

Lexington High School

School Building Committee Meeting

05/12/2025



smma dw **Turner**
DORE + WHITTIER

- 1 Call to Order
- 2 Vote on Previous Meeting Minutes 12:00 – 12:05
- 3 Public Comment 12:05 – 12:10
- 4 Project Updates 12:10 – 12:15
- 5 Confirm HVAC System 12:15 – 12:25
- 6 Review Outdoor Classroom, Roof Terrace & Plaza Design 12:25 – 12:50
- 7 Confirm Lighted Fields & Field Material 12:50 – 1:00
- 8 Confirm Off-Site Improvements 1:00 – 1:20
- 9 Confirm Exterior Design & Design of Building Entrances 1:20 – 1:50
- 10 Reflections & Action Items 1:50 – 2:00
- 11 Adjourn

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GSHP = Ground Source Heat Pump
ASHP = Air Source Heat Pump
VRF = Variable Refrigerant Flow

Option 1

Central GSHP

Option 2

Central ASHP

Option 3

Hybrid –
Central GSHP &
Central ASHP

Option 4

ASHP VRF

Code Baseline: Natural Gas Boiler and water-cooled Chiller [ASHRAE System #7]

SMMA	SLC	Town/DPF	PBC
Option 3: Hybrid	Option 3: Hybrid	Option 3: Hybrid	Option 3: Hybrid
Reasons <ul style="list-style-type: none">• EUI 25 and NZE goal• 30-year positive cash flow• Equipment Low carbon life-cycle (vs. ASHP)• Maintenance• GSHP longer equipment life• Resiliency: GSHP benefit during power outage• GSHP Modular helps reliability• Utility, O&M and peak load cost savings• No refrigerants within the building interior spaces.			

**Recommendations are based on analysis, review and discussion amongst the Department of Public Facilities, Sustainable Lexington Committee (SLC), Mark Sandeen, Dore & Whittier (OPM) and SMMA.

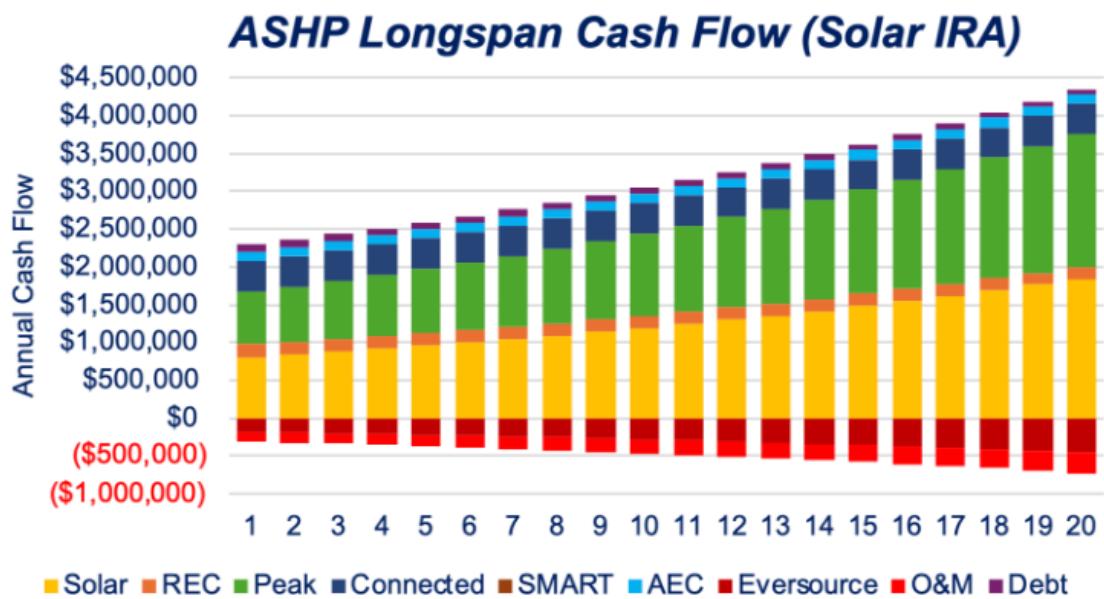
HVAC System Selection / Pros & Cons

Option 1 Ground Source

	Pros	Cons
Option 1 Ground Source	<ul style="list-style-type: none">Excellent energy efficiencyFlexible operation for heating and cooling needsGSHP modular configuration enhances reliabilityNo defrost cycle to limit heating mode operation~20-year equipment lifeIRA incentives may be available.	<ul style="list-style-type: none">Requires interior mechanical room (~2,500 sf)Higher system installation (first) costs.IRA incentives are not a certainty
Option 2 Air Source	<ul style="list-style-type: none">Flexible source for CHW and HWModular configuration helps reliabilityCost effective installation	<ul style="list-style-type: none">Does not meet 25 EUI goalEnergy efficiency is not as good as alternativesSignificant Utility, O&M and peak demand (\$\$\$)Defrost cycle disrupts heating functionRequires interior mechanical room (~1,400 sf)Requires glycol for freeze protection~15-year equipment life
Option 3 Hybrid	<ul style="list-style-type: none">Excellent/very good energy efficiencyGeothermal field size is optimized for HVAC loads servedModular GSHP configuration enhances reliabilityIRA incentives may be available for GSHPGSHP units: ~20-year equipment life	<ul style="list-style-type: none">Requires interior mechanical room (~2,000 sf)Requires glycol for freeze protection of ASHP portionIRA incentive not a certaintyASHP units: ~15-year equipment life
Option 4 VRF	<ul style="list-style-type: none">Good energy efficiencyCost effective installationSatisfies simultaneous heating and cooling demandsNo interior mechanical room space required	<ul style="list-style-type: none">Does not meet 25 EUI goalExtensive refrigeration piping + New refrigerants are class A2LHigh carbon emission (life cycle) due to refrigerantsHighest Utility, O&M and peak demand costs (\$\$\$\$)VRF controls can be troublesome~15-year equipment lifeVRF defrost cycles disrupt heating function

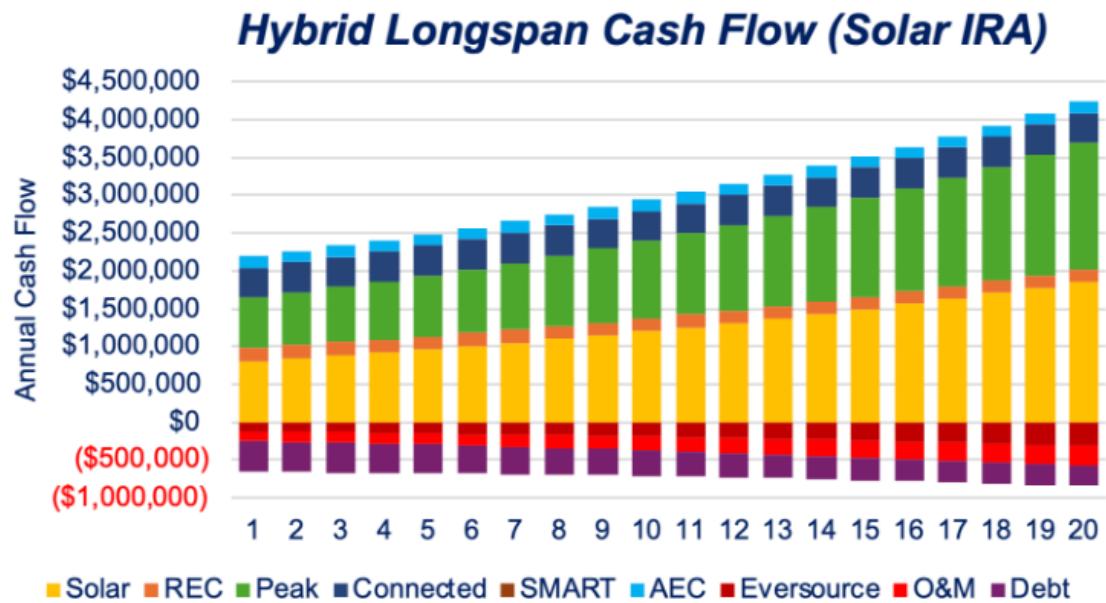
ASHP w/ Longspan Solar

- \$85 to \$107M positive cash flow
 - \$99M expected cash flow
- \$1.5M lower upfront cost
- \$12M Eversource charges

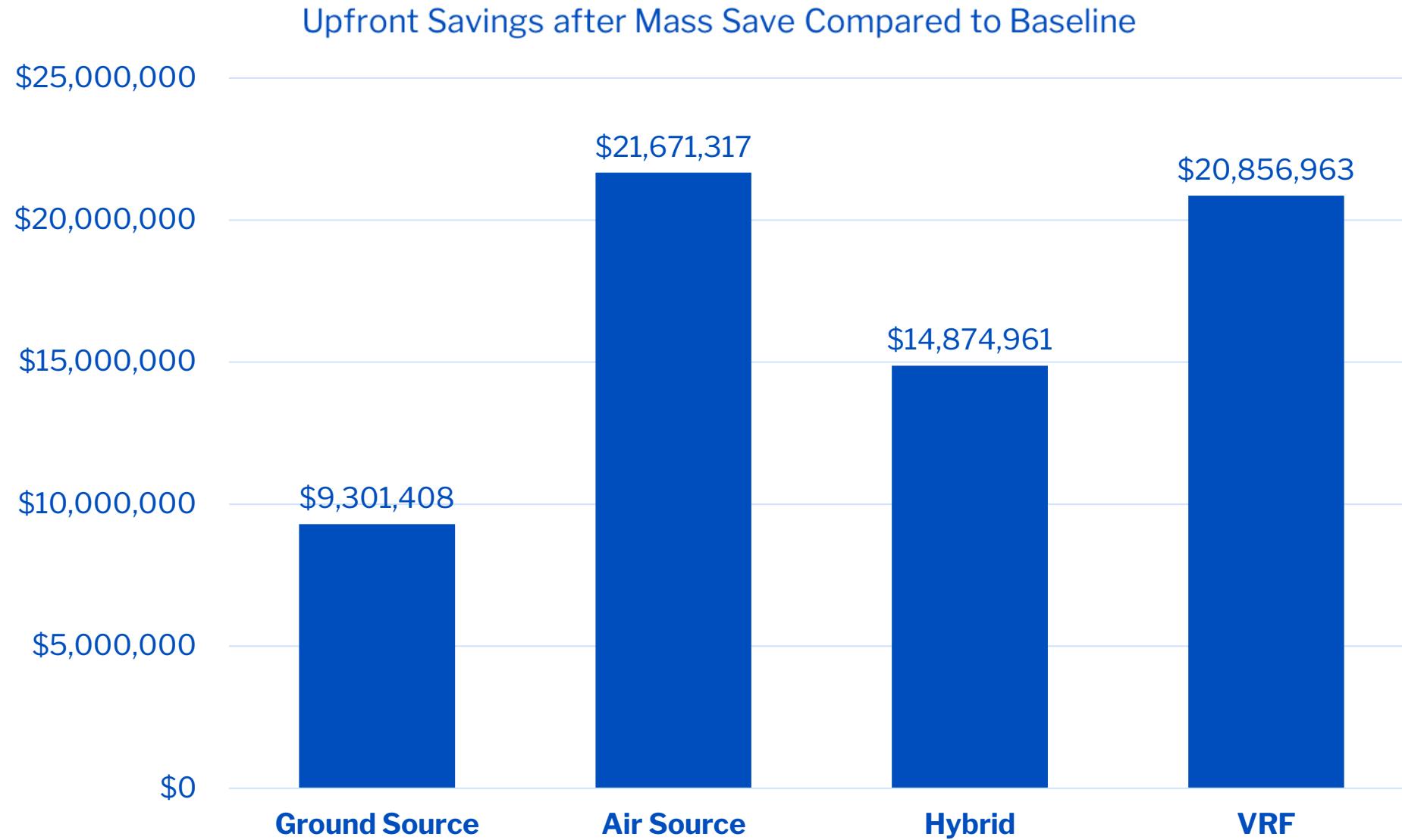


Hybrid w/ Longspan Solar

- \$76 to \$112M positive cash flow
 - \$91M expected cash flow
- \$5.2M additional upfront cost
- \$8.3M Eversource charges



HVAC System Selection / HVAC Upfront Savings after Mass Save Compared to Baseline Gas/Chiller



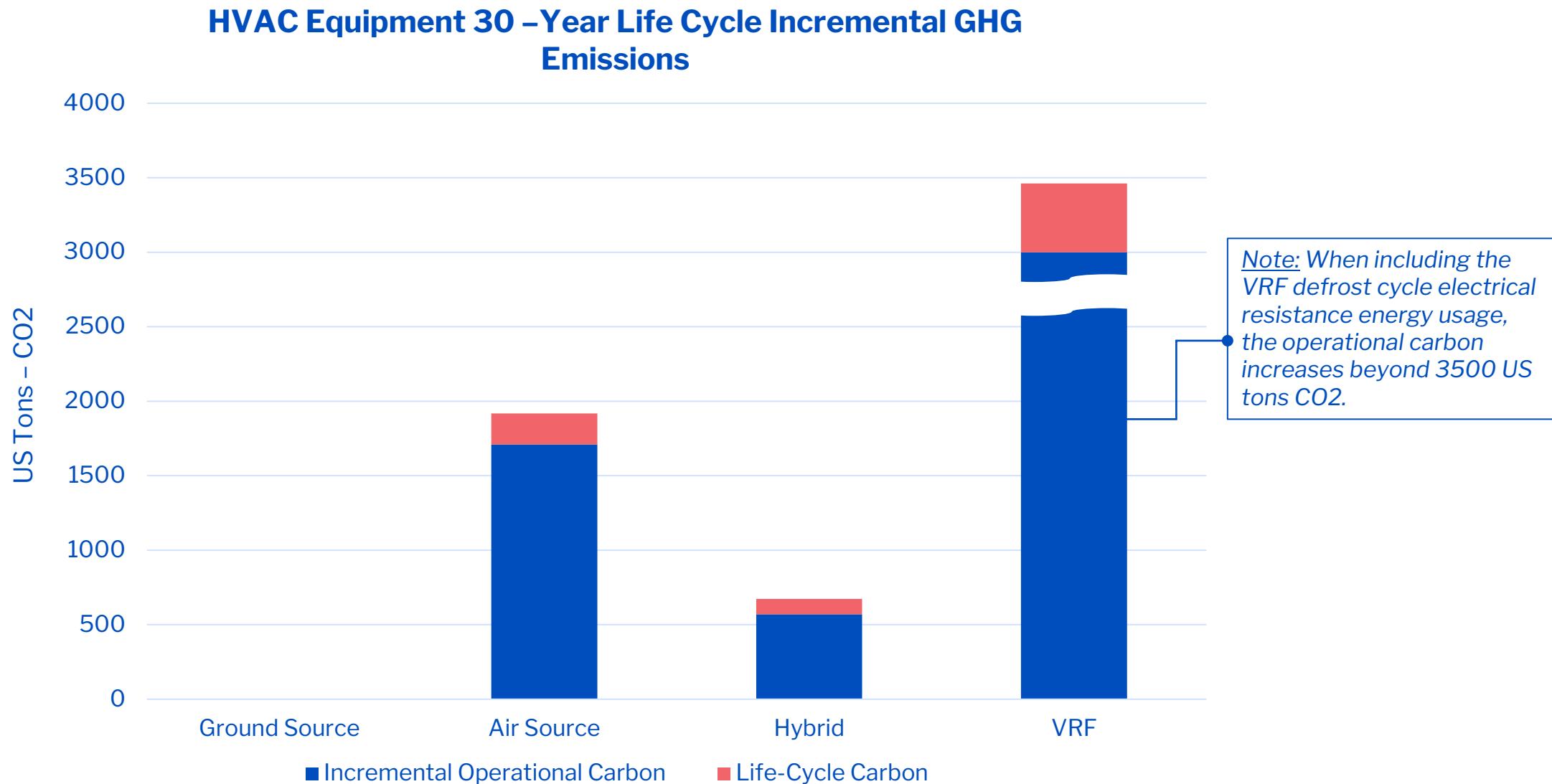
HVAC System Selection / 30 Year Average Cash Flow – Only Solar IRA Scenario

	Option 1 Ground Source	Option 2 Air Source	Option 3 Hybrid	Option 4 VRF
Debt Service	\$(603,828)	\$80,946	\$(279,350)	\$169,253
Eversource	\$(173,645)	\$(400,628)	\$(275,957)	\$(1,233,707)
O&M	\$(230,158)	\$(238,654)	\$(234,430)	\$(303,309)
Solar	\$1,652,586	\$1,625,687	\$1,639,970	\$1,601,168
Peak Demand	\$1,485,417	\$1,542,455	\$1,461,437	\$1,723,665
ConnectedSolutions	\$400,000	\$400,000	\$400,000	\$397,400
RECs	\$163,527	\$160,865	\$162,278	\$158,439
SMART				
AECs	\$172,911	\$123,508	\$148,210	\$59,508
Annual Net Benefit	\$2,866,811	\$3,294,179	\$3,022,159	\$2,572,417
Total 30 Year Positive Cash Flow	\$86,004,330	\$98,825,368	\$90,664,762	\$77,172,508

HVAC System Selection / Space Requirements, Efficiency & Carbon Comparison

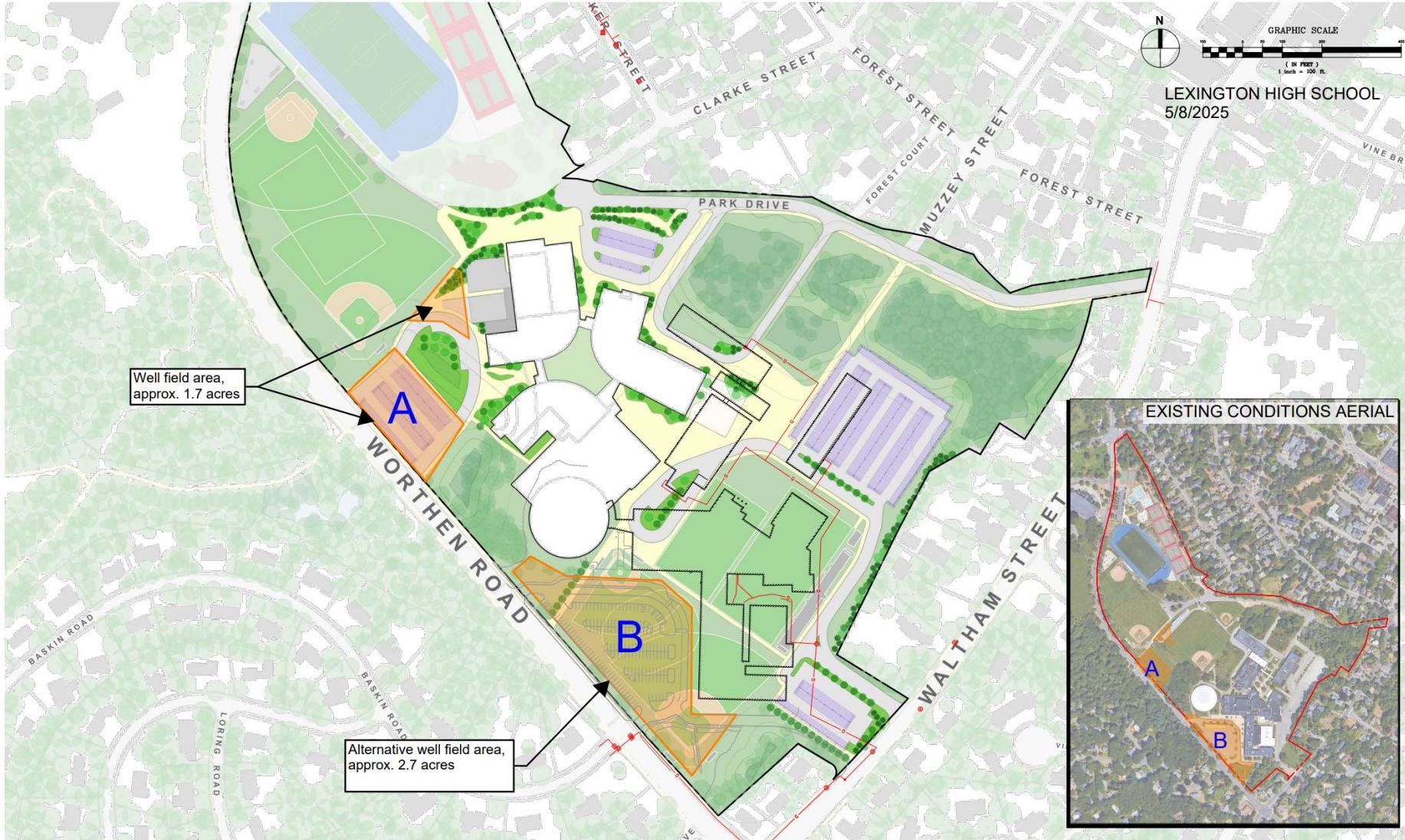
System Type	Mech. Room Space	Efficiency	Incremental Operational Carbon (over Option 1 - GSHP)		Life-Cycle Carbon of Equipment ¹ (Refrigerants)
			US Tons/Yr.	US Tons [30 yr. - Equip. life-cycle]	30 yr. - Equipment life-cycle
Option 1 Ground Source	2,500 SF	Excellent			Very Low (to none)
Option 2 Air Source	1,400 SF	Good	57	1,710	Medium 208 tons/yr. [0.45 lbs./CO2/SF/yr.]
Option 3 Hybrid	2,000 SF	Excellent	19	570	Low 104 tons/yr. [0.225 lbs./CO2/SF/yr.]
Option 4 VRF	0 SF (more space on roof)	Good	100	3000	High 462 tons/yr. [1.0 lbs./CO2/SF/yr.]

1: Source: Life Cycle Carbon - City of Seattle Refrigerant Emissions Leakage Analysis and Chartered Institution of Building Services Engineers (CIBSE) Journal



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Geothermal Field Location

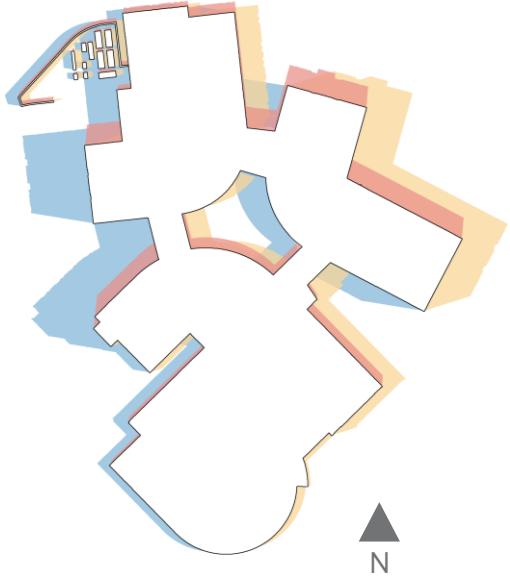


Hybrid Geothermal Well Field

- 20ft grid
- ~130 Boreholes
- ~1.2 Acres

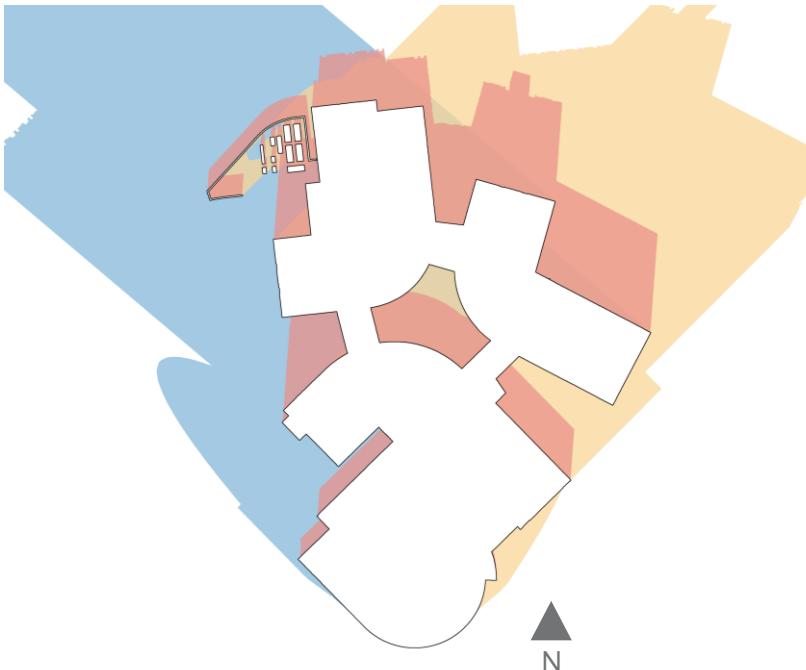
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Overall Site Design Concept / Creating and Defining a Unique Sense of Place: Solar Studies



First Week of School

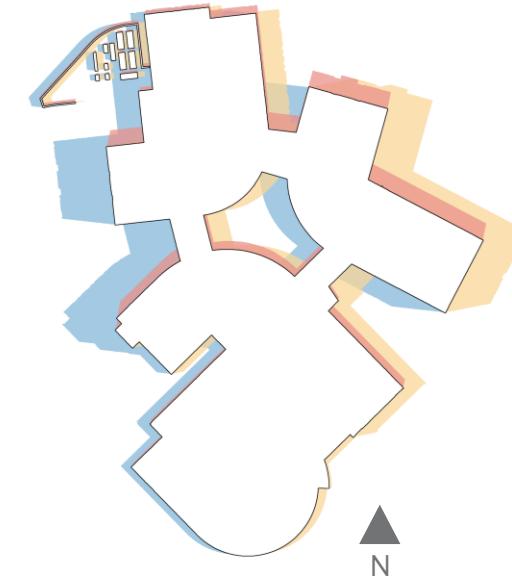
August



Winter Solstice

December

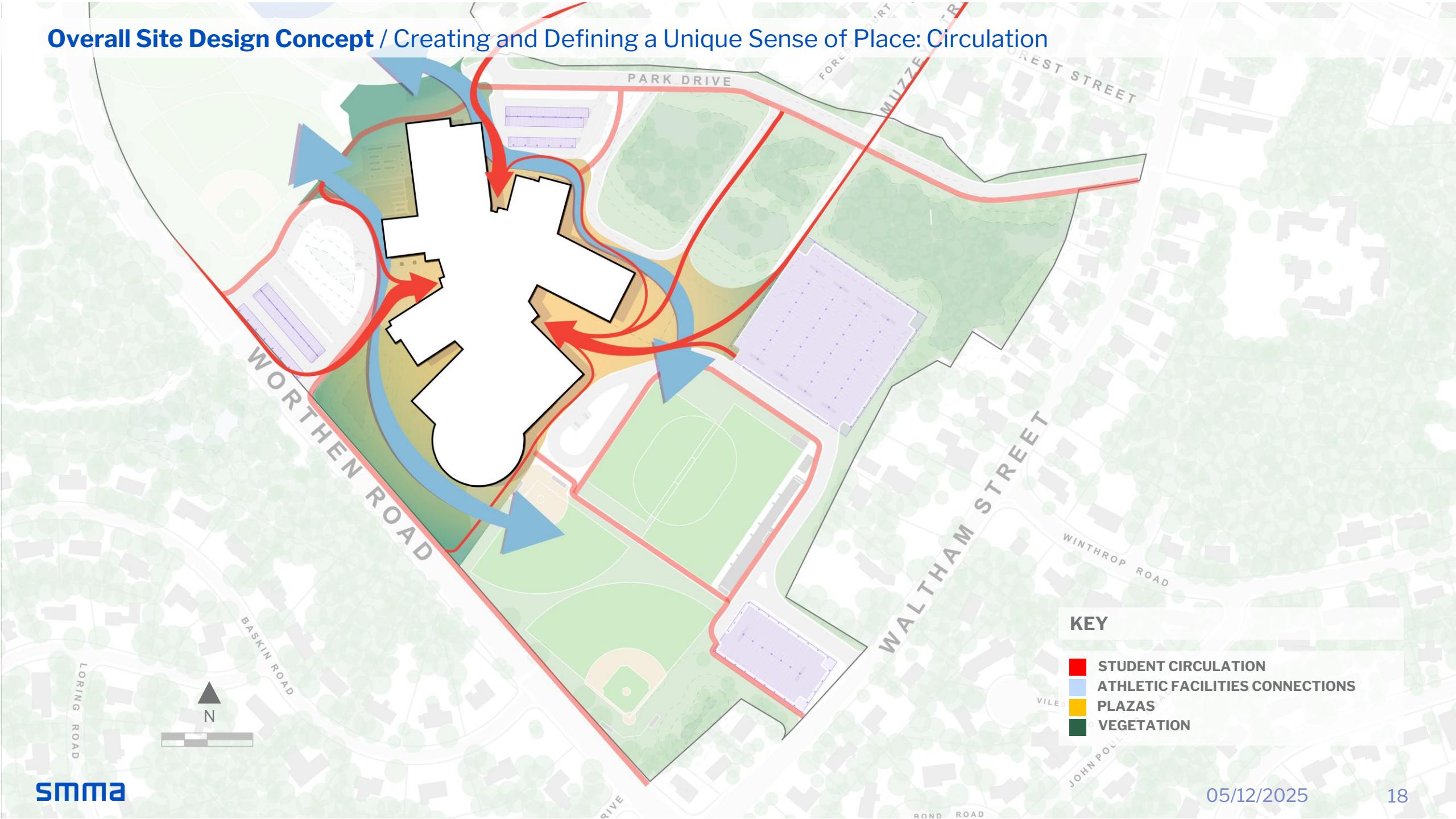
8am 12pm 3pm



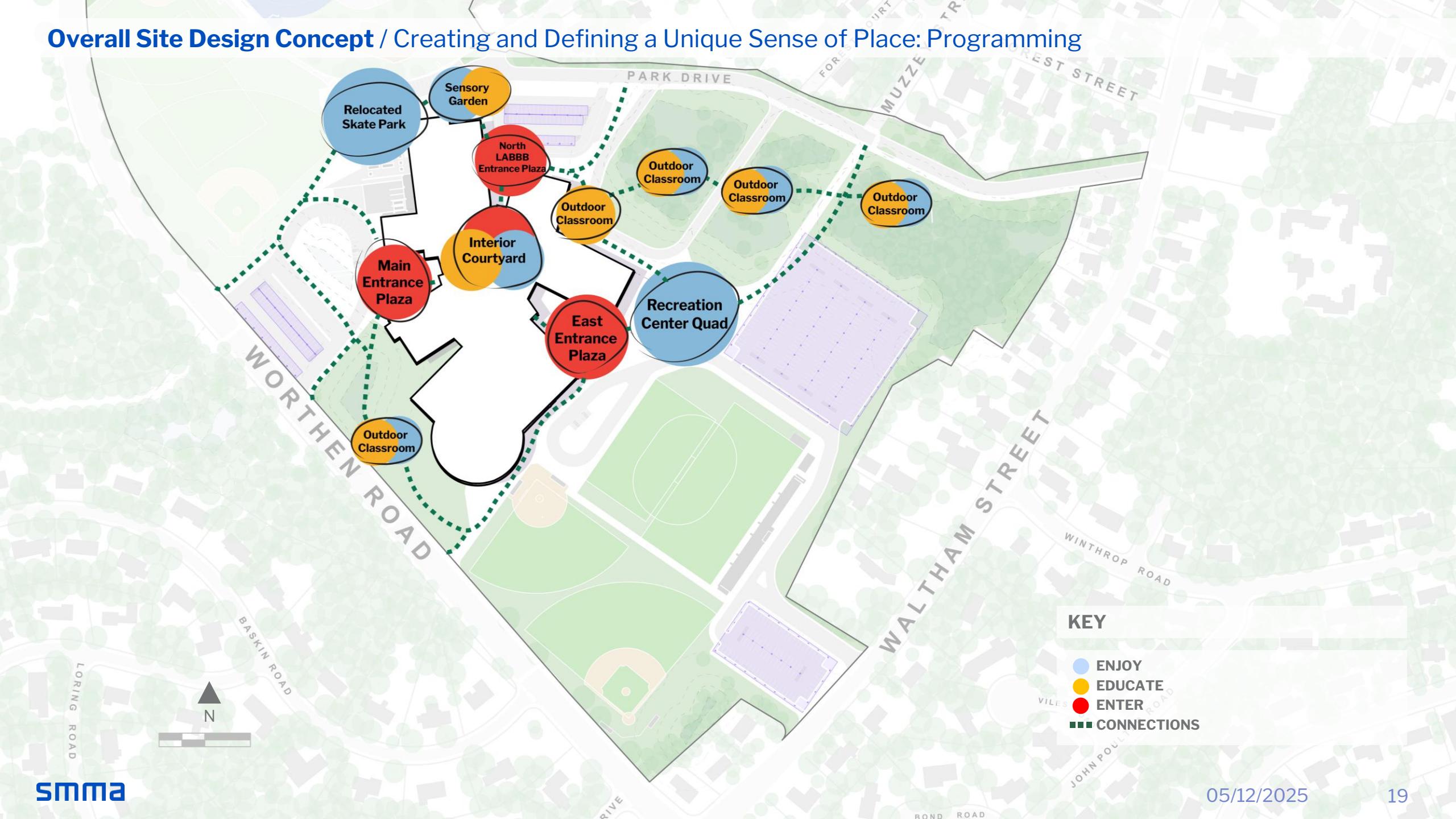
Last Week of School

June

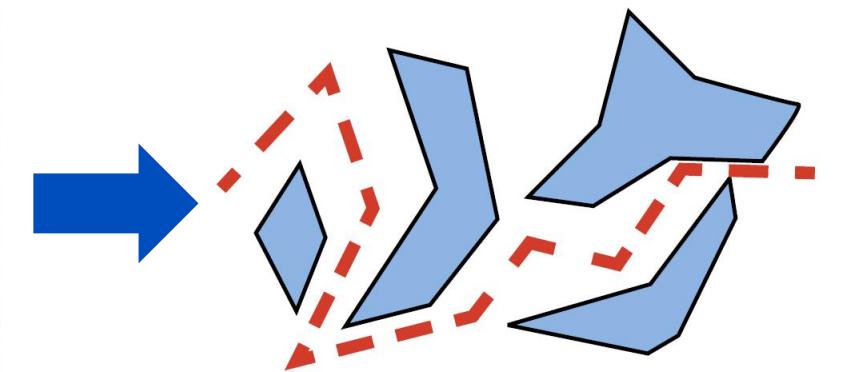
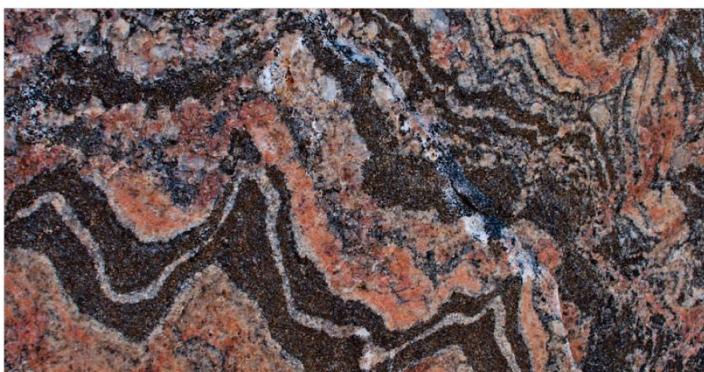
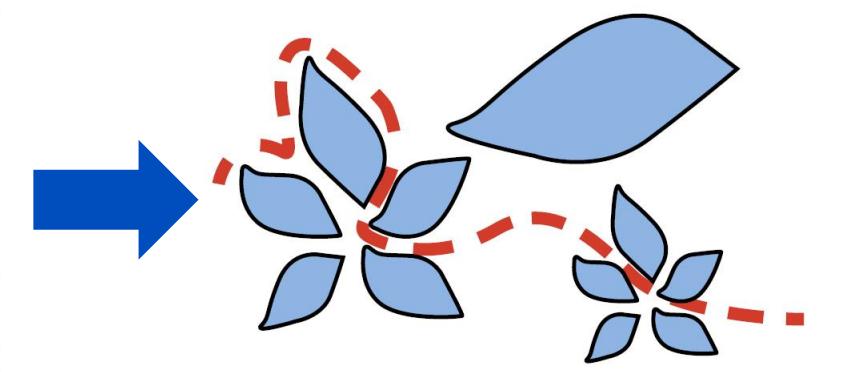
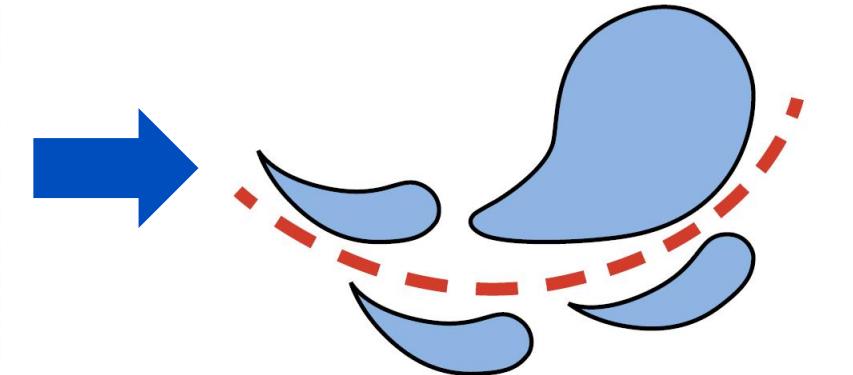
Overall Site Design Concept / Creating and Defining a Unique Sense of Place: Circulation



Overall Site Design Concept / Creating and Defining a Unique Sense of Place: Programming



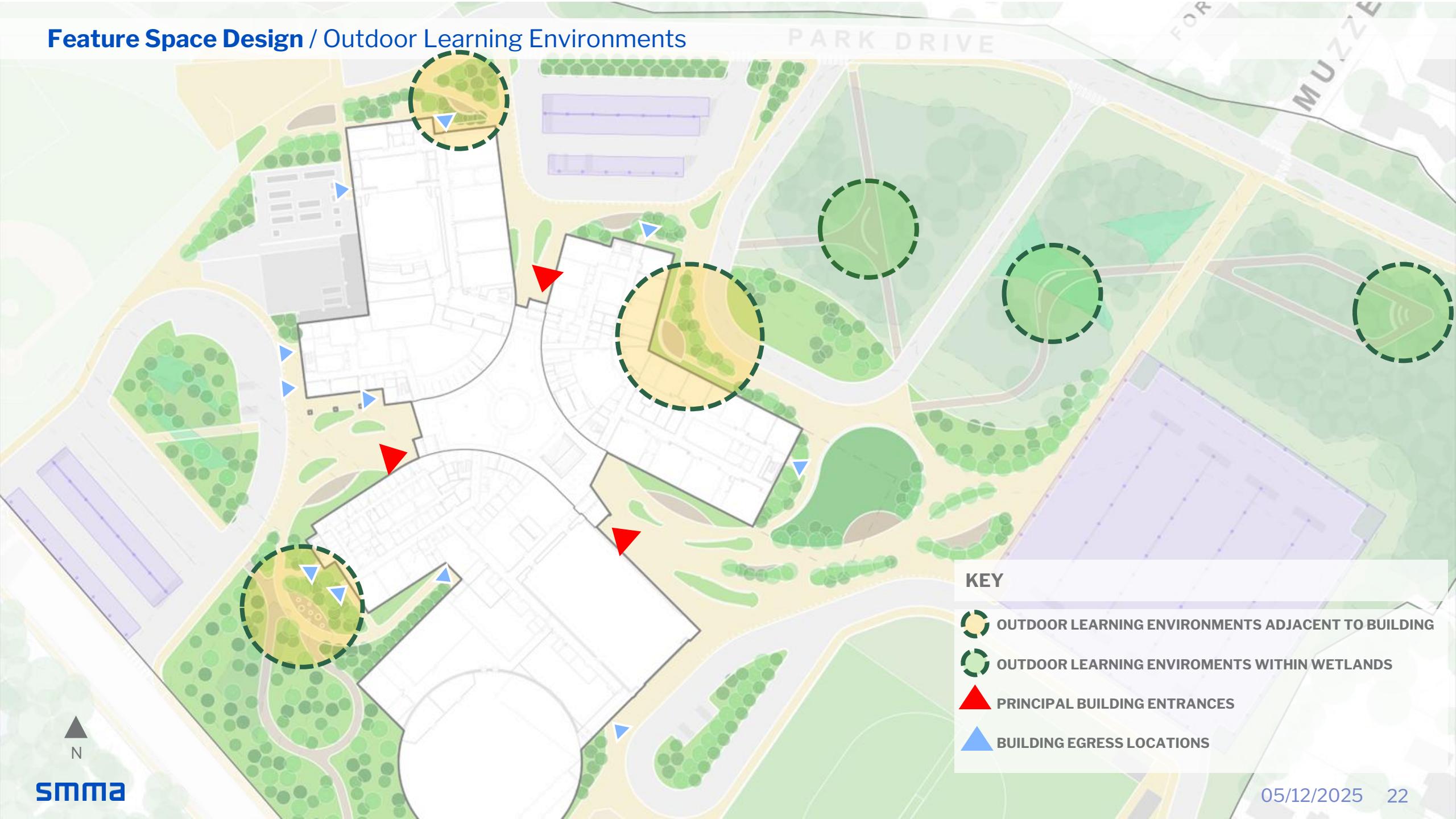
Overall Site Design Concept / Creating and Defining a Unique Sense of Place: Design Concept



Site Design / Campus Scale



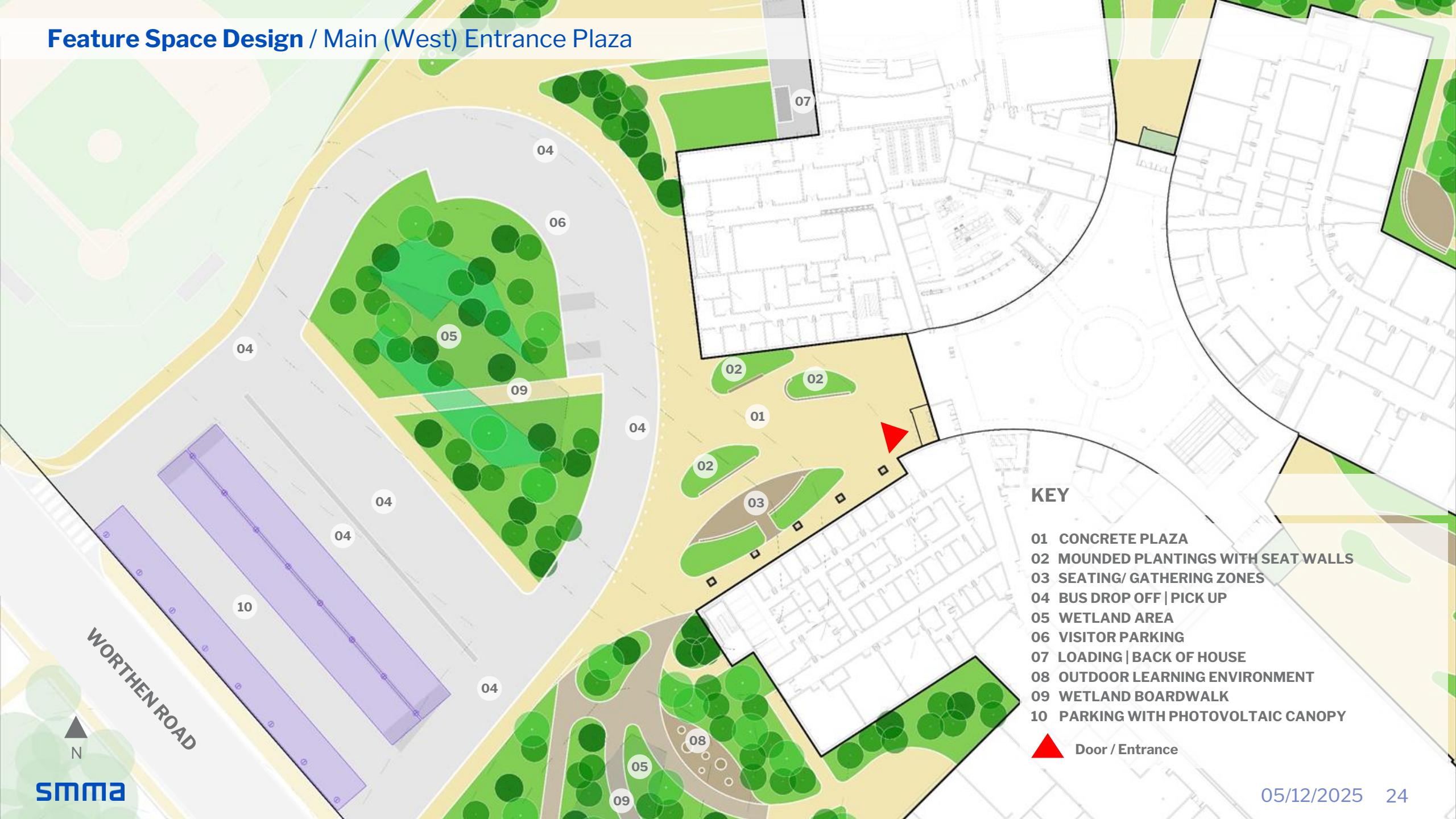
Feature Space Design / Outdoor Learning Environments



Feature Space Design / Outdoor Learning Environments



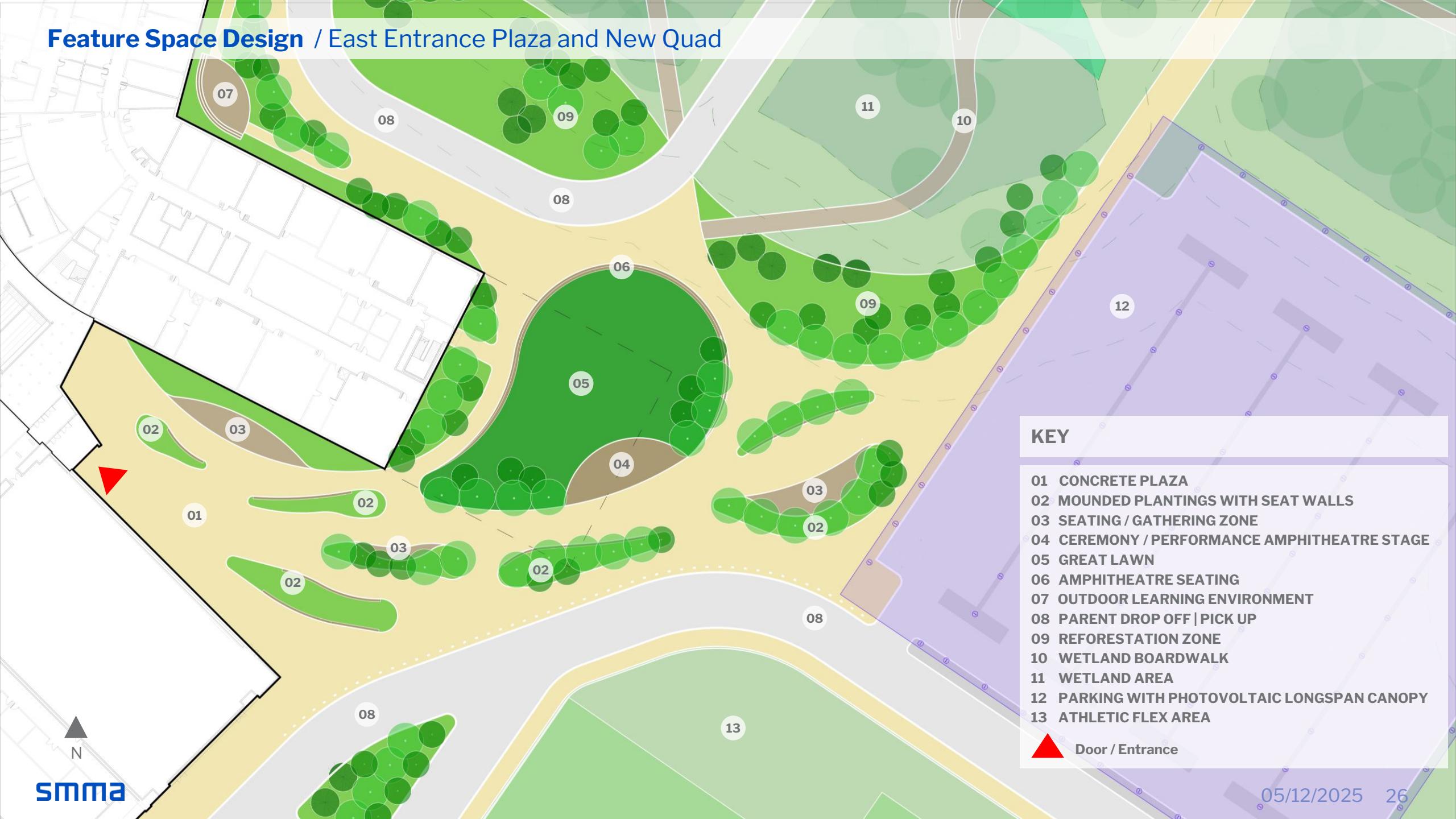
Feature Space Design / Main (West) Entrance Plaza



Feature Space Design / Main (West) Entrance Plaza



Feature Space Design / East Entrance Plaza and New Quad



Feature Space Design / East Entrance Plaza and New Quad



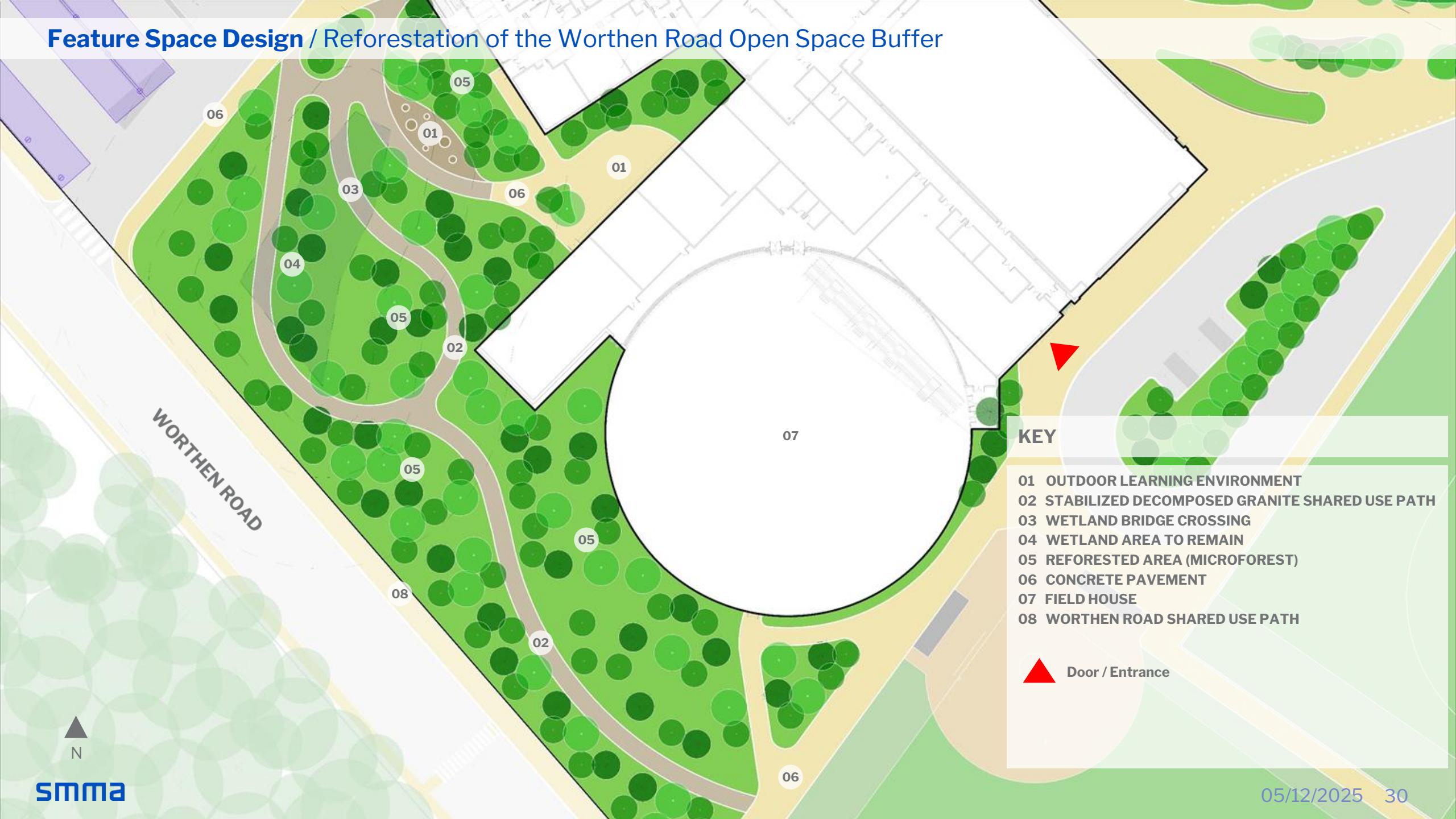
Feature Space Design / North Entrance Plaza



Feature Space Design / North Entrance Plaza



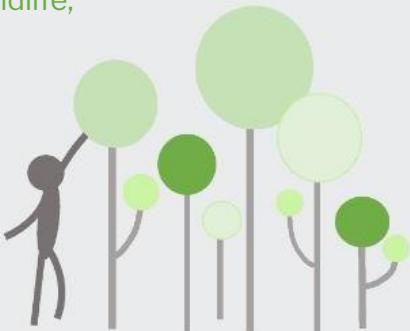
Feature Space Design / Reforestation of the Worthen Road Open Space Buffer



Micro-forests / The Miyawaki Method

The Miyawaki methodology is based on an innovative woodland establishment and management approach developed by Japanese botanist **Dr. Akira Miyawaki**.

This aims to reconstruct indigenous woodlands to enable delivery of benefits for people, wildlife, biosecurity, and ecosystem services.



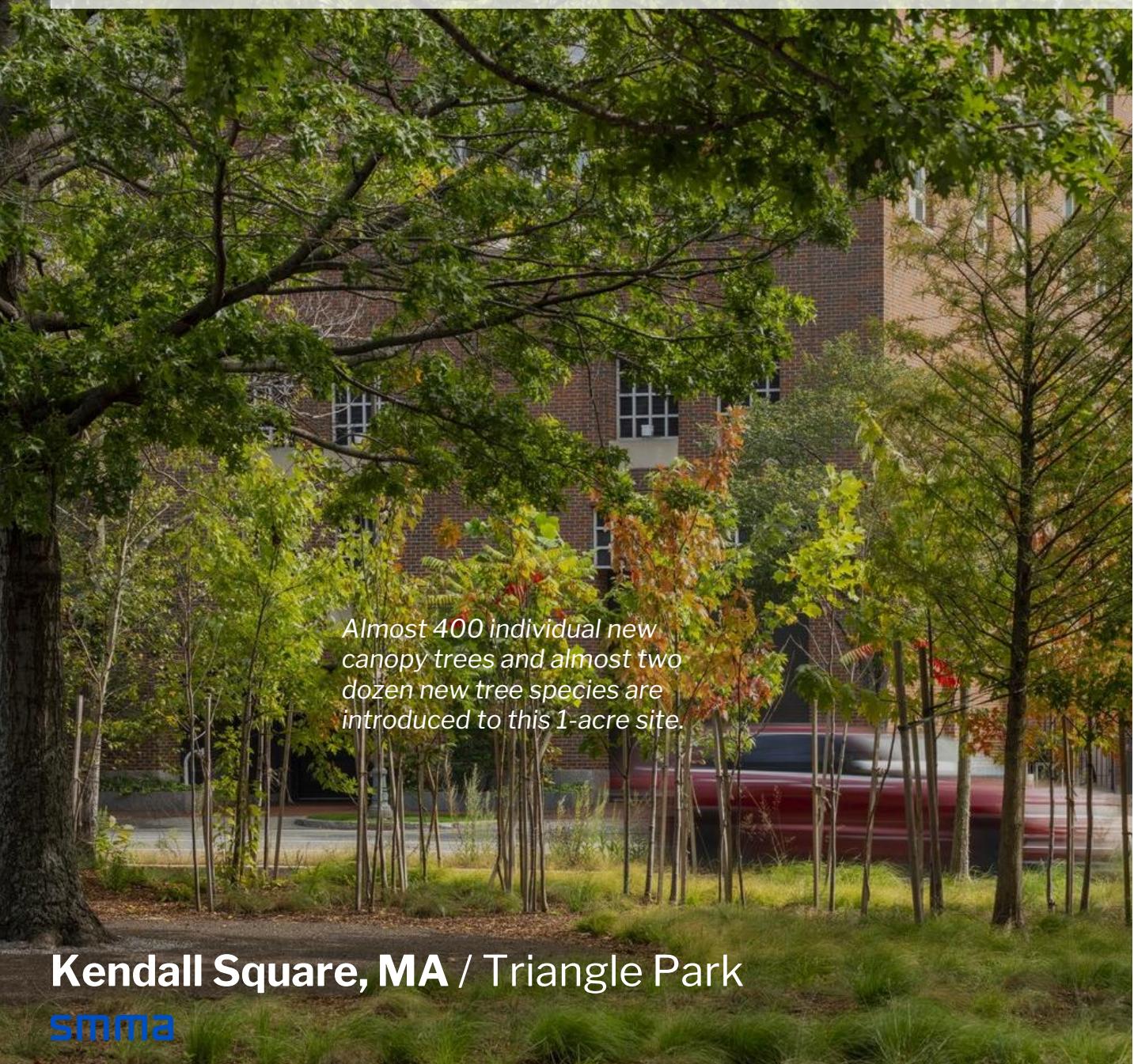
(1) Seedlings are planted densely, 3 trees/m², and randomly (not in line), mixing as many native trees of potential natural vegetation as possible.

(2) Approximately 3 years after planting, natural selection among the seedlings allows the most adapted ones to develop quickly.

(3) By 15-20 years after planting, the early model of a dense mature forest will be established

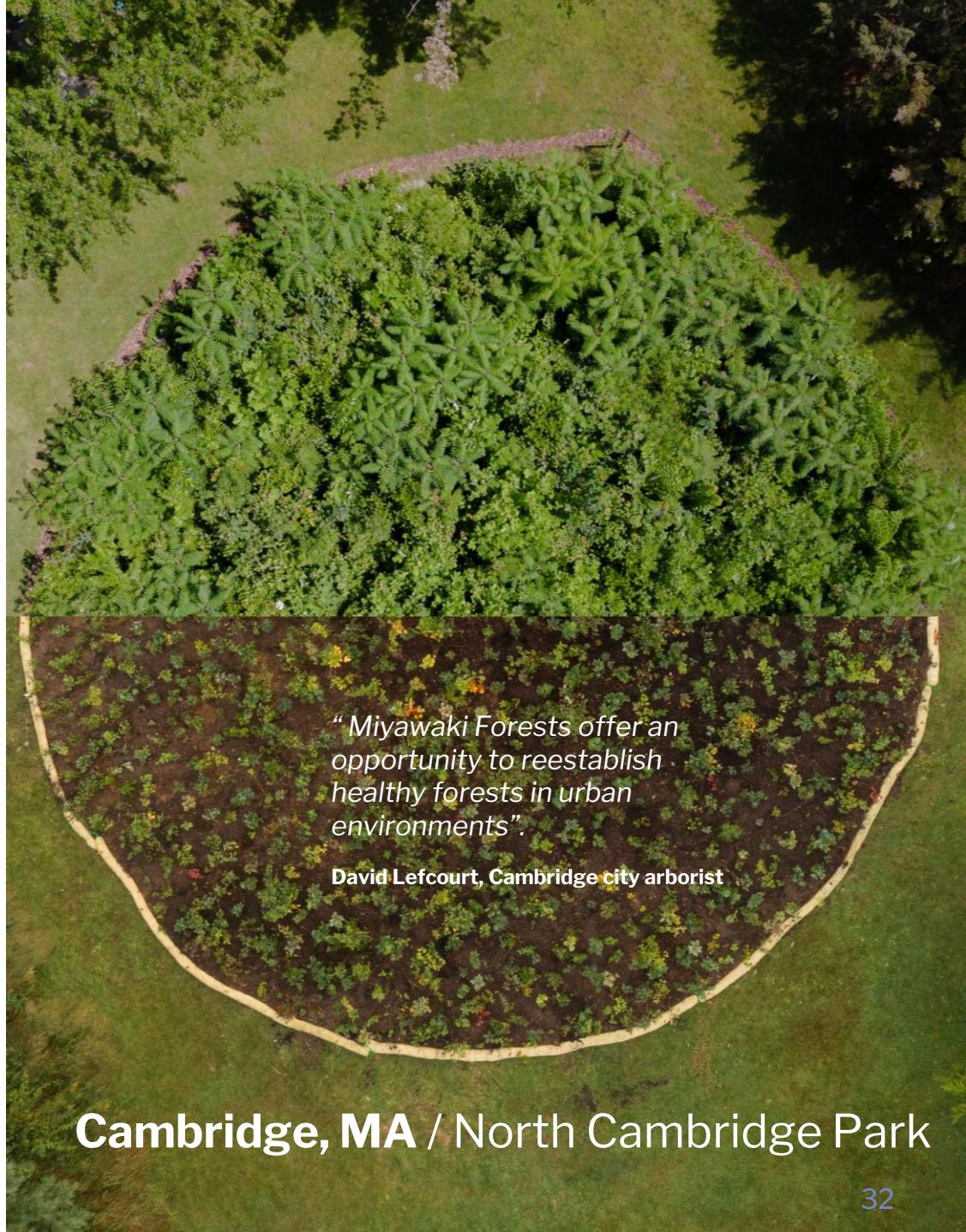


Site Program / Local Miyawaki Method Examples



Kendall Square, MA / Triangle Park

smma

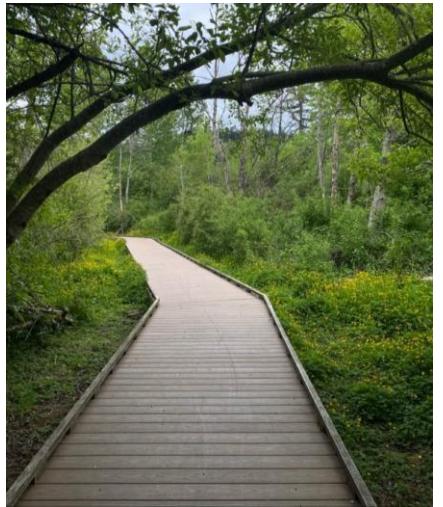


Cambridge, MA / North Cambridge Park

Site Program / Amphitheatre



Ground Plane Treatments



Wood Boardwalk



Stabilized Decomposed Granite



Bituminous Concrete Pavement



Resin Bound Aggregate



Portland Cement Concrete



Porous Asphalt

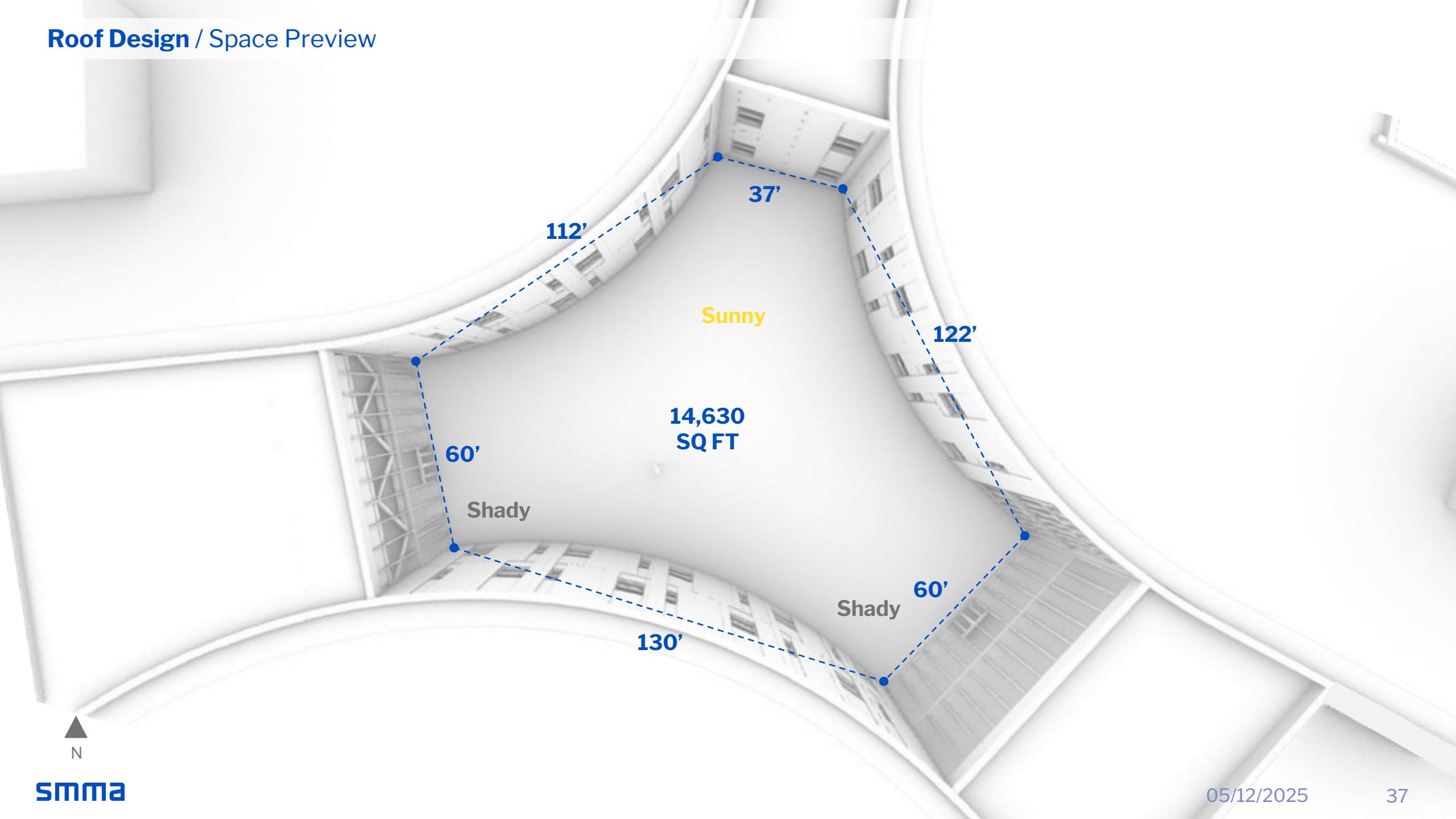
Educational | LEED Signage



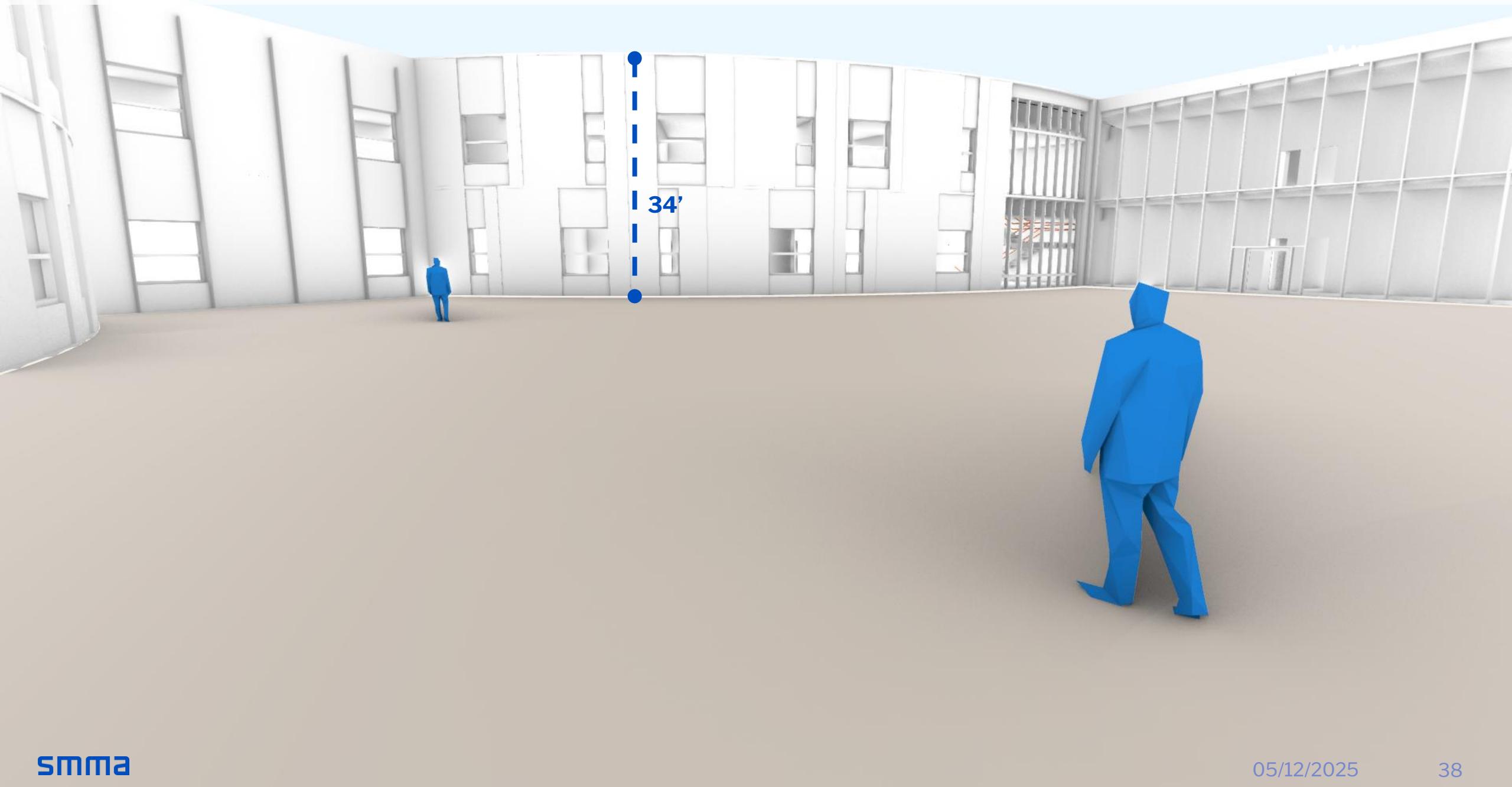
Roof Design / Scale Comparison

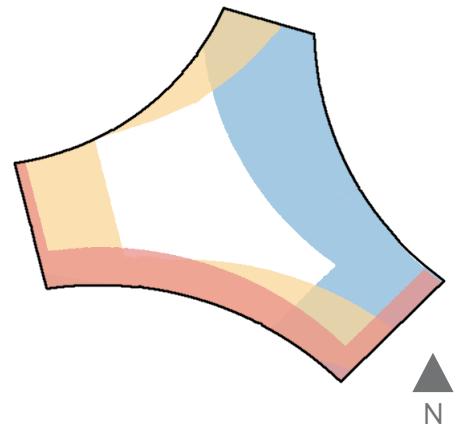


Roof Design / Space Preview



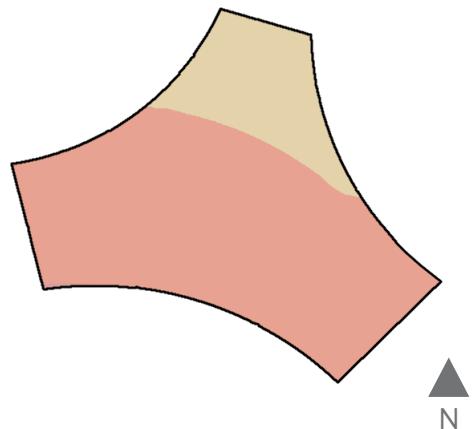
Roof Design / Space Preview





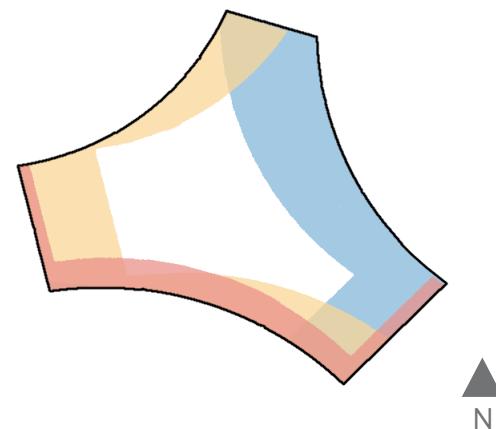
First Week of School

August



Winter Solstice

December



Last Week of School

May

8am-12pm-3pm



Roof Terrace Design / Diagram



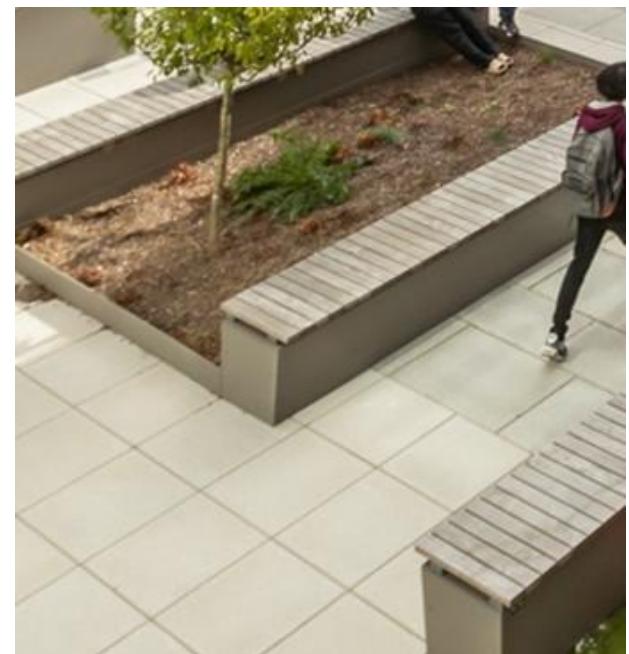
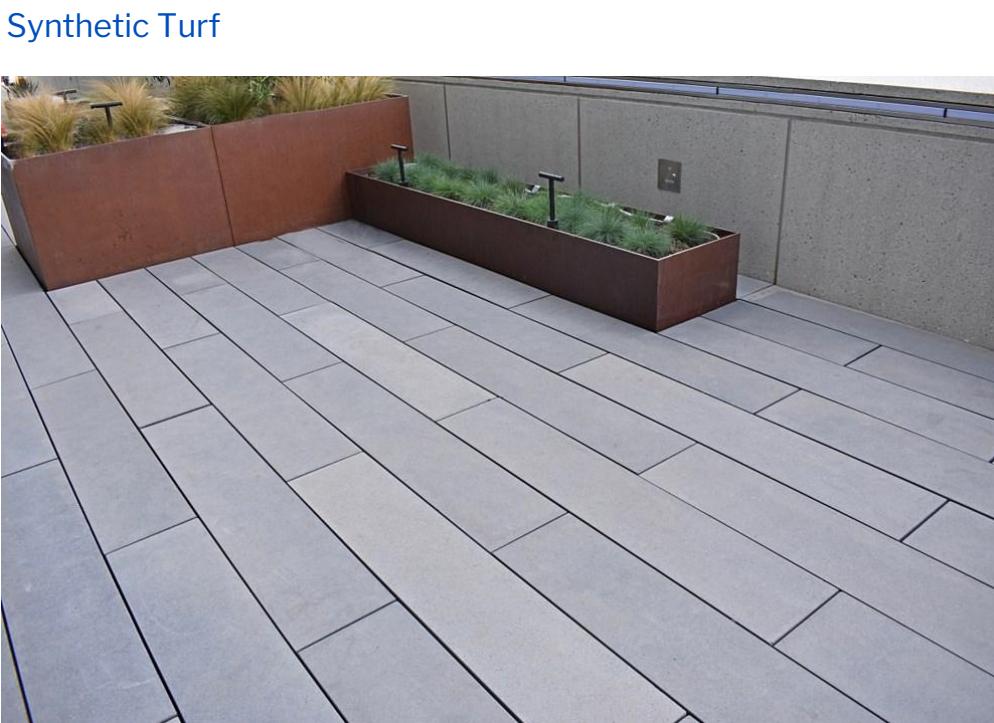
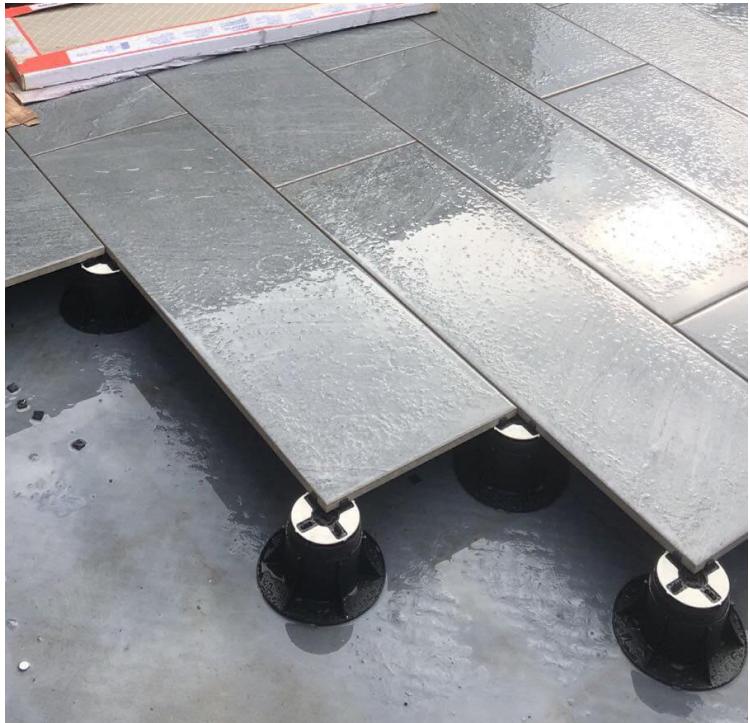
Roof Terrace Design / Site Plan



5' 10' 20'
N

Materiality / Roof Terrace Ground-plane Treatments

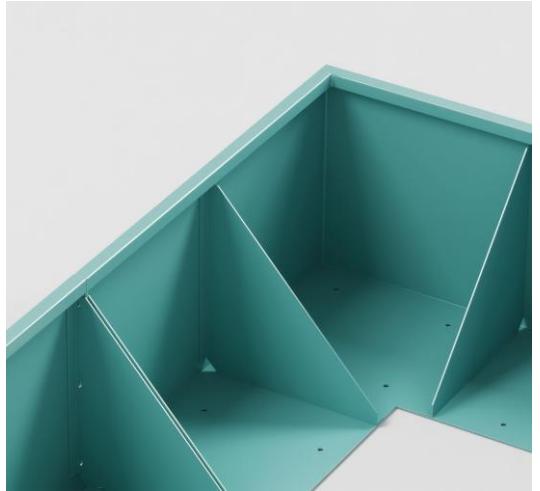
Porcelain Pavers



Synthetic Turf

Concrete Pavers

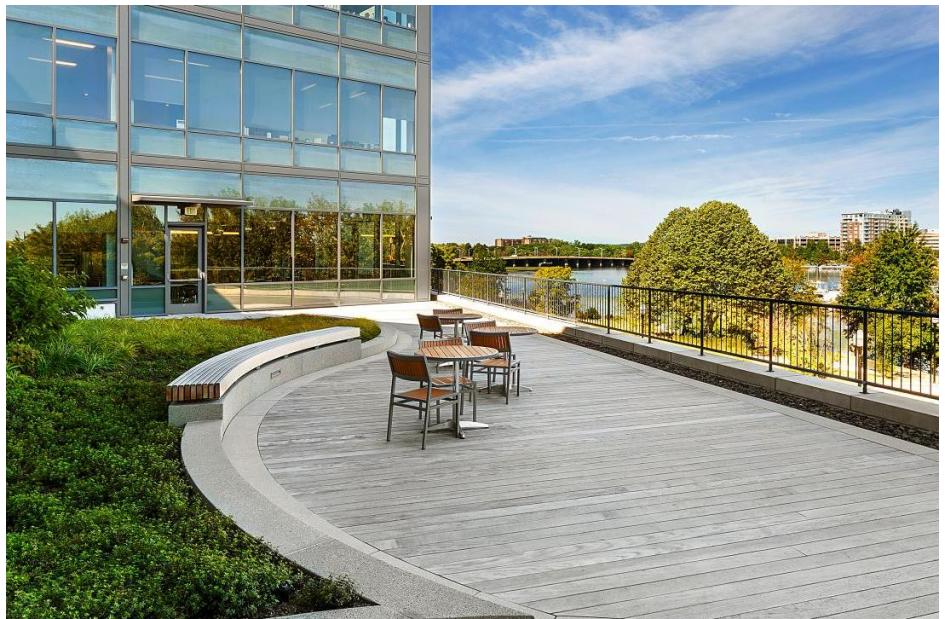
Materiality / Roof Terrace Planting Bed Edges



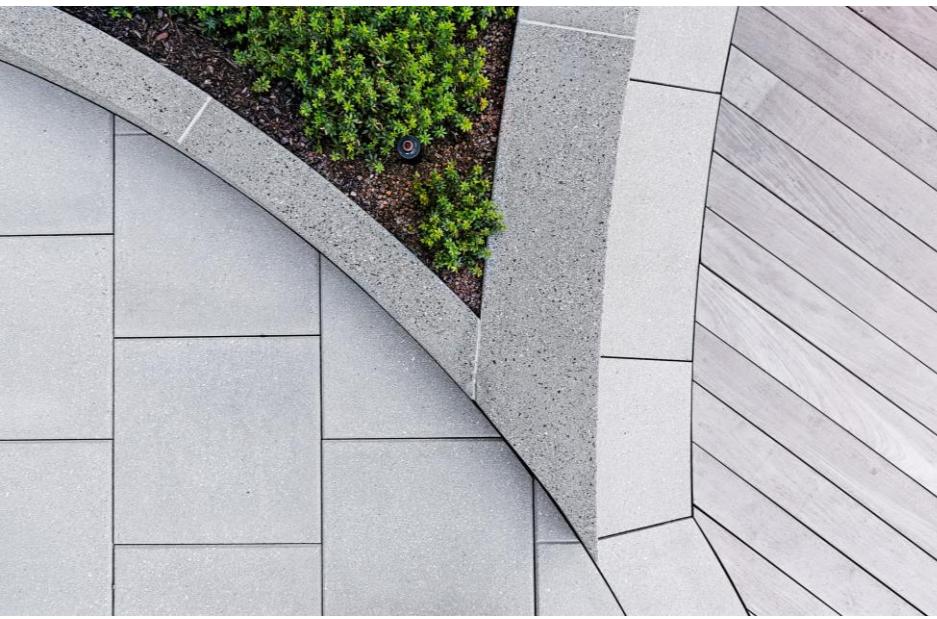
Pre-fab Edge Material



Flexible, Site-installed Metal Edging



Precast Concrete Edging/ Curbs



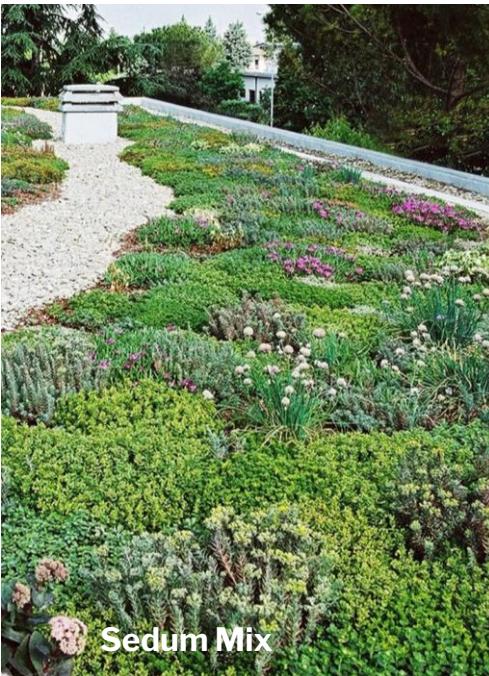
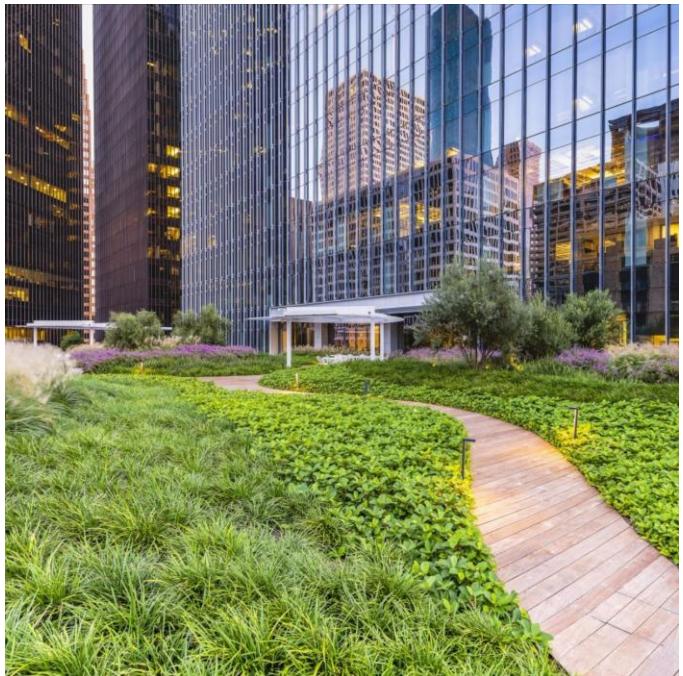
Materiality / Roof Terrace Planting



Winter Interest



Evergreen



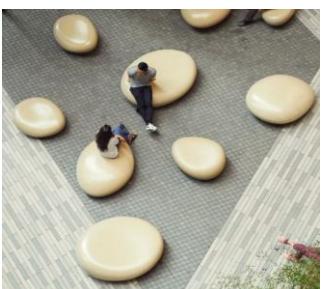
Sedum Mix



Low Maintenance

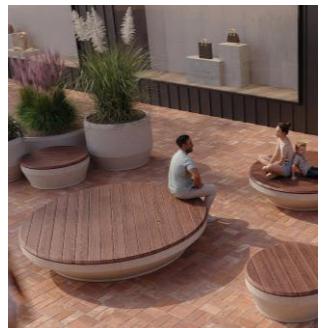
Movable Furniture

- Loose Tables and Chairs
- Formal Worktables
- Lounge Furniture



Fixed Furniture

- Raised Planters
- Integrated Bench



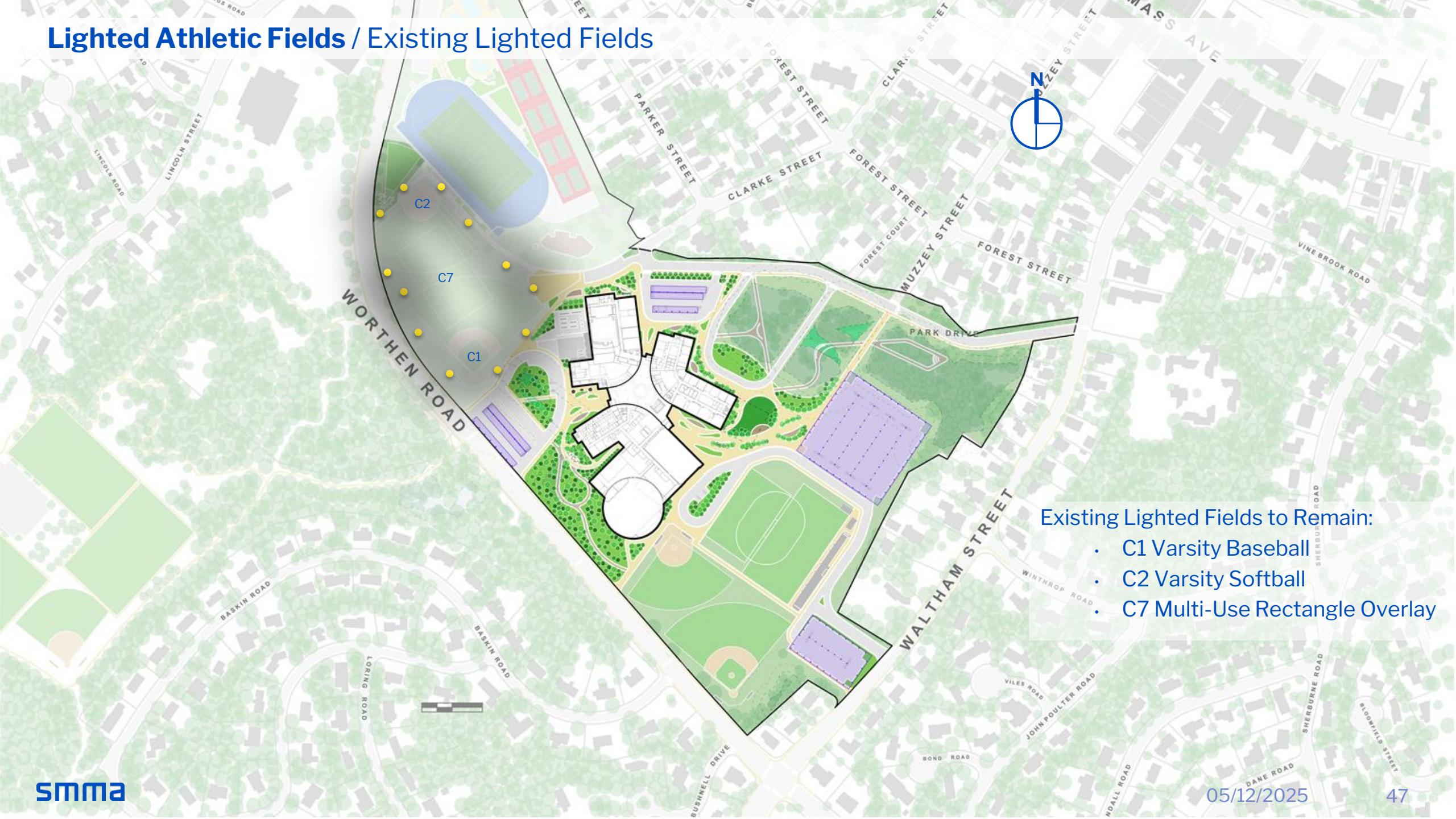
Shelter

- Shade Structure
- Outdoor Classroom

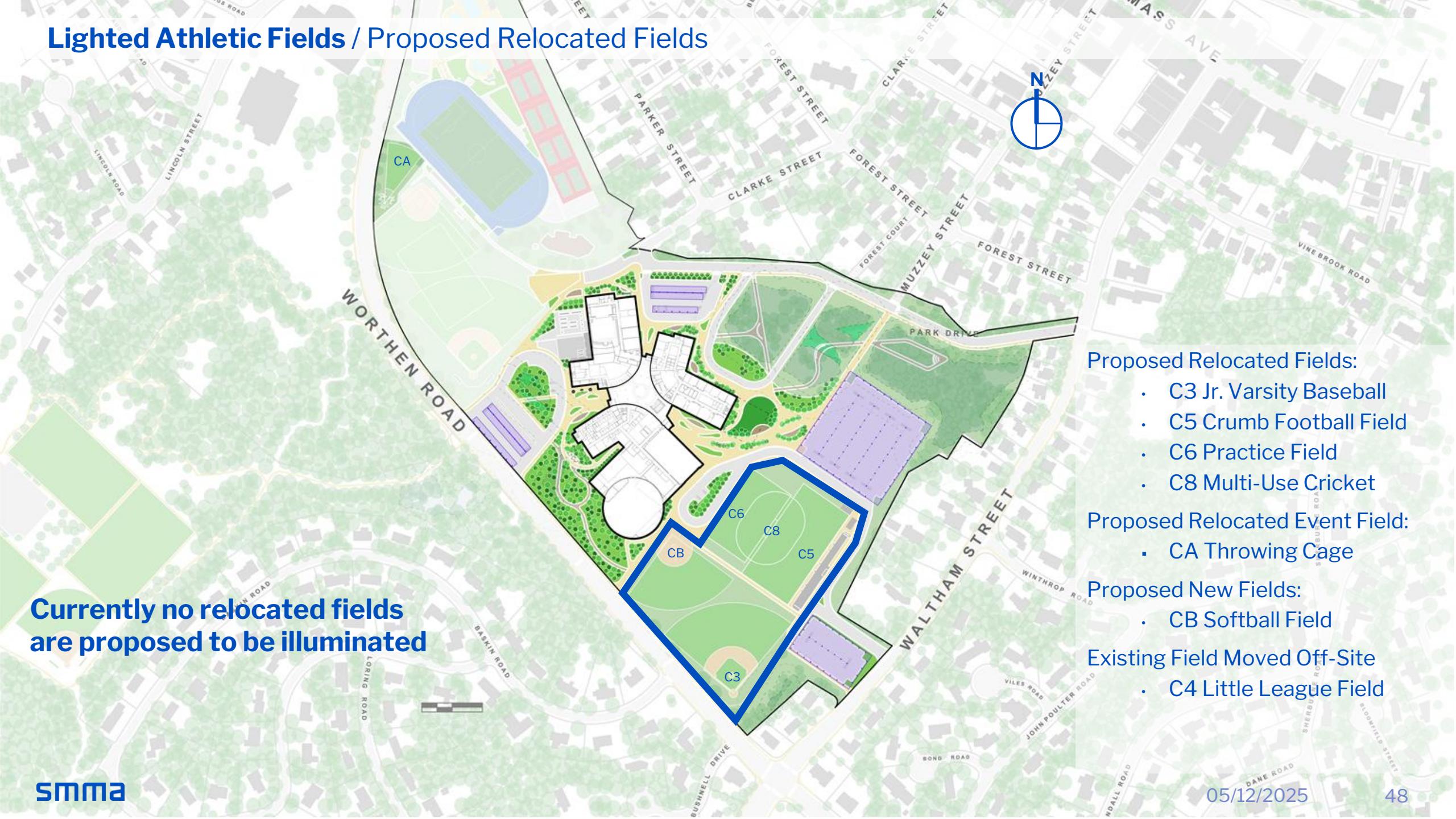


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Lighted Athletic Fields / Existing Lighted Fields



Lighted Athletic Fields / Proposed Relocated Fields



Athletic Field Surfacing

Natural Turf (Sod)

Pros

- Natural Aesthetics
- Cooler Surface
- Environmental Benefits
 - Carbon sequestration, reduce excess stormwater runoff
- Cost Effective to Install
- **Sod Requires a Minimum of 2-3 Weeks for Root Establishment Prior To Use**

Cons

- High Maintenance
- Water Usage
- Durability Issues
 - Overuse and excessive traffic lead to compaction and bare spots; saturated soils/standing water limit playability
- Inconsistent Surface
- Pesticide and Fertilizer Use



Note: Sod was priced at PSR, and the intent is to proceed with sod upon confirmation by the SBC today.

Synthetic Turf

Pros

- Low Maintenance
- Durability
- Consistent Appearance
- Long-Term Cost Effectiveness
- **Able to Use Field Immediately**

Cons

- High Initial Cost
- Heat Retention
- Several Environmental Impacts

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Off-Site Improvements / Included in project budget

Sidewalks & Crosswalks:

1. Sidewalks in and around project site shall be MAAB compliant.
2. Sidewalk network beyond project site should be improved to fill any gaps and install signage.
3. All new or relocated crosswalks shall be installed with highly visible paint and signage.
4. Install lighting at new or relocated crosswalks.
5. Install curb bump-outs at crosswalks along Worthen Road and Waltham Street.
6. Consider installing Rectangular Rapid Flashing Beacons or Pedestrian Hybrid Beacons at crosswalks along Worthen Road and Waltham Street.

Worthen Road & Waltham Street

7. Add “No Turn on Red” signs at intersection.
8. Add reflective borders on traffic signals at intersection.
9. Add “School Ahead” and speed limit signage on Worthen Road and Waltham Street.
10. Consider installing advanced speed radar signs with flashing beacons on Worthen Road and Waltham Street (similar to Hastings Elementary).

Off-Site Improvements / Not included in Project Budget

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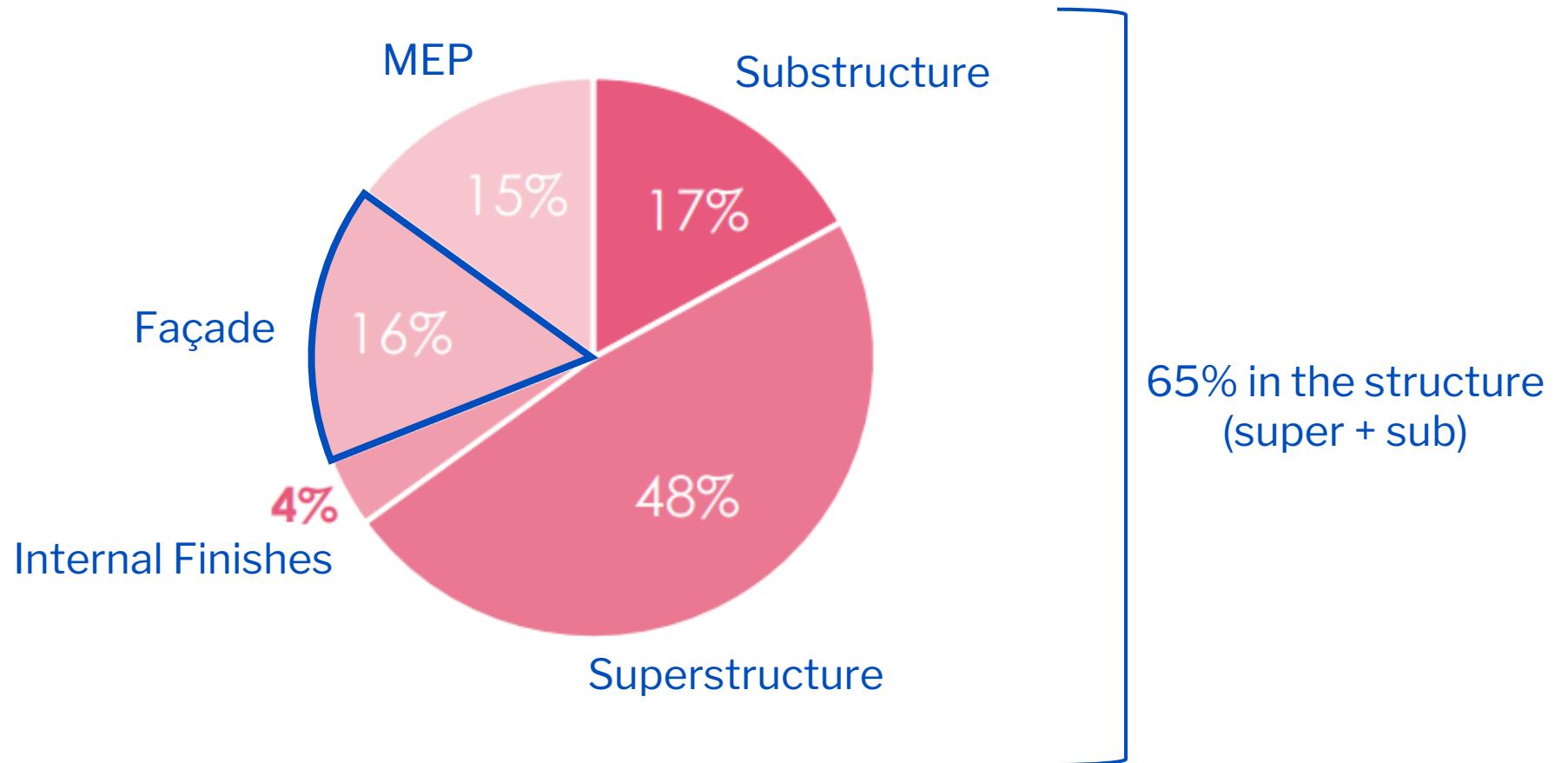
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Potential Materials & Systems / Scope Assumptions – No Change from PSR Estimates

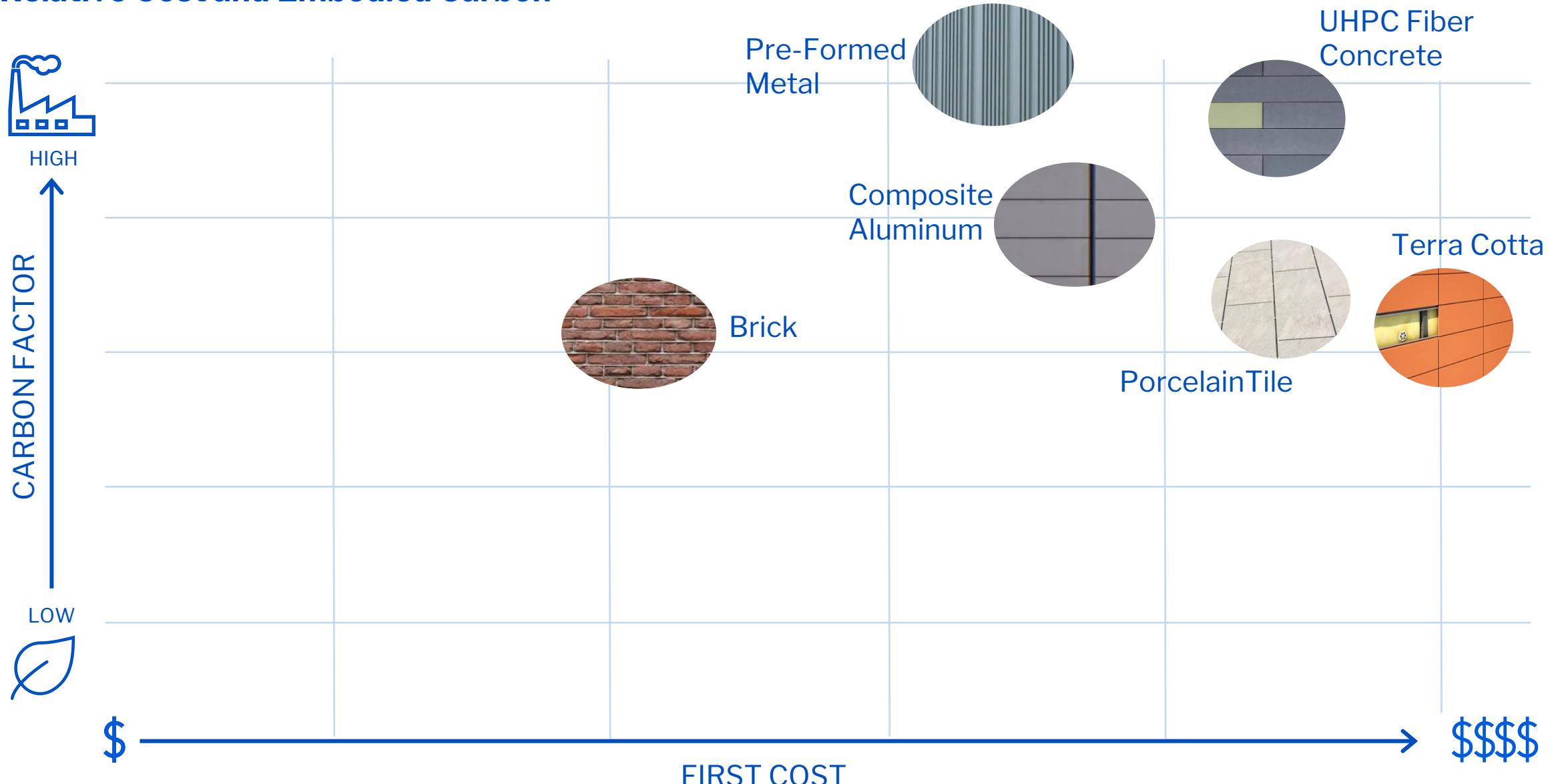
Opaque Masonry Walls (~60% of solid wall area)	Brick Masonry, Precast Accents, Stone Base	<ul style="list-style-type: none"> 75% of Wall Enclosure High Insulation Value Proportion of Masonry to Rainscreen may be increased to reduce cost
Rainscreen Accent Walls (~40% of solid wall area)	Pre-finished Metal Panel Spandrels and Fascias; Accents in Porcelain, Terra Cotta, Pre-formed Metal or Fiber Cement	
Windows (~50% of glazed area)	Triple Insulated-Glazed, Aluminum Frame	<ul style="list-style-type: none"> 25% of Wall Enclosure Utilizes Low-emissivity glass
Curtain Walls and Storefront (~50% of glazed area)	Triple Insulated-Glazed, Aluminum Frame	
Roof Edges & Canopies	Pre-finished Metal	
Soffits	Pre-finished Metal	
Roof Screens	Pre-finished Metal, 50% acoustically rated	
Roofing	PVC Membrane	



Where is Embodied Carbon?



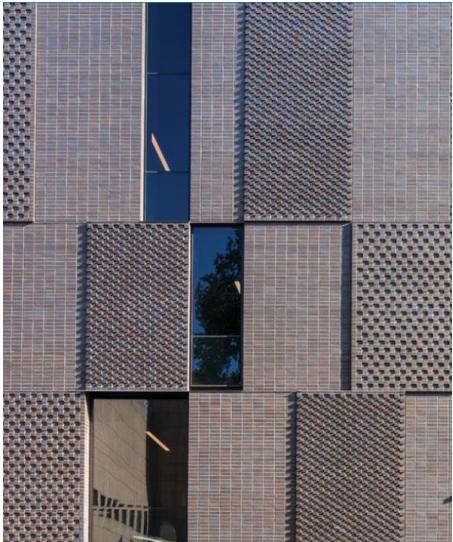
Relative Cost and Embodied Carbon



Potential Materials & Systems

Brick Masonry

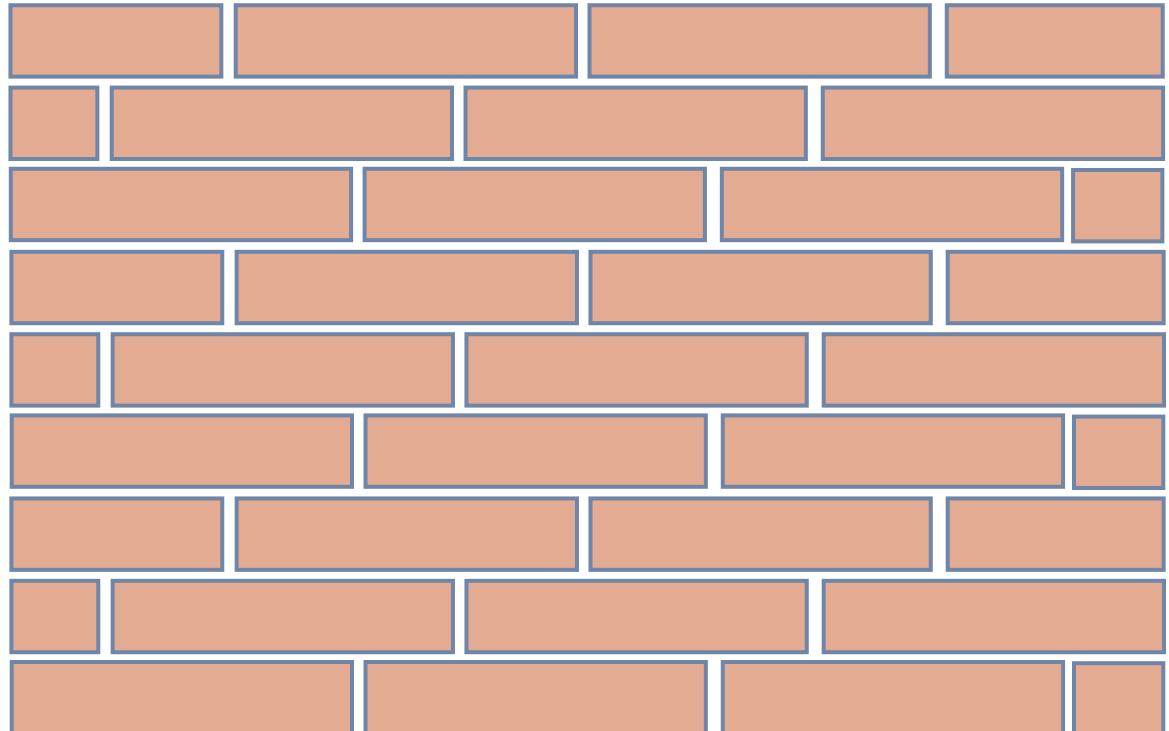
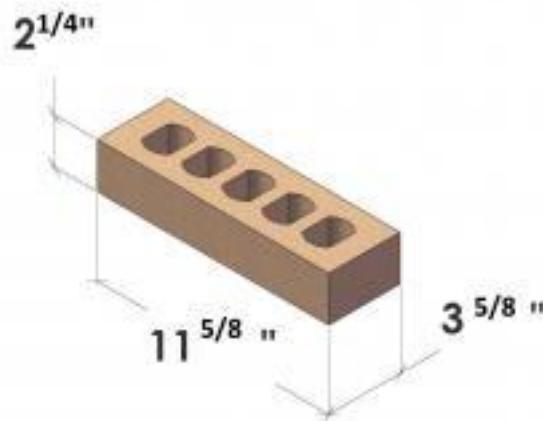
- 60% of Opaque Walls at PSR
- Timeless and reliable
- Wide range of colors and textures available
- **ROM Cost: \$55-60/sf**
- **Carbon Factor: 6.52
(not including steel support)**



Potential Materials & Systems

Brick Masonry – Norman Unit Size

- 50% longer than standard brick
- Faster installation
- Fewer joints to maintain
- May be more limited in availability than standard brick for certain colors and/or special corner shapes



1/3 Running Bond

Potential Materials & Systems – Rainscreen Options

Terra Cotta (Not Recommended)

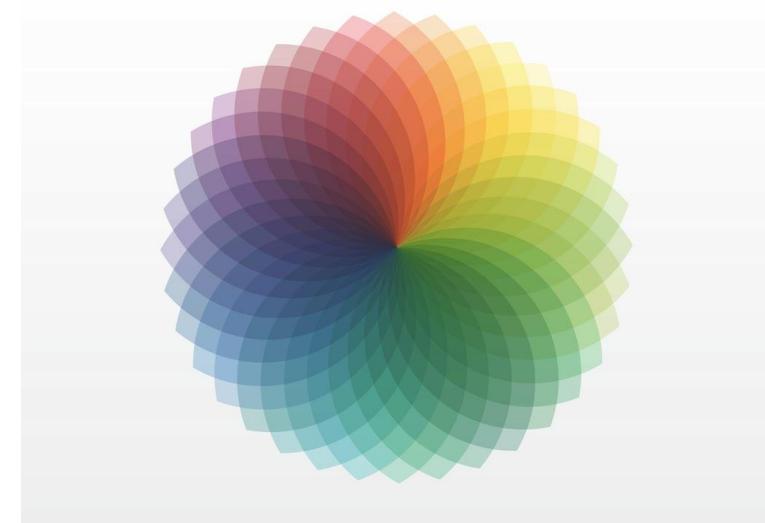
- 20% of Opaque Walls at PSR
- Beautiful, refined aesthetic
- Wide range of colors and textures available
- 5-10yr Warranty
- **ROM Cost: \$145-170/sf**
- **Carbon Factor: 7.08**



Potential Materials & Systems

Pre-Finished Metal Panel

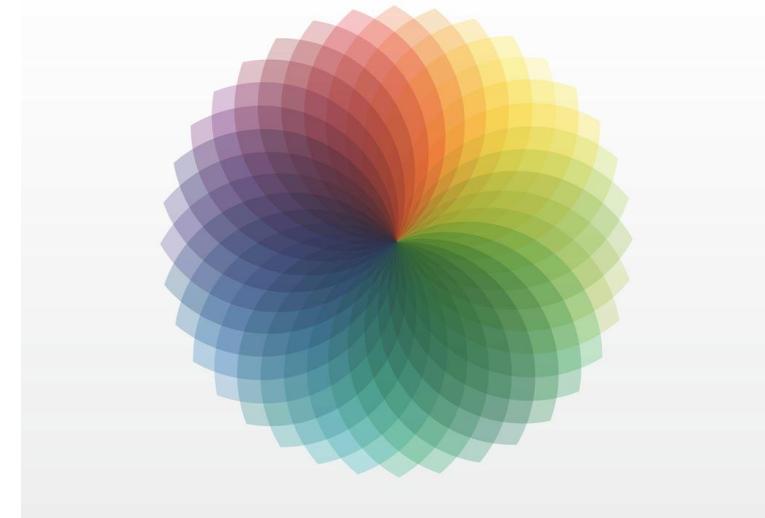
- 18% of Opaque Walls at PSR
- Accent Material
- Flat panels, perforations available
- Full spectrum of colors available including metallics
- 20yr Warranty
- **ROM Cost: \$115-125/sf**
- **Carbon Factor: 8.15**



Potential Materials & Systems – Rainscreen Options

Pre-Finished Metal Siding

- Secondary Accent Material,
- Thin gauge, profiled for strength, perforations available
- Full spectrum of colors available including metallics
- May be less refined visually, depending on detailing
- 20yr Warranty
- **ROM Cost: \$100-120/sf**
- **Carbon Factor: 10.10**



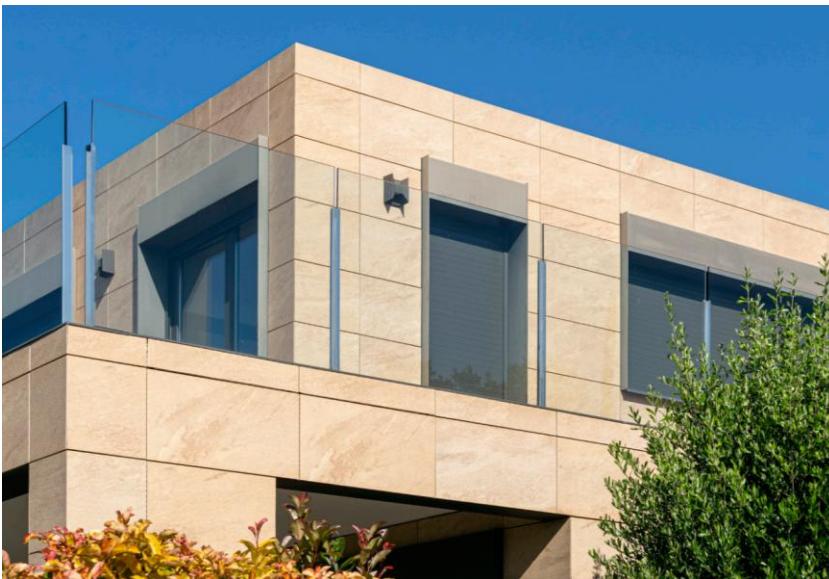
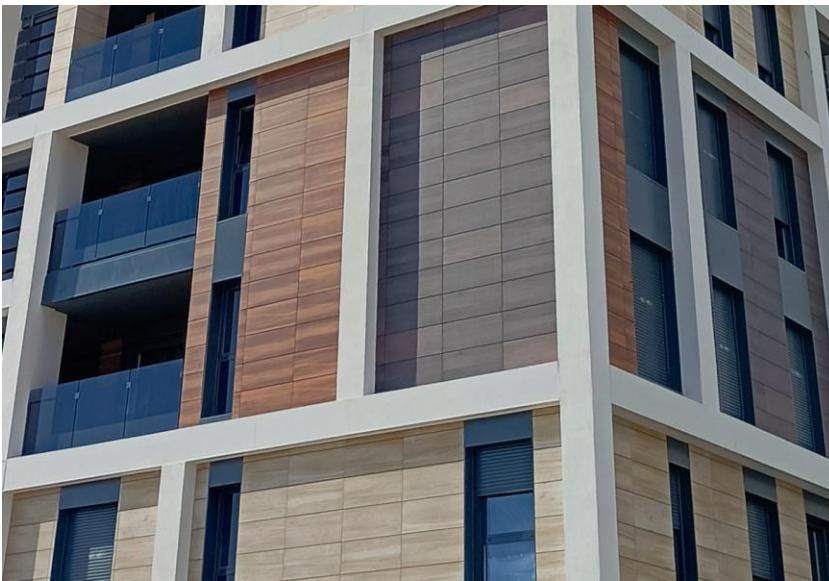
Potential Materials & Systems – Rainscreen Options

Porcelain Tile

- Beautiful, refined aesthetic
- Can mimic stone or wood
- 10yr Warranty
- **ROM Cost: \$140-150/sf**
- **Carbon Factor: 7.35**



Alpha Vci.40 - Concealed Anchor



Stone Series

Our stone-effect ceramic collection is ideal for high-performance exterior applications. Our standard color palette boasts 20 nature-inspired colors.



Concrete Series

Our neutral, exceptionally versatile smooth concrete collection for exterior cladding. Includes 10 neutral, concrete-inspired colors.



Clay Series

Warmth and depth. Inspired by earthy mineral clay deposits from around the world... Our standard color palette has 11 earth-inspired colors.



Metallic Series

Our aged metals series for exteriors, scratched & colored by the passage of time. Includes 11 metallic looking finishes.



Timber Series

This series captures the essence of aged, material wood for high performance exteriors. Our standard color palette includes 10 nature-inspired woodgrains.



(Multiple tiles shown to illustrate range of color variation.)

Potential Materials & Systems – Rainscreen Options

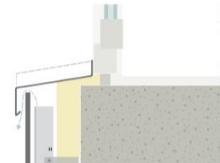
Ultra-High Performance Fiber Concrete

- Open joint system
- Visible or concealed fasteners
- Moderate range of colors and some textures available
- 20yr Warranty
- **ROM Cost: \$140-150/sf**
- **Carbon Factor: 9.04**

Figure 16: Window Head



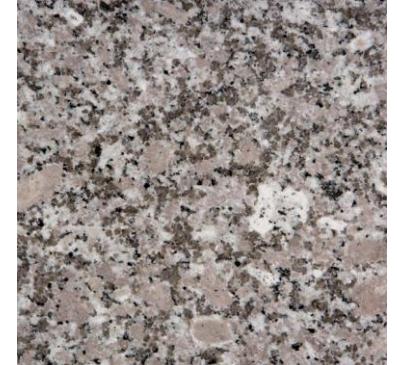
Figure 15: Window Sill



Potential Materials & Systems

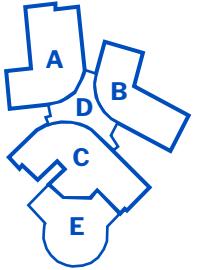
Granite Base and Trim

- Extremely hard and durable, resists damage
- Prevents efflorescence of brick at grade
- Range of local colors readily available
- Natural beauty
- **ROM Cost: \$120-140/sf**
- **Carbon Factor: 1.99**



Building Floor Plans

Level 1



KEY PLAN

- Core Academic
- Science
- Teacher Planning & Small Group
- Admin, Guidance, ALPHA, METCO, Central Offices
- Auditorium / Drama
- Art & Music
- Media Center
- Vocation & Technology
- Physical Education
- Special Education
- Medical
- Restrooms, Custodial
- Kitchen
- Commons
- Circulation
- Vertical Circulation
- Rooftop Open Space
- Other
- Expansion



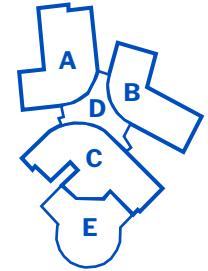
Building Floor Plans

Level 4

- Core Academic
- Science
- Teacher Planning & Small Group
- Admin, Guidance, ALPHA, METCO, Central Offices
- Auditorium / Drama
- Art & Music
- Media Center
- Vocation & Technology
- Physical Education
- Special Education
- Medical
- Restrooms, Custodial
- Kitchen
- Commons
- Circulation
- Vertical Circulation
- Rooftop Open Space
- Other
- Expansion



Central Office / Expansion



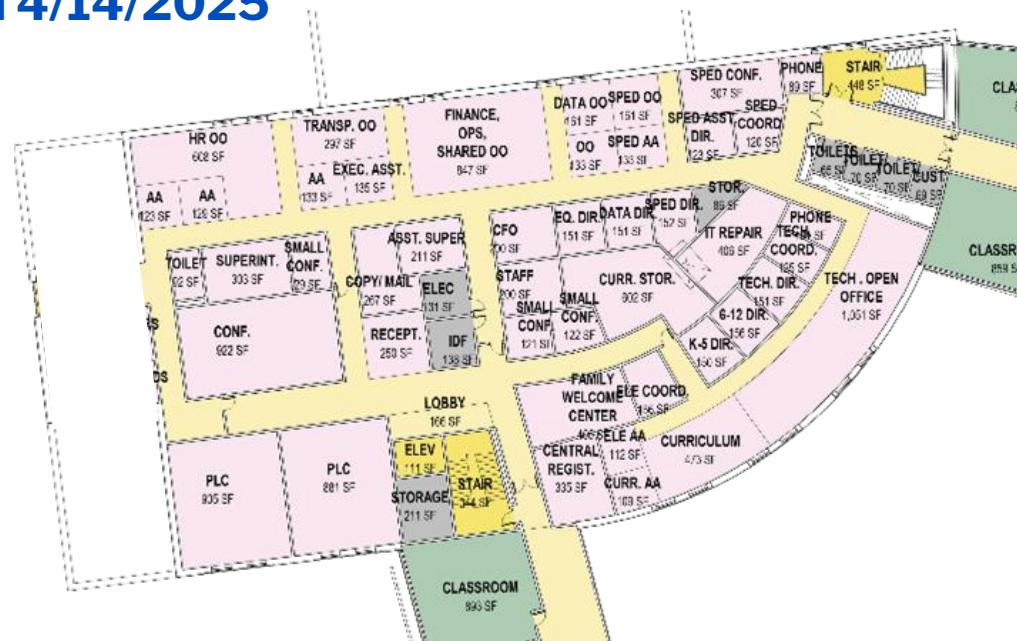
KEY PLAN

Student Enrollment Considerations – Presented 4/14/2025

Level 4 Central Office Expansion Space

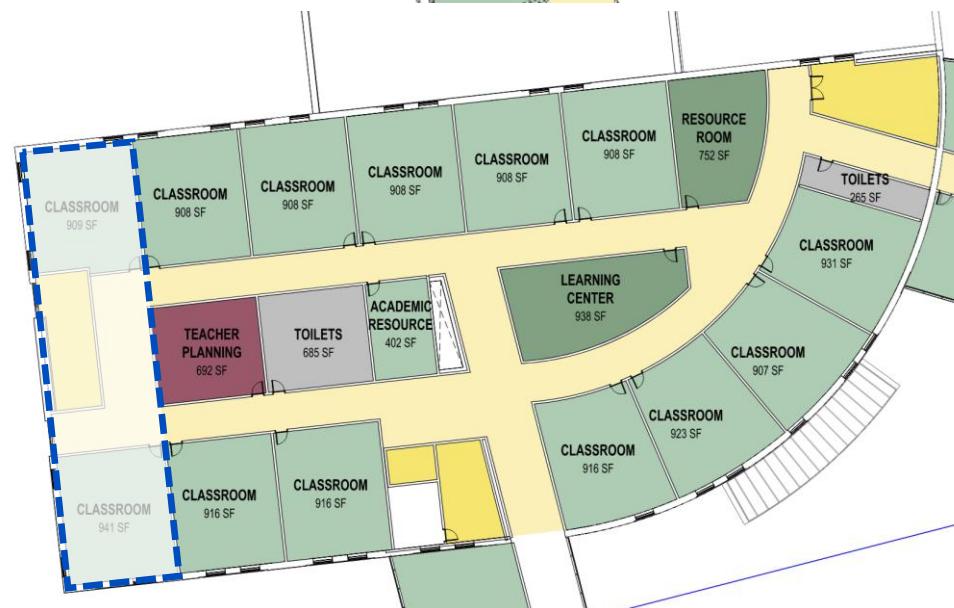
- Office spaces are being planned within classroom bay dimensions for ease of future conversion to educational space
- Additional Capacity based on Gen Ed classroom layout: **253 students**
- **Two additional classrooms (46 students) are possible with exterior enclosure additions as part of future renovation**

(conversion to science classrooms or other lab space may reduce total)



Schematic Design with optimized Central Office

Updated 4/10



Future Classroom Wing Conversion

Updated 4/10

Exterior Design – Previous Massing



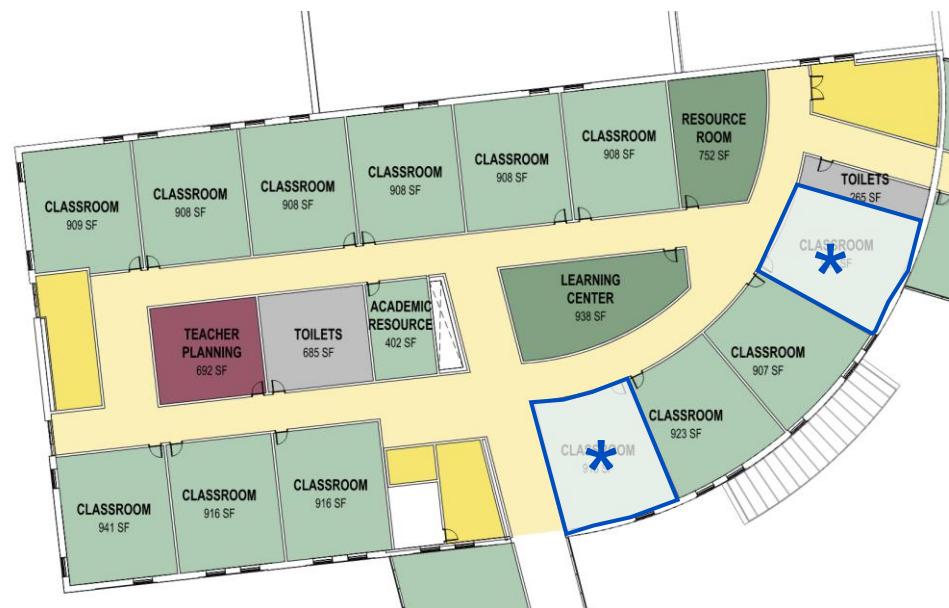
Student Enrollment Considerations – Current Massing

Level 4 Central Office Expansion Space

- Office spaces are being planned within classroom bay dimensions for ease of future conversion to educational space
- Additional Capacity based on Gen Ed classroom layout: **253 students**
- **Two classrooms have been moved into Level 4 footprint of A Wing for a more efficient building form and usability of continuous roof. Massing expression at main entrance returns to 4-stories.**
- (conversion to science classrooms or other lab space may reduce actual student capacity)



Current Schematic Design with Central Office



Future Classroom Wing Conversion

*** Phase 1 LHS Classroom**

Exterior Design – Current Massing



Exterior Design – Material Palette Option 1 – Red Brick with Stone Accents

Stone-look
Porcelain Tile or
UHPC Rainscreen



Brick Masonry
Veneer 1 (Norman
Unit Size)



Brick Masonry
Veneer 2 (Norman
Unit Size)



Pre-formed
Metal Siding with
Metallic Finish



Bright “Bronze”
Painted
Aluminum
Window and
Curtainwall
Frames

Full Bed Granite
Wall Base - Concord
Grey (NH) or Similar



Precast Concrete
Window Sills and
Trim

Exterior Design – Material Palette Option 2 – Stone-like with Wood Accents

Wood-look
Porcelain Tile or
UHPC Rainscreen



Pre-formed
Metal Siding with
Metallic Finish

Wood-look Metal
Plank Soffits



Dark "Bronze"
Painted
Aluminum
Window and
Curtainwall
Frames

Brick Masonry
Veneer 1 (Norman
Unit Size)



Brick Masonry
Veneer 2 (Norman
Unit Size)

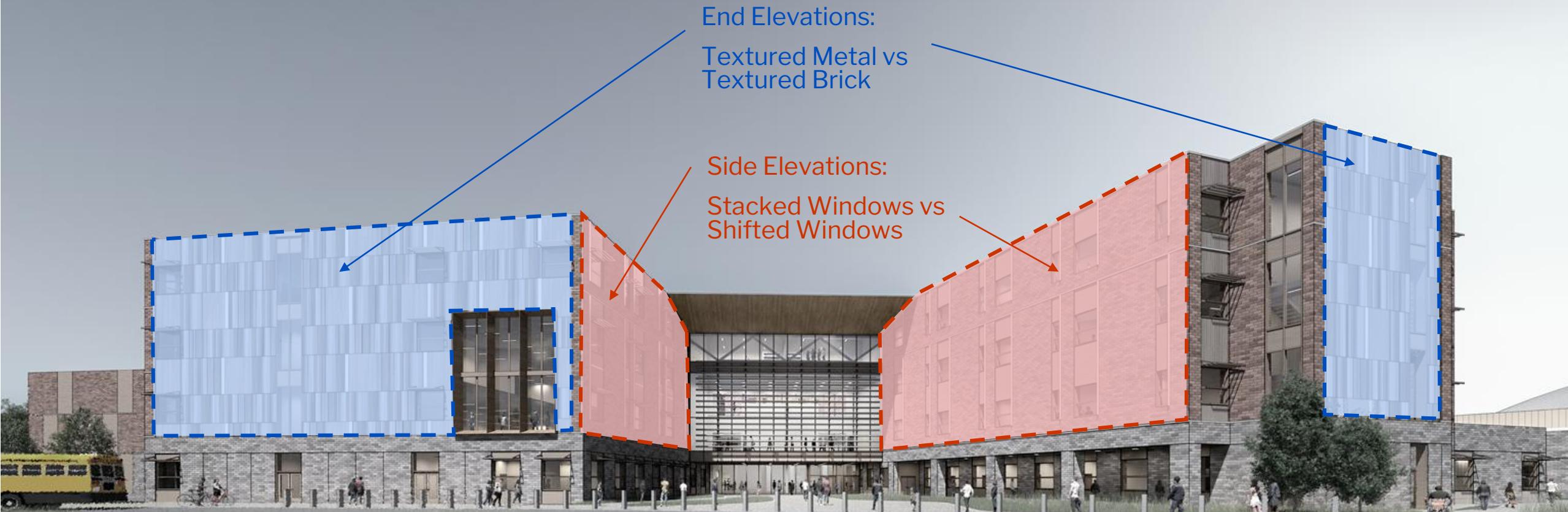


Full Bed Granite
Wall Base - Bethel
White (VT) or
Similar



Precast Concrete
Window Sills and
Trim

Exterior Design – Architectural Variables



Exterior Design – Option 1A – Red Brick Palette, Stacked Windows, Fine-Grained Metal End Walls



Exterior Design – Option 1B – Red Brick Palette, Stacked Windows, Textured Brick End Walls



Exterior Design – Option 1C – Red Brick Palette, Shifting Windows, Fine-Grained Metal End Walls



Exterior Design – Option 1D – Red Brick Palette, Shifting Windows, Textured Brick End Walls



Exterior Design – Option 1C – Red Brick Palette, Shifted Windows, Fine-Grained Metal End Walls



Exterior Design – Option 1D – Red Brick Palette, Stacked Windows, Fine-Grained Metal End Walls



Exterior Design – Option 1 Hybrid – Red Brick Palette, Shifted Windows, Variation of End Walls



Exterior Design – Option 1 D – Red Brick Palette, Shifted Windows, Site PV Canopy



Exterior Design – Option 1 D – Red Brick Palette, Shifted Windows, Site PV Canopy



Exterior Design – “Brick” Palette Options

1A



1B



1C



1D



Exterior Design – Option 2A – “Stone-like” Palette, Stacked Windows, Fine-Grained Metal End Walls



Exterior Design – Option 2B – “Stone-like” Palette, Stacked Windows, Textured Brick End Walls



Exterior Design – Option 2C – “Stone-like” Palette, Shifting Windows, Fine-Grained Metal End Walls



Exterior Design – Option 2D – “Stone-like” Palette, Shifting Windows, Textured Brick End Walls



Exterior Design – Option 2C – “Stone-like” Palette, Shifted Windows, Fine-Grained Metal End Walls



Exterior Design – Option 2D – “Stone-like” Palette, Shifted Windows, Textured Brick End Walls



Exterior Design – Option 2D – “Stone-like” Palette, Shifted Windows, Textured Brick End Walls



Exterior Design – Option 2 B – Pale Brick Palette, Shifted Windows, Site PV Canopy



Exterior Design – Option 2 B – Pale Brick Palette, Shifted Windows, Site PV Canopy



Exterior Design – “Stone-like” Palette Options

2A



2B



2C



2D



- 1 Call to Order
- 2 Vote on Previous Meeting Minutes 12:00 – 12:05
- 3 Public Comment 12:05 – 12:10
- 4 Project Updates 12:10 – 12:15
- 5 Confirm HVAC System 12:15 – 12:25
- 6 Review Outdoor Classroom, Roof Terrace & Plaza Design 12:25 – 12:50
- 7 Confirm Lighted Fields & Field Material 12:50 – 1:00
- 8 Confirm Off-Site Improvements 1:00 – 1:20
- 9 Confirm Exterior Design & Design of Building Entrances 1:20 – 1:50
- 10 Reflections & Action Items 1:50 – 2:00
- 11 Adjourn

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