

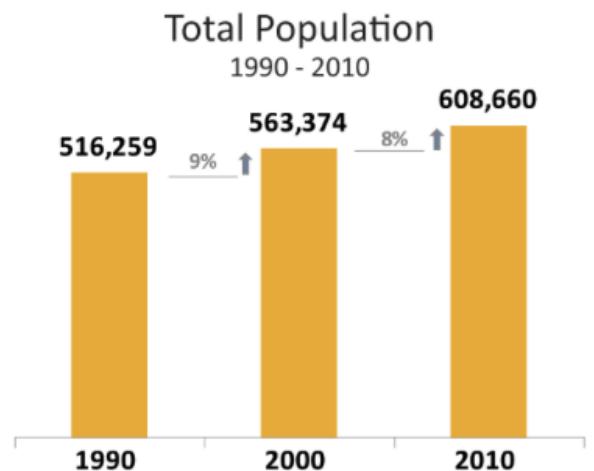
SEATTLE

An aerial photograph of Seattle, Washington, showing the city's dense urban landscape along the Puget Sound. The skyline features numerous skyscrapers, including the Columbia Center and Smith Tower. In the foreground, the Elliott Bay waterfront is visible with several large cargo ships at port. The water is a deep blue, and the sky is overcast with white clouds. The overall scene captures the city's blend of natural beauty and industrial activity.

EVAN OSKIERKO-JEZNACKI // NICCOLO BENIGH // SPRING 2016 // MEBD STUDIO

DEMOGRAPHICS & HOUSING*

*2010 Census



- 2010 population count: 608,660 (metropolitan area 3,439,809)
- Population in households: 583,735
- Number of households: 283,510
- Average household size: 2.06
- Average family size: 2.87
- Population in group quarters: 24,925

2015 population estimate for Seattle: 662,400

- White - 69.5%
- Black or African American - 7.9%
- Amer. Indian & Alaska Native - 0.8%
- Asian - 13.8%
- Native Hawaiian & Other Pac. Islander - 0.4%
- Other race - 2.4%
- Two or more races - 5.1%
- Hispanic or Latino ethnicity (of any race): 6.6%
- Persons of color: 33.7%

Age Groups in Seattle

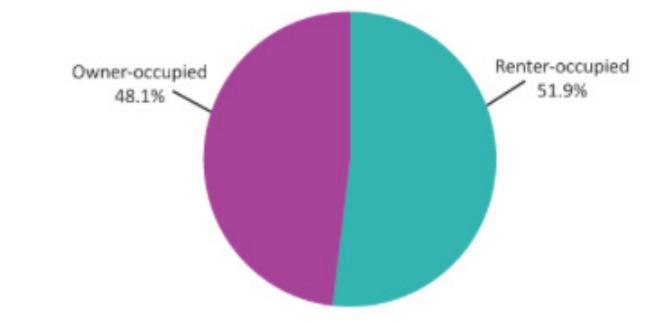
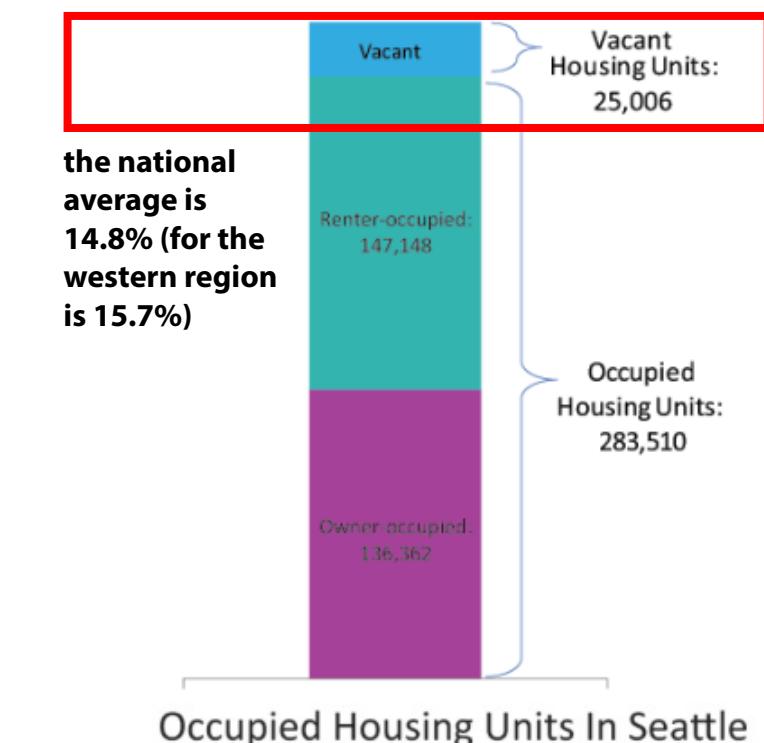


- Total housing units: 308,516
- Occupied housing units: 283,510
- Owner-occupied housing units: 136,362 (48.1 percent)
- Renter-occupied housing units: 147,148 (51.9 percent)
- Average household size: 2.06 persons
- Ave. household size in owner-occupied units: 2.31 persons
- Ave. household size in renter-occupied units: 1.83 persons

The new allocation for Seattle is 86,000 new housing units over a 25-year period



Total 2010 Housing Units in Seattle



CULTURE

- Seattle has **the highest per-capita music and dance attendance in the country**, with 80 live music clubs (not counting the movable dance clubs and shows) and 15 symphony orchestras. (Ray Charles, Quincy Jones, Jimi Hendrix and Ernestine Anderson all lived in Central and South Seattle over the years).
- Seafair is a massive two-month summer festival that showcases the traditions and diversity of Puget Sound with parades, festivals, triathlons, hydroplane races and air shows.
- Alki Beach is one of the city's longest white sand beaches, 2 miles along the west side of West Seattle.
- The seminal utopian described the first ecological utopias and was **influential on the counterculture and the green movement in the 1970s and thereafter**. The “leading edges” (his main ideas for Ecotopian values and practices) were patterns in actual social experimentation taking place in the American West.



COST OF LIVING INDEX

- 1) New York
- 10) Philadelphia
- 12) SEATTLE
- 25) Toronto
- 56) Quebec



OCEANIC CLIMATE



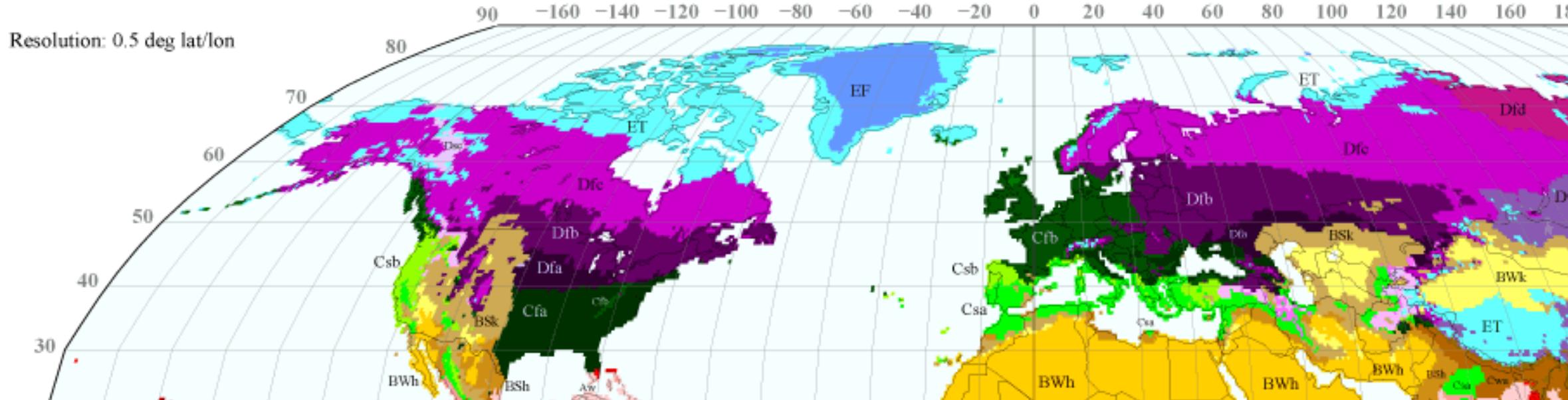
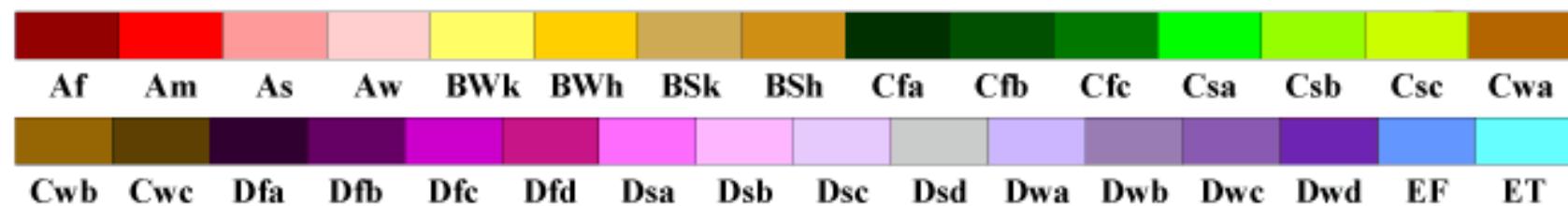
Seattle's climate is classified as oceanic or temperate marine, with **cool, wet winters** and **warm, relatively dry summers**. Like much of the Pacific Northwest, according to the Köppen climate classification it has a Mediterranean climate (Csb=warm temperate, steppe, warm summer). Other climate classification systems, such as Trewartha, place it firmly in the Oceanic zone (Do), like much of Western Europe.

The city and environs are part of USDA hardiness zone 8b, with isolated coastal pockets falling under 9a. Hot temperature extremes are enhanced by dry, compressed wind from the west slopes of the Cascades, while cold temperatures are generated mainly from the Fraser Valley in British Columbia.



World Map of Köppen–Geiger Climate Classification

updated with CRU TS 2.1 temperature and VASClimO v1.1 precipitation data 1951 to 2000



Main climates	Precipitation	Temperature
A: equatorial	W: desert	F: polar frost
B: arid	S: steppe	k: cold arid
C: warm temperate	f: fully humid	a: hot summer
D: snow	s: summer dry	b: warm summer
E: polar	w: winter dry	c: cool summer
	m: monsoonal	d: extremely continental

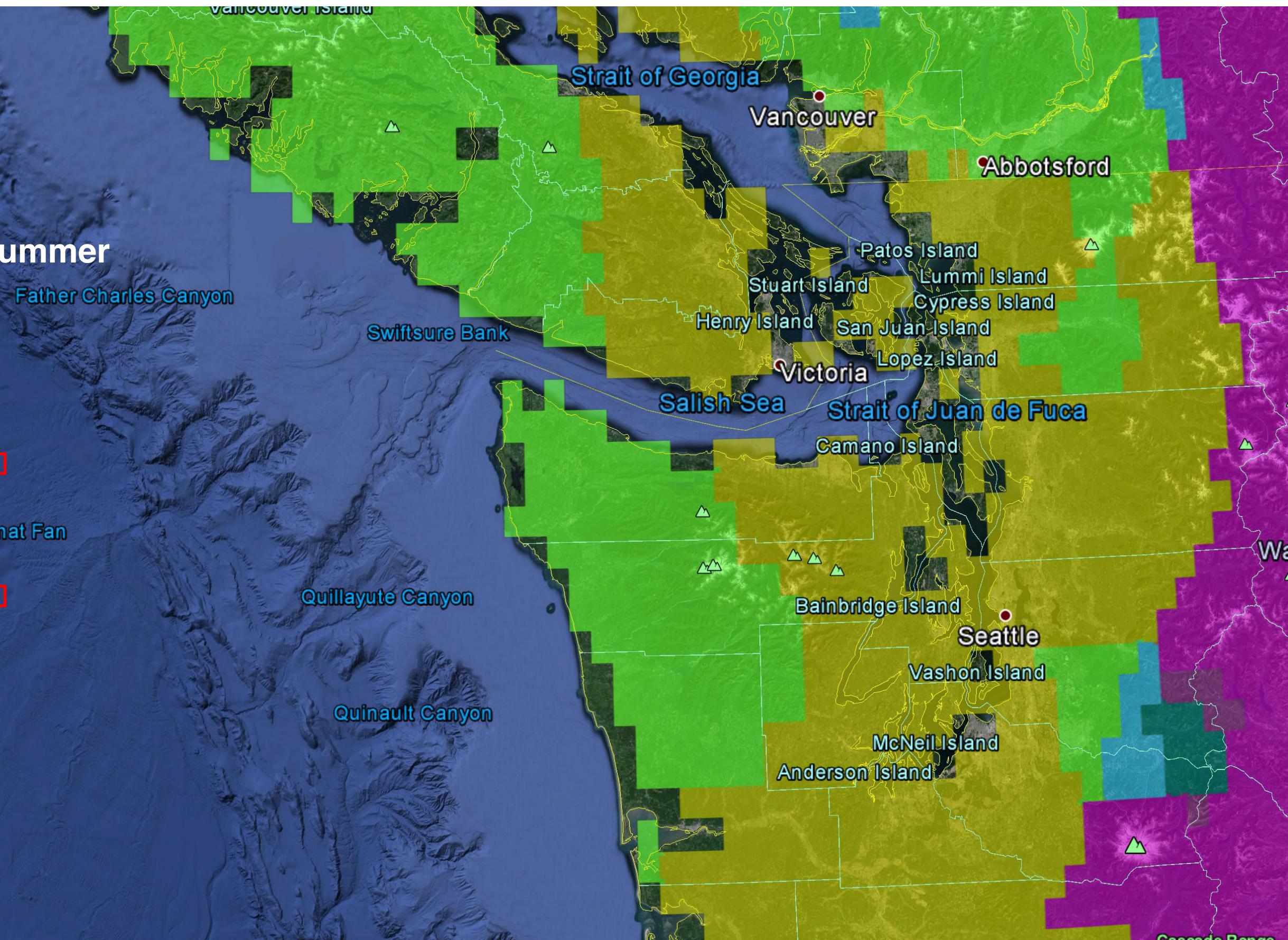
Version of April 2006

OCEANIC CLIMATE

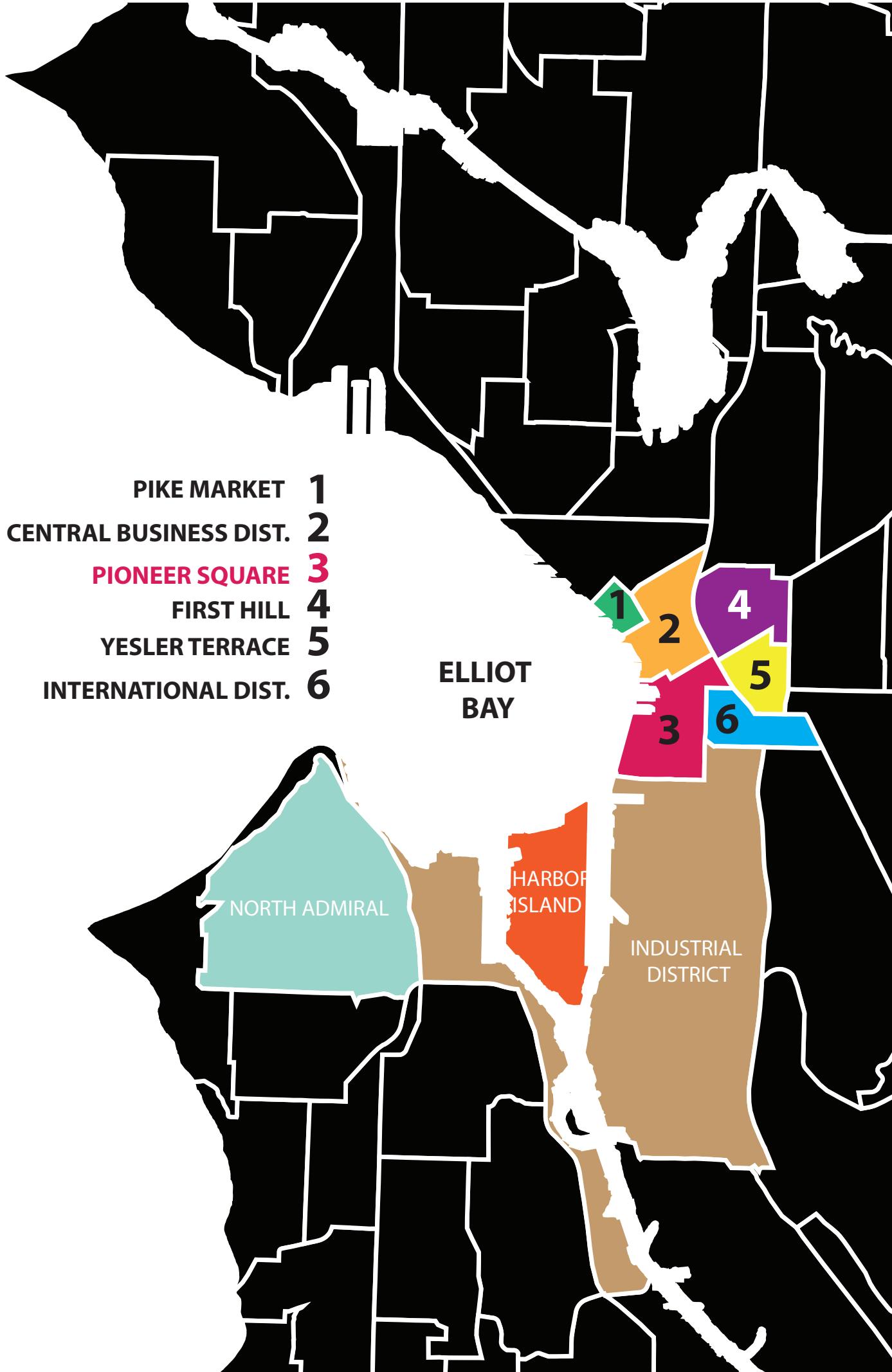
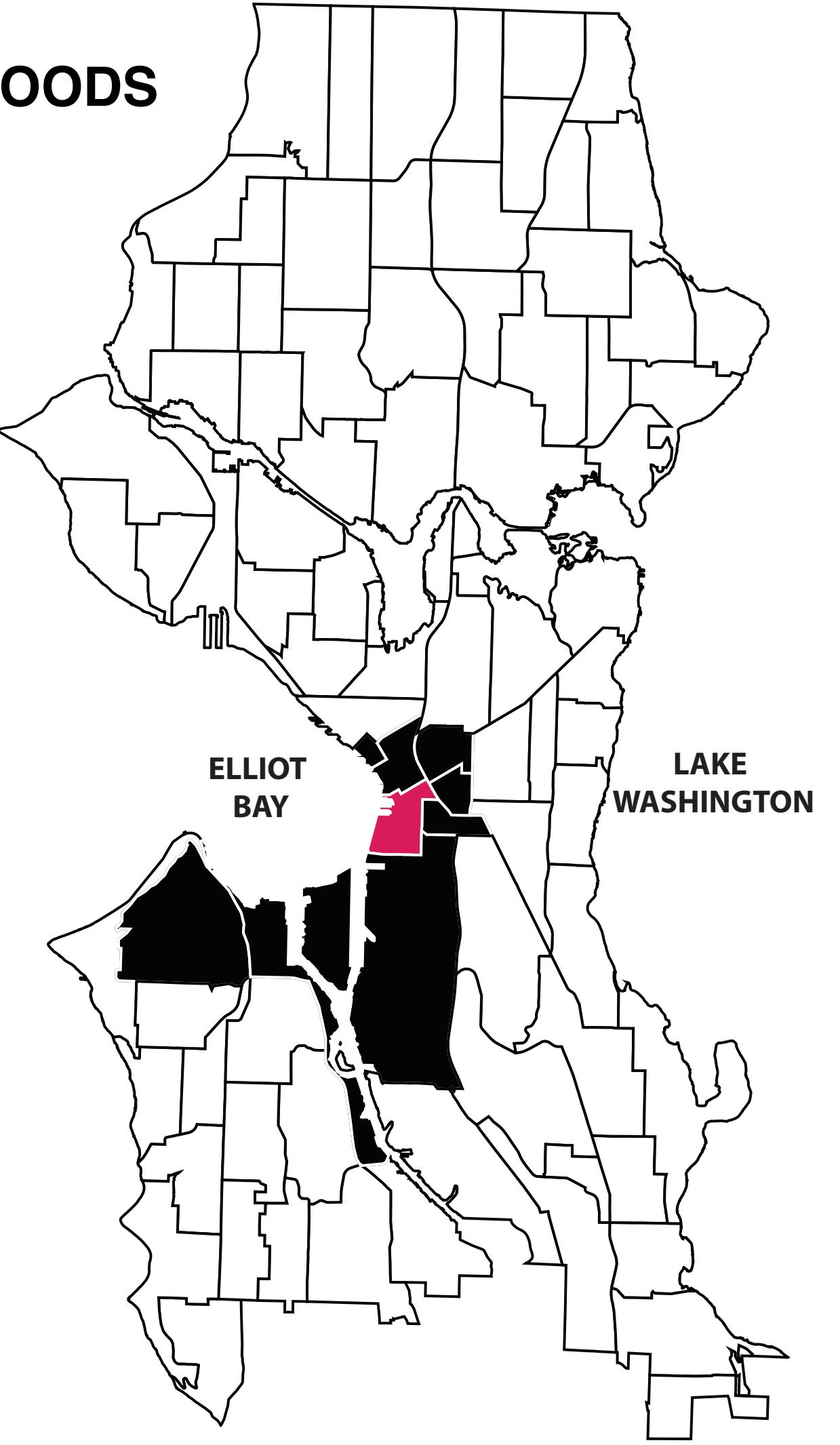
Inland CSB
temperate /
dry summer / warm summer

Coastal CFB
temperate
without dry season / warm summer

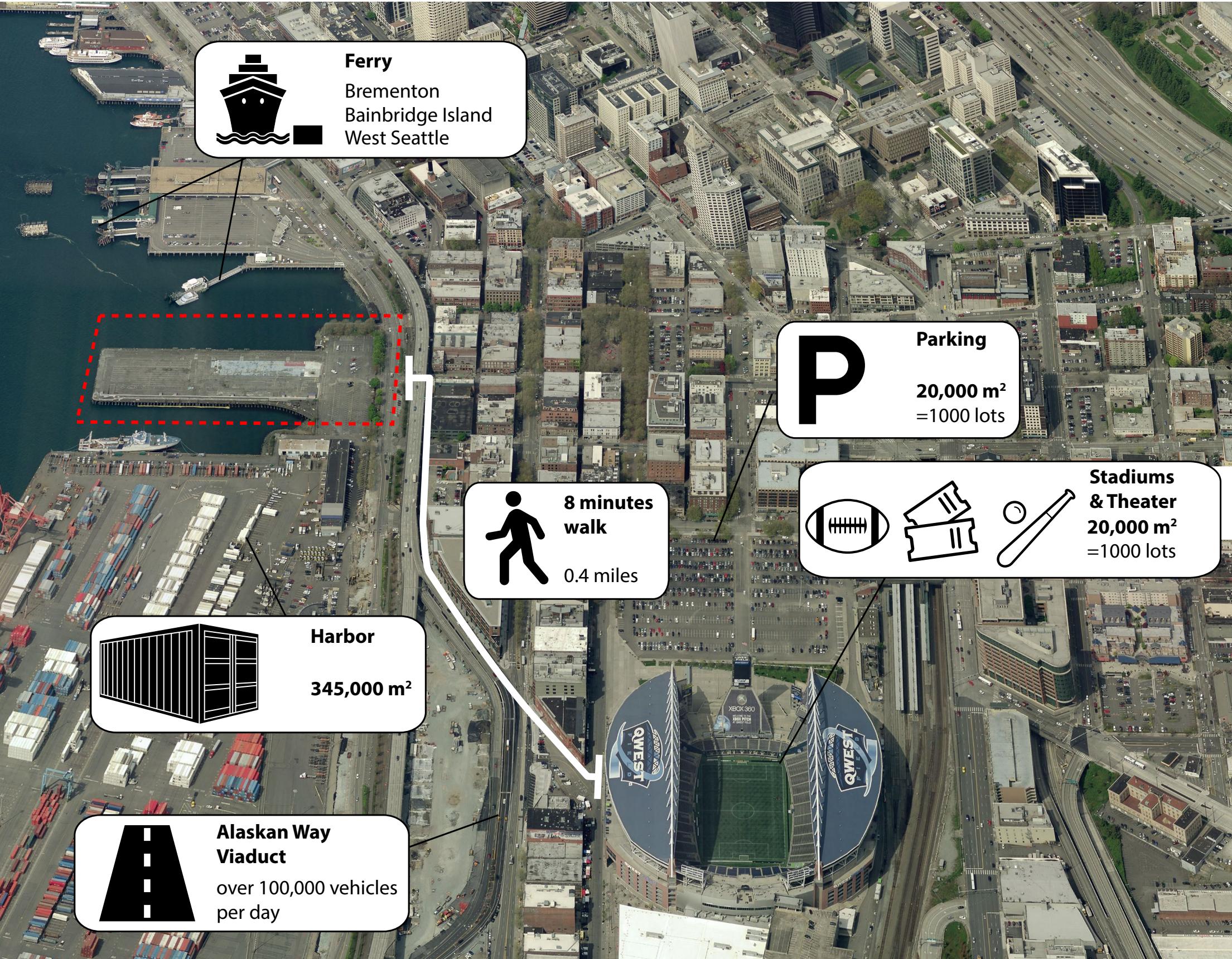
- 1 - Af: Tropical/Rainforest
- 2 - Am: Tropical/Monsoon
- 3 - Aw: Tropical/Savannah
- 4 - BWh: Arid/Desert/Hot
- 5 - Blk: Arid/Desert/Cold
- 6 - BSh: Arid/Steppe/Hot
- 7 - BSk: Arid/Steppe/Cold
- 8 - Csa: Temperate/Dry_Summer/Hot_Summer
- 9 - Csb: Temperate/Dry_Summer/Warm_Summer
- 10 - Csc: Temperate/Dry_Summer/Cold_Summer
- 11 - Cwa: Temperate/Dry_Winter/Hot_Summer
- 12 - Cwb: Temperate/Dry_Winter/Warm_Summer
- 13 - Cwc: Temperate/Dry_Winter/Cold_Summer
- 14 - Cfa: Temperate/Without_dry_season/Hot_Summer
- 15 - Cfb: Temperate/Without_dry_season/Warm_Summer
- 16 - Cfc: Temperate/Without_dry_season/Cold_Summer
- 17 - Dsa: Cold/Dry_Summer/Hot_Summer
- 18 - Dsb: Cold/Dry_Summer/Warm_Summer
- 19 - Dsc: Cold/Dry_Summer/Cold_Summer
- 20 - Dsd: Cold/Dry_Summer/Very_Cold_Winter
- 21 - Dwa: Cold/Dry_Winter/Hot_Summer
- 22 - Dwb: Cold/Dry_Winter/Warm_Summer
- 23 - Dwc: Cold/Dry_Winter/Cold_Summer
- 24 - Dwd: Cold/Dry_Winter/Very_Cold_Winter
- 25 - Dfa: Cold/Without_dry_season/Hot_Summer
- 26 - Dfb: Cold/Without_dry_season/Warm_Summer
- 27 - Dfc: Cold/Without_dry_season/Cold_Summer
- 28 - Dfd: Cold/Without_dry_season/Very_Cold_Winter
- 29,31 - ET: Polar/Tundra
- 30,32 - EF: Polar/Frost



NEIGHBORHOODS



Elliott Bay Area



Existing Site Conditions

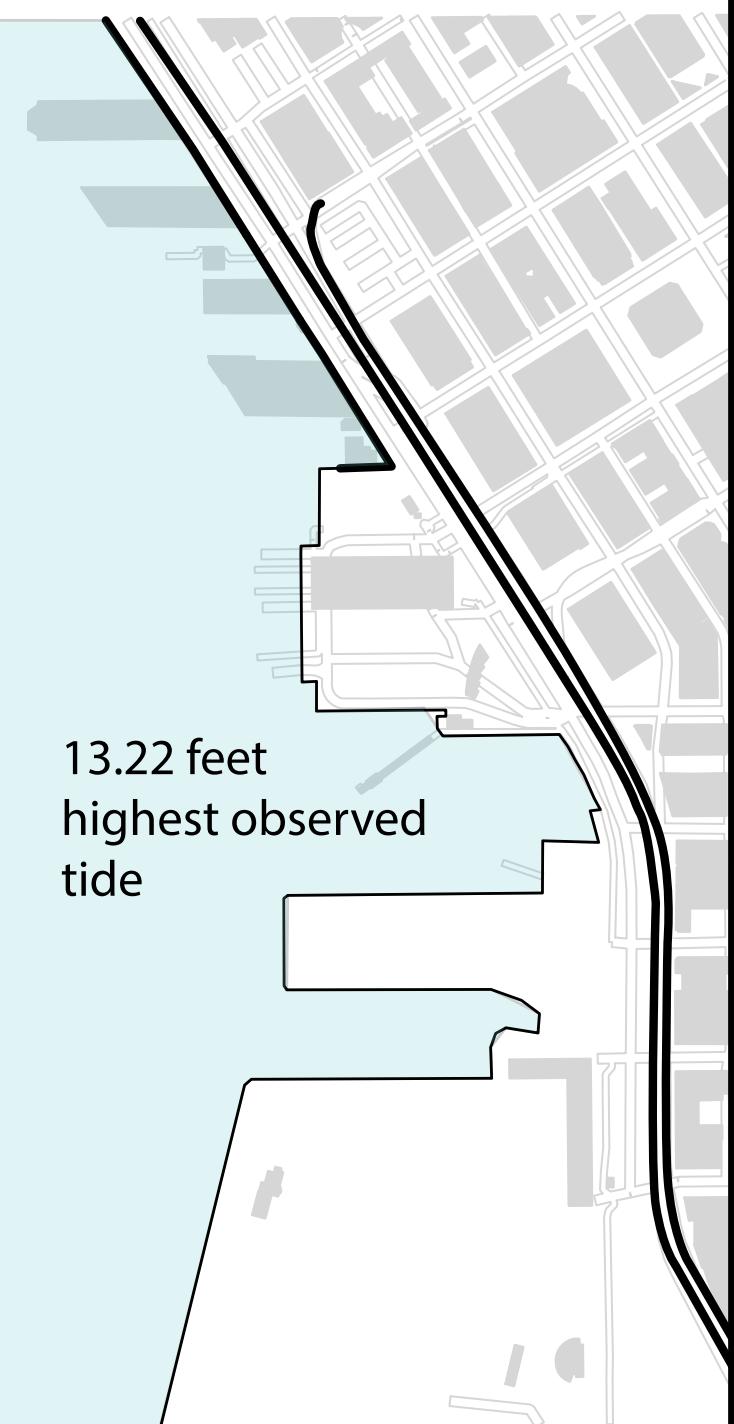


Existing Site Conditions

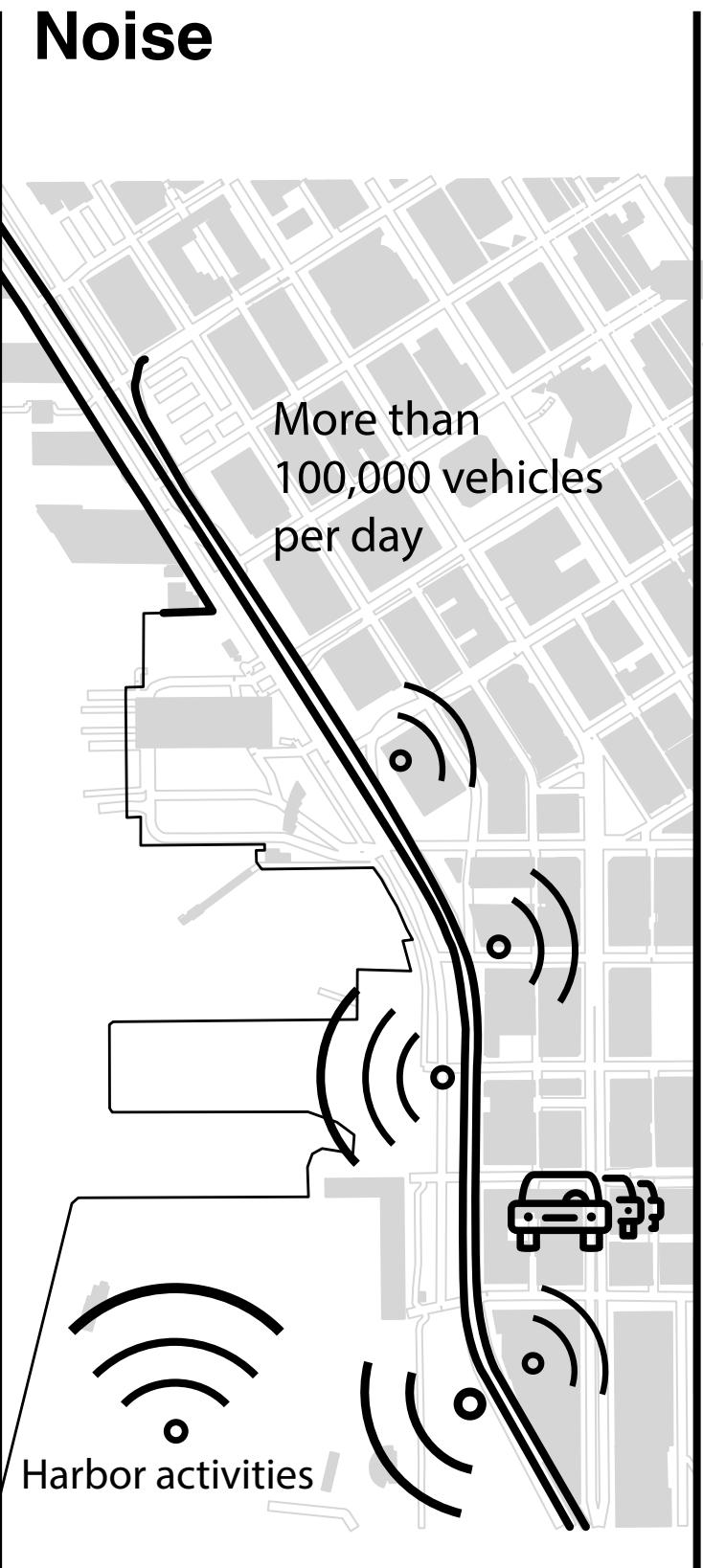


Environmental Issues

Tides



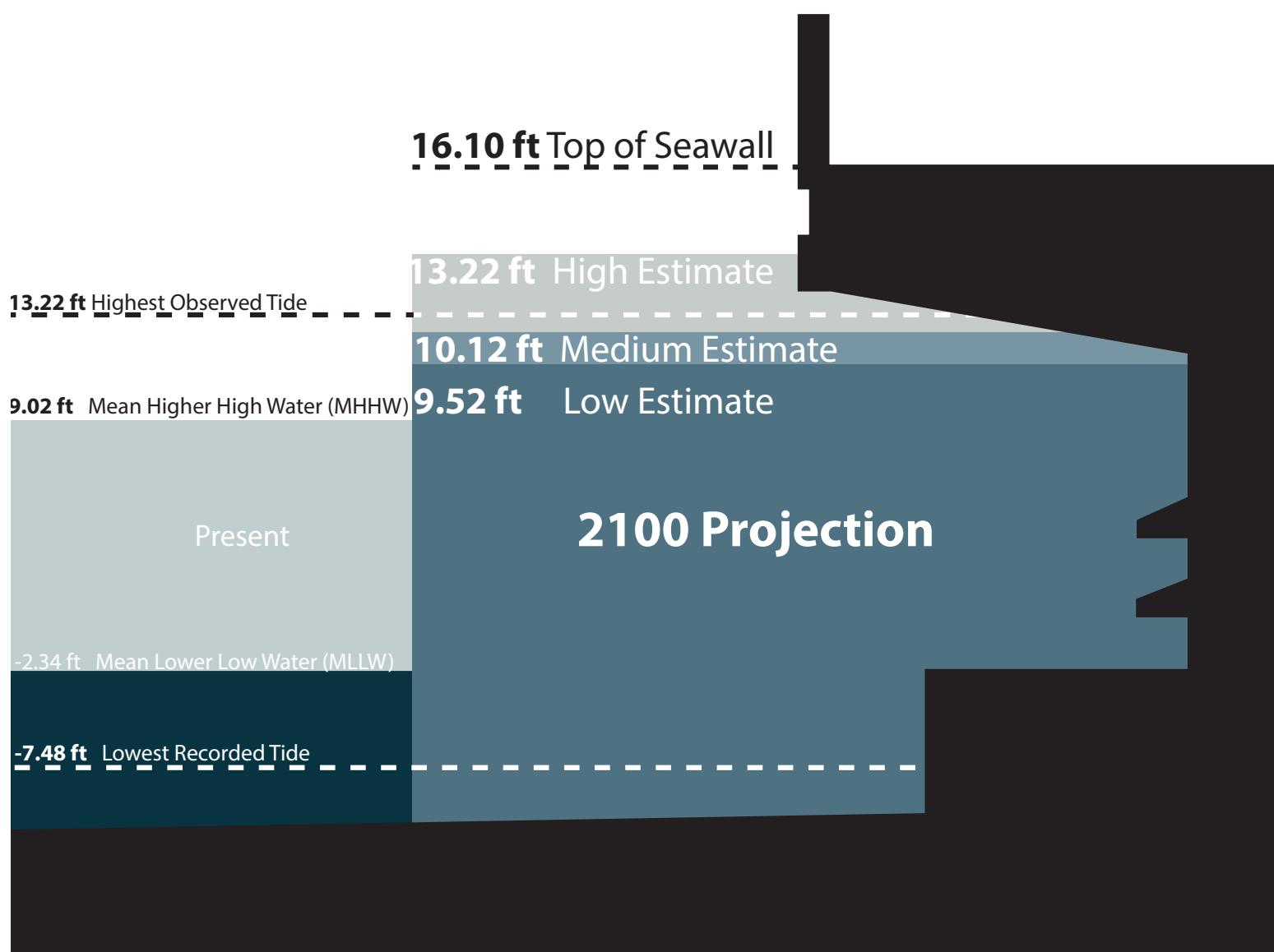
Noise



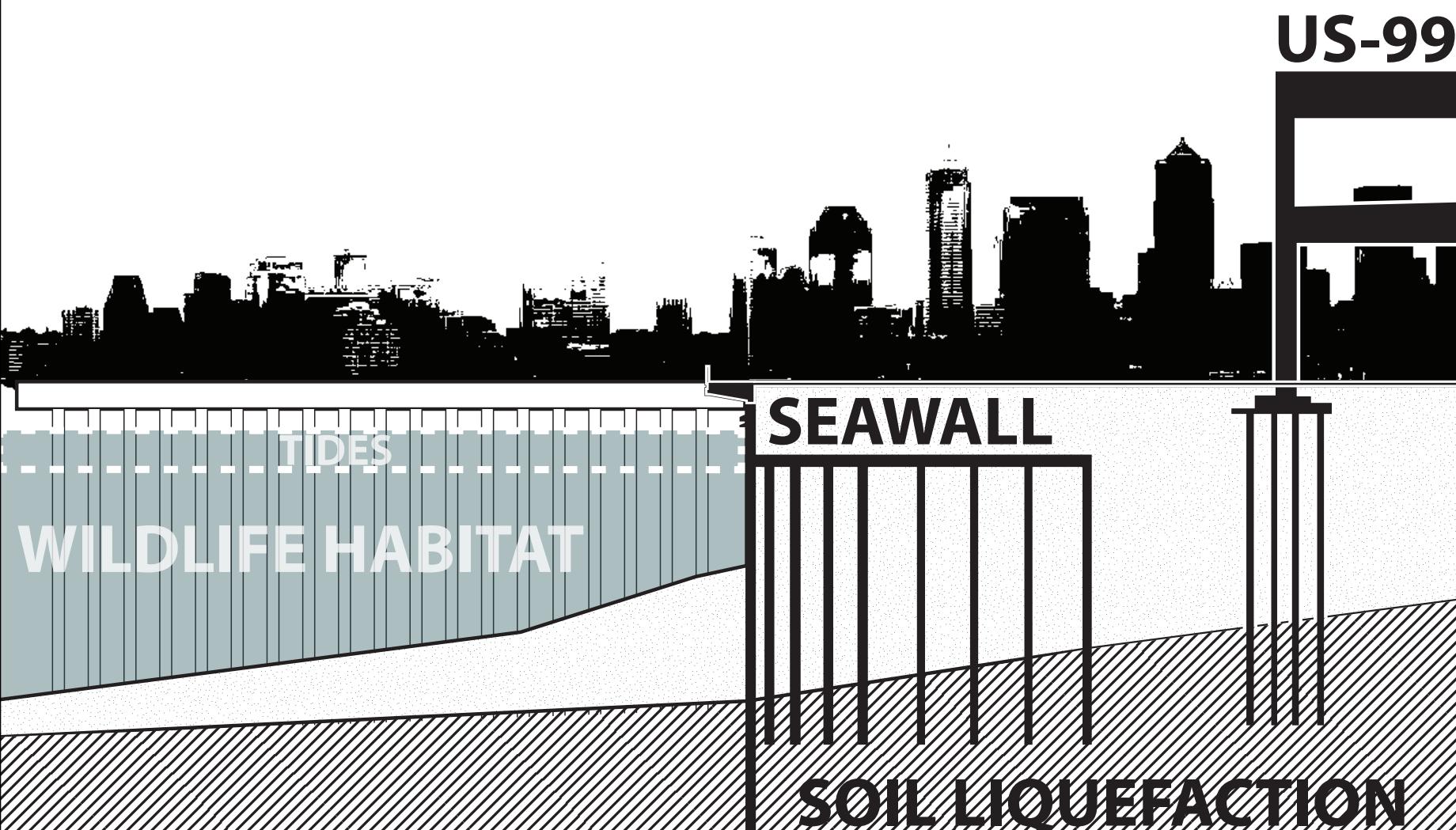
Rainwater Runoff



Rising Sea Levels



Soil Liquefaction and Habitat Preservation



WATER EDGE

WATER EDGE

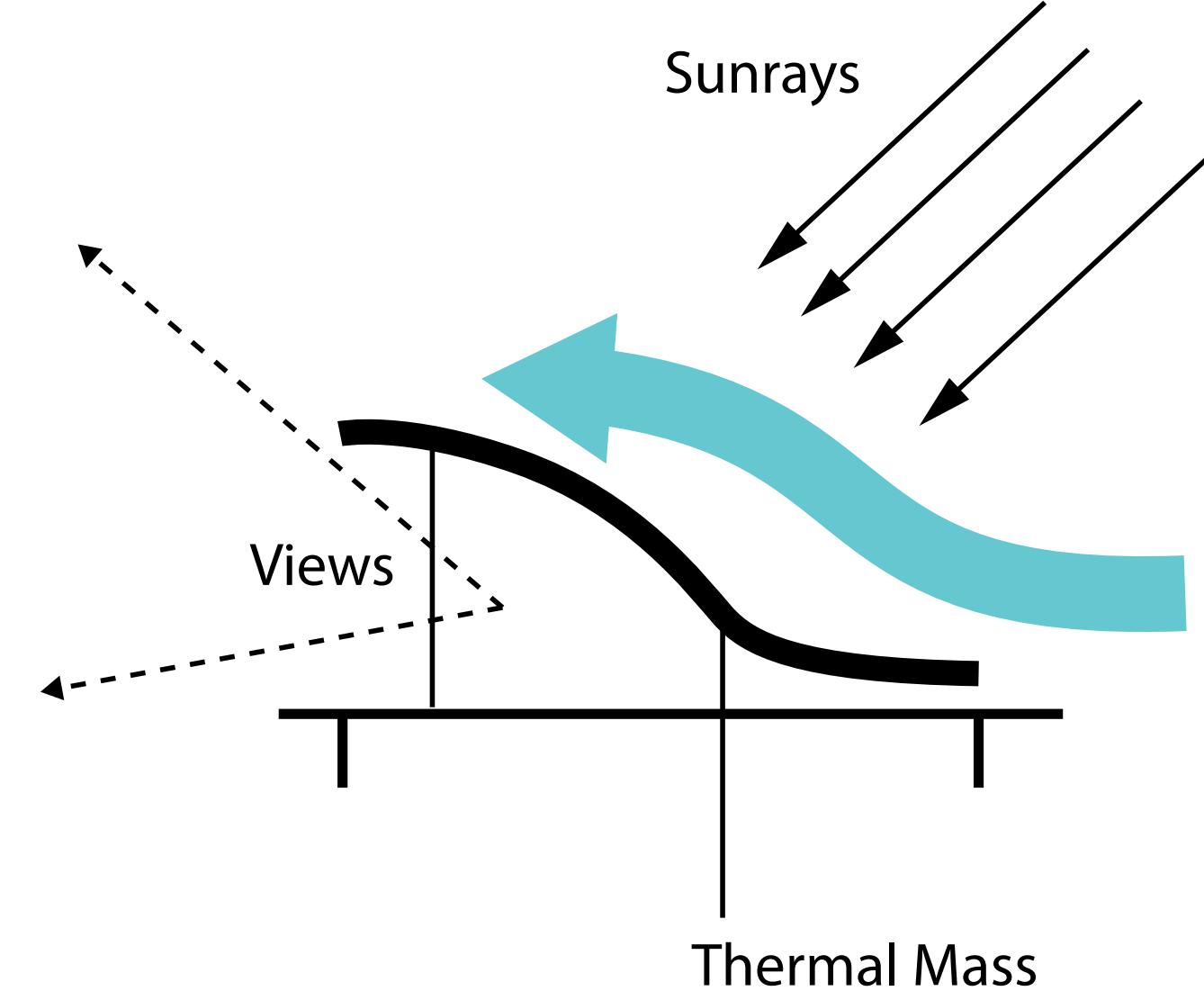
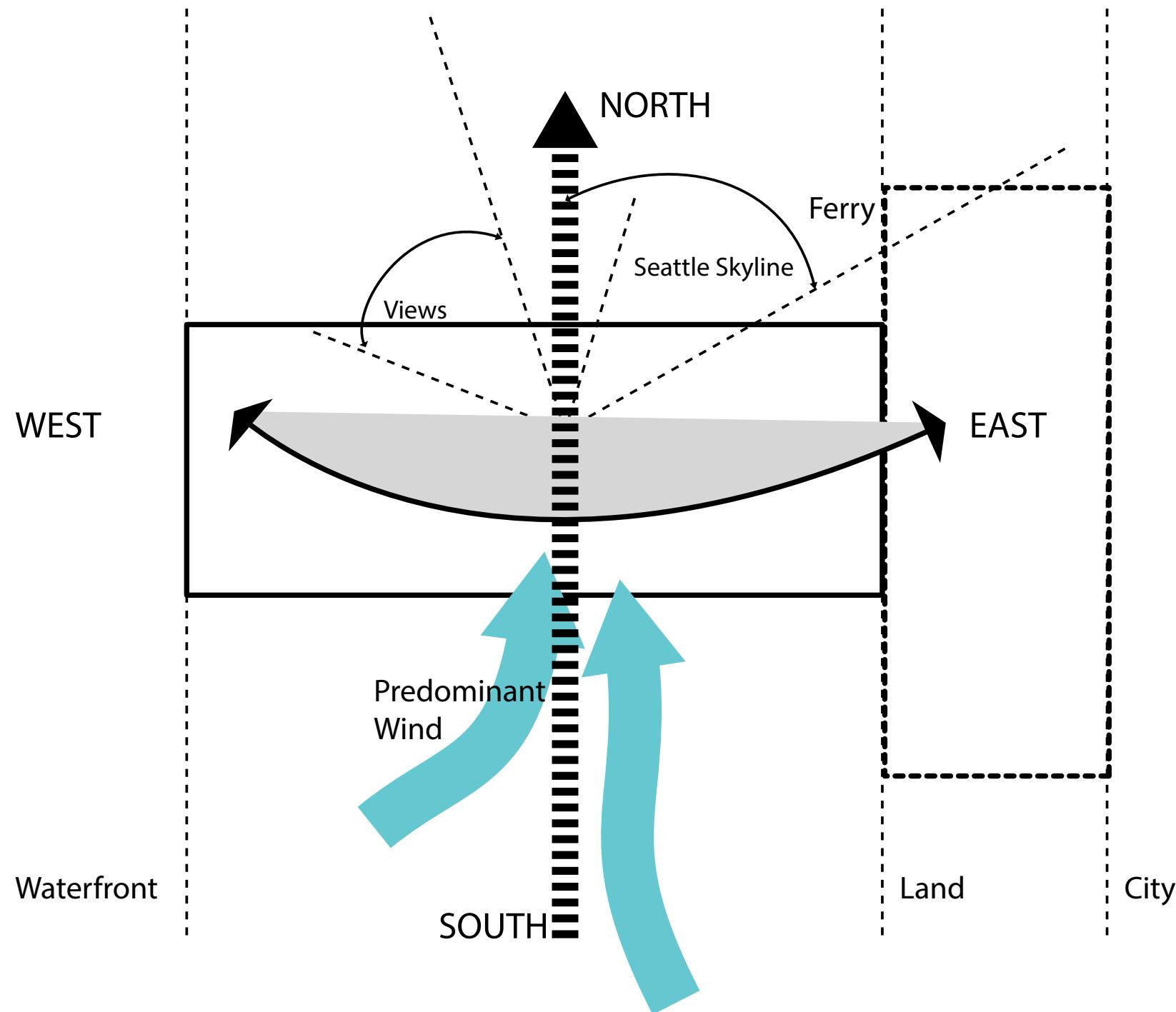
WATER EDGE

WATER EDGE

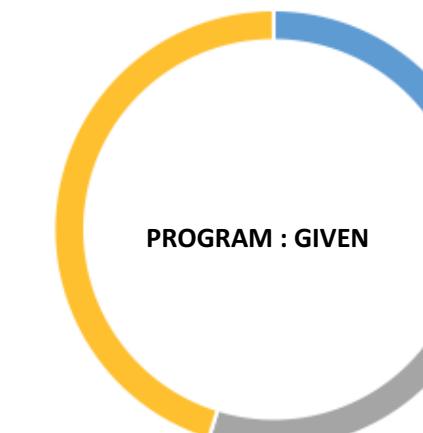
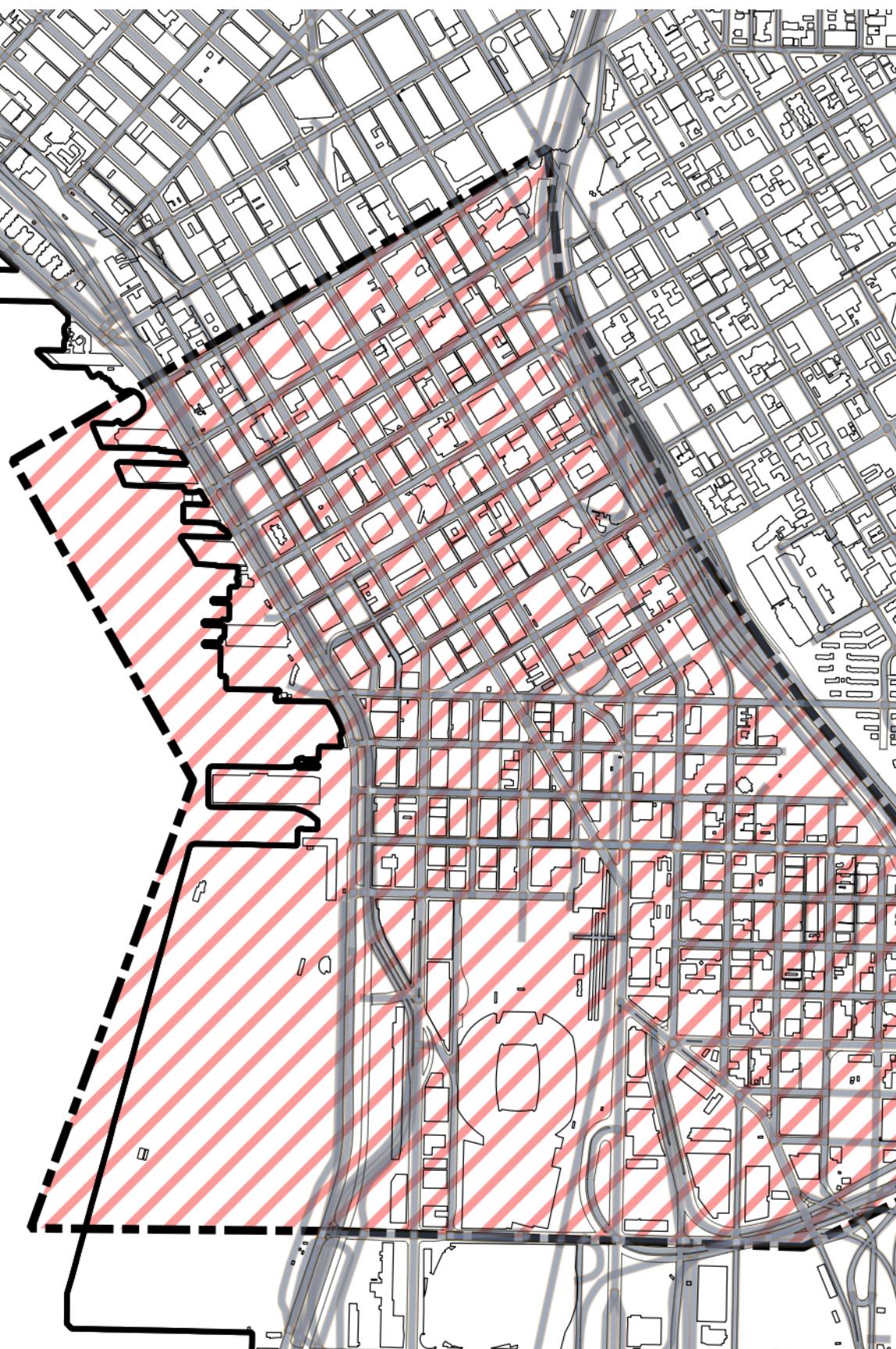
WATER EDGE

WATER EDGE

South/North Comfort Axis

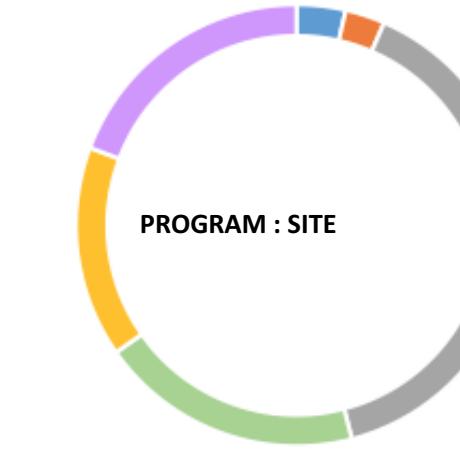


Program Analysis



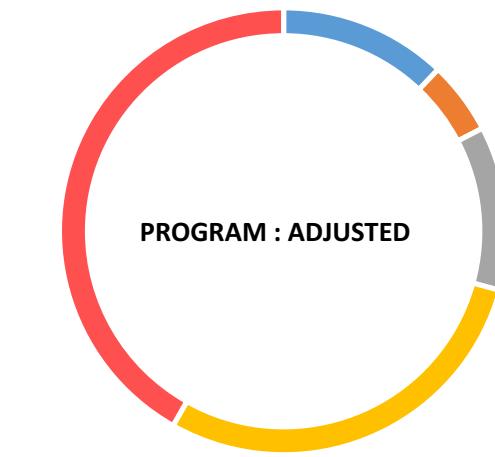
■ PUBLIC ■ ADMINISTRATION ■ RESEARCH ■ RESIDENTIAL

PROGRAM	NUMBER	SF/EACH	SF TOTAL	%
LOBBY	1	700	700	
RETAIL	1	5000	5000	9.1
TOILETS	6	250	1500	
CIRCULATION	1	2500	2500	
MECHANICAL	1	2000	2000	
TRASH	1	400	400	
BYCICLE	1	400	400	
PUBLIC			12500	23
DIRECTOR AND STAFF	1	800	800	
TEAM OFFICE	8	75	600	
CONFERENCE ROOM	2	500	1000	
SMALL OFFICE	6	100	600	
LARGE OFFICE	4	250	1000	
FILES, SERVERS, COPIERS,KITCHEN	1	1000	1000	
ADMINISTRATION			5000	9.1
RESEARCH DIRECTOR & STAFF	1	2500	2500	
RESEARCH OFFICES	12	200	2400	
SMALL CLASSROOMS	6	650	3900	
AUDITORIUM	1	3000	3000	
CONFERENCE AND WORKROOM	1	1000	1000	
RESEARCH			12800	23
RESIDENTIAL	1	25000	25000	45
FINAL TOTAL			55300	100



■ PUBLIC & RECREATIONAL ■ INDUSTRIAL ■ COMMERCIAL
■ RETAIL ■ RESIDENTIAL ■ OTHER

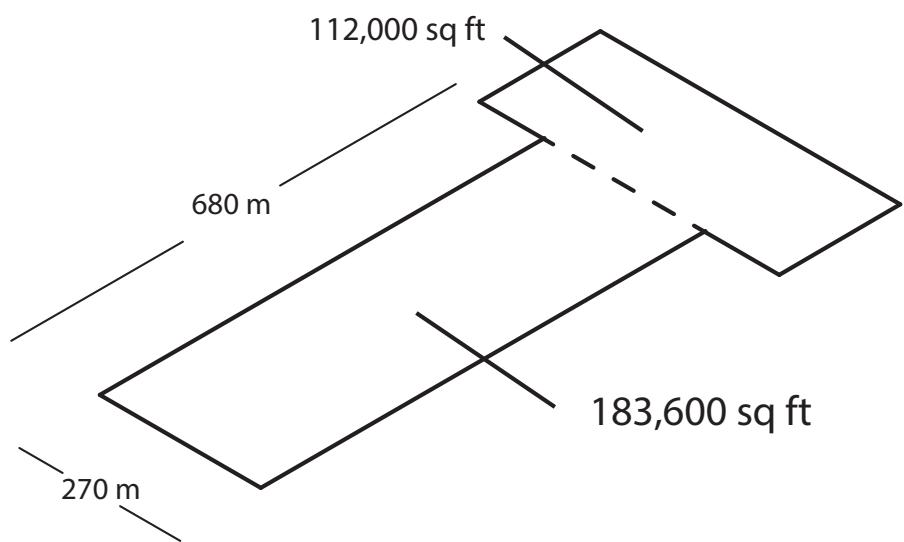
PROGRAM	NUMBER	%
PUBLIC ASSEMBLY	4	
CULTURAL ACTIVITIES	3	
PARKS	5	
REC ACTIVITIES	3	
EDUCATIONAL SERVICES	1	
PUBLIC & RECREATIONAL	16	3.6
UTILITIES	3	
MISC MANUF	6	
MARINE TRANSPORT	1	
RR TRANSPORT	3	
INDUSTRIAL	13	3
BUSINESS SERVICES	102	
REAL ESTATE SERVICES	6	
WHOLESALE TRADE	26	
HOTELS/MOTELS	14	
MISC SERVICES	14	
GOV SERVICES	14	
COMMERCIAL	176	39.5
RETAIL TRADE FOOD	13	
RETAIL RESTAURANT	3	
RETAIL GENERAL MERCH	16	
RETAIL AUTOMOTIVE MARIN	17	
OTHER RETAIL	37	
RETAIL	86	19.3
HOUSEHOLD 5 UNITS +	32	
HOUSEHOLD SINGLE	1	
HOUSEHOLD 2-4UNITS	1	
RESIDENTIAL CONDOS	28	
OTHER RESIDENTIAL	7	
RESIDENTIAL	69	15.5
OTHER	21	
UNDEVELOPED LAND	63	
AUTO PARKING	2	
OTHER	86	
FINAL TOTAL	446	100



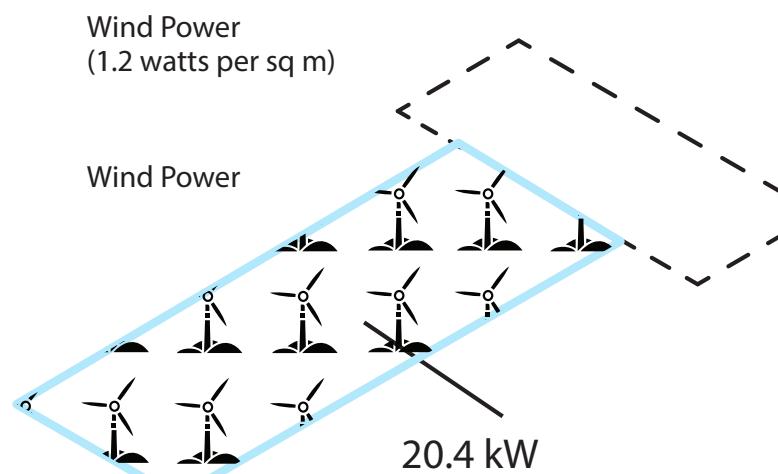
■ PUBLIC ■ ADMINISTRATION ■ RESEARCH
■ RESIDENTIAL ■ SITE (ADDITIONAL, NEW)

PROGRAM	NUMBER	SF/EACH	SF TOTAL
LOBBY	1	400	400
RETAIL	1	4300	4300
TOILETS	6	250	1500
CIRCULATION	1	2500	2500
MECHANICAL	1	2000	2000
TRASH	1	400	400
BYCICLE	1	400	400
PUBLIC			11500
DIRECTOR AND STAFF	1	800	800
TEAM OFFICE	8	75	600
CONFERENCE ROOM	2	500	1000
SMALL OFFICE	6	100	600
LARGE OFFICE	4	250	1000
FILES, SERVERS, COPIERS,KITCHEN	1	1000	1000
ADMINISTRATION			5000
RESEARCH DIRECTOR & STAFF	1	2000	2000
RESEARCH OFFICES	12	200	2400
SMALL CLASSROOMS	6	650	3900
AUDITORIUM	1	2000	2000
CONFERENCE AND WORKROOM	1	1000	1000
RESEARCH			11300
RESIDENTIAL	1	27500	27500
COVERED PLAZA / SEASONAL MARKET	1	3000	3000
SITE RESTORATION	1	13000	13000
NEW FERRY LANDING	1	3000	3000
COVERED OUTDOOR RECREATION	1	20700	20700
TOTAL SITE			39700
FINAL TOTAL			95000

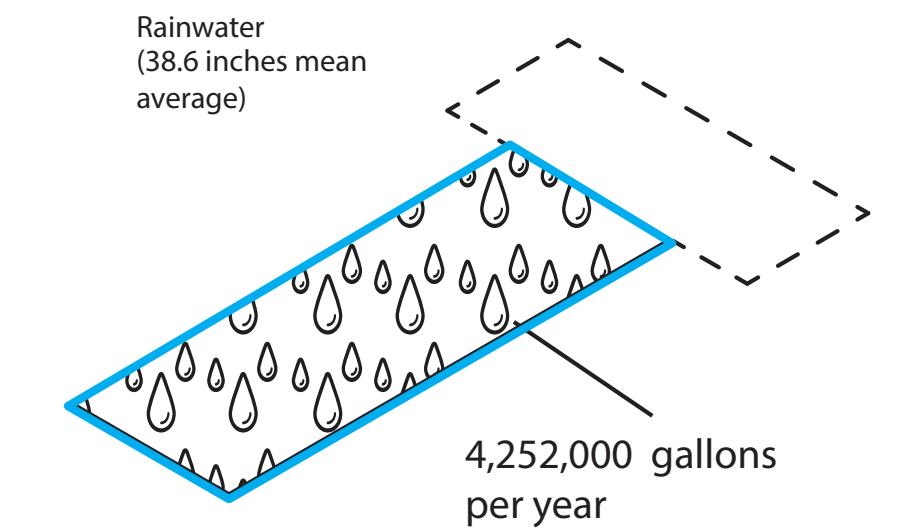
Renewable Energy Potential Resources Comparison



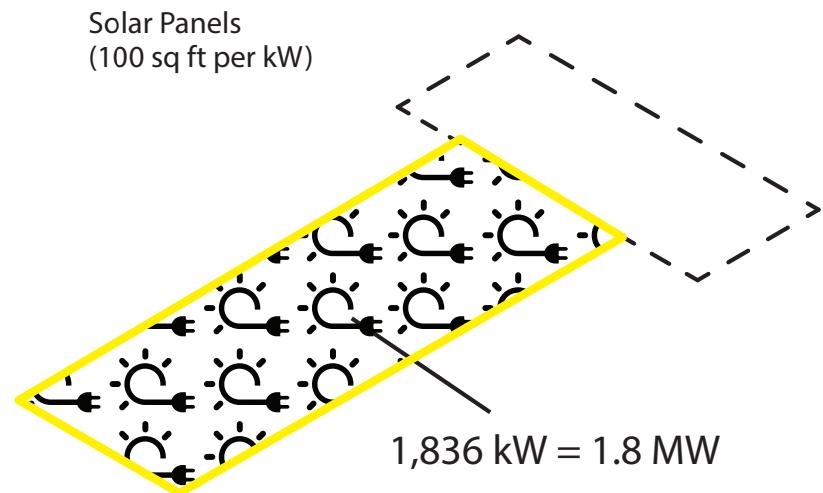
Nowadays the dock is a large brownfield



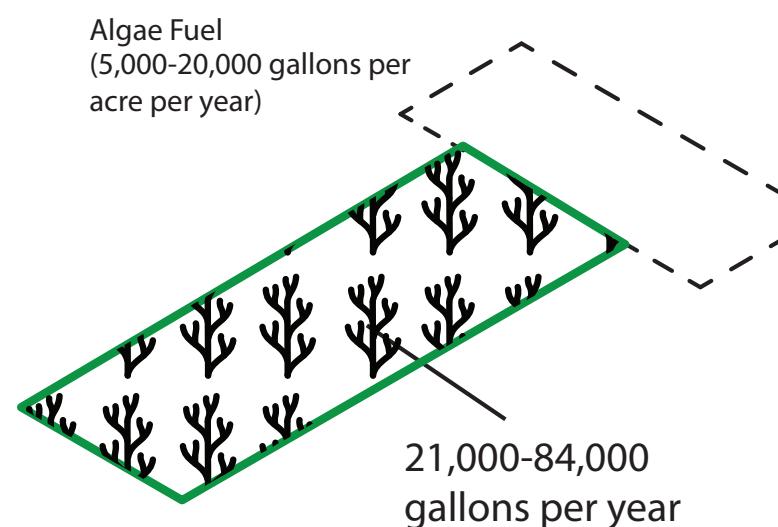
What is the site filled with turbines?



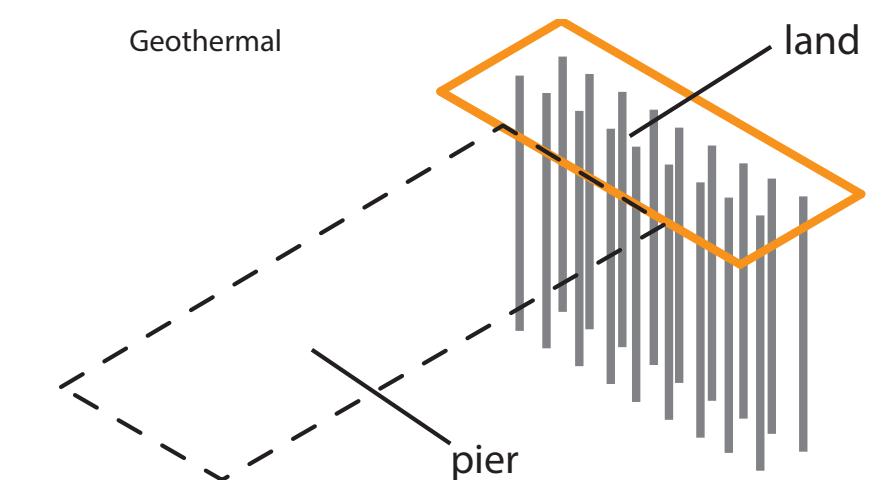
Or, how much rainwater can be collected?



Or PV panels?

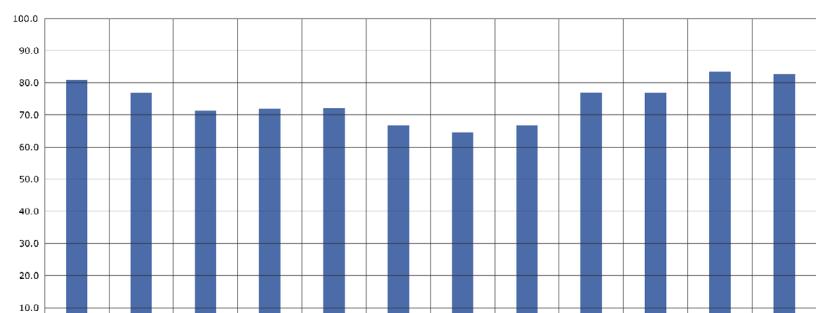
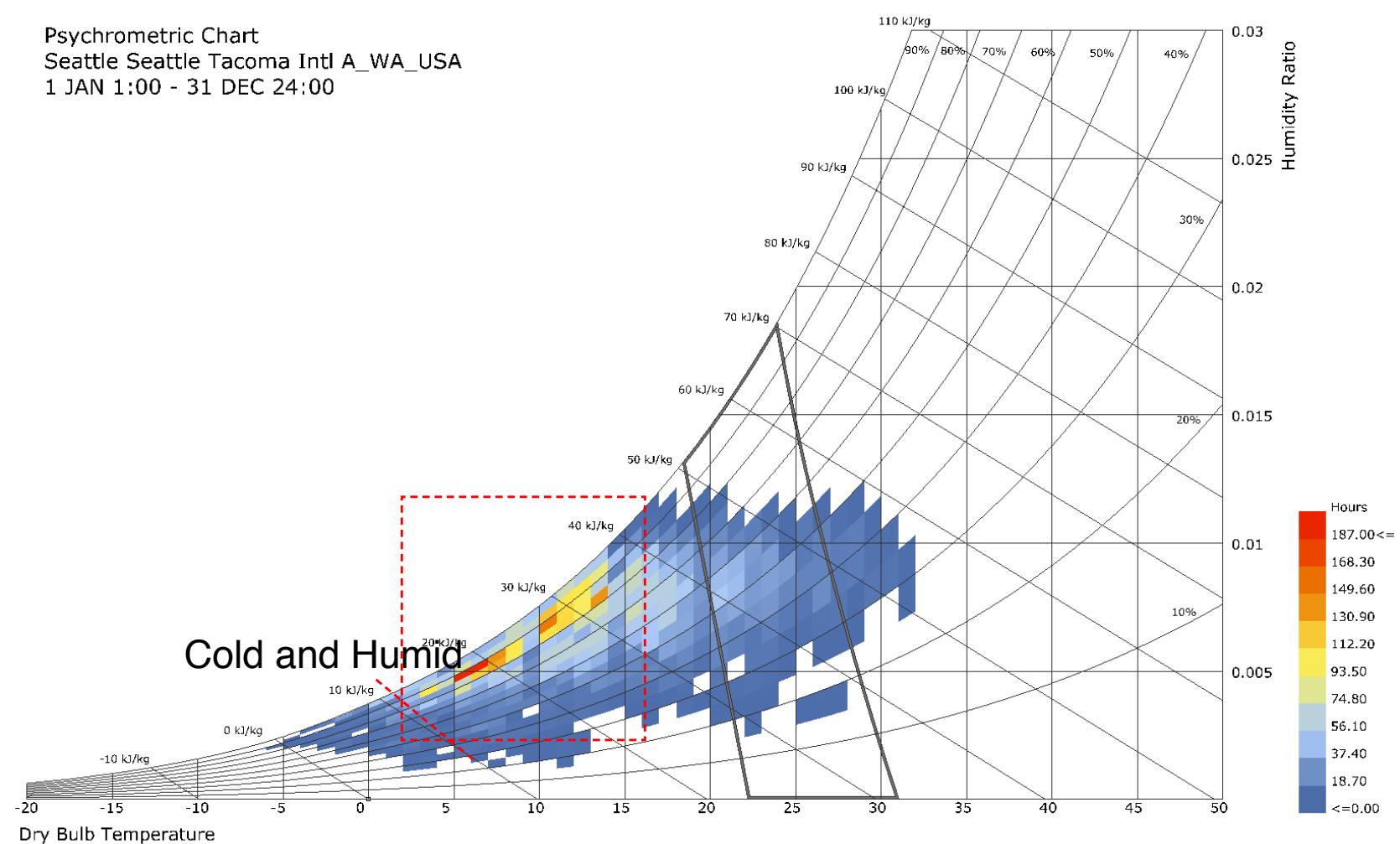


Or an algae field?

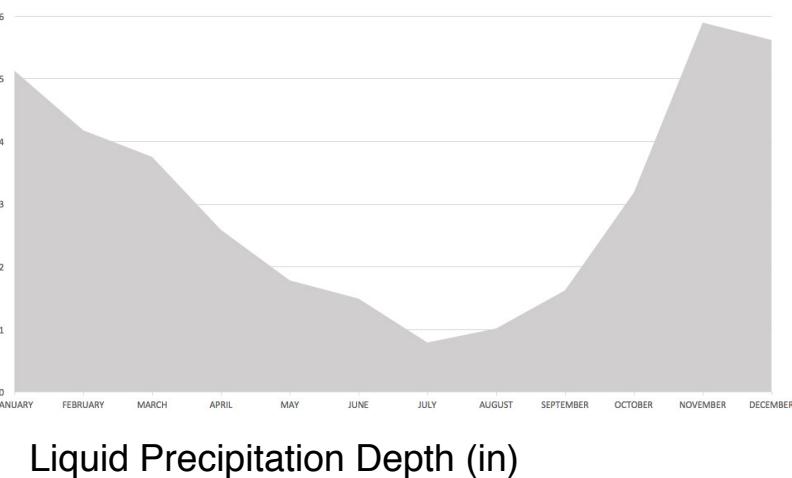


Environmental Analysis

Psychrometric Chart
Seattle Seattle Tacoma Intl A_WA_USA
1 JAN 1:00 - 31 DEC 24:00

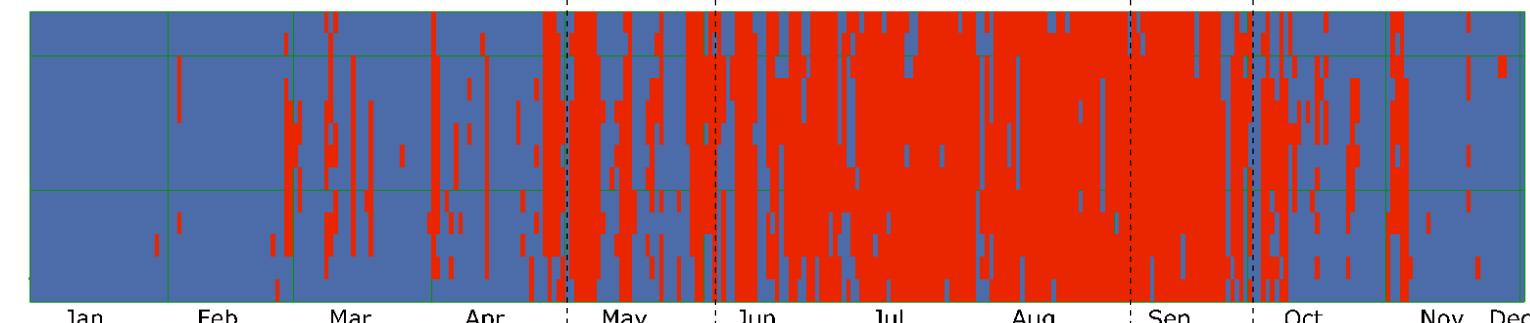


Relative Humidity (%)

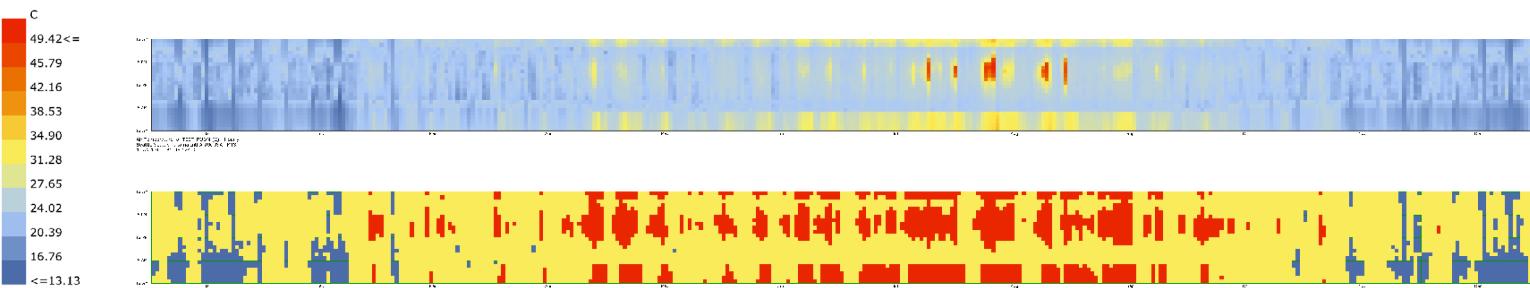


Liquid Precipitation Depth (in)

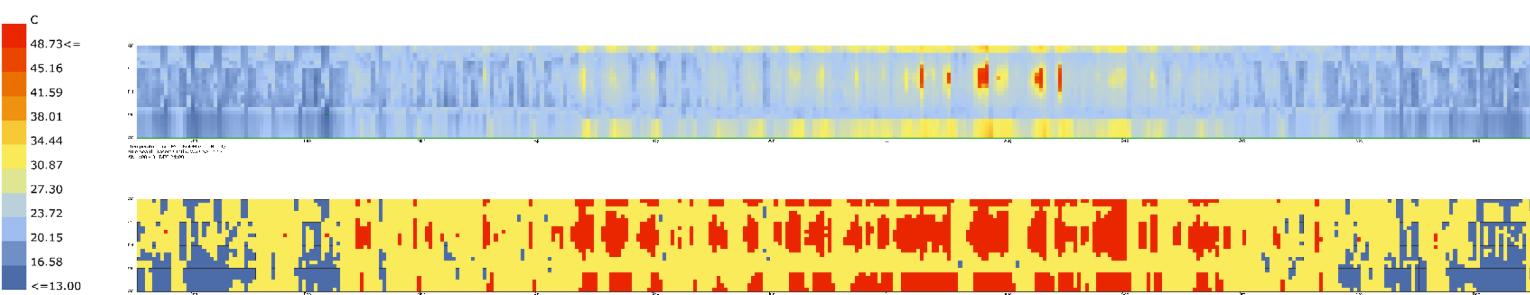
Outdoor and Adaptive Comfort



Residential case study - adaptive comfort 72% (with natural ventilation)



Office case study - adaptive comfort 67% (with natural ventilation)



Typical Weeks Analysis



Heating Design Temp. -4.2°C
Cooling Design Temp. 29.4°C

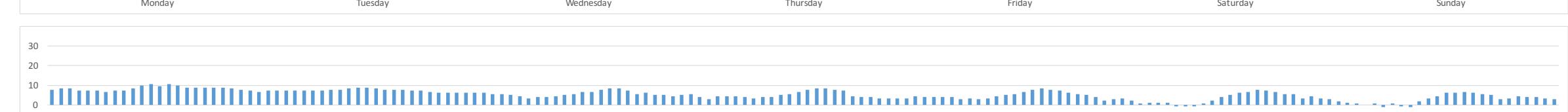
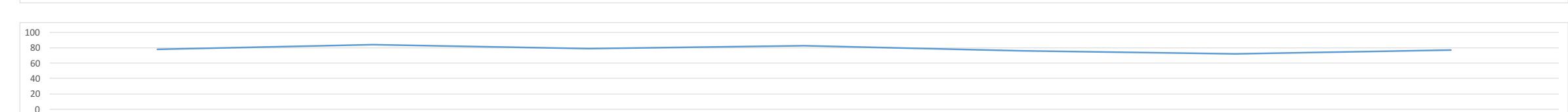
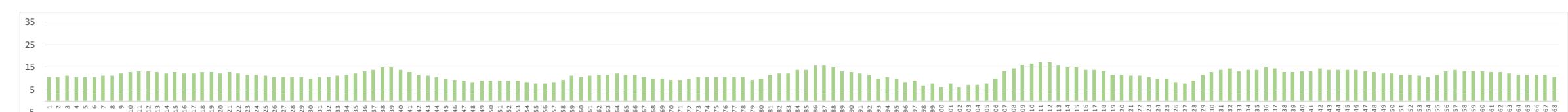
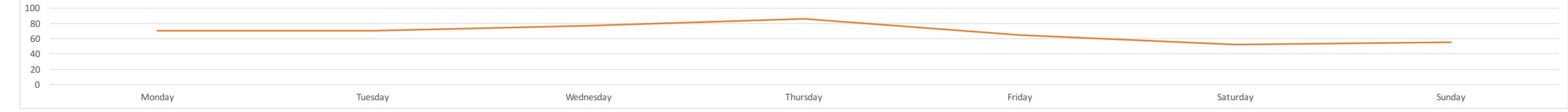
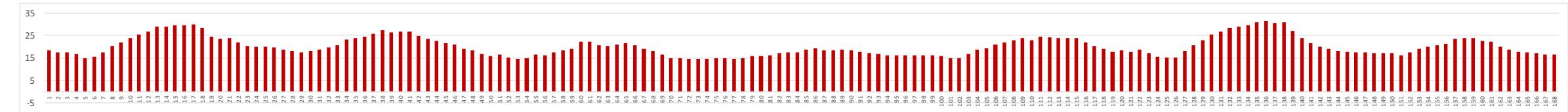
Hottest Week is in August, between the 24th and 30th.

Typical **hot week** is in July, between the 13th to the 19th.

Typical **week** is in October, between the 20th and the 26th.

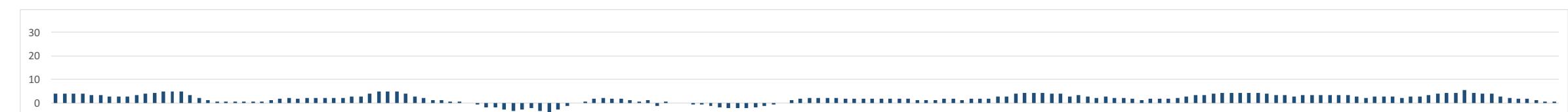
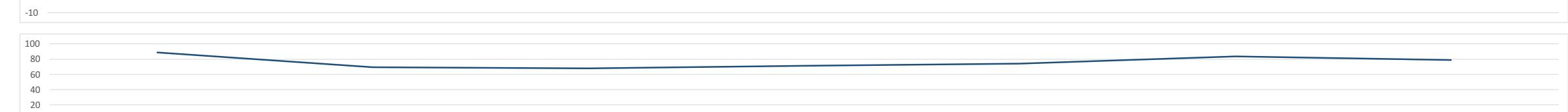
Typical **cold week** is in February, between the 3rd and the 9th.

Extreme cold is in January, between the 13th and the 19th.



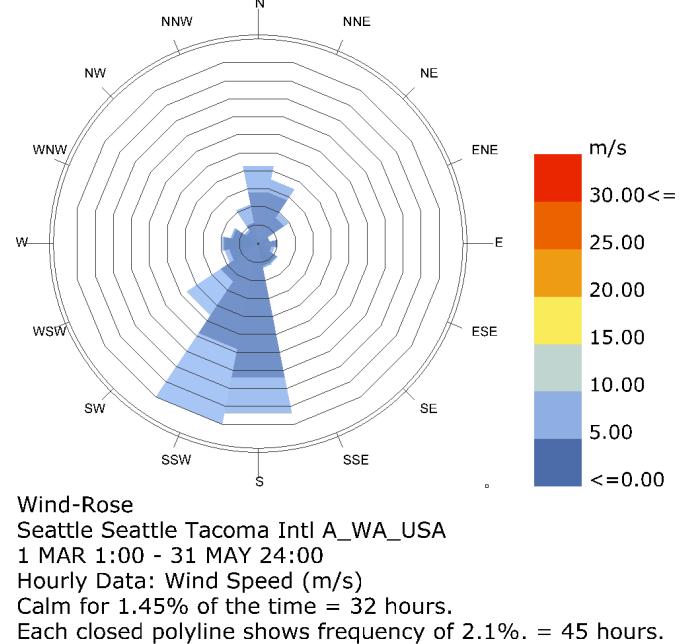
Cooling setpoint 18.3°C
Heating setpoint 23.3°C

Annual HDD, 2675.35
Annual CDD, 36.45

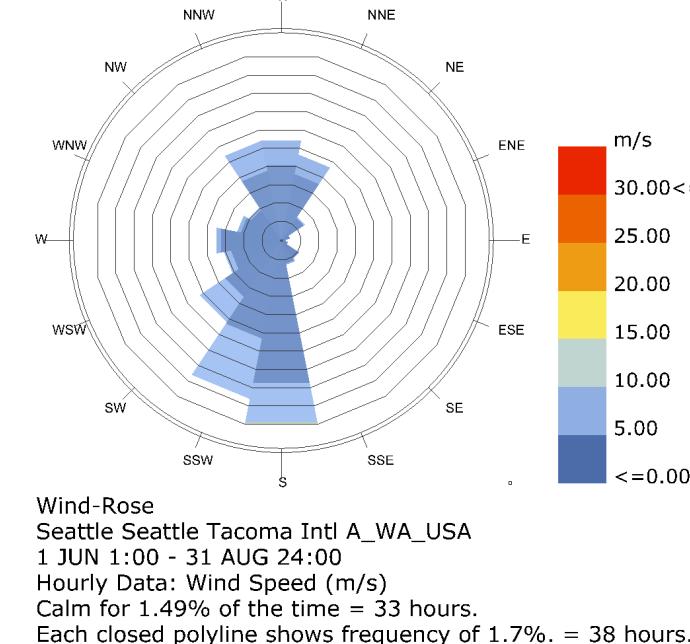


Wind Speed and Direction

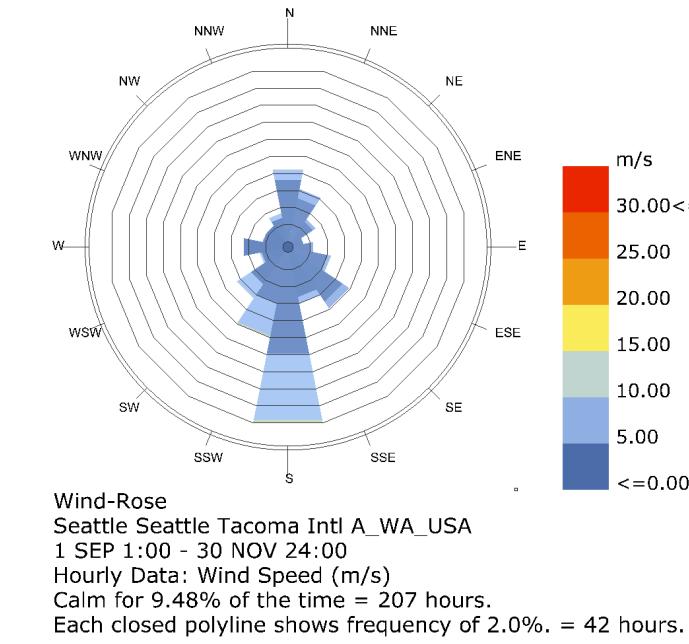
Spring



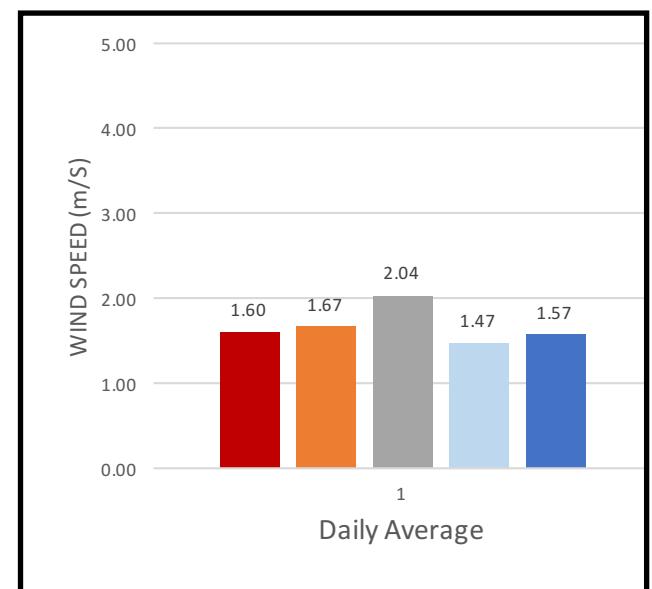
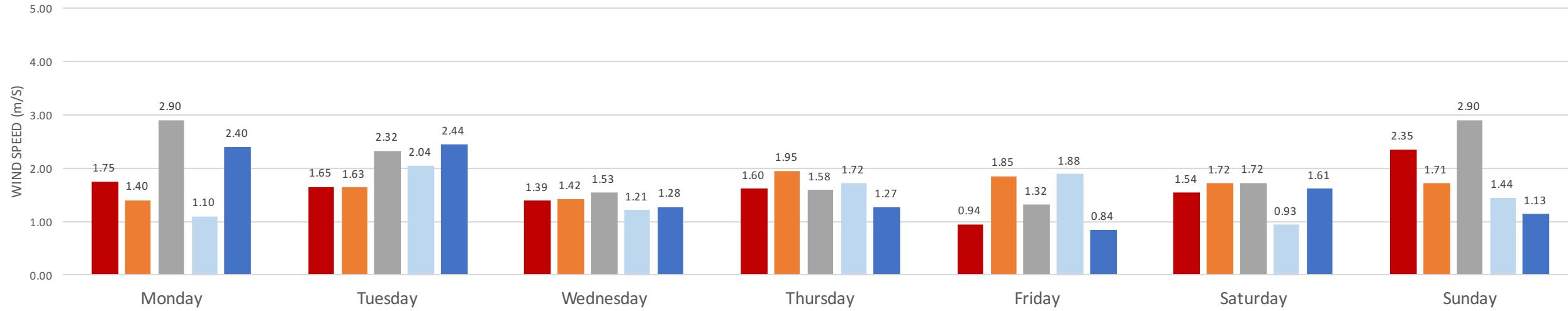
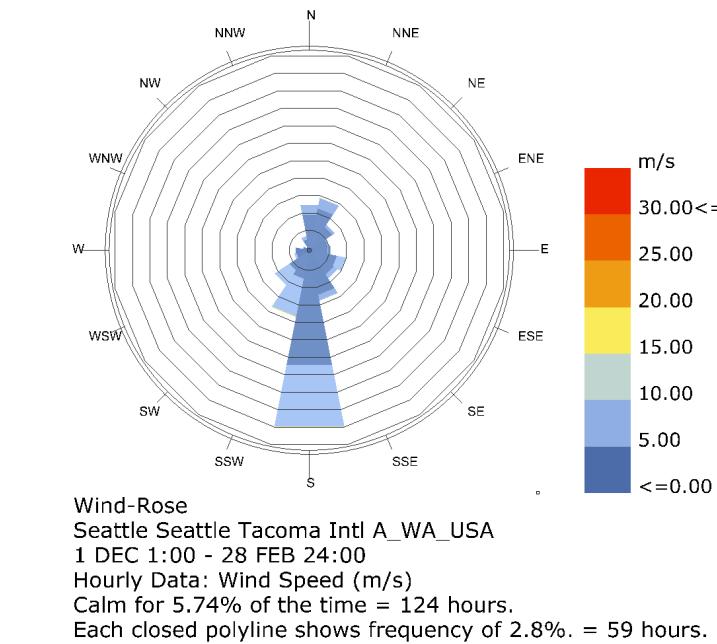
Summer



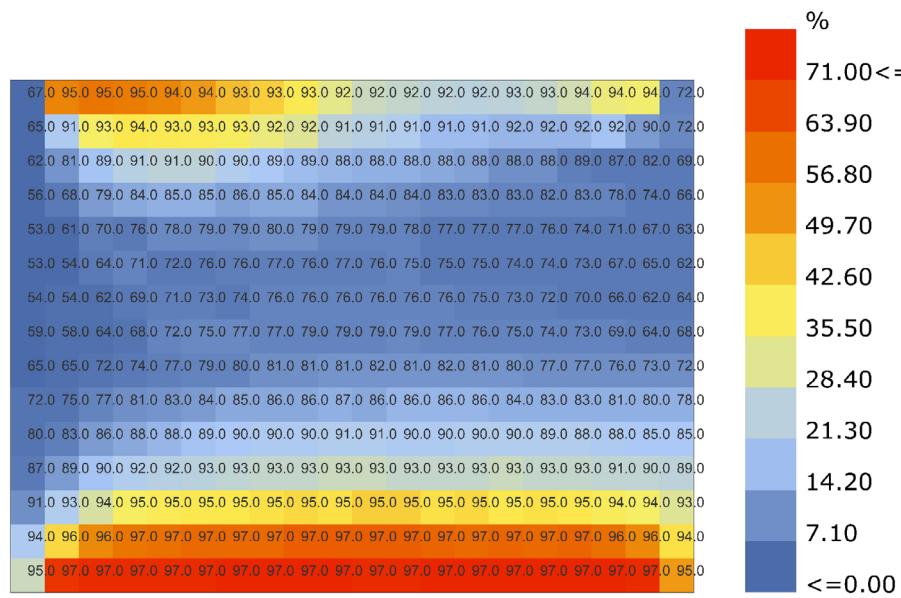
Fall



Winter

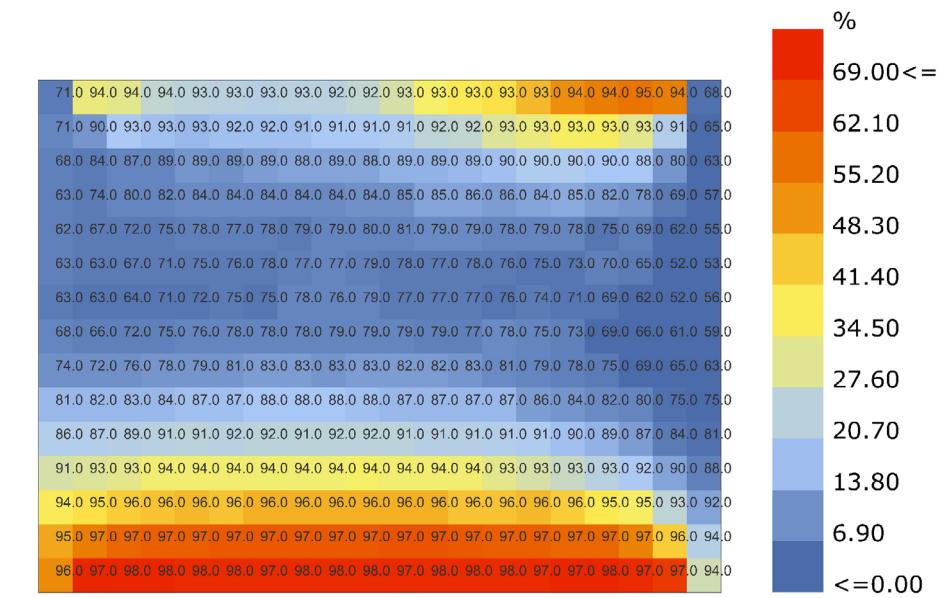
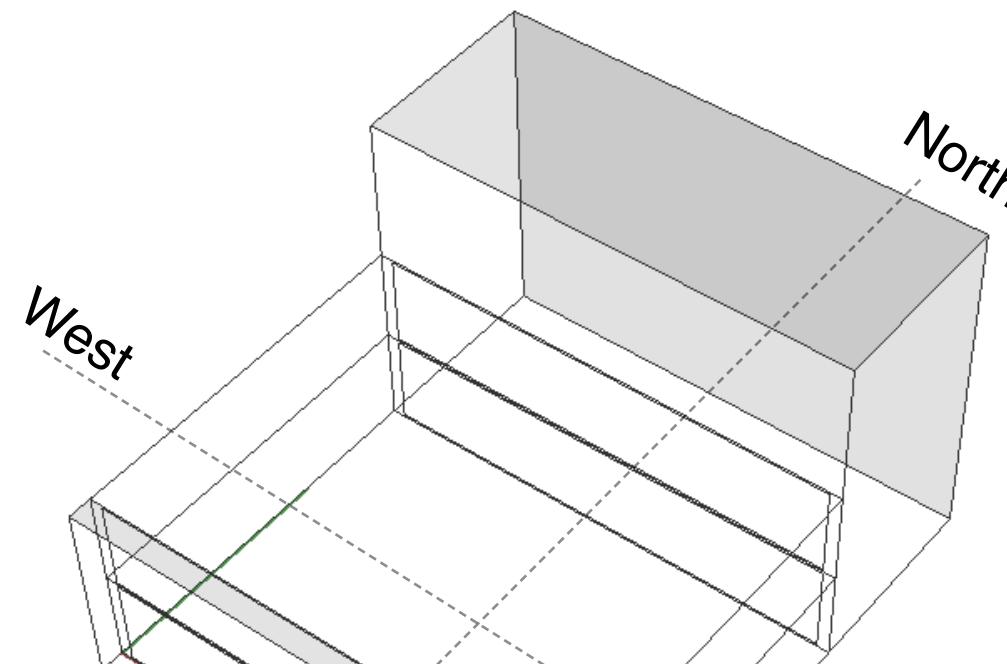


Daylighting Analysis



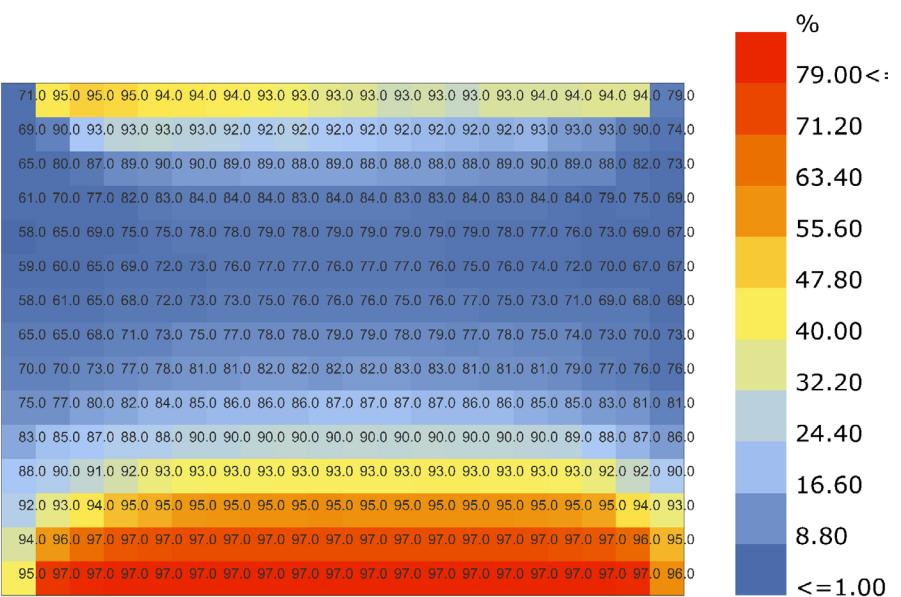
annual analysis
sda:100.00

West



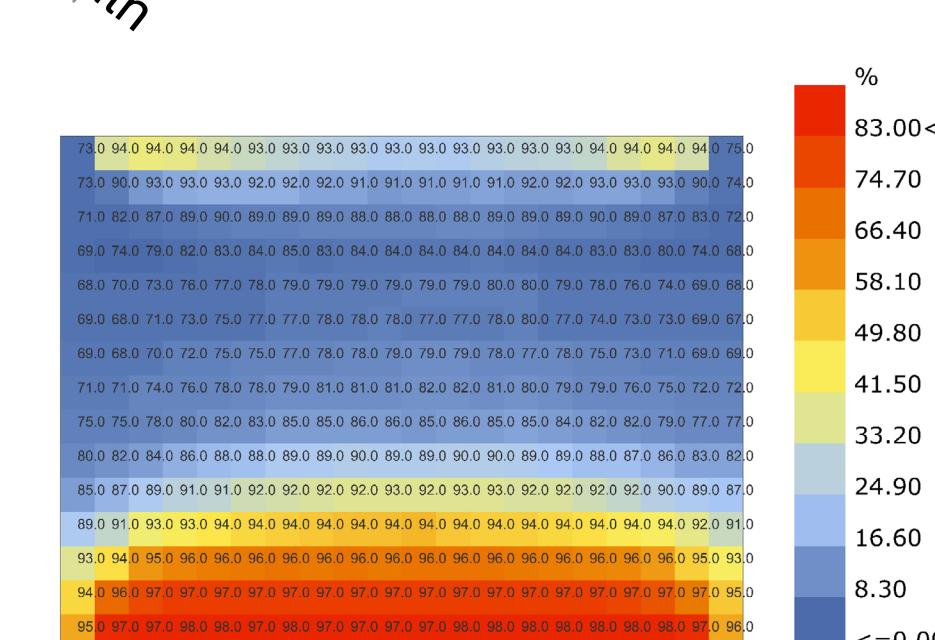
annual analysis
sda:100.00

East



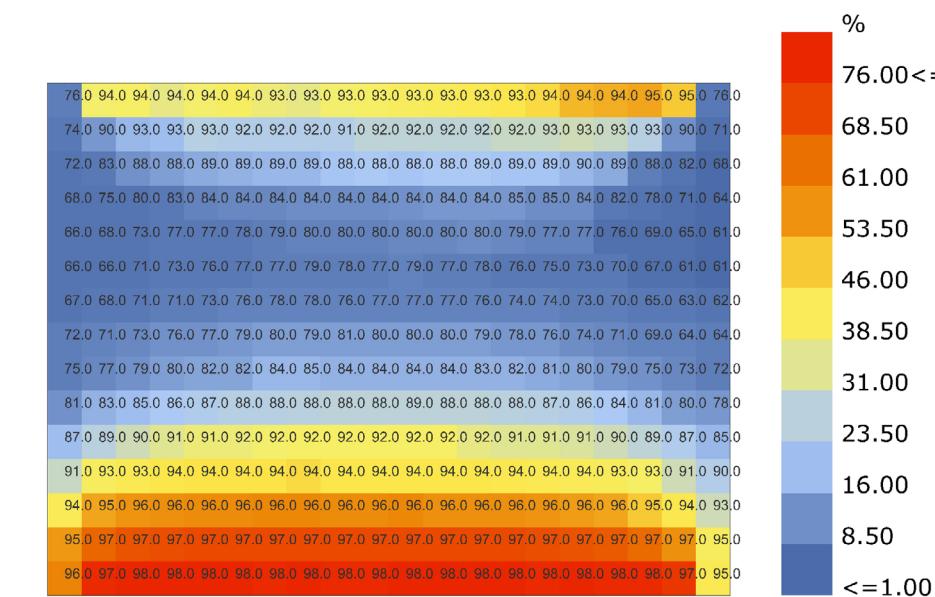
annual analysis
sda:100.00

South West



annual analysis
sda·100.00

South



annual analysis
sda:100.00

South East

BROWNFIELD REMEDIATION 26,901sq.m

Site gross area; impermeable, concrete surface

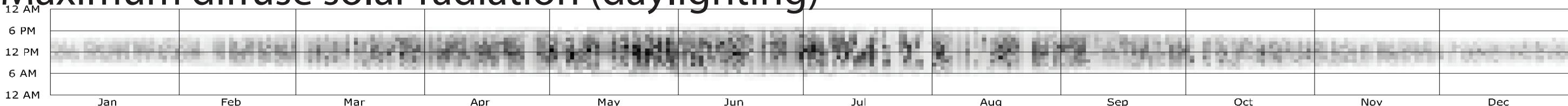
DAYLIGHTING 33%

<50% Cloud Cover



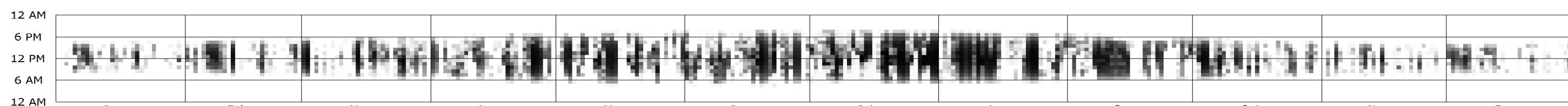
SOLAR RADIATION 571 wh/m²

Maximum diffuse solar radiation (daylighting)



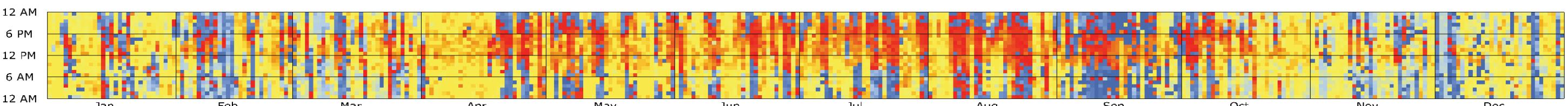
SOLAR RADIATION 940 wh/m²

Maximum direct solar radiation (winter-garden & PV)



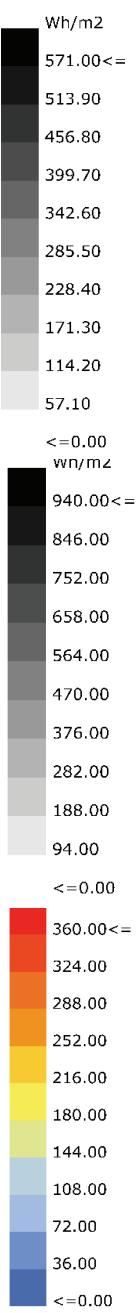
COLD WIND DEFLECTION 50% SE 3.75 m/s

Average wind speed from SE >50% of the year



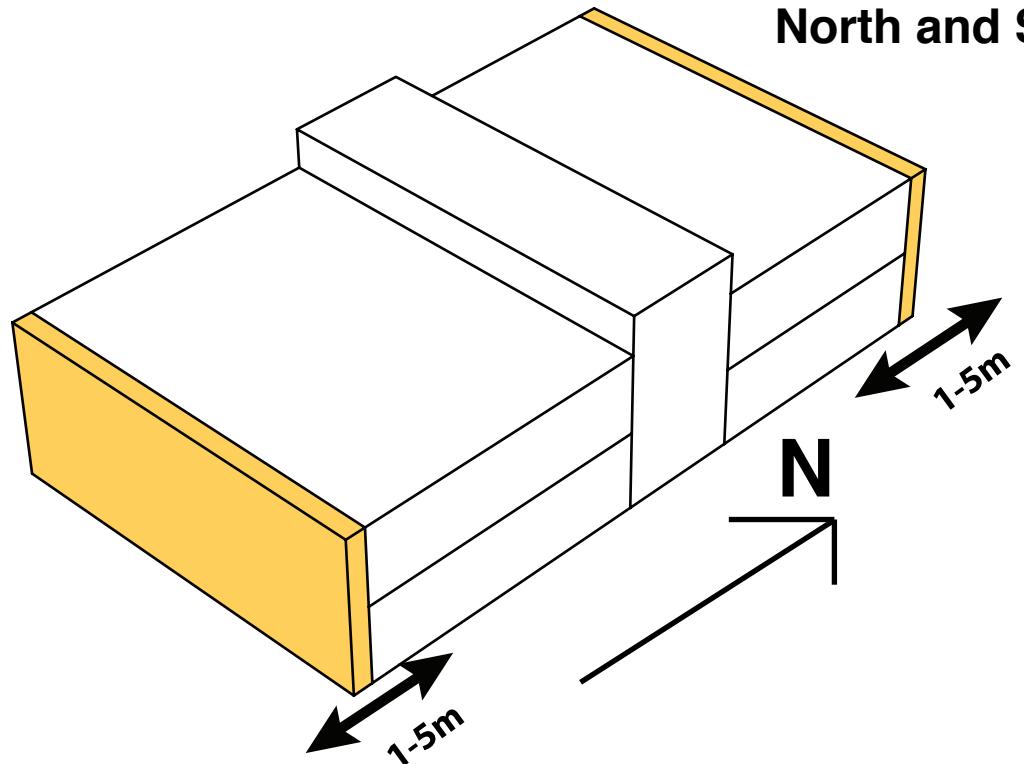
RAINWATER MANAGEMENT 50% 38.6 in

Annual mean precipitation; rain >50% of the year



100%

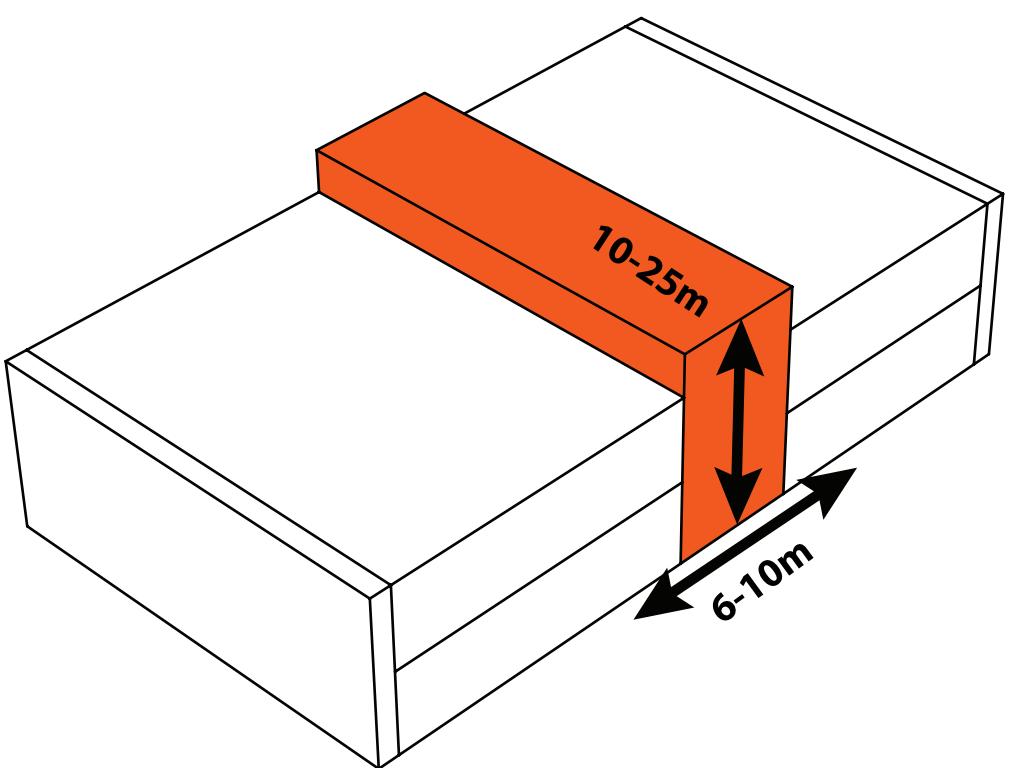
North and South Buffer Width Optimization



In winter, south buffer performs better at a minimum width; on the contrary the northern buffer width has to be increased to improve residential units insulation.

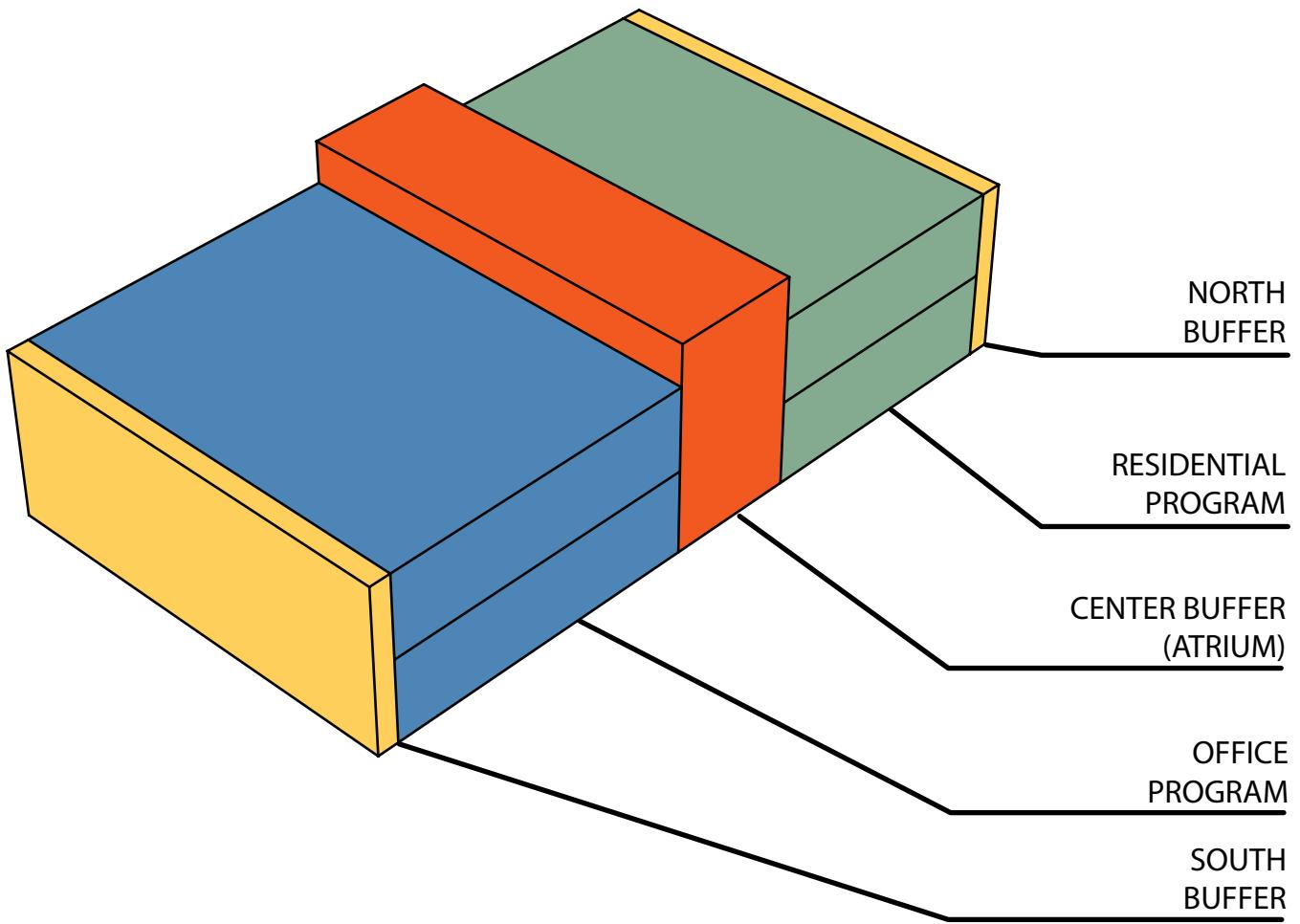
Not taking into account stack-effect, atrium performances are significantly affected by its height: low heights provide higher operative temperatures.

Atrium Height and Width Tuning

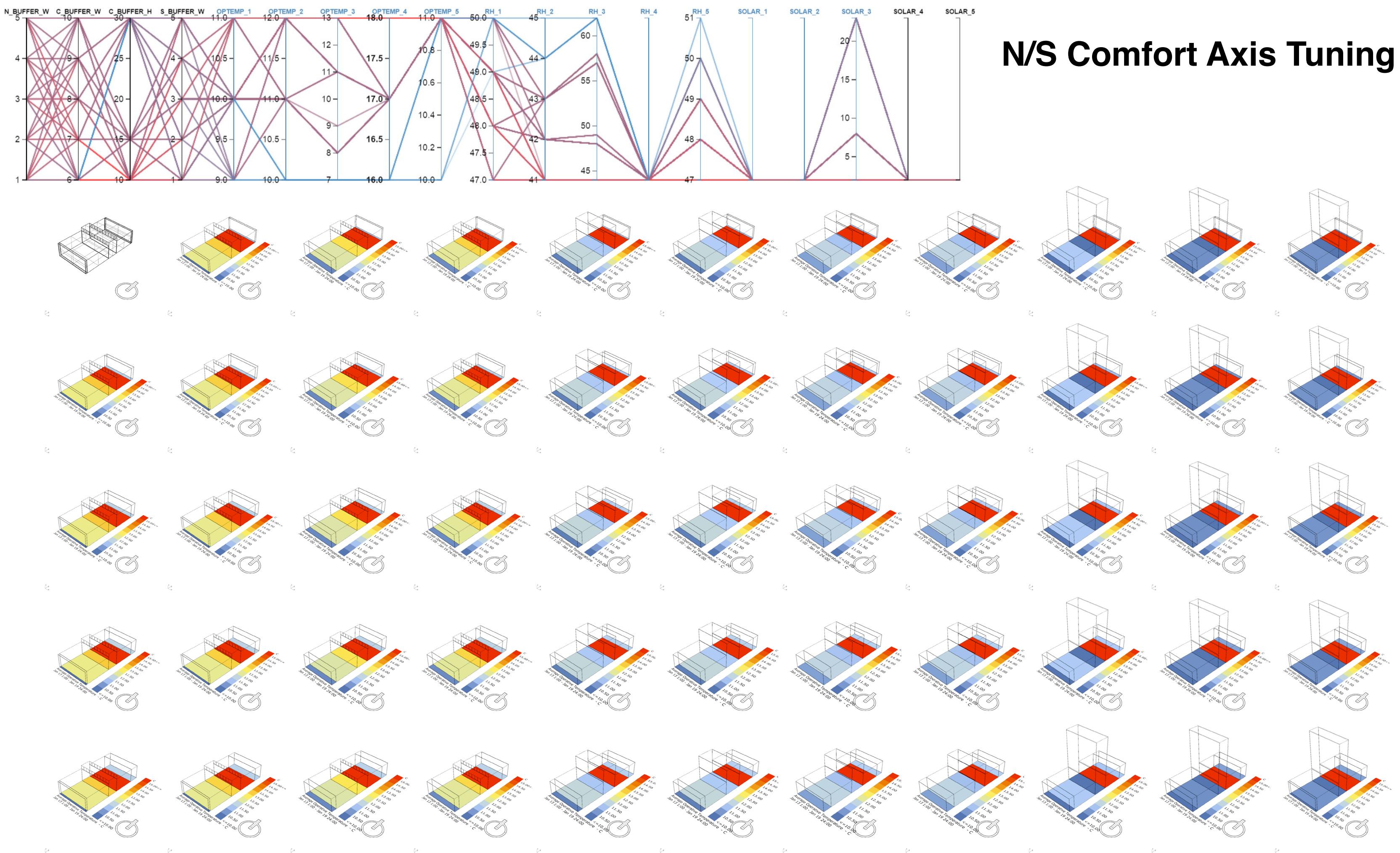


N/S Comfort Axis Study

In an effort to achieve a prototypical program module, the first step was parametric optimization. Variables investigated are the widths of the three buffer spaces and the height of the center atrium.

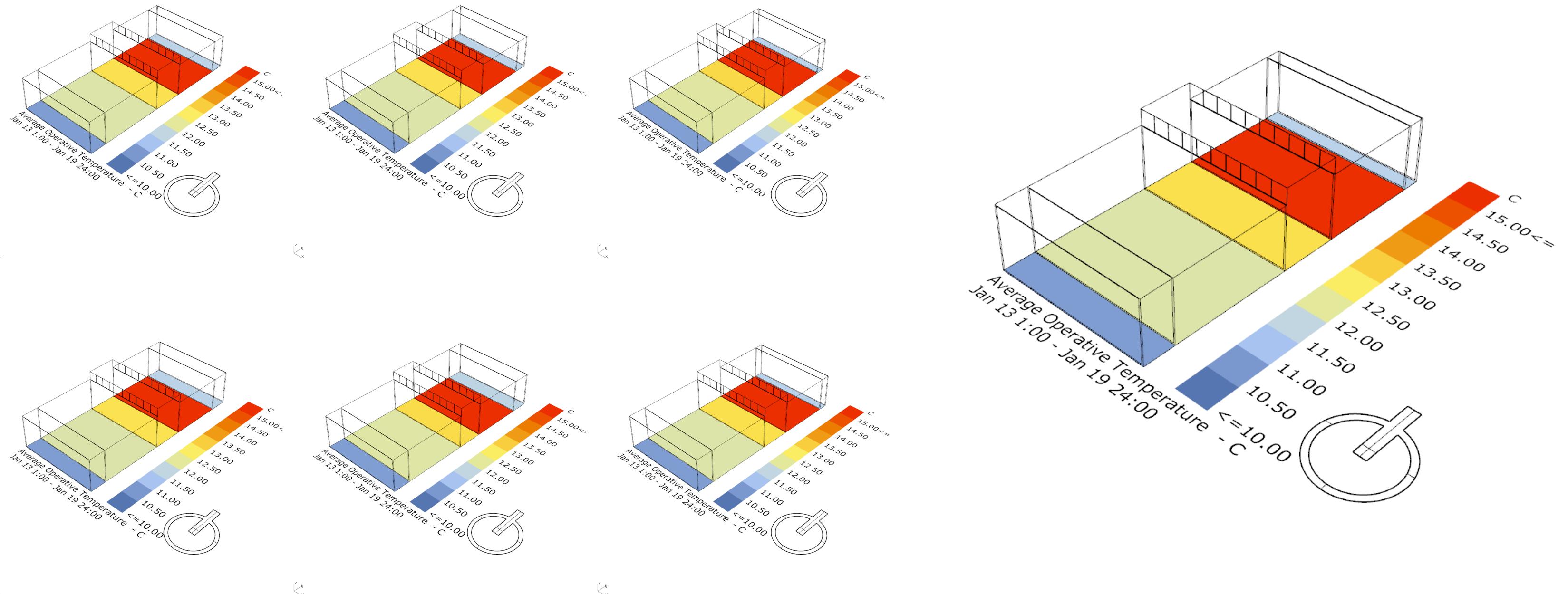
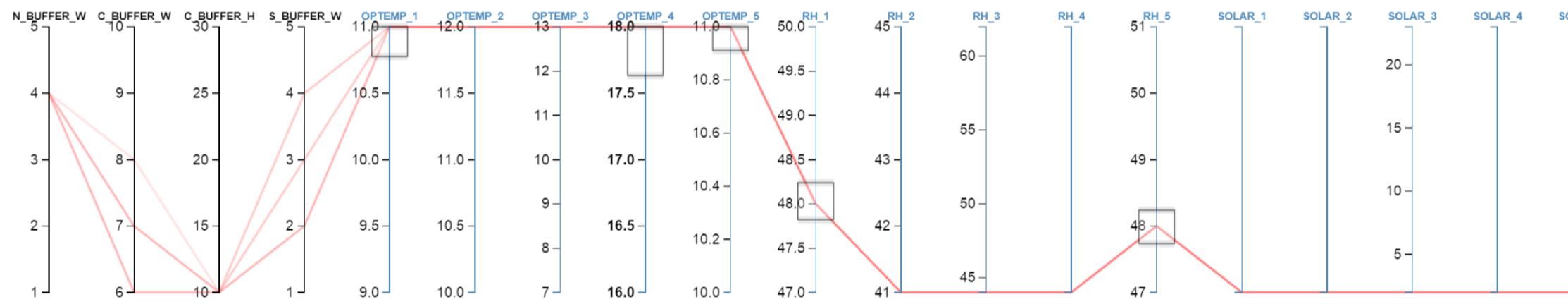


N/S Comfort Axis Tuning



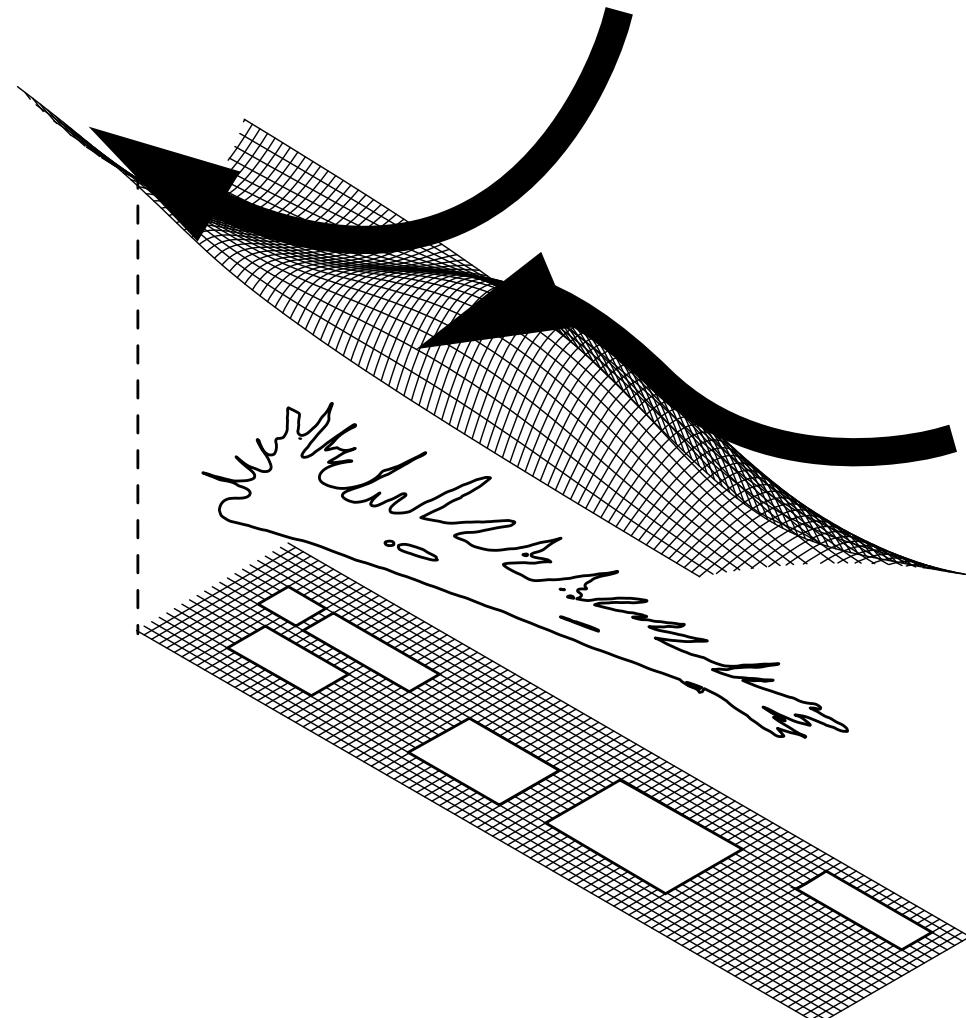
Optimal Winter Comfort Axis Configuration

Optimum configuration reduces RH in the buffer zones while maximizing operative temperature in the permanent occupied zones. Overall the most optimum configuration one that minimizes the construction, while optimizing space.

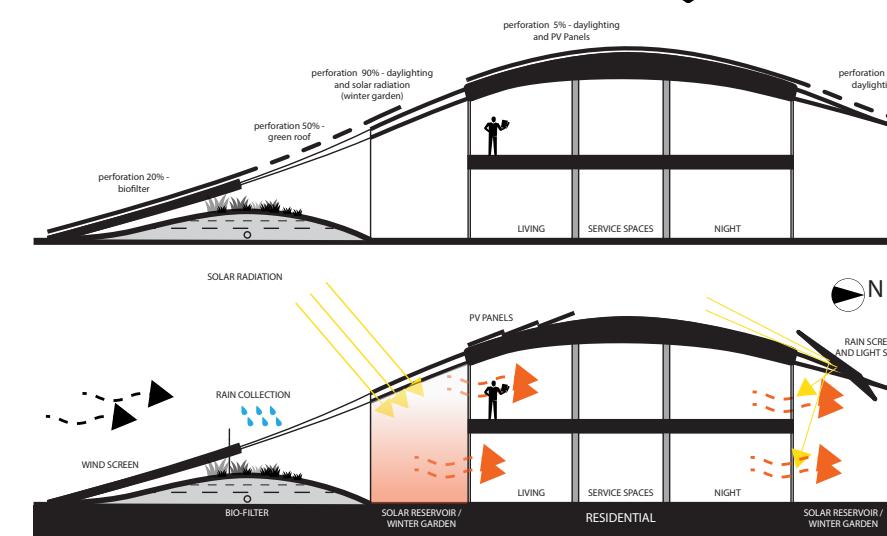
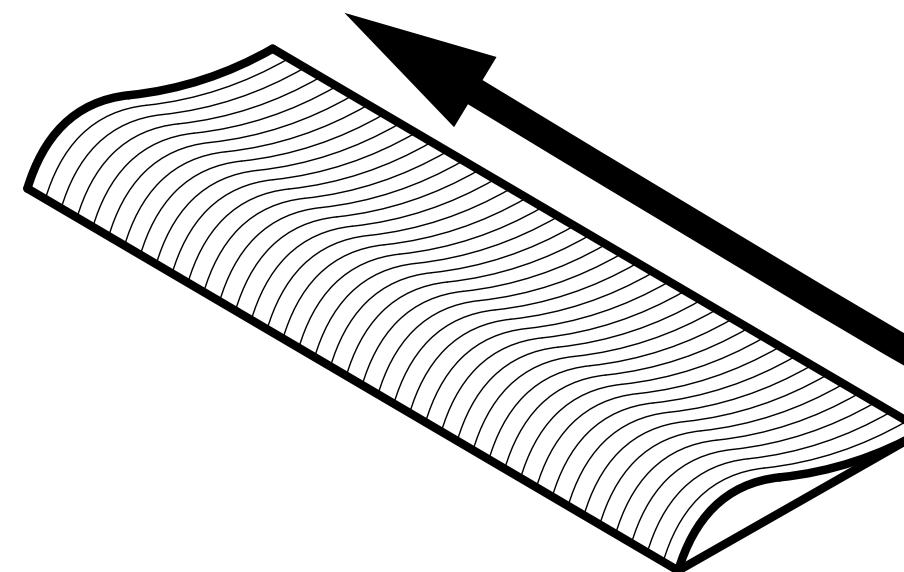


Concept Derivation

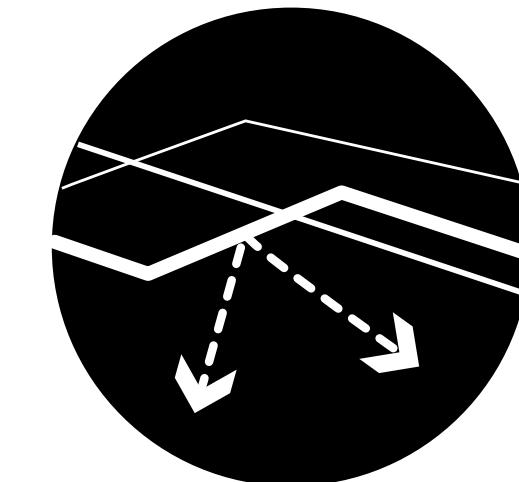
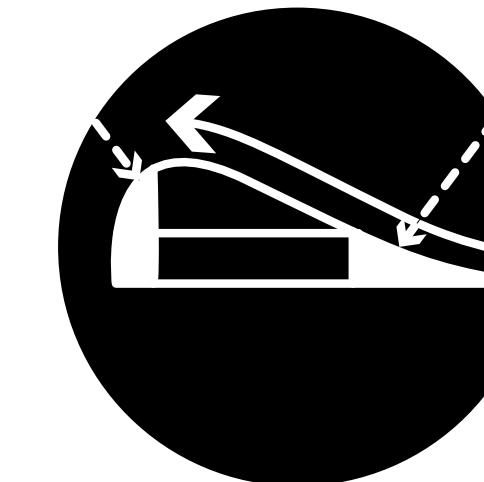
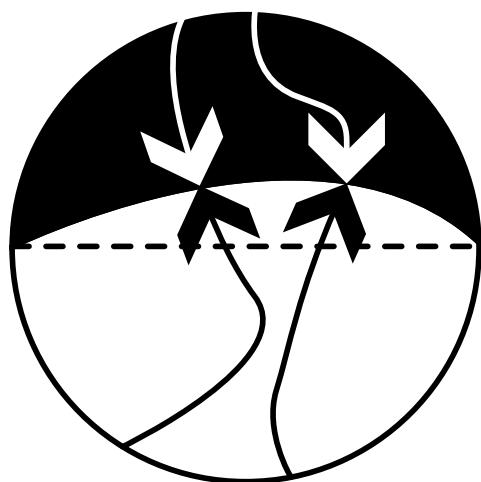
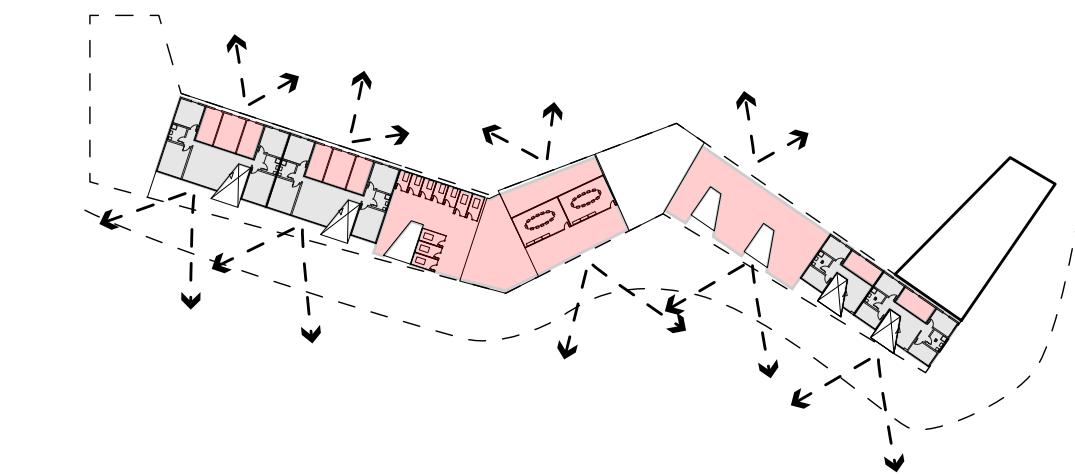
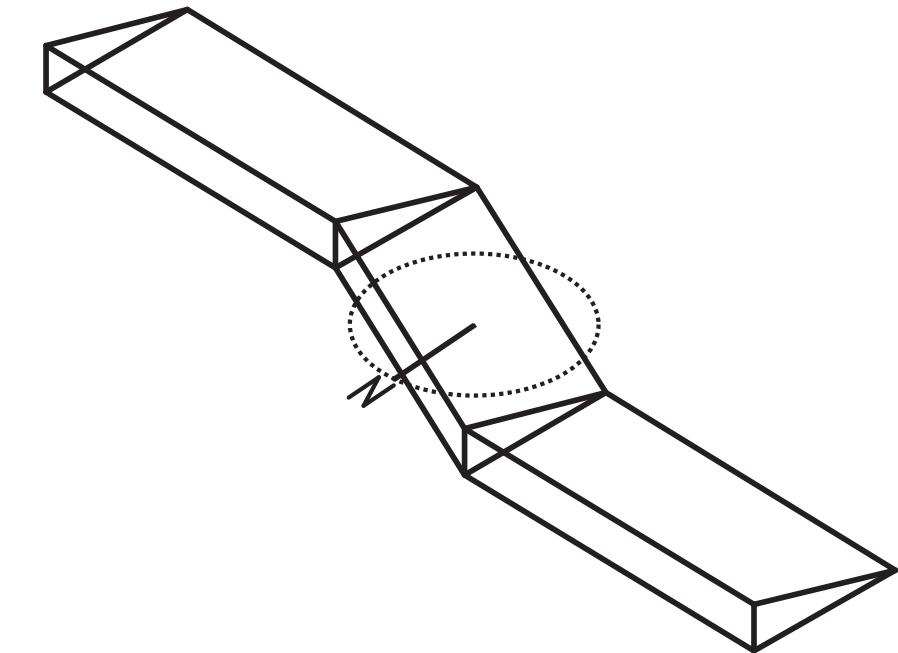
PIN UP 2 // JANUARY



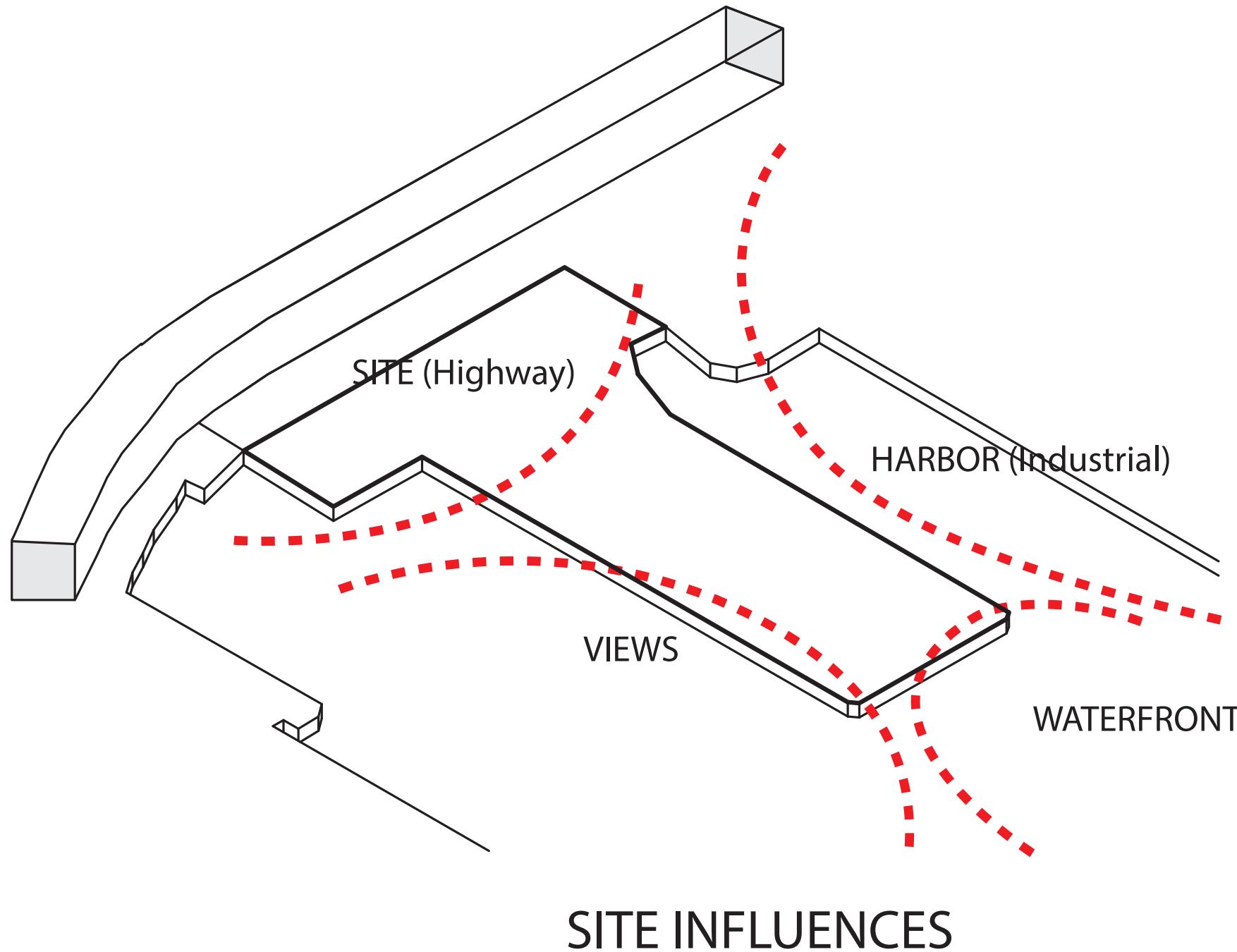
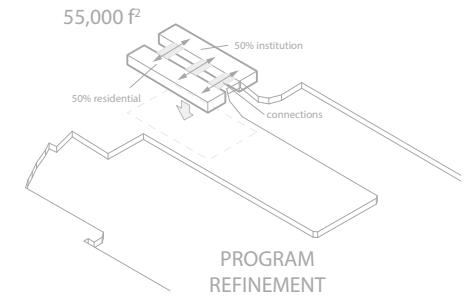
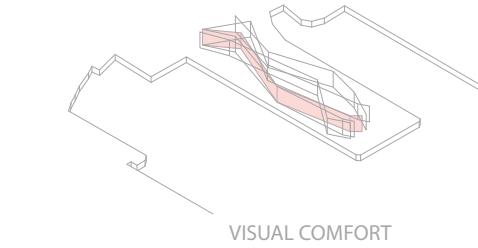
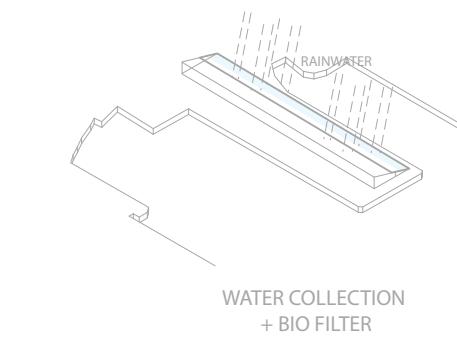
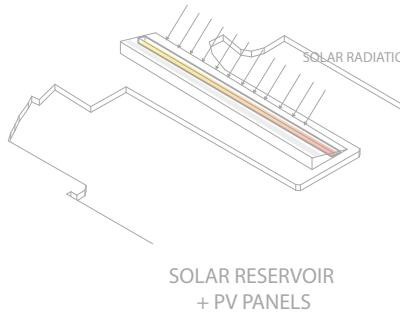
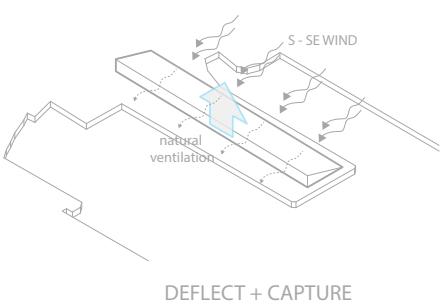
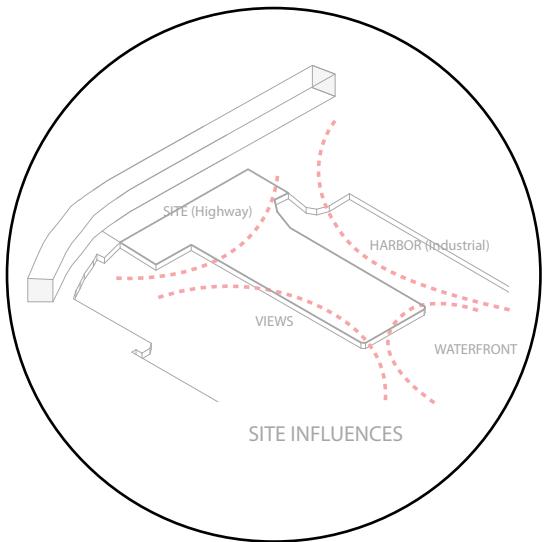
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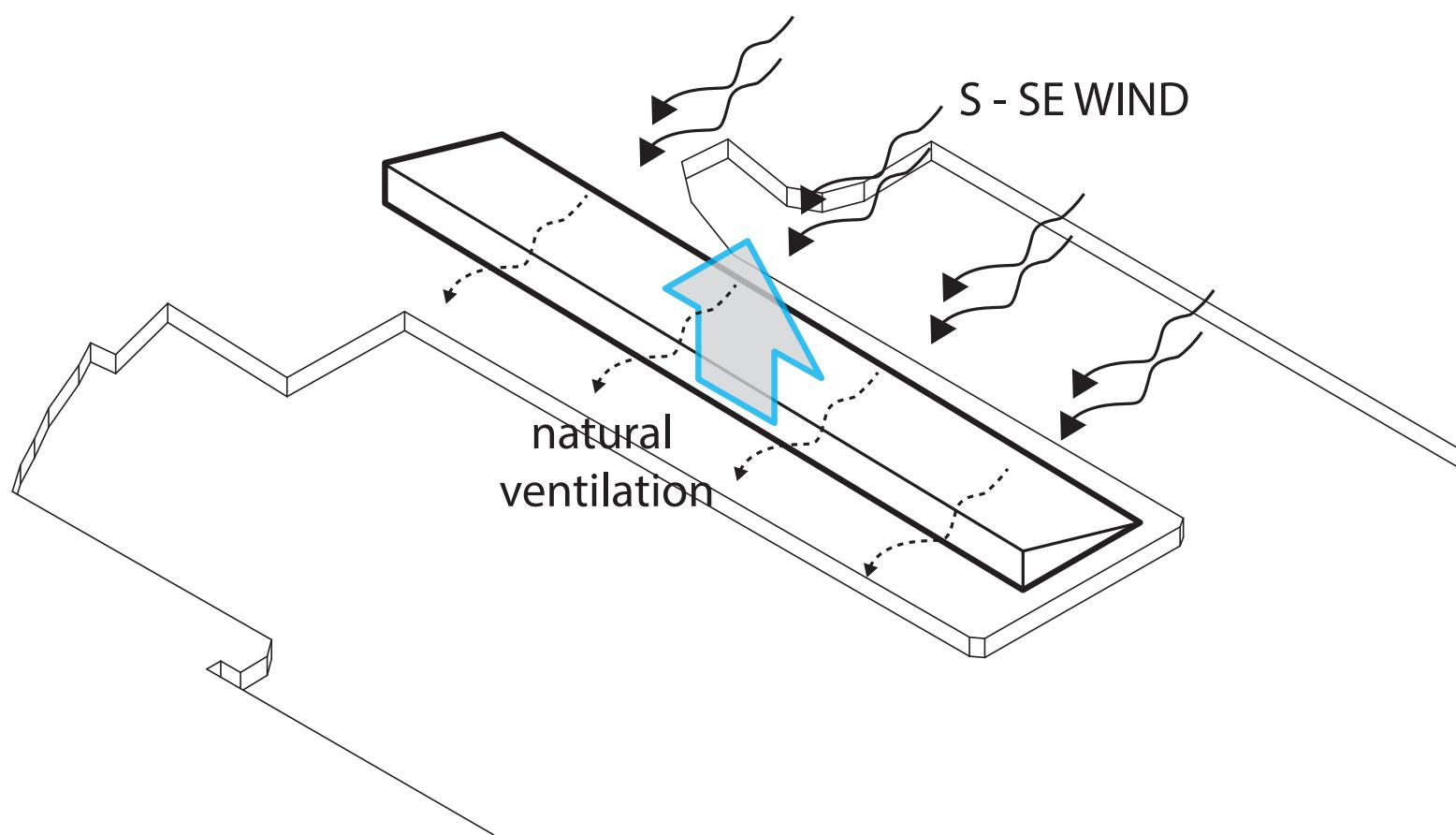
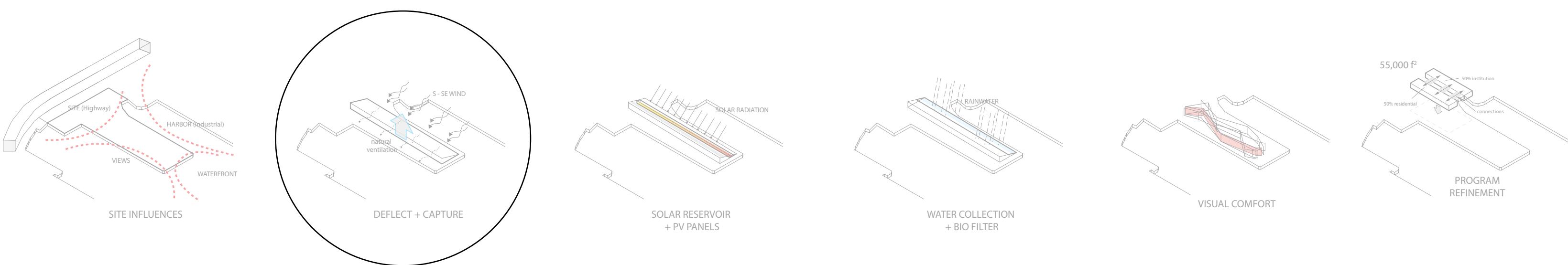
PIN UP 4 // MARCH



Concept Weaving

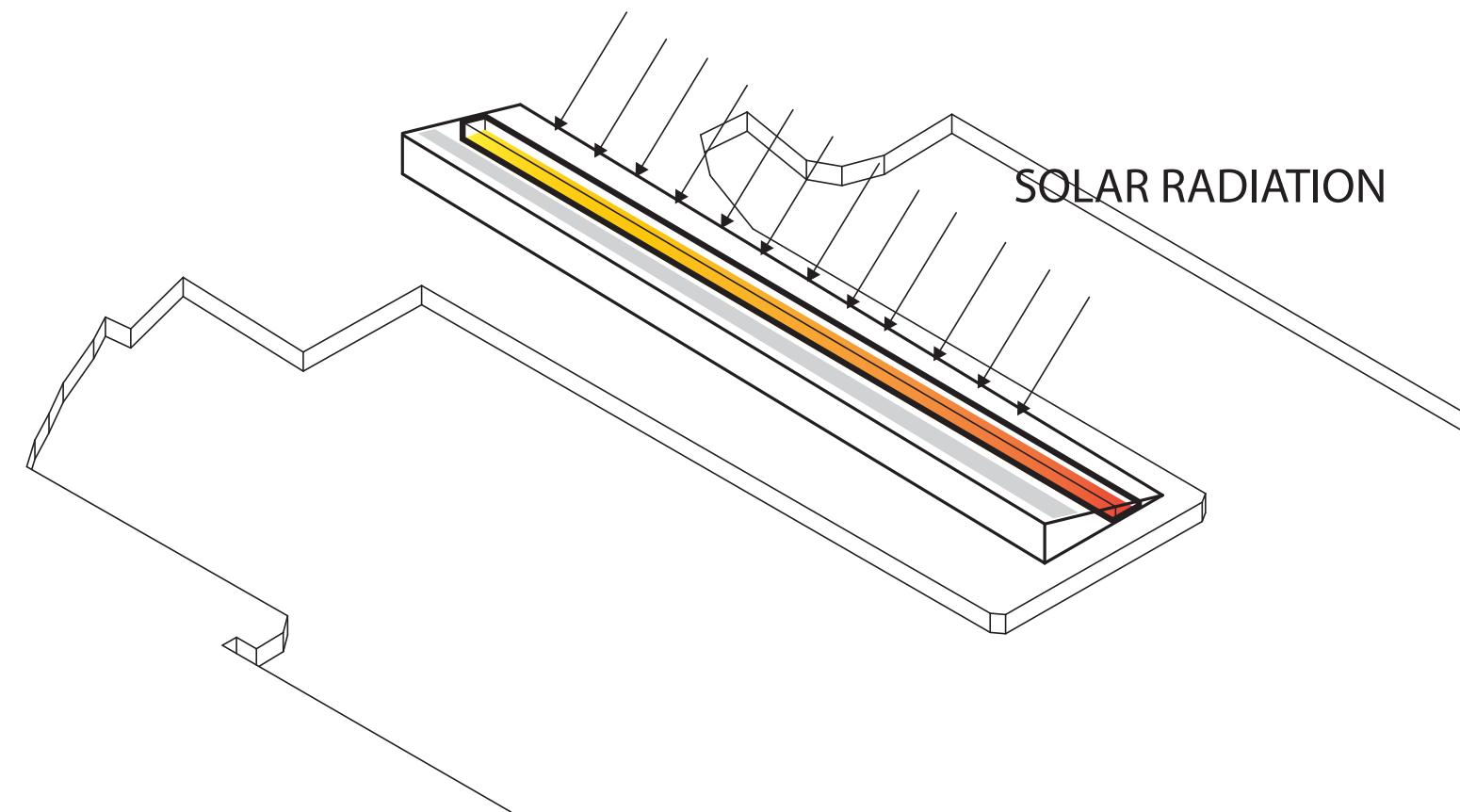
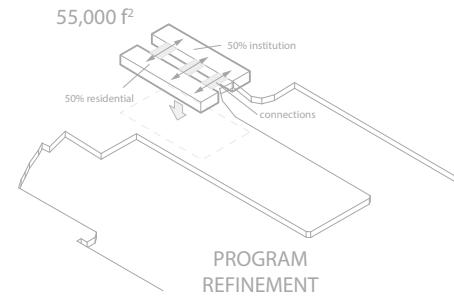
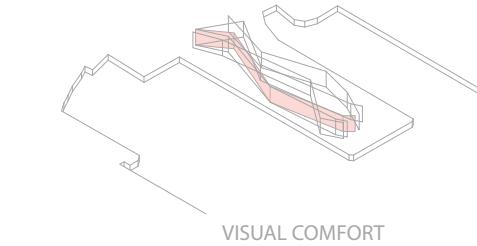
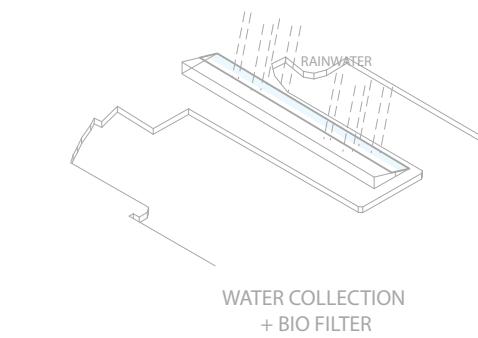
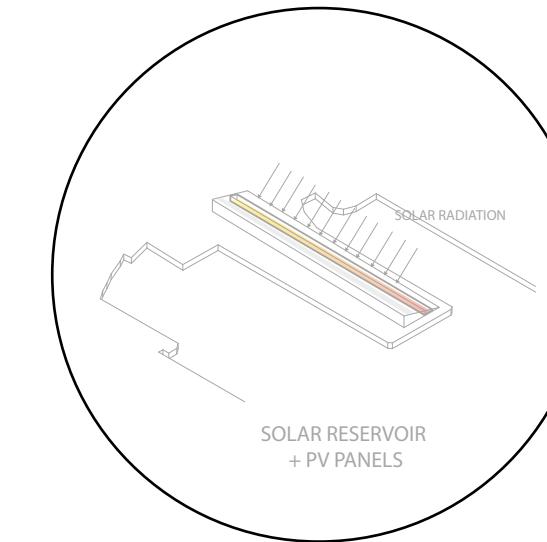
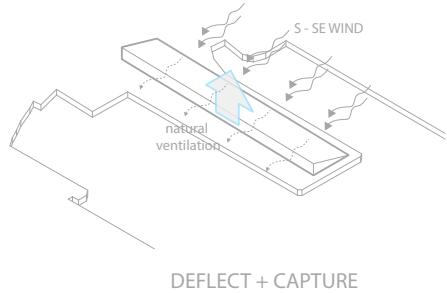
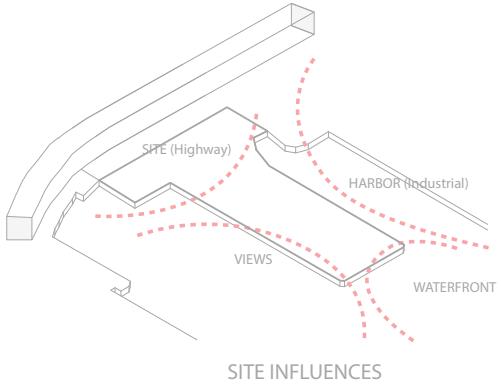


Concept Weaving



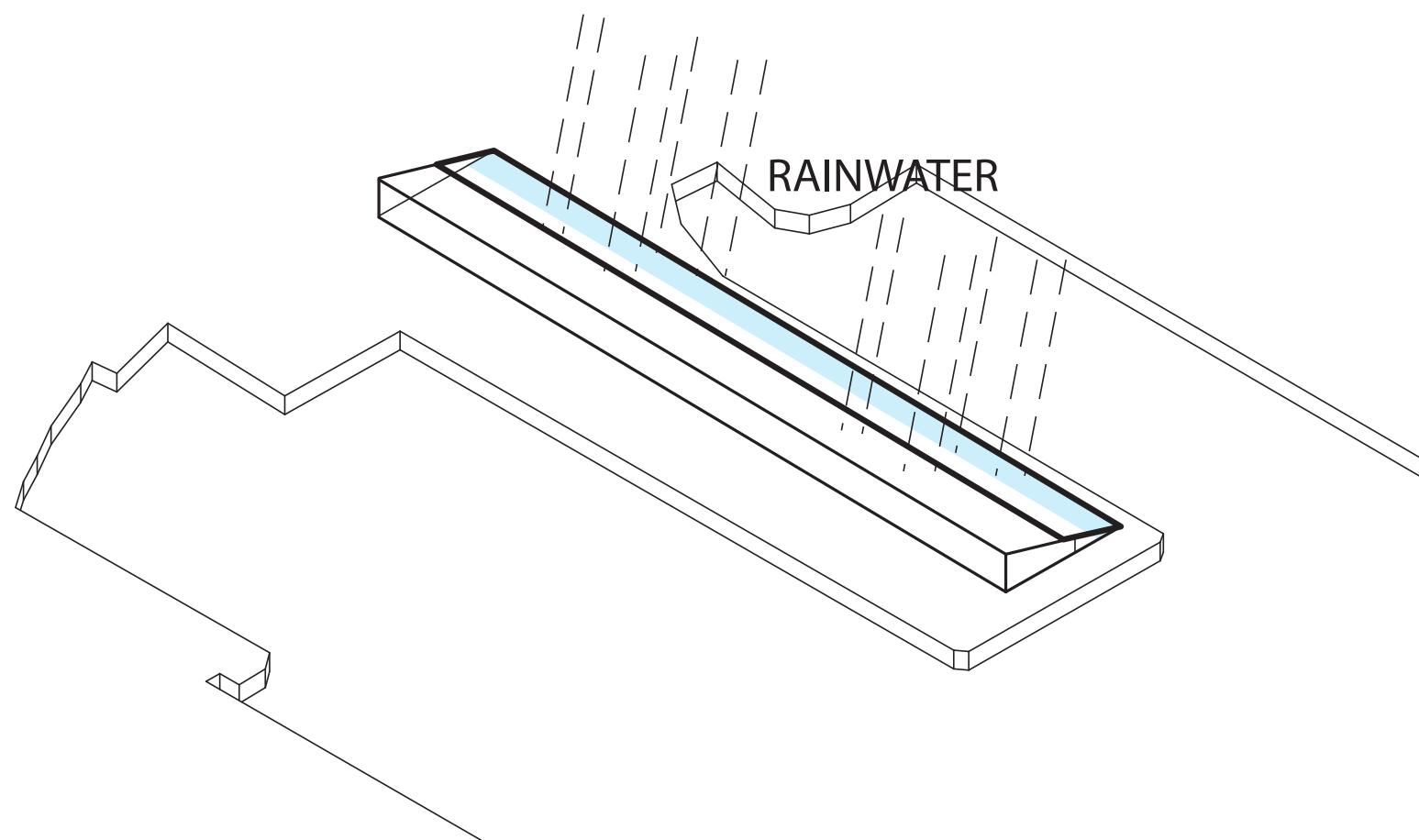
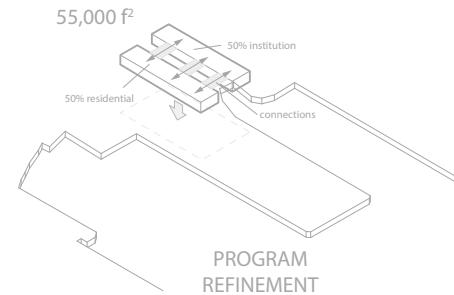
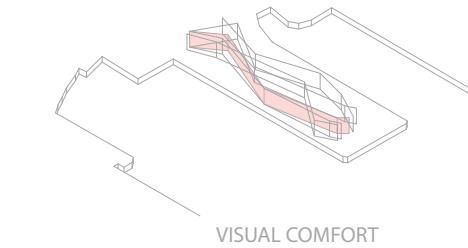
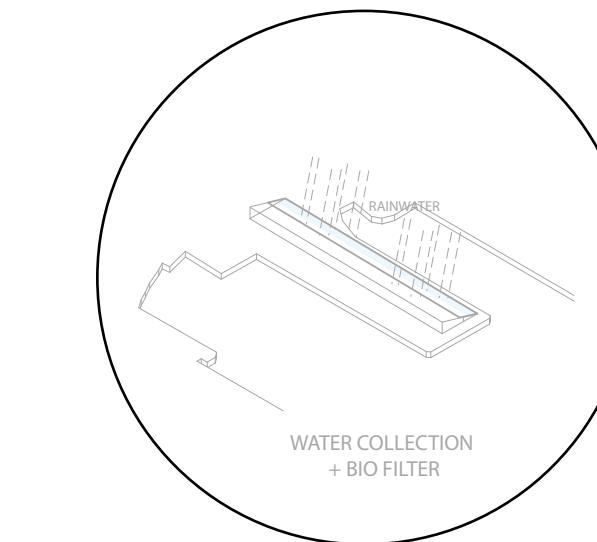
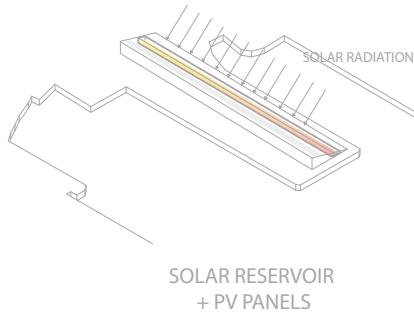
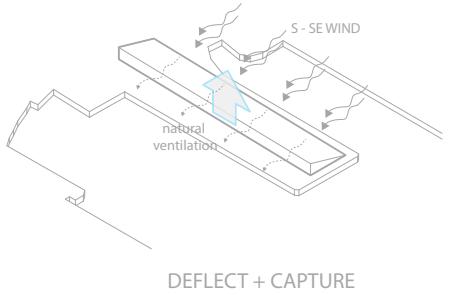
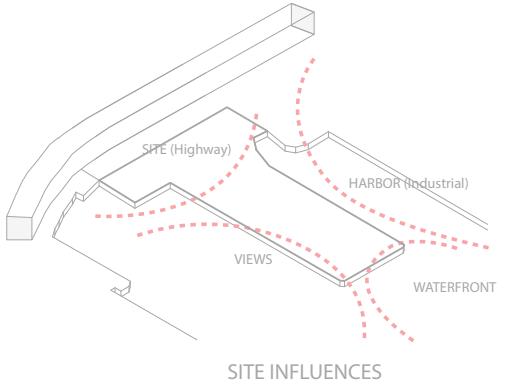
DEFLECT + CAPTURE

Concept Weaving



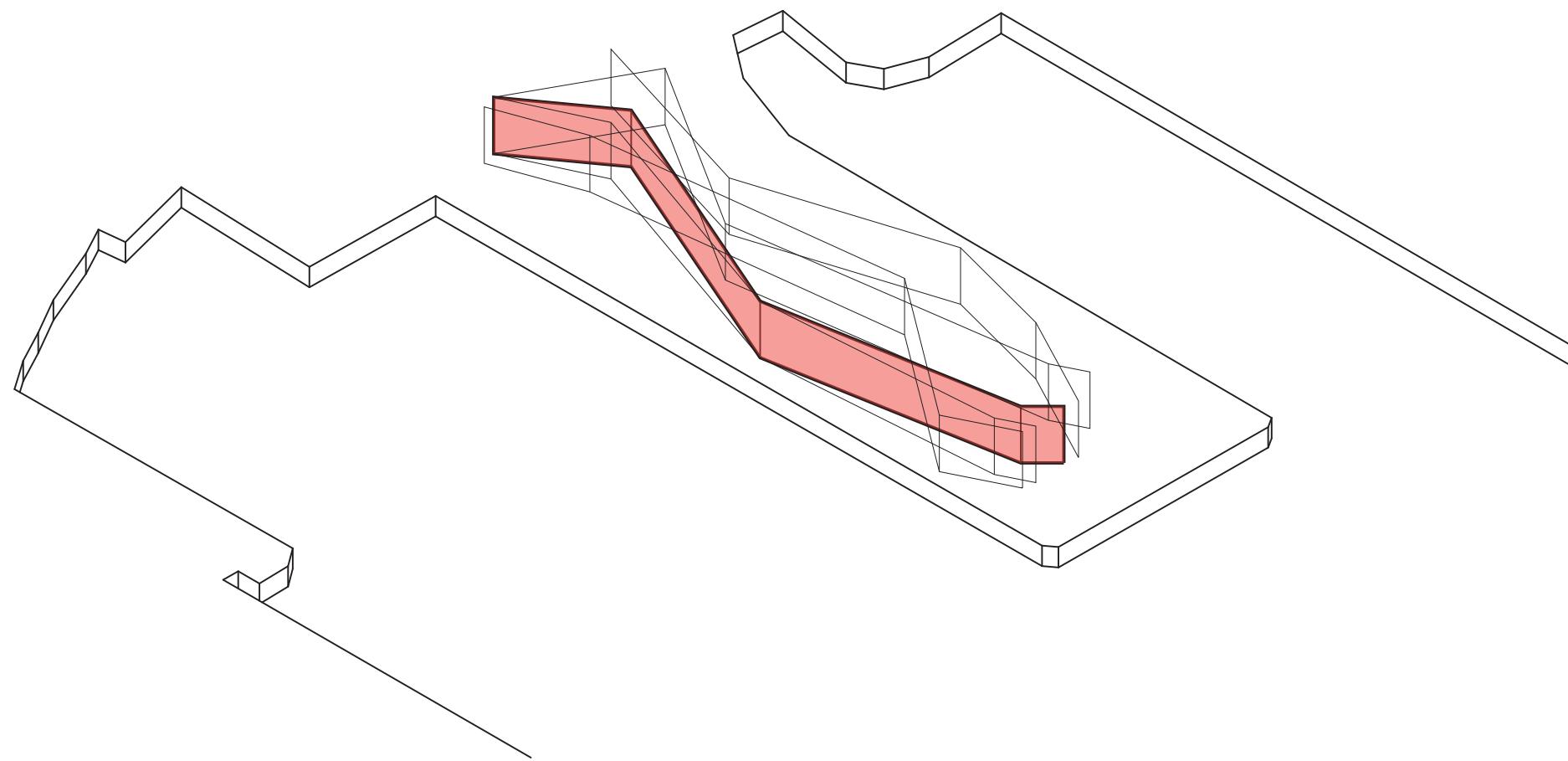
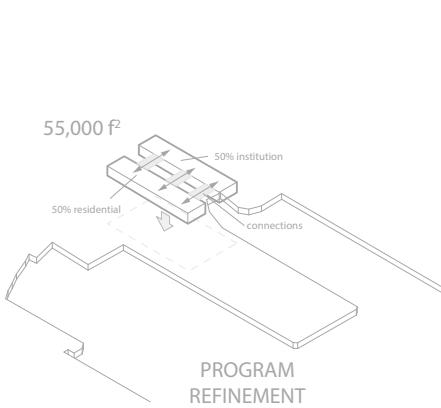
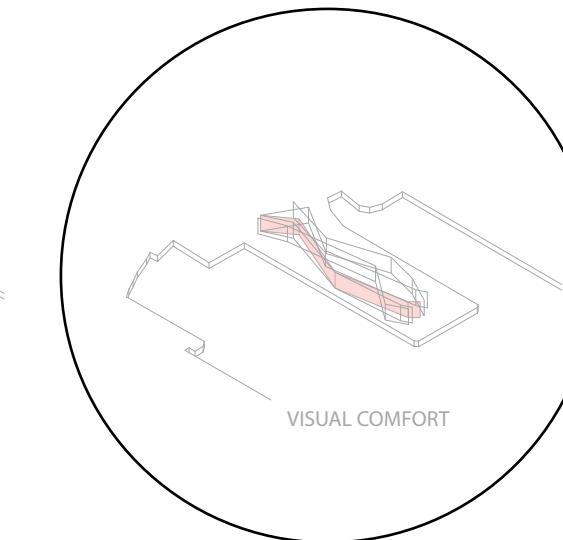
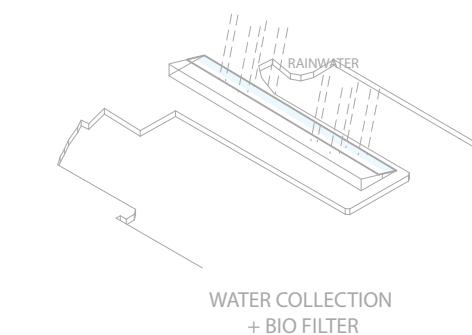
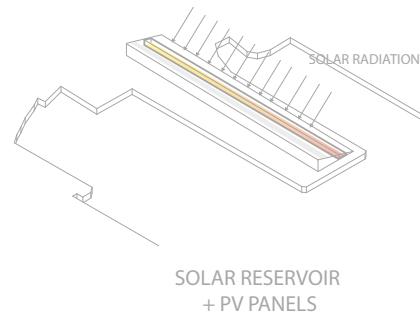
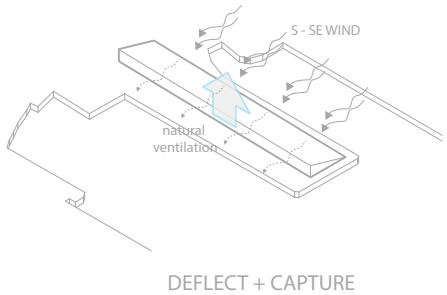
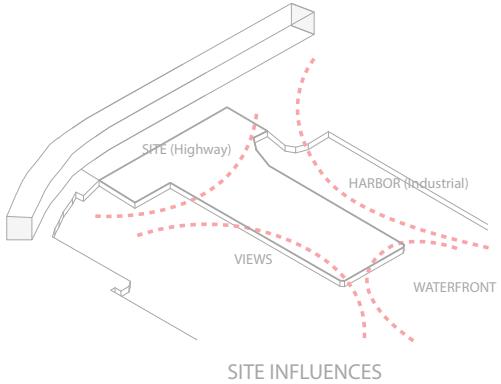
SOLAR RESERVOIR
+ PV PANELS

Concept Weaving



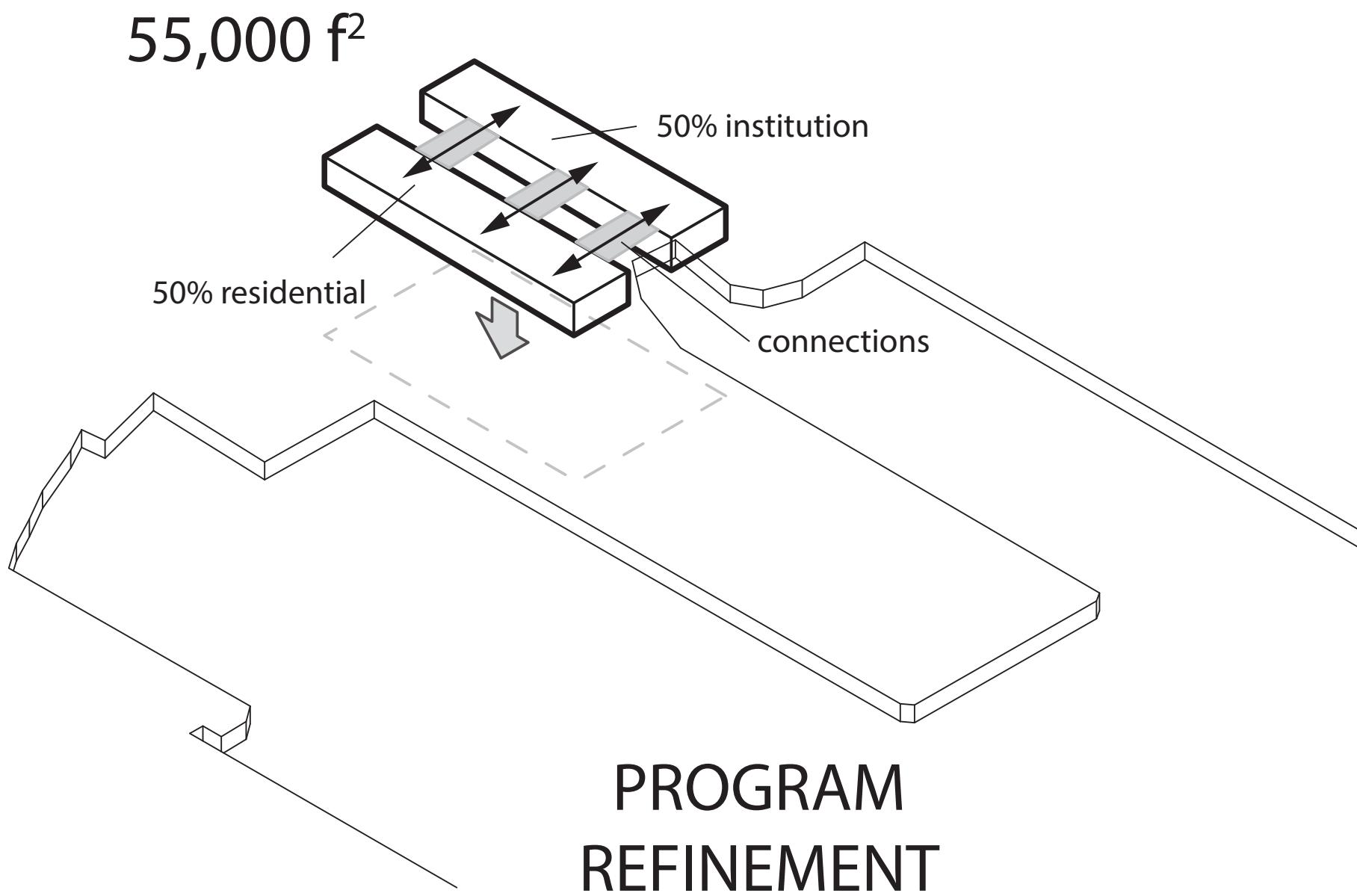
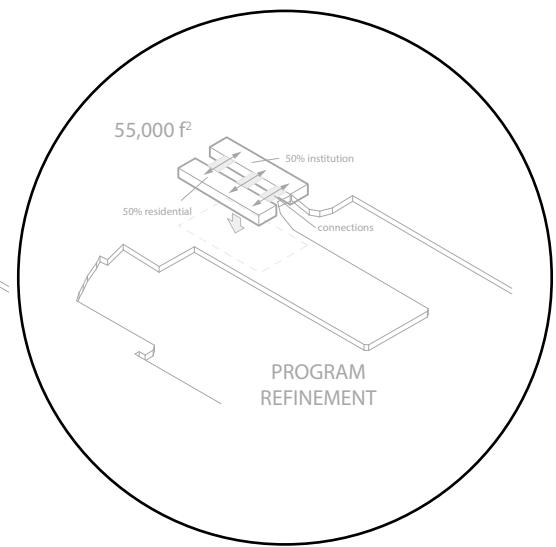
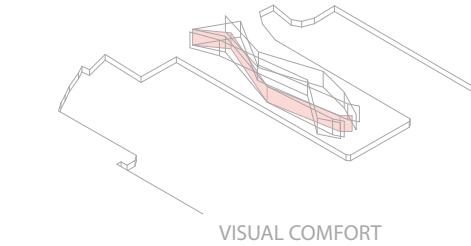
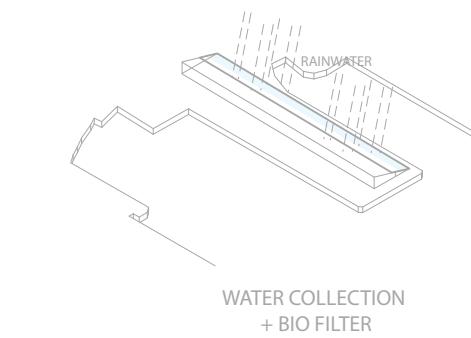
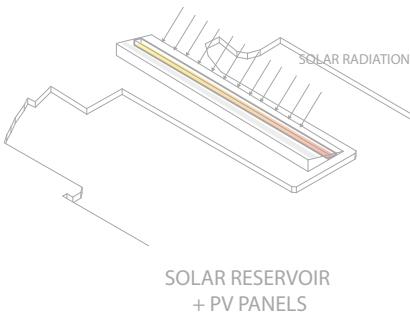
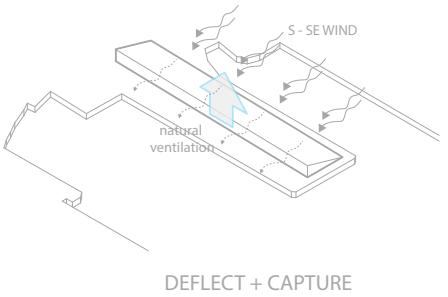
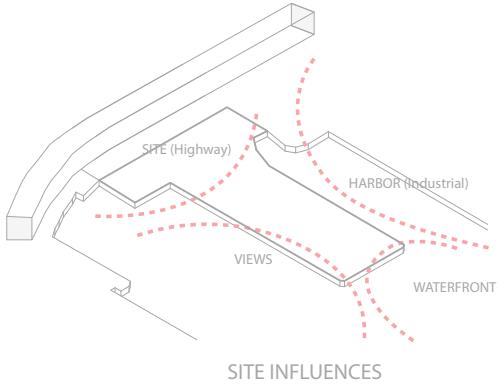
WATER COLLECTION
+ BIO FILTER

Concept Weaving

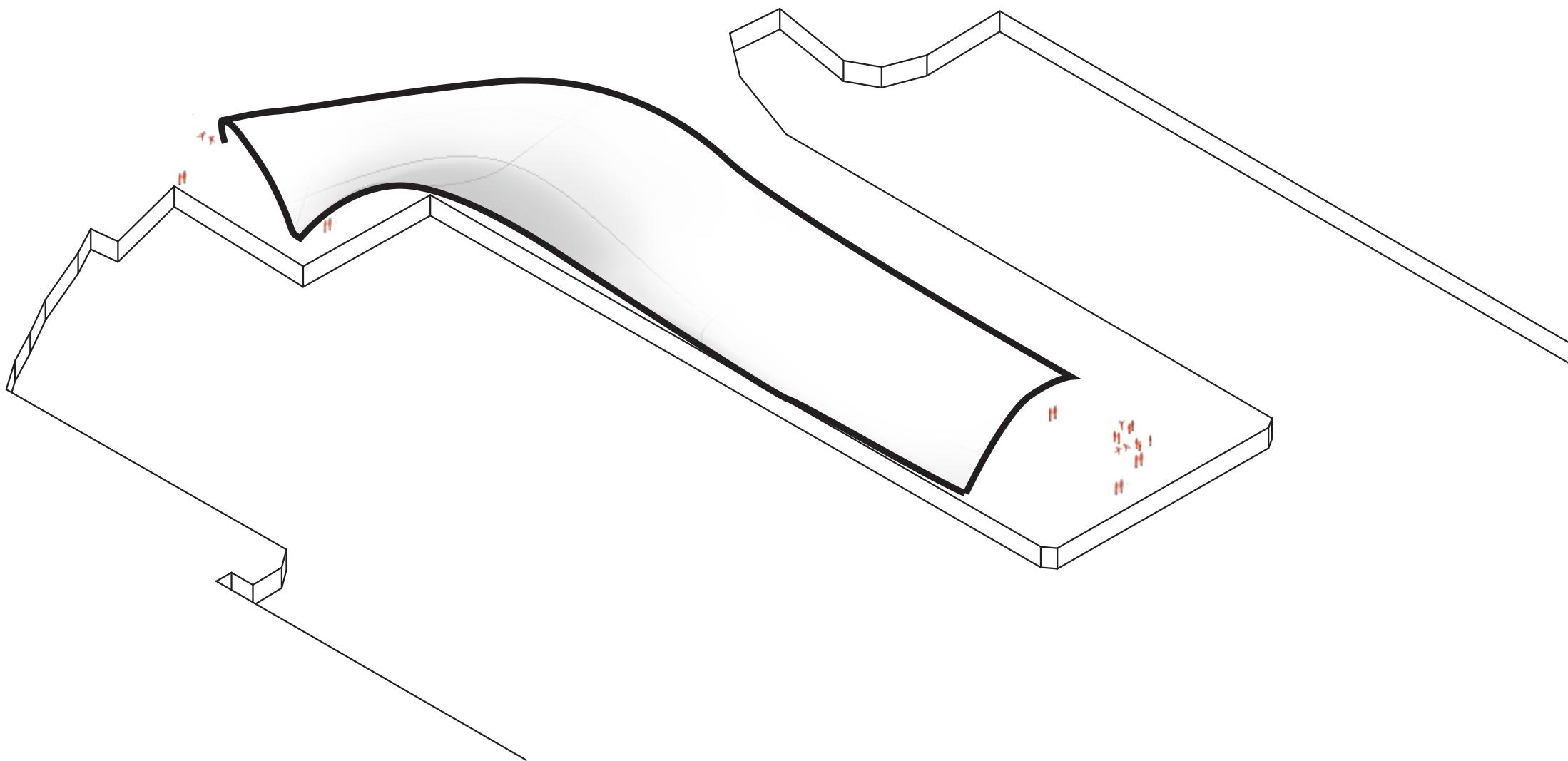
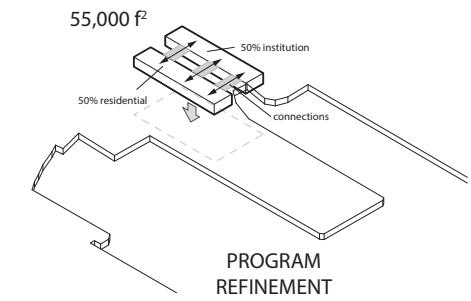
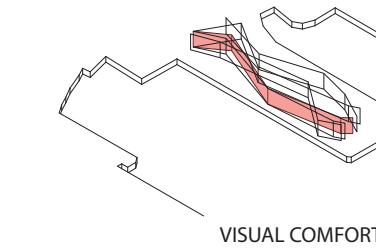
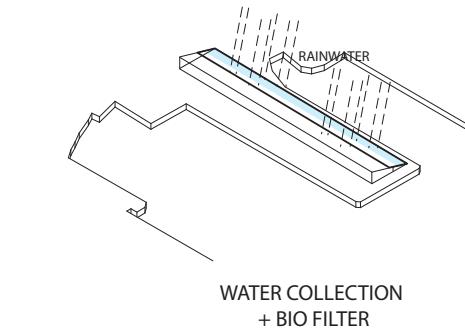
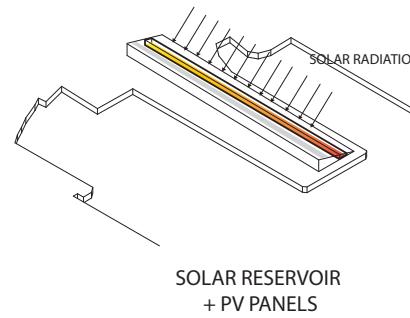
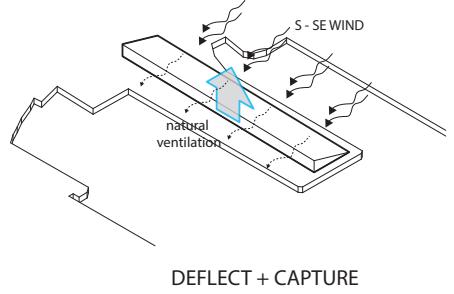
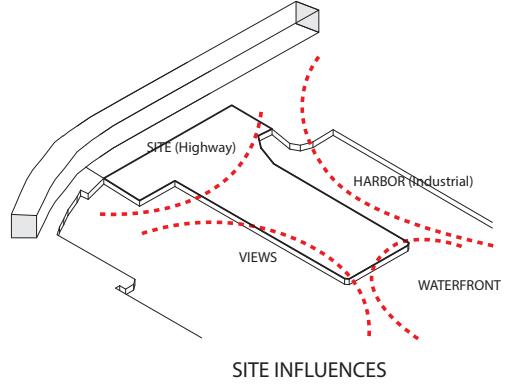


VISUAL COMFORT

Concept Weaving

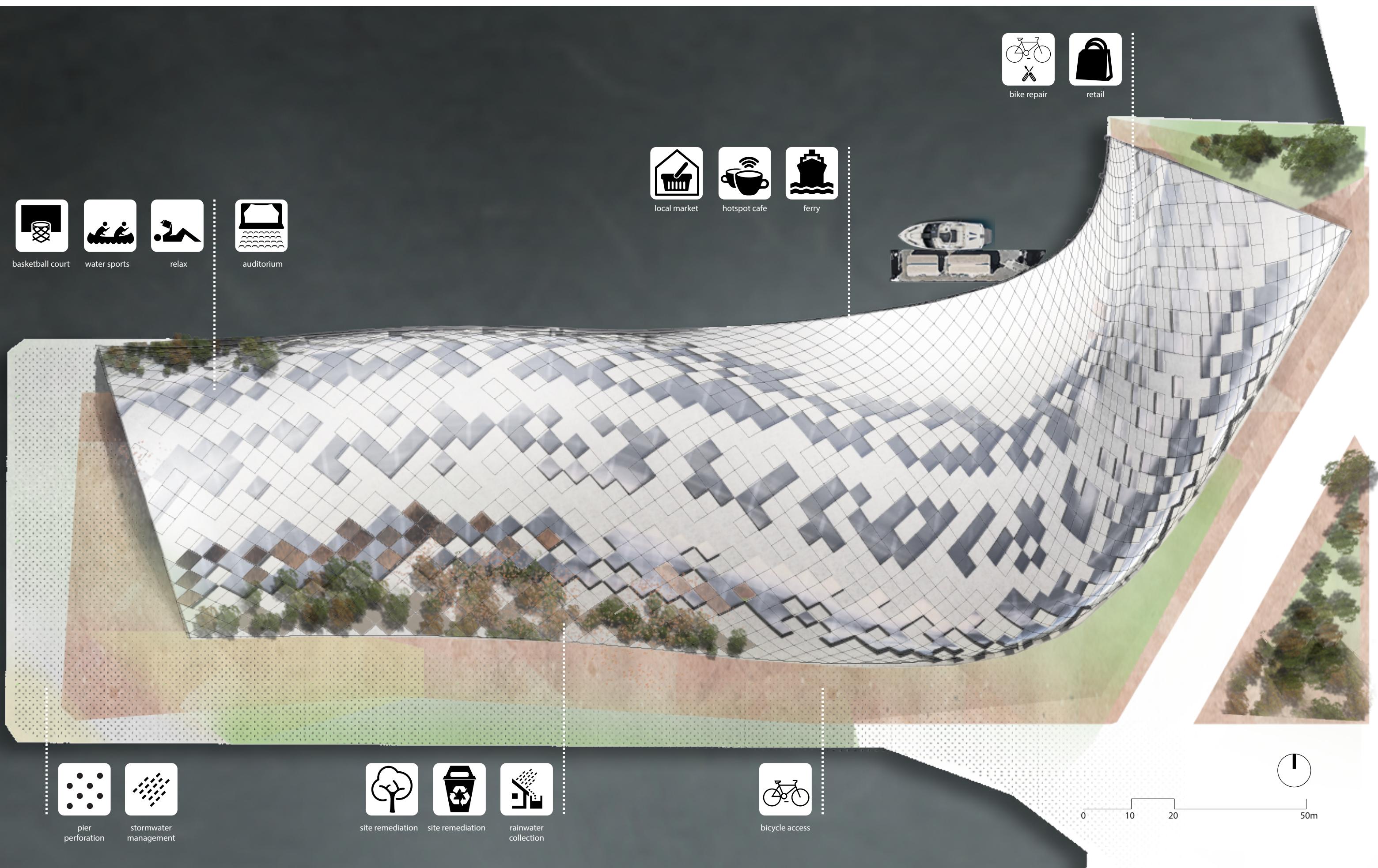


Concept Weaving

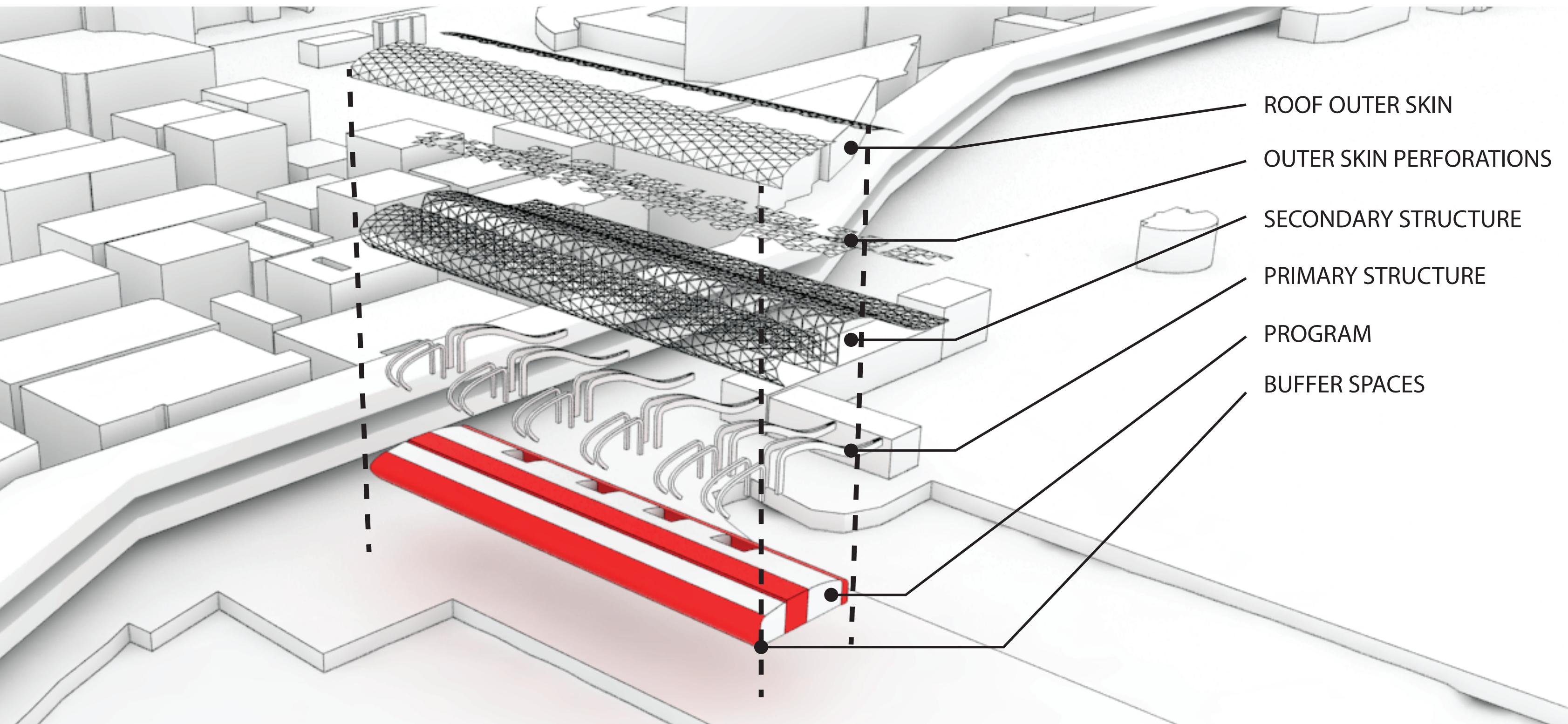


PIER WING

Site Plan

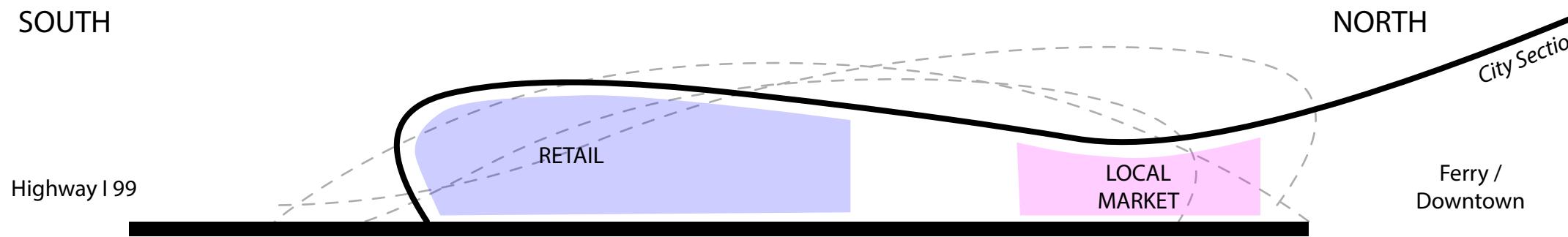


Exploded Axon Diagram

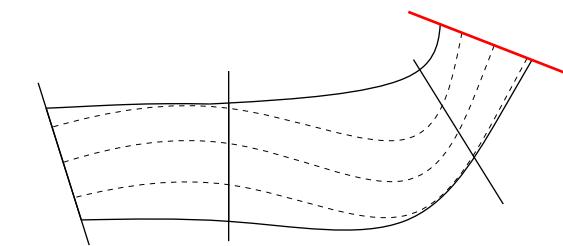


Concept Sections

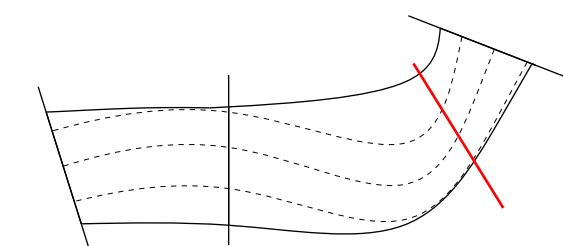
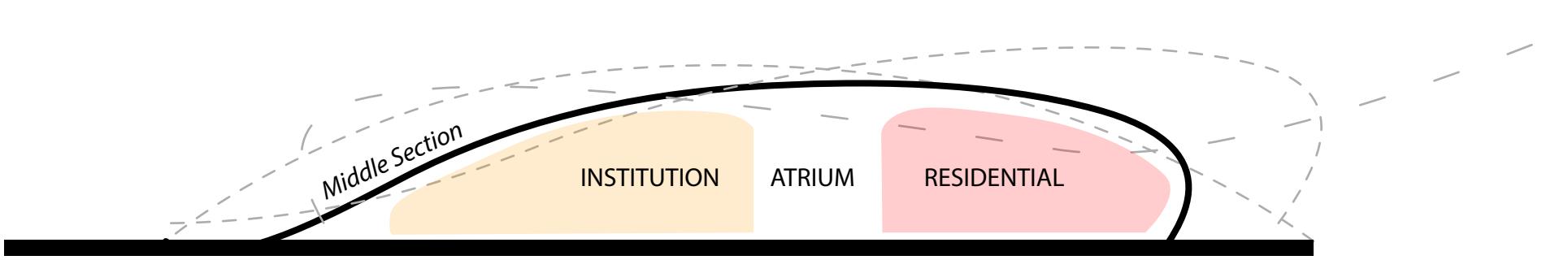
SOUTH



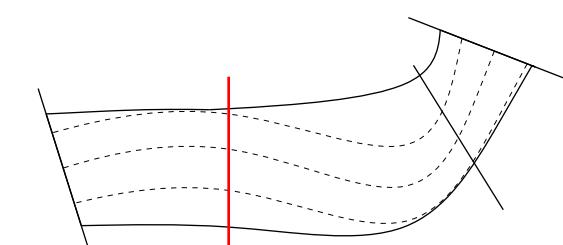
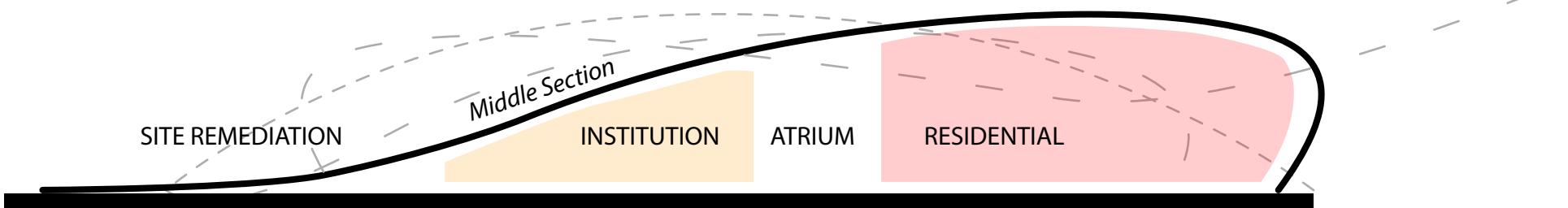
NORTH



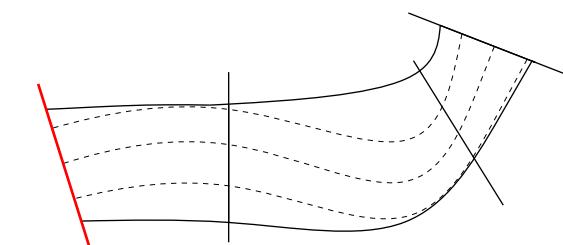
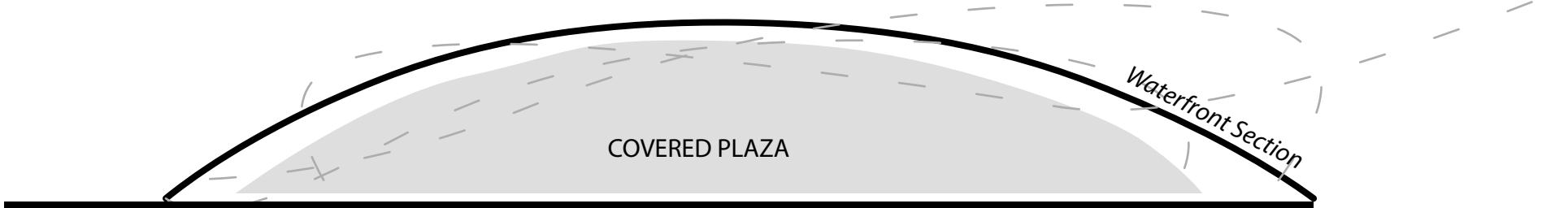
Middle Section



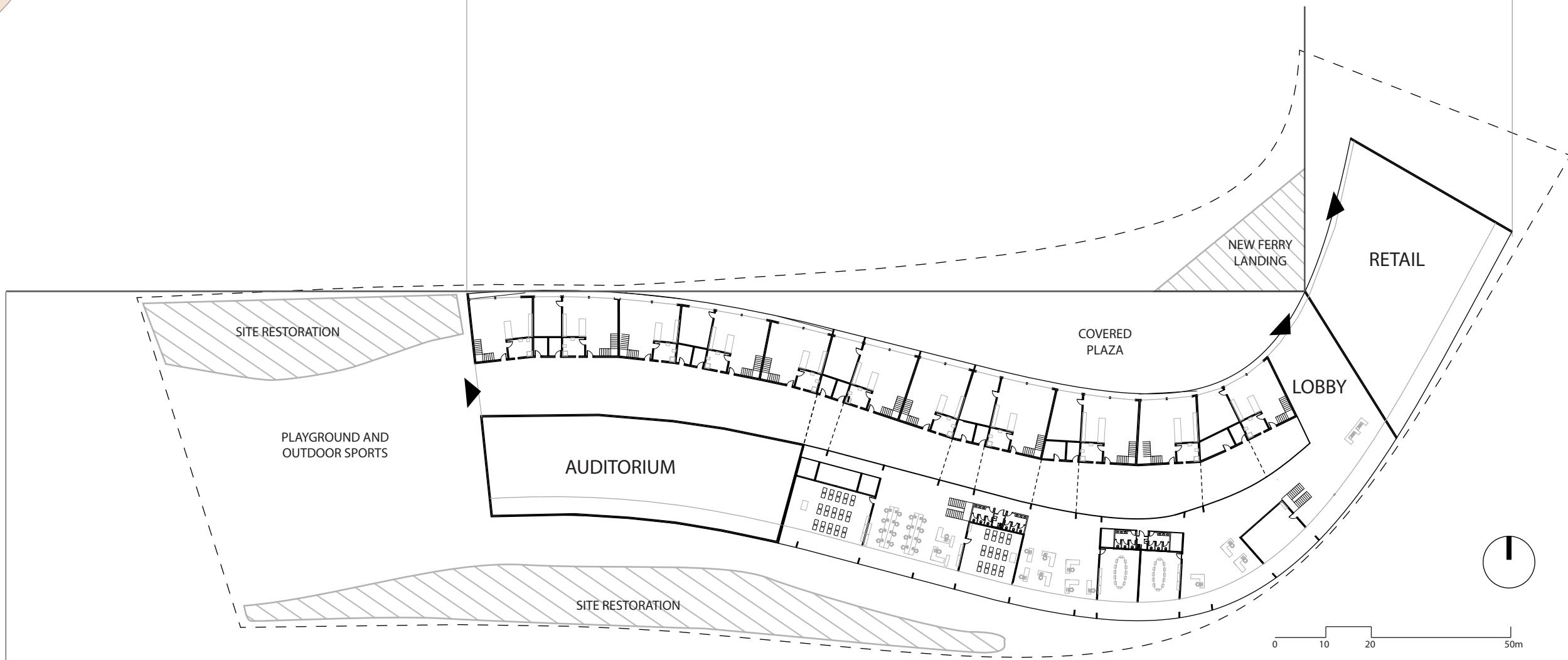
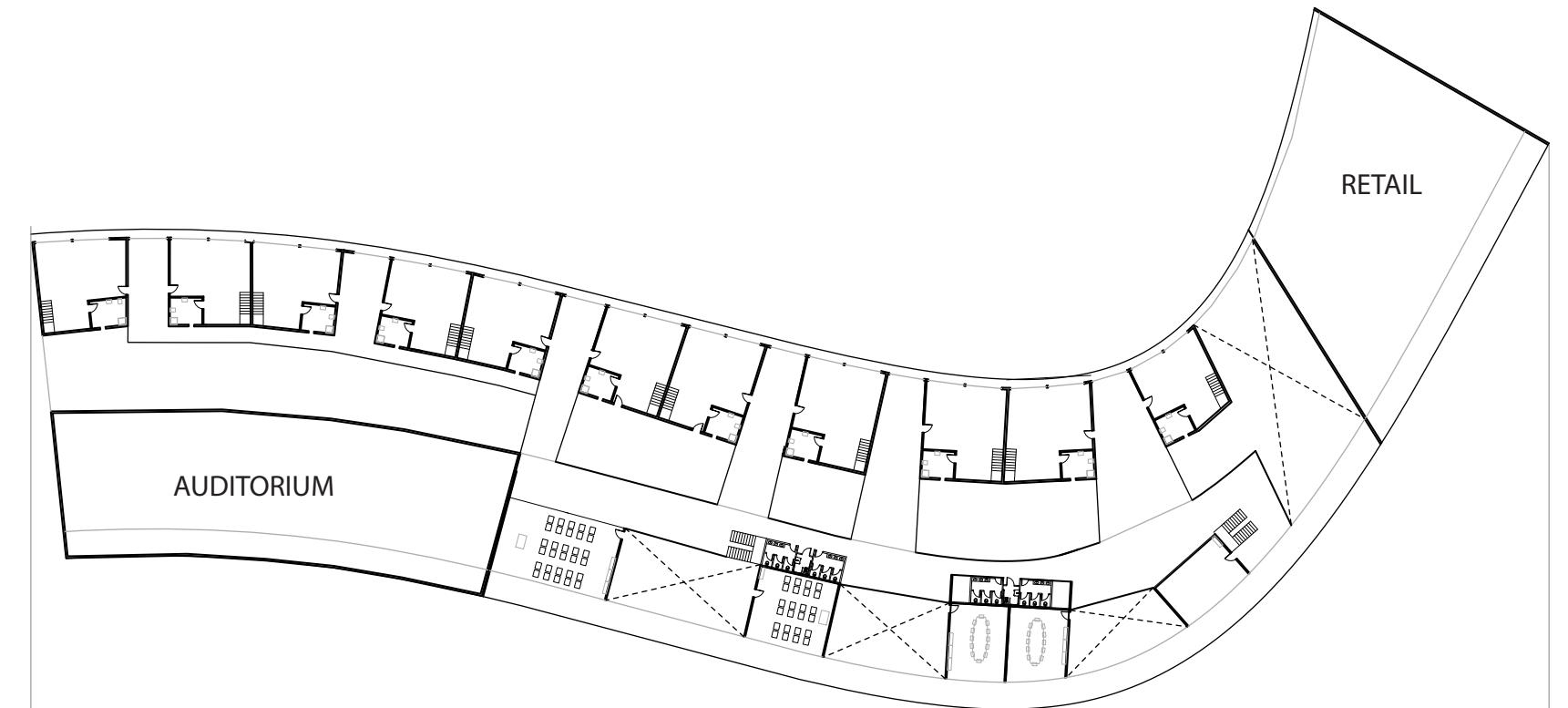
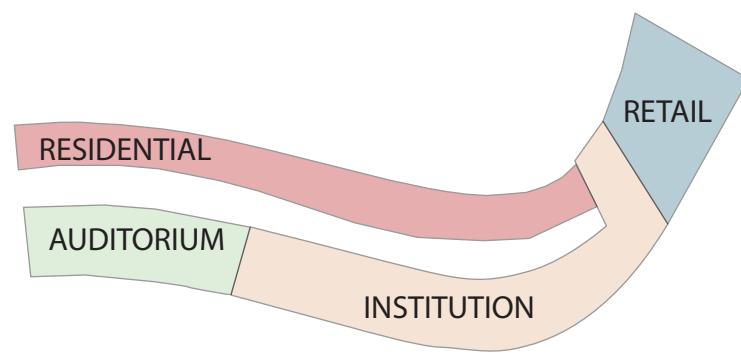
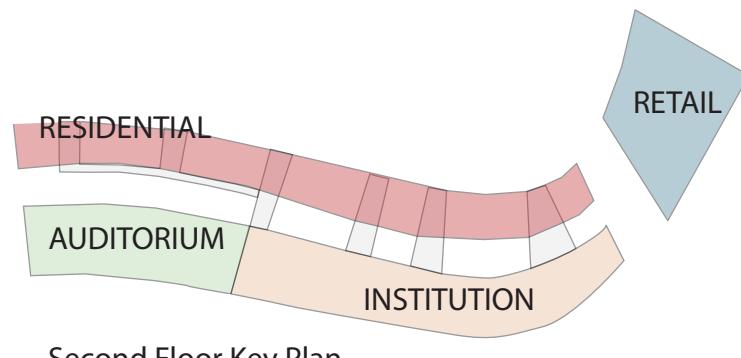
SITE REMEDIATION



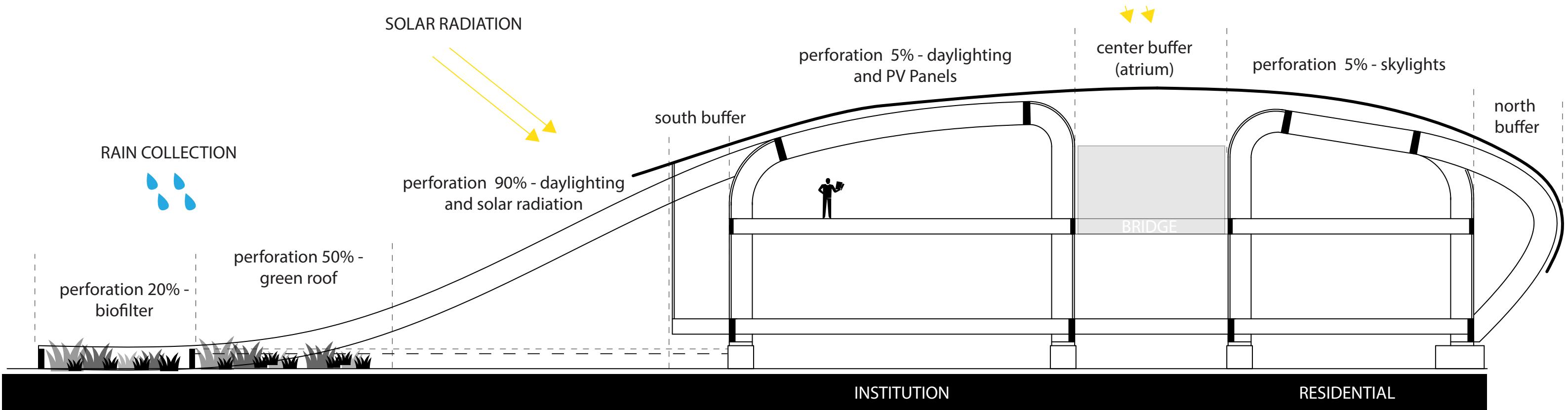
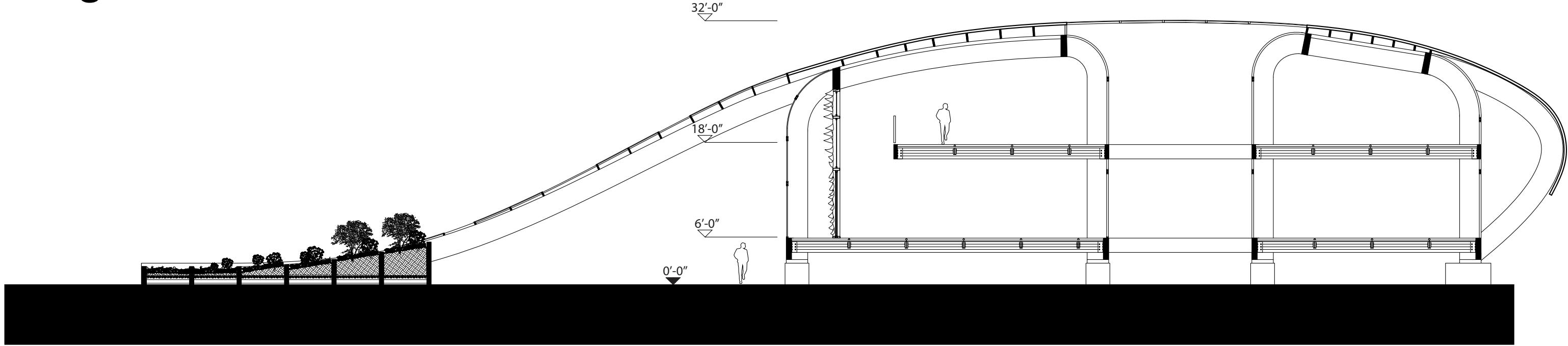
Waterfront Section



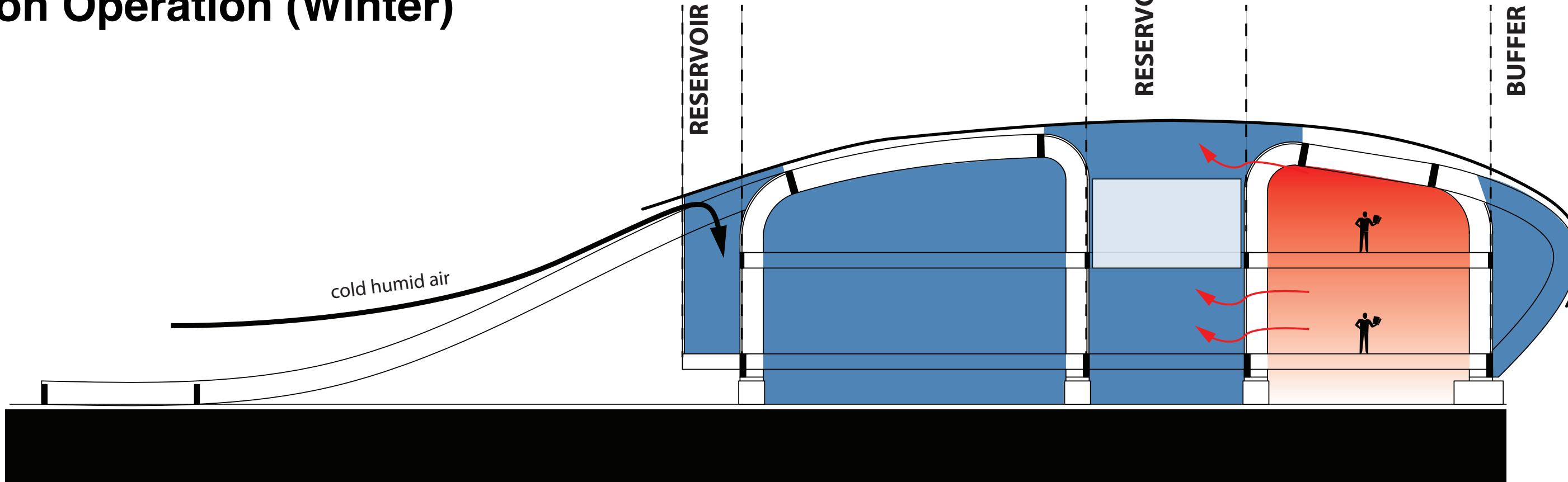
Design Plans



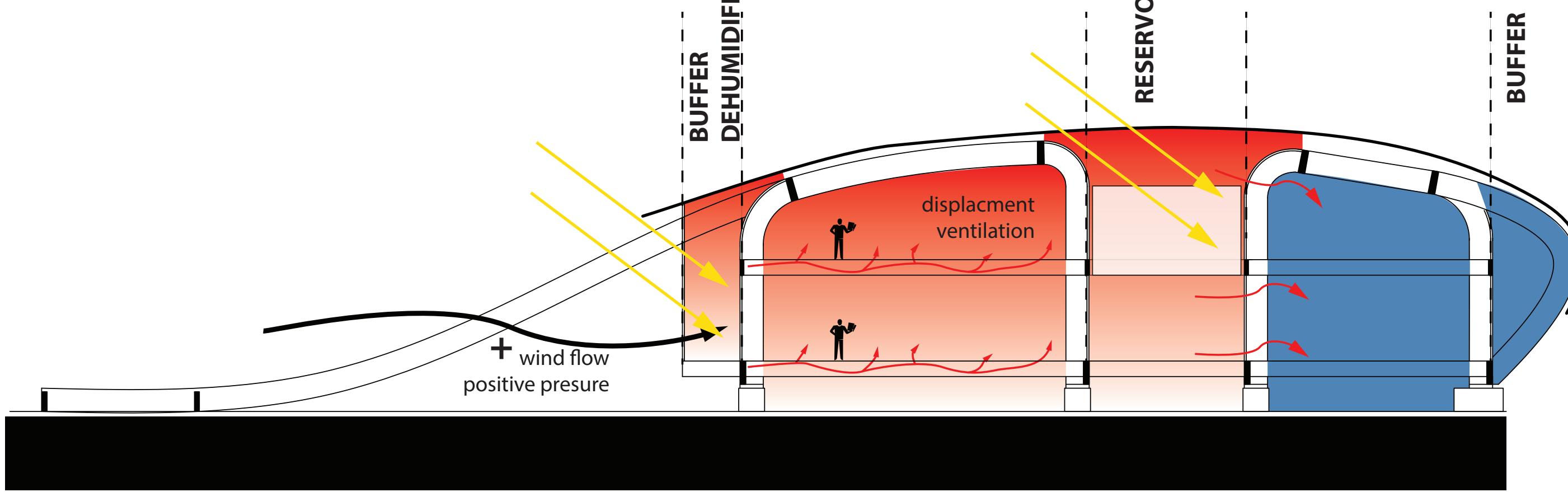
Design Section



Section Operation (Winter)

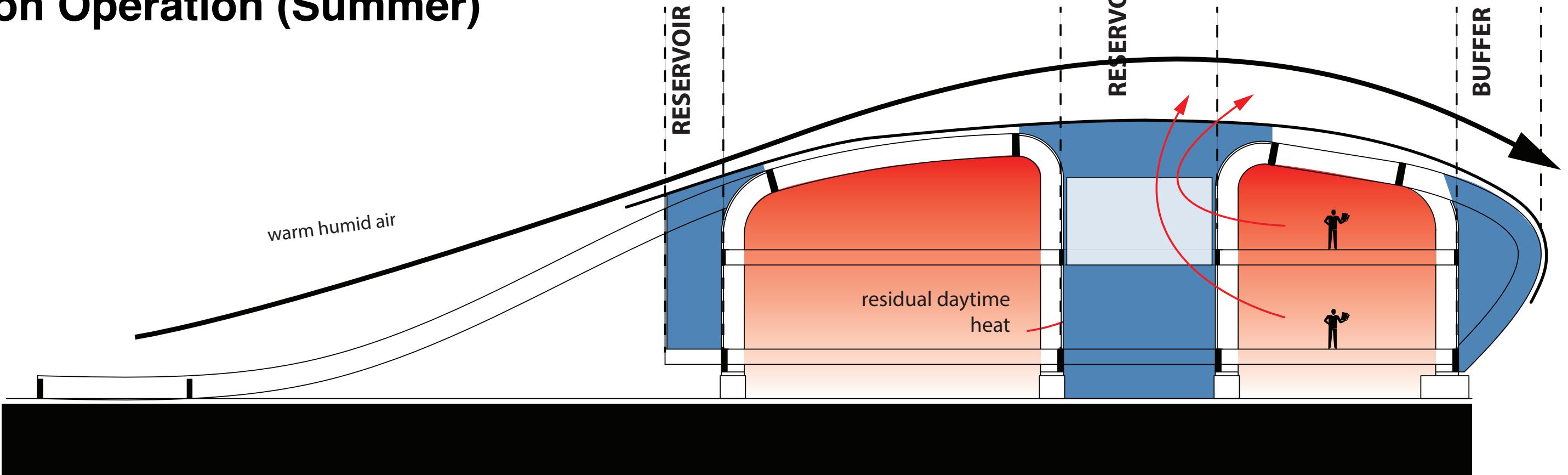


WINTER NIGHT TIME OPERATION

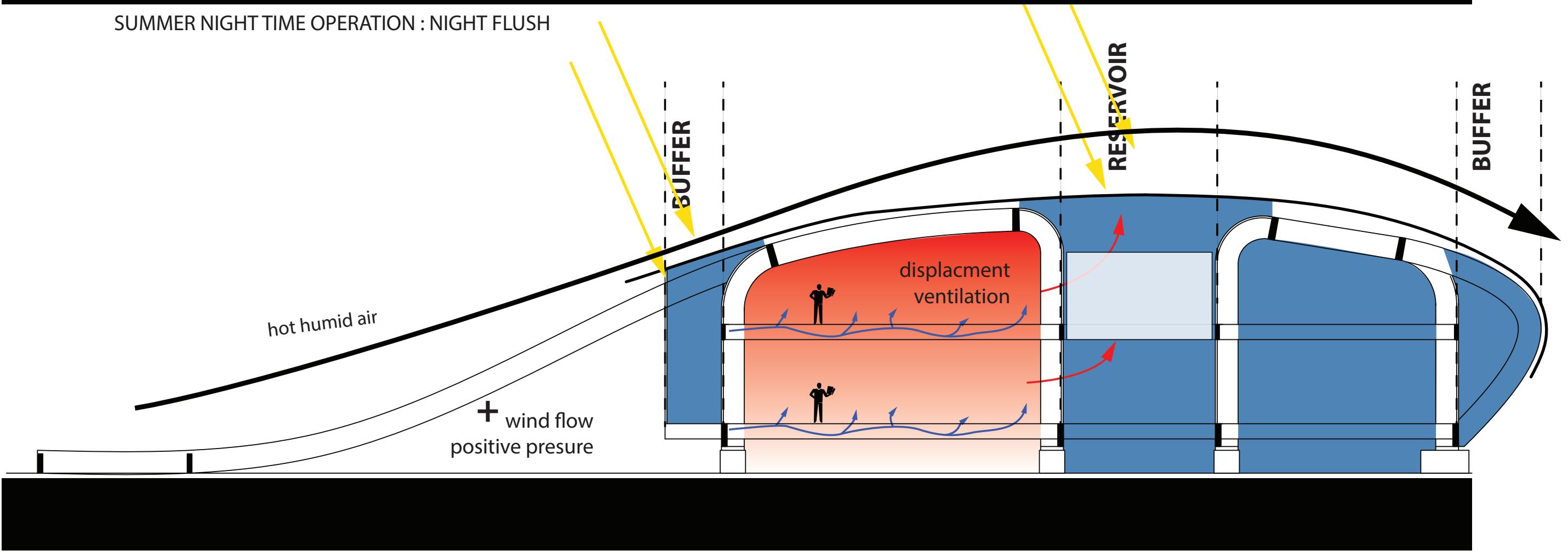


WINTER DAY TIME OPERATION

Section Operation (Summer)

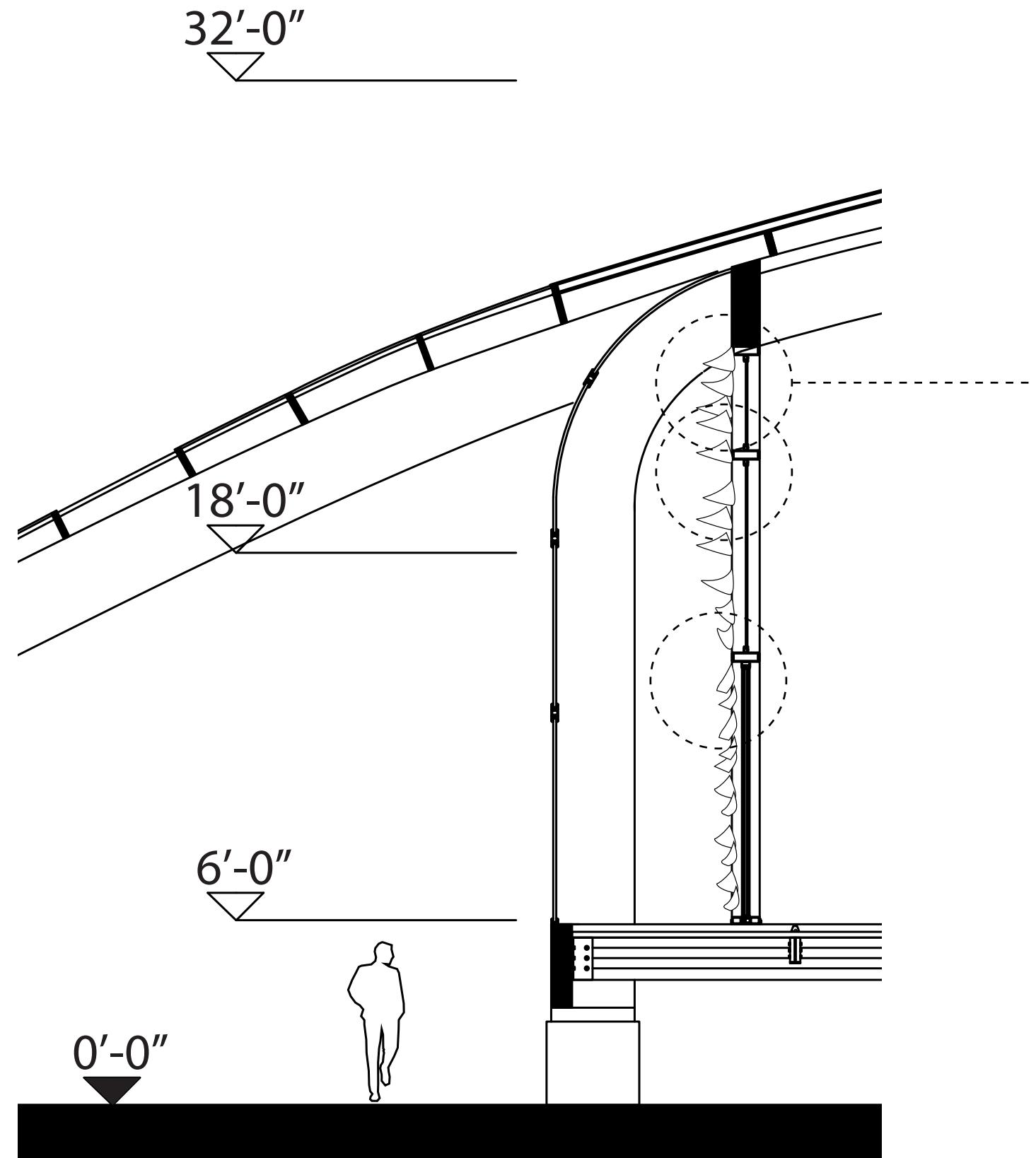


SUMMER NIGHT TIME OPERATION : NIGHT FLUSH

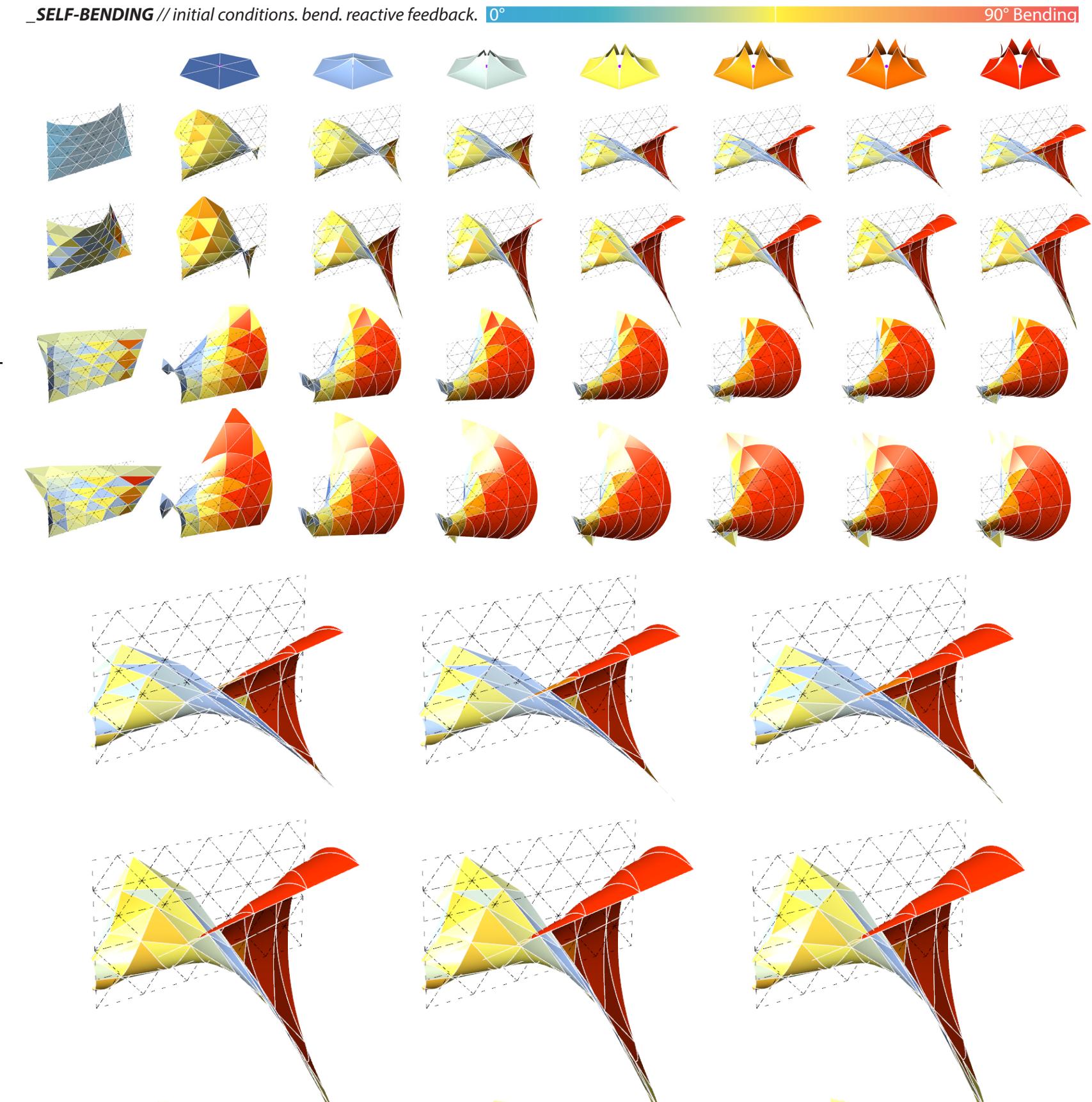


SUMMER DAY TIME OPERATION

Section Details



Moisture Responsive Facade Proposal





Next Steps:

Site Remediation Details and Integration with Building Section

Comprehensive Site Strategy

Moisture Responsive Material and Facade System Details

Summer Performance Analysis and Optimization

Improvement of Visual Comfort