

THE 2 MOST POWERFUL WORDS IN ADVANCING YOUR ORGANIZATION: “WHAT IF?”

REBUILD 10.01.26



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What if we created a campus that produces more energy than it consumes, preserves a century of history, restores an ecosystem, and provides a permanent home for a colony of bats?

learning objectives:

1. Considerations when designing for other species (floral and fauna)
2. How to rejuvenate old (not historic) noncode-compliant structures
3. Learn how to conserve energy with multiple buildings
4. Net positive strategies for simple buildings



ABOUT SHAKER TRACE NURSERY

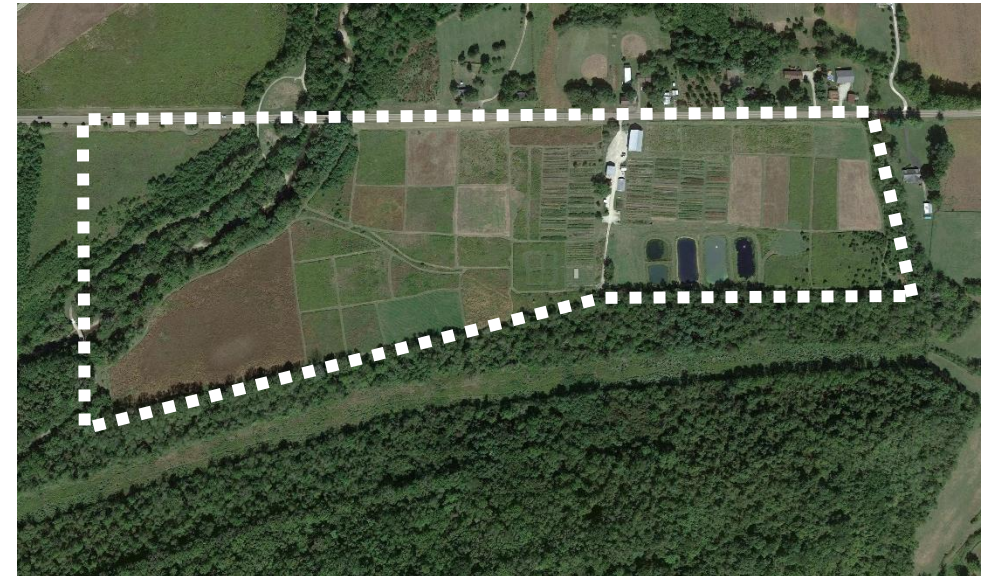
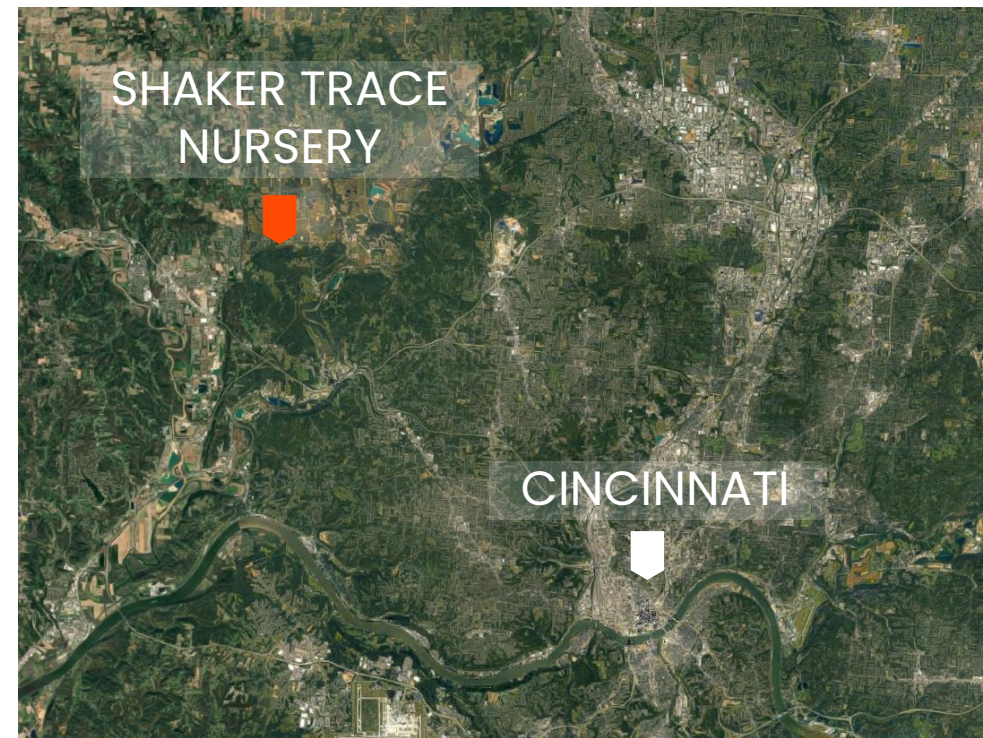
- 23 parks and preserves
- 18,000 acres
- >80% to be preserved as natural area
- 10,000 acres of forest
- 800 acres of prairie restoration
- 640 acres of wetlands





Shaker Trace Nursery

- Native plant nursery established around 1992 with seeds collected from within 100 miles of Hamilton County
- Supports habitat restoration through harvesting, processing, and storing native prairie and wetland seeds, making it a vital hub for conservation and ecological stewardship
- Features a drying barn, greenhouse, outbuildings, plant beds and aquaculture ponds







Pepper Construction
Tomorrow's Today





Great Parks of Hamilton County – Shaker Trace Nursery



the existing barn



the existing barn



BIG BROWN BATS

Bat Conservation

Bats are in decline worldwide, including in Ohio

Bats play important ecological roles that benefit humans

Bats are needed and deserve our help, but are often persecuted





Special Concern



State Endangered



Federally
Endangered



Special Concern



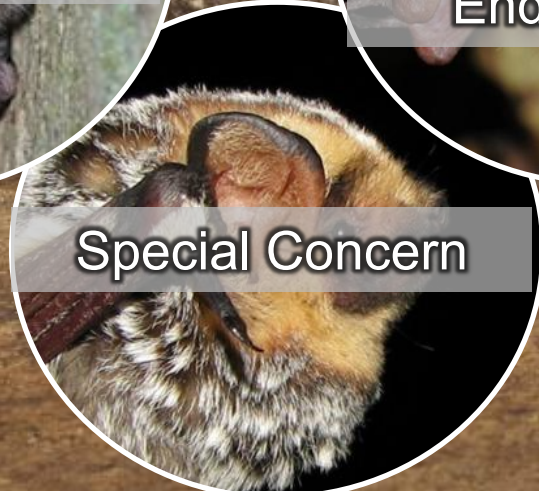
Federally
Endangered



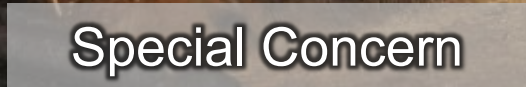
Proposed
Federally
Endangered



Special Concern



Special Concern



Special Concern

Project Goals for the Barn

- Acknowledge the big brown bat colony & their status as rare animals
- Acknowledge and activate our role as a conservation agency
- Renovate the barn mindfully
- Address concerns about “sharing space”
- Time construction to minimize impacts
- Monitor results
- Share the story



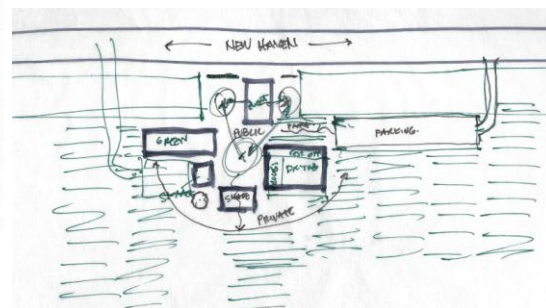
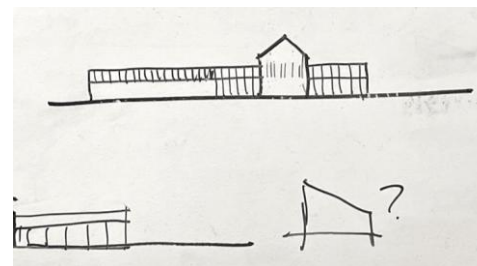
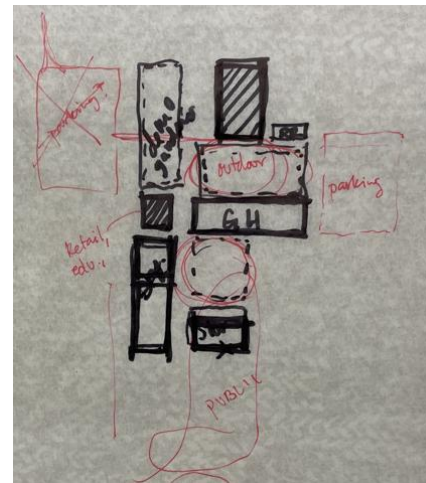
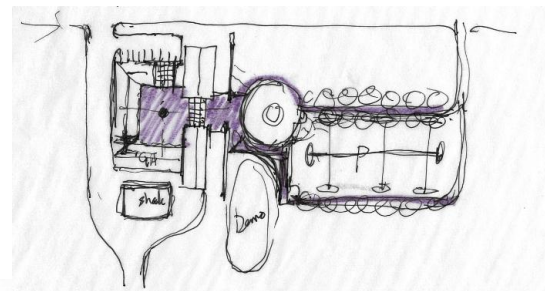
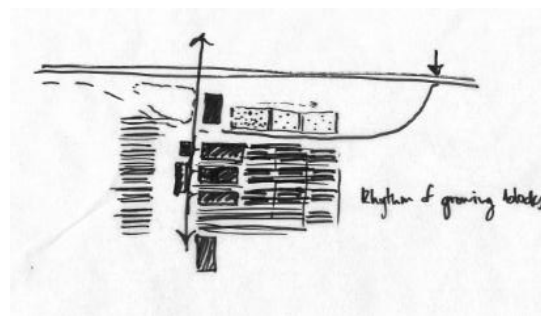
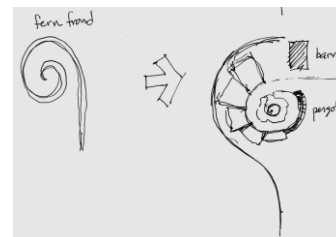
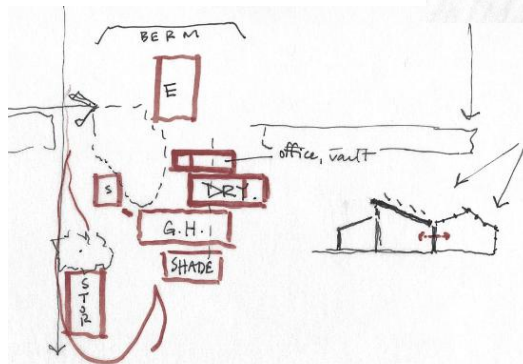
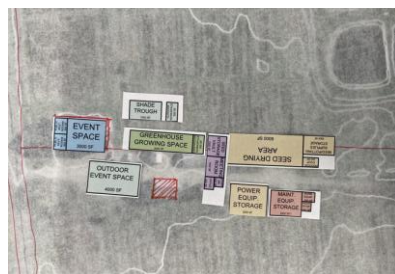
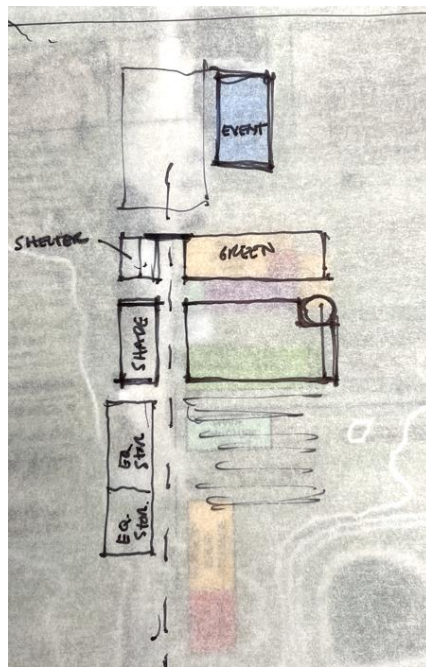
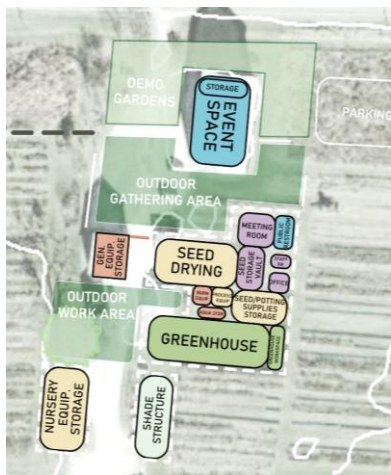
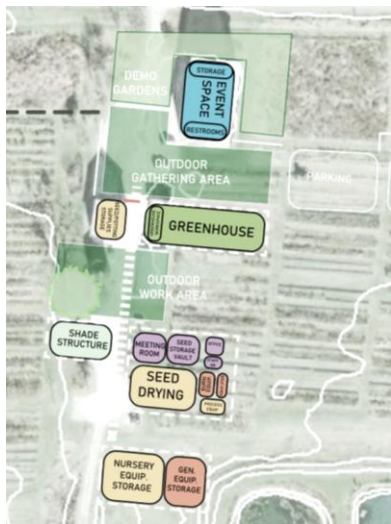
PROJECT DESIGN

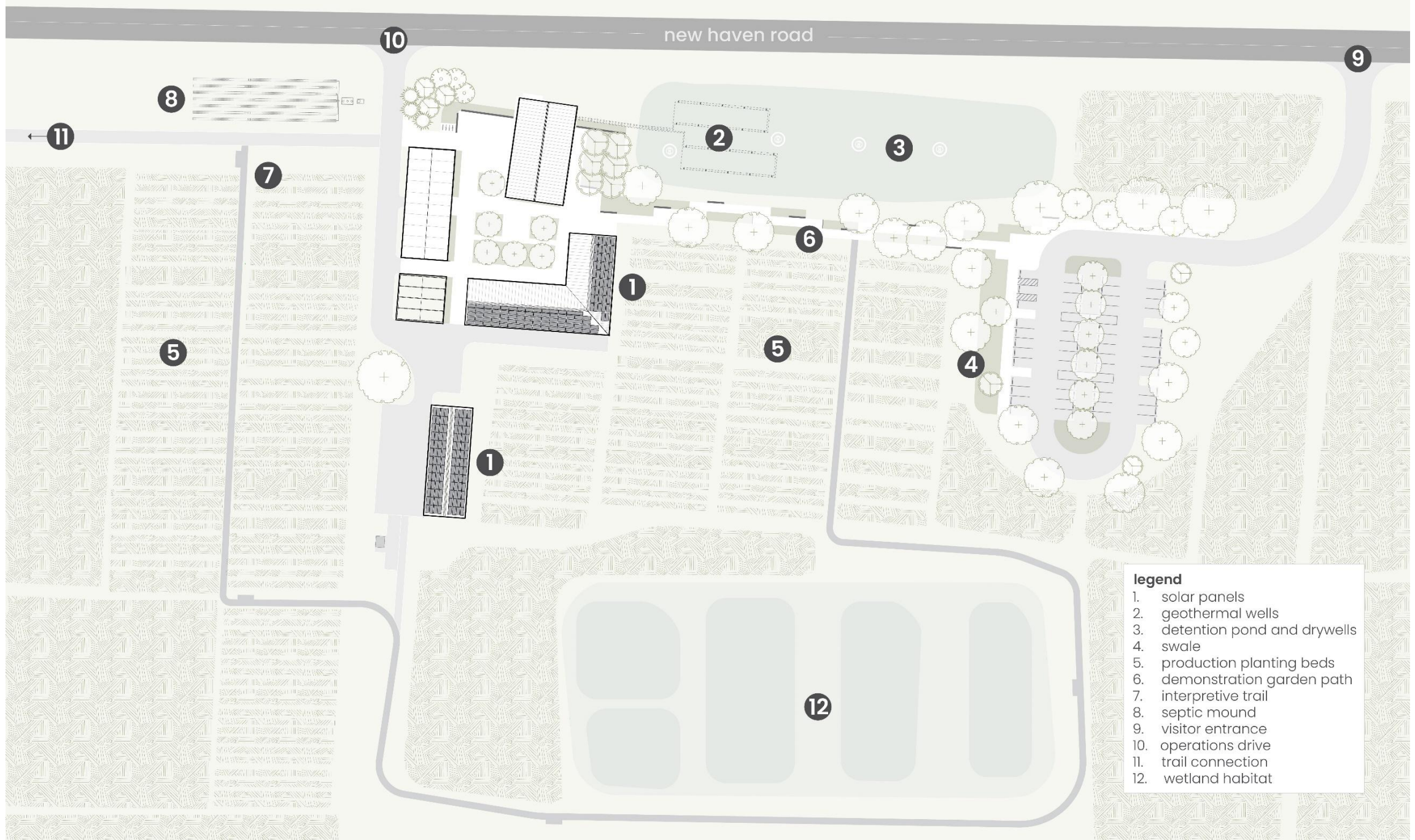
the project

Welcome the public, use the site as an educational tool, and grow nursery operations

- Adaptive reuse of barn into a gathering space
- New operations building
 - Seed drying, seed vault, offices
- New greenhouse and shade structure
- New equipment storage building
- New parking area and interpretive paths







- legend**
- 1. solar panels
 - 2. geothermal wells
 - 3. detention pond and drywells
 - 4. swale
 - 5. production planting beds
 - 6. demonstration garden path
 - 7. interpretive trail
 - 8. septic mound
 - 9. visitor entrance
 - 10. operations drive
 - 11. trail connection
 - 12. wetland habitat

new haven road

nursery
operations access

← trail connection

visitor
parking lot →

equipment barn

legend

1. greenhouse
2. shade house
3. seed drying
4. seed processing
5. seed vault
6. seed production beds
7. multiuse gathering barn
8. office
9. courtyard

new haven road

nursery
operations access

← trail connection

public zone

operations zone

legend

1. greenhouse
2. shade house
3. seed drying
4. seed processing
5. seed vault
6. seed production beds
7. multiuse gathering barn
8. office
9. courtyard

equipment barn





existing barn



Existing Drying Barn
Agricultural Use



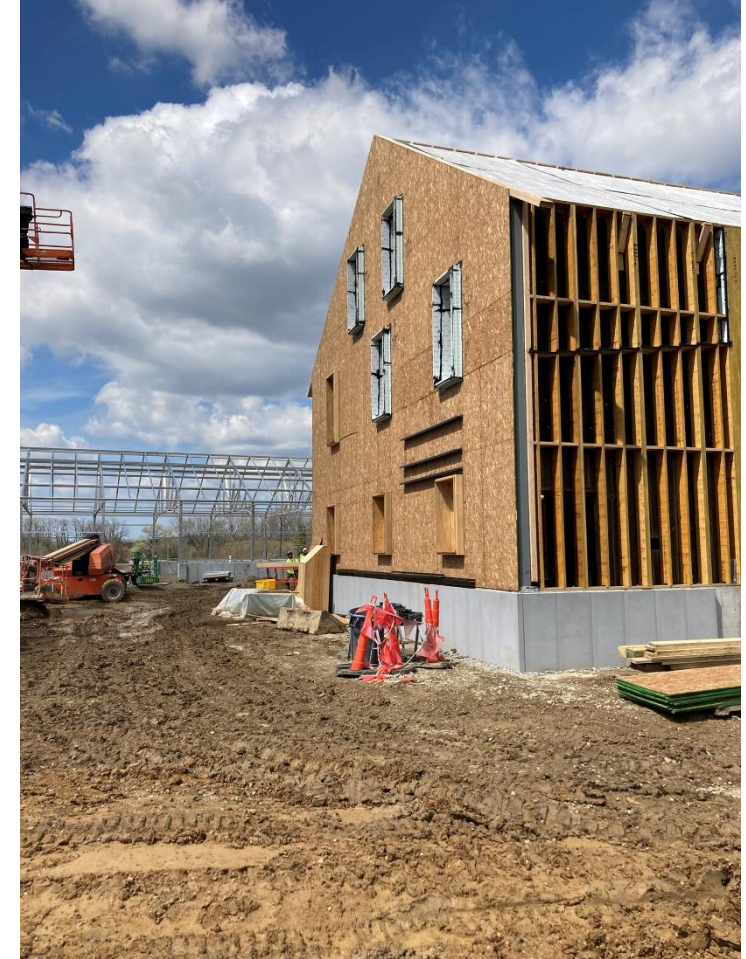
Proposed Event Space
Change of Use to Public Assembly
Required Structural Upgrades
to meet Current Code



Existing Drying Barn



Demolition and Prep



New Envelope Framing
Over Existing Siding



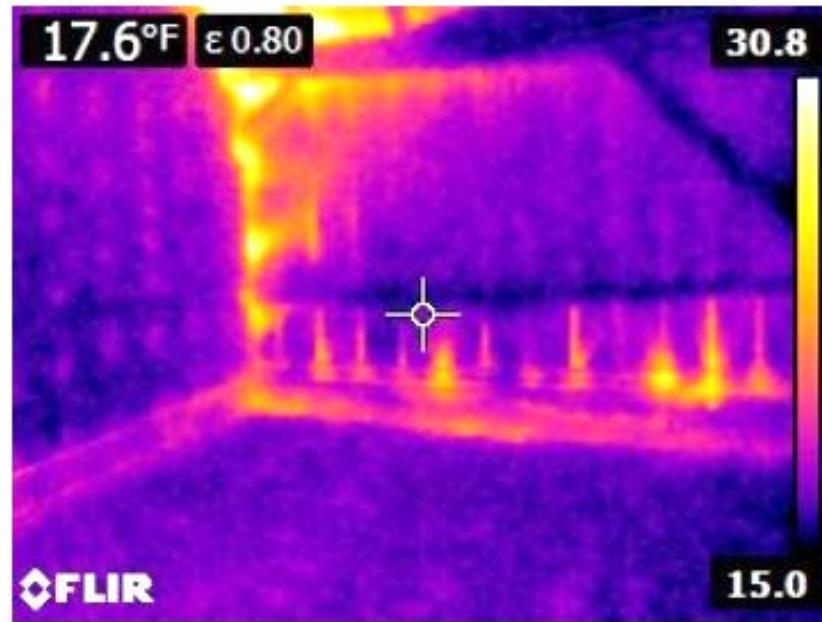
New Insulation
Air/Vapor Barrier



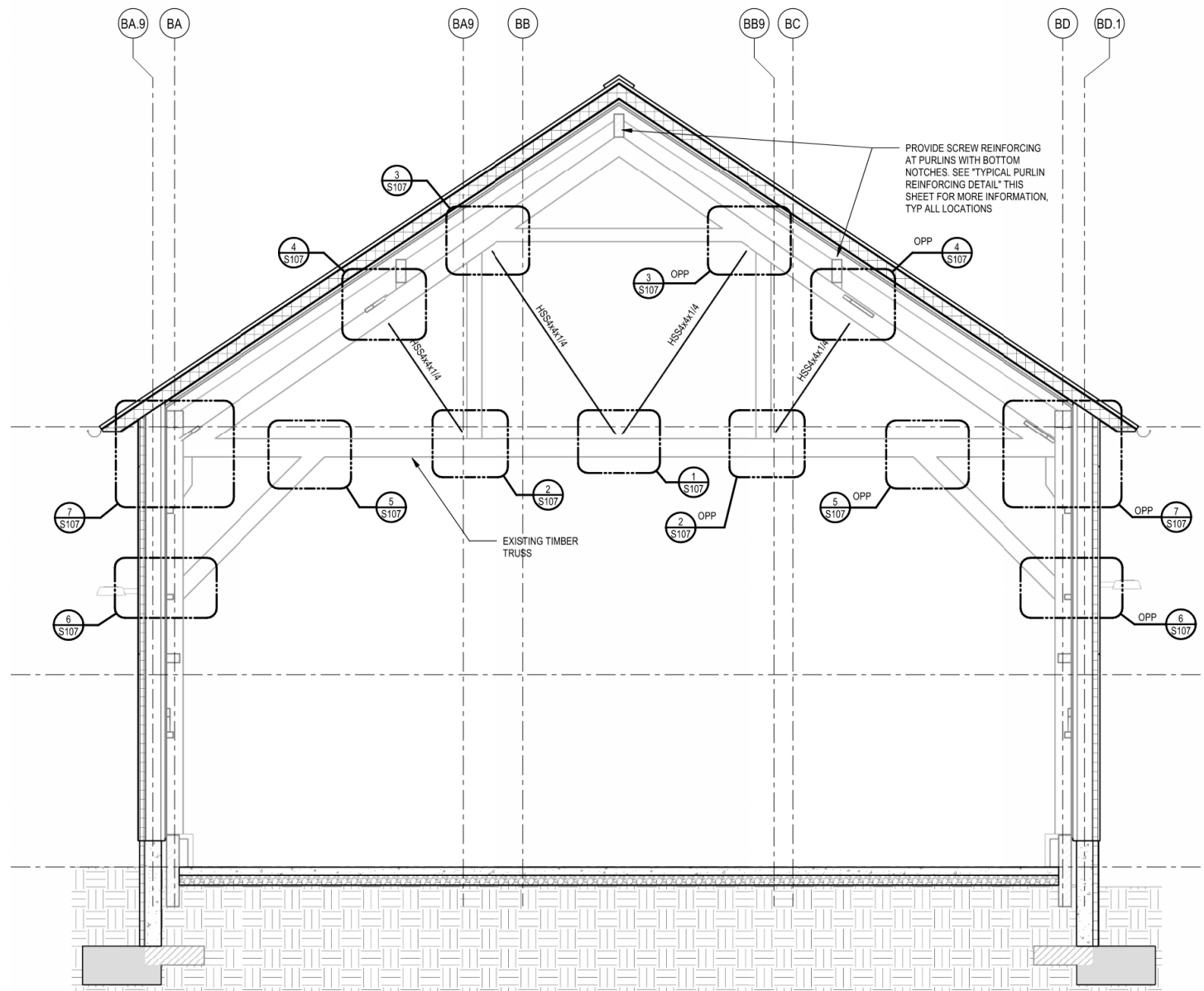
New Fiber Cement Siding
And SIP Roof



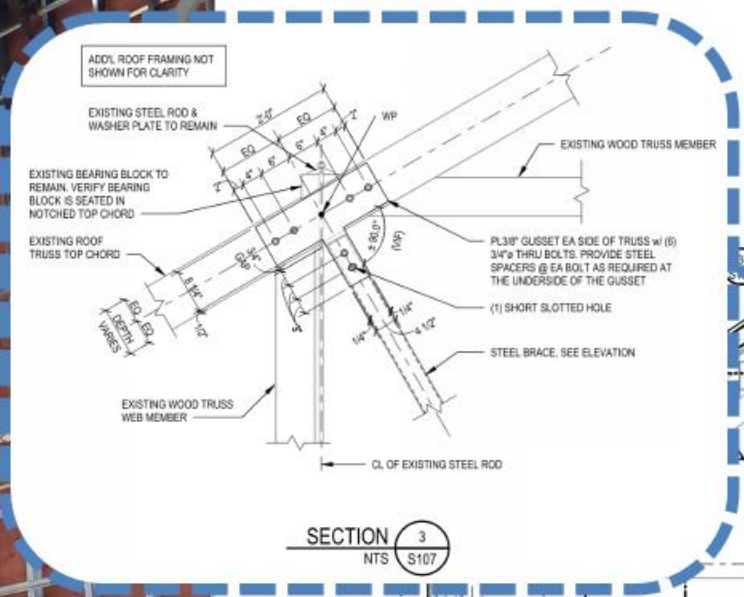
Final New Thermal Envelope
And Bat Louvers



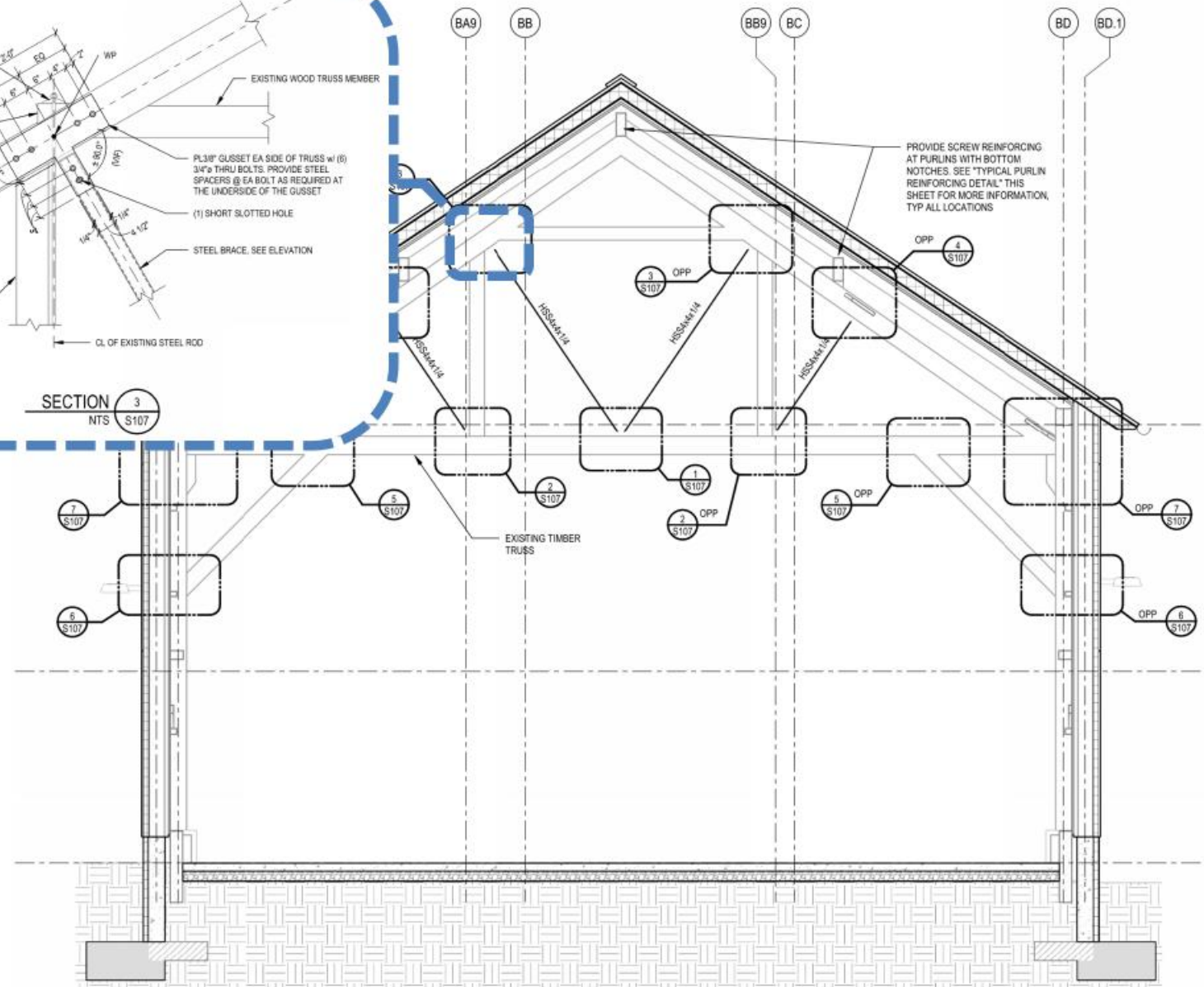




BARN FRAMING ELEVATION 8
1/4" = 1'-0" S107



SECTION 3
NTS S107

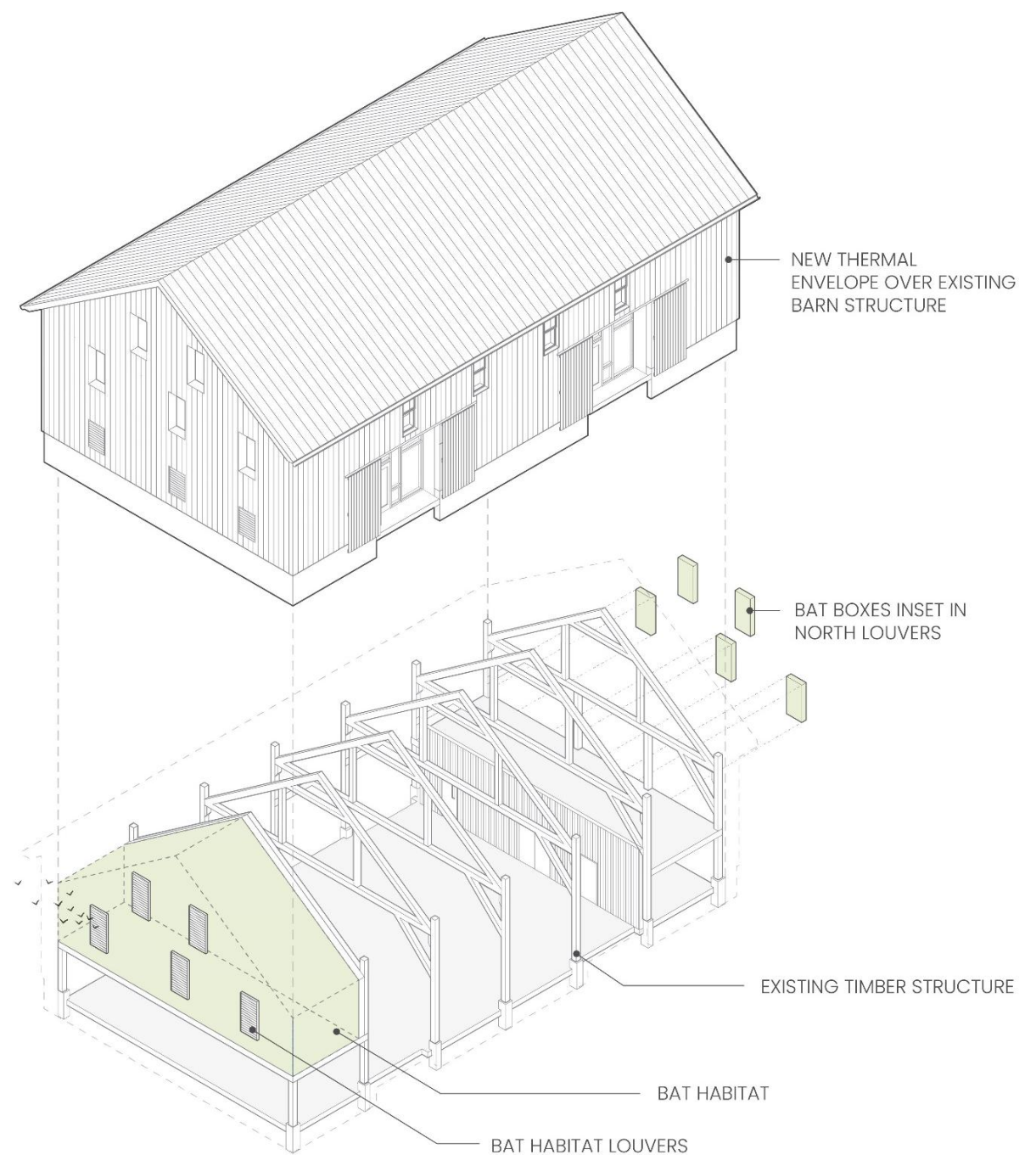


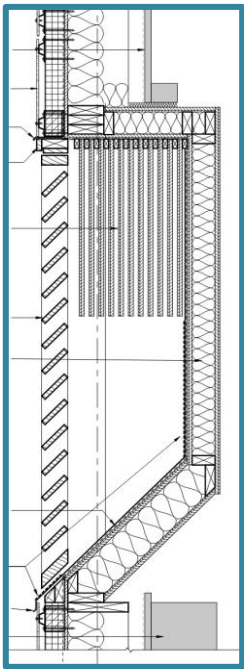


BIG BROWN BATS

integrating bat habitat

- Create separation from human occupiable area for health safety
- Keep conditions intact – preserve a bay of the barn
- Provide habitat option at north and south facade





Integrated Bat Boxes

Air / Vapor / Thermal Barrier
between Bat Habitat and
Human Occupiable Areas



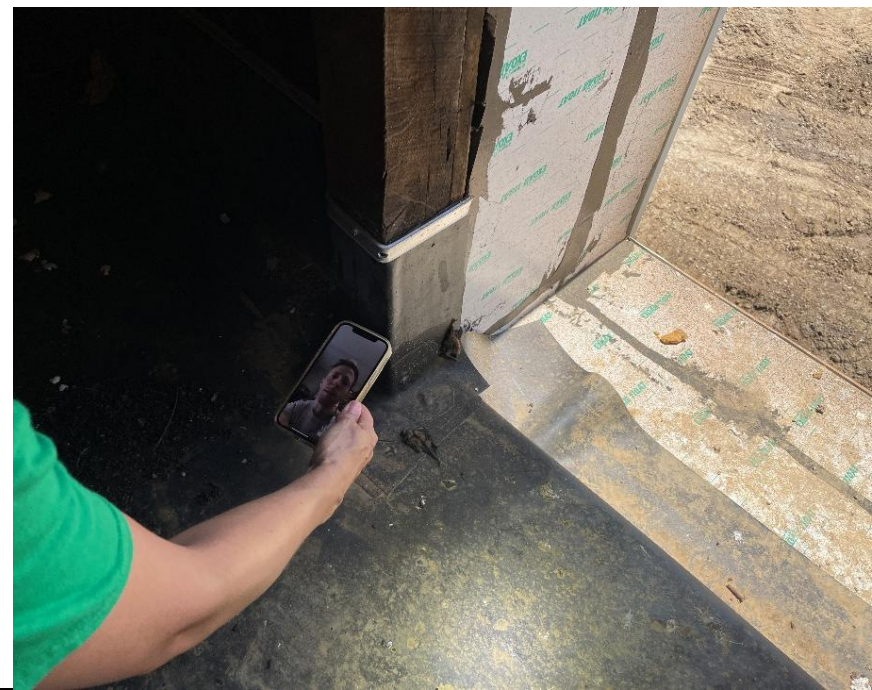






Photo Credit: GPHC

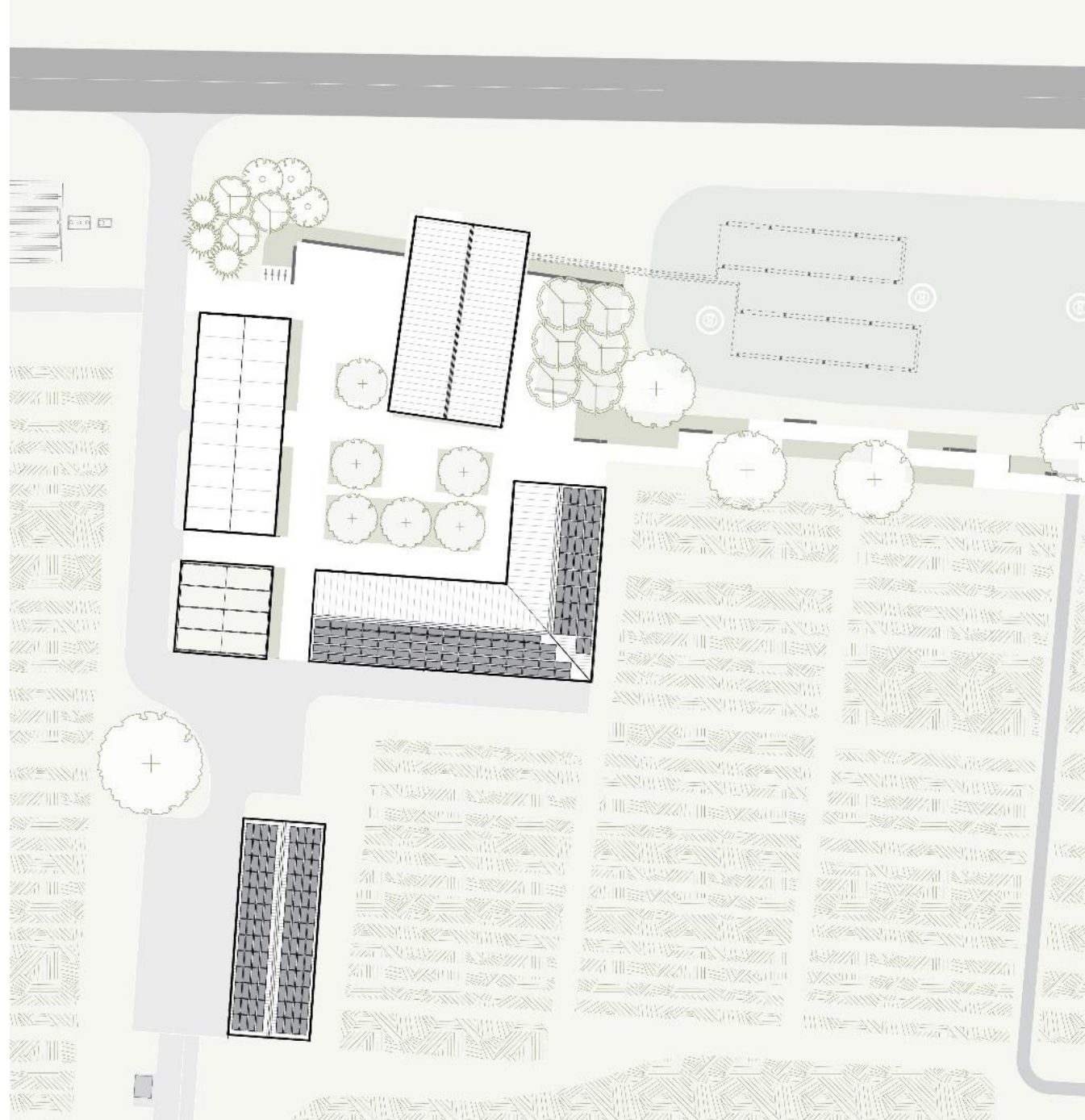
NEW ENVELOPE



CAMPUS SYSTEMS AND ACHIEVING NET POSITIVE

systems approach

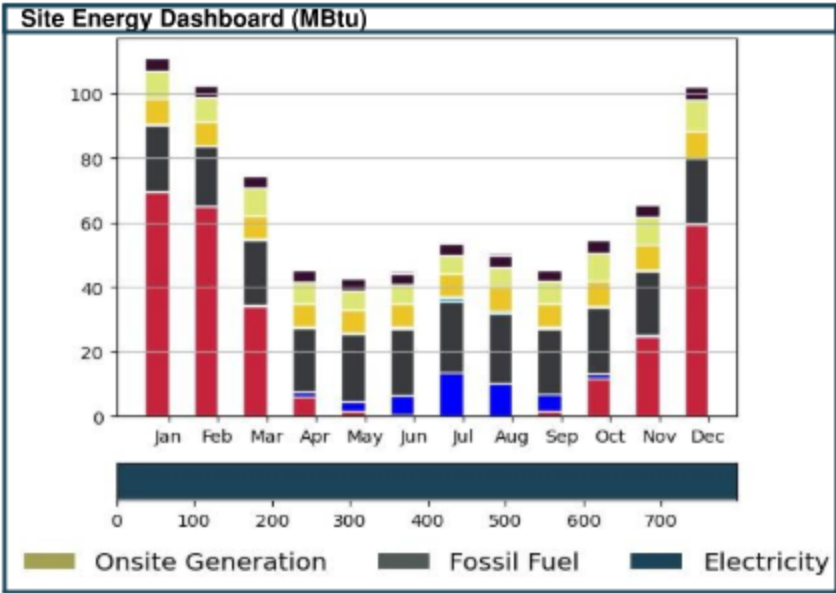
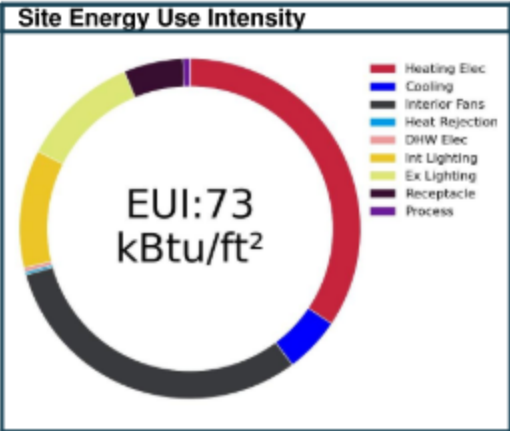
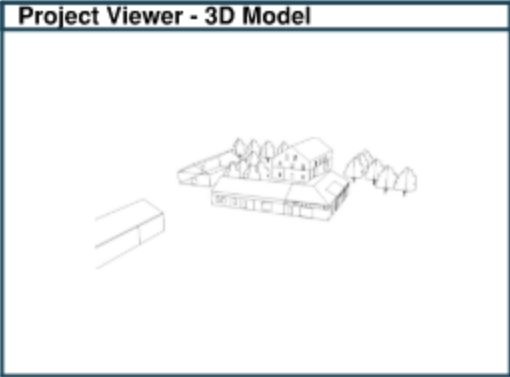
- Energy Modeling
- Geothermal
- Solar Production



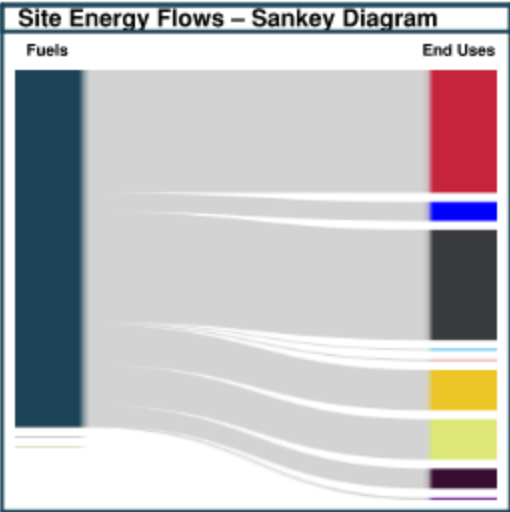
energy modeling

- Baseline Energy Model

Annual Energy Consumption (kBtu/ft²/year) & CO2 KgCO2/ft²/yr			
Energy End Use	Site Energy	Source Energy	CO2 Emissions
Heating Fossil Fuel	0.0	0.0	0.0
Heating Electricity	25.2	79.5	5.2
Space Cooling	3.9	12.2	0.8
Fans Interior	22.6	71.1	4.7
Heat Rejection	0.2	0.8	0.1
Pumps	0.0	0.0	0.0
DHW Fossil Fuel	0.0	0.0	0.0
DHW Electricity	0.3	1.0	0.1
Interior Lighting	8.2	25.9	1.7
Exterior Lighting	8.2	26.0	1.7
Receptacle	4.1	13.0	0.9
Data Center	0.0	0.0	0.0
Cooking Fossil Fuel	0.0	0.0	0.0
Cooking Electricity	0.0	0.0	0.0
Elevators & Escalators	0.0	0.0	0.0
Refrigeration	0.0	0.0	0.0
Process	0.5	1.5	0.1
TOTAL (ex renewables)	73	230	15



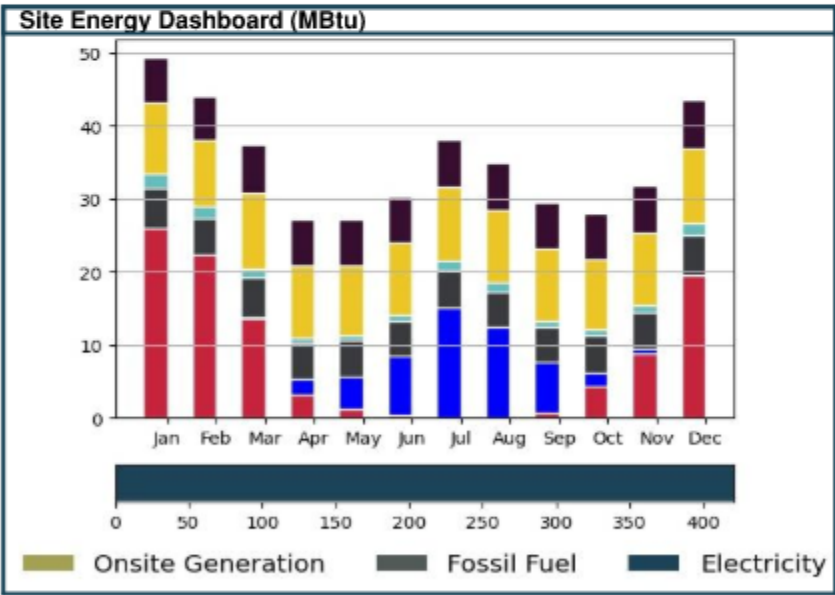
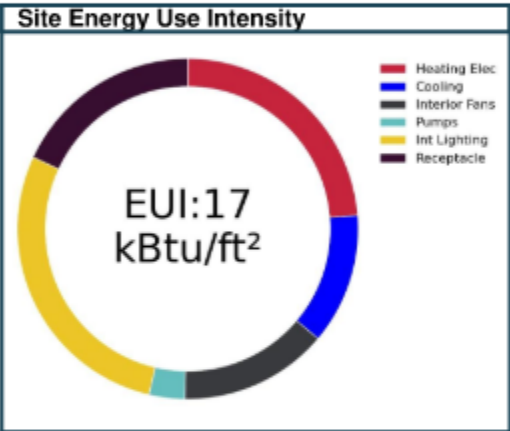
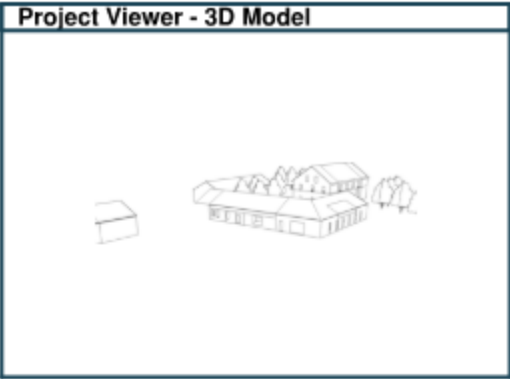
Annual Fuel Costs and Peak Demands				
Fuels	Cost (\$)	Peak Day	Peak Time	Peak Demand
Electricity	31,515.00	12-Feb	6:00	125.1 kW
Fossil Fuel	0.00	01-Jan	0:00	0.0 kBtu/h
Total	31,515.00	01-Jan	0:00	



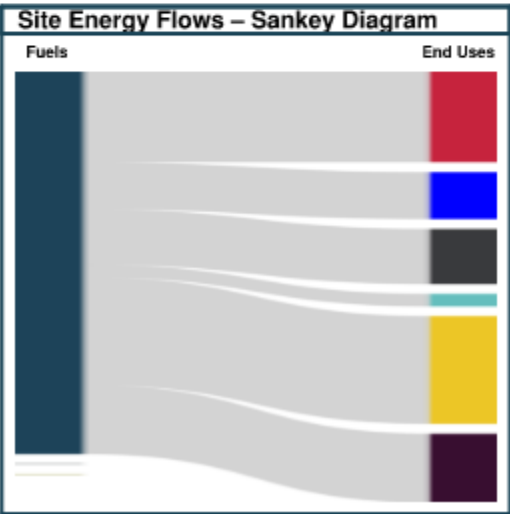
energy modeling

- System Design Energy Model

Annual Energy Consumption (kBtu/ft²/year) & CO2 KgCO2/ft²/yr			
Energy End Use		Site Energy	Source Energy
Heating Fossil Fuel		0.0	0.0
Heating Electricity		4.2	13.3
Space Cooling		2.2	6.8
Fans Interior		2.5	8.0
Heat Rejection		0.0	0.0
Pumps		0.6	1.8
DHW Fossil Fuel		0.0	0.0
DHW Electricity		0.0	0.0
Interior Lighting		5.0	15.7
Exterior Lighting		0.0	0.0
Receptacle		3.2	10.0
Data Center		0.0	0.0
Cooking Fossil Fuel		0.0	0.0
Cooking Electricity		0.0	0.0
Elevators & Escalators		0.0	0.0
Refrigeration		0.0	0.0
Process		0.0	0.0
TOTAL (ex renewables)		17	55
			3



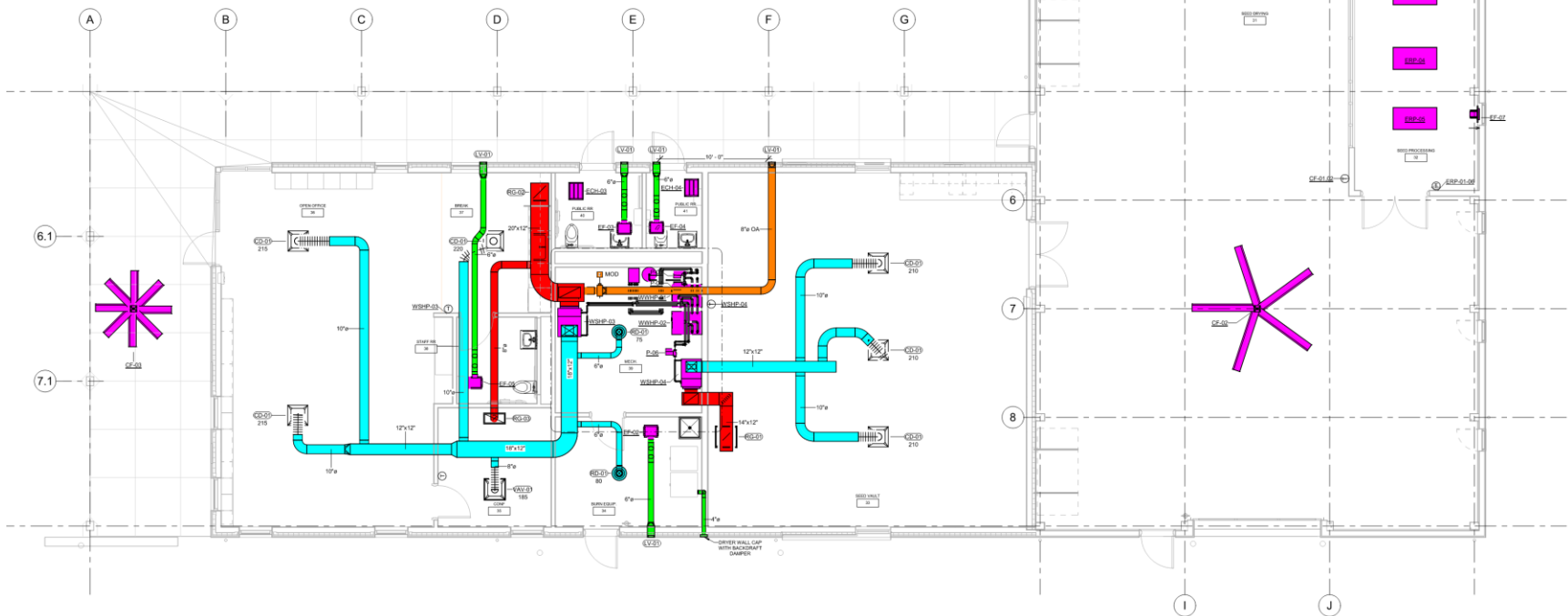
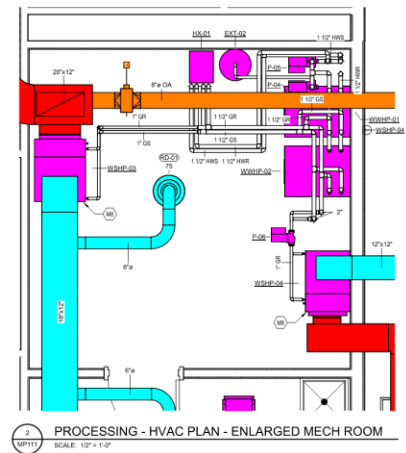
Annual Fuel Costs and Peak Demands				
Fuels	Cost (\$)	Peak Day	Peak Time	Peak Demand
Electricity	16,645.00	14-Jul	16:00	39.1 kW
Fossil Fuel	0.00	01-Jan	0:00	0.0 kBtu/h
Total	16,645.00	01-Jan	0:00	



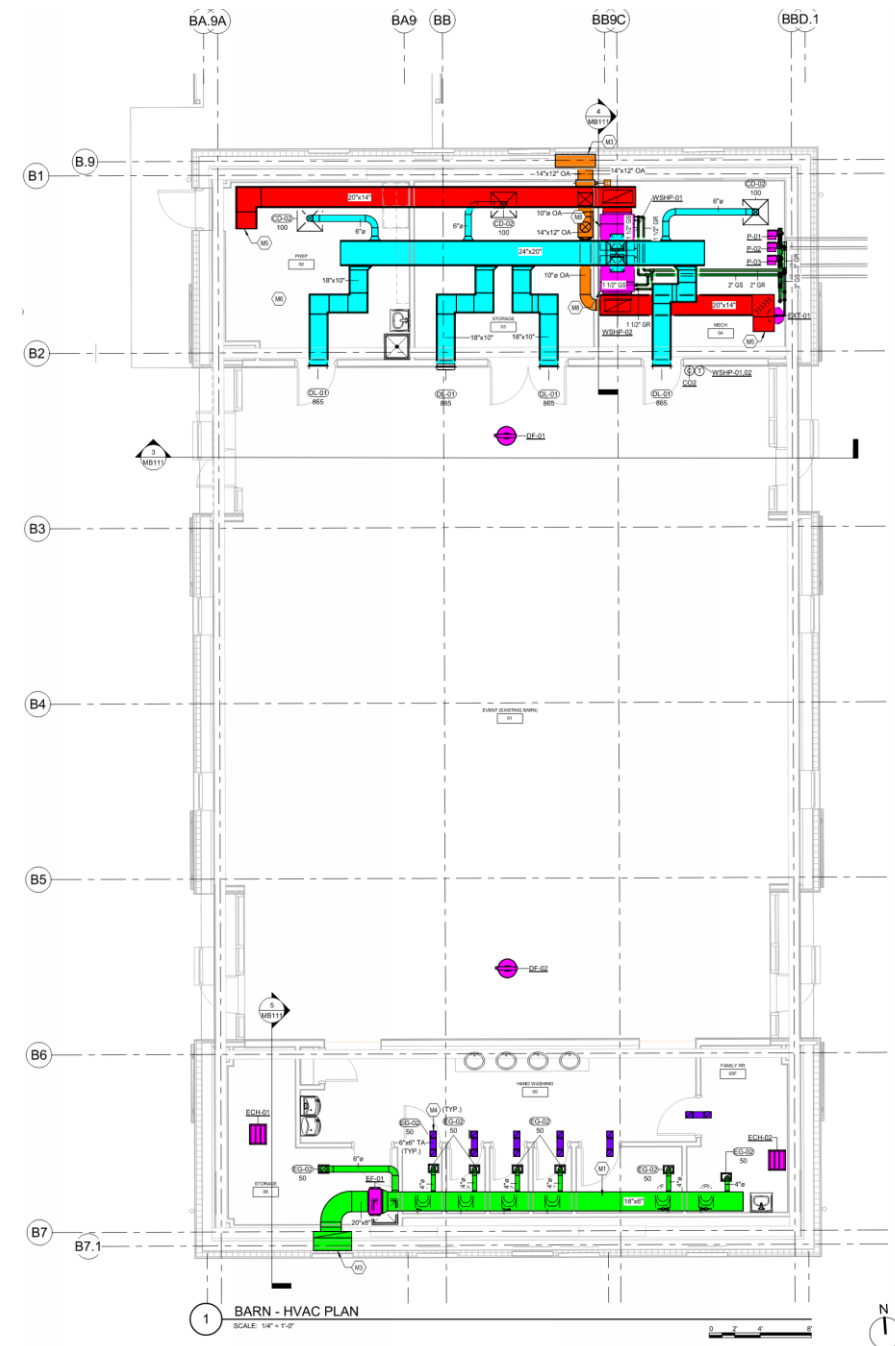
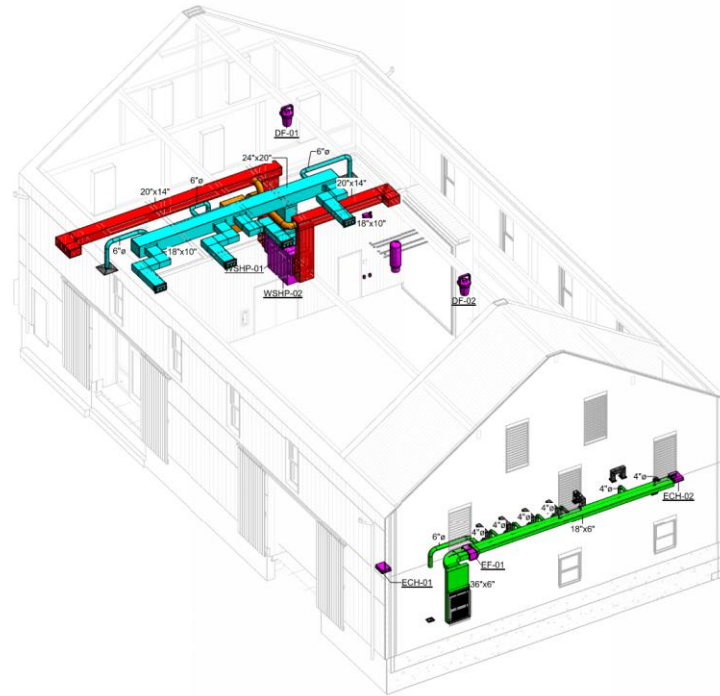
- Well Layout

geothermal

- Processing Building



- Event Barn



geothermal

- Greenhouse

Load Calculation Summary

Load Calculation Method:		User Entered (Manual)	Component Losses:	117,508 Btu/hr
Floorspace Levels:			Radiant Back Losses:	23,002 Btu/hr
Ground Floor:	4,010 SF		Total Heating Load:	141,010 Btu/hr
Total Area:	4,010 SF		Radiant Heating:	117,508 Btu/hr
			Radiant Back Losses:	23,002 Btu/hr
			Total Heating Load:	141,010 Btu/hr
			Surface Temperature:	59 °F

Load Calculation Results

Room	Area	Heating Type	Room Temp	Walls	Windows	Doors	Skylights	Floor	Ceiling	Infiltration	Additional	Recovered Panel Loss	Design Load	Unit Loss
Total For Project	4,010	Radiant	59.0	0	0	0	0	23,502	0	0	0	0	141,010	35.0

Ground Floor

Slab-On-Grade Construction

Room	Area	Heating Type	Room Temp	Walls	Windows	Doors	Skylights	Floor	Ceiling	Infiltration	Additional	Recovered Panel Loss	Design Load	Unit Loss
Room A-01	4,010	Radiant	59.0	0	0	0	0	23,502	0	0	0	0	141,010	35.0
Total Total	4,010	Radiant	59.0	0	0	0	0	23,502	0	0	0	0	141,010	35.0

Zone Heating Summary

Zone #	Zone Area	Construction	Heating Type	RH Circuits	Total Tubing	Manifolds	Floorspace	Head Loss (Circuit Only)	RH Load ⁽¹⁾	Supplemental ⁽²⁾	Zone Load ⁽³⁾
Zone 101	4,010	Embedded Slab	Radiant	12	4,001	2	14,10	2.3	141,010	0	141,010

(1) Complete circuits assigned to this zone. (2) Total Radiant heating load for rooms in zone, including all panel back loss. (3) Total heat for zone including all panel back loss. Does not account for recuperated heat within building envelope.

Room Heating Summary (By Construction Type)

Embedded Slab

Zone #	Room Name	Heating Type	Floor Area	Heated Area	Manifold #	Tube Size	RH Circuits	Tube Spacing	Tubing In Room	Flow Cover #/1	Required Temp	Unit RH Load	RH Load ⁽¹⁾	Supplemental ⁽²⁾	Total Load ⁽³⁾
Zone 101	Room A-01	Radiant	391	3,917	5,097	5/8"	12	12	3,900	0.5	107	36.2	141,010	0	141,010

(1) Circuits assigned to this zone. (2) Includes panel back loss. (3) Total heat including panel back loss. Does not account for recuperated heat within building envelope.

Manifold Summary

Manifold Name	# Zones	# Circuits	Flow	Head Loss ⁽¹⁾	Required Temp.	Supplied Temp.	Temp Drop	Manifold Type	Control Type	# Actuators	# S/R Length ⁽²⁾	S/R Head Loss ⁽³⁾
Manifold 1	1	6	7.08	9.3	107	120	20	PRO-BALANCE 1" Stainless Steel Manifold With Gauges	Manifold	0	-	-
Manifold 2	1	6	7.08	9.3	107	120	20	PRO-BALANCE 1" Stainless Steel Manifold With Gauges	Manifold	0	-	-
Total	1	12	14.16	9.3	-	-	-	-	-	0	-	-

(1) Total head loss includes manifold, circuits and supply/return piping if specified. (2) S/R Length = one way. (3) S/R Head Loss includes manifold, circuits, and supply/return piping if specified. (4) Supply/return piping if specified.

Supply Summary

Name	Temp	Total Fluid Vol	Total Flow	Head Loss ⁽¹⁾	Load ⁽²⁾	# Circuits	# Zones
Water Temperature	120	56.93	14.16	9.3	141,010	12	1

(1) Head loss includes manifold, circuits, and supply/return piping if specified. (2) Load includes all panel back losses.

Manifold Summary

Manifold Name	Circuits	Flowrate	Required Temp.	Supplied Temp.	Manifold Type	S/R Length ⁽¹⁾	S/R Head Loss ⁽²⁾	Manifold Head Loss ⁽³⁾	Circuit Head Loss ⁽⁴⁾	S/R Head Loss ⁽⁵⁾	Total Head Loss ⁽⁶⁾
Manifold 1	6	7.08	107	120	PRO-BALANCE 1" Stainless Steel Manifold With Gauges	-	-	2.0	7.3	9.3	9.3
Manifold 2	6	7.08	107	120	PRO-BALANCE 1" Stainless Steel Manifold With Gauges	-	-	2.1	6.9	9.0	9.0
Total	12	14.16	-	-	-	-	-	2.1	7.3	9.0	9.3

(1) S/R Length = one way. (2) Total Head loss includes manifold, circuits, and supply/return piping if specified. (3) Head loss for manifold only. (4) Design Temp Drop (estimated actual drop). (5) Required head, includes panel back losses. Does not reflect maximum capacity of the circuit. (6) Total head loss for circuit heating only.

Water Temperature (120 °F)

Manifold 1 (120 °F, PRO-BALANCE 1" Stainless Steel Manifold With Gauges, 6 Circuits)

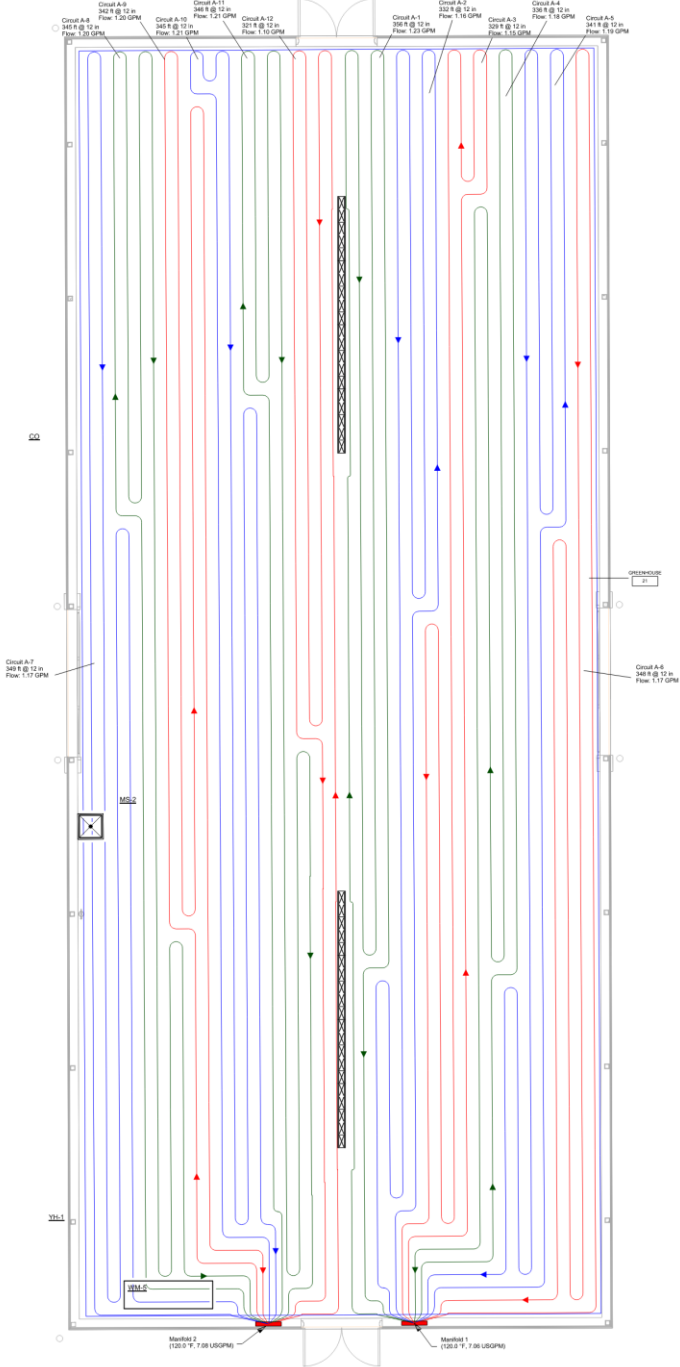
Circuit	Rooms Served	Total Tube Length	Area Covered	Tubing	Flowrate	Head Loss ⁽¹⁾	Temp Drop ⁽²⁾	Load ⁽³⁾	Actuator
A-1	Room A-01	356	12	5/8" RAUPLEX C-2 Barrier Pipe	1.20	7.3	20	12,209	No
A-2	Room A-01	356	12	5/8" RAUPLEX C-2 Barrier Pipe	1.16	6.1	20	11,516	No
A-3	Room A-01	356	12	5/8" RAUPLEX C-2 Barrier Pipe	1.15	6.1	20	11,472	No
A-4	Room A-01	356	12	5/8" RAUPLEX C-2 Barrier Pipe	1.16	6.4	20	11,718	No
A-5	Room A-01	341	12	5/8" RAUPLEX C-2 Barrier Pipe	1.16	6.7	20	11,872	No
A-6	Room A-01	346	12	5/8" RAUPLEX C-2 Barrier Pipe	1.17	6.5	20	11,817	No
Total		2,046	1,951		7.08	7.3	-	70,804	0

(1) Head loss for circuit heating only. (2) Design Temp Drop (estimated actual drop). (3) Required head, includes panel back losses. Does not reflect maximum capacity of the circuit.

Manifold 2 (120 °F, PRO-BALANCE 1" Stainless Steel Manifold With Gauges, 6 Circuits)

Circuit	Rooms Served	Total Tube Length	Area Covered	Tubing	Flowrate	Head Loss ⁽¹⁾	Temp Drop ⁽²⁾	Load ⁽³⁾	Actuator
A-7	Room A-01	346	12	5/8" RAUPLEX C-2 Barrier Pipe	1.17	6.8	20	11,880	No
A-8	Room A-01	346	12	5/8" RAUPLEX C-2 Barrier Pipe	1.20	6.9	20	11,980	No
A-9	Room A-01	342	12	5/8" RAUPLEX C-2 Barrier Pipe	1.20	6.8	20	11,860	No
A-10	Room A-01	349	12	5/8" RAUPLEX C-2 Barrier Pipe	1.21	6.9	20	12,044	No
A-11	Room A-01	349	12	5/8" RAUPLEX C-2 Barrier Pipe	1.21	6.9	20	12,016	No
A-12	Room A-01	371	12	5/8" RAUPLEX C-2 Barrier Pipe	1.10	6.4	20	10,844	No
Total		2,046	1,951		7.08	6.8	-	70,806	0

(1) Head loss for circuit heating only. (2) Design Temp Drop (estimated actual drop). (3) Required head, includes panel back losses. Does not reflect maximum capacity of the circuit.

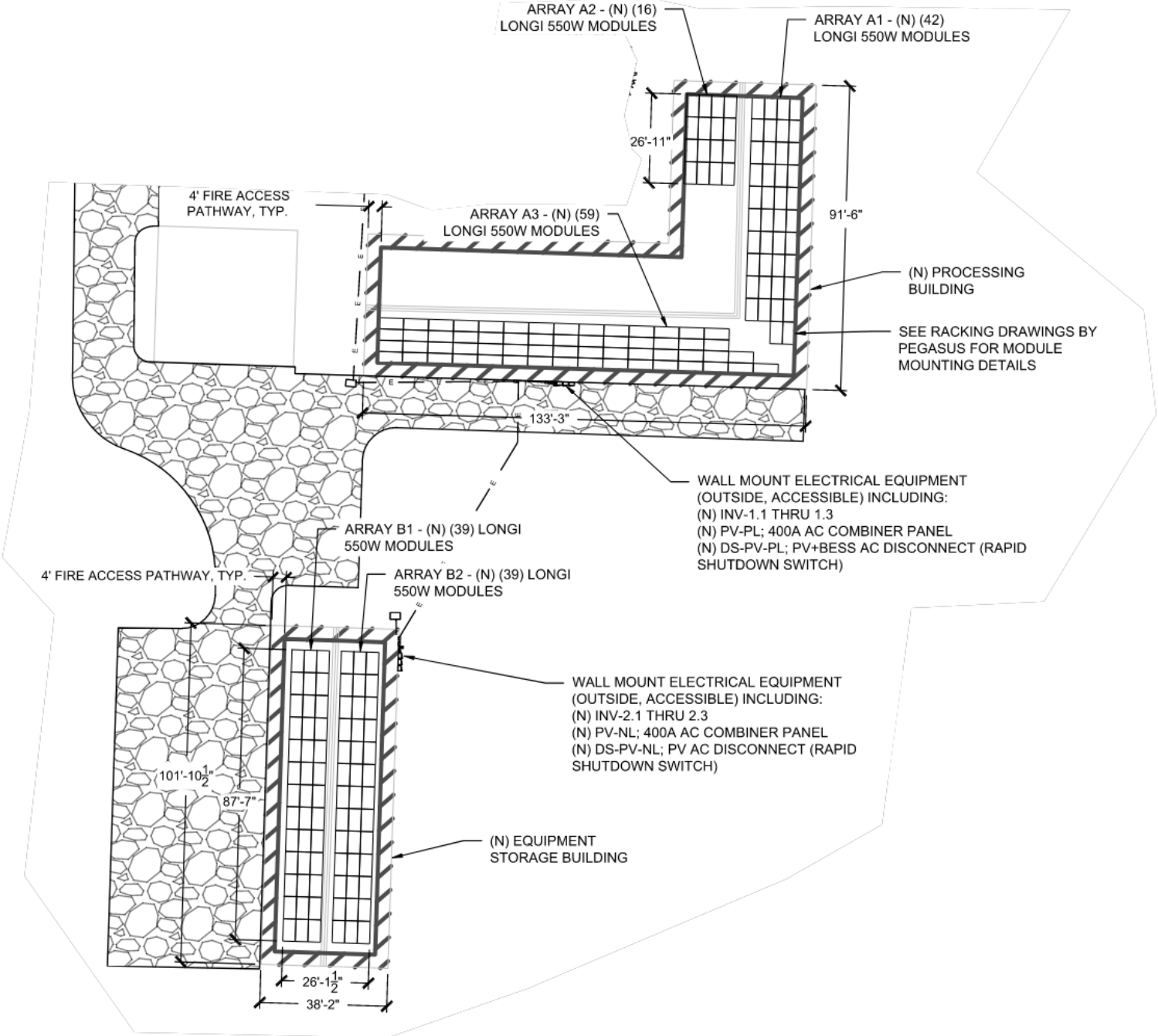


solar production

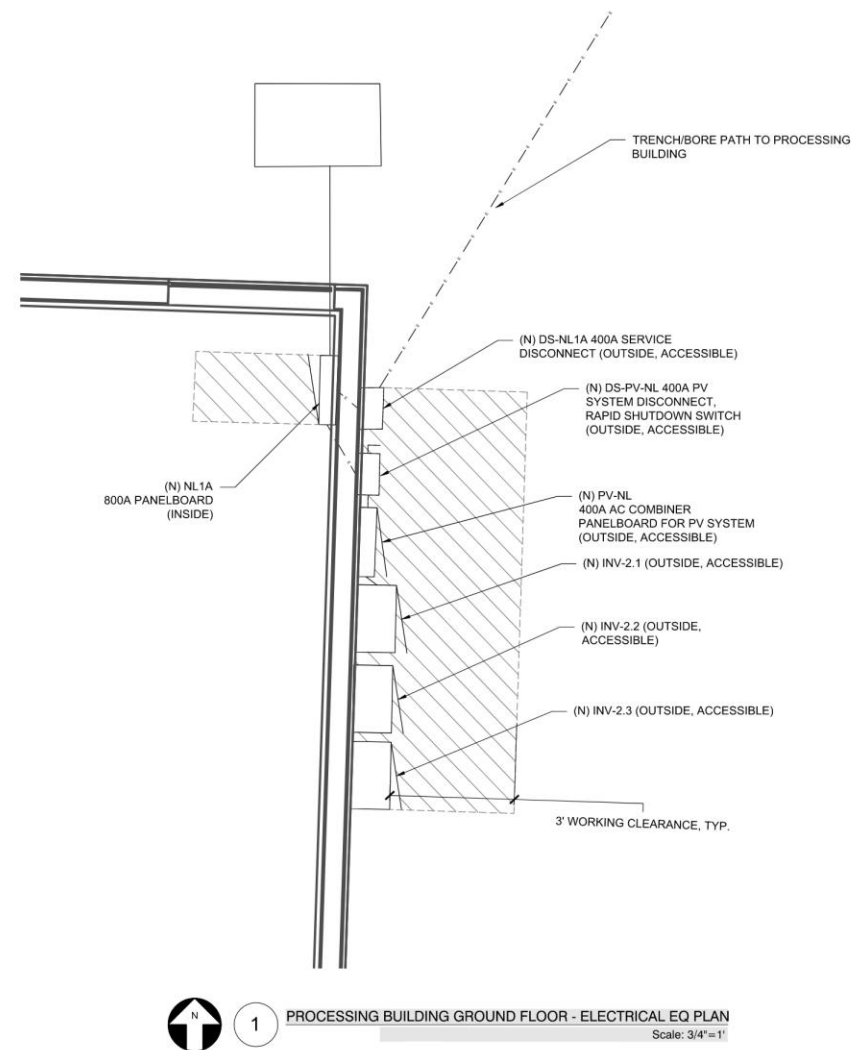
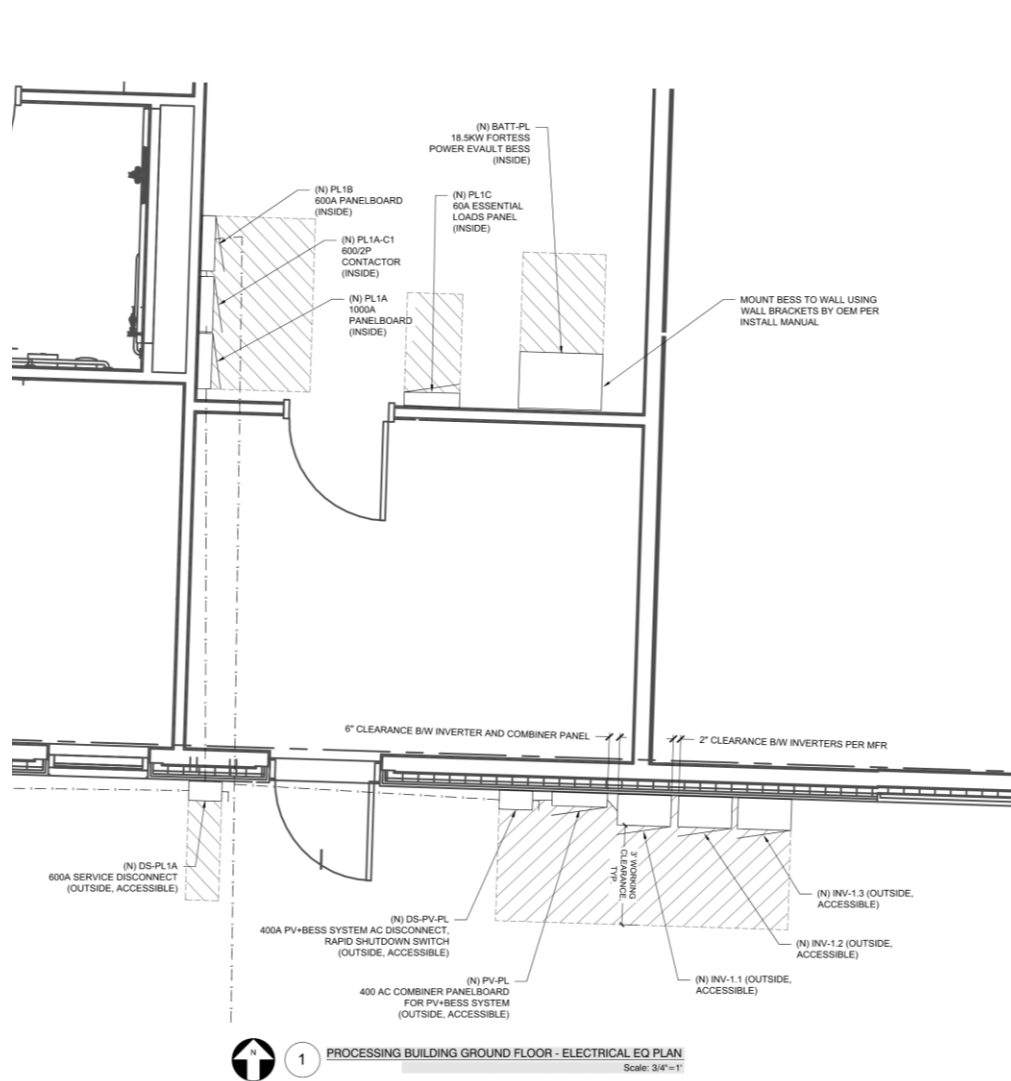


solar production

ARRAY LAYOUT SUMMARY		
ARRAY #	QTY PV MODULES	KW
PROCESSING BUILDING		
A1	42	23,100
A2	16	8,800
A3	59	32,450
EQUIPMENT STORAGE BUILDING		
B1	39	21,450
B2	39	21,450
TOTAL	195	107,250

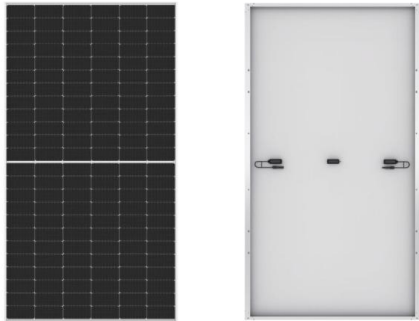
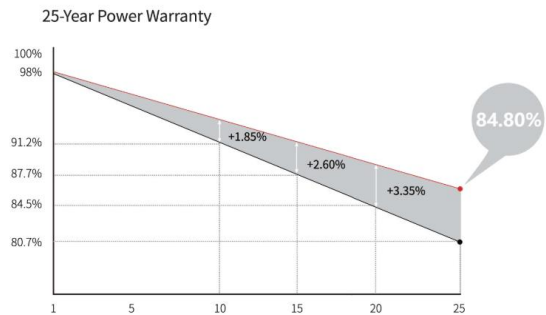


solar production

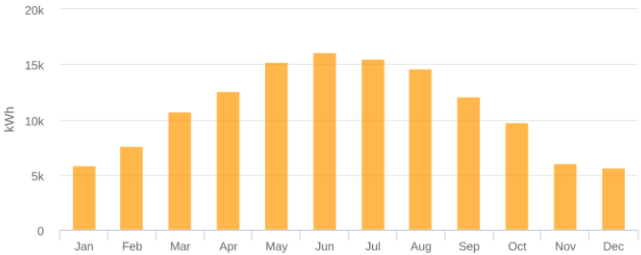


solar production

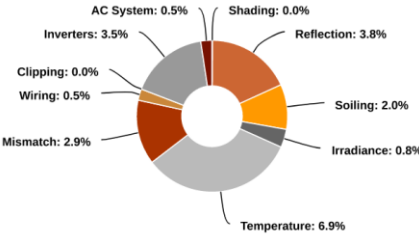
Additional Value



Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m ²)	Annual Global Horizontal Irradiance	1,488.2	
	POA Irradiance	1,521.4	2.2%
	Shaded Irradiance	1,521.0	0.0%
	Irradiance after Reflection	1,463.5	-3.8%
	Irradiance after Soiling	1,434.3	-2.0%
	Total Collector Irradiance	1,434.3	0.0%
Energy (kWh)	Nameplate	153,929.9	
	Output at Irradiance Levels	152,681.6	-0.8%
	Output at Cell Temperature Derate	142,192.7	-6.9%
	Output After Mismatch	138,095.2	-2.9%
	Optimal DC Output	137,401.1	-0.5%
	Constrained DC Output	137,400.1	0.0%
	Inverter Output	132,591.1	-3.5%
	Energy to Grid	131,928.1	-0.5%

Temperature Metrics

Avg. Operating Ambient Temp	14.4 °C
Avg. Operating Cell Temp	29.5 °C

Simulation Metrics

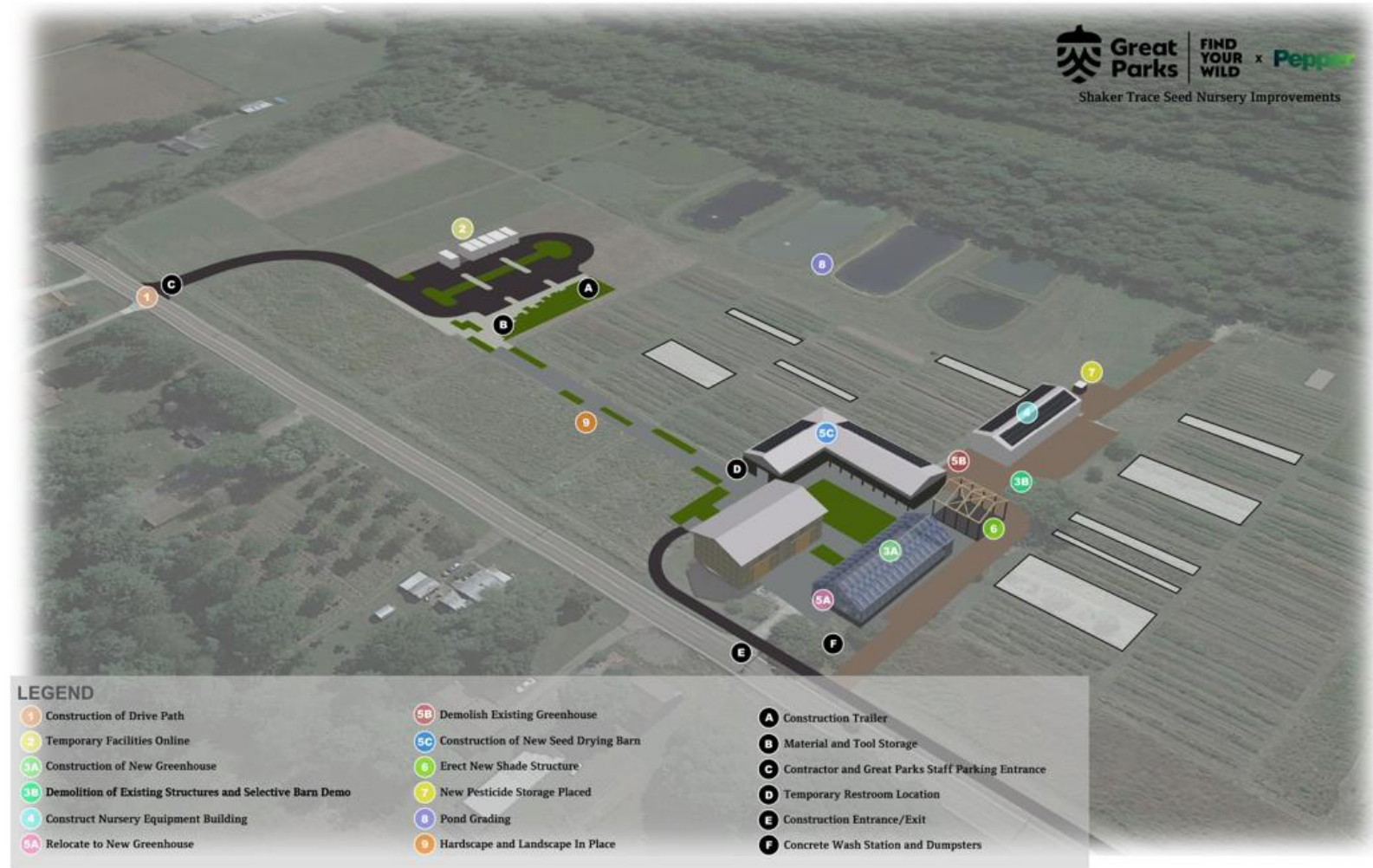
Operating Hours	4659
Solved Hours	4659

CONSTRUCTION



adapt to existing environment

- Protecting the existing assets
- Seed Nursery must remain active



protecting the site's natural resources

- Set up conditioned temporary storage for salvaged rare seed
- Worked with Great Parks to protect native plants and nearby ponds



adapting the existing barn

- Developed new attachment details for uneven, deteriorated foundations
- Shored the barn while addressing unstable conditions beneath the floor



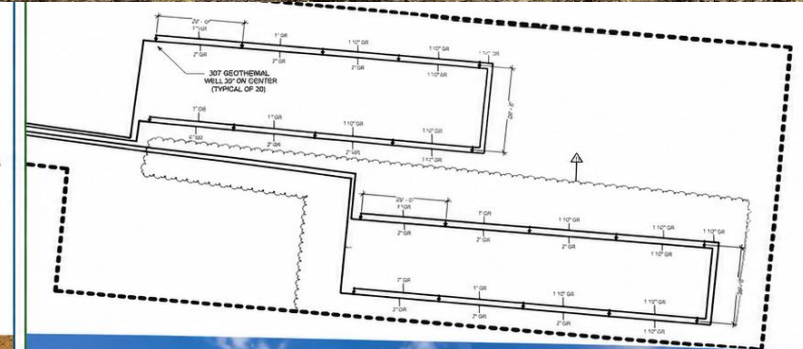
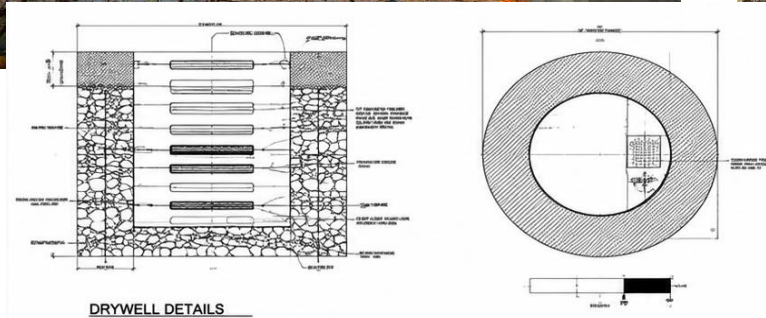
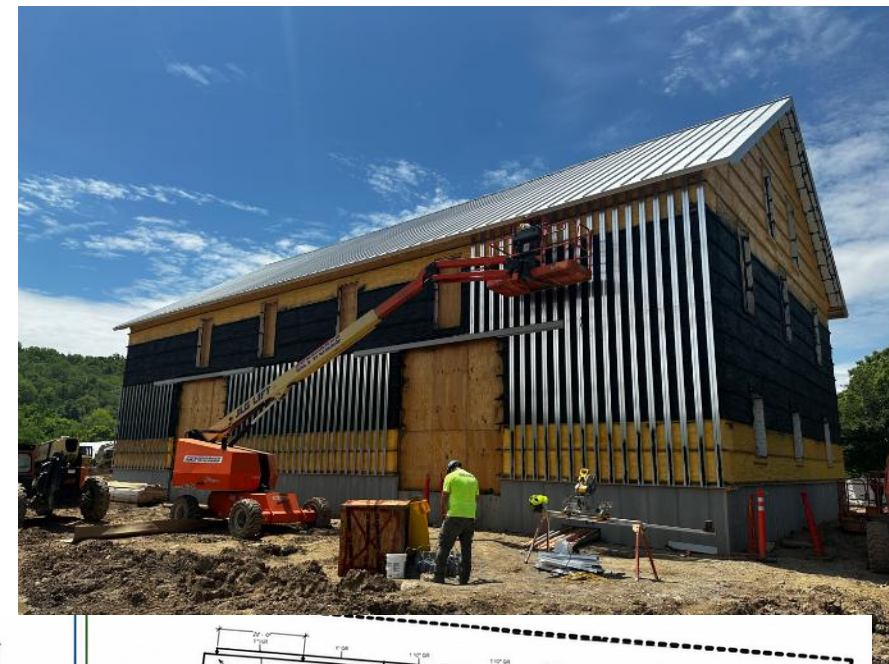
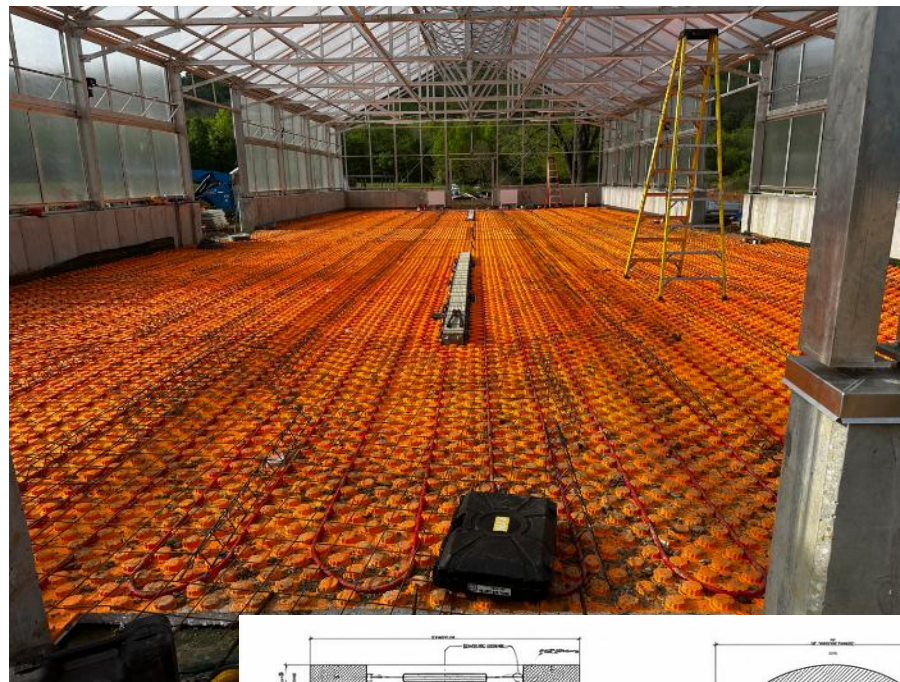
preserving and reusing what was there

- Retained the metal roof, adding blocking to support SIPs panels above it
- Reused demolished concrete in gabion baskets and barn wood as shutters



the details matter

- Radiant floor in green house
- Exterior envelope
- Solar panels
- Geothermal
- Drywells





October 2024



October 2025



Photo Credit: GPHC

new structures

WRAP UP

Sustainability certifications as a tool to tell the story

Currently pursuing:

- LEED Platinum
- SITES Gold
- Net Zero Energy

Alternative Funding – Inflation Reduction Act (IRA)

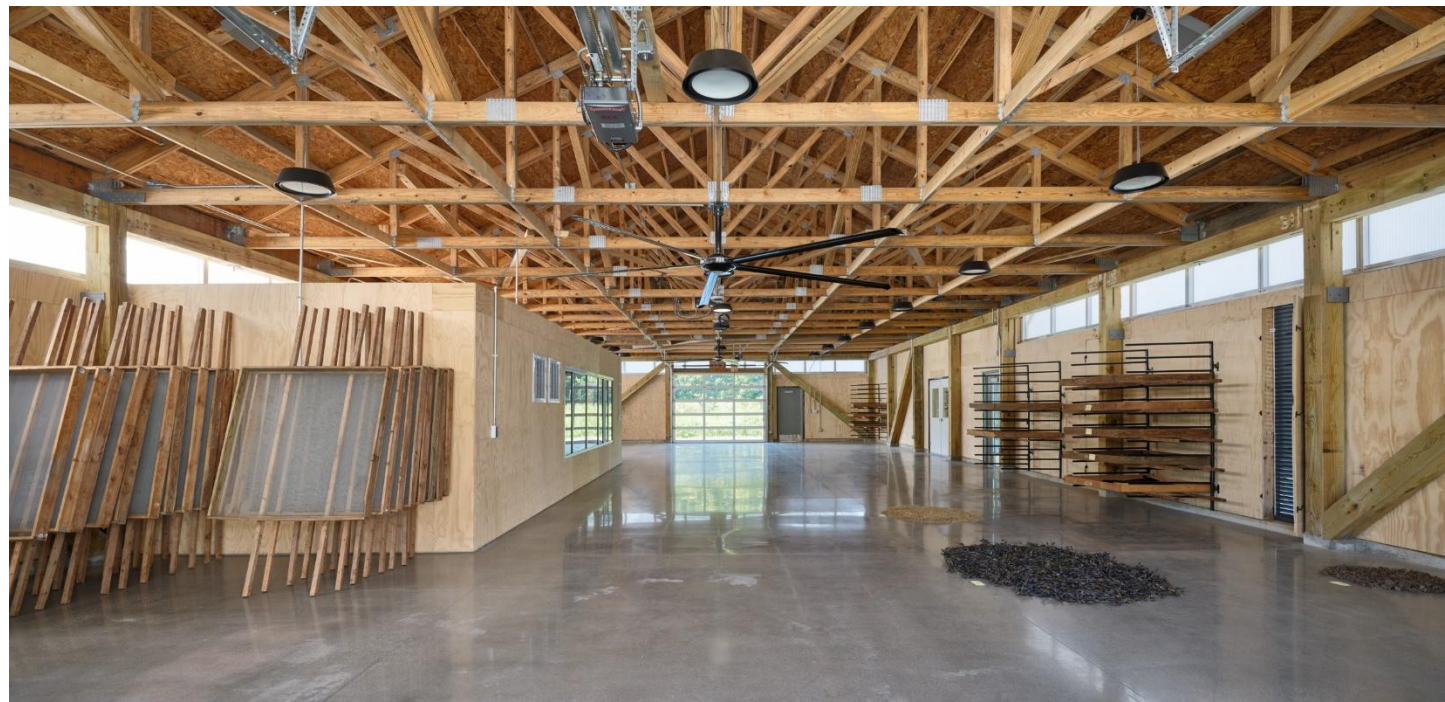
Currently pursuing:

- Geothermal Tax Credit (30% of qualified expenses)
- Solar Tax Credit (30% of qualified expenses)





Photo Credit: GPHC





takeaways

- Net Positive Energy through onsite solar offsets and targeted building performance offsets operational carbon
- careful renovation and reuse of an existing structure preserves the history of the site and provides flexible program space to Great Parks
- Incorporation of conservation-minded strategies as educational tools on the site:
 - innovative bat habitat integration
 - limited areas of disturbance
 - demonstration beds
 - 100% stormwater stays on site
 - bird-friendly glazing
 - storytelling of the growing process thru site design

All because someone asked “what if?”





QUESTIONS