T.C. HOWE DEVELOPMENT CENTER

SOCIALLY SUSTAINABLE INCLUSIVE EDUCATION

Kapua Arsiga
Energy Performance, Engineering, Integrated Performance

Alex Bleiweis
Durability and Resilience, Comfort and Environment Quality

Brittney Castro
Architecture, Comfort and Environmental Quality

Allan Killion
Architecture, Occupant Experience

Shabnam Rajani
Integrated Performance, Engineering

Garrett Stritzel
Market Analysis, Occupant Experience

Spencer Whitmore
Embodied Environmental Impact, Energy Performance

IDA
INCLUSIVE DESIGN ADVOCATES

BALL STATE UNIVERSITY

U.S. DEPARTMENT OF ENERGY
Solar Decathlon

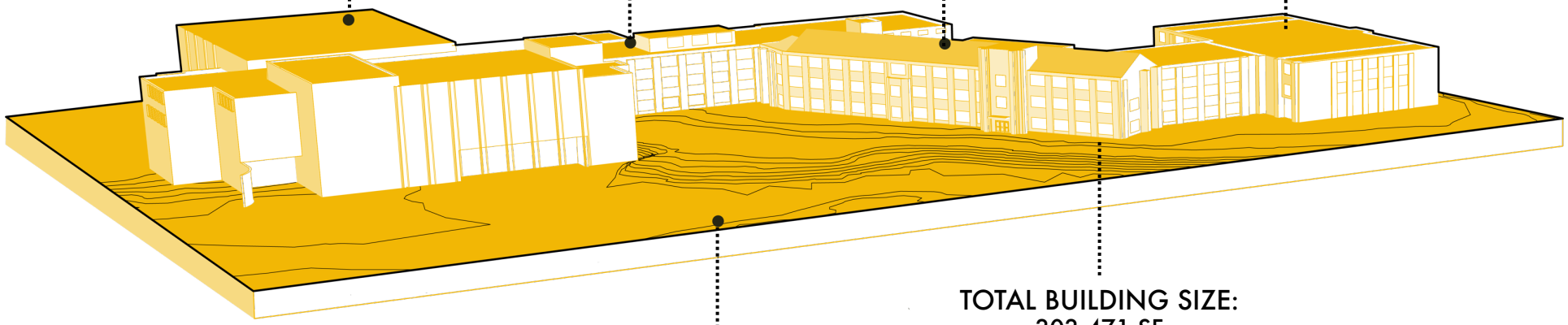
EXISTING FACILITY

OVERSIZED EXTRACURRICULAR FACILITIES

OF EXISTING CLASSROOMS:
50 GENERAL EDUCATION

ORIGINAL BUILD:
1937

LAST ENROLLMENT:
675 STUDENTS



TOTAL BUILDING SIZE:
303,471 SF

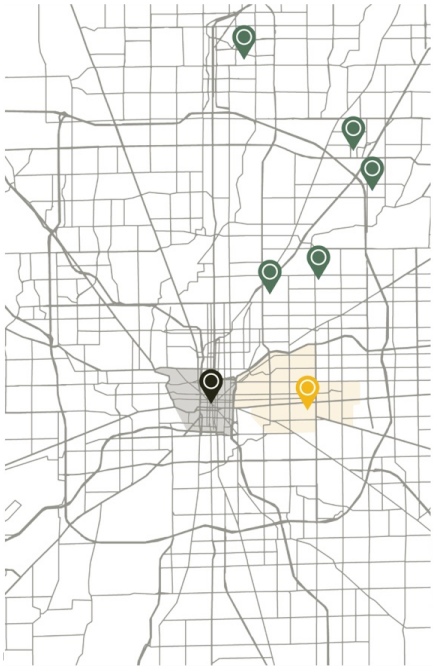
PROPERTY SIZE:
27 ACRES

THOMAS CARR HOWE COMMUNITY SCHOOL

EXISTING CONDITIONS

IDENTIFYING A NEED

INDIANA

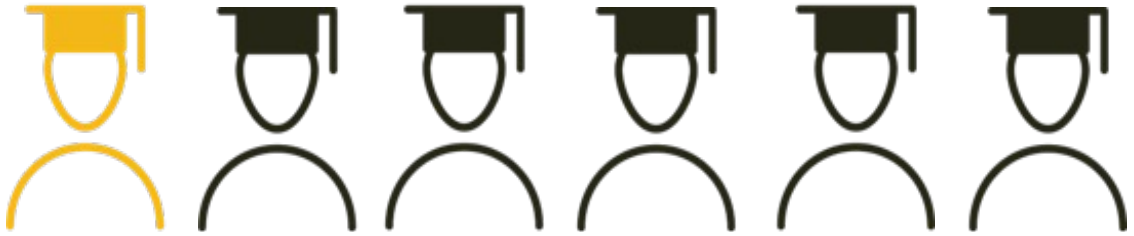


GREATER INDIANAPOLIS

TARGET NEIGHBORHOODS

- T.C. HOWE DEVELOPMENT CENTER
- DOWNTOWN INDIANAPOLIS
- EXISTING SPECIAL EDUCATION FACILITIES

PROGRAM



1 in 6 IPS students has a learning disability

Average Special Needs School Enrollment **122**

T. C. Howe Development Center Enrollment **240**

BARRIER-FREE

RESILIENCY

SUSTAINABLITY

INNOVATION

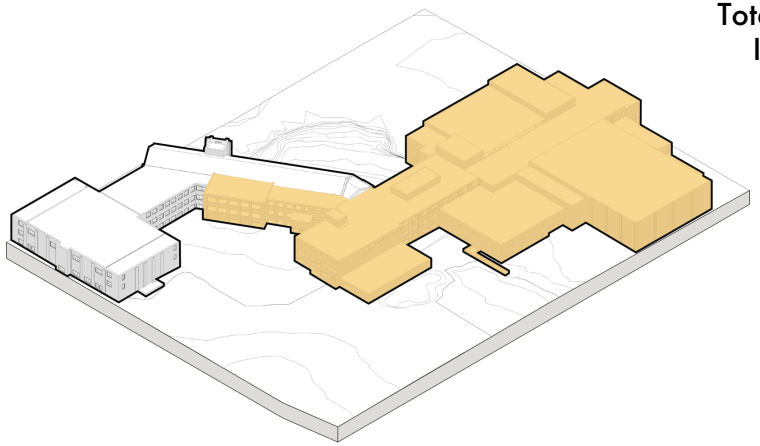
MOVEMENT

VERSATILITY

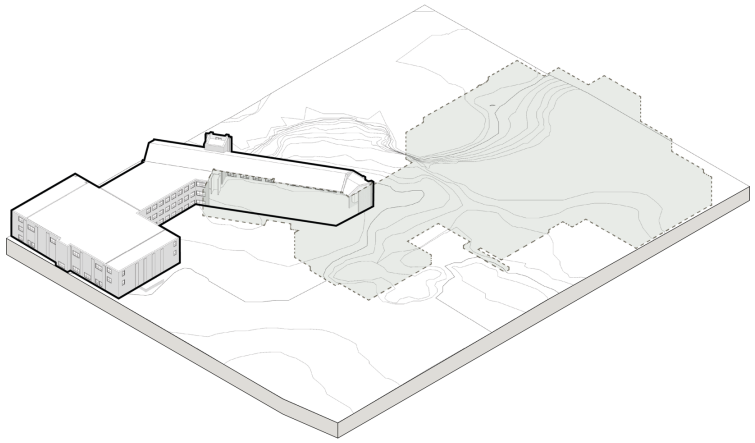
DESIGN GOALS

IDA

RIGHTSIZING



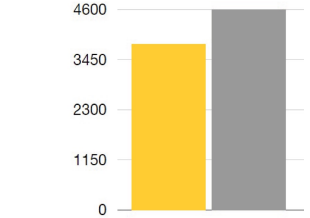
EXISTING BUILDING

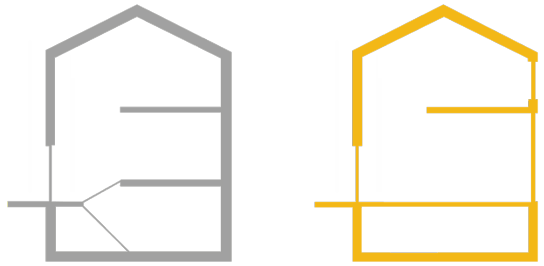


DEMOLITIO N

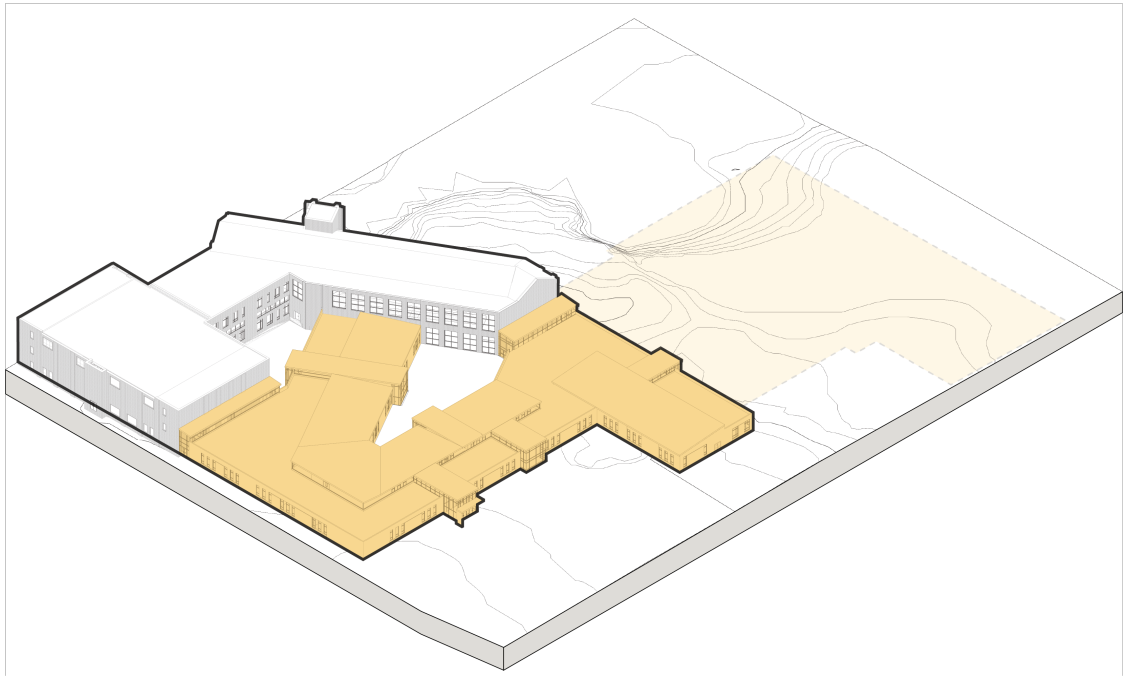
GLOBAL WARMING POTENTIAL PERSPECTIVE

Total Embodied and Operational Carbon Impact in Metric Tons of CO2e/Year





SECTION: EXISTING **SECTION: PROPOSED**

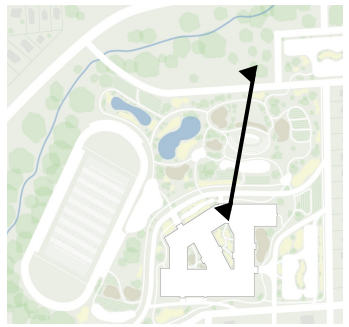


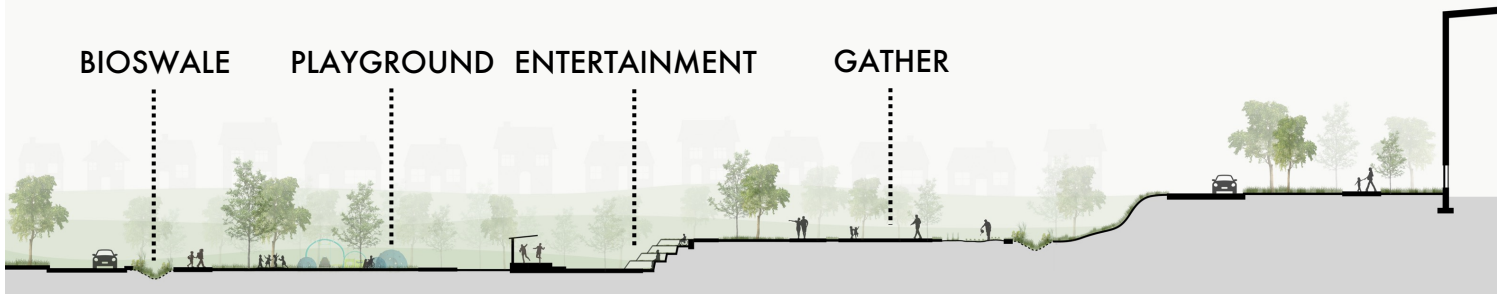
PROPOSED ADDITION

SITE PLAN

Legend:

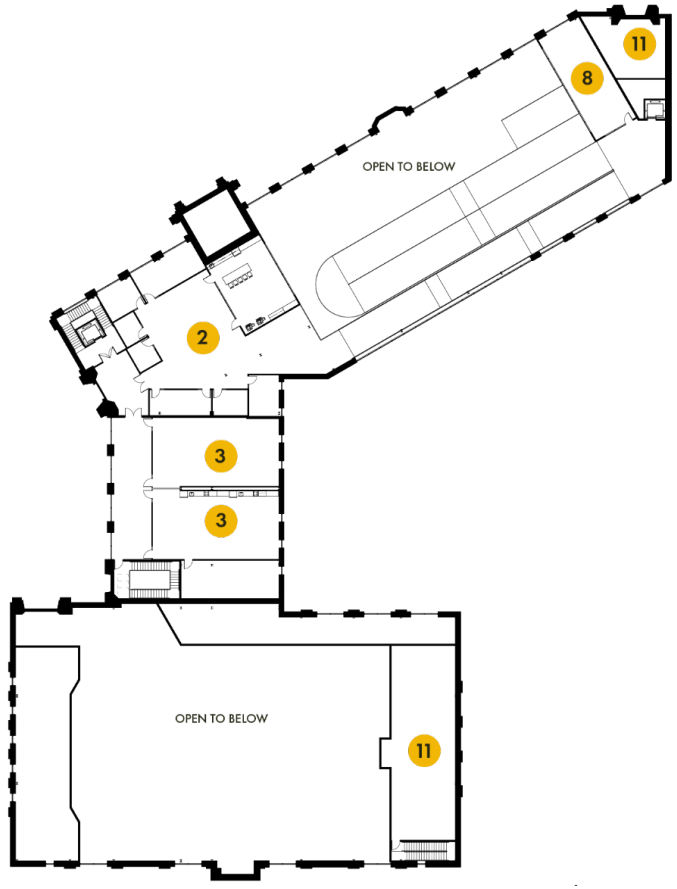
- Bioswales
- Retention and Detention Ponds
- Playground Areas
- Communal Garden





FLOOR PLANS

FIRST FLOOR PLAN



SECOND FLOOR PLAN

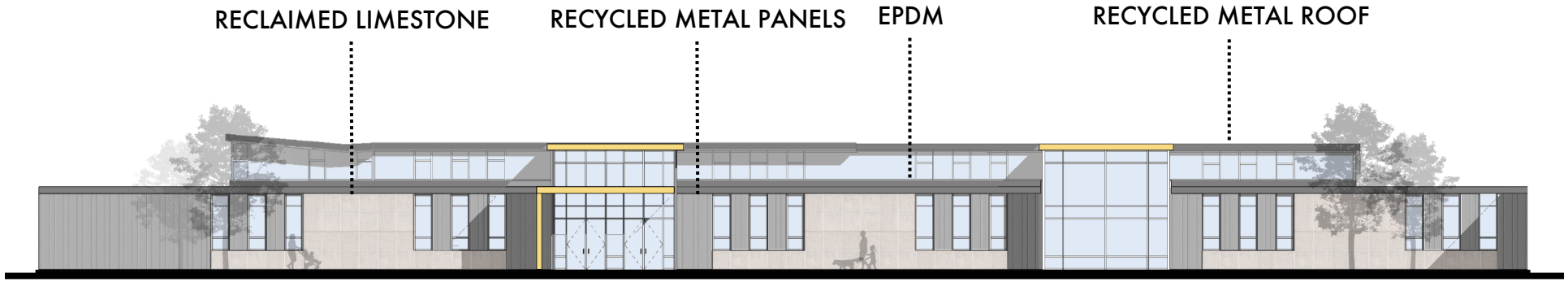
Legend:

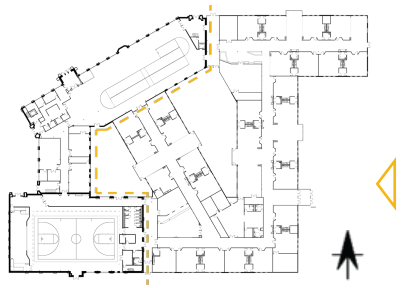
1 – FLEX SPACES
2 – ADMINISTRATION
3 – CLASSROOM
4 – GYMNASIUM
5 – CAFETERIA
6 – HEALTH SERVICES
7 – INDOOR GARDEN LAB
8 – MEDIA CENTER
9 – PLAY COURTYARD
10 – SENSORY GARDEN
11 – MECHANICAL

EXTERIOR PERSPECTIVE

EXTERIOR ELEVATION

PROJECT UTILIZES RECLAIMED AND SUSTAINABLY SOURCED MATERIALS

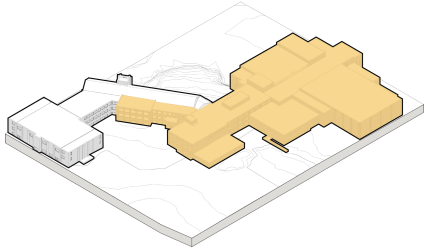


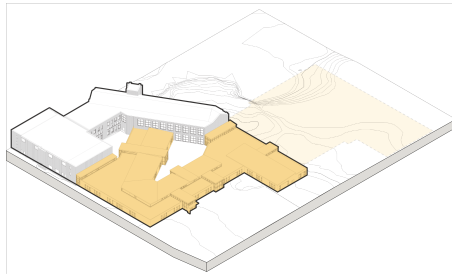


KEY PLAN

COST ANALYSIS

RIGHT SIZING SAVINGS = $537,054 IN O&M COSTS/YEAR





Occupancy - Existing

Design Occupancy	3,000
Actual Enrollment	675 students
Building Size	300,000 ft²
ft²/occupant	100

Build Estimate - Existing

Build Costs $220.70/ft²(210,000ft²)=	$46,347,000
30 year loan (10% rate) interest	$4,634,700

O&M Estimate - Existing

Electricity Costs $15,750mBTU(293kWh)= 4,615,852kWh/yr(.1365) =	$630,063/year
Total Cost	$46,977,073

Occupancy - Proposed

Design Occupancy	340
Predicted Enrollment	240
Building Size	**99,224.42 ft²**
ft²/occupant	291.84

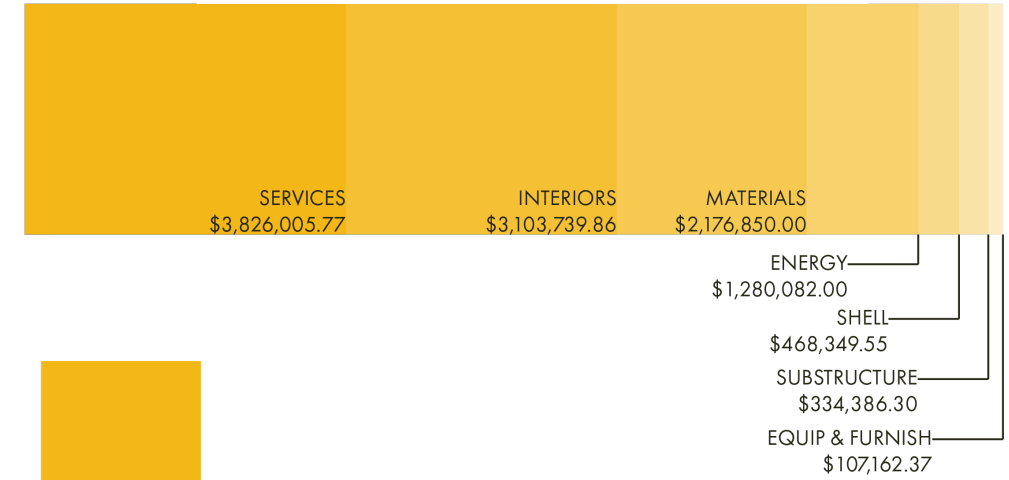
Build Estimate - Proposed

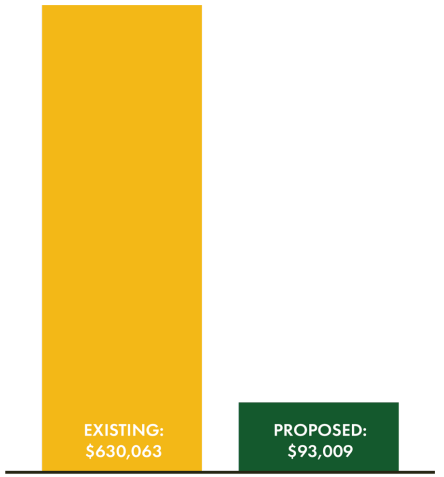
Build Costs $228.72/ft²(99,224.42ft²) =	$22,695,551.69
30 year loan interest	$2,269,555.16

O&M Estimate - Proposed

Electricity Costs $2,325mBTU(293kWh)= 681,386kWh/yr(.1365) =	$93,009/year
Total Cost	$16,081,009
Total Cost Comparison	$30,896,064
O&M Savings	$537,054/year

PROPOSED CONSTRUCTION COST: $22,695,551.69



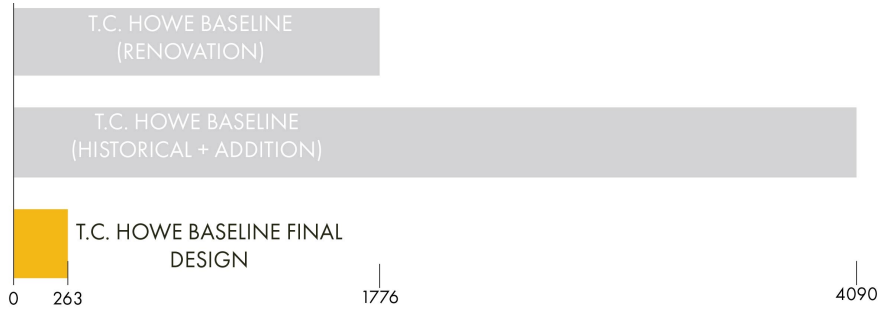


ANNUAL OPERATIONAL COSTS

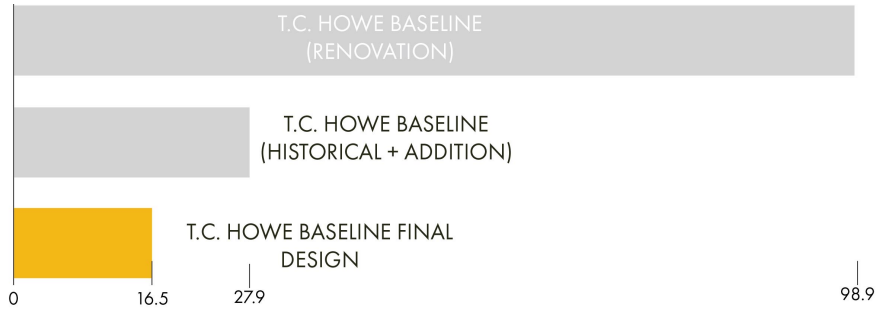
CARBON CONSCIOUS DESIGN APPROACH

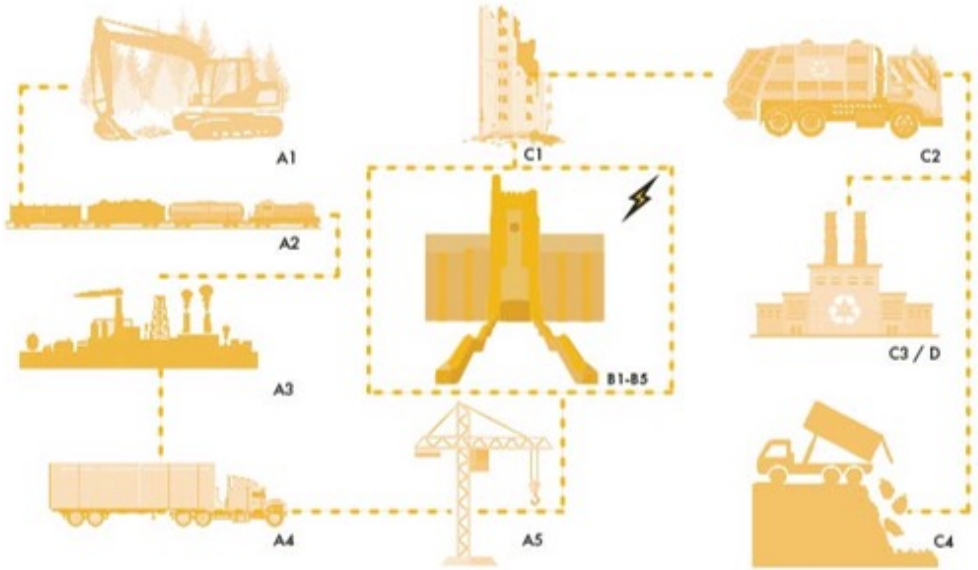
CARE TOOL + TALLY LIFE CYCLE ANALYSIS USED TO CREATE PROGRESSIVE REDUCTIONS

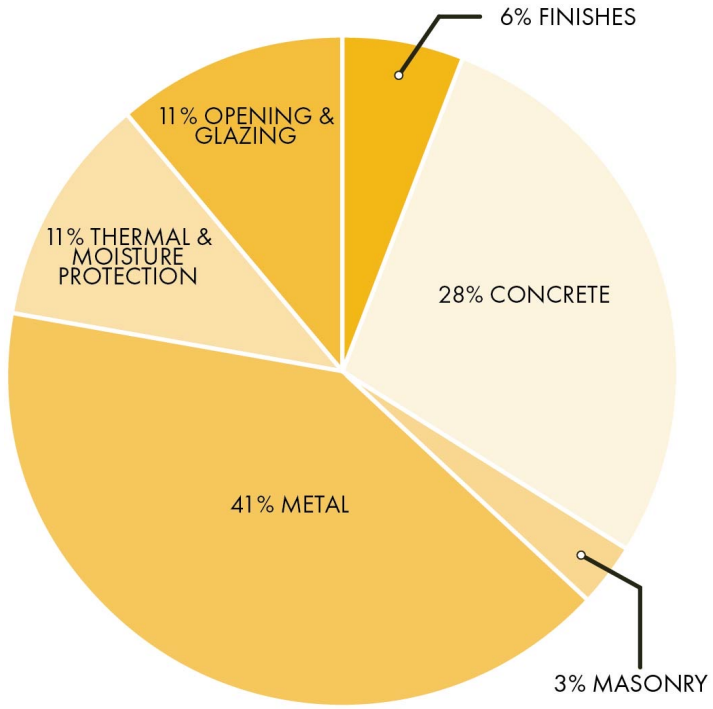
TOTAL EMBODIED ENVIRONMENTAL IMAPCT (kgCO2e/m2)



TOTAL EMBODIED ENVIRONMENTAL IMAPCT (millions of kgCO2e)







GLOBAL WARMING POTENTIAL OF ENVELOPE

WHOLE BUILDING + MATERIAL LIFE CYCLE ANALYSIS USED TO MEASURE GWP TO REDUCE EMBODIED ENVIRONMENTAL IMPA

BUILDING ENVELOPE GLOBAL WARMING POTENTIAL COMPARISON

Total Embodied Carbon Impact in Metric Tons of CO2e/ Year

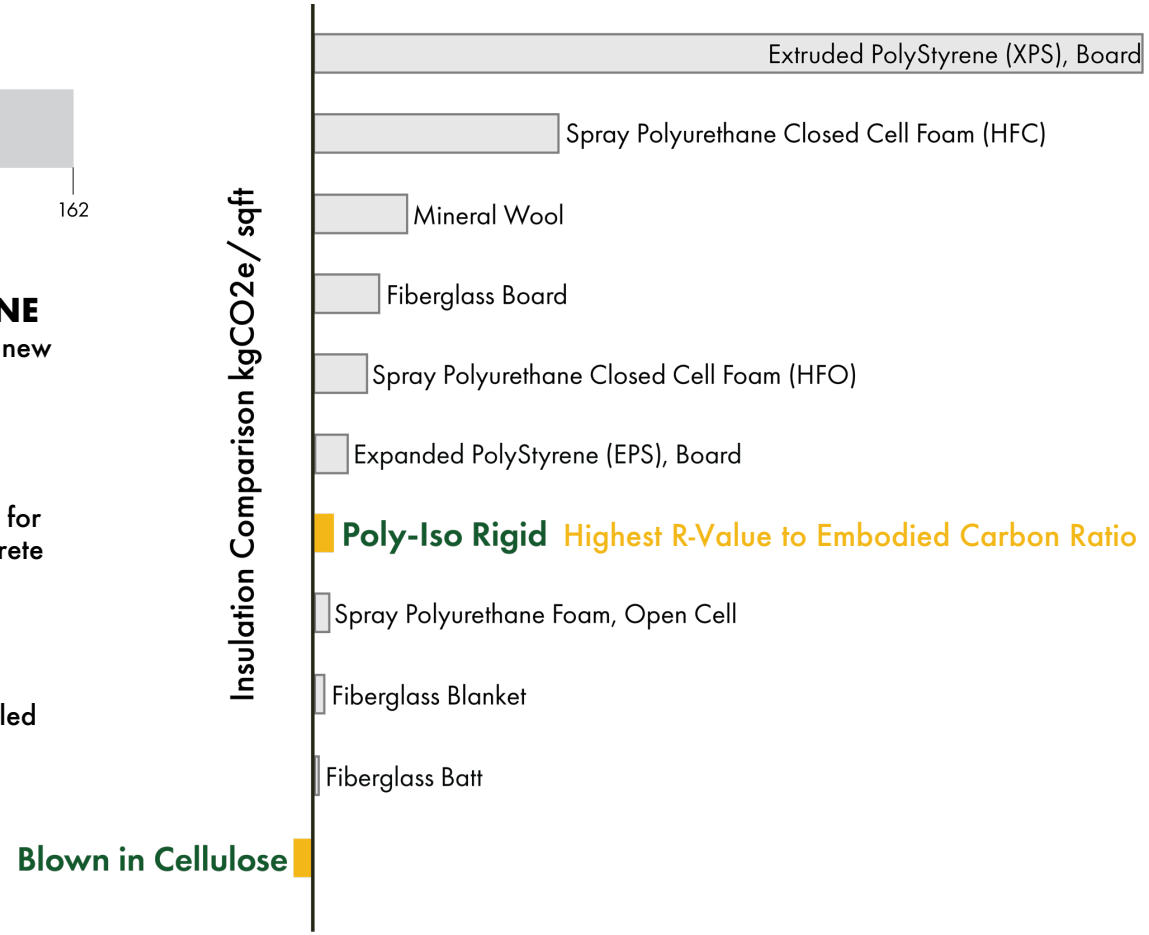
ENVIRONMENTAL IMPACT DRIVEN MATERIALS

LIMESTONE
Used for the new façade and plaza

BRICK
Used as slag for all new concrete that is being poured

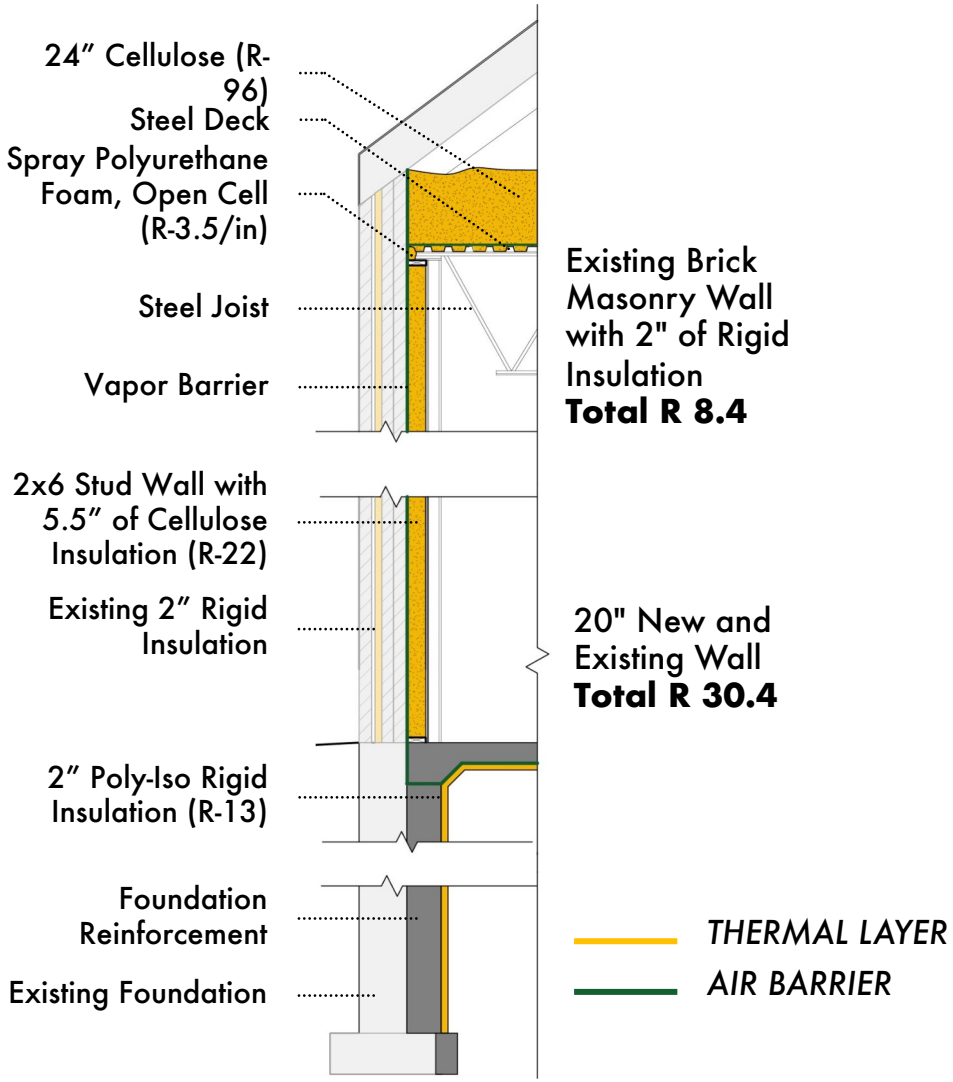
STEEL
83.9% recycled steel panel system

EMBODIED CARBON INSULATION COMPARISON

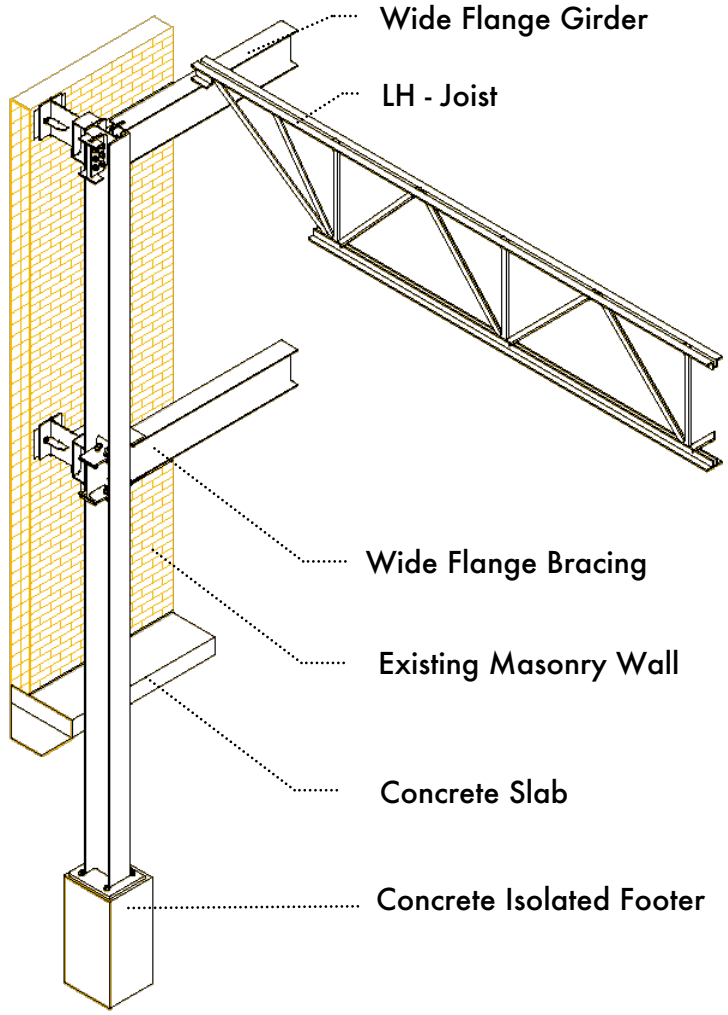


EXISTING BUILDING STRUCTURE

EXISTING BUILDING STRUCTURE ENHANCED WITH INSULATION + REINFORCED WITH STEEL COLUMNS, BEAMS AND JOISTS



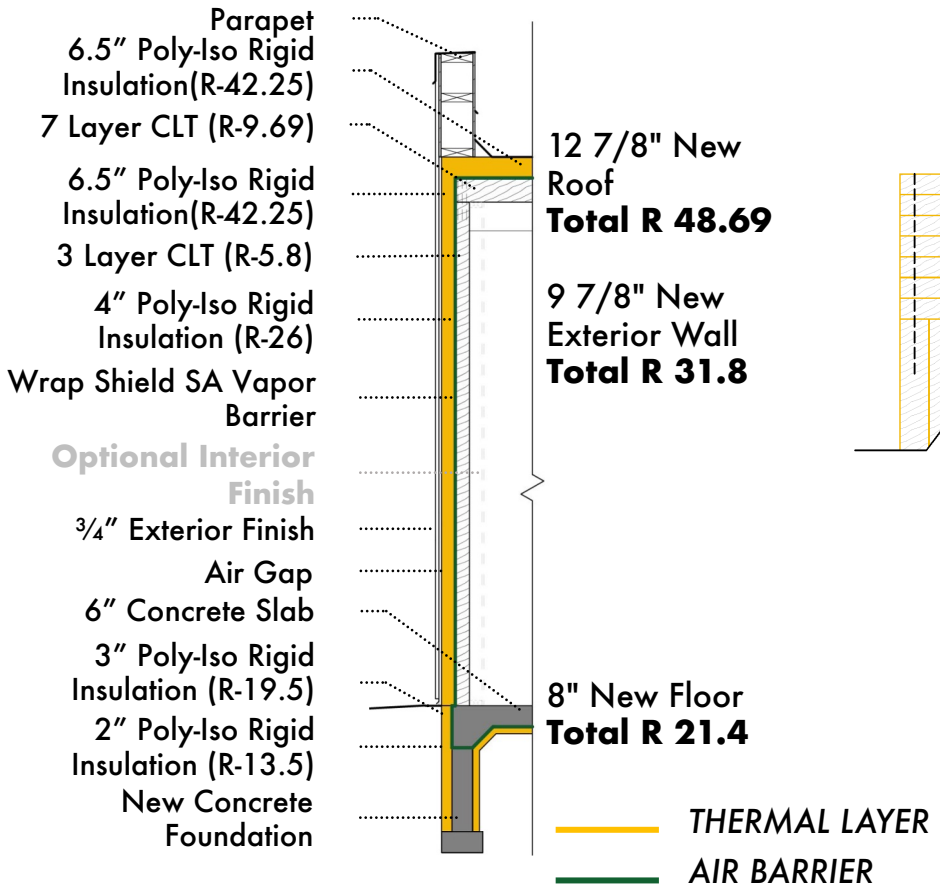
HISTORIC PRESERVED



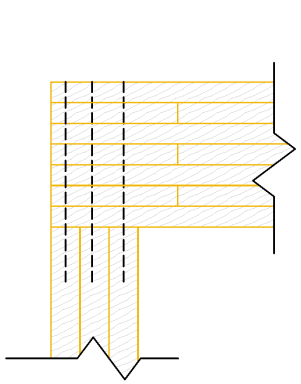
STEEL ELEMENT CONNECTIONS

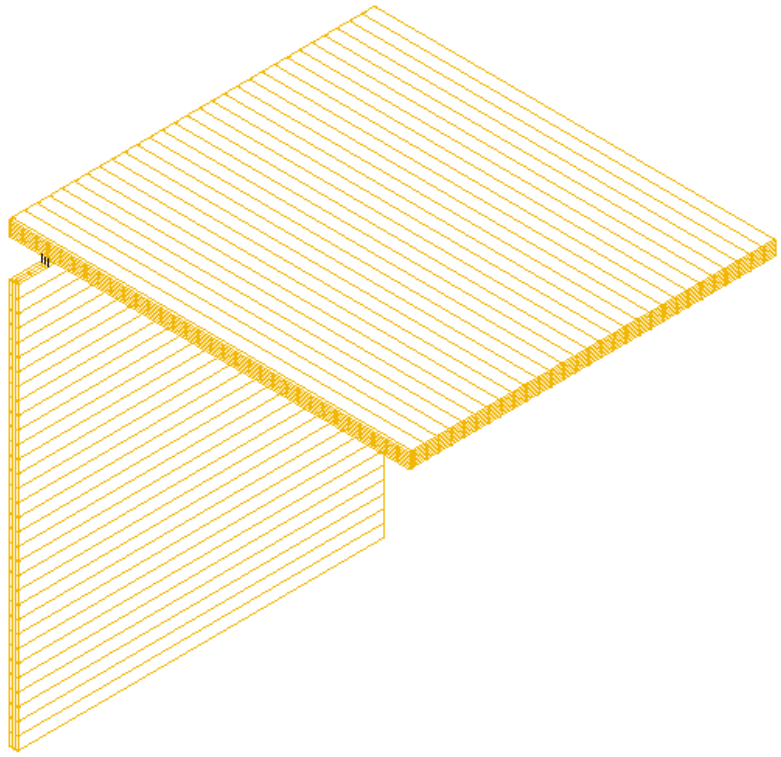
NEW ADDITION STRUCTURE

CARBON SEQUESTERING CROSS-LAMINATED TIMBER IS A STRUCTURAL WALL + EXPOSED INTERIOR FINISH + ROOF DECK



NEW CONSTRUCTION



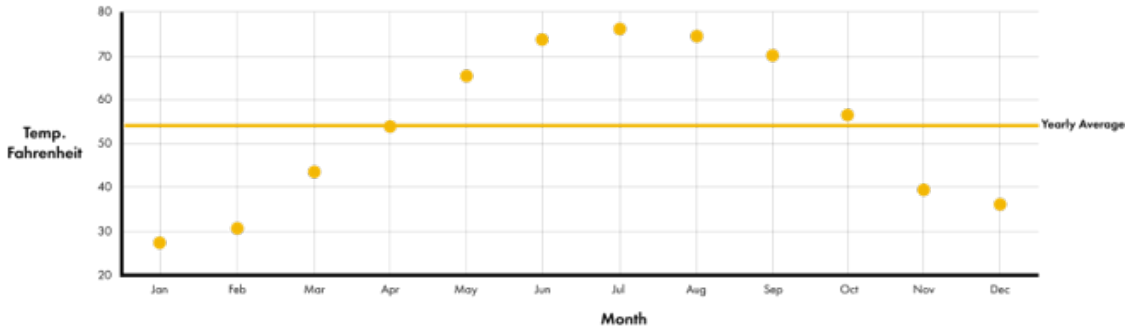


3 LAYER CLT WALL + 7 LAYER CLT ROOF CONNECTION

CLIMATIC CONSIDERATIONS

DESIGN DECISIONS ARE INFORMED BY REANALYSIS OF CLIMATE DATA AND ENERGY MODELING ITERATIONS

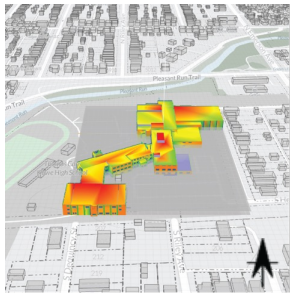
AVERAGE MONTHLY TEMPERATURE IN INDIANAPOLIS



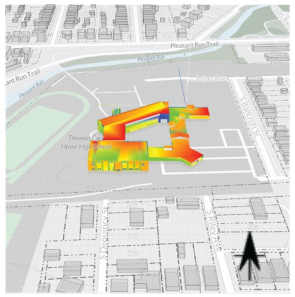
CLIMATE ZONE: 5A

Heating Degree Days	5805
Cooling Degree Days	924
Average Temp	54 F
High temp	95F
Low temp	-10 F
Average Snowfall	25 ½"/ Year

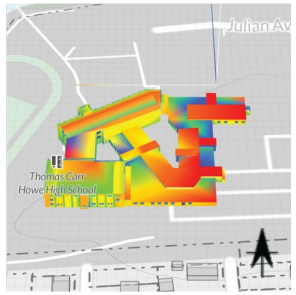
COVE.TOOL Sun Light Analysis 12 hours/day



Original

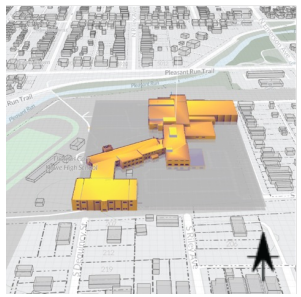


Iteration 1

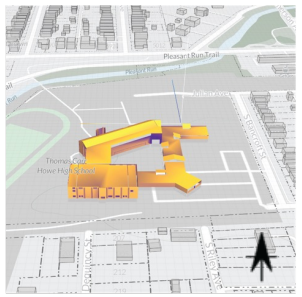


Final

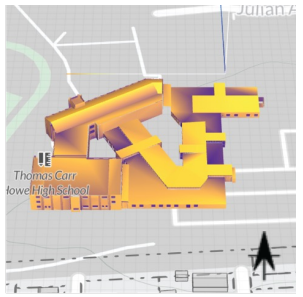
COVE.TOOL Solar Radiation Analysis: 317 kWh/m2



Original



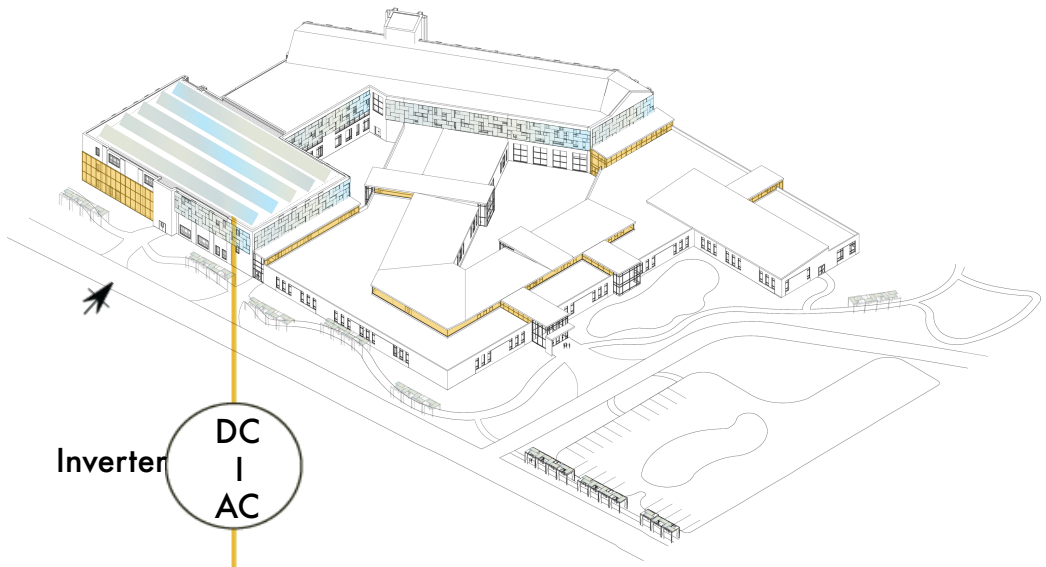
Iteration 1



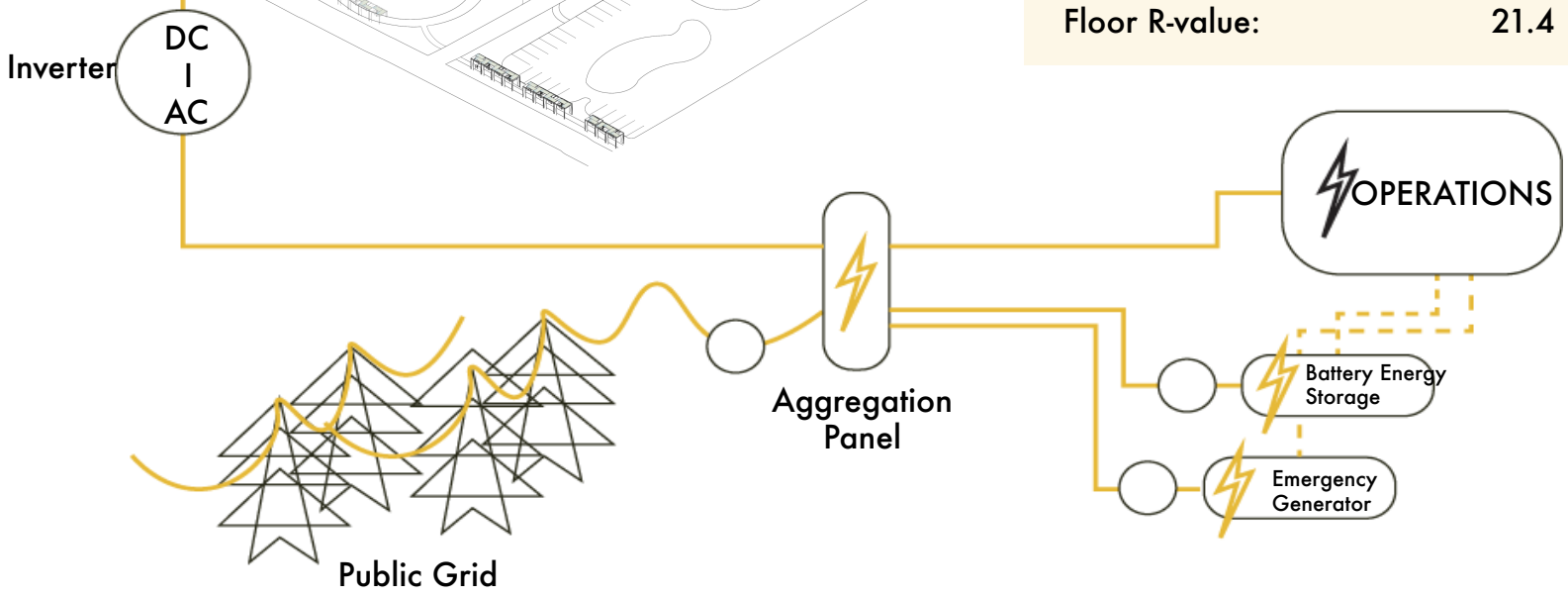
Final

ENERGY DISTRIBUTION

ENERGY IS GENERATED ON SITE AND USED FOR OPERATIONS OR IS STORED IN A BACK UP BATTERY



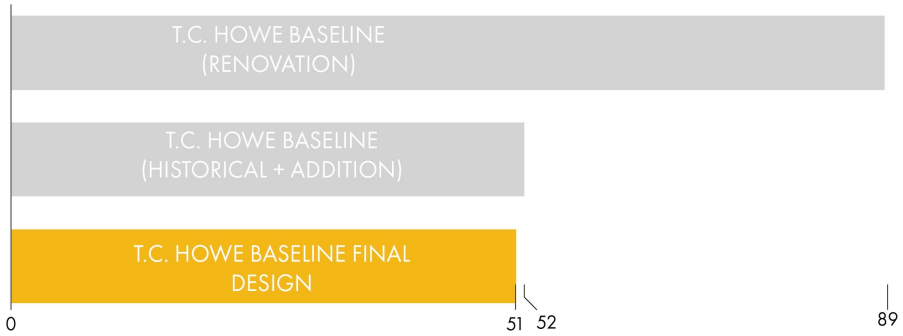
First Floor:	90,006.80 ft²
Second Floor:	9,217.62 ft²
Building Total Size:	99,224.42 ft²
Annual Heating Demand:	2.93 kBTU/ft²/year
Annual Cooling Demand:	1.81 kBTU/ft²/year
Average VRF HP COP:	4.95
Roof R-value:	72.3
Wall R-value:	31.1
Floor R-value:	21.4

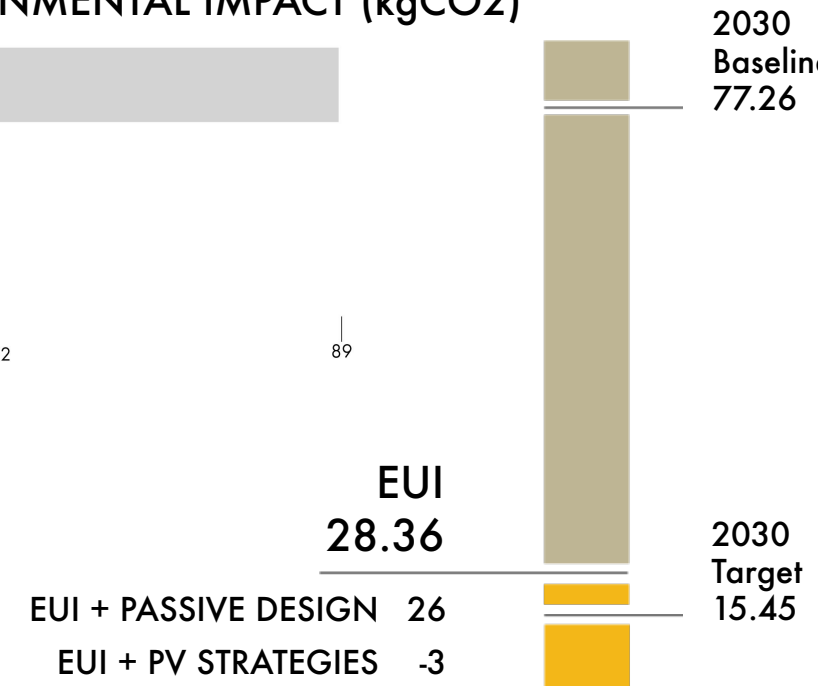


ENERGY USE INTENSITY

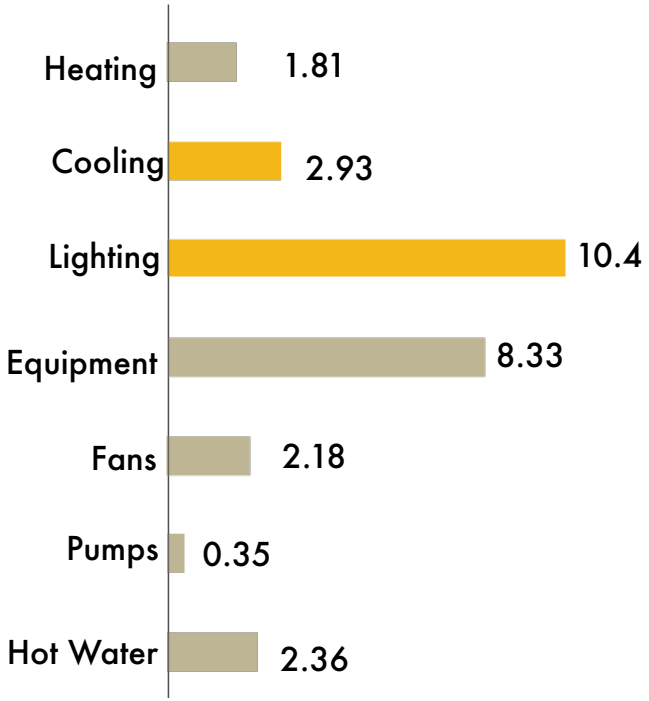
A REDUCTION OF 57% IN OPERATIONAL CARBON AND 63% IN EUI FROM EXISTING BASELINES + NET ZERO POTENTIAL

TOTAL OPERATIONAL ENVIRONMENTAL IMPACT (kgCO2)



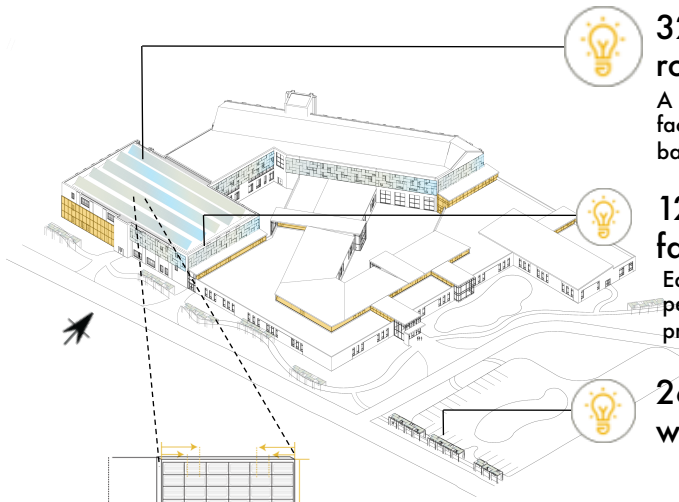


EUI BREAKDOWN



UNIFIED PHOTOVOLTAICS SYSTEM

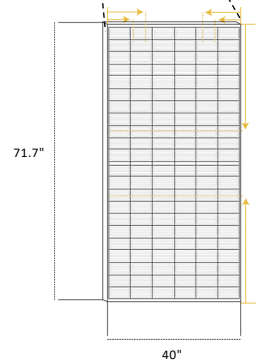
THREE INTEGRATED ARRANGEMENTS OF PHOTOVOLTAICS ACHIEVED FROM USING A SINGLE PV MODULE



320 kW PV roof mounted
A stand-alone, south facing system with battery

125.3 kW PV façade system
East facing to match peak demand and provide shade

260 kW PV walkway mounted



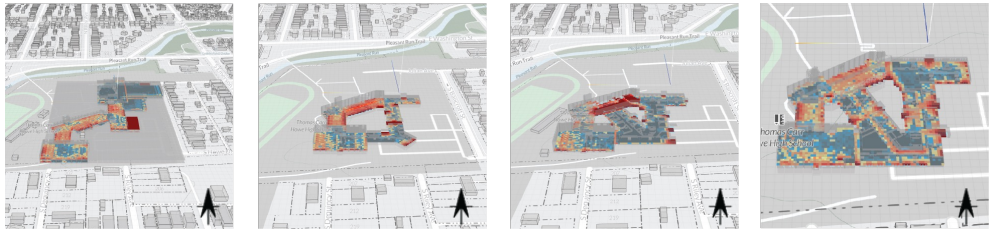
Cell Type:
Mono-crystalline silicon
Dimension:
40" x 71.7" x 1.2"

One Panasonic PV panel module

PV PERFORMANCE CALCULATIONS

PV Arrangement	Panasonic 400 Power Rating	ft²	Total ft²	Generated
Resilience Hub PV System	400 watts/panel	(20 ft²/panel)	16,200 (810 panels)	320 kW 442,272 kWh
Façade Integrated PV System	400 watts/panel	(20 ft²/panel)	5,400 (270 panels)	125.3 kW 108,000 kWh
Walkway Mounted PV System	400 watts/panel	(20 ft²/panel)	11,000 (550 panels)	260 kW 353,816 kWh
			Total Generated	904,088 kWh/year
			Total Demand	902,040 kWh/year

COVE.TOOL sDA Analysis



Original
22% sDA

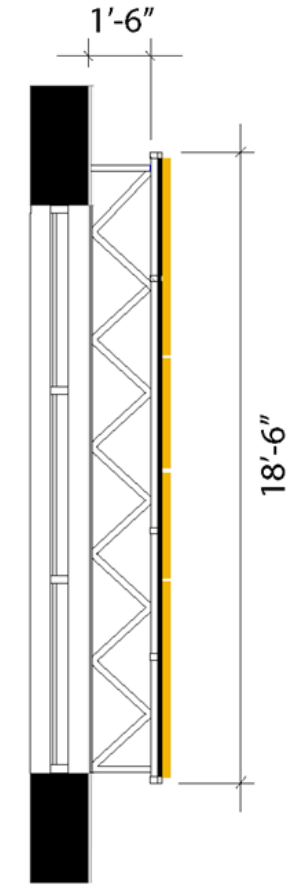
Iteration 1
48% sDA

Iteration 2
51% sDA

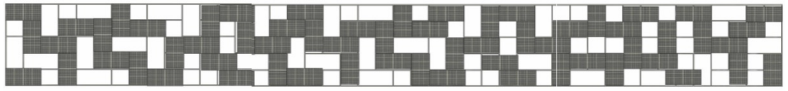
Final
55% sDA

SOLAR SCREEN INTEGRATION

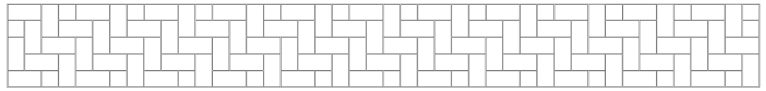
DUAL PURPOSE: SHADING AND GENERATING 123KW OF ENERGY



STEEL TRUSS CONNECTION



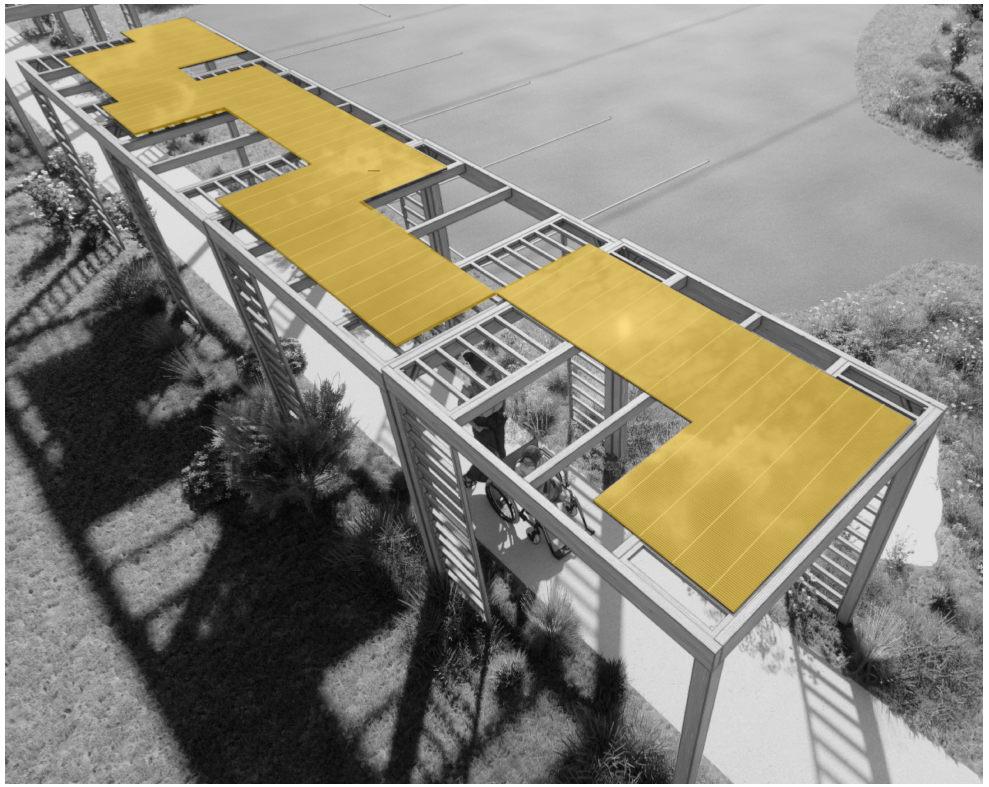
PANEL CONFIGURATION



STEEL FRAME CONFIGURATION

PV WALKWAY INTEGRATION

PROVIDES SHADE THROUGHOUT THE CAMPUS AND GENERATES 260 KWH OF ENERGY

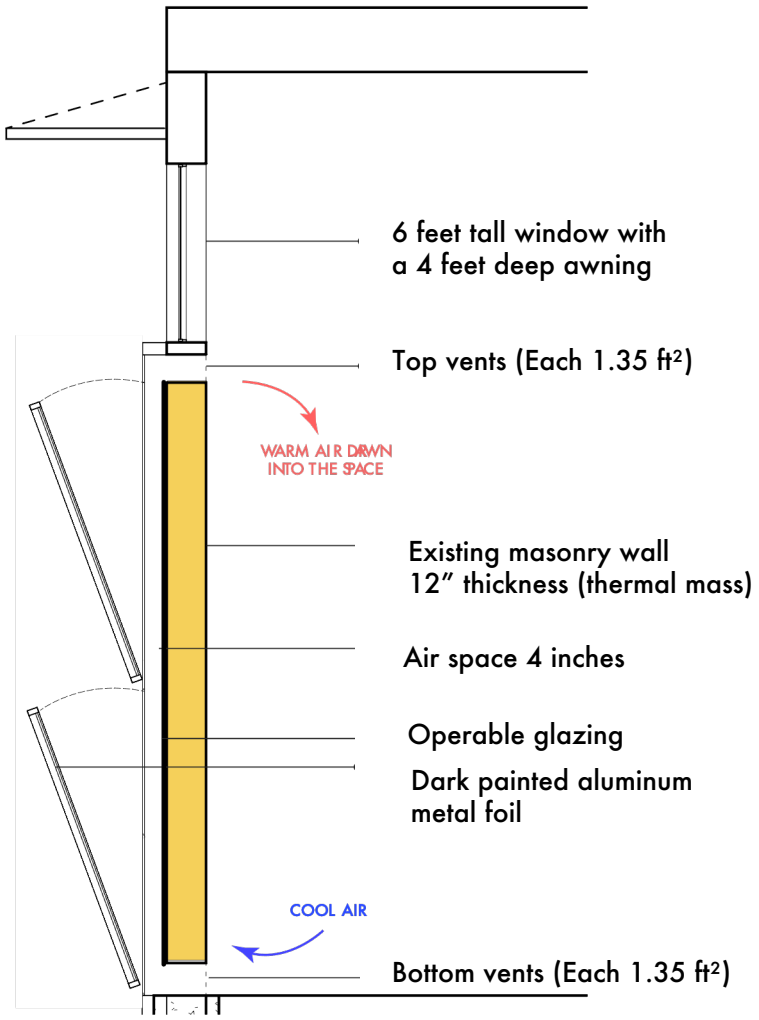


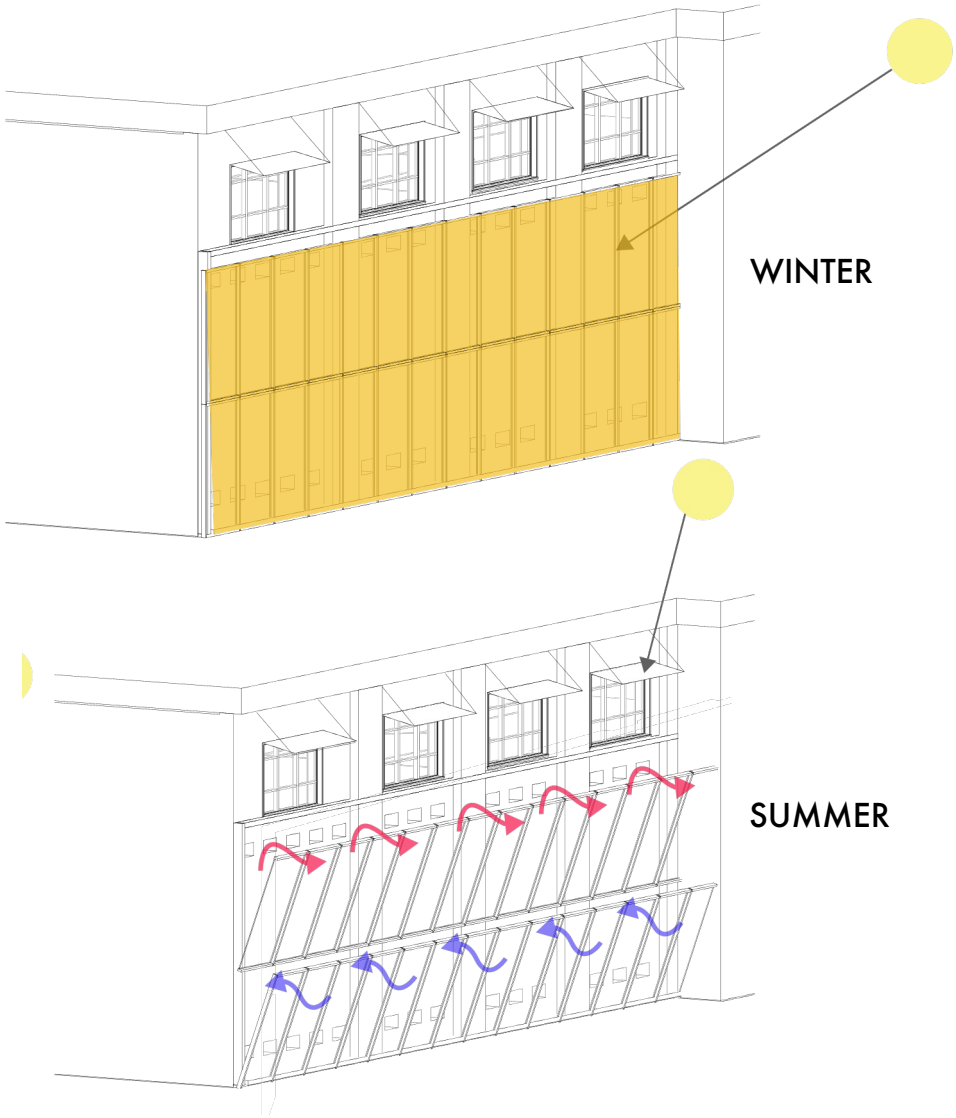
PV WALKWAY

CAMPUS INTEGRATION MAP

TROMBE WALL INTEGRATION

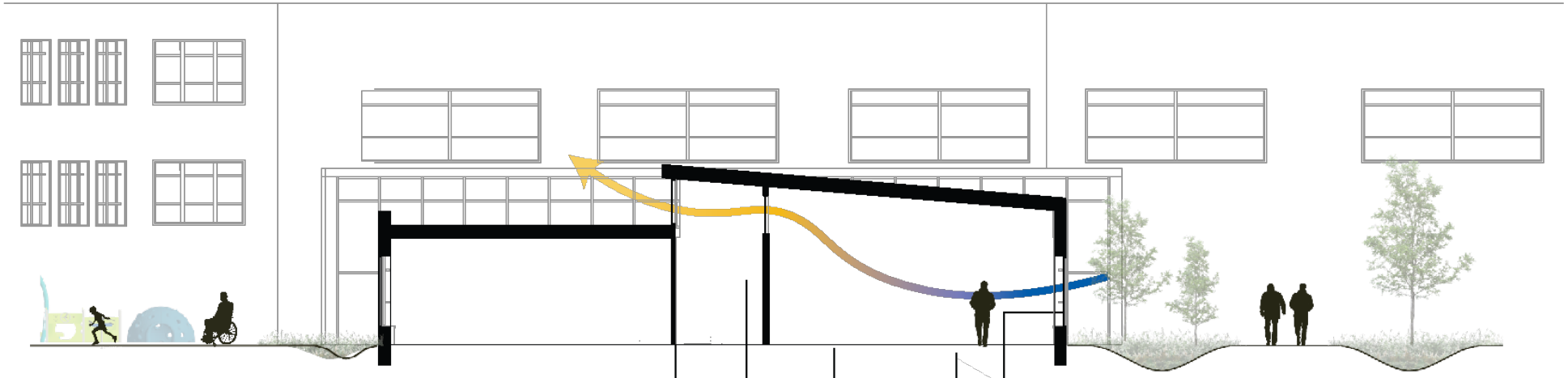
OFFSETS 30% OF THE GYM'S HEATING NEEDS





STACK VENTILATION

FULLY SATISFIES THE COOLING LOAD OF THE CLASSROOMS IN SUMMER + EFFECTIVE VERIFIED INLET AND STACK AREA



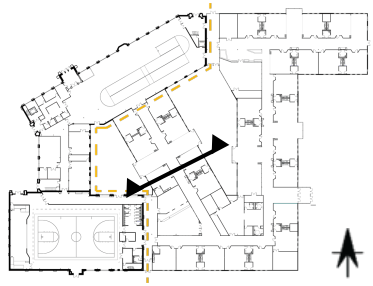
The stack is 18 feet tall (Ventilating height 9 feet)

Stack area is 17% of the floor area

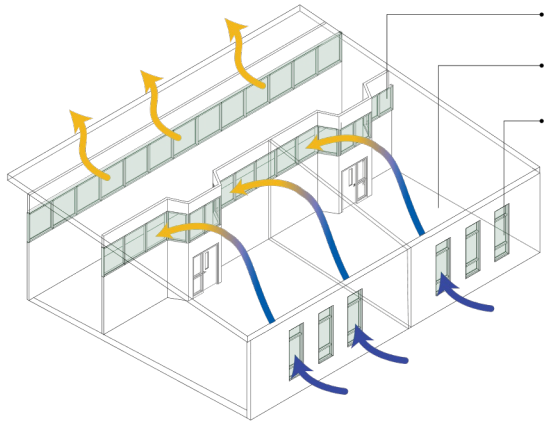
Stack ventilation capacity:
55 btu/hr. ft² >10.82 btu/hr. ft² (required)

Inlet area is 11.25% of floor area to fulfill the cooling load even when the windows are partly open.

Air movement is optimized at occupant level by placing the inlet lower



KEY PLAN



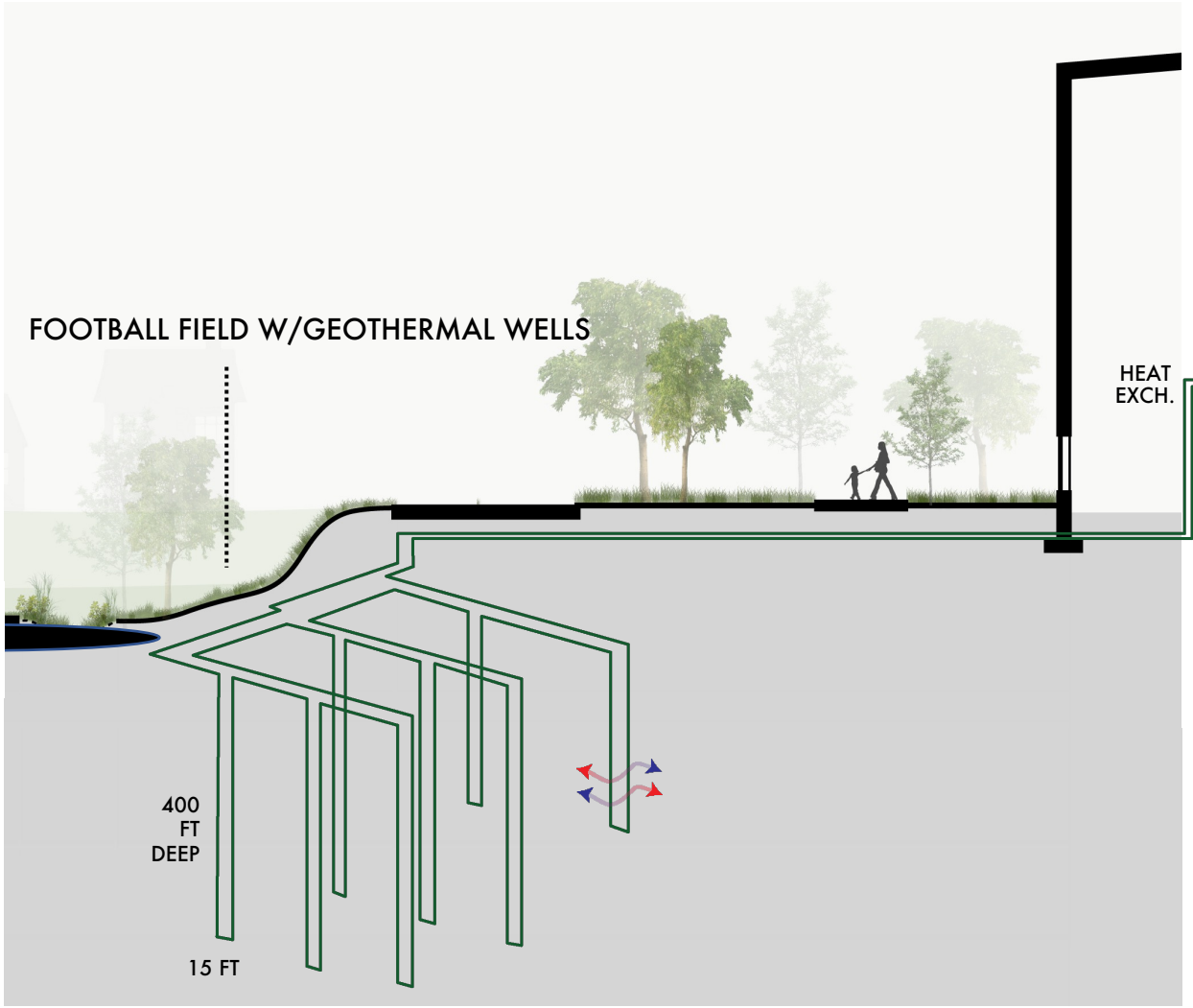
Stack area: 125 ft² (17% of the floor area)

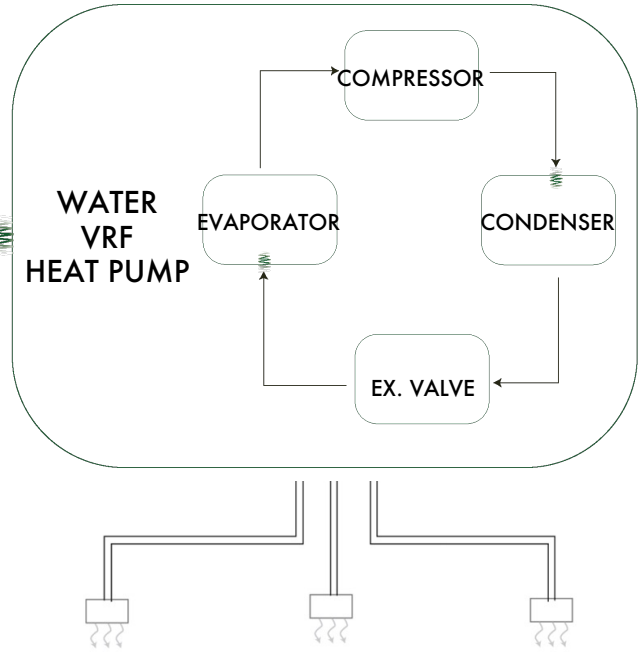
Total floor area per classroom: 720 ft²

Total window area per classroom: 81 ft²

GEOTHERMAL + VRF HEAT PUMP

WATER-SOURCE VRF HEAT PUMP USES GEOTHERMAL AS ITS HEAT SOURCE AND HEAT SINK

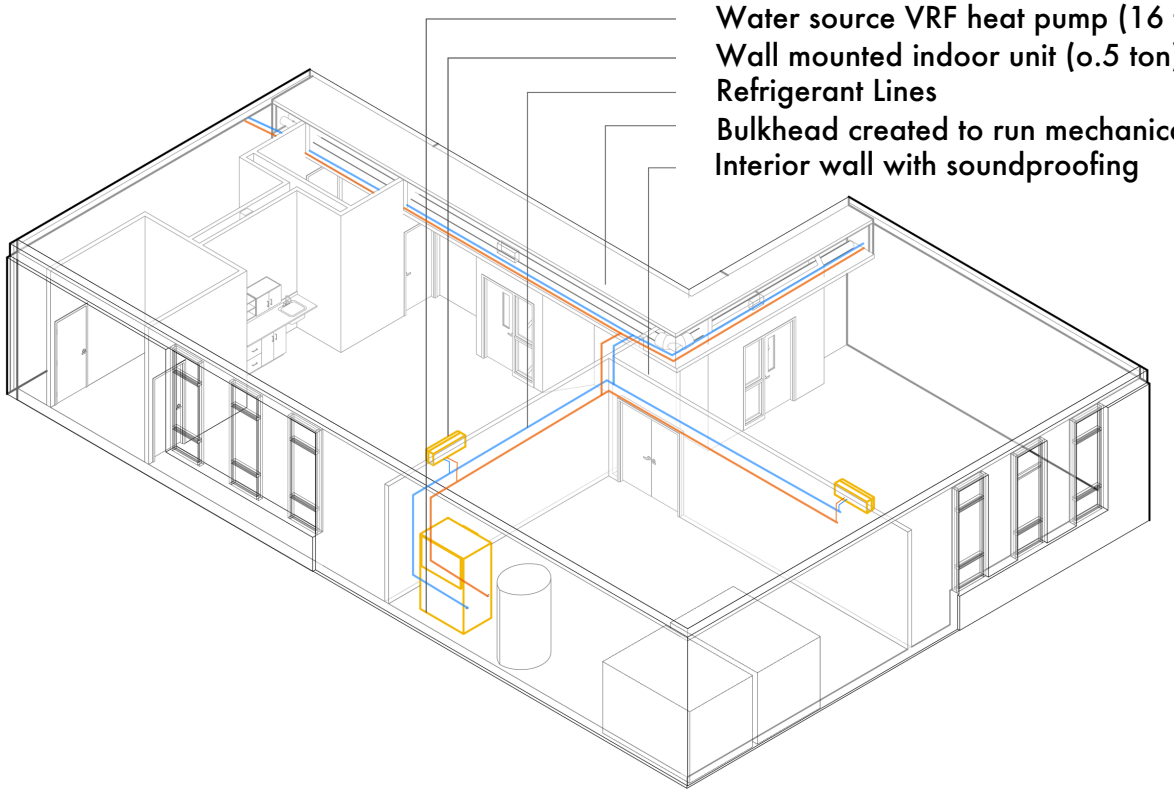




Group connection to indoor units simultaneously heating and cooling

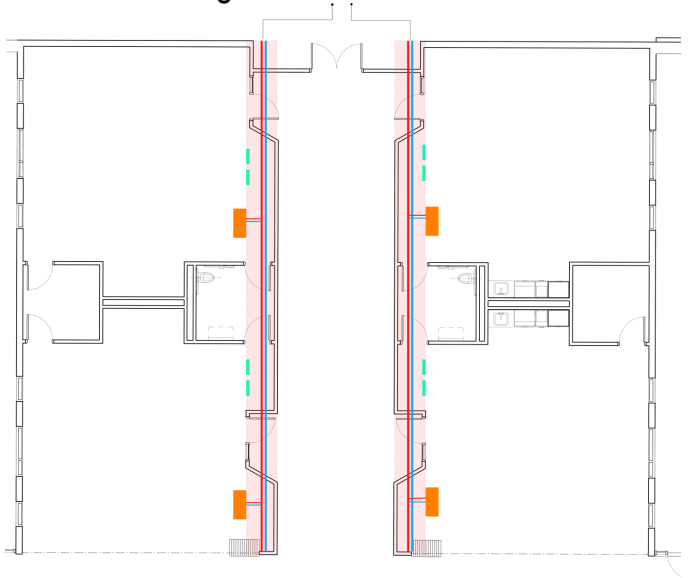
DUCTLESS VRF SYSTEM

MAXIMIZES EFFICIENCY UP TO 50% IN HEATING AND COOLING



Water source VRF heat pump (16 ton)
Wall mounted indoor unit (o.5 ton)
Refrigerant Lines
Bulkhead created to run mechanicals
Interior wall with soundproofing

Refrigerant lines in the Bulkhead



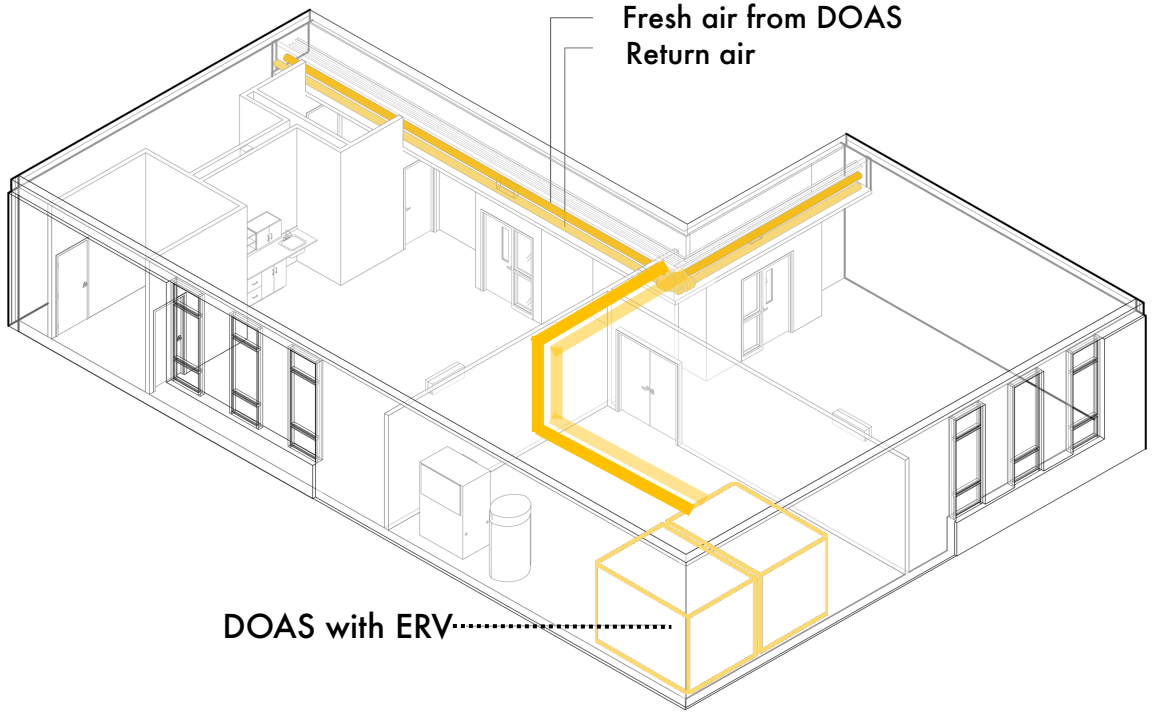
Wall mounted
Indoor unit (o.5 ton)

Ceiling mounted
4-way mini cassette (o.7 ton)

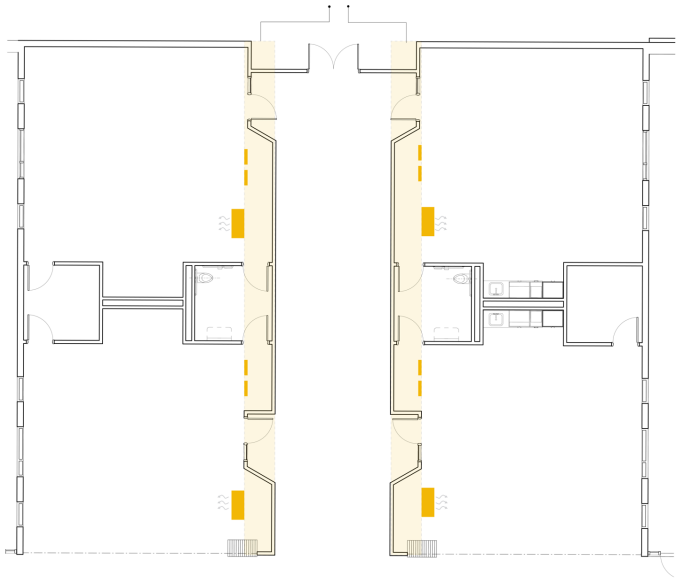
Ceiling mounted
1 way cassette (o.5 ton)

INDOOR AIR QUALITY

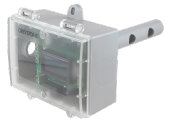
FRESH AIR PROVIDED IN EACH CLASSROOM FROM DEDICATED OUTDOOR AIR SYSTEM INLETS



Bulkheads created to run DOAS ducts and other mechanical lines



Systems dust particulate matter sensor detects environmental dusts and other particles.

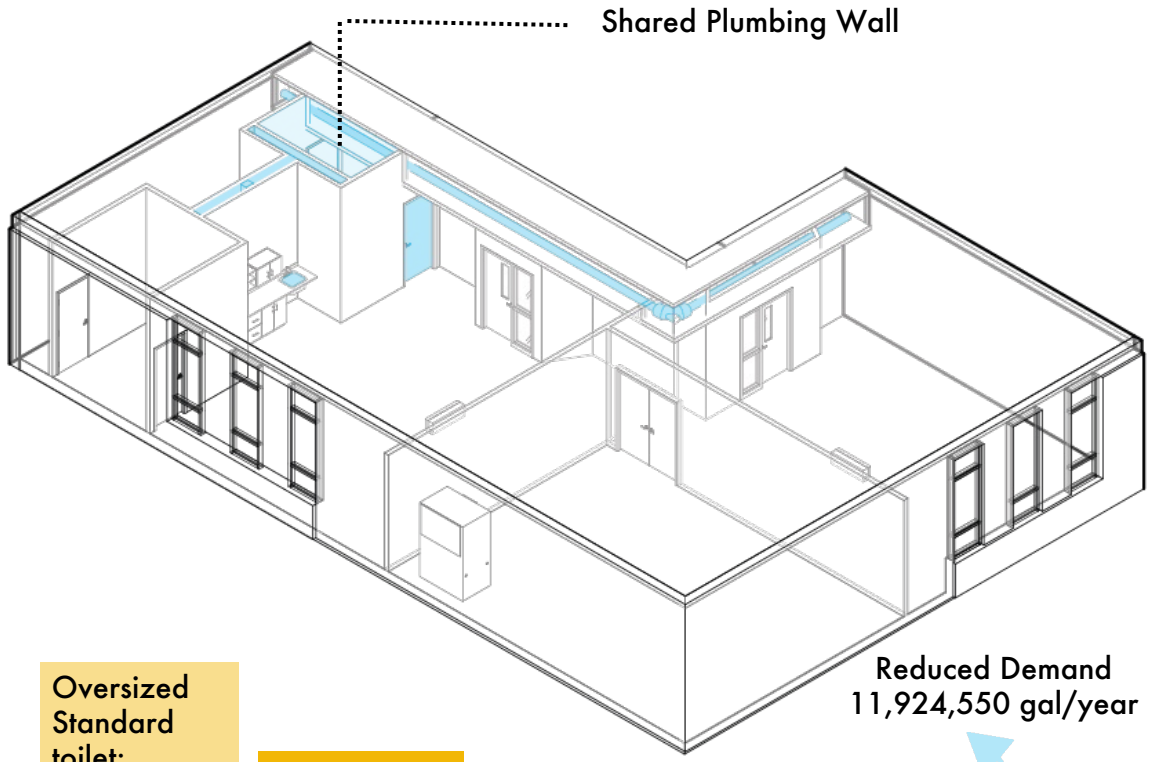


Duct indoor air quality sensor detects a broad range of VOCs

Duct CO2 sensor monitors the CO2 levels in the supply/return air.

SUSTAINABLE WATER MANAGEMENT

INDOOR WATER DEMANDS ARE MET WITH HOT AND COLD GEOTHERMAL WATER LOOPS

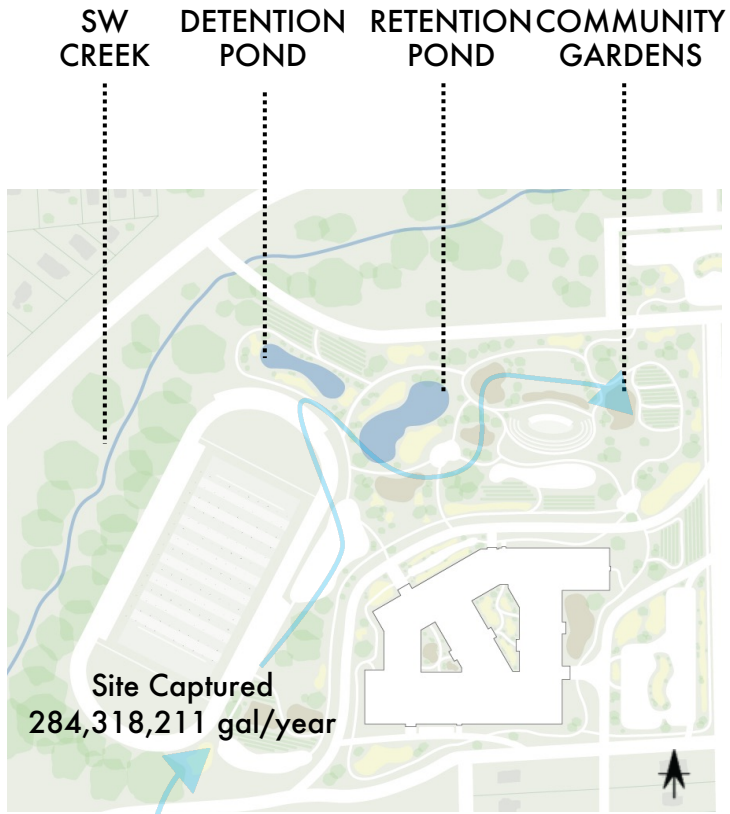


Oversized Standard toilet: >2.0 gpf

Right sized EPA smart toilet: < 1.28 gpf

EPA smart toilet min: > 1.0 gpf

RIGHT SIZED TOILET
ADEQUATE FLOW + WATER CONSERVATION



Reduced Demand
11,924,550 gal/year

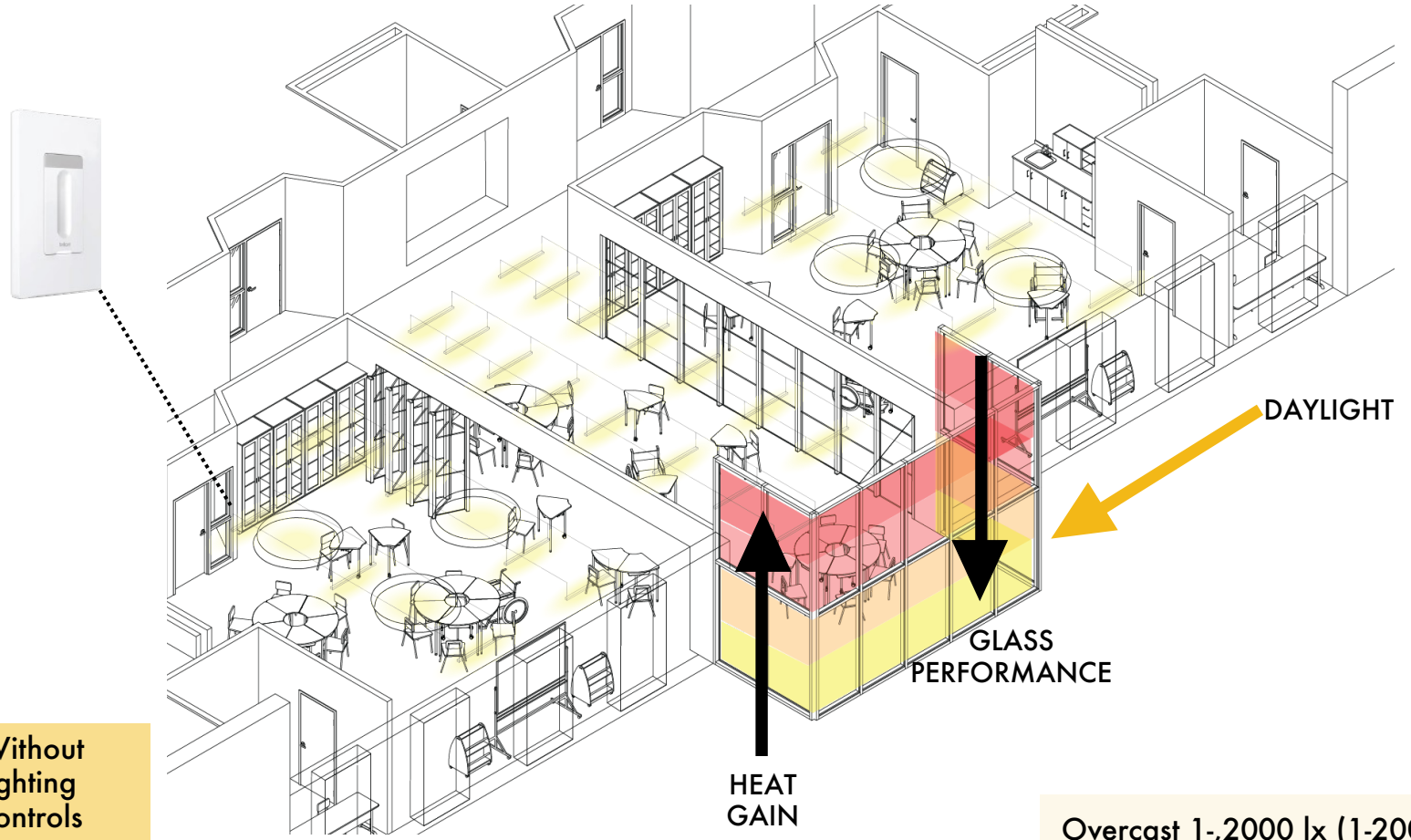
COUNTY WATER: INDOOR USE

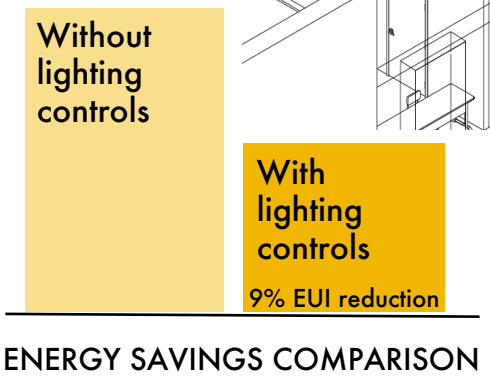
RAINWATER: GARDENS/LANDSCAPE

SUSTAINABLE WATER MANAGEMENT

VISUAL COMFORT

DELIGHTFUL CLASSROOMS – PROVIDING DAYLIGHT, TAILORED LIGHTING SOLUTIONS AND GREATER COMFORT

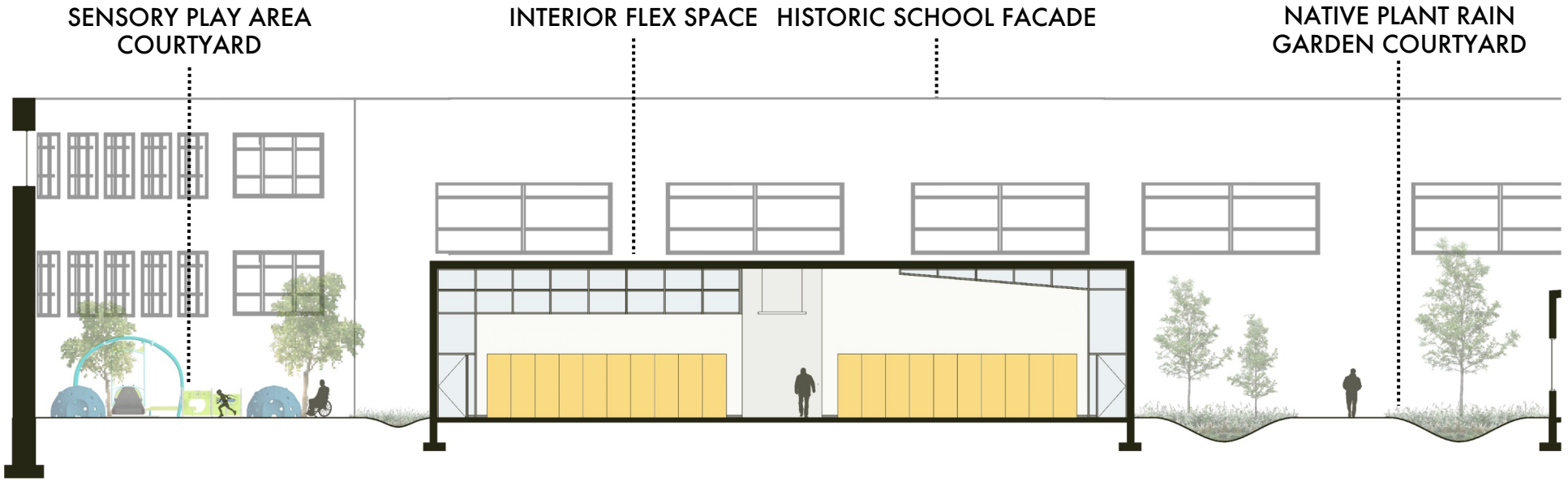


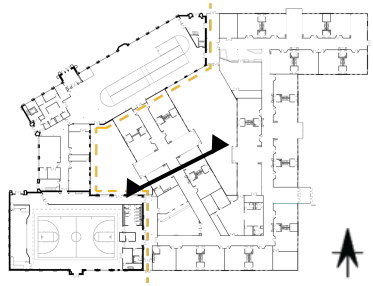


Overcast 1-,2000 lx (1-200 fc)
LED task light bulb 500 lx (50 fc)

Daylight factor = 2% sufficiently lit - 5% well lit
(LEED 2% in 75% of occupied spaces)

COURTYARD EXPERIENCES





KEY PLAN

FLEX SPACE PERSPECTIVE

INDOOR GARDEN PERSPECTIVE

CORRIDOR PERSPECTIVE

DESIGN ELEMENTS

SEATING ALCOVE: Helps alleviate anxiety, neuroses, and lack of self-confidence

MOVABLE PARTITION WALL: Flexibility for space geometry

DAYLIGHT AND NATURAL VENTILATION: Helps with anxiety, neuroses, and depression

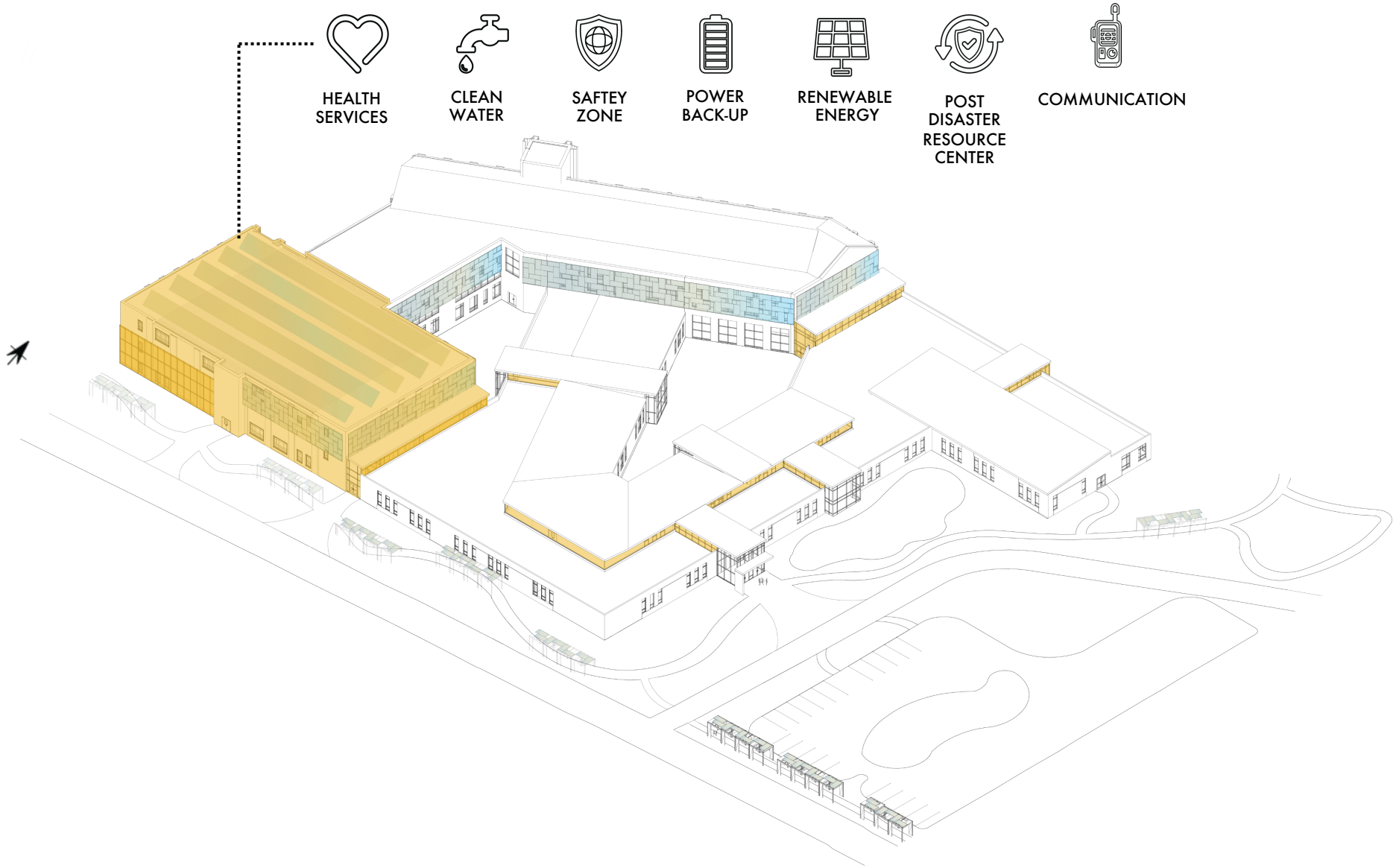
SLOPED CEILING AND ACOUSTIC CLOUDS: Helps with sensory imbalance

RUBBER FLOORING: Sound absorbent and a high coefficient of friction

MOVABLE FURNITURE: Better arrangement for attention deficit disorder

ATRIUM PERSPECTIVE

RESILIENCE HUB



COMMUNITY ENGAGEMENT

January 23
Fanning Howey Architecture: Case Study Presentation

February 20
Chris Downey (California Commission on Disability Access, President): Q & A

February 22
Fanning Howey Architecture: Design Critique

March 17
Andrea Lakin (Learning Community Director and former Assistant Director of Special Education at Indianapolis Public School System): Q & A and Design Critique

March 22
Fanny Howey Architect: HVAC Design Critique