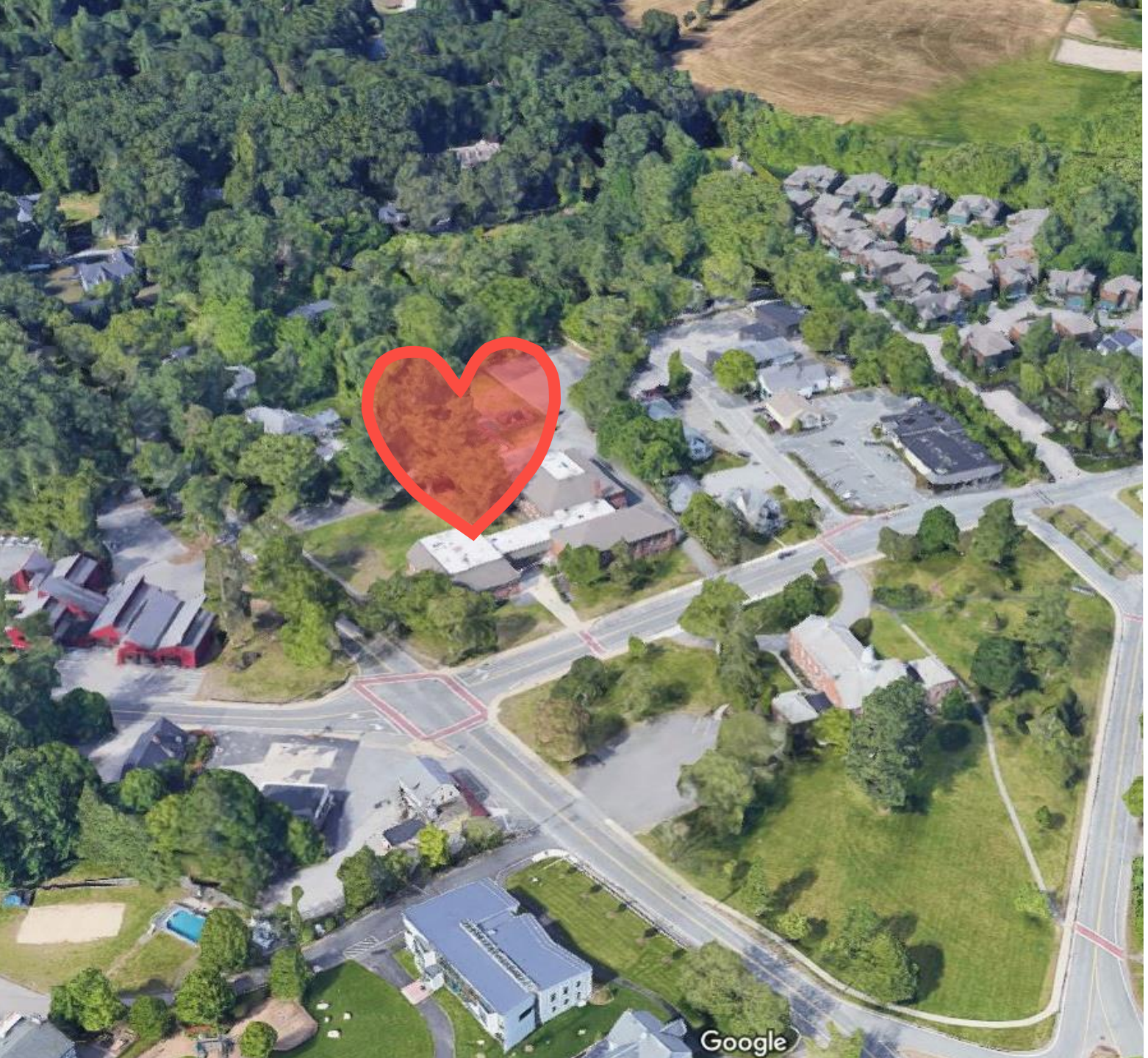


Fennick McCredie Architecture

Town of Dover Community Center

Building Committee

- HVAC System Analysis
- Planning Board

March 9th, 2021

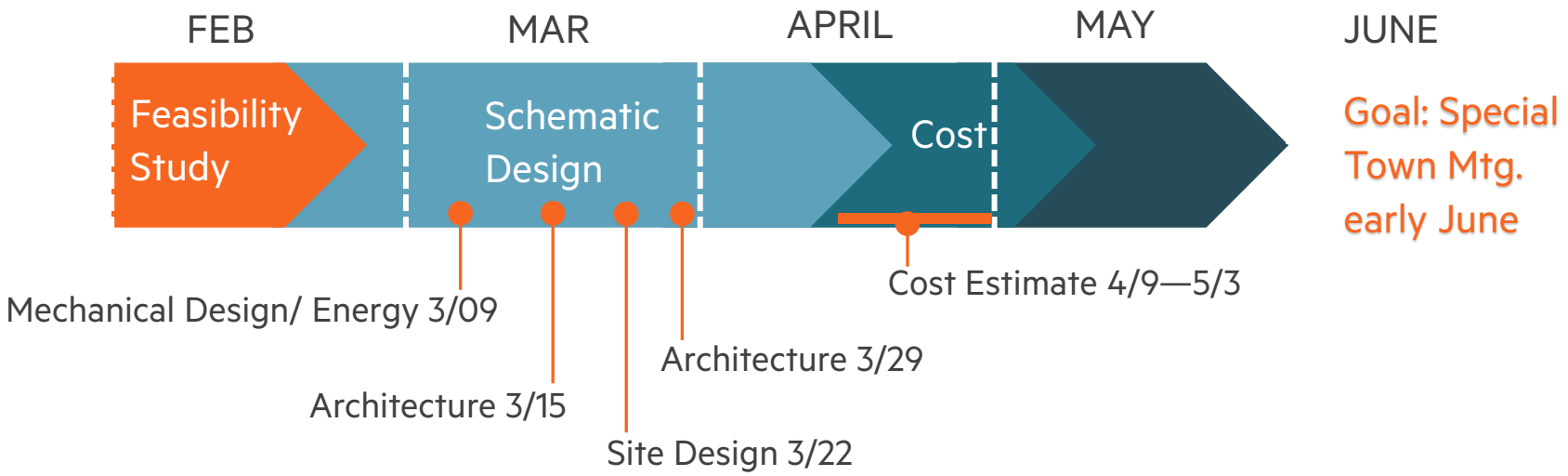
Schematic Design

Upcoming Meetings

- ✓ Energy Sub-Committee – 3/4
- ✓ Review program with COA - 2/24
- ✓ Review program with Parks & Recreation -2/24
- ✓ Meet with Planning to review Parking Options -3/8

Milestones

- Feasibility Report
- Mechanical Design
- Structural Design
- Site Design
- Architectural Design
- Cost Estimating Set



Building a vision
Building consensus

1. Major Building Elements for Energy Efficiency
2. HVAC System Analysis
3. Other Energy Systems
4. Planning Board Summary
5. COA Location in 2-Story Option

Overview of Sustainability Goals -from 11/9 BC Presentation

Highly Efficient Building Metrics

- LEED – certification or certifiable?
- % savings from Baseline ASHRAE code minimum
- EUI – Energy Use Intensity in kbtu/SF
- Net Zero Energy (Actual or Ready?)
- Carbon Neutrality – No fossil fuels, All Electric
- Water Savings
- Building Envelope – Passive House, etc.

EUI – Energy Use Intensity

- 30 kbtu/SF – very aggressive goal with to achieve Net Zero Energy
- 50 kbtu/SF – comparable code minimum building systems/envelope

Existing Energy Use

- 2018-2020 Electric and Oil Bills
- Normalized to account for COVID shut-down in March 2020
- 40,000 gsf existing school building
- Energy Use Intensity (EUI) is per sq. foot for better comparison

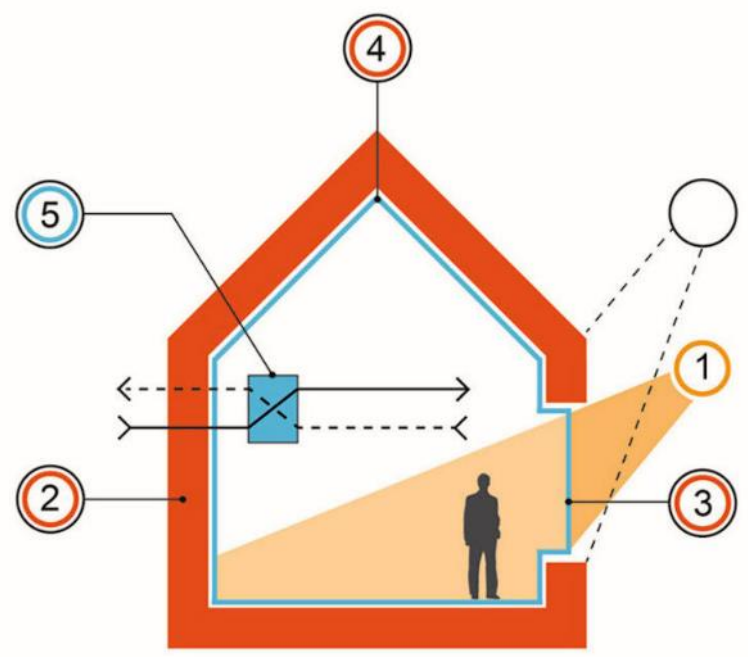
Existing

2030 Baseline
(office)

Current Model
(office)

Major Factors in Energy Use

1. Solar Heat Gain /Orientation
2. Insulation
3. Window U-Value
4. Tight Envelope
5. Mechanical System (Heating/Cooling/ Air)



Insulation

Building Envelope Factors

EUI= 27.9

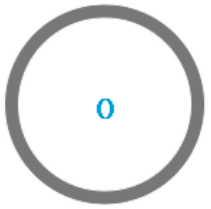
	Baseline	Upgrade	Upgraded EUI	
• Roof Insulation:	R-30	R-50	26.4	-1.3
• Wall Insulation :	R-20	R-30	27.2	-0.7
• Slab Insulation:				
• Tight Envelope:	CODE			

Baseline Energy

Whole Building EUI

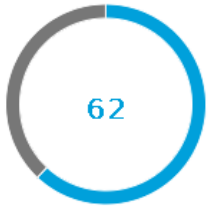
Education 27.92 kBtu/ft²/yr

LEED Points - EAc2 Credit



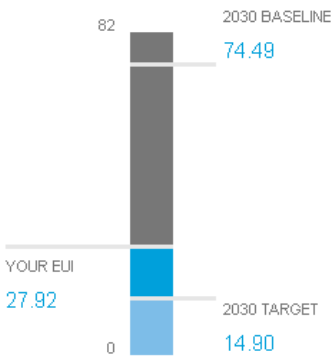
Electricity $22884.82 /yr
Natural Gas $0 /yr

CO2 Reduction %



2030 Baseline 147.2 Tonne/CO2e/yr
Emissions 55.2 Tonne/CO2e/yr
You Saved 14 Trucks of Ice/yr

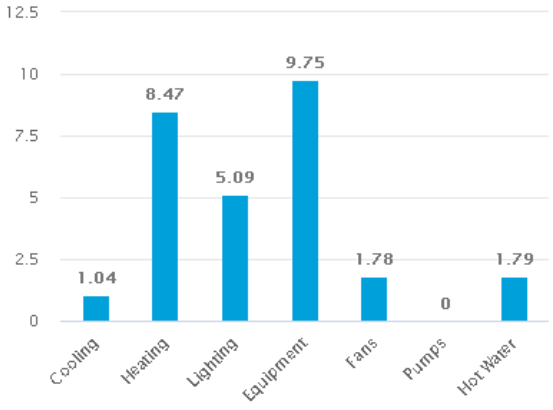
Benchmarking Energy



Update 2030 DDX

Project not yet updated in DDx

Whole Building EUI Breakdown

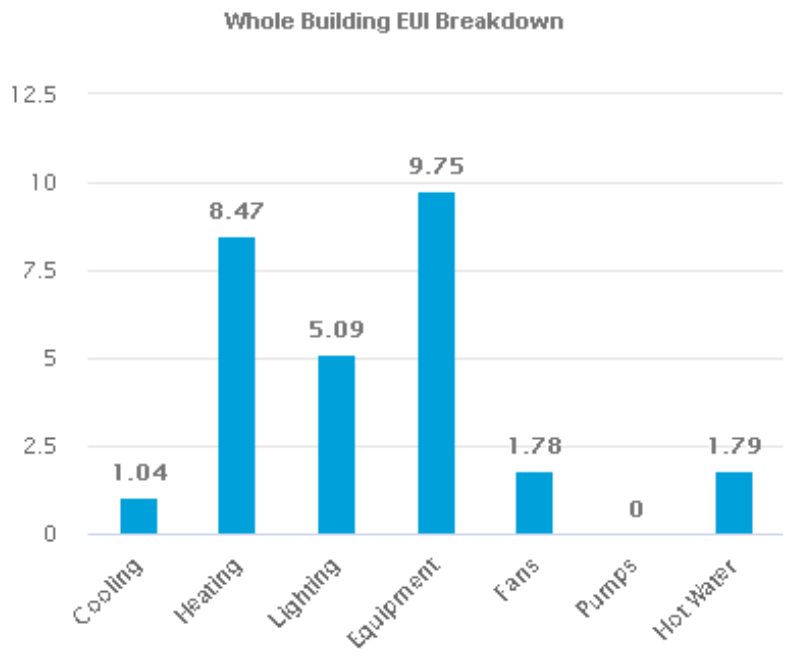


Windows

Building Envelope Factors

EUI= 27.9

	Baseline	Upgrade	Upgraded EUI	
• Orientation:	By Option			
• U-Value:	U=.28	U=.24	27.4	-0.3
• Solar Heat Gain	SHGC=.28	SHGC=.21	28.4	+.5



HVAC System Options

HVAC

System Option 1 – (Ground Source Heat Pumps)

- Heating and cooling generated centrally with a 50 ton heat recovery chillers that will extract/reject heat to a geothermal well system.
- Estimating 2.25-tons per well, project will require 24 wells.
- Can be combined with electric boiler/chiller to offset peak loads.
- Dedicated distribution piping with a run/standby pump configurations for each system (Condenser Water, Chilled Water and Heating Hot Water)
- Vertical duct risers, distribution ductwork and VAV terminals for control.
- Dedicated Outdoor Air System (DOAS) with Energy Recovery

HVAC

System Option 2 – (Air-Source VRF with FCU's & DOAS):

- VRF condensing units coupled with fan coil units for individual zone control.
- Refrigerant distribution will extend from each condensing unit to FCU's throughout.
- Vertical duct risers, distribution ductwork and VAV terminals for control.
- Dedicated Outdoor Air System (DOAS) with Energy Recovery
- Refrigerant distribution will extend from each condensing unit to FCU's throughout.

HVAC

System Option 3 – (Package Roof Top Units):

- (2) 12,500 CFM packaged rooftop units
  - DX/electric cooling.
  - Will utilize hot water boiler/coil in lieu of gas furnace.
- Vertical duct risers, distribution ductwork and VAV terminals for control.
- RTU System provides ventilation throughout.
- Hot water (30% glycol) distribution piping.

HVAC System Matrix

System	GSHP	VRF	RTU
Pro's	❑ Flexibility with range of systems options ❑ More sturdy/reliable ❑ Lower operating cost compared to direct electric ❑ Higher probability of achieving NZE.	❑ Lower initial cost (installation) ❑ Lower equipment maintenance costs ❑ Flexibility with varying tenant schedules ❑ Metering capabilities for billing ❑ Simple building automation ❑ No central mechanical room ❑ No piping heat loss	❑ Lower equipment maintenance costs ❑ Flexibility with varying tenant schedules ❑ Equipment is located in one location ❑ Flexibility on future renovations
Con's	❑ Higher initial cost (installation) ❑ More complicated to operate/repair ❑ Increased maintenance ❑ Advanced building automation ❑ Requires central mechanical room ❑ Location specific (required test wells to determine available capacity)	❑ Less efficient in cold weather (over/under sizing) ❑ Limitations on pipe runs ❑ Multiple compressors ❑ Potential for refrigerant leaks ❑ Aesthetics of exposed equipment ❑ Rapidly developing/changing VRF technology ❑ Proprietary service requirements ❑ Limitation on future expansion	❑ Higher initial cost (installation/equipment) ❑ Aesthetics of exposed equipment ❑ Ambient acoustics ❑ Larger distribution systems ❑ Lower energy efficiency ❑ Requires fossil fuel for heating (gas furnace or boiler system) ❑ Requires central mechanical room

Relative Energy Models

(Cove.tool)

HVAC System 1 – Ground Sourced Heat Pump

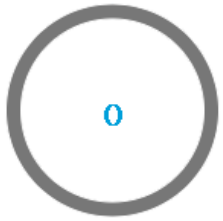
Baseline Energy

Create Report Climate Analysis

Whole Building EUI

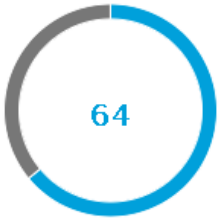
Office 26.74 kBtu/ft²/yr

LEED Points - EAc2 Credit



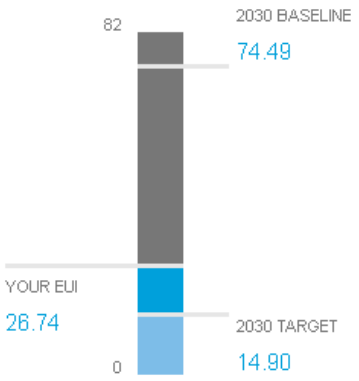
Electricity $21915.5 /yr
Natural Gas $0 /yr

CO2 Reduction %



2030 Baseline 147.2 Tonne/CO2e/yr
Emissions 52.8 Tonne/CO2e/yr
You Saved 14 Trucks of Ice/yr

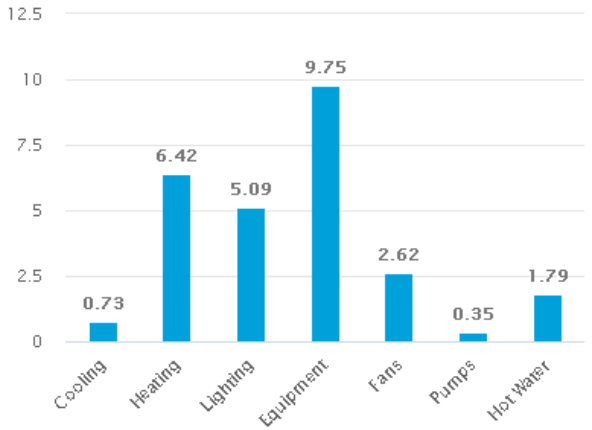
Benchmarking Energy



Update 2030 DDX

Project not yet updated in DDx

Whole Building EUI Breakdown



HVAC System 2 – Variable Refrigerant Flow (VRF)

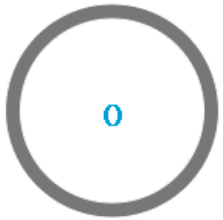
Baseline Energy

Create Report Climate Analysis

Whole Building EUI

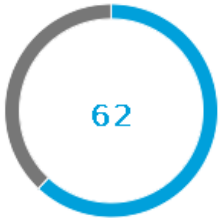
Education 27.92 kBtu/ft²/yr

LEED Points - EAc2 Credit



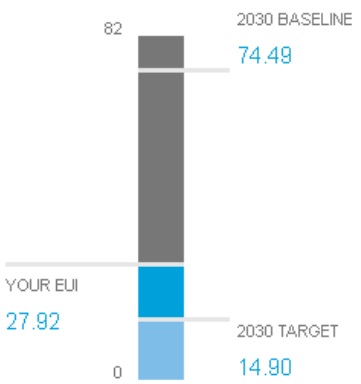
Electricity $22884.82 /yr
Natural Gas $0 /yr

CO2 Reduction %



2030 Baseline 147.2 Tonne/CO2e/yr
Emissions 55.2 Tonne/CO2e/yr
You Saved 14 Trucks of Ice/yr

Benchmarking Energy



Update 2030 DDX

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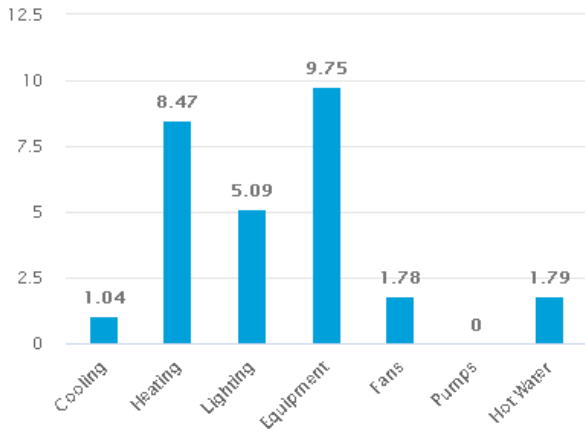
Whole Building EUI Breakdown



HVAC System 3 – Packaged Roof Top

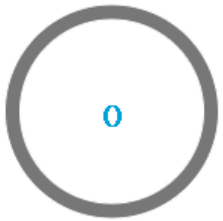
Baseline Energy

Create Report Climate Analysis

Whole Building EUI

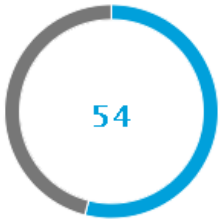
Education 34.19 kBtu/ft²/yr

LEED Points - EAc2 Credit



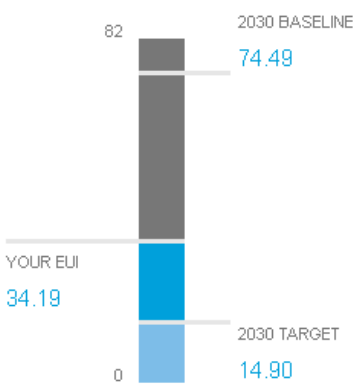
Electricity $28022.85 /yr
Natural Gas $0 /yr

CO2 Reduction %



2030 Baseline 147.2 Tonne/CO2e/yr
Emissions 67.6 Tonne/CO2e/yr
You Saved 12 Trucks of Ice/yr

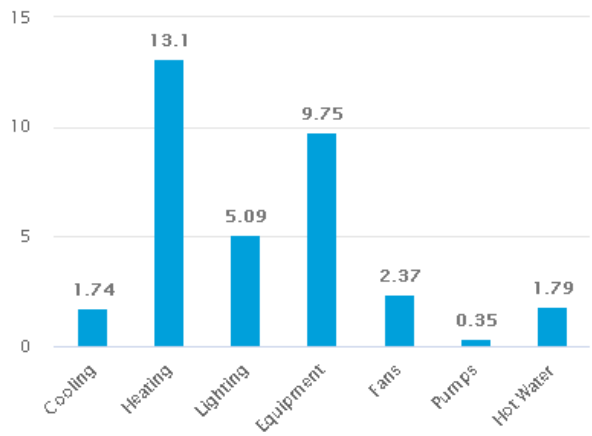
Benchmarking Energy



Update 2030 DDX

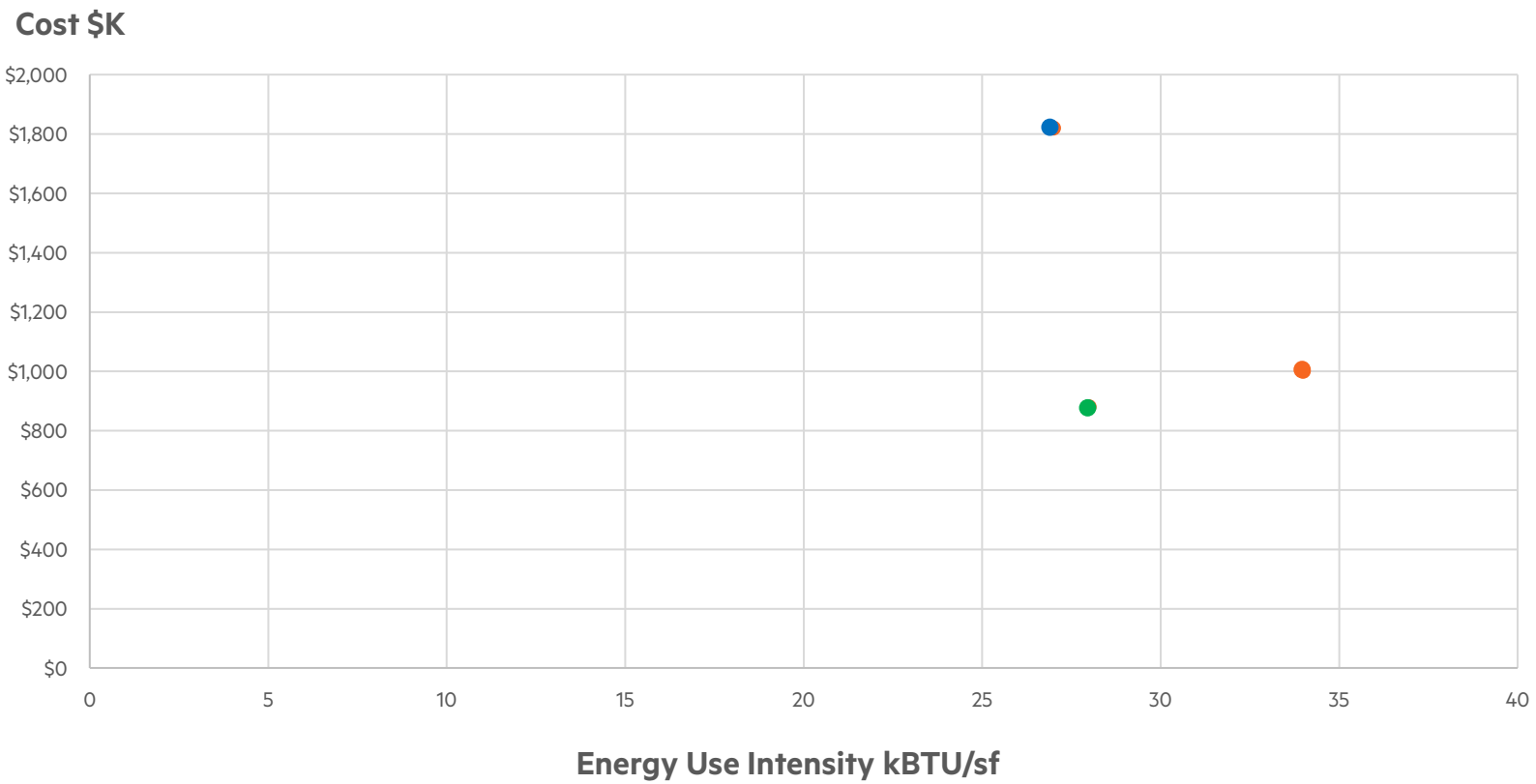
Project not yet updated in DDx

Whole Building EUI Breakdown



HVAC Systems - Cost Benefit

	EUI	Cost $K
Ground Sourced Heatpump	27	$1,820
Variable Refrigerant (VRF)	28	$880
Packaged Rooftop Units (RTUs)	34	$1,000



Other Energy Systems

Electrical

PhotoVoltaic Array Considerations

- Solar Orientation and Shading Impacts
- Space availability on roof and site

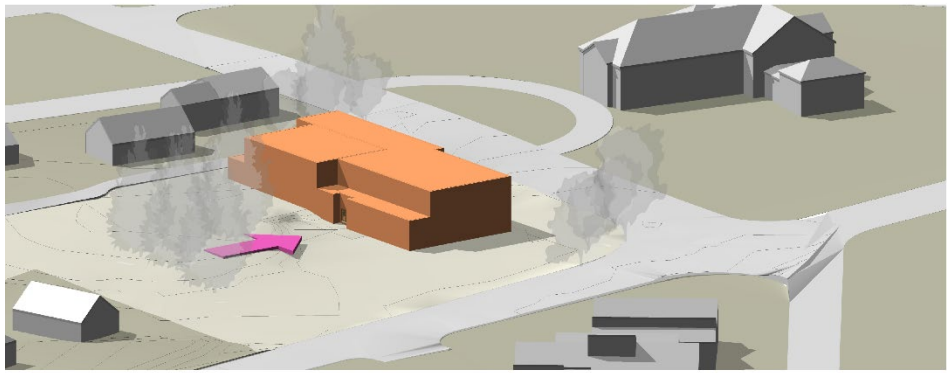
New Two-Story Building Option

- Demand at 30 kbtu/sfy/yr goal = 136,244 kwh/yr
- Potential production using 6,000 SF roof = 113,530 kwh/yr
- % toward NZE goal = 83%

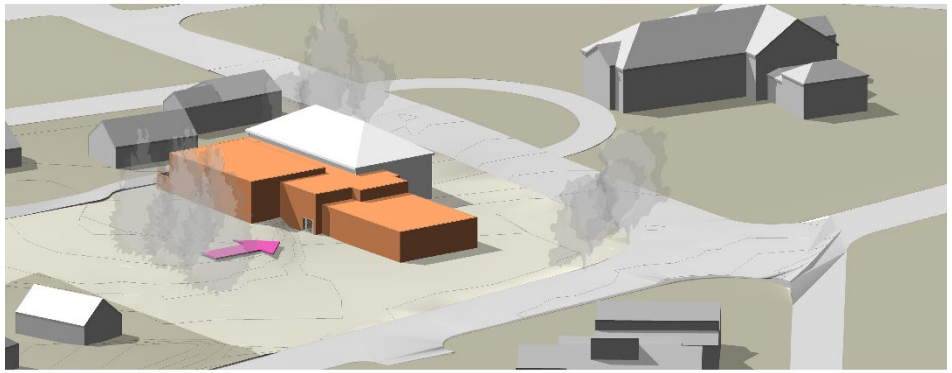
Save 1910 Reno Option

- Demand at 30 kbtu/sfy/yr goal = 153,824 kwh/yr
- Potential production using 4,200 SF roof = 79,470 kwh/yr
- % toward NZE goal = 52%
- If no community roof usage, % NZE = 25%

Continue Pursuit? Involve 3rd party installer or own panels?

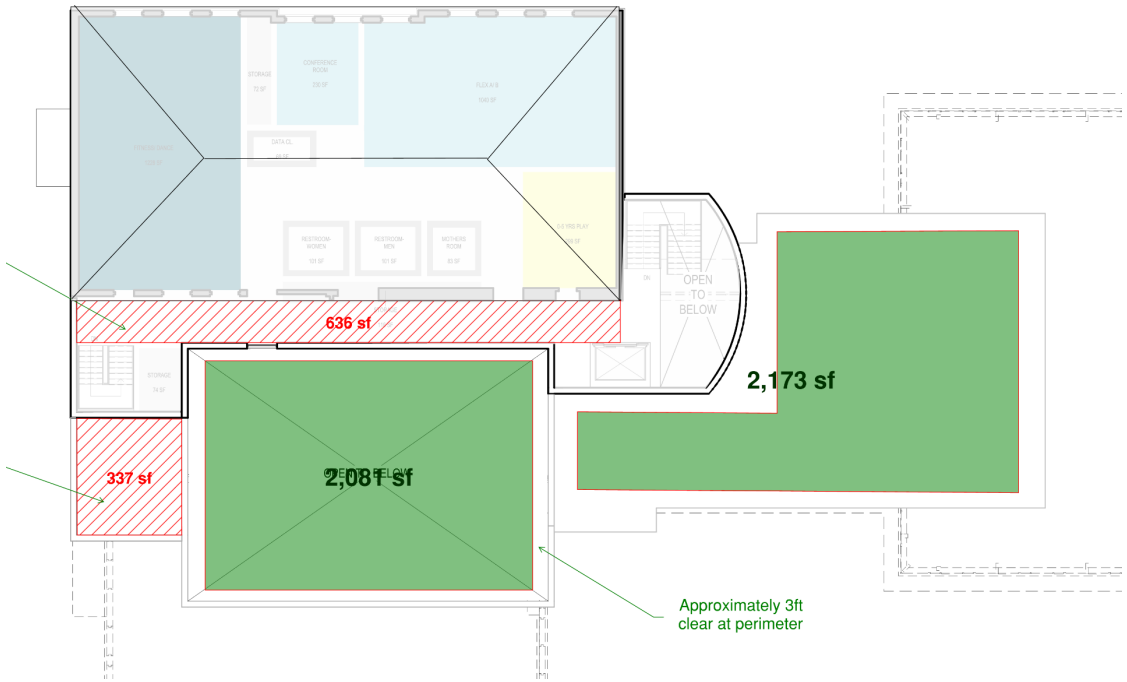


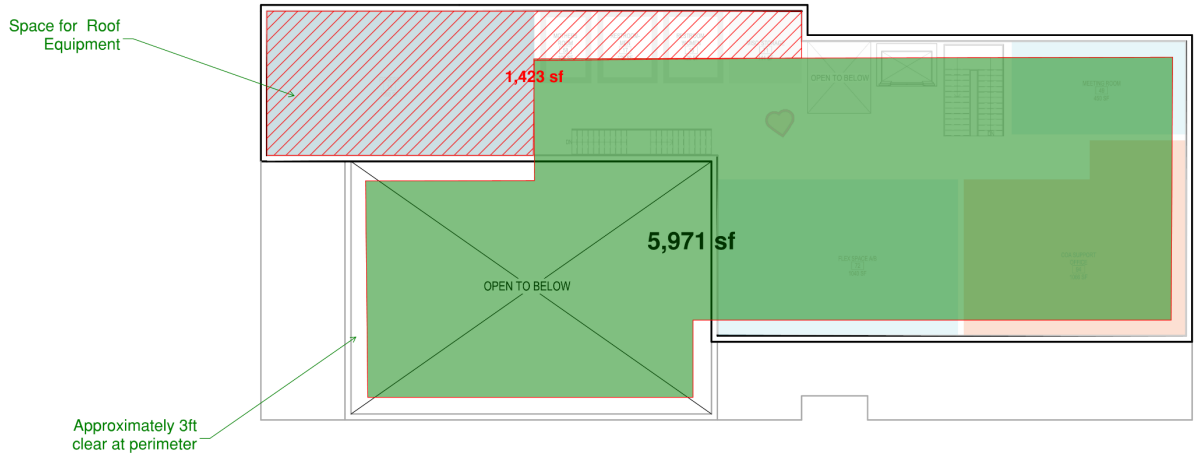
New Two-Story: 6,000sf



Save 1910: 2,000sf + 2,200sf

Electrical - Potential PV Areas





Save 1910: 2,000sf + 2,200sf

New Two-Story: 6,000sf

Emergency Generator
Warming/ Cooling Center

- Budget currently carrying cost for a 200KW generator
- Pending further design detail, should be able to cover entire building load (with diversification) during an emergency “event”.
- Backing up the entire main service panel has premium cost to generator but savings on distribution and flexibility for uses within building during an “event”
- Diesel fuel storage for an “event’ duration of 48hrs will require 1,000 gallon tank.
- Switch to Propane over Diesel will increase size/cost of generator and may limit refueling options

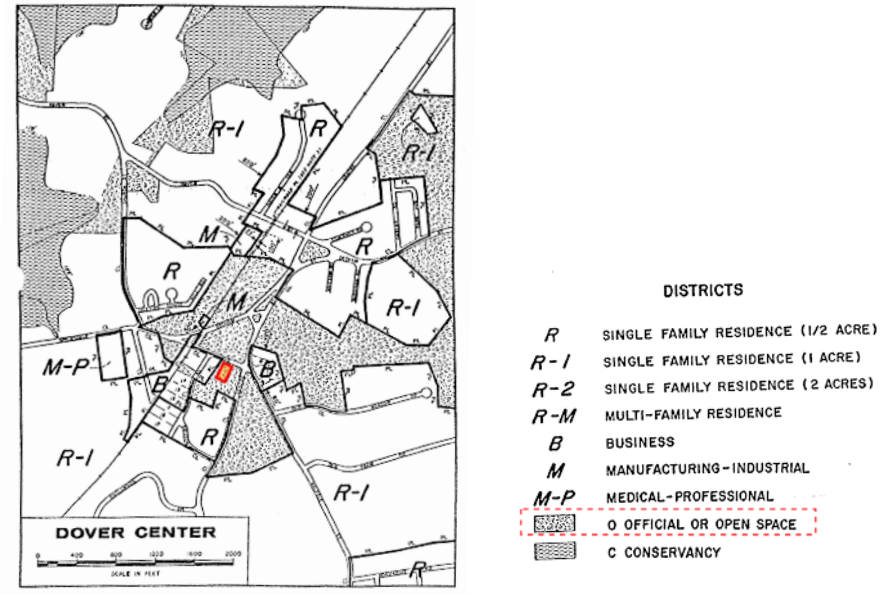
Planning Board – March 8th

Zoning Background

Zoning District: O (Official of Open Space) *hatching per 1981 Zoning Map*
Allowed uses: Church, Educational, Farm, Municipal recreational, Municipal

Dim Requirements:
Front Setback: 40ft
Side Setback: 20ft
Rear Setback: 0ft?
Max Height: 35ft, 2.5 stories
Max. Lot Coverage: 40%

Site Plan Review will be required per §185-40 or Official or Open Space District (coordinated with § 185-36 Site Plan Review)



Zoning Background

Zoning District: O (Official of Open Space) *hatching per 1981 Zoning Map*
Allowed uses: Church, Educational, Farm, Municipal recreational, Municipal

Bldg Requirements (§ 185-40)
Submit to the Board of Selectmen for review prior to building permit:

a) **Emergency access**
b) **Lot size**, frontage, yards and heights of buildings.
c) **Vehicle and pedestrian** safety
d) **Parking** arrangement and the number of parking
e) **Water** supply, sewage, and drainage.

Acoustical considerations: No Dover noise by-law, best practices

Light Trespass: Exterior lights to be specified at Dark Sky compliant and light trespass limited to LEED standard

Existing Site Plan

Set back from Springdale

Main entrance not Accessible

Lacks plaza/ forecourt @ entry

No Drop-off lane

64 parking spaces

Lacks outdoor activities (except pre-k)

Basketball court near neighbor

Feasibility Site Plan

Sited close to Springdale

Plaza/ Forecourt @ entry

Drop-off lane (bus or cars)

New plantings at entry

65-75 parking spaces (existing @ 64)

Outdoor activities : walking, play, garden, gathering

Patios for exterior/interior flow

Basketball (half court), keep field space

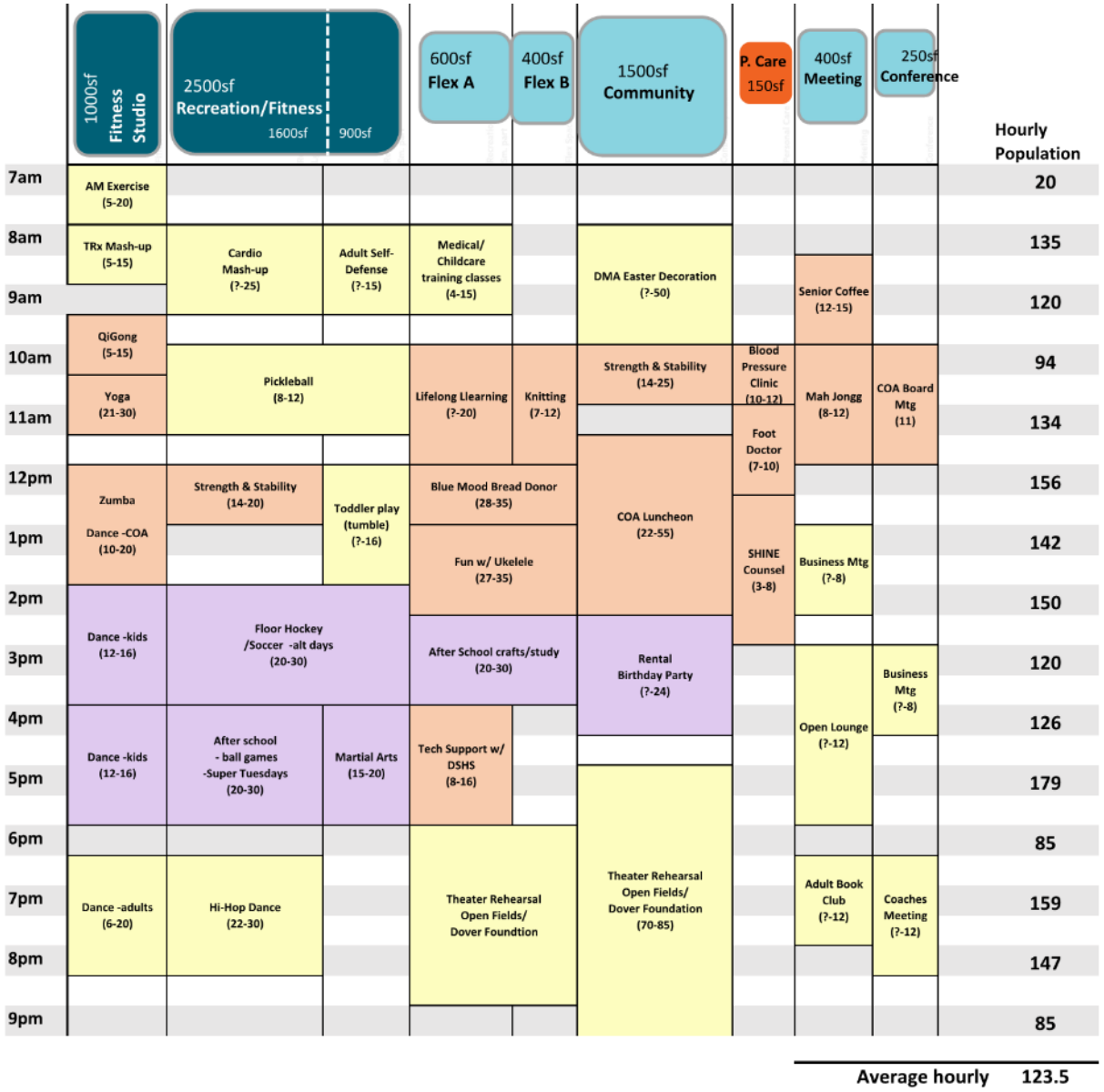
Building lot coverage 8-10%

Impervious ~ 52%

Available Parking

On-Site	70 (5 HC)
Springdale	20 (2 HC)
	90 spaces
Town House:	25
Dover Market	38
7 Whiting Rd.	27
Highway Dept.	45
	135 spaces
Total Available	**225 spaces**

Anticipated Occupancy



Building Code	**800**
Anticipated Avg.	**124**
Big Event	**180**
Dinner	100
Dance Class	20
Flex Room	30
Misc.	30
	180 Occupants

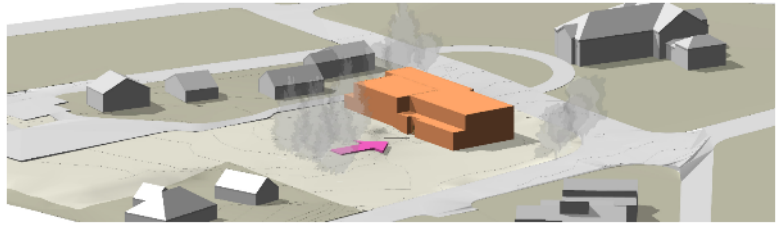
Avg. Occupants per car	**x2.0**
Parking by 4 Springdale	**90 spaces**
Immediate capacity	**180 persons**
Nearby parking	**125 spaces**

Location of COA Offices

(New 2-Story Option)

Options for Schematic Design

New 2-Story

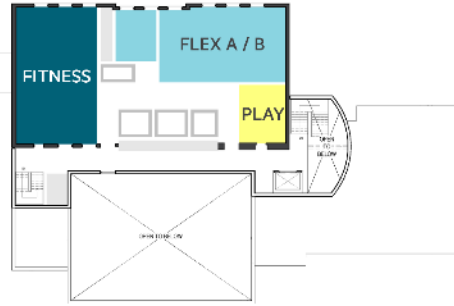


First Floor Plan

Second Floor Plan

Save the 1910

First Floor Plan

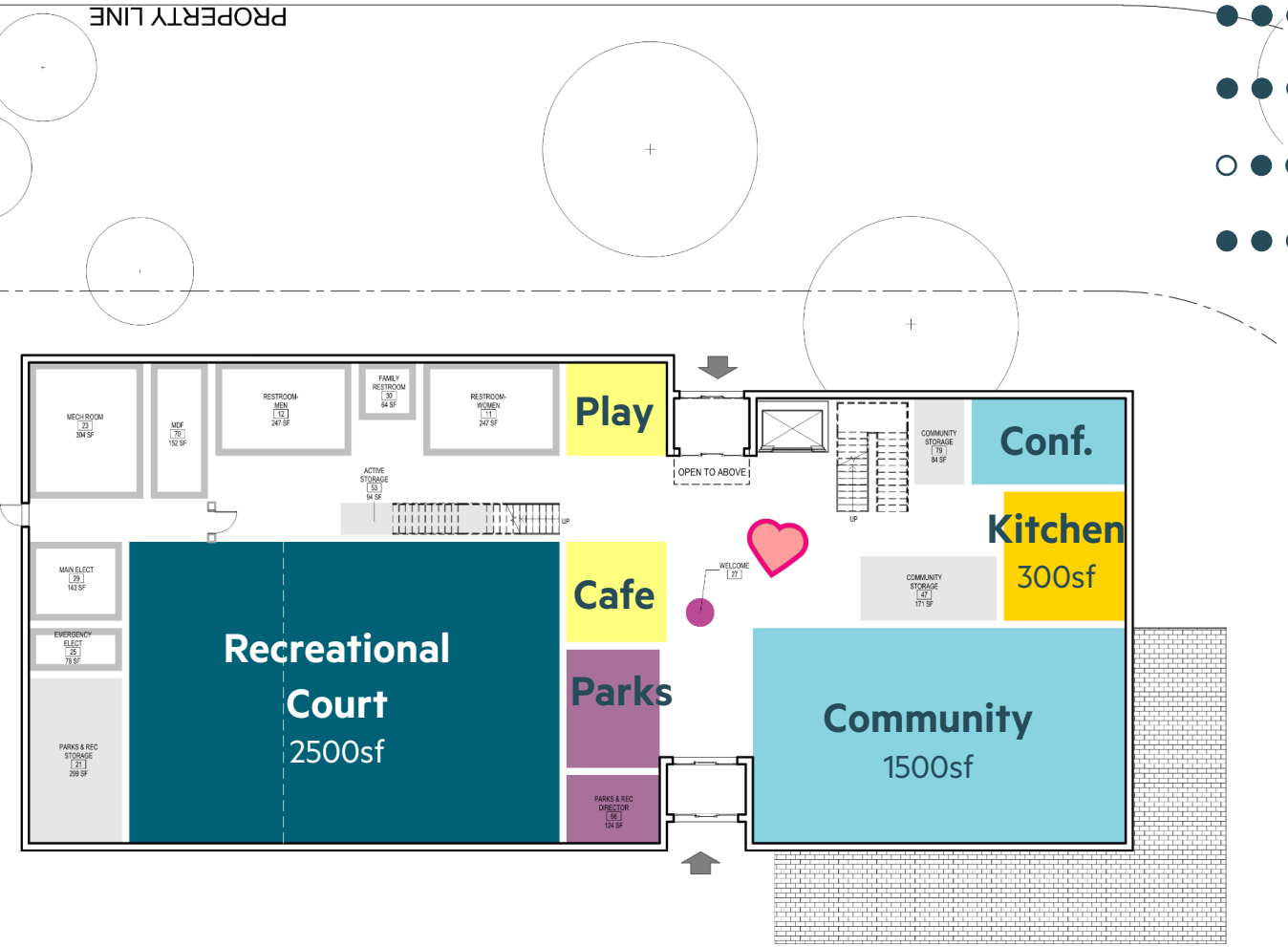


Second Floor Plan

COA Office Location
Approved Concept Plan

Evaluation Factors

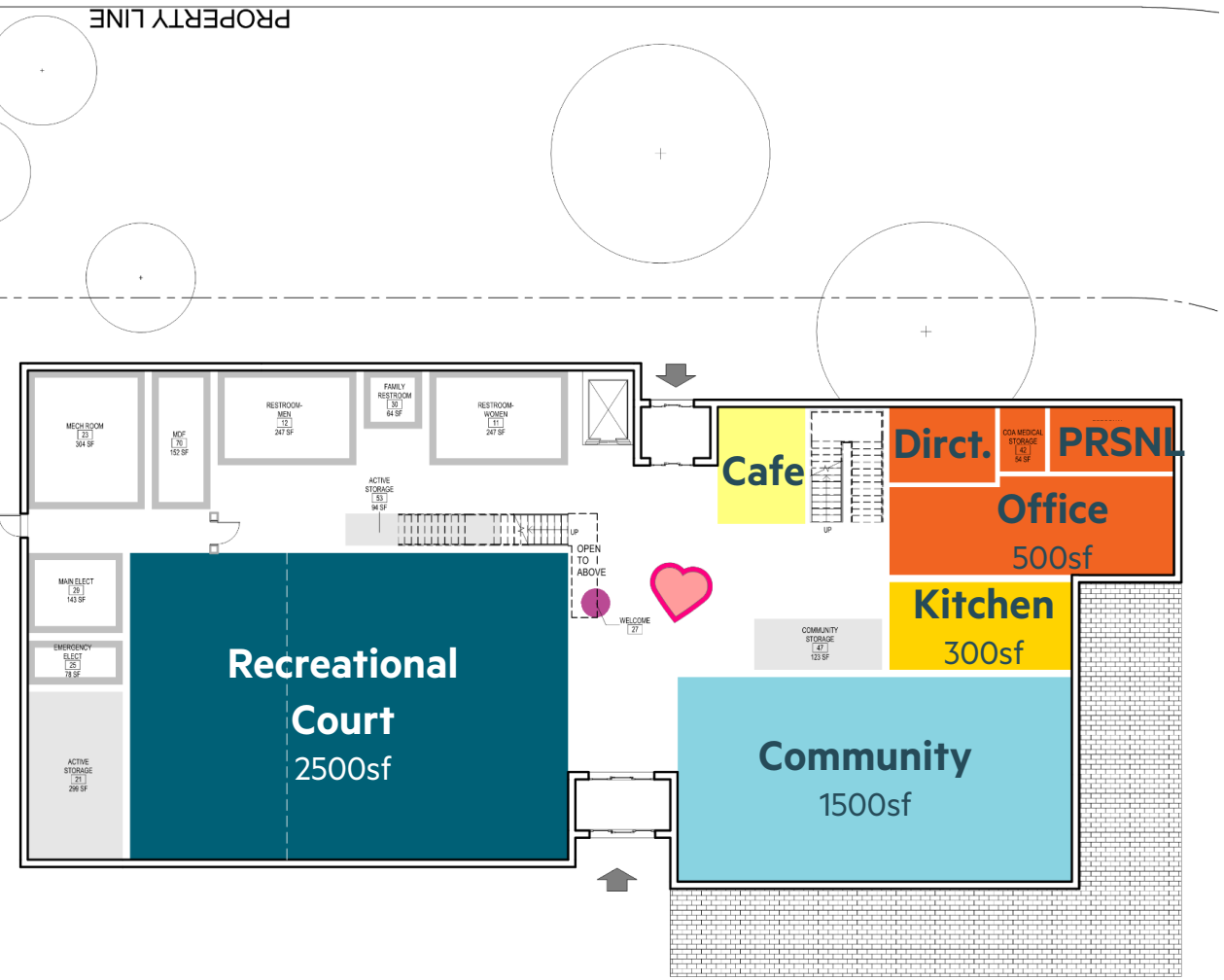
- ○ ○ ● **COA Office Location:** on Upper Level, needs elevator
- ○ ○ ● **Senior Activities Location:** on Upper Level, needs elevator
- ● ● ● **Parks & Rec Office:** on Upper Level, remote from entry
- ● ● ● **Community Room:** on Lower Level, easily accessible
- ○ ● ● **Balanced Upper/Lower:** relatively balanced floors for efficiency
- ● ● ● **Senior Social Area:** has cohesive area for seniors



COA Office Location
Alternate Plan

Evaluation Factors

- ● ● ● **COA Office Location:** on Lower Level, easily accessible
- ○ ○ ● **Senior Activities Location:** on Upper Level, needs elevator
- ○ ○ ○ **Parks & Rec Office:** on Upper Level, remote from entry
- ● ● ● **Community Room:** on Lower Level, easily accessible
- ○ ● ● **Balanced Upper/Lower:** relatively balanced floors for efficiency
- ○ ○ ○ **Senior Social Area:** lacks cohesive area for seniors



Lower Level

Upper Level