TRINITY FINANCIAL

December 19, 2022

Kristine Trierweiler
Town Administrator
Town of Medfield
Town House
459 Main Street
Medfield, MA 02052

Dear Administrator Trierweiler,

On behalf of Trinity Acquisitions LLC (Trinity), I am writing to present our findings for the geothermal and solar feasibility investigations for the Medfield State Hospital (MSH) project. Trinity committed to both a solar energy feasibility study and a geothermal energy feasibility study after meetings with the Medfield Energy Committee during its community outreach process prior to the Special Town Meeting in June 2022. Please find both studies attached to this letter and our conclusions outlined below.

Solar Feasibility

Trinity engaged Resonant Energy to complete its solar feasibility study for the MSH site. Resonant Energy is a mission-driven, Boston-based solar energy company that aims to provide 100% clean energy to 100% of people.

A key financial component in the redevelopment of the MSH involves the use of federal and state historic tax credits. To qualify for the tax credit program, Trinity's proposed rehabilitation of the buildings and treatment of the site will need to adhere to the guidance of the Secretary of the Interior's Standards for the Treatment of Historic Properties.

According to Trinity's historic consultants at Public Archaeology Laboratory (PAL), The Secretary of the Interior's Standards have previously provided guidance regarding solar panels. Typically, solar panels installed on a historic property in a location that cannot be seen from the ground will generally meet the Secretary of the Interior's Standards for Rehabilitation. Conversely, an installation that negatively impacts the historic character of a property will not meet the Standards.

For the MSH site, Trinity's historic consultants have advised solar panels should not be taken into consideration on buildings that have sloped roofs. Additionally, it was recommended that solar panels not be positioned anywhere that could impact the historic inner loop landscape of the MSH site. **Please see the attached Exhibit A for the Resonant Energy Solar Feasibility Study**. Following the guidance of PAL, Resonant studied potential solar arrays for flat-roofed buildings 7, 10, and 13 and on outer parking lots proximate to the Water Tower and Building 7. The study has concluded that these placements could be financially feasible, however all potential locations in the Resonant study will need to be approved by the National Park Service, Massachusetts Historical Commission, the Town of Medfield and the project's lender and investor for approval.

Geothermal District Energy Approach

The team believes the use of geothermal energy is a forward-thinking and sustainable energy alternative if appropriately designed and financially feasible. In order to determine if geothermal technology at MSH renders further study, Trinity engaged the design and engineering team of ICON Architecture, R.W. Sullivan (Mechanical Engineer) and McPhail Associates (Geotechnical Engineer) to provide guidance and consultation.

The team's initial study was to determine if a district energy system would be appropriate for the site. It was suggested that MSH's former steam tunnels could serve as potential conduits for a district-wide geothermal system; however further examinations concluded this was not a viable path. Given the unit mix and square footage, the design team made reasonable assumptions about anticipated energy loads. The design team estimated that approximately 300 wells would be needed to adequately serve the site. While the number of wells may suffice, the distribution is hindered by site restrictions described below. **Please refer to Exhibit B Well Field Layout Site Plans from ICON Architecture.**

Site Restrictions

The design team reviewed the preliminary MSH Site Plan to see if it could accommodate the number of geothermal wells needed to accommodate district energy. Site constraints included, but were not limited to, the required spacing between wells, utility pathways and road infrastructure, building footprints and required setbacks, tree canopies, and locations for future potential plantings to enhance views and open space. Please see attached **Exhibit C Study from McPhail Associates and RW Sullivan.**

Environmental Concerns

Given the site's Phase I Environmental Site Assessment, and the neighboring remediation of the Laundry Parcel and its associated Activity and Use Limitation (AUL) the reuse of existing steam tunnels presents a risk of remediation and an exponential risk of cost overruns that would not be supported by the project.

Cost Restraints

Preliminary estimates for a geothermal district energy system include cost of wells, piping, and central plant. These expected costs, notwithstanding any risks associated with remediation and of the existing tunnels, on top of the project's expected extraordinary site costs surpassing $50 million, are prohibitive to geothermal development.

Select Geothermal Loops

The design team explored the feasibility of vertical closed loop geothermal wells serving ground source heat pumps for select buildings at the MSH campus. **Please refer to Exhibit B Well Field Layout Site Plans from ICON Architecture**. For this exercise, the design team considered three centralized well fields for larger buildings serving buildings with a larger number of units for efficiency. These included one well field servicing Buildings 13 and 10 together; another well field servicing Building 27A; and a final well field servicing Buildings 2 and 7 together. Finally, the team explored a well field servicing one of the smaller buildings, the 9-unit Building 15. The small scale, or by-building approach for well fields is hindered by the limited site area near buildings.

Preliminary cost differential between an electric air-source heat pump system and a geothermal HVAC system, as summarized in R. W. Sullivan Geothermal HVAC Systems Narrative, constitutes approximately a $2,000,000 cost increase for the Select Well Field approach.

Operational Concerns

Concerns were raised about the operational inefficiencies created by multiple utility systems at the site. In consultation with management, it was determined that operations would be best served with consistent systems across the property.

Conclusion

While geothermal energy would be a feasible alternative energy source for the site, the site constraints, capital costs, operational challenges and potential environmental risks, coupled with the inherent complexity already associated with the 27-building, certified historic rehabilitation render it an energy source the development team is not prepared to pursue at this time.

Trinity's priority for the Medfield State Hospital redevelopment continues to be the salvaging of the 27 historic buildings. The development team is engaging on multiple fronts to advance the project. This includes detailed conversations with the National Park Service and Massachusetts Historic Commission regarding acceptable treatment of the buildings' historic features; advancing site plan development for Planning Board Review and strategies to secure funding for the extraordinary site costs for hazardous materials and infrastructure. Finally, in our effort to attract institutional capital to the redevelopment, we remain focused on mitigating the percussive noise from the adjacent gun range training field that we have consistently represented will preclude any private investment on the site.

Sincerely,

Abby Goldenfarb
Trinity Acquisitions LLC

EXHIBIT A

RESONANT ENERGY SOLAR FEASIBILITY STUDY

RESONANT ENERGY

Medfield State Hospital

Preliminary Solar Design Feasibility Study

October 2022

Project Background & Solar Scope

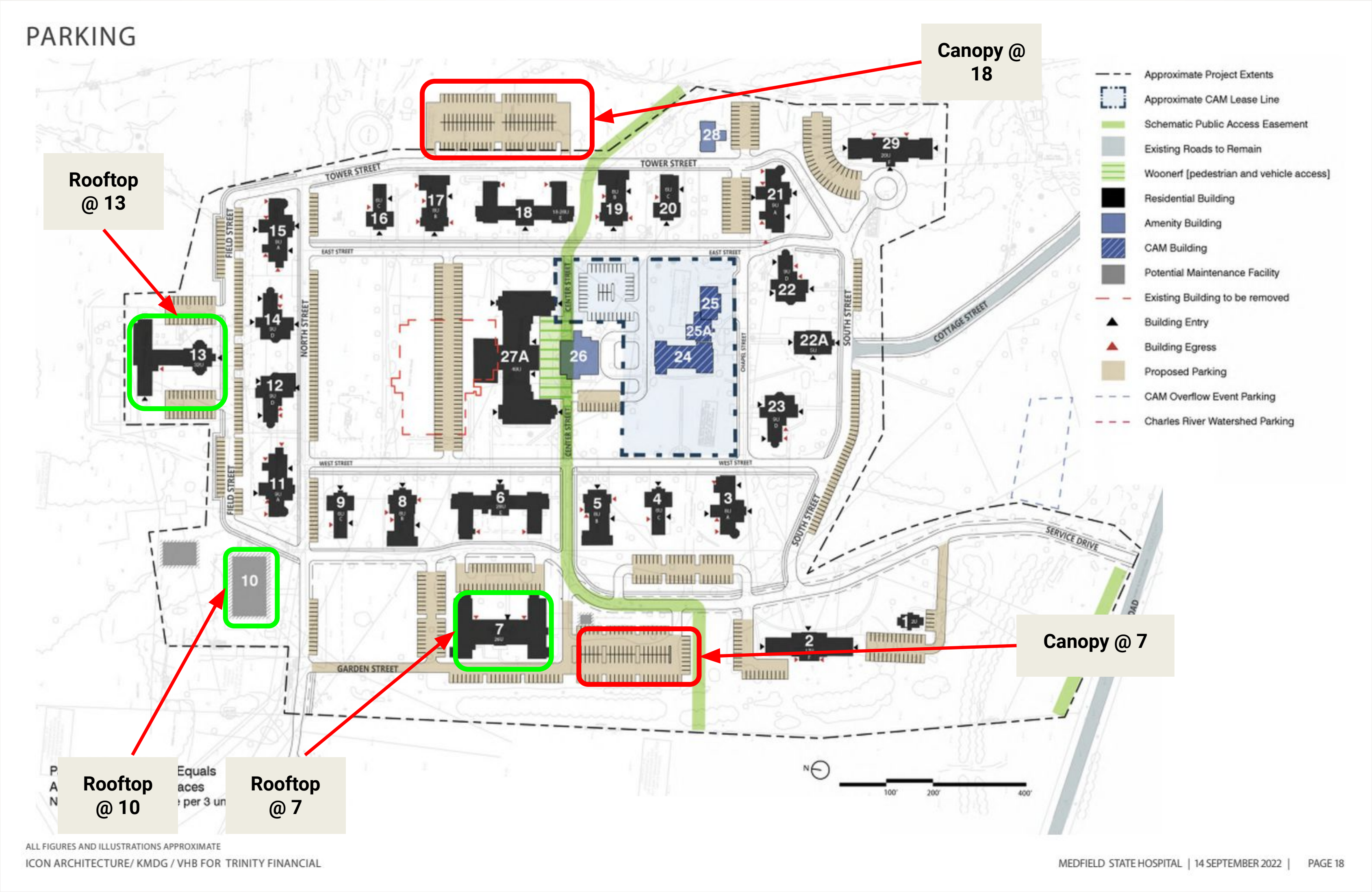
- **Background:** Trinity Financial (Trinity) has been selected by the Town of Medfield to redevelop the Medfield State Hospital campus into a market rate rental development with 334 units (25% affordable), using historic tax credits (Source: Town of Medfield). The Town's energy committee has encouraged Trinity to explore multiple avenues for making this new housing community as green and energy efficient as possible – including exploring on site solar PV options. Completion = Q1 2026.
- **Solar Scope:** Trinity has engaged Resonant Energy to complete a preliminary assessment of the solar PV potential of the campus, using an understanding of the current redevelopment plans and being mindful of historic considerations and restrictions for the campus. The goal is to maximize clean energy potential while minimizing the impact to the overall capital budget for the redevelopment and impacts to historic aspects of the campus.
- **Historic Considerations:** Because the property will be pursuing HTCs, the National Parks Service (NPS) will have oversight during the redesign and for 5 years after. "Solar panels installed on a historic property in a location that cannot be seen from the ground

Historic Considerations in Detail

- **Historic Background:** Because the property will be pursuing Historic Tax Credits (HTCs), the National Parks Service (NPS) will have oversight during the redesign and for 5 years thereafter during the tax credit recapture period.
- **NPS Stance on Solar:** The federal government is firm and clear with their guidance on solar PV: *"Solar panels installed on a historic property in a location that cannot be seen from the ground will generally meet the Secretary of the Interior's Standards for Rehabilitation."* (Source: NPS.Gov)
- **Implications for This Development:** Based on this directive, and Resonant Energy's direct experience seeking approval on other historic tax credit multifamily developments, we believe the following is advisable:
  - Avoid solar PV on all sloped roofs (doubly so due to slate shingles*)
  - Avoid solar PV anywhere in the central quad around Bldg 27a, which NPS sees as of particular historic significance according to Trinity
  - Focus on flat roofs, parking canopies, and outlying ground sites

* Note: Slate is very costly to build solar on and many contractors won't do it at all due to the likelihood of damaging the shingles in the process.

Campus Map - Potential Solar Sites



Individual Project Summary

Site	Array Type	System Size (kW DC)	Output (kWh/Yr)
Bldg 7	Rooftop	132.0	157,608
Bldg 10 *	Rooftop	104.6	123,533
Bldg 13	Rooftop	72.5	87,580
Canopy at 7 *	Carport	515.5	560,349
Canopy at 18	Carport	613.4	670,446
	Totals	1,438	1,599,516

** = assumes no or minimal shading*

PV Design: All Sites

Equipment Overview

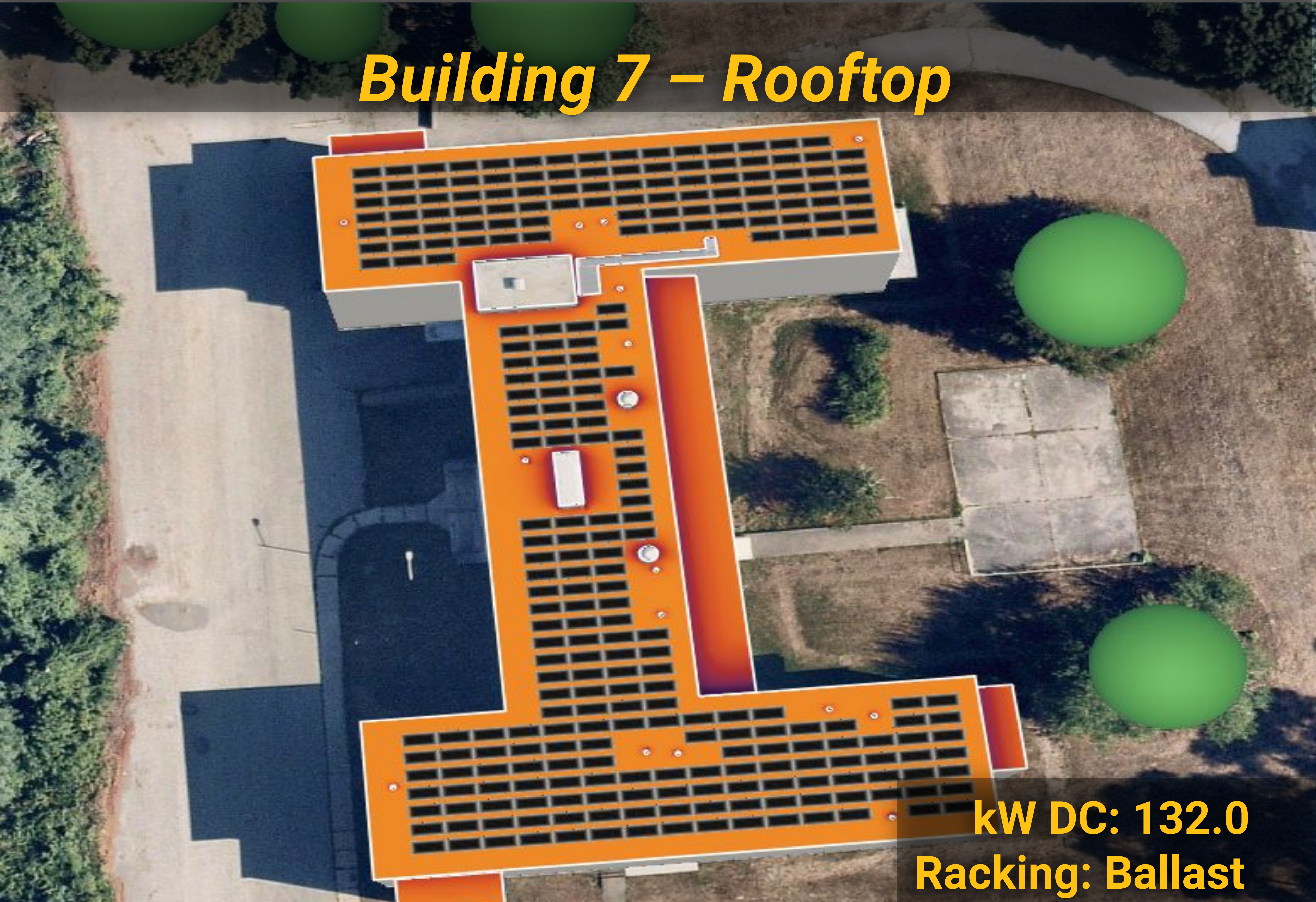
Panels: Bloomberg Tier 1 Manufacturer.
Used for Modeling: 78 Cell Q Cell: 480w

Warranties: 12-year product warranty; 25-year performance warranty

Inverters: with online monitoring.
Rooftop: Solar Edge + optimizers
Canopy: Solectria

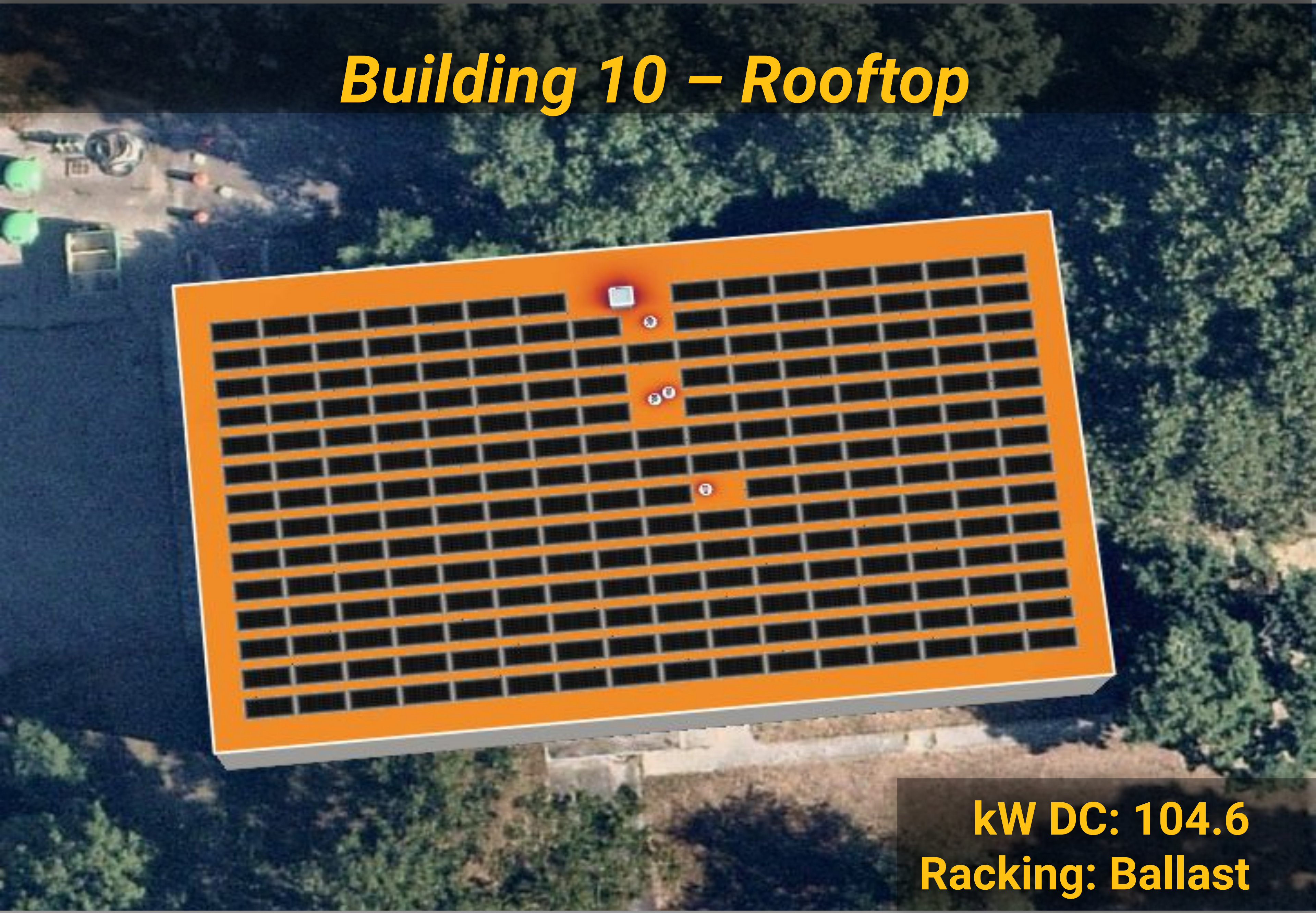
Warranties: 12-yr product warranty with option to extend up to 25

Building 7 – Rooftop



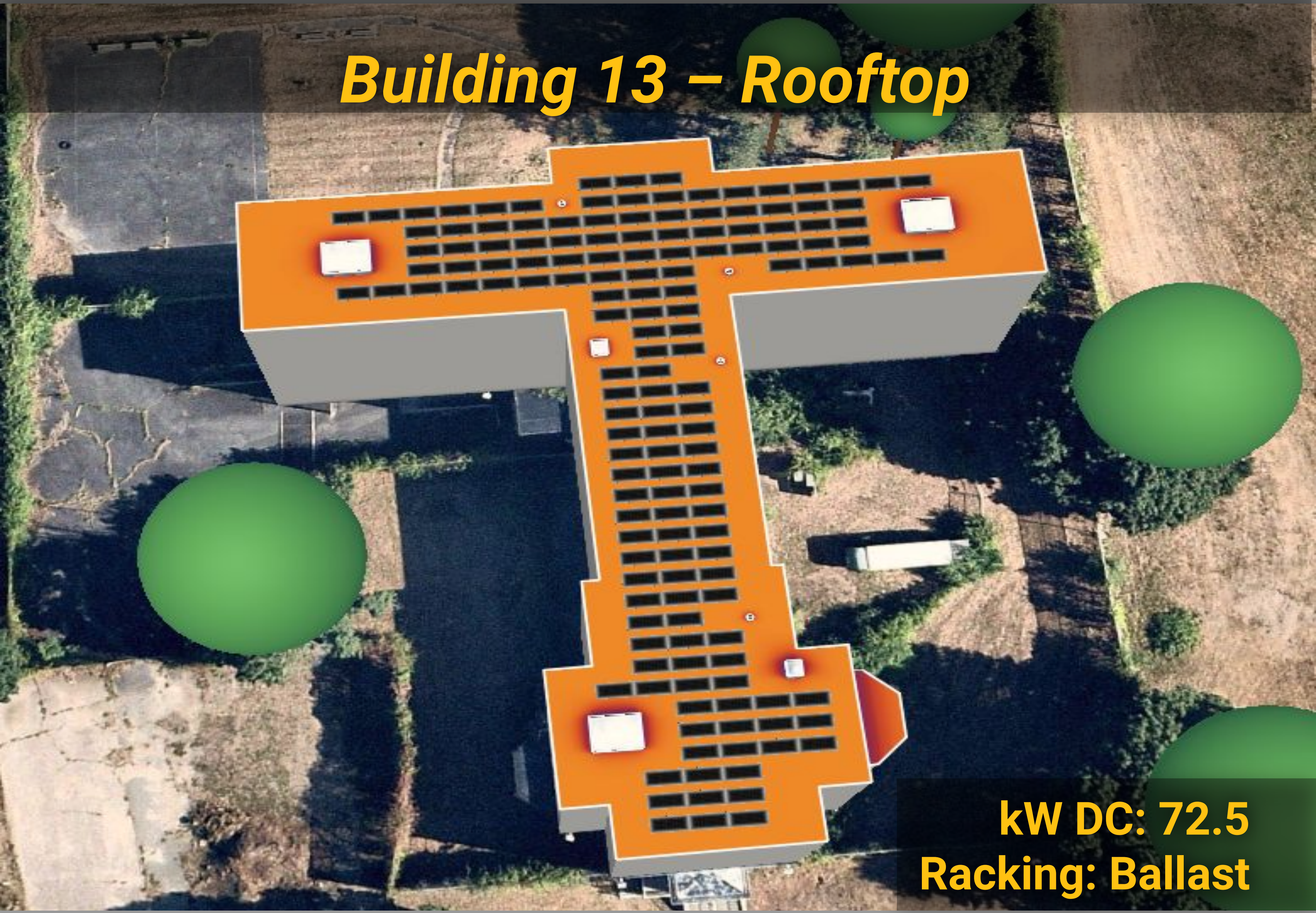
kW DC: 132.0
Racking: Ballast

Building 10 – Rooftop



kW DC: 104.6
Racking: Ballast

Building 13 – Rooftop

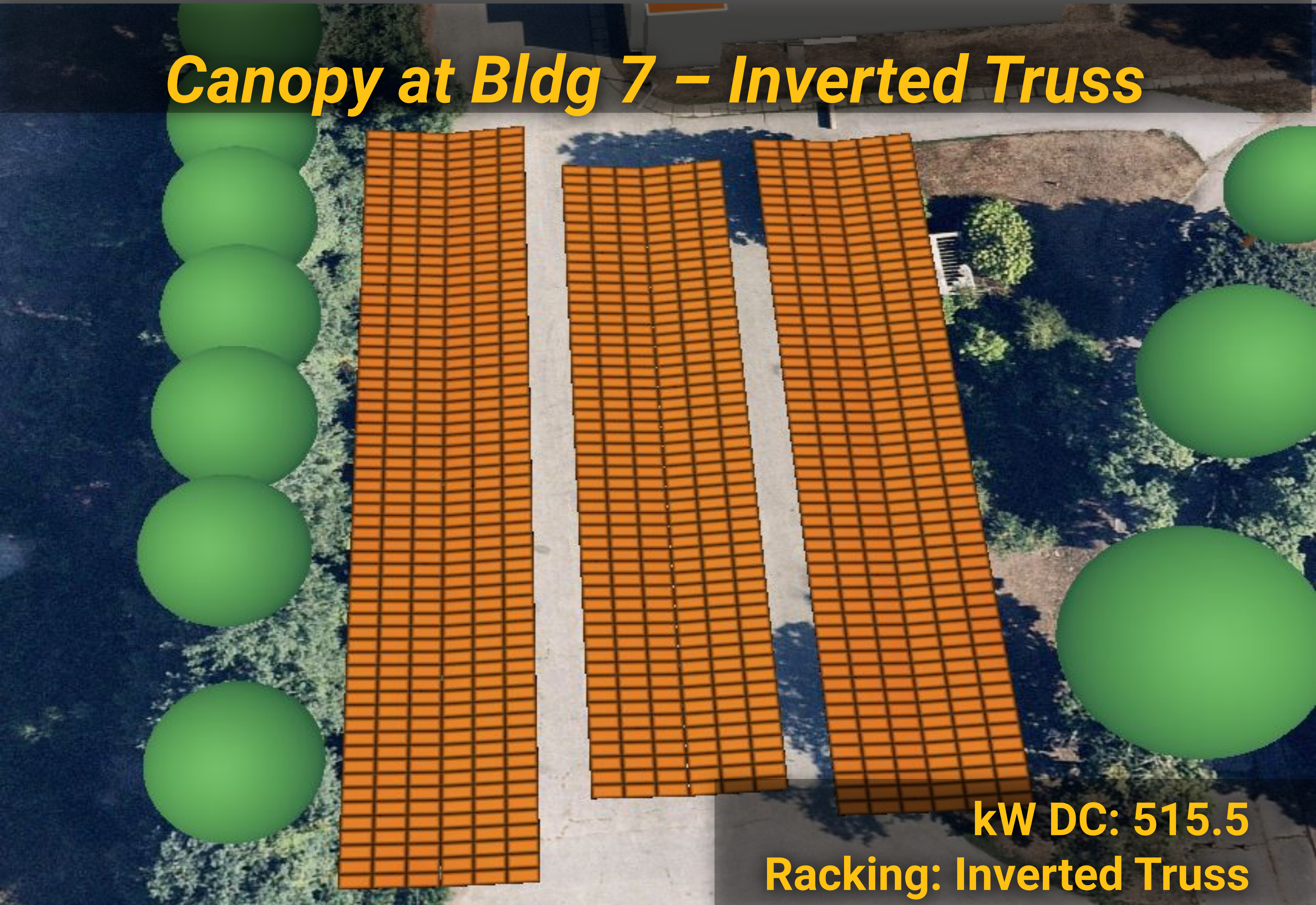


kW DC: 72.5
Racking: Ballast

Example Rooftop Design

Example: 60 kW ballasted solar PV system installed at Commonwealth Kitchen, Dorchester, MA. The racking includes no penetrations and is weighed down on the roof to meet wind loading with cement blocks.

Canopy at Bldg 7 – Inverted Truss



kW DC: 515.5
Racking: Inverted Truss

Canopy at Bldg 18 – Inverted Truss

kW DC: 613.4
Racking: Inverted Truss

Example Canopy Design

Example: 337 kW inverted truss solar PV canopy installed at Temple Emunah (Lexington, MA). This racking type covers parking spaces while leaving aisles open to maintain sunlight access for users.

Project Financing Considerations

- **Preliminary Financial Review:** Based on Resonant Energy's initial review using today's financial conditions, all of the potential sites proposed are very likely to qualify for no cost financing (i.e. a Power Purchase Agreement), with a minimum of a 15% Year 1 discount relative to the 3 year trailing average utility cost of an Eversource G2 rate class with a 1% annual escalator based on the following assumptions:
  - **Federal Tax Credit Value:** 30% (in place for next 10 years)
  - **MA SMART Incentive:** assuming base block 8 and -
    - Site Adders: parking canopy & rooftop, as applicable
    - Offtaker Adder: all sites in the development are eligible for the Low Income property adder so long as 25% of units serve <80% AMI or 20% of units dedicated to <50% AMI
  - **Eversource Electricity Value:** modeling assumes that Trinity will design load to be located near PV production such that all solar PV systems could be installed "behind the meter" with zero net export on a monthly basis. *Under current conditions, virtual net metering solutions will work for all of the sites as well, but with substantially lower lifetime savings potential for the site.*

Project Financing Considerations

- **Additional Legal Requirements:**
  - Contract Term: Trinity should plan on a 25 year term. 20 may be possible, but with a lower savings value.
  - Insurance & Maintenance: The third party financier will fully insure (property & CGL) and cover maintenance for the system for the term of the agreement. Further, they will only bill the property for power that is generated and delivered to the buildings – giving them substantial incentive to keep the systems performing.
  - Underwriting: the third party financier who provides the capital for these solar systems will require 3 years of trailing financials typically for Trinity as the developer / owner as part of their underwriting process for the agreement.

Takeaways

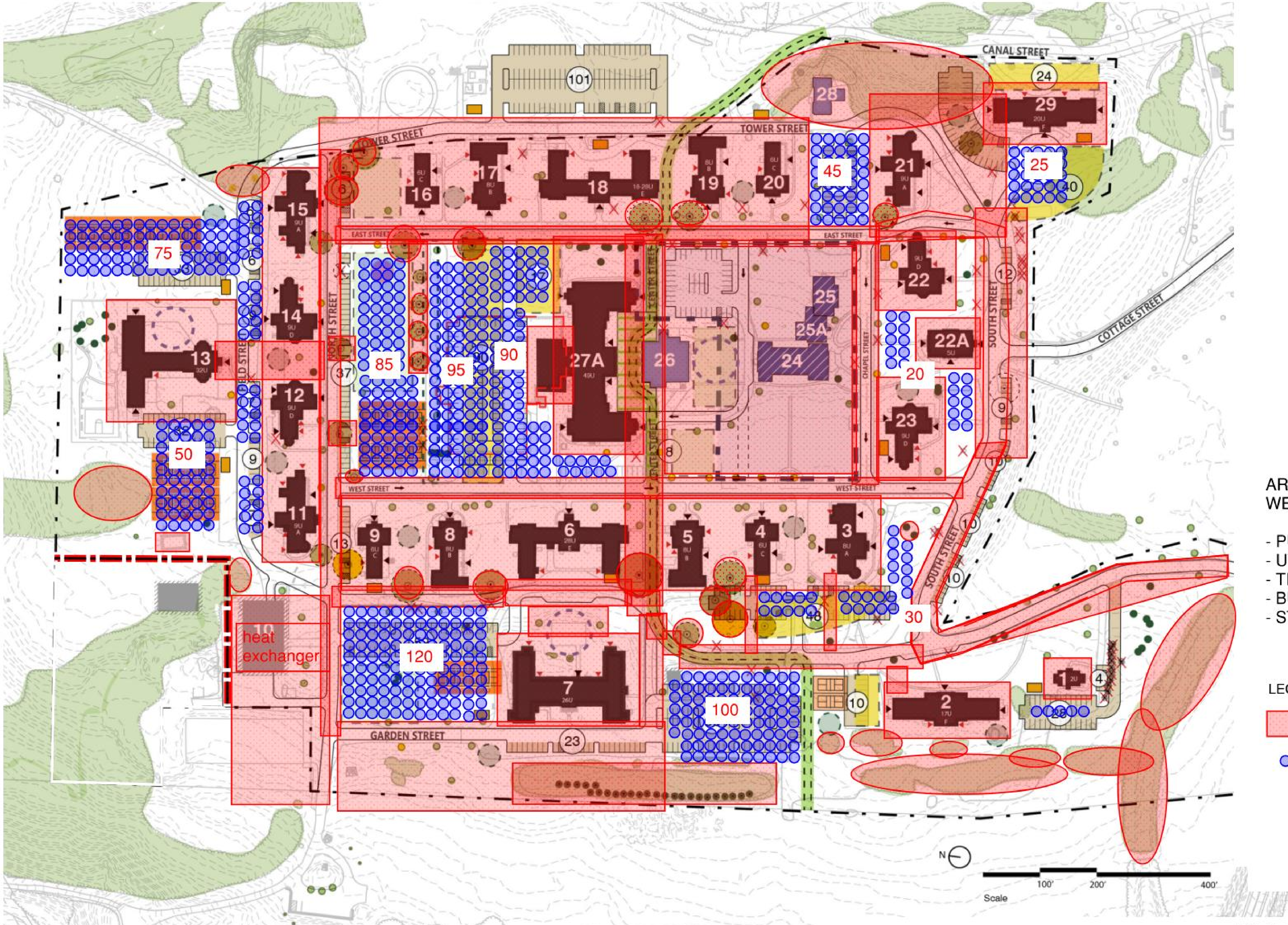
- **Design / Engineering:** Systems of this size and complexity may have significant bearing on transformer sizing for the campus, trenching for underground electrical runs, placement of load (ex. including EV charging, outdoor lighting, etc.), all of which would be best to be managed under a design consulting agreement early in the planning process.
- **Utility Interconnection:** An interconnection application for any combination of systems beyond just the rooftop sites will very likely require a system impact study from Eversource, which will likely cost $15,000 - $30,000 (or more) and may take up to 2 years if it is part of a "Group Study". Starting and planning for this early will be key to success. *Note: these are only valid for a year, but may be extended with a fee, so completion in 2024 with one extension likely makes sense.*
- **Financing:** due to the long timeline associated with this development project, it will be difficult to anticipate the cost of installation, the availability of incentives, and the cost of electricity so far in advance. As such, it's likely that a contract should be signed no sooner than 2 years before the estimated completion timeline - whether ownership or PPA.

Thank You

Isaac Baker
Co-CEO
isaac@resonant.energy

EXHIBIT B

ICON ARCHITECTURE WELL FIELD LAYOUT SITE PLANS



AREAS EXCLUDED FROM GEOTHERMAL WELLS ARE SHOWN IN RED:

- PUBLIC EASEMENTS
- UTILITY TUNNNELS + PATHWAYS
- TREE CANOPIES
- BUILDING FOOTPRINTS (15' OFFSET)
- STORMWATER SYSTEM

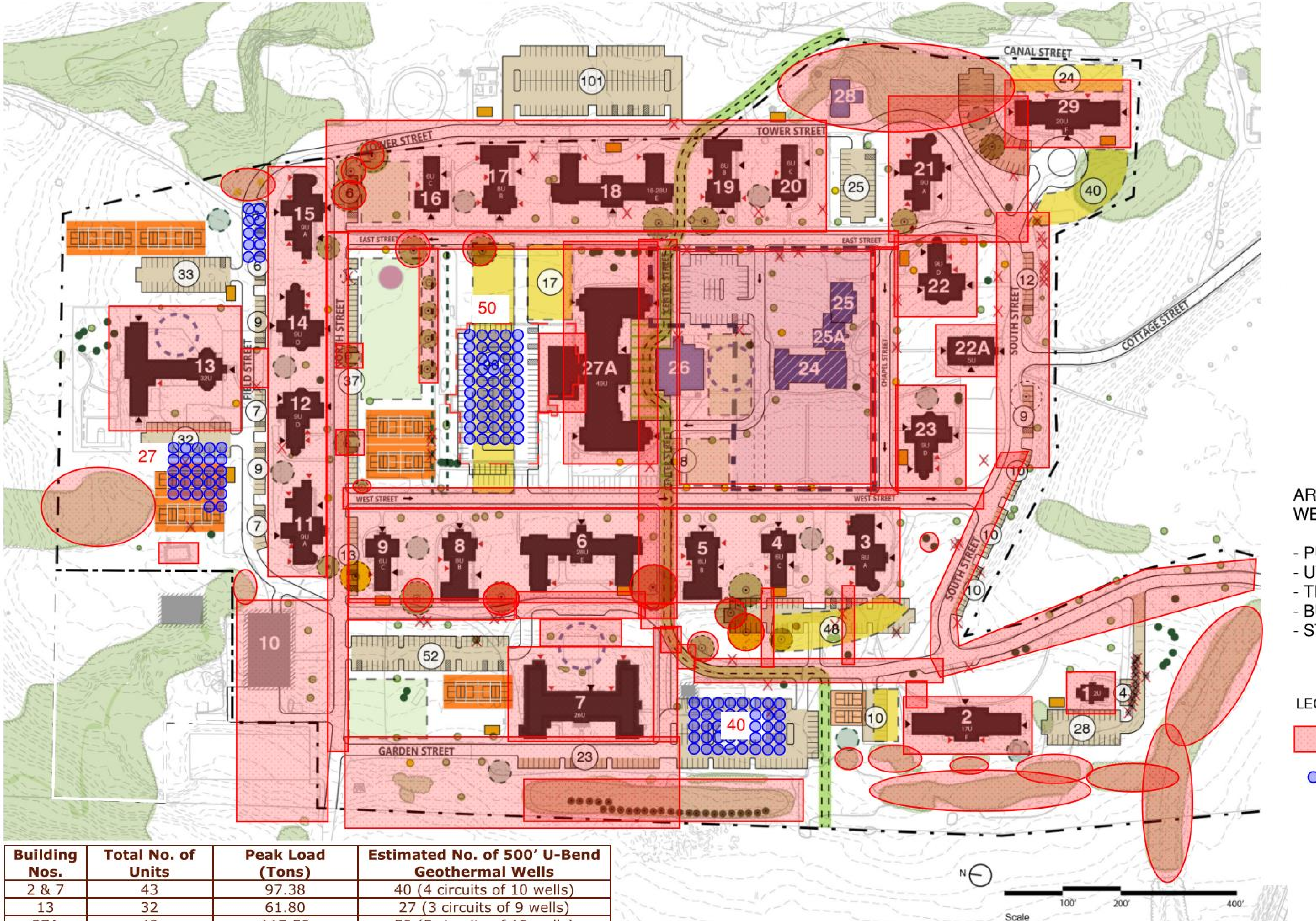
LEGEND:

NOT VIABLE FOR GEOTHERMAL WELLS

SINGLE WELL, 20' spacing

District Energy Well Field Site Plan

Medfield State Hospital Redevelopment Geothermal Study



AREAS EXCLUDED FROM GEOTHERMAL WELLS ARE SHOWN IN RED:

- PUBLIC EASEMENTS
- UTILITY PATHWAYS + TUNNELS
- TREE CANOPIES
- BUILDING FOOTPRINTS (15' OFFSET)
- STORMWATER SYSTEM

LEGEND:

NOT VIABLE FOR GEOTHERMAL WELLS

SINGLE WELL, 20' spacing

Building Nos.	Total No. of Units	Peak Load (Tons)	Estimated No. of 500' U-Bend Geothermal Wells
2 & 7	43	97.38	40 (4 circuits of 10 wells)
13	32	61.80	27 (3 circuits of 9 wells)
27A	49	117.50	50 (5 circuits of 10 wells)
15	9	23.00	10 (1 circuit of 10 wells)

Select Well Field Site Plan

Medfield State Hospital Redevelopment Geothermal Study

EXHIBIT C

McPHAIL ASSOCIATES and R.W. SULLIVAN STUDIES

Memorandum

Date:	November 30, 2022
Recipient:	Trinity Acquisitions, LLC
Attention:	Abby Goldenfarb and Kevin McCarthy
Sender:	Jonathan W. Patch, P.E.
Project:	Medfield State Hospital; Medfield, MA
Project No:	7440.2.G1
Subject:	Preliminary Geothermal Feasibility Study

This memorandum summarizes McPhail Associates preliminary geothermal feasibility study for the proposed redevelopment of the project site. In conclusion, for the reasons stated herein a building specific approach with individual geothermal well fields servicing the needs of some, but not all, of the individual buildings is considered feasible. However, a geothermal district energy approach is not considered to be feasible.

Project Overview

The subject property is comprised of a total of 36 buildings that are located on the approximately 77-acre Parcel A portion of the Medfield State Hospital (MSH) campus. Parcel A fronts to the south onto an area of the campus identified as the green, which fronts onto Hospital Road, to the north to wooded undeveloped land, to the west to Medfield Charles River State Reservation and to the east residential homes. The buildings located on the subject property are vacant and the hospital is no longer in use. Subject property buildings on Parcel A have had various historical uses including a machine shop, training building, administration, chapel, infirmary, clubhouse, service building, food service and cottages.

The proposed redevelopment of Parcel A includes the rehabilitation of 27 of the existing contributing historic buildings to provide a total of 334 dwelling units and approximately14,300 square feet of amenity and management space. Additionally, parking for the property's residences will need to be provided on site.

As part of the project, it is understood that Trinity Acquisitions LLC has agreed to engage in a study to determine if a network of vertical closed-loop geothermal wells servicing ground source heat pumps would be a feasible alternative to heat and cool some, or all, of the buildings.

For this preliminary study, we evaluated district energy and building specific geothermal solutions. For the building specific geothermal solutions, individual geothermal well fields were studied to provide the heating and cooling needs for the following buildings: 1. Building 13 (32 units) and Building 10 (maintenance outbuilding), 2. Building 27A (49 units), 3. Buildings 2 and 7 (43 units combined), and 4. Building 15 (a typical 9 unit "Type A" building). For the district energy approach to provide the heating and cooling needs for all the buildings, it was assumed that a centrally located geothermal well field would be connected to heat exchangers located in a heating/cooling plant in Building 10 and that a new network of chilled water and steam pipes would lead from Building 10 to the 27 individual buildings.

Geologic Conditions

Based on our experience in the direct vicinity of the subject site, we anticipate that the ground surface across the site is underlain by an approximate 5 to 10-foot thickness of fill material. Below the fill, natural glacial deposits are anticipated to be present, which are underlain by bedrock. Groundwater is anticipated to be present at approximately 10 feet below ground surface.

Based on our review of the Massachusetts Department of Environmental Protection (MassDEP) online wells database, bedrock is anticipated to be present below the glacial deposits, within an approximate depth range of 10 to 70 feet from ground surface. Based on our review of an online United States Geological Survey (USGS) bedrock geological map, bedrock across most of the site is characterized as Dedham Granite. Published values of the thermal conductivity of similar types of bedrock range from about 1.1 to 3.0 Btu/hr-ft-°F for granite with 10% quartz content and about 1.5 to 2.1 Btu/hr-ft-°F for granite with 25% quartz content. At the northwest corner of the site, the USGS map indicates the Mattapan Volcanic Complex consisting of rhyolite, melaphyre, agglomerate, and tuff with overlying Roxbury Conglomerate may be present.

Note that thermal conductivity values do not directly translate into the number of feet per ton (i.e., the number of tons expected per well or the total number of wells which will be required for the project). The number of wells required is determined based on the results of a well field analysis using ground energy transfer software programs which include the hourly or monthly heating and cooling loads provided by the project mechanical engineer or energy modeling consultant.

Geothermal Overview

Geothermal systems take advantage of the ground's relatively stable temperature to provide heating and cooling. For heating, geothermal systems extract heat from the ground and utilize heat pumps to boost the temperature then release it inside the space to be heated. For cooling, heat pumps absorb heat from the space to be cooled and release it deep underground. Thus, heat is drawn from the ground during the winter and deposited into the ground during the summer. Typically, geothermal systems work best when there is an annual balance between heating and cooling needs. Buildings that are not air-conditioned, or that have an extreme imbalance of loads are usually not good candidates for geothermal systems. However, it is common for buildings with moderate load imbalances to utilize a supplemental boiler or cooling device to handle peak or seasonal imbalances, with most of the heating and cooling being provided by the geothermal system.

The following are several potential advantages of geothermal systems:

- Environmentally friendly
  - Use electricity rather than fossil fuel, compatible with potential other renewable energy systems such as solar and/or wind
  - Do not create significant amounts of pollution
  - Sustainable, utilizing a renewable energy source.
  - Lower carbon footprint than conventional systems
- Possible Renewable Energy Tax Credits
  - It is recommended that an expert be consulted to determine what tax credits and other incentives may be applicable to the project.
- Contribute to energy efficiency LEED credits
- More efficient than conventional air-source systems
- Less fluctuation in annual operating costs
- Typically, no exposed outdoor equipment associated with the geothermal well field
- Can eliminate the need for flue stacks and ventilation (required for fuel burning equipment)
- Lower maintenance than conventional systems
  - Closed-loop systems require minimal maintenance. Systems that use antifreeze require loop fluid testing. If antifreeze or corrosion inhibitors are used, yearly testing is recommended to confirm that the fluid is not experiencing degradation, which is uncommon, but may occur if systems are operating for long periods of time outside the design temperature ranges.
- Longevity:
  - The materials associated with closed-loop systems, namely High-Density Polyethylene (HDPE) piping, come with a 50-year manufacturer's warranty. It is anticipated that the piping will outlive the warranty with no capacity degradation over time.
  - Conversely, the outdoor cooling equipment typically has a 15-year expected useful life. Therefore, three (3) replacements will be required before the loop warranty expires.

- Access: Permanent access is not required for either the vertical well heads or the horizontal circuit piping that runs from well to well and to the manifold in the mechanical room.

The following are several potential disadvantages:

- Higher first cost compared to a conventional boiler/chiller system
- Requirement of sufficient area to construct the well field
- Schedule
    - Installation of the geothermal wells and ground loop piping could add time to the construction duration depending how construction logistics are managed.
- Noise and vibrations from well drilling could be disruptive to abutters and potentially damage historic buildings.

Closed-Loop Geothermal Systems

In general, there are two main types of geothermal systems: closed-loop and open-loop. In consideration of the operations and maintenance which would be required for an open-loop system, along with the potential risks associated with permitting and water quality, an open-loop system is not recommended.

Closed-loop systems circulate a water-antifreeze solution in a continuous closed piping loop through the mechanical equipment (heat pumps or heat exchangers) and return the water-antifreeze solution to the well field. Closed-loop systems are often more reliable, require less maintenance in the long term, and have negligible potential environmental impacts versus an open-loop system which directly pumps groundwater. However, closed-loop systems generally have a higher upfront installation cost versus open-loop systems which results in a longer delay for return on the initial investment. Permanent access to the well heads or piping for a closed loop system does not need to be maintained.

Conventional closed-loop geothermal wells with HDPE U-bends or quad-loops (double U-bends) are typically installed to depths of about 400 to 800 feet below ground surface and spaced a minimum of 20 to 25 feet on center.

Permitting Requirements and Other Considerations

The MassDEP categorizes closed-loop geothermal wells as Class V closed-loop wells but no longer requires the filing of an Underground Injection Control (UIC) Registration application with Mass DEP provided that the well is installed and operated in accordance with MassDEP's *Guidelines for Ground Source Heat Pumps Wells*.

GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERS
2269 Massachusetts Avenue
Cambridge, Massachusetts 02140
(617) 868-1420

Using the Massachusetts online mapping tool, the site is understood to not be located within a Zone I area of a public water supply well (MassDEP Wellhead Protection Area) which is required by MassDEP for geothermal wells. Furthermore, the site is not located within a Zone II MassDEP Wellhead Protection Area either.

Other key permitting requirements outlined in the MassDEP UIC "Guidelines for Ground Source Heat Pump Wells" dated December 2013 include the following:

- Wells are required to be located more than 25 feet from "existing and potential sources of contamination including, but not limited to, septic tanks/fields, lagoons, livestock pens, and oil or hazardous materials storage tanks."
- Various design and setback requirements must be followed. Setback requirements include minimum distances as follow:
    - 10 feet from potable water and sewer lines
    - 50 feet from private potable water supply wells
    - 10 feet from surface water bodies
    - 10 feet from property lines without the expressed written permission of the abutter
- The project site is understood to not contain wetlands or wetland buffer zone and therefore is not anticipated to be subject to the Wetlands Protection Act regulations which would be governed by the local Conservation Commission.
- Per MassDEP guidelines, closed-loop wells are required to either be fully grouted or have a permanent steel casing installed a minimum of 15 feet into competent, unweathered bedrock.

A Well Permit is anticipated to be required from the Town of Medfield Board of Health. The Medfield regulations also contain setback requirements. At present, it is not known if the setback requirements apply to geothermal wells and are only applicable to private water wells. Regardless, these setback requirements include minimum distances as follow:

- 15 feet from any public or private way or street
- 10 feet from property lot lines
- 50 feet from any part of a septic system
- 100 feet from any leaching area
- 5 feet from any building or projection thereof

As indicated in the Phase I Environmental Site Assessment report prepared for the project dated May 19, 2022, we identified the following possible Recognized Environmental Conditions (RECs) with respect to the subject property:

- The release site associated with Release Tracking Number (RTN) 2-3020799 and the release of tetrachloroethylene (PCE) to soil and groundwater that originated from the southern extent of the former laundry building located on the subject property. This release is actively undergoing remediation under the supervision of others.
    - As a result of this, it is recommended that the geothermal well field and related components not be located to the west of Building 10 or Garden Street.
- Given the identified presence of Asbestos Contain Materials (ACM) within the existing buildings as well as the age and dilapidated condition of the existing buildings the possible presence of asbestos fibers and lead in the soil surrounding existing buildings is area of concern. Also given the historic use of the property the presence of underground utilities insulated with ACM is an area of concern.

Lastly, the location and future size of existing and proposed trees will need to be coordinated with the well field design. In general, large trees should be avoided near the well field as the roots could potentially damage the horizontal circuit piping. Ornamental trees and bushes near the well field may be acceptable.

Preliminary Loading Information and Well Field Sizing

The project MEP Consultant, R.W. Sullivan Engineering (RWS), provided the preliminary estimated peak heating/cooling load on the heat pumps for the buildings which are part of this study. In addition, RWS provided the typical peak load for the various unit types as follows: 1.25 tons/studio, 2 tons/1 bedroom, 3 tons/2 bedroom, and 3.5 tons/3 bedroom. It is understood that the well fields will not be utilized for domestic hot water (DHW) generation.

Since an hourly or monthly heating and cooling load profile was unavailable, accurate modeling using ground energy transfer software programs was not able to be performed. As such, typical “rules of thumb” were used to estimate the number of wells based on the provided peak loads which is typical for a preliminary evaluation.

The preliminary well field analysis considered a traditional 500-foot-deep single U-bend, which typically is considered to have approximately 2.3 to 3 tons of heating/cooling capacity per well. If the peak and total heating and cooling loads are relatively balanced, then the upper bound capacity per well may be applicable. However, at this preliminary stage with only peak loads available, we have assumed that the lower bound capacity of 2.3 tons of heating/cooling capacity per well is applicable. Furthermore, it is not known if the peak loadings provided will occur at the same or different time periods. If there is more diversity in the demand on the geothermal well field, meaning if the peak loads are not all occurring at the same time, then the well field will be more efficient and less wells may ultimately be required.

The following table summarizes the peak loads and estimated number of wells for each of the proposed well fields:

Building Nos.	Total No. of Units	Peak Load (Tons)	Estimated No. of 500' U-Bend Geothermal Wells
2 & 7	43	97	40 (4 circuits of 10 wells)
13	32	62	27 (3 circuits of 9 wells)
27A	49	118	50 (5 circuits of 10 wells)
15	9	23	10 (1 circuit of 10 wells)
All 27 [District Energy Solution]	334	698	300 (30 circuits of 10 wells)

The minimum recommended well spacing is 20 feet on center from adjacent wells. A preliminary well field siting studied was performed in conjunction with other members of the project team (ICON Architecture, VHB, and RWS) which considered the above-mentioned required setback requirements, the known location of existing below-grade utility tunnels which may contain ACM, and areas where future stormwater infiltration systems may be located. However, this preliminary study does not consider all potential conflicts such as existing and proposed underground utilities, setback distances from new water and sewer lines, and other items which are anticipated to further reduce the availability of space for the well field(s). These plans, which are entitled "District Energy Well Field Site Plan" and "Select Well Field Site Plan" are attached herein.

Based on the results of this study in conjunction with the above stated required number of wells for the various buildings, it appears that there may be sufficient area for well fields that serve some of the individual buildings, namely buildings 2 & 7, 13, and 27A. However, there does not appear to be sufficient space for either an individual well field to serve Building 15 nor for a centrally located well field large enough to meet the needs for a geothermal district energy approach.

Additional Considerations for Preliminary Geothermal and Mechanical Design

The following are additional considerations for preliminary design:

- The ground loop should be filled with a minimum 25% propylene glycol (PG) solution. The exact percentage of PG would be determined during the design phase.
- The undisturbed formation temperature is expected to be in the range of 50 to 54° Fahrenheit.

- The minimum Entering Water Temperature (EWT) in heating on the heat pumps should be a maximum of 45° Fahrenheit. A lower minimum EWT may reduce the required size of the well field(s).
- The maximum EWT in cooling on the heat pumps should be a minimum of 85° Fahrenheit. A higher maximum EWT may also reduce the required size of the well field(s).
- To eliminate exposure of the building loop to the water and PG solution in the ground loop, it is understood that plate heat exchangers (HX) with an approach temperature of 2° Fahrenheit may be specified by RWS.
    - A benefit of HX is that PG may not be needed in the building loop(s) if the temperature of the building loop(s) will be above freezing.
    - A negative of HX is that the well field will be slightly less efficient due to the need to account for the approach temperature on the HX.
        - For example, to account for the approach temperature on the well field design, the minimum EWT would be higher (47° Fahrenheit) and the maximum EWT would be lower (83° Fahrenheit).
- For preliminary consideration, the closed loop wells would contain 1-1/2-inch diameter, SDR 11 HDPE U-bend assemblies with 1.2 Btu/hr-ft-°F thermal grout.

Preliminary Cost Estimate

Based on the anticipated subsurface conditions, our experience with similar recent projects, and the assumptions stated herein, the following are the rough order of magnitude preliminary estimated costs for the building specific and district energy well fields discussed herein:

Building Nos.	Required Number of Wells	Well Field Cost	Excavation, Bedding & Backfilling Cost	Off-Site Removal of Excess Soil Cost	Total Estimated Cost	Feasible or Not Feasible Based on Space for Wells?
2 & 7	40	$940,000 ($23,500/Well)	$190,000	$135,000	*$1,265,000**	*Feasible*
13	27	$634,500 ($23,500/Well)	$60,000	$45,000	*$739,500**	*Feasible*
27A	50	$1,175,000 ($23,500/Well)	$115,000	$90,000	*$1,380,000**	*Feasible*
15	10	$235,000 ($23,500/Well)	$25,000	$15,000	*$275,000**	*Not Feasible*
All [District Energy Study]	300	$6,450,000 ($21,500/Well)	$325,000	$300,000	*$7,075,000***	*Not Feasible*

We made the following assumptions regarding the estimated costs:

- *Pricing assumes geothermal well circuit piping terminates in the building mechanical room at a manifold to be installed by the geothermal contractor and that no geothermal vaults are required.
- **Pricing assumes four (4) geothermal vaults are required for the district energy approach and that piping from a circuit maker vault leads to the central heating/cooling plant in Building 10.
- No costs are included for any below-grade utilities other than the geothermal piping associated with the geothermal well field(s). For instance, the cost of chilled water and steam pipes are not included herein.
- Prevailing wage rates are included.
- Excavation cost includes bedding material and backfill for circuit piping and runouts.
- Dewatering costs are included.

- Off-site removal of excess soil assumes drill spoils and material displaced in trenching by bedding and piping and vaults are disposed of off-site at an unlined landfill.
- No costs are included for removal of existing utilities or other subsurface obstructions.
- No costs are included for the handling of ACM.
- No rock excavation is assumed to be required for the geothermal trenching.
- 60 feet of permanent steel casing is assumed for each well.
- Soft costs associated with geothermal test wells and the quality assurance/quality control monitoring of the well field installation and commissioning are not included.

Conclusions

The following are our conclusions based on the above:

- Building Specific Approach
  - A building specific approach is anticipated to be feasible since there may be sufficient area to site individual geothermal well fields to provide the heating and cooling needs to some, but not all, of the existing buildings.

- District Energy Approach
  - A district energy approach is not anticipated to be feasible for the following reasons:
    - Lack of sufficient area to site a well field of the required size.
    - Installation of geothermal piping below the public roadways to connect the centrally located well field to the heating and cooling plant in Building 10 may not be allowed. This also applies to the new network of chilled water and steam pipes which would need to be constructed leading from Building 10 to each building.
      - Installation of this piping is likely to encounter numerous active and abandoned below-grade structures and utilities, some of which likely contain ACM. The cost to install this piping, and to address ACM and other potential oil and/or hazardous materials is presently unknown and represents a potential unknown significant cost.

In conclusion, for the reasons stated herein a building specific approach with individual geothermal well fields servicing the needs of some, but not all, of the individual buildings is considered feasible. However, a geothermal district energy approach is not considered to be feasible.

Future Considerations

If it is decided to pursue geothermal further, the following should be considered:

- Detailed energy models with hourly heating and cooling loads should be performed to determine the energy performance requirements for the selected geothermal design option. The HVAC equipment (e.g., heat exchanger, heat pump) efficiency is a direct function of the geothermal design.
- Using the detailed energy models, modeling using ground energy transfer software programs is recommended to be performed to validate the estimated well quantities contained herein to verify that a geothermal well system is technically valid.
- Additional coordination to understand the relationship between existing and proposed trees, existing utilities, and other below-grade structures and the proposed well fields is required to determine how many wells could be installed and where.
- If a geothermal system remains viable as the project design progresses, geothermal test wells should be installed at each of the proposed well field locations and thermal conductivity tests performed to determine ground conditions for use in modeling a geothermal system.
    - The test wells would provide valuable geologic information for bidding including the depth to bedrock, the approximate amount of steel casing required, the bedrock type, the rate of advancement, and the presence of significant water bearing zones. This information would reduce, but not eliminate, the potential for change orders due to unanticipated geologic conditions.

Closing

We trust that the above is sufficient for your present requirements. Should you have any questions, please do not hesitate to call us.

Attachments:

- "District Energy Well Field Site Plan" and "Select Well Field Site Plan"

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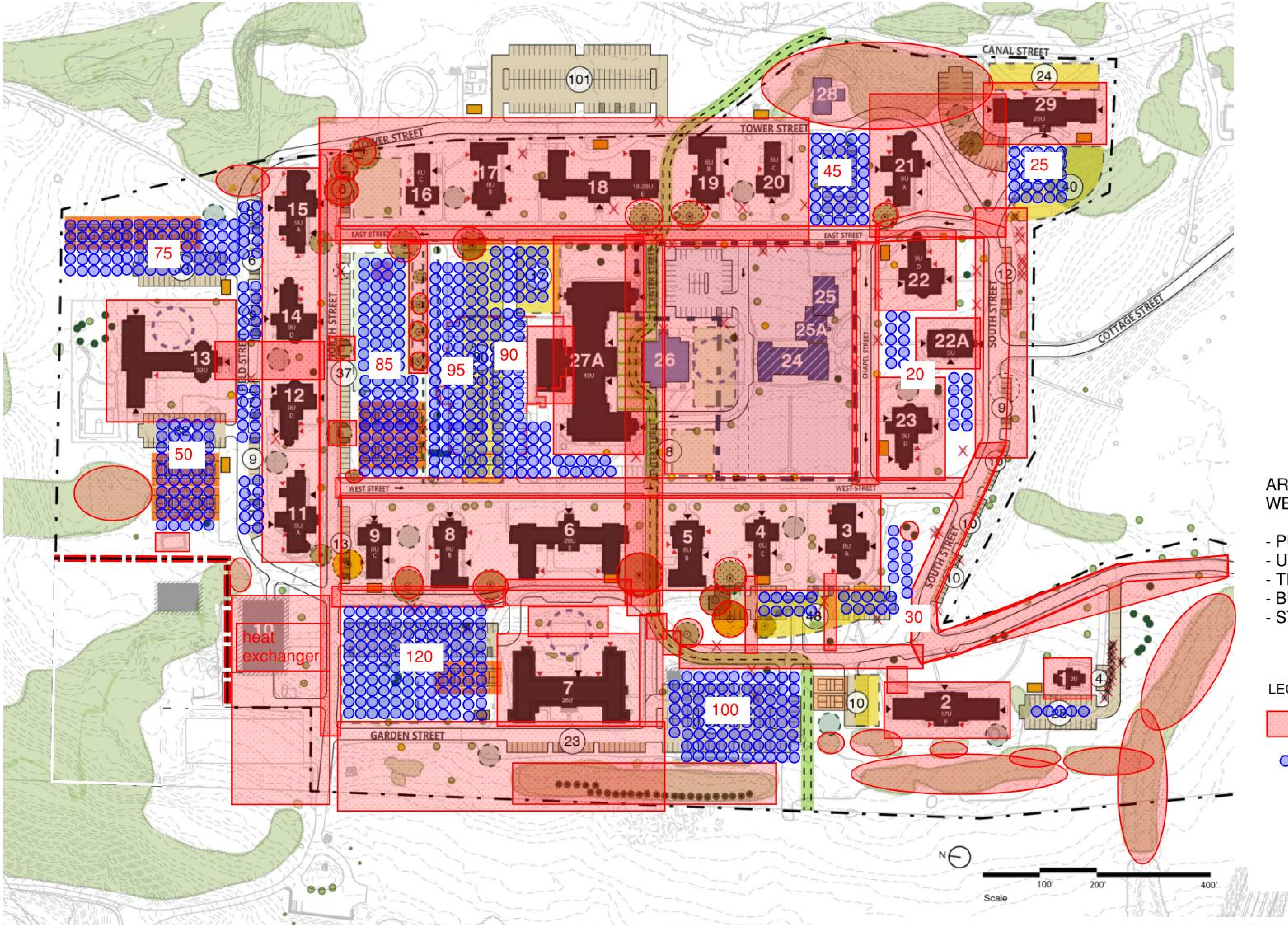


AREAS EXCLUDED FROM GEOTHERMAL WELLS ARE SHOWN IN RED:

- PUBLIC EASEMENTS
- UTILITY TUNNNELS + PATHWAYS
- TREE CANOPIES
- BUILDING FOOTPRINTS (15' OFFSET)
- STORMWATER SYSTEM

LEGEND:

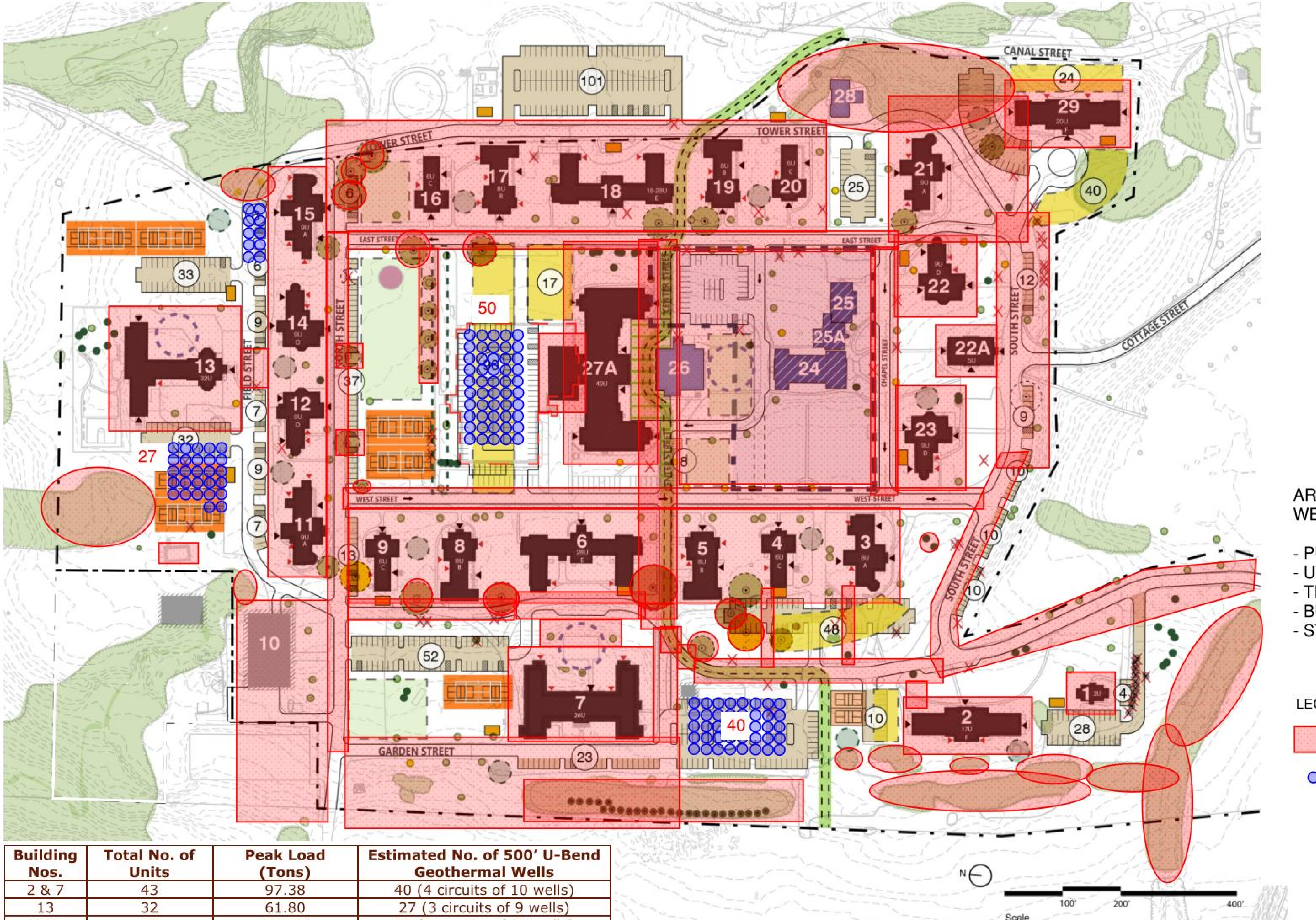
NOT VIABLE FOR GEOTHERMAL WELLS

SINGLE WELL, 20' spacing

District Energy Well Field Site Plan

Medfield State Hospital Redevelopment Geothermal Study

Prepared for Trinity Financial Acquisitions, LLC, By ICON Architecture, McPhail Associates, VHB, and R.W. Sullivan
2022-11-29



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- TREE CANOPIES
- BUILDING FOOTPRINTS (15' OFFSET)
- STORMWATER SYSTEM

LEGEND:

NOT VIABLE FOR GEOTHERMAL WELLS

SINGLE WELL, 20' spacing

Building Nos.	Total No. of Units	Peak Load (Tons)	Estimated No. of 500' U-Bend Geothermal Wells
2 & 7	43	97.38	40 (4 circuits of 10 wells)
13	32	61.80	27 (3 circuits of 9 wells)
27A	49	117.50	50 (5 circuits of 10 wells)
15	9	23.00	10 (1 circuit of 10 wells)

Select Well Field Site Plan

Medfield State Hospital Redevelopment Geothermal Study

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