BERTSCHI SCHOOL LIVING BUILDING SCIENCE WING

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INTRODUCTION

http://www.topboxdesign.com

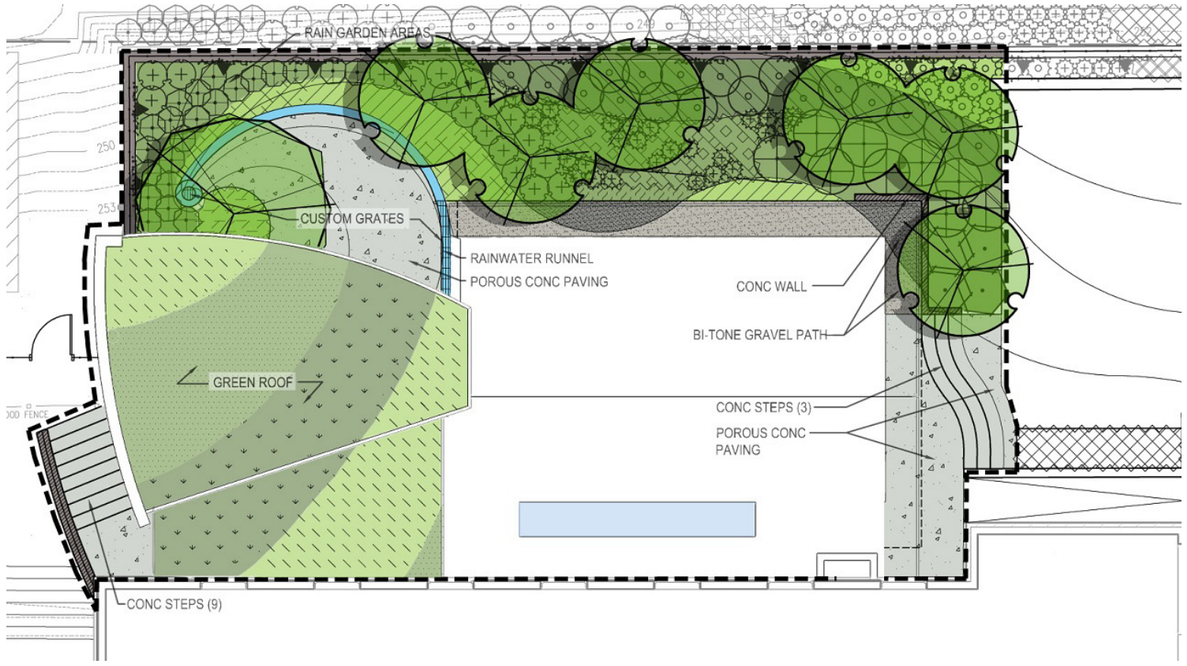
Location	2227 10th Ave E, Seattle, WA 98102
Project Size	1,425 ft²
Total Costs	All design services pro-bono. (Only $935,000 for Construction)
Owner	Bertschi School
Building Architect/Project Team	KMD Architects / Skanska USA Building / GGLO / 2020 Engineering / Quantum Consulting Engineers / GeoEngineers / Rushing / O'Brien and Company / Back To Nature Design, LLC / Parsons Public Relations / Morrison Hershfield

The Bertschi School Living Building Science Wing is the first building to meet the Living Building Challenge 2.0 standards, which include 20 imperatives such as “net zero water,” “net zero energy,” and “adherence to a materials Red List.”

SUSTAINABILITY INTEGRATION COLLABORATION COST-EFFECITIVE

The primary goal of this project was to meet the requirements with restricted costs. To achieve this goal, KMD Architects decided the building should be dependent on and connected to its site. That is, natural local resources of sun, rain, and wood are important factors for a self-sustaining building. Furthermore, the Science Wing integrated building systems, such as solar panels and a modular tray green wall, to the open floor-plan space motivate collaborative activities.

floor plan



roof plan

solarpedia.com

section through classroom

1| North-facing, operable windows with insulated glazing
2| 2x12 wood-framed, cellulose-insulated walls
3| Structural-insulated -panel roof
4| Hydronic radiant floor heating
5| Ventilation system with energy recovery
6| Operable skylight for stack-effect ventilation and toplighting
7| Rain leaders to cisterns, exposed for eduaction
8| Glass-covered interior runnel transports rain water to potable cistern
9| Exterior runnel transports excess rain water for potable use to irrigation cistern and rain garden for infiltration
10| Irrigation cistern
11| Rain garden
12| Stormwater control valves divert water from other campus property to irrigation cistern and rain garden

east facing section through ecohouse

1| Church Building rain leader to cistern, exposed for education
2| Rain leader for classroom butterfly roof
3| Glass-covered interior runnel transports rain water to potable cistern
4| Potable water cistern
5| Potable tank hand pump for water appreciation
6| Energy Recovery Ventilator
7| Operable curtain wall window for ventilation

west facing section through ecohouse

1| North, insulated curtain wall galzing provides daylighting
2| Skylights provide additional toplighting for the Green Wall
3| Greywater filter tanks remove large particulate matter before sending to Green Wall
4| Green Walls treats all greywater onsite through closed-loop evatransporation
5| Vacuum flush toilet
6| Composting units treat all blackwater on-site
7| Potable water treatment system including micron filters and UV light for disinfection
8| Radiant floor hybrid hot water heater
9| Moss Mat green roof
10| 2x12 wood-framed, cellulose insulated walls

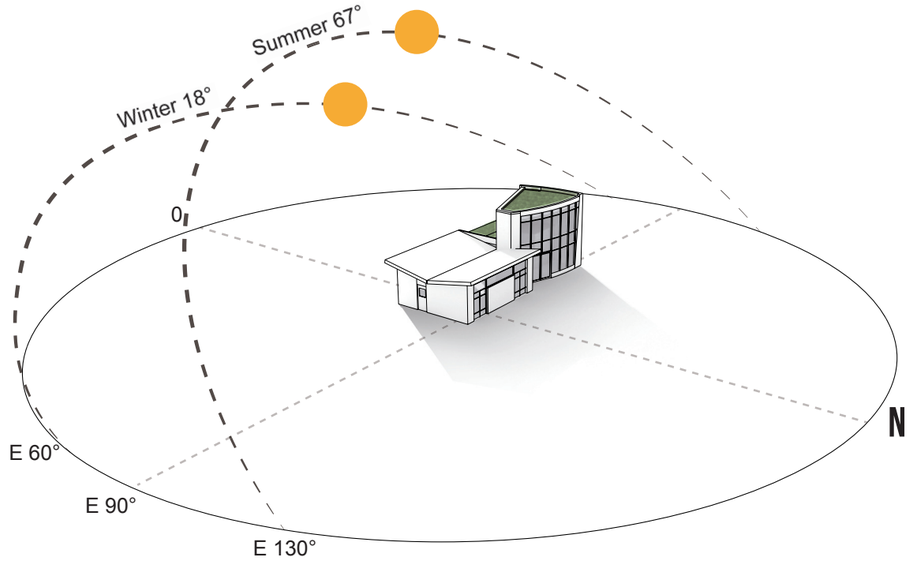
living-future.org/case-study/bertschiscience

www.wbdg.org/references/cs_bslsb.php

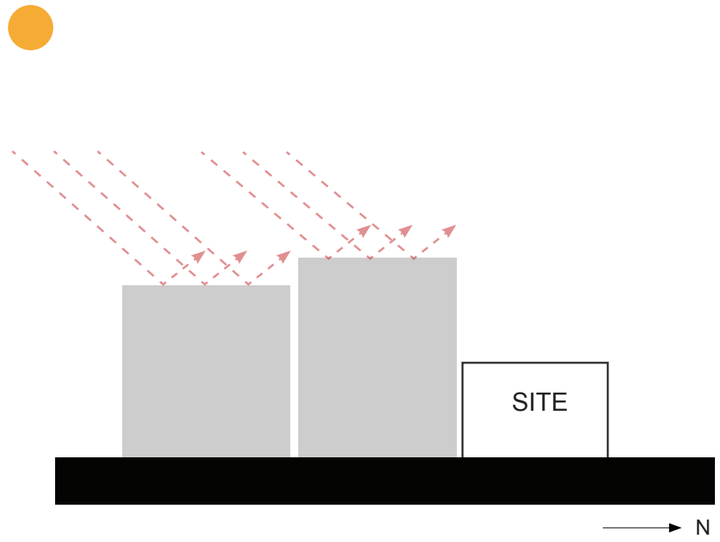
www.wbdg.org/references/cs_bslsb.php

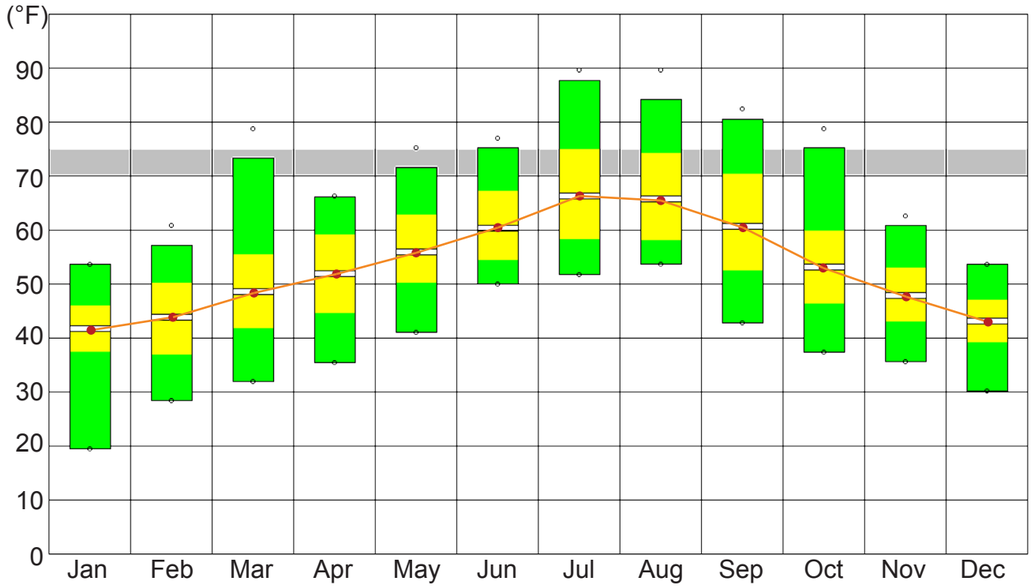
farm4.staticflickr.com/3113/5842957501_e491d2d9e9_z.jpg

SITE ANALYSIS - SOLAR



Solar path diagram

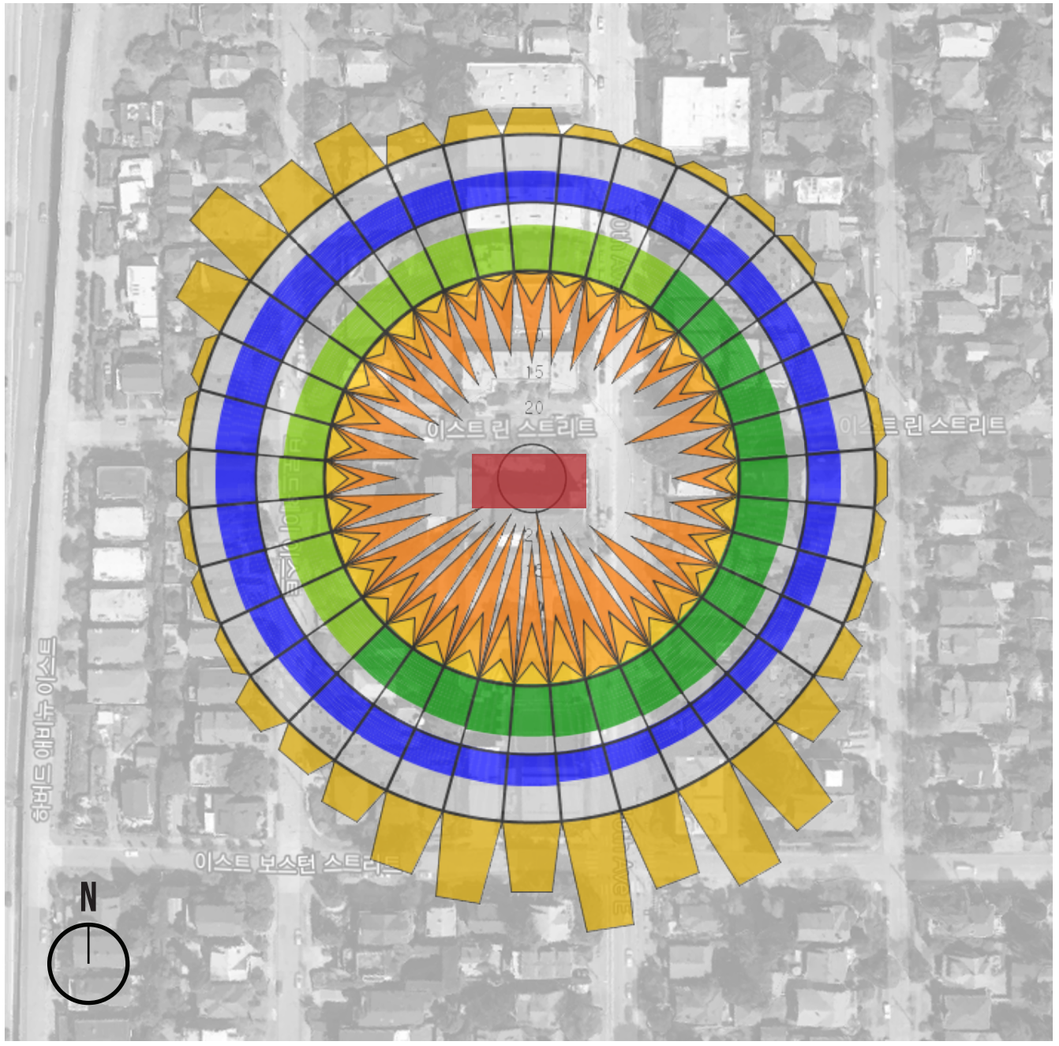




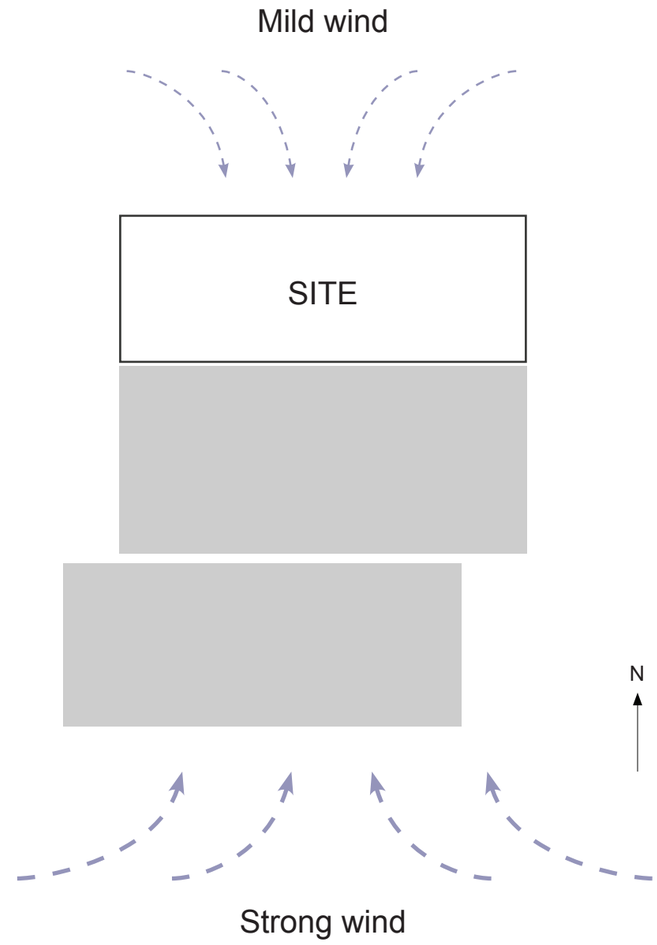
Annual temperature chart
graph generated by Climate Consultant

In Seattle, the solar angles fluxuate between 18° solar in the winter and 67° in the summer. In theory, this building would be primarily dependent on passive solar energy, since an annual temperature is lower than of the comfort zone, indicated by grey shadow in the temperature chart. However, the two buildings on the southern end of the site block the building from the southern sun, making difficult to harvest solar energy for this project.

SITE ANALYSIS - WIND

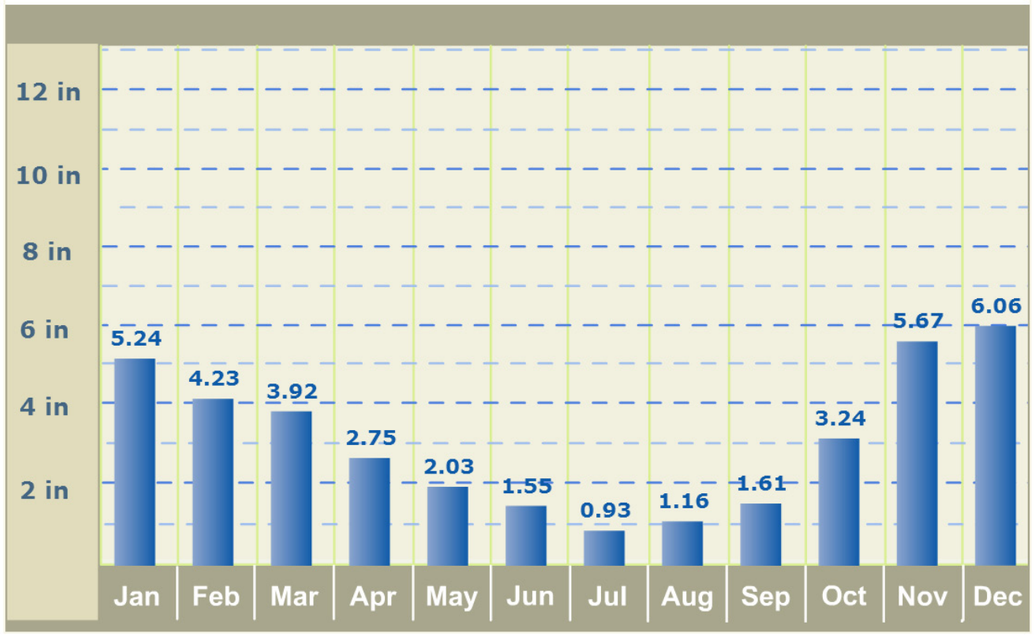


graph generated by Climate Consultant
base image from maps.google.com

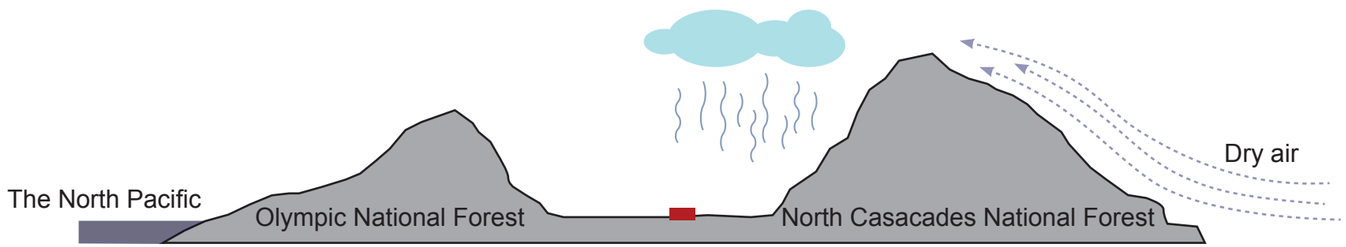


WInd is another good natural resource. At this site, there is a strong wind direction from south to north. Luckly, the two buildings on the south of the Science Wing block the wind, and alleviates the Science Wing from potentially harsh wind conditions.

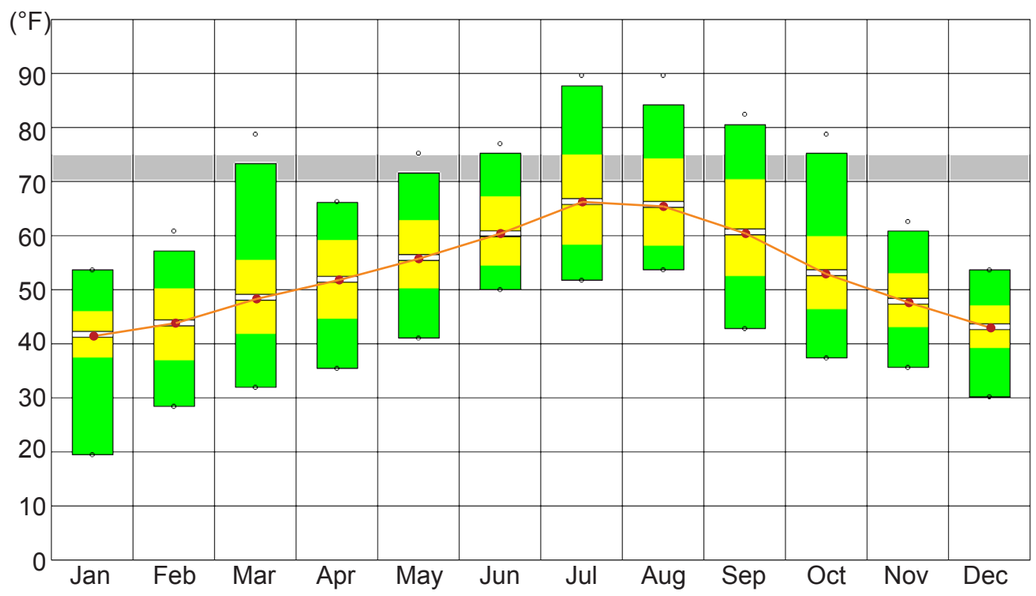
SITE ANALYSIS - PRECIPITATION



http://www.weather.com/weather/wxclimatology/monthly/graph/



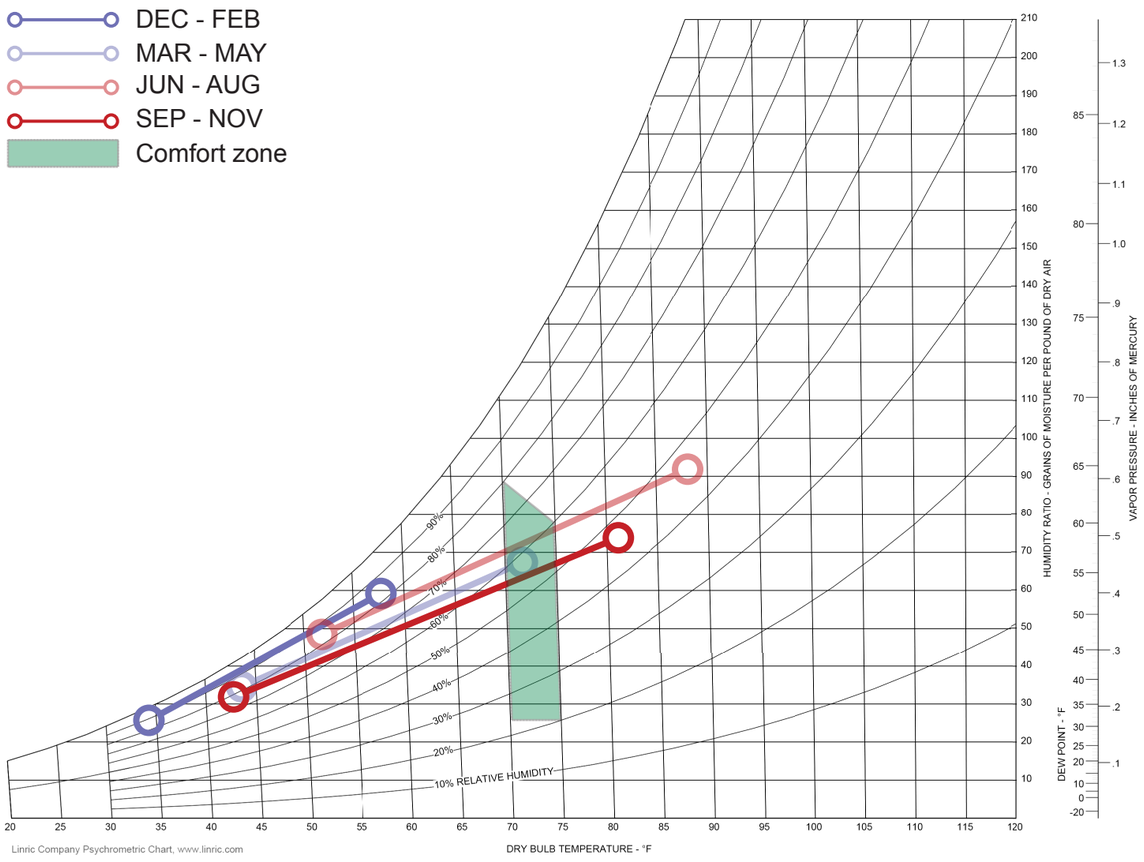
Rain percipitation chart



Annual temperature chart
graph generated by Climate Consultant

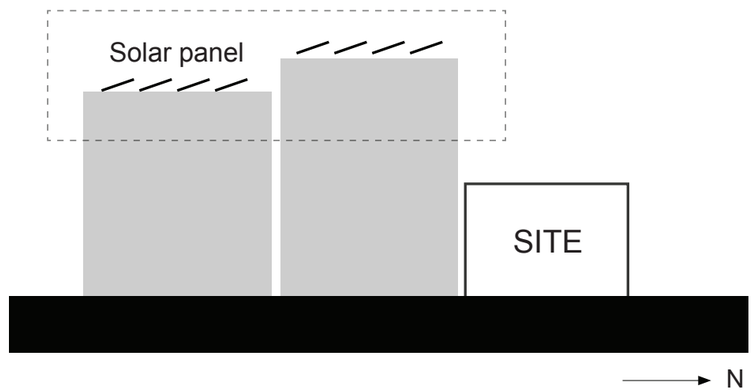
Seattle has a temperate climate. In the winter, the climate is not too cold or dry, and in the summer, not too hot or humid. This effect comes from its geographical location: Seattle is located between the Olympic National Forest and the North Cascades National Forest.Because dry air is changed into clouds when it passes through the North Casacades, and precipitates into rain. Thus, water resources are plentiful at this site, as illustrated in the rain precipitation chart.

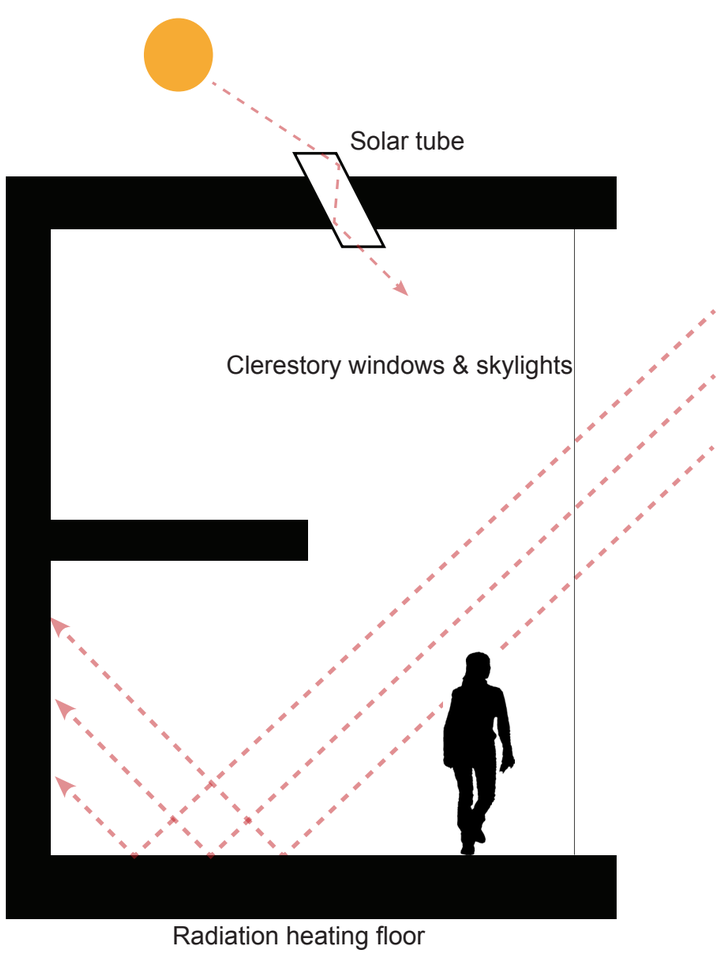
SITE ANALYSIS - PSYCHROMETRIC CHART



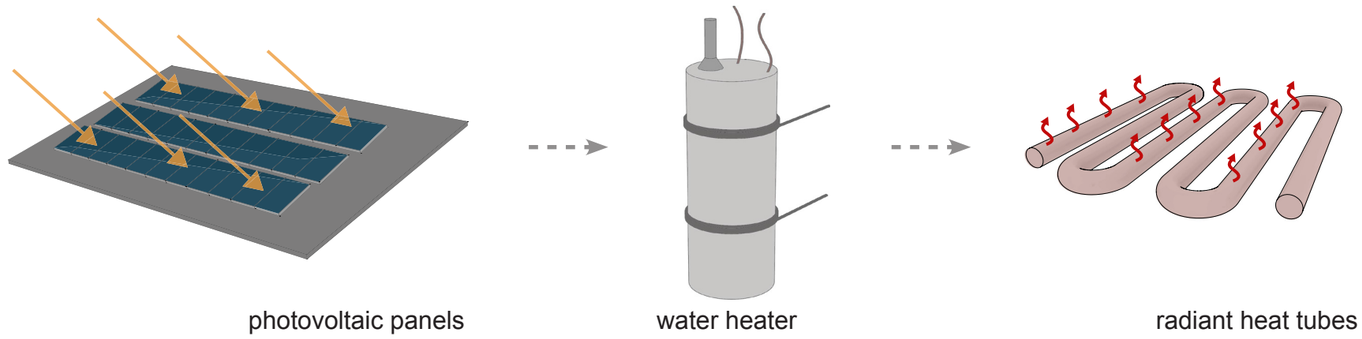
The comfort zone ranges from 70°F to 75° as shown in the psychrometric chart, and Seattle's average temperature is fairly higher than the comfort zone. However, the humidity is relatively fine due to lots of rains. Thus, an important environmental factor is heating for this site. However, the building does not use a mechanical heating system since a degree of the lowest temperature of the site is not too severe. Instead, spaces in the building are heated by solar power. For example, solar panels and the radiant floor system work together to heat the rooms in the Science Wing. The rooms are also heated with insulation that has high R-values. With these strategies, 47% of the total energy consumption was reduced.

PROPOSED SOLUTION - PASSIVE SOLAR ENERGY



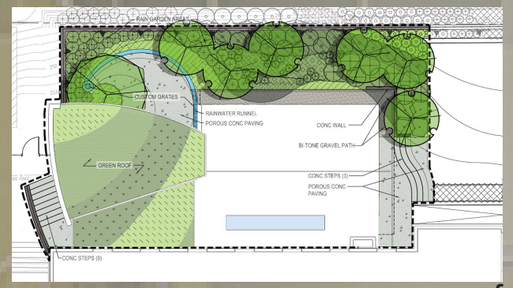


Radiant Heating System



PROPOSED SOLUTION - NET ZERO WATER SYSTEM

Step1 Rain



green roof
1

Collected at tank1

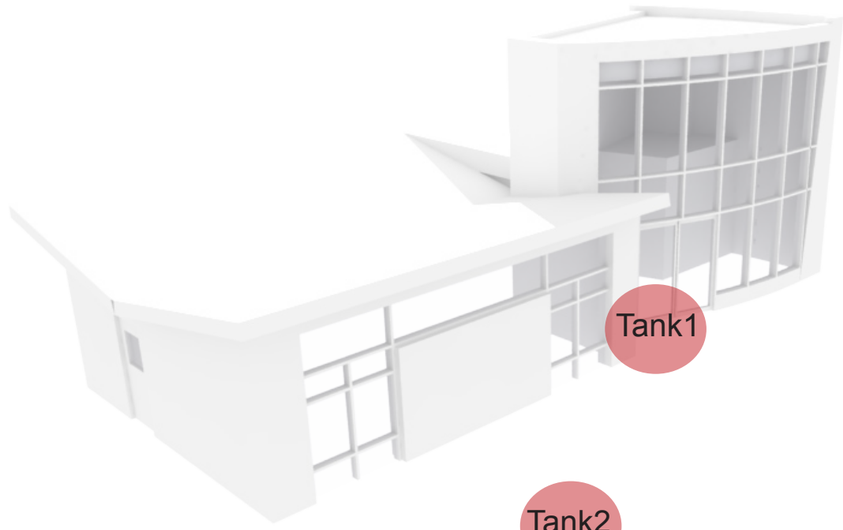
Step2 Grey water

irrigate outdoor plants
2

used in bathroom
3

Collected at tank2

irrigate outdoor plants



Collected at tank1

Step3 Green wall system

4

flickr.com/photos/45379946@N07/7939852938
1| solarpedia.com
2| inhabitat.com
3| www.indigowatergroup.com
nl.dopper.com
4| www.topboxdesign.com

PROPOSED SOLUTION - NATURAL VENTILATION SYSTEM

www.betseybuckheit.com

Exterior vent system at
Ecohouse wall near Green roof

ERV

http://www.bertschi.org/

PROPOSED SOLUTION - INSULATING SYSTEM

Blown-in cellulose insulation http://www.bertschi.org/

2 ×12 wood framing http://www.bertschi.org/

“...The wood framing material in these walls is all Forest Stewardship Council (FSC) certified which means it comes from sustainably harvested sources. The cellulose insulation is natural plant fiber with post-consumer content. As with all of this project's materials, these wall components are appropriately sourced from local sources which contributes to the regional economy and reduces embodied carbon footprint by limiting the energy required for shipping materials.”

reference : http://www.bertschi.org/who-we-are/our-campus/science-wing

LESSONS FROM BERTSCHI SCHOOL

The Bertschi School Living Building Science Wing is a learning device for both students and the public. All sustainable features are accessible and used by students, creating an interactive teaching method to teach students about the water cycle and water conservation. The outdoor garden allows children to have a hands-on experience with botanical and anthropological activities. Students are encouraged to use the plants grown in the garden for art projects, as well as a source of food. Because the Bertschi School is a symbol of its surrounding community, it is hoped that the public will learn from the design strategies demonstrated here and implement them into future similar designs in the area.

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NOTE: All diagrams were created by Sung Lee & Samantha Aisawa unless otherwise cited