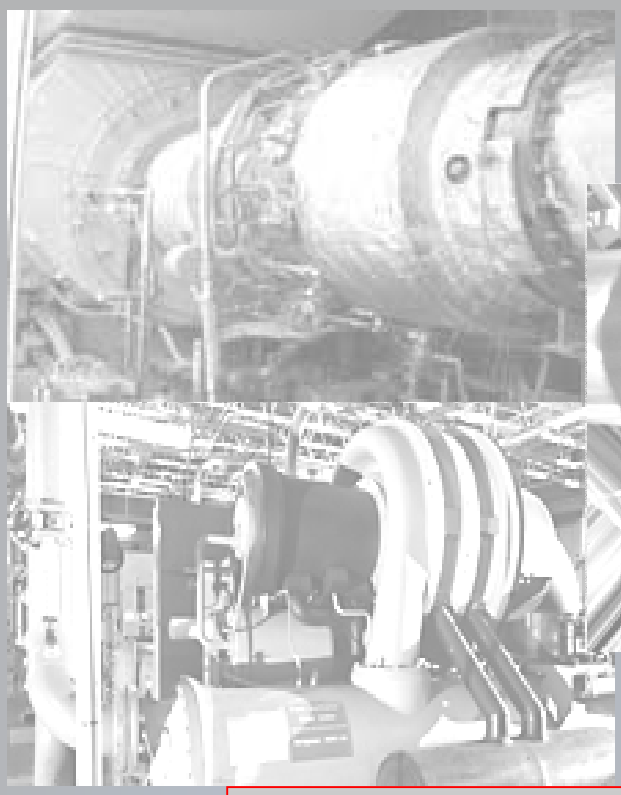


Scoping Report

Montpelier District Energy CHP
Scoping Report

Last modified: 12/1/2009

VEOLIA
ENERGY

Scoping Report

Montpelier District Energy CHP System

VEOLIA ENERGY

1 Introduction

Veolia Energy NA was selected as the development partner by the City of Montpelier to develop the Montpelier Biomass District Energy System and examine the feasibility of Combined Heat and Power (CHP) in Montpelier, Vermont. The first step of the development process is to draft a Scoping Report that identifies and refines the scope of the project.

On 10/2/09, a meeting was held at the Office of the Commissioner of Buildings and Grounds of the State of Vermont. Present were representatives from the office of the Commissioner of Buildings and Grounds, representatives from the City of Montpelier and Veolia Energy. During the meeting it was jointly decided to combine the existing State Capitol District Steam Plant with the new proposed City District System under development. This new proposed system would be designed to meet the complete heating needs of the State of Vermont Capitol District Office Complex and select buildings in the downtown area as well as generate power if possible through Combined Heat and Power (CHP).

2 Executive Summary

This Scoping Report is intended to provide background information on the proposed Montpelier District Energy System CHP. In this report, we will provide detailed and preliminary analysis to construct a new 2000 BHP (69MBH) District energy CHP plant located at 122 State Street that will be utilized to feed steam to the existing Capitol District Office Complex and deliver hot water in the Montpelier downtown corridor.

2.1 Existing State Plant

The existing Capitol District Steam Plant presently serves 18 buildings, totaling 560,000 Square Feet of office space. There is an existing steam distribution system that is in very good condition. However, the boiler plant has two boilers that are well past their life expectancy, in need of replacement and below the flood plain.

Our recommendation is to utilize the 122 State Street site for the location of the Montpelier District Energy CHP facility while replacing the boilers with updated technologies and designing the plant to prevent flooding.

The existing building could be utilized for utility tie-ins, steam distribution connections, auxiliary machinery and control room facilities. A new steam plant would then be constructed adjacent to the existing building to house two new modern biomass boilers, one new oil fired boiler and one relocated oil fired boiler.

2.2 Proposed System Design

The proposed system design would utilize two 600 BHP biomass fired boilers capable of producing High Pressure (HP) steam to be passed through an industrial back pressure turbine for CHP operation. In addition, two 400 BHP oil fired boilers would be utilized as back up to produce Low Pressure steam to the Capitol District Office complex and the Energy Delivery Stations within the city limits as needed. Each Energy Delivery Station would have a heat exchanger and set of pumps that would distribute hot water to municipal accounts within the city.

2.3 Capital Cost

The estimated capital cost of the Montpelier District Energy CHP system is $16,000,000. This estimated cost includes a new building with two 600 BHP Biomass boilers with a 400 KW backpressure steam turbine, one new 400 BHP oil fired boiler and the re-location of an existing 400 HP oil fired boiler. In addition, the facility would have a solid fuel storage facility complete with wood chip storage, automatic conveyors for fuel delivery, auxiliary equipment and control systems. We have also carried the cost of the provision and installation of 5000 feet of hot water distribution piping.

2.4 Proposed Plant Location

In previous studies, 122 State Street was one of three preferred locations to site a new Community Energy Plant by Biomass Energy Resource Center (BERC) in October 2008. We have chosen this site as the preferred site of the Montpelier District Energy CHP plant due to its central location and current arrangement to distribute steam to the Capitol District Office Complex. The location will allow delivery of both solid (wood chips) and liquid (#6

oil) fuel via over the road trucks. There are three different routes for distribution piping that would need to be considered to deliver steam or hot water to the downtown corridor – one along State Street ,one along School Street and one along the railroad bridge . The key determinant will be the routing for distribution piping across the Winooski River.

2.5 Proposed Plant Capacity

Based on the existing connected load and information from previous engineering reports of the Capitol District Steam Plant, we have conceptually come up with a sizing of 2000 BHP. However, during our initial due diligence, we were unable to create a load duration curve as all of the fuel data supplied was average fuel data. Without metering in place, it is difficult to collect the data that would be required to create the curve. (In addition, it would appear that the State Building expansion expected for the next 2-5 years may be on hold indefinitely.)

For the purposes of this report, we would like to consider this "worst case" or "highest demand" scenario in terms of sizing and downsize and refine as we move forward.

We highly recommend installing temporary metering to identify the actual consumption and steam production in the coming months. The plant capacity and layout could then be configured based on this actual usage data.

2.6 Issues/ Concerns

2.6.1 Hot Water Distribution Routing

The routing of the distribution system to the City of Montpelier will need to be based on where the hot water distribution loop is constructed as well as with how it integrates with the Capitol District steam system. The potential routes include: School Street, State Street or along the railroad tracks adjacent to the Winooski River.
The cost associated with the distribution system will need to be analyzed further during the feasibility study. Due to the fact that a route has not been determined, the cost could be affected significantly by rights of public way if multiple street crossings are required.

2.6.2 Plant Design Capacity

Fuel Consumption and steam production data currently available at the Capitol District steam plant only allow for monthly fuel figures and average steam production for the existing boilers. More time will need to be spent on data acquisition during the feasibility study to ensure that sizing is performed accurately and correctly. This could be accomplished by installing temporary metering.

2.6.3 CHP Challenges

CHP will be an economic challenge due to lack of a summer steam load. The State is considering the addition of a chilled water system to 133 State Street that could garner some consideration for summer load. 114 and 111 State Street have chillers, but could be serviced through the same pipe tunnels with a district chilled water system. If this is a viable consideration, district chilled water could be considered during the feasibility study phase of the project or as a later phase in development as existing state operated chillers require replacement.

2.6.4 Flood Plain Issues

The new Montpelier District Energy CHP building will need to be flood proofed in order to meet the Federal and State requirements along with compensatory storage, which will add cost to the construction.

2.6.5 Regulatory Issues- as presented by RFS in their Schematic Design

2.6.5.1 City

The project will need to be reviewed by the City of Montpelier Planning and Zoning Commission once a site plan is prepared. The City Planning Board will look for compliance with Section 816 of the Zoning and Subdivision Standards. On site fuel storage will need to be permitted by the local fire department.

2.6.5.2 State

State permits will be required to establish storm water management, District 5 Environmental Commission review, water and waste water connections. The Capitol Complex Commission most likely will need to review the general design for Architectural compliance, parking and truck access to the facility

2.6.5.3 Federal

The new construction building will need to comply with FEMA 102 building methods (flood proofing). Also, a storm water notice of intent will be required to be filed with the USEPA. In accordance with 40CFR 280.20, the new fuel tanks must be registered with the State of VT and meet all requirements of the CFR. Due to the proximity to the Winooski River a Spill Control Prevention Plant will need to be prepared and submitted to the EPA.

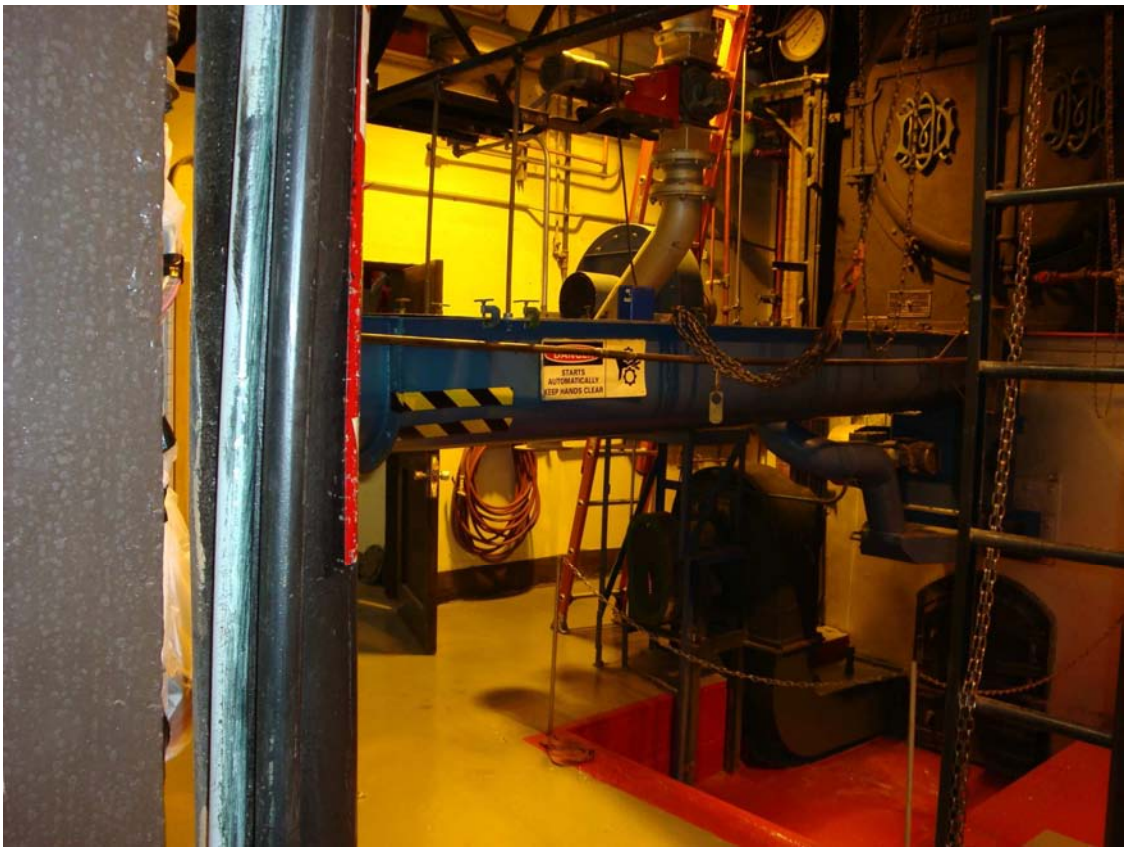
3 Existing Conditions

3.1 Existing State Steam Plant

The Capitol District Steam Plant is located at 122 State Street, in back of 120 State Street and adjacent to the railroad bridge along the North bank of the Winooski River. The plant currently provides 55 PSIG steam to 18 State office buildings in the adjacent four block radius. According to a previous Engineering feasibility study, the system has a connected load of 780 BHP.

Within the plant, there are three (3) boilers currently installed and in operation. Both boiler #1 and boiler #2 were originally coal fired boilers that have been converted. Boiler # 1 is a 1946 vintage Dillon Horizontal Return Tube (HRT) boiler that has been converted to burn wood chips. The boiler is designed to have 1670 Square feet of heating area. This would equate to 167 boiler horse power (BHP). Boiler #2 is the same vintage and has been retrofitted to burn #6 oil. Boiler #2 is designed with 1510 Square feet of heating area (151 BHP) and currently utilizes a #6 oil burner sourced from the steam plant in Waterbury, VT.

The HRT boilers, being 63 years old, are well past normal life expectancy. Most boilers of this type are in service for 30 years, depending on their design, maintenance frequency and material condition. The picture noted above shows the boiler front of boiler #1. The blue conveyor is the solid fuel delivery system.



The picture noted below shows the front of boiler #2 (left) and boiler #3 (right)

Boiler #3 is a 400 BHP (13.4 MBH) Johnston Model PTFA-400-4H150 Scotch Marine Fire Tube steam boiler. The boiler fires on #6 low sulfur (0.5%) fuel oil. Boiler #3 was installed in 2005.

We would recommend that some parts of the fuel delivery system be reviewed for use in the future biomass system. In speaking with plant personnel, the fuel delivery system is capable of being adjusted to feed a larger sized biomass boiler.

3.2 Fuel Tanks

Presently, there is a 20,000 gallon under ground fuel tank that was installed in late 1980's. During the feasibility study, we will need to look at the fuel requirements of the back up oil fired boilers, along with the amount of storage that will be required. In addition, some geo technical surveying will need to be performed along with soil samples taken to determine if the tank has leaked at all. From interviews with the plant staff, the tank is a double wall tank that is nearing 20 years old. For this conceptual design, we have carried the cost of two new 20,000 gallon tanks to be installed.

In terms of liquid fuel tracking, the current plant personnel record fuel meter readings at the beginning and end of each shift. The plant does not utilize a Supervisory Control and Data Acquisition (SCADA) system or building management system to track detailed fuel use.

There is no way of tracking the wood chip fuel usage on a day to day basis as the State does not own a fuel scale or metering system. The only way to track the fuel is by the amount of fuel that is delivered on a weekly or monthly basis.

3.3 Capitol Complex Distribution System

The steam distribution system ranges in pipe diameter size from 10" steam, 4" condensate return exiting the main steam plant to 8" steam main and 3 1/2" condensate return in the pipe trenches between 122 and 128 State Street. From 133 State Street to 114 State Street an underground pipe tunnel connects the buildings. The tunnel is large enough that one can walk through from end to end. In addition to buildings at 133 State Street and 114 State Street, there is a connection to the steam system in 111 State Street. This section of piping includes an 8" steam main and a 2" condensate return line. The tunnel and the piping is clean, dry and in very good shape. Per the previous feasibility study, the piping has approximately 25 years of life left in the system. In addition, there is plenty of room to add piping, should the system require it. No steam leaks or condensate leaks were noted during the walk through. The majority of the drip traps and end of the line steam traps were recently replaced by a contractor as part of a performance contract with the state. In all, the existing steam distribution system connects 18 separate buildings.

3.4 Existing Civil/ Structural configurations

The existing boiler plant itself is currently in the flood plain. In order to address the requirements of the state and city building codes, a new operating level will need to be built. In this configuration, we will strive to meet FEMA 102 – Flood proofing Non- Residential Structures and CFR 44(60)- Requirements for Flood Plain Management Regulations. In all cases, the floors will be a minimum of one foot above the 100 year flood elevation (526.6). Due to the flood plain issue, the existing plant would be retained as a utility tie-in and pump building and Boiler #3 would be placed inside the new Biomass District Energy CHP facility.

Routing of the piping system throughout the city will be a major concern. We have listed below the three different options, along with sketches that depict the routing of the distribution piping. We will need to determine if the line should be run down State Street and how the piping will cross the Winooski River.

There three possible options are:

State Street Bridge

There are concerns about the present condition of this bridge as it appears to have deteriorating concrete and potential structural issues. The picture noted below shows various states of deterioration of concrete on the State Street bridge. On the far right side, exposed rebar can be seen. These issues will need to be reviewed when determining the routing of the distribution piping to the City.

School Street Bridge

This bridge is of newer steel construction; however, it may cost more for piping due to added distances from the Energy Plant.

Railroad Bridge

This bridge is currently owned by the State. Therefore, it would need to be negotiated with the State as to whether or not a set of pipes could be affixed to the structure. One of the positive attributes is that it would allow for easy access to Vermont College, which has been identified as a potential large customer.

The above picture shows the current condition of the State Street Bridge. Please note the water level and deterioration of concrete on the span.

4 Basis for Thermal Sizing of System

The Capitol District Office Complex consists of 18 buildings. This data was compiled by Lane Associates for the State of VT. The following buildings are listed below with their respective location, square footage and estimated heat load:

Location	Square Footage	Est. Heat Load
State House	68,700	4.95 MBH
Sup Court	42,000	1.48 MBH
120 State	76,500	2.61 MBH
133 State	104,700	5.00 MBH
6 Baldwin	32,750	.82 MBH
116 State	2,500	.40 MBH
110 State	11,675	1.00 MBH
109 State	124,880	5.73 MBH

128 State	9,250		.22 MBH
126 State	5,900		.15 MBH
132 State	3,950		.12 MBH
118 State	4,400		.13 MBH
4 Aiken Place	5,700		.20 MBH
2 Western	9,500		.31 MBH
136 State	3,525		.24 MBH
134 State	3,000		.19 MBH
112 State	35,172		1.50 MBH
Totals	559,502	sq. ft.	25.05 MBH

The total of the office space totals approximately 560,000 Square feet.

4.1 Review of system sizing and analysis of future growth

The present size of the State steam load is approaching the maximum capacity of the plant. It is estimated that the plant is 780 BHP, as determined by the data retrieved noted above. With the present configuration, there are no back up boilers or redundancy in its design. If a boiler goes down, they have to make do with the boilers they have available.

In their 2006 schematic design, RFS has determined that the immediate future load is 35.5 MBH or 1060 BHP. They have also estimated that the long term load (10-30 years) to be 43.6 MBH or 1302 BHP. This analysis will need to be reviewed during the feasibility study phase to ensure the system does not end up being oversized for the application. In reviewing the fuel usage data provided by the state, the average demand is 8 MBH. As stated earlier, the installation of temporary metering will help to define the actual peak demand needed to size the boilers. We will need to take a closer look at the actual burn rates once metering is installed to monitor the operation of the plant.

4.2 City of Montpelier Projected Loads

Based on the CANMET study performed in 1999, there are approximately 1,100,000 Square Feet of commercial buildings in the down town area that could potentially be a customer of the Biomass District Energy CHP system to receive hot water. Using the 25 BTUH/ Square Foot average with an 85% diversification factor, this would be approximately 24 MBH of load. Since potential customers have not been contacted, we will use a potential load of 15 MBH as a benchmark until more commercial analysis can be performed. This would be the equivalent of

434 BHP. Based on our analysis, the city would need to have a heating load of approximately 15 MBH to make the project commercially viable and provide competitively priced energy. This represents approximately 66,000 Square Feet of commercial building space heat load. Please see section 6.0- Cost for specific details pertaining to the requirements needed to sustain the costs listed in this spread sheet.

5.0 Plant Configuration

Our conceptual size would be to utilize two new 600BHP Biomass Fired boilers in conjunction with two 400 BHP oil fired boilers. As noted above, a new 400 BHP boiler was purchased in 2005. This boiler is designated boiler #3 and would be integrated into the design of the new plant.

If CHP is utilized, the two 600 BHP Biomass Fired boilers will be designed for 420 PSIG service. When the back pressure steam turbine is installed, it will be run by either of the biomass boilers. The oil fired boilers will both be designed for low pressure (50 PSIG) service. These boilers will be used for steam load only on the distribution system.

Each of the biomass boilers is capable of utilizing a back up oil burner on the heat exchanger as depicted in item 11 can be considered that would allow the boilers to operate on oil as a back up. This would only be used in the case that there were a fuel emergency and biomass fuel was not available.

In previous studies, three sites were considered for the site of the City of Montpelier District Energy Facility. Each site was in a different part of the city:

1. East Side – Barre Street
2. Central – State of Vermont Capitol District Plant -122 State Street
3. West Side – Green Mountain Drive

In our meetings, it was determined that the Central option would make the most sense for all parties. As a result, we will continue to concentrate on the 122 State Street location for the Biomass District Energy CHP plant.

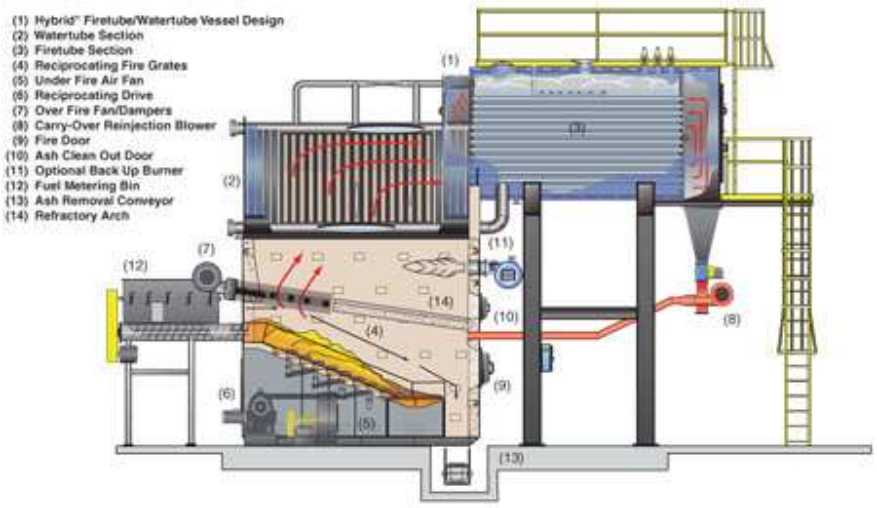
Over the years, it has been an issue that the plant is located within the Flood Plain. If it had been located in the flood way, we could not build on the site. However, since 122 State Street is in the Flood Plain, it is possible to build as long as we meet FEMA 102 and CFR guidelines.

See Section 3.4 above for more detail. A schematic design was develop by RFS Engineering in 2006 that would suit the needs of the State and City loads. We would increase the output of each biomass boiler by 200 BHP to address the additional load of the City. In addition, we would have an additional pad to address future growth requirements.

In regards to the City Loop, we will need to determine if the system is more economical and efficient by placing a heat exchanger at the plant or at a location in the downtown corridor at a steam to hot water energy delivery station.

5.1 Biomass Boiler Design

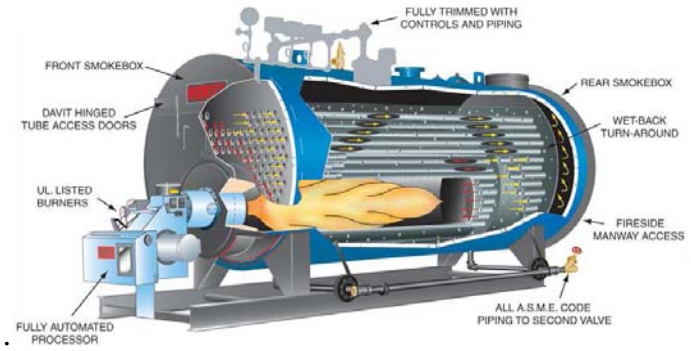
The biomass boiler design that we are considering is called a "hybrid" reciprocating grate design as it has both a fire box section and a water tube section. The reciprocating grate (item 4 in the diagram below), refers to the grates that feed the fuel into the boiler as they are undergoing combustion. The grates move in a back and forth motion to de- ash automatically. The design would be to utilize two 600 BHP wood fired boilers. Installation of back up burners (item 11) can be considered for the biomass boilers. This would allow the boilers to operate on oil as a back up in case there is a fuel emergency.



This system has automatic fuel feed mechanisms and has auto de-ashing capabilities. The efficiency of the boiler with 50% moisture content is approximately 72% efficiency. If we are able to obtain 40% moisture content fuel, that efficiency would be raised to 80%. We have attached cut sheets of the units that being considered. The cost per 600 BHP Biomass Hybrid boiler is approximately $1,200,000.

5.2 Liquid Fuel Boiler Design

The liquid fuel boiler design that is preferred under 1000 boiler horse power (bhp) (33.8 MBH) is the Scotch Marine Fire Tube boiler. We would propose the use of Scotch Marine Fire Tube boilers for the liquid fuel (#6) boilers in the new plant. The cost of a new 400 BHP Scotch Marine Type Boiler is approximately $150,000.



5.3 CHP limitations

Currently, the State of VT boiler plant shuts down for four (4) months every summer. In order to sustain a year round CHP operation, there would need to be a substantial (20,000 #/Hr steam load) year round. Several of the State of VT Office Complex buildings have chillers. However, a district cooling system would need to be added to sustain a thermal load in the summer. During the feasibility study, it is recommended that the cost of fuel and power generation is analyzed. In previous analyses, it was determined that CHP was not feasible. In speaking with plant employees of the State, it was found out that the State is considering installing a new cooling capability at 120 State Street. Currently, there are chillers installed at 109/111 State Street, 110 State Street, 115 State Street and 133 State Street. We will need to determine what types of thermal output that can be utilized during the summer months and what loads could be satisfied by using steam absorption chilled water. This option could also be phased in at a later date to replace chillers as they reach their useful life expectancy.

5.4 CHP electrical sizing.

During the Feasibility Study, the size of the electrical load of the new facility will need to be determined. The current peak demand on the existing plant, according to Green Mountain Power is 385 KW. Most likely, with the additional new equipment, we will be over the 400 KW

requirement at peak load, however, more investigation will need to go into the base load requirement for the electrical load.

If the load is not large enough for the 400 KW that is proposed, a net metering scheme would need to be arranged with Green Mountain Power. There have been developments in the industry that may make this more palatable for a Net Metering arrangement. It is estimated that the current rate is approximately $.13/ KWH as it is currently purchased at the facility.

5.4 Existing Fuel Costs and potential future fuel costs

The State of VT Steam Plant currently satisfies 68% of their load with 0.5% #6 fuel oil and 32% of the load with 50% moisture content wood chips. Overall, the plant has averaged 66% efficiency from 1995 to present, according to fuel figures provided to us by DBGS. The present cost of 0.5% #6 oil is $2.40/ gallon. The State of VT is currently paying $66/ Green Ton for whole tree chips, which have a BTU HHV content of 8.4 MMBTU/ Ton.

Fuel Type	Unit	Cost per Unit	Moisture Content	Avg Seas Efficiency	Delivered MMBTU Per Unit	Cost per MMBTU After Combustion
#6 Oil	gallon	$2.40	0%	85%	0.117	$20.45
Wood Chips	Green Ton	$50	50%	72%	**6.01**	$8.32

As shown in the above spreadsheet, the cost of producing steam is approximately $20.45/ MMBTU. Although the State is currently paying $66/ Ton, historically wood chips have been available at or below the $50/ GT threshold. The future cost of any fuel however is unknown and only reasonable estimates can be made. However, at these estimated rates wood chips are less than half the price of oil on a $/ MMBTU basis.

In addition to the sources listed, we have spoken to the Biomass Energy Resource Center (BERC) and Thermal Systems Inc, who have confirmed that good quality biomass is available in the area in the range of $50/GT. During the feasibility study, we will need to perform a full fuel study of Montpelier to confirm the data that we have obtained by performing initial due diligence

6.0 Cost

When meeting with the State representatives, a keen interest was shown in working with Veolia Energy and the City of Montpelier to develop this project. Due to the age and current configuration of the existing plant, there is a large capital project needed in the near future to maintain a reliable energy delivery system. The boiler plant needs to be upgraded to increase reliability and efficiency. There is also a goal to increase sustainability and utilize local fuel and reduce dependence on foreign oil.

The present plant supplies 30% of its required load through the utilization of the existing biomass boiler (when running). By building the new plant, we would like to increase the average to 70% of the load being supplied by biomass.

The estimated Capital Expenditures to add on to the plant and install new distribution lines to the city is approximated at $16,000,000. This includes two 600 BHP Biomass Hybrid Boilers, one DA, one 400 KW Steam Turbine, installation of one new 400 BHP Scotch Marine Firetube boiler, relocation of one existing 400 BHP Scotch Marine Firetube boiler, installation of 5000 LF of Hot Water distribution piping, one new building to house the Montpelier District Energy CHP plant along with fuel oil storage and delivery systems for the solid wood and liquid fuel systems. Please find listed below a preliminary pro-forma for the project.

Scoping Study - Preliminary Pro-Forma

(These numbers are approximates and will be refined during the detailed study)

Capital Cost Estimate	$16,000,000	
Breakdown		
Plant	$13,500,000	
Distribution to downtown corridor	$2,500,000	
Labor Estimates	$217,000	
Total Repair and Maintenance	$100,000	
Square footage from State Buildings	560,000	sq. ft.
Heat Sales to State Complex	40,000	MMbtu/yr
Heat Sales to City Buildings	60,000	MMbtu/yr
Wood Chip Cost (75% of fuel)	$50	Ton
No. 6 Oil Cost (25% of Fuel)	$2.40	gallon
Approximate Cost per Mmbtu	$37	MMbtu

Notes:
(1) The cost of capital (final ownership) is unknown at this stage for detailed pricing
(2) This does not include any grant funding
(3) State heat load requirements need to be metered and confrimed
(4) City loads need to be targeted and confirmed
(5) This capital cost does not include building connections or retrofits to accept hot water

7.0 Value Engineering

As stated earlier in this document, our opinion is that the overall cost of the project can be reduced as the details and design of the system are advanced. We have estimated approximately 5000 ft of Hot Water Distribution Piping. This length could be reduced, depending on where the system routing ends up.

In addition, the capacity of the plant could be reduced, depending on the outcome of the State expansion and actual load being supplied to the existing buildings identified through new metering data.

Finally, if more pieces of equipment (fuel oil pre-heater skid, solid fuel delivery system, etc.) from the existing plant can be integrated into the new design, costs can be brought down further.

8.0 Conclusion

Overall, the Montpelier Biomass District Energy system is a promising project from both a commercial and technical standpoint. Veolia Energy recommends further pursuit of this project through its partnership with the City of Montpelier. There are man details that we are looking forward to addressing in the upcoming Feasibility Study. We would appreciate your feedback and look forward to discussing the next steps with the City of Montpelier in the near future.

Breakdown of Budgetary Major Component Cost of Montpelier District Energy CHP Plant

(2) 600 HP 400 PSI Hurst Hybrid Biomass Boilers……...$2,875,000

(1) 400 HP 150 PSI Hurst Scotch Firetube Boiler……..$ 150,000

(1) 60,000 #/ Hr Deaerator with Duplex Pump set…….……...$310,000

(2) 2000 gal. Condensate receiver with Duplex Pumps…….…....$ 92,000

(1) 200 Ton Concrete Storage Silo w/ unloader…….$500,000

(2) 14,000 CFM Pulse Jet Baghouse……$1,300,000

(1) 400 KW Back Pressure Steam Turbine……...$ 575,000

(1) Lot- 5000 LF Underground Piping……...….$2,500,000

Medium Voltage Switchgear& Transformer…….…..$ 600,000

(3) 20,000 Gallon Fuel Oil Storage Tanks……..$300,000

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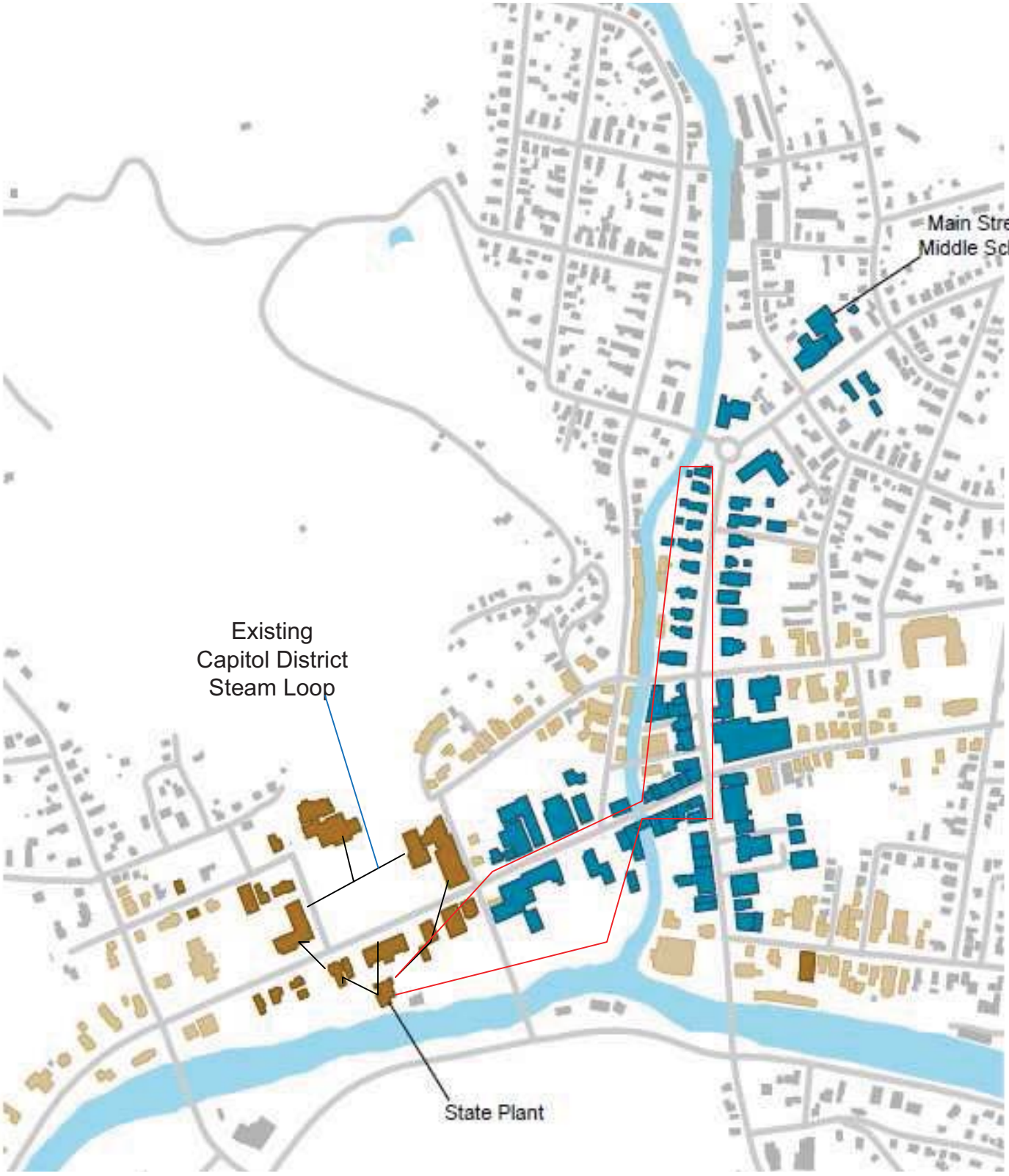

Montpelier District Energy CHP Hot Water Distribution Loop Option #1 – State Street Bridge

Prepared by Veolia Energy NA

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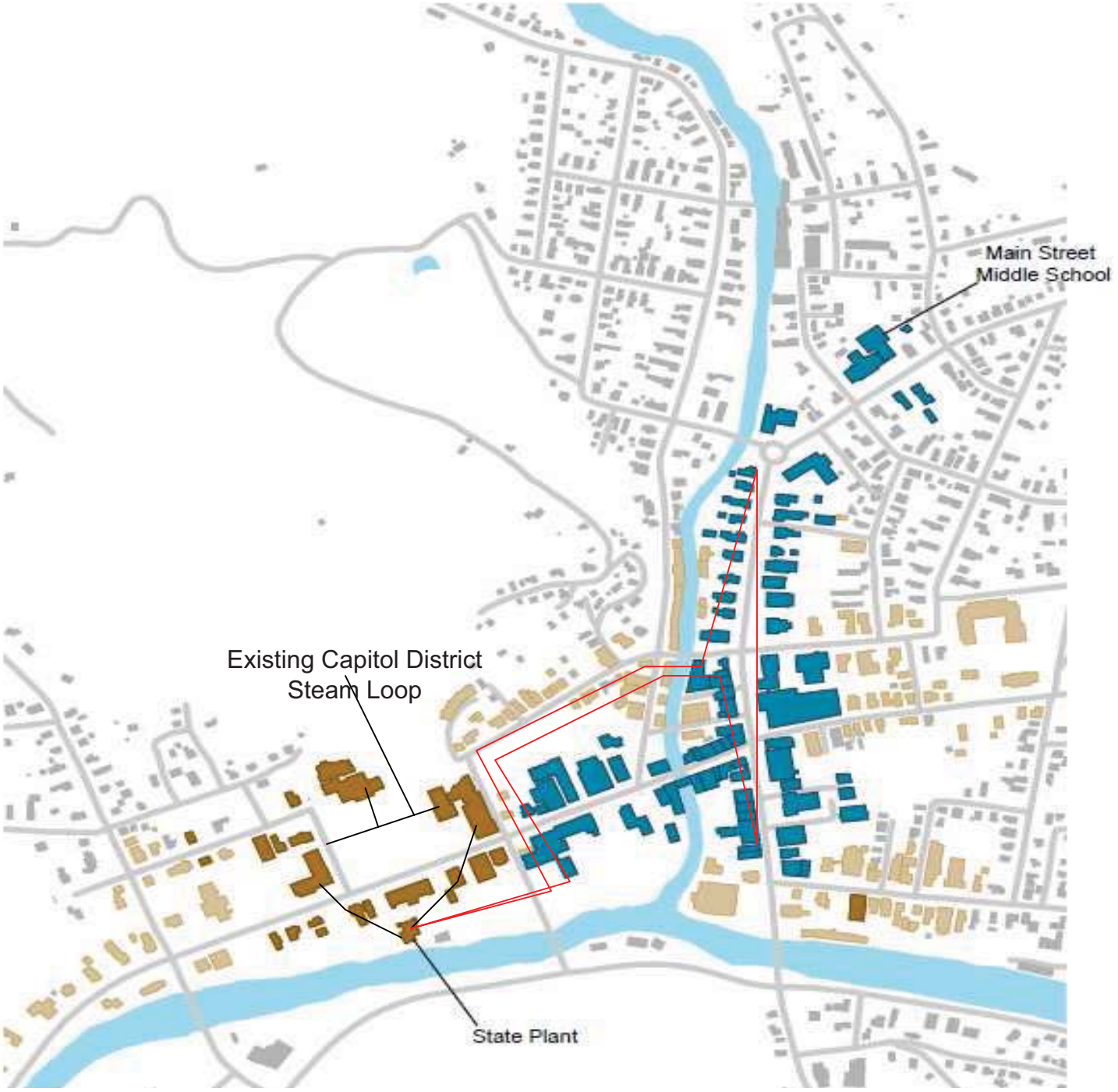

Montpelier District Energy CHP Hot Water Distribution Loop -Option #2
School Street Bridge
Prepared by Veolia Energy NA

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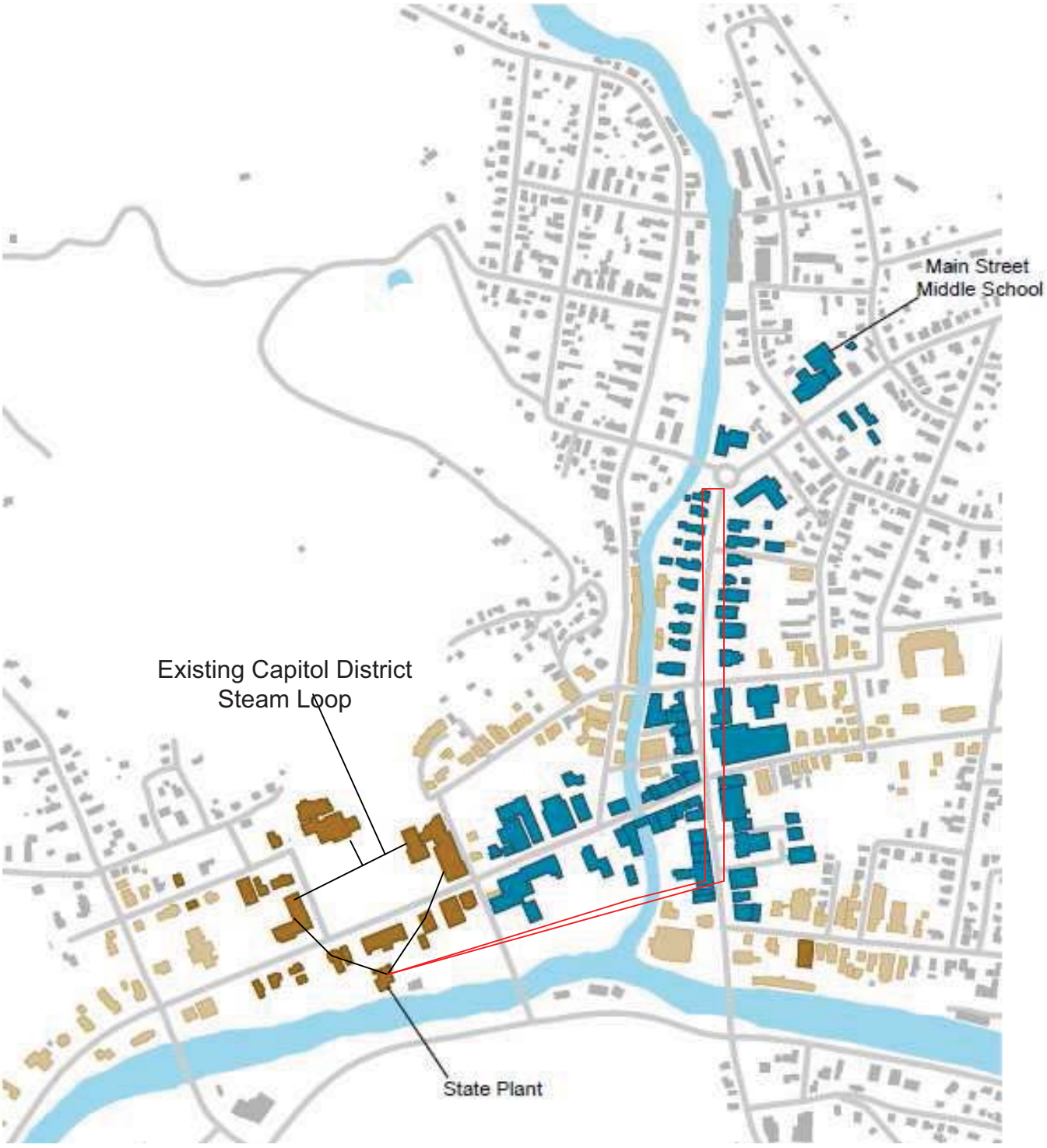

Montpelier District Energy CHP Hot Water Distribution Loop Option #3
Railroad Bridge
Prepared by Veolia Energy NA

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