

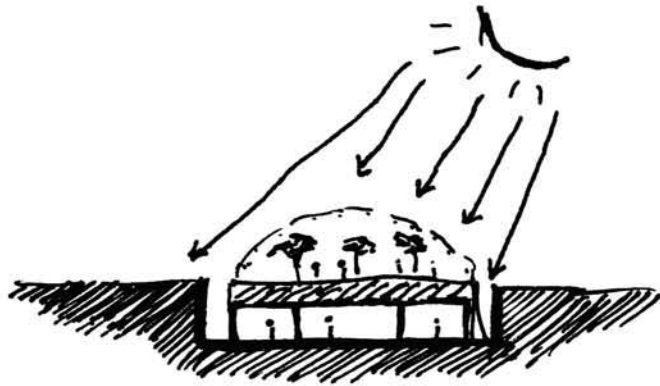
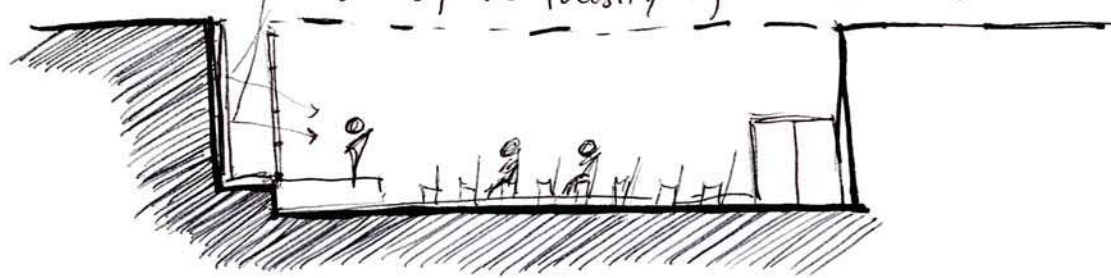
# Sketches by Crystal Rinkenberger

9/13/14

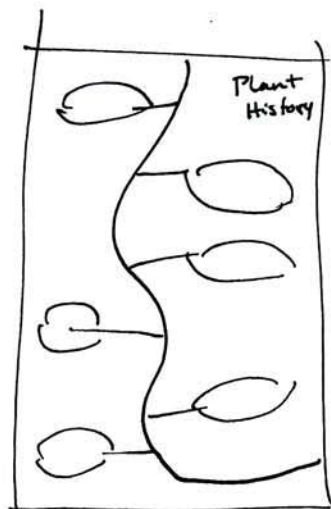
What if it was sunken into the ground?

↳ auditorium @ Kimbell

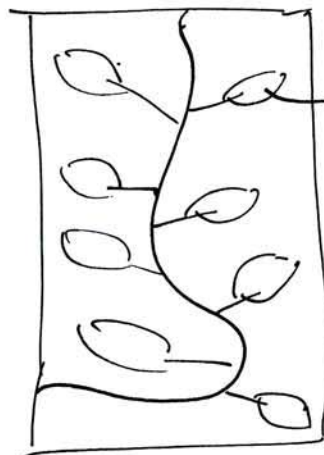
? easy to falsify light in winter?



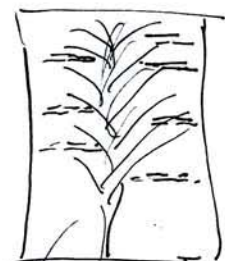
How deep does the soil need to be for 30' trees? 50/60'?



Plant History



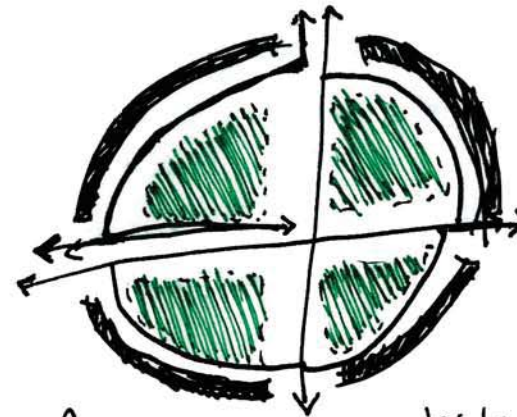
Image/graphic in leaf  
maybe image is leaf shaped.



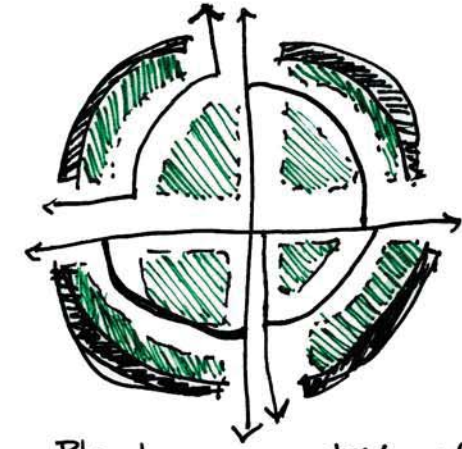
could do a fern underlay.

9/27/14

Does the circulation or plants go near the walls/ext. walls.



or



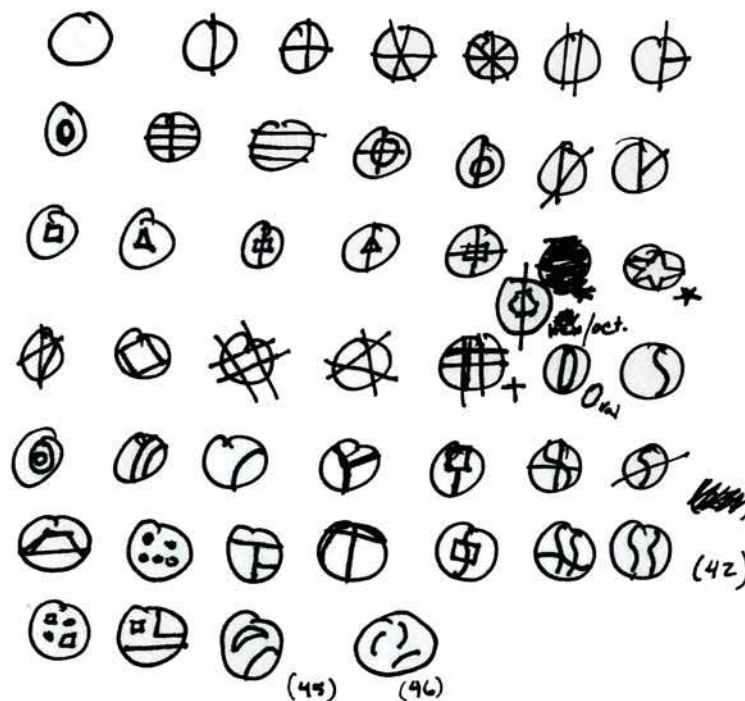
Circulation on outside edge

- Seems emptier
- Confined
- Sterile, clinical

Plants on outside edge

- looks more like a fern grotto, fuller
- seems green even though it maybe smaller
- fresh
- imbued?
- stuffed with more greenery
- not cluttered, but full? stuffed?

How many ways can you divide a circle?





# Sketches by Crystal Rinkenberger

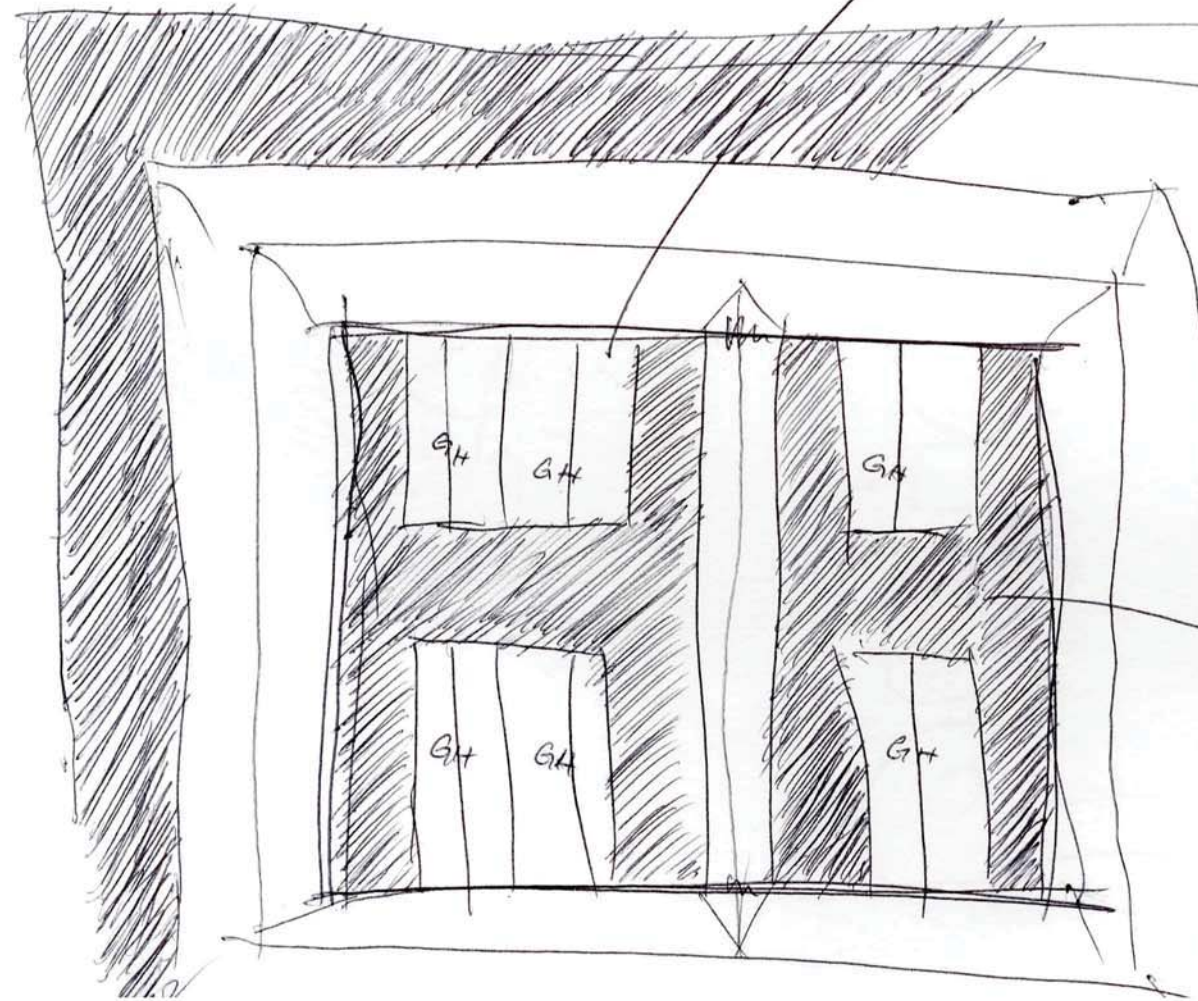
December 11, 2014



Picnic tables, walking paths, tall pines + willow bushes.

hidden, but not hidden by the willows - tucked into.

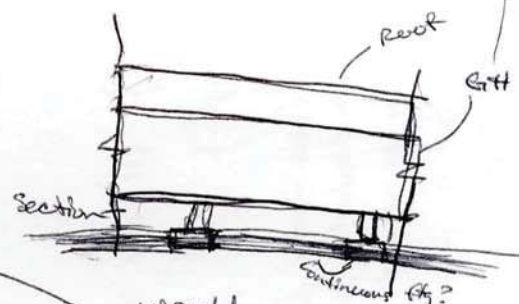
Laura Madison



1/14/15  
Like AES Gtt small wings could be cost effective to add on but an entire ring around it may not be worth while.

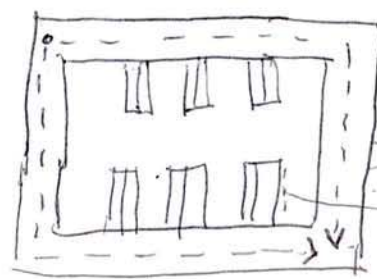
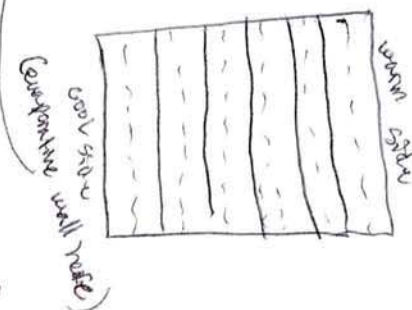
And stunt expansion

Conservatory, education, greenhouse loop?



would gaps between greenhouses or classroom - run be a problem area for snow? or would it blow through since it is off the ground?

would hydroponics benefit from an emp. wall? would still need it?



- get partial shade in areas from ring building  
- expansion limited  
- greenhouse benefit

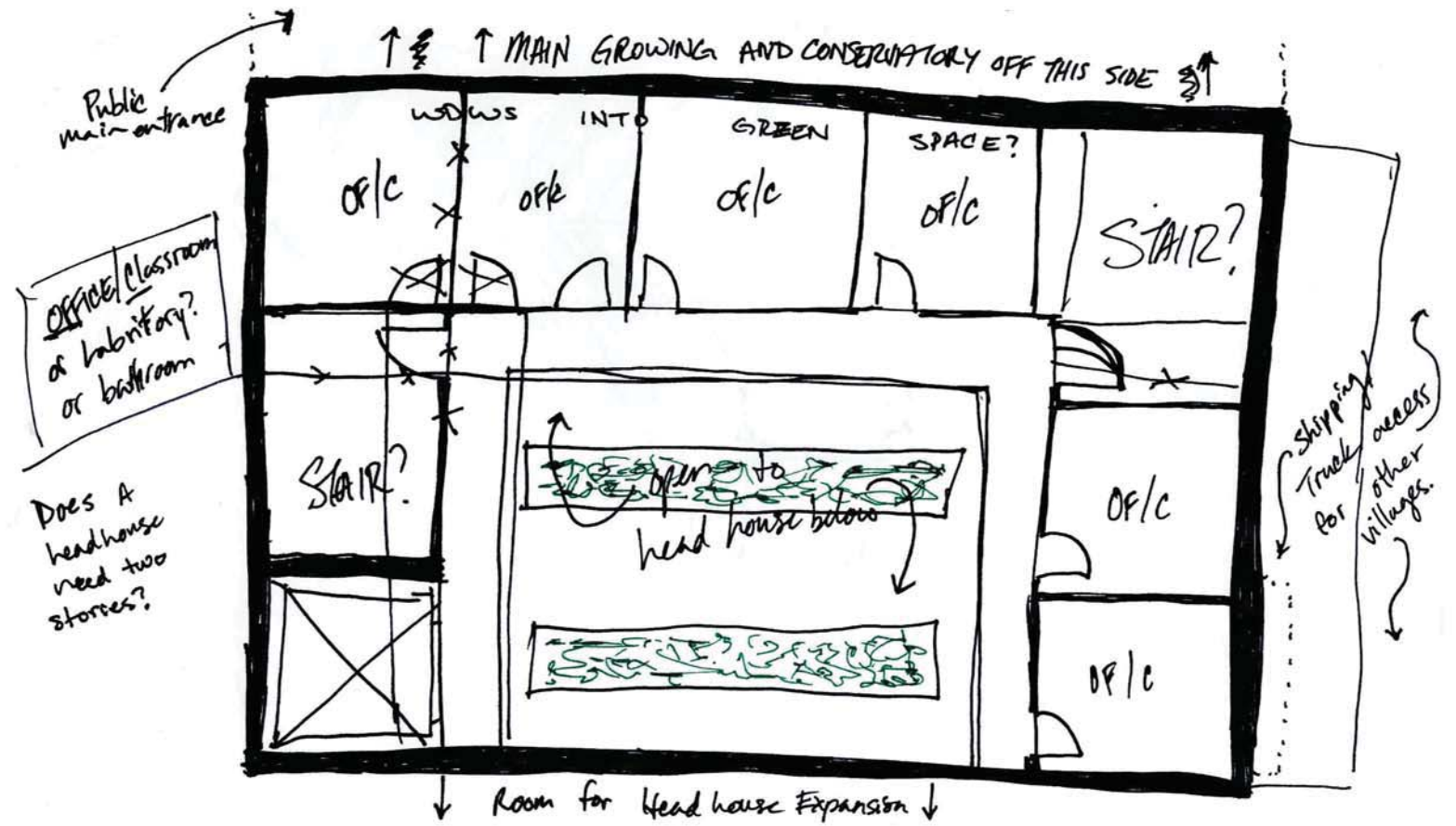
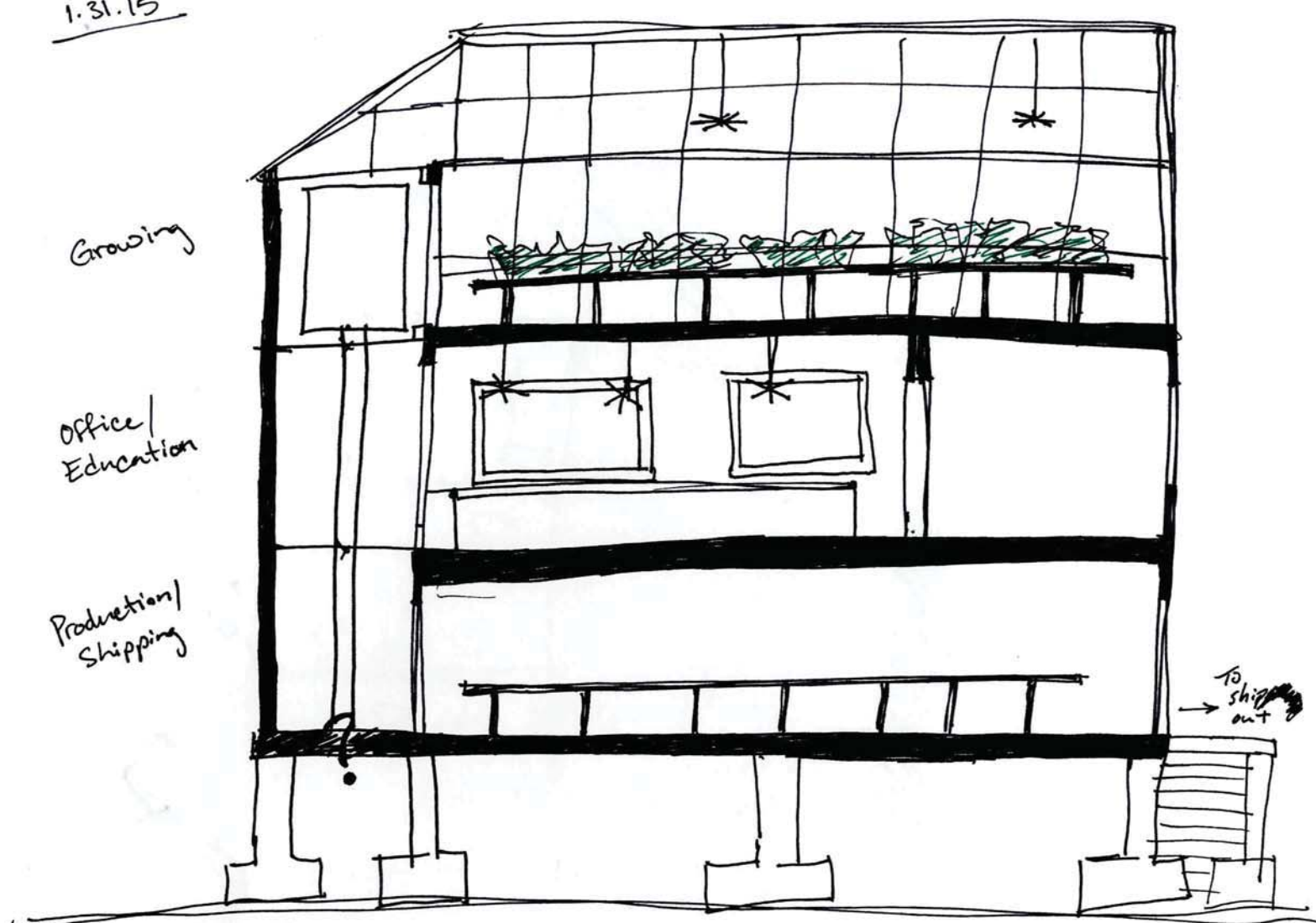
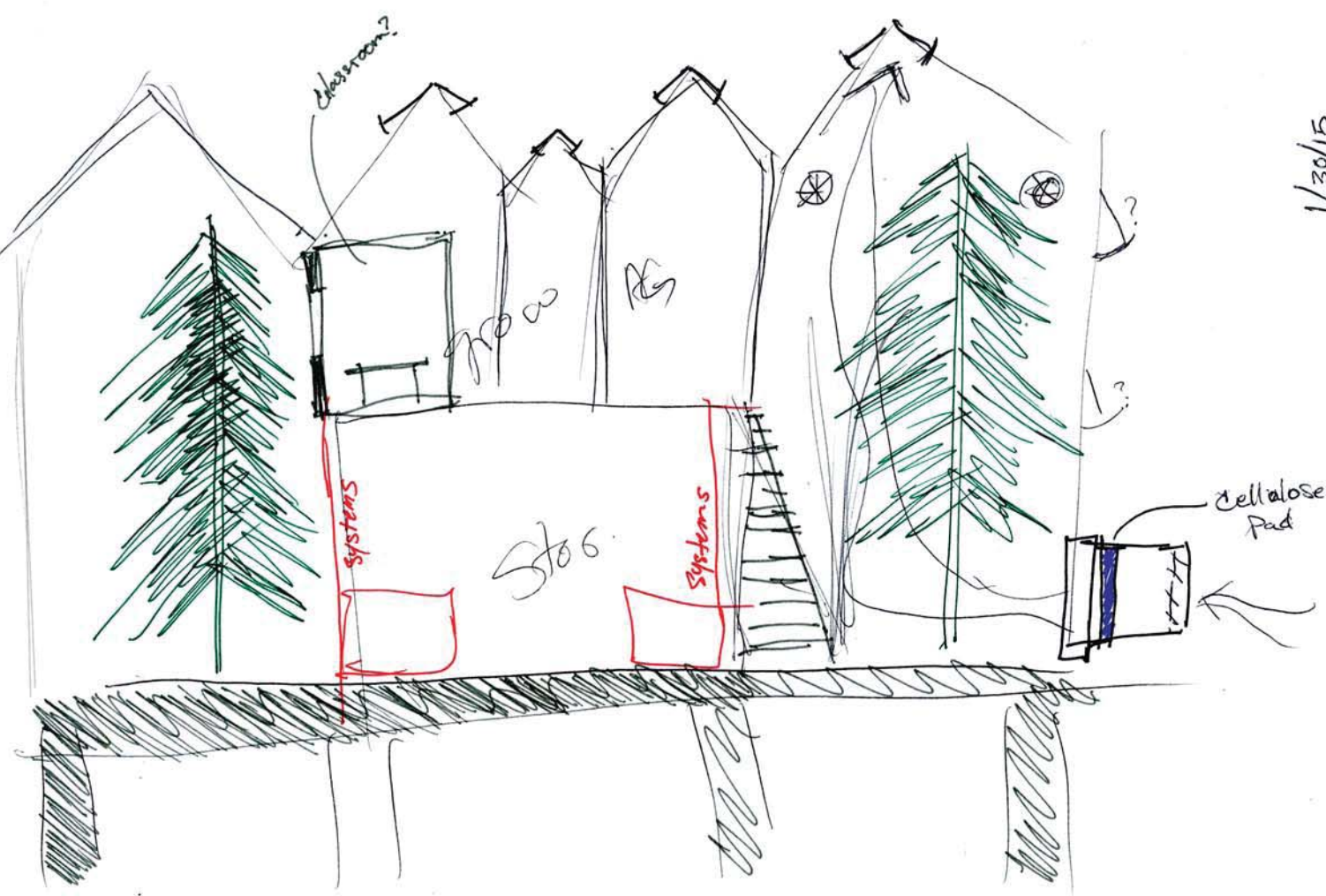
- long way about permafrost + greenhouse? (control)

the only reason to be so detailed about controls, would be for specific rooms like AES labs but food production could be more consolidated + focused like Comco's growing Gtt - cool side to warm side.



Sketches by Crystal Rinkenberger

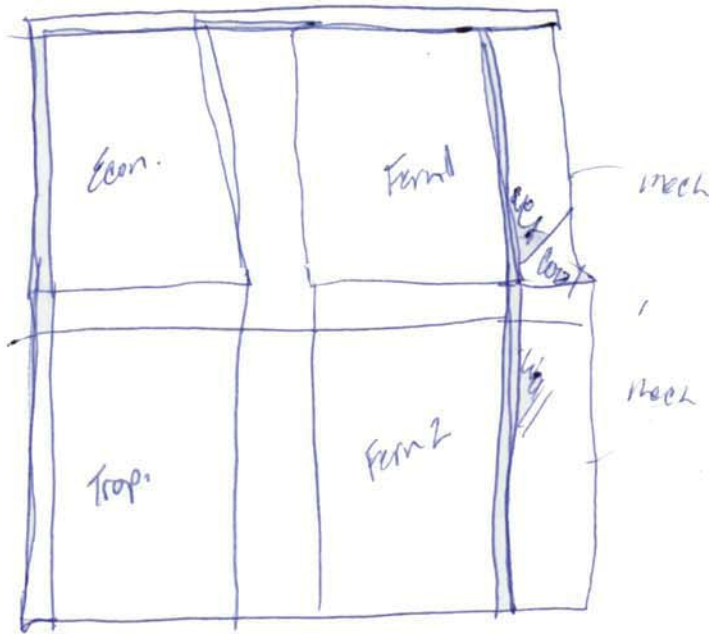
1.31.15



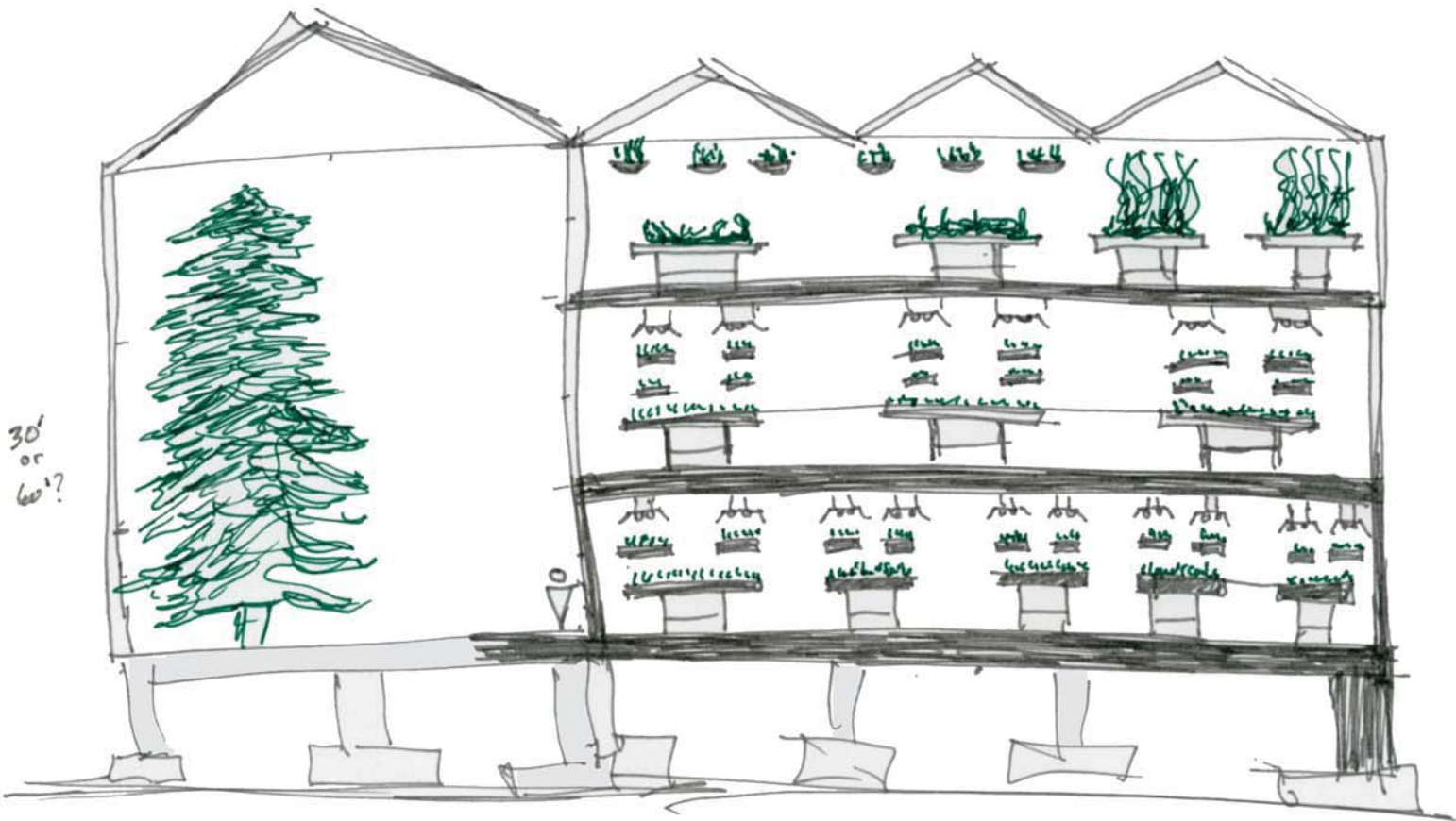


# Sketches by Crystal Rinkenberger

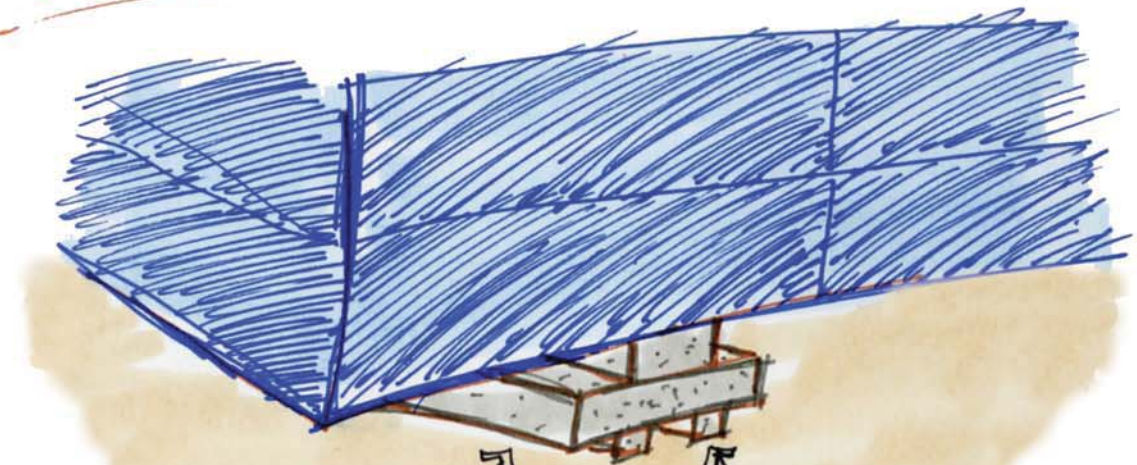
2.8.2015



I could put a large cooling wall along the interior wall to keep the risk of snow out but then the rooms would need to be connected instead of separate to benefit from it. But is one that large even necessary?  
- The tropics room ought to be hotter.



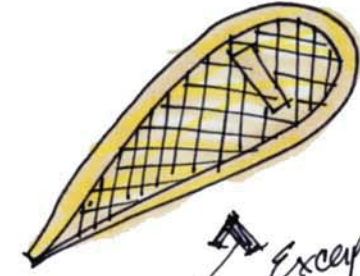
2.20.15 Structure



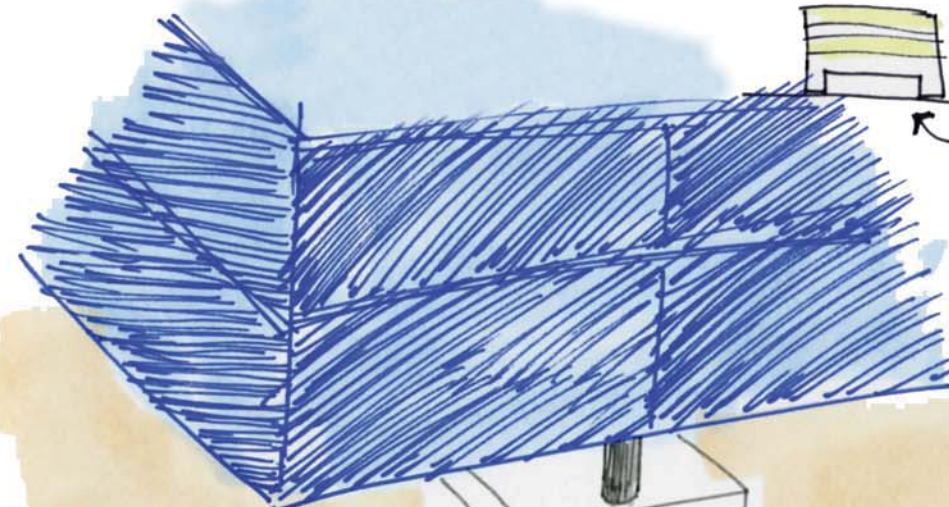
WHAT I THOUGHT THE FOUNDATION SYSTEM OF THE BARROW HOSPITAL WAS FROM GLANCING AT A FEW EXT. PHOTOS.



I thought that maybe there was a float/raft system that would transfer the weight.



Except that somehow they would work more like snow shoes distributing the weight. But that's silly,



That puts more pressure on the edges than they would both sink.

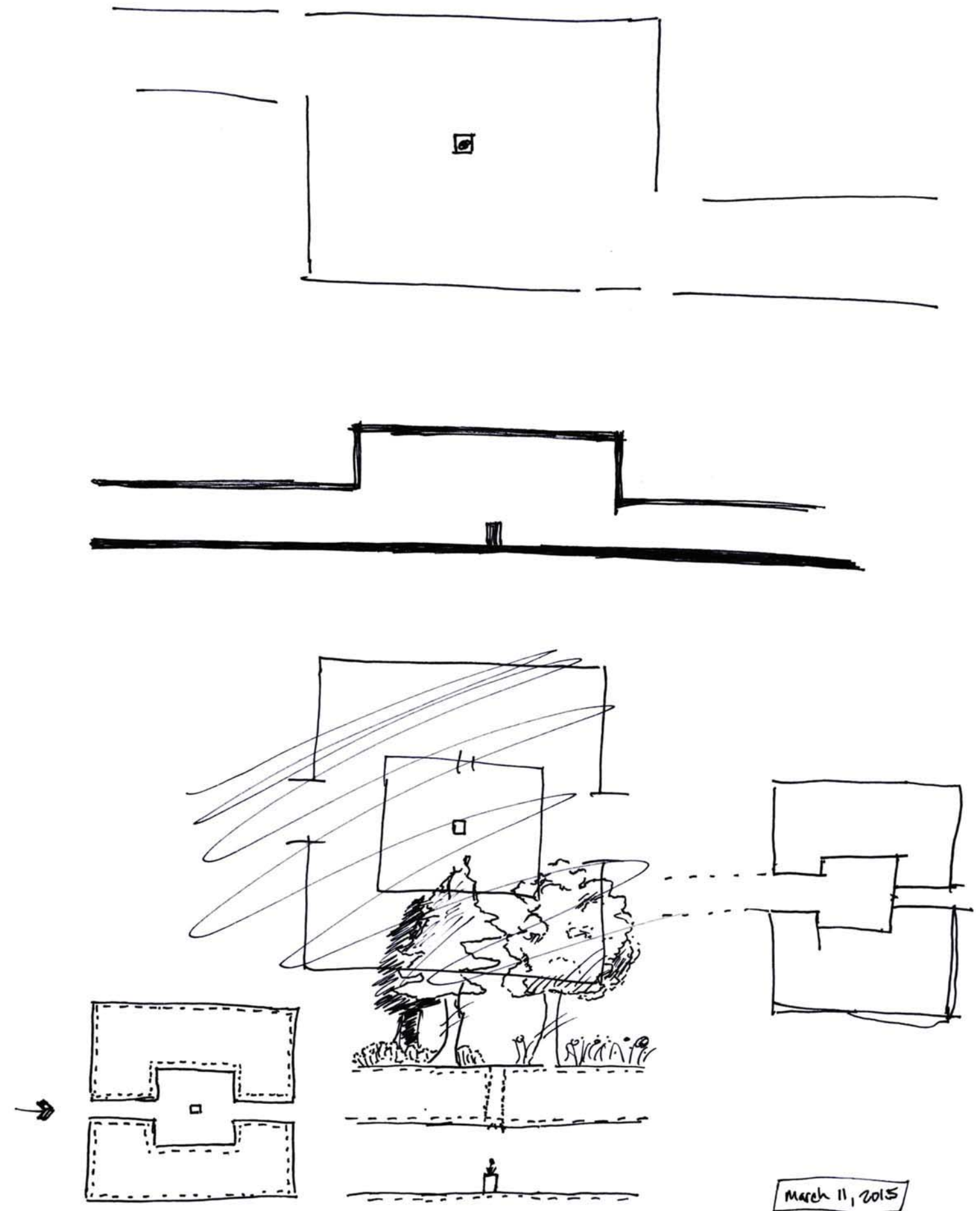
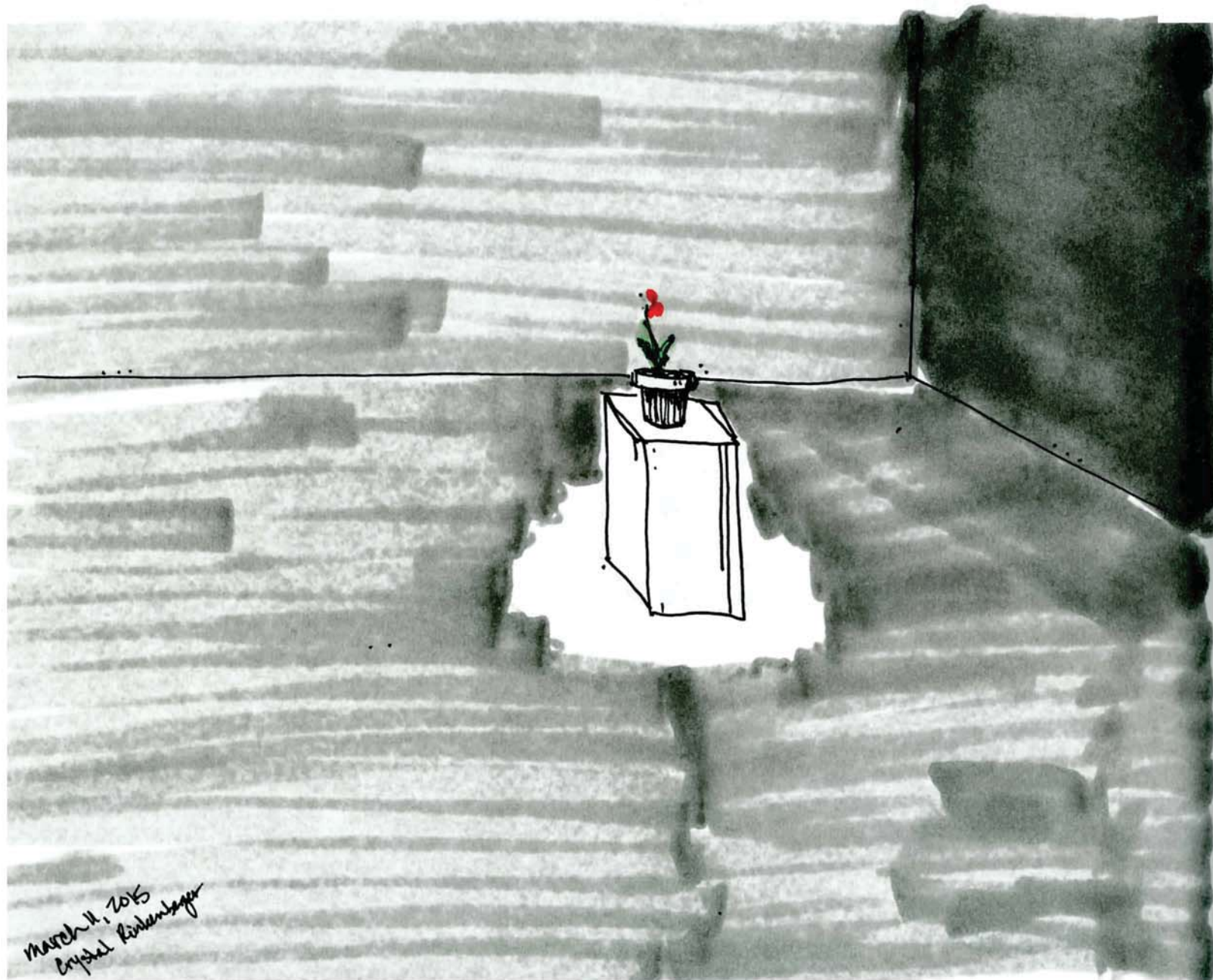
NOT SURE IF THE CAP IS METAL OR ...?

IS ACTUALLY ON PILINGS





# Sketches by Crystal Rinkenberger



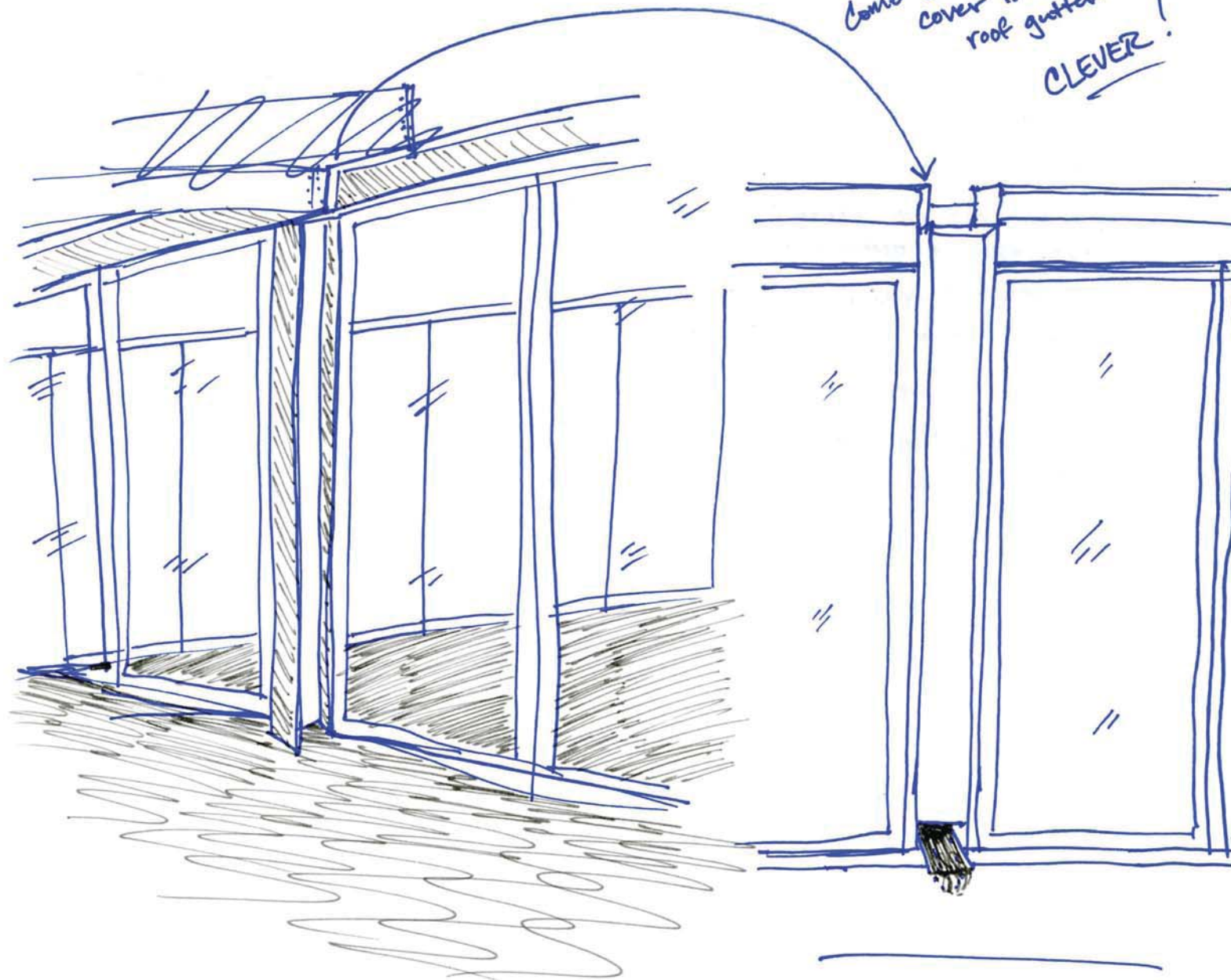


# Sketches by Crystal Rinkenberger

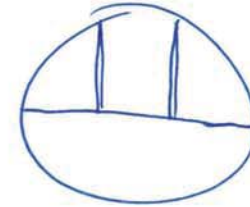
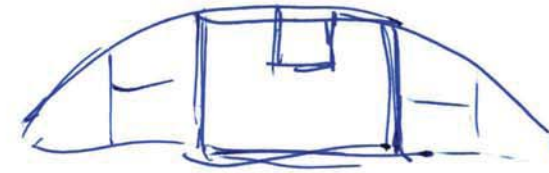
03.07.2015

□ Placing lower wall for Insul. Value  
- Stratification of air near ground is cooler anyway

Como column cover is a roof gutter  
**CLEVER!**



3.13.15



3.25.15  
Inhabitable ice cube - cold.  
w/ a fissure find @ the heart this warmth

3.26.15  
Idea from Alyssa to bring them around a sharp/hard curve and then an abrupt stop open and light faced with wall.



03/23/15

may I use the wind and shape to cool the permafrost?

Surface area to Volume, a faceted shape may not make a better volume



# Sketches by Crystal Rinkenberger

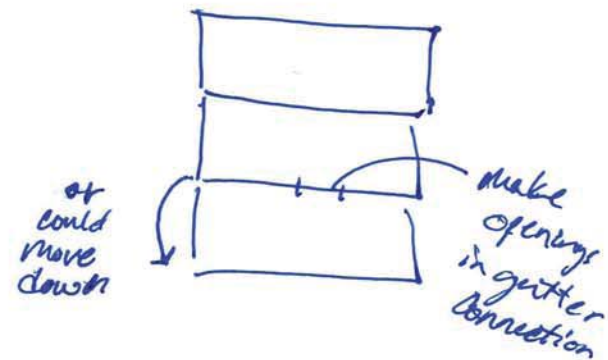
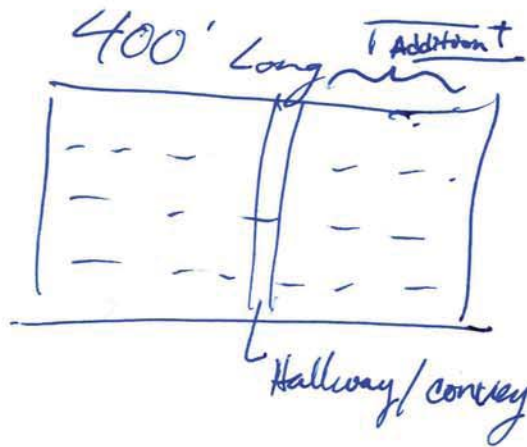
1/27/15

building heights  
are not very tall  
typically (by memory)  
houses are 1/2 stories



1.26.15 cont.

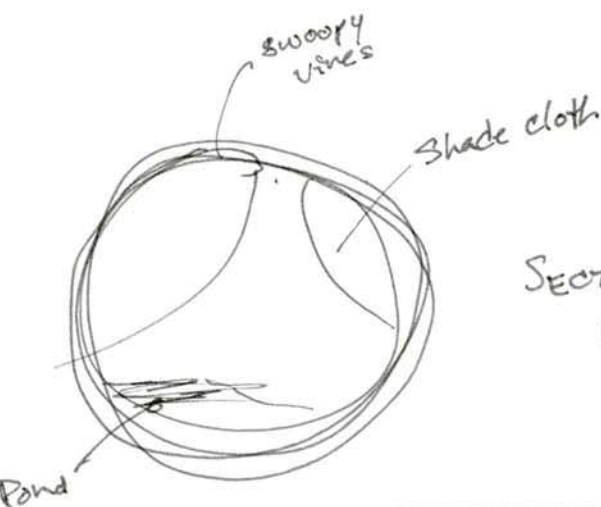
etc.  
50' wide \* 100' Long.  
10 - gutter connected  
12' corridor  
↳ moving products  
to headhouse



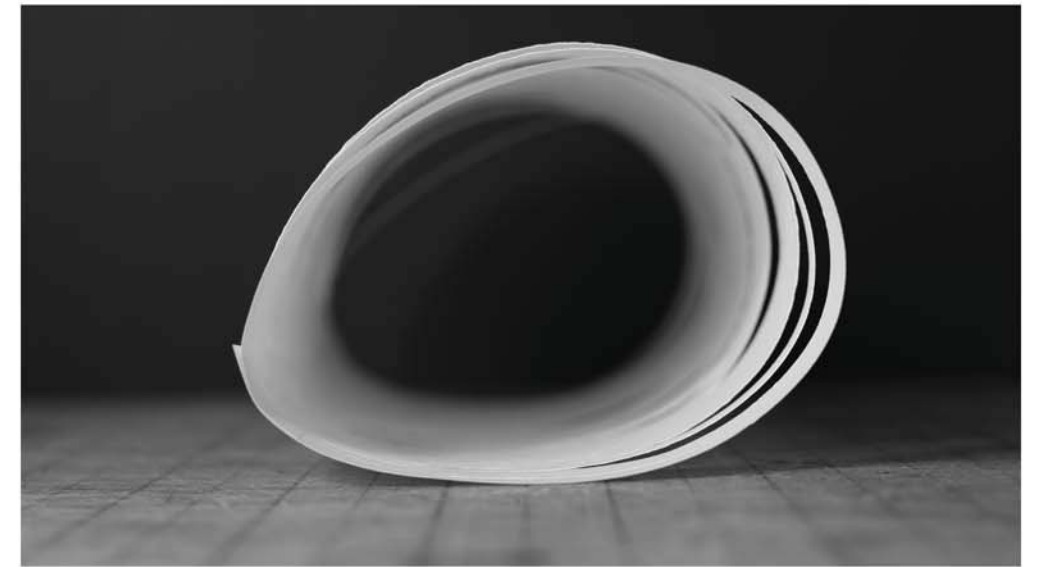
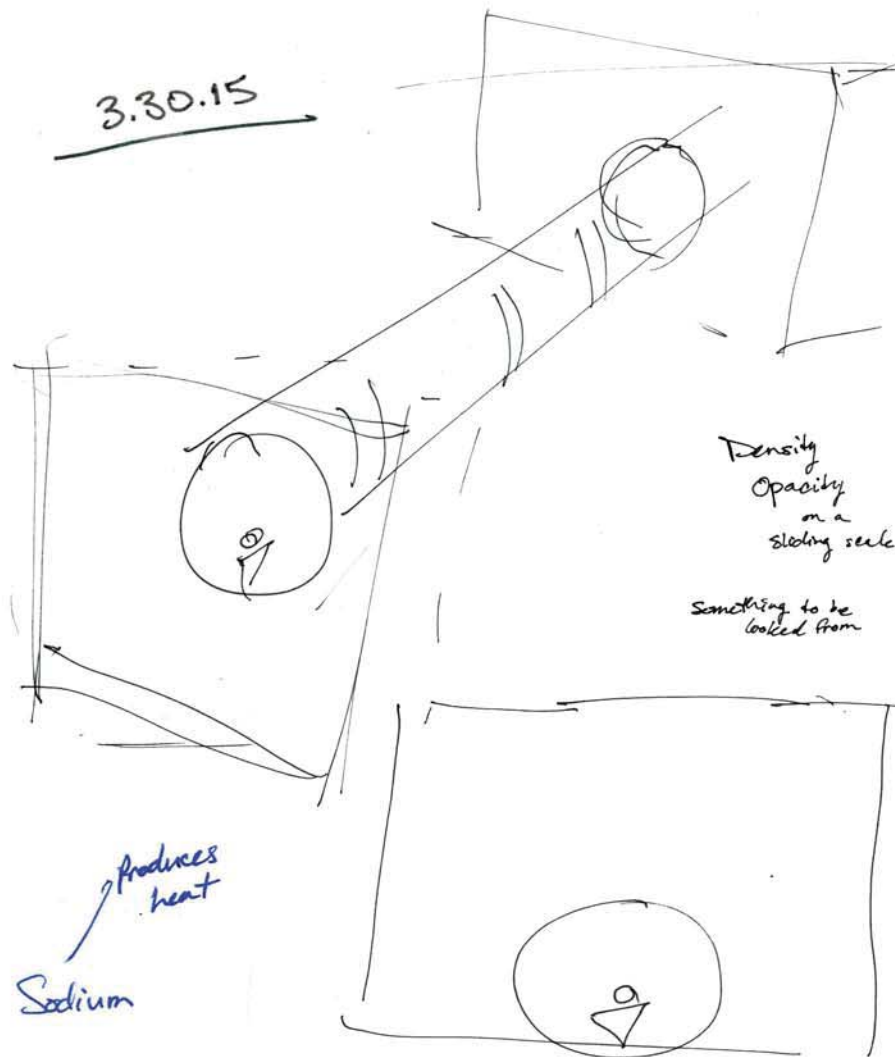
heat lines  
help melt  
snow.

- High Pressure Sodium
- LED not developed enough to be cheap yet.
- less heat

produces heat



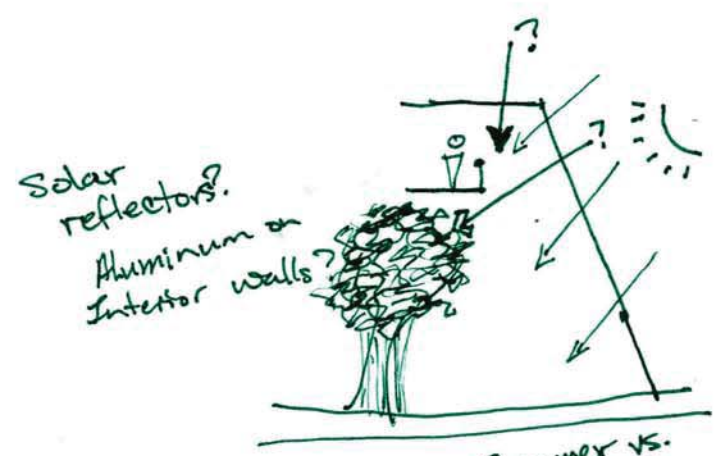
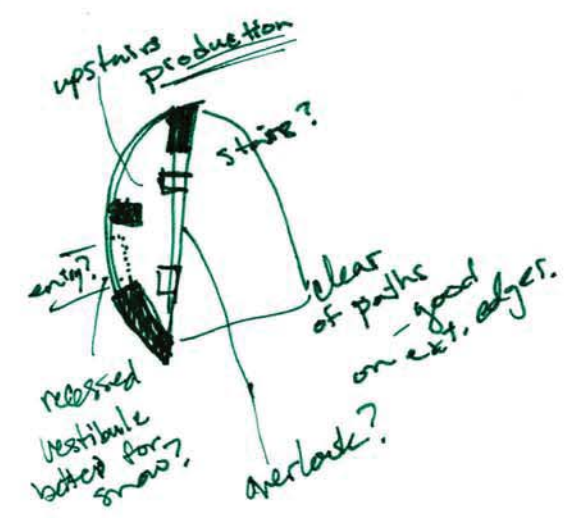
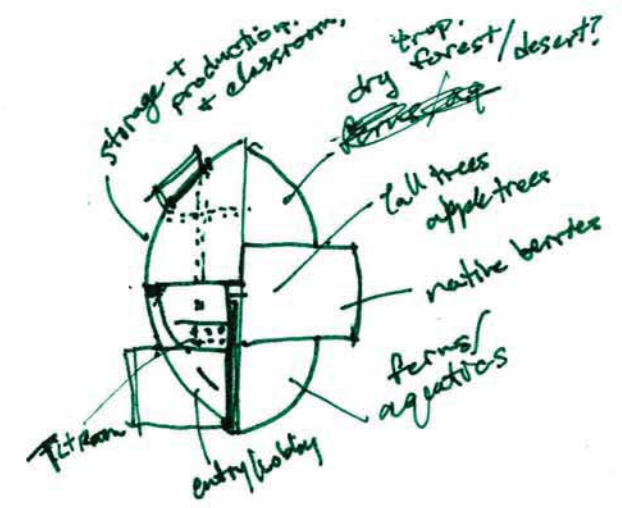
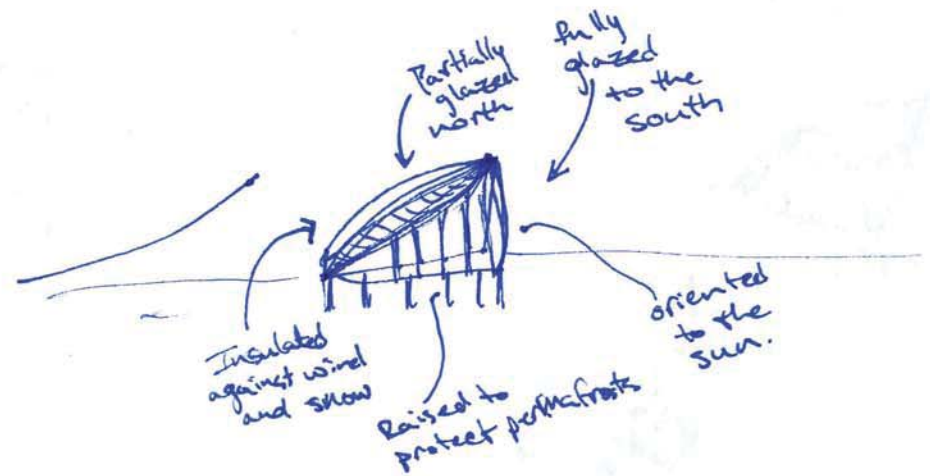
SECTION  
Photo  
100-9033



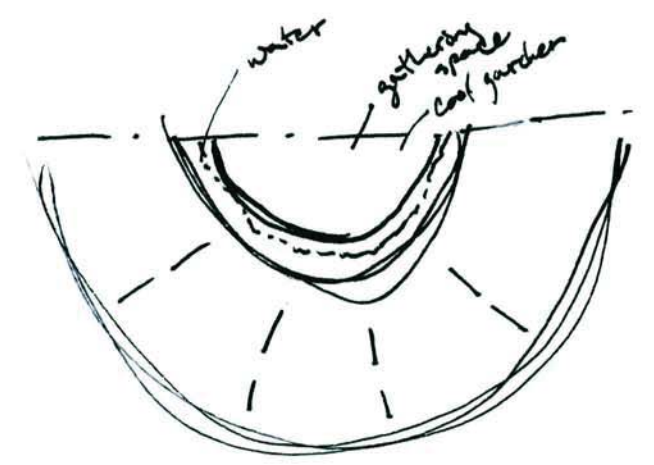


# Sketches by Crystal Rinkenberger

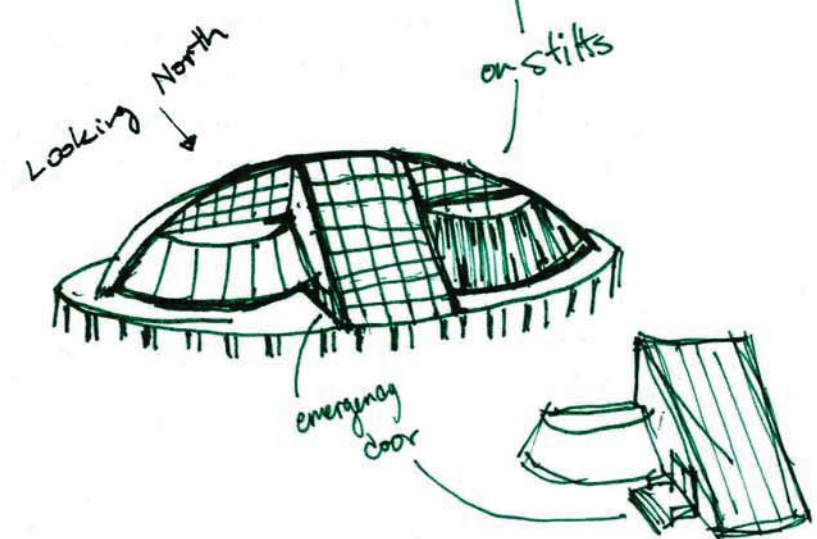
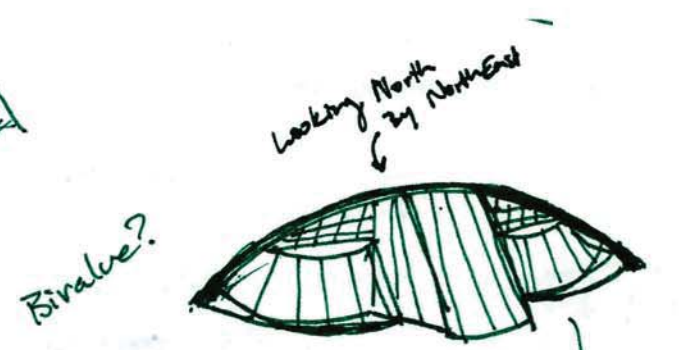
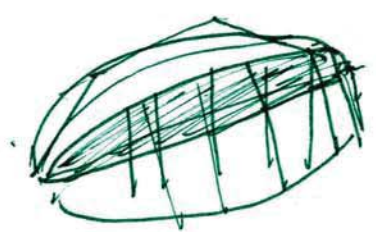
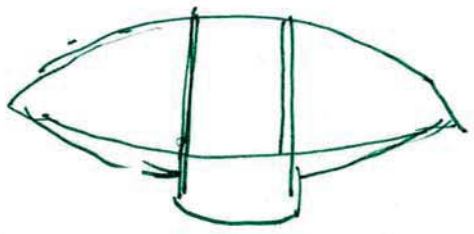
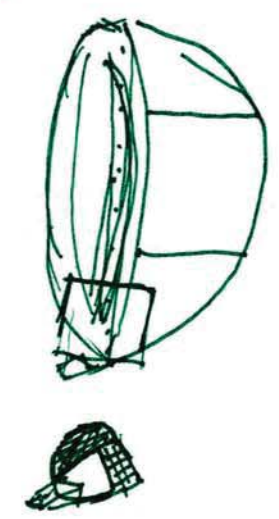
04.02.2015



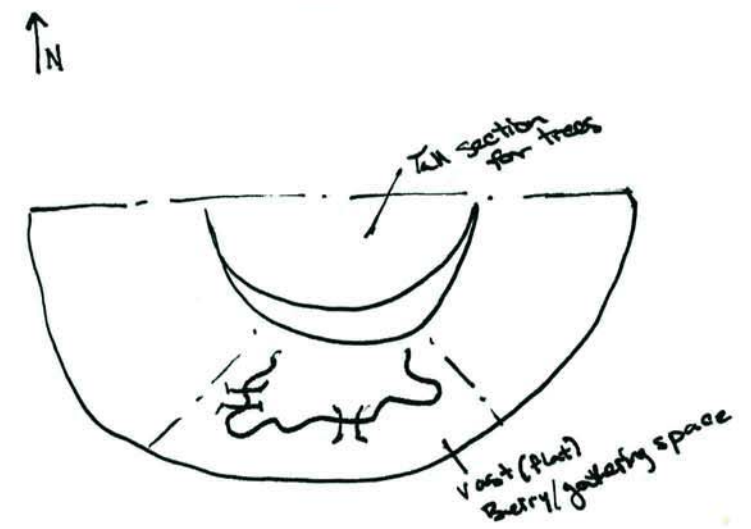
04.08.2015  
Good morning sketches



04.07.2015



Preconception:  
The more glass the better for a conservatory.  
- remember starter and cool rooms at Como only had glass on top. SW wall was opaque w/ equip. cooling equipment (wet wall)  
- Diffused Light may be just as important.





# Welcome to Barrow, Alaska!



or Utqiagvik, which means  
"place to hunt snowy owls."

Barrow's Mayor Harcharek about the New Piuraagvik Recreation Center,

*"The strength of our community is its people. The City of Barrow is known for its unique mix of people who form an ever-growing city population. We need a 21<sup>st</sup> century facility, like the New Piuraagvik. There is a vital need for a cultural, recreational and place of safety for a growing at-risk community."*

(City of Barrow, Press Release - April 3, 2015)

## People need (7 Dimensions of Wellness):

- Social
- Spiritual
- Intellectual
- Emotional
- Physical
- Occupational
- Environmental

## Plants need:

- Sun
- Air
- Water
- Nutrients
- Growing medium
- Space
- Temperature to grow at
- Time



CASE STUDY LOCATIONS



Samuel Simmonds Memorial Hospital  
Barrow, AK



— Cowles Conservatory  
Minneapolis, MN

Como Park Conservatory, St. Paul, MN



AES Greenhouse  
Fargo, ND



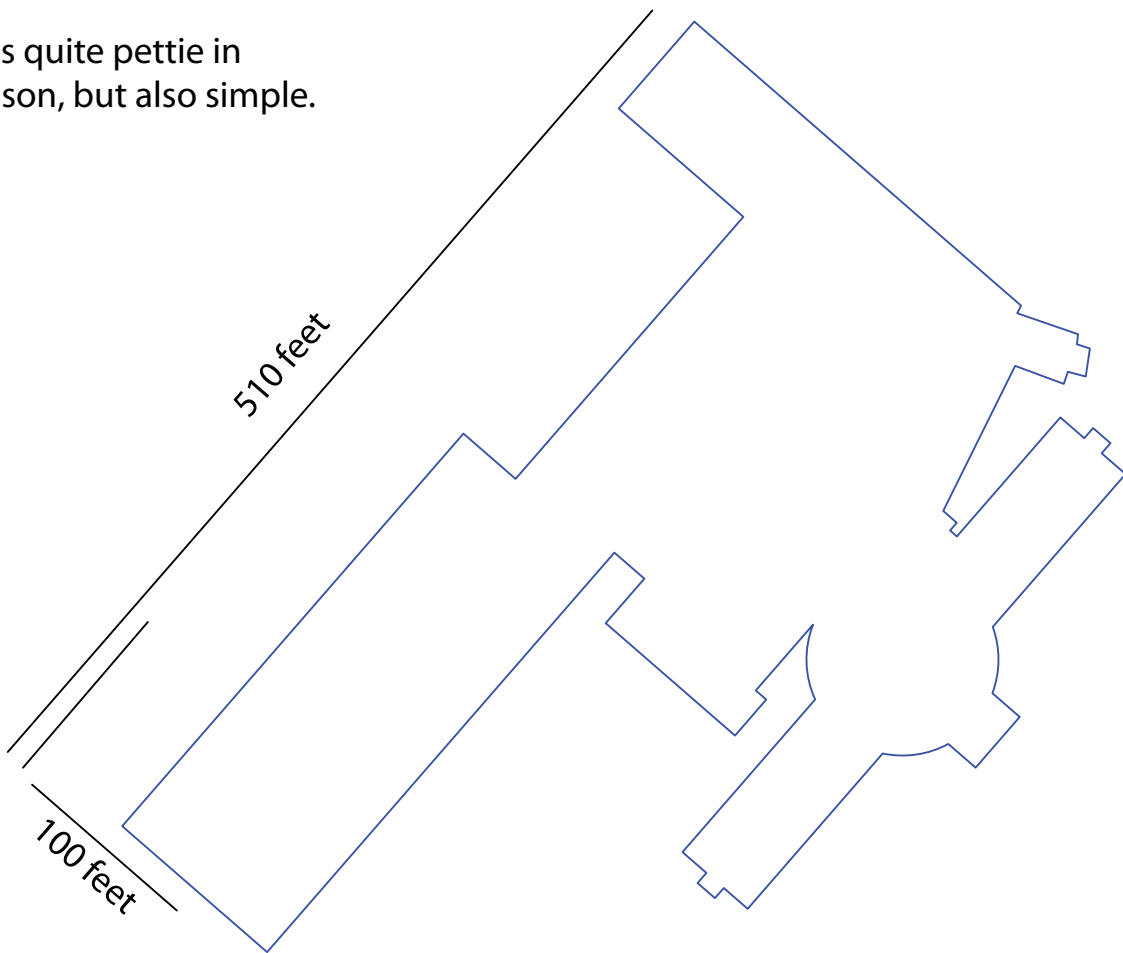
# 4 Case Studies Area Comparison

Jan. 21, 2015  
Crystal Rinkenberger

I find it interesting that approximately 95, 000 sq. ft. can look so different between the Como Park Conservatory and the AES Greenhouse. Where AES is long and drawn out with seperate greenhouse wings, Como has gathered green house spaces and functions in between the major greenhouse wings.

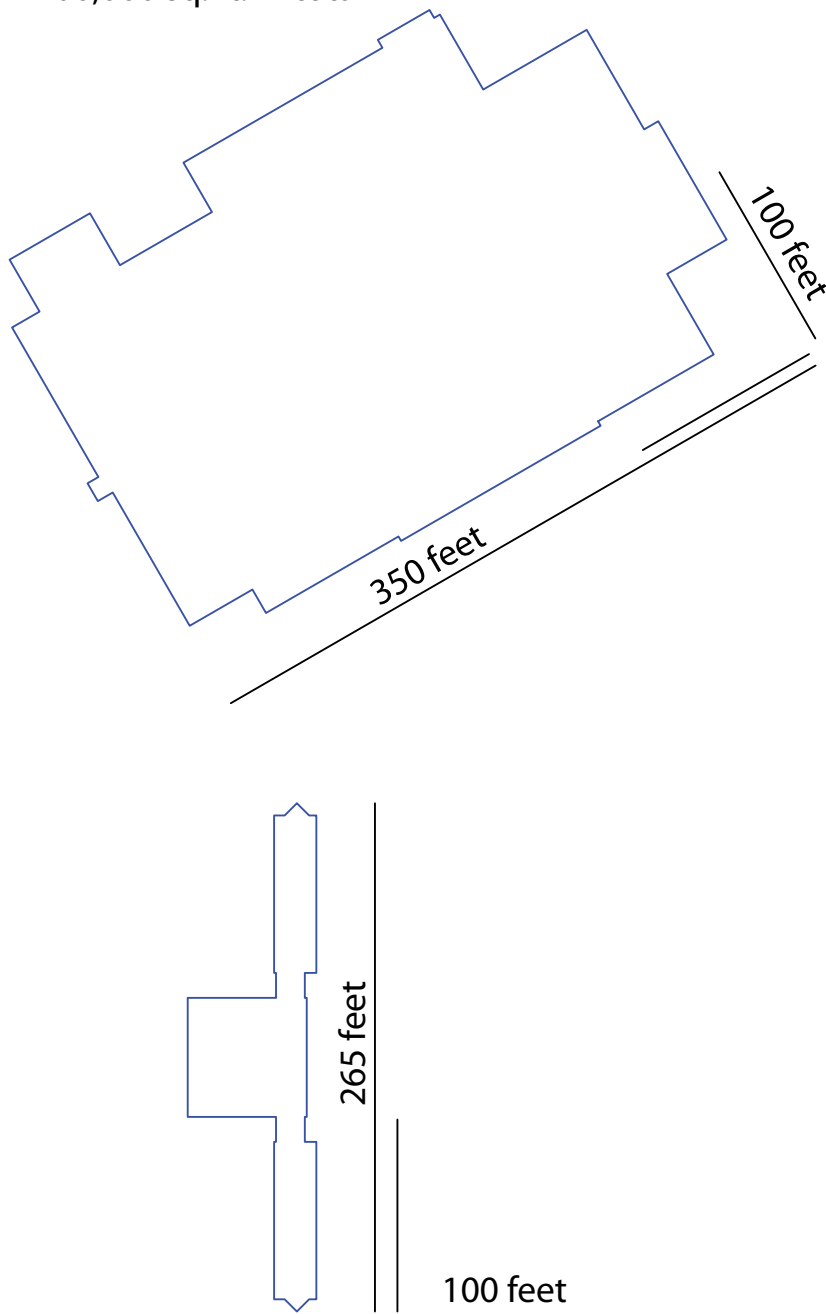
Samuel Simmonds has the most condensed footprint of the three largest buildings. It like, Como has a fair amount of space on its second level.

Colwes is quite pettie in comparison, but also simple.

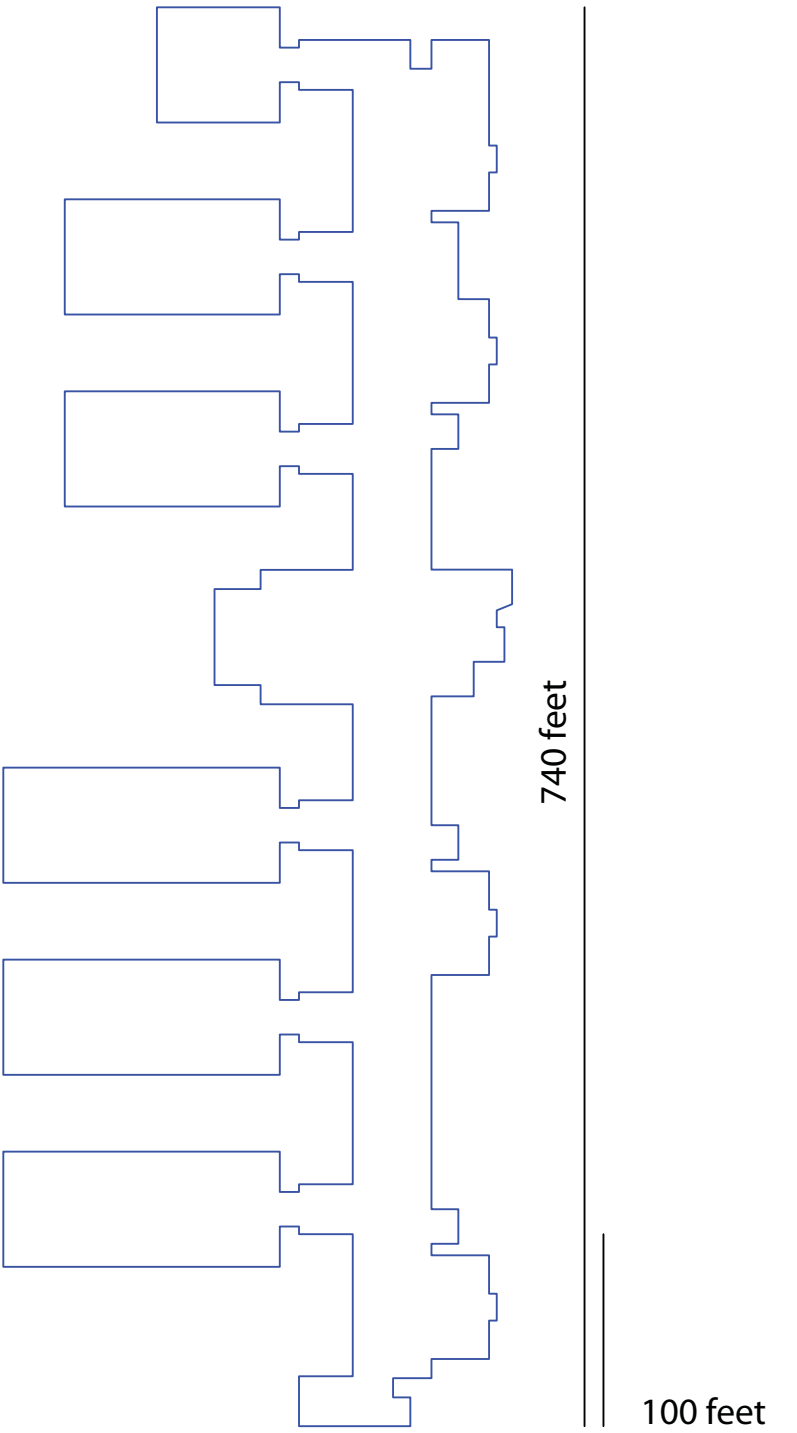


Como Park Conservatory  
St. Paul, MN  
~97,500 sq. ft.

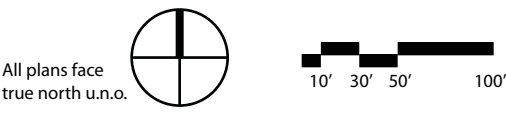
Samuel Simmonds Memorial Hospital  
Barrow, AK  
~ 70,000 sq. ft. at ground level,  
100,000 sq. ft. in total



Cowles Conservatory  
Minneapolis, MN  
~ 8,000 sq. ft.



AES Greenhouse  
Fargo, ND  
-94,000 sq. ft.





**Common Trees of Alaska**  
**Under 60' tall**

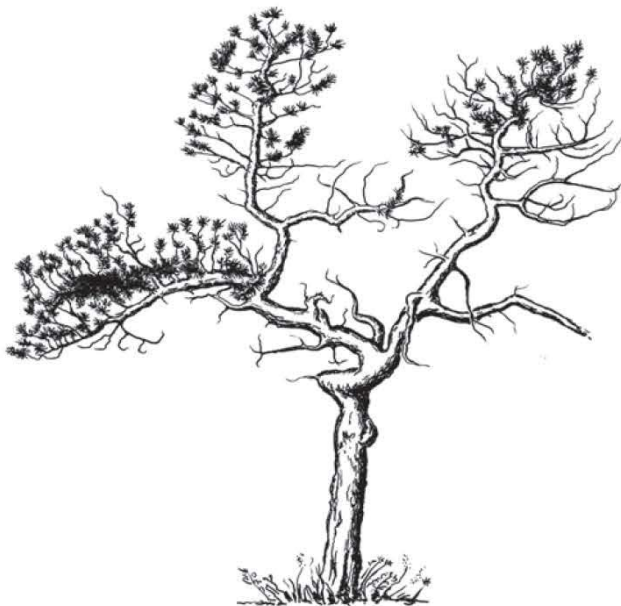
“Black spruce seems to be the tree species best adapted to growing on permafrost soils because of its shallow rooting habit. Often the annual thaw depth (active zone) may be as little as 40 cm (16 in).”  
- USDA Forest Service



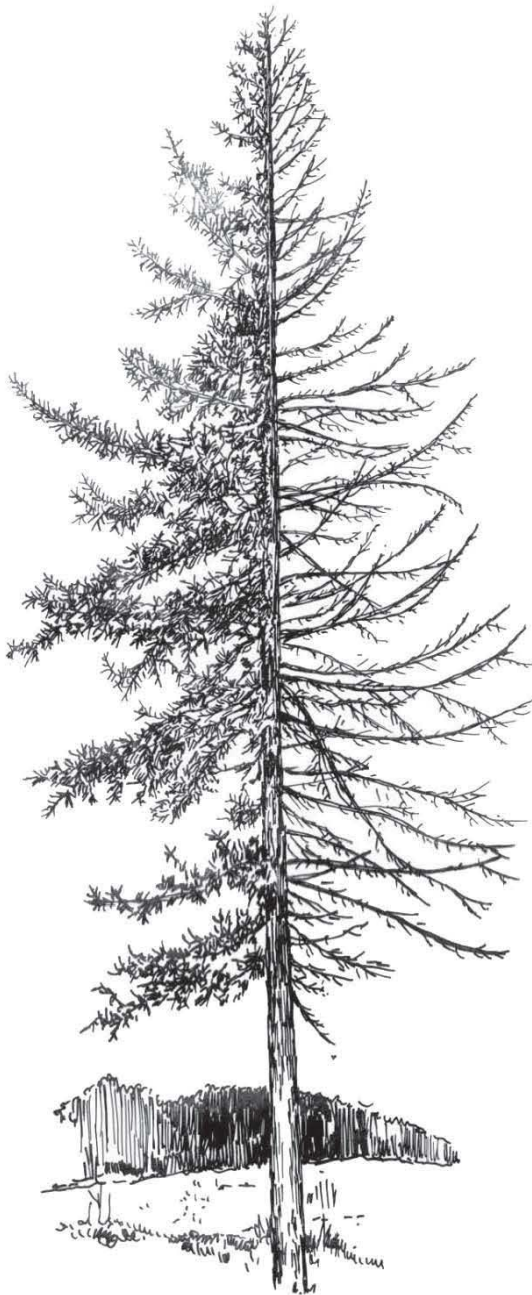
**Black Spruce**



The majority of the Black Spruce trees root ball is within the top 8 inches of soil.



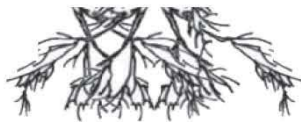
**Shore Pine**



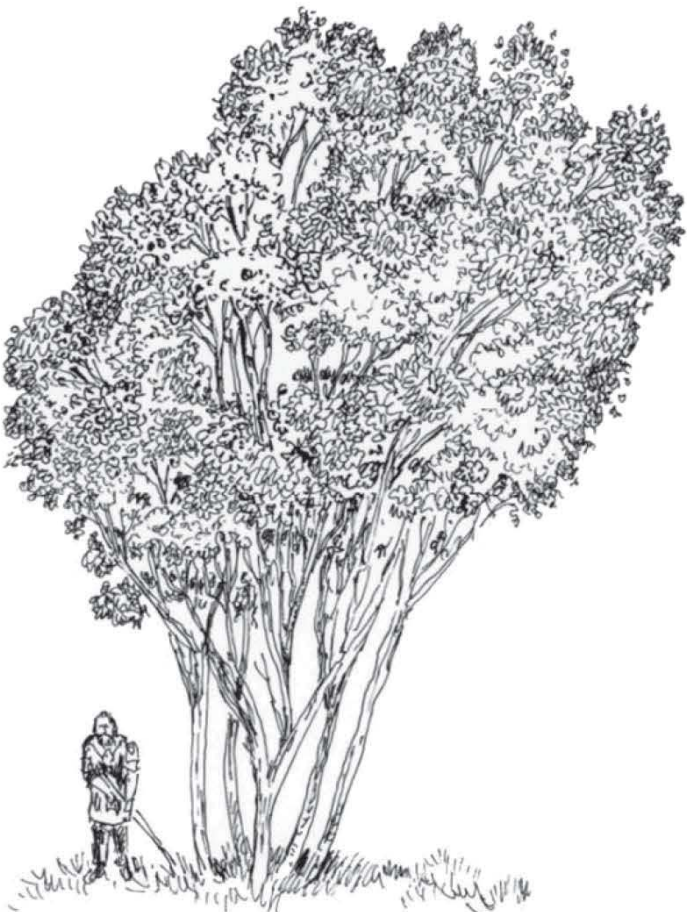
**Tamarack**



**Quaking Aspen**



The Quaking Aspen grows faster than the Black Spruce in similar terrains. Its roots reach 2-3' deep and if the soils permit it will grow as far as 10' deep.



**Scouler Willow**

According to [deeproot.com](https://www.deeproot.com), “Roots require three things: water, oxygen, and soil compaction levels low enough (or with void spaces sufficiently large enough) to allow root penetration.”





# CAN YOU CREATE A PIECE OF ARCHITECTURE THAT ENABLES PEOPLE AND PLANTS TO THRIVE IN A HOSTILE ENVIRONMENT?

Yes, and it would be considered *successful*  
if the **shelter** can be **sustained to:**

- Operate year round/built to last for more than one season
- Does not sink into the permafrost
- Mitigates or controls the climate to permit the growing of plants

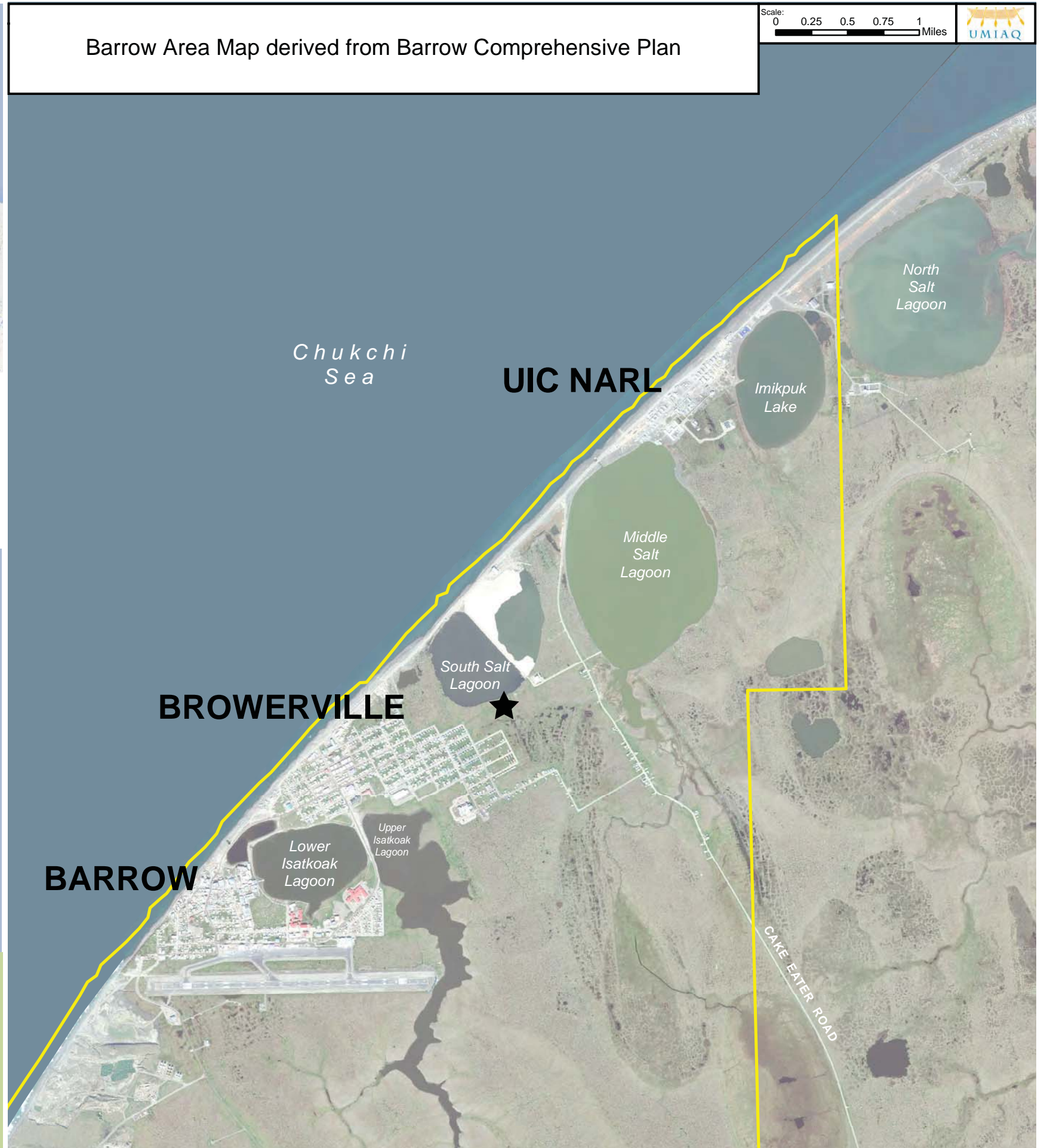




Population: **Barrow - 4,212**  
 Wainwright - 556  
 Point Lay - 189  
 Point Hope - 674

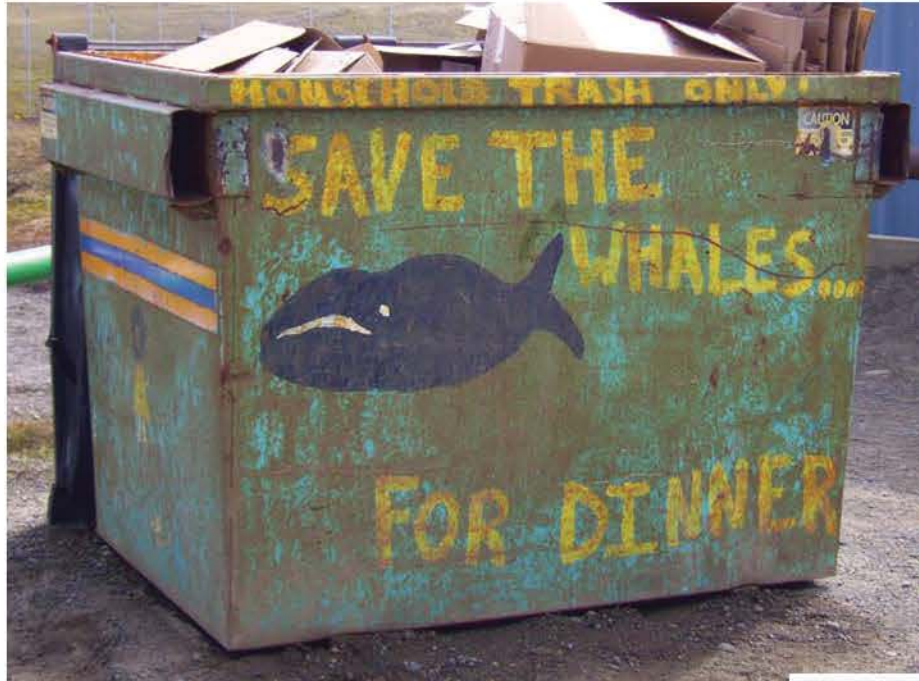
Atqasuk - 233  
 Nuiqsat - 402  
 Kaktovik - 239  
 Anaktuvuk Pass - 324

Population data from American Fact Finder - <http://factfinder.census.gov/>





# Iñupiat Culture



## Subsistence Hunting:

Agvig  
Bowhead Whale  
Aiviq  
Walrus



Natchiq  
Ringed Seal  
ugruk  
Bearded Seal  
Tuttu  
Caribou  
Amagua  
Wolf  
qavvik  
Wolverine

Various Birds  
and Fish

# Iñupiat Values

Qiksiksrautiqaqniq utuqqanaanun,  
Allanun,

Iñuuniagvigmun  
**Respect for Elders, Others,  
and Nature**

Ilagiggñiq  
**Family Kinship Roles**

Piapakcutiqagniq  
**Love and Respect  
for One Another**

Quvianguniq  
**Humor**

Anuniagniq  
**Hunting Traditions**

Paamamagqínnñiq  
**Cooperation**

Iñupíuraallaniq  
**Knowledge of  
the Language**

Sigñataíññiq  
**Sharing**

Qíñuínñiq  
**Humility**

Paaqtaktautaiññiq  
**Avoidance of Conflict**

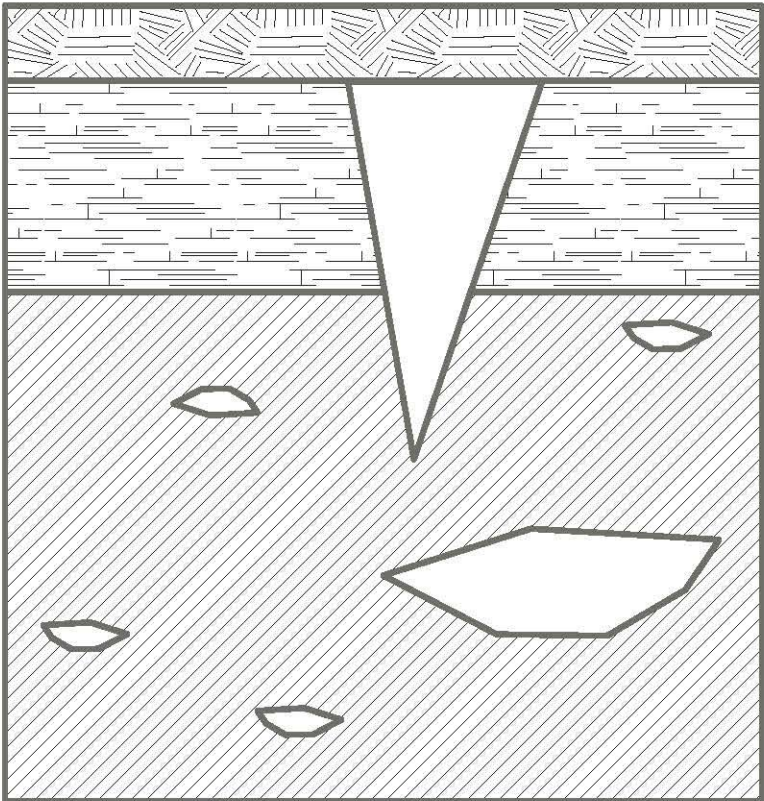
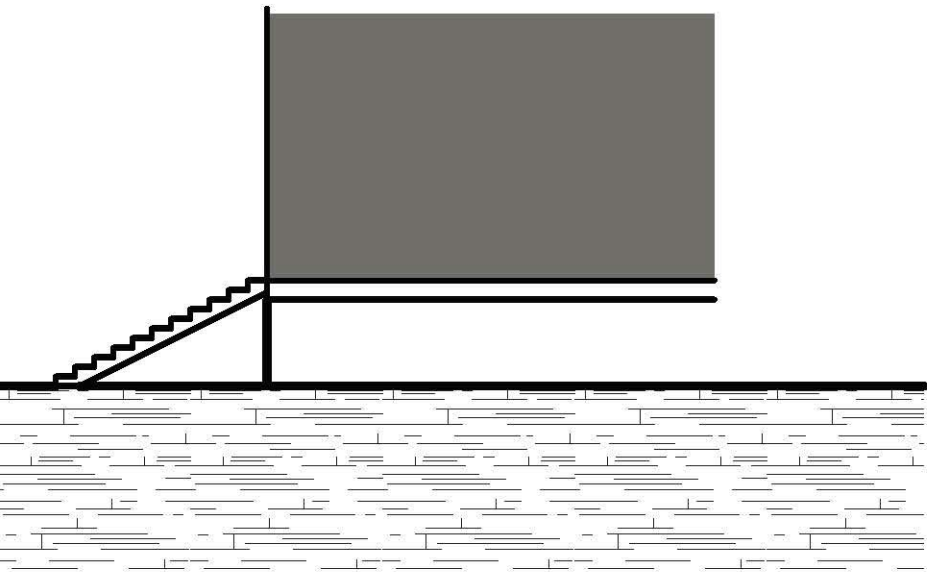
Ukpiqqutiqaqniq  
**Spirituality**

Naglikutiqaqniq  
**Compassion**

Images:  
Save the whale dumpster by Crystal Rinkenberger  
Modern Umiaq by Arctic Slope Regional Corporation  
Umiaq on side and Boatmen from skinboats.org  
Whale bones\_Barrow, AK by Chaplinakair



The entrance of Barrow’s Arctic Conservatory has 11 steps to raise the building off the permafrost.



Permafrost is defined as any soil that has remained continuously frozen for at least two consecutive years.

In Barrow, there is an average of 12 inches of organic matter that is typically wet and strongly acidic. The next few feet consist of various loam and sand mixtures. These two soil horizons will thaw and freeze every year and are known as the active layer of permafrost. Below them are the ice, silt and soils that remain perpetually frozen making up the permafrost.

Ice lens and ice wedges are horizontal and vertical formations of ice that grown the soil from year to year because of the water or moisture that is drawn toward cooler ground surrounding the ice through osmosis.



**Fred Impalook  
Elementary  
School**



**Eben Hopson  
Middle School**



**Barrow High  
School**



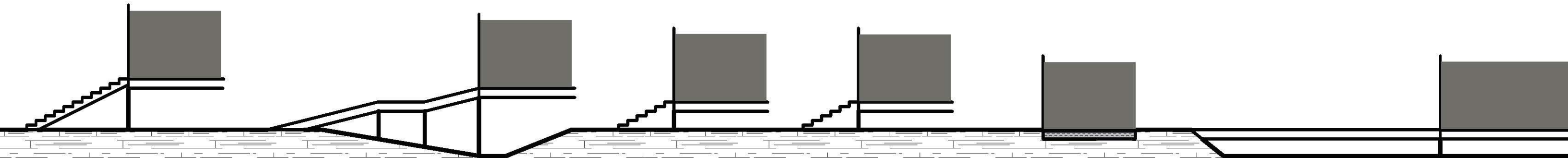
**AC Value Center  
(Superstore;  
groceries and more)**



**Alaska Airlines  
Airport**

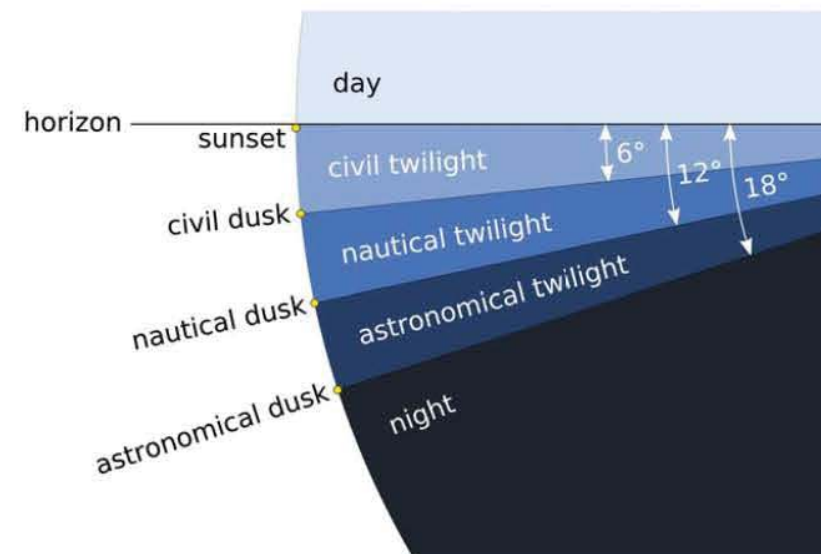
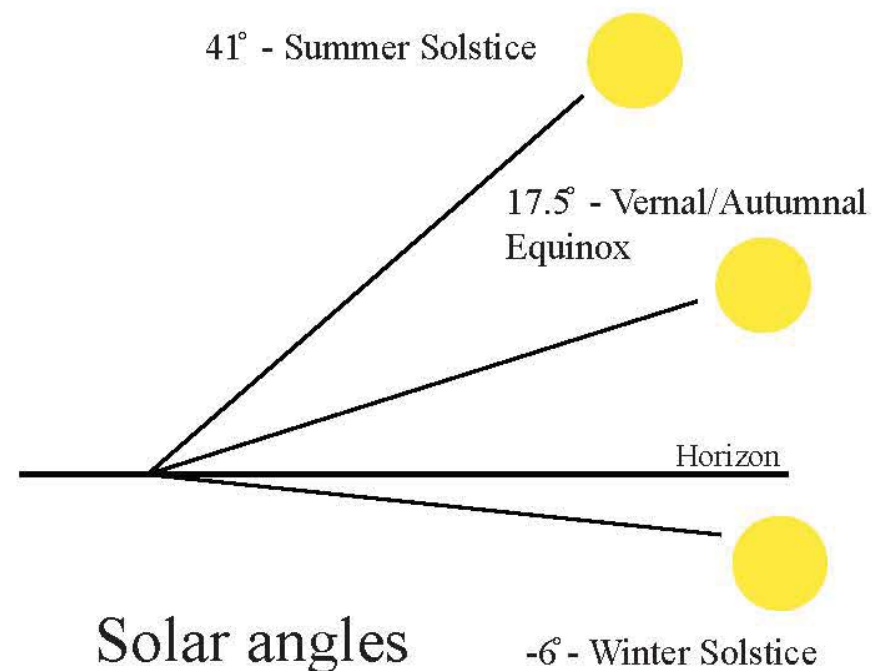
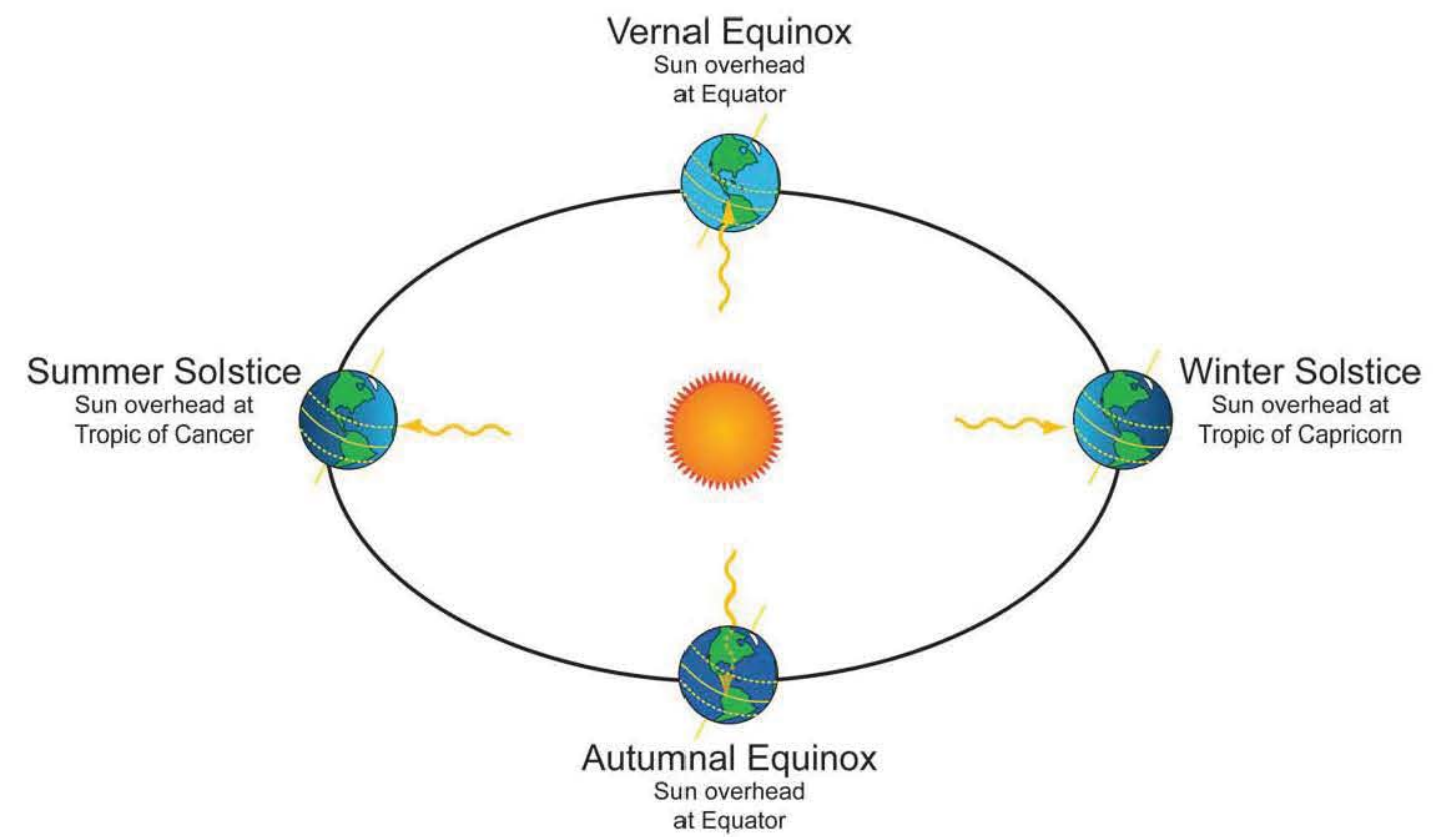
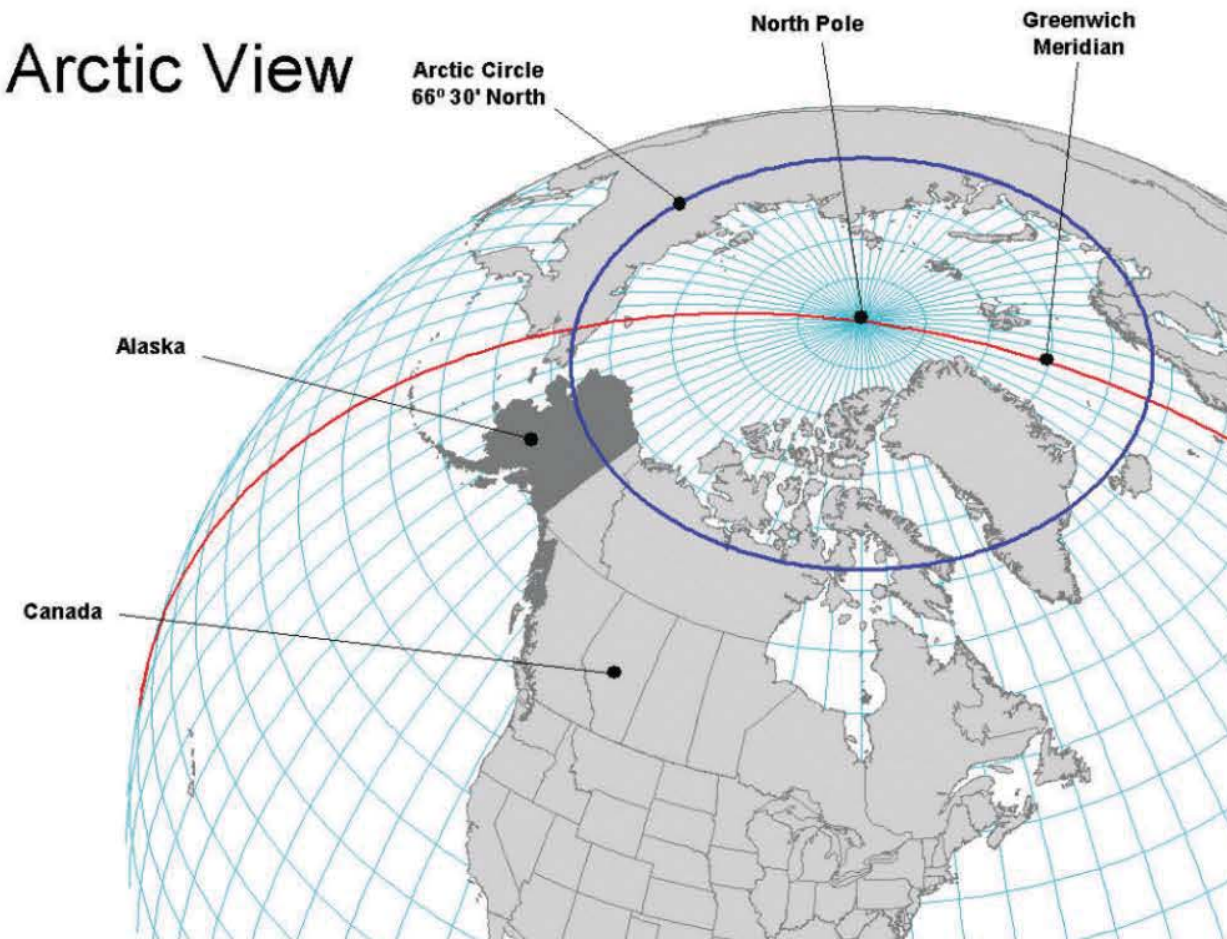


**Samuel Simmonds  
Memorial Hospital**

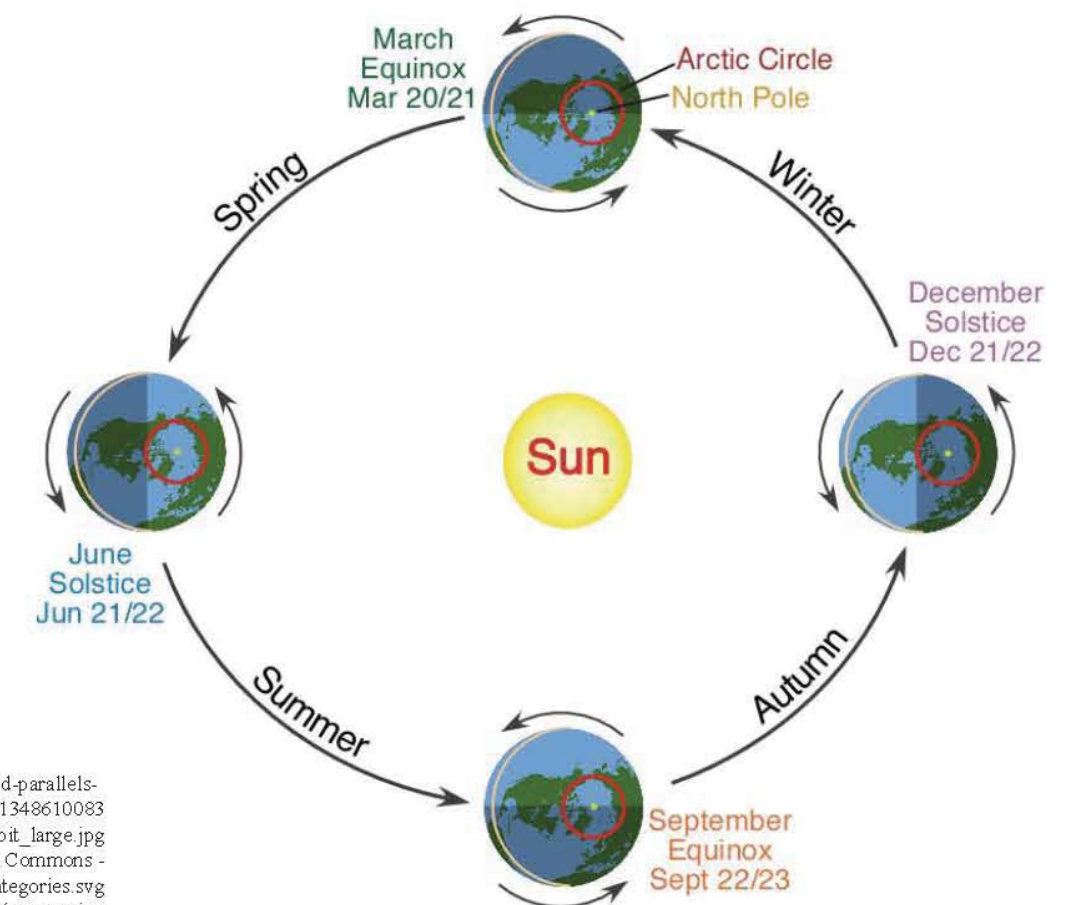




# Arctic View



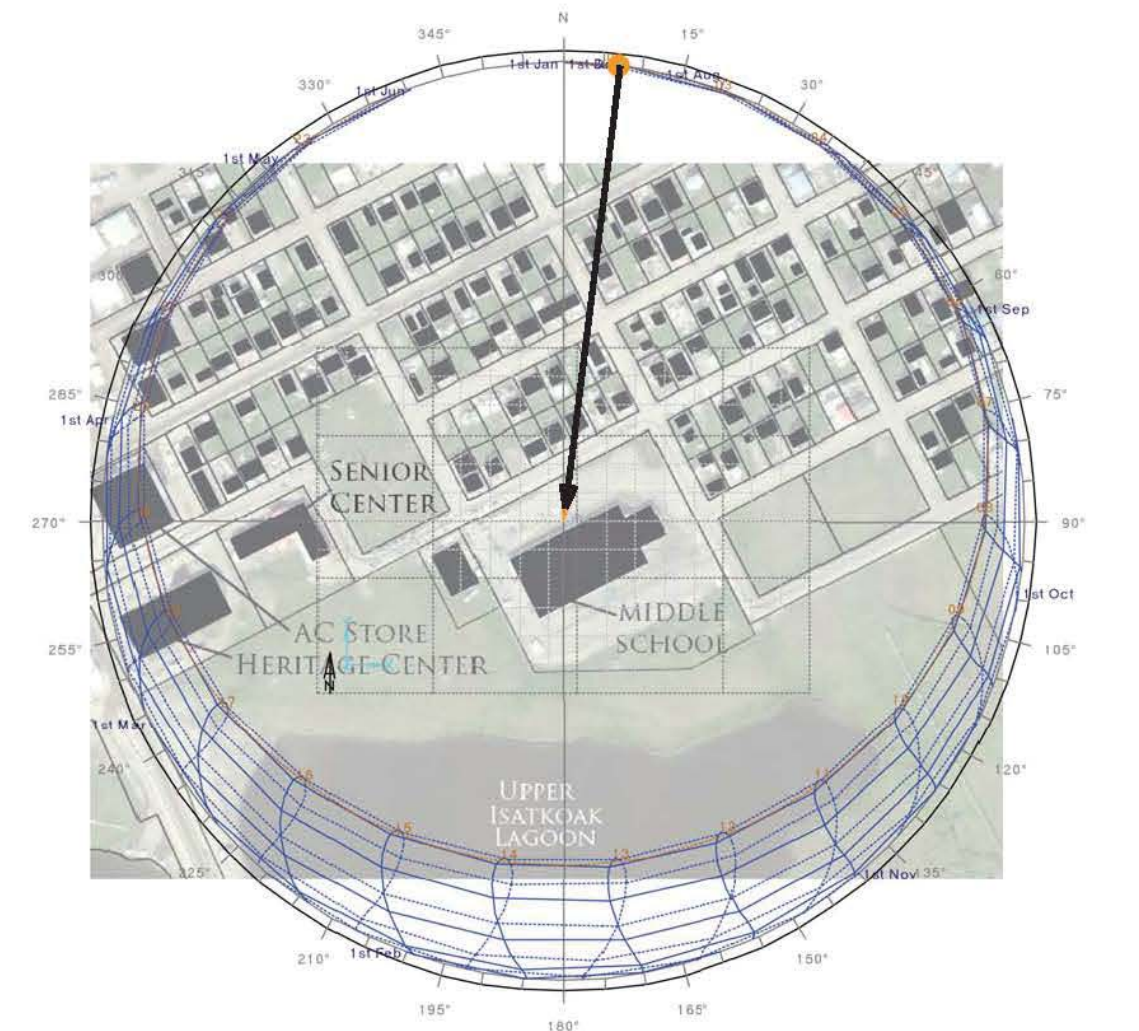
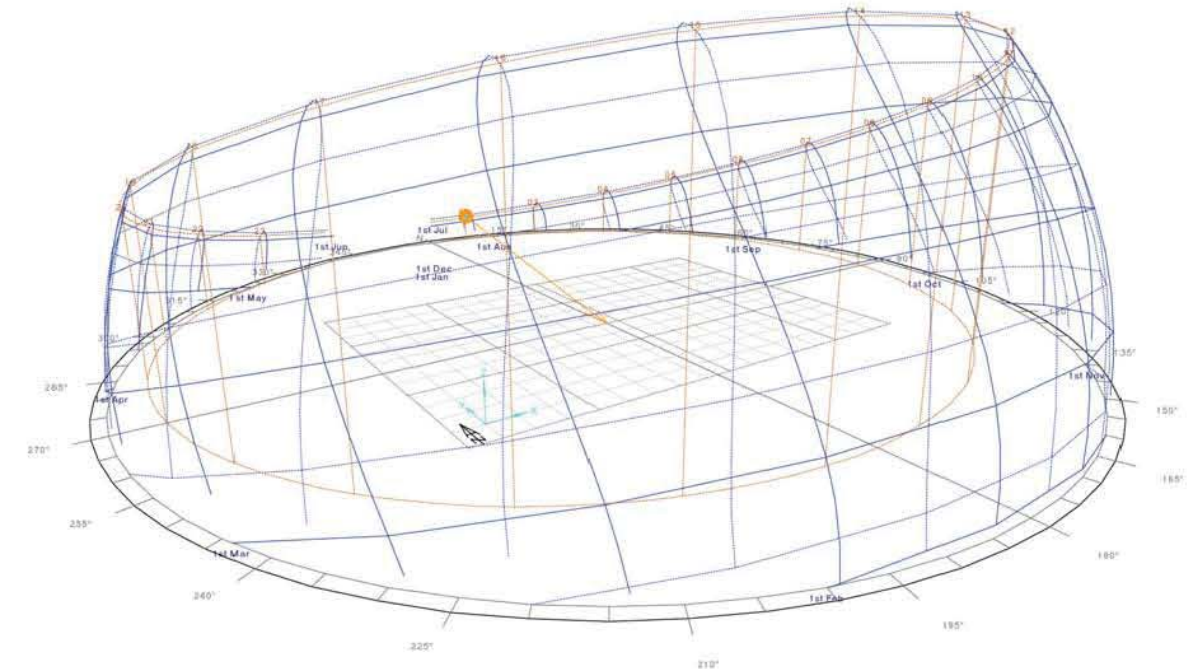
<http://image.slidesharecdn.com/meridians-and-parallel-120925165233-phpapp01/95/meridians-and-parallel-4-728.jpg?cb=1348610083>  
[http://scijinks.jpl.nasa.gov/review/solstice/seasons-earth-orbit\\_large.jpg](http://scijinks.jpl.nasa.gov/review/solstice/seasons-earth-orbit_large.jpg)  
 "Twilight subcategories" by TWC Carlson - Own work. Licensed under CC BY-SA 3.0 via Wikimedia Commons - [http://commons.wikimedia.org/wiki/File:Twilight\\_subcategories.svg#/media/File:Twilight\\_subcategories.svg](http://commons.wikimedia.org/wiki/File:Twilight_subcategories.svg#/media/File:Twilight_subcategories.svg)  
[www.physicalgeography.net/fundamentals/images/seasons.jpg](http://www.physicalgeography.net/fundamentals/images/seasons.jpg)







## My Personal Experience with the Midnight Sun.

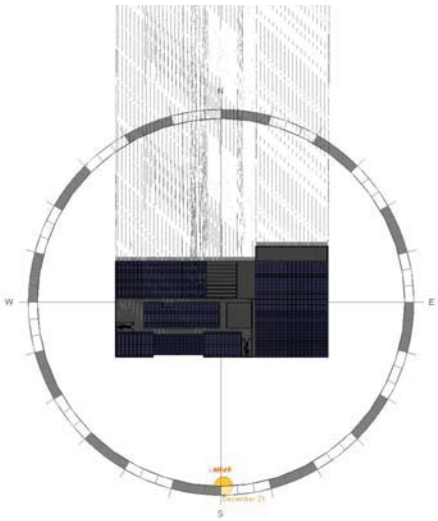
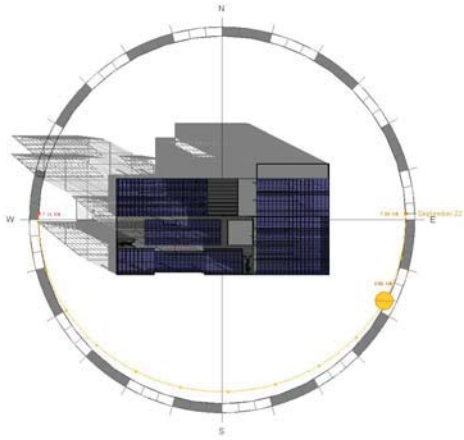
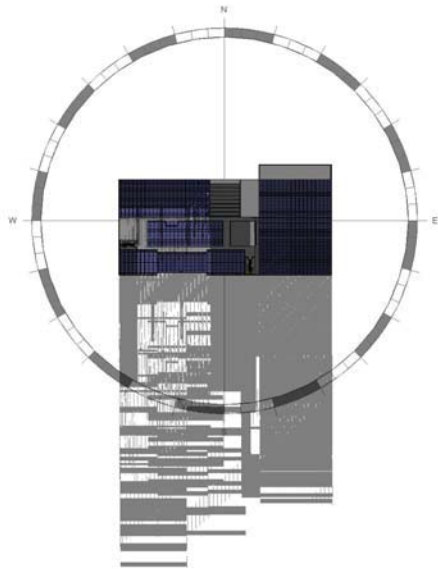


July 10, 2014 - 1:15AM - Barrow Middle School

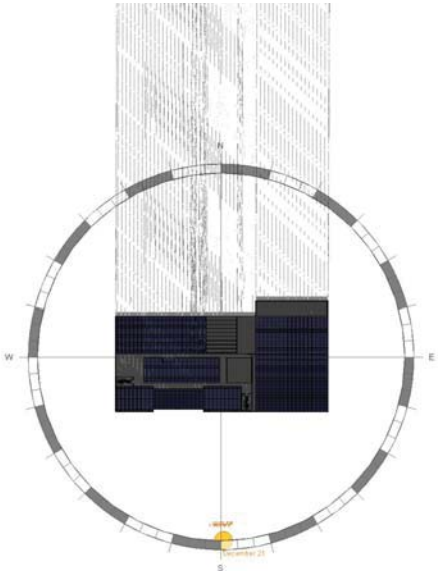
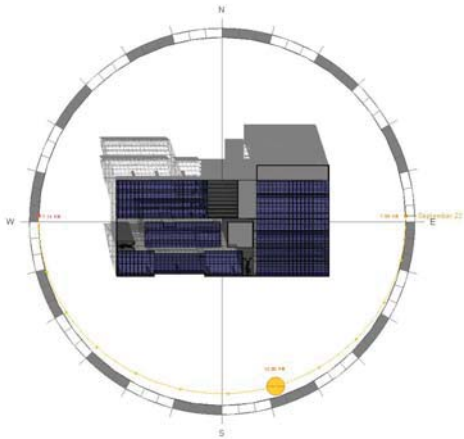
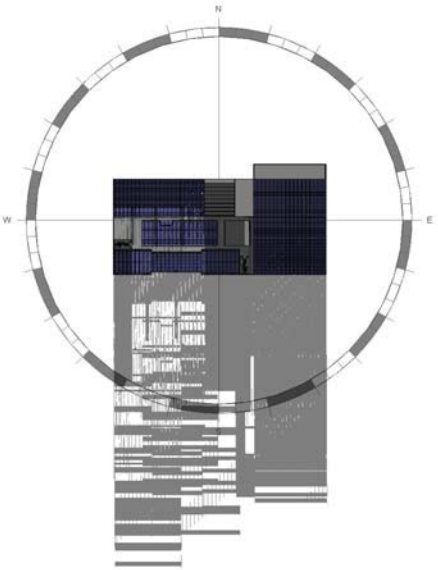
The sun was up all night and came from the north. Inconceivable!<sup>∞</sup>



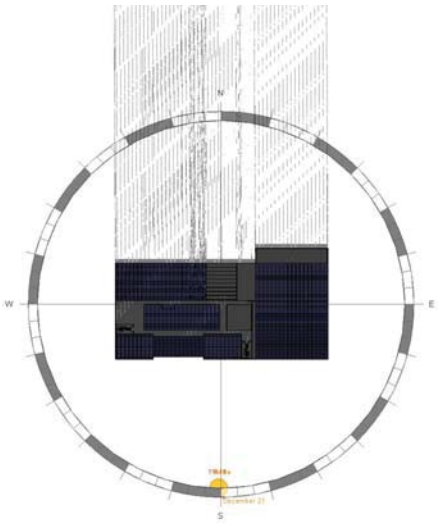
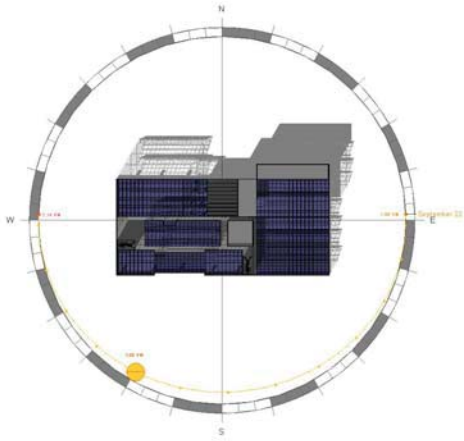
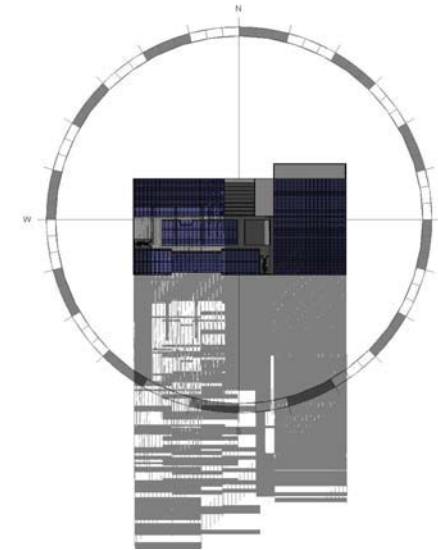
9am



Noon



3pm

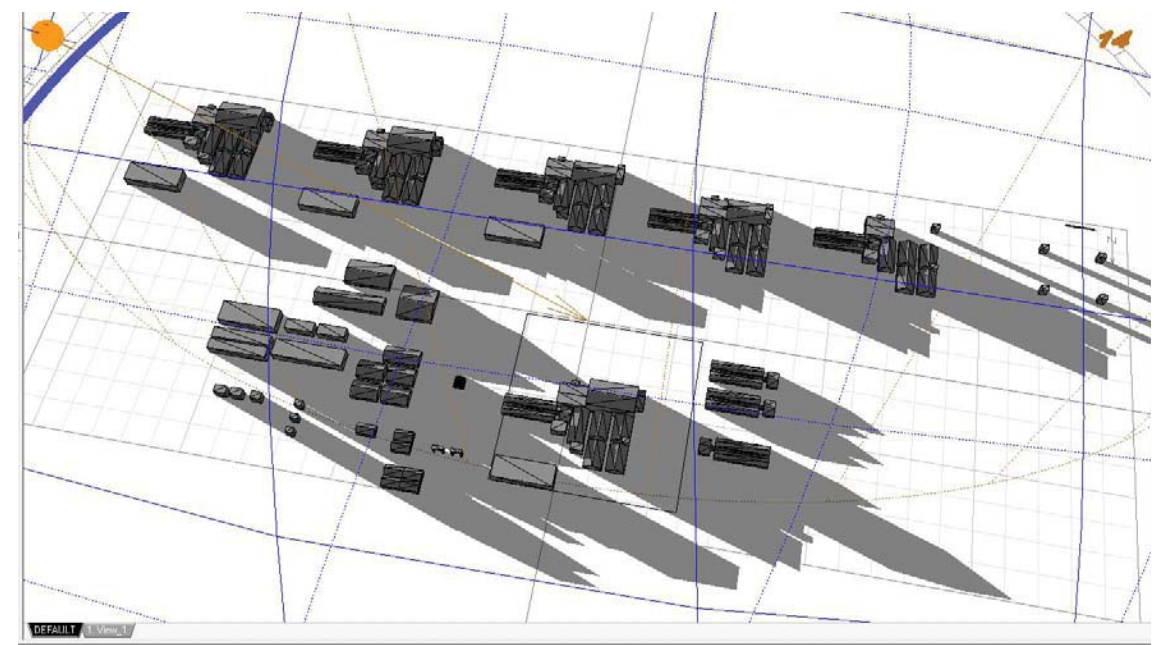
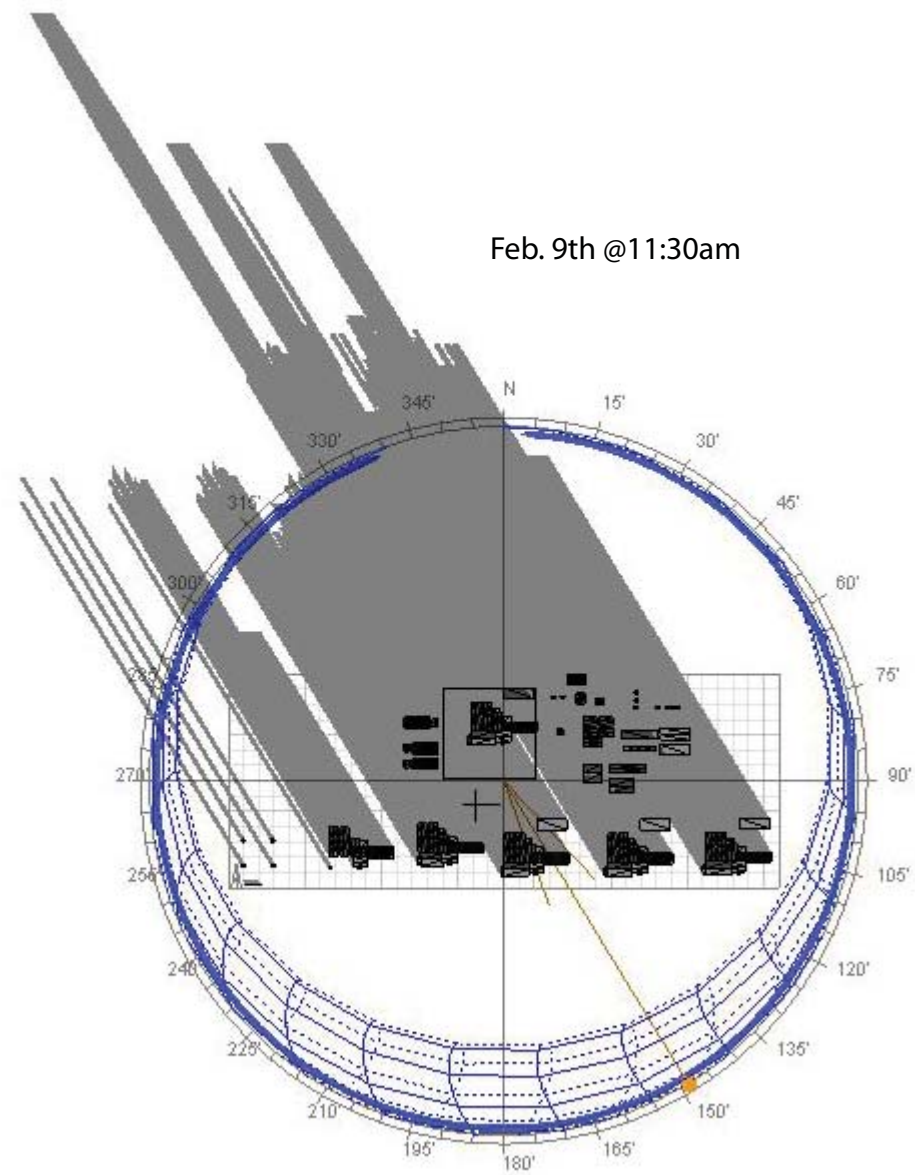


June 21

Mar/Sept 22

Dec 21





## February 2015 — Sun in Barrow

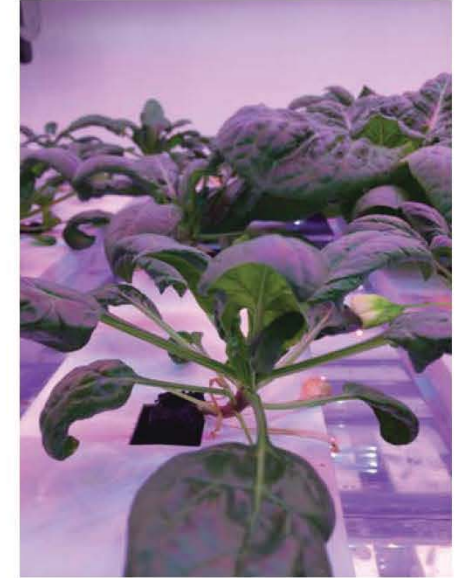
Month:  Year:

2015	Sunrise/set		Daylength		Astro. Twilight		Naut. Twilight		Civil Twilight		Solar noon	
	Sunrise	Sunset	Length	Diff.	Start	End	Start	End	Start	End	Time	Mil. mi
1	11:36 AM \ (150°)	3:47 PM / (210°)	4:10:26	+14:26	7:17 AM	8:06 PM	8:33 AM	6:50 PM	9:58 AM	5:25 PM	1:41 PM (2.0°)	91.602
2	11:29 AM \ (149°)	3:54 PM / (212°)	4:24:22	+13:56	7:14 AM	8:09 PM	8:30 AM	6:53 PM	9:54 AM	5:29 PM	1:41 PM (2.3°)	91.616
3	11:23 AM \ (147°)	4:01 PM / (213°)	4:37:51	+13:29	7:11 AM	8:13 PM	8:26 AM	6:57 PM	9:49 AM	5:34 PM	1:41 PM (2.6°)	91.629
4	11:16 AM \ (145°)	4:07 PM / (215°)	4:50:56	+13:05	7:07 AM	8:17 PM	8:23 AM	7:01 PM	9:45 AM	5:38 PM	1:41 PM (2.8°)	91.643
5	11:10 AM \ (144°)	4:14 PM / (216°)	5:03:43	+12:46	7:04 AM	8:20 PM	8:19 AM	7:05 PM	9:41 AM	5:43 PM	1:41 PM (3.1°)	91.658
6	11:04 AM \ (142°)	4:20 PM / (218°)	5:16:11	+12:28	7:00 AM	8:24 PM	8:16 AM	7:09 PM	9:37 AM	5:47 PM	1:41 PM (3.4°)	91.673
7	10:58 AM \ (141°)	4:26 PM / (220°)	5:28:23	+12:12	6:57 AM	8:28 PM	8:12 AM	7:12 PM	9:32 AM	5:52 PM	1:41 PM (3.7°)	91.689
8	10:52 AM \ (139°)	4:32 PM / (221°)	5:40:22	+11:58	6:53 AM	8:32 PM	8:08 AM	7:16 PM	9:28 AM	5:56 PM	1:41 PM (4.0°)	91.705
9	10:46 AM \ (138°)	4:38 PM / (222°)	5:52:06	+11:44	6:49 AM	8:35 PM	8:04 AM	7:20 PM	9:24 AM	6:00 PM	1:41 PM (4.3°)	91.722
10	10:40 AM \ (136°)	4:44 PM / (224°)	6:03:40	+11:34	6:46 AM	8:39 PM	8:01 AM	7:24 PM	9:19 AM	6:05 PM	1:41 PM (4.7°)	91.739
11	10:35 AM \ (135°)	4:50 PM / (225°)	6:15:04	+11:23	6:42 AM	8:43 PM	7:57 AM	7:28 PM	9:15 AM	6:09 PM	1:41 PM (5.0°)	91.756
12	10:29 AM \ (134°)	4:55 PM / (227°)	6:26:17	+11:13	6:38 AM	8:47 PM	7:53 AM	7:32 PM	9:11 AM	6:14 PM	1:41 PM (5.3°)	91.774
13	10:23 AM \ (132°)	5:01 PM / (228°)	6:37:22	+11:04	6:34 AM	8:51 PM	7:49 AM	7:36 PM	9:06 AM	6:18 PM	1:41 PM (5.6°)	91.792
14	10:18 AM \ (131°)	5:06 PM / (229°)	6:48:17	+10:55	6:30 AM	8:55 PM	7:45 AM	7:40 PM	9:02 AM	6:22 PM	1:41 PM (6.0°)	91.811



## Arctic Greenhouses vs. CEA

120 miles above the Arctic Circle lies the Inuvik Community Greenhouse in the Northwest Territories, Canada. The growing plots are on soil inside a retrofitted hockey arena.



Hydroponics in Nuiqsut by Arth Brown III, teacher at Nuiqsut Trapper School inside a refrigerator car.

Greenhouse - hot or cool these buildings are used to grow plants.

Conservatory - a building in which tender plants are protected and displayed, it is the direct descendant of the orangery; a sunspace attached to a dwelling (Britannica)

Controlled Environment Agriculture (CEA) - integrated science and engineering to create the most favorable environmental conditions for plant productivity while optimizing resource use.

Hydroponics - literally means "working with water." Plant roots are continuously submerged in circulating nutrient-rich water.

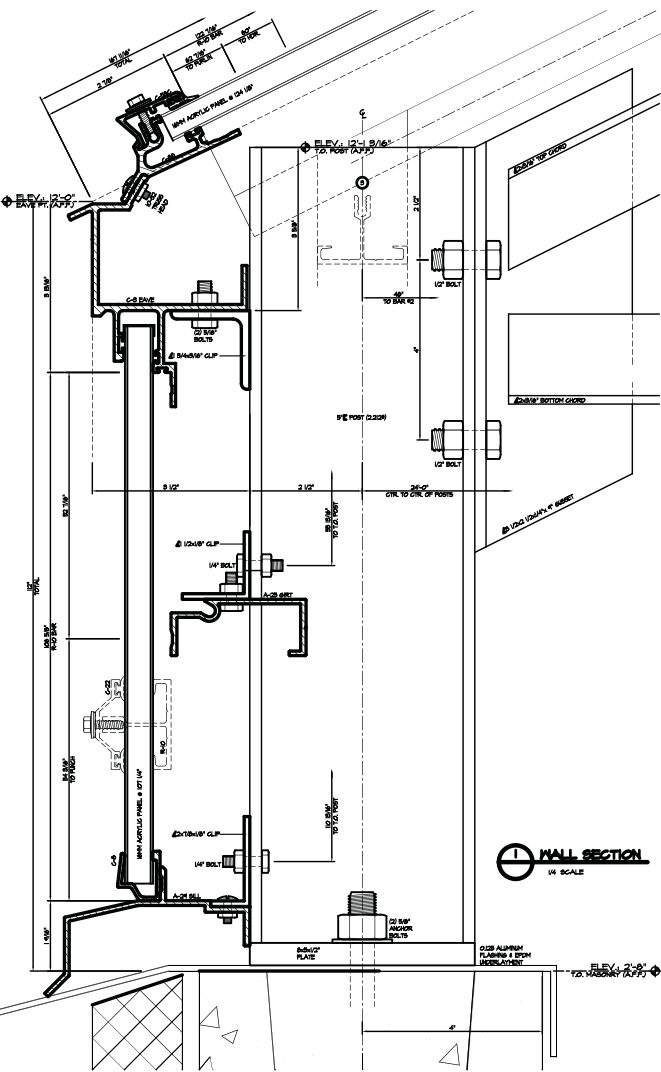
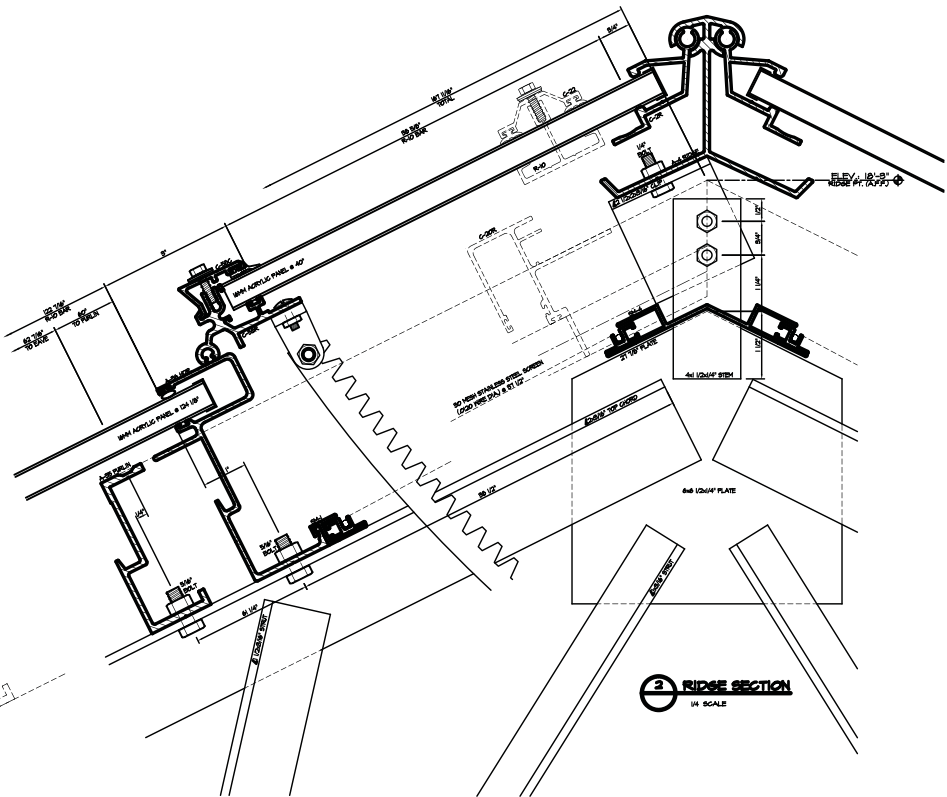
Aquaponics - combines aquaculture (raising fish) with hydroponics utilizing the excrement of the fish and bacteria to create fertilizer for the plants who then filter the water back to the fish.





# Greenhouse Details and Insulation System

The system is based off of the construction of the AES Greenhouse which survives Fargo winters quite well.



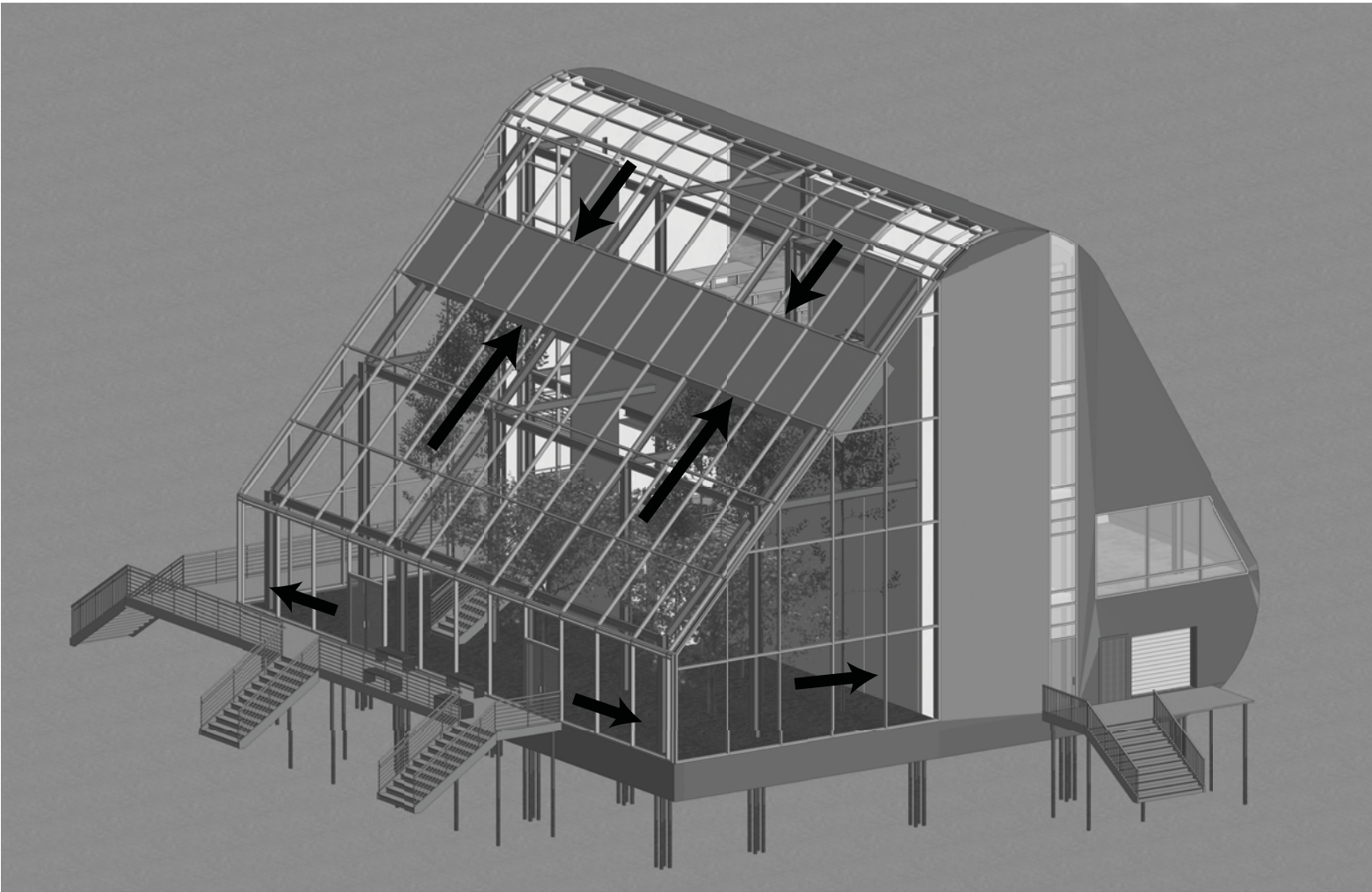
Insulated panels slide on tracks to regulate sun and shade in the summer and heat loss in the winter.

From Albert J. Lauer Inc.  
Greenhouse designer - manufactures - builders

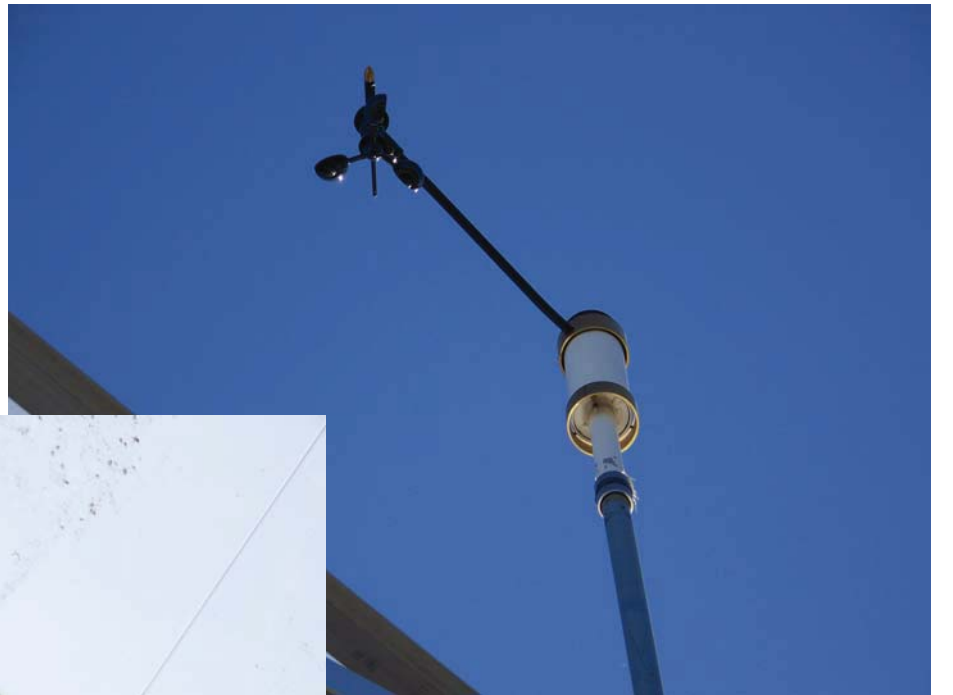
Table A402.1.1 Insulation and Glazing Minimum R-values by Component							
Climate Zone Alaska	Windows & Skylights	Ceiling <sup>a</sup>	Exterior Frame Wall	Floor	Below Grade Wall <sup>b</sup>	Slab <sup>c</sup> & Depth	Crawl Space Wall <sup>b</sup>
Southeast	3	49 or 38	20	30	15/19	15, 4ft	15/19
Southcentral, Aleutians, Kodiak	3	49 or 38	20	30	15/19	15, 4ft	15/19
Interior, Southwest	4	49 or 38	25	38	15/19	15, 4f	15/19
Northwest (Nome, Kotzebue)	4.5	49 or 38	30	38	15/19	15, 4f	15/19
Arctic Slope	5	65 or 52	35	43	NR	NR	NR

Table from UAF Cooperative Extension Program

- 16mm Acrylic - R-2
- SIP (8'') - R-38
- Radiant Foil - R-<3 with air space



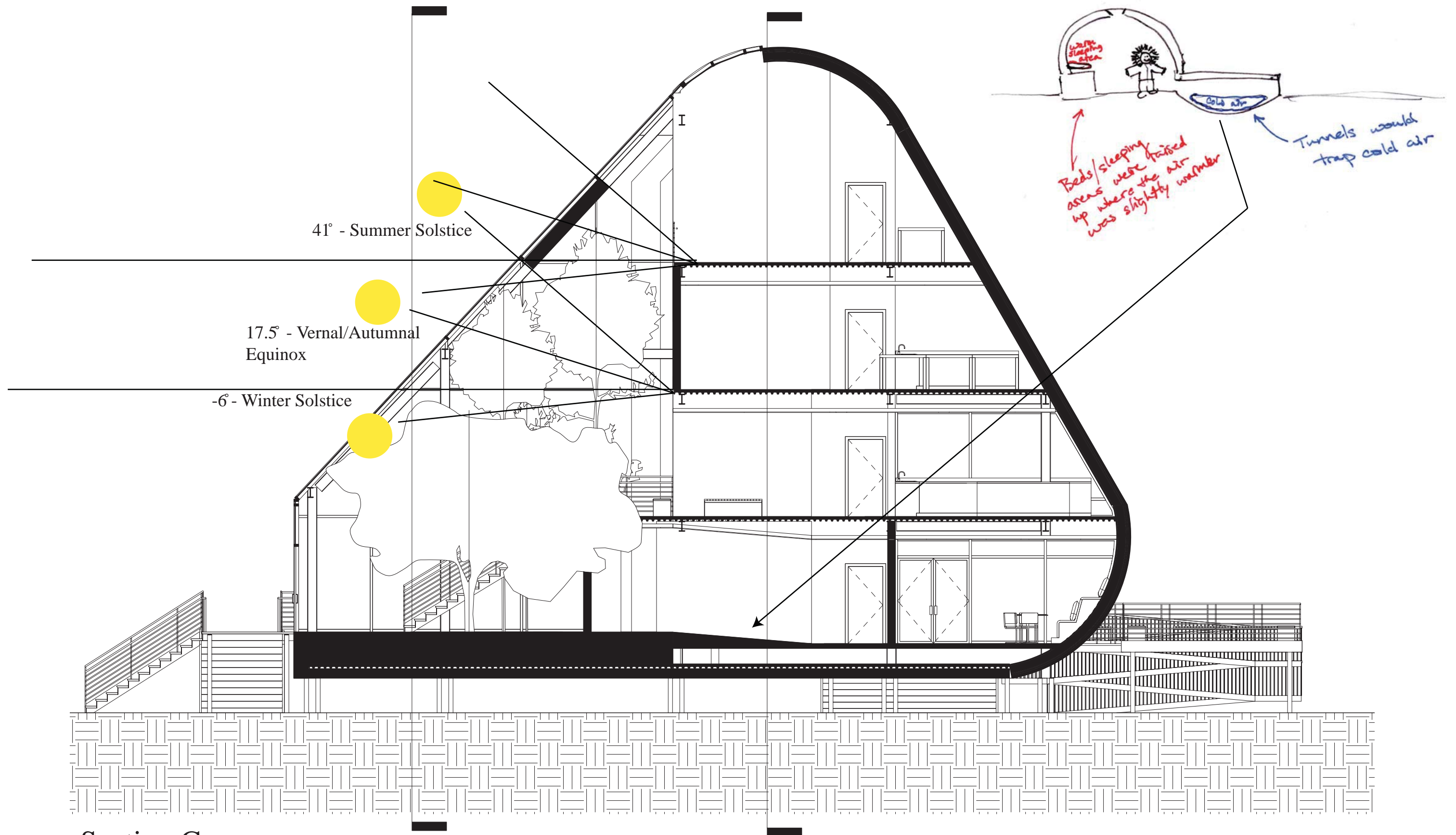




Greenhouse Components







Section C

1/8" = 1'-0"