FREE STATE SOLAR PROJECT, LLC

REVISED VEGETATION & AGRIVOLTAICS MANAGEMENT PLAN

KANSAS SKY ENERGY CENTER (KSEC)

PROJECT NO. 147658

REVISION 1

DECEMBER 6, 2024

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I. Introduction

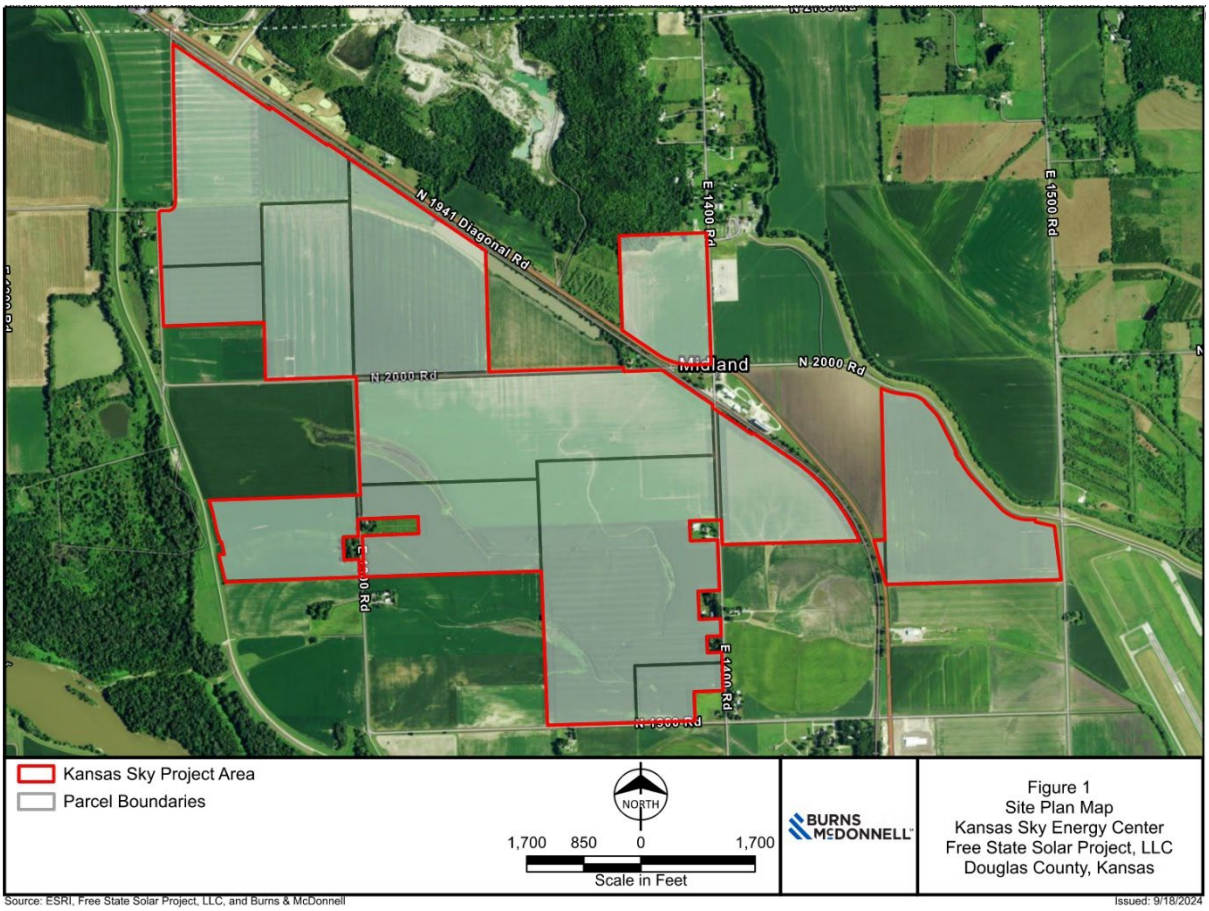
A. Overview

Free State Solar Project, LLC (Free State), a subsidiary of Savion, LLC, is proposing to receive all the necessary regulatory permits for a new utility scale photovoltaic (PV) solar generation facility in Douglas County, Kansas. On May 22, 2024, the Board of County Commissioners of Douglas County, Kansas adopted Resolution 24-14 (the Resolution), approving Conditional Use Permit No. CUP-23-00312 (the CUP), subject to conditions. Pending regulatory approval, The Kansas Sky Energy Center (KSEC, Project) will be constructed by Evergy, Inc., through its regulated utility subsidiaries (Evergy). The project would have a nameplate capacity of 159 Megawatts (MW). The Project is located approximately 1 mile north of Lawrence, Kansas. The Project parcels are depicted on the Project Location Map shown below in Figure 1. The Project would include PV solar arrays containing PV panels attached to a single-axis tracking system mounted to steel piles. The PV panels will track the sun during the day. Direct current (DC) electricity generated from the PV panels will be routed via an aboveground CAB wiring system to Power Conversion Units (PCUs), also known as inverters, located throughout the PV solar arrays. The electricity will then move to the Project substation via underground wiring and ultimately the interconnection point at an existing substation. Each PV solar array will be within security fencing and have gated access at the access road entrances. Constructed access roads will be gravel and approximately 16 feet wide. Pending regulatory approval, construction of the Project is anticipated to begin in 2025 and be completed in 2027.

1. Area Description

The total project area is approximately 1,105 acres (Figure 1) (Project Area). For the purpose of this Vegetation Management Plan (Plan), areas that are disturbed for Project purposes will be re-vegetated per the Storm Water Pollution Prevention Plan (SWPPP), the CUP as approved by the Resolution, and the solar regulations (codified as Section 12-306-49) (the Solar Regulations). This Plan supplements and does not replace the long-term goal for permanent vegetation as defined in the National Pollutant Discharge Elimination System (NPDES) Permit that will be submitted for the Project.

Figure 1: Project Location Map



2. Array Spacing and PV Panel Ground Clearance

The typical minimum leading-edge height between the PV panels and the ground is approximately 18 inches. Post-to-post spacing between rows is approximately 21 feet. Final spacing within the arrays will be determined once equipment selection is finalized and the detailed engineering plan is complete. The installation of low-growing plant species and performance of vegetation management practices within the PV panel areas will be conducted to minimize vegetation touching or shading the panels.

B. Plan Purpose and Intent

This revised Plan amends and restates in its entirety that certain *Vegetation & Agrivoltaics Management Plan* dated August 17, 2023. This Plan constitutes the revised *Vegetation Management & Agrivoltaics Plan* contemplated by paragraph e, *Conditions of Approval*, of the Resolution. This Plan outlines the various phases of agrivoltaics and provides more detailed information on the agrivoltaic activities being proposed. This Plan also addresses the management of vegetation in the Project Area during operation of the Project. Vegetation management during the construction and decommissioning of the Project is separately addressed.

This Plan includes the steps for the following:

- Preservation of topsoil
- Use of native and/or naturalized plant species
- Use of pollinator-friendly plant species
- Control of noxious weeds and invasive species

- Prevention of erosion and control of stormwater
- Establishment of vegetation as required by the SWPPP, the CUP, the Resolution and the Solar Regulations
- Vegetation management
- Establishment of an agrivoltaics fund and advisory board
- Creation of a grant application process to expand the type of agrivoltaic uses of the Project Area and promote agrivoltaic research and development
- Seek grant opportunities in furtherance of expanding agrivoltaic uses of the Project Area

The Plan is designed to manage the soil and vegetation in the Project Area so that the Project Area can readily return to cultivation after decommissioning. This Plan was prepared alongside several other plans relating to land and water management in the Project Area, including those addressing erosion and sediment control, stormwater management, soil sampling, vegetative screening, and decommissioning. This Plan may be updated as needed based on changing conditions, new methods, and/or Project needs.

Specific goals of this Plan include the following:

- Compatibility, adaptability, and compliance with the SWPPP, the CUP, the Resolution and the Solar Regulations.
- Compliance with post-construction re-vegetation requirements per Section 12-306-49 of the Solar Regulations.
- Maintain and improve soil health so that the Project lands can be returned to productive agricultural land use after Project decommissioning.
- Develop and install permanent seed mixes that support the following objectives:
    - Low growth, low maintenance, shade tolerant grasses and forbs for areas under panels and between panel rows,
    - Species adapted to site specific environmental parameters including soils, drainage, and local climate,
    - Compatible with engineering objectives including height restrictions as well as capacity to form continuous, dense vegetation stands, and
    - Use of native or naturalized species, including pollinator-friendly plantings, in all areas requiring revegetation.
- Prepare soils and employ seed installation methods suitable for temporary and permanent seed; and
- Establish and maintain a vegetation maintenance program for the Project Area through the anticipated life span of the facility.

C. Existing Conditions

1. Land Use

Land use within the Project Area is primarily cultivated crops (96%), with interspersed pasture/hay, deciduous forest, wetlands, and developed areas (Table 1; Figure 2). Historically, this area was dominated by prairie and forest. Existing land uses in the Project Area are open water, open space development, low intensity development, medium intensity development, deciduous forest, pasture/hay, cultivated crops, and wetlands. Much of the Project Area is cultivated for corn or soybean production.

Deciduous forests occur near the stream and wetland corridors that are within the northern regions and boundary of the Project Area. The small areas of deciduous forests observed in the Project Area are comprised of cottonwood (*Populus deltoides*) and common hackberry (*Celtis occidentalis*). However, no tree clearing activities will occur on the Project.

The areas surrounding the Project Area are similar in composition with a higher percentage of deciduous forest and open water (the Kansas River) southwest of the Project Area. The Lawrence Municipal Airport is southeast of the Project Area.

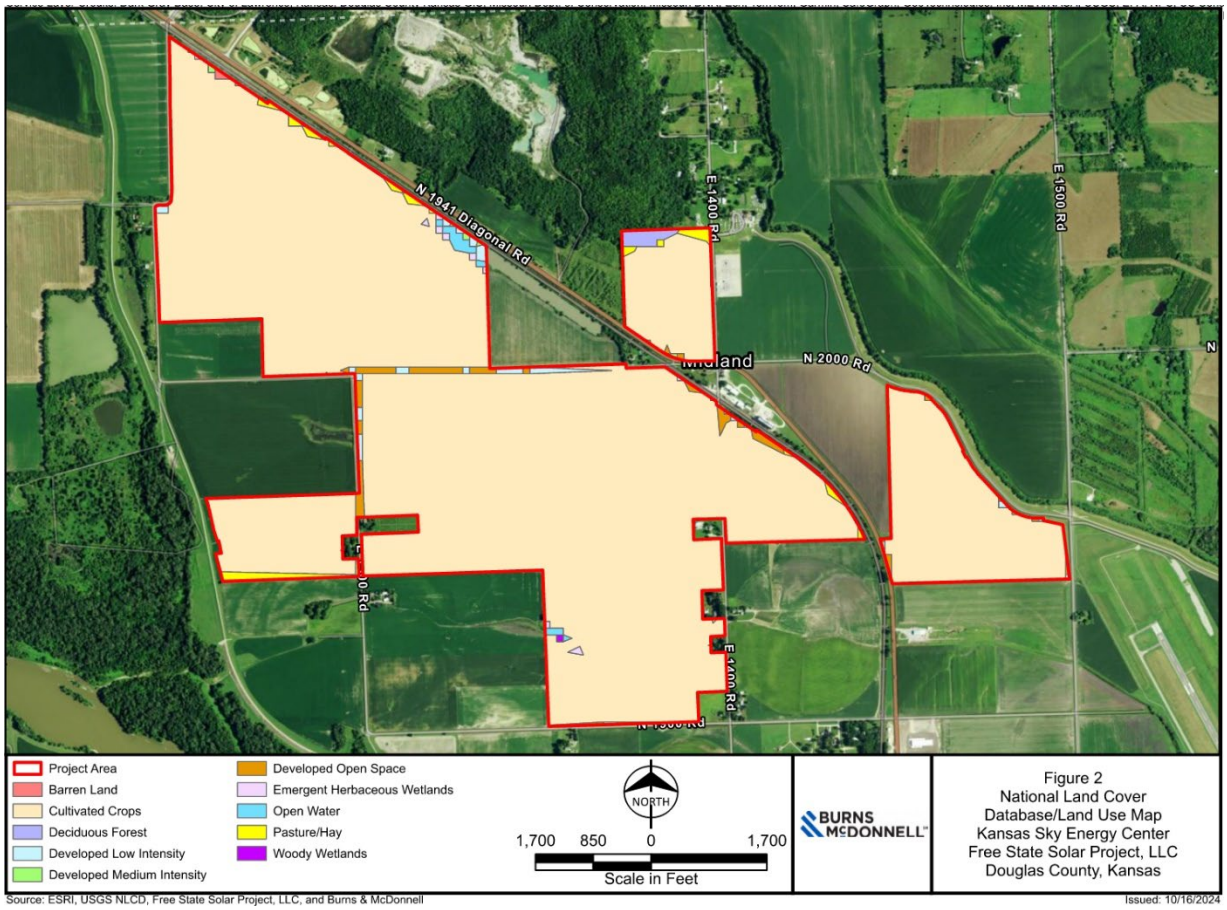
Based on the results of the desktop review, the Project Area land use is predominantly cultivated crops as summarized in Table 1, as follows:

Table 1: Existing Land Cover within the Project Area

Land Use Type	Acres
Cultivated Crops	1,060.7
Developed, Open Space	13.5
Pasture/Hay	11.9
Developed, Low Intensity	9.1
Deciduous Forest	3.6
Open Water	3.4
Emergent Herbaceous Wetland	1.6
Developed, Medium Intensity	1.1
Barren Land	0.7
Woody Wetlands	0.2
Total	1.105.3

Source: USGS National Landcover Database (2021)

Figure 2: National Land Cover Database / Land Use Map



2. Soil Types

The NRCS Soil Survey Geographic Database (SSURGO) was used to identify the specific soil map units associated with the Project Area as mapped by the U.S. Department of Agriculture (USDA)-National Resources Conservation Service (NRCS). The SSURGO dataset is generally the most detailed level of soil geographic data available and utilizes information contained in published NRCS soil surveys. The Project Area is comprised of 16 soil map units, as mapped by the USDA-NRCS and as depicted on Figure 3 and summarized in Table 2.

The following soil map units located within the Project Area are classified as hydric in Douglas County:

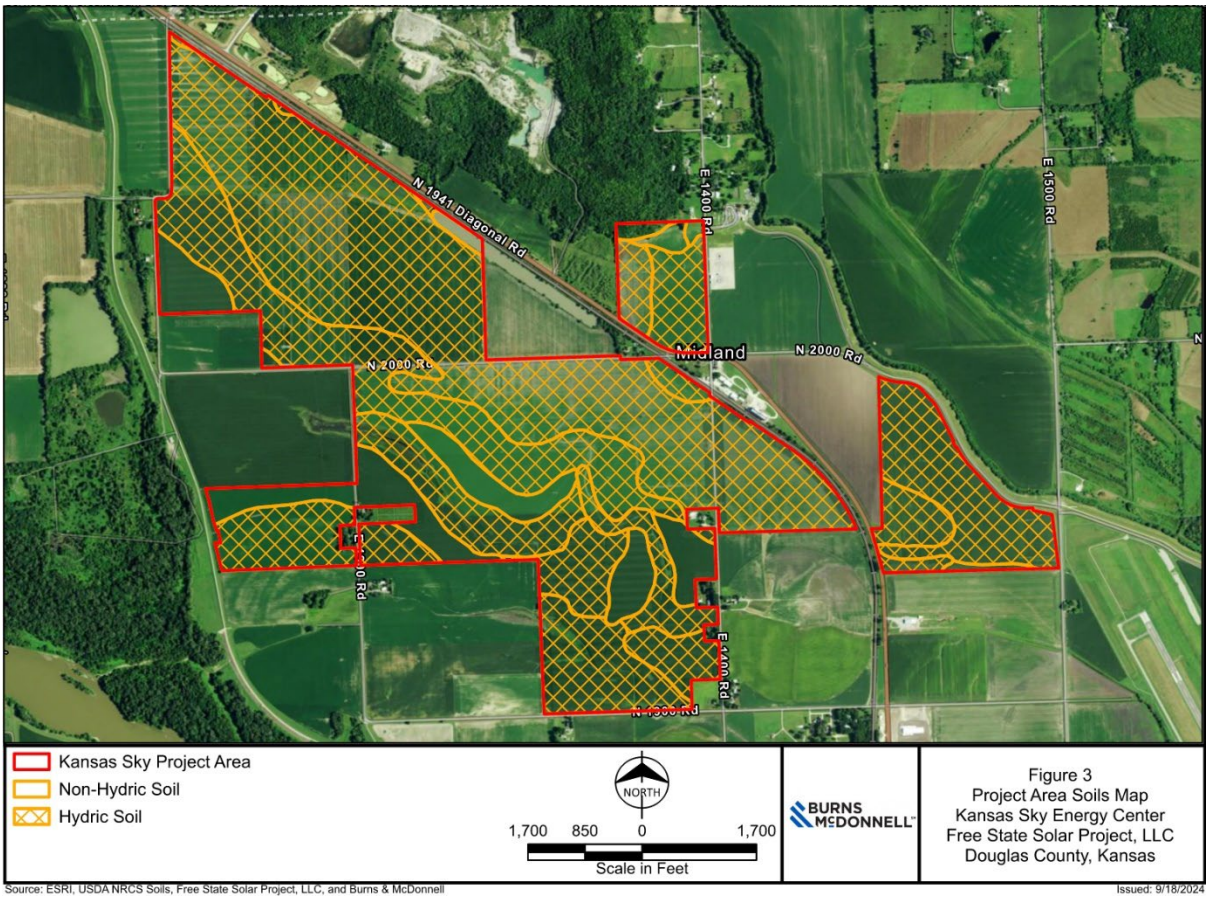
- Eudora-Bismarckgrove fine sandy loams, overwash, occasionally flooded
- Eudora-Bismarckgrove silt loams, rarely flooded
- Eudora silt loam, rarely flooded
- Eudora-Kimo complex, overwash, rarely flooded
- Kennebec silt loam, occasionally flooded
- Kimo silty clay loam, rarely flooded
- Muscotah silty clay loam, very rarely flooded
- Reading silt loam, moderately wet, very rarely flooded
- Reading silt loam, rarely flooded
- Wabash silty clay loam, occasionally flooded
- Wabash silty clay, very rarely flooded

Hydric soil map units account for a total of 88% of the Project Area (967 acres).

Table 2: Soil Map Units within the Project Area

Mapunit Name	Mapunit Symbol
Eudora-Bismarckgrove fine sandy loams, overwash, occasionally flooded	7035
Eudora-Bismarckgrove silt loams, rarely flooded	7106
Eudora-Kimo complex, overwash, rarely flooded	7127
Eudora silt loam, rarely flooded	7123
Falleaf-Grinter soils, 8 to 20 percent slopes	7271
Kennebec silt loam, occasionally flooded	7050
Kimo silty clay loam, rarely flooded	7155
Martin silty clay loam, 3 to 7 percent slopes	7302
Muscotah silty clay loam, very rarely flooded	7208
Reading silt loam, moderately wet, very rarely flooded	7213
Reading silt loam, rarely flooded	7170
Rossville silt loam, very rarely flooded	7176
Vinland-Martin complex, 7 to 15 percent slopes	7657
Wabash silty clay loam, occasionally flooded	7090
Wabash silty clay, very rarely flooded	7280
Water	9999

Figure 3: Project Area Soils Map



3. Hydrology

A wetland delineation of the Project Area to identify wetlands and other water resources was conducted in June 2022 by Burns & McDonnell wetland scientists. Hydrologic indicators were recorded at sample plots across the site. The site topography is relatively flat with few low spots. The primary source of hydrology for the wetlands identified was overland flow. Indicators within the wetlands included surface water, high water table, saturated soils, aquatic fauna, and drainage patterns.

a. Delineated Areas

Eleven wetlands and seven streams were identified during the field survey. The wetlands and stream types included Palustrine Emergent (PEM) and Palustrine Unconsolidated Bottom (PUB) wetlands. The PEM wetlands encompassed 6.24 acres and PUB wetlands consisted of 16.13 acres. The streams identified were intermittent and ephemeral. Delineated features are anticipated to be avoided during Project construction and operations.

4. Vegetation

The current Project Area vegetation is comprised mostly of agricultural row crops including corn *(Zea mays*) and soybeans (*Glycine max*). Some types of row crop fields provide ideal mediums for planting seed mixes for solar projects, however, bare ground, herbicides, and fertilizers previously used could cause increased potential of excessive weed growth.

Vegetation within delineated PEM wetlands consisted of fox sedge (*Carex vulpinoidea*), common spikerush (*Eleocharis compressa*), bur-reed sedge (*Carex sparganioides*), Pennsylvania smartweed (*Persicaria pensylvanica*), pale knotweed (*Persicaria lapathifolia*), American water plantain (*Alisma subcordatum*), and reed canary grass (*Phalaris arundinacea*).

Vegetation surrounding delineated PUB wetlands included bur-reed sedge, Johnson grass (*Sorghum halepense*), Pennsylvania smartweed, Bermudagrass (*Cynodon dactylon*), common spike rush, pale knotweed, fox sedge, and Canada wildrye (*Elymus canadensis*).

D. Summary of Agrivoltaics Phases

The Project will have three different agrivoltaics phases, which are summarized in Table 3.

Table 3: Summary of Agrivoltaics Phases

PHASE	TIMELINE	AGRIVOLTAICS PRACTICE	SUMMARY
1	Pre- Construction through End of Project Operations (i.e., through decommissioning)	Re-vegetation; Pollinators	Project will be revegetated with pollinator beneficial seed mixes across the site.
2	Post Construction through End of Project Operations	Phase 1 uses together with grazing RFP and vegetation management	Project will issue a Request for Proposal (RFP) for vegetation management options, including but not limited to sheep grazing and farming.
3	Post Construction through the life of the CUP	Agrivoltaics Research & Demonstration	Initially, the Operator will establish a $250,000 “Agrivoltaics Fund” and establish an advisory board, all in collaboration with TNC.

II. Phase 1 – Pollinator Vegetation

Establishing permanent perennial vegetation after completion of construction is a necessary first step toward implementation of agrivoltaics. Except for those portions of the Project Area utilized for project buildings (e.g., substation, operations and maintenance), parking, inverter pads, and internal access roads (which collectively constitute approximately 3% of the Project Area), permanent vegetation must be established on all of the land of the Project Area that is disturbed during construction. The seeding plan for this Project includes temporary seed installation and permanent seed installation, as described in detail in the following sections and included in the Kansas Sky Energy Center Vegetation Management Decision Tree (Appendix A). In certain areas and at certain times, where appropriate, this plan allows for the simultaneous establishment of both temporary and permanent seed mixes. The Plan generally calls for pollinator beneficial seed mixes including a mesic-moist short mix beneath the solar array, and wet or mesic-moist mid-tall mix in the perimeter area outside of the fence line including wildlife corridors. The exceptions to this are areas identified for grazing or agriculture in Phase 2 or Phase 3 (discussed below), which may need to be revegetated with a forage seed mix or some type of crop, respectively, as illustrated on Appendix A. While all seed mixes utilized in Phase 1 are acceptable for grazing, a sheep grazer utilizing specific areas that have been identified for grazing activity may desire to revegetate that area with a forage seed mix, for example.

A. Installation & Seeding Plan

The dominance of hydric soil in the Project, and potential soil compaction during solar construction could decrease water infiltration resulting in wetter soils that favor graminoid species more tolerant to moist conditions. Construction phasing is still to be determined and the amount of soil compaction will depend on a variety of factors including time of year, existing vegetation/crop residue, and precipitation. The combination of potential soil compaction, different soil types, construction intensities, coupled to Project vegetation height compatibility goals requires site-specific seed mix design. The proposed seed mixes, consist of low growth stature species suitable to dry mesic through moist mesic conditions, and tolerant to both full sun and shade. The diverse species seed mixes and corresponding seeding rates allow for a variety of species suitable to site-specific parameters for rapid and robust establishment throughout the Project Area.

1. Temporary Seed Installation

The purpose of temporary seeding is to stabilize soils disturbed by the Project prior to or as a result of construction or that have been removed from productive land use until permanent vegetation establishes, and is intended to meet two primary objectives:

- Compliance with the SWPPP, CUP, and the Resolution.
- Enhancement of soil quality prior to installation of permanent seed mixes in the array areas.

Annual grasses will be utilized to stabilize soils and enhance soil organic matter. The specific species to install and the installation rate shall be selected based on the timing of installation and whether the temporary cover is being installed with or without permanent seed.

a. Pre-Construction Site Preparation

Depending on the type of field crops in production, different pre-construction treatments will be required before solar construction and temporary cover crop installation begins. Soybeans, small grains, and forage crops produce miminal crop residue and thus provide ideal soil surfaces for temporary plantings. Corn field production generally produces excessive crop residue and compacts soils which can lead to decreases in evaporation and drainage, creating issues for vegetation management and solar construction. Final crops prior

to construction should be determined in consultation with the current land management. The best final crop before construction begins is one that will produce minimal field residue and the least amount of compaction. If past hebicide use on the Project is listed as having a residual affect that would negatively impact the germination and growth of the chosen seed cover crop, a seed mix will be designed to counteract the herbicide residual affect period, which can be upwards of 18 months.

b. Temporary Seed Cover Crops & Installation

Temporary cover (crop) species will be comprised of native and naturalized annual grasses. Annual cereal grasses such as common oats (*Avena sativa*), annual rye-grass (*Lolium multiflorum),* or winter wheat (*Triticum aestivum*) establish quickly, provide erosion control, establish residue for later permanent seedings, build soil organic matter, and assist with weed suppression.

Temporary cover installation rates are higher when the seed is not installed concurrently with permanent seed in order to provide adequate vegetative cover. Seeding rates will also vary depending on the season they are installed.

2. Permanent Seed Installation

Proposed Project seed mixes will be in alignment with Kansas native and naturalized species and the requirements developed in the 2020 Nationwide Monarch Candidate Conservation Agreement with Assurances (CCAA). Proposed seeding locations are dependent on the final approved design (e.g., panel placement, distance between panels, fence placement) as reflected in the approved site plan (as such design may be amended from time to time in accordance with the Solar Regulations). Figure 4 indicates the different vegetation and land use options for the leased land inside and outside of the project fence. Final seeding preparation will depend on vegetation management during construction, soil amendment and reparation, and eradication of undesirable vegetation.

a. Soil Reparation & Seed bed Preparation

Vegetation management should be ongoing during the construction period and not performed in areas under active construction. Weed control is critical to promote establishment of root systems in native seedlings. Control of invasive and noxious weeds may consist of mowing or herbicide treatments (See Vegetation Management). Coordination of vegetation management and construction should be established during the development of the construction schedule. It is anticipated that herbicide use will decrease from the current condition, and continue to decline upon establishment of permanent vegetation.

Soil sampling timing and analyses will be in accordance with Section 12-306-49 of the Solar Regulations, and include but are not limited to total carbon, heavy metals, and phospholipid fatty acid. More details are provided in the Project Soil Sampling Plan (Appendix C). No phosphorous shall be used at the time of planting unless soil testing indicates a phosphorous deficiency that is harmful or will prevent new vegetation from proper establishment. If tests indicate a phosphorous deficiency that will impact establishment of vegetation, then phosphorous will be applied at the minimum recommended level prescribed in the soil test following all applicable standards, requirements, and regulations. Compacted soils should be chisel plowed or disc harrowed and then drag harrowed to create a suitable bed for seeding. If space is limited, such as under PV panels, for tilling/harrowing equipment, plant species can be selected and application rates can be adjusted to mitigate the lack of seed bed preparation. Soil amendments may be necessary if topsoil conditions are depleted or deviate from pre-construction conditions. Amendments may consist of biochar, compost, fertilizer, and mycorrhizae applications.

Prior to the final installation of a permanent seed mix, existing temporary vegetation should be removed by mowing to a height of <4 inches at least 1 week prior to final seed installation. Mowing is expected to be the most efficient method of removing the temporary vegetation contemplated by this plan, but the Project may

employ other means as reasonably necessary to comply with the SWPPP, the CUP or the Conditions. Vegetation cutting shall be appropriately timed to assist with control of invasive species (e.g., mow biennial species during flowering but prior to seed production) and to remove vegetation to assist with site seedbed preparation. Hand mowing may be required if equipment cannot access certain areas due to standing water, slopes, or tight spaces. Depending on the herbicides used for weed control, the application should occur at least two weeks prior to seeding. One application may be sufficient as the land was previously used for agriculture. Use of herbicides will be in accordance with local and state ordinances.

b. Permanent Seed Mix and Post-Construction Installation Inside the Project Fence

In accordance with the Project decision tree, permanent seed will generally be installed after construction, after weedy and invasive species of concern have been managed, except where planting temporary and permanent seed mixes are expected to be optimal for the most efficient establishment of permanent ground cover. The permanent native and naturalized seed mixes should be installed during the spring seeding window (approximately March 15-June 15) or the fall/frost seeding window (October 30-snow cover or during a period of light snow in the winter). A temporary cover crop may be installed with the permanent seed if installed during the spring (common oats) but may require a separate and earlier installation than the permanent seed if installed during the fall/frost seeding window (annual rye-grass or winter wheat).

Seed may be installed with a seed drill or with a broadcast seeder within and between the PV panel rows and near above-ground structures. Following seed broadcasting, a roller should be used to facilitate good seed to soil contact. Areas receiving permanent seed mixes may be mulched with clean, weed-free straw, as needed to retain moisture and promote seed germination. Areas without remnant temporary cover crop thatch may need mulching. Once seeded, spot treatment of weeds will be completed manually or using spot application of herbicide.

One permanent seed mix has been identified for the Project within the array (Figure 4), that is based on commercial availability and meeting the requirements for the Nationwide Monarch CCAA and with input from the Kansas Biological Survey. Some future modifications may be made based on further review and input from the Kansas Biological Survey. The permanent seed mix can be found in Appendix B and is as follows:

1. Mesic-Moist Short Mix

The seed mix is intended to provide permanent, low maintenance, low growth, shade, and drought tolerant vegetative cover containing native grasses, sedges, rushes, and wildflowers. Additionally, this mix is designed to be cost-effective, while providing deep-rooted plants that are highly diverse in locations where other wildflowers are not suitable. Once established, this seed mix has the potential to offer a variety of wildlife benefits. This mix may be installed within the paneled areas where the establishment of permanent, low growing (less than 24 inches in height), shade tolerant and drought tolerant species are needed, such as under and between the PV panel arrays. This mix may also be installed around the PCUs/inverters, as they may be subject to frequent disturbance, and within a five-foot buffer from the access roads to maintain low growing and green vegetative cover where there is adjacent vehicle traffic. Please see Appendix B for the full species list.

c. Permanent Seed Mixes & Post-Construction Installation Outside of the Project Fence

In accordance with the Project decision tree, permanent seed will be installed outside of the Project fence after construction, if the landowner has not elected to revert the land to agriculture production, and after weedy and invasive species of concern have been managed. The permanent native and naturalized seed mixes should be installed during the spring seeding window (approximately March 15-June 15) or the fall/frost seeding window (October 30-snow cover or during a period of light snow in the winter). A temporary cover crop may be installed with the permanent seed if installed during the spring (common oats) but may require a

separate and earlier installation than the permanent seed if installed during the fall/frost seeding window (annual rye-grass or winter wheat).

Seed may be installed with a seed drill or may also be broadcast. Following seed broadcasting, a roller should be used to facilitate good seed to soil contact. Areas receiving permanent seed mixes may be mulched with clean, weed-free straw, as needed to retain moisture and promote seed germination. Areas without remnant temporary cover crop thatch may need mulching. Once seeded, spot treatment of weeds will be completed manually or using spot application of herbicide.

Two permanent seed mixes have been identified for the Project within the wetter or drier areas outside of the Project fence (Figure 4), that are based on commercial availability and input from the Kansas Biological Survey. Some future modifications may be made based on further review and input from the Kansas Biological Survey. The permanent seed mixes can be found in Appendix B and are as follows:

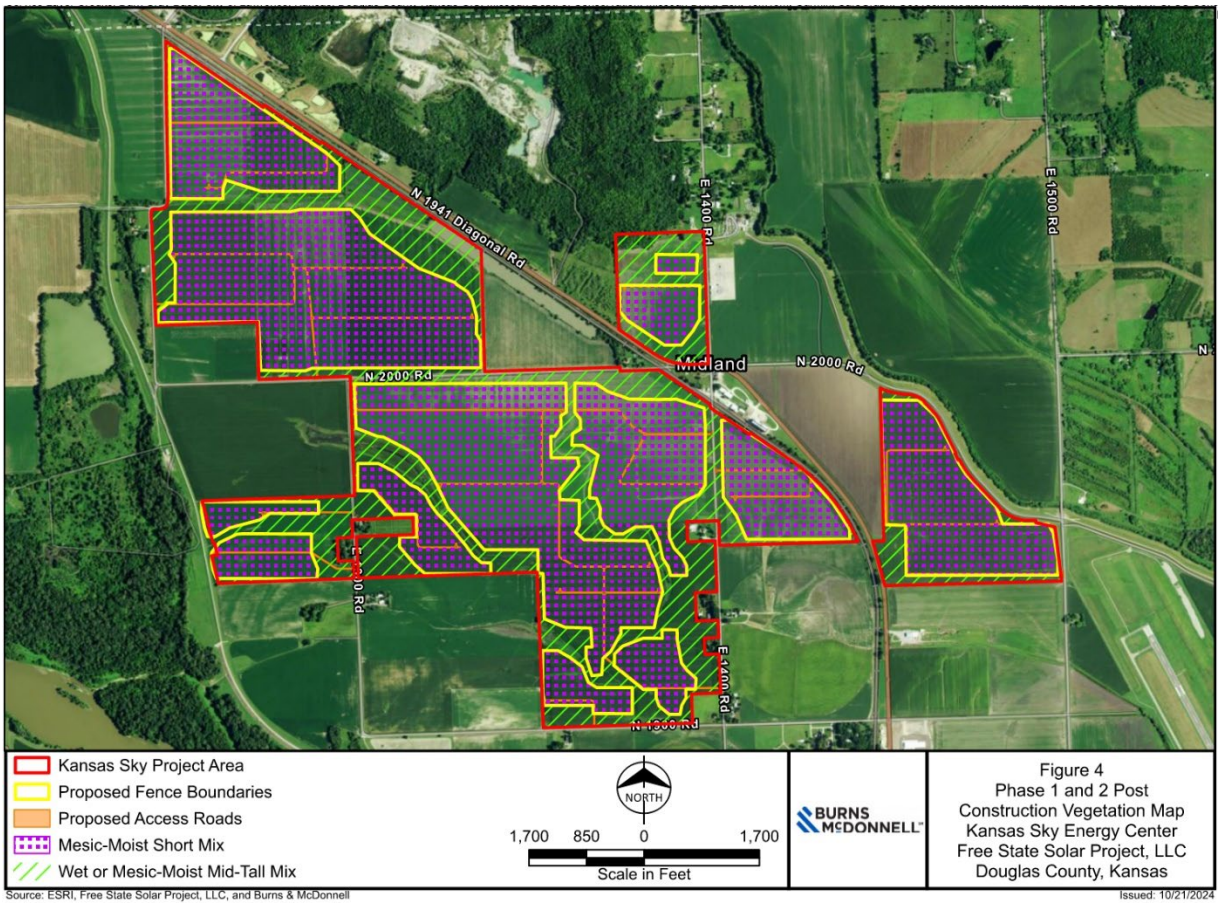
1. Wet Mid-Tall Mix

This mix contains native grasses, sedges, rushes, and wildflowers. The mix is intended to promote a diversity of wildflowers, with flowering occurring over each of the three blooming periods (spring, summer, and fall), along with native bunch grasses and sedges that are friendly to pollinators and can tolerate wetter conditions. The seed mix is intended to be cost-effective yet robust, provide native plant cover and diversity, and improve soil health. This mix may be installed in the drainageways and wetlands outside of the Project fence.

2. Mesic-Moist Mid-Tall Mix

This mix contains native grasses, sedges, rushes, and wildflowers. The mix is intended to promote a diversity of wildflowers, with flowering occurring over each of the three blooming periods (spring, summer, and fall), along with native bunch grasses and sedges that are friendly to pollinators. The seed mix is intended to be cost-effective yet robust, provide native plant cover and diversity, and improve soil health. This mix may be installed outside of the Project fence in the drier areas, especially near existing habitat; specifically, areas such as tree lines and grasslands.

Figure 4: Phase 1 and 2 Post-Construction Vegetation Map



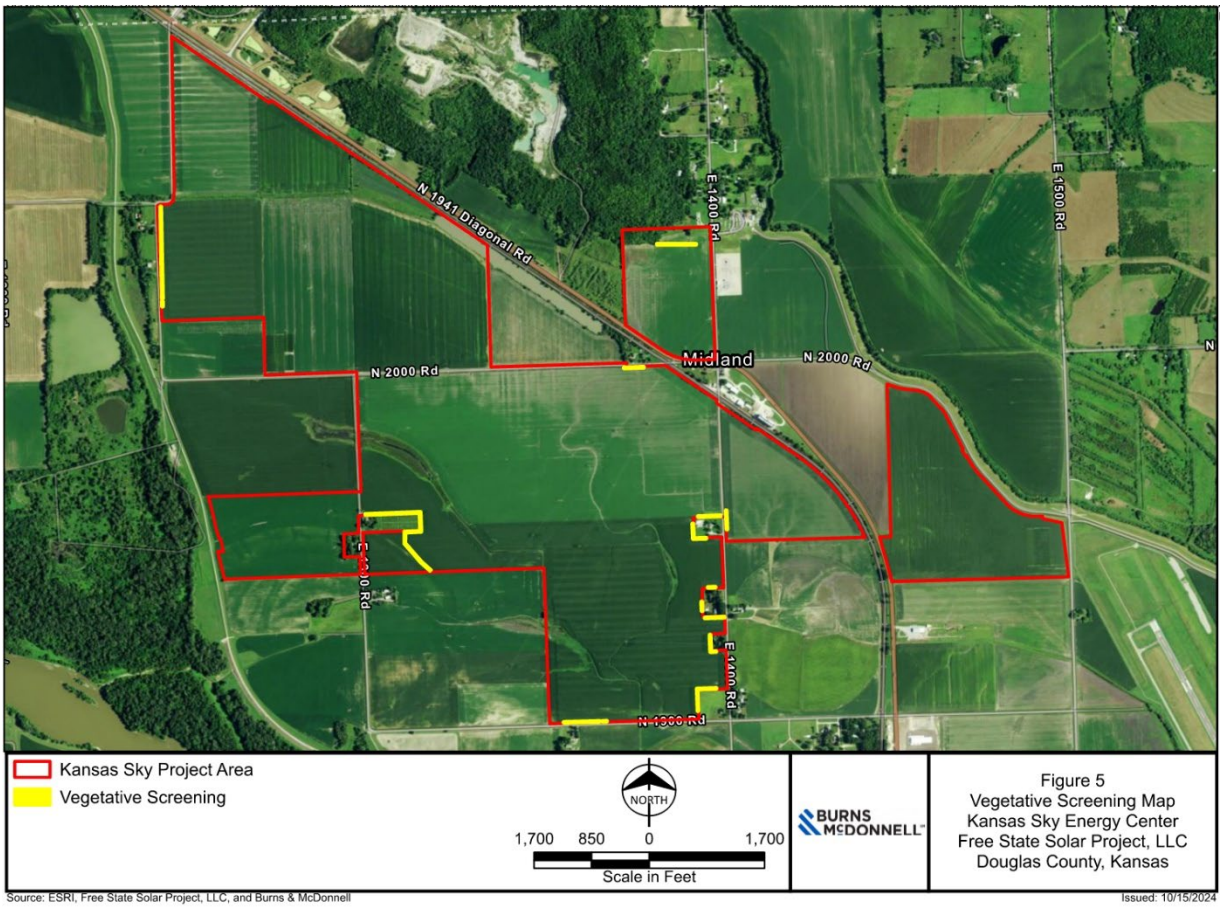
B. Buffering & Screening

Landscape buffer requirements in Section 12-306-49 of the Douglas County Code Zoning and Land Use Regulations state:

> "Unless waived by the property owner, a 25-foot deep buffer area shall be provided, and maintained, along property lines between the systems and adjoining nonparticipating residential properties, or along the Site Area fencing for participating residential properties, for the purpose of screening the residential portion of the property."

Free State is proposing to install approximately 4.6 acres of vegetative screening near residences (Figure 5) to buffer the view of the facility from the residence and the residential portion of the property. The specifications of the landscape buffer can be found in the Landscaping Plan documents. The specific plantings for each landscaped buffer shall be determined in accordance with the process set forth in the Resolution, *Conditions of Approval*, paragraph f.

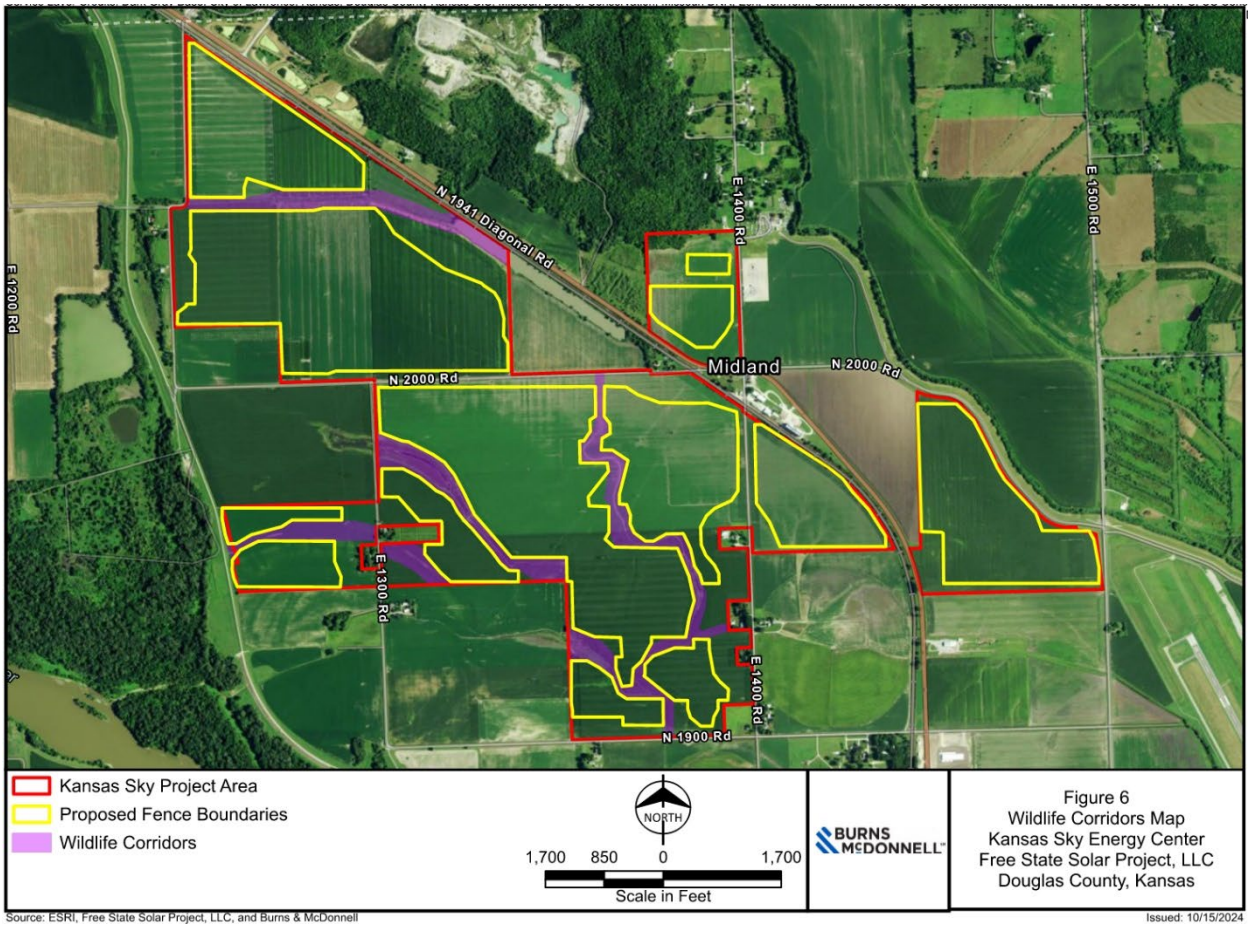
Figure 5: Vegetation Screening Map



C. Wildlife Corridors

Based on preliminary survey data and habitat evaluations, the Project is proposed to be primarily built on land that has been cleared and is actively maintained for agriculture. The conversion from cropland to agrivoltaic uses (and future return to agricultural use following decommissioning) is not likely to have a significant adverse impact on the wildlife currently utilizing the area, and a significant shift in the wildlife community is not anticipated. Existing wildlife corridors (stream channels and wetlands) are not expected to be impacted during solar construction and operation. However, any wildlife corridors that require re-seeding will be included in the post-construction installation outside of the Project fence.

Figure 6: Wildlife Corridors Map



D. Seed Planting Schedule

Annual oats and other appropriate temporary seed mixes will be hand broadcasted or drilled promptly after fine grading has occurred. The three potential seed mixes should be planted between April 1st through June 18th or October 1st through November 30th after construction is complete

III. Phase 2 – Vegetation Management

Site vegetation would be considered established when the Kansas Department of Health and Environment General Construction Stormwater Permit Notice of Termination has been filed, and the vegetation bond required as *Conditions of Approval* paragraph ee. of the Resolution, in the amount of $1,100/per acre for each acre within the limit of disturbance, has been released. Phase 2 of this Plan addresses the methods of vegetation management to be utilized within the Project Area. Initially, the majority of vegetation management is anticipated to be mechanical. However, during vegetation establishment, the Project will issue an RFP for vegetation management services including, but not limited to sheep grazing and farming outside of the Project fence line. Over time, as more portions of the Project Area are utilized for research and demonstration in Phase 3 or managed via grazing or farming activities, the Project's use of mechanical vegetation management should decrease (but there will always be areas requiring mechanical mowing or weed trimming). Years 3-5 represent a transition phase where desirable vegetation becomes increasingly established but remains susceptible to weed growth.

A. First Three Years

The Project Area will be monitored after construction and during the vegetation establishment period when the site is most vulnerable to colonization by invasive vegetation and noxious weeds. The establishment period typically lasts 2-3 years, while native plants establish root systems and have periods of flowering and germination. Invasive species and weeds will be controlled using methods deemed appropriate for maintenance of the solar array and soil integrity (e.g., spot application of herbicide, manual removal). Monitoring and maintenance of vegetation within the Project Area will be completed in coordination with SWPPP inspection requirements by a qualified person that is able to identify desired vegetation to facilitate proper establishment.

Areas of bare soil will be reseeded within six months of the first monitoring event post construction to minimize soil erosion and loss of nutrients. Newly seeded areas will be inspected within six months following application, and in the spring, summer, and fall thereafter. Areas with less than 70% coverage will be repaired or reseeded. Overseeding to repair bare spots should be completed annually between March 15 and May 15 or between September 1 and October 15.

B. Vegetation Management

Monitoring of established vegetation should be conducted by personnel that are qualified to identify undesirable plant species, as identified by the Douglas County Noxious Weed Department and more particularly described in Appendix D, for treatment. Long-term vegetation monitoring should occur a minimum of two times per year during the growing season (May 1 to October 15),

a) Vegetation Monitoring Methodology

Vegetation will be monitored using aerial imagery, general field observations and data collection via transects established across the Project. Transects will be fixed, random or mixed, and the number will be identified depending on the needs of the site as determined post construction. For consistency between years, fixed transects will be surveyed during each monitoring event. During the monitoring, plants within the transect will be identified to species, when possible. The number of native, naturalized, invasive, and noxious plants will be evaluated to determine the vegetation dominance within the Project area. These general observations, imagery and collected data will inform management practices to be implemented post-survey. As predominant areas of the project are deemed well established, stable and of desired vegetation, vegetation monitoring may be reduced to annual after 10 years of monitoring.

b) Herbicide

Herbicide application should only occur when necessary and once vegetation has been established and applied by an applicator certified by the Kansas Department of Agriculture. Primary vegetation management with herbicides should focus on spot treatment. Broadcast herbicide treatment should only be considered if large areas of noxious or invasive weeds have been established. Extra caution should also be taken to avoid desirable species that have been seeded. Herbicide should not be applied within 50 feet of any wetlands or streams within the Project and during the non-blooming season. If herbicide is needed during the blooming season it is recommended to apply spot treatment of herbicides early or late in the day, on cloudy, cool days when pollinators are least active. The use of herbicides will be in accordance with local and state ordinances. Herbicide use should be discontinued at least one year prior to decommissioning to ensure breakdown of residual herbicides prior to return to agricultural production.

c) Cutting/Mowing

To maintain access to infrastructure, mowing will be completed any time prior to seeding or after vegetation has been established in seeded areas, by reaching a height of 8 to 12 inches across the entire Project site. Areas within the Project fence that have reached 8 to 12 inches in height, will be mowed and maintained to a height of approximately 4 to 8 inches. The vegetation outside of the Project fence should initially be mowed to 6 to 8 inches during the first and second growling season, and then raised to 10 to 12 inches for the third growing season and the rest of the CUP lifespan. Mowing will be targeted to occur October 15th to April 1st on a regular frequency (Table 4), to the extent practical to avoid monarch butterfly season, migratory bird nesting season and pollinator flowering times. The secondary window for mowing, which is recommended only if necessary, is June 30th to July 10th (Monarch Joint Venture, 2019). The number of mowing occurrences per year will vary based on conditions but should generally fall within these timeframes. Additional mowing events may be required depending on the seasonal rainfall events.

The frequency of mowing may be reduced (approximately once per year or once every other year in the long term (i.e., years 6-25)), or transition to selective mowing or grazing to target specific areas of weed growth and minimize vegetation height under the PV panels. Mowing at this time may be done to reduce thatch and litter build-up and minimize the establishment of woody vegetation. See Table 4 for preliminary mowing timings and frequency for the first four years of the Project.

Table 4: Preliminary Mowing Timing and Frequency

Seed Mix	TimeLine			
	Year 1	Year 2	Year 3	Year 4+
Mesic-Moist Short Mix	When vegetation reaches 8-12 inches following seeding, then every 4-6 weeks	Every 6 weeks or when vegetation reaches 18 inches	Every 6 weeks or when vegetation reaches 18 inches	When vegetation reaches 18 inches
Wet Mid-Tall Mix	When vegetation reaches 8-12 inches following seeding, then every 4-6 weeks, unless saturated soils or inundation prohibits	Biannually or as needed	Biannually or as needed	Annually or biennially
Mesic-Moist Mid-Tall Mix	When vegetation reaches 8-12 inches following seeding, then every 4-6 weeks	Biannually or as needed	Biannually or as needed	Annually or biennially

C. Grazing

The Project Area will include areas for the grazing program RFP for vegetation maintenance. Replacing traditional methods of vegetation maintenance with grazing decreases fuel emissions and makes the area safer for wildlife, especially ground nesting birds. The Project has obtained a Grazing Management Plan (Grazing Plan), which is attached to this Plan as Appendix E. In the event of a conflict between the terms of this Plan and the Grazing Plan, this Plan shall govern and control. The Grazing Plan is suggestive, and is intended to be a supporting document to the RFP. The RFP will encourage respondents to identify opportunities to improve the RFP and make it more specific and appropriate for the Project conditions based on the respondents' local knowledge and expertise. At this time, only sheep grazing proposals are anticipated to be requested or considered (and such proposals may also be considered in combination with mechanical mowing). Because the cost of vegetation management (whether via grazing, farming, or other acceptable means) is an expense of the Project, and due to the regulatory constraints of the Project budget, Evergy shall retain full and final discretion over the terms and conditions of the RFP, and shall have sole authority to select winning proposals, if any. TNC will manage grazing activities at the Project once an awardee has been identified.

As the Grazing Plan notes, sheep are the recommended livestock for grazing underneath panels and racking equipment because they are small and agile (Appendix E, p. 4). Their size and strength mean that any rubbing on equipment is unlikely to impact the PV panels negatively (Appendix E, p. 4). The RFP will incorporate the recommended regenerative grazing practices described in the Grazing Plan. Although some degree of mechanical vegetation management will be necessary during the life of the Project, particularly around fences and at the base of solar panels, Phase 2 includes, as part of the overall vegetation management of the Project, an RFP soliciting grazing services. The Operator will provide a draft of the RFP (whether one or more) to the Board (defined below) at least thirty (30) days prior to publicizing the RFP, for the Board to provide comments and input on the activities included in the RFP. To the extent any additional fencing is required to create grazing paddocks (Appendix E, p. 18) or other agricultural structures are proposed to be installed, the Project will obtain appropriate agricultural use determinations from Douglas County, if applicable.

The Project will always require some mechanical (e.g., mowing, weed trimming) vegetation management. For example, mechanical vegetation management will be necessary to manage vegetation around fences, to

create and maintain fire breaks, to control invasive species, promote native vegetation growth and otherwise implement the then-current Fire Safety Plan. The post-construction agrivoltaic reviews and reports will describe the areas where mechanical vegetation management are necessary and incorporate by reference applicable Fire Safety Plans.

IV. Phase 3 – Agrivoltaics Research and Demonstration

In Phase 3, the Project will utilize various resources and processes to promote and incorporate additional agrivoltaic activities, research and concepts. Agrivoltaics is intended to support biodiversity, and to promote agricultural practices that improve soil health, promote diverse vegetation types, build soil organic carbon, foster a diverse soil microbial community, reduce stormwater runoff, sequester more carbon in soils, reduce nutrient leaching, reduce soil erosion, minimize fertilizer use, create habitat, and cultivate fertile pastureland. Evergy proposes to collaborate with TNC, to enable TNC and other stakeholders to establish an agrivoltaics program (the Program). The purpose of the Program is to support innovation and research in agrivoltaics that could lead to the future expansion and diversification of agrivoltaics at the Project with numerous benefits to the local agricultural producers and the Douglas County food system as a whole. Phase 3 may occur contemporaneously with and after the completion of activities in Phase 2. Phase 3 activities will occur at locations to be determined within the Project (including under solar panels and outside the fenced areas). Agrivoltaics is a nascent industry, and the Project has the potential to pioneer previously untested or presently unknown agrivoltaic uses of the land. While many of the details of the agrivoltaics used in Phase 3 will not be ascertainable until after the Project has been completed and re-vegetated, this Plan represents the foundation of investment and collaboration with key parties to maximize opportunity and visibility to the expansion of agrivoltaics.

A. Potential Phase 3 Agrivoltaic Activities

Agrivoltaics is the dual use of land on solar facilities for agricultural practices. In accordance with Section 12-306-49.06 of the Solar Regulations, the Project will include agrivoltaics onsite. In addition to the pollinator vegetation and site grazing agrivoltaic uses established in Phases 1 and 2, the following non-exclusive additional agrivoltaic uses are possible in Phase 3, both inside and outside of the Project fence:

1. Specialty Crops

The planting of specialty crops such as sunflowers, lavender, or vegetable crops may be used to assist in nutrient retention and water infiltration into the soil, at locations to be determined.

2. Perennial Agriculture

Perennial grain crops such as legumes, oilseeds, rice and sorghum are species that do not need to be reseeded, replanted, and utilize significantly less herbicides. These plants assist in nutrient retention and water infiltration into the soil. The aim of perennial agriculture is to assist in restoring the ecosystem to what is found in natural and undisturbed systems.

3. Apiary

The Project will be planting vegetative cover containing native grasses, sedges, rushes, and wildflowers, which is the preferred habitat for pollinators. A grant awardee may propose to establish and maintain beehives or boxes.

4. Research and Demonstration

Areas vegetated with permanent seed mixes can be studied to ascertain soil composition over the life of the Project. Phase 3 may also include other types of scientific and agricultural research and other concepts to experiment with agricultural uses within the solar project.

B. Collaboration with The Nature Conservancy

Evergy intends to collaborate with TNC, and TNC intends to assist in the implementation of certain agrivoltaics projects within the Project Area, with the aim of increasing and promoting knowledge of successful agrivoltaics practices. TNC's primary goal is to develop replicable and scalable resources supporting the clean energy transition with responsible land use. Outcomes associated with that primary goal include:

1. Measurement

Measurable and replicable results for both agricultural producers and utility scale solar project operators.

2. Data

Agricultural production research that would provide techniques, inputs, and yields for various types of agriculture, including those most likely to be applied in areas of future renewable deployment.

3. Demonstration

Develop research that would demonstrate access controls, lease and legal agreements (on owned and leased acreage), engineering modifications, and payment rates suitable for profitable but responsible agrivoltaic sites at the Project.

Given the size proposed for this agrivoltaic project, there would be no predetermined set minimum or maximum acres. Rather, acreage would be incorporated into the Project as called for by the implementation plan and with consideration to the uncharted nature of agrivoltaics on leased land as a research area. If TNC's involvement with the Project should cease, the Project will attempt to identify another third party consultant to assume TNC's role.

C. Establishment of an Agrivoltaics Research Fund

A fund (Agrivoltaics Fund) in the amount of $250,000 will be set up to directly support Phase 3 and leverage matching funds for the Program. The Agrivoltaics Fund includes a $100,000 commitment from Savion, LLC, and a $150,000 commitment from Evergy. The Agrivoltaics Fund will be established prior to the completion of construction of the Project, and will be available to award grants to awardees and other uses deemed worthwhile by TNC or the Board.

D. Organization of an Agrivoltaics Advisory Board

Prior to the Project's completion date (i.e., the date the Project commences commercial operations), the operator of the Project (Operator) and TNC will identify and invite other stakeholder organizations to join an agrivoltaics advisory board (the Board). The Board will be comprised of stakeholders representing at least Douglas County, TNC, Evergy, and may also include representatives from local agriculture, industry experts and researchers. Once the initial membership of the Board has been determined, the Board's first activity will be to adopt bylaws or other governing documents (the Bylaws). The Board will be an advisory body, managed by TNC or other approved third-party. The Board is not expected to file articles of incorporation or similar organizational documents with the Kansas Secretary of State's Office, but nothing in this Plan prevents the Board from doing so, in its discretion. The Board will consist of volunteers. Notwithstanding the inclusion of a representative of Douglas County, Kansas, this Plan does not anticipate the need for County staff to provide support.

In general, the Board will: (a) review and provide commentary to the grazing RFP anticipated in Phase 2; (b) assist in the drafting and parameters of agrivoltaic grant fund applications and criteria and target grant recipient groups; (c) approve grant recipients and corresponding grant funds, up to the limits of the then-current Agrivoltaic Fund; (d) review and document on a regular basis the progress toward Phase 3 agrivoltaic

activities; (e) assist in the preparation of and documenting metrics related to post-construction Phase 3 agrivoltaic plans and reports; and (f) such other activities described in the Bylaws or determined by the Board not inconsistent with the Bylaws. The membership of the Board will be subject to reappointment in a manner described in the Bylaws. As a not-for-profit advisory board, the Board will not own any assets or possess any powers greater than those set forth in the Bylaws.

The Resolution requires multiple agrivoltaic reviews over the term of the Project, the first being twelve to twenty-four months from the release of the Certificate of Completion. The Board will assist the Operator in preparing the detailed agrivoltaic report, listing the agrivoltaic area and the type of agrivoltaic activities achieved. The Board will assist in identifying measurable metrics in accordance with the conditions of the Resolution.

E. Grant Applications and Administration

The Board will establish the standardized rubric for evaluating grant applications, with considerations for approach, impact, innovation, agricultural producer benefits, diversity, equity and inclusion, budget, experience, research diversity and such other parameters that the Board may reasonably establish. The Board will prepare the grant application documents and be responsible for disseminating the grant application invitations. The grant application would be publicized within a reasonable time following completion of construction, with the goal of awarding up to three (3) grants within twelve (12) months. The applicant awardees could commence research and development activities upon completion of Phase 1. The vegetation management activities within Phase 2 include the issuance of an RFP for utilizing sheep grazing and/or farming to provide necessary site vegetation management.

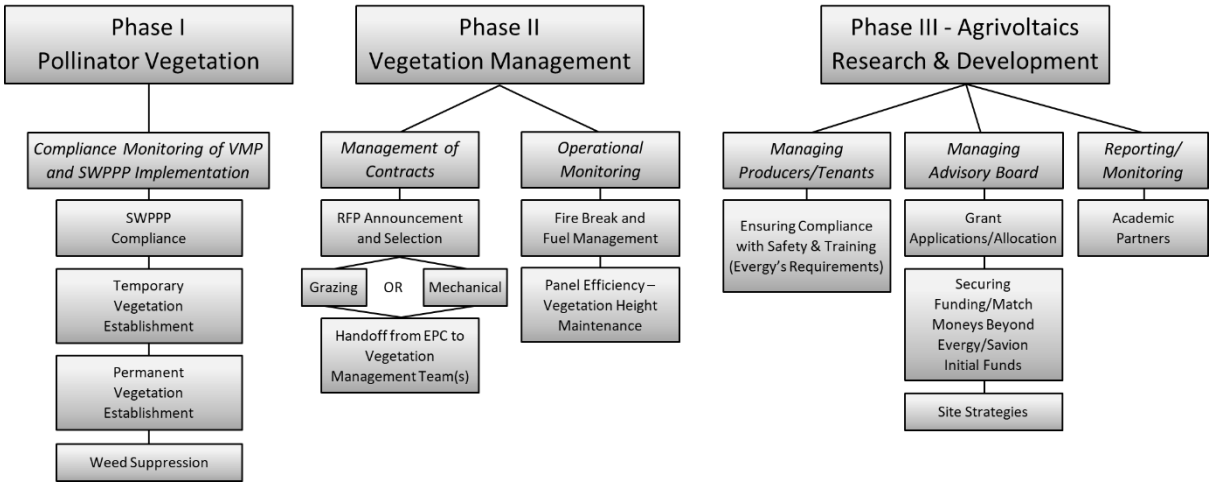
F. Agrivoltaics Reporting

Grant recipients will be required to provide the Board periodic reports and updates. To the extent the County has representation on the Board, such County appointee may provide updates to the County Commission. The periodic reports will also be considered for inclusion in various agrivoltaic reports and updates required by the CUP. In addition, the Resolution requires multiple agrivoltaic reviews over the term of the Project, the first being twelve to twenty-four months from the release of the Certificate of Completion. The Board will assist the Operator in preparing the detailed agrivoltaic report, listing the agrivoltaic area and the type of agrivoltaic activities achieved. The Board will assist in identifying measurable metrics in accordance with the conditions of the Resolution. The Board will also assist in the creation of a map depicting areas of agrivoltaic uses of the Project Area.

G. Phasing Workflows

As depicted in Figure 7, Evergy (as the proposed owner and operator of the Project) has the primary responsibility of implementing Phase 1 and Phase 2, except that TNC will administer any grazing programs selected as a result of the RFP. TNC will have primary responsibility to administer the agrivoltaics research and development activities described in Phase 3. With respect to each of the functions described in Figure 7, regardless of which party is designated as having primary responsibility, both parties will work collaboratively.

Figure 7: Phasing Workflows

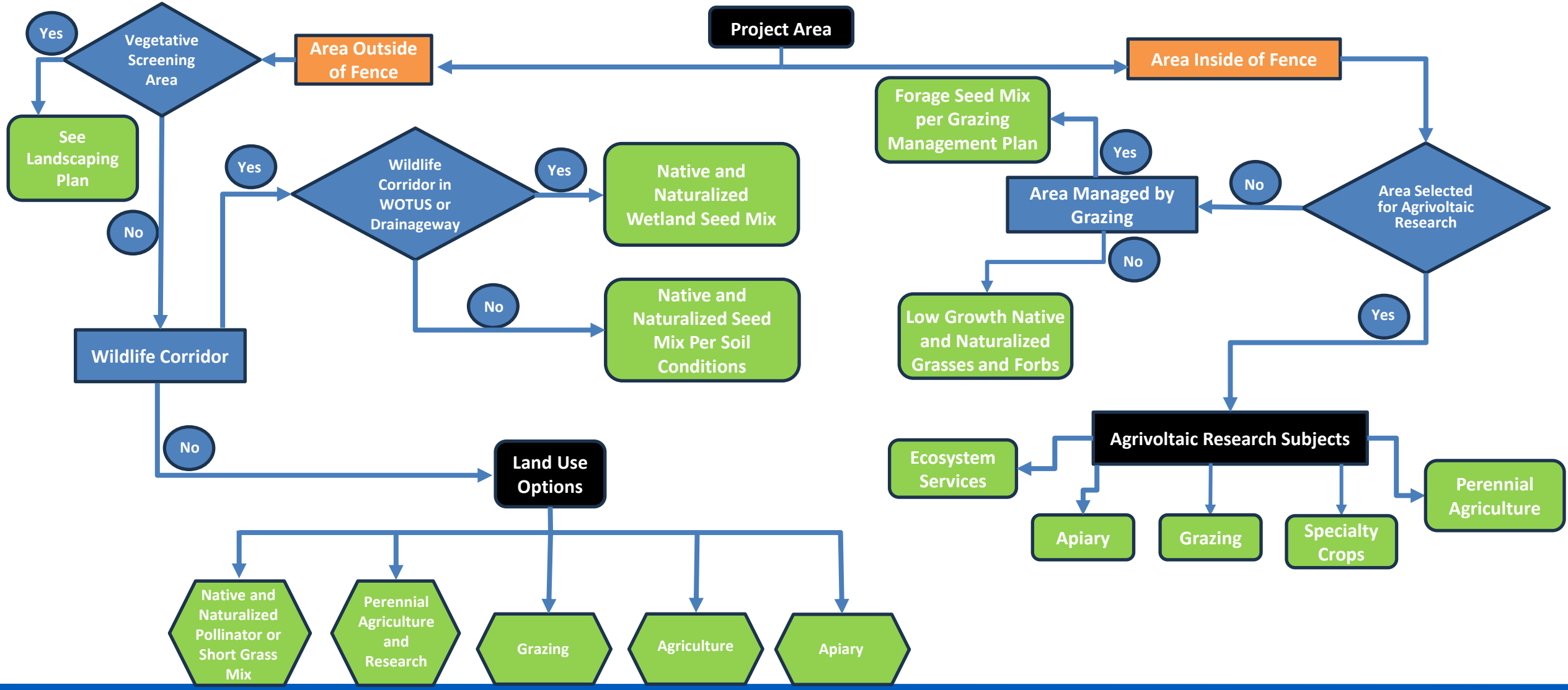


V. Summary

This Vegetation & Agrivoltaics Management Plan addresses the management of vegetation in the Project Area during the construction and operation of the Kansas Sky Energy Center. This plan satisfies the requirements of the Solar Regulations, the CUP and the Resolution. It is anticipated that by following this plan during the construction and operation of the facility, there will improved soil health, increased nutrient retention, higher native plant species diversity, and a preferred habitat for local wildlife and pollinators, including the Monarch butterfly, when compared to the conventional monoculture practices currently in use. This plan will allow the Project Area to become a more nutrient rich soil for any desired agricultural practices after Project decommissioning.

APPENDIX A – KANSAS SKY ENERGY CENTER VEGETATION MANAGEMENT DECISION TREE

Kansas Sky Energy Center Vegetation Management Decision Tree



APPENDIX B - SEED MIXES

Mesic-Moist Short Mix

Shorter statured species mix of native cool and warm season grasses, sedges, rushes and wildflowers/forbs. This mix is best where low growth height is desired, such as solar arrays, or other areas where low height vegetation is desired. If a taller visual screen is desired at the outer perimeter/buffer or to establish wildlife corridors, a tall native pollinator mix may be used in such areas. Forbs listed in this table are all nectar plants for the Monarch Butterfly, beneficial to other pollinators such as bees and other butterflies.

If any species of this mix are unavailable, omitting or a substitution of a species may be made after review and approval by Owner.

Project Name- **Acres Seeded with Mix-** **Location-**

Common & Scientific Name	**Height of plant & species notes**	**Blooming Period** (flowers all season provide nectar as the Monarch migrates spring thru fall)	**Wetland Indicator Status (MW)**	**Color of Flower**	**PLS lbs./acre and % by weight**
GRASSES and grass-like plants such as sedges or rushes –	Native grasses and grass-like are larval host plants to many species of pollinators.	Flowers of grasses and grass-like plants are small and inconspicuous			Approximately 60-90% by weight
Virginia Wild Rye, *Elymus virginicus*	24”, seed head may extend to 36”		FACW		
Autumn Bentgrass, *Agrostis perennans*	24”		FAC		
Fox Sedge, *Carex vulpinoidea*	24”, seed head may extend to 36”		FACW		
June Grass, *Koeleria macrantha*	24”		UPL		
Prairie Dropseed, *Sporobolus heterolepis*	24”		FACU		
Path Rush*, Juncus tenuis*	12”		FAC		
Inland Rush, *Juncus interior*	24”		FAC		
Dudley’s Rush, *Juncus dudleyi*	24”		FACW		
EARLY SEASON BLOOMING FORBS –	High Quality Nectar Plants of the Monarchs and other pollinators.				Approximately 10-40% by weight
Blackeyed Susan, *Rudbeckia hirta*	12-24”	May-June-July-Aug.-Sept	FACU	yellow	
Dakota Verbena, *Glandularia bipinnatifida*	6-18”	May-June-July	NI	lavender	
Indian Paintbrush, *Castilleja coccinea*	6-24”	May-June-July	FAC	Red-orange	
Red Clover, *Trifolium pratense*	6-36”	May-June-July-Aug-Sept	FACU	Pink-purple	
Dutch Clover, Trifolium repens	8”	May-June-July-Aug-Sept	FACU	white	

MID-SEASON BLOOMING FORBS –	High Quality Nectar Plants of the Monarchs and other pollinators.				
Purple Prairie Clover, *Dalea purpurea*	12-24”	June-July-Aug.	NI	purple	
Lanceleaf Coreopsis, *Coreopsis lanceolata*	12-24”	June-July	FACU	yellow	
Slender Mountain Mint, *Pycnanthemum tenuifolium*	24”	July-Aug.	FAC	white	
Yarrow, *Achillea millefolium*	18”	June-July-Aug.-Sept	FACU	white	
LATE SEASON BLOOMING FORBS –	High Quality Nectar Plants of the Monarchs and other pollinators.				
Heath Aster, *Symphyotrichum erichoides*	12-24”	Sept.-Oct.	FACU	White	
Spotted Bee Balm, *Monara punctata*	12-24”	July-Aug.-Sept	FACU	lavender	
Partridge Pea, *Chamaecrista fasciculata*	24”	July-Aug.-Sept	FACU	yellow	
American Wild Mint, *Mentha arvensus*	24”	July-Aug.-Sept	FACW	white	
					60-65 PLS/acre total

Seeding March thru September - Add Oats (*Avena sativa)* at rate of 10-20 lbs per acre, to the mix to serve as a temporary cover crop.

Seeding August thru November - Add Winter Wheat (*Triticum aestivum*) at 10-60 lbs per acre OR Annual Rye *(Lolium multiflorum*) at 30-45 lbs per acre to the mix to serve as a temporary cover crop.

Indicator Category	*Estimated Probability of Occurrence in Wetlands*
Obligate Wetland (OBL)	Plants that almost always occur in wetlands; >99% of the time.
Facultative Wetland (FACW)	Plants that usually occur in wetlands; 67–99% of the time.
Facultative (FAC)	Plants that are just as likely to occur in wetland and in non-wetland areas; 34–66% of the time.
Facultative Upland (FACU)	Plants that occasionally occur in wetlands; 1–33% of the time.
Upland (UPL)	Plants that almost always occur in uplands; 99% of the time.
No Indicator (NI)	Assigned to plants that lack sufficient information to base an indicator status.
No Agreement (NA)	Assigned where reviewers could not achieve a unanimous agreement for an

Wet Mid-Tall Mix

Forbs listed in this table are nectar plants for the Monarch Butterfly and beneficial to other pollinators such as bees and other butterflies. If any species of this mix are unavailable, omitting or a substitution of a species may be made after review and approval by Owner.

Project Name- **Acres Seeded with Mix-** **Location-**

Common & Scientific Name	**Height of plant & species notes**	**Blooming Period** (flowers all season provide nectar as the Monarch migrates spring thru fall)	**Wetland Indicator Status**	**Color of Flower**	**PLS lbs./acre and % by weight**
GRASSES and grass-like plants such as sedges or rushes –	Native grasses and grass-like are larval host plants to many species of pollinators.	Flowers of grasses and grass-like plants are small and inconspicuous			Approximately xx% by weight
Switchgrass, *Panicum virgatum* (Blackwell or Native)	48”		FAC		
Little Bluestem, *Andropogon gerardii* (Native or Aldous)	36”, partial shade to sun		FAC		
Prairie Cordgrass, *Spartina pectinata*	8 feet – TALL, sharp grassbaldes		FACW		
Virginia Wild Rye, *Elymus virginicus*	24”, partial shade to sun		FACW		
Franks Sedge, *Carex frankii*	24”		OBL		
Porcupine Sedge, *Carex hystericina*	36”		OBL		
Fox Sedge, *Carex vulpinoidea*	24”		FACW		
Path Rush, *Juncus tenuis*	12”		FAC		
Plains Oval Sedge, *Carex brevior*	12”		FAC		
Inland Rush, *Juncus interior*	24”		FAC		
EARLY SEASON BLOOMING FORBS –	High Quality Nectar Plants of the Monarchs and other pollinators.				Approximately XX% by weight
Golden Alexanders, *Zizia aurea*	36”	April-May-June	FAC	yellow	
Seedbox, *Ludwigia alternifolia*	36”	May-June-July	OBL	yellow	
Pale Spiked Lobelia, *Lobelia spicata*	24”	May-June-July-Aug.	FAC	purple	
MID-SEASON BLOOMING FORBS –	High Quality Nectar Plants of the Monarchs and other pollinators.				

Swamp Milkweed, *Asclepis Incarnita*	48”	June-July-Aug	OBL	pink	
Scarlet Toothcup, *Ammania coccinea*	48”	June-July-Aug.	OBL	pink	
Swamp Marigold, *Bidens aristosa*	48”	June- July-Aug.-Sept	FACW	yellow	
Frog Fruit, *Phyla lancelata*	6”	June-July-Aug.-Sept	OBL	pink	
LATE SEASON BLOOMING FORBS -	High Quality Nectar Plants of the Monarchs and other pollinators.				
Great Blue Lobelia, *Lobelia siphilitica*	36”	July-Aug.-Sept	OBL	blue	
Cardinal Flower, *Lobelia cardinalis*	48”	July-Aug.Sept	OBL	red	
New England Aster, *Symphyotrichum nocae-angliae*	60”	Aug.-Sept.-Oct.	FACW	purple	

Seeding March thru September - Add Oats (*Avena sativa)* at rate of 10-20 lbs per acre, to the mix to serve as a temporary cover crop.
Seeding August thru November - Add Winter Wheat (*Triticum aestivum*) at 10-60 lbs per acre OR Annual Rye *(Lolium multiflorum*) at 30-45 lbs per acre to the mix to serve as a temporary cover crop.

Indicator Category	*Estimated Probability of Occurrence in Wetlands*
Obligate Wetland (OBL)	Plants that almost always occur in wetlands; >99% of the time.
Facultative Wetland (FACW)	Plants that usually occur in wetlands; 67–99% of the time.
Facultative (FAC)	Plants that are just as likely to occur in wetland and in non-wetland areas; 34–66% of the time.
Facultative Upland (FACU)	Plants that occasionally occur in wetlands; 1–33% of the time.
Upland (UPL)	Plants that almost always occur in uplands; 99% of the time.
No Indicator (NI)	Assigned to plants that lack sufficient information to base an indicator status.
No Agreement (NA)	Assigned where reviewers could not achieve a unanimous agreement for an

Mesic-Moist, Mid-Tall Mix

Forbs listed in this table are nectar plants for the Monarch Butterfly and beneficial to other pollinators such as bees and other butterflies. If any species of this mix are unavailable, omitting or a substitution of a species may be made after review and approval by Owner.

Project Name- **Acres Seeded with Mix-** **Location-**

Common & Scientific Name	**Height of plant & species notes**	**Blooming Period** (flowers all season provide nectar as the Monarch migrates spring thru fall)	**Wetland Indicator Status**	**Color of Flower**	**PLS lbs./acre and % by weight**
GRASSES and grass-like plants such as sedges or rushes –	Native grasses and grass-like are larval host plants to many species of pollinators.	Flowers of grasses and grass-like plants are small and inconspicuous			Approximately xx% by weight
Switchgrass*, Panicum virgatum* (Blackwell or Native)	48”		FAC		
Indian Grass, *Sorghastrum nutans* (Native, Cheyenne or Scout	6 feet tall		FACU		
Little Bluestem, *Andropogon gerardii* (Native or Aldous)	36”, partial shade to sun		FAC		
Side Oats, *Bouteloua curtipendula* (Native or El Reno)	24”		NI		
Virginia Wild Rye, *Elymus virginicus*	24”, partial shade to sun		FACW		
Autumn Bentgrass, *Agrostis perennans*	24”, prefers partial shade		FAC		
Canada Wild Rye, *Elyms canadensis*	48”		FACU		
Fox Sedge, *Carex vulpinoidea*	24”		FACW		
Path Rush, *Juncus tenuis*	12”		FAC		
Plains Oval Sedge, *Carex brevior*	12”		FAC		
Inland Rush, *Juncus interior*	24”		FAC		
Copper Shouldered Oval Sedge, *Carex bicknelli*	36”		FACU		
EARLY SEASON BLOOMING FORBS –	High Quality Nectar Plants of the Monarchs and other pollinators.				Approximately XX% by weight
Blackeyed Susan, *Rudbeckia hirta*	12-24”	May-June-July-Aug.-Sept	FACU	yellow	
Lanceleaf Coreopsis, *Coreopsis lanceolata*	12-24”	June-July	FACU	yellow	
Common Milkweed, *Asclepias syriaca*	36”	June-July-Aug.	FACU	pink	
Indian Paintbrush, *Castilleja coccinea*	6-24”	May-June-July	FAC	Red-orange	

Golden Alexander, *Zizia aurea*	36”	April-May-June	FAC	yellow	
Butterfly Milkweed, *Asclepias tuberosa*	12-24” larval host plant of Monarch	May-June-July-Aug.-Sept.	NI	orange	
MID-SEASON BLOOMING FORBS –	High Quality Nectar Plants of the Monarchs and other pollinators.				
Purple Prairie Clover, *Dalea purpurea*	12-24”	June-July-Aug.	NI	purple	
White Prairie Clover, *Dalea candida*	12-24”	June-July-Aug.	NI	white	
Slender Mountain Mint, *Pycnanthemum tenuifolium*	24”	July-Aug.	FAC	white	
Sullivants Milkweed, *Asclepias sullivantii*	24”-48”	June-July	FAC	Pink- lt.purple	
Pale Spike Lobelia, *Lobelia spicata*	24”	May-June-July-Aug.	FAC	white	
LATE SEASON BLOOMING FORBS -	High Quality Nectar Plants of the Monarchs and other pollinators.				
Spotted Bee Balm, *Monara punctata*	12-24”	July-Aug.-Sept	FACU	lavender	
Partridge Pea, *Chamaecrista fasciculata*	24”	July-Aug.-Sept	FACU	yellow	
American Wild Mint, *Mentha arvensus*	24”	July-Aug.-Sept	FACW	white	
Prairie Blazing Star, *Liatris pycnostachya*	48”	July-Aug.-Sept	FAC	purple	
Blue Vervain, *Verbena hastata*	5 feet	July-Aug.-Sept	FACW	purple	
Yarrow, *Achillea millefolium*	18”	June-July-Aug.-Sept	FACU	white	
Bearded Beggarticks, *Bidens polylepis*	48”	Aug.-Sept-Oct	NI	yellow	
					60-65 PLS/acre total

Seeding March thru September - Add Oats (*Avena sativa)* at rate of 10-20 lbs per acre, to the mix to serve as a temporary cover crop.
Seeding August thru November - Add Winter Wheat (*Triticum aestivum*) at 10-60 lbs per acre OR Annual Rye *(Lolium multiflorum*) at 30-45 lbs per acre to the mix to serve as a temporary cover crop.

Indicator Category	*Estimated Probability of Occurrence in Wetlands*
Obligate Wetland (OBL)	Plants that almost always occur in wetlands; >99% of the time.
Facultative Wetland (FACW)	Plants that usually occur in wetlands; 67–99% of the time.
Facultative (FAC)	Plants that are just as likely to occur in wetland and in non-wetland areas; 34–66% of the time.
Facultative Upland (FACU)	Plants that occasionally occur in wetlands; 1–33% of the time.
Upland (UPL)	Plants that almost always occur in uplands; 99% of the time.
No Indicator (NI)	Assigned to plants that lack sufficient information to base an indicator status.
No Agreement (NA)	Assigned where reviewers could not achieve a unanimous agreement for an

APPENDIX C – SOIL SAMPLING PLAN

BURNS McDONNELL

FREE STATE SOLAR PROJECT, LLC

SOIL SAMPLING PLAN

KANSAS SKY ENERGY CENTER (KSEC)

PROJECT NO. 147658

REVISION 0

AUGUST 11, 2023

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FIGURES

List of Abbreviations

Abbreviation	Term/Phrase/Name
CSECS	Commercial/Utility Scale Solar Energy Conversion System
CUP	Conditional Use Permit
EPA	U. S. Environmental Protection Agency
Free State	Free State Solar Project, LLC
GPS	Global Positioning Systems
KDHE	Kansas Department of Health and Environment
MS/MSD	Matrix spike/matrix spike duplicate
MW	Megawatt
Plan	Soil Sampling Plan
PLFA	phospholipid fatty acids
PPE	Personal Protective Equipment
Project	Kansas Sky Energy Center Project
Project Area	Project Development Area
PV	photovoltaic
QA/QC	Quality Assurance/Quality Control
Region	fenced PV array area(s)
SOP	Standard Operating Procedure
TIC	total organic carbon
TOC	total inorganic carbon

1.0 Introduction

1.1 Overview

Free State Solar Project, LLC (Free State), is proposing to construct a new utility scale photovoltaic (PV) solar generation facility in Douglas County, Kansas. The Kansas Sky Energy Center (Project) would have a nameplate capacity of 159 Megawatts (MW). The Project is located approximately 1 mile north of Lawrence, Kansas. The Project parcels are illustrated on Figures 1 and 2. The Project location was selected by Free State based on the area's strong solar resource, land use, and proximity to existing transmission infrastructure. The Project would include solar array blocks containing PV panels attached to a single-axis tracking system mounted to steel piles. The PV panels will track the sun during the day. Direct current electricity from the PV panels will be routed underground through collection wiring to Power Conversion Units located throughout the PV array areas. Each PV array area will be fenced and have gated access at the road entrances. One or more fenced PV array areas (Regions) are illustrated on Figures 3-1 through 3-7. Constructed access roads will be gravel and approximately 16 feet wide. Pending regulatory approval by the Kansas Department of Health and Environment (KDHE) and Douglas County, construction of the Project is anticipated to begin in 2024 and be completed in 2025.

This Soil Sampling Plan (Plan) has been prepared as a required component of the application submittal for the Conditional Use Permit (CUP) for a Commercial/Utility Scale Solar Energy Conversion System (CSECS). This Plan is in accordance with the Board of County Commissioners of Douglas County, Kansas Zoning Regulations Ordinance Resolution No. 22-16 under the Douglas County Code, Chapter 12: Zoning and Planning, Article 3 Zoning Regulations subsection 12-306-49 Limited Scale Solar Energy Conversion System and CSECS.

1.1.1 Area Description

The total Project study area is approximately 1,000 acres (Figure 2). For the purpose of this Soil Sampling Plan (Plan), Project Development Area will refer to only areas within the primary (631 acres) (Project Area).

Land use within the Project Area is primarily cultivated crops (95%), with interspersed pasture/hay, deciduous forest, wetlands, and developed areas (Figure 2). Much of the Project Area is comprised mostly of agricultural row crops including corn and soybeans.

1.1.2 Array Spacing/PV Panels

The typical minimum leading-edge height between the PV panels and the ground is approximately 18 inches. Post-to-post spacing between rows is approximately 21 feet. Final spacing within the arrays will be determined once equipment selection is finalized and the detailed engineering plan is complete. The installation of low-growing plant species and performance of vegetation management practices within the PV panel areas will be conducted to minimize vegetation touching or shading the PV panels.

1.2 Soil Sampling Plan Purpose and Intent

To support compliance with the Douglas County Code Zoning Regulations, this Plan outlines the methods and procedures to perform soil sample collection at designated sample locations within each Region to characterize and document the soil health and potential presence of heavy metals at the following project phases: before construction begins, when construction is complete, prior to renewing the CUP, prior to beginning decommissioning and reclamation, and following decommission/reclamation of the Project site. The Plan is designed to characterize and document the soil health and potential presence of contaminants in the upper 6-inches from sample collection areas established prior to construction that are representative of the vegetation and soil conditions for each fenced Region within the Project Area prior to construction and during the duration of the project. This Plan was prepared alongside several other plans relating to land and water management in the Project Area, including those addressing vegetation management, erosion and sediment control, stormwater management, perimeter landscaping, and decommissioning. This Plan may be updated as needed based on changing conditions, new methods, and/or Project needs. Standard Operating Procedures (SOPs) for activities that are anticipated for each soil sampling event are included in Appendix A. Prior to the start of work, the contractor collecting soil samples shall review and evaluate the procedures included in this Plan and the SOPs to determining if any modifications are necessary to promote the safe and proper collection of soil samples given site conditions at that time.

2.0 Soil Sampling Methods and Procedures

2.1 Health and Safety

A site-specific health and safety program will be prepared and implemented by the contractor performing soil sampling activities. The health and safety program will present procedures and protocols required to safely guide field activities, identify and describe hazards, outline required personnel protection equipment (PPE), and present contingency plans for site personnel to follow.

2.2 Pre-mobilization Activities

Prior to the start of any intrusive field activities, soil sampling locations will be marked in the field. Some soil sampling locations will likely be on private property and require access agreements and/or access coordination for soil sampling activities with private property owners. While not expected, utility locates (Kansas One-Call) and/or private utility locating services will be performed in the event field activities require excavation using mechanical means and methods (e.g. – excavator). Procedures for utility clearance are outlined in SOP 501, included in Appendix A.

2.3 Soil Sampling

Soil sampling events will be conducted to characterize and document the soil health and evaluate the potential presence of heavy metals at the following frequency:

- Before construction begins

- When construction is complete
- Prior to renewing the CUP
- Prior to beginning decommissioning and reclamation
- Following decommission/reclamation of the Project site

During each event soil samples will be collected from the 13 soil sampling locations illustrated on Figures 3-1 through 3-7. Soil sampling locations are located within the fenced proposed facilities area and seven Regions comprised of 12 fenced PV array areas. The soil sampling locations will be utilized for each scheduled sampling event.

Each soil sampling location consists of one 25-foot by 25-foot sampling area within each of the 13 fenced areas. One composite soil sample will be collected from each one of the sampling locations during each sampling event. A total of five discrete soil samples will be collected from the upper 6-inches of soil and homogenized to form a composite sample for each 25-foot by 25-foot sample area deemed to be representative of the vegetation and soil conditions for the fenced area. The location of each aliquot sample will be documented using a Global Positioning Systems (GPS) unit to confirm that it is collected from within the established 25-foot by 25-foot area. Prior to the initial sampling event, the 25-foot by 25-foot grids will be established and marked or documented so the extents are known for future sampling events. Procedures for collection of Geospatial Data Using GPS Technologies are outlined in SOP 503, included in Appendix A. Procedures for collecting composite surface soil sampling are outlined in SOP 102, included in Appendix A. Non-dedicated equipment/tools used in the collection of soil samples will be cleaned between sampling of each location. Procedures for decontamination are outlined in SOP 504, included in Appendix A.

Each soil sample will be collected and submitted to an off-site EPA-certified laboratory for analysis of total organic carbon (TOC) and total inorganic carbon (TIC) by Standard Method 5310C, cadmium, lead, and zinc by U. S. Environmental Protection Agency (EPA) Method 6020A, and phospholipid fatty acids (PLFA) by PLFA Method under standard turn-around time. EPA certification is not required for laboratories performing PLFA analysis. One duplicate soil sample will be collected per sampling event. One matrix spike/matrix spike duplicate (MS/MSD) and one equipment rinsate blank sample will be collected per event. Procedures for sample packaging and shipping are outlined in SOP 592, included in Appendix A.

2.4 Documentation

Field notes will be recorded in the field logbook and include field site soil sampling activities and pertinent information. Procedures for field documentation are outlined in SOP 701, included in Appendix A.

Photographic documentation of sample locations illustrating the location, vegetation, and soil conditions for the fenced area will be included in Appendix B once the contractor performing the soil sampling activities is determined.

2.5 Additional Soil Sampling

Additional soil sampling may be required by Douglas County or KDHE to evaluate potential impacts to soil in the event damaged panels are not removed within 30 days of initial damage or a damaged panel is suspected of leaching materials to the soil. The location of additional soil sampling, an account of soil sampling activities, and analytical results will be documented in a report that will be provided to the Douglas County Zoning and Codes office.

2.6 Sample Handing and Analysis

Analytical methods and sample storage procedures for soil samples are outlined below. Additional information regarding sample packaging and shipping is outlined in SOP 592, included in Appendix A.

Sample Media	Analyses/Method	Container/Storage	Preservation	Holding Time
Soil	TOC – SM 5310C	4 oz. glass soil jar / cooled to 4°C	None	28 days
Soil	TIC – SM 5310C	4 oz. glass soil jar / cooled to 4°C	None	28 days
Soil	Cadmium – 6020A	4 oz. glass soil jar / cooled to 4°C	None	6 months
Soil	Lead – 6020A	4 oz. glass soil jar / cooled to 4°C	None	6 months
Soil	Zinc – 6020A	4 oz. glass soil jar / cooled to 4°C	None	6 months
Soil	PLFA	8 oz. glass soil jar / cooled to 4°C	None	24-48 hours
Rinsate Blank Water	TOC – SM 5310B	3 x 40 mL vials / cooled to 4°C	Sulfuric Acid	28 days
Rinsate Blank Water	TIC – SM 5310B	3 x 40 mL vials / cooled to 4°C	Sulfuric Acid	28 days
Rinsate Blank Water	Cadmium – 6010D or 6020B	250 mL plastic bottle / cooled to 4°C	Nitric Acid	6 months
Rinsate Blank Water	Lead – 6010D or 6020B	250 mL plastic bottle / cooled to 4°C	Nitric Acid	6 months

2.7 Sampling Equipment Decontamination

Clean nitrile gloves will be worn when collecting and handling soil samples and changed between sampling locations to minimize potential for cross contamination between sampling points. All reusable sampling equipment will be decontaminated between each sample collection using non-phosphate detergent solution (e.g. - Liquinox®), potable water rinse, and drying by use of disposable paper towels or air drying. Sample collection equipment and PPE

generated during the sampling event will be disposed of as municipal solid waste. Decontamination procedures are outlined in SOP 504, included in Appendix A.

2.8 Soil Remediation

A soil remediation plan will be prepared and submitted to the Douglas Counting Zoning and Codes office for review if soil testing results indicate contamination or soil degradation has occurred from Project activities. In the event soil remediation is required, remediation measures will be implemented in accordance with a KDHE-approved soil remediation plan.

3.0 Quality Assurance/Quality Control

The Quality Assurance/Quality Control section of this Plan presents the objectives and specific quality assurance (QA) and quality control (QC) activities designed to achieve data quality goals. QA/QC samples and procedures will be implemented to achieve acquisition of valid data. QA/QC sampling protocol and procedures are presented below.

A EPA-certified laboratory will perform analytical testing, with the exception of PLFA analytical testing. Laboratory analytical testing for soil samples will be in accordance with EPA methodologies when applicable. The laboratory will be responsible for all chemical sample analyses, data validation, and data verification. Soil samples will be analyzed for TOC and TIC by Standard Method 5310C, cadmium, lead, and zinc by EPA Method 6020A, and PLFA by PLFA Method under standard turn-around time. Duplicate samples will be collected at a frequency of one per event. One MS/MSD and one equipment rinsate blank sample will be collected per event.

Precision is expressed in terms of standard deviation or relative percent difference and is assessed by evaluating duplicate sample results. Method blanks and calibration standards will be used to determine calibration stability and analytical method accuracy of the laboratory analysis. Field duplicates will be collected to evaluate the overall precision of field sampling, field screening methods, and laboratory analytical methods.

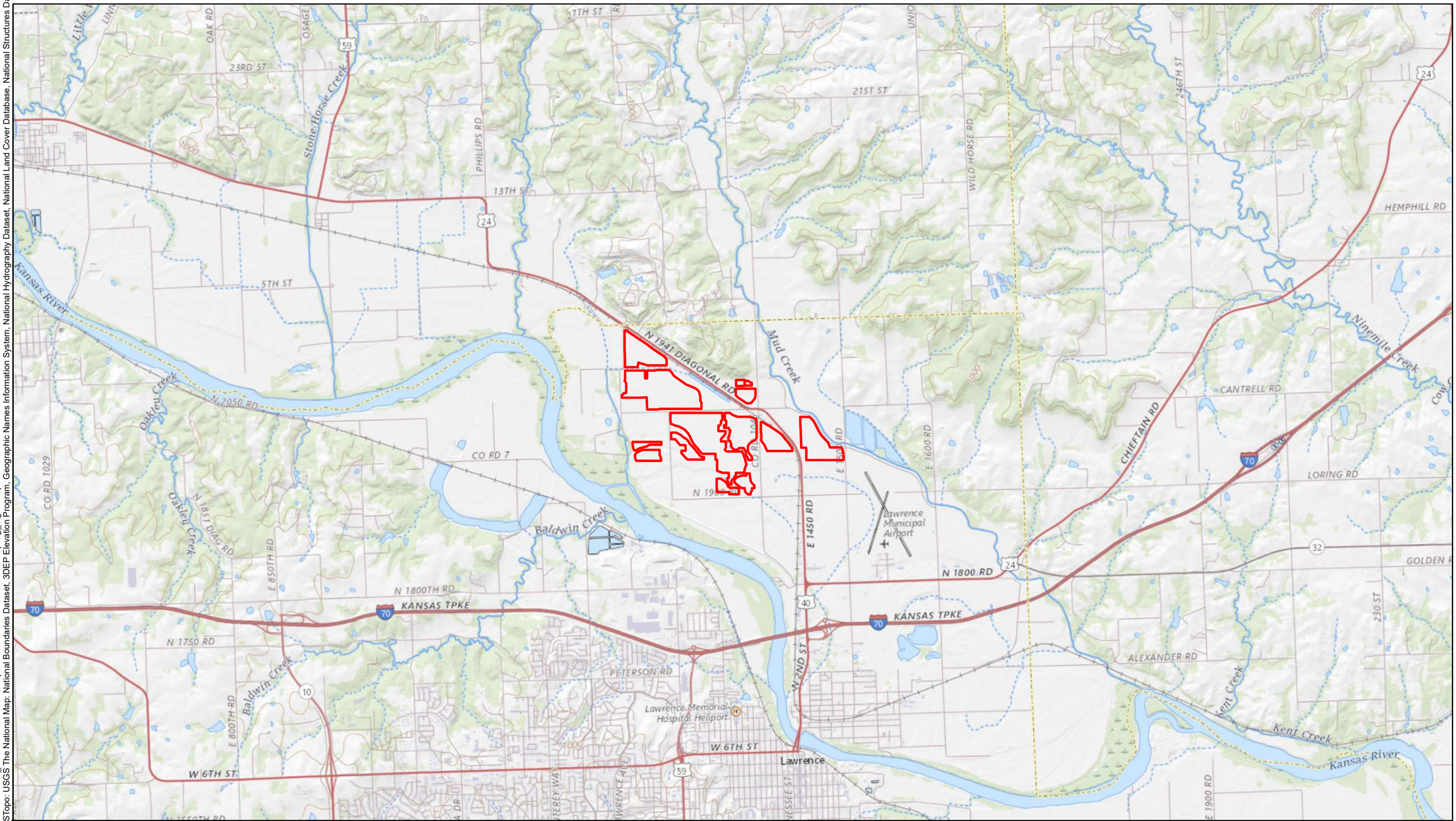
Accuracy is expressed in terms of percent recovery and measures the degree of agreement between a measurement and its true value. Accuracy is assessed by evaluating spike sample recoveries (i.e., surrogate and matrix spike samples) and blank results (i.e., laboratory, rinsate, and MS/MSD).

Analytical laboratory data obtained during the course of this project will be validated for completeness and accuracy by the contractor performing the soil sampling activities through an internal data validation process in accordance with EPA National Functional Guidelines.

4.0 Reporting

Upon completion of each soil sampling event, a Soil Sampling Report will be submitted to Free State, KDHE, and Douglas County. The letter report will include a summary of the completed field activities, compilation of laboratory analytical data, site excavation figures, and appendices that will include a copy of field log notes and field photographs.

FIGURES



Proposed Project Fence Boundary

NORTH

1 0.5 0 1

Miles

BURNS McDONNELL

Figure 1
General Location Map
Kansas Sky Energy Center
Free State Solar Project, LLC
Douglas County, Kansas

Source: ESRI and Burns & McDonnell

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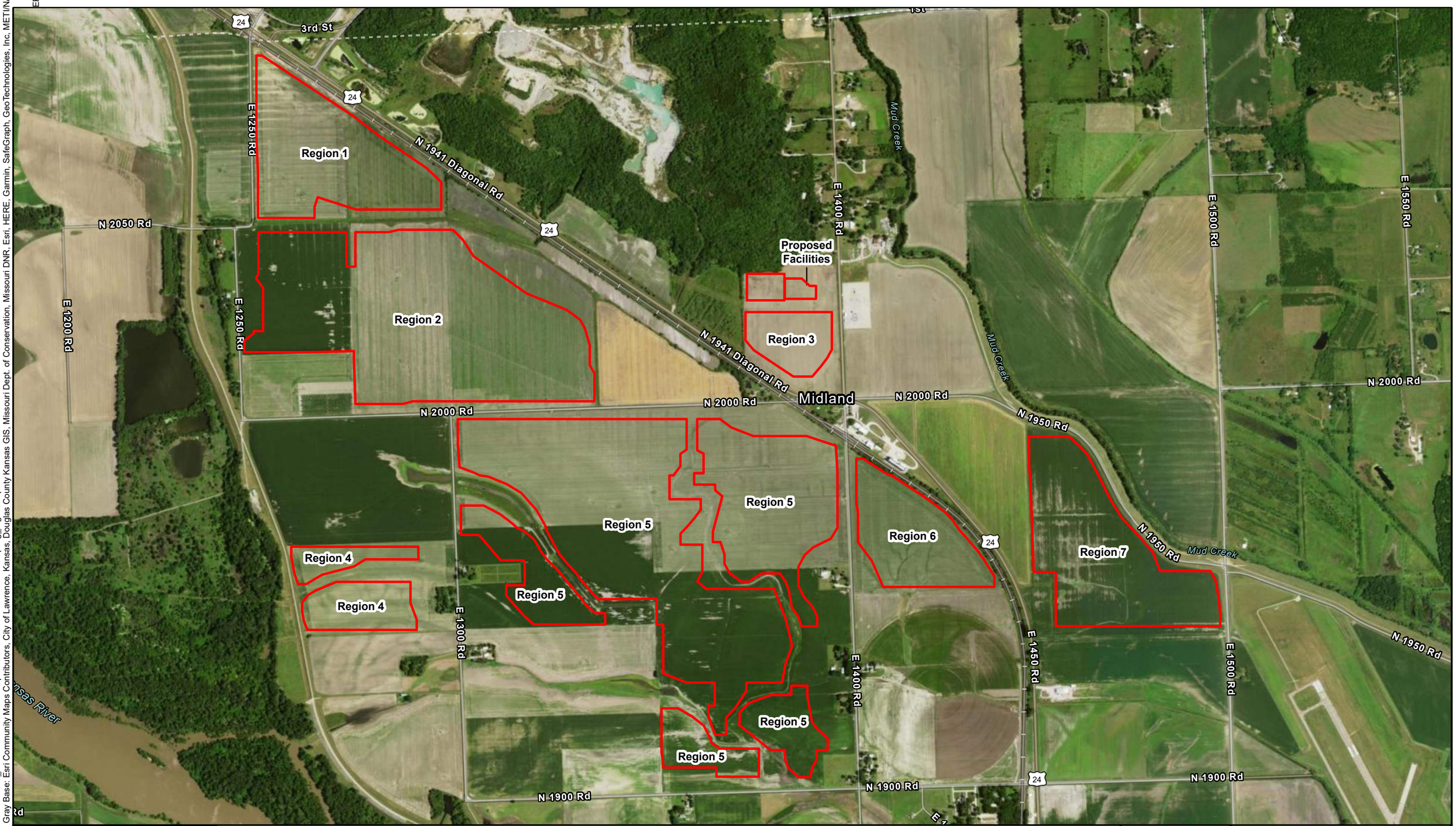

Proposed Project Fence Boundary

NORTH

1,200 600 0 1,200

Scale in Feet

BURNS McDONNELL

Figure 2
Site Vicinity Map
Kansas Sky Energy Center
Free State Solar Project, LLC
Douglas County, Kansas

Issued: 8/15/2023

Source: ESRI and Burns & McDonnell

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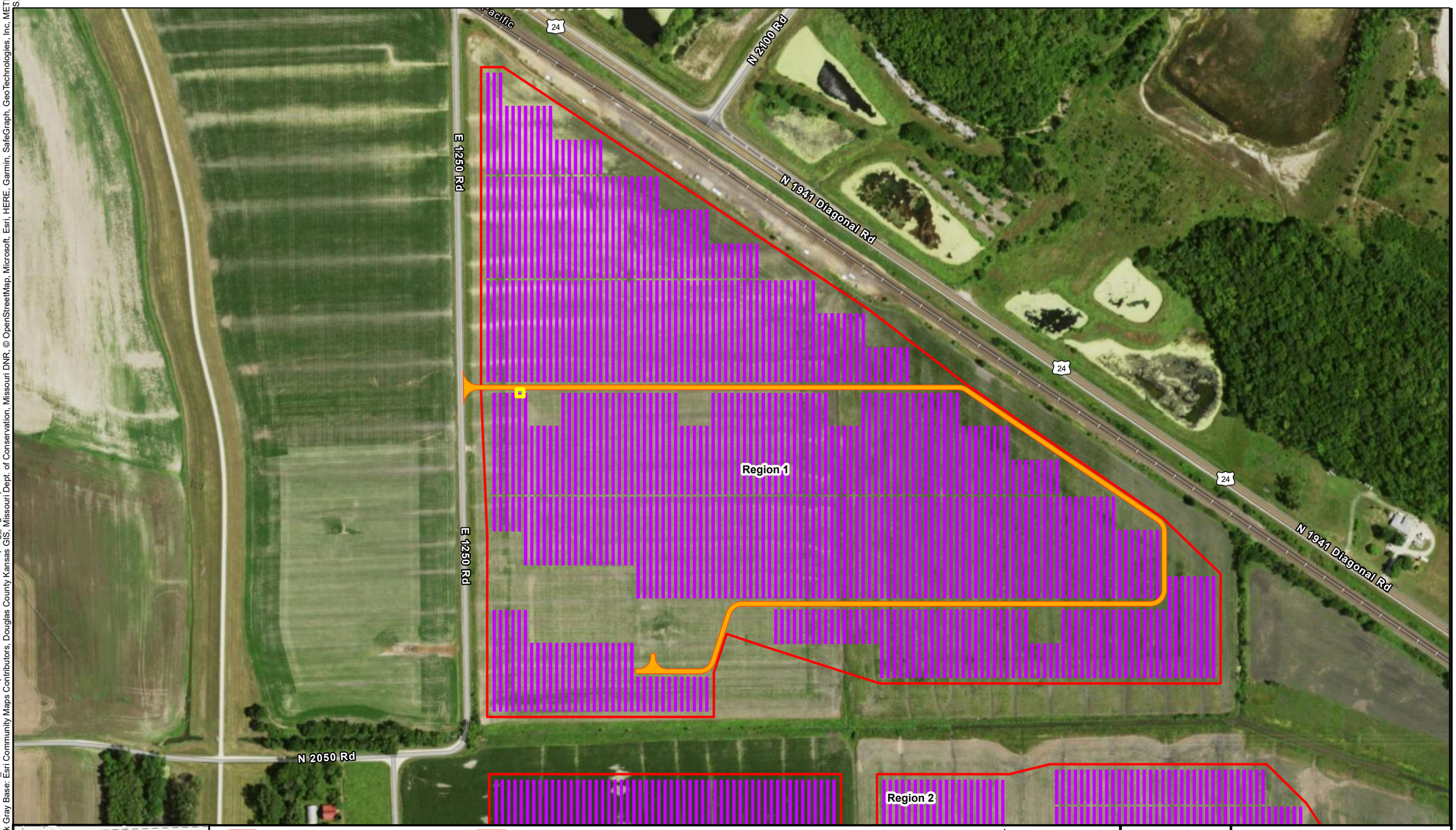

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Source: ESRI and Burns & McDonnell

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Figure 3-2
Soil Sampling Site Location Map
Kansas Sky Energy Center
Free State Solar Project, LLC
Douglas County, Kansas
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Source: ESRI and Burns & McDonnell

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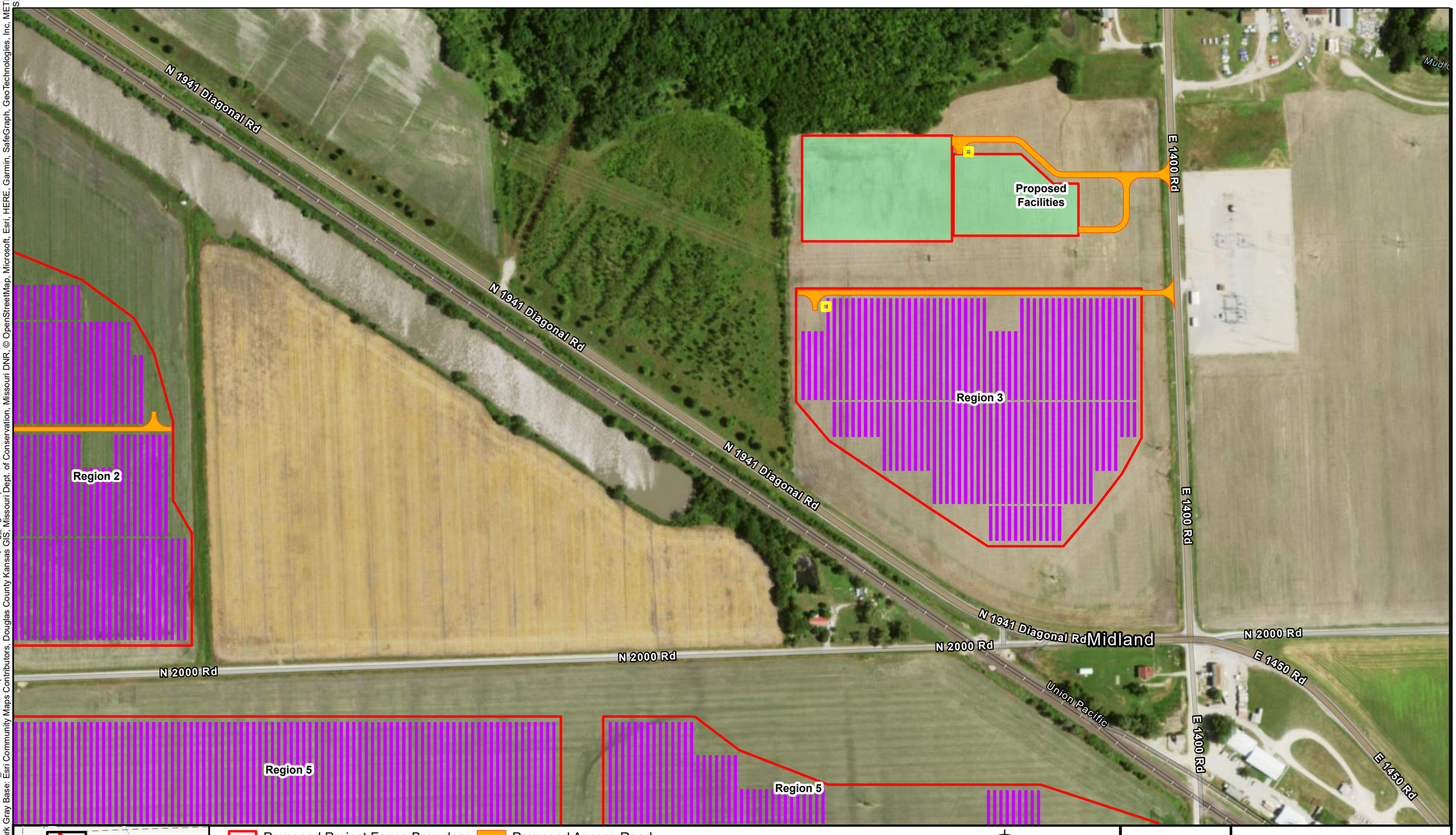
N 1941 Diagonal Rd
N 1941 Diagonal Rd
N 1941 Diagonal Rd
N 1941 Diagonal Rd
E 1400 Rd
Proposed
Facilities
Region 3
Region 2
Region 5
Region 5
N 2000 Rd
N 2000 Rd
N 2000 Rd
N 2000 Rd
Midland
E 1450 Rd
E 1400 Rd
E 1450 Rd
Union Pacific
Proposed Project Fence Boundary
Soil Sampling Site
Proposed Facilities
Proposed Access Road
Proposed Solar Array
NORTH
300 150 0 300
Scale in Feet
BURNS McDONNELL
Figure 3-3
Soil Sampling Site Location Map
Kansas Sky Energy Center
Free State Solar Project, LLC
Douglas County, Kansas
Page 3 of 7
Issued: 8/15/2023
Source: ESRI and Burns & McDonnell
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Missouri Dept. of Conservation

Region 4

Region 4

Region 5

Region 5

E 1300 Rd

E 1300 Rd

1
2
3
Maryland
4
5
6
7

Proposed Project Fence Boundary
Soil Sampling Site
Proposed Facilities
Proposed Access Road
Proposed Solar Array

NORTH

300 150 0 300

Scale in Feet

BURNS McDONNELL

Figure 3-4
Soil Sampling Site Location Map
Kansas Sky Energy Center
Free State Solar Project, LLC
Douglas County, Kansas
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Source: ESRI and Burns & McDonnell

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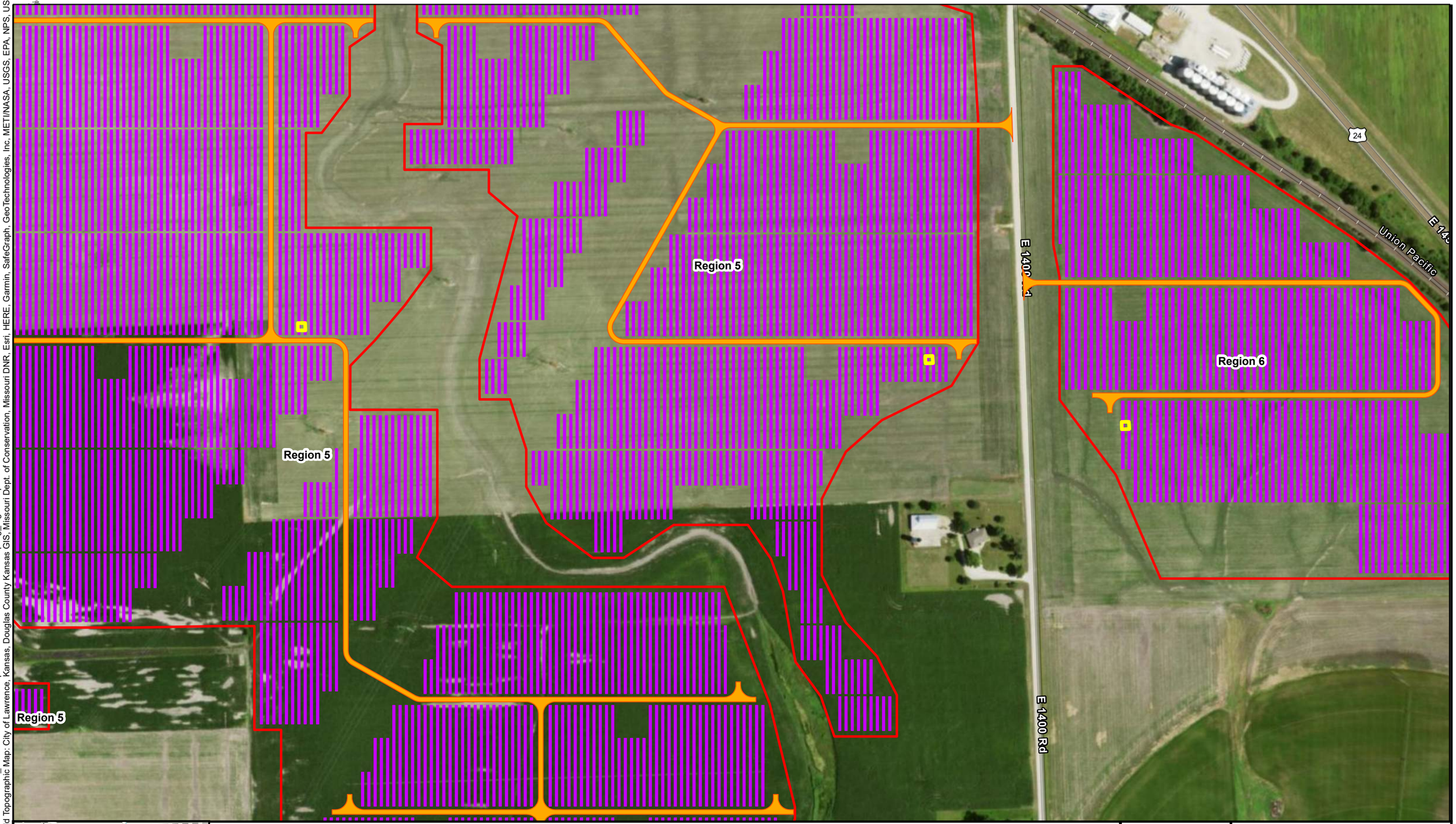

Figure 3-5
Soil Sampling Site Location Map
Kansas Sky Energy Center
Free State Solar Project, LLC
Douglas County, Kansas
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Source: ESRI and Burns & McDonnell

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Proposed Project Fence Boundary
Soil Sampling Site
Proposed Facilities
Proposed Access Road
Proposed Solar Array

NORTH

300 150 0 300

Scale in Feet

BURNS McDONNELL

Figure 3-6
Soil Sampling Site Location Map
Kansas Sky Energy Center
Free State Solar Project, LLC
Douglas County, Kansas
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Source: ESRI and Burns & McDonnell

Issued: 8/15/2023

Region 5

Region 5

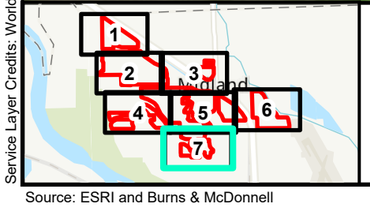
Region 5

E 1400 Rd

N 1900 Rd

N 1900 Rd

N 1900 Rd



Proposed Project Fence Boundary
Soil Sampling Site
Proposed Facilities
Proposed Access Road
Proposed Solar Array

NORTH

300 150 0 300

Scale in Feet

BURNS McDONNELL

Figure 3-7
Soil Sampling Site Location Map
Kansas Sky Energy Center
Free State Solar Project, LLC
Douglas County, Kansas
Page 7 of 7

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Source: ESRI and Burns & McDonnell

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APPENDIX A – STANDARD OPERATING PROCEDURES

SOP 102 – Surface Soil Sampling Composite

SOP 501 – Utility Clearance

SOP 503 – Global Positioning System (GPS)

SOP 504 – Decontamination

SOP 592 – Sample Packing and Shipping

SOP 701 – Field Documentation

SOP 102
Collection of Composite Surface Soil Samples

Revision 01
04/06/2018

Approved by:

04/02/2018

Martha Hildebrandt, PG, Associate Geologist,
Environmental Services Division

Date

04/02/2018

Reynold Tomes, PG, Senior Geologist,
Environmental Services Division

Date

04/06/2018

John Hesemann, PE,
Remediation Technical Service Area Leader
Environmental Services Division

Date

Biennial Review:

Revision/Review	Date	Responsible Party	Description of Change
Revision 01	04/02/2018	Hildebrandt, Martha	Minor grammar and reference updates

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Page No.

1.0 PURPOSE AND APPLICABILITY

The purpose of *Standard Operating Procedure (SOP) 102 Collection of Composite Surface Soil Samples* is to establish a uniform procedure for the collection of composite surface soil samples. This SOP covers the *process* for the collection and field compositing of surface soil samples; sample rationale and scope including locations, depths, required sample amounts, sample preservatives, etc., are detailed in the Project-Specific Work Plan(s). *SOP 102 Collection of Composite Surface Soil Samples* has been prepared in accordance with the *Guidance for the Preparing of Standard Operating Procedures* (USEPA, 2007) and the Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) *Policy Manual* (Burns & McDonnell, 2018).

2.0 SUMMARY OF METHOD

Composite soil sampling is a technique that combines a number of discrete soil samples (i.e. aliquots) into a single homogenized sample for the purpose of analysis. The objective of composite surface soil sampling is to represent the average conditions in a specified area of surface soil. Composite soil samples will be collected from specific locations and depths per the Project-Specific Work Plan. Composite soil sampling consists of collecting multiple aliquots from a given area, homogenizing the aliquots by mixing, then filling the sample containers with the homogenized soil. Soil can be collected using a variety of techniques including shovels, spoons, or probes. The specific tools to be used will be detailed in the Project-Specific Plan. Composite soil samples are typically not collected for volatile organic compound (VOC) analysis. Composited samples are placed into the sample container from the mixing container.

3.0 DEFINITIONS

- **Composite soil sample** – A soil sample comprised of a number of discrete soil samples which are combined into a single sample designed to be representative of an area.

- **Discrete soil sample** – A single soil sample from a specific location and depth interval. Discrete soil samples are also referred to as aliquots or subsamples when they are to be composited into a single composite soil sample.

- **Homogenization** – Combining and mixing of discrete soil samples to produce a uniform distribution of soil particles and other constituents throughout a composite soil.

- **Project-Specific Accident Prevention Plan/Site Safety and Health Plan** (Project-Specific APP/SSHP) – A plan or plans that address occupational safety and health hazards associated with site operations.

- **Project-Specific Work Plan** – The plan that details the rationale, scope, and techniques to be used at the site to achieve the project objectives. Project-Specific Work Plans can include work plans, field sampling plans, quality assurance project plans, technical memorandums, and other documentation of proposed work.

- **Surface soil** – Soil near the ground surface. Surface soil in environmental work is typically considered to extend from the ground surface to 1.5 – 2.0 feet deep unless a different depth range is stated the Project-Specific Work Plan.

4.0 SAFETY AND HEALTH

Field activities as detailed in this SOP will be performed in accordance with applicable safety related documents/requirements which may include but are not limited to: Project-Specific APP/SSHP, the Burns & McDonnell *Safety and Health Program* (Burns & McDonnell, 2017), and site / client-specific requirements. Prior to any field work involving intrusive activities, utility clearance will be required per *SOP 501 Utility Clearance*. Personal protective equipment (PPE) including safety glasses and gloves should be worn as appropriate and as detailed in the Project-Specific APP/SSHP. PPE requirements should be assessed daily and on a per task basis.

5.0 CAUTIONS

Composite samples should not be homogenized if the sample is to be analyzed for a constituent that is easily volatilized. Dependent upon required analysis, soil type, and required precision, compositing may be better done within a laboratory setting than the field. Care should be taken to limit the amount of non-soil components (rocks, sticks, roots) within the sample. If sampling for munition constituents, any projectiles or munition debris found should be removed from the sample. The description and amount of any non-soil components that are removed should be noted in the field logbook. Depths should be measured from the original surface.

6.0 PERSONNEL QUALIFICATIONS

Burns & McDonnell personnel conducting on-site environmental activities will have completed the 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and

Emergency Response (HAZWOPER) course and annual 8-hour HAZWOPER refresher courses. At a minimum, one person on site will be certified in first aid and cardiopulmonary resuscitation (CPR) and, if multiple people are on site, at least one person will have completed the 8-hour HAZWOPER Supervisor Training course. If Burns & McDonnell subcontractors are on site then, at a minimum, one Burns & McDonnell person will have completed the OSHA 30-hour Construction Industry Outreach Training.

7.0 EQUIPMENT AND SUPPLIES

Equipment to be used during composite surface soil sampling may include:

- Sampling tool(s) as prescribed in the Project-Specific Plan such as direct push sampling tools equipped with liners, core sampler, shovel, auger, spoon, etc.
- Mixing bowl(s) and spoon(s)
- Disposable gloves
- Tape measure
- Laths, survey stakes, or pin flags
- Ribbon/string
- Sample containers and sample preservatives per Project-Specific Work Plan
- Personal protective equipment (PPE) and safety equipment per the Project-Specific APP/SSHP

Equipment and utensils that will be in direct contact with the sample material should be constructed of non-reactive materials and free of coatings or platings. Equipment to be used for location, logging/characterization, decontamination, and sample labeling, packing and shipping can be found in the SOPs for those activities.

Prior to the start of field activities, the Field Site Manager and/or the Project Manager should determine that 1) necessary permits, right of entries, and utilities clearances have been obtained; 2) the Project-Specific APP/SSHP has been reviewed by Burns & McDonnell personnel participating in the work and subcontractors who will be on site; 3) appropriate PPE has been obtained for Burns & McDonnell personnel and will be available on site; 4) equipment and meters are available, in working order, and complete with needed components; 5) applicable safety data sheets are on site and available to the field team; and 6) sample containers provided by the laboratory are the correct size and type, are preserved, if required, per the Project-Specific Work Plan, and are sufficient in number for the planned field activities.

8.0 PROCEDURES

Composite surface soil samples will be collected following the following steps:

1. Survey in the corners of the area over which the composite sample is to be collected using a GPS per *SOP 503 GPS* or mark the corners of the area by measuring from known, fixed locations.

2. Divide the area into uniform grid cells to achieve the number of subsamples detailed in the Project-Specific Work Plan. Mark the subsample locations with flags or survey stakes.

3. For each subsample location:

    a. Clear the area to be sampled of surface debris and vegetation using equipment that will not be used for sample collection.

    b. Collect discrete soil subsamples (aliquots) using the method specified in the Project-Specific Work Plan. Transfer the soil directly to a sample bowl for later homogenization. Subsamples should be uniform in volume

    c. Fill in the sample hole and restore the area to match the original conditions.

4. Describe the lithology of the composited sample in accordance with *SOP 521 Field Classification and Description of Soil and Bedrock* as required by the Project-Specific Work Plan. Record this information in the field logbook.

5. Remove any sticks, grass, or rocks from the sample. Note the removed materials in the field logbook.

6. Thoroughly homogenize the soil by mixing in the sample bowl with a spoon or by hand, while wearing clean, new gloves. Clean, disposable gloves will be worn and changed after the collection of each composite sample.

7. Place the composited surface soil in appropriate sample containers, label the containers, and place immediately in a cooler with ice. In general, sample containers will be filled in from most volatile to least volatile. Specific sample order, sample containers, and sample preservatives will be detailed in the Project-Specific Work Plan.

8. Decontaminate non-disposable sampling equipment prior to the start of the sampling event and between samples as specified in *SOP 504 Decontamination*.

9. Enter the appropriate information on the chain of custody (COC) and in the field logbook in accordance with *SOP 701 Field Documentation.*

10. Pack the samples for shipping as specified in the Project-Specific Work Plan and *SOP 592 Sample Packaging and Shipping.*

9.0 DATA AND RECORDS MANAGEMENT

Environmental field activities will be documented as detailed in *SOP 701 Field Documentation*. Field documentation will be completed as activities are conducted and will be relayed to the Field Site Manager or Project Manager at a minimum weekly or on a more frequent basis if so stated in the Project-Specific Work Plan.

10.0 QUALITY ASSURANCE/QUALITY CONTROL

Prior to the start of any field activity, Burns & McDonnell personnel will have read and understood the Project-Specific Plans as well as this SOP. Field personnel will be trained for a minimum of 40 hours prior to their working solo on environmental field activities.

Quality control (QC) samples will be collected in the field to aid in the determination of the validity of the analytical results. The type, number, and location of QC samples to be collected will be detailed in the Project-Specific Plans. Typical field QC samples for surface soil samples include:

- Field duplicates
- Matrix spike/matrix spike duplicates (MS/MSDs)
- Equipment rinsate blanks (ERBs)
- Temperature blanks

10.1 Field Duplicate Samples

Field duplicate samples will be obtained at the same time and analyzed for the same set of parameters as the investigative sample they are intended to replicate. Field duplicates are used to assess precision, including variability associated with both the laboratory analysis and the sample collection process. For soil samples that are homogenized, the sample within the bowl will be halved and the original sample will be collected from one half and the duplicate from the other half. The original and duplicate samples will be placed in separate, but identical containers and preserved in the same manner. Both the original and the duplicate will be sent to the primary laboratory or on-site laboratory, as applicable, and analyzed for the

same analytical parameters. Field samples will be identified with unique sample identification numbers. Field duplicates will be numbered so to be blind to the laboratory. Sample locations where field duplicate samples are collected will be documented in the field logbook. Field duplicates are typically taken on 10 percent of the original samples collected.

10.2 MS/MSDs

MS/MSDs will be analyzed for the same constituents as the actual sample. MS/MSD samples provide information on matrix interference encountered during extraction, digestion, and analysis (i.e., suppression or enhancement of instrument signals). MS samples are principally used to evaluate accuracy by measuring recovery of the spiked compounds. When the MS sample is used together with an associated MSD sample, information is obtained on analytical precision. Soil samples will be collected in triplicate volume at certain locations unless previous arrangements have been made with the analytical laboratory regarding sample volume requirements. The samples will be identified as the original, MS, and MSD and will be collected in the same manner as duplicate samples. The COC will be completed to notify the laboratory that a MS/MSD should be completed in addition to the original sample.

MS/MSDs are typically taken on 5 percent of the original samples collected; however, some projects may require a site-specific MS/MSD for each batch analyzed at the laboratory. For analytical methods with short holding times (i.e., less than 7 days), it may be necessary to collect MS/MSDs at a frequency greater than 5 percent. The analytical laboratory should be consulted regarding their MS/MSD batching needs when requesting sample analysis for short holding time methods.

10.3 ERBs

ERBs will be prepared for non-dedicated sampling equipment used to collect soil samples for chemical analyses. ERBs are used to evaluate potential cross-contamination between samples caused by residual contamination on the sampling equipment. To prepare an ERB, the portion of the equipment that could potentially touch a sample will be decontaminated per *SOP 504 Decontamination* and then rinsed with analyte-free water. The water from the post-decontamination rinse (i.e. rinsate) will be placed directly into specified aqueous sample containers, labeled as the ERB, placed into a cooler with ice, and analyzed for the same parameters as the primary soil sample. The type of water and batch number, if using laboratory grade water, used to prepare the ERB will be noted in the field logbook. ERBs are typically not required for disposable equipment that is not reused. ERBs are typically taken a minimum of once per sample type per sample event.

10.4 Temperature Blanks

Temperature blanks consist of small containers filled with water that are included in each cooler. The temperature of each blank will be measured by laboratory personnel upon arrival at the laboratory to determine if method-specific preservative requirements (i.e., ≤ 4°C) were met. Temperature blanks are often prepared by the laboratory and included with the sample container order shipment to Burns & McDonnell.

11.0 REFERENCES

Burns & McDonnell Engineering, Co, Inc. (Burns & McDonnell), 2018. *Policy Manual*,

- Chapter 8, Employee Safety & Health Program, April 2017.
- Chapter 10, Quality Control Manual, January 2017.

United States Environmental Protection Agency (USEPA), 2007. *Guidance for Preparing Standard Operating Procedures*. EPA/600/B-07/001. April

12.0 ATTACHMENTS

None.

SOP 501
Utility Clearance

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04/06/2018

Approved by:

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04/02/2018
Date

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04/02/2018
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04/06/2018
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1.0 PURPOSE AND APPLICABILITY

The purpose of *Standard Operating Procedure (SOP) 501 Utility Clearance* is to establish a uniform procedure for field personnel to use for utility clearance prior to intrusive work at an environmental site. This SOP covers the ***process*** for the utility clearance; specifics of the utility clearance including property ownership and potential utilities are detailed in the Project-Specific Work Plan and the Project-Specific Accident Prevention Plan/Site Safety and Health Plan (Project-Specific APP/SSHP). *SOP 501 Utility Clearance* has been prepared in accordance with the *Guidance for the Preparing of Standard Operating Procedures* (USEPA, 2007) and the Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) *Policy Manual* (Burns & McDonnell, 2017).

2.0 SUMMARY OF METHOD

Prior to any field work involving intrusive activities, utility clearance will be required. Subcontractor or Burns & McDonnell personnel will locate utilities with the aid of state-mandated utility location services, private utility location services, as-built drawings, client personnel, and/or individual property owners. Typically, utility locates are the responsibility of the subcontractor conducting the intrusive activities; however, in some cases, such as hand augering, the intrusive activities are being conducted by Burns & McDonnell, in which case, Burns & McDonnell is responsible for the utility clearance prior to the start of the intrusive activities.

3.0 DEFINITIONS

- **Project-Specific Accident Prevention Plan/Site Safety and Health Plan** (Project-Specific APP/SSHP) – A plan or plans that address occupational safety and health hazards associated with site operations.
- **Project-Specific Work Plan** – The plan that details the rationale, scope, and techniques to be used at the site to achieve the project objectives. Project-Specific Work Plans can include work plans, field sampling plans, quality assurance project plans, technical memorandums, and other documentation of proposed work.

4.0 SAFETY AND HEALTH

Utility clearance is required prior to conducting any intrusive activity at a site. Hitting a utility can result in property destruction, injury, or even death. Work may be stopped at ***any*** time by ***any*** team personnel due to utility concerns. At some locations, client requirements will include additional precautions for utility clearance such as using an air knife, hydro vacuum, and/or soil vacuum.

Field activities as detailed in this SOP will be performed in accordance with applicable safety related documents/requirements which may include but are not limited to: Project-Specific APP/SSHP, the Burns & McDonnell *Safety and Health Program* (Burns & McDonnell 2017), and site / client-specific requirements. Personal protective equipment (PPE) should be worn as appropriate and as detailed in the Project-Specific APP/SSHP. PPE requirements should be assessed daily and on a per task basis.

5.0 CAUTIONS

See Section 4.0

6.0 PERSONNEL QUALIFICATIONS

Burns & McDonnell personnel conducting on-site environmental activities will have completed the 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) course and annual 8-hour HAZWOPER refresher courses. At a minimum, one person on site will be certified in first aid and cardiopulmonary resuscitation (CPR) and, if multiple people are on site, at least one person will have completed the 8-hour HAZWOPER Supervisor Training course. If Burns & McDonnell subcontractors are on site then, at a minimum, one Burns & McDonnell person will have completed the OSHA 30-hour Construction Industry Outreach Training.

7.0 EQUIPMENT AND SUPPLIES

Equipment and supplies are the responsibility of the subcontractor or utility location service.

8.0 PROCEDURES

Utility clearance activities start during the project planning process. Information on the location of utilities should be requested from the client and locations and potential locations of utilities should be avoided when planning sample locations. A minimum of two full business days' notification is required for most state one-calls prior to commencing intrusive activities. Utility clearance activities, including the ticket number, request date and end date, utilities notified, and the names and companies of persons granting utility clearance will be documented on the ticket and in the field logbook. If a subcontractor is performing the utility clearance, a copy of the utility clearance ticket will be requested for documentation purposes. The Field Site Manager should track the effective date of the utility clearance and check that the utility clearance has been renewed prior to the ticket expiring.

Specific utility clearance procedures will be detailed in the Project-Specific Work Plan and the Project-Specific APP/SSHP. At a minimum, drilling rigs/equipment will be positioned such that they are no closer than the lesser of the height of the mast/tallest part of the equipment or 20 feet of overhead lines with voltages 0-50 kV; for other voltages refer to 29 CFR 1926.550 (a) (15) and 29 CFR 1910.333 (i) (1). Other vehicles will remain a minimum lateral distance of 30 feet from overhead utilities to reduce the possibility of arcing. Intrusive activities will be no closer than 10 feet from buried utilities. Specific procedures for any activities that are closer than 10 feet will be detailed in the Project-Specific Work Plan and in the Project-Specific APP/SSHP.

Due to the presence of underground or overhead utilities, it may be necessary to offset boring locations. This will be done with the approval of the Field Site Manager and documented in the field logbook. Notification of the relocation of boring locations due to utility or other interference will be reported to the Project Manager by the Field Site Manager immediately.

9.0 DATA AND RECORDS MANAGEMENT

A copy of the utility clearance ticket number will be kept in the project file and notes regarding utility location activities will be maintained in the field logbook as described in *SOP 701 Field Documentation*. Field documentation will be completed as activities are conducted and will be relayed to the Field Site Manager or Project Manager at a minimum weekly or on a more frequent basis if so stated in the Project-Specific Work Plan. The client will be notified if data collected in the field screening indicates unmarked or unknown underground lines are present so that they can update their records.

10.0 QUALITY ASSURANCE/QUALITY CONTROL

Prior to the start of any field activity, Burns & McDonnell personnel will have read and understood the Project-Specific Work Plan as well as this SOP. Field personnel will be trained for a minimum of 40 hours prior to their working solo on environmental field activities.

11.0 REFERENCES

Burns & McDonnell Engineering, Co, Inc. (Burns & McDonnell), 2018. *Policy Manual*,

- Chapter 8, Employee Safety & Health, April 2017.
- Chapter 10, Quality Control Manual, January 2017.

United States Environmental Protection Agency (USEPA), 2007. *Guidance for Preparing Standard Operating Procedures*. EPA/600/B-07/001. April

12.0 ATTACHMENTS

None.

SOP 503
Collection of Geospatial Data Using Global Positioning Systems (GPS) Technologies

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Approved by:

04/02/2018

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1.0 PURPOSE AND APPLICABILITY

The purpose of *Standard Operating Procedure (SOP) 503 Collection of Geospatial Data Using Global System Positioning Systems (GPS) Technologies* is to establish a uniform procedure for collecting Global Positioning System (GPS) field data. This SOP is designed to provide a framework to promote the collection of consistent and accurate geospatial positioning data (e.g. - latitude and longitude coordinates) when utilizing hand-held GPS systems. This SOP covers the *process* for the collecting GPS data; specific details such as make and model of GPS unit to be used or the precision and accuracy required are detailed in the Project-Specific Work Plan. *SOP 503 Collection of Geospatial Data Using Global System Positioning Systems (GPS) Technologies* has been prepared in accordance with the *Guidance for the Preparing of Standard Operating Procedures* (USEPA, 2007) and the Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) *Policy Manual* (Burns & McDonnell, 2018).

2.0 SUMMARY OF METHOD

GPS technologies are used to collect spatial data including latitude, longitude, and elevation. The data collected in the field may be post-processed or verified by project staff to assess accuracy as required by Project-Specific Work Plan. Once the data is deemed acceptable for its intended end-use, it is managed in accordance with the Project-Specific Work Plan.

3.0 DEFINITIONS

- **Project-Specific Accident Prevention Plan/Site Safety and Health Plan** (Project-Specific APP/SSHP) – A plan or plans that address occupational safety and health hazards associated with site operations.

- **Project-Specific Work Plan** – The plan that details the rationale, scope, and techniques to be used at the Site to achieve the project objectives. Project-Specific Work Plans can include work plans, field sampling plans, quality assurance project plans, technical memorandums, and other documentation of proposed work.

4.0 SAFETY AND HEALTH

Field activities as detailed in this SOP will be performed in accordance with applicable safety related documents/requirements which may include but are not limited to: Project-Specific APP/SSHP, the Burns & McDonnell *Safety and Health Program* (Burns & McDonnell, 2017), and site / client-specific

requirements. Personal protective equipment (PPE) should be worn as appropriate and as detailed in the Project-Specific APP/SSHP. PPE requirements should be assessed daily and on a per task basis.

5.0 CAUTIONS

The make and model of the GPS unit used to collect geospatial data will influence the accuracy of the data collected. It is important that field staff is familiar with the project-data requirements and the GPS unit's capabilities prior to collecting data. Furthermore, GPS data can be influenced by a number of environmental factors such as dense trees, steep hillsides, or tall buildings. These factors can reduce a GPS unit's accuracy by limiting the number of satellites a GPS unit communicates with while in use. Field personnel should monitor the number of satellites in communication with the GPS unit throughout its use and take corrective action in the event the number of satellites decreases significantly in certain portions of the site.

6.0 PERSONNEL QUALIFICATIONS

There are no general qualifications (e.g. – classes or certifications) required for using basic, GPS-enabled devices for the collection of field data; however, project-specific requirements may exist. Burns & McDonnell personnel conducting on-site environmental activities will have completed the 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) course and annual 8-hour HAZWOPER refresher courses. At a minimum, one person on site will be certified in first aid and cardiopulmonary resuscitation (CPR) and, if multiple people are on site, at least one person will have completed the 8-hour HAZWOPER Supervisor Training course. If Burns & McDonnell subcontractors are on site then, at a minimum, one Burns & McDonnell person will have completed the OSHA 30-hour Construction Industry Outreach Training course.

7.0 EQUIPMENT AND SUPPLIES

The GPS model and specifications selected for use should meet the data accuracy specifications presented in the Project-Specific Work Plan. In the event no accuracy requirements are available, the project staff will select a unit that provides reasonable accuracy for the intended end-use of the data being collected.

Prior to the start of field activities, the Field Site Manager and/or the Project Manager should determine that 1) necessary permits, and right of entries have been obtained; 2) the Project-Specific APP/SSHP has been reviewed by Burns & McDonnell personnel participating in the work and subcontractors who will be on site; 3) appropriate PPE has been obtained for Burns & McDonnell personnel and will be available on

site; 4) equipment and meters are available, in working order, and complete with needed components; and 5) applicable safety data sheets are on site and available to the field team.

8.0 PROCEDURES

8.1 Points

Point features will be collected using GPS instruments to provide x, y, and/or z data necessary for the documentation of a specific location (e.g. -sample locations, corner of a building, etc.). Operation of the GPS unit selected for the project will be conducted in accordance with the unit-specific operator's manual (provided by the manufacturer). The following general procedure will be used for collecting point features:

1. Prior to collecting data, compare the selected GPS unit's accuracy to the project requirements. Information on the GPS unit including make and model should be entered into the field logbook as detailed in *SOP 701 Field Documentation*.

2. Once positioned at the location, allow the GPS unit to process the point for a minimum of 30 seconds (or as otherwise specified in the manufacture's specifications).

3. While the unit is collecting the location, enter a location ID and other attribute data into the appropriate fields on the data collector for that point (e.g. – sample ID, description, etc.).

4. When a cloud-based database/file is being used (e.g. – SDE GIS Database) and an active internet connection is available, the data collected will be automatically synched as it is collected. In the event an active internet is not available, data will be saved to the device and synched as soon as the field personnel has access to internet (end of each day).

5. If a cloud-based database/file is not in use, the data will be downloaded for temporary storage after the data has been collected and uploaded to the project drive when access to the internet is available.

6. Prior to leaving the project site, the collected features will be reviewed for accuracy and completeness to determine if any additional data should be collected and/or if features need to be verified.

7. When finalized, the dataset will be processed and managed in accordance with project requirements.

8.2 Lines and Polygons

Collecting line and polygon features will be performed using GPS instruments to document the location of linear features and areas (e.g. –excavation extent, building, etc.). Specific procedures for operation of the GPS unit selected for the project will be conducted in accordance with the unit-specific operator's manual (provided by the manufacturer). The following general procedure will be used for collecting line and polygon features:

1. Prior to collecting data, compare the selected GPS unit's accuracy to the project requirements. Information on the GPS unit including make and model should be entered into the field logbook as detailed in *SOP 701 Field Documentation*.

2. Position the unit at the start of the location (or first vertex), then allow the GPS unit to process the point for the minimum duration specified in the manufacture's specifications.

3. While the unit is collecting the location, enter a location ID and other attribute data into the appropriate fields on the data collector for that point (e.g. – feature ID, description, etc.).

4. When a cloud-based database/file is being used (e.g. – SDE GIS Database) and an active internet connection is available, the data collected will be automatically synched as it is collected. In the event an active internet is not available, data will be saved to the device and synched as soon as the field personnel has access to internet (end of each day).

5. If a cloud-based database/file is not in use, the data will be downloaded for temporary storage after the data has been collected and uploaded to the project drive when access to the internet is available.

6. Prior to leaving the project site, the collected features will be reviewed for accuracy and completeness to determine if any additional data should be collected and/or if features need to be verified.

7. When finalized, the dataset will be processed and managed in accordance with project requirements.

9.0 DATA AND RECORDS MANAGEMENT

GPS data will be managed in accordance with the Project-Specific Work Plan and client requirements.

10.0 QUALITY ASSURANCE/QUALITY CONTROL

Prior to the start of any field activity, Burns & McDonnell personnel will have read and understood the Project-Specific Work Plan as well as this SOP. Necessary site-specific information including but not

limited to topographic maps, site boundary, and site base map will be uploaded to the GPS instruments prior to entering the field. Upon arrival at the site, the GIS instrument's accuracy will be tested against a known point prior to field use. This field verification will be performed at the start of a project, when new GPS equipment is brought on to a project, if the GPS equipment has been sent to the home office/manufacturer for software updates, and as specified in Project-Specific Work Plan.

11.0 REFERENCES

Burns & McDonnell Engineering, Co, Inc. (Burns & McDonnell), 2018. *Policy Manual*,

- Chapter 8, Employee Safety & Health, April 2017.
- Chapter 10, Quality Control Manual, January 2017.

United States Environmental Protection Agency (USEPA), 2007. *Guidance for Preparing Standard Operating Procedures*. EPA/600/B-07/001. April

12.0 ATTACHMENTS

None.

SOP 504
Decontamination

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04/06/2018

Approved by:

04/03/2018

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04/04/2018

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04/06/2018

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Revision 01	04/03/2018	Hildebrandt, Martha	Minor grammar and reference updates.

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1.0 PURPOSE AND APPLICABILITY

The purpose of *Standard Operating Procedure (SOP) 504 Decontamination* is to establish a uniform procedure for field personnel in the decontamination of environmental equipment. Proper equipment decontamination is essential in ensuring the quality and integrity of samples collected during a given sampling event. This SOP covers the *process* for the equipment decontamination; specifics of decontamination including decontamination fluids and rinses, location of decontamination places and pad, and extra washes and rinses to be used are detailed in the Project-Specific Work Plans. *SOP 504 Decontamination* has been prepared in accordance with the *Guidance for the Preparing of Standard Operating Procedures* (USEPA, 2007) and the Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) *Policy Manual* (Burns & McDonnell, 2018).

2.0 SUMMARY OF METHOD

Decontamination is the process of removing contamination from equipment prior and post sampling. Removing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces transfer of contaminants to clean areas, and prevents the mixing of incompatible substances. Decontamination typically includes both physical (scrubbing) and chemical (soap and acid or solvent rinses). It is important that decontamination is performed using materials and equipment that can effectively remove anticipated contaminants of concern while not damaging the equipment. After decontamination, equipment should be handled only by personnel wearing clean gloves and moved out of the decontamination area to prevent re-contamination.

3.0 DEFINITIONS

- **Distilled Water** - Water that has had many of its impurities removed through distillation. Distillation involves boiling the water and then condensing the steam into a clean container.

- **Laboratory Grade Detergent** – A detergent formulated specifically for use in laboratories to be clean rinsing and phosphate free. Standard brands include Alconox® and Liquinox®.

- **Potable Water** - Treated municipal water or well water used and approved for drinking.

- **Project-Specific Accident Prevention Plan/Site Safety and Health Plan** (Project-Specific APP/SSHP) – A plan or plans that address occupational safety and health hazards associated with site operations.

- **Project-Specific Work Plan** – The plan that details the rationale, scope, and techniques to be used at the Site to achieve the project objectives. Project-Specific Work Plans can include work plans, field sampling plans, quality assurance project plans, technical memorandums, and other documentation of proposed work.

4.0 SAFETY AND HEALTH

Field activities as detailed in this SOP will be performed in accordance with applicable safety related documents/requirements which may include but are not limited to: Site Safety and Health Plans, the Burns & McDonnell *Safety and Health Program* (Burns & McDonnell, 2017), and site / client-specific requirements. Personal protective equipment (PPE) including safety glasses and gloves should be worn as appropriate and as detailed in the Project-Specific APP/SSHP. PPE requirements should be assessed daily and on a per task basis. Rinses such as acids and solvents should be handled with care during transportation to and from the site and stored properly while on site. A Safety Data Sheet should be on site for all chemical rinses.

5.0 CAUTIONS

High concentrations of contaminants or the requirement of very low detection levels may require decontamination procedures that are more stringent than that described in this SOP. This should be considered during work plan development but also recognized if encountered in the field.

Prior to field mobilization, the expected types of contamination should be evaluated to determine if the field cleaning and decontamination activities will generate rinsates and other wastewaters that might be considered Resource Conservation and Recovery Act (RCRA) hazardous waste thus require special handling and disposal procedures.

Care should be taken to remove all visible potential contamination from sample equipment to prevent cross contamination which could result in false positive analytical results.

6.0 PERSONNEL QUALIFICATIONS

Burns & McDonnell personnel conducting on-site environmental activities will have completed the 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) course and annual 8-hour HAZWOPER refresher courses. At a minimum, one person on site will be certified in first aid and cardiopulmonary resuscitation (CPR) and, if multiple people are on site, at least one person will have completed the 8-hour HAZWOPER Supervisor

Training course. If Burns & McDonnell subcontractors are on site then, at a minimum, one Burns & McDonnell person will have completed the OSHA 30-hour Construction Industry Outreach Training course.

7.0 EQUIPMENT AND SUPPLIES

Typical decontamination equipment and supplies include the following items:

- Potable water
- Distilled water
- Non-phosphate laboratory-grade detergent
- Wash bottles
- Buckets
- Scrub brushes
- Plastic sheeting
- Garbage bags
- PPE and safety equipment per the Project-Specific APP/SSHP

Additional rinsates including methanol, isopropyl, and hexane, may be required dependent upon the chemicals of concern.

Prior to the start of field activities, the Field Site Manager and/or the Project Manager should determine that 1) necessary permits, and right of entries have been obtained; 2) the Project-Specific APP/SSHP has been reviewed by Burns & McDonnell personnel participating in the work and subcontractors who will be on site; 3) appropriate PPE has been obtained for Burns & McDonnell personnel and will be available on site; 4) equipment and meters are available, in working order, and complete with needed components; and 5) applicable safety data sheets are on site and available to the field team.

8.0 PROCEDURES

8.1 Decontamination of Non-Dedicated Bladder Pumps

Non-dedicated bladder pumps will be decontaminated according to the following procedure:

1. Leave or attach approximately 4 feet of air supply and water discharge tubing to the pump. Place the pump inside a solid/blank 5-foot section of 2-inch inside diameter polyvinyl chloride (PVC) pipe that has one end capped.

2. Attach the air supply tube to the controller, which is attached to the compressed air source, and direct the discharge tube back into the PVC pipe to recirculate the wash water. Fill the PVC pipe with distilled or potable water, adding approximately one-half teaspoon of non-phosphate, laboratory-grade detergent.

3. Turn on the pump and circulate the wash water for approximately one minute.

4. Direct the discharge into a bucket and pump the detergent water from the PVC pipe.

5. Pump 3 to 5 liters of distilled water through the pump, adding water to the pipe as needed, to rinse the detergent from the pump.

6. Retain decontamination fluids per *SOP 601 Investigative Derived Waste Storage, Sampling, and Disposal*.

8.2 Decontamination of Other Sample-Contacting Equipment

Non-disposable and other non-dedicated equipment which contacts the sample will be decontaminated prior to the collection of each sample and at the close of each day. This equipment includes, but is not limited to, sampling knives and spoons, mixing bowls, split-sampling barrels, direct-push shoes and subs, and reusable containers.

Sampling equipment will be decontaminated according to the following procedure:

1. Fill a nonmetallic wash tub or bucket to a depth of approximately 6 inches with potable water. Mix a detergent solution in the tub. The solution shall consist of approximately 1 tablespoon of non-phosphate laboratory-grade detergent (e.g. Liquinox) per gallon of water.

2. Scrub sampling equipment with a stiff-bristled brush and detergent solution to physically remove visible gross contamination.

3. Transfer the equipment to another wash tub partially filled with distilled water and rinse.

4. Rinse the sampling equipment again with fresh distilled water.

5. Place the equipment on clean plastic and allow it to air dry.

6. Store the equipment covered with plastic or aluminum foil upon the completion of decontamination.

7. Retain decontamination fluids per *SOP 601 Investigative Derived Waste Storage, Sampling, and Disposal*.

8.3 Decontamination of Meters and Probes

Meter probes, water level indicator and oil/water interface probe, will be decontaminated prior to use at each sample location and at the close of each day. Water indicator probes and tapes will be decontaminated per the following procedure.

1. As the tape is being reeled onto the instrument, the tape will be wiped with paper towels that have been sprayed or dampened with a detergent solution. The solution shall consist of approximately 1 tablespoon of non-phosphate laboratory-grade detergent (e.g. Liquinox) per gallon of water.

2. Decontaminate the probe portion of the instrument by spraying with the detergent solution then rinsing with water. If sediment is present on the probe, then ensure the sediment is removed by the cleaning followed by a distilled water rinse.

If nonaqueous phase liquids are encountered or if the measured media is severely impacted, then decontaminate water level indicators and oil/water interface probes by:

1. Fill a nonmetallic wash tub or bucket to a depth of about 6 inches with potable water. Mix a detergent solution in the tub. The solution shall consist of approximately 1 tablespoon of non-phosphate laboratory-grade detergent (e.g. Liquinox) per gallon of water.

2. Clean the portions of the meters and probes that had contact with site media with the detergent solution.

3. Rinse the portions of the meters and probes with distilled water.

4. Place the equipment on clean plastic and allow it to air dry.

5. Store the equipment in the provided case or covered with plastic or aluminum foil.

6. Retain decontamination fluids per *SOP 601 Investigative Derived Waste Storage, Sampling, and Disposal*.

Instruments such as pH meters, conductivity meters, and other instruments that do not come into contact with the material that will be collected for analysis may be decontaminated by thoroughly rinsing the instrument probes.

8.4 Decontamination of Non-Sample-Contacting Equipment

Down-hole sampling tools such as drill string, augers, and direct-push rods, as well as drill rigs and direct-push trucks/vans, will be decontaminated prior to the start of work on site, between each borehole, and prior to leaving the site. Decontamination of subcontractor-owned equipment is typically the responsibility of the subcontractor. Decontamination should be according to the following procedure:

1. Construct a three-sided decontamination pad using planks as a frame and plastic sheeting as the bottom. The pad should be constructed on a slight slope with the open side facing uphill.

2. Back the drill rig or direct-push rig into the decontamination pad or place equipment in a rack off the ground inside the pad.

3. Use pressurized, potable water to completely remove visible soil and contamination from surfaces. Include the inside of drill string, augers, and direct-push rods. If necessary, use a stiff-bristled brush to remove soil and contamination. Dependent upon the contaminant present, the Project-Specific Work Plan may require the use of hot, pressurized water with laboratory grade detergent. The use of a detergent wash will require a rinse with potable water.

4. Place the equipment on clean plastic and allow to air dry.

5. Store equipment and cover with plastic after decontamination.

6. Retain decontamination fluids as described in *SOP 601 Investigative Derived Waste Storage, Sampling, and Disposal*.

9.0 DATA AND RECORDS MANAGEMENT

A documentation of field activities will be maintained in the field logbook as described in *SOP 701 Field Documentation*. Field documentation will be completed as activities are conducted and will be relayed to the Field Site Manager or Project Manager at a minimum weekly or on a more frequent basis if so stated in the Project-Specific Work Plan.

10.0 QUALITY ASSURANCE/QUALITY CONTROL

Equipment rinstate blanks (ERBs) are often collected from non-disposable, sample-contacting equipment to determine if cross contamination is occurring. Procedures for the collection of ERBs can be found in the SOPs for the specific sampling method.

Prior to the start of any field activity, Burns & McDonnell personnel will have read and understood the Project-Specific Plans as well as this SOP. Field personnel will be trained for a minimum of 40 hours prior to their working solo on environmental field activities.

11.0 REFERENCES

Burns & McDonnell Engineering, Co, Inc. (Burns & McDonnell), 2018. *Policy Manual*,

- Chapter 8, Employee Safety & Health, April 2017.
- Chapter 10, Quality Control Manual, January 2017.

United States Environmental Protection Agency (USEPA), 2007. *Guidance for Preparing Standard Operating Procedures*. EPA/600/B-07/001. April

12.0 ATTACHMENTS

None.

SOP 592
Sample Packaging and Shipping

Revision 01
04/06/2018

Approved by:

04/03/2018

Martha Hildebrandt, PG, Associate Geologist,
Environmental Services Division — Date

02/22/2018

Justin Carter, PG, Senior Geologist,
Environmental Services Division — Date

04/06/2018

John Hesemann, PE,
Remediation Technical Service Area Leader
Environmental Services Division — Date

Biennial Review:

Revision/Review	Date	Responsible Party	Description of Change
Revision 01	02/22/2018	Carter, Justin	Minor grammar and updated references.

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1.0 PURPOSE AND APPLICABILITY

The purpose of *Standard Operating Procedure (SOP) 592 Sample Packaging and Shipping* is to establish a uniform procedure for field personnel to use in the packaging and shipping of environmental samples for chemical and physical analysis. This SOP only applies to the packaging and shipping of limited quantity, low concentration environmental samples. This procedure does not apply to those samples considered hazardous materials, hazardous waste, mixed waste, radioactive waste, and/or dangerous goods. Requirements for packing and shipping those types of samples are specified in the U.S. Department of Transportation (DOT) 49 Code of Federal Regulation (CFR) 114-327 and the International Air Transport Association (IATA) procedures. This SOP covers the *process* for the packaging and shipping of environmental samples; specific of shippers and shipping dates are detailed in the Project-Specific Work Plan. *SOP 592 Sample Packaging and Shipping* has been prepared in accordance with the *Guidance for the Preparing of Standard Operating Procedures* (USEPA, 2007) and the Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) *Policy Manual* (Burns & McDonnell, 2018).

2.0 SUMMARY OF METHOD

Samples collected for laboratory analysis shall be packed and shipped in a way to maintain quality control and limit breakage of sample containers. Dependent upon the analyses, samples may require placement in coolers with an appropriate amount of ice to maintain an internal temperature of 4° Celsius (C) during shipping from the field to the lab. Chain-of-custody (COC) documentation will be included inside of the cooler.

Samples will be sent to the laboratory via overnight shipment (ie FedEx) or a laboratory courier. If sent via FedEx, a FedEx air bill will be completely filled out and the cooler(s) will be delivered directly to a FedEx agent or to an authorized agent for shipment. The shipment tracking number will be recorded in the field logbook. (For additional questions regarding shipping, contact FedEx at 1-800-463-3339.) If sent via laboratory courier, the courier will sign the COC upon receipt of the packed samples.

3.0 DEFINITIONS

- **Environmental Sample** - A limited quantity, low concentration sample that does not require DOT or IATA hazardous waste labeling as a hazardous waste or material.

- **Hazardous Material** - A substance or material in a quantity or form, which may pose an unreasonable risk to health, safety, and/or property when transported in commerce. Hazardous material is defined and regulated by DOT (49 CFR 173.2 and 172.101) and IATA (Section 4.2).

- **Hazardous Waste** - Any substance listed in 40 CFR Subpart D (260.30 et seq.) or otherwise characterized as ignitable, corrosive, reactive, or toxic as specified in Subpart C (261.20 et seq.) that would be subject to manifest and packaging requirements specified in 40 CFR 262. Hazardous waste is defined and regulated by the United States Environmental Protection Agency (USEPA).

- **Hazardous Waste Sample** - A medium or high concentration sample requiring, either DOT or IATA labeling as a hazardous waste or material.

- **Project-Specific Accident Prevention Plan/Site Safety and Health Plan** (Project-Specific APP/SSHP) – A plan or plans that address occupational safety and health hazards associated with site operations.

- **Project-Specific Work Plan** – The plan that details the rationale, scope, and techniques to be used at the Site to achieve the project objectives. Project-Specific Work Plans can include work plans, field sampling plans, quality assurance project plans, technical memorandums, and other documentation of proposed work.

- **Sample** - Physical evidence collected from a facility or the environment which is representative of conditions at the point and time at which the sample is collected.

4.0 SAFETY AND HEALTH

Field activities as detailed in this SOP will be performed in accordance with applicable safety related documents/requirements which may include but are not limited to: Project-Specific APP/SSHP, the Burns & McDonnell *Safety and Health Program* (Burns & McDonnell, 2017), and site / client-specific requirements. Care should be taken when handling sample bottles that have been prepared with preservatives such as acids or bases. Personal protective equipment (PPE) as listed in the Project-Specific APP/SSHP should be worn while handling and packing filled sample containers. PPE requirements should be assessed daily and on a per task basis.

5.0 CAUTIONS

Sample quality is dependent upon proper preservation including sample temperature. Care should be taken not to over or under dilute the preservative within pre-preserved sample containers. Care should be taken to ensure that sufficient ice is present in the coolers during sampling and that the ice is replenished prior to shipping. Samples that contain liquids (including the ice) should be double bagged so to prevent leakage during shipment.

6.0 PERSONNEL QUALIFICATIONS

Burns & McDonnell personnel conducting on-site environmental activities will have completed the 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) course and annual 8-hour HAZWOPER refresher courses. At a minimum, one person on site will be certified in first aid and cardiopulmonary resuscitation (CPR) and, if multiple people are on site, at least one person will have completed the 8-hour HAZWOPER Supervisor Training course. If Burns & McDonnell subcontractors are on site then, at a minimum, one Burns & McDonnell person will have completed the OSHA 30-hour Construction Industry Outreach Training course.

7.0 EQUIPMENT AND SUPPLIES

Equipment and supplies required when shipping and handling samples can include:

- Packing materials such as bubble wrap, plastic sealable bags, tape, etc.
- Contractor-grade plastic trash bags
- Ice
- Coolers
- Labeling supplies such as shipping labels, waterproof pens, etc.
- PPE and safety equipment per the Project-Specific APP/SSHP

Equipment to be used for decontamination and documentation can be found in the SOPs for those activities.

Prior to the start of field activities, the Field Site Manager and/or the Project Manager should determine that 1) the Project-Specific APP/SSHP has been reviewed by Burns & McDonnell personnel participating in the work and subcontractors who will be on site; 2) appropriate PPE has been obtained for Burns & McDonnell personnel and will be available on site; 3) equipment and supplies are available, in working

order, and complete with needed components; and 4) sample shipping containers provided by the laboratory are the correct size and type, and are sufficient in number for the planned field activities.

8.0 PROCEDURES

The sample packaging and shipping procedures to be used for the shipment of samples by an overnight carrier are based on USEPA specifications and Department of Transportation regulations (49 CFR Parts 172 and 173). Samples will be packed and shipped according to requirements for low hazard-level samples. The following procedure will be used to pack samples being shipped by overnight carrier:

1. At the time of sampling, wipe the outside of each sample container with a paper towel and place a label on each container. Each glass container will be wrapped with bubble wrap. Place each sample bottle in an individual, sealable plastic bag. Volatile organic compound (VOC) vials may be grouped within a bag by sample. Remove as much air as possible from the plastic bag prior to sealing. Complete the COC as detailed in *SOP 701 Field Documentation.*

2. Prior to shipping, arrange sample containers in groups by sample number.

3. Tape drains shut on shipping cooler, if present.

4. Place an absorbent pad in the bottom of the cooler, followed by a layer of bubble wrap.

5. Insert a contractor-grade (minimum of 2 mils thick) plastic trash bag into the cooler.

6. Place the sample containers inside the trash bag in an upright position so they do not touch. Place one temperature blank in each cooler.

7. Add ice (double packaged in sealable plastic bags).

8. Check the COC against the contents of the cooler. Sign the COC and indicate the time and date the cooler is sealed. Record the time in the field logbook.

9. If shipping via overnight carrier (i.e. FedEx):

    a. Separate the copies of the COCs. Seal the top form (original) in a large, sealable, plastic bag and tape them to the inside of the cooler lid.

    b. Complete shipping paperwork (if applicable). Include air bill number and name of carrier on the COC, and record the information in the field logbook.

c. Close the lid and latch the cooler. Tape the cooler shut on both ends, make several revolutions with the strapping tape. The strapping tape should cover the ends of the clear tape used to secure the shipping label but should not cover the label.

d. Affix signed custody seals over lid openings (opposite corners of the cooler). Cover the seals with clear, plastic tape.

e. Attach the FedEx air-bill to the top of the cooler. Use two strips of clear tape to securely fasten the shipping label to the cooler so that the label will not peel off even if the coolers are stacked during shipment. The clear tape should extend across the entire top of the cooler. Field samples will be shipped to the contracted laboratory(ies).

f. Enter the appropriate information including air-shipping number, and time and date relinquished to the shipper in the field logbook.

10. If shipping via a laboratory courier:

a. Have the courier sign the COC noting receipt of samples.

b. Separate the copies of the COCs. Seal the top form (original) in a large, sealable, plastic bag and tape to the inside of the cooler lid.

c. Close the lid and latch the cooler. Tape the cooler shut on both ends, make several revolutions with the strapping tape. The strapping tape should cover the ends of the clear tape used to secure the shipping label but should not cover the label.

d. Affix signed custody seals over lid openings (opposite corners of the cooler). Cover the seals with clear, plastic tape.

e. Enter the appropriate information including name of the courier, and time and date relinquished to the courier in the field.

9.0 DATA AND RECORDS MANAGEMENT

Shipping information including COC numbers, shipping numbers, and date and times should be entered into the field logbook as detailed in *SOP 701 Field Documentation*. Field documentation will be completed as activities are conducted and will be relayed to the Field Site Manager or Project Manager at a minimum weekly or on a more frequent basis if so stated in the Project-Specific Work Plan.

10.0 QUALITY ASSURANCE/QUALITY CONTROL

Prior to the start of any field activity, Burns & McDonnell personnel will have read and understood the Project-Specific Plans as well as this SOP. Field personnel will be trained for a minimum of 40 hours prior to their working solo on environmental field activities.

11.0 REFERENCES

Burns & McDonnell Engineering, Co, Inc. (Burns & McDonnell), 2015. *Policy Manual*,

- Chapter 8, Employee Safety & Health, April 2017.
- Chapter 10, Quality Control Manual, January 2017.

United States Environmental Protection Agency (USEPA), 2007. *Guidance for Preparing Standard Operating Procedures*. EPA/600/B-07/001. April

12.0 ATTACHMENTS

None.

SOP 701
Field Documentation

Revision 01
04/06/2018

Approved by:

04/03/2018

Martha Hildebrandt, PG, Associate Geologist,
Environmental Services Division

Date

04/02/2018

Ben Clement, R.G., Senior Geologist,
Environmental Services Division

Date

04/06/2018

John Hesemann, PE,
Remediation Technical Service Area Leader
Environmental Services Division

Date

Biennial Review:

Revision/Review	Date	Responsible Party	Description of Change
Revision 01	04/06/2018	Hildebrandt, Martha	Minor grammar and reference updates.

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1.0 PURPOSE AND APPLICABILITY

The purpose of *Standard Operating Procedure (SOP) 701 Field Documentation* is to establish a uniform procedure for documentation of field activities on environmental sites. Soil and bedrock logging for excavations and borings is not included in this SOP but can be found in *SOP 521 Soil and Bedrock Logging*. This SOP covers the ***process*** for the field documentation; specific documentation requirements that may be required by the client, regulator, or specific processes are detailed in the Project-Specific Work Plan. *SOP 701 Field Documentation* has been prepared in accordance with the *Guidance for the Preparing of Standard Operating Procedures* (USEPA, 2007) and the Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) *Policy Manual* (Burns & McDonnell, 2017).

2.0 SUMMARY OF METHOD

Each sample, field measurement, and field activity will be properly documented to facilitate timely, correct, and complete analyses, and support actions concerning site work. The documentation system will provide a means to identify, track, and monitor individual samples from the point of collection through the final reporting of data and to record field activities that occurred. Field forms referenced in this SOP are attached.

3.0 DEFINITIONS

- **Field Forms** – Forms prepared for specific activities. Forms used in the field should either be Burns & McDonnell standard forms or be included in the Project-Specific Work Plans.

- **Field Logbook –** A bound logbook that is kept per team during environmental work. Whenever possible, logbooks should have pre-numbered pages and stitched bindings.

- **Project-Specific Accident Prevention Plan/Site Safety and Health Plan** (Project-Specific APP/SSHP) – A plan or plans that address occupational safety and health hazards associated with site operations.

- **Project-Specific Work Plan** – The plan that details the rationale, scope, and techniques to be used at the site to achieve the project objectives. Project-Specific Work Plans can include work plans, field sampling plans, quality assurance project plans, technical memorandums, and other documentation of proposed work.

4.0 SAFETY AND HEALTH

Field activities as detailed in this SOP will be performed in accordance with applicable safety related documents/requirements which may include but are not limited to: Project-Specific APP/SSHP, the Burns & McDonnell Safety and Health Program (Burns & McDonnell, 2017), and site / client-specific requirements. Personal protective equipment (PPE) should be worn as appropriate and as detailed in the Project-Specific APP/SSHP. PPE requirements should be assessed daily and on a per task basis.

5.0 CAUTIONS

Field documentation should be completed with indelible marking/ink pens preferably in blue or black. Hand entries should be printed and the author should ensure that the writing is legible and clear. Any errors made should be lined out so that the original writing is still visible, initialed, and dated. Field documentation should stay either with the field personnel on site or be kept within a secure location. Upon completion of the field activities, field documentation is kept with the project files. The Project Manager should ensure that photographs or videos are allowed prior to the start of field activities.

6.0 PERSONNEL QUALIFICATIONS

Burns & McDonnell personnel conducting on-site environmental activities will have completed the 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) course and annual 8-hour HAZWOPER refresher courses. At a minimum, one person on site will be certified in first aid and cardiopulmonary resuscitation (CPR) and, if multiple people are on site, at least one person will have completed the 8-hour HAZWOPER Supervisor Training course. If Burns & McDonnell subcontractors are on site then, at a minimum, one Burns & McDonnell person will have completed the OSHA 30-hour Construction Industry Outreach Training course.

7.0 EQUIPMENT AND SUPPLIES

Equipment to be used during field documentation may include:

- Field logbooks
- Field forms
- Labels and seals
- Indelible marking pen/ink pens, black or blue in color
- Digital cameras/recorders

- Personal protective equipment (PPE) and safety equipment per the Project-Specific APP/SSHP

Equipment to be used for sampling activities can be found in the SOPs for those activities.

8.0 PROCEDURES

Included below are procedures for completing field logbooks and specific forms and labels. Which forms and labels should be completed on a project is a function of the activities to be performed and the preferences of the client and regulator. Refer to the Project-Specific Work Plan for the specific project documentation that is to be completed.

Field documentation should be completed as the activities are being done. On a regular basis, typically not less than once a week, the field personnel should scan their field documentation for placement in the project file. At the completion of a field effort, the field personnel are responsible for ensuring that a complete scan of the documentation is in the files and that the originals have been given to the project manager for inclusion in the project files.

8.1 Corrections to Documentation

Original recorded data will be written with indelible, waterproof ink. Accountable serialized documents will not be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. Errors will be corrected by marking a line through the error, entering the correct information, and initialing and dating the correction. The erroneous information will not be obliterated. Any subsequent error discovered later on an accountable document will be corrected, initialed, and dated by the person who made the entry.

8.2 Field Logbook

Information pertinent to the investigation will be recorded in a bound logbook with consecutively-numbered, water-resistant pages. The field personnel responsible for the entries will sign and date each entry or page. Logbook entries will be made in waterproof, indelible ink. The time and date of each entry will be noted in the logbook.

General rules cannot specify the exact information that must be entered in a logbook for a particular site. However, the logbook should contain sufficient information so that field activities can be reconstructed without discussion with the original author. Logbooks will be kept in the field personnel's possession or a secure place during the investigation. Following the investigation, logbooks will become part of the

project file. The following list contains typical field logbook entries to be recorded on a daily basis, depending upon field activities being performed.

- Date
- Weather conditions
- Names of field personnel and site visitors including time on and off the site
- Documentation of daily safety meeting including topics and attendance
- Calibration record of field equipment
- Name and location of area of investigation
- Location of sample (may include a sketch)
- Type of sample (soil, groundwater, sediment, air, etc.)
- Time (military) of sample collection
- Sample identification number
- Interval and depth of sample
- Field screening results
- Sample collection procedure/equipment
- Sample description (color, odor, etc.)
- Field observations of sampling event
- Parameters requested for analyses
- Field measurements
- Quality assurance/quality control (QA/QC) sample information
- Equipment decontamination procedures
- Sample shipment information
- Number assigned to chain of custody (COC)
- Documentation of investigative derived waste (IDW) per *SOP 601 Investigative Derived Waste Storage, Sampling, and Disposal*
- Air monitoring results
- Level of PPE

8.3 Field Forms

Field forms can be specific forms for field measurements such as water level forms, sampling forms, forms associated with specific activities such as well development or in-situ testing, equipment calibration forms, or health and safety forms. Specific field forms to be used should be referenced in the Project-

Specific Work Plan or the Project-Specific APP/SSHP. In all cases, the forms should be completed in entirety. Items on the forms that do not apply should be filled with NA. Forms should be completed in waterproof, indelible ink. Time entries should be military.

8.4 Daily Quality Control Reports

Daily Quality Control Reports (DQCR) are used to transmit a summary of daily activities to the client or to the regulators. DQCRs are used on most Department of Defense projects. DQCRs can be used on state or private projects if the client or regulator requests a daily field summary. With DQCRs, field activities will be recorded daily by the Field Site Manager (FSM) to verify that procedures outlined in the Project-Specific Work Plans are implemented. DQCRs will be completed with the following information:

- **Site Information** - To accurately track field activities from one site location to another, site-specific information will be recorded on the DQCR form. Information such as site location, project number, area of investigation, date, time, crew numbers, names of crew members, and the name of the FSM will be recorded.

- **Weather Conditions** - General weather conditions such as air temperature, relative wind speed and direction, and relative humidity will be estimated daily and recorded on the DQCR forms. Any change in weather conditions encountered during the day will be recorded on the DQCR.

- **Subcontractors and Equipment** - The subcontractors performing work associated with the investigation at the site will be tracked by recording on the DQCR form the subcontractor's company name, crew size, and a list of the major equipment used during daily field activities.

- **Summary of Work Performed -** A brief description of the daily field activities performed at the site will be recorded on the DQCR form. For field measurements, the numerical value and units will be recorded on the DQCR form.

- **Instrument Calibration** - Instrumentation used for sampling and personal protection, and verification of instrument calibration during daily field activities will be recorded on the DQCR form. Additional instruments used will be written in the space provided. Further information on calibration procedures will be recorded on the calibration log for each instrument used during daily field activities.

- **Health and Safety Requirements** - The level of protection used during daily field activities and any other health and safety modifications will be recorded in the DQCR form. Modifications that may occur during field activities, including upgrading to higher levels of protection based on air-monitoring data and other chemical or physical hazards encountered at the site that were not previously known to exist, will also be recorded on the DQCR form.

- **Sample Numbers Collected Including QA/QC Samples** – A summary of the samples collected, including QA/QC samples and the relationship of the QA/QC samples to the original samples, will be recorded on the DQCR form under the "Summary of Work Performed" heading.

- **Deviations from the Approved Site-Specific Documents** - Any anticipated deviation in field activities that is not specified in the site-specific documents will be recorded on the DQCR form. The actual deviation will not be performed until a written request is submitted by the Project Manager to the client and approval, written or verbal, has been granted by the client.

- **Problems Encountered/Corrective Action Taken** - During daily field activities, any problems encountered and the corrective actions taken for each incident will be recorded on the DQCR form. For each problem encountered, the Project Manager will be notified and the date and time recorded of when notification was given.

- **Work Status for the Following Day** - A summary of field activities planned for the following day will be recorded on the DQCR form.

The FSM will verify completion by signing and dating the DQCR form. The DQCR form will be completed and forward to the Project Manager daily. The DQCRs and any attachments will be submitted to the client either daily or weekly as requested. Copies of the completed forms will be placed in the project file.

8.5 Chain-of-Custody Records

The COC will be employed as physical evidence of sample custody. Field personnel will initiate a COC with acquisition of the sample. Transferred possession of samples will be recorded on the COC by both the person relinquishing and the person receiving the samples by signing, dating, and noting the time the transfer of possession takes place. Samples are considered to be in a person's custody if they are within that person's line of sight, kept in a locked room or vehicle, or adequately sealed with custody seals.

A COC will be prepared for each cooler shipped or transported to the laboratory. All samples packed in the cooler will be recorded on the COC accompanying that cooler. A document control number consisting of the date and consecutive alphabetic suffix will be completed in the space provided on the COC. For example, if a shipment of samples is prepared on January 31, 2016 with two coolers, the document control numbers will be 01312016A for the COC(s) included with the first cooler and 01312016B for the COC(s) included with the second cooler.

The following information is to be included on the COC:

- Sample numbers
- Signature(s) of field personnel
- Date of collection
- Time (military) of collection
- Sample type (solid, etc.)
- Identification of sampling point (including depth)
- Number of containers
- Preservative used
- Parameters requested for analysis
- Signature of person(s) involved in the chain of possession
- Inclusive dates and times of possession
- Notations regarding the possible compromise of sample integrity
- Notation regarding sample temperature
- Document control number

After completing the COC, the original (white copy) will be enclosed in a plastic bag and secured to the inside of the cooler lid for the laboratory and the yellow copy will be placed in the project file.

8.6 Sample Labels

Each sample removed from a site and transferred to a laboratory for analysis will be identified with a sample label containing specific information regarding the sample. Each completed sample identification label will be securely fastened to the sample container. Complete sample labels will include the following information:

- Date

- Time (military) of sample collection
- Type of analyses requested
- Sample number
- Sample collection depth, if appropriate
- Location of sample collection
- Type of preservative
- Initials of sampler

8.7 Custody Seals

From the time the coolers are packed until they are opened in the laboratory, custody seals will be used to preserve the integrity of the cooler during shipment. Custody seals must be attached so that it is necessary to break the seals to open the cooler and should be initialized by the person applying the seal. The custody seals will be covered with clear tape. All samples shipped overnight to the laboratory will be shipped in coolers sealed on two opposite sides with custody seals. As long as the COCs are sealed inside the sample cooler and custody seals remain intact, commercial carriers and laboratory couriers are not required to sign the custody form.

8.8 Digital Cameras or Recorders

Sample points and field activities may be documented using cameras or recorders. Photographs and recordings may be used to document sample characteristics, sample collection activities, remediation activities, equipment used, and features of the site and surrounding areas. Photographs and recordings taken to document sampling points should include one or more reference points to facilitate relocating the sample location at a later date. Where appropriate, a scale should also be included in the photograph or recording. Date and time stamps should be turned on for all digital documentation. Photographs and recordings can be located using the built-in GPS unit on the camera or recorder, a handheld GPS, or a photograph location sketch drawn in the field logbook. The following information will be recorded in the field logbook for each photograph or recording:

- Date
- Time
- Photographer
- Name of building or area
- General direction faced and description of subject
- Sequential number of the photograph or recording

- Camera or recorder serial number

9.0 DATA AND RECORDS MANAGEMENT

9.1 Field Activities

Field documentation should be completed as the activities are being done. On a regular basis, typically not less than once a week, the field personnel should scan their field documentation for placement in the project file. At the completion of a field effort, the field personnel are responsible for ensuring that a complete scan of the documentation is in the files and that the originals have been given to the project manager for inclusion in the project files.

9.2 Filing System

A project file will be established to organize and maintain data throughout the life of the project. The field data file will include either hard or electronic copies of record documents generated in the field including but will not be limited to the following:

- Field logbooks
- Site planning documents and project-specific plans
- Contract specifications
- Subcontractor agreements/purchase orders
- Safety Data Sheets for chemicals used on the site
- Field instrument operating manuals
- List of important phone numbers
- Shipping forms
- Equipment calibration records
- Health and safety forms
- Applicable field forms
- Applicable laboratory forms

Field forms in hard format should be electronically scanned and placed in the electronic project files upon return to the office.

The project file in the office can also include, but is not limited to:

- Chemical laboratory data file including copies of the COCs, cooler receipt forms, requests for chemical analysis, and the laboratory results
- Physical laboratory data file including requests for physical analysis and the laboratory results
- Field data file including boring log originals, field logbooks, field transmittals, photographs, and field performance and system reviews
- Data record file including backup copies of the computerized data record system.
- Project correspondence including transmittal letters
- Project memoranda including minutes of meetings and progress reports
- QA/QC file including copies of the laboratory's QA/QC manual, the laboratory's QA/QC project plan, the laboratory's QA/QC internal audit, and performance and system QA reviews
- Report originals in pdf (portable document file) format
- Drawing and plan file including original report exhibits, original maps, and miscellaneous plans and drawings related to the field investigation

10.0 QUALITY ASSURANCE/QUALITY CONTROL

Prior to the start of any field activity, Burns & McDonnell personnel will have read and understood the Project-Specific Work Plan as well as this SOP. Field personnel will be trained for a minimum of 40 hours prior to their working solo on environmental field activities. Field documentation will be completed as activities are conducted and will be relayed to the FSM or Project Manager at a minimum weekly or on a more frequent basis if so stated in the Project-Specific Work Plan.

11.0 REFERENCES

Burns & McDonnell Engineering, Co, Inc. (Burns & McDonnell), 2018. *Policy Manual*,

- Chapter 8, Employee Safety & Health, April 2017.
- Chapter 10, Quality Control Manual, January 2017.

United States Environmental Protection Agency (USEPA), 2007. *Guidance for Preparing Standard Operating Procedures*. EPA/600/B-07/001. April

12.0 ATTACHMENTS

The following example forms are attached to this SOP:

- DQCR

- COC
- Sample label
- Custody seal

Project-specific forms should be included with the Project-Specific Work Plans.

Attachments

DAILY QUALITY CONTROL REPORT

Site: _____
Project No: _____
Date: _____
Crew No: _____
Crew Mem: _____

Weather (circle)

	Bright Sun	Clear	Overcast	Rain	T-storm	Snow
Temp:	to 32	32-50	50-70	70-85	85+	
Wind:	Still	Gusty	Moder.	High	**Direction: NW**	
Humidity:	Dry	Moder.	Humid			

Subcontractors and Equipment on Site: None

Health and Safety Levels: (circle)

D	Mod. D.	C	B	A

Summary of Health and Safety Activities: _____

Instrument Used: (circle)
Calibrated: (check)

PID	**pH**	**Cond.**	**Therm.**	**Turbidity**	**DO**	**ORP**	**Other**

For actual calibration results, see field calibration forms.

Summary of Work Performed: _____

All Samples Were Collected According to Procedures Outlined in the Work Plan?
Yes _____ No _____

Problems Encountered/Corrective Action Taken: _____

Time Project Manager Contacted: _____

Tomorrow's Expectations: _____

Name: _____ Signature: _____

Burns & McDonnell
SINCE 1898

Request for Chemical Analysis and Chain of Custody Record

Burns & McDonnell Engineering 9400 Ward Parkway Kansas City, Missouri 64114 Phone: (816) 333-9400 Fax: (816) 270-0575 Attention:	Laboratory: Address: City/State/Zip: Telephone:
Project Number: Client Name:	Document Control No: Lab. Reference No. or Episode No.:

Sample Number	Location	Material Sampled	Sample Collection Date	Sample Type Matrix: Air	Wipe	Bulk	Analysis				Remarks (sq. ft, linear ft, volume)

Sampler *(signature)*:		Sampler *(signature)*:		Special Instructions:
Relinquished By *(signature)*: 1.	Date/Time	Received By *(signature)*:	Date/Time	Ice Present in Container: Yes ☐ No ☐ / Temperature Upon Receipt:
Relinquished By *(signature)*: 2.	Date/Time	Received By *(signature)*:	Date/Time	Laboratory Comments:

032703 Form WCD-KC-105

ROUTE TO		ANALYSIS
	Burns & McDonnell WCD 9400 Ward Parkway Kansas City, MO 64114 Phone: (816) 333-9400	

Sample Group: _____

Sample Point: _____

Sample Designator: _____

Sample Round: _____ Year: _____

Sample Depth From: _____ To: _____

Date Sampled: _____

Time Sampled: _____

Preservation: _____

_____

090705 Form WCD-97N

WCD-101

Burns & McDonnell ENV
9400 Ward Parkway
Kansas City, MO 64114-3319

Signature _____

Date _____

APPENDIX B – PHOTOGRAPHIC DOCUMENTATION


BURNS McDONNELL

APPENDIX D – DOUGLAS COUNTY NOXIOUS WEED PLANT LIST

Douglas County Noxious Weed Plant List

Common Name	Scientific Name
Canada thistle	*Cirsium arvense*
Field bindweed	*Convolvulus arvenis*
Johnson grass	*Sorghum halepense*
Musk thistle	*Carduus nutans*
Sericea lespedeza	*Lespedeza cuneata*

*Species as identified in the 2022 Douglas County Vegetation Management Plan

APPENDIX E – GRAZING MANAGEMENT PLAN

Kaw Valley Grazing & Agrivoltaics, LLC

Kansas Sky Energy Center
Grazing Management Plan

OCTOBER 10, 2023

Prepared for:
Free State Solar Project, LLC
422 Admiral Blvd
Kansas City, MO 64106

Prepared by:
Kaw Valley Grazing & Agrivoltaics, LLC
110 Riverfront Road
Lawrence, KS 60444
Jacqueline Smith, President

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A. Project Overview

The Kansas Sky Energy Center (KSEC, Project) is a proposed 159-megawatt (MW) utility-scale photovoltaic (PV) solar generation energy facility. The proposed Project will co-locate agrivoltaics throughout the Project Area.

The Project may encompass approximately 1,100 acres north of Lawrence, Kansas, pending regulatory approval. The Project is under development by Free State Solar Project, LLC (Free State), a subsidiary of Savion, LLC, with a proposal for Evergy to build, own, and operate the energy facility, pending regulatory approval.

Free State has engaged the services of Kaw Valley Grazing & Agrivoltaic, LLC (KVGA), a Douglas County grazing and agrivoltaics consultant company, in preparing the Grazing Management Plan.

The Grazing Management Plan (GMP) provides a plan for managing the vegetation at the solar site using soil-regenerating grazing methods. The GMP is developed in collaboration with Central Grazing Company, Inc., a women-owned and operated regenerative lamb grazing company located in Douglas County, Kansas.

B. Vegetation Management

1. Service Area

Solar facilities must have regular vegetation management during the growing season to prevent the shading of PV panels. Vegetation that grows underneath panels reaching heights above the leading edge of panels will cause shading and must be managed several times yearly.

The KSEC Project proposed GMP recommends sheep grazing for vegetation management treatment on installed perennial pollinator-friendly vegetation. The proposed GMP outlines Grazing Management and Soil Health methods recommended by the United States Department of Agriculture Natural Resource Conservation Service (USDA-NRCS). The recommended grazing methods are proven to build soil, enhance ecosystems, and increase profits for the grazer. ("Grazing Management and Soil Health")

Grazing management areas within the Project Area will be determined through advanced engineering design, public approval processes, and a competitive bid process. The KSEC Vegetation Management Decision Tree provides additional detail on potential grazing management areas.

Using the USDA-NRCS grazing recommendations, KSEC may improve the biological attributes of the Project Area by responsibly incorporating managed grazing practices. These practices build soil fertility, help retain groundwater, nurture native prairie species, secure food systems, and provide opportunities to agricultural businesses.

Applying the USDA-NRCS Grazing Management and Soil Health practices will also:

- Conserve the natural resources within the Project Area.
- Support the symbiotic relationships with native prairie species and pollinators.
- Encourage wildlife habitat restoration.
- Promote good animal welfare farming practices.
- Create economic opportunities for local sheep grazers.
- Contribute to increased quality of life for the rural community by regeneration of soils.
- Preserve the agricultural economy at solar sites.

The agrivoltaic goals of the project are to:

- Provide vegetation management for the Project Area.
- Improve soil fertility using regenerative grazing methods.
- Create economic opportunities for new, beginning, and minority farmers.
- Strengthen rural public/private partnerships to contribute to a robust local food system.
- Keep the land in agricultural use.

2. Sheep Employed for Vegetation Management

Grazing is highly effective in managing vegetation around and under panel areas that can be hard to reach or expensive with conventional mowing equipment. Sheep are the recommended livestock for grazing underneath panels and racking equipment because they are small and agile. Their size and strength mean that any rubbing on equipment is unlikely to impact the PV panels negatively. Including sheep grazing for vegetation management will also have additional economic and ecological benefits.

"Grazing Management and Soil Health." *Natural Resources Conservation Service*, USDA - NRCS, http://www.nrcs.usda.gov/sites/default/files/2022-09/Grazing%20Management_SoilHealth_0.pdf. Accessed 14 September 2023.
Kaw Valley Grazing & Agrivoltaics, LLC: GMP 230914

3. Seed Mixes

Soil testing is recommended at the Project Area before the proposed seed mixes' finalization and construction commencement. The soil testing will inform the species selection and seeding rates suitable for grazing at KSEC.

The seed mixes will be customized based on existing conditions, the nutritional needs of the flock, and the expected construction timeline for installing the PV panels. The seeding plan for the Project Area includes seeding a cover crop preconstruction, terminating the cover crop, and then installing a species-rich mix of permanent perennial species with a cover crop to establish quick soil coverage. Alternately, the area may be seeded with a combined temporary seed and permanent perennial seed mix at preconstruction. The proposed seed mix will not include invasive or noxious species under State of Kansas Laws and Administration Rules.

a. Cover Crops

Cover crops containing annual grasses and legumes establish quickly, provide erosion control, build soil organic matter, reduce soil compaction, and assist with weed suppression before seeding perennial seed mixes. Seeding rates for cover crops are selected based on timing, seeding methods, and whether cover crops are seeded with or without permanent seed. Seed mix specifications for cover crops will be determined by soil test, timing, and season.

Cover crop seed mixes are designed to meet two primary objectives:

- Assist with establishing permanent vegetation.
- Soil stabilization occurs when agricultural land is left idle or overwintered before permanent seeding or Project construction.

b. Permanent Perennial Seed

The seed mixes will be customized to establish permanent and perennial ground cover compatible with the Project vegetation management goals.

i. Native / Non-Native Seed Mix

The seed mixes will be customized to blend native and non-native grasses, forbes, and wildflowers. The customized species will be adapted to compacted soils, moist soils, well-drained soils, wet and drought conditions, sun and shade, cool and warm seasons, and cold and hot weather.

Furthermore, the customized seed mix will provide good nutritional resources for sheep and encourage wildlife habitat restoration. Once established, this mix will enhance several ecosystem services compared to existing agricultural conditions or traditional turf grass mixes.

Immediate and long-term benefits include:

- Reduced soil erosion and runoff.
- Nutrient building.
- Water infiltration and purification,
- Biodiversity, increased pollinators, and other wildlife habitats.

ii. Native Pollinator Habitat Seed Mix

The customized seed mix will contain native grasses, sedges, rushes, forbes, and wildflowers. The blend provides a diversity of wildflowers, with flowering occurring over each of the three blooming periods (spring, summer, and fall), along with native species that provide benefits to pollinators and other wildlife. The seed mix is intended to be cost-effective, provide short to medium-stature plant cover, and improve soil health.

4. Seed Mix Vendors

The seed will be purchased from local vendors, when practical, that supply quality sourced seed. All seeds, including cover crops and permanent seed mixes, will be supplied with seed tags that indicate seed weight, pure live seed, region of origin, and noxious weed content. Seed mix vendors will develop permanent seed mixes that support the following objectives:

- Contracting with producers and seed companies to grow specialty seed mixes that meet the nutritional requirements of the flock measured by finishing rates.
- Low growth, quickly established, perennial, and native pollinator-friendly seed mix.
- A diverse mix of seeds targeted to soil type, drainage, sun and shade, and climate.
- Compatible with engineering objectives, including low-growth vegetation.
- Control of woody and invasive species.
- Conserving and regenerating soil health and biodiversity of the Project Area to preserve the rural agricultural land and economy for future generations.

C. Seeding Phases

A cover crop is recommended to stabilize the soils following harvest and pre-construction. Pre-seeding a cover crop will ensure ground cover through construction.

- Cover Crops
    - It is recommended that KSEC install cover crop seeds in the Project Area post-agricultural harvest.
        - The cover crop seed may also be combined with the permanent perennial seed mix.
- Permanent Perennial Seeds
    - The areas under the array area.
    - The perimeter areas inside the fence.
    - The perimeter areas outside the fence.

1. Anticipated Seeding Phases

Seeding of the permanent perennial seed and wildflower seed mix is anticipated to be completed in phases.

2. Seed Timing

Through time, native grasses will eventually establish naturally. To intentionally plant warm-season native grasses, the best time is between December 1 to May 15. After mid-May, cover crops should be used, followed by termination by mechanical mowing or grazing, then seeding of perennial mixes.

Winter seeding may be done between January and March when the ground temperatures cycle between freeze and thaw. Seeding should happen when there is light snow cover, preferably on dry days when the ground temperature is near but not above freezing. Seeding on windy days should be avoided.

Soil disturbance should be minimized throughout the construction process. Another suitable native seeding window is spring through July 15, but it should not occur if the seeding areas are experiencing a large flush of weedy species; soils should be prepped first and then seeded.

3. Seeding Methods

Seed installation methods depend on existing conditions and PV installation timing. Three standard methods are drill, broadcast, and culti-packer seeding (e.g., Brillion seeder).

a. Drill Seeding

Drilling is the preferred method for seed installation, where cover crop stubble and minor amounts of residue are present. Drill seeding typically requires less soil preparation and less seed. Drill double-disc openers should not exceed 6 inches between discs. For adequate coverage, the drill should pass over the soil two times from opposing directions. A drawback to drill seeding is difficulty maneuvering in tight spaces (e.g., near PV panels), and drill seeders are not viable for placing seed under PV panels. A native seed drill is recommended to install native species.

b. Broadcast Seeding

Broadcast seeding is required to install temporary and permanent seed mixes post-construction under PV

panels. Native species should be planted no deeper than ½ inch. Broadcasting seeds before moving sheep into the area is the best practice, and this will allow the weight of the flock to compact the soil and achieve seed/soil contact after spreading the seed. It is recommended that broadcast seeding be done up to 2 weeks before the installation of livestock. The high stocking density of the flock will help 'hoove' the seeds in creating more seed-to-soil contact.

4. Seeding Depth

Caution is recommended to minimize burying seeds too deep during broadcasting and subsequent packing/raking or drilling. Loose soils, such as in areas that are disced before seeding, are prone to deep seed burial. The recommended planting depth is between 1/16 - 1/4 inches deep, especially for tiny seeds that comprise much of the permanent mixes. Large seeds, such as cover crops, can be seeded slightly deeper, no more than ½ inch deep. Minimizing vehicle and equipment traffic in recently planted areas is recommended to minimize additional compaction and seed burial.

D. Site Preparation

Preparation for permanent seeding typically includes reducing cash crop residues, soil preparation on tilled soil such as discing, vertical tillage, or soil cultivator, and packing soils for firming before seed installation. Excessive field crop residue and associated soil compaction may hinder seed installation and establishment. Small grain stubble such as wheat, oats, and rye provide an excellent seedbed for cover crop seedling establishment.

Following cover crop termination, soil conditions provide a good seedbed for permanent perennial and native pollinator habitat seed mix.

1. Pre-construction

The construction timeline and soil tests will determine the seed mixes, termination strategy, and installation strategy of the cover crop and permanent perennial seed mix.

- The prior seeded cover crop should be terminated for the successful installation of permanent perennial seeds.
- Combining grazing and mowing will allow the best outcome to maintain the recommended cover crop height.
    - Depending on cover crop seed mix, construction timeline, soil temperatures, rainfall, and growing degree days, it is recommended that grazing and mowing start four weeks after cover crop seedlings emerge to maintain the appropriate height and to reduce weeds from flowering and seeding.
- Termination can include; grazing, rolling, chemical termination, mowing, or a combination of termination strategies.
    - Termination will be determined by construction timeline, soil temperature, rainfall, and growing degree days.

It is highly recommended that construction and seeding operations maintain good communication to anticipate which areas of the Project Area need to be terminated and seeded with permanent, perennial seed mixes, or alternatively will be seeded with a combination of cover crop and permanent perennial seed mixes.

Depending on the construction timeline, soil conditions, and rainfall, any mix utilized will be installed prior to construction. Grazing shall cease after termination of cover crop, and not begin again until 70% vegetation cover has been achieved after permanent seeding has occurred. Or alternately, grazing shall not begin until after 70% vegetation coverage after seeding of the temporary seed & permanent seed mix has been achieved by predominantly perennial species. This will assist in ensuring the successful establishment of vegetation coverage as required by the KDHE Construction Storm Water Permit.

2. Construction through Post-construction

Construction activity (e.g., pile driving, racking, and routine traffic) in areas where the permanent perennial seed mix is established is expected to result in moderate disturbance. These areas should be prepped and evaluated for reseeding using the permanent perennial seed mix or a combination of cover crop and permeate perennial seed mix.

3. Soil Amendments

Routine soil fertility and mineral testing are recommended to obtain any recommendations for soil amendments. Organic and non-organic fertilizers or other soil amendments should be used as indicated by

seed mix recommendations and in conformance with applicable local, state, and federal regulations. Native species establish best in low-nutrient environments. It is recommended that no synthetic and non-organic fertilizers or other soil amendments be applied after perennial species are established and when grazing commences. The exception is lime, which may be needed to increase the soil pH, making the soil less acidic and more alkaline. All soil amendments will be informed by soil testing and in accordance with applicable local and state regulations and recommendations.

a. Mulching

Mulch may need to be applied following permanent seeding to assist with seed germination in areas with limited vegetation establishment. Local sources of clean, seed-free hay or straw mulch are acceptable. Certified weed-free hay or straw is preferred. Wool can be a good substitute for hard-to-establish areas and is a natural byproduct of sheep management. Site-specific determination should be considered when addressing the mulching. All mulching management treatments are to be implemented in accordance with applicable local and state regulations and recommendations.

4. Invasive Weed Control Methods.

Appropriately timed seeding of cover crops and perennial species, along with adequately managed rotational grazing, can significantly reduce overall maintenance requirements for weed control. For the proposed Project Area, invasive and noxious weed species are defined under the following two categories:

- Includes species covered under State of Kansas Laws and Administration Rules.
- Species that are not legally defined as noxious or invasive but may interfere with the PV panels. Plant height may interfere with ecological goals and the establishment of native species or pose vegetation management concerns.

Invasive and noxious weeds can persist and thrive in abandoned agriculture fields. Excessive weed-seed germination often follows agriculture crop termination (aka, fallowing). This includes annual, biennial, and perennial weeds. The weed flush, left unchecked, will out-compete establishing permanent seed, and the site will become dominated by fast-growing, noxious, and incompatible weeds that compromise project goals.

Vegetation management facilitates plant establishment during the first two growing seasons. And proper management will ensure early problems do not become larger issues.

Invasive and noxious weed management should be conducted.

- Minimize the spread of noxious weeds from existing populations.
- Reduce competition and improve the establishment and success of the permanent seed mixes (as needed).
- Reduce vegetation impacts on PV panels and other solar facility infrastructure.

Besides grazing, noxious and weed species management may include cutting/mowing, hand-pulling, smothering, and spot application of herbicidal treatments.

a. Herbicides

Herbicides may be needed at various points of the site construction and operation process to control noxious species. Proper selection, use, and application of herbicides are important and outlined below.

In addition to natural controls like grazing or hand-pulling, mechanical controls such as mowing or

cutting, and in unique circumstances, biological controls are all tools to control invasive and noxious weeds. Herbicides are an effective tool for managing persistent invasive and noxious weeds, which may be needed during Project operation. However, respecting the vegetation and being ecologically sensitive to the Project Area is highly important. Using herbicides as the last "tool in the toolbox" to manage invasive and noxious weeds respects vegetation and ecologically sensitive areas and is highly recommended only after all other tools have been exhausted.

i. Herbicide Standard Industry Practices

Herbicides are vegetation management tools when used according to the manufacturer's instructions and following standard industry practices. The following practices are recommended when using herbicides to manage undesirable vegetation:

- Vegetation managers should apply principles of integrated vegetation management.
  Herbicide labels and Safety Data Sheets should be read before transport, mixing, loading, and application.
- The appropriate volume of herbicides and adjuvants necessary to complete a vegetation management task should be utilized.
- This includes targeted application techniques and properly calibrated equipment to minimize the environmental effects of sensitive areas.
- As product labels recommend, the appropriate concentrations of herbicides and adjuvants are used to achieve the intended outcomes.
- Use of selective herbicides to limit effects on non-target plants.
- Persistent noxious weeds typically require several treatments to control re-growth and spread adequately.
- Herbicide applications should be conducted during favorable weather conditions to maximize herbicide efficiency and minimize off-site drift and run-off.
- Avoid herbicide application during persistent heat, drought, freezing, or wet conditions.
- Herbicide should be applied to plants when plants are most physiologically prone to injury by active ingredients. Plants are most prone to herbicide injury when they are actively growing. Plant life cycles targetable for herbicide application include the flower bud stage and rosette stage. Plants that have senesced following flowering or are inactive due to high heat or drought should not be treated.
- Care should be taken to avoid injury to desirable grass species by waiting to apply herbicides after grass seedlings have matured for at least 90 days or have flowered at least once. Also, consult the herbicide label for application restrictions following seeding.

ii. Non-Selective Herbicides

Using non-selective herbicides for the KSEC Project Area is not recommended.

iii. Broadleaf-Selective Herbicides

It is recommended to use Broadleaf-selective herbicides cautiously for the KSEC Project Area.

iv. Grass-Selective Herbicides

It is recommended to use Grass-Selective herbicides with caution for the KSEC Project Area. Grass-selective herbicides are intended to injure or kill only grasses.

b. Herbicide Application Methods and Timing

Low-volume/spot applications are the only methods recommended for the KSEC Project Area. Timing should be based on a site-specific evaluation of target species, vegetation composition, and sensitivity of adjacent areas to herbicide applications.

i. Low Volume/Spot Applications

This method utilizes a hand-held sprayer mounted to small (3.5 to 25-gallon) tanks to selectively deliver herbicide to individual plants or small clumps of plants. Backpack sprayers are suitable for small areas, while pistol sprayers mounted to an all-terrain or utility terrain vehicle (UTV) are suitable for larger areas or large clumps of vegetation. Wicks may also be used for ultra-low volume delivery of herbicide to undesirable plants growing in sensitive ecological areas. These methods are appropriate for managing discrete populations of weedy and invasive species after construction.

ii. Broadcast Applications

This application method is not recommended for the KSEC Project Area.

iii. Herbicide Adjuvants

Adjuvants are typically added to herbicide mixes to improve herbicide performance. Herbicide labels should be consulted for recommendations on the types of adjuvants to add to a mix. Aquatic-approved adjuvants should be used to minimize potential impacts on wildlife, including pollinators. Aquatic-approved adjuvants should always be used in and near areas of standing water. Individuals should perform herbicide treatments in accordance with all applicable laws, regulations, and herbicide label instructions.

E. Grazing / Cutting / Mowing

Grazing or mechanical cutting/mowing should be appropriately timed once perennial vegetation is established to control noxious and weedy species (e.g., mow annual and biennial species during flowering and before seed production). Methods should be selected based on weed vegetation type, cover, and site accessibility.

Grazing or mechanical cutting/mowing is the primary management tool for establishing desirable vegetation. Grazing and mechanical cutting/mowing reduce the height of flowering or undesirable vegetation and maintain sunlight at the ground surface to encourage the germination and growth of desirable species.

Mowing using a deck mower is applicable in areas that are accessible with a small tractor and mower. Flail mowers are preferred, but rotary mowers are acceptable if significant clumping of grass clippings is minimized. A 3-point side-mounted trimmer mower attached to a small tractor may also cut vegetation around steel piles and under panels.

1. Mowing Height

Specific recommendations for mowing height vary by seed mix and location within the Project Area.

2. Frequency and Timing

The frequency and timing of grazing, mechanical cutting//mowing depend on the vegetation establishment timing. Mowing will be implemented throughout the establishment and maintenance phases with the goal of introducing the flock after predominate perennial vegetation has reached 70% coverage. The flock stocking rate will be increased to full capacity and stocked at a rate that is determined adequate by visual plant coverage, species biodiversity, and soil tests. At least one mowing per growth season (hot/cold/dormant) should occur during the first and second establishment year and grazing is expected to begin during the second establishment year.

It will take time for the established species to reach the required 70% coverage. Planning a grazing rotation before the grazing season starts is necessary, which is the guide for the flock manager's rotation plan. The flock manager would then use their experience and observations to decide daily if the rotation plan is reasonable and responsible and to make necessary adjustments in rotation days and stocking rates.

Examples of common adjustments to rotation plans include:

- First, in late spring, after rain events and warming weather, stocking rates may have to be increased to clear the vegetation growth.
- Secondly, in the summer, the flock may have to be moved from paddock to paddock faster than in spring or fall due to the slowed growth of cool-season vegetation.
- Predator and wildlife pressure.
- Weather.

a. Grazing: Establishment Phase

In the Project Area, frequent vegetation management is needed to manage vegetation height under the PV panels and to reduce fast-growing weeds.

The USDA - NRCS CONSERVATION PRACTICE STANDARD PRESCRIBED GRAZING Code 528 (Ac) applies to all agricultural lands where grazing animals are managed.

Following cover crop seeding, it is recommended that rotational grazing starts before the cover crops go to seed. If reseeding of the permanent perennial seeds is needed in disrupted areas, it is recommended that broadcast seeding be implemented up to 7 days before introducing the flock to the reseeded area.

Grazing will allow the flock to terminate the cover crops naturally. This technique will allow the management of the flock's health and productivity while nurturing the desired seeds and minimizing the use of synthetic fertilizers, leaving the soil covered to prevent soil erosion.

Utilizing grazing in the cover crop will also;

- Improve forage quantity and quality for grazing animals' health and productivity.
- Improve surface water quality and quantity.
- Improve or maintain riparian and watershed function.
- Reduce soil erosion, and improve soil health.
- Improve the quantity, quality, or connectivity of food and cover available for wildlife.
- Minimize soil compaction.
- Reduce fast-growing weeds.
- Maintain the land for agricultural use as necessary for agrivoltaics.

The GMP will minimize runoff and erosion and build soil organic matter through managed rotational grazing systems. The GMP will project the flock's stocking weight, frequency, timing, and duration to assist in establishing permanent perennial plants. The GMP will also;

- Minimize the flow of animal wastes into water bodies.
- Minimize animal impacts on streams or wetland areas.
- Provide adequate ground cover and plant density to maintain or improve infiltration capacity and reduce runoff.
- Maintain adequate riparian community structure and function to sustain associated riparian, wetland, floodplain, and stream species.

Additionally, mowing should be incorporated into the GMP until the permanent flock's stocking weight can increase to the Project Area's capacity. The stocking weight is determined by soil tests, the biodiversity of the permanent perennial plant communities, and the desired goals of the Project. The GMP will conform to all applicable Federal, State, and local laws.

b. Grazing: Transition Phase

By the third growing season, desirable vegetation should begin to be established. Years 3-5 represent a transition phase where desirable vegetation becomes increasingly diverse but remains susceptible to weed invasion. A minimum of one grazing or mowing should occur. Flock managers should target mowing for specific weed growth areas and reduce the incompatible vegetation height under the PV panels.

3. Long-Term Maintenance

Over the long term (years 6-30), grazing should continue at least once yearly. Mowing should occur once every 2-3 years as site conditions allow. Mowing is typically done during the dormant season (late fall to early spring) or, if necessary, in mid-to-late summer. The goal of routine mowing is to reduce weeds, encourage the growth of grasses, and minimize the establishment of woody vegetation. Actual mowing

frequency depends on soil moisture; wet areas and wet weather require more frequent mowing, while dry areas and dry weather reduce mowing frequency.

Haying, if feasible, offers better long-term management than mowing, as haying both mows and removes vegetation. The removal process reduces soil nitrogen. Reduction in soil nitrogen benefits desirable vegetation while discouraging noxious vegetation. Nitrogen reduction benefits native plants and pollinator habitats. Haying also benefits the producer with forage crops. The customized seed mixes will exclude non-edible, high bloat, and potentially toxic species to help make haying more feasible.

4. Grazing Hour

The amount of time the flock will spend in a paddock (grazing hour) will be considered for species regrowth, soil health, and flock nutrient needs. To allow for optimal plant regrowth, any flock's time in any grazing paddock should not exceed four days unless it is a dedicated sacrifice area or part of the grazing management to control weeds. The regrowth of plant species starts after four days of being grazed, and any grazing of this early regrowth can adversely affect plant health. Furthermore, a 4-day maximum rotation period reduces fecal matter contamination and improves pasture hygiene.

The pasture rest period (time between grazing periods) in the Great Plains should not be less than 40 days to minimize internal parasite pressure for sheep and to allow the plants to recover. As managed grazing is partially aimed at optimizing sheep's health and food sources, this health risk to sheep is minimized by following the GMP.

The Project Area also consists of access roads, inverter pads, and other site infrastructure that may consume a percent of the area within the Project Area and effectively reduce the overall vegetation area. The graziers should consider this acreage separately for each paddock. Furthermore, full vegetation coverage of the Project Area is expected to be low in the first 2-3 years. Increased reseeding rates should be considered during the first three years of grazing. However, once vegetation is established in and around the PV, and there should be no reduction in the flock's productivity compared to a traditional pasture once the pasture has recovered from construction. This GMP accounts for changes in growth using soil and forage testing to determine the grazing schedule and stocking rates.

NRCS. “Natural Resources Conservation Service CONSERVATION PRACTICE STANDARD PRESCRIBED GRAZING Code 528 (Ac).”

www.nrcs.usda.gov/sites/default/files/2022-09/Prescribed_Grazing_528_CPS.pdf.

F. Soil Fertility Improvements: Regenerative Grazing Method

Because KSEC is converting conventionally farmed agricultural land into a regenerative perennial grazing site, the Project Area soil, ecological, and biodiversity conditions will significantly improve. A carefully managed grazing system that utilizes skilled shepherds and recommendations from the United States Department of Agriculture- Natural Resources Conservation Services (USDA - NRCS) is critical for regenerating and conserving native ecosystems.

Carefully managed rotational grazing practices mimic how native ecosystems evolved. This practice is more advantageous to building soil fertility than managing vegetation through chemicals or mowing. Proper installation of a perennial species will maximize the forage nutrition while conserving and improving the soil for future agricultural use.

Sheep grazing has an essential role in maintaining soil health over the lifespan of a solar installation. A properly planned and managed rotational grazing system offers benefits.

- Direct soil fertilization via sheep grazing conserves and builds healthy soil ecology.
  Proper grazing and rest periods for the plants. These periods both encourage and protect plant root development.
- Living plant root structures in the soil year-round enhance soil microbial activity, nutrient flows, and a well-functioning water cycle.
- Prevents erosion, meaning soils are retained and enhanced.
- Soil structures improved over time.

1. High Stock Density Grazing using Adaptive Multi-paddock Grazing

It is recommended that KSEC utilizes High Stock Density Grazing (HSD) using Adaptive Multi-paddock (AMP) grazing to manage the vegetation. HSD using AMP grazing focuses on keeping animals in smaller areas at a time and then moving them regularly (often daily) so that vegetation can recover and regrow before being grazed again. The adaptive part of the system relies on direct observation of vegetation to determine the correct amount of time for animals to be in a single paddock and when the paddock is ready to be grazed again.

It is essential to distinguish between an HSD using AMP systems and a more traditional “selective grazed” (continuous grazing), where animals are put into a large pasture and left for extended periods. HSD using AMP is a practice of managing livestock grazing that mimics how native prairie ecosystems evolved - in relationship with herbivores. By focusing on quick, rapid grazing with long rest times, HSD using AMP allows species to grow long root systems that tap water deep in the soil bed, allowing a more extended grazing season in drought. Native species repopulate the pastures, allowing nutrient-building organisms to thrive.

HSD using AMP, calculates animal body weight and grazing area to determine paddock size. In this system, the goal is to move animals every 12-48 hours. Grass density is also a factor when determining the pasture's nutrient value. HSD using AMP causes more grasses and forbs to be utilized by animals eating or smashing the grasses down. Theoretically, the sheep eat 50% of the grasses, while 50% becomes ground cover. This system also concentrates animal waste into a more controlled and smaller area so that the soil organic matter increases from the wasted grass and the animal waste. This plan incorporates grazing to strengthen soil fertility and improve pastures. This rotational grazing system significantly improves soil health and forage yield over selective grazing or mechanical mowing and thus can support

greater animal stocking rates. Increased stocking rates and higher levels of animal performance with managed grazing will improve the economic returns to the producers.

An HSD using an AMP system in the GMP reduces synthetic pesticides and eliminates the need for non-organic fertilizers. This system does require more labor to manage vegetation. However, the overall parasitic management of the flock decreases due to the grazing rotation, thus decreasing parasitic exposures and management labor.

The GMP will outline a planned rotation for the flock. Each paddock's stocking rate is calculated based on the season, the flock's nutritional needs, and the biodiversity of the paddock. To allow for optimal soil regeneration, any flock's time in a grazing paddock should not exceed four days with optimal targets of 24-hour rotation.

A successfully managed sheep grazing system on large solar sites utilizes the following:

- Initial project grazing plan rotational map.
- Grazing experience in farm management.
- Ability to calculate stocking rates with pasture biodiversity density.
- Improve sheep genetics to promote stable flock health.
- A breeding plan allowing sheep yields to compete with the global market.
- Stringent treatment protocols for flock wellness that allow natural flocking behavior.
- Fulfilled nutritional requirements of the flock based on finishing rates.
- Access to mineral feed and clean and freshwater 24/7.
- Health checks every rotation day.
- Well-designed humane handling systems for animal wellness checks and treatment.

The pasture's biodiversity and soil health are expected to be low until perennial species and forbs are established. The GMP allows season and climatic events to shift the rotation. The producer would then use their experience and observations to decide daily if the rotation plan is reasonable and responsible and to make necessary adjustments in rotation days and stocking rates.

2. Soil and Forage Tests

Soil and forage tests should be performed before and after construction. A detailed organic matter (OM) soil test and nutritional forage test protocol are recommended for the GMP. These tests will help inform sheep stocking rates. Grazers may perform soil and forage testing at regular intervals to analyze the health of the soil and the nutrient quantity of the forage for the flock. Soil and forage tests will allow for adjustments to the planned grazing rotation.

3. Planning, Production, & Rotation

The agrivoltaics plan centers around a managed rotational grazing system outlined by a GMP. The GMP is a blueprint for managed grazing that determines:

- Sheep stocking rates.
- Potential paddock size.
- Timing of flock movements.
- Duration of pasture rest periods.
- Seeding protocols.
- Weed control protocols.

The GMP facilitates site management that achieves targets for vegetation control, flock production, soil

health, stormwater runoff reduction, pollinator supply, and water quality improvements.

4. Sheep Pasture Rotation & Grazing Plan

The Project Area will have ample fenced areas by its planned design. From the view of a grazier, the fencing at solar sites serves as grazing areas that, once subdivided into grazing paddocks, will assume ideal conditions for a pasture rotation with sheep.

The perimeter fencing and rotational grazing serve as predator deterrents, the solar panels provide shading and shelter for the animals, and the land used for PV panels provides nutritious pasture species for ruminant health. In turn, rotationally grazed sheep provide adequate and comparatively cheap and community-building vegetation management for solar, optimal ground coverage, and thus reduced erosion and run-off, and agricultural usage of lands that can add to the viability of farming communities.

Each permanently fenced array will be divided into smaller grazing units. The GMP requires dividing each array into fenced areas. Paddocks are created using permanent perimeter fencing and portable, battery-charged Electronet® fencing. The Electronet® is a portable fence used by grazers. It is a white, lightweight, temporary fence that is energized using a portable battery/solar combination or 110V power supply. This fencing is simple to power on/off and will only be inside the permanently fenced areas.

Typically, the grazer will mow perimeter paths where the grazing team will install the Electronet®. Using permanent and temporary fencing to form paddock walls, although some paddocks may be formed entirely by lengths of portable fencing. This system allows the grazers a high level of control over the vegetation. The portable, battery-charged Electronet® fencing allows for a simple, efficient rotation.

5. Wildlife

Properly managed perennial pastures can provide vast benefits to wildlife. Wildlife use of native grasses is well documented. Grassland nesting birds and other wildlife species utilize pastures. Grazers must avoid overgrazing to encourage wildlife diversity in the Project Area (unless overgrazing is strategically implemented as weed control). The GMP will include consideration for wildlife needs in the grazing rotation.

During operation and after initial ground vegetation establishment, management of array vegetation should minimize mowing impacts on wildlife, particularly grassland bird nesting, from late spring through summer of each year. Vegetation management activities should be scheduled outside this avoidance period to the extent feasible. Since mowing lanes is required during the avoidance period to install the grazing paddocks properly, personnel should be trained to look for sensitive wildlife to minimize impacts before engaging in such activities.

6. Pollinators

Planting a diverse permanent perennial species mix provides pollinators with blooms throughout the year. Establishing cover of native grasses, legumes, and forbs increases pasture biodiversity to ensure flowers bloom for as long as possible. This will attract pollinators throughout the growing season.

After establishment, well-managed grazing of the Project Area vegetation should minimize impacts on pollinators. Grazing will improve permanent perennial species composition and vigor of plant communities. It is recommended to include managing for pollinator forage or nest sites in the Project Area.

7. Predator Protection

Well-trained Livestock Guard Dogs (LGD) and herding dogs are valuable assistance to farmers. LGDs will permanently live with the flock at all times. LGDs are trained to protect the flock from coyote predation specifically. Herding dogs will be used to sort and control the flock's movement and aid in animal handling. Herding dogs do not live with the flock but are the manager's helpers. All dogs working around livestock must be properly trained and under control at all times. Working dog protocols will be incorporated into the GMP.

Based on the final facility design, if any culverts are determined to require predator barriers to protect grazing sheep and LGDs, appropriate features will be added. These barriers will only be required if a culvert of sufficient size is constructed that may allow predators such as coyotes to enter or allow LGDs to exit grazing areas.

8. Animal Welfare

Practical and common-sense Animal Welfare (AW) standards are recommended for the GMP. AW's main function is to provide commercial flocks at solar sites with good, peaceful, and humane lives. Flocks should be raised outdoors on pasture for their entire lives using AW standards. AW is important to healthier farming ecosystems, contributes to pasture hygiene, and supports community values.

The AW standards at KSEC should have a minimum of the following:

- Improved genetic protocols for effective and humane grazing under the PV. This will also allow for additional income for the producers.
- It is recommended to graze similar groups together
    - Dry (non-lactating) ewes, open (non-pregnant) ewes, ewes in their early stages of pregnancy, yearling ewes, or growing lambs. In the case of groups of growing lambs post-weaning, the lambs should be of the same sex or the males castrated by banding.
- Ad libitum clean and fresh water access.
    - Site-specific amenities like well water, connection to municipal water lines, or well water access are necessary for grazing. Before the commencement of grazing, suitable freshwater sources will be identified for the Project Area. Municipal water is not currently available at the Project Area; therefore, sources that will be considered include existing wells, new wells, existing ponds, or water tanks filled with freshwater transported to the site via truck. The wells or other water sources are anticipated to tie into a 1-inch plastic irrigation line on top of the ground and reach each paddock in the array. Freeze-proof watering troughs will tie into this, and the line can be drained in the fall and remain in place for the winter.
    - For sheep of the recommended production stages (non-lactating and > 60 lbs growing lambs), water requirements are very low in spring and fall and higher during summer. Typically, dry, non-gestating ewes consume between 5 and 10 % of their body weight in water daily, while lactating ewes can consume up to a gallon of water daily.
    - On average, each well/water source will serve the entire flock and should not need to draw more than 2,000 gallons a day in the hottest part of the summer. In early spring and late fall, the sheep have lower water needs from the wells/water source.
- Mineral feed must be available ad libitum and contain adequate concentrations.
    - Mineral feed is specially blended and commercially available for sheep producers. This is an important animal welfare and nutritional requirement often insufficient in the soil. It is recommended to set up standards for testing the minerals in the soil. Until and if the mineral content of the soil increases to sufficient levels, the mineral feed should be

offered in troughs that can be moved with the flock daily.

- The flock care team will visually inspect the sheep every day. Moving the flock(s) to the next paddock is a great time to seek out, monitor, and care for any sheep requiring it.
- A wellness inspection of individual sheep is recommended at regular intervals.
    - It is recommended that buffer areas at the Project Area consist of hay fields, animal handling pastures, compost, barn, and flock handling areas.
    - This inspection is only possible with a handling system. A well-thought-out handling system will be an essential tool for the flock manager. Handling systems for sheep can be portable or permanent.
    - The handling system and sacrifice areas will be semi-permanently located at a central location, and collapsible handling systems will be transported on a trailer for quick wellness checks as needed.
    - The system must allow gathering, leading in a single-file line through a treatment chute, stopping, and sorting sheep. Several commercial manufacturers of these systems are available in the US, including Sydell, Premier 1, and Te Pari. Handling sacrifice areas within the Project Area will be decided once the final civil layout is made.
- Before the flocks begin the grazing season each spring, certain protocols are recommended to ensure the flock is in optimal health before seasonal grazing begins.
    - Hooves must be checked and trimmed.
    - Ear tags replaced or added in compliance with The United States Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), National Scrapie Eradication Program.
    - Wool sheep must be shorn.
    - Body condition scored before moving on site. This measurement provides information about the nutritional and health status of any animal on site and can be used to adjust the grazing rotation.

G. Creating Rural Economic Opportunities

As the KSEC development progresses in Douglas County, rural economic opportunities for a sheep grazing industry in Douglas County will emerge.

The agrivoltaic sheep grazing industry will:

- Promote opportunities for new, beginning, and minority farmers.
- Preserve agricultural land production.
- Create agricultural jobs for rural families.
- Build valuable and rare infrastructure for rural communities in multiple markets, including food, wool, and leather production.
- Scale secondary markets in rural communities' feedstuff commodities, farming equipment, vet services, and skilled contracted labor.
- Strengthen local services such as regional freight haulers and third-party fulfillment logistics.
- Attract investments for agricultural, market, and technological entrepreneurship.
- Increase the state and local tax base.
- Secure local and regional food systems from climate and economic disruptions.

A developed agrivoltaic industry catalyzes agricultural entrepreneurial opportunities to build robust local and regional food industries. In addition, KSEC's goal is to evaluate the feasibility of managed grazer(s) utilizing long-term contracts. Having contracts for long durations offers more security for producers and will allow them to invest in animals, agricultural infrastructure, and logistics they may need. Land access through agrivoltaics offers the following benefits for participating local food entrepreneurs:

- Producers can use long-term grazing contracts to build and scale commercial sheep enterprises. Access to securely fenced grazing areas can provide a resource base for a sheep flock that produces feeders, market lambs, and breeding stock.
    - The grazing area within the Project Area provides a feedstock resource that the farmer traditionally needs to purchase.
    - Producers can use their animals, time, and expertise to gain additional income from a vegetation maintenance contract with the Project owner.
    - The income from the grazing vegetation management contract provides meaningful revenue and can improve farm viability for farmers.
- KSEC will design an efficient grazing model.
- Permanent low interior fencing may be installed for easier grazing rotations.
- Also, semi-permanent above-ground water lines and freeze-proof water troughs fed by on-site wells or tanked water for easy delivery to the sheep flocks may be installed based on site development.
- The site plans might include a barn and animal handling areas to maintain year-round agrivoltaic management at the solar site.
- Additional buffer areas may be included as hay fields for winter feed for the flock.

Soil and forage tests, the biodiversity of the Project Area, the construction timeline, and the growing season will determine the total number of sheep for the Project Area. The initial estimated carrying capacity of the proposed site in the vegetation establishment phase is 1,430 mature ewes. As the soil, forage, and biodiversity of the Project Area improves, so will the carrying capacity of the soil. These animals may be contracted from one or more farms until a permanent flock is established in the Project Area.

H. Conclusion: Strengthening Rural Public/Private Partnerships

As the solar grazing industry emerges, research and policy are needed to facilitate best practices supporting grazers and solar developers. The American Solar Grazing Association (ASGA), a national organization, was founded to promote sheep in solar areas. It is recommended that the KSEC Project becomes certified through the ASGA Solar Grazing Training Certification Program. The ASGA-Certified training course covers key topics and best practices for using sheep to manage vegetation on solar energy sites.

Additional educational resources in this region make it advantageous for agrivoltaics to scale here. Agrarian Future Alliance offers services for new, beginning, and minority farmers interested in agrivoltaic careers. Johnson County Community College provides a sustainable agriculture certificate covering many critical food topics. The University of Kansas also offers a small business development center for business planning, financing, accounting, marketing, and taxes. In neighboring Manhattan, KS, the SAVE Farm trains veterans to become successful producers.

Furthermore, multiple regional organizations are already working to improve local food access and capacity. Based out of Kansas City, the Growing Growers program provides workshops and a connection for new producers to intern with existing producers and gain vital experience and knowledge. A sister organization, Cultivate KC, is working to improve local food access and support local producers inside the greater Kansas City urban area. The Kansas Rural Center and Sustainability Action Network are aligned nonprofits that support and do research in support of local food issues and access in this region.

In addition, Douglas County is home to CORE, a community initiative to energize Douglas County's entrepreneurial ecosystem. Douglas County Sustainability Department also focuses on agricultural lands and local food, including an FPC Food System Plan of Douglas County, Kansas.

Douglas County, Kansas, has a long history of support for local food production, agricultural heritage, farming values, and rural economics. Furthermore, the culture surrounding local and regional food production has created a path for agricultural innovations that solve many industry bottlenecks for new and beginning and minority farmers, including access to land and agricultural infrastructure. Plus, local agricultural entrepreneurs have resoundingly shown interest in recognizing the scale this unique opportunity provides for the sheep grazing industry.

The proposed Grazing Management Plan:

- Outlines a seeding plan, methods, establishments, and vegetation management through sheep grazing.
- Keeps agricultural land in production with a scheduled rotational grazing system.
- Conserves the rural economy by keeping the land in production.
- Builds soil fertility using proven regenerative grazing methods.
- Incorporates the highest animal welfare standards, allowing the flocks to live naturally.
- Eliminates land access barriers for new and beginning and minority farmers.
- Brings investment opportunities to build vital agricultural infrastructure.
- Creates agricultural entrepreneur opportunities for a secure local and regional food system.

The unique confluence of these factors - strong support for local food producers by city and county government, an existing strong culture of local food, small farms, and agricultural

entrepreneurs, and experienced and scalable local sheep brands and grazing experts - makes Douglas County, Kansas, the best place - and Kansas Sky Energy Center the best Project to scale agrivoltaics.

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