

Mount Vernon District Energy System

Final Report | Report Number 24-36 | March 2024



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Mount Vernon District Energy System

Final Report

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Preferred Citation

New York State Energy and Research Development Authority (NYSERDA). 2024. "Mount Vernon District Energy System, Final Report" NYSERDA Report Number 24-36. Prepared by Endurant Energy, New York, NY. nysesda.ny.gov/publications

Abstract

This study assesses the technical and economic viability of various district thermal system options as alternatives to conventional, building-specific heating, ventilation, and air conditioning (HVAC) systems. All configurations analyzed offer substantial operational improvements and reductions in carbon emissions compared to business-as-usual (BAU) scenarios. The preferred district system would reduce annual emissions by approximately 800 tons, a 55% reduction relative to business-as-usual, and yield annual utility cost savings of \$160,000 to \$180,000. Additionally, the system would enhance resilience, lower long-term maintenance needs, and future-proof connected buildings against anticipated carbon pricing, fossil fuel restrictions, and electrification mandates.

While initial capital costs exceed those associated with retaining existing systems, the district options provide a lower 25-year lifecycle cost when conventional HVAC system replacement costs are considered. To improve economic viability and support long-term implementation, the study recommends two complementary strategies: (1) expanding the district system to include neighboring properties, thereby increasing system revenues and reducing unit costs, and (2) pursuing external funding opportunities from municipal, county, state, and federal sources to offset capital expenses. The town is advised to assess the regulatory feasibility of each district system option and engage with relevant stakeholders to advance project development.

Keywords

district thermal systems, carbon emissions reduction, operational efficiency, lifecycle cost analysis, system replacement, utility cost savings, system resilience, building electrification readiness, carbon pricing mitigation, fossil fuel phase-out compliance, capital cost management, public-private partnerships, interconnection strategy, decarbonization feasibility study, regulatory feasibility assessment, funding opportunities, energy infrastructure investment planning

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Acronyms and Abbreviations

/gal	per gallon
°C	degrees Celsius
°F	degrees Fahrenheit
AC	air conditioning
AHU	air handling unit
AIM Act	American Innovation and Manufacturing Act of 2020
AMI	Area Median Income
Army Corps	U.S. Army Corps of Engineers
ASHP	air-source heat pumps
BAU	business as usual
BOD	biochemical oxygen demand
Btu	British thermal units
Btu/h/ft/°F	British thermal units per foot per degree Fahrenheit
CAA	Clean Air Act
CAPEX	capital expenditures
CARB	California Air Resources Board
CCTV	closed-circuit television
cfm	cubic feet per minute
CIPP	cured-in-place pipe
CME	Christian Methodist Episcopal
CMOM	Sanitary Sewer System Capacity, Management, Operations, and Maintenance Plan
CO2	carbon dioxide
CO2e	carbon dioxide equivalent
Con Ed	Consolidated Edison, Inc.
CSI&R	Comprehensive Sewer Investigation and Rehabilitation
CWA	Clear Water Act
CZMA	Coastal Zone Management Act
DEC	New York State Department of Environmental Conservation
DEIS	Draft Environmental Impact Statement
DHW	domestic hot water
DOJ	U.S. Department of Justice
DOT	Department of Transportation
DPW	Department of Public Works
DX	direct expansion
EAF	Environmental Assessment Form
ECL	New York State Environmental Conservation Law

EER	energy efficiency ratio
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERV	energy recovery ventilation
ETS	energy transfer station
ft	foot or feet
GHG	greenhouse gas
GHX	ground heat exchanger
gpm	gallons per minute
GSHP	ground-source heat pump
GWP	global warming potential
HCR	New York State Homes and Community Renewal
HEFPA	Home Energy Fair Practices Act
HFCs	hydrofluorocarbons
HOME Program	HOME Investment Partnerships Program (HOME Program)
HUD	Department of Housing and Urban Development
HVAC	heating, ventilation, and air conditioning
I&I	inflow and infiltration
IRA	Inflation Reduction Act
IRS	Internal Revenue Service
ITC	investment tax credit
kBtu	kilo-British thermal unit
kW/MBH	kilowatts per thousand British thermal units per hour
kW/ton	kilowatts per ton
kWh	kilowatt hours
kWh/year	kilowatt hours per year
kWth	kilowatt thermal
MMBtu	million British thermal units
MS4	municipal separate storm sewer system
MSA	Metropolitan Statistical Area
MWth	megawatts thermal
NEPA	National Environmental Policy Act
NGO	nongovernmental organizations
NPDES	National Pollution Discharge Elimination System
NWM	National Water Main
NYS Parks	New York State Office of Parks, Recreation and Historic Preservation
ORES	Office of Renewable Energy Siting
POTW	Publicly Owned Treatment Works
PSC	Public Service Commission

PV	photovoltaic
SDWA	Safe Drinking Water Act
SEQRA	State Environmental Quality Review Act
Sewer Act	[Westchester] County Environmental Facilities Sewer Act
SF	square foot or feet
SHPO	State Historic Preservation Office (SHPO)
SHX	sewer heat exchanger
SNAP	Significant New Alternative Policy
SPDES	State Pollutant Discharge Elimination (SPDES)
SSES	Sewer System Evaluation Survey
SWPPP	Stormwater Pollution Prevention Plan
Treasury	U.S. Department of the Treasury
TSS	Ten State Standards
USPS	U.S. Postal Service
VAV	variable air volume
VRF	variable refrigerant flow
WCDEF	Westchester County Department of Environmental Facilities
WET	Wastewater Energy Transfer
WSHP	water-source heat pump

Executive Summary

The development of a district thermal energy system in Mount Vernon, NY, is intended to provide an efficient, flexible, and sustainable means of delivering heating and cooling services to a combination of new and existing buildings within a defined service area. By using a combination of ground-source heat pumps (GSHPs), air-source heat pumps (ASHPs), and thermal energy recovery from public sewers, the proposed system would reduce reliance on conventional fossil-fuel-based systems, lower greenhouse gas emissions, and enhance local energy resilience. This study explores the technical, regulatory, and financial This section outlines the significant project design features that carry regulatory implications and compares the proposed centralized system with potential decentralized alternatives from a regulatory standpoint.

1 Project Area and Development Background

Mount Vernon, NY, is situated in Westchester County just north of the Bronx and west of Yonkers. The city has a population of approximately 75,000 people. The northern section of Mount Vernon consists predominantly of residential areas, while the southern section contains municipal buildings and the central business district. Metro-North Railroad operates the Mount Vernon East station, which lies at the center of this study’s area of interest. Mount Vernon continues to experience an increasing rate of development.

The City of Mount Vernon, in partnership with local developers, community leaders, building owners, and Westchester County, seeks to explore the technical and economic potential of a district thermal system. The proposed district thermal energy system would serve both new and existing buildings. A joint development between Trinity Financial, Comrie Enterprises, LLC, and Direct Invest Development, LLC, is constructing a new building at 20 S. 2nd Ave. This project includes 317 residential units and commercial space on the ground floor.

In addition to the new building at 20 S. 2nd Ave., surrounding buildings have expressed interest in participating in and connecting to a district thermal system. Table 1 lists the buildings considered in this study, and Figures 1 and 2 illustrate their locations on the site map.

Table 1. Buildings Considered as Participants in the District Thermal System

Building	Address
Mount Vernon Public Library	28 S. 1st Ave.
Mount Calvary CME Church	39 S. 2nd Ave.
Westchester County Office Building	100 E. 1st St.
Westhab Inc.	17 S. 2nd Ave.
USPS	15 S. 1st Ave.
20 S. 2nd Ave.	20 S. 2nd Ave.

Figure 1. Map of Mount Vernon Study Area

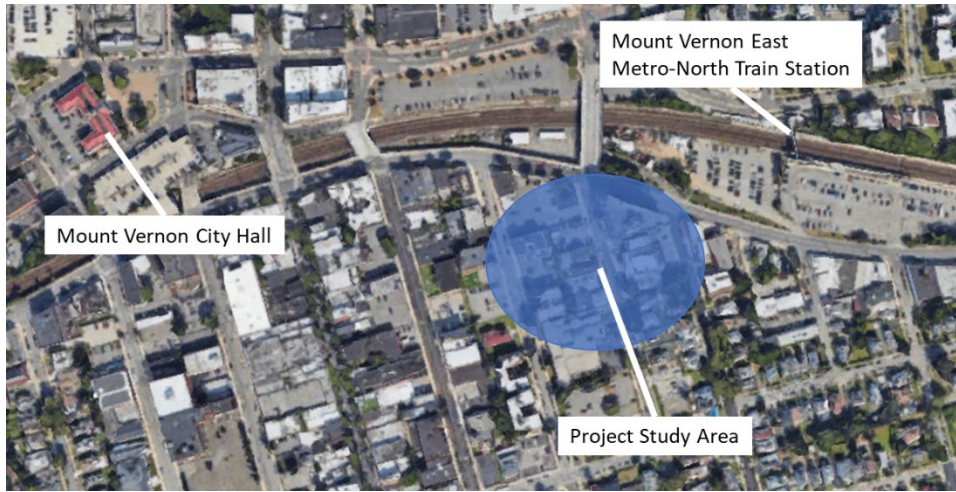
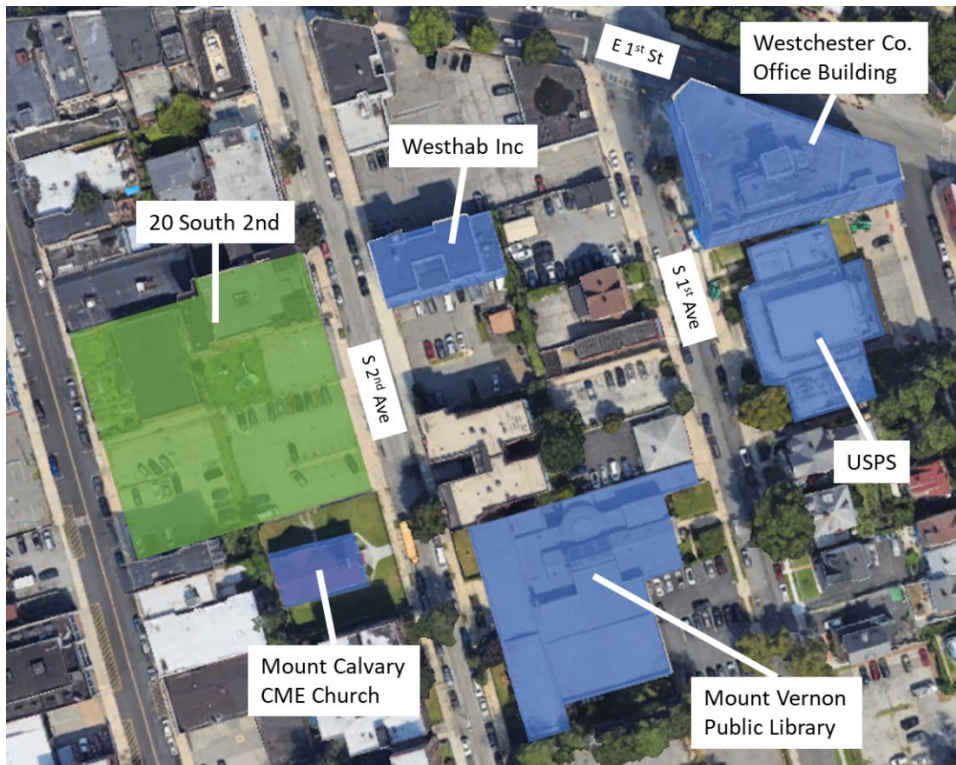


Figure 2. Map of District Thermal Project Site



2 Baseline Energy Conditions

To design and assess the feasibility of a district thermal system to support the target buildings, the team gathered available information from existing buildings. The team collected monthly utility data from recent years, including 2020, 2021, and 2022. Utility bills and billing summary sheets documented gas, fuel oil, electric delivery, and electricity supply. Although the monthly sample data is incomplete, the team gathered enough data to inform business-as-usual (BAU) utility costs and annual heating and cooling energy use. In addition, the team conducted site visits to confirm the types of heating, ventilation, and air conditioning (HVAC) systems and their respective vintages.

Tables 2 and 3 summarize the types of HVAC systems and their corresponding baseline energy use.

Table 2. Existing Building HVAC Systems

Building	Heating System	Cooling System
Mount Vernon Public Library	VRF ASHPs (0.0851 kW/MBH), gas-fired boiler rated at 67% efficiency	VRF ASHPs (1.24 kW/ton)
Mount Calvary CME Church	Gas-fired boiler rated at 83% efficiency. Radiators throughout	Window AC units (limited use)
Westchester County Office Building	VAV with radiators served by gas boiler at 56% efficiency	Chiller (0.668 kW/ton)
Westhab Inc.	Gas-fired heating (79% efficient). Some electric heating	Combination of split units (first floor) and window AC units (2nd and 3rd floors). Average EER = 9.0. Air-cooled unitary DX in AHUs (EER=11.2)
USPS	Gas-fired boiler with radiators (72% efficiency)	Air-cooled unitary (EER = 11.5)

Table 3. Utility Use and Cost: Historic Data

Building	Baseline Year	Electricity	Gas	Fuel Oil
Mount Vernon Public Library	2022	242,720 kWh	665 therms	N/A
		\$53,133 (\$0.219/kWh)	\$1,018 (\$1.53/therm)	N/A
Mount Calvary CME Church	2022	2,819 kWh	1,478 therms	N/A
		\$923 (\$0.328/kWh)	\$3,268 (\$2.23/therm)	N/A
Westchester County Office Building	2022	1,187,298 kWh	77,507 therms ^a	N/A
		\$310,697 (\$0.262/kWh)	\$59,097 (\$0.76/therm)	N/A
Westhab Inc.	2022	233,440 kWh	7,308 therms	13,365 gal ^b
		\$36,132 (\$0.155/kWh)	\$11,212 (\$1.53/therm)	\$42,617 (\$3.19/gal)

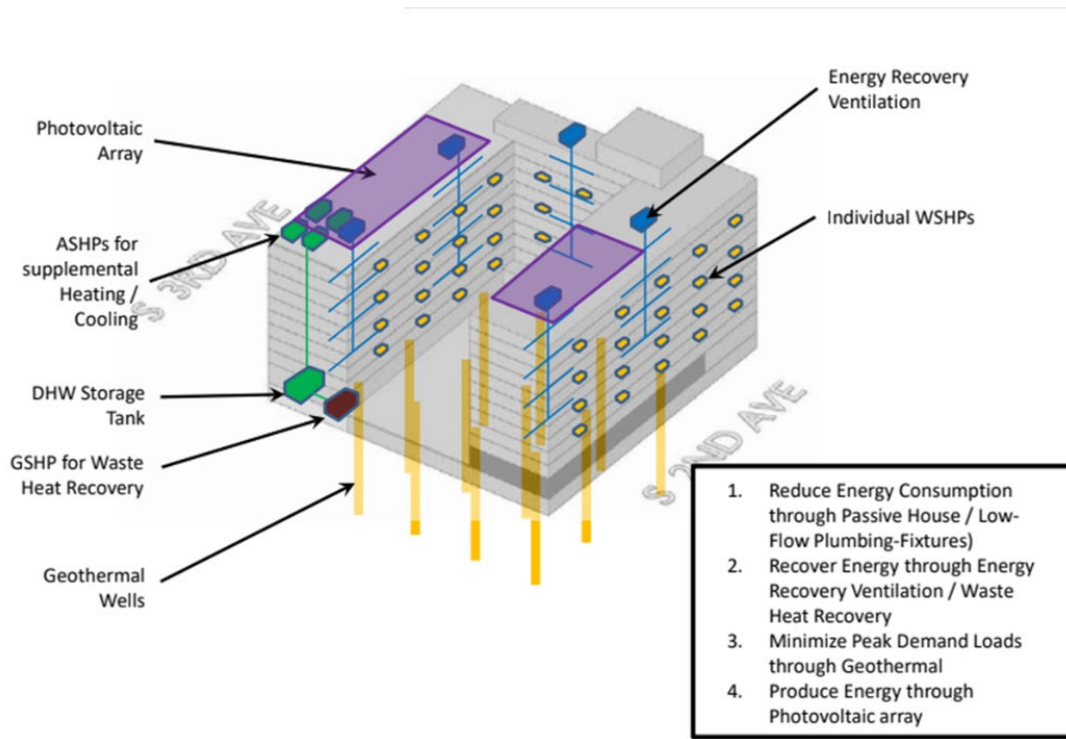
^a Assumes gas accounts associated with space heating. Does not include domestic hot water (DHW) boiler or gas to shop.

^b Includes fuel oil use between May 2021 and April 2022.

The project at 20 S. 2nd Ave. is the only new construction building included in the study. This 12-story, 317-unit apartment building includes commercial space on the ground floor. The design team designed 20 S. 2nd Ave. as an all-electric building, incorporating rooftop solar photovoltaic (PV), energy recovery ventilation (ERV), and a geothermal system that combines both air-source heat pumps (ASHPs) and ground-source heat pumps (GSHPs) to efficiently deliver heating and cooling. This combination of systems is expected to qualify the building for Passive House certification. Figure 2 illustrates the major building systems included in the design.

Figure 3. Major Building Systems at 20 S. 2nd Ave.

Image credit: Trinity Financial.



3 Energy Model

The team created an hourly, dynamic energy model for each of the target buildings within the project. Available data, including site visits, equipment surveys, and historic utility bill summaries, informed the energy model for existing buildings. These models establish the basis of heating and cooling loads that the thermal district system would need to supply.

As a method for comparison, the team used the modeled data as the basis for business-as-usual energy use, energy cost, and carbon emissions. This approach established a complete, annual energy profile for each building, normalized to the same weather data file.

3.1 Methodology

In the absence of detailed drawings of each building, the team developed hourly energy models in Trane Trace 700 based on existing representative building energy models slated for connection to the proposed district thermal system. The team modified representative models (previously modeled buildings with similar sizes and functions to the project buildings) to incorporate construction types (wall and window U-values), lighting and plug loads, and HVAC equipment consistent with each project-specific building based on information provided by owners and gathered from site walk-throughs. The team simulated the energy models were simulated with White Plains, NY, hourly weather data, calibrated to historical energy consumption data provided for each building. Appendix A includes detailed input assumptions.

3.2 Electricity and Natural Gas Use

Table 4 summarizes annual electricity, natural gas/fuel oil use, and energy costs for each building. These energy costs reflect historic unit pricing and modeled annual energy use.

Table 4. Utility Use and Cost: Modeled Data

Building	Electricity		Gas/Fuel Oil		Total Annual Cost
	kWh	Annual Cost	Therms or Gal	Annual Cost	
Mount Vernon Public Library	235,795 kWh	\$51,639	665 therms	\$1,018	\$52,657
Mount Calvary CME Church	4,043 kWh	\$1,326	1,140 therms	\$2,543	\$3,869
Westchester County Office Building	1,272,095 kWh	\$333,289	80,280 therms	\$61,013	\$394,302
Westhab Inc	169,480 kWh	\$26,269	13,365 gal ^b	\$42,634	\$68,903
USPS ^a	687,404 kWh	\$180,100	24,738 therms	\$18,801	\$198,901
20 S. 2nd Ave.	2,820,205 kWh	\$530,199	0 therms	\$0	\$530,199
All Buildings	5,189,022 kWh	\$1,122,822	125,334 therms	\$126,009	\$1,248,831

^a Utility bills were not available from USPS. Modeled energy loads are based on reasonable assumptions and unit energy costs from the Westchester County office building.

^b Energy content of 13,365 gallons of fuel oil converted to 18,511 therms to total fossil fuel use for all buildings in the same units.

Table 5. Greenhouse Gas Emissions: Modeled Data

Building	Electricity		Gas/Fuel Oil	
	kWh	Annual GHG Emissions (tCO _{2e}) ^b	Therms or Gal	Annual GHG Emissions (tCO _{2e}) ^b
Mount Vernon Public Library	235,795 kWh	68.1	665 therms	3.5
Mount Calvary CME Church	4,043 kWh	1.2	1,140 therms	6.1
Westchester County Office Building	1,272,095 kWh	367.6	80,280 therms	426.4
Westhab Inc	169,480 kWh	49.0	13,365 gal	137.4
USPS ^a	687,404 kWh	198.6	24,738 therms	131.4
20 S. 2nd Ave.	2,820,205 kWh	814.9	0 therms	0
All Buildings	5,189,022 kWh	1,499.4	125,334 therms + 13,365 gal	704.8
Total Annual GHG Emissions	2,204.2 tCO_{2e}			

^a Utility bills were not available from USPS. The team based modeled energy loads on reasonable assumptions.

^b Greenhouse gas emissions coefficients are taken from Local Law 97 coefficients defined for utility electricity, gas, and fuel oil.

4 Heating and Cooling Loads

The team created hourly estimated heating and cooling demands for each building. They generated these models using Trane Trace software and normalized the results to available energy use data from utility bills. Tables 6 and 7 present the monthly heating and cooling demands. Figure 3 illustrates the total monthly heating and cooling loads for all buildings in the study area. These loads serve as the design basis for the district thermal systems examined throughout this study.

Table 6. Monthly Heating Loads by Building

Figures in kBtu.

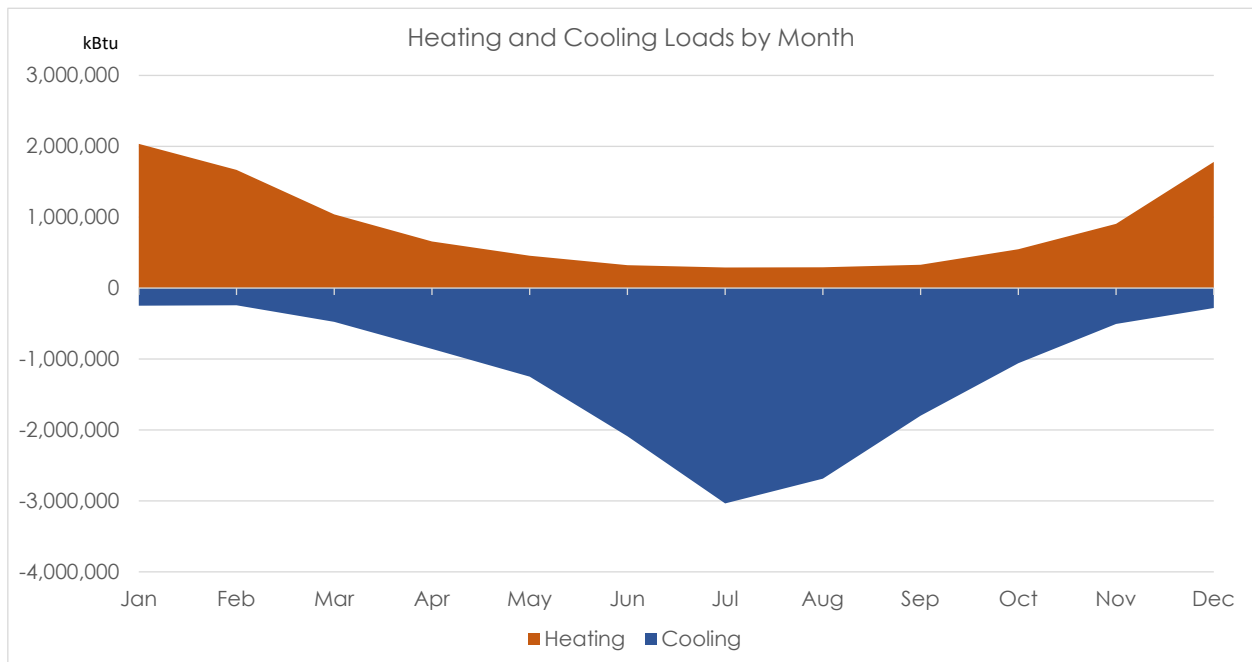
Month	Library	Church	Westchester County	Westhab	USPS	20 S. 2nd Ave.	Total
Jan	103,257	27,792	424,626	158,828	424,186	896,309	2,034,998
Feb	58,882	17,075	273,102	104,071	293,428	921,015	1,667,573
Mar	32,432	8,397	150,495	72,391	173,090	603,451	1,040,257
Apr	19,333	3,896	89,171	54,186	109,360	381,105	657,051
May	8,706	1,096	41,960	38,733	51,866	313,541	455,902
Jun	2,597	0	19,453	31,423	29,338	240,210	323,021
Jul	143	0	5,671	30,579	16,149	239,251	291,792
Aug	1,100	0	3,579	31,040	17,702	240,739	294,159
Sep	2,046	0	10,662	30,028	32,384	254,095	329,214
Oct	15,337	2,997	63,142	41,173	90,859	334,297	547,805
Nov	33,014	9,410	155,784	64,713	174,692	468,507	906,121
Dec	83,578	23,434	365,006	133,123	368,320	807,145	1,780,605
	360,425	94,097	1,602,651	790,288	1,781,374		
Total	360,425	94,097	1,602,651	790,288	1,781,374	5,699,665	10,328,498

Table 7. Monthly Cooling Loads by Building

Figures in kBtu.

Month	Library	Church	Westchester County	Westhab	USPS	20 S. 2nd Ave.	Total
Jan	-3,217	-13	-98,447	-2,090	0	-144,084	-247,852
Feb	-10,779	-8	-98,729	-5,387	0	-127,071	-241,974
Mar	-29,096	-11	-140,003	-8,984	-5,867	-292,628	-476,589
Apr	-41,567	-103	-170,091	-13,578	-51,393	-579,441	-856,173
May	-67,023	-231	-221,514	-20,033	-76,950	-863,250	-1,249,000
Jun	-102,365	-2,714	-330,275	-43,581	-187,523	-1,421,502	-2,087,959
Jul	-135,058	-6,175	-431,556	-71,909	-313,499	-2,076,192	-3,034,390
Aug	-123,985	-3,076	-397,391	-61,220	-261,823	-1,837,427	-2,684,923
Sep	-84,844	-690	-284,123	-38,292	-172,933	-1,218,527	-1,799,408
Oct	-45,083	-62	-175,476	-17,246	-43,870	-777,042	-1,058,780
Nov	-14,326	-6	-124,174	-5,662	-2,091	-357,380	-503,639
Dec	-4,230	-22	-108,670	-3,112	-722	-163,857	-280,613
			-2,580,449				
Total	-661,573	-13,111	-2,580,449	-291,094	-1,116,671	-9,858,401	-14,521,300

Figure 4. Total Heating and Cooling Loads by Month



5 Design Methodology

As noted, the team designed the district thermal system around the new planned 20 S. 2nd Ave. development and neighboring buildings (Figure 1). They explored three conceptual designs for a district system that would serve as the thermal backbone for the newly constructed 20 S. 2nd Ave. building and nearby buildings. The major difference between the designs lies in the type of ground heat exchanger (GHX) connected to the ambient loop.

The team began the district system design by establishing hourly heating and cooling load profiles for each building. Milestone 1 describes and Tables 6 and 7 summarize these loads. The team estimated the building hourly thermal loads using Trane Trace software and then imported the data into the TRNSYS software program.

TRNSYS simulates energy systems performance. It models each component within a district system and integrates them to represent a cohesive and unified large-scale system. For this project, the team used TRNSYS to model the performance of equipment commonly found in the district thermal system, including GHXs, dry fluid coolers, and the sewer heat exchange system. The team estimated the energy to power the heat pumps in each connected building using Trane Trace, but TRNSYS computes the heat pump compressor energy introduced into the district system. TRNSYS also simulates dry fluid cooler performance based on manufacturer specifications and historical local weather data. The team modeled GHX performance using data from soil conditions. Noventa estimated the sewer heat exchanger (SHX) performance characteristics used in TRNSYS, including daily expected wastewater flow rates, yearly temperature profiles, and shell and tube heat exchanger specifications. Using this information, TRNSYS projects the hourly wastewater flow rate and temperature throughout the year and simulates the shell and tube heat exchanger's operation. Collectively, TRNSYS integrates these individual components to provide a holistic representation that gauges the district energy system's overall performance.

5.1 Sewer Heat Exchange Description

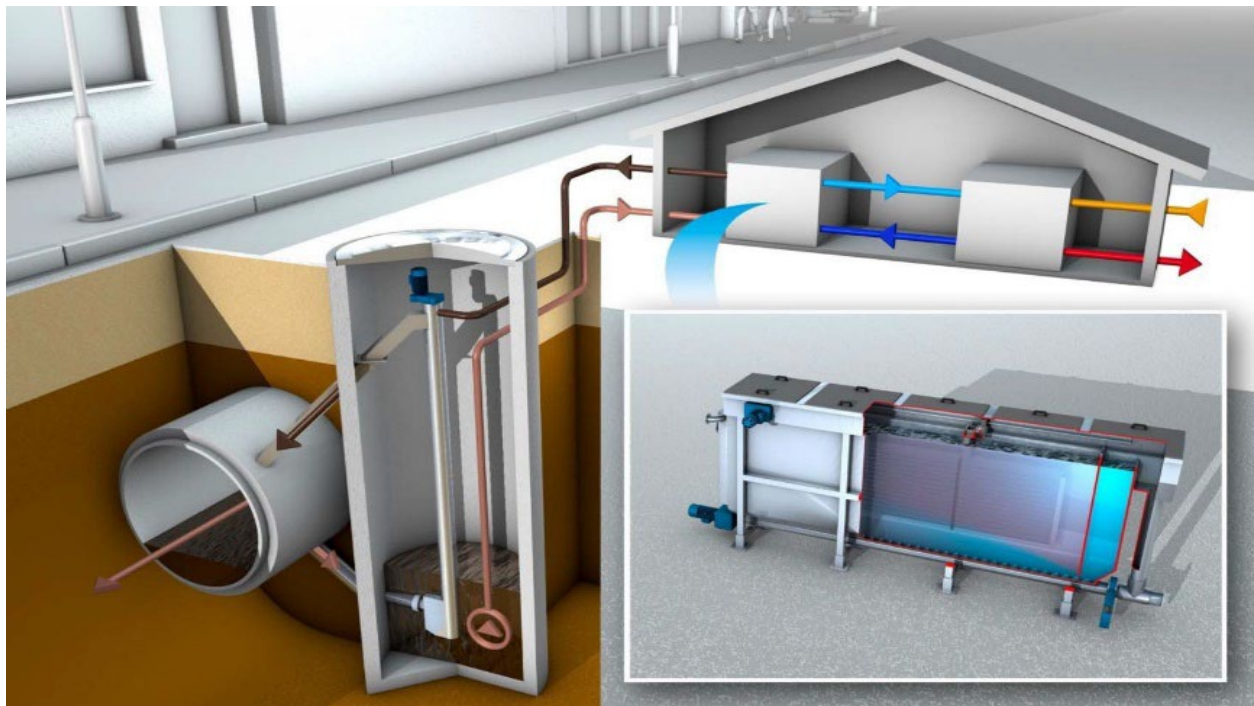
Wastewater provides an abundant and underutilized source of thermal energy in North America. Sanitary sewers experience predictable flow profiles and maintain consistent temperatures of approximately 65 degrees Fahrenheit (°F) to 70°F year-round. Wastewater's high density and specific heat capacity, coupled with its constant availability, make it an excellent source of thermal energy or a heat sink for HVAC systems.

The team conducted a desktop analysis of the thermal potential in the 36-inch sewer line that runs along East 1st Street. The team assumes the 36-inch sewer line is a vitrified clay sewer, with approximately 30% fill and a slope of 0.0015, resulting in an average flow rate of 1,553 gallons per minute (gpm). The team expects the sewer flow temperature to remain between 62°F and 68°F throughout the year. No temperature or meter data is available from the sewer.

5.1.1 Huber ThermWin System

Noventa's patented Huber ThermWin Wastewater Energy Transfer (WET) system can reject and extract thermal energy from wastewater, repurposing it to supply heating and cooling to buildings. HUBER Technology, the manufacturer of the ThermWin System, leads globally in wastewater equipment and has extensive experience designing equipment specific for wastewater. Figure 5 illustrates the system's major components.

Figure 5. Schematic of a Typical WET System Installation



The team installed the HUBER Pumping Station Screen (the ROTAMAT RoK4) within the intake structure (wet well). The RoK4 includes a fine screen that removes particulate matter from the wastewater before pumping it to the RoWin self-cleaning heat exchangers. With more than 1,200 installations worldwide, the ROTAMAT RoK4 pumping station ensures prescreening of

wastewater to protect the heat exchangers from large-format materials. After screening, the system transports the separated solids upward by a vertical screw conveyor and returns them to the sewer via gravity feed. The system pumps the screened wastewater to the RoWin self-cleaning heat exchangers, where thermal energy is either extracted from wastewater to provide heating or rejected to the wastewater to supply cooling.

The innovative Huber RoWin heat exchanger, a shell-and-tube configuration, was specifically developed for wastewater energy transfer applications. The team manufactures the RoWin heat exchanger entirely from stainless steel, featuring a patented corrosion-proof coating. The RoWin heat exchanger is odor-tight, enabling installation in the most sensitive spaces. The system's patented self-cleaning mechanism and sediment removal screw guarantee continuous operation with no required maintenance. Conversely, conventional plate-frame heat exchangers, even wide-gap models, are highly susceptible to fouling, which rapidly degrades heat transfer performance. Consequently, such exchangers require regular isolation and cleaning, resulting in high maintenance costs, dangerous and unsanitary sludge handling, and extensive system downtime.

5.1.2 Project Layout

The proposed WET system includes the following equipment:

- Four Huber RoWin BG8 wastewater heat exchangers installed in the energy transfer station (ETS)
- One Huber RoK4 500 wastewater screen installed in the wet well
- One Flygt N-Technology submersible wastewater pump installed in the wet well

5.1.3 Energy Transfer Station

The team assumed the energy transfer station would be located within an existing building on the south side of East 1st Street (Figure 6). The station will be architecturally clad, with internal dimensions of 50 ft by 55 ft, and will house four Huber RoWin BG8 wastewater heat exchangers, distribution pumps, and other ancillary equipment.

The RoWin heat exchangers will cascade on the wastewater side. Wastewater will be sent to a primary set of RoWins, then to a secondary set, before discharging it back into the sewer.

5.1.4 Wet well and Sewer Connection

The wet well will be a subterranean structure adjacent to the sewer, featuring an access hatch at grade. The wet well will be an 8-ft-diameter concrete structure housing one RoK4 BG500 screen and one submersible wastewater pump. The wet well will extend approximately 5 to 6 ft below the invert of the sewer and will be accessible from grade by a maintenance hole. Two connections will be installed between the wet well and the sewer. The first connection (the extraction point) will be located near the bottom of the sewer, approximately at the 5 o'clock position, allowing wastewater to flow by gravity into the wet well. The extraction point will not be located at the very bottom of the sewer to minimize the extraction of solids and grit. The second connection (the discharge point) will lie about 3 ft downstream of the extraction point, where wastewater will discharge back into the sewer. All solids and liquids removed from the sewer will be returned to the sewer.

Noventa strongly recommends installing valves on the two connections between the wet well and the sewer. In the event of a sewer surcharge, the valves will close to prevent wastewater from overflowing the wet well.

Noventa suggests using the Flygt N-Technology pumps, which the company specifically designs for wastewater applications.

6 District Thermal Energy System Design Options

The team developed three design options for a district thermal system. Each option uses an ambient loop to thermally connect the buildings and the GHXs. Each building will install, own, and operate its water-source heat pumps (WSHPs).

The design options differ in the size, number, and type of GHXs. Two of the options include an SHX with various sizes of conventional GHXs (borefields). One option eliminates the SHX and includes only GHXs. Following are illustrations and descriptions of each option.

6.1 Sewer Heat Exchange: Major Capacity

This design concept relies on the sewer heat exchange and a single ground heat exchanger (GHX A) to provide thermal energy to the district. Each building will own and operate water-source heat pumps connected to the ambient loop. The ambient loop uses an 8-inch pipe to circulate a 20% propylene glycol fluid. One dry fluid cooler will sit on the roof of 20 S. 2nd Ave. and will include 120 boreholes. This configuration may require two connections to the SHX energy transfer station and would use 66% of the thermal capacity of the SHX system. Figure 6 illustrates this configuration.

Figure 6. Sewer Heat Exchange: Major Capacity Configuration



6.2 Sewer Heat Exchanger: Minor Capacity

This design concept resembles the former design but differs in that it relies on a single connection to the SHX energy transfer station and adds a second GHX (GHX B) in the library's parking. As in the previous configuration, each building will own and operate water-source heat pumps connected to the ambient loop. The ambient loop will circulate a 20% propylene glycol fluid through an 8-inch pipe. Two dry fluid coolers will sit on the roof of 20 S. 2nd Ave. The borefield under the building (GHX A) will include 120 boreholes across approximately 40,000 square feet (SF). The borefield adjacent to the library (GHX B) will contain 80 boreholes across approximately 25,000 SF. This configuration requires

a single connection to the SHX energy transfer station and uses 33% of the thermal capacity of the sewer heat exchange system. By using less thermal capacity from the SHX system, this configuration allows for expansion, enabling other buildings to tie into the remaining thermal capacity of the SHX energy transfer station. Figure 7 illustrates this configuration.

Figure 7. Sewer Heat Exchanger: Minor Capacity Configuration



6.3 Ground Heat Exchanger Only

The third conceptual design eliminates the SHX option and supplies thermal energy to the district using vertical boreholes only. In addition to GHX A and GHX B from the previous configuration, this option introduces a borefield in the Metro-North parking lot north of East First Street. Both GHX B and GHX C would include 90 vertical boreholes over approximately 29,000 SF. As in the other configurations, each building will own and operate water-source heat pumps connected to the ambient loop. The ambient loop will circulate a 20% propylene glycol fluid through an 8-inch pipe. In addition to the two dry fluid coolers located on the roof of 20 S. 2nd Ave., a third dry fluid cooler is required and will be installed on the roof of the Westchester County office building. Figure 8 illustrates this configuration.

Figure 8. Ground Heat Exchanger Only



6.4 Electricity Loads

All the district thermal system configurations described above operate as all-electric systems that do not burn fossil fuels for heating. As part of implementing this solution, each building will upgrade existing HVAC mechanical systems to water-source heat pumps. The electricity for these heat pumps will be used within the building and paid for as a regular electric load. Table 8 summarizes estimates for the annual electricity required to power heat pumps in each building. Because the heat pumps would operate the same under each configuration, the figures in Table 8 remain building-specific and consistent across each district configuration.

Table 8. Annual Heating and Cooling Electricity by Building Assuming District Thermal System Operations

Building	Heating & Cooling Electricity (kWh)
Mount Vernon Public Library	80,809
Mount Calvary CME Church	10,944
Westchester County Office Building	254,585
Westhab Inc.	81,034
USPS	573,764
20 S. 2nd Ave.	1,036,202
All Buildings	2,037,338

In addition to building heat pumps, the district thermal system requires electricity to power the circulating pumps, dry air coolers, and SHX energy transfer station. Table 9 summarizes the annual electricity required to power the mechanical systems associated with the common assets (outside of any individual building). Table 9 shows the energy use that the district system would meter and bill.

Table 9. Annual District Electricity by Configuration

Configuration	District Thermal System Electricity (kWh)
SHX: Maximum Capacity	287,997
SHX: Minor Capacity	273,673
GHX Only	367,802

7 Economic Analysis

The team assessed the system’s economic performance by comparing the lifecycle costs of the business-as-usual approach to heating and cooling with those under the various district thermal system alternatives.

7.1 Thermal Network Capital Costs

The team estimated capital costs for each configuration evaluated in this analysis. Tables 10, 11, and 12 list the major components of these capital costs along with estimates for engineering, procuring, and constructing the systems. Costs for replacing HVAC systems in existing buildings are estimated separately in Section 7.3.

Table 10. Sewer Heat Exchanger: Major Capacity

Major System Components	Capital Cost
SHX Energy Transfer Station	\$10,124,000
Distribution Network	\$15,373,000
Total Cost	\$25,497,000

Table 11. Sewer Heat Exchanger: Minor Capacity

Major System Components	Capital Cost
SHX Energy Transfer Station	\$10,124,000
Borefield (GHX B, 80 bores)	\$3,001,000
Distribution Network	\$15,373,000
Total Cost	\$28,498,000

Table 12. Ground Heat Exchanger Only

Major System Components	Capital Cost
Borefield (GHX B, 90 bores)	\$3,241,000
Borefield (GHX C, 90 bores)	\$3,241,000
Distribution Network	\$15,373,000
Total Cost	\$21,855,000

7.2 Federal Investment Tax Credits

The U.S. Department of the Treasury (Treasury) and the Internal Revenue Service (IRS) offer investment tax credits (ITCs) for commercial geothermal systems under Section 48 of the Internal Revenue Code. The Inflation Reduction Act (IRA) revised these ITC rules. Qualifying geothermal heat pump equipment now qualifies for a base rate of 6%, while projects meeting prevailing wage and apprenticeship requirements are eligible for a 30% base rate. Additional bonus rates apply to:

- projects that meet domestic content requirements
- projects located in designated energy communities (as defined by the U.S. Department of Energy)

A project can earn a 10% bonus (or a 2% bonus on a 6% base rate) for each of these categories. For example, qualifying geothermal heat pump equipment eligible for a 30% ITC could increase to 50% if it meets both bonus conditions.

For this analysis, the team assumed that the project could qualify for a 40% ITC by satisfying prevailing wage, apprenticeship, and domestic content requirements.

The IRS defines geothermal heat pump property as assets using the ground or groundwater as a thermal source or sink. A proposed Treasury rule (November 22, 2023) would expand this definition to include “other underground working fluids.”¹ If finalized, this rule would likely enable the SHX energy transfer station to qualify for ITCs. The geothermal industry continues to seek guidance to formally include SHX assets and multiple ownership models. Table 13 summarizes the estimated ITC values.

Table 13. Estimated Federal Investment Tax Credit Value

Major System Components	CAPEX Cost	ITC Value
SHX Energy Transfer Station	\$10,124,000	\$4,049,600
Borefield (GHX B, 80 bores)	\$3,001,000	\$1,200,400
Borefield (GHX B, 90 bores)	\$3,241,000	\$1,296,400
Borefield (GHX C)	\$3,241,000	\$1,296,400
Distribution Network	\$15,373,000	\$6,149,200

7.3 New York State Incentives

New York State is phasing out natural-gas-fired appliances and promoting programs that support energy-efficient and building electrification. The Clean Heat program, administered by Consolidated Edison, Inc. (Con Ed), in Mount Vernon, offers incentives for ground-source heat pump installations based on the annual million British thermal units (MMBtu) of energy the system is expected to avoid.

The current program offers incentives based on the annual energy savings (MMBtu) achieved by the geothermal system. For this analysis, the team assumed that buildings considered in this study would qualify as Category 4: Existing Buildings. Additionally, the 20 S. 2nd Ave. building would be eligible for ground-source heat pump incentives for new construction, multifamily buildings. Table 14 summarizes the incentive amounts by building.

Table 14. Clean Heat Program Incentives by Building

Building	Clean Heat Incentive Rate	Annual Energy Saved	Uncapped Incentive Amount	Capped Incentive Amount
Mount Vernon Public Library	\$200/MMBtu	152	\$30,400	\$30,400
Mount Calvary CME Church	\$200/MMBtu	107	\$21,400	\$21,400
Westchester County Office Building	\$200/MMBtu	8,321	\$1,664,200	\$1,000,000
Westhab Inc.	\$200/MMBtu	2,777	\$555,400	\$555,400
USPS	\$200/MMBtu	2,380	\$476,000	\$476,000
20 S. 2nd Ave.	\$125/MMBtu	1,184	\$148,000	\$148,000
All Buildings				\$2,231,200

These estimated incentive values would offset the cost of in-building retrofits. Each existing building would replace its existing HVAC equipment with new water-source heat pumps and in-building distribution piping to fan coil units. Table 15 presents cost estimates for these upgrades. The estimates are based on building area and unit pricing for mechanical equipment.

Table 15. Existing Building HVAC Retrofit Cost

Building	Estimated Retrofit Cost	Clean Heat Incentive	Net Retrofit Cost
Mount Vernon Public Library	\$2,316,000	\$30,400	\$2,285,600
Mount Calvary CME Church	\$362,000	\$21,400	\$340,600
Westchester County Office Building	\$4,104,000	\$1,000,000	\$3,104,000
Westhab Inc.	\$1,133,000	\$555,400	\$577,600
USPS	\$3,549,000	\$476,000	\$3,073,000
Total	\$11,464,000	\$2,083,200	\$9,380,800

7.4 Operational Costs

Each system incurs operational costs that include utility costs, scheduled maintenance, and major equipment replacement costs. The utility costs were estimated by modelling the energy use for each building under a district thermal system and generating an hourly electricity profile. Annual modelled electricity use and historic unit pricing for electricity served as the basis for estimating electricity costs under the district thermal system. The district system also requires electricity to operate, and these costs would be socialized among connected customers. Table 16 summarizes the annual utility costs for each building and the three district thermal system configurations.

Table 16. Annual Heating and Cooling Electricity Use and Cost

Building or District System Design	Heating & Cooling Electricity (kWh)	Annual Electric Cost
Mount Vernon Public Library	80,809	\$17,697
Mount Calvary CME Church	10,944	\$3,590
Westchester County Office Building	254,585	\$66,7001
Westhab Inc.	81,034	\$12,560
USPS	573,764	\$150,326
20 S. 2nd Ave.	1,036,202	\$194,806
All Buildings	2,037,338	\$445,680
SHX, Maximum Capacity	287,997	\$57,600
SHX, Minor Capacity	273,673	\$54,735
GHX Only	367,802	\$73,560

Operating the district system more efficiently than conventional systems generates operational cost savings. Table 17 compares the HVAC-related utility costs from the business-as-usual scenario to each district system alternative.

Table 17. Annual Heating and Cooling Electricity Cost

Cost Component	BAU	SHX-Max	SHX-Min	GHX Only
Building HVAC Electric Cost	\$528,404	\$445,680	\$445,680	\$445,680
District Electric Cost	—	\$57,600	\$54,735	\$73,560
Gas Cost	\$109,307	—	—	—
Fuel Oil Cost	\$42,634	—	—	—
	\$680,345			
Total Cost	\$680,345	\$503,280	\$500,415	\$519,240
Savings from BAU	\$0	\$177,066	\$179,931	\$161,106

Table 18 summarizes the annual carbon emissions for each option as compared to business-as-usual. The team used emissions factors for natural gas and electricity established under New York City Local Law 97. While Mount Vernon does not fall under New York City’s jurisdiction, these emissions factors reasonably represent the grid-supplied gas and electricity emissions because Mount Vernon shares the same utility.

Table 18. Annual Heating and Cooling Electricity Cost

Cost Component	BAU	SHX Max	SHX Min	GHX Only
Annual HVAC Elec (kWh)	2,360,780	2,325,335	2,311,011	2,405,140
Annual Gas (therms)	123,773	0	0	0
Annual Fuel Oil (gal)	13,365	0	0	0
CO ₂ e from Electricity	682.2	671.9	667.8	695.0
CO ₂ e from Gas	657.4	0	0	0
CO ₂ e from Fuel Oil	137.4	0	0	0
Total Annual CO₂e Emissions^a	1,476.9	671.9	667.8	695.0

^a Emissions factors are as follows: 0.000288962 tCO₂e per kilowatt hour (kWh), 0.00005311 tCO₂e per kilo-British thermal unit (kBtu) of gas, 0.00007421 tCO₂e per kBtu of fuel oil.

7.5 Lifecycle Cost Analysis

The team compared each district thermal configuration to business-as-usual operations over a 25-year period. All scenarios assume a 3.0% utility cost escalator, a 2.5% inflation rate, and a 4.0% discount rate, in addition to the assumptions in Table 19.

Table 19. 25-Year Lifecycle Cost and Emissions Comparison

Cost Components	BAU	SHX Major Capacity	SHX Minor Capacity	GHX Only
SHX Energy Transfer Station	\$0	\$10,124,000	\$10,124,000	\$0
Borefield	\$0	\$0	\$3,001,000	\$6,482,000
Distribution Network	\$0	\$11,463,000	\$11,463,000	\$15,373,000
Total District Thermal System Cost	\$0	\$21,587,000	\$24,588,000	\$21,855,000
ITC Value	\$0	(\$8,634,800)	(\$9,835,200)	(\$8,742,000)
In-Building HVAC Upgrade (Years 1 & 21)	\$11,464,000	\$0 ^a	\$0 ^a	\$0 ^a
Net In-Building Retrofit Cost ^b	\$0	\$9,381,000	\$9,381,000	\$9,381,000
Annual Utility Cost	\$680,346	\$503,280	\$500,415	\$519,240
Annual Maintenance Cost	\$575,000	\$287,500	\$287,500	\$287,500
25-Year Lifecycle Cost	\$46,752,000	\$43,219,000	\$45,019,000	\$43,379,000
25-Year Cumulative CO_{2e} (tons)	36,925	16,800	16,700	17,375

^a In SHX major and minor capacities and GHX only scenarios, the conventional HVAC systems are replaced or retrofitted at project implementation (Year 1) as part of the net in-building retrofit cost. No additional HVAC replacement is assumed at Year 21, unlike the BAU case, which assumes a 20-year life and requires replacement.

^b Net in-building retrofit cost reflects reductions from available Clean Heat incentives (see Table 15).

8 Conclusion and Recommendations

All district system options offer reduced carbon emissions and increased operational efficiency compared to the continued use of existing conventional HVAC systems. The primary challenge remains that the initial capital costs for system construction cannot be justified solely by the annual energy savings for the buildings studied. However, considering conventional HVAC replacement costs, district systems yield a lower 25-year lifecycle cost.

Key benefits of the district thermal system include:

- Carbon emissions reduction of approximately 800 tons per year (about 55% below business-as-usual levels)
- Annual utility cost savings between \$160,000 and \$180,000
- A more resilient thermal system with longer operational life, greater efficiency, and lower maintenance needs than conventional HVAC systems
- Future-proofing connected buildings against carbon taxes, fossil fuel phaseouts, or building electrification requirements

The team recommends that the town explore the regulatory feasibility of each district's options.

In addition, we recommend pursuing two strategies to improve economic performance:

- Engage neighboring properties to increase building interconnections, increasing direct revenues and lowering costs for all connected users.
- Collaborate with Endurant and other stakeholders to seek all possible funding sources, including grants and capital support from the City of Mount Vernon, Westchester County, New York State, or the federal government, to reduce upfront capital costs.

Appendix A. District Thermal System Configurations and Lifecycle Cost Analysis

Appendix A presents the results of a lifecycle cost analysis for four district thermal system configurations evaluated for the project site. It summarizes capital costs, operational costs, emissions impacts, and economic performance for each scenario over 25 years. The analysis compares these options against a business-as-usual (BAU) case to assess financial feasibility and carbon reduction potential.

Table A-1. Representative Model for Mount Vernon Public Library

General	
Location	White Plains, NY
Building Type	Library
Floor Area Summary	Total = 48,169 SF
Envelope Performance	
Roof U-value	Average 0.078 Btu/h/SF/°F
Wall U-value	Average 0.099 Btu/h/SF/°F
Glass U-value	0.50 Btu/h/SF/°F
Shading Coefficient	SC = 0.46
Door U-value	0.200 Btu/h/SF/°F
FDWR	47.0%
Infiltration	—
Building Loads	
Lighting	33.7 kW peak 97,934 kWh/year
Plug Loads	9.6 kW peak 38,943 kWh/year
Occupancy Loads	640 at peak
Design Conditions	
Indoor Temperature (Heating)	70°F
Indoor Temperature (Cooling)	74°F
HVAC Systems	
System(s) Description	VRF air-source heat pumps using 1.24 kW/ton in cooling and 0.0851 kW/MBH in select areas supplemented by an existing gas-fired boiler rated at 67% efficiency. Hydronic radiators are connected to the boiler system in areas without cooling (vestibules and stairwells).
Outdoor Air	3,925 cfm
Heat Recovery	None

Table A-2. Representative Model for Mount Calvary Christian Methodist Episcopal Church

General	
Location	White Plains, NY
Building Type	Church
Floor Area Summary	Total = 9,027 SF
Envelope Performance	
Roof U-value	0.035 Btu/h/SF/°F
Wall U-value	0.0776 Btu/h/SF/°F
Glass U-value	0.50 Btu/h/SF/°F
Shading Coefficient	SC = 0.55
Door U-value	0.200 Btu/h/SF/°F
FDWR	25.8 %
Infiltration	—
Building Loads	
Lighting	5.4 kW peak 3,261 kWh/year
Plug Loads	1.0 kW peak 612 kWh/year
Occupancy Loads	88 at peak
Design Conditions	
Indoor Temperature (Heating)	70°F occupied, 65°F unoccupied
Indoor Temperature (Cooling)	80°F
HVAC Systems	
System(s) Description	Gas-fired boiler with a rated efficiency of 83%. Radiators throughout. Limited use of through-the-wall style AC units.
Outdoor Air	Natural ventilation only
Heat Recovery	None

Table A-3. Representative Model for Westchester County Office Building

General	
Location	White Plains, NY
Building Type	Office
Floor Area Summary	Total = 66,659 SF
Envelope Performance	
Roof U-value	0.0658 Btu/h/SF/°F
Wall U-value	0.125 Btu/h/SF/°F
Glass U-value	0.95 Btu/h/SF/°F
Shading Coefficient	SC = 0.95
Door U-value	0.200 Btu/h/SF/°F
FDWR	18.2%
Infiltration	4,398 cfm
Building Loads	
Lighting	85.8 kW peak 339,561 kWh/ year
Plug Loads	117 kW peak 349,241kWh/ year
Occupancy Loads	680 at peak
Design Conditions	
Indoor Temperature (Heating)	72°F occupied, 70°F unoccupied
Indoor Temperature (Cooling)	76°F occupied, 80°F unoccupied
HVAC Systems	
System(s) Description	Chiller using 0.668 kW/ton serving VAV system and with radiators served by gas boiler at 56% efficiency. Hydronic radiators are connected to the boiler system in areas without cooling (vestibules and stairwells).
Outdoor Air	70,028 cfm
Heat Recovery	None

Table A-4. Representative Model for Westhab Inc.

General	
Location	White Plains, NY
Building Type	Office
Floor Area Summary	Total = 20,986 SF
Envelope Performance	
Roof U-value	0.106 Btu/h/SF/°F
Wall U-value	0.130 Btu/h/SF/°F
Glass U-value	0.60 Btu/h/SF/°F
Shading Coefficient	SC = 0.66
Door U-value	0.387 Btu/h/SF/°F
FDWR	28.0%
Infiltration	2,290 cfm
Building Loads	
Lighting	14.0 kW peak 59,077 kWh/year
Plug Loads	8.0 kW peak 23,980 kWh/year
Occupancy Loads	70 at peak
Design Conditions	
Indoor Temperature (Heating)	71.6°F
Indoor Temperature (Cooling)	75.2°F occupied, 82.4°F unoccupied
HVAC Systems	
System(s) Description	Gas-fired heating (79% efficient). Combination of split units (first floor) and window AC units (2nd and 3rd floors; average EER = 9.0), air-cooled unitary (DX) in AHUs (EER = 11.2).
Outdoor Air	2,025 cfm
Heat Recovery	None

Table A-5. Representative model used for the USPS Building

General	
Location	White Plains, NY
Building Type	Office
Floor Area Summary	Total = 70,489 SF
Envelope Performance	
Roof U-value	0.0458 Btu/h/SF/°F
Wall U-value	0.0728 Btu/h/SF/°F
Glass U-value	0.50 Btu/h/SF/°F
Shading Coefficient	SC = 0.55
Door U-value	0.105 Btu/h/SF/°F
FDWR	32.0%
Infiltration	1,161 cfm
Building Loads	
Lighting	50.5 kW peak 162,373 kWh/year
Plug Loads	44.8 kW peak 182,127 kWh/year
Occupancy Loads	563 at peak
Design Conditions	
Indoor Temperature (Heating)	72.5°F
Indoor Temperature (Cooling)	74.5°F
HVAC Systems	
System(s) Description	Gas-fired boiler serving AHUs and radiators (efficiency = 72%). Air-cooled unitary AC (EER = 11.5)
Outdoor Air	25,698 cfm
Heat Recovery	None

Table A-1. Summary of Existing Building Characteristics and HVAC System Configurations

Parameter	Mount Vernon Public Library	Mount Calvary CME Church	Westchester County Office Building	Westhab Inc.	USPS
General					
Location	White Plains, NY	White Plains, NY	White Plains, NY	White Plains, NY	White Plains, NY
Building Type	Library	Church	Office	Office	Office
Floor Area Summary	Total = 48,169 SF	Total = 9,027 SF	Total = 66,659 SF	Total = 20,986 SF	Total = 70,489 SF
Envelope Performance					
Roof U-value	Average 0.078 Btu/h/SF/°F	0.035 Btu/h/SF/°F	0.0658 Btu/h/SF/°F	0.106 Btu/h/SF/°F	0.0458 Btu/h/SF/°F
Wall U-value	Average 0.099 Btu/h/SF/°F	0.0776 Btu/h/SF/°F	0.125 Btu/h/SF/°F	0.130 Btu/h/SF/°F	0.0728 Btu/h/SF/°F
Glass U-value	0.50 Btu/h/SF/°F	0.50 Btu/h/SF/°F	0.95 Btu/h/SF/°F	0.60 Btu/h/SF/°F	0.50 Btu/h/SF/°F
Shading Coefficient	SC = 0.46	SC = 0.55	SC = 0.95	SC = 0.66	SC = 0.55
Door U-value	0.200 Btu/h/SF/°F	0.200 Btu/h/SF/°F	0.200 Btu/h/SF/°F	0.387 Btu/h/SF/°F	0.105 Btu/h/SF/°F
FDWR	47.0%	25.8 %	18.2%	28.0%	32.0%
Infiltration	—	—	4,398 cfm	2,290 cfm	1,161 cfm
Building Loads					
Lighting	33.7 kW peak 97,934 kWh/year	5.4 kW peak 3,261 kWh/year	85.8 kW peak 339,561 kWh/ year	14.0 kW peak 59,077 kWh/year	50.5 kW peak 162,373 kWh/year
Plug Loads	9.6 kW peak 38,943 kWh/year	1.0 kW peak 612 kWh/year	117 kW peak 349,241 kWh/ year	8.0 kW peak 23,980 kWh/year	44.8 kW peak 182,127 kWh/year
Occupancy Loads	640 at peak	88 at peak	680 at peak	70 at peak	563 at peak
Design Conditions					
Indoor Temperature (Heating)	70°F	70°F occupied, 65°F unoccupied	72°F occupied, 70°F unoccupied	71.6°F	72.5°F
Indoor Temperature (Cooling)	74°F	80°F	76°F occupied 80°F unoccupied	75.2°F occupied 82.4°F unoccupied	74.5°F

Table A-1. (Continued)

Parameter	Mount Vernon Public Library	Mount Calvary CME Church	Westchester County Office Building	Westhab Inc.	USPS
HVAC Systems					
System(s) Description	<ul style="list-style-type: none"> - VRF air-source heat pumps using 1.24 kW/ton in cooling and 0.0851 kW/MBH in select areas supplemented by an existing gas-fired boiler rated at 67% efficiency - Hydronic radiators are connected to the boiler system in areas without cooling (vestibules and stairwells) 	<ul style="list-style-type: none"> - Gas-fired boiler with a rated efficiency of 83% - Radiators throughout. Limited use of through-the-wall style AC units 	<ul style="list-style-type: none"> - Chiller using 0.668 kW/ton serving VAV system and with radiators served by gas boiler at 56% efficiency - Hydronic radiators are connected to the boiler system in areas without cooling (vestibules and stairwells) 	<ul style="list-style-type: none"> - Gas-fired heating (79% efficient) - Combination of split units (first floor) and window AC units (2nd and 3rd floors; average EER = 9.0), air-cooled unitary (DX) in AHUs (EER = 11.2) 	<ul style="list-style-type: none"> - Gas-fired boiler serving AHUs and radiators (efficiency = 72%) - Air-cooled unitary AC (EER = 11.5)
Outdoor Air	3,925 cfm	Natural ventilation only	70,028 cfm	2,025 cfm	25,698 cfm
Heat Recovery	None	None	None	None	None

Appendix B. Regulatory Assessment

B.1 Basis for Establishing a District Energy System

The development of a district thermal energy system in Mount Vernon, NY, is intended to provide an efficient, flexible, and sustainable means of delivering heating and cooling services to a combination of new and existing buildings within a defined service area. By using a combination of ground-source heat pumps (GSHPs), air-source heat pumps (ASHPs), and thermal energy recovery from public sewers, the proposed system would reduce reliance on conventional fossil-fuel-based systems, lower greenhouse gas emissions, and enhance local energy resilience. This section outlines the significant project design features that carry regulatory implications and compares the proposed centralized system with potential decentralized alternatives from a regulatory standpoint.

B.1.1 Significant Project Design Features Having Regulatory Implications

The proposed district thermal energy system would be constructed to serve both new and existing buildings in Mount Vernon, NY. Among these, a new mixed-use building at 20 S. 2nd Ave. will provide 317 residential units and ground-floor commercial space. Additional buildings to be served include both privately owned and government facilities.

The project proposes to use a combination of public sewers, ground-source heat pumps, and air-source heat pumps as the thermal heat sources and sinks.

B.1.1.1 Sewers

Sanitary sewers offer predictable flow profiles and maintain relatively consistent temperatures of approximately 65 degrees Fahrenheit (°F) to 70°F year-round. The high density and specific heat capacity of wastewater, coupled with its constant availability, make it a reliable source of thermal energy or heat sink for HVAC systems. A sewer-based heat system would require installations at individual properties to divert wastewater through heat exchangers for heat extraction before returning it to the public sewer system.

B.1.1.2 Ground Heat Exchangers

Ground heat exchangers (GHXs) are proposed beneath 20 S. 2nd Ave., consisting of 120 boreholes distributed across approximately 40,000 square feet (SF). An additional borefield is planned adjacent to the Mount Vernon Public Library, containing 80 boreholes within 25,000 square feet (SF).

B.1.2 Alternative: Decentralized Building-Level Thermal Systems

An alternative configuration involving individual, decentralized systems for each building could simplify operational responsibilities by avoiding shared ownership and maintenance of the central loop. However, this approach would require duplicative investments in equipment and management, reducing the likelihood that building owners would independently pursue geothermal network infrastructure. Furthermore, using the public sewer system as a heat source would not be feasible without a coordinated, city-endorsed plan.

B.2 Applicable Laws and Regulations

This section organizes applicable laws and regulations by federal, state, and local jurisdictions. However, enforcement responsibilities are often shared or delegated, so regulatory discussions are organized by the primary level of administration.

B.2.1 Federal Regulations

No bodies of water or waterways protected under the Clean Water Act (CWA) or the Rivers and Harbors Act are implicated by this project. Additionally, no endangered or threatened species protected under the Endangered Species Act have been identified within the project area.

B.2.1.1 National Environmental Policy Act: Environmental Review for Federal Issuance of Permit

The National Environmental Policy Act (NEPA) requires federal agencies to assess the potential effects of their action on the human environment.² NEPA mandates that federal agencies identify and evaluate the environmental impacts of any “major federal actions significantly affecting the quality of the human environment.”³ If the proposed project applies for federal funding or requires federal permits, NEPA requirements will apply.

Under NEPA, any federal action that may significantly affect the quality of the environment requires the preparation of an Environmental Impact Statement (EIS).⁴ The EIS must address not only the significant environmental effects of the proposed action, but also those of all reasonable alternatives.⁵ While NEPA compels federal agencies to evaluate and document these environmental impacts, it does not require them to adopt a specific course of action based on the findings.⁶ In other words, NEPA does not require that agencies take one type of action or another based on the adverse environmental impacts.⁷ However, the sufficiency of an EIS is subject to potential citizen challenge under NEPA.⁸

The Council on Environmental Quality regulations classify “major federal action[s]” into several categories including “approval of specific projects, such as construction or management activities located in a defined geographic area. Projects include actions approved by permit or other regulatory decision as well as federal and federally assisted activities.”⁹

If NEPA applies, whether because the geothermal component requires federal action or due to nongeothermal aspects of the project, the application of NEPA to this project will necessitate a review of the potential environmental impact of the geothermal elements. However, a Consent Decree, by its own terms, does not constitute a permit; therefore, it is not a federal action and does not trigger NEPA requirements.

B.2.1.2 National Historic Preservation Act

Under the National Historic Preservation Act of 1966, federal agencies conducting, funding, or licensing a project must consider the project’s impact on structures or properties included in the National Register of Historic Places before issuing a permit for a project.

Furthermore, under Section 106 of the National Historic Preservation Act, federal agencies:

. . . must make a reasonable, good faith effort to identify historic properties, . . . determine whether identified properties are eligible for listing on the National Register, . . . assess the effects of the undertaking on any eligible historic properties found, . . . determine whether the effect will be adverse, . . . [and] avoid or mitigate any adverse effects.¹⁰

This process entails consultation with the New York State Historic Preservation Office (SHPO) and, in certain circumstances, with the Advisory Council on Historic Preservation.¹¹

State Historic Preservation Officers have the opportunity to review and comment on all individual permit activities, and the Advisory Council on Historic Preservation may review certain proposed activities requiring a federal permit.¹²

The Section 106 review encourages, but does not mandate, preservation of historic properties. This review ensures that preservation values are factored into federal agency planning and decision-making, allowing the public to hold the federal agency publicly accountable for decisions affecting historic properties.

The U.S. Post Office (USPS, 15 S. 1st Ave., Mount Vernon) is listed on the National Register of Historic Places. Consequently, the U.S. Army Corps of Engineers (Army Corps) must consider its historic status in issuing any permit and will likely condition approval on adoption of measures to mitigate the impact of development on its historic features.

B.2.2 State Regulations

B.2.2.1 State Clean Water Requirements

The federal CWA establishes a permitting scheme that regulates the discharge of pollutants into U.S. waters, known as the National Pollution Discharge Elimination System (NPDES) permit program.¹³ NPDES requires all facilities that discharge pollutants, including heat, into surface water from a point source to obtain a permit before discharging.¹⁴ NPDES permits incorporate both water quality standards and technology-based effluent limitations to protect water quality.

The CWA authorizes the U.S. Environmental Protection Agency (EPA) to delegate enforcement authority to the states and allows states to administer their own State Pollutant Discharge Elimination (SPDES) program upon EPA approval. New York State's SPDES program has received EPA approval for the control of surface wastewater and stormwater discharges by the CWA. Notably, New York State law is broader in scope and stricter than the federal NPDES program, requiring a SPDES permit for point source discharges of pollutants into all State waters, including both surface waters and groundwater.

The CWA also directs states to adopt water quality standards to protect, maintain, and improve the quality of the nation's surface waters.¹⁵ State water quality standards define the maximum allowable levels of chemical pollutants and are used as regulatory targets for permitting, compliance, enforcement,

monitoring, and assessing the quality of the State’s waters. Pursuant to the CWA, “water quality standard[s] shall consist of designated uses of the navigable waters involved and the water quality criteria for such waters based on such uses.”¹⁶

Additionally, EPA regulations require states to include an antidegradation policy in their water quality standards.¹⁷

Accordingly, effluent standards set in NPDES and SPDES permits must ensure state water quality standards for the receiving waters are met.¹⁸ These effluent limitations rely either on technology-based standards prescribed by the EPA,¹⁹ or on water-quality-based standards when applicable technology standards would still result in an exceedance of state water quality standards for the receiving water body.²⁰ SPDES permits may also impose additional conditions such as temperature monitoring and reporting, as well as limitations on the amount of heat the system can discharge, depending on the receiving water body’s classification.

B.2.2.2 State Discharge and General Water Quality Standards Application to Geothermal

The NPDES and SPDES discharge requirements, as well as New York State water quality standards, potentially regulate geothermal systems. These regimes, both rooted in the CWA, can be applied separately or together, depending on the geothermal design and regulatory decisions made by the New York State Department of Environmental Conservation (DEC).

Under the SPDES program, a discharge includes thermal discharges.²¹ Separately, under New York State’s general water quality standards, thermal discharges are defined as “a discharge that results or would result in a temperature change of the receiving water.”²² Pursuant to DEC’s criteria governing thermal discharges, “[a]ll thermal discharges to the waters of the State shall assure the protection and propagation of a balanced, indigenous populations of shellfish, fish, and wildlife in and on the body of water.”²³

Open-loop systems clearly fall under both regimes through the issuance of a SPDES permit that authorizes effluent discharge in accordance with general water quality requirements. For closed-loop systems, DEC would apply general water quality standards, but whether a SPDES permit would be required as part of its regulatory approach remains unclear.

More specifically, geothermal systems that discharge heat, cooling, or water treatment chemicals into State surface waters must obtain a SPDES permit. While this typically applies to open-loop systems, all systems are subject to New York State's water quality standards and best use criterion set forth at 6 NYCRR Parts 649–758, including criteria for thermal discharges.²⁴

Under all approaches that DEC might adopt, DEC can require meeting technological standards for the geothermal activity to mitigate thermal impacts on the receiving water body, which could include criteria for mixing zones.

B.2.2.3 SPDES for Geothermal Systems

The specific requirements of a SPDES permit will depend on whether the geothermal system discharges to groundwater or surface water, the classification of the receiving water body, and whether the system discharges heat or any type of water or heat treatment chemicals.²⁵ Generally, geothermal systems that discharge heat, cooling, or water treatment chemicals into State waters must obtain a SPDES permit. Open-loop residential systems with a design flow greater than 1,000 gallons per day or those using water treatment chemicals, as well as all commercial open-loop systems, require a SPDES permit. Additionally, depending on circumstances, DEC may require a SPDES permit for closed-loop systems if the system discharges heat or otherwise changes the temperature of a receiving water body.

B.2.2.4 SPDES Permits for Construction and Stormwater Pollution

A SPDES permit might also be required for construction-related activities. Section 402 of the CWA requires permits for stormwater discharges from construction activities, which would include geothermal drilling operations that disturb one or more acres of land. In New York State, a SPDES General Permit for Stormwater Discharges from Construction Activity is required for construction activities involving soil disturbances of one or more acres based on a common plan, and soil disturbances of less than one acre that could potentially contribute to a violation of a water quality standard or pollutants to surface waters.²⁶ To qualify for the permit, applicants must develop a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the requirements outlined in the General Permit, which prevents the discharge of construction-related pollutants to surface waters.²⁷

B.2.2.5 State Water Quality Standards of General Application

Beyond the requirements under the SPDES program, New York State water quality standards always apply to geothermal and other activities, even when operations do not require a SPDES permit, so geothermal or other activities must not cause or contribute to any violation of water quality standards.²⁸ DEC must review the system to determine whether it would violate State water quality standards or require a SPDES permit.

New York State's water quality standards establish classifications and designated uses for all waters in the State, including groundwater.²⁹ The best uses of the classes of waters include fish, shellfish, and wildlife propagation and survival, fishing, drinking water supply, and primary and secondary contact recreation.³⁰ DEC regulations also contain general conditions applying to all water classifications, including criteria governing thermal discharges.³¹ Pursuant to DEC regulations, thermal discharges are defined as "a discharge that results or would result in a temperature change of the receiving water."³² DEC's thermal discharge criteria include general and water body-specific standards for thermal discharges, mixing zone criteria, and additional limitations on thermal discharges that may ultimately impact system design.

No surface waters currently exist on the site. However, pursuant to DEC regulations, a presumption exists that discharges to the ground will result in discharges to groundwater.³³ Accordingly, because groundwater is present on the site, DEC must review the system to ensure that it will not violate applicable State water quality standards for groundwater and DEC's thermal discharge criteria.

At the time of review, DEC may also impose additional conditions appropriate to the system, which may require the applicant to provide biological information on the water body and an analysis of available technology or operational measures to minimize any adverse impacts caused by the thermal discharge.

B.2.2.6 Department of Environmental Conservation Water Quality Certificate under Section 401 of the Clean Water Act

Pursuant to CWA Section 401, a federal agency may not issue a permit unless the state either certifies that the proposed activity will not violate state water quality standards or waives its certification authority. If the state denies a 401 water quality certification, the activity cannot proceed.³⁴ States can also impose

significant conditions on the permit or project through the 401 certification process to reduce the activity's impacts.³⁵ In New York State, a developer typically applies simultaneously to both the federal agency and the DEC, which administers the State's environmental laws and CWA water quality certification permits, allowing the reviews to occur concurrently.

Accordingly, the Army Corps cannot issue a 404 water discharge permit until DEC issues a water quality certificate or waives the requirement.

B.2.2.7 State Environmental Quality Review Act

New York's State Environmental Quality Review Act (SEQRA) requires State and local agencies to consider environmental factors in the planning, review, and decision-making processes regarding permits, zoning changes, or government funding. New York State projects that require some form of discretionary State or local government approval trigger SEQRA review.³⁶

The SEQRA review process requires agencies to determine whether actions they directly undertake, fund, or approve may have a significant impact on the environment ("a determination of significance"), and if so, to prepare require an EIS assessing the proposed actions' potential impacts, along with ways to avoid or mitigate those impacts.³⁷ The lead agency responsible for authorizing the project issues a "negative declaration" if it determines that the proposed action will not result in a significant environmental impact. This concludes the SEQRA review process and may lead to subsequent litigation brought by project opponents.³⁸ A positive declaration triggers the procedural mandates leading to the preparation of a Final EIS, which serves as the basis for the final decision to fund or approve the project.³⁹

An action is subject to SEQRA review if any State or local agency has authority to issue a discretionary permit, license, or other approval for that action, or if an agency funds or directly undertakes a project. Consequently, any State or local approvals, such as issuing a permit, will trigger SEQRA's provisions. Additionally, any NYSERDA funding for subsequent project phases would likely constitute an agency action subject to SEQRA.

Once an agency takes an "agency action," it must determine whether the action is subject to SEQRA. Type II actions, which have been determined not to have a significant effect on the environment, are exempt from the SEQRA review process.⁴⁰ However, if an action does not fall within one of these

exclusionary categories, it becomes subject to SEQRA, and the agency must determine whether it qualifies as a Type I action or an unlisted action because each category triggers different procedural requirements.

To determine significance, the agency prepares an Environmental Assessment Form (EAF), selecting either a short or full EAF based on the nature of the action. The short form EAF, used for unlisted actions deemed to have a significant effect, requires the lead agency to consider whether the proposed action would cause “an increase in the use of energy” and whether it “fails to incorporate reasonably available energy conservation or renewable energy opportunities.”⁴¹ The full EAF also requires applicants for commercial and industrial projects to provide information about the proposed action’s new or additional demand for energy, including information about the anticipated sources of energy.⁴²

If the agency issues a positive declaration, it must require the preparation of an EIS, beginning with a Draft Environmental Impact Statement (DEIS), which the agency then circulates for public review and comment.⁴³ In addition to “analyzing the significant adverse impacts and evaluating all reasonable alternatives,” the DEIS must include an “assessment of impacts only where relevant and significant,” including “impacts of the proposed action on the use and conservation of energy . . . [and] . . . measures to avoid or reduce both an action’s impacts on climate change and associated impacts due to the effects of climate change. . . .”⁴⁴

The necessary upgrades to existing buildings and the sewer work will likely qualify as Type II actions and therefore remain outside the scope of SEQRA review. Explicitly listed Type II actions include

. . . replacement, rehabilitation or reconstruction of a structure or facility, in kind, on the same site, including upgrading buildings to meet building or fire codes, . . .⁴⁵ street openings and right-of-way openings for the purpose of repair or maintenance of existing utility facilities, . . .⁴⁶ [and] extension of utility distribution facilities, including . . . sewer connections to render service in approved subdivisions. . . .”⁴⁷

Taken together, these exclusions indicate that most work needed to implement the geothermal project, including but not limited to existing building envelope and HVAC updates, street and rights-of-way openings, and extensions and upgrades to existing sewer distribution lines and connections, are exempt from SEQRA review. However, nongeothermal aspects of the project may trigger SEQRA review as a Type I or unlisted action, potentially affecting project timing.

B.2.2.8 Office of Renewable Energy Siting Approval

Geothermal systems with a planned capacity of 25 megawatts thermal (MW_{th}) or greater are subject to the permitting requirements of the Office of Renewable Energy Siting (ORES).⁴⁸ A geothermal system of this size would support a small community of approximately 2,000 homes.⁴⁹ ORES regulations establish an application process similar to Article 10 of the Public Service Law for siting major electric generating facilities and impose uniform standards and conditions on all proposed projects. Applicants must work with municipal authorities in the proposed facility's location, secure several environmental approvals from ORES prior to applying, and file an application including exhibits addressing impacts on land use, public health, safety and security, noise and vibration, cultural resources, endangered and threatened species, visual impacts, water quality, and wetlands. Applications are also subject to a comment period and public hearing procedures.

Under Section 94-C, the siting agency has 60 days to review an application and determine whether it meets applicable requirements. ORES cannot deem an application complete unless the record demonstrates that the applicant consulted with host municipalities and communities. Applicants must coordinate with host municipalities where the proposed facility would be located, secure several environmental approvals from ORES before applying, and submit an application with exhibits addressing impacts on land use, public health, safety and security, noise and vibration, cultural resources, endangered and threatened species, visual impacts, water quality, and wetlands.

During the Section 94-C comment period, the host municipality must submit a statement "indicating whether the proposed facility is designed to be sited, constructed and operated in compliance with applicable local laws and regulations, if any, concerning the environment, or public health and safety."⁵⁰ Following the public comment period, the agency may schedule an adjudicatory hearing to consider arguments or issue a ruling on the application.

ORES must issue a permit within 12 months of deeming the application complete. The agency may issue a permit only after finding that the applicant has avoided or minimized significant adverse environmental impacts, conducted a review of applicable local zoning laws, and demonstrated compliance with applicable laws and regulations. When making its compliance determination, ORES may elect to waive laws and ordinances in favor of a uniform set of standards and conditions established in the regulations implementing Section 94-C. However, the current regulations do not include specific guidelines for geothermal energy systems.

B.2.2.9 Drilling Permits

New York State imposes different requirements for geothermal wells based on depth, adapting permitting regimes originally designed for nongeothermal systems. Wells less than 500 feet (ft) deep fall under the jurisdiction of the DEC's Division of Water, which requires submission of driller and pump installer registration and certification, as well as preliminary notice and well completion reports for open-loop or standing-column systems.⁵¹ The agency waives completion reports for closed-loop geothermal systems with boreholes up to 500 ft deep.⁵²

DEC's Division of Mineral Resources regulates the drilling, construction, operation, and plugging of geothermal wells deeper than 500 ft.⁵³ Table B-1 summarizes the additional requirements for wells exceeding this depth. These include submitting detailed information on well locations, depth, use, casing material, cementing procedures, drilling fluid, and cutting disposal methods, as well as completing an EAF for DEC to assess environmental impacts and determine whether to require any "special permit conditions, a Supplemental Environmental Impact State, or any additional NYSDEC permits."⁵⁴ DEC also imposes reporting requirements throughout the permitting and drilling process and requires a separate permit to plug and abandon a well permanently.⁵⁵

Before obtaining a drilling permit for a well that may produce brine, saltwater, or other polluting fluids in sufficient quantities to harm the surrounding environment, a well owner must secure a permit for the safe and proper disposal of those fluids.⁵⁶ Depending on the disposal method, DEC may require additional permits for discharge and disposal.

DEC enforces minimum standards for all wells through the division's Casing and Cementing Practices, designed to protect groundwater by preventing fluid migration.⁵⁷ The agency imposes stricter permitting conditions for wells drilled through primary and principal aquifers, in areas with unknown subsurface conditions or where high pressures are expected.

The Division of Mineral Resources also consults with the New York State Office of Parks, Recreation and Historic Preservation (NYS Parks) to assess whether a proposed well lies within a State-listed historic area.⁵⁸ If so, NYS Parks reviews the project and ensures it does not adversely impact cultural resources.⁵⁹ The permit application process typically takes 6 to 8 weeks but may extend longer depending on the project. Filing fees vary based on well depth.⁶⁰ Table B-1 summarizes drilling permit requirements and restrictions for both regimes.

Table B-1. Requirements for Closed-Loop Ground Source Loops

Source: New York State Department of Environmental Conservation (DEC), "Well Owner and Applicants Information Center," accessed March 6, 2021, <https://www.dec.ny.gov/energy/1522.html>; DEC, "Well Operator Responsibility," accessed March 6, 2021, <https://www.dec.ny.gov/energy/1639.html>; New York Geothermal Energy Organization (NY-GEO), "Ground Source Heat Pump Drilling Regulations Discussion," presentation, November 12, 2020.

Less than 500 Ft	Greater than 500 Ft
Driller and pump installer certification and registration	
Municipalities may impose additional requirements	
	Organizational report (Form 85-15-12)
	Application for permit to drill well (Form 85-12-5)
	Environmental Assessment Form (Form 85-16-5)
	Financial Security Worksheet (Form 85-11-2) and deposit of required financial security (starting at \$2,500 per well ≥500 ft)
	Certified site plan
	Casing and cementing plan
	Drilling progress reports
	Periodic drilling drift correction ⁶¹
	Well drilling and completion report (Form 85-15-7)
	Annual reports of status and use of well
	Incident reports of leakage or risk to the environment, health, safety, welfare, or property
	Permit to plug and abandon

Table B-1. Requirements for Closed-Loop Ground Source Loops

Requirement	<500 ft	≥500 ft
Organizational report (Form 85-15-12)	Yes	Yes
Application for permit to drill well (Form 85-12-5)	Yes	Yes
Environmental Assessment Form (Form 85-16-5)	No	Yes
Financial Security Worksheet (Form 85-11-2) and deposit of required financial security (starting at \$2,500 per well ≥500 ft)	No	Yes
Certified site plan	No	Yes
Casing and cementing plan	No	Yes
Drilling progress reports	No	Yes
Casing and cementing plan	No	Yes
Drilling progress reports	No	Yes
Periodic drilling drift correction	No	Yes
Well drilling and completion report (Form 85-15-7)	No	Yes
Annual reports of status and use of well	No	Yes
Incident reports of leakage or risk to the environment, health, safety, welfare, or property	No	Yes
Permit to plug and abandon	No	Yes

B.2.2.10 New York State Historic Preservation Office

The SHPO, within NYS Parks, helps communities identify, evaluate, preserve, and revitalize their historic, archeological, and cultural resources. SHPO administers programs under the National Historic Preservation Act of 1966 and the New York State Historic Preservation Act of 1980. These programs and services include:

- Statewide Historic Resources Survey
- New York State and National Registers of Historic Places
- Federal historic rehabilitation tax credit
- Certified Local Government program
- State historic preservation grants program
- State and federal environmental review
- A range of technical assistance delivered through regional teams

In performing these responsibilities, SHPO reviews projects, specifies conditions for site modifications under its jurisdiction, and approves or assists other agencies in approving modifications to historic sites. Project sponsors must, to the fullest extent practicable and consistent with other laws, avoid or mitigate adverse impacts to historic properties, fully explore feasible and prudent alternatives, and give due consideration to mitigation plans.⁶²

For geothermal systems, this means design and construction, including drilling, must avoid impacts to historic features.

Because the USPS building is listed on the National Register of Historic Places, SHPO will exercise jurisdiction and is expected to condition approval on measures that mitigate any impacts to the site's historic features.

B.2.2.11 Uniform Heat Standards for Multiunit Residential Buildings

New York State mandates minimum heating standards in multiunit buildings. Heating systems must maintain indoor temperatures of at least 68°F. From October 1 through May 31, heat must be provided when:

- The outdoor temperature falls below 55°F between 6 a.m. and 10 p.m.: Apartments must be heated to at least 68°F.
- The outdoor temperature falls below 40°F between 10 p.m. and 6 a.m.: Apartments must be heated to at least 55°F.⁶³

B.2.2.12 Utilities Regulation

New York State’s Public Service Law delegates utility regulation to the Public Service Commission (PSC). It governs electricity, natural gas, water, and telecommunications, but excludes geothermal services and heat provision generally.⁶⁴ (Also, because geothermal falls outside the scope of the law, private providers of heat services are not regulated under the Public Service Law.) However, the Utility Thermal Energy and Jobs Act of 2022 promotes the development of thermal energy networks and requires investor-owned utilities to pursue pilot projects.

Beyond the omission of geothermal from the Public Service Law, common law principles suggest that a company providing geothermal heat services on a competitive basis, without holding a monopoly or exerting market power, would not qualify as a utility or face regulation as one. Utility regulation originated in the early 1900s as a form of antitrust legislation addressing concerns over market power. Courts have since refined the modern approach to defining a utility when determining whether to regulate an energy provider as such, often in cases involving third-party power providers entering into power purchase agreements with energy users, an arrangement analogous to providing geothermal services. In making this determination, courts consider multiple factors to assess whether the activity constitutes the provision of utility services:

- The nature of the transaction and relationship between the parties is an arm’s-length transaction between a willing buyer and a willing seller
- Whether the services are for public or private use, determined in part by whether the provision of energy is in front of or behind the meter
- Whether the service provided is an indispensable service that generally requires public regulation; if the service is structured so that the end user has alternative grid-supplied options in addition to the service, it may be deemed nonessential or not requiring regulation
- Whether market power or monopoly exists
- Whether the provider can serve all members of the public
- Whether the provider can discriminate against members of the public
- Whether actual or potential competition exists with other entities that are regulated in the public interest⁶⁵

A geothermal provider contracting directly with a building that retains backup utility service is unlikely to be regulated as a utility.

B.2.2.13 Home Energy Fair Practices Act and Submetering Regulations for Electric Heat

Although geothermal services may fall outside utility regulation, a building or provider that submeters electricity or electric heat to residents must comply with the Home Energy Fair Practices Act (HEFPA), part of the Public Service Law §§30–53, and the PSC’s Residential Electrical Submetering regulations,⁶⁶ pursuant to the New York Public Service Law.⁶⁷ Importantly, for purposes of submetering, electric heat services include those provided by electric heat pumps.⁶⁸

HEFPA and its regulations hold covered parties to the same standards as utilities for initiating and terminating service, billing and deposits, resolving disputes over service and charges, and maintaining standards for quality service. The submetering regulations also require buildings to apply to the PSC for permission to submeter, with approval subject to conditions the PSC may impose. These conditions can include rate caps, and violations of PSC conditions or regulatory requirements can lead to reductions in rate caps,⁶⁹ sanctions, or termination of submetering authority.⁷⁰

For existing master-metered buildings converting to submetering, the PSC must determine the conversion serves the public interest and ensures safe, adequate electric service.⁷¹ This requirement applies to rental buildings, condominiums, and cooperative buildings.

For conversion of rental buildings, the application requires notice to all residents and publication for public comment. The PSC may consider all supplemental information submitted, including public comments.⁷² Conversion of an existing building involves a far more cumbersome process because actual tenants with preexisting contractual and statutory rights must be considered, and these rights require adjustment if submetering is to be permitted.

For mixed-use buildings that include both rental and condominium units, such as those where sponsors retain ownership of certain units as rentals, the regulations do not specify which regime is followed. The determination should depend on whether the sponsor remains obligated to pay the submeter bill under the lease or can pass that responsibility to tenants. Contract, landlord-tenant, rent control, and other laws would govern what is permissible.

Applications must detail plans to meet HEFPA, efficiency, equipment, income-based housing assistance, rate cap, and other requirements.⁷³ The review process is complex and time-intensive, requiring months to complete. The PSC holds a relatively high standard for the public interest finding. However, if submetering supports meeting State and local climate targets by enabling geothermal technologies and meets all other requirements, the PSC could deem it to be in the public interest.

B.2.2.14 Nonelectric Heat and Cooling

While HEFPA regulates electric heat submeters, HEFPA and the submetering regulations exclude nonelectric heat and cooling. The absence of a specific regulatory regime allows other nonenergy regimes at the State and local levels to set default rules without providing a clear path for submetering residential units for these services. As the following section describes, these include municipal landlord-tenant laws.

State and municipal law as well as leases allocate nonelectric heating as a landlord's responsibility, whereas both generally omit cooling. This situation may enable bifurcated business models that more easily support offering cooling as a service, the provision of electric heat under HEFPA, and nonelectric heat facing barriers under local law.

Proposals to submeter geothermal energy will likely require adapting the submetering regulations for electricity and electric heat to incorporate geothermal energy, or developing new regulations for specifically for geothermal energy.

B.2.2.15 Other Protection Laws for Consumers and Tenants

Contract law, consumer protection laws, tort laws, and other relevant laws and regulations governing the marketing of heat services apply regardless of whether heat services are billed as electric heat or therms.

When building contractors provide geothermal heat services and sell them to tenants, local landlord-tenant laws protect tenant-consumers. This protection necessarily expands the range of regulatory stakeholders to include municipal regulatory authorities that regulate buildings and protect tenants. As a result, New York State's Division of Homes and Community Renewal (HCR), as well as municipal tenant advocates, could actively participate, including the Westchester County Housing and Community Development. Other nongovernment tenancy advocacy groups will also likely take action to influence government decision-making processes.

The New York State construction code requires buildings to provide a means to heat residential units but does not allocate specific responsibility for the cost of operation or fuel of those units:

§27-740 Heating requirements. All habitable or occupiable rooms or spaces, and all other rooms or spaces . . . shall be provided with means of heating in accordance with the requirements of this subchapter and reference standard RS 12-1. . . .⁷⁴

As the prior section notes, in the absence of a regulatory regime such as HEFPA for nonelectric heating, municipal landlord-tenant laws may allocate heating responsibility to landlords. Similarly, incumbent leases allocate responsibility to landlords for existing buildings.

Absent a municipal law allocating heating cost responsibility to landlords, navigating incumbent rights contained in leases raises contract law issues, and although HEFPA would not apply, municipal regulators may require a process similar or more onerous than HEFPA.

Assuming a building provider may separately provide and bill for heat, failure to provide adequate heat according to standards set in municipal regulations protecting tenants could result in violations and penalties under these laws. This, in turn, could trigger contractual violations between the building owner and a third-party heat provider.

B.2.2.16 Affordable Housing

Federal law deems a building affordable housing when New York State and local municipal regulations set maximum amounts that may be charged in multiunit residential buildings. Housing affordability calculations must include all housing costs. In rental units, housing costs include rent and any tenant-paid utilities. In ownership units, costs include the mortgage payment (principal and interest), property taxes and homeowner insurance, and any common charges or homeowners' association fees for condominiums or cooperatives.

The U.S. Department of Housing and Urban Development (HUD) sets income limits annually for a variety of housing programs, known as the Area Median Income (AMI), for each Metropolitan Statistical Area (MSA). MSAs typically comprise large cities or counties. Westchester County Housing and Community Development uses the AMI standard to set eligibility requirements for its funding programs for both rental and ownership housing. Affordability broadly means that a household pays no more than 30% of its monthly gross income toward housing costs. The number of persons in the household determines the specific amount of housing costs that may be charged to stay within affordability thresholds.

In addition, HUD annually publishes rent limits for affordable housing programs under the HOME Investment Partnerships Program (HOME Program) for each MSA. These limits are based on affordability for households with incomes at or below 50% AMI or up to 60% AMI.

In rental units, because both rent and utilities factor into affordability calculations, any arrangement between a building owner and third-party heat providers must rely on contractual arrangements that ensure compliance with affordability thresholds.

B.2.3 Local Regulations

The City of Mount Vernon has not developed permitting guidelines for geothermal systems; however, a federal consent decree governing Mount Vernon's sewer system and various local laws and regulations could apply to the geothermal aspects of the project.

The project area does not lie in a designated special flood hazard zone.

B.2.3.1 Federal Consent Decree

The City of Mount Vernon possesses 185 miles of sewers built more than 100 years ago. As the sewers have aged, the city faced worsening flooding, backups, and violations of environmental regulations. Most relevant to this analysis are ongoing illicit discharges from sanitary sewer lines into the stormwater system that empties into the nearby Bronx and Hutchinson Rivers, a violation of the federal CWA.⁷⁵ In response to these CWA violations, the city entered a Consent Decree with the U.S. Department of Justice (DOJ) and the EPA in 2018.⁷⁶

The Consent Decree is a legal agreement between the U.S., New York State, and the City of Mount Vernon. The background includes allegations of the city violating the CWA and related regulations. The decree superseded all prior court orders and fines and established a framework for the city to achieve compliance, with an extended schedule due to significant capital costs. To mitigate these issues and comply with the Consent Decree, Mount Vernon is undergoing a multiyear Comprehensive Sewer Investigation and Rehabilitation (CSI&R) Program. New York State provided the city with a \$150-million investment, with part of those funds allocated to investigating and rehabilitating the Outfall 24 drainage area identified in the Consent Decree as a major pollutant source.⁷⁷

By entering the Consent Decree, Mount Vernon accepted responsibility for the violations related to its municipal separate storm sewer system (MS4) under the CWA and the New York State Environmental Conservation Law (ECL), and agreed to the terms outlined in the decree, including payment of a civil penalty⁷⁸ and various compliance requirements.⁷⁹ Important compliance requirements include:

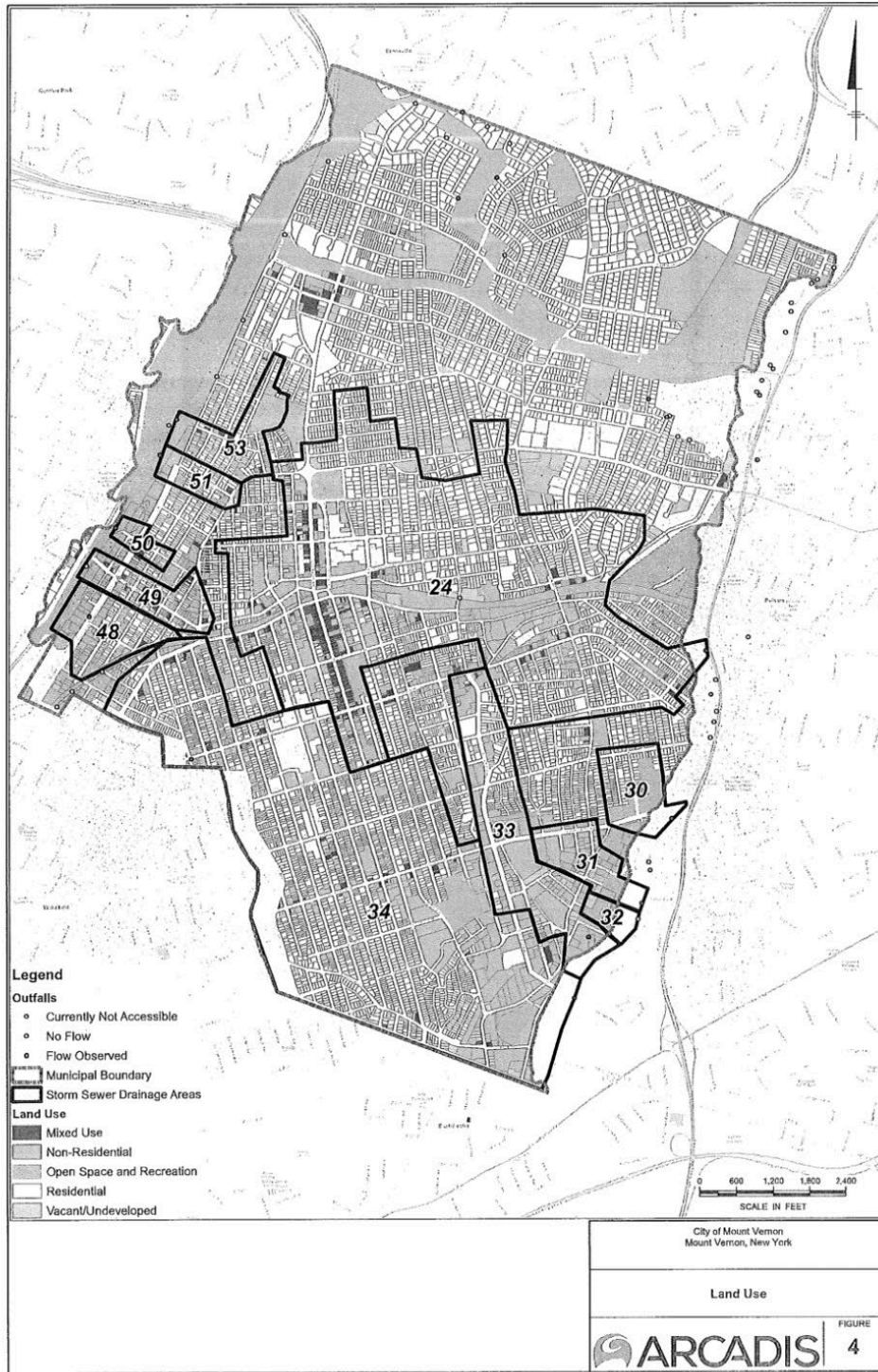
- Mount Vernon must maintain a comprehensive spreadsheet of all MS4 outfalls and an up-to-date digital map depicting outfalls, roads, waterbodies, and storm sewer sheds.⁸⁰
- Mount Vernon must complete construction and repairs to address potential illicit discharges by specified dates.⁸¹
- Mount Vernon must conduct a Sewer System Evaluation Survey (SSES) followed by the submission of a Corrective Action Plan.⁸²
- State and federal representatives have the right to enter covered facilities, monitor progress, verify data, obtain samples, and assess compliance.⁸³

Later sections of the Consent Decree pertain to reporting requirements, stipulated penalties, force majeure, and handling unforeseen events.⁸⁴

The CSI&R Program established in the Consent Decree includes a 5-year Implementation Plan, under which the city must complete an investigation to identify areas of concern and commence rehabilitation work for the critical areas within the first two to three years.

Figure B.1. Outfall 24

The proposed Library Square project sits within the Outfall 24 drainage area⁸⁵ and will be subject to the ongoing CSI&R Program.



The Outfall 24 section of Mount Vernon's sewers is 1 of 52 Outfall Networks that comprise the city's municipal system. Outfall 24 services some of the city's central neighborhoods and essential public spaces, including the Mount Vernon Public Library. The proposed Library Square district thermal project overlaps Outfall 24, where a significant number of sewer lines struggle with inflow and infiltration (I&I).

Inflow and infiltration typically describes water infiltration from stormwater into the sewers.⁸⁶ However, the inflow and infiltration occurring in Outfall 24 includes infiltration of water from the sewer systems into the stormwater system, causing enterococcus and other bacteria found in human waste to enter New York State waterways, most notably the Bronx and Hutchinson Rivers. This CWA violation forms one of the central reasons for the Consent Decree.

B.2.3.2 Current Status of Comprehensive Sewer Investigation and Rehabilitation Program

Scheduled initiatives for 2023 included cleaning and inspecting the Outfall 24 area, as well as conducting sewer and maintenance hole repairs. Since December 2023, Mount Vernon has actively focused on the primary investigative portion of the CSI&R Program, specifically on completing a citywide SSES. The city estimates that it is currently in its second year of compliance with the Consent Decree, leaving just over one year to complete the investigation and commence rehabilitation. Because the worst inflow and infiltration occurs in Outfall 24, city officials have announced a strict timeline to complete the Outfall 24 investigation within one year. The Consent Decree, however, names May 31, 2025, as the official deadline for the Outfall 24 investigation.⁸⁷

In early 2023, Mount Vernon completed a bid solicitation process for the cleaning, inspection, and rehabilitating of sewer system areas covered by the federal Consent Decree. On January 9, 2023, the city issued two solicitations: the first for the first phase of rehabilitation work (SS Rehab Phase 1), and the second for the cleaning and inspection of Outfall 24 (OF24 C&I). Although we have not yet received the full bid documentation, we discerned initial information from public filings.

- **SS Rehab Phase 1 Solicitation**

The solicitation sought sewer cleaning, inspection, and rehabilitation services for stormwater and sanitary sewer mains, sewer service connections, and maintenance holes, and catch basins throughout Mount Vernon. The express contract parameters include a two-year contract for sewer cleaning, inspection, and rehabilitation for the various stormwater and sanitary system elements identified above. Covered rehabilitation work may include cured-in-place pipe (CIPP) lining; testing and seating of service connections or joints; maintenance hole and catch basin rehabilitation or repair, including cementitious lining; excavation pipeline point repairs; raising maintenance hole grade; trenchless repair; and miscellaneous rehabilitation work.⁸⁸

- **OF24 C&I Solicitation**

The solicitation sought further sewer cleaning and closed-circuit television (CCTV) inspection of 200,000 linear feet of Mount Vernon sanitary and storm sewers in the Outflow 24 drainage area. Express contract characteristics included a one-year contract for sewer cleaning and CCTV inspection of the 200,000 linear feet sanitary and storm sewer system, plus 30 days of post- CCTV inspections for illicit discharges. The solicitation expressly included smoke and dye testing as inspection methods.⁸⁹

Mount Vernon awarded both bids to National Water Main (NWM), after the city held a prebid conference on January 17, 2023, and closing both solicitations on February 14, 2023. As of December 2023, NWM has commenced investigative work into the state of Mount Vernon’s compromised stormwater and sanitary sewer systems. Primary consultants include the engineering firm Arcadis of New York.

Following investigative work, NWM plans to initiate rehabilitation work in or around spring 2024, although the full scope of Outfall 24’s rehabilitation remains a moving target, pending results from ongoing investigative measures. Rehabilitation work that aligns with this project’s development schedule may reduce project costs if both rehabilitation work and sewer modifications for SHX work can be combined.

B.2.3.3 Sewer Regulations and Standards

The City of Mount Vernon owns and operates its sanitary and storm sewers, exercising several key authorities in managing its wastewater systems. The city controls both the quantity and quality of wastewater originating from new developments and satellite collection systems. It also identifies and addresses sources of infiltration and inflow within its sewer infrastructure. The city enforces standardized design and construction practices for new and rehabilitated sewers and connections,

aligning with the Ten State Standards (TSS).⁹⁰ Moreover, the city mandates standard installation, testing, and inspection procedures for new and rehabilitated sewers. To ensure effective oversight, the city maintains access to all components of the collection system, enabling comprehensive management and maintenance of its wastewater infrastructure.⁹¹

Mount Vernon derives its authority from Article VI of the city's local laws.⁹² Article VI establishes regulations for installing, connecting, and discharging into the city's sewer and drainage systems, aiming to ensure compliance with standards, protect water quality, and prevent damage to public property. Section 227-30, designed to regulate connections to sanitary sewers, stormwater drains, and water mains, sets rules for installing and repairing sewer, drainage, and water service lines in public areas. The law requires compliance with Department of Public Works (DPW) regulations, adherence to DPW's specifications, and use of defined materials and standards for these service lines. Article VI also regulates the type and amount of discharge, prohibiting the release of domestic sewage, industrial wastes, or harmful substances into stormwater drains or water bodies.⁹³ Finally, the law governs connections to sanitary sewers and stormwater drains by specifying approved types and conditions and outlining procedures for existing pipes and maintenance holes.⁹⁴ In summary, Article VI establishes clear regulations for installing and connecting to the city's sewer and drainage systems, which the Library Square district thermal project must comply with during construction.

DPW's Bureau of Sewers is responsible for managing all aspects of its wastewater collection system, except for treatment. The bureau staffs 10 full-time operation and maintenance employees and relies on external contractors for maintenance and emergency support.

B.2.3.4 Property Owners and Customers

In addition to county-owned main lines and municipal MS4 tributary lines, property owners own the service sewer lines running from their buildings to the point of connection with the municipal line. This model differs from the one typically used for water lines, where municipalities maintain upper and lower lateral service lines extending from main lines to property lines. With sewer lines, the connecting property owner owns and maintains the entire service line from the house to the municipal line. Proposed customers of the Library Square district thermal system will need to account for this as a key expense.

B.2.3.5 Additional Sources for Requirements and Standards

In addition to the primary sources of regulation, requirements, and standards identified earlier, other standards for sewer construction exist.

First, both bid documents for the Outfall 24 solicitations included sewer construction standards. These standards hold particular significance because the city developed them itself for the exact sewer system that Library Square intends to connect to..

Second, a Sanitary Sewer System Capacity, Management, Operations, and Maintenance Plan (CMOM) accompanies the Consent Decree. Finalized in April 2023, the CMOM outlines the implementation of the Consent Decree and the city’s sewer systems. It provides an overview of collection system management, including general system information (system description and details, age distribution, and pipe length by diameter), as well as cleaning, inspection, and maintenance requirements.⁹⁵

The CMOM references a set of Ten State Standards for sewer repair and construction. Research identified these as a set of “Recommended Standards for Wastewater Facilities” issued by the Great Lakes–Upper Mississippi River Board of State Sanitary Engineers, offering guidelines for sewage plant design and specifications. DEC provides an online copy of these standards, which includes Chapter 30, covering sewer system design.⁹⁶

B.2.3.4 Building Code and Permitting

Mount Vernon’s DPW and Department of Buildings issue permits for access to public rights-of-way and alterations to buildings.

Mount Vernon adopted the New York State Uniform Fire Prevention and Building Code as its building code.

The city advises geothermal mechanical contractors to obtain permits for work on private property from the Department of Buildings. Although Mount Vernon lacks prior permitting precedent for geothermal systems, it treats HVAC systems as the closest analogue. For a geothermal system, an equipment and electrical permit will likely be required. Excavation work may require an additional permit for digging.

B.2.3.7 Public Works

PW holds jurisdiction over city sewer infrastructure and infrastructure on public property, as well as public rights-of-way. DPW also regulates road closures for construction work.

To connect business, commercial, and industrial buildings to the sewer system, applicants must obtain a permit requiring an indemnification and hold harmless agreement in favor of the city.⁹⁷

B.2.3.8 Use of Sewer System as Thermal Source and Sink

A variation of the geothermal system design proposes using the project's sewage stream as a heat source and sink. The system would divert sewage through a bypass pipe coupled with a heat exchange unit and then return the sewage to the main line before it reaches the municipal sewage lines.

Westchester County exercises oversight when projects impact a municipal sewer system connected to a county system. Mount Vernon's sewers lead to the county's Publicly Owned Treatment Works (POTW) in Yonkers. Since 1935, Mount Vernon and Westchester have maintained a Joint Sanitary Sewer System Agreement for wastewater treatment, most recently renewed in 2001. As a result, Westchester County requires Mount Vernon to comply with Westchester County Ordinance Chapter 824, also known as the County Environmental Facilities Sewer Act (Sewer Act). The Westchester County Department of Environmental Facilities (WCDEF) administers the sewer regulations.

When new users connect to a municipality's tributary sewer systems, the Department of Environmental Facilities must receive notification to assess an annual sanitary sewer charge, billed directly to individual property owners.

The Sewer Act does not expressly prohibit a municipality from using its sewers for heat recovery in Westchester County. The potential limitation is that extracting heat from a sewer line falls outside the uses expressly established in the Sewer Act. The ordinance restricts "[t]he use of the county trunk sewer system and the tributary sewer systems . . . to receive and accept the discharge of sewage, industrial wastewater and other wastewater generated on or discharged from real property lying within the bounds of the Westchester County sanitary sewer districts. . . ."⁹⁸ The county's Department of Environmental Facilities should be consulted or, at a minimum, informed of the proposed project.

Although no prohibition exists, the county regulates and controls the discharge of sewage, industrial wastes, and other pollutants into the trunk and tributary sewer systems. Its objectives include preventing excessive volumes and flow rates, addressing inflow and infiltration problems, prohibiting contributions that create hazards or operational difficulties, ensuring uniform requirements, avoiding interference with treatment works, promoting recycling of wastewaters and sludges, equitably distributing operation and maintenance costs, cooperating with health and environmental agencies, protecting public health and welfare, and complying with federal and State laws governing publicly owned treatment works.⁹⁹

The Library Square project will require the use and modification of Mount Vernon's tributary sewer systems (and potentially country truck sewers) and the development of a new multiunit residential building. Accordingly, the project must comply with Westchester County's Sewer Act and provide notification to the Department of Environmental Facilities.¹⁰⁰

Based on the proposed system, the following assumptions apply:

- The system would remain entirely closed, preventing discharge into the environment.
- The sewage stream would remain unchanged in terms of biochemical oxygen demand (BOD), total suspended solids, pH, fecal or total coliform bacteria, phosphate and phosphorus compounds, fats, oils, and greases would conform to applicable requirements.
- Only temperature changes would occur in the diverted and return sewage stream.
- System cleaning and maintenance would use ordinary water and mild degreasing agents without introducing prohibited substances.
- System operation would not significantly increase water use.
- The concentration of viscosity of waste streams would remain unchanged.
- System design and connections would comply with all applicable codes, including DEC regulations, governing sewage system materials and design.

Municipal law serves as the primary regulator of sewers, with county requirements, DEC regulations, New York State Plumbing Codes, and EPA standards supplementing local building and construction codes as needed.

B.2.3.9 Temperature of Discharge

Municipal regulations set a default outflow temperature range for the public sewer system, which the Bureau of Sewers may vary if temperatures could harm the sewer system, treatment process, or public health. Temperatures are regulated at the point of entering the municipal system pipes and at the sewage treatment plant. According to Westchester County regulations:

1. Sewage streams entering publicly owned treatment works may not exceed 104°F, or 40 degrees Celsius (°C).¹⁰¹
2. Although no minimum temperature is specified, waste streams should remain above freezing to avoid icing.
3. The county does not specify default temperatures for entry into the sewer system pipes, but may impose additional requirements as permit conditions.

Together, these requirements would limit the use of sewage streams as a heat source and sink to outflows entering the public sewer to no greater than 104°F (40°C). The sewer authority may specify a narrower temperature range as part of the review process.

B.2.3.10 Right-of-Way

If the sewage thermal exchange unit remains entirely on the project premises and receives service without extending beyond project boundaries, the project would not require additional easements or rights-of-way for the thermal exchange unit beyond those needed for the conventional sewer system. By confining the thermal exchange system in this way, the project limits approvals to standard design and right-of-way requirements.

B.2.3.11 System Construction

All sewage system construction must contain waste and prevent environmental pollution. Accordingly, connections between the diversion and main line must comply with DEC sewer construction standards and remain watertight, preventing leakage into or out of the connections. Westchester County sewer construction requirements would also apply to the heat exchange component of the project's proposed sewer system.

Mount Vernon regulates sewer connections through Chapter 227, Part I, Article VI of its code.¹⁰²

DPW coordinates permitting for all related approvals. Accordingly, connections between the diversion and main line must comply with DEC standards and remain watertight. The system design and materials will be reviewed through the standard permitting process. Although no specific geothermal requirements exist, limited familiarity with these systems may extend the review period.

B.3 Relevant Precedents

No comparable precedents exist in Mount Vernon. There are no operating multi-party geothermal energy networks that rely on sewer heat exchangers in Westchester County.

Table B-2. Permitting and Regulatory Review Requirements for the District Thermal Energy Project

Authority Having Authority	Permit, Approval, or Action Required	Purpose & Description	Estimated Timeframe	Risks & Considerations
Federal				
U.S. Environmental Protection Agency (EPA)	Exercise supervision over Army Corps and DEC under CZMA, CWA, SDWA, Endangered Species Act, and NEPA	May block issuance of CWA Section 404 permits if the project causes unacceptable adverse effects on water supplies, shellfish beds, fishery areas, wildlife, or recreational areas	Army Corps review timeframe unless complications arise	Risk of permit denial if the environmental impacts are deemed significant or unsupported findings
U.S. Department of Housing and Urban Development (HUD)	Ensure compliance with affordable housing rules	Enforce housing affordability and tenant protection requirements	Follow the State process unless complications arise	Risk of public complaints or legal challenges
State				
Department of Environmental Conservation (DEC)	Issue permits and approvals, including: <ul style="list-style-type: none"> • CWA Section 401 Water Quality Certification • SPDES permits (for water discharges, thermal extraction, and potential drinking water impacts) • Division of Water or Division of Mineral Resources well approvals • Sewer construction approvals 	Protect water quality, wetlands, and habitats; regulate water discharges, drilling, and sewer construction	Concurrent with Army Corps review	Risk of habitat impairment and river and wetlands conflicts
State Historic Preservation Office (SHPO)	Approve work affecting protected historic properties or cultural resources	Preserve and protect registered historic properties and cultural resources	Concurrent with Army Corps review	Risk of project design changes to avoid resource impacts
Department of Transportation (DOT)	Approve road closures, easements, and work within road or railroad rights-of-way	Control access and ensure public safety in transportation corridors	Weeks	No significant risks anticipated
Office of Renewable Energy Siting (ORES)	Approve geothermal systems for projects over 25 MW _{th}	Grant siting approvals for qualifying geothermal system projects	Up to 12 months	Minimal risk if preapplication consultation and regulatory compliance are maintained

Table B-2. (continued)

Authority Having Authority	Permit, Approval, or Action Required	Purpose & Description	Estimated Timeframe	Risks & Considerations
State				
Public Service Commission (PSC)	Approved submetering applications under HEFPA	Regulate submetering for energy services	6 months to 1 year	Potential pricing constraints and regulatory misalignment for nonelectric services
Department of Public Service (DPS)	Approve submetering under Residential Submetering Regulations; receive historical artifacts notices	Monitor and enforce submetering and historical site reporting requirements	6 months to 1 year	Pricing and regulatory compliance challenges for nonelectric services
New York State Homes and Community Renewal (HCR)	Regulate provision and cost of heat in affordable housing	Enforce affordability, heat provision, and tenant protections	None unless complaints arise	Risk of pricing disputes and public opposition
Local				
City of Mount Vernon Department of Public Works (DPW)	Approve work in public rights-of-way, road closures, easements, and sewer work under the EPA consent decree	Control public infrastructure access and enforce sewer system milestones under the federal Consent Decree	Weeks for routine issues; consult Consent Decree for sewer system milestones	Risk of delays or additional conditions related to the EPA Consent Decree requirements
City of Mount Vernon Building Department	Issue building, electrical, mechanical, excavation, and geothermal permits	Review and approve construction permits, including for geothermal system	Months	Risks related to design approvals and permit timing
Westchester County Department of Health	Approve water, sewer system, and heating service impacts	Protect public health through oversight of utility and heating system operations	Incorporated within project permitting unless complaints arise	Risks related to heating service reliability or system design
Westchester County Department of Environmental Facilities	Approve connections to water or sewer systems, and review temperature control impacts	Protect infrastructure integrity and operational reliability	Incorporated within local project permitting	Risk of additional design revisions
Westchester County Department of Housing and Community Development (HCR)	Regulate rent, and monitor tenant protections and heat provision in affordable housing	Enforce tenant protections and affordability requirements	None unless opposition arises	Risk of community opposition or compliance disputes
Local and State Courts	Adjudicate landlord-tenant disputes regarding heat provision and costs	Resolve legal challenges affecting project operations	None unless disputes occur; resolution may require months to years	Risk of public opposition or litigation forcing business model changes

Table B.3. Stakeholder Approvals, Consents, and Coordination Requirements

Stakeholder	Approval, Consent, or Action Required	Purpose & Description	Estimated Timeframe	Risks & Considerations
Project Development Investors and Building Owners	Execute common management agreement	Establish agreement among separately owned buildings for shared project elements, ownership terms, maintenance, and cost allocation	Months; should be initiated early due to business model implications	Delay or failure to finalize agreement may cause project delays, increased costs, or stalemates
Electric and Gas Utility	Coordinate submetering for electric heat under HEFPA	Ensure compliance with HEFPA requirements for submetering electric heating systems	6 months to 1 year	See PSC regulatory risks in Table B-2
All Utilities (electricity, gas, water, sewer, cable, telephone)	Secure rights-of-way and franchise approvals	Confirm utility access rights, ensure no franchise conflicts, and negotiate provisions for compensation, maintenance, decommissioning, and liability	Weeks to months	Negotiations may be lengthy without default regulations
Electrical Utility	Approve electric load and capacity upgrades	Authorize electrical interconnections and capacity expansion for new heat pumps and heat exchangers	Weeks	No significant risks anticipated
Nongovernmental Organizations (NGOs) and Community	Participate in public hearings and consultation	Provide community outreach, present project details, and address public concerns at hearings and stakeholder meetings	Not quantifiable	Risk of public opposition or reputational challenges

B.4 Anticipated Challenges and Risks

The implementation of the proposed district geothermal system in Mount Vernon faces several regulatory, technical, and operational challenges that must be addressed to ensure project viability. These risks range from federal oversight constraints on sewer infrastructure improvements to the absence of a municipal permitting framework for district geothermal systems, complex rights-of-way negotiations, and evolving state and federal environmental regulations. Early coordination with municipal, county, State, and federal agencies, as well as affected property owners and utilities, will be critical to navigating these challenges and minimizing delays.

B.4.1 Federal Consent Decree Will Determine Project Timeline and Requirements

Use of the sewer system as a thermal source and sink may require repairs to the sewer infrastructure, which must comply with the federal Consent Decree. Because the decree imposes deadlines for Mount Vernon to implement corrective measures, the city will necessarily prioritize sewer-related measures that meet those compliance requirements. This federal oversight will complicate the approval process

compared to a scenario without such supervision. The project developer should coordinate with the City of Mount Vernon, considering both the city’s obligations and timetable under the federal Consent Decree and its need to engage with State and federal authorities. As a result, this process will likely cause delays and introduce additional conditions.

- The timing of Library Square depends on the rehabilitation schedule for Outfall 24. Stakeholders must determine whether the Outfall 24 rehabilitation must be completed before connecting the district thermal system, or whether the infrastructure can be installed concurrently during the rehabilitation phase. Coordination among Mount Vernon, NWM, Endurant, and potentially the DOJ and EPA should begin immediately to assess whether concurrent work is financially and logistically feasible, and whether the Consent Decree requires modification to permit it. At a minimum, Endurant should advise on any nonrehabilitation-related upgrades or expansions needed for the geothermal system.
- DPW’s Bureau of Sewers manages all wastewater collection system responsibilities except treatment, while the Department of Environmental Facilities provides additional regulatory oversight.
- Key regulatory sources and standards for sewer construction in the Outfall 24 area include the Consent Decree (and its Sanitary Sewer System CMOM), Article VI of the Mount Vernon City Code, Westchester County Ordinance Chapter 824 (County Environment Facilities Sewer Act), two January 2023 bid solicitations for Outfall 24, and “Recommended Standards for Wastewater Facilities” incorporated in the CMOM.
- City officials believe that Endurant, under its contracts with NWM, is responsible for coordinating with NWM on areas of Outfall 24 covered by the SS Rehab Phase 1 and OF24 C&I solicitations. They do not anticipate additional procurement for sewer servicing and engineering firms for Library Square. The extent of NWM’s involvement will become clearer through further stakeholders meetings and continued city review of the contract terms.
- The Consent Decree sets strict schedule requirements. The CSI&R Program created by the decree includes a 5-year Implementation Plan, requiring the city to complete investigations and begin rehabilitation for critical areas within the first two to three years. City officials estimate they are now in the second year of compliance, leaving just over one year to complete investigations and start rehabilitation.

B.4.2 Lack of Municipal Regulatory Regime for District Geothermal Systems

Few municipalities in New York State have established permitting guidelines for geothermal systems, and none have created standards for multiproperty district systems. Without a dedicated permitting regime and equipment standards, developers and municipal officials must interpret various zoning, building, mechanical, and environmental regulations that were never intended specifically for geothermal applications.

This improvised, piecemeal approach increases costs, delays approvals, and raises both uncertainty and risk. In projects requiring the consent or approval of multiple stakeholders, including property owners, utilities, and government agencies, the lack of geothermal-specific permitting and standards often prevents decisions and leads to bureaucratic gridlock. Applying existing zoning and other regulations, which are often unsuitable for geothermal systems, such as setback requirements, can hinder projects in dense urban and periurban areas with small lot sizes.

To mitigate this challenge, developers should begin educating municipal permitting authorities and elected officials about the project's geothermal features and risk mitigation measures as soon as they finalize a proposed design and complete the mitigation assessment. Developers should also prepare for early engagement with environmental and community organizations interested in the project.

B.4.3 Rights-of-Way and Approvals

Developers must secure either fee simple ownership or easements to drill and install a shared ground loop across multiple properties. Easements and approvals from the owner or authority responsible for their operation will be required to cross property lines, streets, railroad tracks, and existing utility infrastructure.

Acquiring rights-of-way can prove expensive and time-consuming. Developers should consult with each utility that has subsurface infrastructure during the approval process to confirm that proposed designs and construction activities will not disrupt the proposed operations. Safely installing geothermal piping without interfering with other utilities will likely require those utilities to conduct site visits to individual properties. The associated costs and risk of damage will likely cause those utilities to resist granting approval.

Granting easements over a property limits a property owner's ability to use their own property and can adversely affect private property rights or diminish private property values. Valuing compensation for an easement and its impact on the servient property can be challenging,¹⁰³ potentially resulting in deadlock during negotiations.

Without government intervention, geothermal developers must negotiate with property owners and affected utilities to secure approval, which may be conditioned upon agreement on compensation, maintenance, decommissioning, and indemnification for liability.

Well-documented costs for obtaining rights-of-way for roads, pipelines,¹⁰⁴ telecommunications, railroads, subways, intracity surface rail, and other types of infrastructure that cross property lines may include a one-time acquisition fee, annual fees, excessive or escalating fees,¹⁰⁵ and the time and cost of organizational staff and legal professionals to procure rights.

In New York State, investor-owned electric and gas utilities resolve rights-of-way issues by entering into franchise agreements with municipalities.

B.4.4 Business Model

Geothermal development can follow one or more of several business models, each exhibiting differing technical economies relative to transactional diseconomies. The present project could be categorized as a “Multiple Properties—Multiple Owners Under a Common Agreement” business model.¹⁰⁶

In this model, each building either currently sits or will sit on its own individual property for tax purposes and each building remains its own entity and operates independently from the others. The buildings vary in size, use, and energy consumption and do not currently fall under common management or an agreement that unifies geothermal system and other aspects of the development.

Geothermal development under this model requires complex property rights arrangements because the system crosses property boundaries and requires cooperation across properties and organizations. Developers would need to establish a common agreement covering maintenance, management, pricing, and financial and other responsibilities for the system, supported by an owner’s association or similar entity accompanying association fees or charges.

B.4.5. Submetering and Tenant Billing

If the project plans to submeter heating services so individual tenants control their usage and pay for heat services individually, the developer or a third-party energy services provider must apply to the PSC for approval to submeter tenant units. PSC submetering regulations require compliance with metering, billing, dispute resolution, and other requirements.

Obtaining submetering approval for a new development is far less complex than for a building with existing tenants. Introducing submetering to an existing tenant relationship requires additional public hearings and lease amendments.

Currently, New York State’s submetering regulations apply to electricity and electric heating services. No regulatory arrangement exists for billing heating services in measured in thermal units.

To simplify submetering arrangements, the project should introduce submetering before entering into agreements with any prospective tenants and preferably before advertising rental units. Furthermore, the project should measure and bill heat services as electric heat, following established guidelines to conform as closely as possible to current regulations. If the project proposes submeter-based measurement and billing of services, developers should consult with the PSC and the New York State Department of Public Service at the earliest possible time for guidance because this request will raise novel issues that may require adaptation of existing rules.

B.4.6 Evolving Regulation of Hydrofluorocarbons and Implications for Certain Geothermal Systems

B.4.6.1 American Innovation and Manufacturing Act of 2020

The American Innovation and Manufacturing Act of 2020 (AIM Act) directs the EPA to promulgate regulations that will reduce U.S. hydrofluorocarbon (HFC) production and consumption by approximately 85% by 2035.¹⁰⁷ Specifically, the act directs the EPA to:

- Phase down the production and consumption of 18 HFCs listed in the act through an allowance allocation and trading program
- Establish management requirements for listed HFCs and their substitutes
- Facilitate the transition to next-generation technologies by restricting listed HFCs use in specific sectors or subsectors¹⁰⁸

The phase-down requirements target companies that produce or import bulk HFCs and companies that use HFCs in the following six applications:

1. As propellants in metered dose inhalers
2. In defense sprays
3. In structural composite preformed polyurethane foam for marine use and trailer use
4. For etching of semiconductor material or wafers and cleaning chemical deposition chambers in the semiconductor manufacturing sector
5. For mission-critical military end uses
6. In onboard aerospace fire suppression systems¹⁰⁹

The act also grants the EPA authority to restrict HFC use either fully, partially, or on a graduated schedule in specific sectors or subsectors. The EPA may initiate rulemaking procedures on its own or act upon petitions from individuals.¹¹⁰ On October 8, 2020, the EPA announced that it would grant or partially grant 11 petitions filed under the AIM Act to restrict HFC use in the refrigeration and air conditioning, aerosols, and foam sectors. EPA will have two years to promulgate regulations through public comment and rulemaking procedures addressing these petitions.

B.4.6.2 New York State Law: Significant New Alternative Policy Rules 20 and 21

Before Congress enacted the AIM Act, the EPA attempted to restrict HFC use under its authority in Title VI of the Clean Air Act (CAA) to regulate ozone-depleting substances. It did so through the CAA's Significant New Alternative Policy (SNAP) program by promulgating SNAP Rules 20 and 21. These rules prohibited the use of certain end-use applications such as commercial refrigeration and air conditioning. However, upon judicial review, the courts held that the EPA exceeded its authority under the SNAP program because HFCs are not ozone-depleting substances.

In response, several states moved independently to adopt SNAP Rules 20 and 21, reinstating the EPA's restrictions on HFCs. For example, in 2018, California passed the California Cooling Act, incorporating SNAP 20 and 21 into state regulations. Other states, including New York State, followed California's lead by enacting similar HFC restrictions. In 2020, New York State promulgated regulations incorporating SNAP 20 and 21.

DEC regulations prohibit the sale, installation, and commercial use of certain HFC refrigerants in new or retrofitted food refrigeration equipment, large air conditioning equipment (chillers), and vending machines. They also restrict the use of specific substances as aerosol propellants and foam-blowing agents in new consumer products.¹¹¹ The regulations do not require replacement or modification of existing operational equipment; however, Part 494 requirements may apply at the end of its useful life.

B.4.6.3 Implications for Geothermal

Project developers should consider the potential for evolving regulations to increase maintenance costs and require replacement of regulated refrigerants at the end of equipment life when making investment decisions about technology selection. Although the EPA has already authorized several lower-global-

warming-potential (GWP) refrigerants for air-conditioning applications under the SNAP program,¹¹² regulatory requirements continue to change rapidly. Some states, such as California, have taken additional steps to impose restrictions based on refrigerant's GWP level.¹¹³

Many next-generation refrigerants introduce environmental and regulatory risks, including higher flammability levels compared to commonly used refrigerants.¹¹⁴ Additionally, these refrigerants cannot serve as “drop-in” replacements for existing equipment. Manufacturers must first develop systems designed to accommodate these substitutes, and state building codes must establish specific requirements for their use.¹¹⁵

Given the uncertainty surrounding regulations for HFCs and the challenges associated with safe and effective substitutes, hydronic systems or other options that eliminate refrigerants altogether could offer a more economical choice today when evaluating technology options over their full life cycles and assessing the risks posed by regulatory changes.

B.5 Recommendations to Overcome Geothermal System Operational Challenges

Contractual arrangements between the developer and other stakeholders can address some of these challenges. Recommended contractual arrangements include:

- **Common Agreement**
The project will need a common agreement to operate the geothermal system among properties owned by different entities. This agreement should specifically address the ownership, operation, and maintenance of the geothermal system because it will cross internal property boundaries and require cooperation across separate properties and ownership structures. The agreement must establish terms for maintenance, management, pricing, financial contributions, and other operational responsibilities. It must also develop a common management body, such as an owner's association or similar entity, and support it through association fees.
- **Third-Party Energy Services**
The common agreement would enable the project to enter into a third-party energy services agreement with a geothermal system operator. The third party could provide a turnkey solution or perform discrete tasks on behalf of the project's common management association. Any arrangement with a third-party energy services provider must require performance and compliance consistent with the developer's obligations to tenants and with requirements that the PSC or other government agencies may impose concerning the provision of heat to tenants.

- **Submetering and Tenant Leases**

If the project plans to submeter heating services, allowing individual tenants to control their usage and pay for their heat services on an individual basis, it must obtain PSC approval for the submetering arrangements before entering into leases with any tenants. Leases must then include language that allocates financial responsibility for billed services to the tenant.

- **Tax Optimization**

The geothermal system qualifies as a depreciable asset, offering opportunities for tax-advantaged financing. The project should explore a geothermal financing structure with stakeholders early in the planning process because this approach could enhance the overall project.

Endnotes

- ¹ 88 Fed. Reg. 82188-82223 (2023).
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