



State of Connecticut Capital Area System

Thermal Energy Plant Site Evaluations DRAFT

PREPARED FOR:
State of Connecticut

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1. EXECUTIVE SUMMARY

The State of Connecticut owns a thermal energy pumping and distribution piping network which runs throughout downtown Hartford. This piping network, known as the Capitol Area System (CAS), supplies State and private facilities with both hot and chilled water for conditioned air and domestic hot water heating. At present, Capitol District Energy Center Cogeneration Association (CDECCA) is contracted to supply steam and chilled water from their power plant located at 490 Capitol Avenue to the state-owned pump house where heat exchangers convert steam to hot water and pumps transport hot and chilled water throughout the energy distribution network.

This document provides high level technical and financial site evaluations for a new thermal energy plant (TEP) to serve the Capitol Area System (CAS) thermal distribution network in downtown Hartford, CT. The proposed TEP will include hot water boilers, electric chillers, and pumps sized to match the existing load of the CAS. In order to optimize the use of the property, the TEP will likely be constructed within a new parking garage. A phased approach may be used for this project with the TEP constructed first, perhaps underground, with the parking garage structure built at a later time.

Methodology and Results

To compare each site equally, the sites were evaluated by a set of “comparison criteria”. Similar criteria were then grouped together into “comparison criteria sections” and were then assigned a “criteria weight”. This criteria weight number represents the relative importance of the comparison criteria section to the others. Each site receives a ranking number from 1 to 3 for each comparison criteria section and is then multiplied by that criteria weight for that section. The total scores for each comparison criteria section are then added together. Sites with the highest scores have the highest probability of success and therefore are recommended as the top option for a new plant. Table 1-1 shows each comparison criteria section evaluated and the corresponding criteria weight assigned to that section.

Table 1-1: Comparison Criteria Sections and Weight

Comparison Criteria Section	Criteria Weight
Infrastructure Size and Proximity	2
Project Cost Comparison	3
Location Impact	3
Structure Dimensions	2
Parking Impact	1

The sites evaluated within this report include Lot A, 25 Sigourney Street, the Cap Ave Complex, and 340 Capitol Avenue.

Table 1-2 shows the final results of the site evaluation with a high score reflecting a site with more advantages than a site with a lower score.

Table 1-2: Site Evaluation Results

Comparison Criteria	Lot A	25 Sigourney	Cap Ave Complex	340 Capitol Ave
Total Score	28	18	30	32
Current Use of Property	Parking Lot	Parking Garage [Presently Unoccupied]	Parking Lot	Parking Lot

Of these sites, 340 Cap Ave has been selected for its advantages over the other potential TEP sites. These advantages include:

- A central location on the CAS
- Closer proximity to CAS piping
- Closer proximity to Utilities
- Lower Residential Impact
- Lower Commercial Impact
- Minimal issues with Cooling Tower placement
- Minimal issues with Stack / Emissions
- Lower Impact with State Operations
- Lower Impact during Demolition
- Lower Cost of Demolition
- Lower Impact during Construction
- Potentially Larger Available Footprint

Though the site has many advantages, it does carry with it the disadvantage of sitting over the Park River Conduit, also known as the Aqueduct. If this section of the Aqueduct is not structurally capable of withstanding the weight of a building, or if the Authority Having Jurisdiction for this Aqueduct does not permit construction over this area, then the footprint of the parking garage that would potentially house the new TEP would be greatly reduced. That being said, 340 Cap Ave still carries the highest score and therefore remains the top choice.

When selecting a site, particular attention should be taken to address the proximity of the cooling towers and the stack to residences, commercial buildings, and I-84. In addition, due to the reduction in CAS line size at distance from the existing pump house, a TEP that is centrally located on the CAS will have greater potential for success. End-user flow rates through the sites' smaller CAS lines should be evaluated further if either 25 Sigourney or Lot A are selected.

I-84 to Grade

The Connecticut Department of Transportation has been working with a consultant, TranSystems, to evaluate the cost to lower I-84 to grade. This roadwork has the potential to create significant interferences between the highway and the proposed sites. TranSystems, has provided a draft map which displays the expected routing of I-84 through the city following the modifications. This draft map, "Alternative 3B", can be seen at the end of the report in Attachment A.

2. TECHNICAL EVALUATION

2.1. FACILITY SIZE AND DESCRIPTION

A facility footprint estimate of approximately 15,000 square feet was taken from a preliminary site evaluation and design, performed by SourceOne in the fall of 2014, which utilized the existing pump house for the TEP site. In addition to floor space, the facility will require approximately 5,500 square feet of rooftop space for a bank of cooling towers. The 15,000 square foot footprint allows sufficient space for the following:

- Three 15 MMBTU Hot Water Boilers
- Three 1800 Ton Electric Chillers
- Boiler Chemical Treatment
- Electrical Switchgear
- Control Room
- Distribution Pumps

The pump house, which is owned by the State, contains chilled water and hot water pumps that will provide flow through the CAS. It should be noted that the footprint of 15,000 square feet was driven by the desire to locate the new TEP within the existing footprint of the pump house; therefore the design is optimized with respect to required area. Final TEP design footprint is subject to change; however the 15,000 square foot value provides an adequate placeholder at this stage of project development and site evaluation.

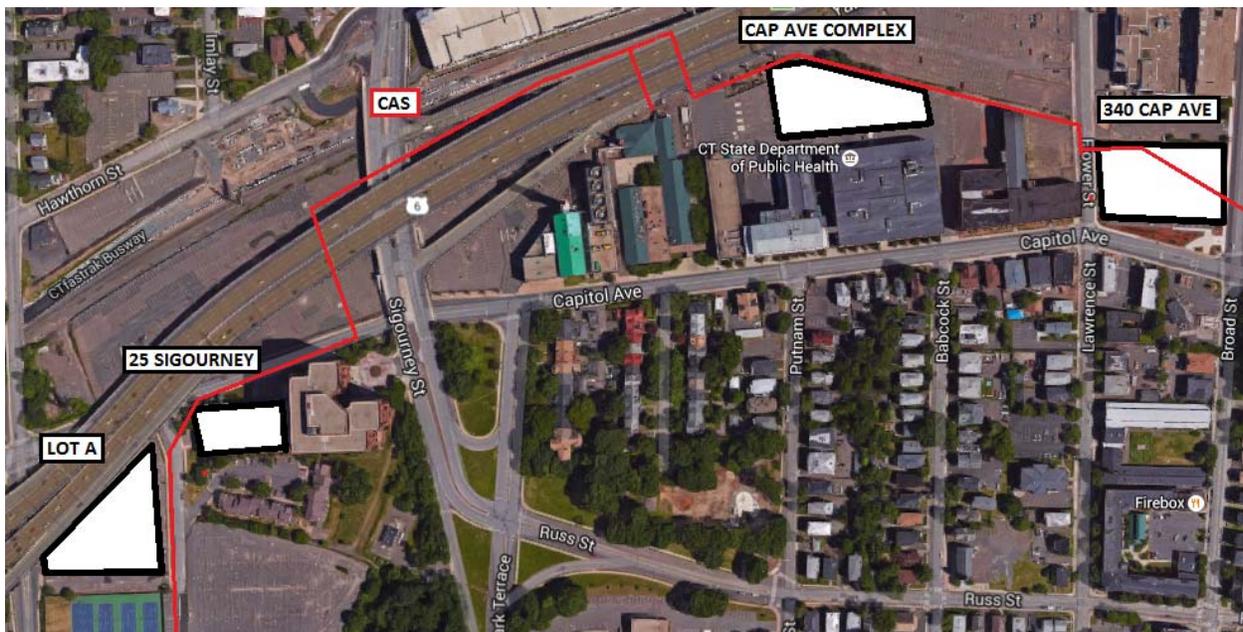
2.2. STATE OF CONNECTICUT SITE SUGGESTIONS

The State suggested that a total of four state-owned sites be comparatively and parametrically evaluated for the new TEP. To better utilize the real estate footprint, it was suggested that a parking garage be constructed to house the TEP in the ground or sub-ground floor(s). The structure would also provide sufficient height for the use of cooling towers in the congested downtown business park sites. The following sites were suggested by the State to be evaluated.

Site Name	Site Address
“Lot A”	57 Woodbine Street
“25 Sigourney”	25 Sigourney Street
“Cap Ave Complex”	410 Capitol Avenue
“340 Cap Ave”	340 Capitol Avenue

Figure 2.2-1 is a high elevation photograph that includes all of the four proposed sites. Within this figure, the CAS has been overlaid to show its proximity to each site.

Figure 2.2-1: Site Map Overview



* Locations are approximate.

2.3. SITE EVALUATIONS

The following table presents the comparison criteria, parameters and results of SourceOne’s rank and score methodology. This table was prepared to focus on infrastructure size and proximity, as well as a comparison of project costs between the sites, the issues that might impact the project based on location, including parking and the footprint available for the structure.

Table 2-1: Site Evaluations, provides an overview of the findings for the following sites. In this table, high scores suggest a site that has more advantages than sites with lower scores. Full descriptions of the site “Comparison Criteria” listed on the left side of the table can be found in section 2.4: Comparison Criteria Descriptions.

Table 2-1: Site Evaluations

Comparison Criteria	Lot A	25 Sigourney	Cap Ave Complex	340 Cap Ave
Total Score	28	18	30	32
Current Use of Property	Parking Lot	Parking Garage [Presently Unoccupied]	Parking Lot	Parking Lot
Infrastructure Size and Proximity [Criteria Weight = 2]				
Section Score	2	2	2	3
CAS Proximity	<50 ft	<50 ft	<50 ft	<50 ft
Hot Water Line Size	12"	12"	14"	14"
Chilled Water Size	20"	20"	20"	20"
City Sewer Proximity	100'	100'	250'	100'
City Water Proximity	100'	100'	250'	100'
Natural Gas	100'	100'	250'	100'
Electrical Proximity	100'	100'	250'	100'
Project Cost Comparison [Criteria Weight = 3]				
Total Score	3	2	3	3
Demolition Impact	NA	Low	NA	NA
Demolition Cost	NA	High	NA	NA
Construction Impact	Low - impact to parking	Medium - impact to residential area and parking	Low - impact to parking	Low - impact to parking
Construction Cost	Equivalent, for purposes of this comparative summary			
Infrastructure / Piping Cost	Equivalent, for purposes of this comparative summary			
Location Impact [Criteria Weight = 3]				
Total Score	3	1	3	3
Construct Parking Garage	Yes	Yes	Yes	Yes
Cooling Tower Impact	Moderate	High	Low	Low
Park River Conduit Impact [Aqueduct]	No	No	No	Potentially
Residential Impact	Low	Moderate	Low	Low
Commercial Impact	Low	Low	Low	Low
Stack / Emissions Impact	Low	High	Low	Low
State Operations Impact	None	None	Low	None
Logistical Delivery Issues	None	None	None	None
Space for Fuel Oil Storage	Yes	Yes	Yes	Yes

Comparison Criteria	Lot A	25 Sigourney	Cap Ave Complex	340 Cap Ave
Noise Impact	Low	Low	Low	Low
Temp. Boiler & Chiller Space	Yes	Yes	Yes	Yes
Structure Dimensions [Criteria Weight = 2]				
Total Score	2	1	3	3
Available Footprint	35,000 sq ft	27,000 sq ft	41,500 sq ft	43,750 sq ft
Available Footprint [If footprint is impacted by Park River Conduit]	No Impact	No Impact	No Impact	18,750
Parking Impact [Criteria Weight = 1]				
Total Score	2	3	2	2
Parking Displacement (# of Spaces) [During Construction]	~200	NA	~160	~150
Notes				
Greatest Potential Issues	Proximity to I-84.	Proximity to I-84. Demolition of existing garage. Proximity of stack to existing building. Proximity of cooling towers to existing building.	Proximity to I-84.	Proximity to Park River Conduit (Aqueduct).

2.3.1. Site Evaluation Summaries

The following sections provide summaries of each of the four locations along with an aerial photograph which displays the proposed parking garage location, which shall contain the TEP, and the location of the hot water and chilled water CAS piping. An orange footprint of 15,000 square feet, which is the minimum expected size of the TEP, is also shown on each photograph for relative position and size purposes only.

2.3.2. Lot A

This parking lot, which is closely situated to 25 Sigourney, is located on the western side of the CAS. In this section, the hot water line size is slightly reduced from 14" to 12" and then again from 12" to 6". Locating the TEP at one end of the CAS poses flow rate and heat loss issues. This lot is also closely situated to I-84 which, in the short term before the highway is lowered, may require a much higher stack height.

At present, the plans to lower I-84 to grade may require that a significant portion of the existing parking garage footprint be repurposed for the highway. With this in mind, this site should be avoided. Attachment A, at the end of this document, shows the proposed path through this area. Figure 2.3-1 shows the site and the CAS. The black triangular area covers approximately 35,000 square feet. It should be noted that utilities (Natural Gas, Electrical, City Water, City Sewer) are at Woodbine Street.

Figure 2.3-1: "Lot A" [57 Woodbine Street]

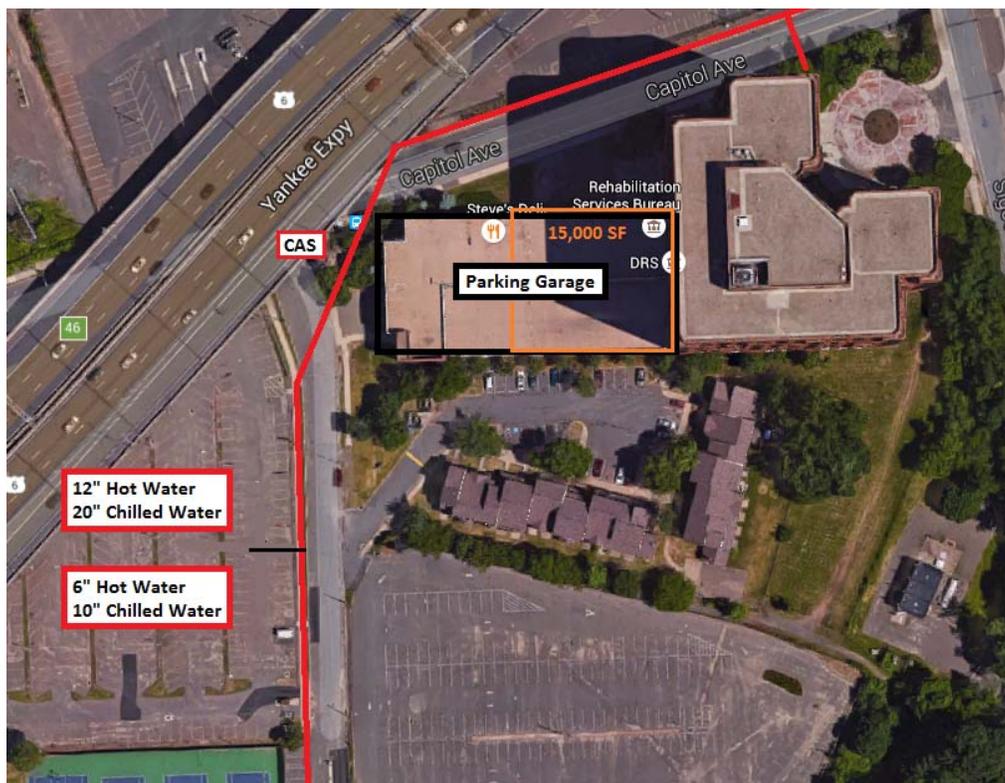


2.3.3. 25 Sigourney

This site is on the western side of the CAS and is comprised of a high rise office building and a parking garage. It has close proximity to the CAS and also to Lot A. The parking garage is a post tension concrete structure, is beyond repair, and will be demolished in the near future. The State also has plans to mothball the office building due to other issues. With its close proximity to the office building and I-84, this site poses potential problems for both the stack height and placement of the cooling towers.

At present, the plans to lower I-84 to grade may require that a significant portion of the existing parking garage footprint be repurposed for the highway. With this in mind, this site should be avoided. Attachment A, at the end of this document, shows the proposed path through this area. Figure 2.3-2 shows the 25 Sigourney site and the CAS. The black rectangular area, which covers the footprint of the existing parking garage, is approximately 27,000 square feet. It should be noted that utilities (Natural Gas, Electrical, City Water, City Sewer) are at Capitol Avenue.

Figure 2.3-2: "25 Sigourney"



2.3.4. Cap Avenue Complex

The Cap Ave Complex has a very large parking lot on the northern side of the property which borders I-84, the CAS, and the Park River Conduit. Though the proposed site has a close proximity to the Conduit, it will not impact construction at this site. The buildings within the Cap Ave Complex are occupied office spaces. Figure 2.3-3 shows the location of the site, the CAS piping system, the pump house, and the location of the Park River Conduit. The black rectangular area covers approximately 41,500 square feet. It should be noted that utilities (Natural Gas, Electrical, City Water, City Sewer) are at Capitol Avenue.

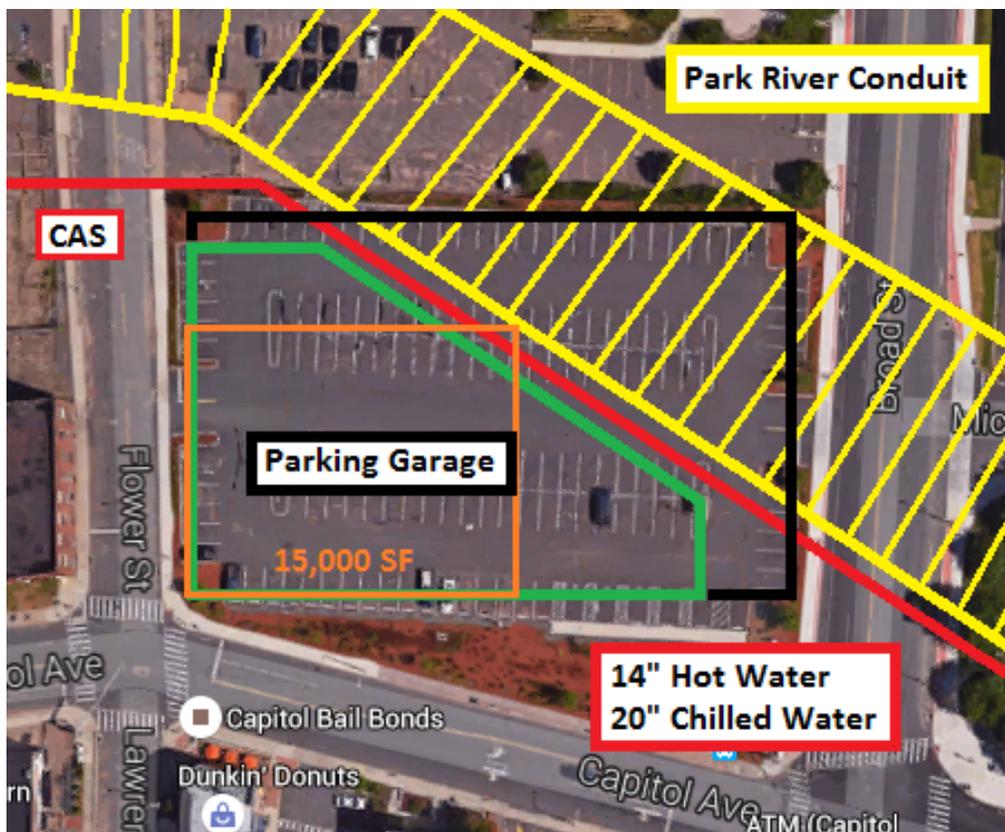
Figure 2.3-3: “Cap Ave Complex” [410 Capitol Avenue]



2.3.5. 340 Cap Ave

This site is currently a parking lot under which the Park River Conduit runs. Prior to the use of this area as a parking lot, a building of considerable age had been located here and was razed after it was observed to be sinking. This area may be prone to underground flooding from the Park River Conduit but modern geotechnical techniques should provide a solution. Detailed depth maps of the Park River Conduit system could not be located at the time of this evaluation. Figure 2.3-3 shows the site, the Park River Conduit, and the CAS. The black rectangular area covers 43,750 square feet and the green triangular area covers 18,750 square feet. This green triangular area represents the maximum building footprint if the Authority Having Jurisdiction does not permit the State to build over the Park River Conduit. It should be noted that utilities (Natural Gas, Electrical, City Water, City Sewer) are at Capitol Avenue.

Figure 2.3-4: "340 Cap Ave"



2.4. COMPARISON CRITERIA DESCRIPTIONS

This section provides definitions for the table labels listed above.

Current Use of Property (Existing Use)

The proposed sites of Lot A, the Cap Ave Complex, and 340 Cap Ave are all presently being utilized as parking areas. 25 Sigourney, although presently a parking garage, is not in use because of disrepair.

Infrastructure Size and Proximity

Criteria Weight (x2)

- *CAS Proximity* – Distance from the center of the proposed site from the nearest CAS tie-in point.
- *Hot Water Line Size* – Size of the CAS hot water supply and return lines at the “CAS Proximity” distance.
- *Chilled Water Size* – Size of the CAS chilled water supply and return lines at the “CAS Proximity” distance.
- *City Sewer Proximity* – Distance from the center of the proposed site to the nearest city sewer tie-in point.
- *City Water Proximity* – Distance from the center of the proposed site to the nearest city water tie-in point.
- *Natural Gas Proximity* – Distance from the center of the proposed site to the nearest natural gas tie-in point.
- *Electrical Proximity* – Distance from the center of the proposed site to the nearest electrical tie-in point.
- *Voltage* – Description of the voltage available at the “Electrical Proximity” distance.

Project Cost Comparison

Criteria Weight (x3)

- *Demolition Impact* – How severely the demolition of existing structures will impact local residents, commercial buildings, or existing state operations.
- *Demolition Cost* – How the demolition cost of each site compares to the others.
- *Construction Impact* - How severely construction will impact local residents, commercial buildings, or existing state operations.
- *Construction Cost* – How the construction cost of each site compares to the others.
- *Infrastructure / Piping Cost* – Relative cost of the upgrades required to be made to the CAS.

Location Impact

Criteria Weight (x3)

- *Construct Parking Garage* – Parking Garage to be constructed at this site.
- *Cooling Tower Impact* – Impact of the cooling towers on nearby residential area, commercial area, or state operations.
- *Park River Conduit Impact [Aqueduct]* – Whether or not the Park River Conduit [Aqueduct] will impact the footprint of the site.
- *Residential Impact* – Potential for TEP to impact the local residential area.
- *Commercial Impact* – Potential for TEP to impact the local commercial area.
- *Stack / Emissions Impact* – Impact that the stack and emissions will affect the local residents, commercial buildings, or state operations.
- *State Operations Impact* – Impact that the TEP will have on state operations in this area.
- *Logistical Delivery Issues* – Issues that may arise in this location regarding the delivery of equipment or fuel oil (if necessary).
- *Space for Fuel Oil Storage* – Adequate space underground to store fuel oil tanks (if necessary).
- *Noise Impact* – How severely the noise will generated by the TEP will affect the local resident and commercial buildings.
- *Temp. Boiler & Chiller Space* – Whether or not there is sufficient space to store a temporary boiler or chiller in the event that one is needed.

Structure Dimensions [Facility Requires Approximately 15,000 sq ft]

Criteria Weight (x2)

- *Available Footprint* – Total area of the footprint of the proposed parking garage.
- *Available Footprint If Park River Conduit Impacts [Aqueduct]* - Total area of the footprint of the proposed parking garage if the Park River Conduit (Aqueduct) reduces the footprint.

Parking Impact

Criteria Weight (x1)

- *Parking Displacement [During Construction]* – The number of parking spaces that will be lost temporarily during construction.

Notes

- *Greatest Potential Issues* – Issues that are unique to this site that carry cost implications.

3. RECOMMENDATIONS

Of the site evaluated, 340 Cap Ave has been selected for its advantages over the other potential TEP sites including.

- A central location on the CAS
- Closer proximity to CAS piping
- Closer proximity to Utilities
- Lower Residential Impact
- Lower Commercial Impact
- Minimal issues with Cooling Tower placement
- Minimal issues with Stack / Emissions
- Lower Impact with State Operations
- Lower Impact during Demolition
- Lower Cost of Demolition
- Lower Impact during Construction
- Potentially Larger Available Footprint

Though the site has many advantages, it does carry with it the disadvantage of sitting over the Park River Conduit, also known as the Aqueduct. If this section of the Aqueduct is not structurally capable of withstanding the weight of a building, then the footprint of the parking garage will be greatly reduced. That being said, 340 Cap Ave will still carry the highest score of the site comparison.

Both 25 Sigourney and Lot A have many potential construction issues including proximity to the highway, distance from the center of the CAS and, in the case of 25 Sigourney, potential issues with the high rise office building. Due to their many issues, it is not advised that these sites be used to house the TEP.

Attachment A

