



## 100' Section Poultry Conversion Plan

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**CAROLINA GREENHOUSES**

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Kinston, NC 28501  
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## **100' SECTION POULTRY CONVERSION PLAN**

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The below is intended as a basic guide, with estimated system costs, for converting a 100-foot section of a poultry house to a crop-production facility in association with Mercy For Animals' Transformation program.\*

### **This guide covers the following:**

<b>Conversion of existing roofing</b> .....	<b>3</b>
<b>Partitioning construction</b> .....	<b>4</b>
<b>Lighting, control, and electrical requirements</b> .....	<b>4</b>
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*\*Carolina Greenhouses strongly suggests contacting your local extension agent for resources concerning your crop or project.*

## Roofing Conversion

To convert the structure to a crop-production facility, one must first decide on the lighting source. Typically, two choices are available: natural lighting and grow lights. If natural lighting is desired, the solid roof must be replaced with a material that will transmit light into the structure. For this application, an 8 mm, polycarbonate structured sheet (PCSS) is the material of choice. ThermaGlas is a "clear" PCSS that has an 80% PAR transmission rate. The 8 mm PCSS also has an R-factor of 1.72.

Panels can be stored outside but not in direct sunlight if they are stacked. If possible, store the panels inside. ThermaGlas should be stored on a flat, sturdy surface. If outside storage is required, be sure to cover the panels with cardboard, white polyethylene sheeting, or any insulating material. NEVER walk on the panels.

When installing a PCSS, be sure to install the panel with the label side out (exposed to weather); this is the UV-protected exterior surface. Always use scaffolding or crawling boards to evenly distribute the installer weight across the panel.

ThermaGlas ships with a protective scrim (film) on the UV-protected side of the panel. In some cases, protective scrims are on both sides. The scrim on the interior must be removed prior to installation, and the exterior scrim should be removed shortly after installation. Failure to do so may cause deterioration of the film and void the warranty.

The upper ends of the panels should be sealed with adhesive-backed ThermaGlas solid tape to prevent moisture from entering the panels' cavities. The lower ends of the panels should be covered by ThermaGlas permeable tape. This tape allows condensation moisture to escape but keeps dust and contaminants out. The bottoms of the panels are also covered by the "U" profile. Weep holes 1/8" in diameter should be drilled into the U profile so that moisture can escape. These holes should be 18" to 24" apart.

PCSS panels can support a wind- or snow-load rating of up to 30 psf with the proper supports. Typically, a rating of 15 psf is used. This load rating requires that the roof purlins (horizontal supports) be at 35" on center. The owner should check the load requirements of local building codes. If a different load requirement is needed, please consult the manufacturer's guidelines.

ROOFING REPLACEMENT (TWINWALL PCSS)				
CGH Item #	Description	Quantity	Price ea.	Total price
21100	ThermaGlas 6' x 24', 6", 8 mm	35	\$400.00	\$14,000.00
20000	Splice bar 12', snap channel and bast	64	\$60.00	\$3,840.00
21115	U channel 12'	18	\$20.00	\$360.00
01830	1" Tek screws	11	\$16.00	\$176.00
01827	Bonded seal washers	11	\$14.00	\$154.00
1810	Ridge flashing 10'	10	\$100.00	\$1,000.00
1810	Edge flashing 10'	19	\$100.00	\$1,900.00
1810	Square spacers	1,100	\$1.50	\$1,650.00
			<b>Material total</b>	<b>\$23,080.00</b>
			<b>Labor total</b>	<b>\$7,500.00</b>
			<b>Open total</b>	<b>\$30,580.00</b>

## Partitioning

If partitioning is required or desired, sectioning off the structure can be accomplished in several ways. The simplest way is to hang plastic from the rafters to serve as a "partition wall." The plastic must be anchored at the top and bottom to keep it in place. This method works well when heating is required. A more expensive and structured method is to frame up the partition using either wood or metal posts and girts. A polycarbonate material is then anchored to the frame. Since this is a more permanent option, doors can be added to the wall. The amount of material needed will depend on the size and design of the existing structure.

PARTITION (THINWALL PCSS) (1)				
CGH Item #	Description	Quantity	Price ea.	Total price
21185	ThermaGlas 6' x 12', 8 mm	3	\$170.00	\$510.00
21180	ThermaGlas 6' x 10', 8 mm	4	\$141.00	\$564.00
21175	ThermaGlas 6' x 8', 8 mm	1	\$112.00	\$112.00
21110	Splice bar 12'	8	\$30.00	\$240.00
21115	U channel 12'	8	\$10.00	\$160.00
01830	1" Tek screws	4	\$16.00	\$64.00
01827	Bonded seal washers	4	\$14.00	\$56.00
00895	2" x 24" square tubing	11	\$125.00	\$1,375.00
01593	Endwall bracket, straight	10	\$3.50	\$35.00
01594	Endwall bracket, 90 degree	40	\$4.00	\$160.00
			<b>Material total</b>	<b>\$3,276.00</b>
			<b>Labor total</b>	<b>\$1,200.00</b>
			<b>Open total</b>	<b>\$4,476.00</b>

## Lighting

Lighting is essential for any greenhouse operation. For our example, we will use minimal lighting for plant growth and flipping to flower if needed. Although many types of lighting are available, our example will use a high-pressure sodium (HPS) light. One of these 1,000-watt lights will cover 150 square feet of floor space when mounted eight to 10 feet above the plant canopy. The lights should be equally spaced over the plant canopy to reduce unused light. Depending on the needs of the specific crop being grown, more lights or increased intensity may be needed. Keep in mind that substantial electrical updating may be required when adding lights to the structure. Consultation with a licensed electrician is highly recommended to determine wire sizing and supply requirements for the lighting system. All electrical systems should comply with all codes and standards.

The lights come with mounting points and can be suspended with chains or other means as necessary.

A light-control system of some type is typical. These lights will have to be controlled by a timer system with an override capability.

LIGHTING AND CONTROLS				
CGH Item #	Description	Quantity	Price ea.	Total price
81560	Gavita Pro 1000e lights, 208v	30	\$350.00	\$10,500.00
	Lighting-control box	1	\$5,000.00	\$5,000.00
<b>Material total</b>				<b>\$15,500.00</b>
<b>Installation total</b>				<b>\$2,000.00</b>
<b>Optional wiring</b>				<b>\$3,000.00</b>
<b>System total</b>				<b>\$20,500.00</b>

## Ventilation, Cooling, Heating, and Control Systems

A general rule of thumb for determining the air flow requirements of a greenhouse is  $length (L) \times width (W) \times 8 \text{ cfm}$ . This simple calculation will give the cfm for about one air exchange per minute. Some warmer climates may require an air exchange of 1.5 times per minute.

Using this calculation for a 46' x 100' area, we can determine the following:  $46 \times 100 \times 8 = 36,800 \text{ cfm}$ . According to this calculation, fans that would move this much air at 0.10 static pressure should be selected.

To determine the square footage of the cool cell pad, we take the 36,800 cfm airflow rate and divide it by 350 cfm, which is the standard value for 6"-thick cooling pads. Therefore,  $36,800 / 350 = 105$  square feet. If our cool cell is 5' tall, then  $105 / 5 = 21$ . We would need a cool cell that is 5' tall x 6" thick x 21' long to adequately cool the plant area.

The fans should be equally spaced on the wall across from the cool cell and mounted high enough for the air exhaust to freely discharge. Refer to the exhaust fans data sheet for rough opening requirements.

The cool cell system should be installed in accordance with the manufacturer's guidelines. Pumping and piping should frequently be double-checked for leakage. The roll seal is installed on the outside of the structure to ensure the cool cell is sealed when not in use. The outside of the cool cell system should always be sealed using the shutters or another closure system to prevent damage to the pads. *(Using the system already in place may be more efficient than relocating fans and cool cell structures. If the customer chooses to move the ventilation and cooling systems, they may have to be relocated again if the operation is expanded.)*

HAF fans are used to continuously circulate air in the plant area even when the exhaust fans are not operating. This helps prevent air stagnation and, in some cases, helps with stem caliber. The fans can be arranged as needed, depending on the crop requirements. A typical arrangement is equally spaced on each side of the crop area but staggered on each side. The fans also blow in opposite directions on each side. Crops such as hemp may require the fans to blow directly at them.

Heating uses an outside-mount 225,000 BTU heater, such as Hired Hand model HH-SS-225-XL. A direct spark ignition unit with built-in error indicators, this heater is available in both natural gas and LP, with a universal mounting bracket and a standard gas hook-up kit.

The programmable ventilation control system (VCS) includes 12 relay stages (12 FLA) and four independent variable stages (12 FLA). The VCS can be used for multiple-zone buildings that require fully configurable relay stages for heating and cooling, duty cycles, timed events, or curtains and inlets. It offers one control for multiple-zone buildings, which is great for large facilities requiring four sensor inputs or smaller, separate environments. The control features a temperature sensor, an ambient temperature range of 32°F–122°F, an LCD display, and a Fahrenheit or Celsius display. The upgraded system can also use a humidity sensor for system control. A manual override is available for maintenance and testing. Password security prevents unauthorized changes to the system.

It can be used in conjunction with light-control panels and other control systems if needed. The VCS is compatible with FarmQuest, FarmSite, and Wi Farm telesystem technologies when upgraded. The input capabilities are up to four inside temperature sensors, one outside temperature sensor, one humidity sensor, and four potentiometer inputs.

<b>VENTILATION, COOLING, AND HEATING</b>				
<b>CGH Item #</b>	<b>Description</b>	<b>Quantity</b>	<b>Price ea.</b>	<b>Total price</b>
41000A	50" SW fan with cone, 1 hp SF, 21,600 cfm	2	\$2,050.00	\$4,100.00
41000B	42" SW fan with cone	1	\$1,900.00	\$1,900.00
41115	20" HAF fan	6	\$295.00	\$1,770.00
EC101	Modular base	4	\$790.00	\$3,160.00
EC102	Kit, ending	1	\$337.20	\$337.20
EC103	Sealant	6	\$26.74	\$160.44
EC104	Tank kit	1	\$960.00	\$960.00
81420	High-volume pump	1	\$270.00	\$270.00
ECP048	48" cool cell pad (uncoated)	40	\$33.26	\$1,330.40
ECSF40	Cool cell framing kit	1	\$1,282.00	\$1,282.00
41000C	Roll seal 4' x 40'	1	\$32,500.00	\$32,500.00
81590	Ventilation controller, 12 stage, 1 hp board	1	\$2,800.00	\$2,800.00
81592	Wireless communications board	1	\$390.00	\$390.00
81595	Interface module control, 3G, wireless	1	\$1,700.00	\$1,700.00
31565	Hired Hand heater, 225,000 BTU	1	\$995.00	\$995.00
31568	Universal mounting kit for Hired Hand heater	1	\$360.00	\$360.00
			<b>Material total</b>	<b>\$54,015.04</b>
			<b>Labor total</b>	<b>\$8,100.00</b>
			<b>Optional control wiring</b>	<b>\$6,000.00</b>
			<b>System total</b>	<b>\$68,115.04</b>

## Estimated Project Cost

<b>Materials</b>	<b>\$103,051.74</b>
<b>Installation</b>	<b>\$29,300.00</b>
<b>Total estimated cost*</b>	<b>\$132,351.74</b>
<small>* Estimated cost does not include any additional expenses or materials that are based on specific jobs. Material list is for reference only. Actual materials will be determined on the basis of specific needs and requirements.</small>	





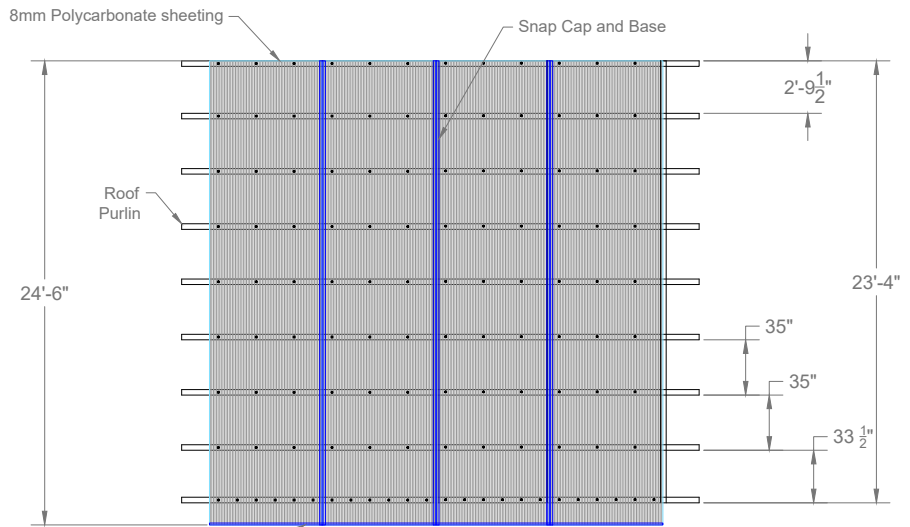
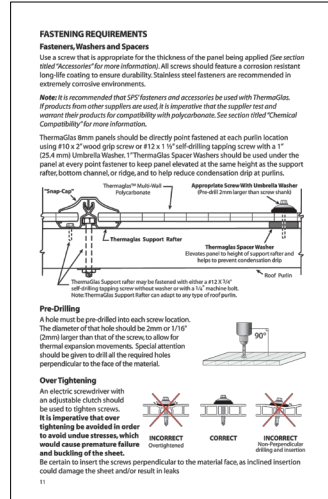
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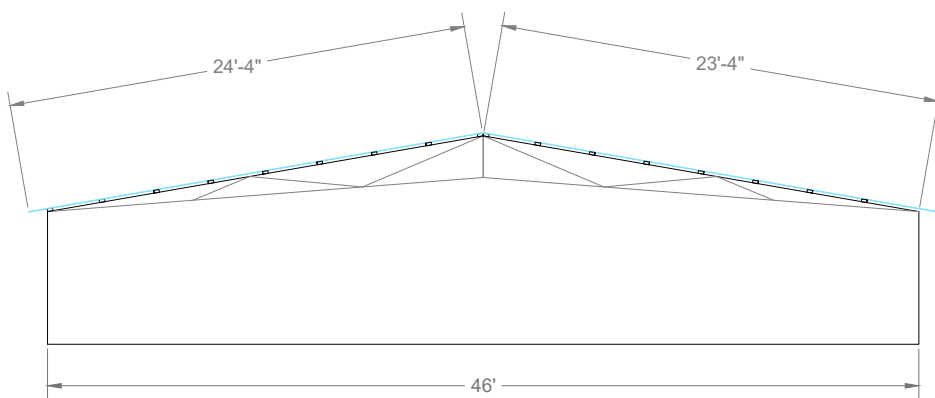
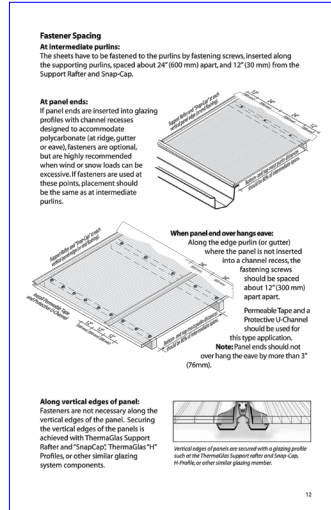
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Fig. 1



"U" Channel Panel Installation  
 Refer to Fig. 1 and Fig. 2 for proper mounting and fastener spacing

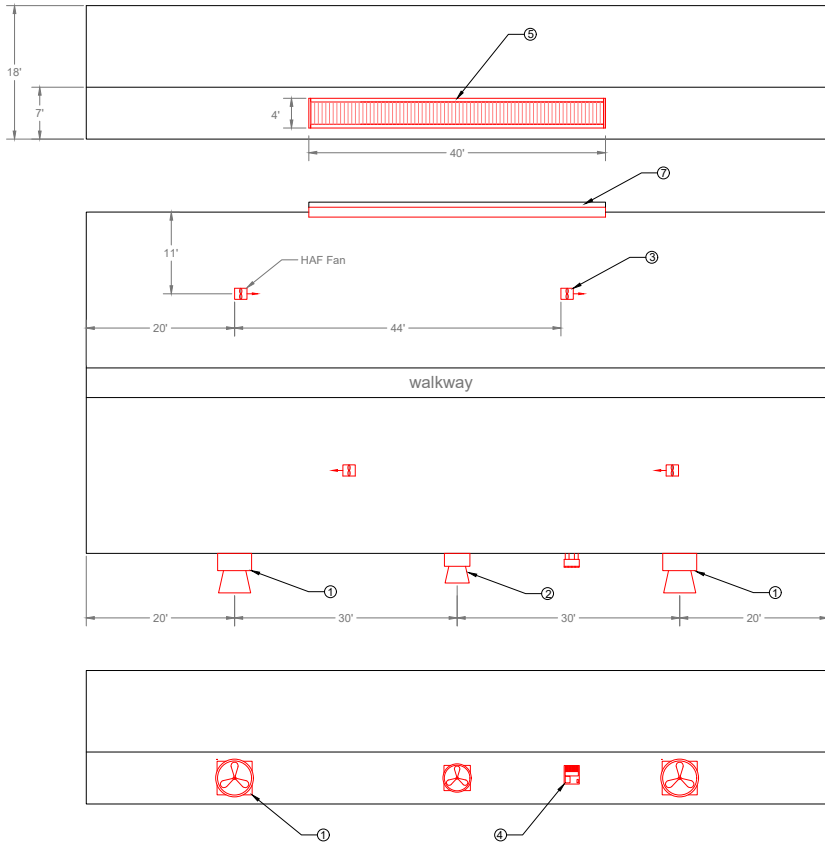
Fig. 2



Note: Diagram shown if for reference only. Actual placement of roof purlins and screw placement depends on existing construction. Refer to installation guide for wind/snow loads.

	DWN. BY	GDS	MWF	TITLE	PCSS Guide
	APP. BY				
	DATE			CAROLINA GREENHOUSES	PART NO.
	SCALE	NTS		1504 Cunningham Road Kinston, NC 28501	TransFarm_001
FILE NAME				PART OF	MFA





COMPONENTS			
Item	Description	Part Number	QTY
1	50" Slatwall Fan with Cone	41525	2
2	42" Slatwall Fan with Cone	41000	1
3	20" HAF Fan	41115	4
4	250,000 Blu Outside Mount Heater	31565	1
5	Cool Cell, 4' x 40' x 6" with Pump	ECS4048M	1
6	Ventilation Control (not shown)	81550	1
7	4 x 40' Roll Seal	41000	1

**Generic Ventilation Calculations**

A greenhouse's fan capacity should be based on 8 cfm per square foot of floor area. Given our section's dimensions, 46' x 100', we calculate 4,600 square feet of floor area. Therefore, the total cfm are 36,800 (8 x 4,600). This will allow for about one air exchange per minute. In warmer climates an air exchange of 1.5 per minute is preferred, so we would calculate 55,200 cfm (36,800 x 1.5) or 55,000 cfm rounded. All fans selected should be sized at 0.10 sp. to ensure proper operation.

For example, to achieve our 55,200 cfm, we can select from these options:  
 Two 50" fans with cones @19,785 cfm @0.1" sp. = 39,570 cfm  
 One 42" fan with cone @14,950 cfm @0.1" sp. = 14,950 cfm  
 Total = 54,520 cfm

To determine the square footage requirement for a six-inch-thick cooling pad, we use the standard value of 350 cfm. Pad size is determined by dividing the cfm requirement by the pad value: 55,200 cfm / 350 cfm = 157 square feet of pad. Using this total, we can select from the following pad sizes:  
 6' x 26' | 5' x 32' | 4' x 40'

**Air Circulation**

HAF fans circulate air throughout a greenhouse even when the exhaust fans are not operating. This prevents air stagnation and helps with plant growth. The fans are staggered on the sides of the greenhouse and face opposite one another. This arrangement helps the air move in a circular direction.

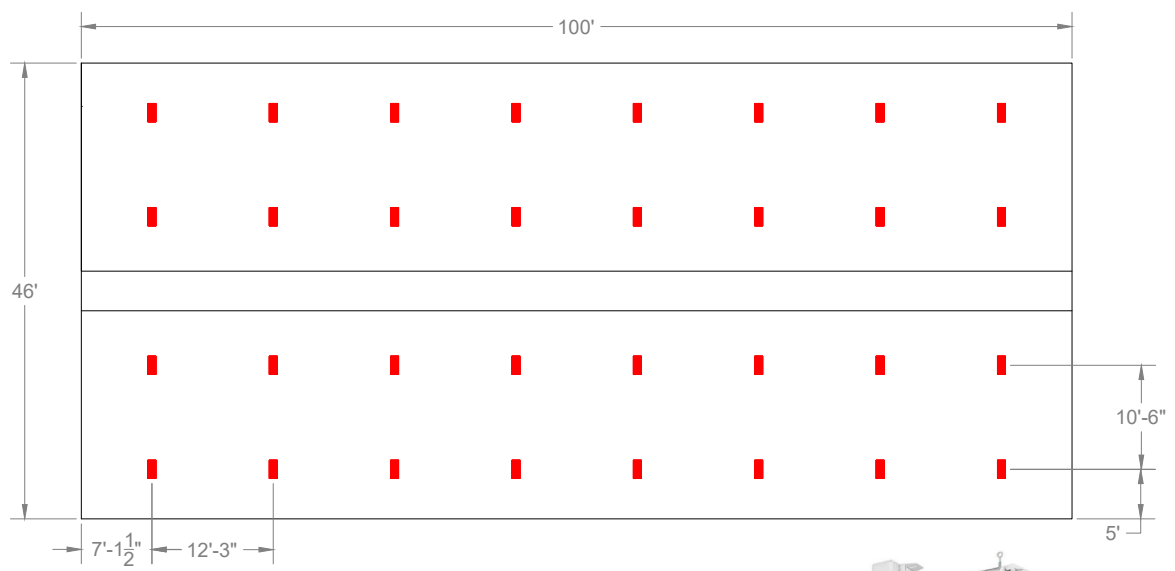
**Heating**

Heating is accomplished using an outside-mount 225,000 BTUH heater, similar to a Hired Hand Model HH-55-225-XL. This heater is available in both natural gas and LP. It is a direct spark ignition unit with built-in error indicators. It is also available with a universal mounting bracket and a standard gas hook-up kit.

**Ventilation Control System**

The programmable ventilation control system includes 12 relay stages (12 FLA) and four independent variable stages (12 FLA). It can be used for buildings with multiple zones that require fully configurable relay stages for heating-cooling, duty cycles, timed events, and curtains or inlets. With one control for multiple-zone buildings, it is great for large facilities requiring four sensor inputs or smaller separate environments. The control features a temperature sensor, an ambient temperature range of 32°F-122°F, an LCD display, and a Fahrenheit or Celsius display. A manual override is available for maintenance and testing. Password security prevents unauthorized changes to the system. The ventilation control system is compatible with FarmQuest, FarmSite, and Wi Farm teletystem technologies when upgraded. The input capabilities are up to four inside temperature sensors, one outside temperature sensor, one humidity sensor, and four potentiometer inputs.

	DWN.BY	gds	WPA	FILE	Ventilation Guide
	APP.BY				
	DATE				
NAME	SCALE	CAROLINA GREENHOUSES	1504 Cunningham Road	Part	TransFarm 002
			Kinston, NC 28501	Rev. 01	WPA

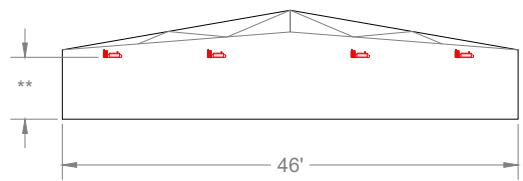


Gavita Pro 1000e

**Lighting and Electrical Notes**

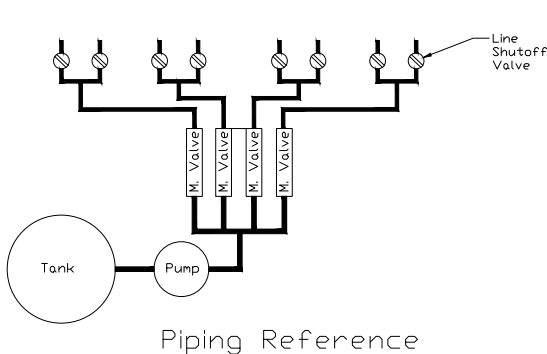
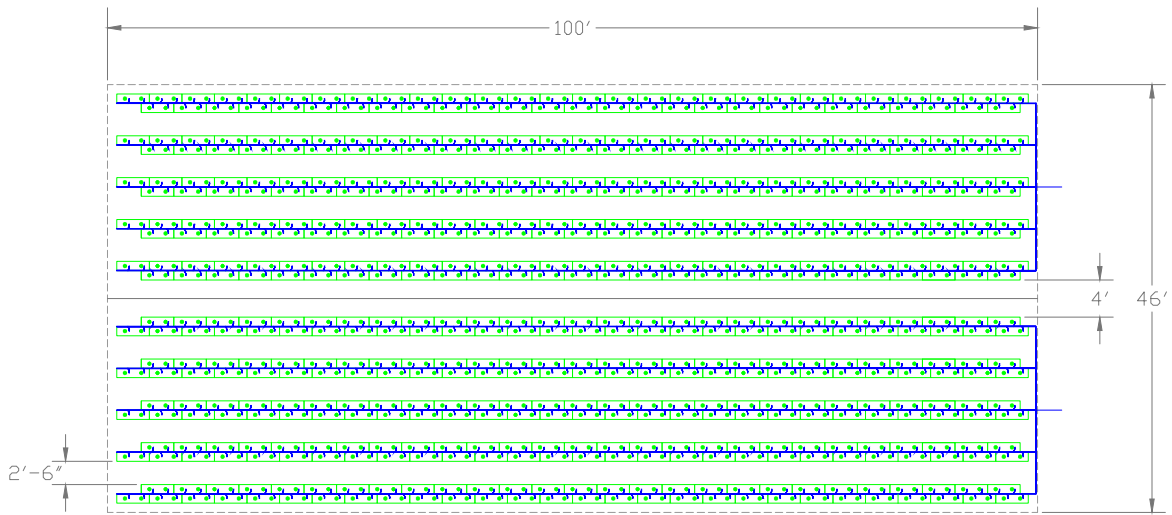
Minimal lighting using Gavita lights is one per 150 sq. ft. The 100' section of house will require approximately 32 lights equally spaced throughout the section. Lighting must be controlled from a dedicated lighting panel, or it can be timer controlled from the ventilation control with a relay panel. Lighting may also require substantial rewiring of the structure and possibly increasing the power supply to the structure.

At 240v, the input current for the light at 100% is 4.5 amps. These 4.5 amps multiplied by 32 lights is 144 amps. Using 30 amp breakers and the 75% rule of thumb, it will take seven individual circuit breakers for the lights. Wire sizing and connections should be performed by a licensed electrician and should conform to all local codes and standards.



\*\* Minimum light height from plant surface is 40". Typical height is 6' to 8' from plant surface.

	DWN.BY	gds	WPA	FILE	Lighting Reference
	APP.BY				
	DATE				
NAME	SCALE	CAROLINA GREENHOUSES	1504 Cunningham Road	Part	TransFarm 003
			Kinston, NC 28501	Rev. 01	WPA

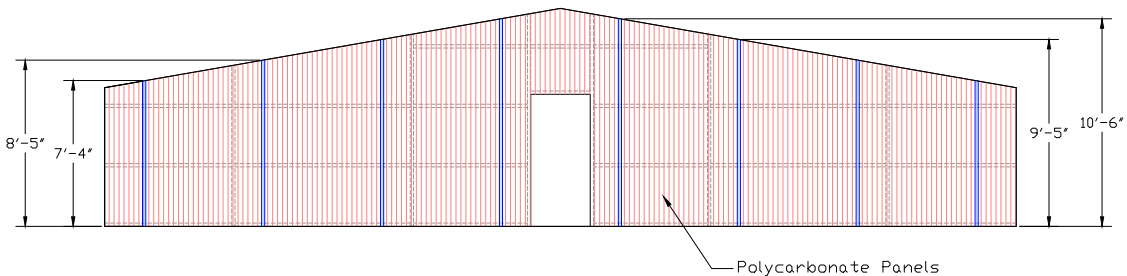
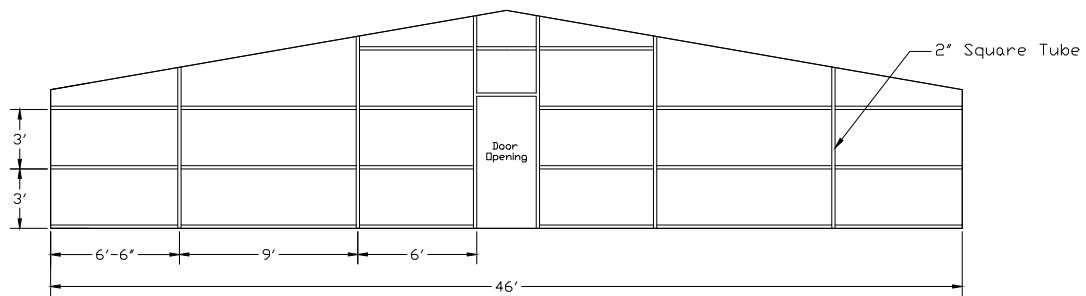


Piping Reference

**Plant Capacity**

Plant capacity is established using the CSC veggie bags laid out in a grid of double units in a staggered formation and placing two plants per bag. The maximum quantity would be 10 rows of 55 bags (550 bags total) that are spaced with 30" access between rows. This will provide space for 1,100 plants. This arrangement would leave enough room for a 48" walkway at the center of the house. Irrigation lines can be between rows and service both sides of line. (Note: the location on the irrigation lines may have to be changed based on the crop and need for a clear row.) Each plant site will have a drip line assembly inserted into the bag. Fertilizer and other chemicals can be delivered to the plants from either a premixed tank or a fertilizer injector, depending on the grower's preference. Regardless of delivery method, a manifold system is used to direct the solution into the irrigation lines. The manifold system can be controlled by a timer or by manually manipulating the valves. The manifold and timer system will control which irrigation line is to be fed and for how long. Each individual irrigation line will have a manual shutoff valve. Irrigation lines are typically 1/2" poly lines and can be either black or white.

	DWN BY	CSC	DATE	TITLE	Plant Layout Reference
	APP BY				
	DATE				
	SCALE	N/A			TransForm 004



**Partitioning**

If a permanent partition is desired, the partition can be framed up with either wood or metal posts and girts. A polycarbonate material is then anchored to the frame. Since this is a "more permanent" option, doors can be added to the wall. The materials needed will depend on the size and design of the existing structure. The polycarbonate material is secured using screws and bonded washers. The rubber spacers are optional for this type of installation. The H channel connector and the U channel seal should be used in a manner similar to that used on the roof of the structure.

	DWN BY	CSC	DATE	TITLE	Partition Guide
	APP BY				
	DATE				
	SCALE	N/A			TransForm 005