Medford High School

Sustainability and MEP Systems
Advisory Team Meeting #6

09/23/2026



smma

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Agency
Landscape + Planning

Agenda

- Sustainability Givens Overview

- Net Zero Energy & Minimizing Cost of Ownership
  - Preliminary Life Cycle Cost Analysis (LCCA) Information
- Preliminary Solar PV Assessment
- Red List Free Materials
- Embodied Carbon & Mass Timber
- Water Efficiency & Stewardship

- Next Steps

Sustainability Givens Overview

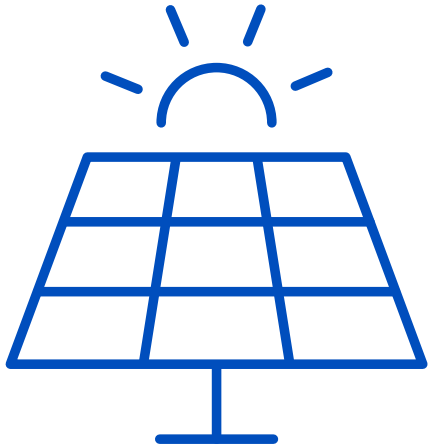
Sustainability and MEP Systems – Sustainability Givens Overview

MSBA Green School Policy:

- LEED version 4 Silver (minimum)
- Stretch Energy Code
- MEP/BE/Ongoing LEED Commissioning
- 3 LEED MR/IEQ points

MSBA 4% Additional Reimbursement:

- Specialized Stretch Energy Code (3%)
- 5 LEED MR/IEQ points (1%)



Specialized Stretch Energy Code:

- **Standard Stretch Energy Code Compliance**
- **Pathways Options:**
  - All-Electric HVAC & DHW
  - Fossil Fuel Heating:
    - Electrification of Heating Readiness
    - Renewable Energy Installation



1. **Go Green Medford**
2. **Solar Ordinance (Solar PV)**
3. **Sustainable Design Guidelines**
   - LEED version 4 (minimum)
   - Net Zero Energy
   - Healthy Materials
   - Water Stewardship
   - Cost of Ownership

Medford High School – School Committee Motion
[voted and approved by SC 7.20.26, reviewed with Sustainability Advisory Team 7.21.26]

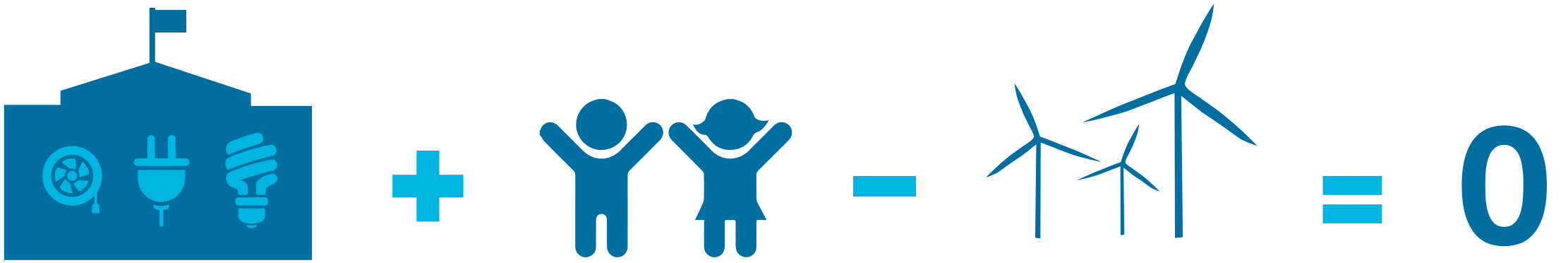
The Comprehensive Medford High School project shall achieve a **minimum of LEED v4 Silver** certification to meet MSBA requirements; however, the project shall prioritize building performance, occupant health, and lifecycle cost over point accumulation. To that end, the project shall:

- **Strive to achieve net-zero energy** (as technically feasible) through integrated passive design strategies, all-electric high-efficiency systems, and on-site renewable energy generation;
- **Specify red list- free, healthy materials** for all materials except MEP/FP and prioritize LEED healthy materials credits necessary to obtain the maximum IAQ MSBA reimbursement to ensure superior indoor air quality for students and staff.
- **Prioritize water efficiency and stewardship** to reduce indoor potable water consumption by a minimum of 30%; while trying to eliminate potable water for irrigation use;
- **Minimize the total cost of ownership**, designing operational systems, controls and monitoring to substantially reduce energy, water, and maintenance costs over the life of the building.

The long-term cost of operating and maintaining the building shall remain at the forefront of every design decision.

Net Zero Energy and Minimizing Cost of Ownership

Sustainability and MEP Systems – Net Zero Energy Goal



Energy Consumption (KBTU/yr)

35 pEUI

People

20% Energy Use Contingency

Renewables

Solar PV [Sizing]

Net Zero Energy

Sustainability and MEP Systems – Energy Performance, LCCA and Net Zero Energy

Massachusetts Specialized Stretch Code



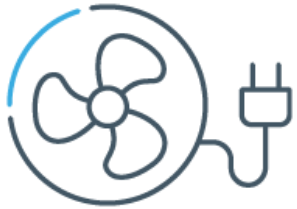
Passive Strategies



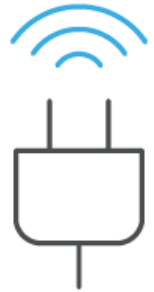
Super-insulated Enclosure



Triple Glazing



All-Electric HVAC



Plug Load Management

35

kBtu/SF/Yr.

Predicted Energy Use Intensity (EUI) Goal

The 35 pEUI goal is informed by a reasonable impact of the CTE programs on overall building energy consumption vs. typical NZE school with no CTE programs [25-30 EUI]

Sustainability and MEP Systems – Building and Site Relationship



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Sustainability & MEP Systems – LCCA Approach

Life Cycle Cost Analysis (LCCA) is used to assess and compare the associated initial and operating costs of building systems (HVAC) over the life cycle of the building (50 years)

MHS Preliminary PSR LCCA includes:

- Initial costs
- Replacement Costs
- Maintenance Costs
- Energy savings from Utility Costs
- 50-yr. life cycle
- 3% cost escalation
- Incremental Costs, Payback and Incentives

Main School Building HVAC Systems LCCA

Option 1	Option 2	Option 3
Ground Source Heat Pump - GSHP	**Hybrid – GSHP (50%) and AtWHP (50%)**	**Air To Water Heat Pump - AtWHP**

Code Baseline: Natural Gas Boiler and Water-Cooled Chiller [ASHRAE System #7]

GSHP = Ground Source Heat Pump
AtWHP = Air Source Heat Pump
LCCA = Life Cycle Cost Analysis

Pool Building – Pool Hot Water System LCCA

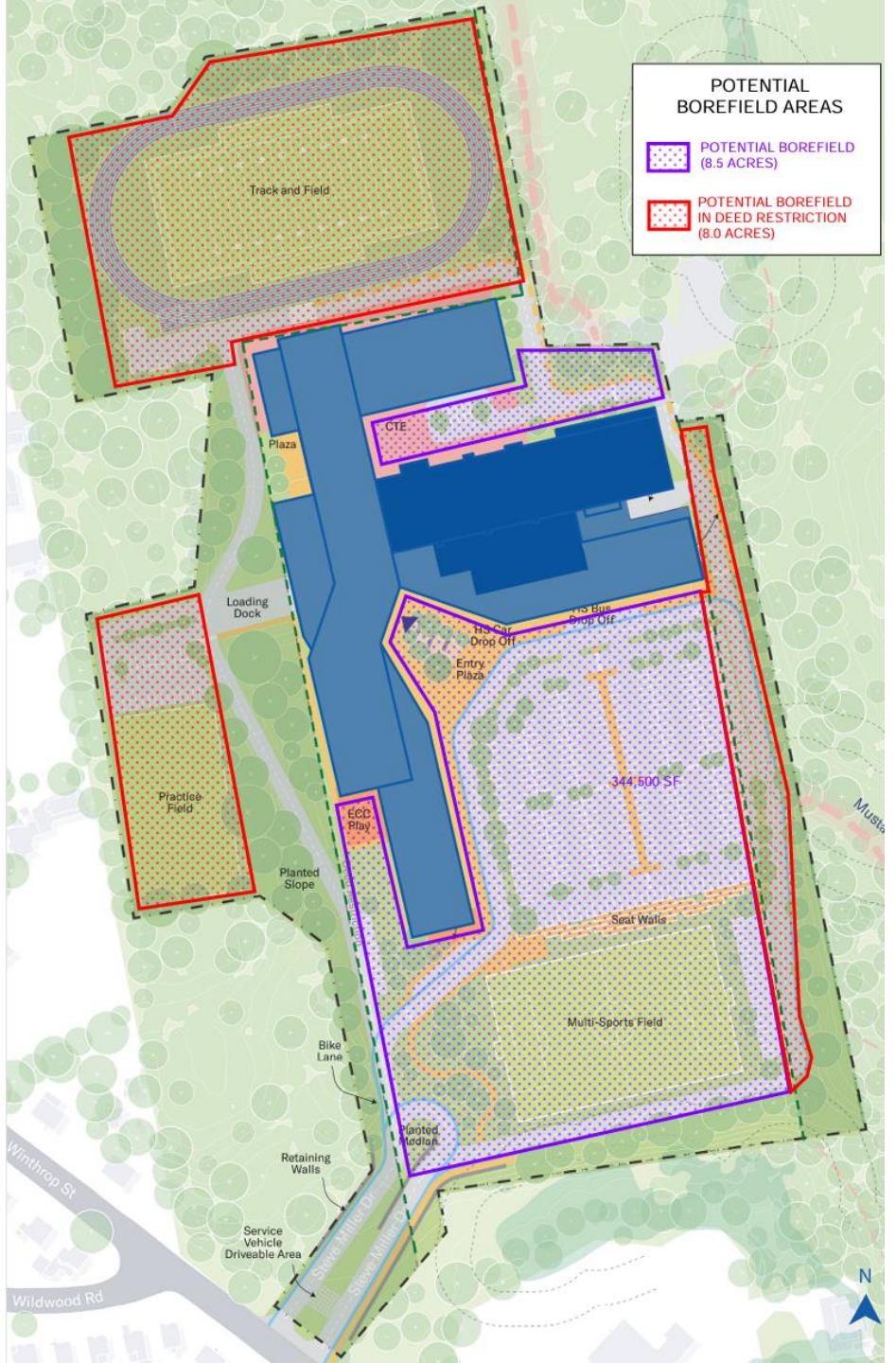
Option 1	Option 2
Air to Water Heat Pump - AtWHP	**Natural Gas Boilers**

Building space heating and cooling system: Hybrid GSHP and AtWHP (main building)

GSHP = Ground Source Heat Pump
AtWHP = Air Source Heat Pump
LCCA = Life Cycle Cost Analysis

Sustainability and MEP Systems – Site Overview & Constraints

	Bore (Wells) Area	
Depth	**800 ft**	**500 ft**
Ground Source Heat Pump – GSHP [100%]	~9 Acres	~12 Acres+
Hybrid – GSHP [50%] / **AtWHP** [50%]	~4.5 Acres	~8+ Acres
Site Available Area	~8.6 Acres	



Sustainability and MEP Systems – Preliminary SD 50-year Life Cycle Cost Analysis (LCCA)

System Type	Required Bore Wells Area (SF/acres)	Location of Bore Wells	Site Staging Impact/ Limits	Initial Cost	50-yr Cost
Baseline - Fossil Fuel System (Baseline)	-	-	-	$77,290,000	**$173,009,000**
Option 1 Ground Source Heat Pump - GSHP	9 acres	Main Parking Lower Field Areas	Temporary HVAC System – 3.5 yrs	$93,417,000	**$164,744,000**
Option 2 Hybrid – GSHP (50%) and AtWHP (50%)	4.5 acres	Main Parking	Temporary HVAC System – 3.5 yrs	$74,279,000	**$142,076,000**
Option 3 Air-to-Water HP (AtWHP)	-	-	-	$62,378,000	**$133,402,000**

Notes:

1.Energy costs use Medford's 2025 utility rates, while HVAC system costs reflect recent estimates.
2.A 3% annual escalation rate is compounded over 50 years (Net Present Value).
3.Utility incentives are capped at $3,000,000 for 100% GSHP; estimates are $2,550,000 for Hybrid and $2,100,000 for 100% AtWHP.
4.Options 2-Hybrid: the temporary heating and cooling system may see cost reduction if wells are allowed in deeded land, pending Art. 97 costs.
5.Additional state incentives may be available at occupancy, including annual DOER AEC REC revenue, further improving GSHP payback.
6.Option 1 – GSHP: Federal IRA incentives are excluded because domestic-content and prevailing-wage/training requirements have proved difficult to meet, and availability at the time of system installation (application) remains uncertain.
7.The Pool building is not included in the LCCA. A separate Pool Building LCCA will be provided

Sustainability and MEP Systems – 50-year Life Cycle Cost Analysis (LCCA)- Incremental Costs/Payback

System Type	Estimated Installation Costs	Estimated Incremental Costs			Estimated Annual Energy Cost Savings	Estimated Payback
		($) Over Code Baseline [Fossil Fuel]	($) Over GSHP 100%	(%) Over Total Project Cost		Years
Baseline - Fossil Fuel System (Baseline)	$77,290,000					
Option 1 Ground Source Heat Pump - GSHP	$93,417,000	$16,126,000		Included in current budget	$393,258	41 [33 with Incent.]
Option 2 Hybrid – GSHP (50%) and AtWHP (50%)	$74,279,000	($3,011,000)	($19,138,000)	(3.2)%	$334,323	0
Option 3 Air-to-Water HP (AtWHP)	$62,378,000	($14,912,000)	($31,039,000)	(5.6)%	$211,745	0

Notes:

1. *Utility Incentives will be capped at $3,000,000 for the 100% GSHP option. The Hybrid is estimated at $2,550,000, and the 100% AtWHP at $2,100,000.*
2. *Option 2-Hybrid: The temporary heating and cooling system cost may see a cost reductions if wells are allowed in the deeded land, pending Art. 87 costs.*
3. *HVAC Systems' costs based on recent estimates. Energy costs based on Medford Utility data (2025)*
4. *Additional State Incentives may apply at the time of occupancy, such as DOER AEC RECs' annual revenues, which would further benefit the GSHP payback.*
5. *Option 1 –GSHP: Federal IRA GSHP Incentives are not included due to required levels of domestic content, prevailing wages/training criteria, proven challenging, as well as uncertainty of it being available at the time of the systems installation (time of application).*
6. *The Pool Building is not included in the above LCCA. A separate Pool Building will be provided separately.*

Sustainability and MEP Systems – 50-year Life Cycle Cost Analysis (LCCA)

System Type	Estimated Installation Costs ($)	Estimated Replacement Costs ($)	Estimated Maintenance Costs ($)	Estimated Energy Costs ($)	Estimated 50-yr LCCA Cost ($)	Estimated Incentives ($) [Mass Save]	Estimated EUI (kBtu/SF/Yr)
Baseline - Fossil Fuel System (Baseline)	$77,290,000	$43,781,000	$5,984,000	$45,954,000	**$173,009,000**		89.2
Option 1 Ground Source Heat Pump - GSHP	$93,417,000	$29,793,000	$5,918,000	$35,616,000	**$164,744,000**	$3,000,000	36.1
Option 2 Hybrid – GSHP (50%) and AtWHP (50%)	$74,279,000	$24,487,000	$6,304,000	$37,006,000	**$142,076,000**	$2,550,000	37.5
Option 3 Air-to-Water HP (AtWHP)	$62,378,000	$25,981,000	$5,146,000	$39,897,000	**$133,402,000**	$2,100,000	40.4

Notes:

1.Energy Costs based on Medford's utility costs (2025)
2.3% cost escalation compounded over 50 yrs for replacement, maintenance and estimated energy costs (Net Present Value)
3. Additional State Incentives may apply at the time of occupancy, such as DOER AEC RECs' annual revenues.
4.Utility Incentives will be capped at $3,000,000 for the 100% GSHP option. The Hybrid is estimated at $2,550,000, and the 100% AtWHP at $2,100,000.
5.Option 2-Hybrid: the temporary heating and cooling system may see cost reductions if wells are allowed in deeded land, pending Art. 87 costs.
6.Option 1 –GSHP: Federal IRA GSHP Incentives are not included due to required levels of domestic content, prevailing wages/training criteria, proven challenging, as well as uncertainty of it being available at the time of the systems installation (time of application).
7.The Pool Building is not included in the LCCA. A separate Pool Building LCCA will be provided.

Sustainability and MEP Systems – Schematic Design Preliminary LCCA Analysis Takeaways

Initial Costs

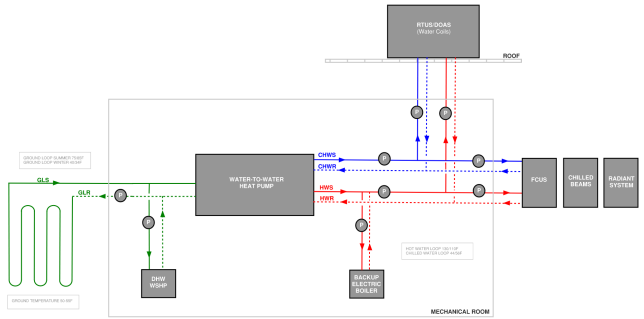
- Fossil Fuel baseline initial cost is more expensive vs. Hybrid GSHP/AtWHP and 100% AtWHP
- Challenges with 100% Geo-thermal (GSHP) include higher costs upfront and site bore areas [pending on land with the deed restriction outcome]
- The 100% GSHP option is included in the current project budget. Both alternative options bring first cost reductions.
- GSHP additional costs bring an estimated 44 yrs. Payback, 33 years with Mass Save incentives

50 yr. Cost of Ownership

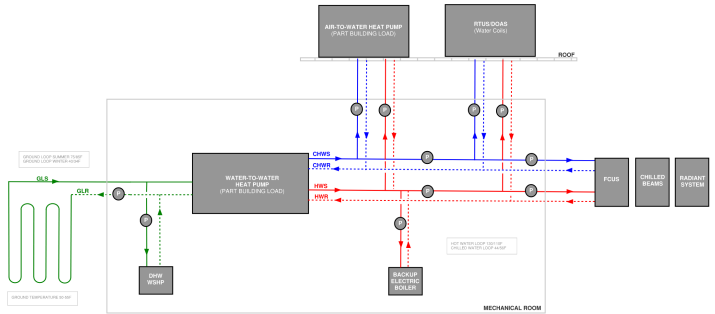
- All 3 HVAC system alternatives are less expensive than the fossil fuel baseline over the cost of ownership (50 yr. Life Cycle Cost)

Sustainability and MEP Systems – Mechanical System Selection – System Options

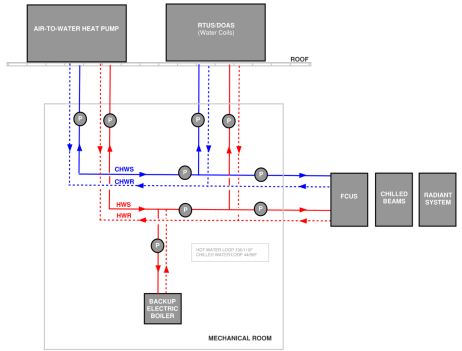
Full Geothermal



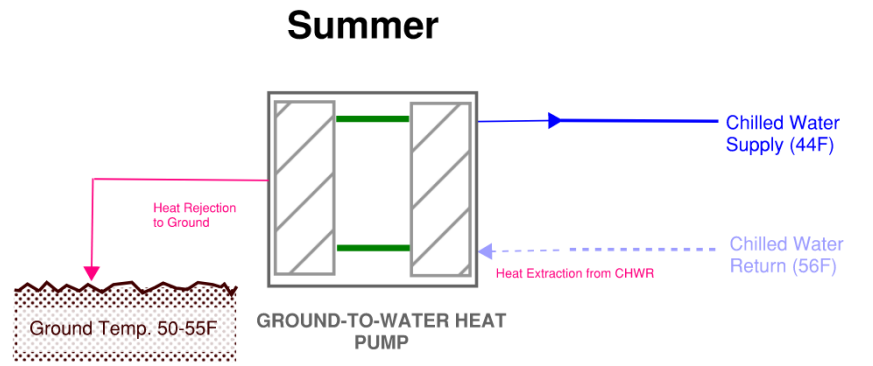
Hybrid – Geothermal/Air-to-Water Heat Pump



Full Air-to-Water Heat Pump

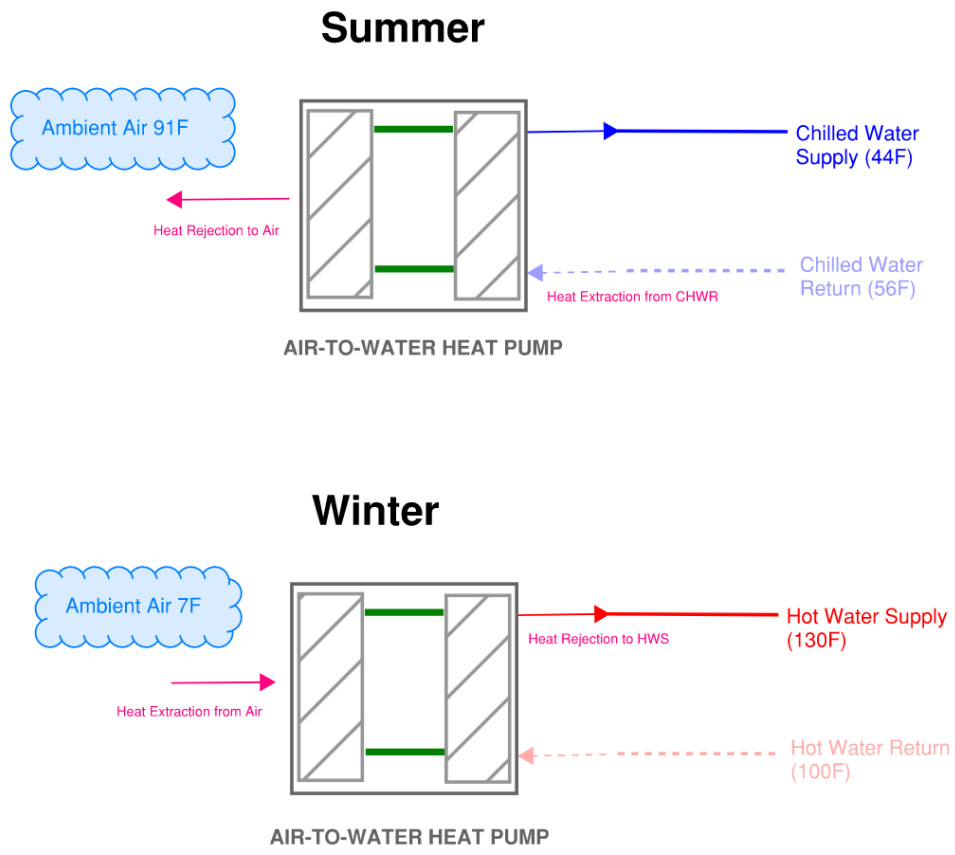


**Air-to-Air systems are also viable to supplement these options*



Ground Source Heat Pump

(COP ~4.1)

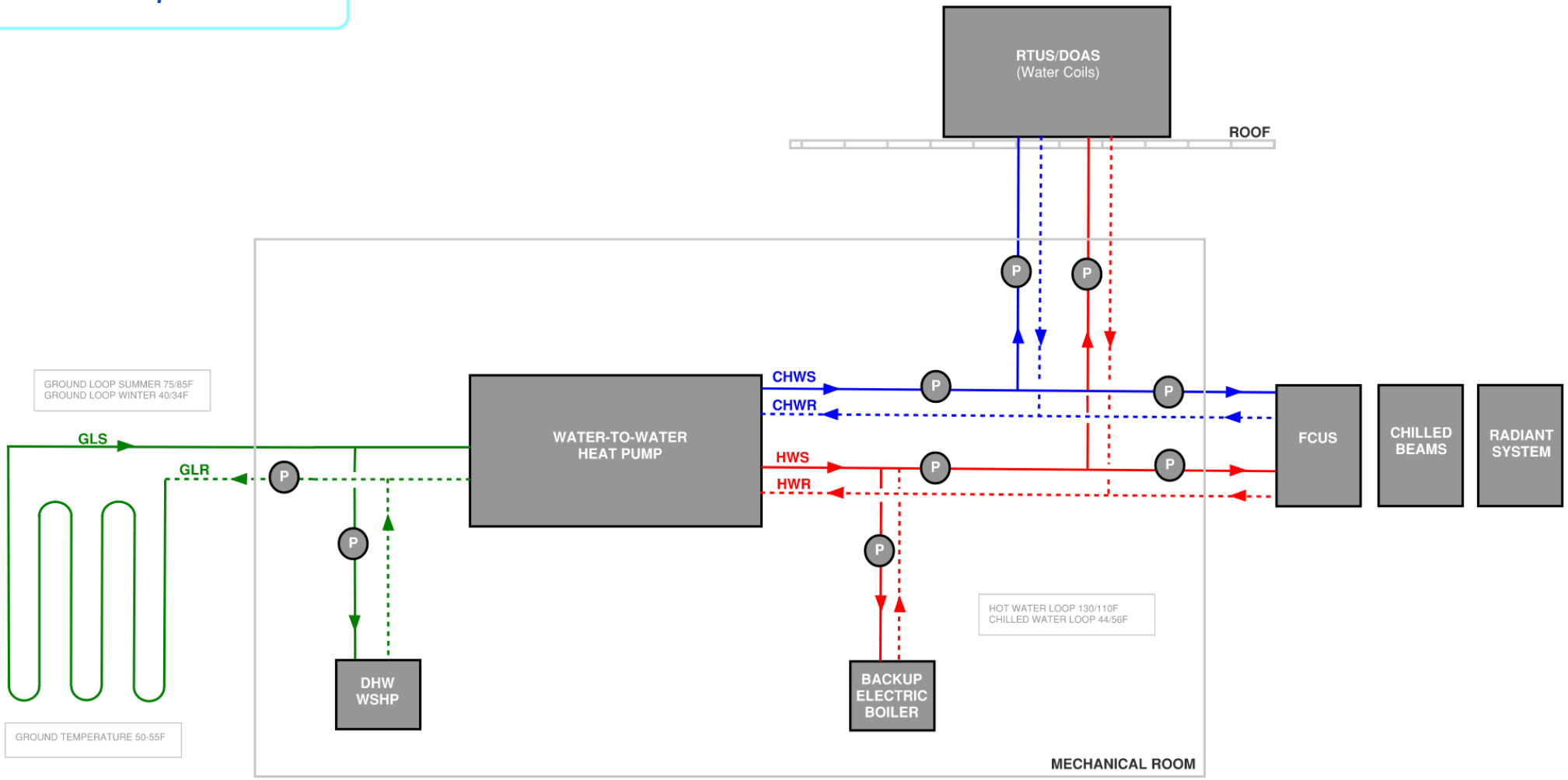


Air-to-Water Heat Pump

(COP ~3.0)

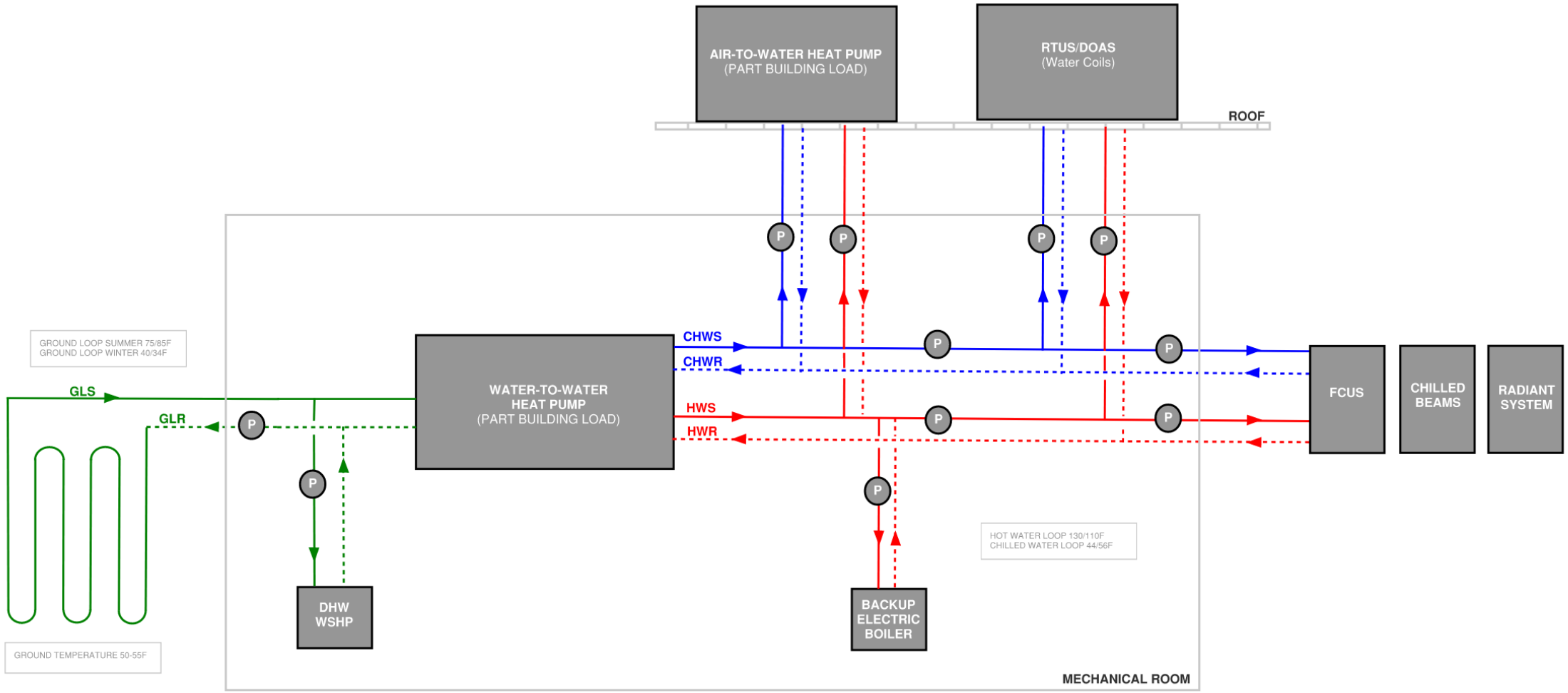
Sustainability and MEP Systems – Mechanical System Selection – System Options

Full Geothermal Option



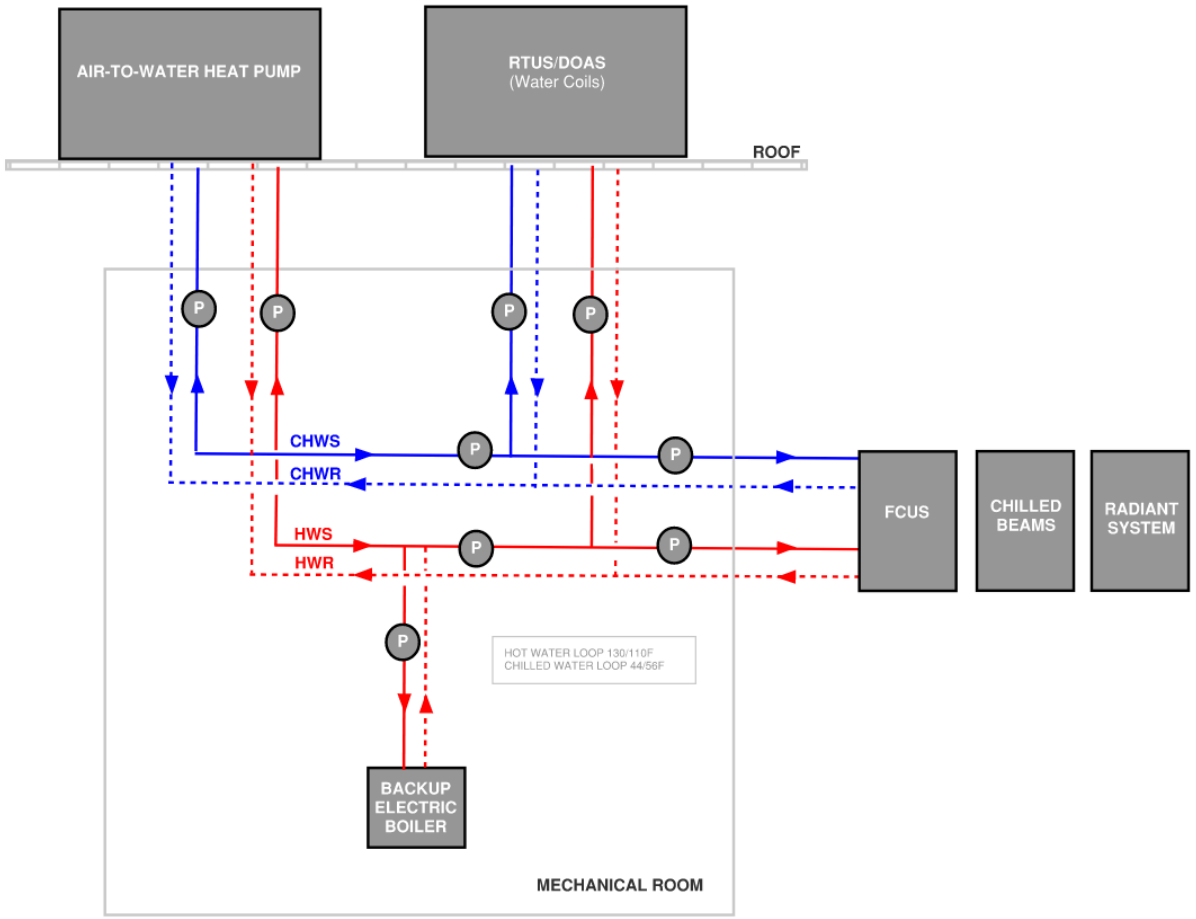
Sustainability and MEP Systems – Mechanical System Selection – System Options

Hybrid – Geothermal/Air-to-Water Heat Pump



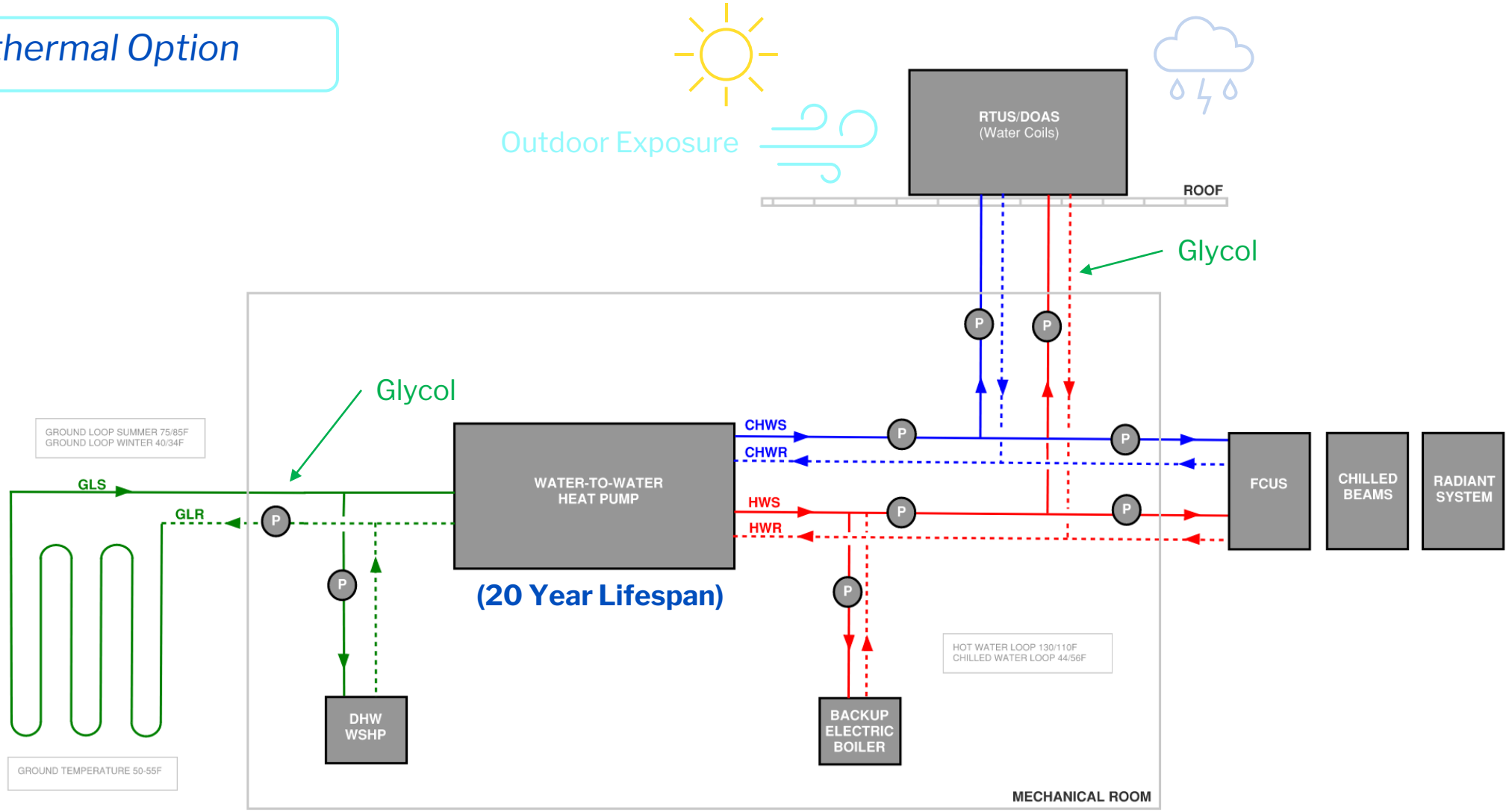
Sustainability and MEP Systems – Mechanical System Selection – System Options

Full Air-to-Water Heat Pump



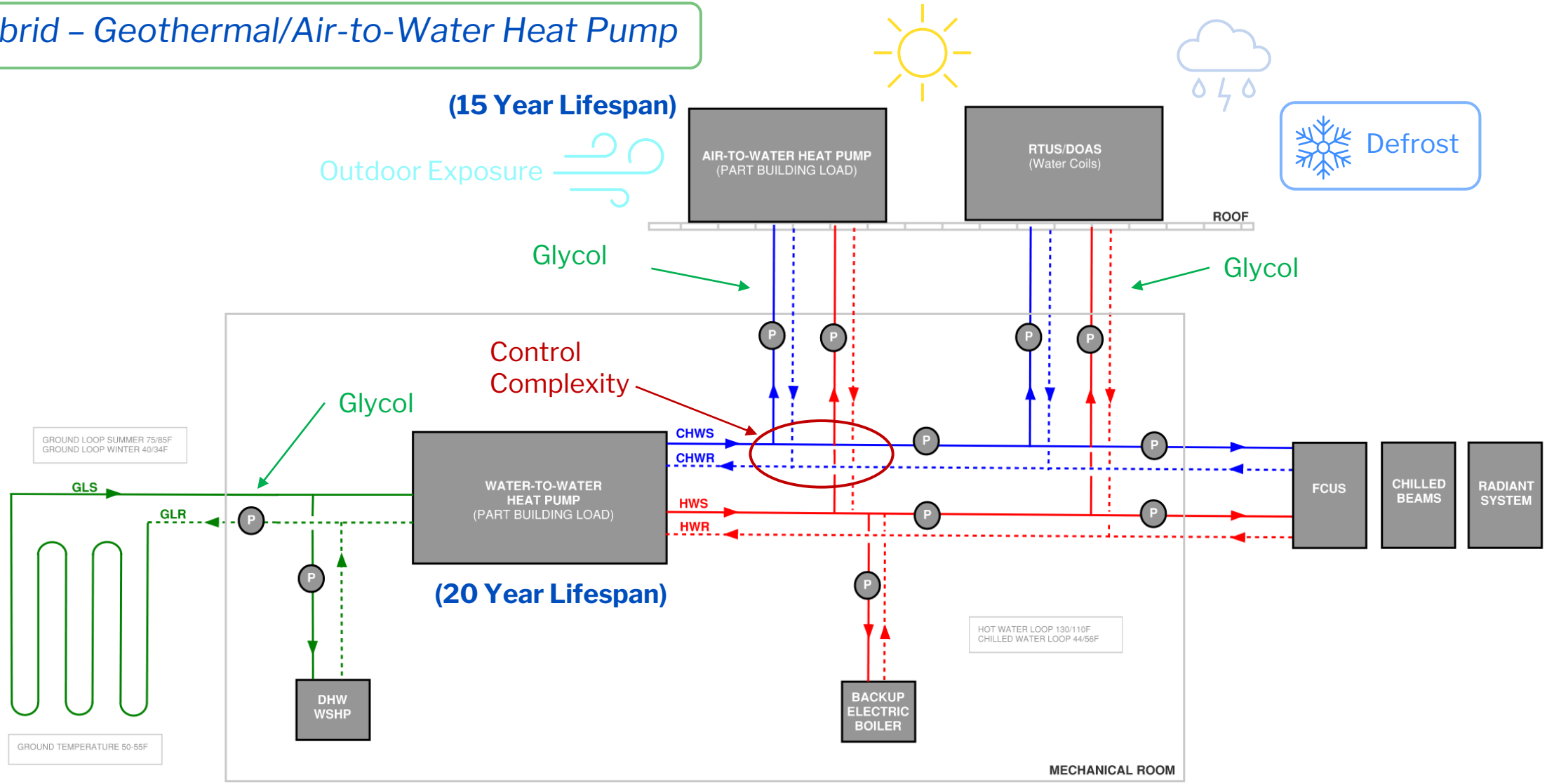
Sustainability and MEP Systems – Mechanical System Selection – Maintenance, Reliability, & Lifespan

Full Geothermal Option



Sustainability and MEP Systems – Mechanical System Selection – Maintenance, Reliability, & Lifespan

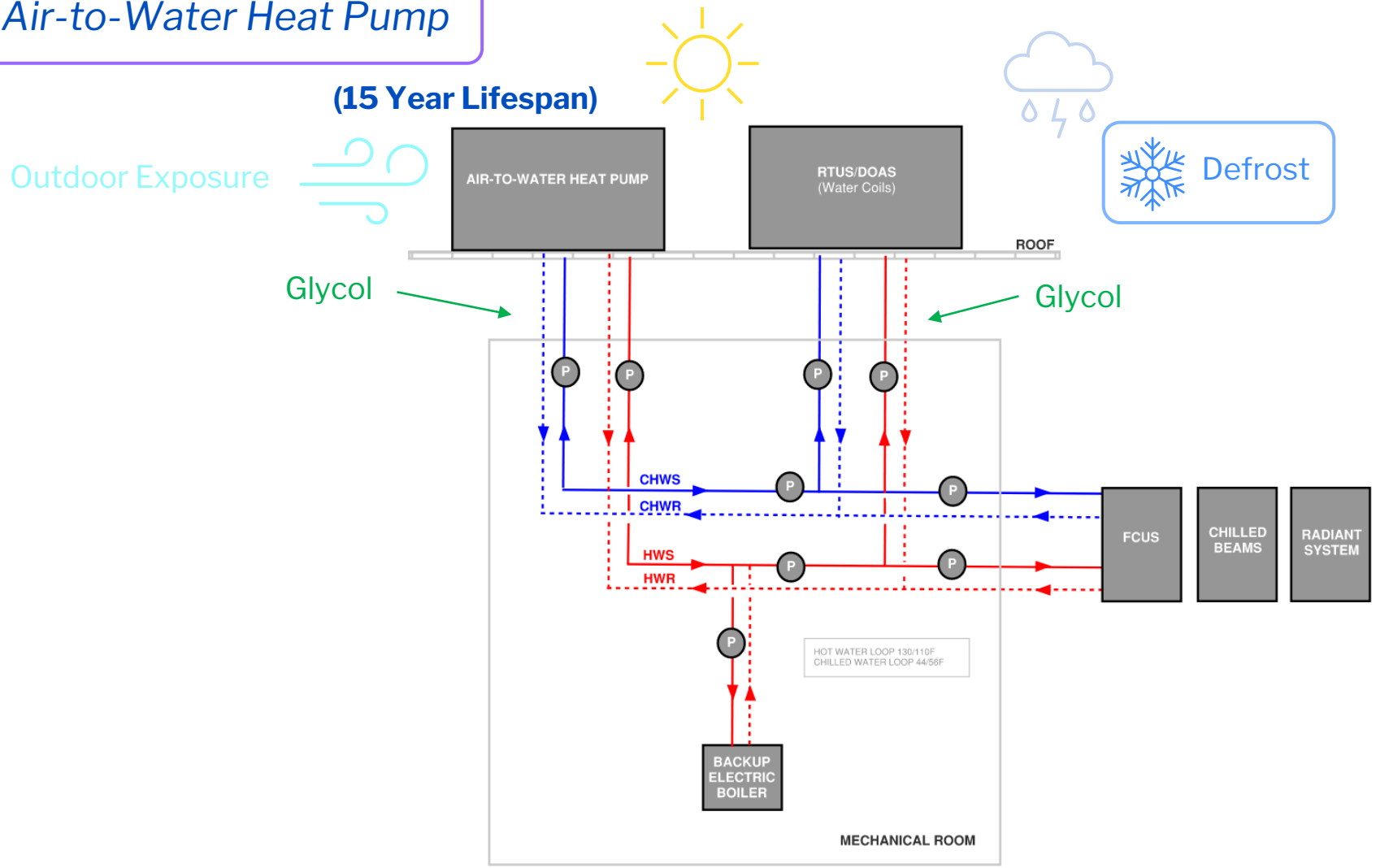
Hybrid – Geothermal/Air-to-Water Heat Pump



Sustainability and MEP Systems – Mechanical System Selection – Maintenance, Reliability, & Lifespan

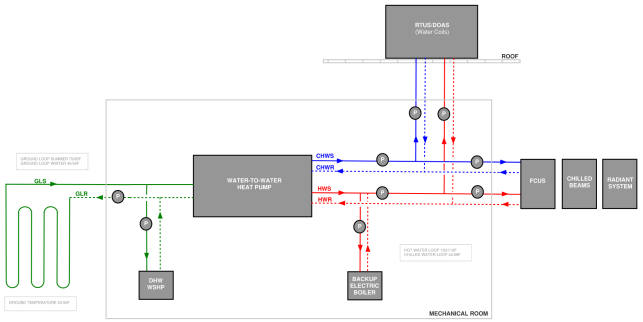
Full Air-to-Water Heat Pump

(15 Year Lifespan)

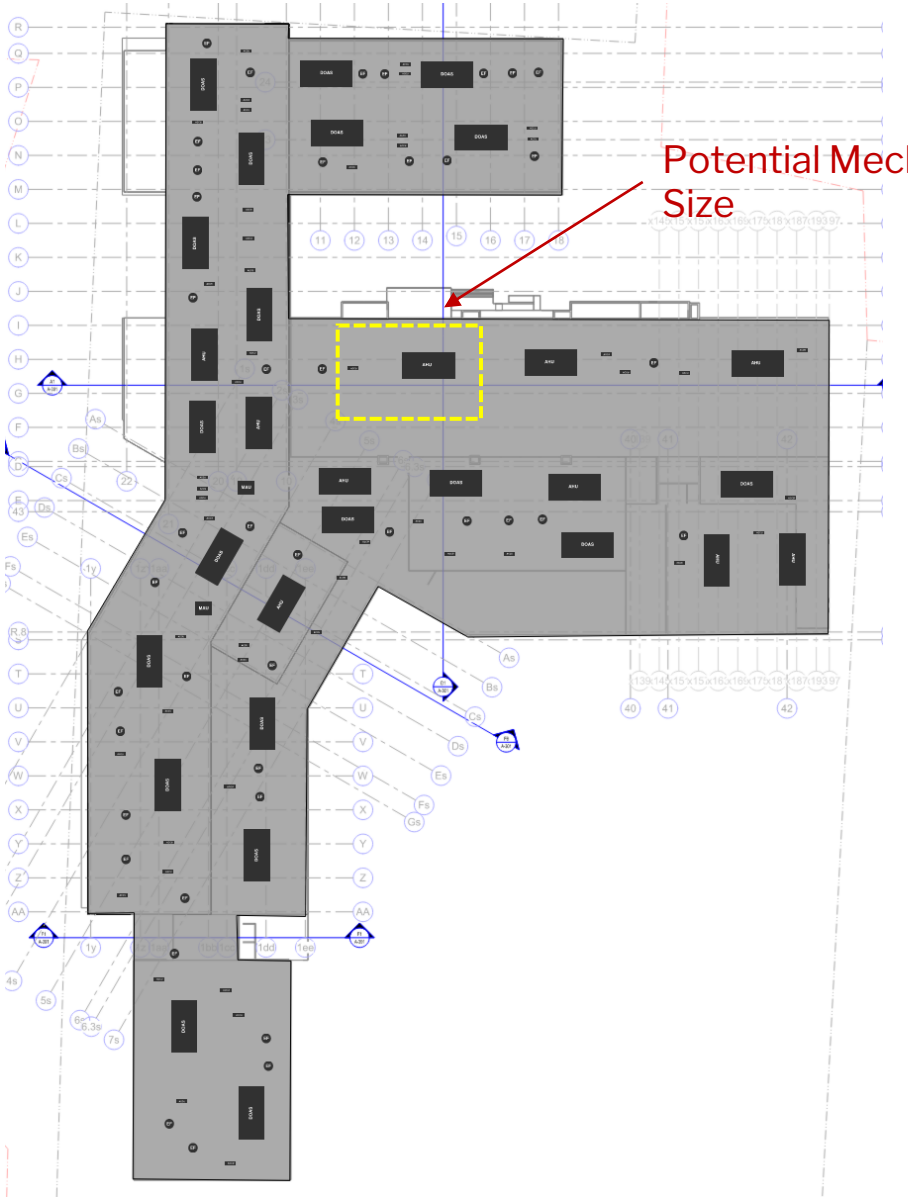


Sustainability and MEP Systems – Mechanical System Selection – Roof Space

Full Geothermal Option



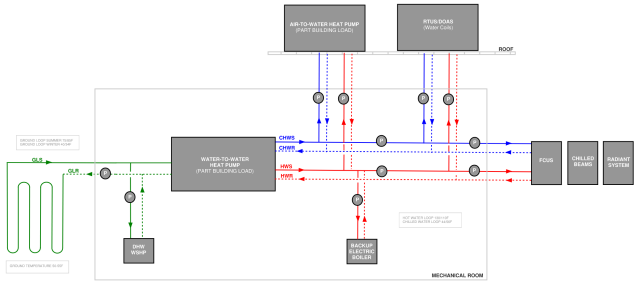
Large Amount of Mechanical Room Space Required



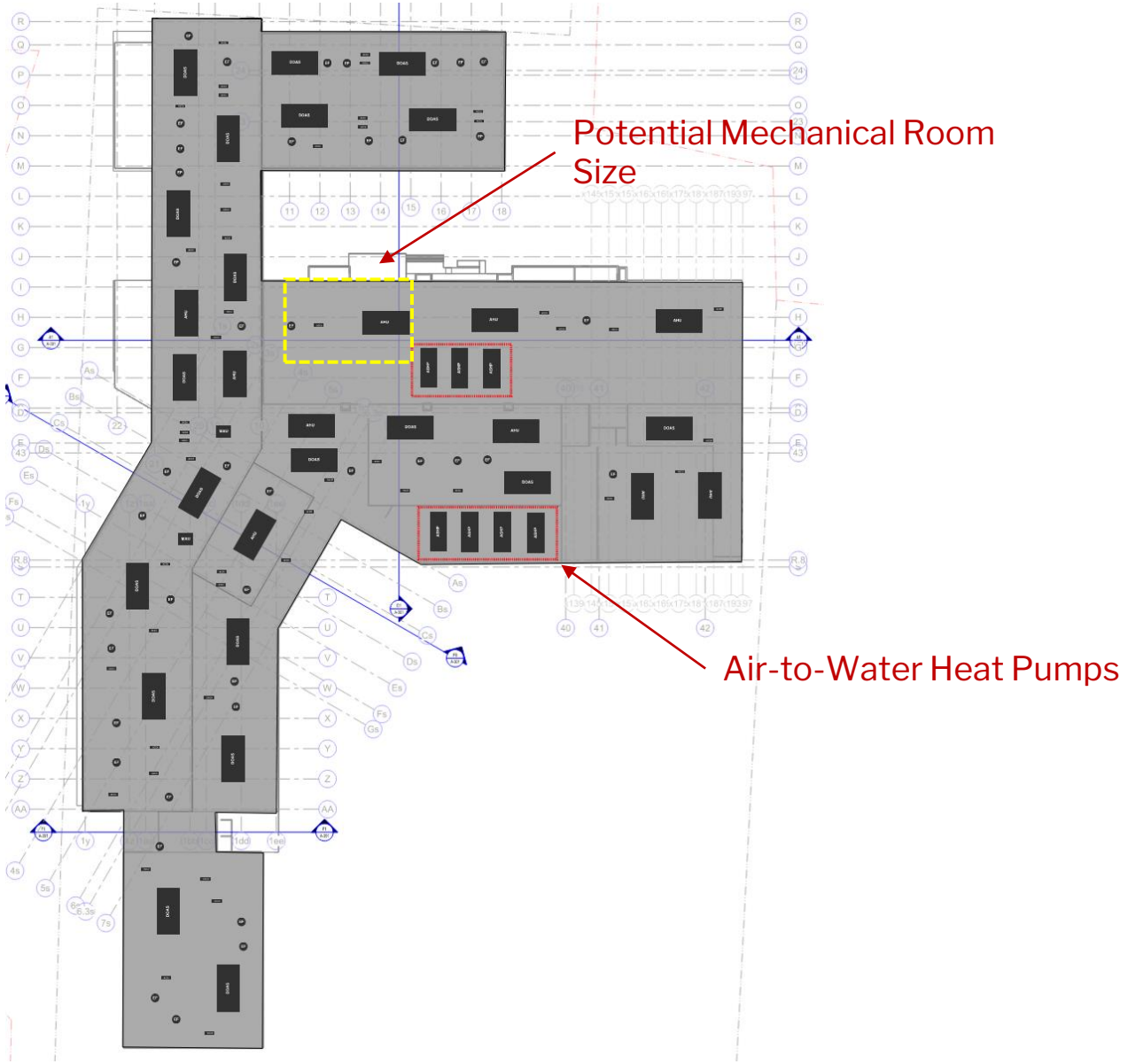
Preliminary Roof Layout

Sustainability and MEP Systems – Mechanical System Selection – Roof Space

Hybrid – Geothermal/Air-to-Water Heat Pump



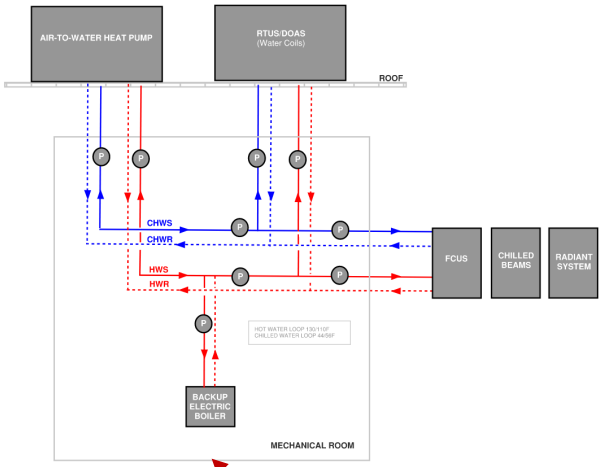
Significant Amount of Mechanical Room Space Required



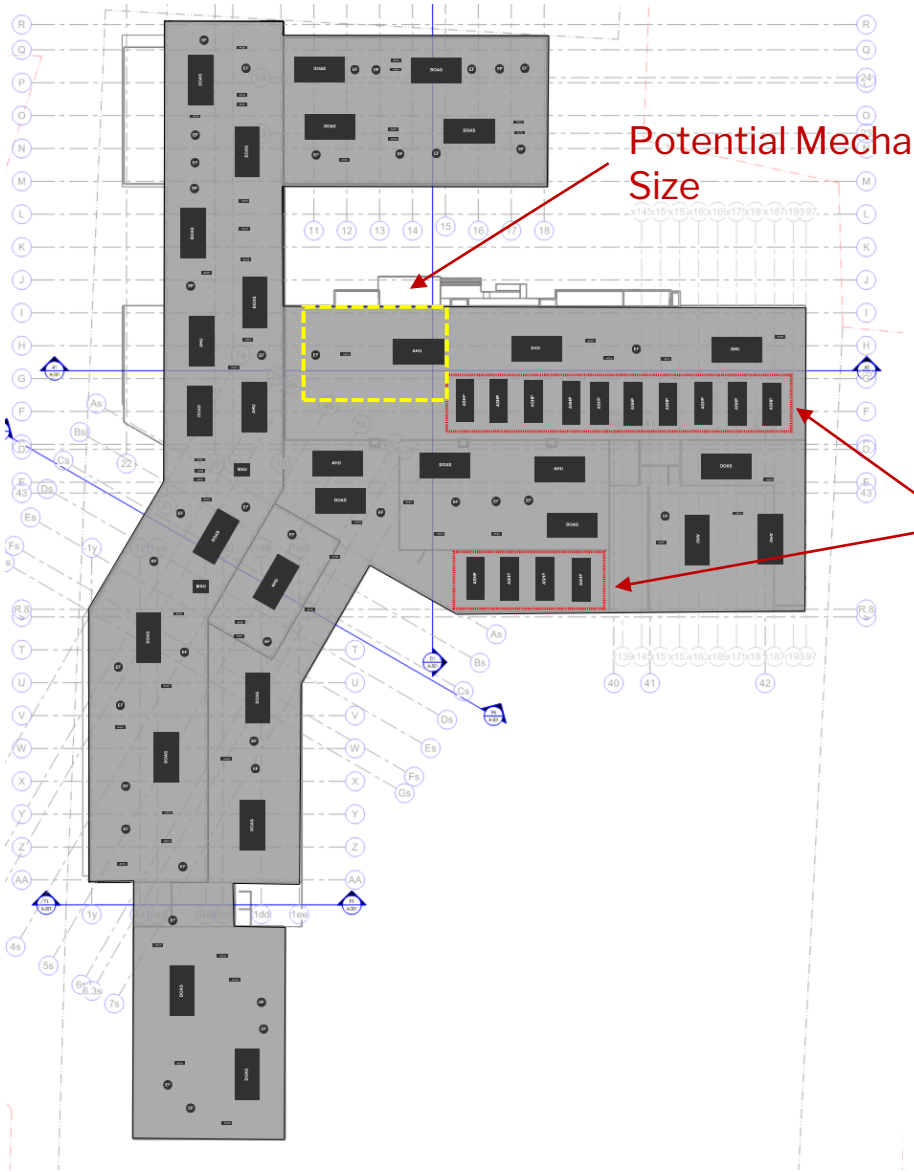
Preliminary Roof Layout

Sustainability and MEP Systems – Mechanical System Selection – Roof Space

Full Air-to-Water Heat Pump



Limited Mechanical Room Space Required



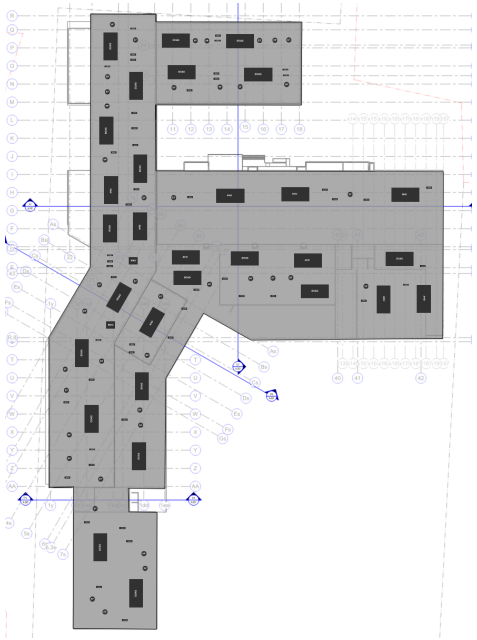
Potential Mechanical Room Size

Air-to-Water Heat Pumps

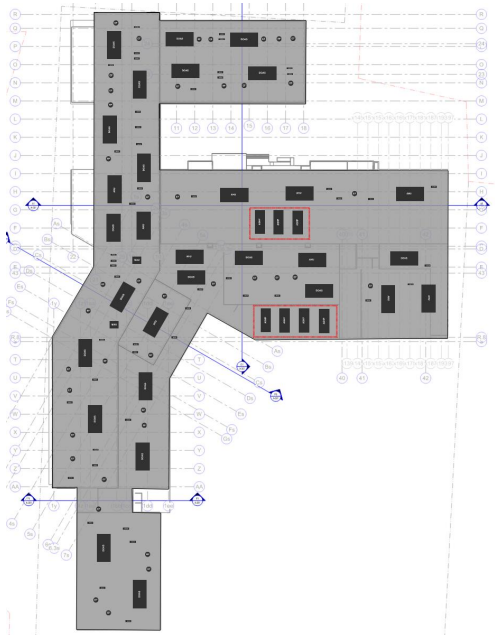
Preliminary Roof Layout

Sustainability and MEP Systems – Mechanical System Selection – Roof Space

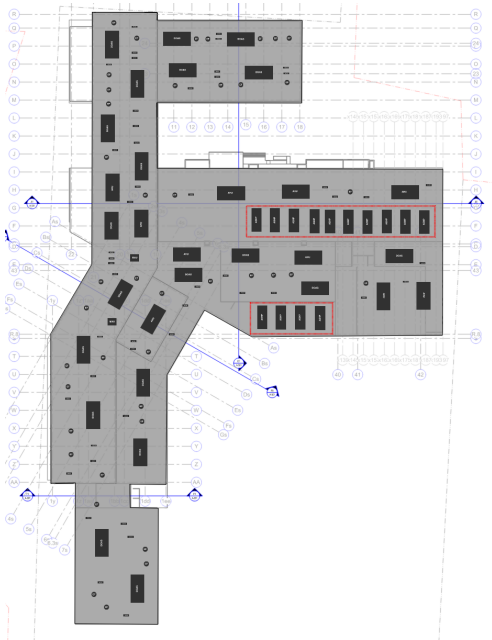
	Roof Area Required for HVAC Equipment Including Clearances	Approx. % of Total Usable Roof Space
100% GSHP	50,778 sf	28%
50% GSHP/50% ASHP	55,919 sf	31%
100% ASHP	61,060 sf	34%



Full Geothermal Option

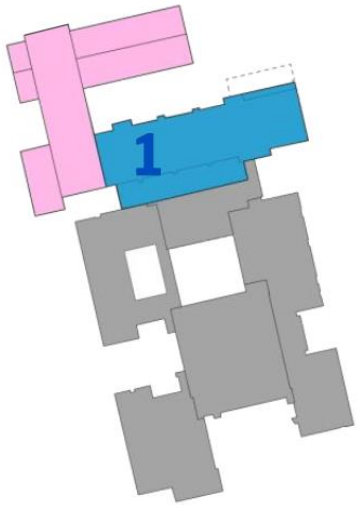


Hybrid – Geothermal/Air-to-Water Heat Pump

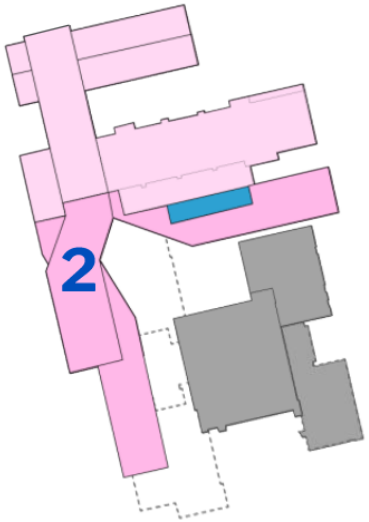


Full Air-to-Water Heat Pump

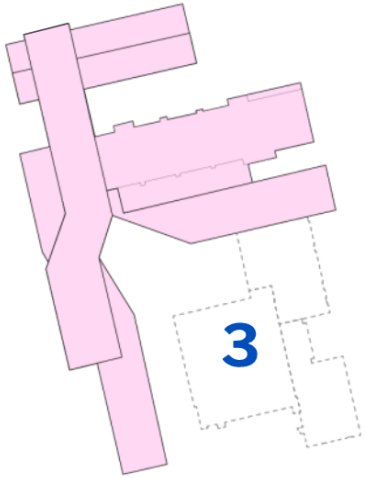
Sustainability and MEP Systems – Mechanical System Selection - Phasing



Phase 1
- Demolish existing mechanical room, renovate D, E & F Wings (including Pool), build northern part of New Addition.
- Existing building (without pool and gym) in use



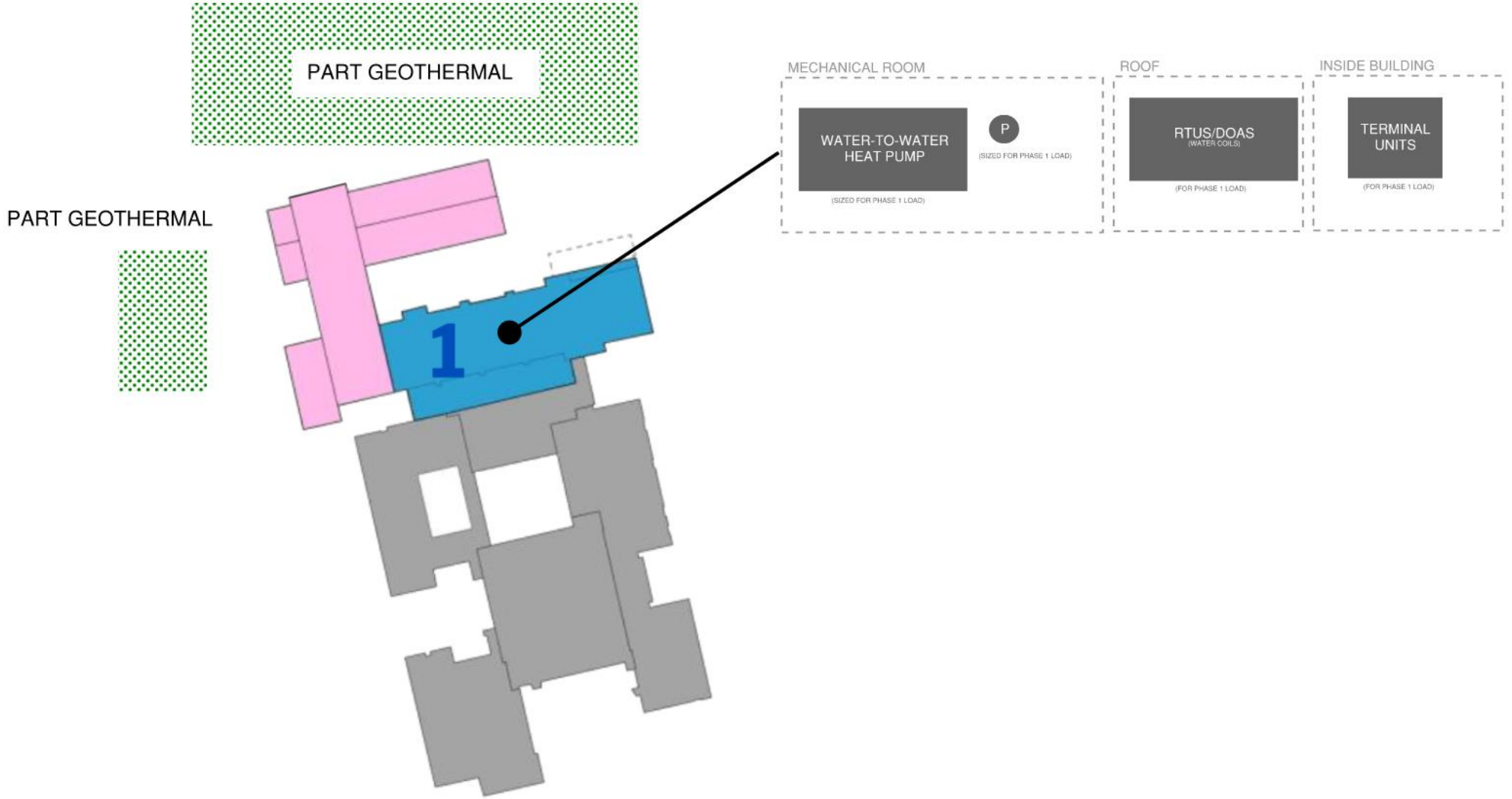
Phase 2
- Demolish A, C and part of G Wings. Renovate remainder of D Wing, build remaining New Addition.
- Phase 1 Renovation & Addition areas in use



Phase 3
- Demolish remainder of existing building.
- Renovation & Addition fully occupied.

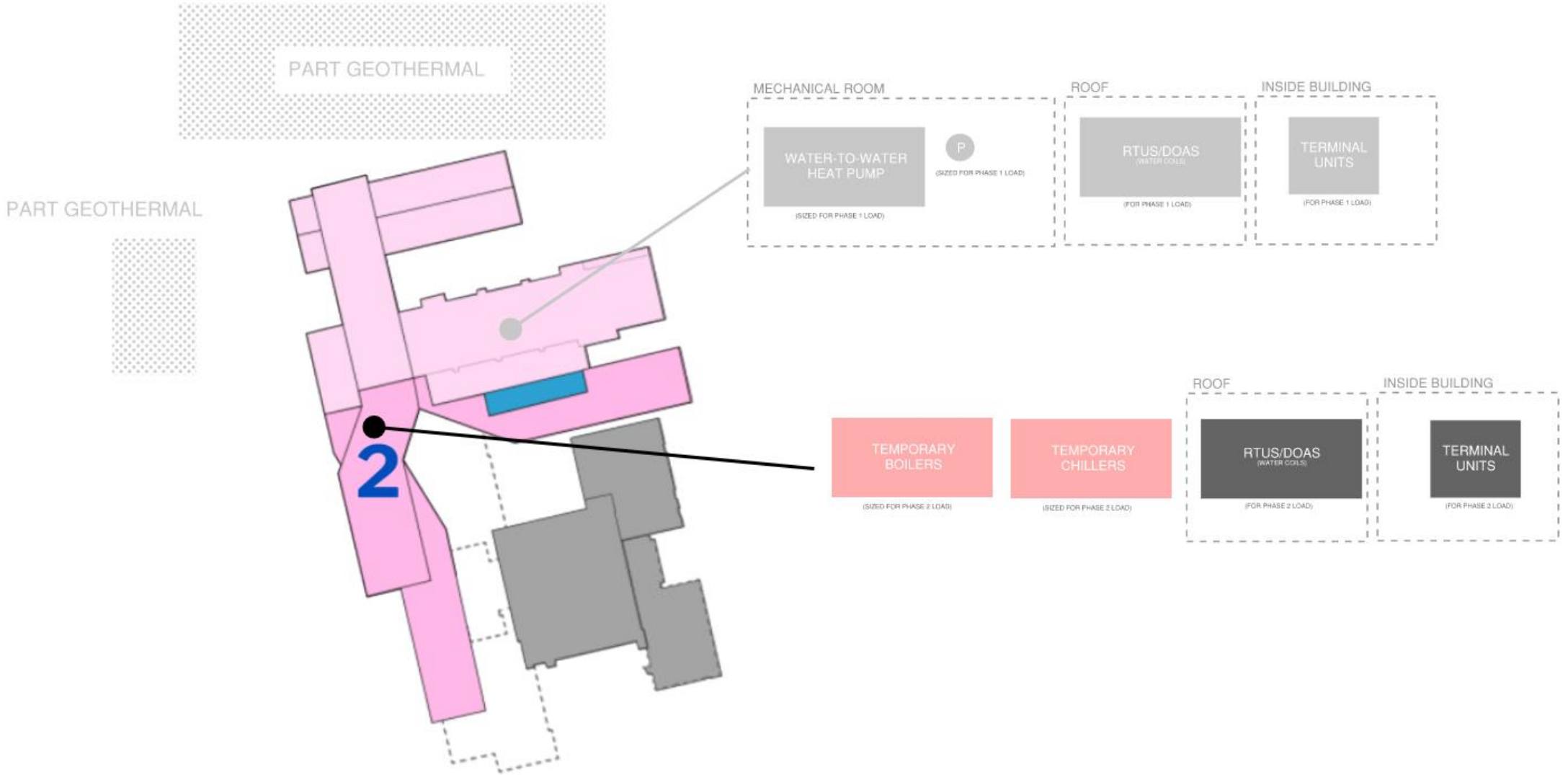
Sustainability and MEP Systems – Mechanical System Selection - Phasing

Full Geothermal Option – PHASE 1



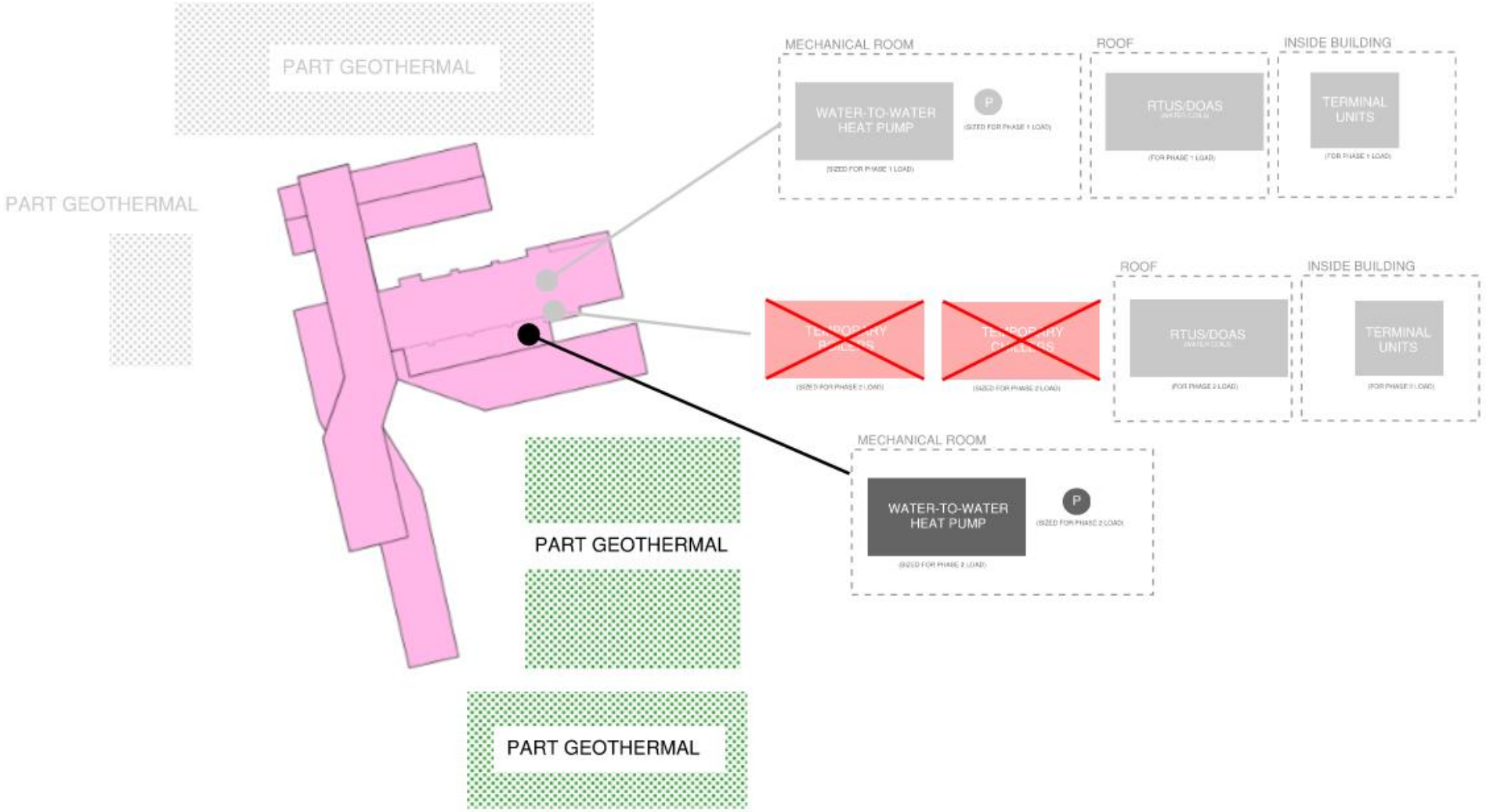
Sustainability and MEP Systems – Mechanical System Selection - Phasing

Full Geothermal Option – PHASE 2



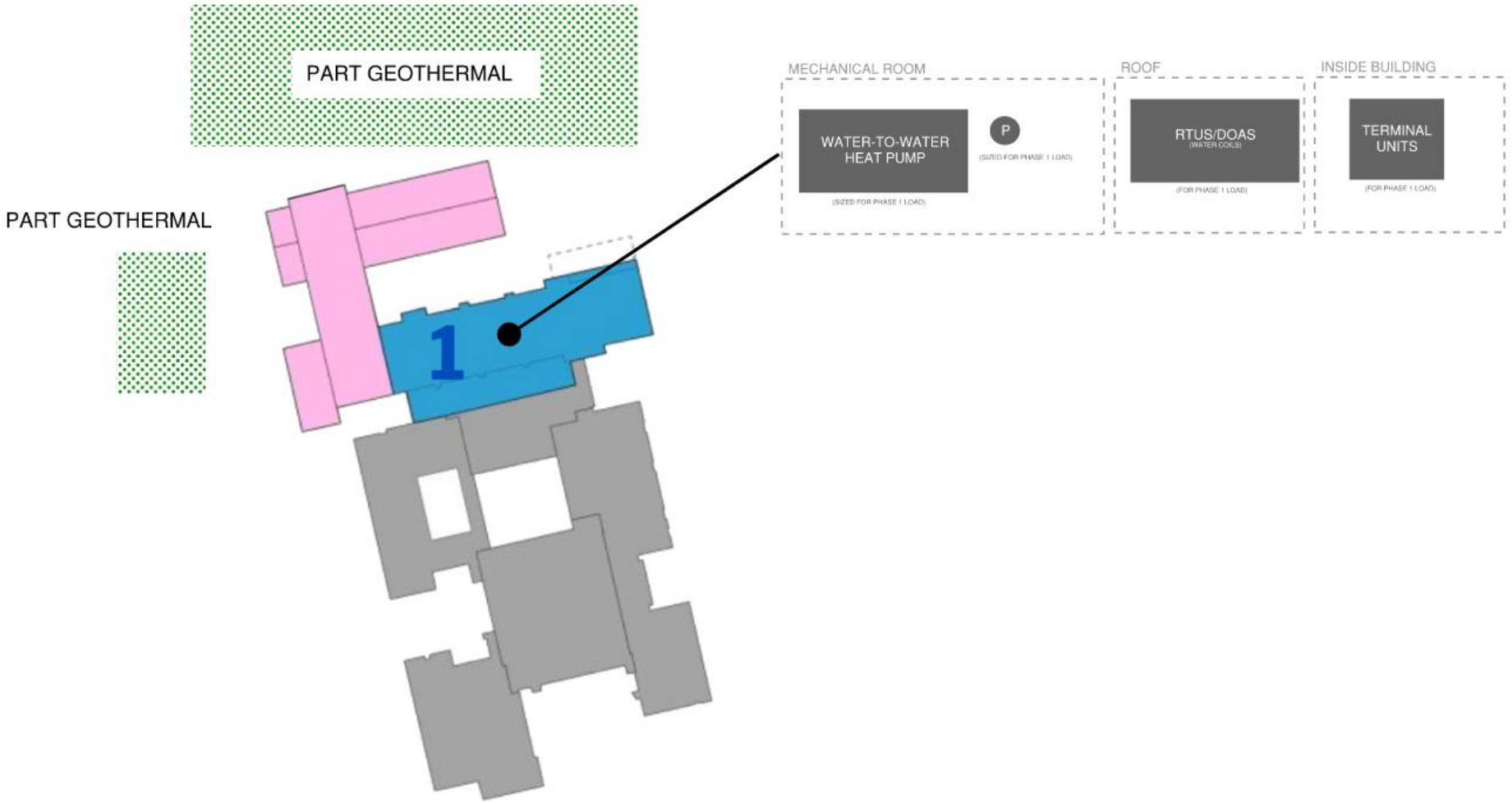
Sustainability and MEP Systems – Mechanical System Selection - Phasing

Full Geothermal Option – PHASE 3



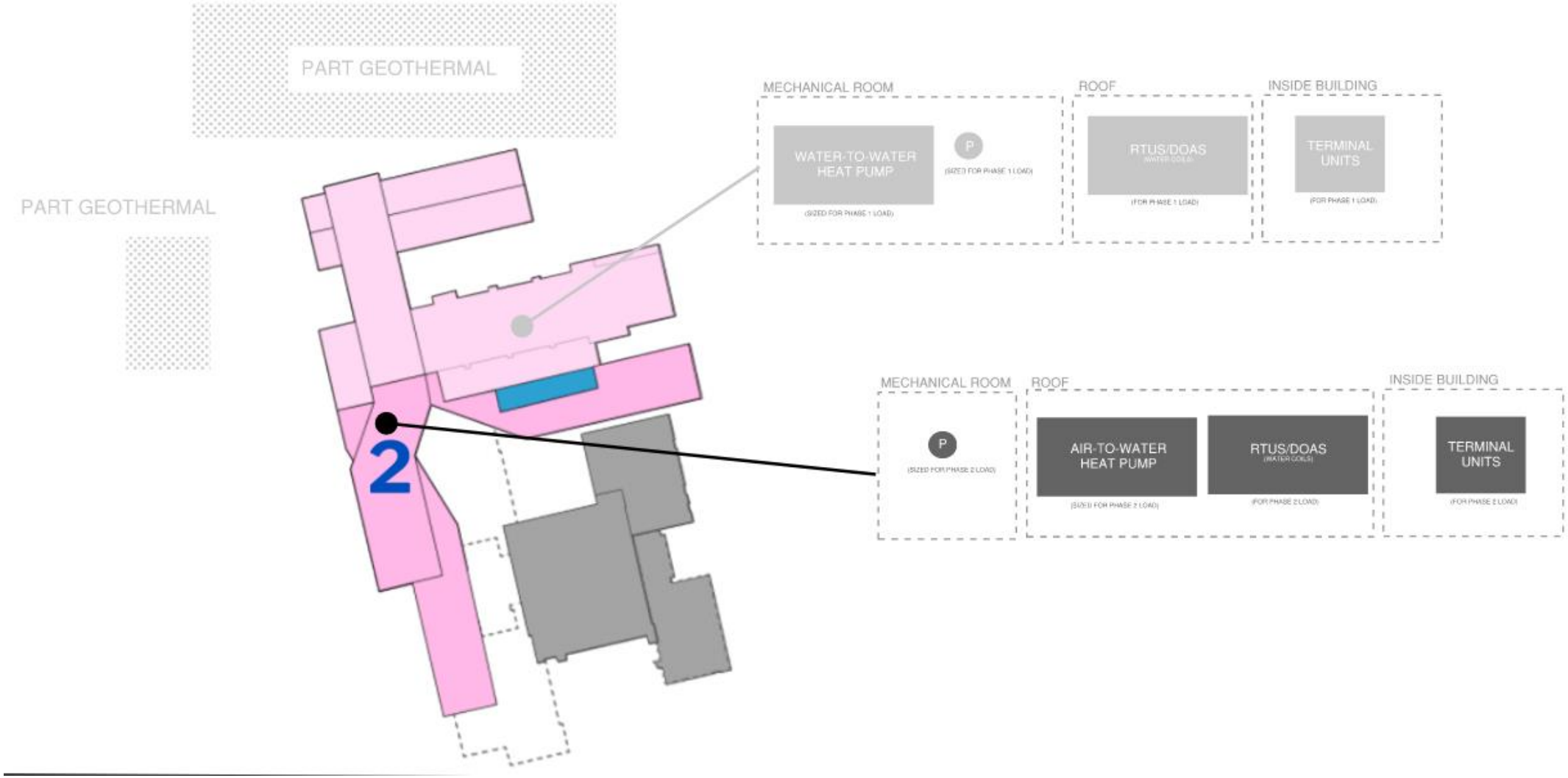
Sustainability and MEP Systems – Mechanical System Selection - Phasing

Hybrid – Geothermal/Air-to-Water Heat Pump – PHASE 1 (USE OF DEED RESTRICTED LAND)



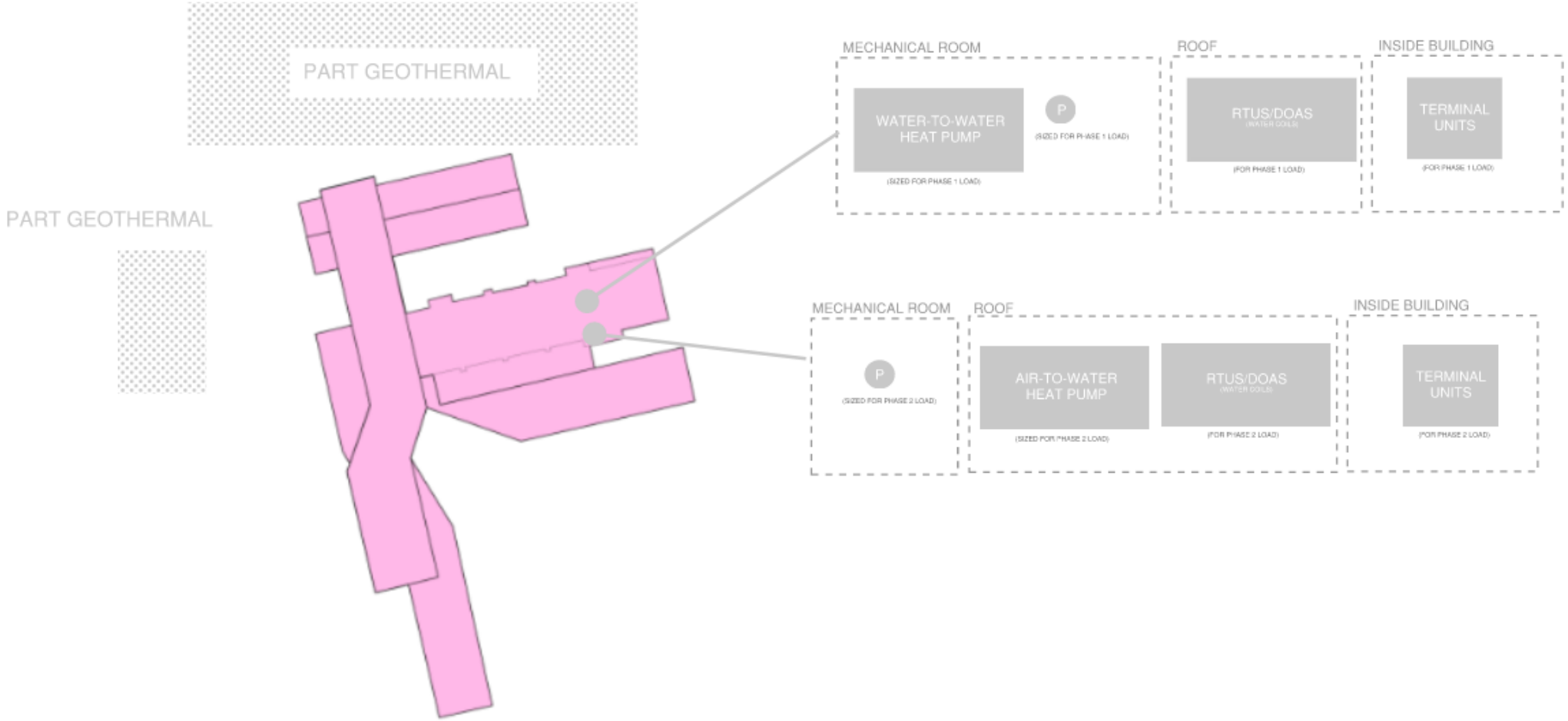
Sustainability and MEP Systems – Mechanical System Selection - Phasing

Hybrid – Geothermal/Air-to-Water Heat Pump – PHASE 2 (USE OF DEED RESTRICTED LAND)



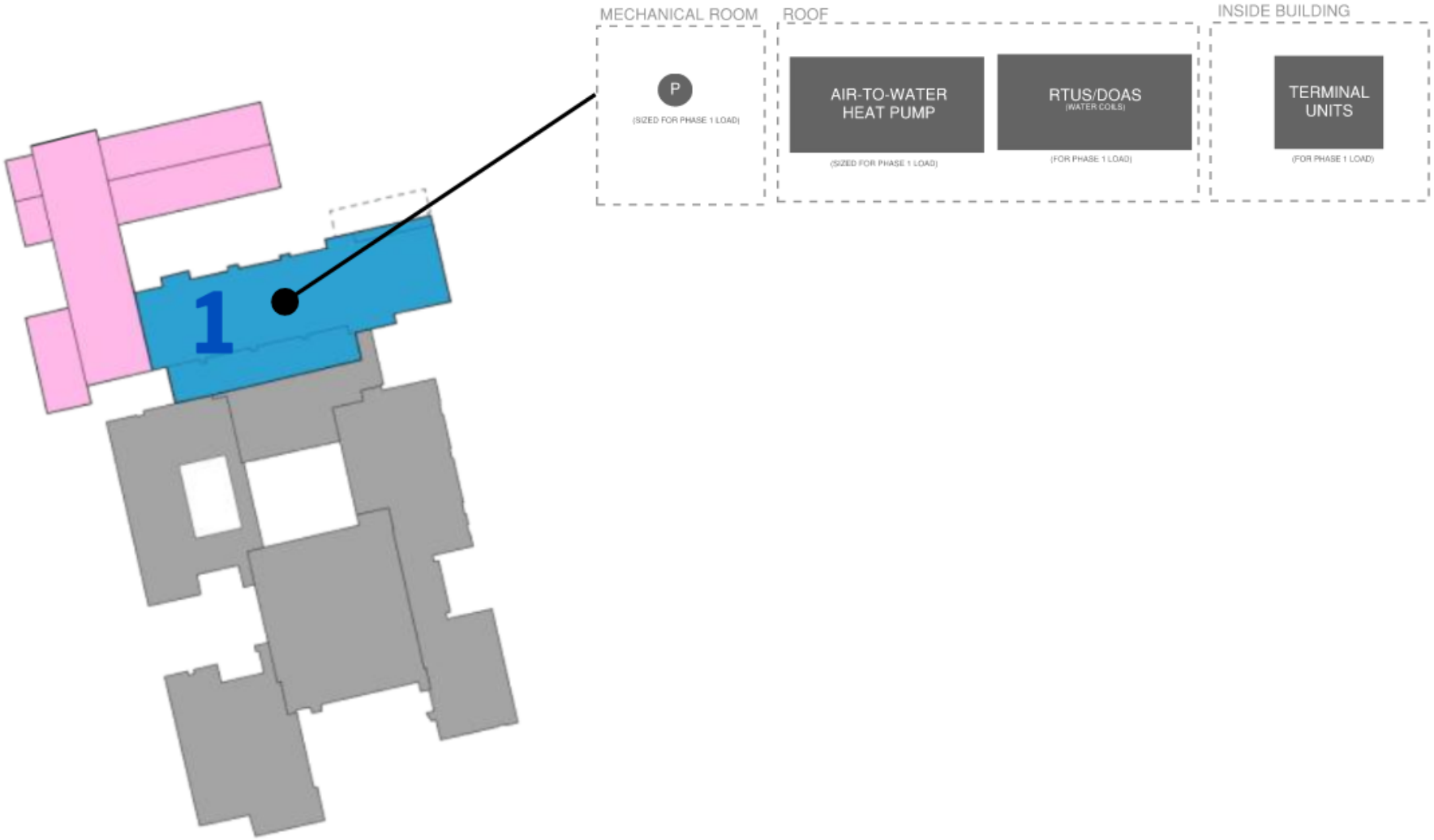
Sustainability and MEP Systems – Mechanical System Selection - Phasing

Hybrid – Geothermal/Air-to-Water Heat Pump – PHASE 3 (USE OF DEED RESTRICTED LAND)



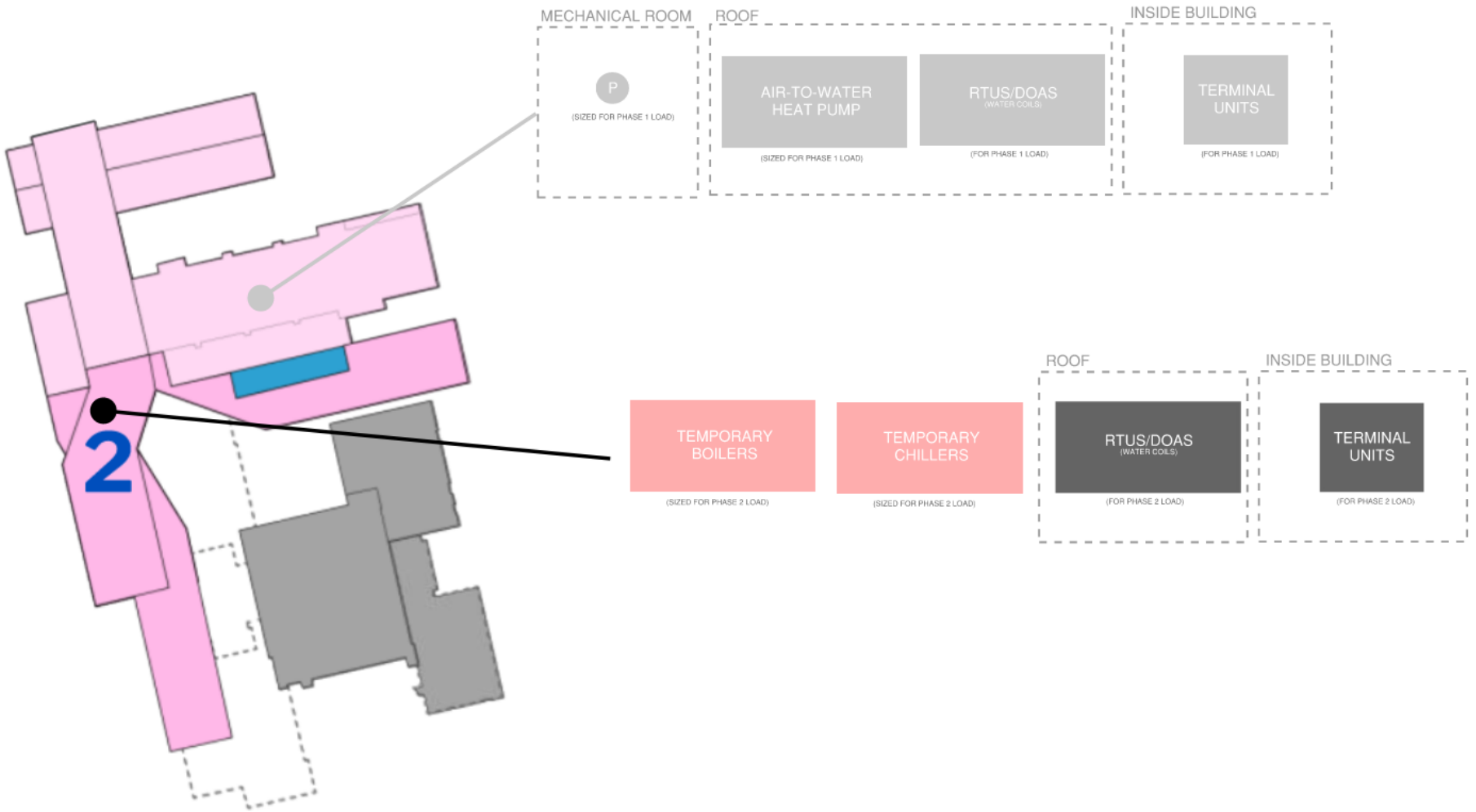
Sustainability and MEP Systems – Mechanical System Selection - Phasing

Hybrid – Geothermal/Air-to-Water Heat Pump – PHASE 1 (USE OF NON-DEED RESTRICTED LAND)



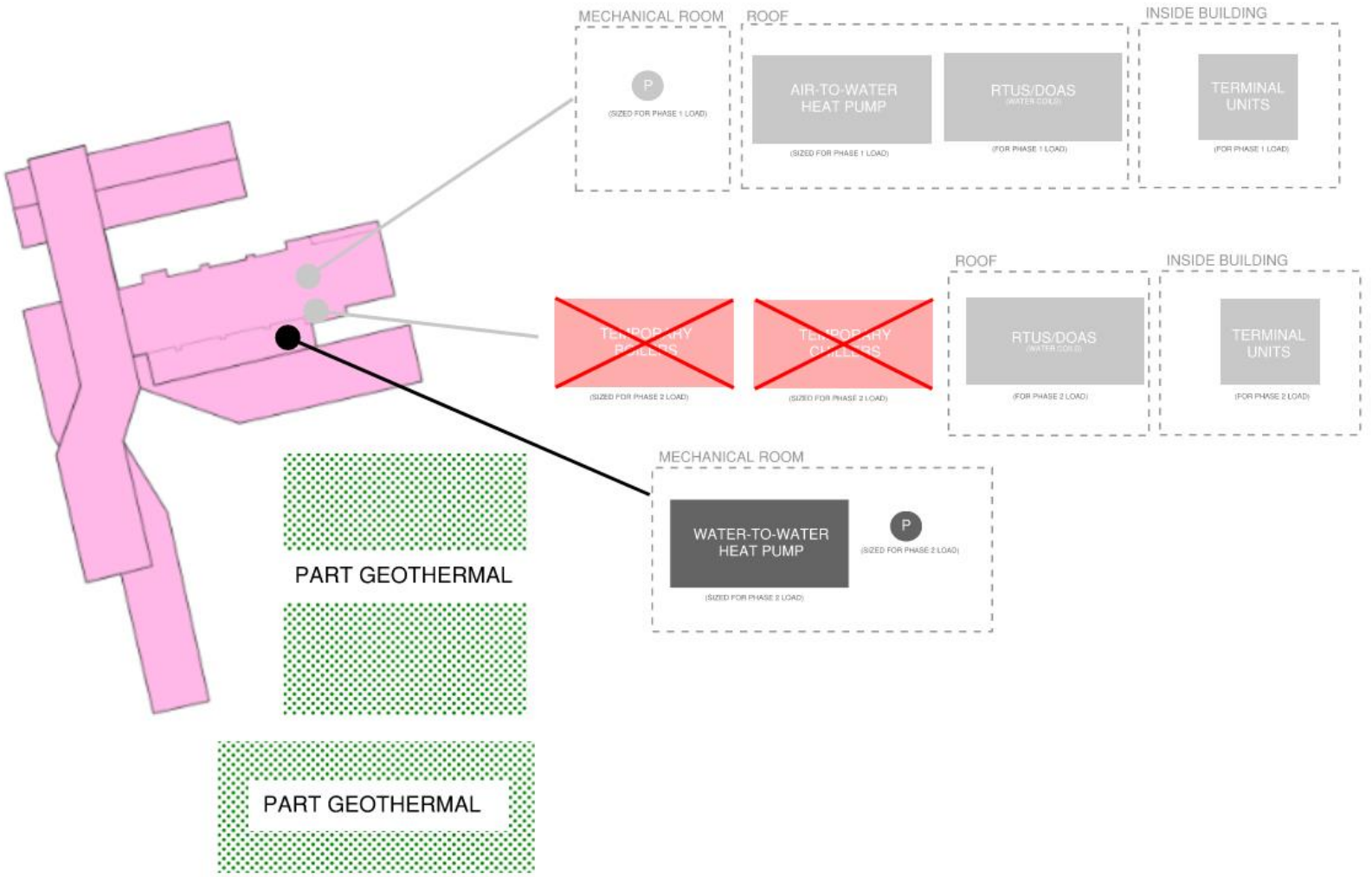
Sustainability and MEP Systems – Mechanical System Selection - Phasing

Hybrid – Geothermal/Air-to-Water Heat Pump – PHASE 2 (USE OF NON-DEED RESTRICTED LAND)



Sustainability and MEP Systems – Mechanical System Selection - Phasing

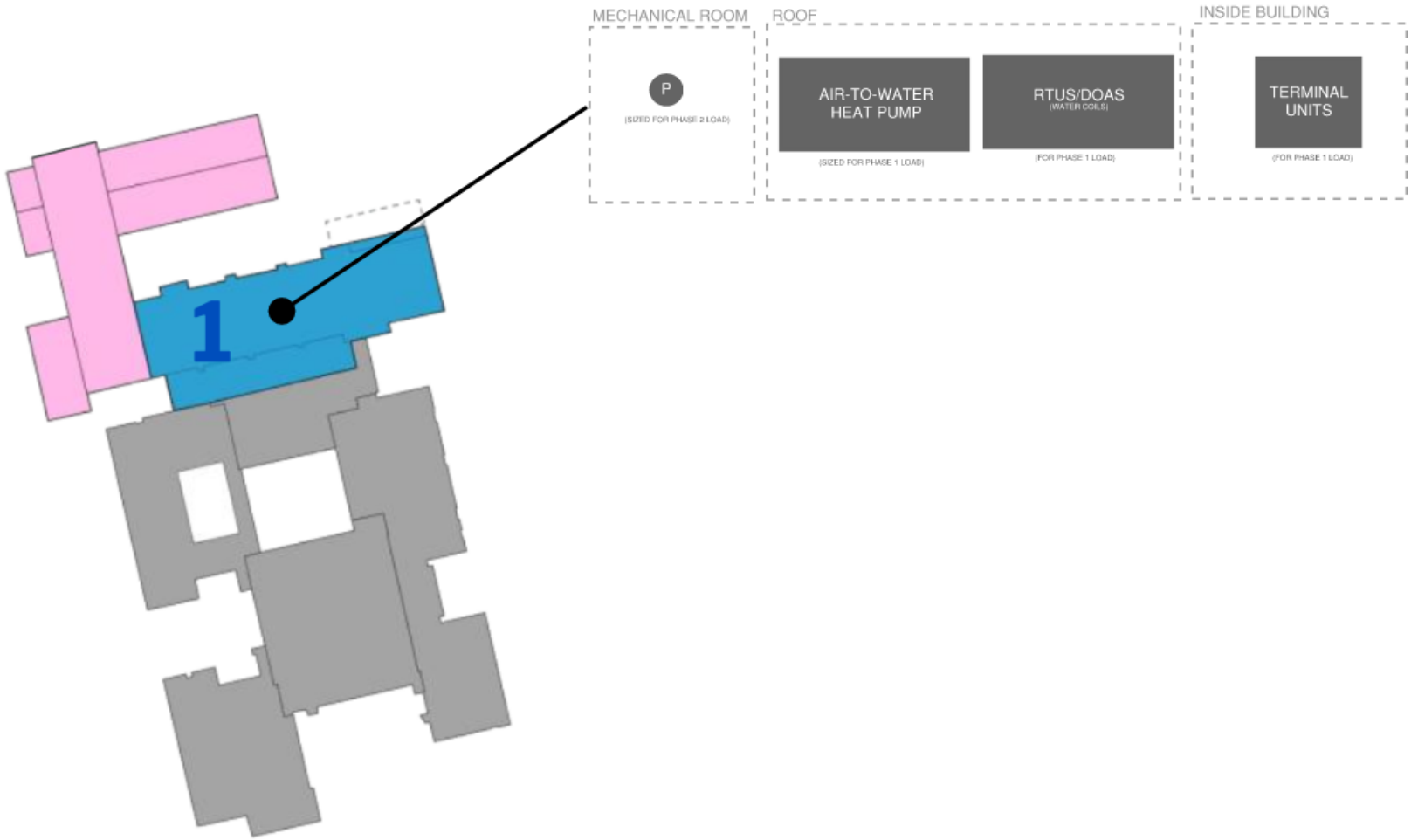
Hybrid – Geothermal/Air-to-Water Heat Pump – PHASE 3 (USE OF NON-DEED RESTRICTED LAND)



Sustainability and MEP Systems – Mechanical System Selection - Phasing

Full Air-to-Water Heat Pump

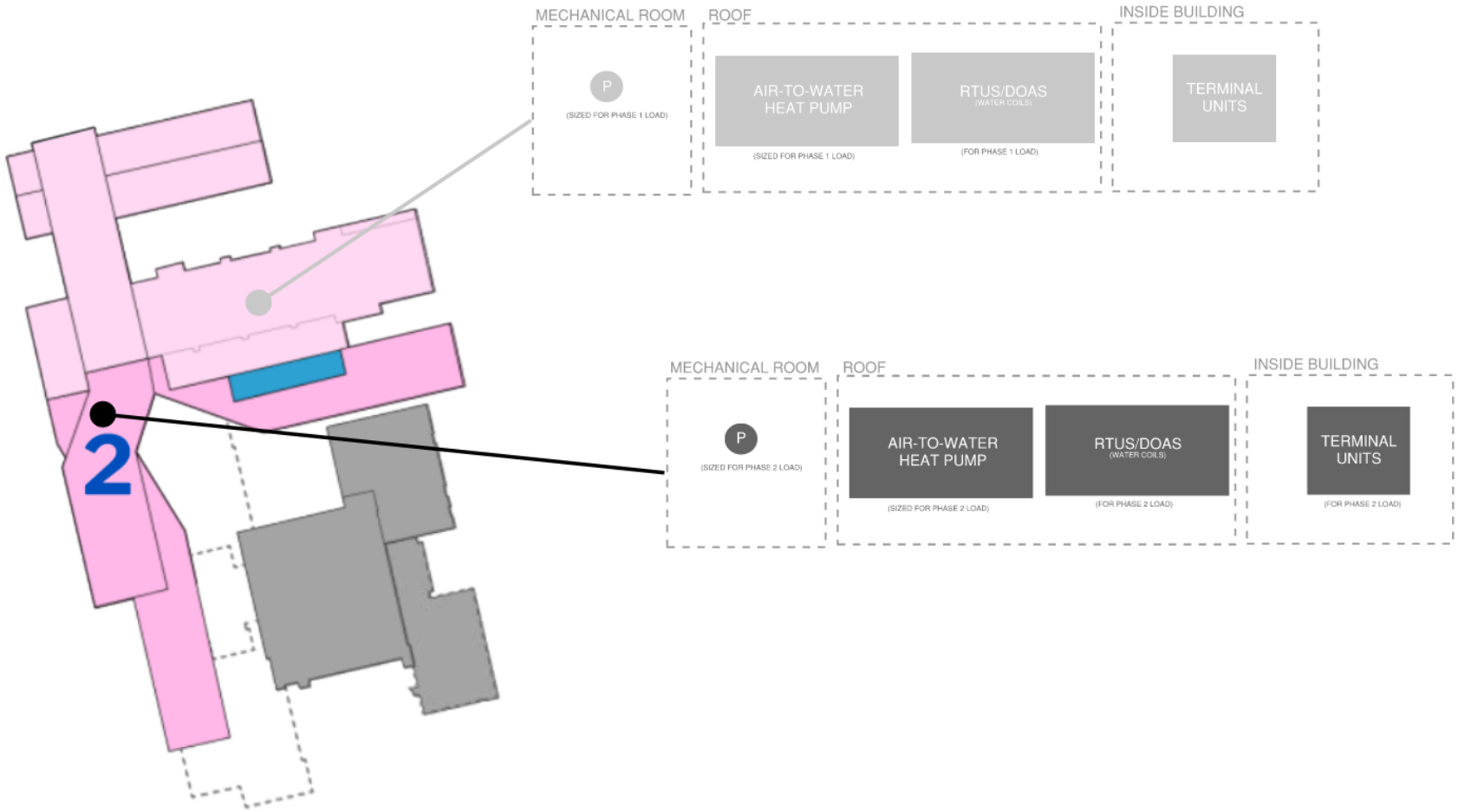
PHASE 1



Sustainability and MEP Systems – Mechanical System Selection - Phasing

Full Air-to-Water Heat Pump

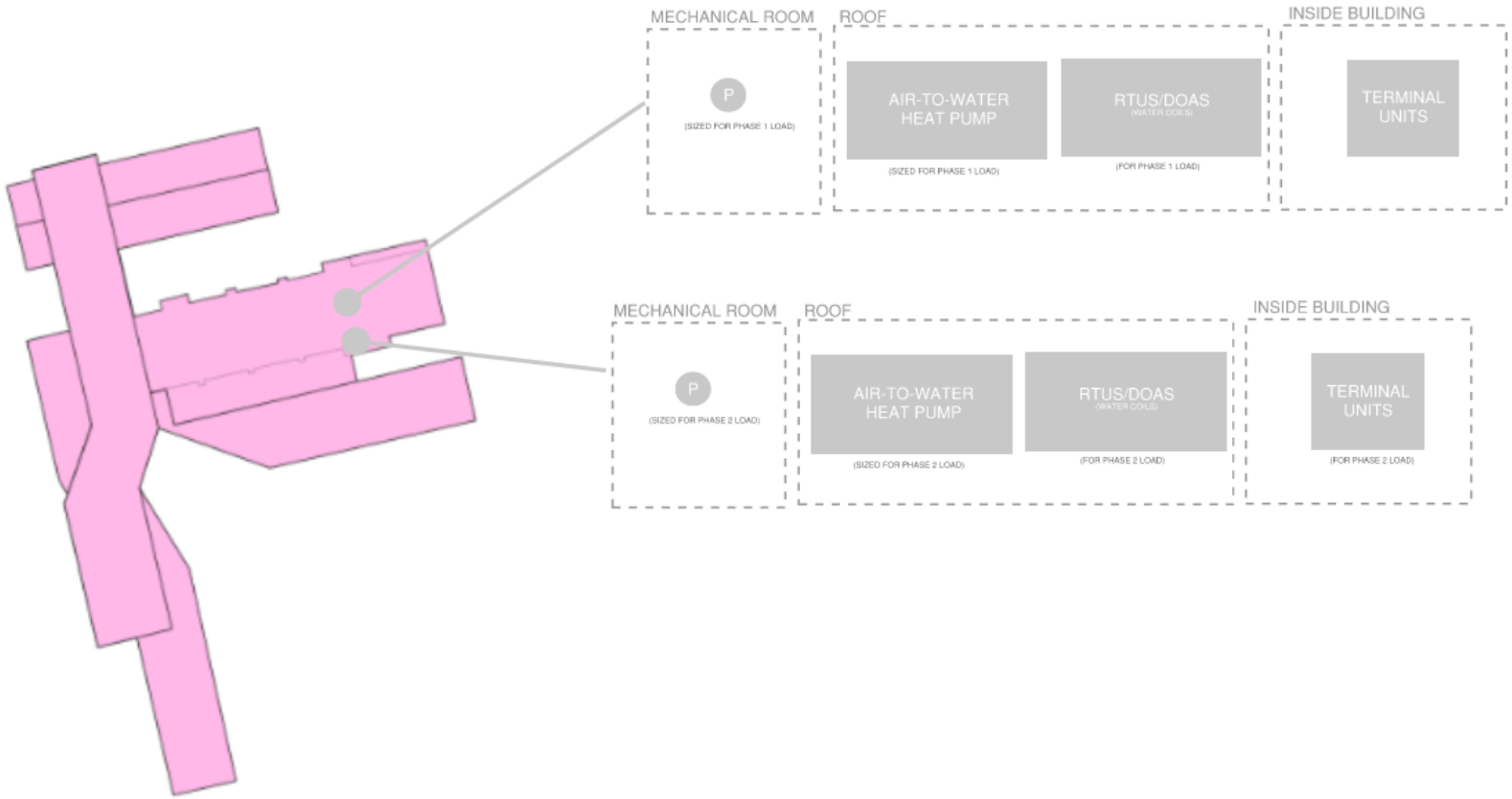
PHASE 2



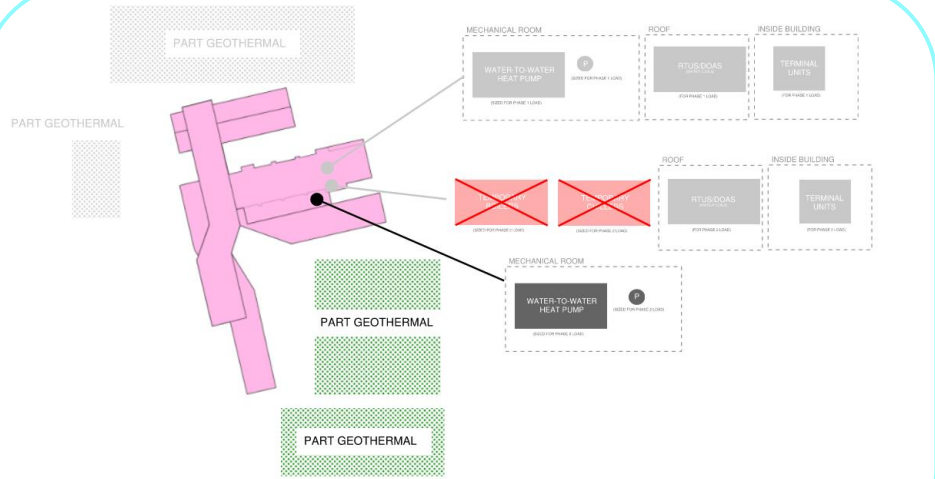
Sustainability and MEP Systems – Mechanical System Selection - Phasing

Full Air-to-Water Heat Pump

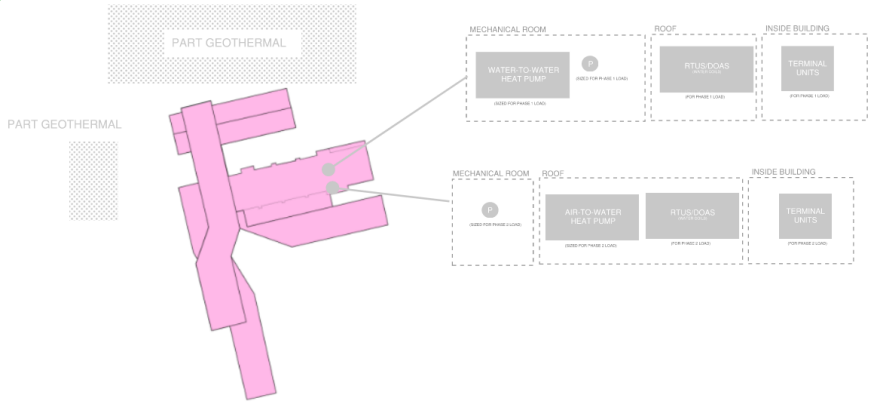
PHASE 3



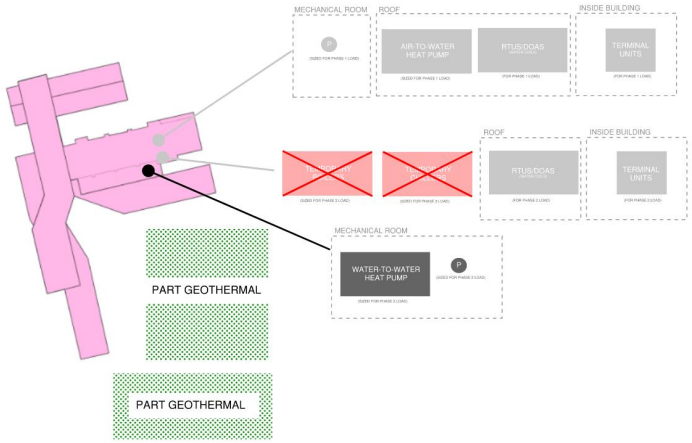
Sustainability and MEP Systems – Mechanical System Selection - Phasing



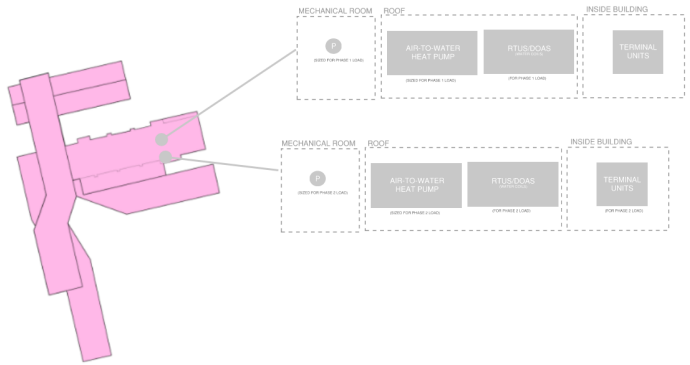
Full Geothermal Option



Hybrid – Geothermal/Air-to-Water Heat Pump – (USE OF DEED RESTRICTED LAND)



Hybrid – Geothermal/Air-to-Water Heat Pump – (USE OF NON-DEED RESTRICTED LAND)



Full Air-to-Water Heat Pump

Sustainability and MEP Systems – Mechanical System Selection - Summary

System Type	PROS	CONS
Full Geothermal (GSHP)	• Excellent efficiency • Reduced rooftop equipment • Limited equipment replacement over the lifespan of the school • Less maintenance compared to other systems • No concern with cold weather/defrost	• Would require use of deed restricted land • May require multiple mechanical rooms • Requires a large amount of mechanical space inside the building • Heavy coordination with site and underground utilities • Requires a temporary heating/cooling system • Higher first cost than other options
Hybrid – GSHP/Air-to-Water HP	• Good efficiency • Diversity of equipment	• Increased amount of rooftop equipment compared to geothermal option • Concern with cold weather/defrost • Heavy coordination required with site and underground utilities • More glycol than 100% geothermal system • Requires a large amount of mechanical room space • Would require temporary systems if using the non-deed restricted land
Full Air-to-Water HP	• Good efficiency (though not as high as geothermal options) • Simpler system, simpler controls • Doesn't require site work or coordination • Does not involve the deed restrictions	• Significant amount of rooftop equipment • Concern with cold weather/defrost • Shorter equipment lifespans compared to geothermal systems • More glycol required than the geothermal options

Preliminary Solar Photovoltaic (PV) Assessment

Sustainability and MEP Systems – SD Preliminary Solar PV Assessment

Roof Solar Photovoltaic (PV) System

Low Ballasted System



SMMA Project: North Middlesex Regional High School

High Canopy System



Solar Design Associates Project: Clark University

Parking Solar Photovoltaic (PV) System

Long Span Canopy System



Solar Design Associates Project: Oberlin

Parking Space Cover System



SMMA Project: The Lincoln School

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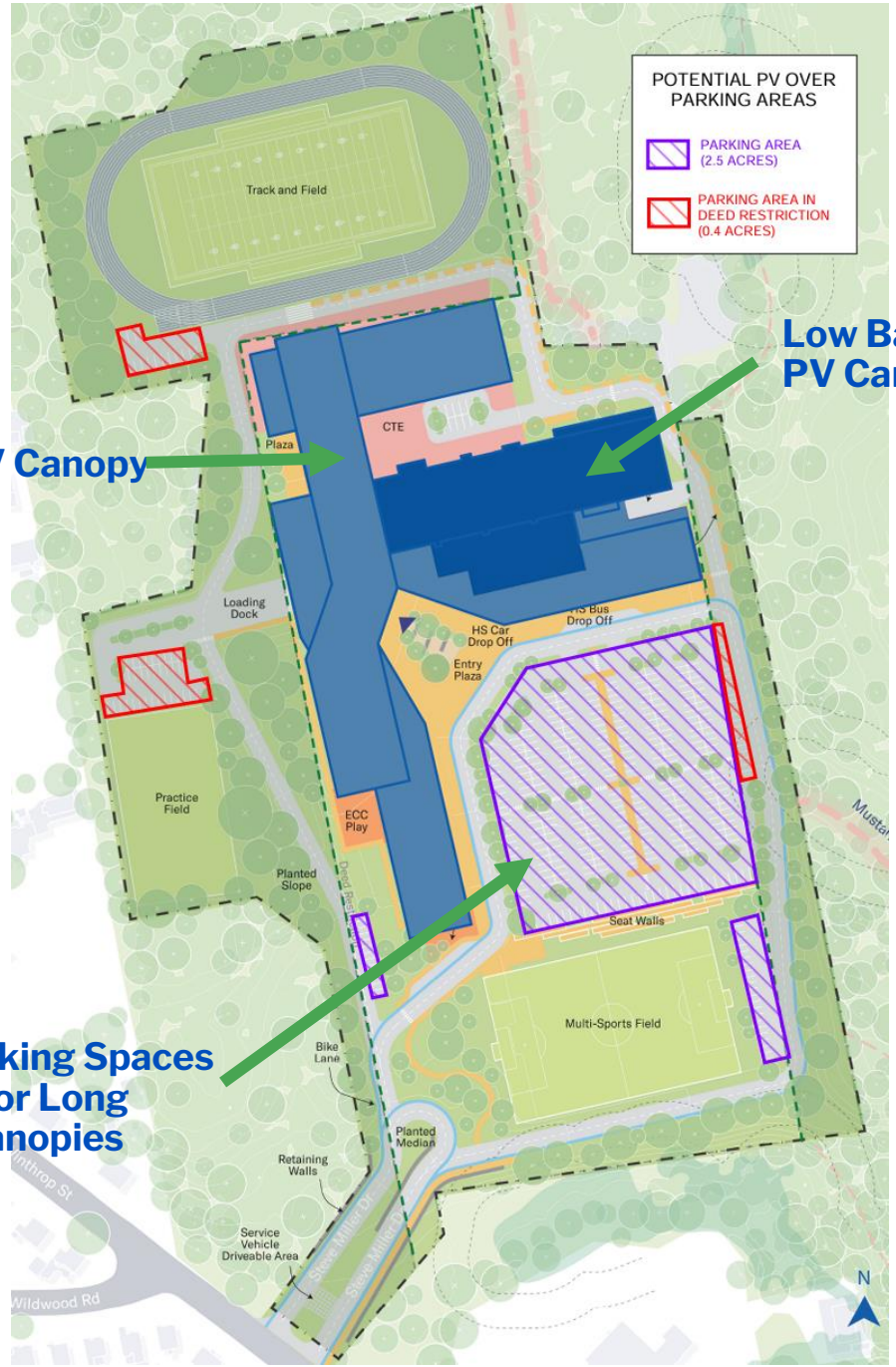
Sustainability and MEP Systems – SD PV Analysis

Solar PV System	Estimated NZE contribution
	(%)
ROOF Hybrid Solar PV High Canopy /Low ballasted systems	~50%
PARKING Hybrid Solar PV Long span/parking space canopies	~50%
Total	~100%

100% Net Zero Energy (NZE) Site Capacity Assessment

~5.5-6.0

MWh



Low Ballasted Roof PV Canopy

High Roof PV Canopy

Hybrid: Parking Spaces Cover and/or Long Span PV Canopies

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Sustainability and MEP Systems – SD PV Analysis

Solar PV Procurement Options	Ownership Criteria		Financial Benefits		Comments
	PPA	**Building Owner**	**PPA**	**Building Owner**	
Power Purchase Agreement	Design, Procurement, Installation, Maintenance, Replacement and utility coordination by PPA Will likely include battery storage system*	Solar PV readiness at roof and parking + Electrical Utility Infrastructure	Owns and benefits all energy production grants/incentives, peak load reductions, etc. [may own RECs, pending contract agreement*]	Obtains a reduction on the utility $/kWh ~$0.02-$0.05/kWh or estimated $121,000-$302,608*	LEEDv4: Renewable energy points requires Owner own the RECs and full Cx of PV systems [Challenges with PPA process)
School/City Ownership		Design, Procurement, Installation, Maintenance, Replacement, infrastructure and coord. With utility May elect with or without battery storage system		Owner benefits from all grants/incentives, peak load reductions and RECs – ***Estimated Benefits in progress***	LEEDv4: 3-5 points - must include Cx of PV system for Renewable Energy/Green Credit points

**Notes: Subject to PPA contractual negotiations.*

Sustainability and MEP Systems – SD PV Analysis

Solar PV System	Combination High (70%) + Low (30%)	Comments
ROOF		
Total Annual Energy Production (kWh)	2,991,000	
Total Estimated Costs ($)	$19,677,000	PV 1-PSR Alternate-50% low ballasted : $3,274,000
NZE %	~50%	~20%
PARKING		
Total Annual Energy Production (kWh)	2,681,777	
Total Estimated Costs ($)	$20,979,000	PV 2-PSR Structure Only (100% NZE PPA): $28,792,000
NZE %	~50%	
TOTAL		
Annual Energy Production(kWh)	5,672,777	
Estimated Costs($)	**~$40,656,000**	PV 3 – Ownership PV/Structure (100% NZE): $59,352,000 [Incl. Battery Storage/Micro-Grid]
	~100%	
Battery Storage/Micro-Grid	~$4,900,000	

**Notes:*

1. *Costs includes market rates structure and panels.*
2. *MA Stretch Code requires 40% roof area readiness.*

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Red List Free Materials

Sustainability and MEP Systems – Healthy and Sustainable Materials

- LEEDv4:
  - Low-Emitting Materials
  - Reduced Embodied Carbon Materials
  - Sustainable Materials Attributes: EPDs, HPDs
- Living Building Challenge's Red List Approved/Free

SMMA Precedents/Research

TIER 1: LEED Equivalency	TIER 2: Targeted Products	TIER 3: Division 9 Focus	TIER 4: Division 9 & Beyond
LEEDv4 equivalency for materials credits (HPDs for all identified product categories)	Identify the Top 10-15 products or product categories to vet using the **Red List** or class-based approach.	Vet all finishes in Division 9 using the Red List or a class-based approach	Vet all finishes in Division 9 & include other targeted categories that have the largest impact on human & environmental health



Sustainability and MEP Systems – Healthy and Sustainable Materials

Red List Free Material Selection - Interior Materials Prioritized:

Where most of the human interaction with building materials takes place:

- Floors
- Walls
- Ceilings







Consideration as part of Red List Materials selection:

- Massachusetts Stretch Energy Code compliance and meeting EUI goal or better may want to be prioritized over Red List's less-performing products/systems, specifically for windows and exterior wall assembly products.
- Consideration for lower embodied carbon (transportation, location).
- Red List Free availability based on manufacturer documentation and/or LBC Declaration label
- **Red List Selection Options**:
  - **Red List Free**: 3 equals available
  - **Red List Approved**: 2 equals of either Red List Free or 2-3 equals of Red List Approved
  - Proprietary: 1 product only available**
  - Specifications will require DECLARE red list reporting only when no Red List Free/Approved Available.

***Note: Excluding major manufacturers may impact price competition. Cost impact based on availability of Red list equals*

Sustainability and MEP Systems – Healthy and Sustainable Materials

Spec Section Division	Are Red List Free/Approved Products Available?
03-Concrete	Minimal Red List Compliant Products
04-Masonry	Minimal Red List Compliant Products
05-Metals	Minimal Red List Compliant Products
06-Wood, Plastics, Carpentry	Some Red List Free/Approved Products
07-Thermal & Moisture Protection	Some Red List Free/Approved Products
08-Openings	Some Red List Free/Approved Products
09-Finishes	Division w/ the Most Red List Free/Approved Products
10-Specialities	Minimal Red List Compliant Products
11-Equipment	No Market Availability
12-Furnishings	Minimal Red List Free Products – Ongoing Research with FFE Consultant
13-Special Construction	No Market Availability

Spec Section Division	Are Red List Free/Approved Products Available?
14-Conveying Equipment	Minimal Red List Compliant Products
21-Fire Suppression	No Market Availability
22-Plumbing	Insulation: Some Red List Free Products
	Fixtures: Some Red List Free Products
23-Heating Ventilating and Air Conditioning	Insulation: Some Red List Free Products
	Equipment: N/A, No Market Availability
25 – Integrated Automation	No Market Availability
26-Electrical	Fixtures: Some Red List Free Products
27-Communications	Very Limited Market Availability
28-Electronic Safety and Security	No Market Availability
31-Earthwork	No Market Availability
32-Exterior Improvements	No Market Availability

EXAMPLE

Sustainability and MEP Systems – Healthy and Sustainable Materials

Spec. Div.	Material Type	Manufacturer #1 (BOD)	Manufacturer #2	Manufacturer #3	Red List Free Availability	Cost Impact	Proximity/Exposure to Occupants	Red List Recommendation [Free or Approved]
09-Finishes	**Gypsum Wall Board** (Low Carbon)	USG [EcoSmart: Low-Carbon] (select locations) *Proprietary	Nation Gypsum	CertainTeed	Yes-Proprietary only**	Yes	✓	**Confirm**
	Gypsum Board	USG	Nation Gypsum	CertainTeed	Yes-Proprietary only**	Yes	✓	**Confirm**
	Gypsum Board (High impact and Abuse Resistant)	USG	National Gypsum	CertainTeed	No	Yes	✓	**Confirm**
	Tiling (Porcelain)	Creative Materials Corp.*	Crossville	Dal Tile	Yes	No	✓	Free
	Tiling (Ceramic)	Fireclay	Dal Tile	Crossville	Yes	No	✓	Free
	Acoustical Ceiling Panels	Armstrong	CertainTeed	USG	Yes – 2 equals**	Yes	✓	**Confirm**
	Acoustical Metal Pan Ceilings (Dining Commons, Library, LGI & Ext Entries)	Armstrong	Rockfon	USG	No	No	✓	Approved
	Wood Ceilings (Sound Reflective Panels)	Armstrong	Rulon International*	9Wood	Yes – 2 equals**	Yes	✓	**Confirm**

EXAMPLE

Note: The aesthetics are not equal between manufactures within the same material type.

Red List Free	Red List Approved	Declared	No Practical Alternative Available

* Self Declared Products (not third party verified). Products are only defined as an equal based on red list status.
**Excluding major manufacturers may impact price competition.

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Embodied Carbon & Mass Timber

Sustainability and MEP Systems – Mass Timber

Wood & Mass Timber Feasibility Considerations

- Cost
- Code regulation impacts
- Early coordination with manufacturer needed
- Fire resistance
- Acoustics
- Tighter column spacing and/or deeper beams



SMMA Project: Smith Vocational and Agricultural High School



Innoventum Solar Carport Project

Sustainability and MEP Systems – Embodied Carbon & Mass Timber

Healthy Materials & Embodied Carbon Reduction Strategies:

- Low-Carbon Materials Procurement
- High-Recycled Content in new building materials
  - Concrete
  - Steel
  - Windows
  - Insulation
- Optimization of materials reuse
- Low-Emitting Materials
- Recycled Content, FSC Wood
- Local/Regional Materials (as feasible)

Design Option Analyzed	Embodied Carbon Reduction (%)
Proposed Design with Steel/Concrete Construction	**-20.2%**
Proposed Design with 10% Mass Timber Construction ILO Steel/Concrete	-21.1%
Proposed Design with 50% Mass Timber Construction & 50% Steel/Concrete	**-25.9%**
Proposed Design with 100% Mass Timber Construction	**-31.9%**

Notes:

The PSR Mass Timber alternates estimated costs:

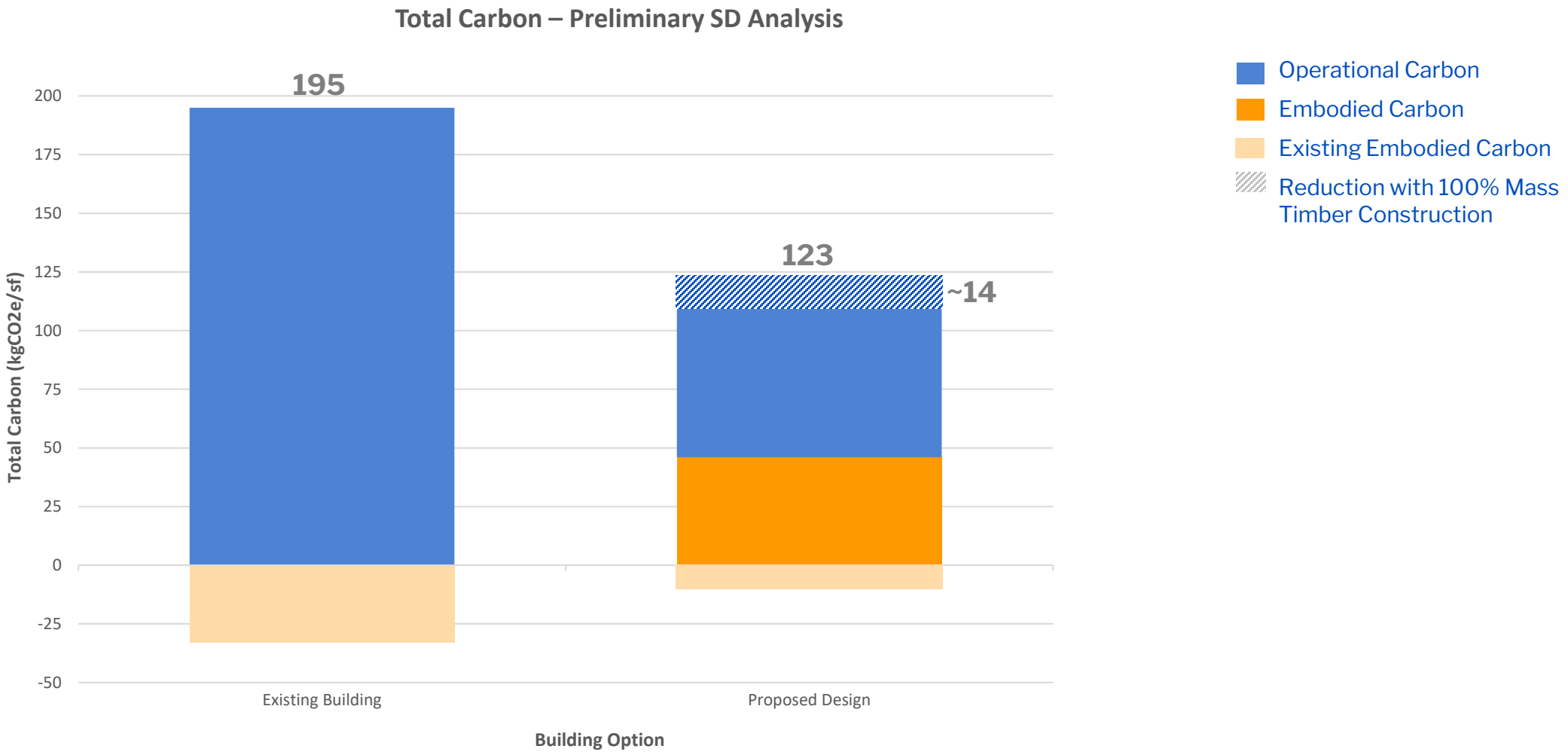
- **TIMB1** (50% - New addition mass timber structural frame): Estimated $17,830,714.
- **TIMB2** (100% -New addition mass timber structural frame): Estimated $35,661,427.
- Note: PSR based on 609,000 SF.

Sustainability and MEP Systems – Total Carbon

Total Carbon = Operational Carbon (Energy) + Embodied Carbon (Materials)

Operational Carbon is the greenhouse gas (GHG) emissions associated with the annual energy consumption of the building.

Embodied Carbon is the greenhouse gas emissions associated with the life cycle of the building materials, including manufacturing, transportation, installation, maintenance, and disposal.



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Water Stewardship

Sustainability and MEP Systems – Water Stewardship

- Project has a goal of 30% indoor water use reduction (contributing to 3 points in LEEDv4)
- No irrigation or reduced outdoor water use (minimum 1 point in LEEDv4)
  - Majority of native plantings
  - Limited irrigated areas

- Additional Strategies for Consideration:
  - Rainwater Harvesting System [CTE program use]



Rainwater Harvesting at Somerville High School

Next Steps



Sustainability and MEP Systems – Next Steps

Next Steps

- Advisory Team will provide recommendations to the SBC to consider and adopt the recommendations including:
  - Solar PV and Battery Storage Extent and Approach
  - All-Electric Heating/Cooling System Options for Schematic Design LCCA:
    - 3 systems' options: Ground Source, Hybrid with Air Source, or only Air Source
    - Pool HVAC system: all-electric vs. Natural Gas
  - Mass Timber Approach to Addition Structure

Next Meetings:

- **Sustainability & MEP Systems Advisory Team Meeting**
  - Thursday October 1st, 5:30 – 7:00pm

- **School Building Committee (SBC) Meeting**
  - Tuesday October 6th, 6:00pm

Thank you.

