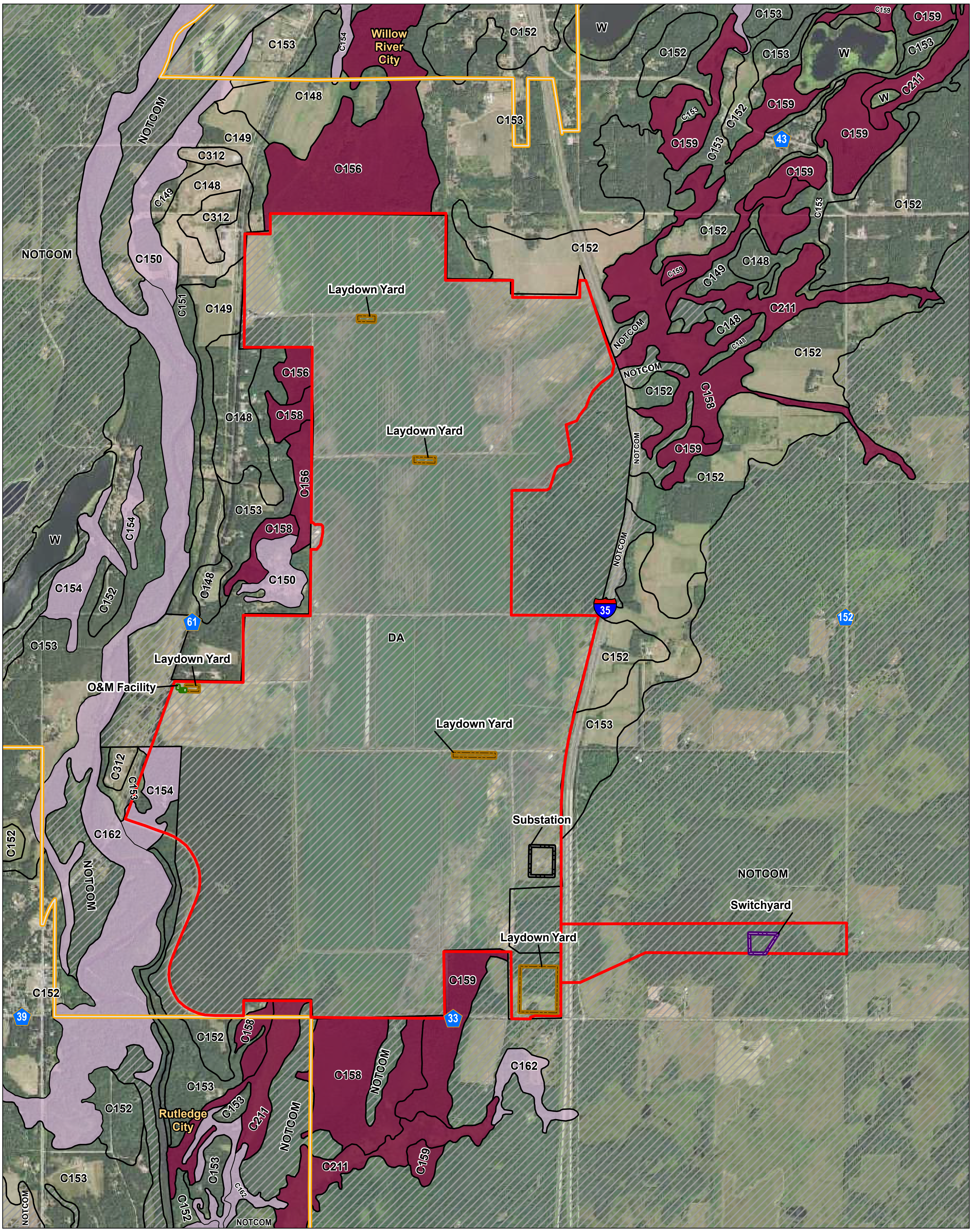
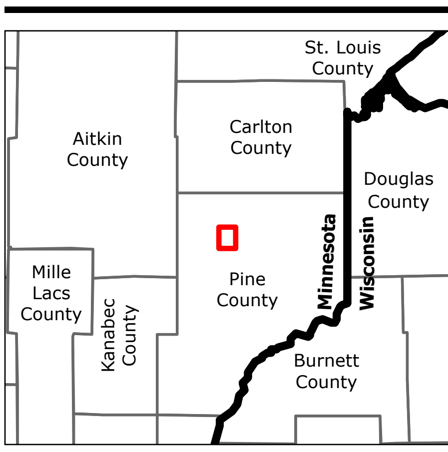




Legend

- Project Area Boundary
- Municipal Boundary

NRCS Soil Survey Data*

Hydric Soil Rating

- Hydric
- Predominantly Non-Hydric
- Non-Hydric
- Denied Access / No Digital Data Available

*Available NRCS data incomplete for significant portion of project area.

Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Swift Current Energy, Stantec, ESRI, MnGeo, MnDOT, NRCS
3. Background: 2021 NAIP

0 1,000 2,000 Feet
(At original document size of 11x17)
1:24,000

N

Stantec

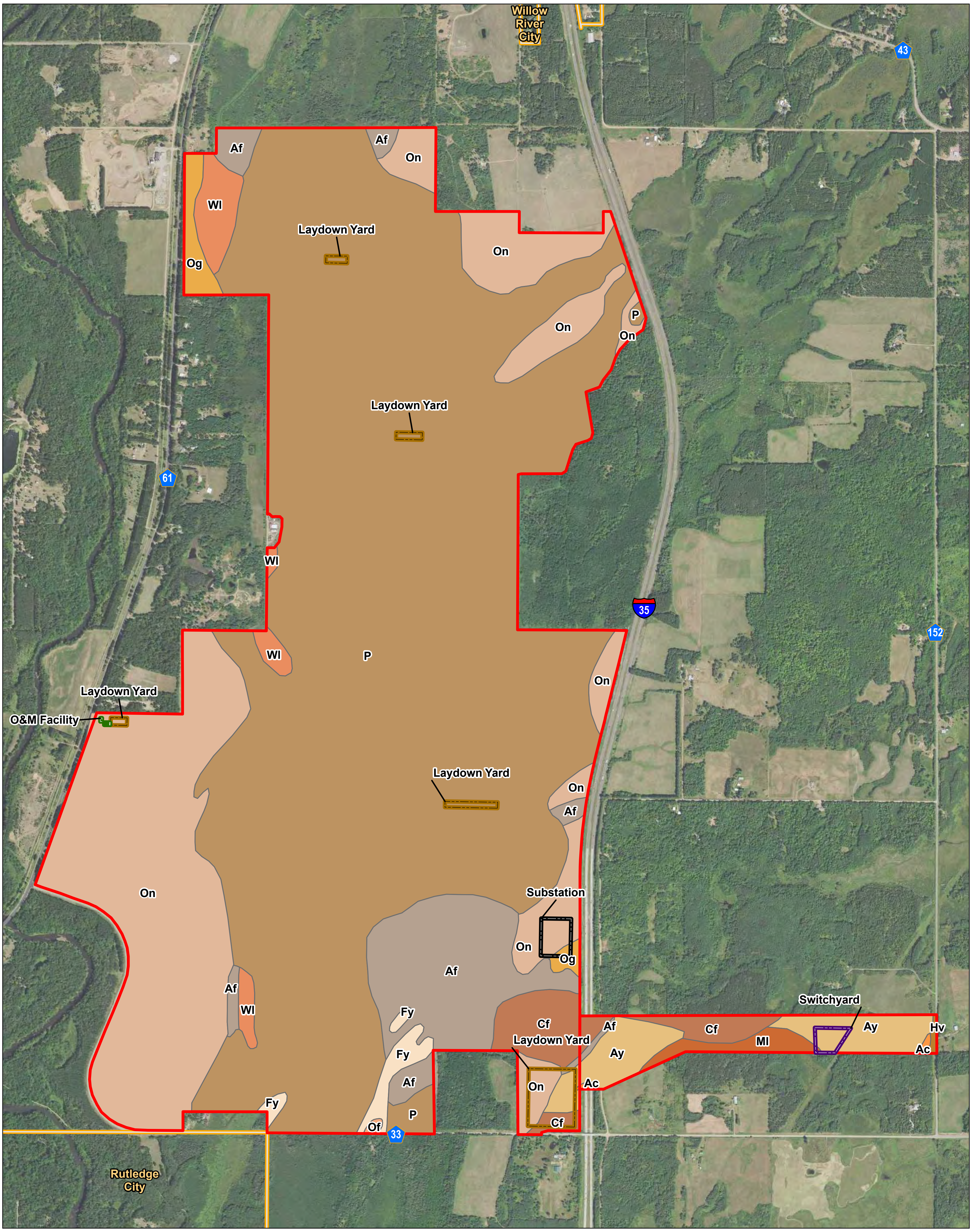
Project Location
Kettle River Township
Pine County, Minnesota

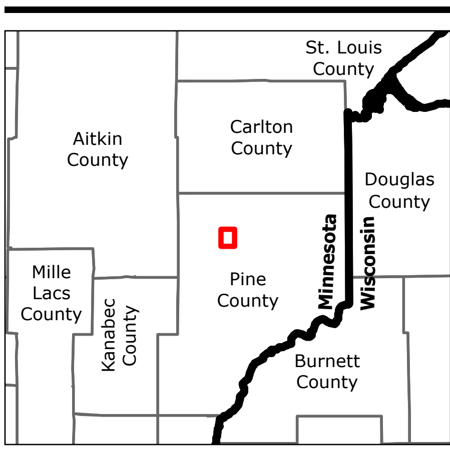
Prepared by KJM on 2024-01-25

Client/Project
193708962
Iron Pine Solar, LLC
Iron Pine Solar Project
MnPUC Site Permit Application

Figure No.
A.2

Title
Soil Resources - NRCS





Notes
1. Coordinate System: NAD 1983 UTM Zone 15N
2. Data Sources: Swift Current Energy, Stantec, ESRI, MnGeo, MnDOT, NRCS
3. Background: 2021 NAIP

Legend
- Project Area Boundary
- Municipal Boundary

Pine Co. 1935 Soils Map
- Ac - Adolph silty clay loam
- Af - Adolph fine sandy loam
- Ay - Askov fine sandy loam
- Cf - Cloquet fine sandy loam
- Fy - Freer fine sandy loam
- Hv - Hibbing very fine sandy loam
- Ml - Milaca loam
- Of - Onamia fine sandy loam
- Og - Omega gravelly loamy fine sand
- On - Omega loamy fine sand
- P - Peat
- Wl - Warman loamy fine sand

0 800 1,600 Feet
(At original document size of 11x17)
1:19,200

N

Stantec

Project Location
Kettle River Township
Pine County, Minnesota

Prepared by KJM on 2024-01-25

Client/Project
193708962
Iron Pine Solar, LLC
Iron Pine Solar Project
MnPUC Site Permit Application

Figure No.
11b

DRAFT

Title
Soil Resources - Pine Co Soils Map 1935

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