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Solar Development in Ohio

Trends, Processes, and Legal Issues with Solar Energy Development:

Session 5: Pre & Post Construction Considerations

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Spring Webinar Series

March 31, 2023

THE OHIO STATE UNIVERSITY EXTENSION

TEACHING EXTENSION RESEARCH

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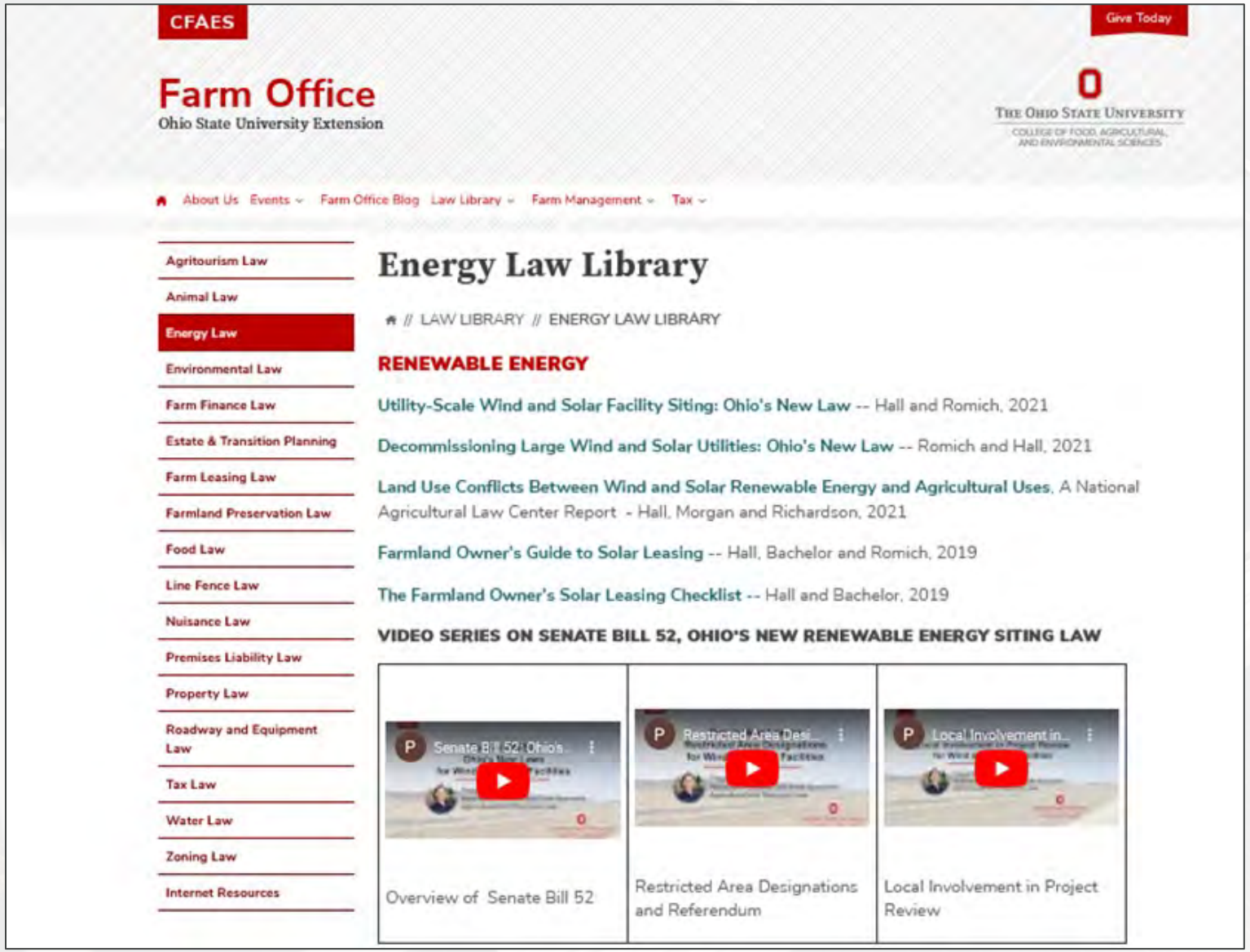

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OSU Extension Ohio Solar Development 2023 Webinar Series

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Session #1
Solar Energy Overview & Trends

Session #2
The Solar Development Lease

Session #3
Connecting to the Electric Grid

Session #4
Solar Project Approval in Ohio

Session #5
Pre & Post Construction Considerations

What does solar project construction involve, and what happens at the end of a project's life? We'll cover the construction process, common construction issues, regulatory oversight of construction, and requirements for decommissioning a project in the future.

Lease Agreement: Developer must show evidence of **site control**.

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Critical Layers of Solar Development Regulatory Oversight

1. Approval to **Interconnect** to the Power Grid
   - Public Utilities Commission of Ohio
   - PJM

2. Permit to **Construct**, Own, and Operate
   - Ohio Power Siting Board
   - County Restricted Zone
   - Local Zoning

3. Qualified Energy Facility **Tax** Exemption
   - Ohio Department of Development
   - County Commissioners

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Image Source: Adobe Stock

Program Objectives

1. Overview of Utility-Scale Solar Construction Process
2. Common Construction Issues
    - Topsoil
    - Surface / Subsurface Drainage
3. Compliance and Enforcement Rules
4. End of Project Decommissioning
5. Research Update: Solar Hay Production
6. Resources, Questions, and Discussion

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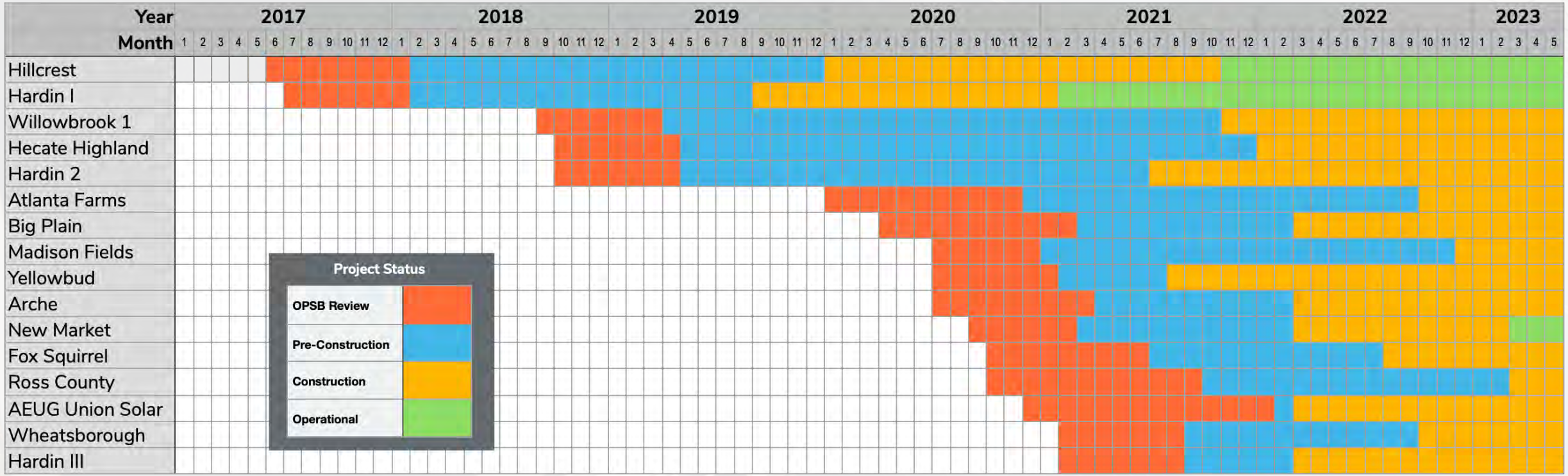
Transition from projects in pre-construction to projects that are under construction

OPSB Construction Timeline



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Project Impacts to Topsoil


CAT


CAT


CAT CP-563C
64.9996


12/16/2


JEFFERS
223-9010
593-0421
JEFFERS

Application Example #1

Due to the relatively low relief across the Project Area, significant amounts of grading are not anticipated. The topsoil will remain in place over a majority of the Project Area, but the topsoil will be removed from the following areas:

- Access roads;
- Driveways;
- Parking areas;
- Inverter and transformer areas;
- O&M building;
- Substation and Switchyard; and
- Temporary construction laydown areas.

This list is not inclusive, but topsoil disturbance will be limited as much as possible. Stockpiled soils will be graded and seeded to reduce erosion. Once the construction activities have

Source: Ohio Power Siting Board. Available at: www.opsb.ohio.gov

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Sample OPSB Applications: **Topsoil**

Sample OPSB Applications: **Topsoil**

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Application Example #2

Topsoil: Most of the topsoil within the Project Area will be left in place. AUS expects a minimal amount of grading on this Project. The topsoil within the footprint of the access roads, parking area, O&M building, storage building, and substation/switchyard area will be removed prior to development and stockpiled on the property from where it was removed, unless directed otherwise by the landowner. The stockpiled topsoil will be spread out as much as possible and

Source: Ohio Power Siting Board. Available at: www.opsb.ohio.gov

Sample OPSB Applications: **Topsoil**

Application Example #3

Topsoil removal and de-compaction will occur in agricultural areas, which constitute most of the Facility footprint. These practices will also mitigate any potential impacts that soil compaction could have on infiltration of rain and snowmelt, thereby further reducing any potential impact to groundwater recharge.

Source: Ohio Power Siting Board. Available at: www.opsb.ohio.gov

Sample OPSB Applications: **Topsoil**

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Application Example

(a) *Electric Power Generation Equipment*

Once Project access roads are complete, construction and assembly of the trackers and mounting of the PV modules will commence. Some grading is anticipated to accommodate the PV arrays. In areas where grading is proposed, topsoil will be stripped and stockpiled and then re-spread over the subsoil once grading is complete. The construction activities could also result in some degree of soil compaction. Following the completion of construction, soil compaction measurements will be performed to assess the extent of soil density in areas designated for revegetation. Soil decompaction will occur in seeding and planting areas where the soil density compaction level exceeds 80% of maximum dry weight according to ASTM 1557. The PV modules will be secured on a single-axis tracker racking system supported on metal piles that will be driven into the ground to a depth between 6 and 12 feet. Pile driving does not require excavation.

Source: Ohio Power Siting Board. 21-0960-EL-BGN

Sample OPSB Applications: **Topsoil**

Application Example

Site Suitability

Some grading is anticipated for construction of the Project. Where little to no grading is required, trees and brush can be selectively removed to preserve existing topsoil and grass. Terracon's analyses of the soils in the area indicate low corrosive potential.

Source: Ohio Power Siting Board. 21-0960-EL-BGN

Sample OPSB Applications: **Topsoil**

Application Example

2.(iii) Topsoil segregation, decompaction, and restoration

Topsoil movement will occur during installation of foundations for the collection substation and inverters, trenching of collection lines, installation of the laydown yard, and the installation of access roads. In areas where grading is proposed, topsoil will be stripped where required by federal, state, and/or local environmental regulations. Any topsoil that is to be stripped prior to site grading will be stockpiled on-site in a manner that meets all federal, state and/or local requirements. After construction in an area, topsoil will be re-spread over the subsoil once grading is complete.

Source: Ohio Power Siting Board. 21-0960-EL-BGN

Project Impacts to Drainage


Ground Control
Ground Control


50D


GAYK Baumaschinen GmbH

How many piles (post) are in a Utility-Scale Solar Project?

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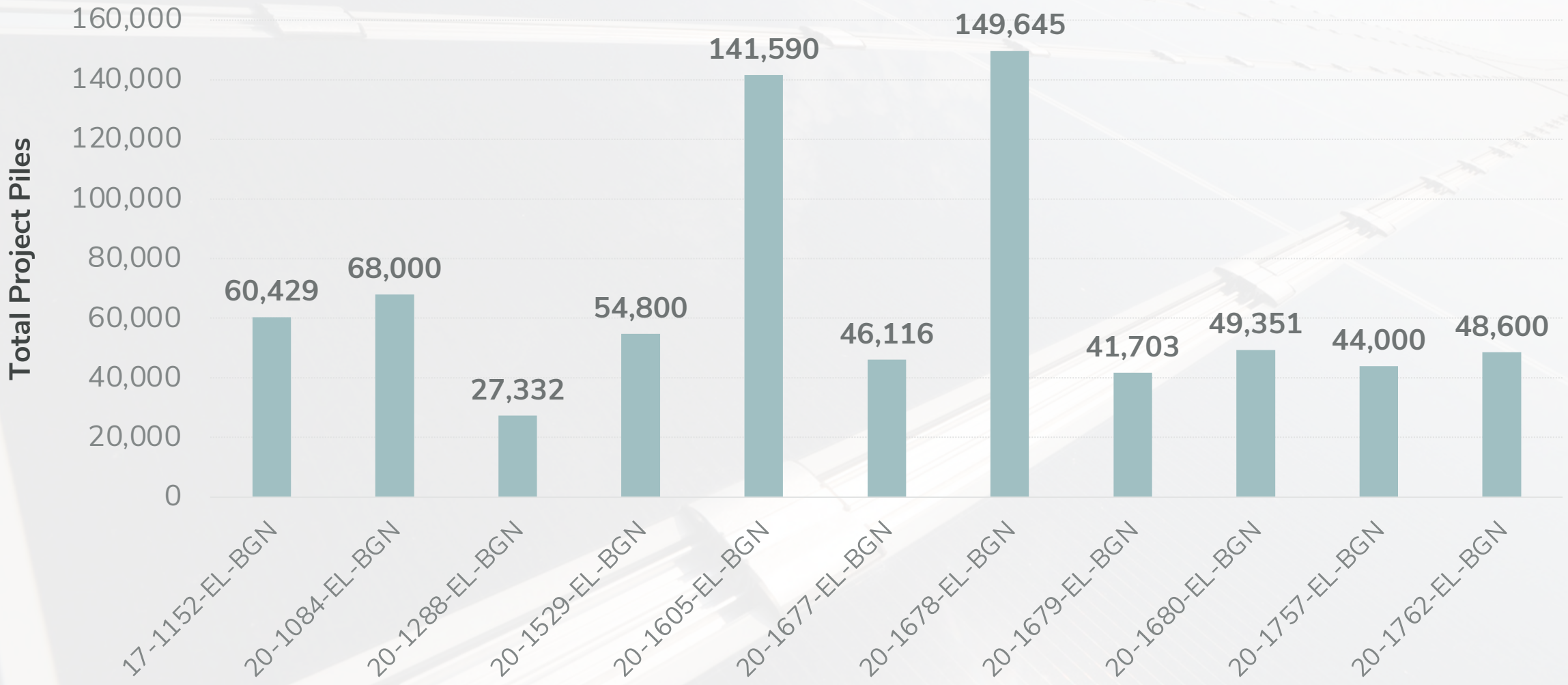

Source: Ohio Power Siting Board. www.OPSB.Ohio.Gov

OAC Chapter 4906-4: Certificate Applications for Electric Generation Facilities

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Rule 4906-4-08 (E): The applicant shall provide information regarding agricultural districts and potential impacts to agricultural land.

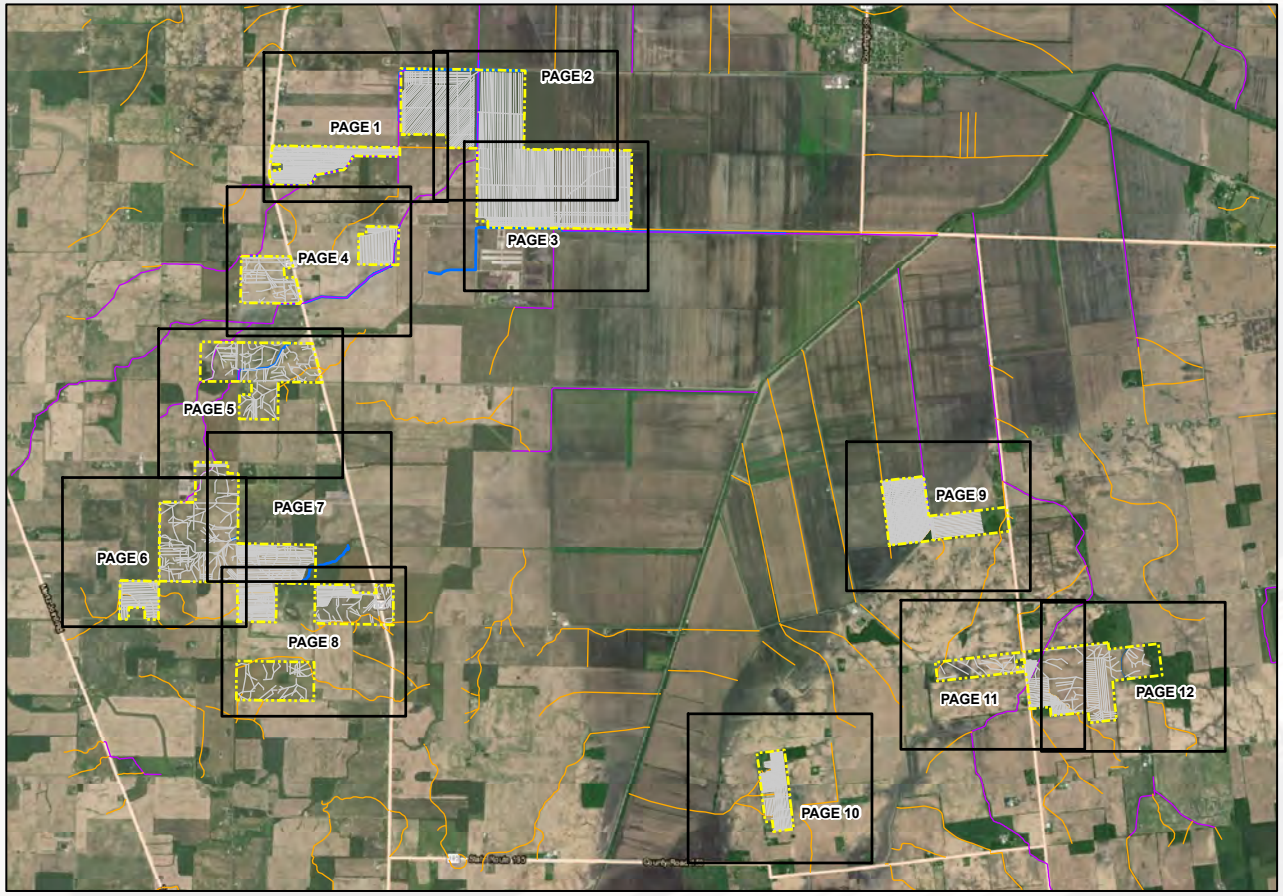
(c) **A description of mitigation procedures** to be utilized by the applicant during construction, operation, and maintenance to reduce impacts to agricultural land, structures, and practices. The description shall illustrate how avoidance and mitigation procedures will achieve the following:

(i) Avoidance or minimization to the maximum extent practicable of any damage to field tile drainage systems and soils in agricultural areas.

(ii) Timely repair of damaged field tile systems to at least original conditions, at the applicant's expense.

(iii) Segregation of excavated topsoil, and decompaction and restoration of all topsoil to original conditions unless otherwise agreed to by the landowner.

Exhibit AA: Drainage Tile Assessment and Construction Impact Report



Source: Ohio Power Siting Board. Case No20-1678-EL-BGN

OPSB Application: Drainage Narrative

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The Applicant will avoid, where possible, drainage tiles and will repair all tiles that are impacted. The Applicant is working with the landowner to minimize impact to the existing drainage system by avoiding tile mains and repairing damaged tiles wherever commercially feasible. Existing drainage ditches will be maintained when possible. The final site drainage plan will ensure the as-built conditions meet or exceed the sites pre-construction drainage profile. The Applicant does not anticipate that the permeability of the site will be reduced and will be responsible for maintaining adequate drainage during operations of the Facility.

Source: Ohio Power Siting Board. Case No. 17-773-EL-BGN 4906-4-08

OPSB Application: Field Tile Narrative

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(ii) Timely repair of damaged field tile systems

If "Applicant" becomes aware during construction or operation of circumstances indicating that the Project has damaged functioning drain tile that are adversely affecting adjacent landowners or public drains, then "Applicant" will promptly investigate the matter and use commercially reasonable efforts to promptly address and mitigate any such negative impacts to adjacent landowners or public drains. Mitigation efforts may include drainage routing or corrections in stormwater flow through retention facilities.

Union County - AEUG Union Solar

- Roughly 9 landowners reported issues to Union SWCD, who then contacted the developer to investigate
- Recommendations
  - Conduct stream flow and surface analysis
  - Isolate the system by encouraging a perimeter drain dig around and design reroute with inspection access.
- Based on county agreements, if an issue was found the developers had to 24 to 36 hours to implement corrective actions

AEUG Union Solar

Case Number: 20-1405-EL-BGN

Capacity (MW): 325.0

Acres: 3,500

Application Filed: 12/23/2020

OPSB Approved Date: 2/17/2022

Construction Start : 3/14/2022

Oversight & Enforcement:

OPSB, Local, Lease

Current Enforcement Rules (OAC Rule 4906-7-02)

Compliance Monitoring

~~Enforcement investigations~~ by the board

- **Upon finding reasonable grounds** the board shall initiate a proceeding to investigate an alleged violation
- While alleged violation is under investigation, the board **may order the suspension of the activity**
- **Within 21 days,** the OPSB staff shall file a **written report** of the investigation including the **staff's findings** of the alleged violation and recommended action
- The board may require an **evidentiary hearing**

If the board finds a violation of the issued certificate occurred, the board may order appropriate remedies including:

- Direct to cease the violation
- Direct certificate compliance
- Require corrective action
- Assess forfeitures
- Direct the attorney general to seek enforcement of OPSB orders including assessing forfeitures and appropriate remedies in state or federal court.

OPSB Rule Review – Proposed New Rules

- **4906-7-04 Annual Reporting Requirement:** Three years after commercial operation, the certificate holder will submit an annual report addressing the facility status, monitoring report, compliance report, facility modification, status of surety, and incident report.

- **4906-7-05 Reporting Violations:** Within 30 days of discovering a violation of the original certificate, the certificate holder will docket a written report describing the violation and corrective actions. The OPSB staff will investigate every report submitted under this rule.

- **4906-7-06 Self-Reporting of Incidents:** Within 30 minutes of incident discovery, operator must notify the OPSB, local law enforcement, and first responders by telephone and submit a report within 30 days. The facility cannot restart or resume construction approved by the OPSB executive director.

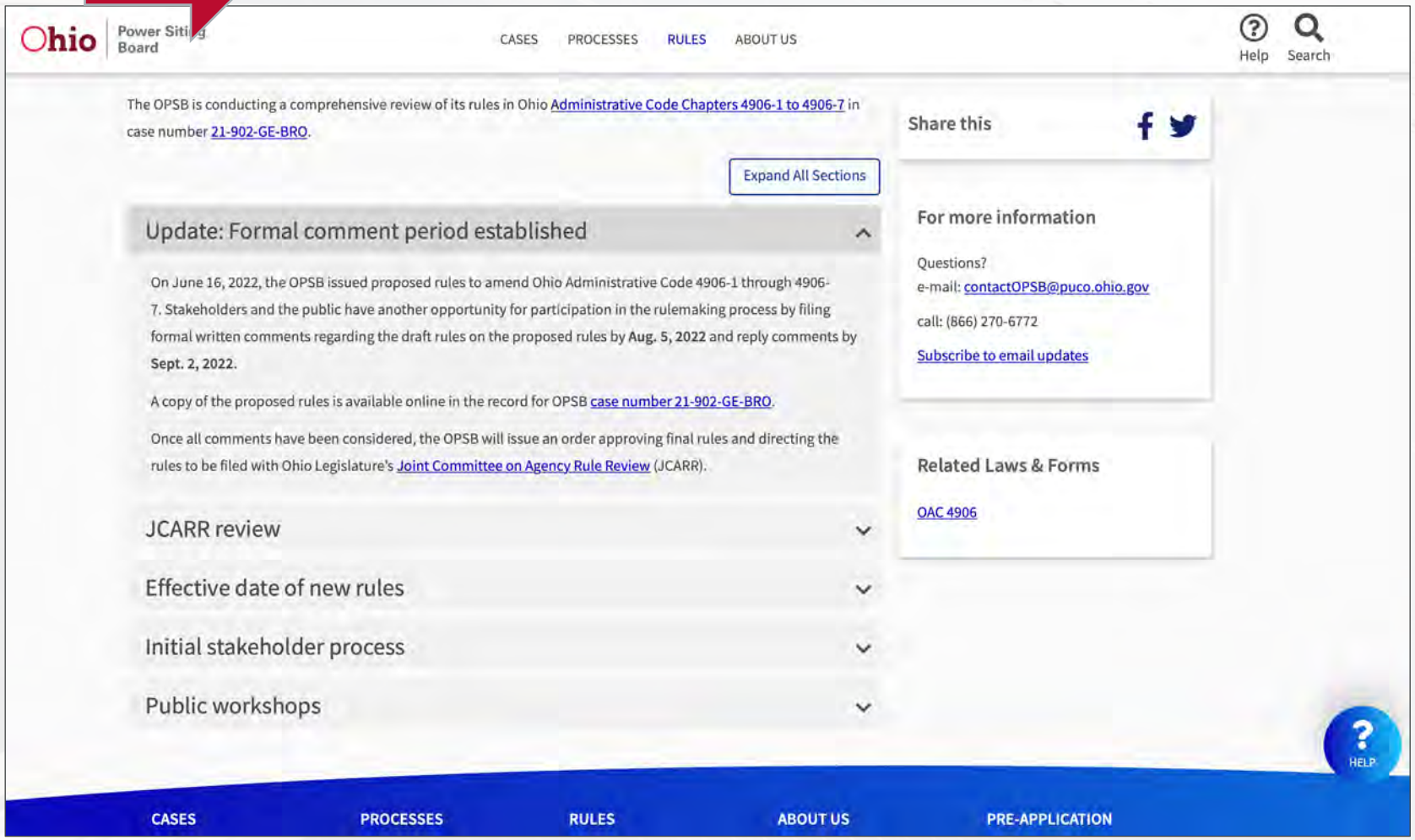
- **4906-7-07 Compliance Site Review:** Certificate holder will allow representatives of the OPSB compliance staff or its contractors, to inspect the operations of a certificated facility at any time.

TimeLine for OPSB Rule Review

- **June 16, 2022**, the OPSB issued proposed rules to amend OAC 4906-1 through 4906-7.
- Stakeholders and public can participate in rulemaking process by filing formal written comments regarding draft rules by **Aug. 5, 2022** and reply comments by **Sept. 2, 2022**.
- Once all comments have been considered, the OPSB will issue an order approving final rules and directing the rules to be filed with Ohio Legislature's Joint Committee on Agency Rule Review (JCARR).
- A copy of the proposed rules is available online in the record for OPSB case number 21-902-GE-BRO.

OPSB Current and Proposed Compliance and Enforcement Rules

https://opsb.ohio.gov/rules/opsb-rule-review



End of Project Life:

Utility Solar Decommissioning

Old OPSB Rules

"the applicant shall **describe the plan for decommissioning** the proposed facility, including a discussion of any **financial arrangements** designed to assure the required financial resources."

Common Issues Under Old Rules

1. Calculation Methods of Decommissioning Cost
2. Timing of Financial Assurance for Project Removal

Ohio Administrative Code Section 4906-4-06

Sample Lease

Example of Landowner Challenges Post Project Remediation

Section 4.4 Removal of Project Company's Improvements

(a) **Project Company Will Remove Solar Facilities**. At the end of the Term, including upon any early termination of the Lease, Project Company will remove all its Solar Facilities, including any foundations, to a depth of three (3) feet below grade, within twelve (12) months from the date the Term expires or the Lease terminates. Owner grants Project Company an easement for such removal, which easement will survive for twelve (12) months after the expiration or termination of this Lease.

(b) **Owner's Right to Remove Solar Facilities Upon Failure by Project Company**. If Project Company fails to remove any of the Solar Facilities within the required time period, such Solar Facilities will be considered abandoned by Project Company and Owner may remove these Solar Facilities from the Premises and dispose of them in its sole discretion without notice or liability to Project Company. In such event, if Owner removes such Solar Facilities at Owner's expense, Project Company will reimburse Owner for all reasonable costs of removing those Solar Facilities as required by the Lease, less any salvage value received by Owner, within thirty (30) days after receipt of an invoice from Owner.

(c) **Security for Removal**. Commencing with the fifteenth (15th) year of the Operating Term, Project Company will establish security payable to Owner to cover Project Company's obligations under Section 4.4(a) above (the "**Restoration Security**") through one of the following means to be selected by Project Company in its sole discretion: (i) by establishing an escrow account with a bank selected by Owner, or (ii) by delivering to Owner a letter of credit, bond, corporate guarantee from an investment grade company or equivalent security. The amount of the Restoration Security will be equal to the Net Removal Cost (as defined below),

- Within 12 months developer will remove all solar facilities and foundation to a depth of 36" below grade.
- Landowner will provide access easement.

Sample Lease

Example of Landowner Challenges Post Project Remediation

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- If developer fails to remove any of the facilities within 12 months, facility is considered abandoned and the **landowner may remove** the solar facility.
- Project owner will reimburse the landowner for all **reasonable cost**, minus any salvage value.

Sample Lease

Example of Landowner Challenges Post Project Remediation

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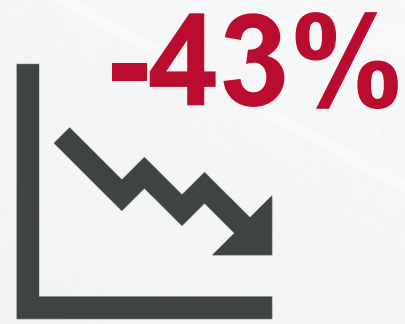
- Starting in **year 15**, the company shall establish a security payable to the landowner to cover obligations in this section.
- The amount of restoration security shall be equal to the **Net Removal Cost**.

Old OPSB Decommissioning Rules

Example of Net Decommissioning Cost

Item	Cost/Revenue
Decommissioning Expenses	**$11,543,690**
Potential Revenue – salvage value of panel components and recoverable materials	**$4,984,240**
Net Decommissioning Cost	**$6,559,450**



Source: OPSB Case #: 20-1677-EL-BGN

Old OPSB Decommissioning Rules

Example of Net Decommissioning Cost

Table 4 Estimated Decommissioning Revenues

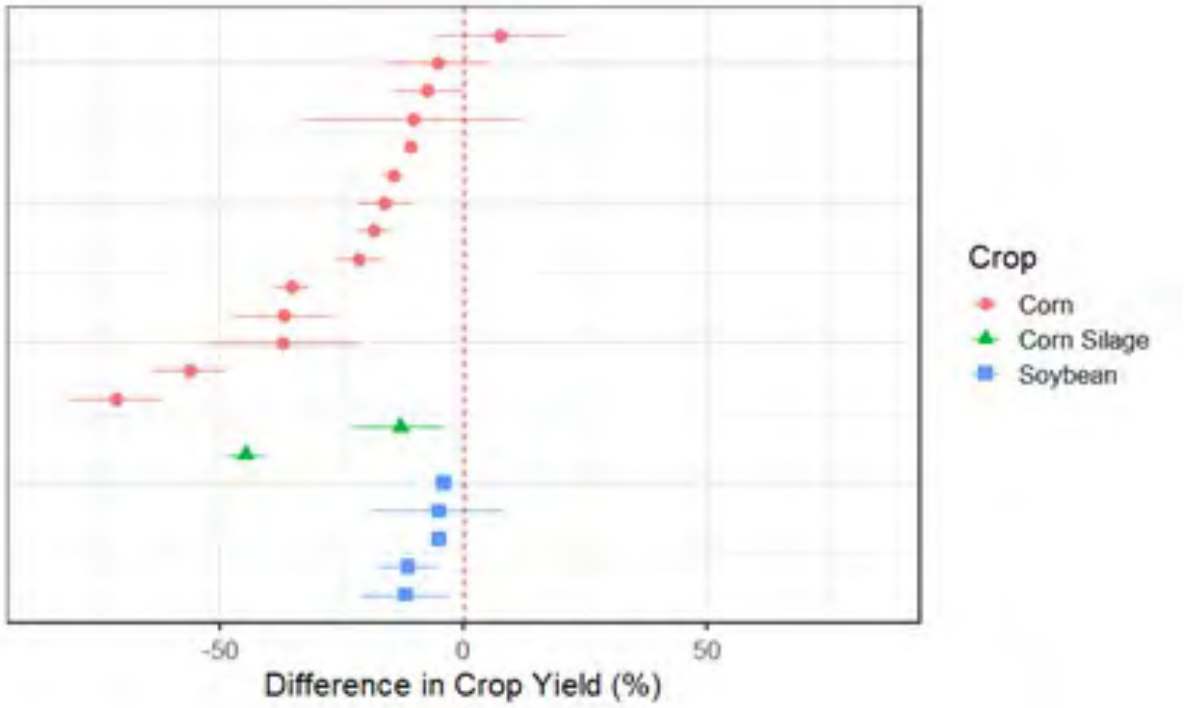
Item	Unit of Measurement	Quantity per Unit	Salvage Price per Unit	Total Salvage Price per Item	Number of Items	Total
Panels - Silicon	Pounds per Panel	1.8	$0.40	$0.720	677,556	$487,840
Panels - Aluminum	Pounds per Panel	2.8	$0.40	$1.120	677,556	$758,863
Panels - Glass	Pounds per Panel	26.7	$0.05	$1.335	677,556	$904,537
Tracking System and Posts	Metric tons per $MW_{[AC]}$	40	$253	$10,120	275	$2,783,000
Substation Components (steel and transformers)	Lump Sum	1				$50,000
Total Potential Revenue						$4,984,240

Source: OPSB Case #: 20-1677-EL-BGN

End of Project Life:

Remediation of Agricultural Land

Long-Term Impacts of Compaction: Does Pipeline Installation have a Lasting Effect on Crop Yields?



Source: Does Pipeline Installation have a Lasting Effect on Crop Yields? (2022). Culman, S., and Brehm, T., Ohio State University.

- **In preliminary findings, Ohio crop yields follow similar patterns to previous studies when pipelines are installed. On average:**
- **Corn grain yields decreased an average of 23.8%**
- **Silage corn decreased an average of 28.8%**
- **Soybean yield decreased an average of 7.4% over the pipeline compared with adjacent areas.**

Sample from Solar Applicant Decommissioning Plan

3.1 SOILS AND AGRICULTURAL LAND

Areas of the Project that were previously utilized for agricultural purposes will be restored to their preconstruction condition and land use as dictated by landowner lease agreements. Restored areas will be revegetated in consultation with the current landowner and in compliance with regulations in place at the time of decommissioning. Land disturbed by Project facilities will be restored in such a way to be used in a reasonably similar manner to its original intended use as it existed prior to Project construction.

Source: OPSB Case No. 20-1405-EL-BGN

Section 4906.211 | Decommissioning plan requirements and estimated costs.

Ohio Revised Code / Title 49 Public Utilities / Chapter 4906 Power Siting

Previous Next

Effective: *October 11, 2021* ***Latest Legislation:*** *Senate Bill 52 - 134th General Assembly* ***PDF:*** *Download Authenticated PDF*

(A) The decommissioning plan submitted to the power siting board under section 4906.21 of the Revised Code shall be prepared by a professional engineer registered with the state board of registration for professional engineers and surveyors. The board may reject the engineer chosen by the applicant and to require the applicant to choose another qualified engineer.

(B) The plan shall contain the following:

(1) A list of all parties responsible for decommissioning;

(2) A schedule of decommissioning activities, not to extend beyond twelve months from the date the utility facility ceases operation;

(3) An estimate of the full costs of decommissioning the utility facility, including the proper disposal of all facility components and restoration of the land on which the facility is located to its pre-construction state. The estimate shall not take into account the salvage value of any materials from the facility.

Last updated July 23, 2021 at 4:51 PM

So…..What Could Possibly Go Wrong?

Exhibit O: Decommissioning Plan

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3.1 SOILS AND PRIME FARMLAND

- The proposed solar facility is predominantly located on land currently utilized for agricultural purposes. The Project site is relatively flat with natural and man-made drainage waterways located in low-lying areas.

- Areas of the Project that were previously utilized for agricultural purposes will be restored, as near as practicable, to their preconstruction condition and land use. Restored areas will be revegetated in consultation with the current landowner and in compliance with regulations in place at the time of decommissioning.

Source: Case No. 20-1677-EL-BGN

Closing thoughts on restoration

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While Ohio's new law references the obligation of "restoration of the land on which the facility is located to its pre-construction state," it does not.....

- Describe how to establish the pre-construction state of the land.
- Outline what happens if the land is not properly restored.
- Assure funds are available for this portion of the decommissioning.
- ORC Section 4906.211 does not apply to projects under 50 MW.

Utility-Scale Solar Hay Research Project:

Phase 1: Proof of Concept

What are Agrivoltaics?
Why Utility-Scale Solar Hay?

Current Challenge: Photovoltaic solar is a technology with a low power density.

- Turfgrass – high maintenance cost, limited environmental benefit
- Pollinators – high establishment and maintenance cost, weed control
- Specialty crops – labor intensive
- Advanced Agrivoltaic solutions add additional racking cost
- Grazing – heard size, internal fencing and rotation
- **Solutions must be scalable!**
- Forages could provide both economic and environmental benefits

Project Objectives

- Establish recommendations for forage stand establishment
- Compare impact of full sun vs. full shade
- Estimate forage quantity
- Evaluate forage quality
- Identify key challenges to managing site on commercial scale

Research Test Site & Design

Preliminary Experimental Site & Design

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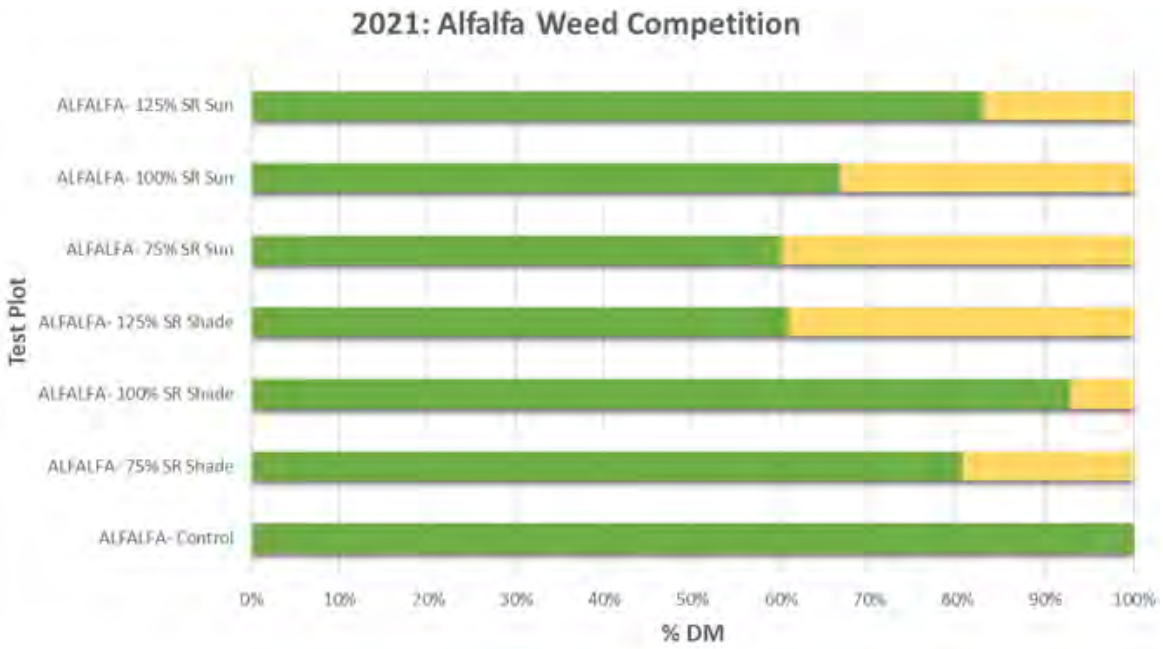
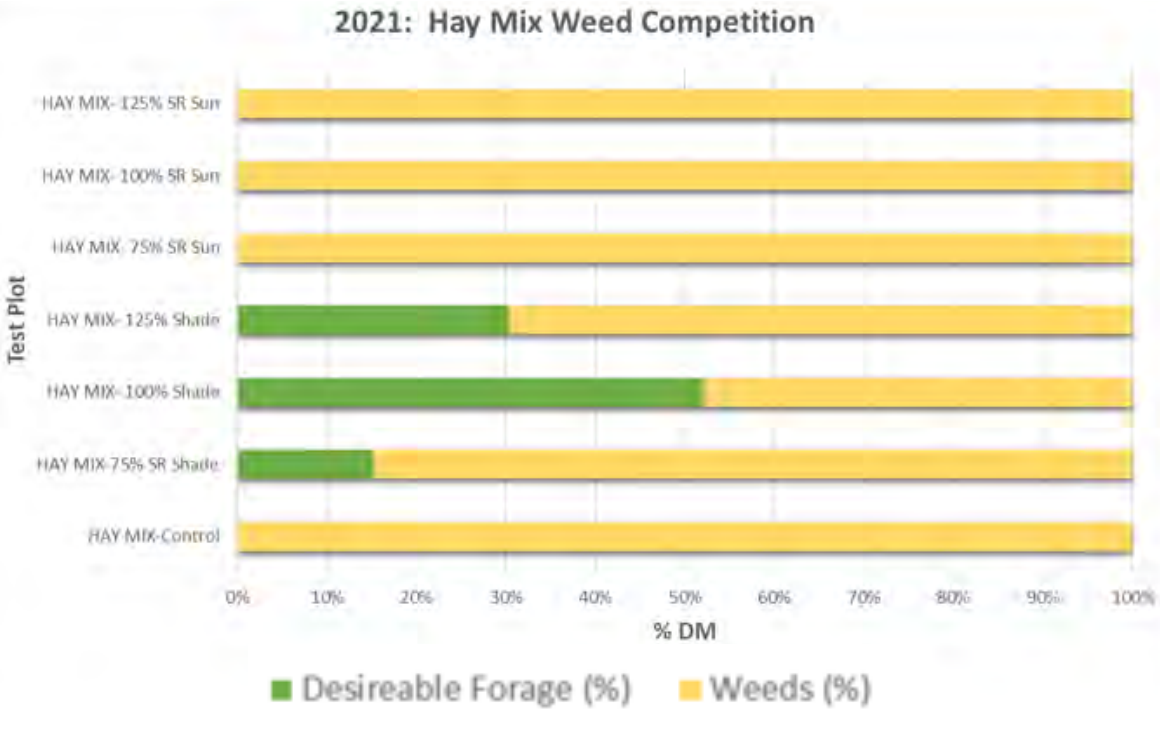
Control - Cool Season Hay Mix 100% Seeding Rate – (102g)	Control - Alfalfa 100% Seeding Rate – (61g)	Control - Teffgrass / Crimson 100% Seeding Rate (20g Tef / 123g Crim)
	Module Array / Row #4	
Teffgrass / Crimson Clover 75% Seeding Rate (15g Tef / 92g Crim)	Teffgrass / Crimson Clover 100% Seeding Rate (20g Tef / 123g Crim)	Teffgrass / Crimson Clover 125% Seeding Rate (26g Tef / 153g Crim)
	Module Array / Row #3	
Alfalfa 75% Seeding Rate – (46g)	Alfalfa 100% Seeding Rate – (61g)	Alfalfa 125% Seeding Rate – (77g)
	Module Array / Row #2	
Cool Season Hay Mix 75% Seeding Rate – (77g)	Cool Season Hay Mix 100% Seeding Rate – (102g)	Cool Season Hay Mix 125% Seeding Rate – (128g)
	Module Array / Row #1	

- **Control Plots-** Each forage type grown at the normally recommended seeding rate outside of the solar array.
- **Cover Crop Plots-** Summer annual followed by a winter annual within the array at varied seeding rates.
- **Alfalfa Plots-** Alfalfa within the array at varied seeding rates.
- **Hay Mix Plots-** Cool-season grass and legume mix within the array at varied seeding rates.

Forage Lab Results (2021 & 2022)

Establishment Year (2021) Weed Competition





Alfalfa Results (2021 & 2022)

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Alfalfa Results from 2021 & 2022

Chart 2: Alfalfa Samples by % Crude Protein (DM)

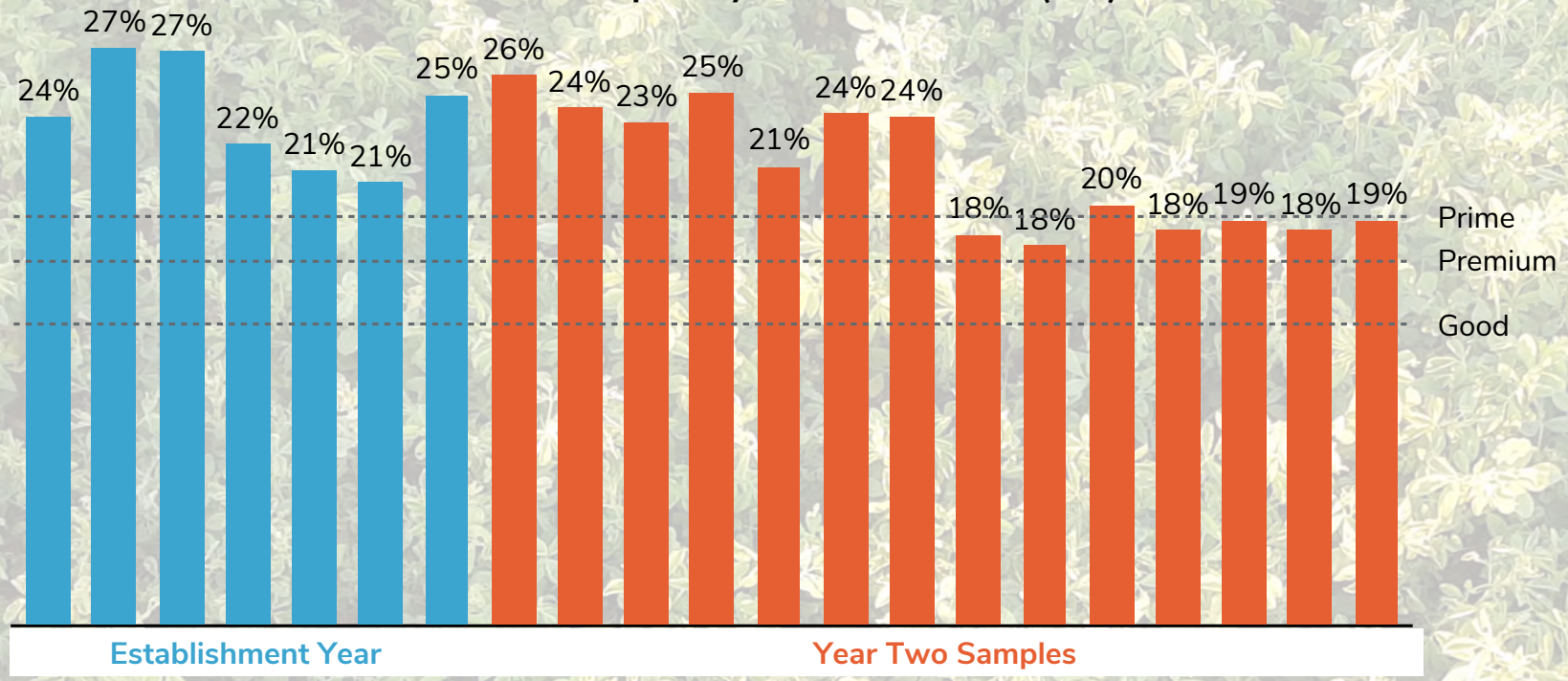


Chart 6: Alfalfa Samples by RFQ (DM)

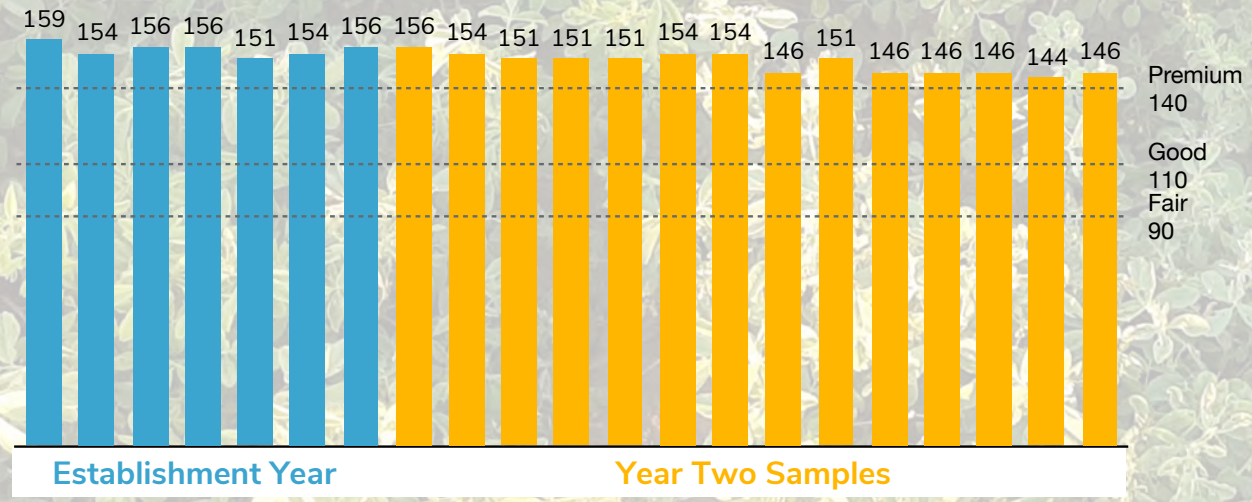
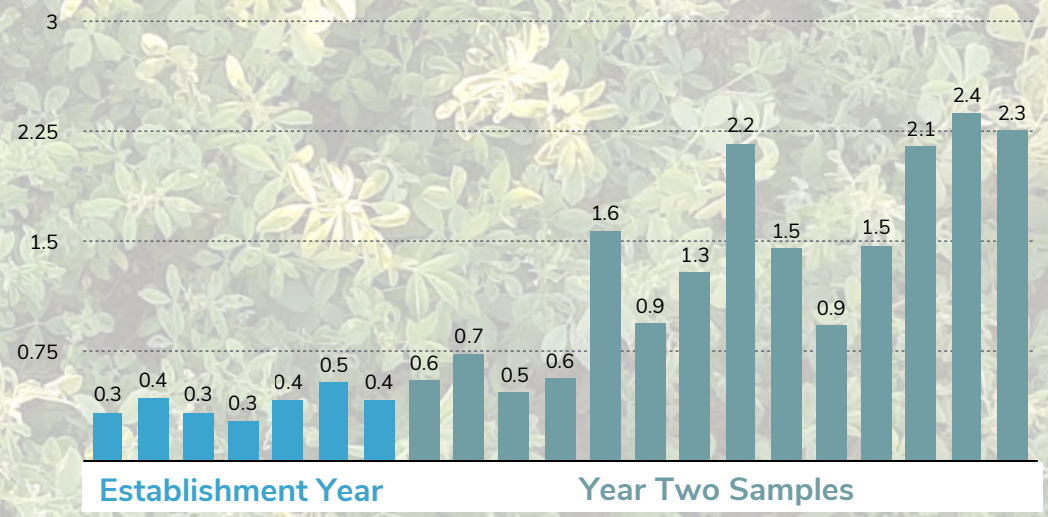
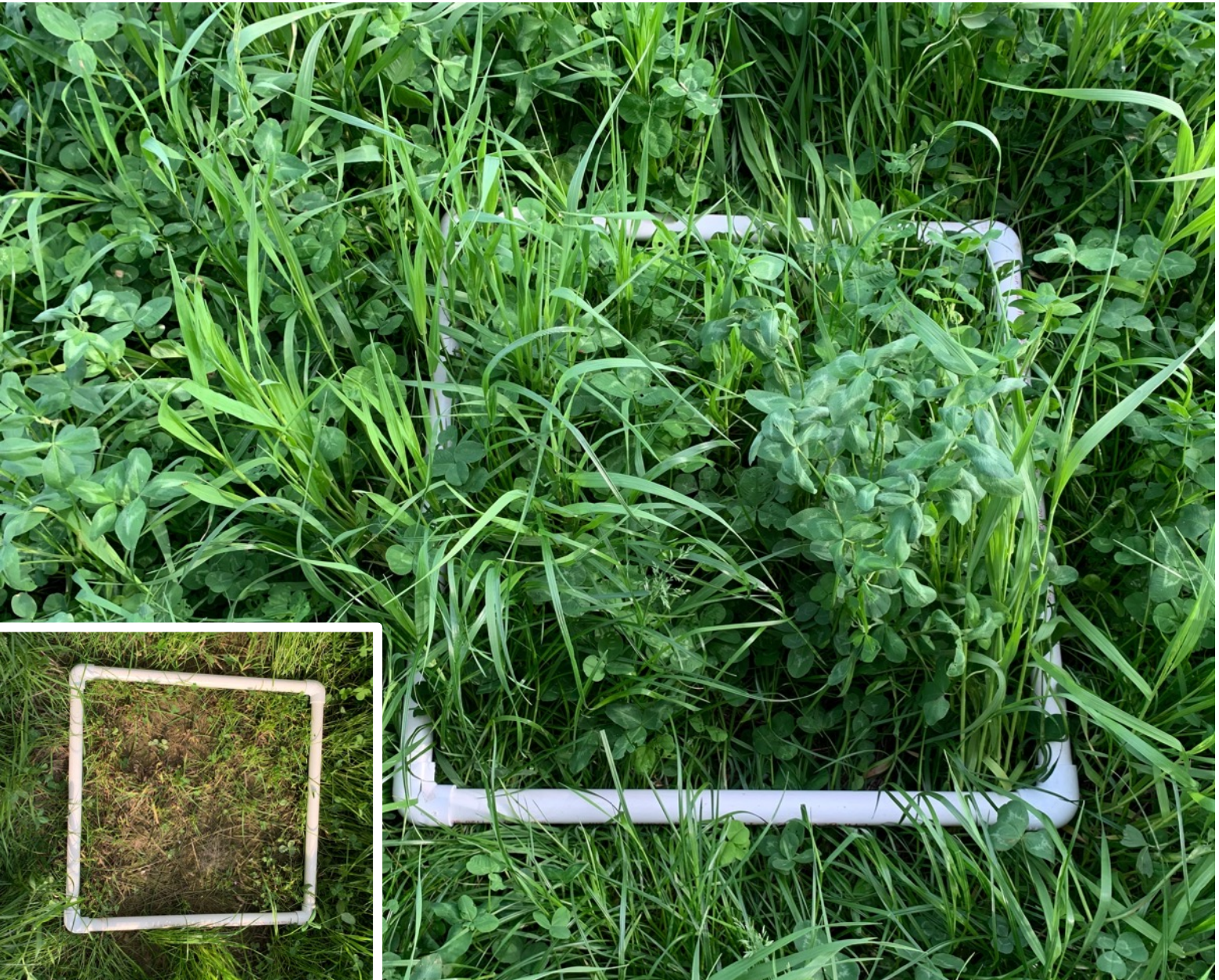
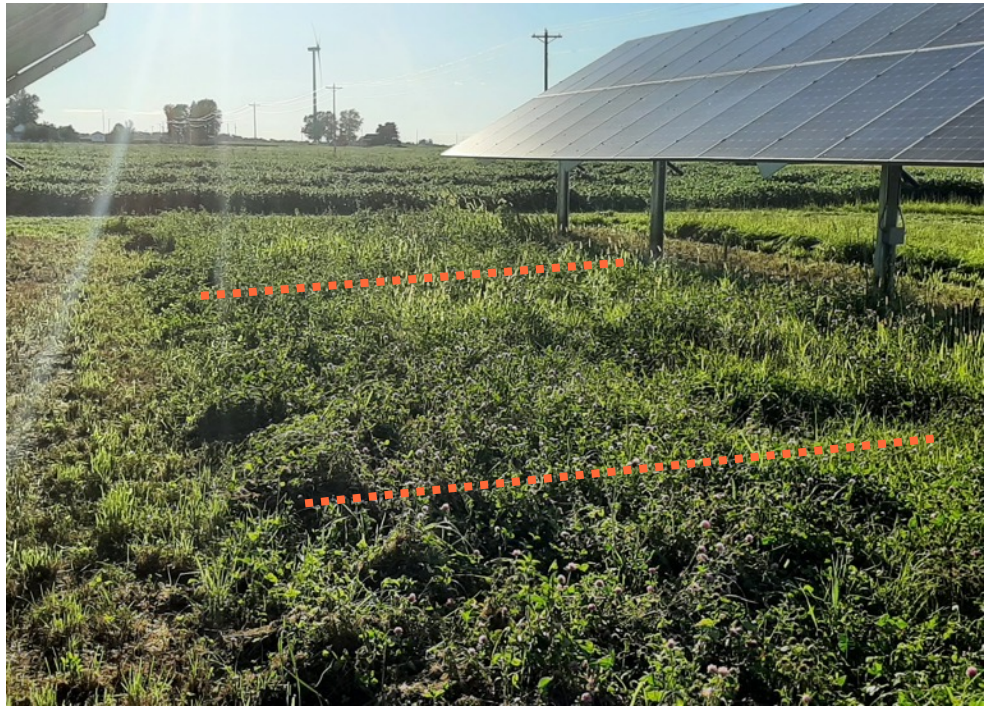


Chart 1: Alfalfa Samples by Yield (Tons per Acre)



Hay Mix Results (2021 & 2022)





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Hay Mix Results from 2021 & 2022

Chart 2: Hay Mix Samples by % Crude Protein (DM)

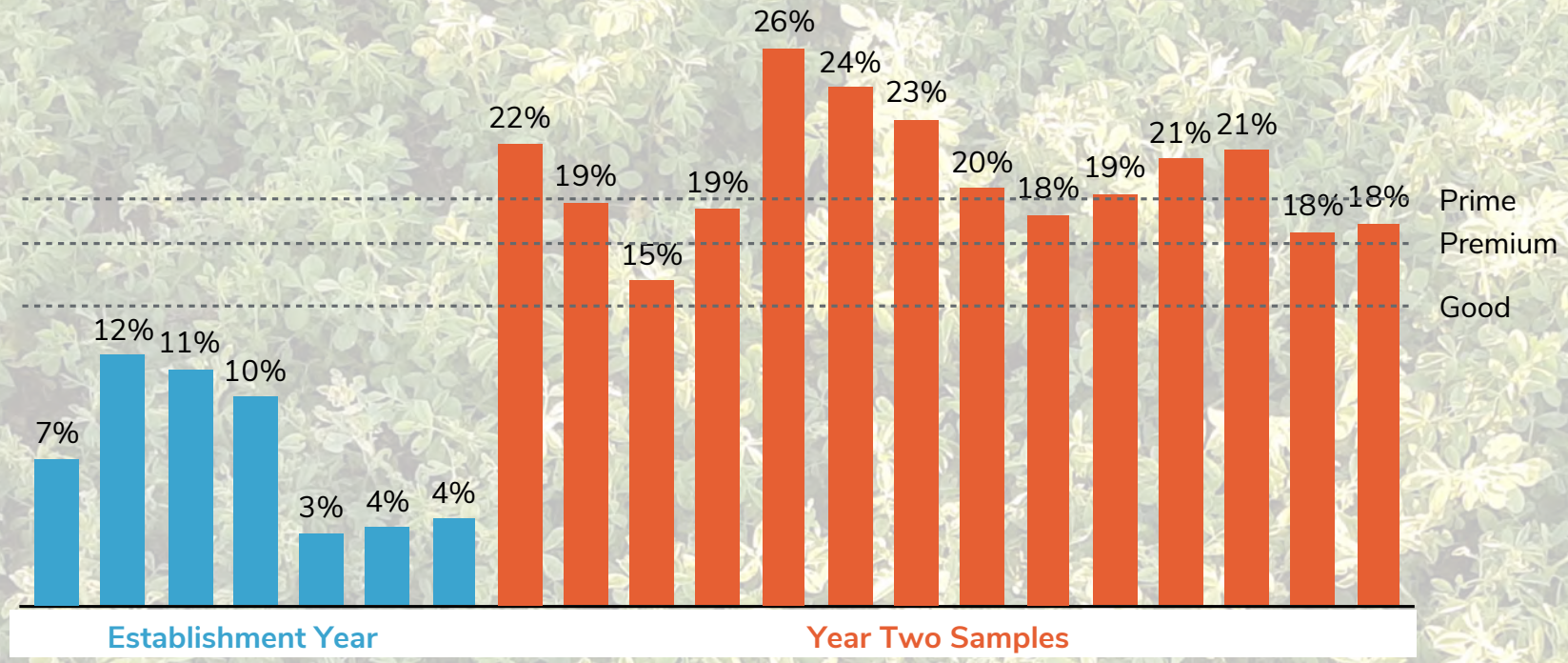


Chart 12: Hay Mix Samples by RFQ (DM)

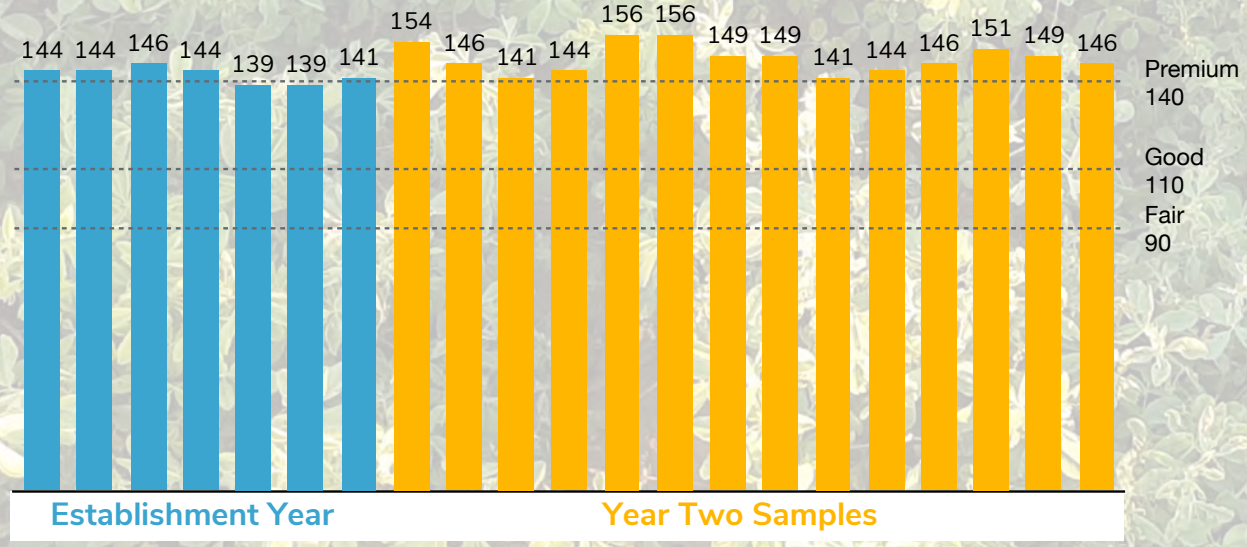
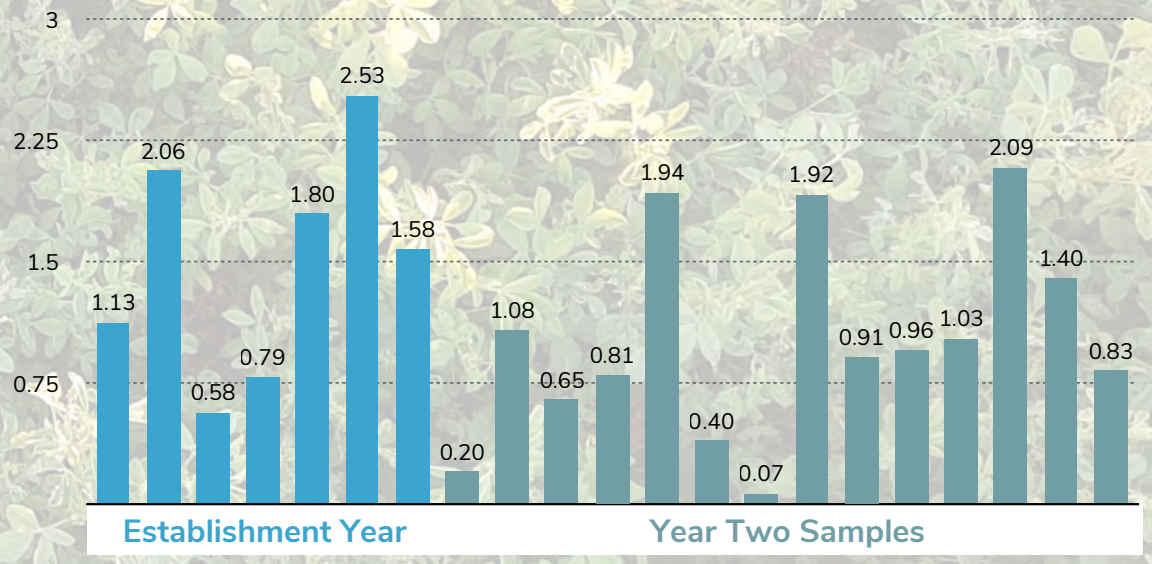


Chart 7: Hay Mix Samples by Yield (Tons per Acre)



Harvest Photos

Solar Hay Research Phase 2:
Partnerships and Team Members

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- **Braden J. Campbell**, Ph.D. - Sheep production, grazing, animal health, and nutrition
- **Eric Romich** - Utility-scale solar, behind-the-meter solar, and farm energy management
- **Elizabeth Hawkins**, Ph.D. - Agronomy, digital and precision agriculture
- **Scott A. Shearer**, Ph.D., P.E. - Digital and precision agriculture, automation, and robotics
- **Andrew Klopfenstein** - Digital and precision agriculture, automation, and robotics
- **Christine Gelley** - Forage and pasture crops, grazing
- **James Morris** - Agribusiness, agronomy, and forage crops
- **Amanda Douridas** - Agribusiness, agronomy, and soil health
- **Sarah Moser** - Utility-scale solar project development
- **Kyle Gehres** - Agronomic crop operations and management
- **Aaron Boerger** - Agronomic crop operations and management

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Solar Hay Phase 2: Priority Research Focus

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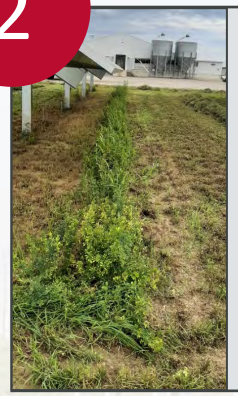
1

Forage Crops:
Maximize production value through assessment of forage crop seeding rates, forage quality, and forage yield

2

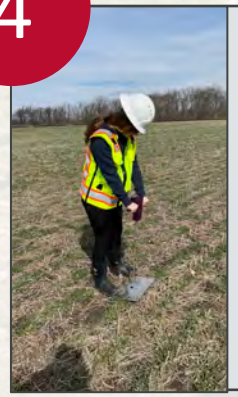


Complimentary Grazing:
Monitor animal behavior, growth, health, and management infrastructure needs to **increase animal performance**

3

Precision Agriculture: Optimize efficiency of site management utilizing digital technologies and supervised autonomy

4



Soil Health:
Quantify impact of construction on forage environment and determine the value of cover crops to **restore soil health**

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Additional Resources, Questions, & Discussion

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Webinar Series Follow-up

- We'll send an email and links when webinar recordings and PPT slides are available on these websites.
- We'll also ask you to complete an evaluation of the webinars you viewed, and appreciate hearing your comments, needs and suggestions!

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Questions and Discussion

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