FEASIBILITY STUDY

for the

CITY OF MONTPELIER
DISTRICT ENERGY CHP SYSTEM

Prepared for:

The City of Montpelier

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EXECUTIVE SUMMARY

Vermont's Capital City, Montpelier, is deeply committed to leading the nation in implementing replicable strategies to deploy renewable energy technologies and reduce its carbon footprint.

The City has committed to a goal of reducing greenhouse gas emissions and fossil fuel consumption by the City, its citizens, and its business community by at least 80% by 2030. A major component to reach these goals is the development of a biomass fueled district energy system. This forward thinking project was awarded an $8 million grant by the U.S. Department of Energy.

> *"This award is yet another example of how Vermont continues to be a national leader when it comes to generating green energy. Not only will this spur new investments in renewable energy, it will create the green jobs that will help revive Vermont's economy."*
> *Senator Patrick Leahy - January 21, 2010*

The projects will promote investment in clean energy systems, create jobs, help communities provide long-term renewable energy, and save consumers money. They also will serve as models for other local governments, colleges and small utilities.

City of Montpelier Needs

In support of the City of Montpelier's strategic direction, Department of Planning and Community Development formally requested a proposal seeking an experienced partner to develop the first stage of a city-wide wood-fired district energy system. The Montpelier Community Energy System had been studied extensively, resulting in a strong commitment to construct the system on the part of the Montpelier City Council.

Veolia Energy Approach

Veolia Energy brings to Montpelier the deep experience in the engineering design, cost estimation, organization, finance, construction and operation of district energy systems for Montpelier.

Veolia Energy has performed a feasibility study and has worked closely with the City to evaluate and refine various technical and commercial options to best serve the City, State and its citizens and achieve its goals of developing this exciting project.

Project Benefits

- Local jobs in construction, engineering and operations
- Stimulation of the local economy
- Montpelier becomes a national showcase as a sustainable community
- Green energy to City buildings
- Green energy to State Office Complex
- Green energy option to downtown community
- Reduction in reliance of foreign fuel
- State of Vermont utilizes its own local renewable energy fuel resource (wood chips)
- "State of the Art" system that can be used as a learning tool
- Designed for expansion to include future growth
- Unique City, State and Veolia partnership that utilizes best resources and core competencies to execute a sophisticated project
- CEAD program allows non-downtown community to benefit from $8 million DOE grant
- Creation of a more reliable system that is currently in place

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Introduction

Project Background

Veolia Energy North America (VENA) was selected as a development partner by the City of Montpelier, VT to develop the Montpelier Biomass District Energy CHP System. The intent of the new proposed system would be to meet the complete heating needs of the State of Vermont Capitol District Office Complex as well as select City of Montpelier and other commercial buildings in the downtown Montpelier area. The proposed system would also generate electrical power through a Combined Heat and Power (CHP) application.

Veolia Energy led a team of professional experts to execute the project. R.G. Vanderweil Engineers, LLP (RGV) has been retained by VENA to develop a feasibility study to support the development of the proposed system. Epsilon Associates, Inc. (EAI) has been retained to assist with the evaluation of potential regulatory and permitting issues for the proposed plant. Thermal Systems, Inc. (TSI) has been retained to assist with the evaluation of biomass heating and wood chip material handling systems. Innovative Natural Resource Solutions, LLC (INRS) has been retained to provide analysis of biomass fuel availability and pricing information.

Previous Studies

The City of Montpelier, the State of Vermont, and the Biomass Energy Resource Center (BERC) have been investigating and assessing the applicability of a central biomass district heating system to serve the downtown Montpelier area for over ten years. Over this span of time, several studies have been performed on the viability of a biomass heating system to serve different portions of the downtown Montpelier area, most notably studies performed by the Biomass Energy Resource Center (BERC-2008), Rist-Frost-Shumway Engineering (RFS-2006), and Community Renewable Energy (CORE-2001). This feasibility study expands upon preliminary work and data that was collected and presented in these previous studies, as well as evaluating the new proposed system's goals and requirements.

Project Scope

The scope of this feasibility study would include the following:

- Indentify proposed buildings in the downtown Montpelier area for inclusion of the new system and develop heating load profiles based on available historic data from end users.
- Perform due diligence verification of existing State Complex boiler plant to evaluate existing infrastructure and feasibility of constructing a new plant in the same general location.
- Research and develop recommendations for Combined Heat and Power (CHP) generation of electricity.
- Review and identify potential regulatory and permitting requirements, including air emissions, floodplain and floodway issues, historical structures, etc.
- Develop conceptual level plans for the new district energy system including process flow diagrams, plant general arrangement drawings and proposed piping distribution runs.

Assumptions

This study is based on the following assumptions/givens to meet the goals of the project.

1. Due to a number of factors that are listed later in the report, the preferred location for the proposed plant is the site of the existing state plant at 122 State Street.

2. The total capacity of the biomass boiler plant is to be 41 MMBTUH (1200 BHP).

3. The Combined Heat and Power (CHP) generation of electricity analysis is to be based on a back-pressure turbine size of 400 kW.

Existing Conditions

Existing State Capitol Complex Boiler Plant

The site of the existing state boiler plant has been identified as the preferred location for the new centrally located biomass district heating plant, and the heating loads that are being served by the existing plant will be served by the new proposed plant.

The existing state boiler plant is located at 122 State Street in downtown Montpelier, VT and supplies steam heating for 17 buildings totaling approximately 545,000 square feet of the State Capitol Complex. Based on information previously compiled by Lane Associates for the State of Vermont, the peak heating loads of the systems served by the existing boiler plant totals approximately 25 MMBTUH, and is used for building heating, humidification, and snow melt systems.

The existing boiler plant system currently consists of three (3) boilers totaling approximately 720 BHP and is located in the basement of the existing facility. Boilers #1 and #2 were installed in 1946 and were originally coal-fired boilers. Boiler #1 (167 BHP) has since been retrofitted to burn wood chips, and Boiler #2 (151 BHP) has been retrofitted to burn #6 oil. At 64 years old, both Boilers #1 and #2 have exceeded their expected life-expectancy and are in need of replacement. Boiler #3 (400 BHP) was installed in 2005 and also burns #6 oil. At 5 years old, Boiler #3 is in good working condition and is expected to be relocated and re-used for back-up capacity under the proposed scope of work for the new district heating plant.

Existing State Capitol Complex Boiler Plant - Heating Load

There is no existing metering or building management control system that tracks boiler run-time hours, heating load, or fuel usage, but monthly fuel usage records have been provided by the state for use in this study. Based on the information provided, an analysis was done on the existing fuel records and monthly heating profiles were created. In order to create the heating profiles we used the heating records for the latest three years of records provided (2006 - 2008) and using heating content of 9.02 MMBTU/ton (assuming heating value of GHV-DS of 8,200 btu/lb and 45% moisture content) for wood chips and 153,000 BTU/gallon for #6 oil. Figure 1 shows the blended fuel input load (woodchips and oil) for a three year period for the existing plant.

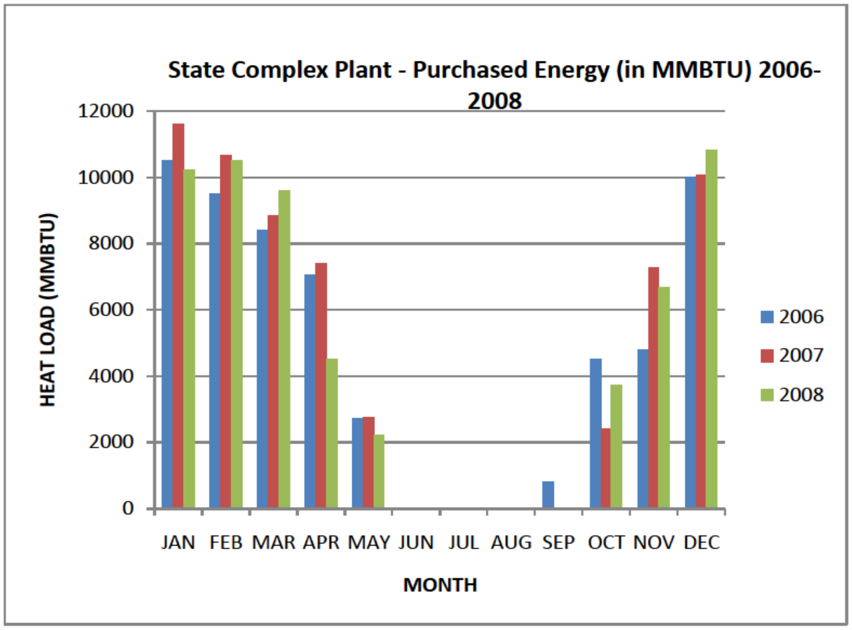


Figure 1 - Purchased Energy for 3-year period for Existing Plant (input in MMBTU)

Figure 2 shows the average of the three year period for the fuel usage of the existing plant.

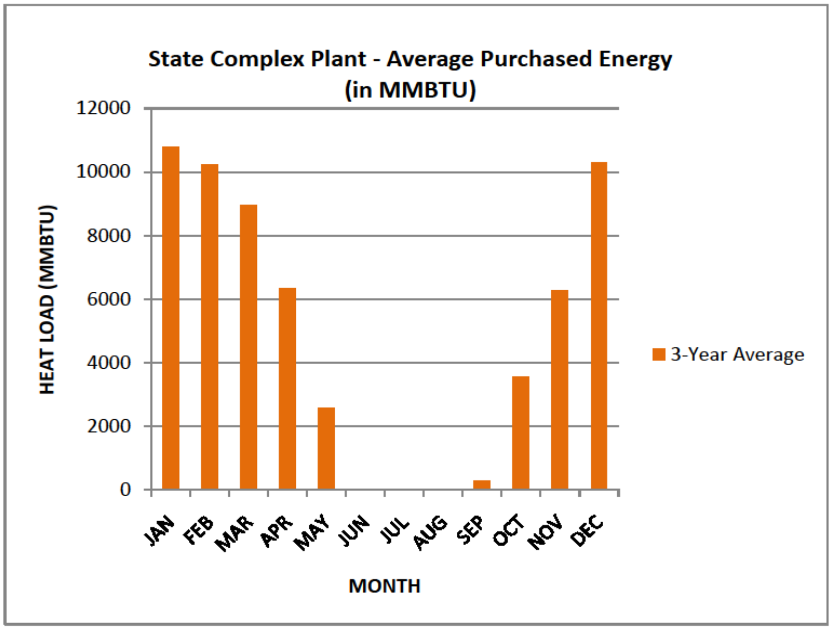


Figure 2 - Purchased Energy Average for Existing Plant (input in MMBTU)

As can be seen from the fuel usage profiles, the existing plant is typically operational for 8 months of the year, and not in use for a 4-month period from June through September. For the 3-year period analyzed, the heating load of the existing plant is evenly served by both the wood chip and oil-fired systems with approximately 48% of the load being served by wood chips and the remaining 52% being served by #6 oil. The calculated yearly input heating load for the existing plant is approximately 59,300 MMBTU. Assuming estimated efficiencies of 55% for the existing wood-burning boiler and 80% for the existing oil-burning boilers, the calculated yearly output heating load for the existing buildings being served is 40,280 MMBTU.

Permitting and Environmental Review Considerations

Background

This document supports the Veolia Energy Feasibility Study for the Montpelier District Energy combined heat and power (CHP) district energy system (the Project). The Project description, context, and funding sources are as described in the Feasibility Study.

The purpose of this document is to identify applicable review processes and permits, discuss approximate timeframes, and highlight potential issues that could delay or halt the Project.

Summary

Based on information reviewed to-date, there are no critical environmental permitting issues that would prevent the construction of the Project. The Project is subject to: the National Environmental Policy Act; Section 106 of the National Historic Preservation Act; the Vermont Public Service Board Act 248; Capitol Complex Commission review; Vermont Department of Environmental Conservation Air Pollution Control Permit review; and City flood plain approval. The longest timeframe is associated with the Act 248 process; that schedule is very dependent on whether parties intervene against the project.

Land Use/ Siting Review Processes

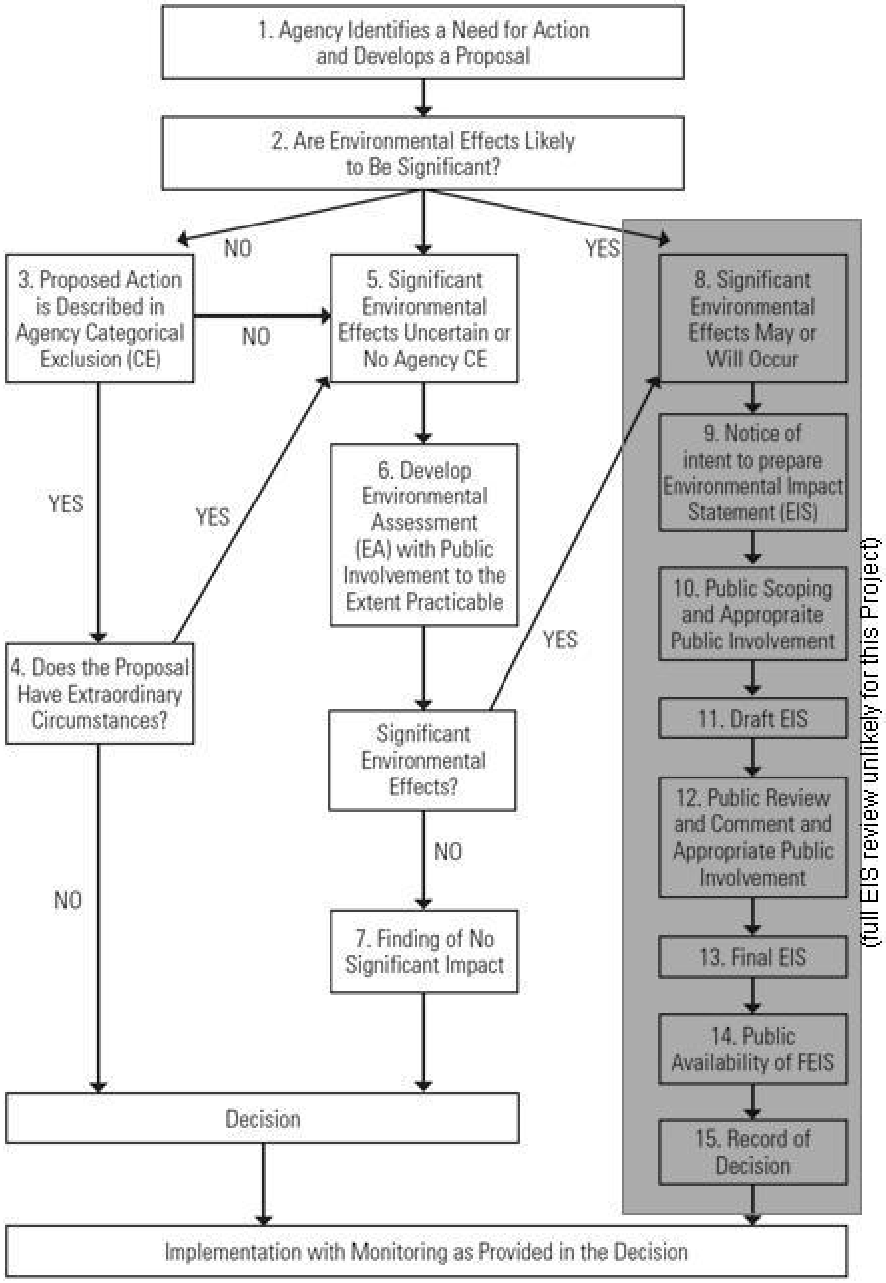
National Environmental Policy Act (NEPA)

On January 21, 2010, the U.S. Department of Energy (DOE) selected the Project to receive $8.0 million from the American Recovery and Reinvestment Act. The use of those DOE funds constitutes a federal action, making the Project subject to National Environmental Policy Act (NEPA) regulation. The DOE would be the lead federal agency managing the NEPA process.

The NEPA process can be broadly broken into three categories, with corresponding levels of effort required. The simplest would be to obtain a Categorical Exclusion, if one is available. More complicated is the preparation of an Environmental Assessment. The most lengthy and complicated process is the Environmental Impact Statement process. The decision tree for the NEPA process is shown below[1]:

[1] A Citizen's Guide to the NEPA, Council on Environmental Quality, December 2007

The NEPA Process



Availability of a Categorical Exclusion:

The DOE has promulgated its list of Categorical Exclusions as Appendix A to Subpart D of Part 1021. Based on a review of that list, the Categorical Exclusion that has the best chance of applying to the Project is B5.1, "Actions to conserve energy." That exclusion applies to:

Actions to conserve energy, demonstrate potential energy conservation, and promote energy-efficiency that does not increase the indoor concentrations of potentially harmful substances. These actions may involve financial and technical assistance to individuals (such as builders, owners, consultants, designers), organizations (such as utilities), and state and local governments. Covered actions include, but are not limited to: programmed lowering of thermostat settings, placement of timers on hot water heaters, installation of solar hot water systems, installation of efficient lighting, improvements in generator efficiency and appliance efficiency ratings, development of energy-efficient manufacturing or industrial practices, and small-scale conservation and renewable energy research and development and pilot projects. The actions could involve building renovations or new structures in commercial, residential, agricultural, or industrial sectors. [emphasis added]

Use of the Categorical Exclusions would require that the Project not:

- Threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health;
- Require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities;
- Disturb hazardous substances; or
- Adversely affect environmentally sensitive resources, including historic resources, threatened/endangered species habitat, or wetlands.

If the Categorical Exclusion is not available, the Project will need to prepare an Environmental Assessment, to determine the significance of the environmental effects and to look at "alternative means to achieve the agency's objectives." A properly-designed Project should qualify for a Finding of No Significant Impact ("FONSI") at the conclusion of the review of the Environmental Assessment. A full Environmental Impact Statement should not be required for the Project.

The decision to seek a Categorical Exclusion will depend on direction received from the DOE, which in turn will depend on whether similar projects funded by the American Recovery and Reinvestment Act are seeking Categorical Exclusions.

An additional issue associated with the NEPA Process relates to possible upcoming directives limiting construction in floodplains. The White House has drafted but not issued an Executive Order (Version: 0510/2009V1) that would restrict federal funding for power plants in the 500-year floodplain. Specifically, under the conditions in the draft Executive Order the DOE would need to determine whether the Project is a "critical action" ("power generation and other utilities" is given as an example). If the Project is a "critical action," the DOE must look at alternatives outside the 500-year floodplain, including the no-action alternative. If the DOE concludes the alternatives are not practicable, the Project can move forward at the existing site, but: the Project must minimize impacts to the floodplain, and; the DOE must provide additional public notice. If the Executive Order is issued, the Project can still receive federal funding, but the NEPA process will become more involved and DOE may require additional steps to protect the floodplain.

Act 248

Vermont statute 30 V.S.A § 248 requires that electric generation facilities obtain a Certificate of Public Good from the Vermont Public Service Board (PSB). A statutory exemption is provided for "electric generation facilities that are operated solely for on-site electricity consumption by the owner of those facilities." While the intent of the Project is to provide power for use in Montpelier by Project owners, based on the current Project design some electricity will be sold to the grid and therefore the Project will not qualify for the exemption.

Per the statute, to obtain a Certificate of Public Good the PSB must determine that the project:

- will not unduly interfere with the orderly development of the region with due consideration having been given to the recommendations of the municipal and regional planning commissions, the recommendations of the municipal legislative bodies, and the land conservation measures contained in the plan of any affected municipality;
- is required to meet the need for present and future demand for service which could not otherwise be provided in a more cost effective manner through energy conservation programs and measures and energy-efficiency and load management measures;
- will not adversely affect system stability and reliability;
- will result in an economic benefit to the state and its residents;
- will not have an undue adverse effect on esthetics, historic sites, air and water purity, the natural environment and the public health and safety;
- with respect to purchases, investments, or construction by a company, is consistent with the principles for resource selection expressed in that company's approved least cost integrated plan;
- is in compliance with the electric energy plan approved by the department under section 202 of this title, or that there exists good cause to permit the proposed action;
- does not involve a facility affecting or located on any segment of the waters of the state that has been designated as outstanding resource waters;
- with respect to a waste to energy facility, is included in a solid waste management plan adopted pursuant to 24 V.S.A. § 2202a; and
- can be served economically by existing or planned transmission facilities without undue adverse effect on Vermont utilities or customers.

Of the ten criteria above, #6 and #9 are not applicable to the Project. The PSB rules expand on the specific requirements needed to satisfy the statutory criteria.

The Act 248 review process is an adjudicatory process, and the Project should be represented by counsel for the process. The process should take about six to twelve months. The Project as designed should meet all the criteria for approval. The process allows for public intervention, and because that intervention can cause review delays, the Act 248 process adds significant schedule uncertainty.

Act 250

The Land Use Panel of the Natural Resources Board governs Vermont's Land Use and Development Law, called the Act 250 program, which is "a public, quasi-judicial process for reviewing and managing the environmental, social and fiscal consequences of major subdivisions and developments in Vermont." Assuming that the Project is subject to Act 248 and is governed by the PSB, it is automatically exempted from Act 250 jurisdiction.

Absent Act 248 (should power not be sold to the grid), because the Project does not propose any major development or subdivisions as defined in the Act 250 program (generally commercial or industrial development on more than 10 acres, construction of improvements to commercial, industrial or residential uses above 2,500 feet in elevation, or more than 10 housing units, among other triggers), the Act 250 program still does not apply.

Section 106 of the National Historic Preservation Act/ Capitol Complex Commission

Use of DOE funding triggers review under Section 106 of the National Historic Preservation Act. The lead federal agency (in this case the DOE) is responsible for initiating Section 106 review, gathering information to decide which properties in the project area are listed in or eligible for the National Register of Historic Places; determining how historic properties might be affected; exploring alternatives to avoid or reduce harm to historic properties; and reaching agreement with the State Historic Preservation Officer (SHPO) and any affected tribes on measures to deal with any adverse effects. As a practical matter the Project proponents will need to perform many of these tasks on behalf of the DOE.

To avoid affecting nearby historic properties, new above-grade structures should be architecturally similar to the existing nearby structures. Also, project layouts that significantly block views of the capitol dome should be avoided. The hot water pipe route through back-lots where possible, will limit historic impact; however it is possible that archaeological investigations will be required for trenching in certain areas.

In addition to the review of cultural resources under Section 106, the Capitol Complex Commission ("CCC")has authority under Title 29, Chapter 6, § 181 *et. seq.* to review and approve plans for construction in the Capitol Complex historic district, including the boiler plant site. The statute establishes a 60-day time frame to approve plans "or suggest alterations or modifications." Commission review includes size, setback, parking requirements, landscaping, and design continuity with other structures in the capitol complex. CCC review is essentially a design review process that focuses on compatibility of proposed developments with the architectural character of the district, which may include consideration of above-grade (visible) segments of pipe crossing bridges.

Air Quality Review

Estimated Project Emissions

A recent approval for a project using a similar-sized wood-fired boiler is the 2007 Massachusetts approval for a "Hurst Boiler Super 600" high pressure water tube boiler at Seaman Paper (approval copy attached). That approval required the use of a multiclone, fabric filter baghouse, and flue gas recirculation for emissions control. Emissions limits for that project are:

Nitrogen Oxides (NOx)	0.22 pounds per million British Thermal Units (lb/MMBtu)
Particulate Matter (PM)	0.01 lb/MMBtu*
Sulfur Dioxide (SO2)	0.03 lb/MMBtu
Carbon Monoxide (CO)	0.45 lb/MMBtu
Volatile Organic Compounds (VOC)	0.03 lb/MMBtu

The Seaman Paper approval has a particulate matter limit of 0.01 lb/MMBtu, but that includes filterable particulate only. The limit should be about 0.02 lb/MMBtu if filterable and condensable particulate is included. Federal and Vermont regulators are transitioning to include condensable PM. Both particulate matter less than 10 microns (PM10) and particulate matter less than 2.5 microns (PM2.5) will be regulated. Most recent approvals have similar limits for PM10 and PM2.5.

Thresholds

If permitted for full-load, year-round operation, the Project will exceed Vermont's major source thresholds (50 tons per year of any pollutant). That triggers a public meeting and a longer review "clock" (175 days). The Project may be able to take an annual operating restriction to limit potential emissions below Vermont's major source thresholds. Restricting full-load equivalent hours to 3,500 hours per year will keep potential emissions below major source thresholds.

The project would not be subject to U.S. EPA permitting requirements under the Prevention of Significant Deterioration (PSD) program as the potential emissions are expected to be less than PSD thresholds. Similarly, the project would not be a major non-attainment New Source Review source for NOx or VOC (requiring offsets) since the potential emissions are less than 100 tpy and 50 tpy, respectively. Although not subject to EPA PSD requirements, Vermont includes PSD modeling requirements in its permitting program.

Control Technology

Control equipment for the Seaman Paper project includes flue gas recirculation, multiclones, and a fabric filter baghouse. Use of a fabric filter baghouse is recommended because US EPA is due to issue revised National Emission Standards for Hazardous Air Pollutants (NESHAPs) for boilers, and EPA presentations have indicated the agency is considering requirements for require fabric filtration. Regarding the backup boilers, recent Vermont approvals have required the use of Number 6 fuel oil with no more than 0.5% sulfur.

A Most Stringent Emission Rate (MSER) analysis will be required for each pollutant over the significant threshold of 50 tons per year potential emissions. MSER is similar to Best Available Control Technology (BACT) requirements applied by U.S. EPA and several states. Since Vermont MSER is comparable to Massachusetts BACT, the Seaman Paper emission rates presented above can be considered an example of emission rates that would meet MSER requirements.

Vermont has Hazardous Ambient Air Standards (HAAS) for several pollutants that can be emitted from wood and Number 6 fuel oil combustion. Many of the hazardous emissions are likely to exceed Action Levels and would thus require application of the Hazardous Most Stringent Emission Rate (HMSER). Those below the action levels do not need HMSER or any air modeling. The heavy metals and some condensable organics would be limited by the particulate control measures (e.g. fabric filtration), while the lighter molecular weight organics would be controlled by good combustion. CO could be a surrogate monitoring parameter for these compounds.

Modeling

In the Vermont air construction permit application process, the Project will need to document that emissions will not cause or significantly contribute to any violation of National Ambient Air Quality Standards (NAAQS). This is done using computer modeling, which accounts for stack parameters, weather conditions, and terrain. Modeling is also required to assess compliance with HAAS, there are special standards and procedures in-place for certain federal wilderness areas and Vermont state sensitive areas, and Vermont uses some EPA PSD modeling requirements even for projects that are not subject to the EPA PSD rule (like the Project). Following the Vermont DEC guidance in *Technical Manual – Air Quality Impact Evaluation Guidelines* (last updated in 2002), a modeling protocol should be submitted to clarify exactly how modeling will be conducted; this is especially important because EPA guidance for modeling PM2.5 and nitrogen dioxide is currently in transition.

Local terrain (e.g. residences on high hills on the north side of the city) could make compliance more difficult. Use of the tall existing stack will improve dispersion over any alternative that includes a shorter stack. The use of fabric filters on the wood boilers will limit PM2.5 and metals impacts. Also, if the Project can commit to not running the backup boilers at the same time as the main boilers that could limit the chance of a predicted violation of ambient air standards.

Vermont Village Green Renewable Pilot Program

This financial incentive program states "If, during 2009, the U.S. Environmental Protection Agency proposes updated emissions standards applicable to wood-fueled boilers to be used in connection with the project, the project shall comply with such proposed standards." The Vermont Legislature was probably referring to the revised NESHAP rules that were due to be proposed in 2009 and are now due April 2010.

Floodplain/ Floodway/ Wetlands

The entire steam plant site, and indeed much of downtown Montpelier, lies within the 100-year floodplain. The City of Montpelier regulates construction in the floodplain through their Zoning and Subdivision regulations (Article 3, Section 309, as authorized by 24 V.S.A. 4424). Approval is required by the Administrative Officer. The schedule for approval includes a 30-day waiting period for VT DEC to provide comments. There is a procedure for appeal to the Environmental Court.

Applications to the City for flood plain approval must include plans and descriptions of flood proofing measures. Standards for compliance are listed in Section 716.B. below.

New construction or substantial improvement of any commercial, industrial or other non-residential structure shall either have the lowest floor, including basement, elevated to the level of the base flood elevation or, together with attendant utility and sanitary facilities, be flood-proofed so that below the base flood level the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydro-dynamic loads and effects of buoyancy. A registered professional engineer or architect shall certify that the standards of this subsection are satisfied...

All new construction and substantial improvements with fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwater. Enclosed areas below the lowest floor which are subject to flooding shall be used solely for parking of vehicles, building access, or storage.

Designs for meeting this requirement must either be certified by a registered professional engineer or architect or meet or exceed the following minimum criteria:

- A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided.
- The bottom of all openings shall be no higher than one foot above grade.
- Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwater

In addition, work in the floodway is prohibited unless "certification by a professional registered engineer or architect is provided demonstrating that encroachment shall not result in any increase in flood levels during occurrence of the base flood discharge." The Project would probably have to provide compensatory storage to avoid an increase in flood levels. This could be done by lowering the ground level elsewhere in the floodway to make up for volume lost to Project construction in the floodway.

Both the floodplain maps and the floodplain regulations are under review, and may be modified before the Project submits applications. The City has provided the draft new floodplain maps; on those maps the floodway reaches the edge of the existing steam plant. The attached figure shows the City-provided floodplain and floodway data layered onto publicly-available parcel and orthophoto data.

Comments that Vermont DEC has made on the Montpelier regulations include:

- a suggestion that Montpelier require that new construction occur one or two feet above the Base Flood Elevation;
- a suggestion that Montpelier require that electrical, heating, ventilation, plumbing & air conditioning equipment be designed or located to prevent water from entering; and
- a suggestion that Montpelier more specifically require that work in the floodway create no increase in flood levels, no risk to surrounding properties, and that underground utilities are protected from scour.

The Project could be required to keep equipment one or two feet above the 100-year floodplain elevation, and keep work out of the floodway. These requirements could come as part of a revision to City of Montpelier regulations, or through review of environmental impacts in the NEPA or Act 248 processes.

Work will also trigger Army Corps of Engineers (ACOE) permitting under its Programmatic General Permit (PGP) program for Vermont (most likely PGP A, which is non-reporting). The proposed hot water pipe route along the railway bridge might trigger a Conditional Use Permit for crossing of the Winooski River, but this may be avoidable by limiting earthwork to areas well removed from the river banks, and use of an existing structure (i.e., the railroad bridge) to cross the river. No significant issues with respect to wetlands and floodway issues are anticipated.

Other

Water use and wastewater discharge should be similar to the existing plant, and will probably not trigger any new requirements.

Use of the existing stack will avoid the need for Federal Aviation Administration (FAA) approval for any structures with the possible exception of construction cranes. The Project is sufficiently far from any runway that FAA obstruction approval will not be an issue.

Based on site location, and discussion with state plant personnel, construction may encounter subsurface contamination.

The use of indoor material storage will minimize operational storm water contamination concerns, and regulatory requirements.

Oil storage will trigger federal Spill Prevention Containment and Countermeasures (SPCC) plan requirements.

Obtaining permission to locate on Central Vermont Railroad right-of-way may be a lengthy process.

System Sizing Considerations

Thermal Sizing of Proposed Heating System

On January 21, 2010, the U.S. Department of Energy (DOE) had selected the proposed Montpelier district heating and CHP project to receive $8M from the American Recovery and Reinvestment Act. The federal funds were the result of a grant application that was submitted by the City of Montpelier. In the grant application, the thermal sizing of the new proposed biomass heating system was stated to be 41 MMBTUH (approximately 1200 BHP) and was based on previous studies and evaluations that were performed for the district heating plant.

Based on the proposed sizing of the grant application and the subsequent award of these funds, we have assumed that the 41 MMBTUH sizing would be the minimum plant size considered for the basis of the new plant.

We have preliminarily identified 23 buildings (including 17 that are currently served by the State Complex Boiler Plant) that we would recommend be included on the system for the initial build-out phase of the system (Phase 1). For this initial phase we have identified buildings that were owned by the City of Montpelier or the State of Vermont and were close to proposed piping runs to minimize initial distribution costs. The buildings that we have identified in this first phase would constitute approximately 80% of the total final 41 MMBTUH capacity of the biomass district heating system and include the following buildings:

Building Owner	Building Location	Building Area (sq. ft.)	Est. Heat Load (MMBTUH)
State of Vermont	State House	68,700	4.95
State of Vermont	Supreme Court	42,000	1.48
State of Vermont	120 State St.	76,500	2.61
State of Vermont	133 State St.	104,700	5.00
State of Vermont	6 Baldwin St.	32,750	0.82
State of Vermont	116 State St.	2,500	0.40
State of Vermont	110 State St.	11,675	1.00
State of Vermont	109 State St.	124,880	5.73
State of Vermont	128 State St.	9,250	0.22
State of Vermont	126 State St.	5,900	0.15
State of Vermont	132 State St.	3,950	0.12
State of Vermont	118 State St.	4,400	0.13
State of Vermont	4 Aiken Place	5,700	0.20
State of Vermont	2 Western St.	9,500	0.31
State of Vermont	136 State St.	3,525	0.24
State of Vermont	134 State St.	3,000	0.19
State of Vermont	112 State St.	35,172	1.50
City of Montpelier	City Hall/Fire Dept.	42,450	0.80
City of Montpelier	Police Station	3,000	0.08
City of Montpelier	Union Elem. School	58,000	3.00
City of Montpelier	East State School	25,600	0.65
City of Montpelier	Montpelier High School	89,174	3.00
Phase 1 Totals		**762,326**	**32.58**

Buildings for the remainder of the biomass district heating load, or approximately 8.4 MMBTUH, would be identified as suitable public and commercial users are identified.

Proposed Distribution Piping Layout

The proposed piping distribution piping layout for the initial phase of the plant would consist of two (2) separate hot water piping runs, to the east and to the west of the new proposed plant as shown on drawing M-04 in Appendix C.

The east piping run would be 6” hot water supply and return lines which would run east from the new plant and would parallel the existing railroad tracks, crossing the Winooski River at the existing railroad bridge. The piping run would extend across Main Street, and turn north, run behind the Montpelier City Hall building, continuing and eventually terminating at the Union Elementary School. The routing of the east piping run was located to minimize disruption to the downtown area, and also pick up larger city and state buildings to the east of the plant. Take-offs would be located on the piping runs at approximately every city block in order to allow future connections to buildings as new customers are identified.

The west piping run would be 4” hot water supply and return lines which would extend to the west and would parallel the Winooski River, also crossing at an existing railroad bridge. The piping run would primarily target the Montpelier High School, and also pick up additional loads where feasible.

The low-temperature hot water (LTHW) system is proposed to operate at 240°F supply temperature and 180°F return temperature utilizing a thin-wall, European-style piping system. The stainless steel lines are enclosed in a closed-cell urethane insulation with a high density polyethylene (HDPE) outer jacket. This system has been used on other projects in New England including a large installation at the Massachusetts Institute of Technology (MIT) in Cambridge, MA. Thermal losses with this type of system are extremely low. A glycol solution is proposed to provide freeze protection for the hot water distribution system.

An evaluation of the existing state complex steam piping system was performed. Veolia Energy walked the exposed portions of the system and building conditions. The system was found to be extremely well maintained and in good condition. A steam trap rehabilitation program has recently been completed. We do not recommend conversion of the existing state distribution system to LTHW at this time. Under the proposed scope of this report, the existing state complex heating load requirements would be re-fed with 50 psig steam from the new boiler plant.

Proposed Plant Layout

General Plant Considerations

The proposed plant would be located in the same general location as the existing boiler plant serving the State Capitol Complex located at 122 State Street. (See Appendix C for proposed layout drawings.)

The location of the new proposed plant would be restricted by the line of the floodway area on the south and by the adjacent 120 State Street building on the north. The layout and configuration of the new facility has been arranged such that the existing chimney can be re-used for both the new oil- and wood-burning boilers. Additionally, the taller portions of the new facility which would house the wood chip storage silos have been located such that they would be behind the 120 State Street building (when observing from State Street), which is a 5-story structure.

The new plant would be separated into two separate buildings, one for the biomass boilers and wood chip storage and material handling, and one for the oil burning boilers. We would recommend the separation of the two facilities in order to allow redundancy in the event of one or the other facilities being out of operation for any extended period of time. A control room that would be used to monitor both oil- and wood-burning operations would be located in between the oil and biomass facilities in order to give the operator easy access to either facility.

The new oil building would be built prior to the demolition of the existing state building in order to perform the overall construction of the new facility without an interruption in heating service to the existing state complex buildings.

The electrical equipment for both the oil and biomass buildings, as well as distribution equipment for to existing and district heating loads would be located in the oil building. This has the advantage of allowing the existing boiler plant electrical transformer to have its loads disconnected and re-fed prior to the demolition of the existing boiler plant. Electrical service to buildings located at 120, 126, and 128 State Street (currently fed from existing boiler house transformer) could continue to supply building power in the event of a fire in the biomass building. A reconfiguration of electrical feeders in the area of the existing power plant will be required to relocate some of the utility poles and overhead power lines out of the way of the new plant buildings.

The proposed configuration utilizes 400 psig steam to drive a back-pressure steam turbine which exhausts steam at 50 psig. The back-pressure exhaust steam would be reconnected to the state complex steam distribution piping, and also converted to hot water for district heating distribution.

Biomass Plant Configuration

The biomass plant building would be an approximately 11,500 sq.ft. structure that would house the biomass boiler systems as well as the wood chip storage and material handling systems. The height of the building would be two levels, with the height of the boiler side approximately 40 feet, and the height of the wood storage side approximately 65 feet.

The biomass boiler system would consist of two (2) 600-HP wood chip burning boilers. The basis of design for the biomass boilers for the feasibility study is Hurst hybrid boilers. Each boiler would be equipped with reciprocating grate stokers, wet ash system, metering bin, combustion air pre-heater, mechanical collector with reinjection, economizer, flue gas recirculation, and PLC controls.

While reviewing the plant layout, the following configurations were considered:

One 1200 HP biomass fired boiler, two 400 HP biomass fired boilers, two 600 HP biomass boilers and two 800 HP biomass boilers. At the request of the City of Montpelier, we were asked to determine the largest output plant for the area available adjacent to the existing State plant. The single 1200 HP boiler could not be used optimally as the turndown would not be sufficient for the shoulder months.

In the case of the 400 HP boilers, the units were too small to carry the load. The 800 HP units were too large for the site and turned out to increase the cost too much as the units would require greater fuel storage for the site, thus increasing the overall footprint by 15%.

For emissions control, each biomass boiler system would be equipped with a pulse-jet fabric filter baghouse which would tie into the existing chimney stack.

The proposed total size of the wood chip storage for the new biomass boiler system is 600 tons. The proposed wood storage would allow for full plant output for a 5 day period between combined wood and oil storage capacity. The silo arrangement would be for two (2) 300-ton silos, each measuring approximately 32 feet in diameter by 60 feet tall. Schematic arrangement would be for each silo to have a bucket elevator style loader, and each individual silo would have a “Flying Dutchman” type unloader. The wood chips would be delivered via self-unloading truck to a loading dock located on the north side of the facility. From the truck, the chips would be loaded into a receiving bin, and from the receiving bin the wood chips would be transported via automated conveyor system to the storage silos and from the storage silos to the metering bins of the biomass boilers. The conveyor system feeding the biomass boilers would be arranged such that any silo would be able to feed wood chips to either boiler.

All new fuel handling and ash removal systems for the new biomass plant will be automated via PLC controls which will simplify overall plant operation.

Oil Plant Configuration

The oil plant building would be an approximately 5,500 sq.ft. structure that would house the oil-burning boiler systems and the hot water distribution systems. The height of the building would be approximately 30 feet.

The oil burning boiler system would consist of two (2) 400-HP #6 oil-fired boilers. One (1) 400-HP oil-burning boiler would be relocated from the existing state boiler plant facility; one (1) 400-HP oil boiler would be new. The basis of design for the new oil-burning boiler for the feasibility study is Hurst (Series500) four-pass, #6 oil-fired boiler.

The boiler breeching for the new and relocated oil boilers would tie into the existing chimney stack.

Boiler system ancillary equipment such as condensate storage tank, condensate pumps, deaerator and storage tank, and boiler feed pumps would be located in the oil plant building.

The hot water conversion and distribution systems would also be located in the oil plant building. The steam to hot water conversion system would consist of (2) shell-and-tube heat exchangers that would each be sized for approximately 75% of the proposed hot water load. The hot water distribution pumps would be base-mounted, end-suction style pumps and each would be sized for 100% of the hot water load (N+1 redundancy). The hot water system would also consist of ancillary equipment such as air separators, expansion tanks, etc. that would also be located in the oil plant building.

A new electrical room which will house electrical distribution equipment including new transformers, switchgear, etc. will be located in the oil building.

Two (2) new 20,000 gallon, double-wall fuel oil storage tanks will be located under the existing parking lot to the west of the oil plant building. The existing fuel 20,000 gallon fuel oil tank for the state plant is approximately 20 years old, and is not anticipated to be re-used for the new plant. Fuel oil system ancillary equipment such as day tanks and fuel transfer pumps will be located in the oil plant building.

A new 650 KW standby power generator will be located to the north of the new oil building and will provide back-up power to the biomass and oil building operations in the event of an electrical power failure. The boiler plant will be capable of operating stand-alone in the event of a loss of utility power.

Construction Phasing

The new oil building would be built in the first phase of construction to the west of the existing state boiler house and existing chimney stack. Some existing utility power poles and lines will need to be relocated in this first phase in order to allow the new oil building to be built. The existing power house transformer which also supplies power to buildings at 120, 126, and 128 State Street will remain in place during this phase in order to perform the construction without interruption to the existing heating or electrical services. A new electrical room to be built in the oil building will supply power to new proposed boiler plant and will also include a transformer to back feed the building fed from the existing electrical transformer. Depending on the project schedule, a temporary 400-HP oil boiler may need to be rented to enable full capacity for the state complex heating loads during construction. If the oil plant is constructed in the non-heating season, the existing 400-HP oil burner may be relocated without requiring a rented replacement

Once the new oil plant is built and operational it will allow for the existing state boiler plant to be demolished and the new biomass building to be built in its place. Included in this second phase of construction will be a scheduled electrical shutdown of the electrical power for the buildings at 120, 126, and 128 State Street in order to re-feed the loads from the new transformer. Some existing utility power poles and lines will also need to be relocated in the second phase of construction in order to allow the new biomass building to be built.

Financial and Schedule Considerations

Construction Cost Estimate

An estimate of probable construction costs for the proposed district heating project based on preliminary plant sizing and schematic system configurations was performed on the mechanical and electrical systems in the new plant.

Based on the preliminary cost analysis performed, the projected construction costs for the preliminary Phase 1 build-out of the plant would be approximately $21,395,362. Phase 1 of the construction would include the complete construction of both the new oil plant and biomass plant, hot water conversion and distribution systems, steam piping and connection to exiting state building complex, and new hot water piping and connection to six (6) additional City of Montpelier and State of Vermont buildings as identified previously in report. Revenue metering would be performed at each building and via a central steam meter for the existing state house complex.

The full build out of the plant would consist of additional connections to future customers in order to bring the plant up to full peak heating load connected capacity of 41 MMBTUH. Based on survey data provided in the CORE report, the average building size of potential system customers is approximately 13,000 sq.ft. Assuming an average of 25 BTUH/sq.ft. for peak building heating loads, it is estimated that the remaining capacity of the plant can include approximately an additional 26 buildings based on this average area and heating load estimate. The connection costs, including metering and energy transfer stations (ETSs) for each additional building is estimated at approximately $69,000/building, which for an additional 26 buildings would bring increase the total construction cost approximately $1,800,000, or $23,239,500 total.

The numbers above do not include the cost of the proposed CHP back-pressure turbine option for electrical power generation. It is estimated that the CHP option would increase the estimated construction costs by approximately $1,400,000.

A summary of the estimated construction costs are as follows:

	Phase 1 Construction (w/o CHP Option)	Phase 1 Construction (with CHP Option)	Full Build out Construction (w/o CHP Option)
Cost Estimate	$21,395,362	$22,825,362	$23,239,500

See Appendix E for detailed cost estimate breakdown.

Wood Chip Fuel Costs

The price of wood chips for use in biomass heating systems is currently in the range of $40 - $60 per ton.

The State of Vermont currently pays a rate of $66/ton for wood chips used in the biomass boiler in the existing state plant. It is believed that the price paid for the current plant usage is inflated due to the fact that there is limited wood chip storage capacity for the existing plant and the wood chip supplier is required to leave the trailer that the wood chips are delivered in on site. The current means of delivery and storage causes the supplier to uncouple and couple trailers at each visit and leave one trailer on site for unloading. The additional time and labor increases fuel cost.

Based on the increased fuel requirement and storage capacity of the new proposed plant, lower wood chip costs may be negotiated than the current costs paid by the state.

Innovative Natural Resources, LLC was contracted to perform a biomass fuel availability analysis as part of the scope of this feasibility study. Timber growth within 30 miles of Montpelier exceed harvest levels by 650,000 green tons per year with all current and historic markets. The region also has a number of existing major markets for low-grade wood, the closest being large-scale biomass electric plants in

Burlington and Ryegate. Based on the analysis performed it is estimated that the price of wood chips will fall within the range $ 40- 60/ ton estimated, and will increase annually at a rate of approximately 3.5%.

See Appendix F for full analysis of biomass fuel availability.

Financial Analysis on Thermal Heating Plant

The following financial models are representative of the different options analyzed in the study.

An analysis has been performed to look at the existing cost for the State and City buildings as a benchmark model to evaluate with the possible future energy costs from the new plant.

Analyses were performed for the heating plant based on the estimated construction costs for Phase 1 and final build-out of the plant. Wood fuel costs were estimated at @ $50/ton based upon the fuel study. The analysis takes into account the estimated construction costs for the new systems, and includes scenario's that have credits for the awarded DOE grant, State of Vermont grant, State providing a 15% Capital Contribution, City of Montpelier Bond and the Village Green Renewable Pilot Grant. The analysis assumes that operations and maintenance costs for the proposed and existing state facility are approximately equal, and does not predict future escalation of fuel costs.

The various models include analysis of:

1) Existing Case for the City and State Thermal Energy Supply
2) Phase 1 includes City and State Buildings Connections with the City owning the system
3) Phase 1 plus CHP includes City and State Connections with the City owning the system
4) Full Build includes City, State and Private Business Connections with the City owning the system
5) Full Build plus CHP includes City, State and Private Business Connections with the City owning the system
6) Impact of the State making a 15% capital contribution to the project
7) Same analysis as above with 3rd Party Finance

For the purpose of this analysis it is assumed that wood chip and fuel oil costs will escalate at approximately the same rate over the life of the plant. The following tables summarize the findings of the calculations for the thermal plant.

Assumptions					
Cost of Water & Chemicals	$/Mlb		0.20		
Manager Base Salary	$		1	50,000	
Operator Base Salary	$		3	35,000	
Fringe & benefits	%		40%		
Total Labor Costs	$			217,000	
Total R&M Costs				350,000	
Electric Cost		$0.13			
Electric Export Rate		$0.125			
DOE Grant		$000	8,000		
State of Vermont Grant		$000	0		
City Bond - Approved 2003		$000	100		originally $250K
Village Green Renewable Pilot Grant		$000	200		

CURRENT CASE - STATE AND CITY ENERGY COST ANALYSIS

State Expansion				City Existing Cost			
Fuel				***Fuel***			
Site Steam	Mlb		40,280	Site Steam	MMBtu		16,436
Future Fuel Consumption	MMBtu		62,372	City Fuel Consumption	MMBtu		20,544
Future Fuel Costs	$/MMBtu		5.5	City Fuel Costs (Oil)	$/MMBtu		16.3
Future Fuel Costs	$		**345,744**	Future Fuel Costs	$		**335,694**
O&M				***O&M***			
Heating Load	Mlb		40,280	Heating Load	MMBtu		16,436
Cost of Water & Chemicals	$/Mlb		0.20	Cost of Water & Chemicals	$/MMBtu		0.20
Cost of Water & Chemicals			8,056	Cost of Water & Chemicals			3,287
Manager Base Salary	$		50,000	Manager Base Salary	$		0
Operator Base Salary	$	3	35,000	Operator Base Salary	$	1	0
Fringe & benefits	%	40%		Fringe & benefits	%	40%	
Total Labor Costs			217,000	Total Labor Costs			0
Total R&M Costs			350,000	Total R&M Costs			24,000
Total O&M Costs			575,056	Total O&M Costs			27,287
		0%	0			0%	0
Total O&M Costs			575,056	Total O&M Costs			27,287
Capital Expense				***Capital Expense***			
Planned Plant Overhaul	$	*	18,547,000	Planned Plant Overhaul	$	**	100,000
Available Funding	$			Available Funding	$		
Adjusted Capex	$		18,547,000	Adjusted Capex	$		100,000
State Cost of Capital	%	4%		State Cost of Capital	%	4%	
Period Amortization	Years	20		Period Amortization	Years	20	
Annual Amortization	$		1,364,721	Annual Amortization	$		7,358
Total Cost				***Total Cost***			
Total Cost	$		**2,285,521**	**Total Cost**	$		**370,340**
Heat Unit Cost				*Heat Unit Cost*			
Fuel Cost	$/MLb		8.58	Fuel Cost	$/MMBtu		20.42
O&M Cost	$/MLb		14.28	O&M Cost	$/MMBtu		1.66
Capital Cost	$/MLb		33.88	Capital Cost	$/MMBtu		0.45
Total	$/MLb		56.74	Total	$/MMBtu		22.53

*State capital cost estimated from New Plant design minus the distribution system and additional boiler capacity.

Fuel Assumptions
$50 Ton Wood Chips
$2.50 gallon #6 oil

** Estimated Capital Replacement cost over next twenty years

This State Expansion analysis includes the capital required to build a new plant due to the age and existing condition of the current plant.

PROJECT FINANCIAL ANALYSIS - CITY OWNED

			Phase 1	Phase 1 + CHP	Full Build	Full Built + CHP
Capital Expense						
Project Cost	$000		21,395	22,825	23,239	24,639
Available Funding for Project	$000		8,300	8,300	8,300	8,300
Net Adjusted Capex	$000		13,095	14,525	14,939	16,339
Financing Period	Years	20				
Financing Interest Rate	%	3.00%				
Annual Financing	**$000**		**880**	**976**	**1,004**	**1,098**
Physicals						
Steam Sales State	MMBtu		40,280	40,280	40,280	40,280
Hot Water Sales City	MMBtu		16,436	16,436	16,436	16,436
Hot Water Sales Other	MMBtu		-	-	12,565	12,565
Energy Sales	**MMBtu**		**56,716**	**56,716**	**69,281**	**69,281**
Electric Sales	MWh		-	1,112	-	1,358
Fuel Consumption	MMBtu		87,822	90,130	107,279	110,098
Parasitic Load (power required to run plant)	MWh		463	463	743	743
Revenue						
Electric Revenue	**$000**		**-**	**139**	**-**	**170**
Steam Sales to the State	MMBtu		40,280	40,280	40,280	40,280
Fuel Rate	$/MMBtu	8.6	346	346	346	346
O&M Charge	$/MMBtu	11.3	453	453	453	453
Capacity Charge	$000	100%	1,365	1,365	1,365	1,365
Total State Steam Sale			**2,164**	**2,164**	**2,164**	**2,164**
Total Rate ($/MMBtu)			*53.72*	*53.72*	*53.72*	*53.72*
Compare with State Alternative ($/MMBtu)			*55.78*	*55.78*	*55.78*	*55.78*
Hot Water Sales to the City	MMBtu		16,436	16,436	16,436	16,436
Fuel Charge	$000		141	141	141	141
O&M Charge	$000		185	185	185	185
Capacity Charge	$000	0%	-	-	-	-
Total City Steam Sale			**326**	**326**	**326**	**326**
Total Rate ($/MMBtu)			19.8	19.8	19.8	19.8
Compare with Existing			22.5	22.5	22.5	22.5
Hot Water Sales to the Other Customers	MMBtu		-	-	12,565	12,565
Fuel Charge	$000		-	-	108	108
O&M Charge	$000		-	-	141	141
Capacity Charge	$000	18%	-	-	182	199
Total Others Steam Sale			**-**	**-**	**431**	**449**
Total Rate ($/MMBtu)			-	-	34.3	35.7
Costs						
Fuel Costs	$000		487	500	595	610
Electricity Costs	$000		60	60	97	97
Cost of Water & Chemicals	$000		11	11	14	14
Labor Costs	$000		217	217	217	217
Repair & Maintenance	$000		350	350	350	350
Costs	**$000**		**1,125**	**1,138**	**1,272**	**1,288**
Project Economics						
Revenue	$000		**2,490**	**2,629**	**2,921**	**3,108**
Costs	$000		(1,125)	(1,138)	(1,272)	(1,288)
Financing	$000		(880)	(976)	(1,004)	(1,098)
Soft Cost	$000	-200	(200)	(200)	(200)	(200)
Net Cash	$000		285	315	445	522
IF STATE CONTRIBUTES 15% OF CAPITAL TO THE PROJECT						
State Contribution						
State Contribution		15% of Capital Cost				
State Contribution	$000		3,209	3,424	3,486	3,696
Avoided Capacity payment from State	$000		216	230	234	248
Reduction in State Rate	$/MMBtu		5.36	5.71	5.82	6.17
New State Rate			48.37	48.01	47.91	47.55

PROJECT FINANCIAL ANALYSIS - 3RD PARTY FINANCED

				Phase 1	Phase 1 + CHP	Full Build	Full Built + CHP
Capital Expense							
Project Cost	$000			21,395	22,825	23,239	24,639
Available Funding for Project	$000			8,300	8,300	8,300	8,300
Net Adjusted Capex	$000			13,095	14,525	14,939	16,339
Financing Period	Years	20					
Financing Interest Rate	%	10.00%					
Annual Financing	**$000**			**1,538**	**1,706**	**1,755**	**1,919**
Physicals							
Steam Sales State	MMBtu			40,280	40,280	40,280	40,280
Hot Water Sales City	MMBtu			16,436	16,436	16,436	16,436
Hot Water Sales Other	MMBtu			-	-	12,565	12,565
Energy Sales	**MMBtu**			**56,716**	**56,716**	**69,281**	**69,281**
Electric Sales	MWh			-	1,112	-	1,358
Fuel Consumption	MMBtu			87,822	90,130	107,279	110,098
Parasitic Load (power required to run plant)	MWh			463	463	743	743
Revenue							
Electric Revenue	**$000**			**-**	**139**	**-**	**170**
Steam Sales to the State	MMBtu			40,280	40,280	40,280	40,280
Fuel Rate	$/MMBtu		8.6	346	346	346	346
O&M Charge	$/MMBtu		11.3	453	453	453	453
Capacity Charge	$000		100%	1,365	1,365	1,365	1,365
Total State Steam Sale				**2,164**	**2,164**	**2,164**	**2,164**
Total Rate ($/MMBtu)				*53.72*	*53.72*	*53.72*	*53.72*
Compare with State Alternative ($/MMBtu)				*55.78*	*55.78*	*55.78*	*55.78*
Hot Water Sales to the City	MMBtu			16,436	16,436	16,436	16,436
Fuel Charge	$000			141	141	141	141
O&M Charge	$000			185	185	185	185
Capacity Charge	$000		0%	-	-	-	-
Total City Steam Sale				**326**	**326**	**326**	**326**
Total Rate ($/MMBtu)				19.8	19.8	19.8	19.8
Compare with Existing				22.5	22.5	22.5	22.5
Hot Water Sales to the Other Customers	MMBtu			-	-	12,565	12,565
Fuel Charge	$000			-	-	108	108
O&M Charge	$000			-	-	141	141
Capacity Charge	$000		18%	-	-	318	348
Total Others Steam Sale				**-**	**-**	**568**	**597**
Total Rate ($/MMBtu)				-	-	45.2	47.5
Costs							
Fuel Costs	$000			487	500	595	610
Electricity Costs	$000			60	60	97	97
Cost of Water & Chemicals	$000			11	11	14	14
Labor Costs	$000			217	217	217	217
Repair & Maintenance	$000			350	350	350	350
Costs	**$000**			**1,125**	**1,138**	**1,272**	**1,288**
Project Economics							
Revenue	$000			**2,490**	**2,629**	**3,058**	**3,257**
Costs	$000			(1,125)	(1,138)	(1,272)	(1,288)
Financing	$000			(1,538)	(1,706)	(1,755)	(1,919)
Soft Cost	$000	-200		(200)	(200)	(200)	(200)
Net Cash	$000			(373)	(415)	(169)	(150)
IF STATE CONTRIBUTES 15% OF CAPITAL TO THE PROJECT							
State Contribution							
State Contribution		15%	of Capital Cost				
State Contribution		$000		3,209	3,424	3,486	3,696
Avoided Capacity payment from State		$000		377	402	409	434
Reduction in State Rate		$/MMBtu		9.36	9.98	10.16	10.78
New State Rate				44.36	43.74	43.56	42.94

Project Implementation Schedule

A project implementation schedule for the proposed plant has been developed and is included in Appendix F. Based on preliminary estimates, it is estimated that if the decision to move forward and detailed design were to begin on June of 2010, then final completion of the plant would be in the spring of 2012. The construction phase of the project is estimated to be approximately 16 - 18 months. Permitting requirements and the pre-purchasing of long lead-time equipment such as the biomass boilers and material handling and storage systems would be critical path items in the overall project implementation schedule.

Electrical Generation and Distribution

In the DOE grant application, the electrical generation sizing of the new proposed Combined Heating and Power (CHP) was stated to be 1.8 million kWh. From our analysis, based on evaluating a 400 kW steam turbine and the hours of operation for the thermal plant, it appears that approximately 1.1 million kWh is a reasonable estimate for the Phase 1 portion of the construction. Since there is no summer steam load for the connected systems, the CHP portion of the project sized at 400 kW steam turbine backpressure generator that would operate approximately 8 months of the year in order to attain the proposed 1.1 million kWh load. For the final build-out of the plant with the system fully subscribed, the estimated annual electrical generation would increase to approximately 1.35 million kWh with the 400 kW turbine sizing.

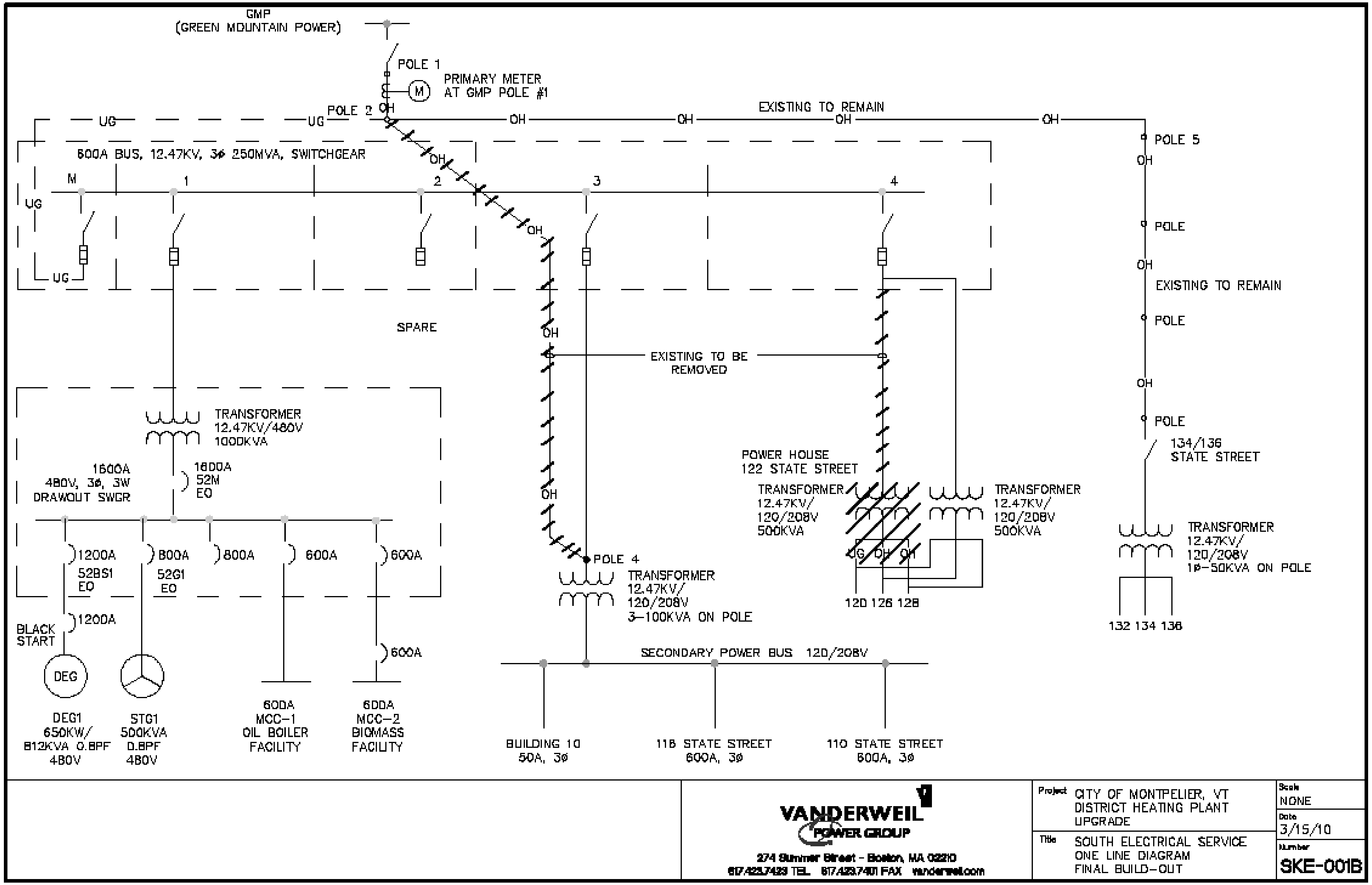
We have evaluated hourly interval data provided by the utility provider (Green Mountain Power) for the south electrical service that is closest to the proposed power plant location, and have determined that the base electrical loading on the south service is insufficient to use the full 400 kW proposed load. Therefore, the electrical power generated from the CHP system would be fed back onto the utility side of the meter. See SKE-001B on following page (and in Appendix B) for proposed one line diagram of the electrical systems including the proposed CHP system integration.

Based on information published from the State of Vermont Public Service Board, the interim standard offer price for Sustainably Priced Energy Enterprise Development ("SPEED") resources as of September 15, 2009 for biomass resources was $0.125/kwh. The standard offer price was updated on January 15, 2010 and remained the same for biomass renewable power. The standard offer has an overall cap of 50 MW of overall renewable energy production and a technology specific sub-cap of 12.5 MW. It is unknown whether the standard offer is still currently available for renewable power resources or if the program has been fully subscribed to. Further investigation will need to be performed to determine overall and biomass-specific availability.

Simple payback analysis for the CHP electrical power generation and has been calculated based on the published standard offer price of $0.125/kwh and varying fuel costs of wood chips of $40/ton, $50/ton, and $60/ton and is summarized in the following table:

	$40/ton Wood Chips	**$50/ton Wood Chips**	**$60/ton Wood Chips**
Construction Cost Spread	20 years	20 years	20 years
Base Construction Cost Estimate (Phase 1 + CHP)	$22,825,362	$22,825,362	$22,825,362
DOE Grant	($8,000,000)	($8,000,000)	($8,000,000)
City Bond (Approved 2003)	($100,000)	($100,000)	($100,000)
Village Green Renewable Pilot Grant	($200,000)	($200,000)	($200,000)
Total Construction Costs	**$14,525,362**	**$14,525,362**	**$14,525,362**
Annual O&M Costs	$666,780/year	$666,780/year	$666,780/year
Parasitic Load Cost	$60,114/year	$60,114/year	$60,114/year
Cost for Steam Generation	$10,227/year	$12,783/year	$15,340/year
Revenue	$138,834/year	$138,834/year	$138,834/year
Simple Payback on CHP	**11.1 years**	**11.3 years**	**11.6 years**

If the CHP option were to be eliminated due to the payback or change in standard offer for the renewable energy production, the overall steam system pressure could be reduced which would result in additional savings in the base cost of the oil and biomass steam plants due to lower pressure piping and equipment requirements.



GMP
(GREEN MOUNTAIN POWER)
POLE 1
PRIMARY METER
AT GMP POLE #1
POLE 2
UG
OH
EXISTING TO REMAIN
POLE 5
600A BUS, 12.47KV, 3Ø 250MVA, SWITCHGEAR
M
1
2
3
4
SPARE
EXISTING TO BE
REMOVED
POLE
EXISTING TO REMAIN
134/136
STATE STREET
TRANSFORMER
12.47KV/480V
1000KVA
1600A
480V, 3Ø, 3W
DRAWOUT SWGR
1600A
52M
EO
1200A
52BS1
EO
800A
52G1
EO
800A
600A
600A
BLACK
START
1200A
600A
DEG
DEG1
650KW/
812KVA 0.8PF
480V
STG1
500KVA
0.8PF
480V
600A
MCC-1
OIL BOILER
FACILITY
600A
MCC-2
BIOMASS
FACILITY
POLE 4
TRANSFORMER
12.47KV/
120/208V
3-100KVA ON POLE
POWER HOUSE
122 STATE STREET
TRANSFORMER
12.47KV/
120/208V
500KVA
TRANSFORMER
12.47KV/
120/208V
500KVA
UG
OH
OH
120 126 128
TRANSFORMER
12.47KV/
120/208V
1Ø-50KVA ON POLE
132 134 136
SECONDARY POWER BUS 120/208V
BUILDING 10
50A, 3Ø
118 STATE STREET
600A, 3Ø
110 STATE STREET
600A, 3Ø
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Project
CITY OF MONTPELIER, VT
DISTRICT HEATING PLANT
UPGRADE
Title
SOUTH ELECTRICAL SERVICE
ONE LINE DIAGRAM
FINAL BUILD-OUT
Scale
NONE
Date
3/15/10
Number
SKE-001B

Appendix A - GIS Sketches

Proposed Floodplain and Floodway Designations

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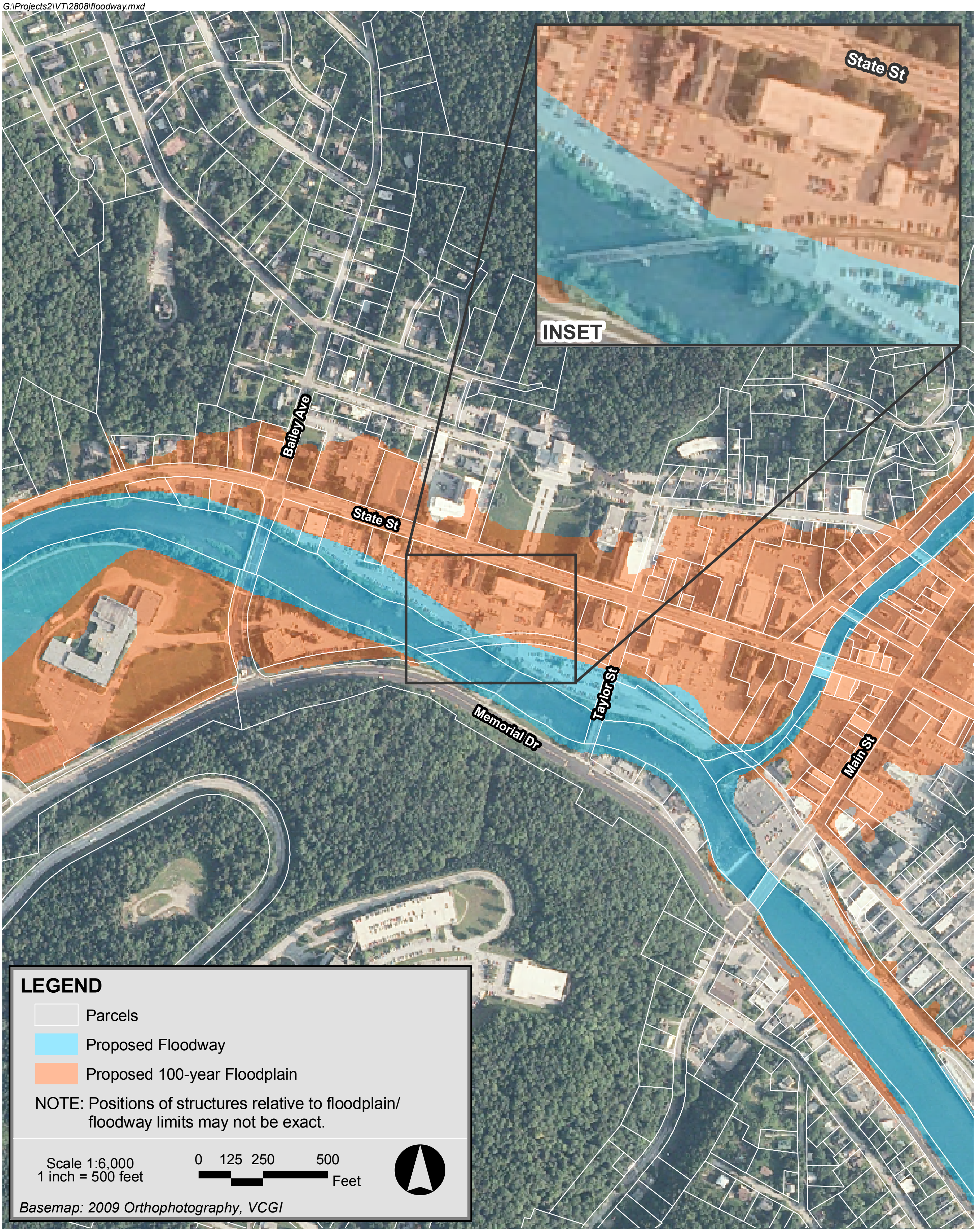


Montpelier CHP **Montpellier, Vermont**

Epsilon ASSOCIATES INC.

Proposed Floodplain and Floodway Designations

Appendix B - Process Flow Sketches

SKM-001 - HP Steam and Feed water System Process Flow Diagram

SKM-002 - LP Steam and Feed water System Process Flow Diagram

SKM-003 - HW and Condensate Process Flow Diagram

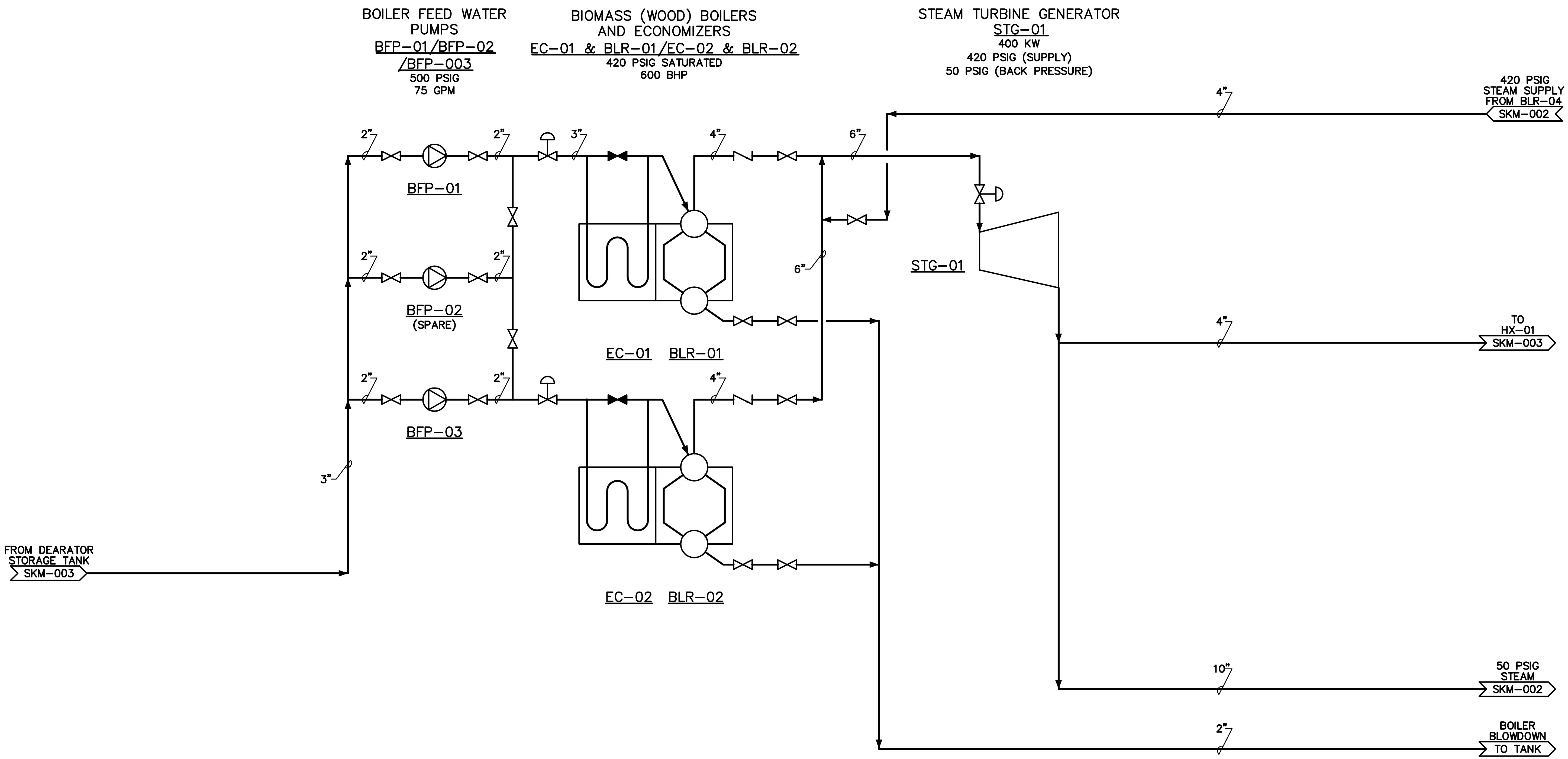
SKM-004 - Biomass Boilers (Wood Chips) Material Handling Process Flow Diagram

SKM-005 - Biomass Boilers Ash Removal and Exhaust Process Flow Diagram

SKM-006 - District Heating System Energy Transfer Station Process Flow Diagram

SKE-001A - South Electrical Service - One-Line Diagram Phase 1

SKE-001B - South Electrical Service - One-Line Diagram Final Build-out



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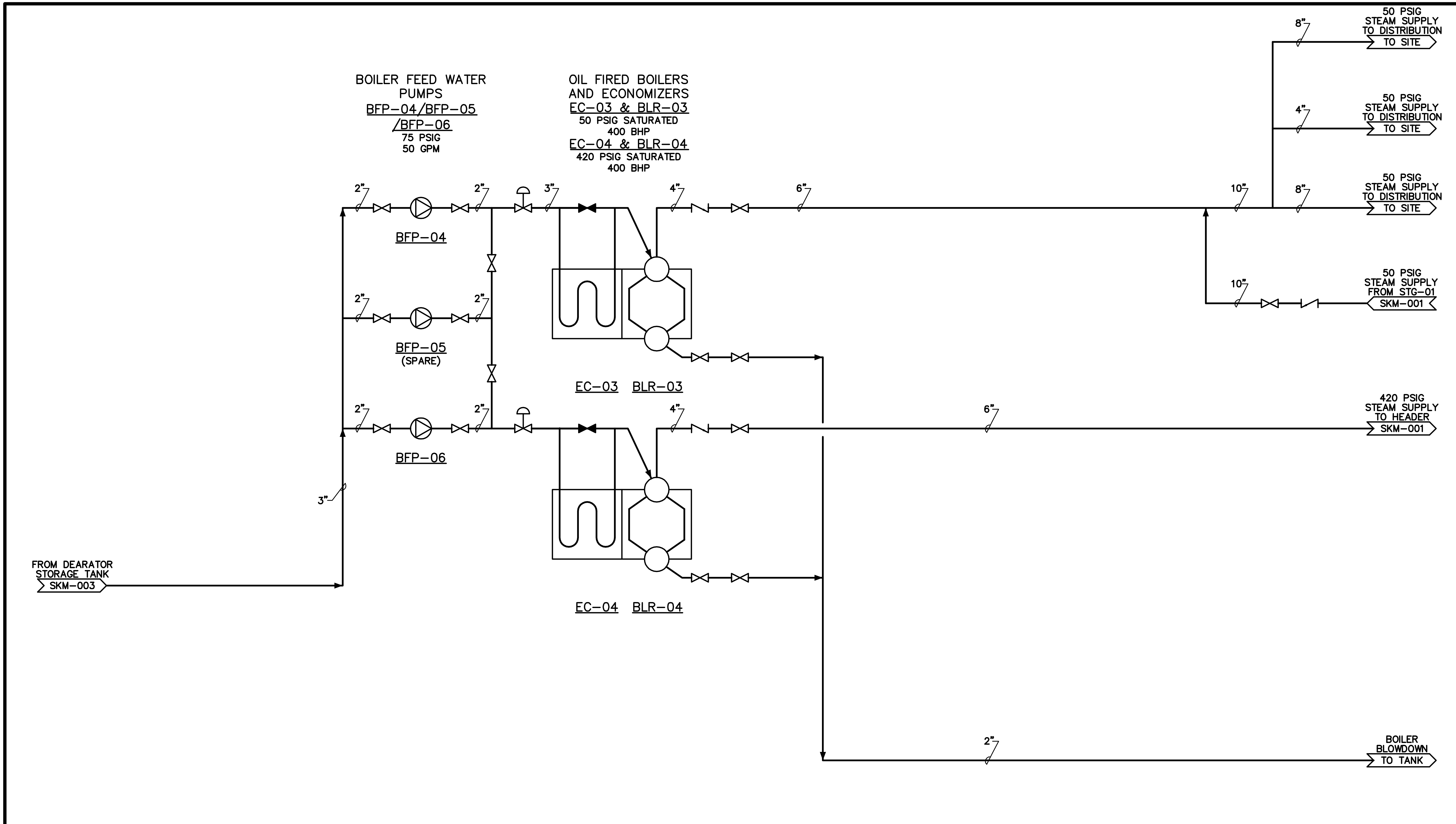
Title	HP STEAM AND FW SYSTEM PROCESS FLOW DIAGRAM	Number	SKM-001



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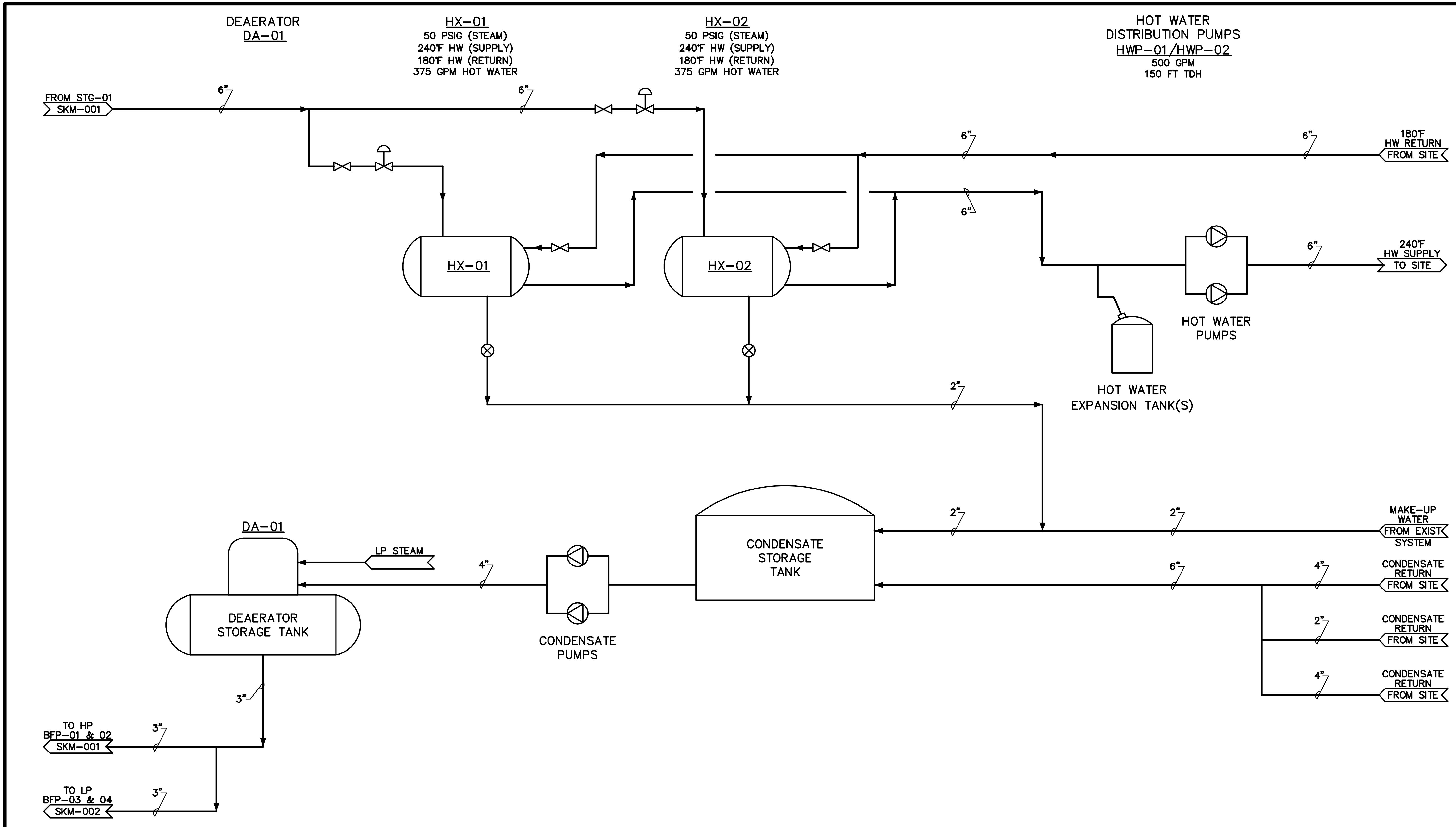
Number	SKM-002



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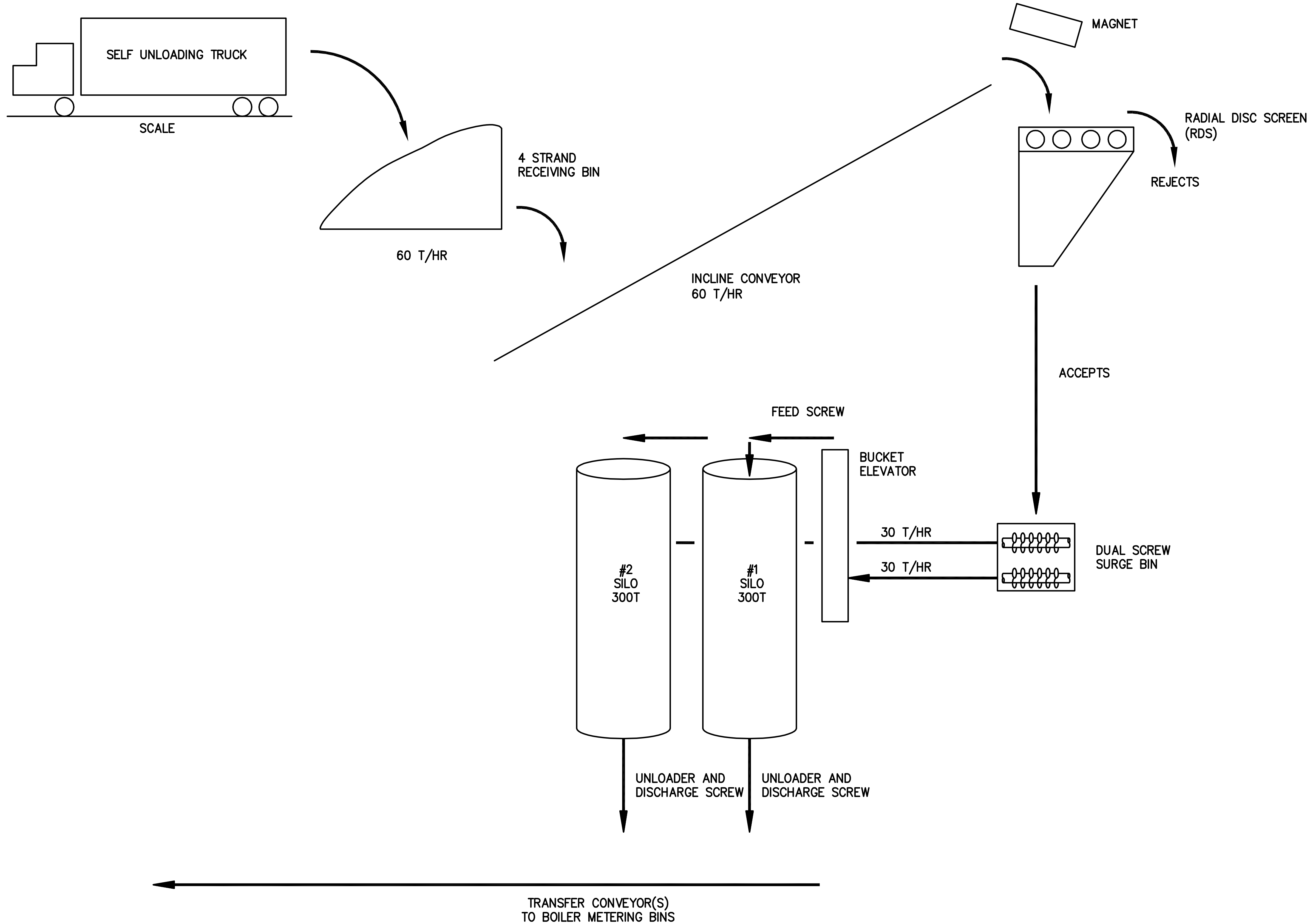
Title	HW AND CONDENSATE PROCESS FLOW DIAGRAM	Number	SKM–003



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Project	CITY OF MONTPELIER, VT DISTRICT HEATING PLANT UPGRADE
Title	BIOMASS BOILERS (WOOD CHIPS) MATERIAL HANDLING PROCESS FLOW DIAGRAM
Scale	NONE
Date	03-15-10
Number	SKM-004

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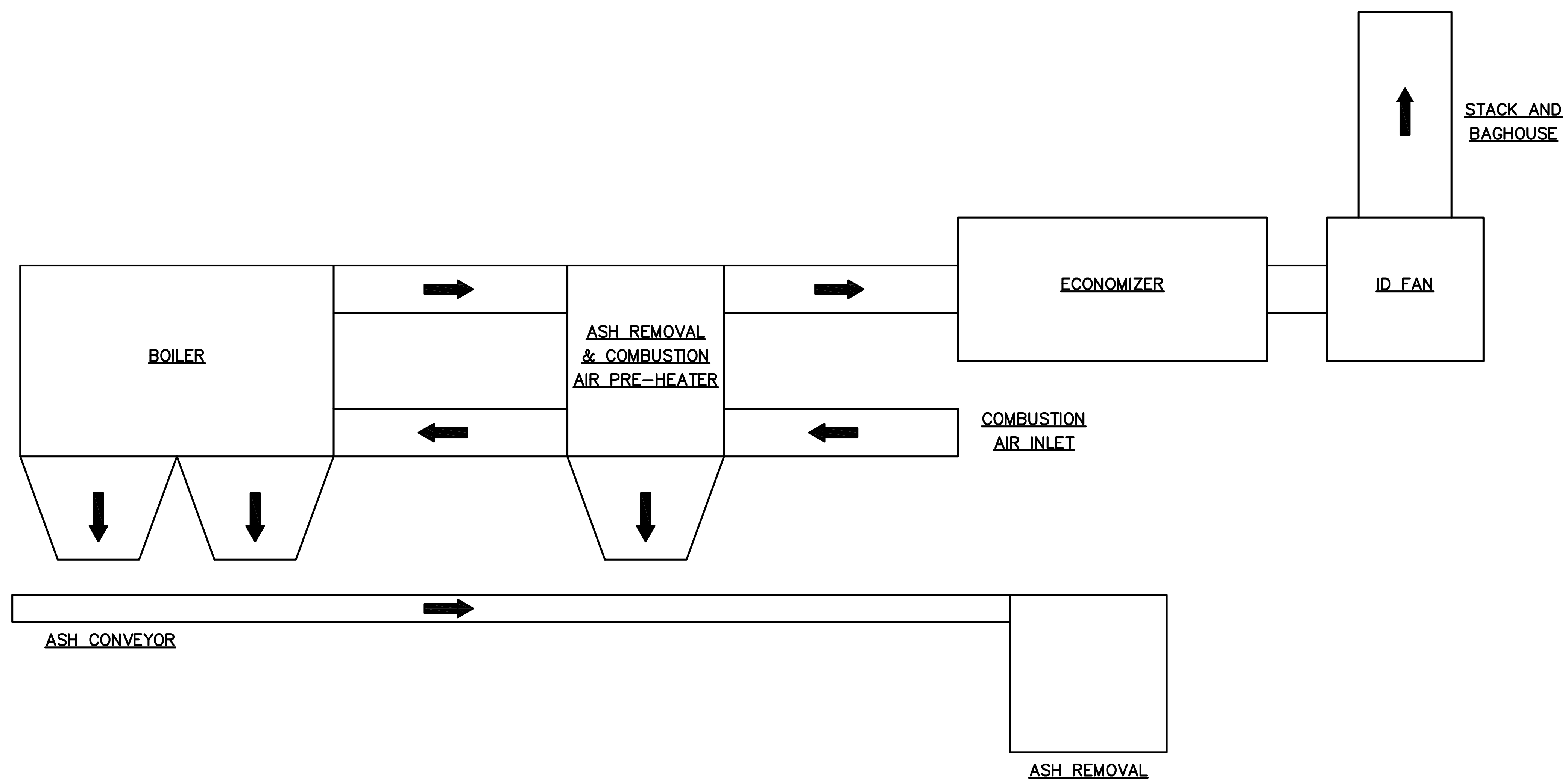

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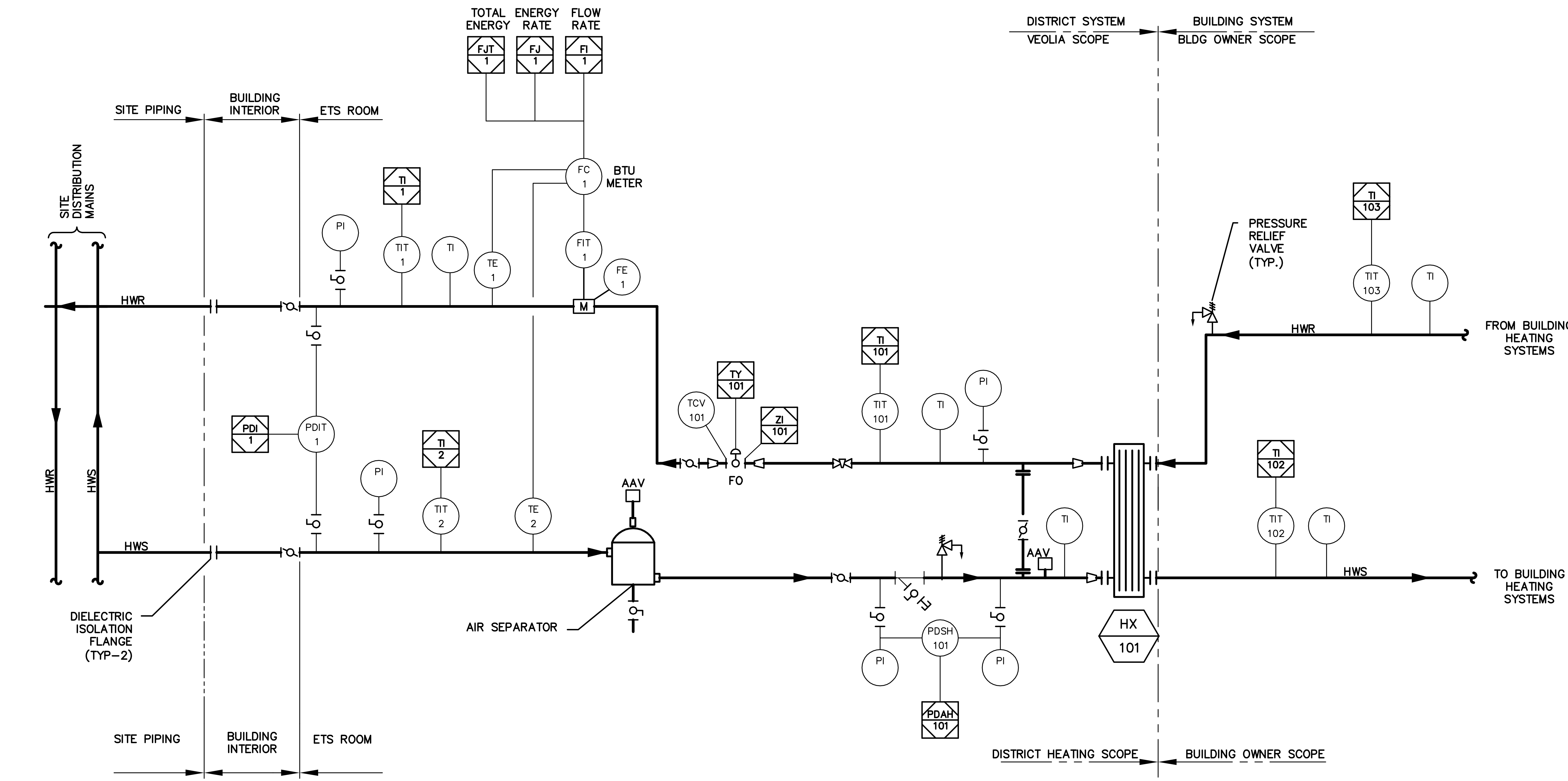
Number	SKM-005



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Project	CITY OF MONTPELIER, VT DISTRICT HEATING PLANT UPGRADE
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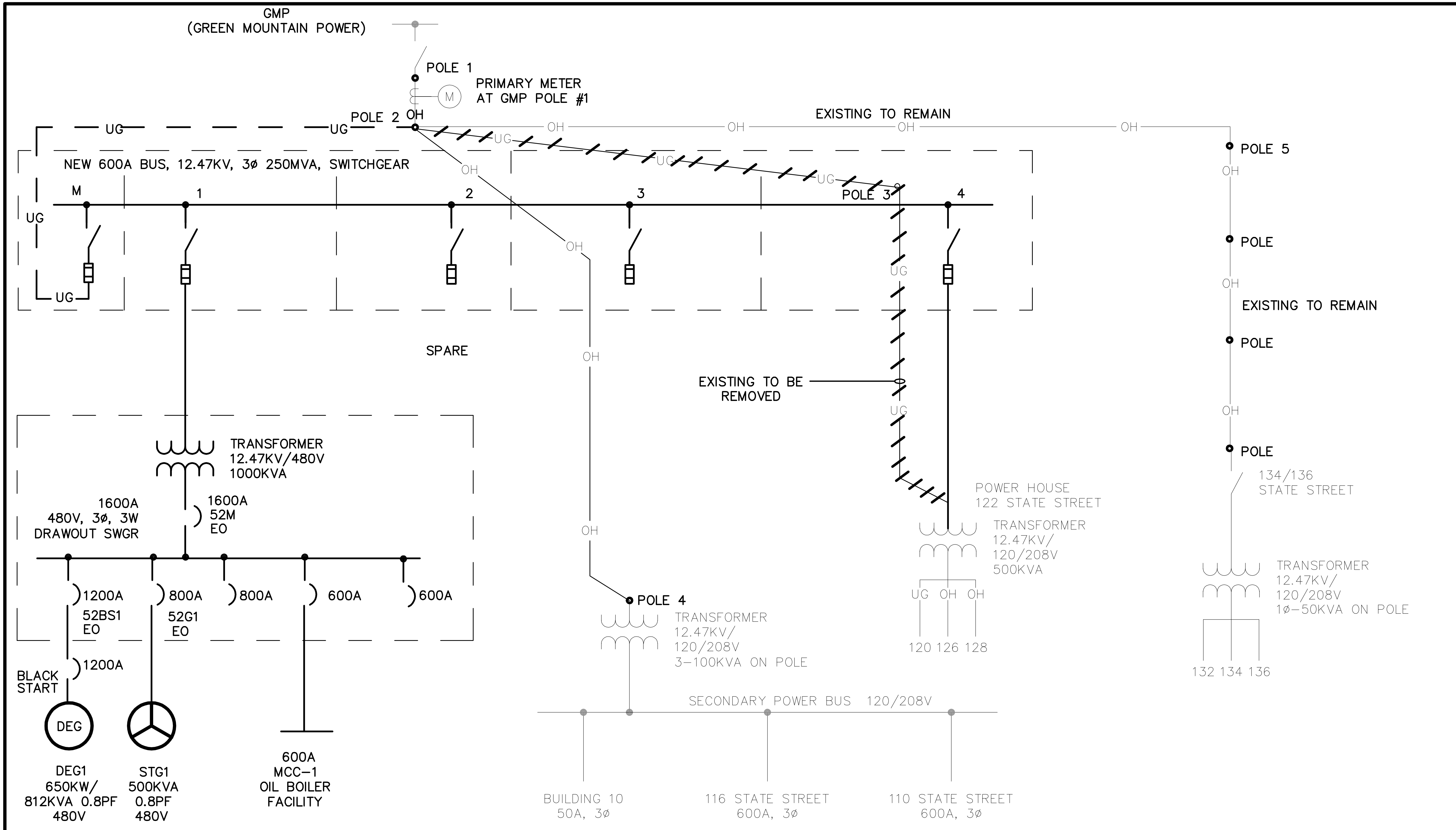
Number	SKM-006



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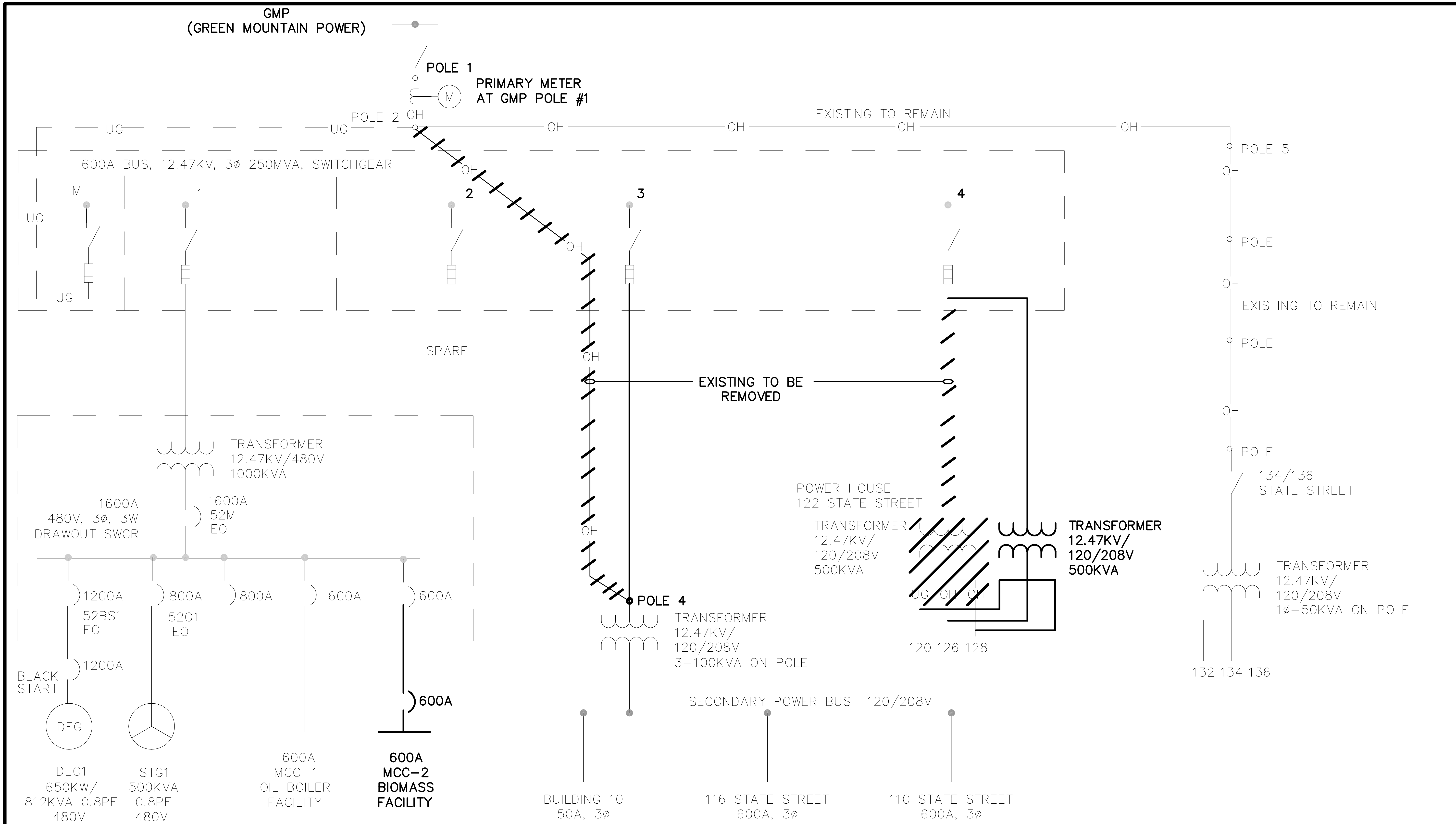

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Project	CITY OF MONTPELIER, VT DISTRICT HEATING PLANT UPGRADE
Title	SOUTH ELECTRICAL SERVICE ONE LINE DIAGRAM FINAL BUILD–OUT
Scale	NONE
Date	3/15/10
Number	SKE-001B

Appendix C - Layout Drawings

M-01 - Existing Site Layout

M-02A - Proposed Site Plan - Phase 1

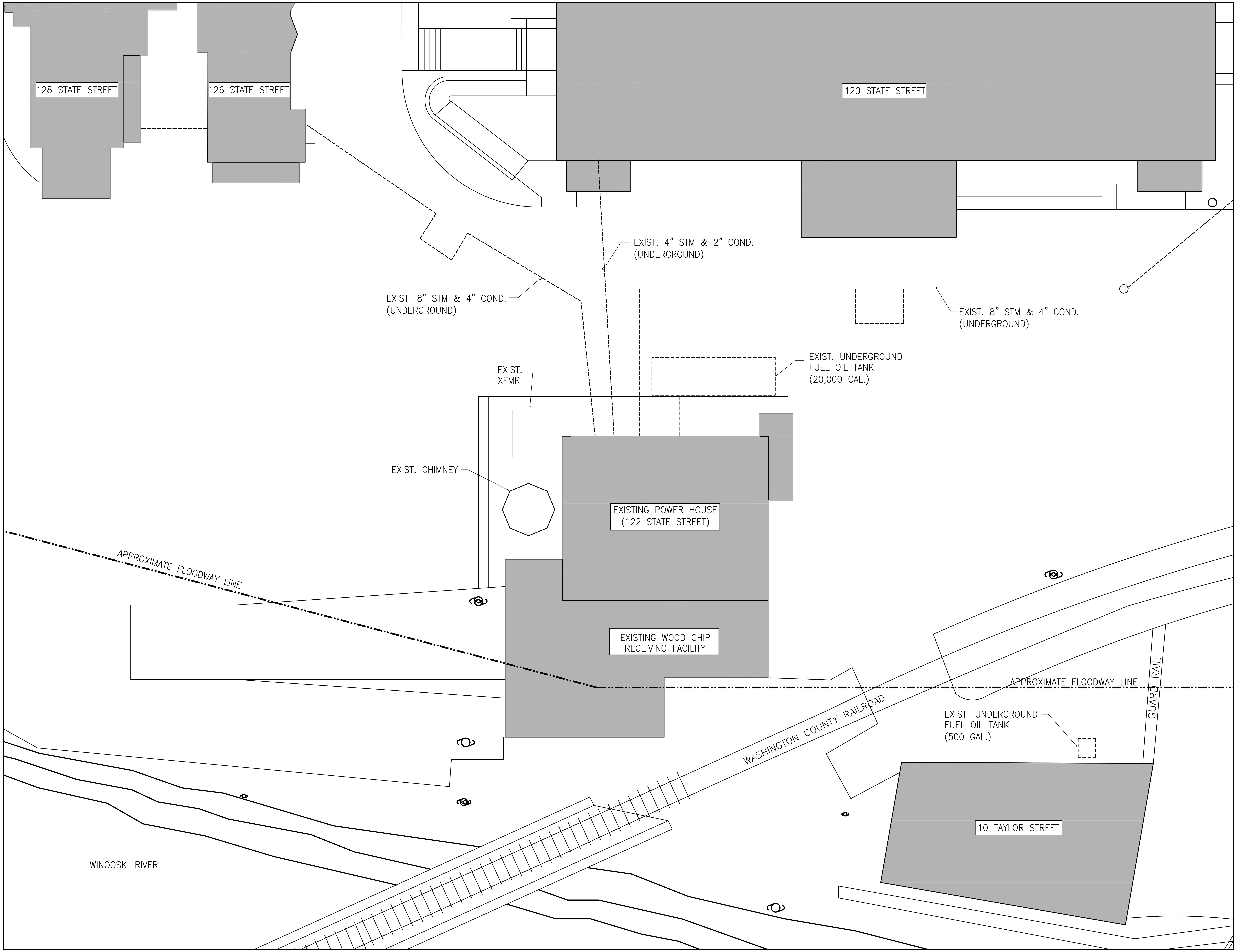
E-02A - Electrical Site Plan - Phase 1

M-02B - Proposed Site Plan - Final Build-out

M-03A - Proposed Mechanical General Arrangement Plan A

M-03B - Proposed Mechanical General Arrangement Plan B

M-04 - Proposed Hot Water Distribution Piping Routing



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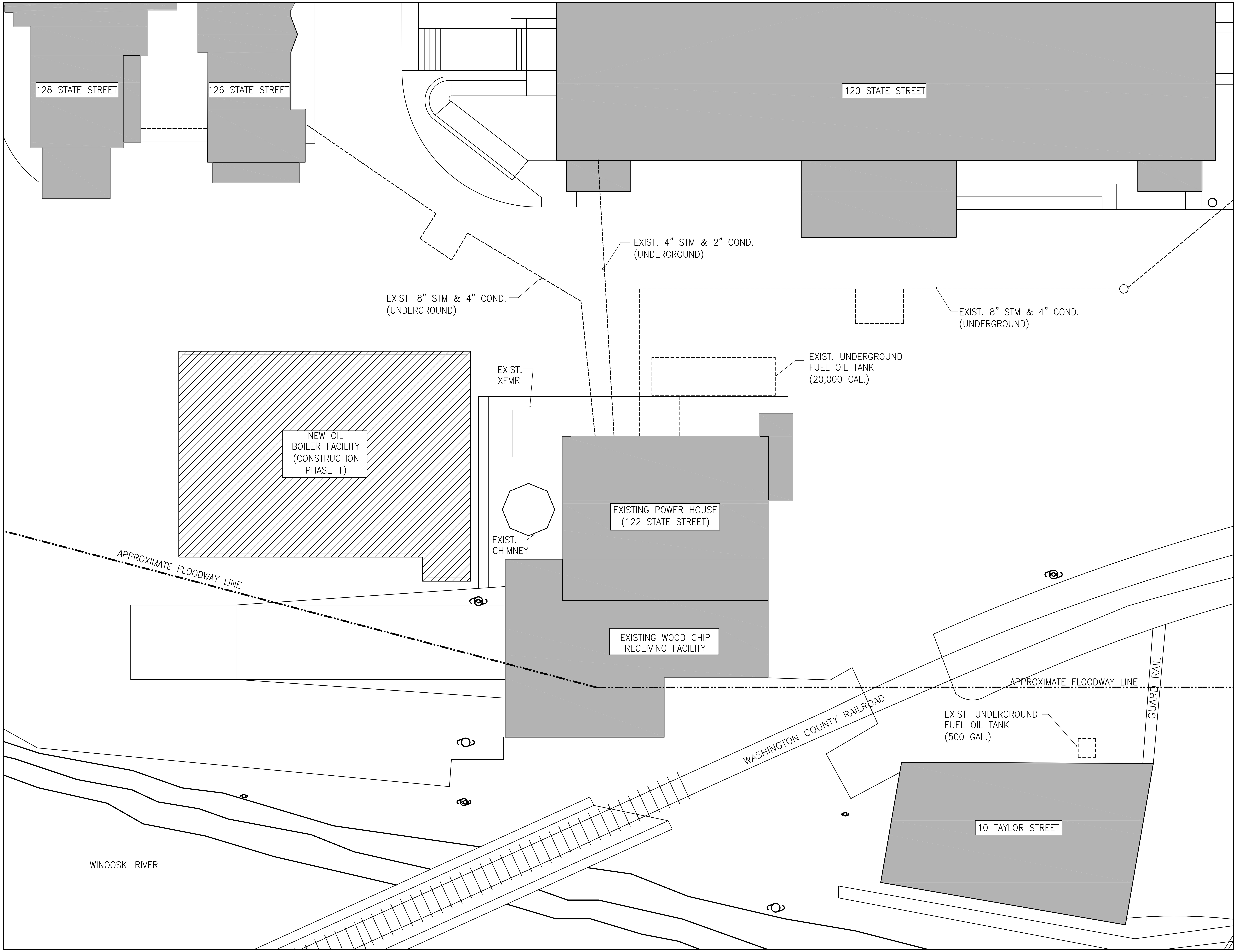
Project

EXISTING
SITE PLAN

M-01



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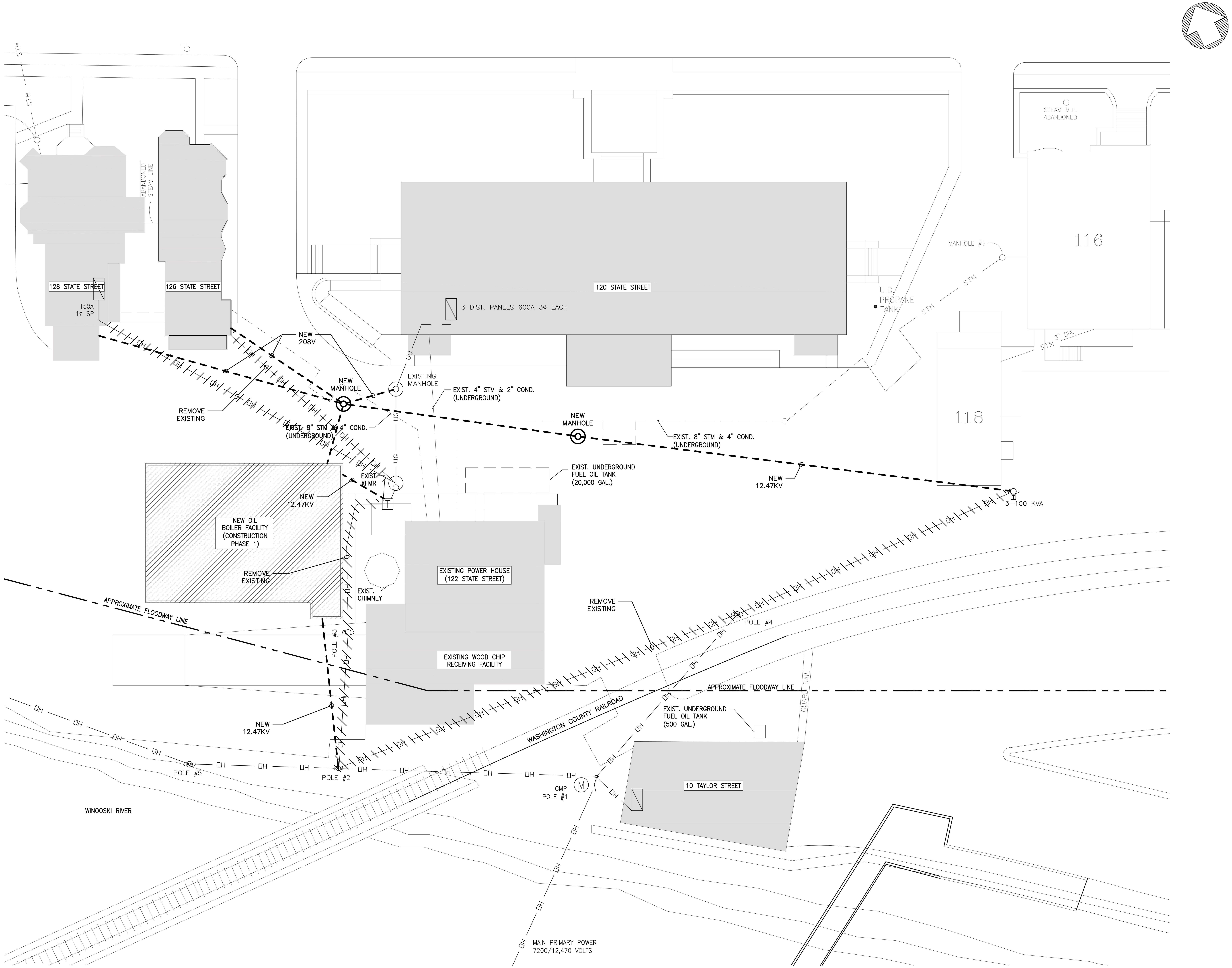
Project

PROPOSED
SITE PLAN
PHASE 1

M-02A

CITY OF MONTPELIER DISTRICT ENERGY CHP



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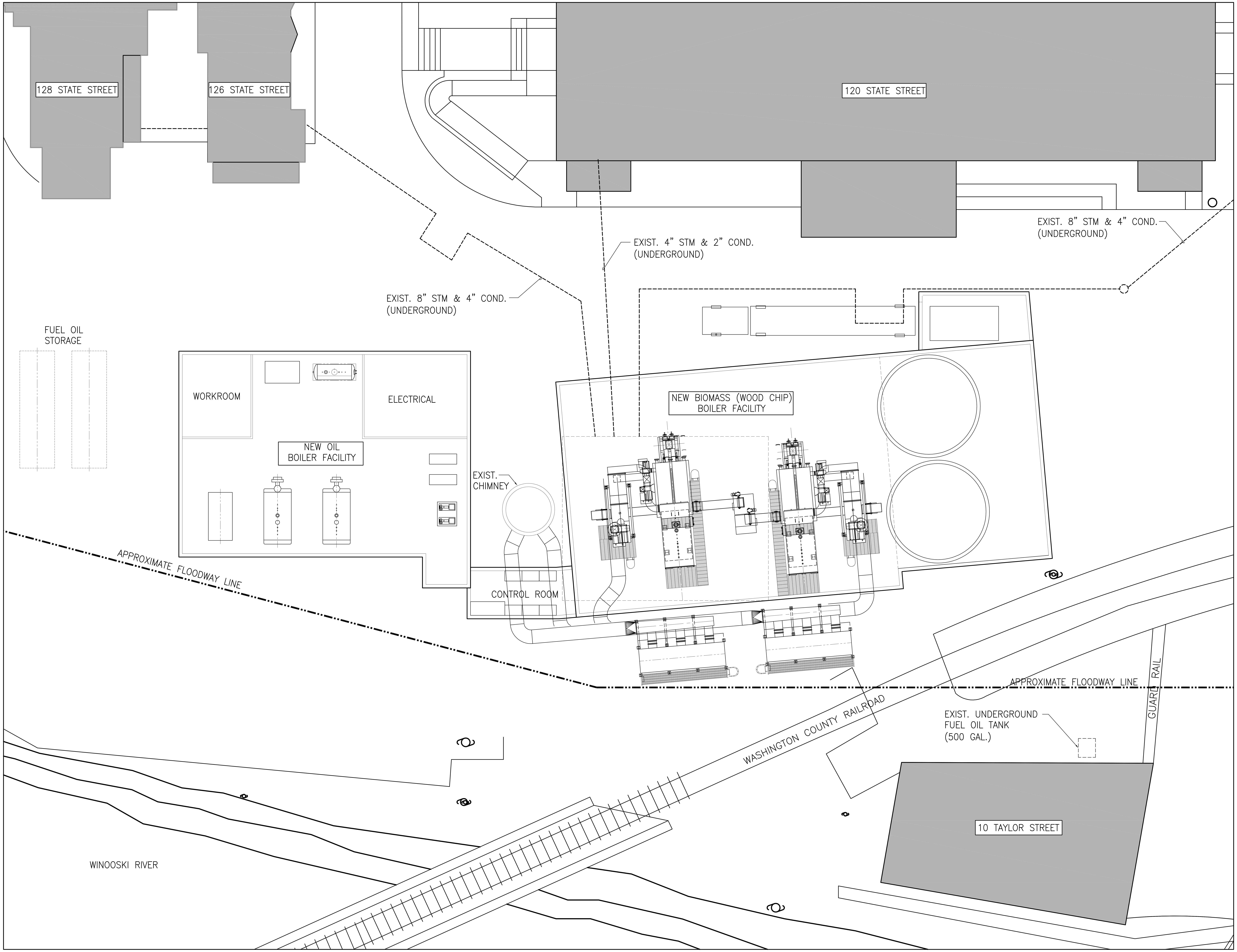
Project

ELECTRICAL PROPOSED SITE PLAN PHASE 1

E-02A



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PROPOSED
SITE PLAN
FINAL BUILD-OUT

M-02B

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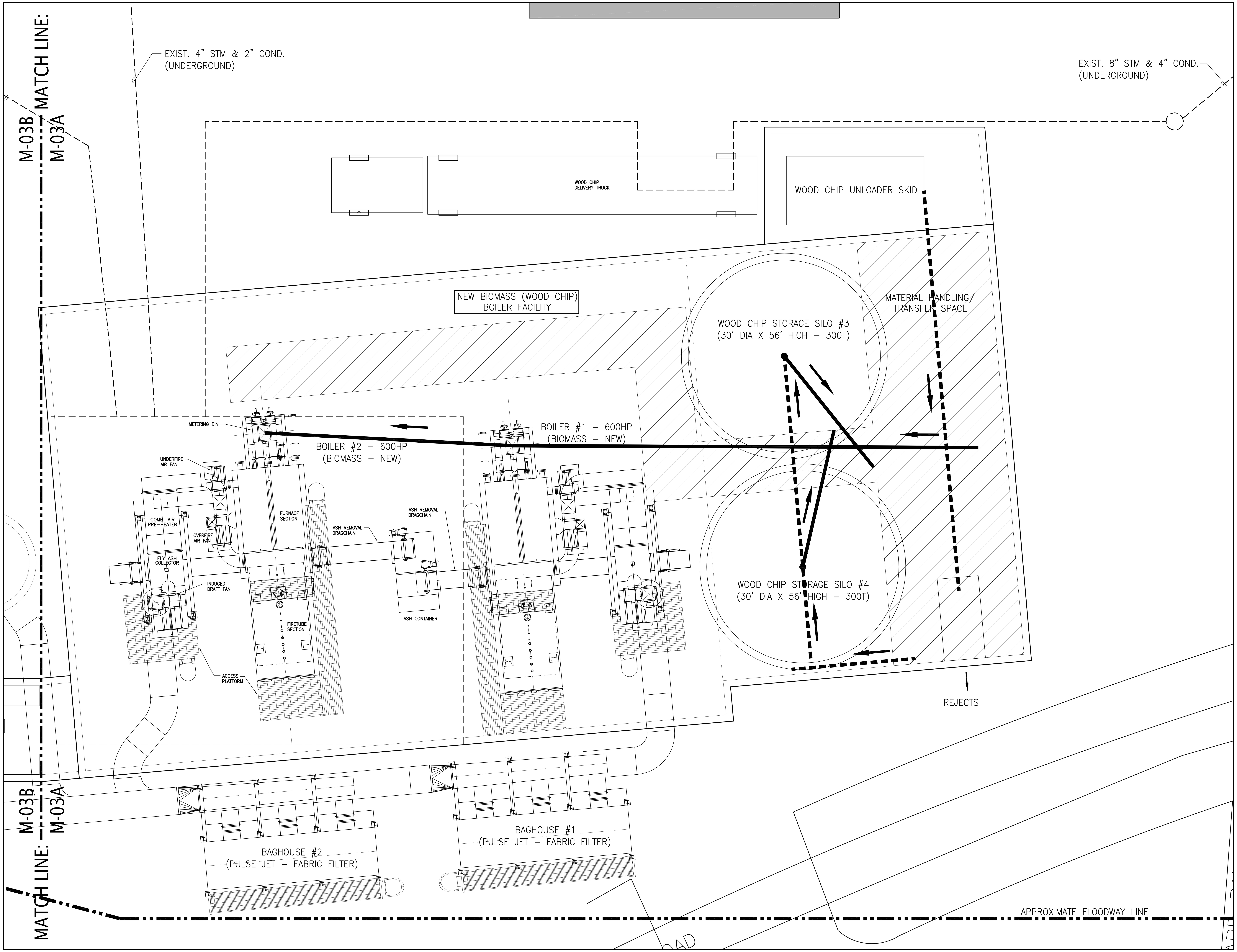

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PROPOSED MECHANICAL
GENERAL ARRANGEMENT
PLAN A

M-03A

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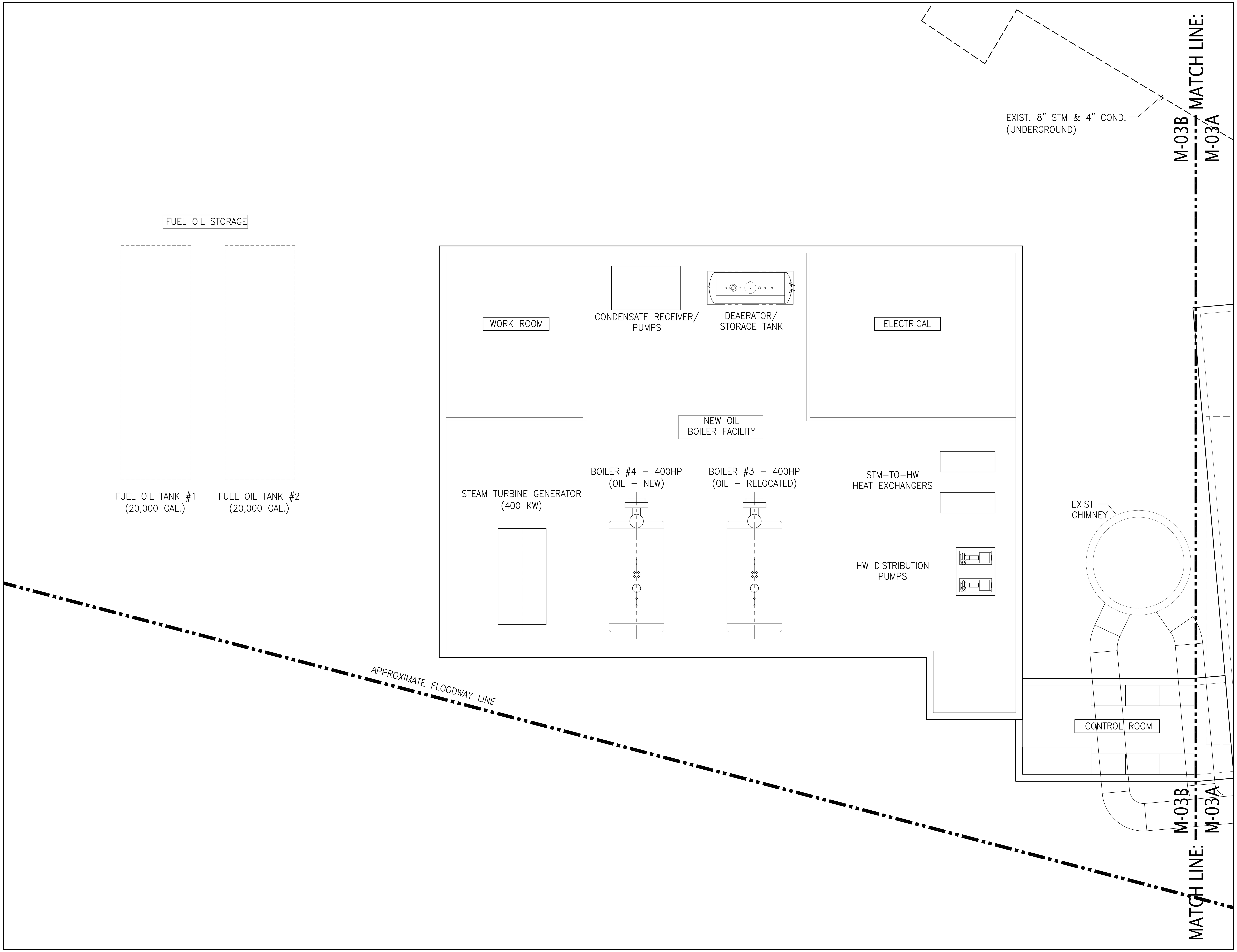

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DISTRICT ENERGY CHP

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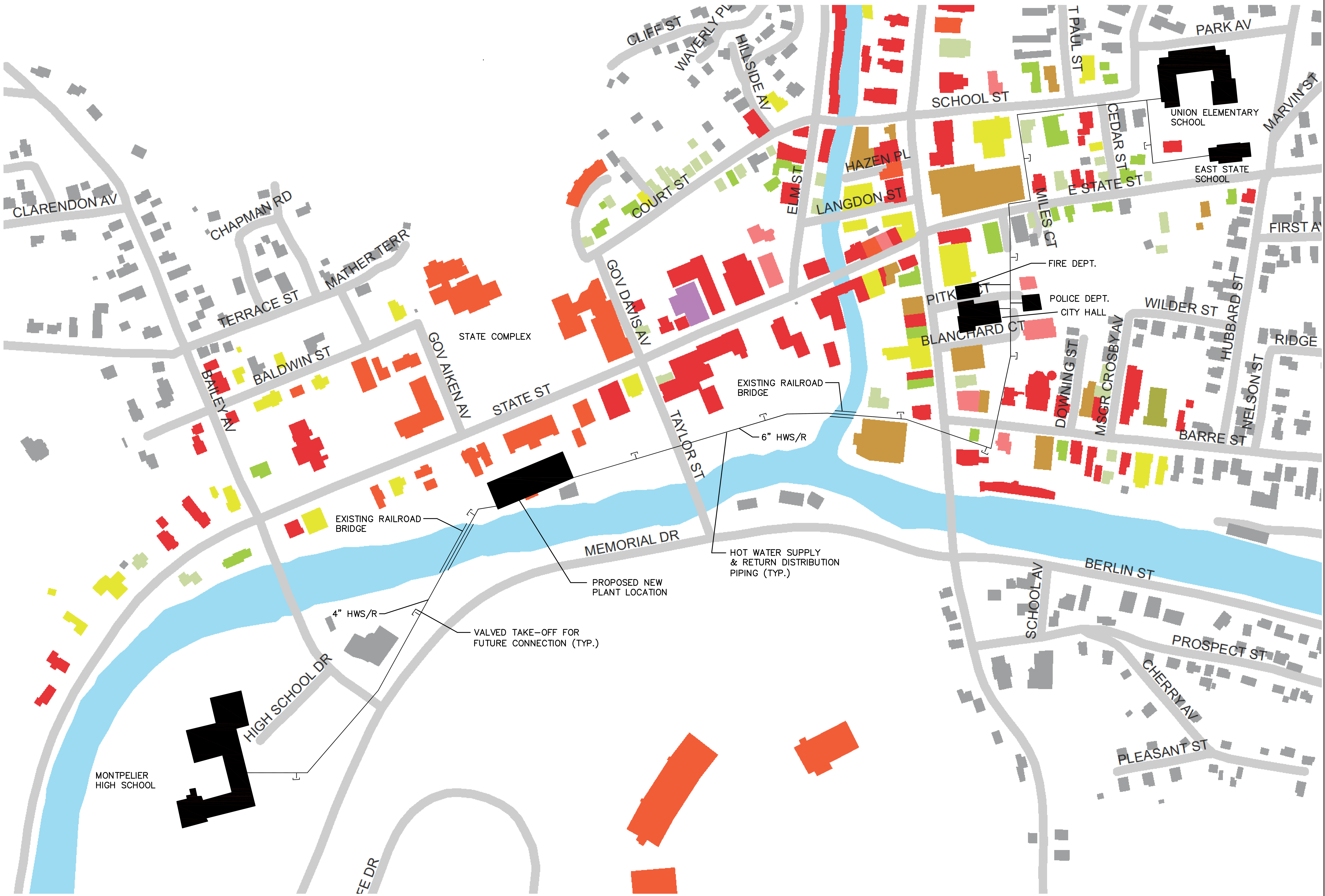
Project

PROPOSED MECHANICAL
GENERAL ARRANGEMENT
PLAN B

M–03B



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Project

PROPOSED HOT WATER DISTRIBUTION PIPING ROUTING

M-04

Appendix D - Calculations

Estimate of Average Monthly Heat Load for Existing State Complex (3-year span)

Proposed Phase 1 Buildings - Estimated Peak Heating Loads

New Heating Plant - Estimated Yearly Heating Loads

R.G. Vanderweil Engineers, LLP
Project: Montpelier District Energy CHP Feasibility Study

Calculation: Estimate of average monthly heat load for state complex (3-year span)

Variables:

Heating Value of Wood Chips: 9.02 MMBTU/ton
Heating Value of #6 Oil: 153,000 BTU/Gallon
Heating Value of #6 Oil: 0.153 MMBTU/Gallon

Efficiency of Existing Wood Boiler: 55% (Estimated)
Efficiency of Existing Oil Boiler: 80% (Estimated)

2006 - State Complex Plant - Monthly Fuel Usage

Month	Boiler #1 Tons	Boiler #2 Gallons	Boiler #3 Gallons
JAN	682.56	28567	0
FEB	417.52	12318	25270
MAR	666.52	1788	13956
APR	35	4235	39896
MAY	0	0	17768
JUN	0	0	0
JUL	0	0	0
AUG	0	0	0
SEP	0	0	5322
OCT	0	0	29426
NOV	0	0	31425
DEC	634.01	14472	13541

2007 - State Complex Plant - Monthly Fuel Usage

Month	Boiler #1 Tons	Boiler #2 Gallons	Boiler #3 Gallons
JAN	784.14	2980	26734
FEB	655.01	3005	28165
MAR	434.54	3106	29098
APR	617.13	8944	3148
MAY	0	0	18017
JUN	0	0	0
JUL	0	0	0
AUG	0	0	0
SEP	0	0	0
OCT	0	673	15188
NOV	367.24	1509	24431
DEC	777.45	6709	13359

2008 - State Complex Plant - Monthly Fuel Usage

Month	Boiler #1 Tons	Boiler #2 Gallons	Boiler #3 Gallons
JAN	757.27	9921	12220
FEB	837.47	1276	18114
MAR	612.63	3547	23182
APR	146.02	557	20359
MAY	0	0	14590
JUN	0	0	0
JUL	0	0	0
AUG	0	0	0
SEP	0	0	0
OCT	0	8830	15451
NOV	299.84	1739	24362
DEC	780.5	3632	21186

2006 - State Complex Plant - Total Purchased Energy

Month	Boiler #1 MMBTU	Boiler #2 MMBTU	Boiler #3 MMBTU	PLANT MMBTU
JAN	6156.7	4370.8	0.0	10527.4
FEB	3766.0	1884.7	3866.3	9517.0
MAR	6012.0	273.6	2135.3	8420.8
APR	315.7	648.0	6104.1	7067.7
MAY	0.0	0.0	2718.5	2718.5
JUN	0.0	0.0	0.0	0.0
JUL	0.0	0.0	0.0	0.0
AUG	0.0	0.0	0.0	0.0
SEP	0.0	0.0	814.3	814.3
OCT	0.0	0.0	4502.2	4502.2
NOV	0.0	0.0	4808.0	4808.0
DEC	5718.8	2214.2	2071.8	10004.8
TOTALS	**21969.2**	**9391.1**	**27020.4**	**58380.8**

37.6% % WOOD 62.4% % #6 OIL

2007 - State Complex Plant - Total Purchased Energy

Month	Boiler #1 MMBTU	Boiler #2 MMBTU	Boiler #3 MMBTU	PLANT MMBTU
JAN	7072.9	455.9	4090.3	11619.2
FEB	5908.2	459.8	4309.2	10677.2
MAR	3919.6	475.2	4452.0	8846.8
APR	5566.5	1368.4	481.6	7416.6
MAY	0.0	0.0	2756.6	2756.6
JUN	0.0	0.0	0.0	0.0
JUL	0.0	0.0	0.0	0.0
AUG	0.0	0.0	0.0	0.0
SEP	0.0	0.0	0.0	0.0
OCT	0.0	103.0	2323.8	2426.7
NOV	3312.5	230.9	3737.9	7281.3
DEC	7012.6	1026.5	2043.9	10083.0
TOTALS	**32792.3**	**4119.7**	**24195.4**	**61107.4**

53.7% % WOOD 46.3% % #6 OIL

2008 - State Complex Plant - Total Purchased Energy

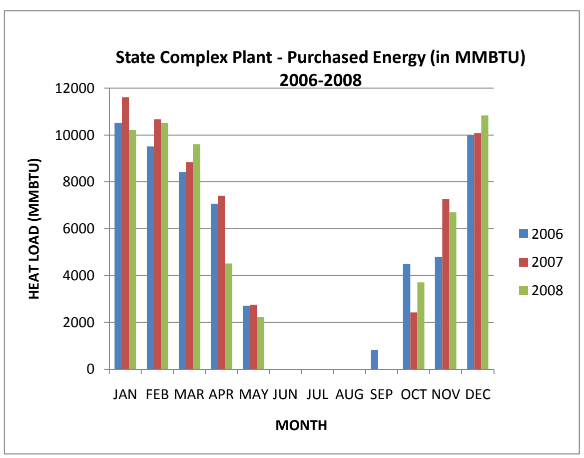
Month	Boiler #1 MMBTU	Boiler #2 MMBTU	Boiler #3 MMBTU	PLANT MMBTU
JAN	6830.6	1517.9	1869.7	10218.1
FEB	7554.0	195.2	2771.4	10520.6
MAR	5525.9	542.7	3546.8	9615.5
APR	1317.1	85.2	3114.9	4517.2
MAY	0.0	0.0	2232.3	2232.3
JUN	0.0	0.0	0.0	0.0
JUL	0.0	0.0	0.0	0.0
AUG	0.0	0.0	0.0	0.0
SEP	0.0	0.0	0.0	0.0
OCT	0.0	1351.0	2364.0	3715.0
NOV	2704.6	266.1	3727.4	6698.0
DEC	7040.1	555.7	3241.5	10837.3
TOTALS	**30972.2**	**4513.8**	**22868.0**	**58354.0**

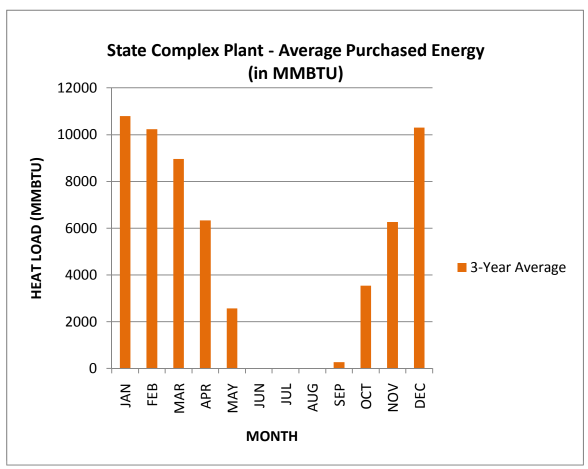
53.1% % WOOD 46.9% % #6 OIL

State Complex Plant - Average Purchased Energy (3-Year Average)

Month	Boiler #1 MMBTU	Boiler #2 MMBTU	Boiler #3 MMBTU	PLANT MMBTU
JAN	6686.7	2114.9	1986.7	10788.3
FEB	5742.7	846.5	3649.0	10238.3
MAR	5152.5	430.5	3378.0	8961.0
APR	2399.8	700.5	3233.6	6333.9
MAY	0.0	0.0	2569.1	2569.1
JUN	0.0	0.0	0.0	0.0
JUL	0.0	0.0	0.0	0.0
AUG	0.0	0.0	0.0	0.0
SEP	0.0	0.0	271.4	271.4
OCT	0.0	484.7	3063.3	3548.0
NOV	2005.7	165.6	4091.1	6262.5
DEC	6590.5	1265.5	2452.4	10308.3
TOTALS	**28577.9**	**6008.2**	**24694.6**	**59280.7**

48.2% % WOOD 51.8% % #6 OIL





Vanderweil Engineers R.G. Vanderweil Engineers, Inc.	Client:	Veolia Energy Nrth America
	Project:	City of Montpelier District Energy CHP System

Calc By:	Check By:	Job No.:	File Name:	Sheet Name:	Date:
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Calculation Sheet

Topic: **Proposed Phase 1 Buildings**
Estimated Peak Heating Loads

Building Owner	Building Location	Building Area (sq. ft.)	Est. Heat Load (MMBTUH)	Information Source
State of Vermont	State House	68,700	4.95	Lane Associates for State of VT
State of Vermont	Supreme Court	42,000	1.48	Lane Associates for State of VT
State of Vermont	120 State St.	76,500	2.61	Lane Associates for State of VT
State of Vermont	133 State St.	104,700	5.00	Lane Associates for State of VT
State of Vermont	6 Baldwin St.	32,750	0.82	Lane Associates for State of VT
State of Vermont	116 State St.	2,500	0.40	Lane Associates for State of VT
State of Vermont	110 State St.	11,675	1.00	Lane Associates for State of VT
State of Vermont	109 State St.	124,880	5.73	Lane Associates for State of VT
State of Vermont	128 State St.	9,250	0.22	Lane Associates for State of VT
State of Vermont	126 State St.	5,900	0.15	Lane Associates for State of VT
State of Vermont	132 State St.	3,950	0.12	Lane Associates for State of VT
State of Vermont	118 State St.	4,400	0.13	Lane Associates for State of VT
State of Vermont	4 Aiken Place	5,700	0.20	Lane Associates for State of VT
State of Vermont	2 Western St.	9,500	0.31	Lane Associates for State of VT
State of Vermont	136 State St.	3,525	0.24	Lane Associates for State of VT
State of Vermont	134 State St.	3,000	0.19	Lane Associates for State of VT
State of Vermont	112 State St.	35,172	1.50	Lane Associates for State of VT
City of Montpelier	City Hall/Fire Dept.	42,450	0.80	CORE Data & Estimate
City of Montpelier	Police Station	3,000	0.08	CORE Data & Estimate
City of Montpelier	Union Elem. School	58,000	3.00	CORE Data
State of Vermont	East State School	25,600	0.65	CORE Data & Estimate
City of Montpelier	Montpelier High School	89,174	3.00	CORE Data
Phase 1 Totals		762,326	32.58	
			973.3	BHP

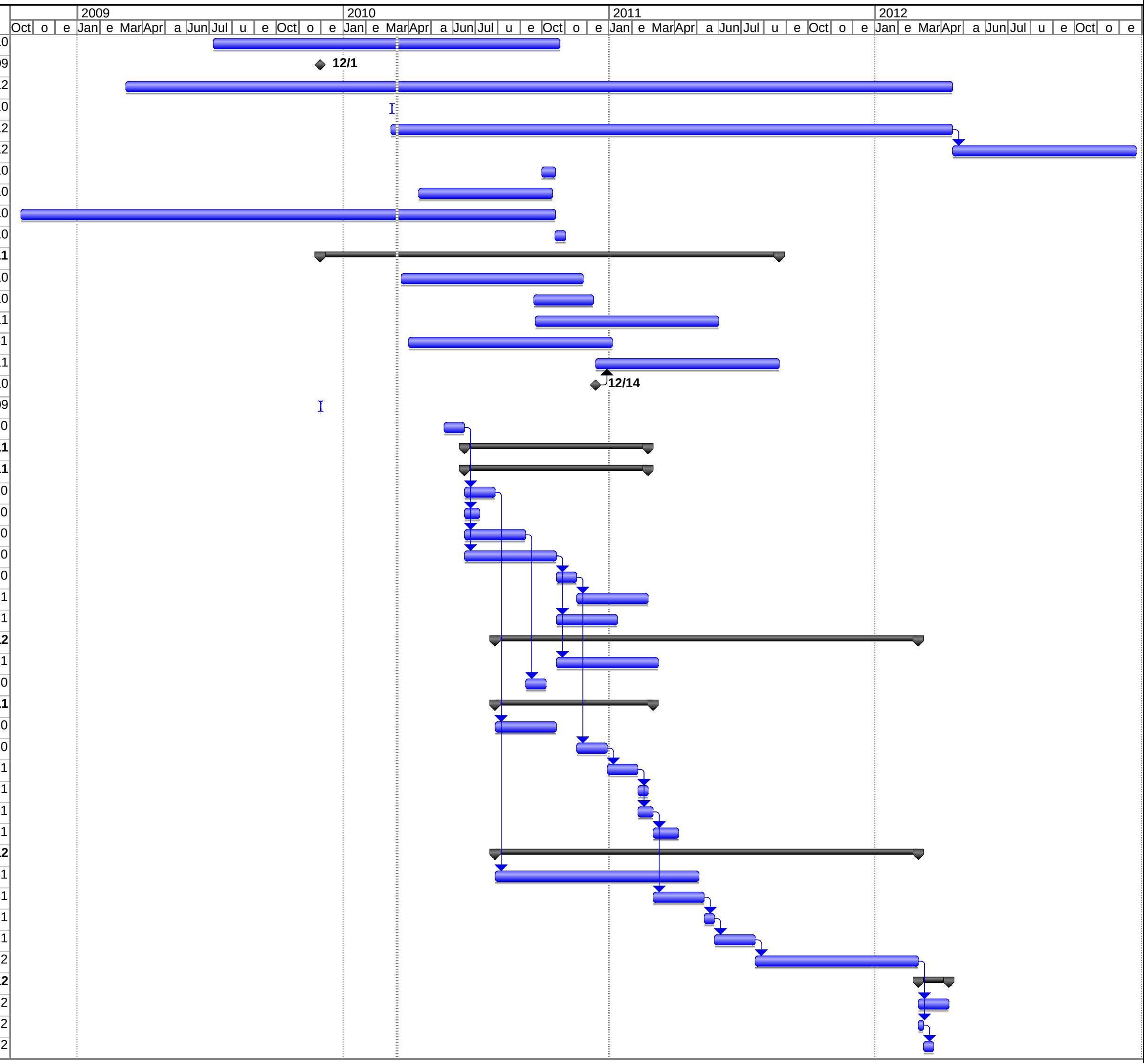
Vanderweil Engineers R.G. Vanderweil Engineers, Inc.	Client:	Veolia Energy Nrth America				
	Project:	City of Montpelier District Energy CHP System				
	Calc By:	Check By:	Job No.:	File Name:	Sheet Name:	Date:
	PBH	CH	25513	d Yearly Heatin	Page1	3/13/2010
Calculation Sheet	Topic:	New Heating Plant Estimated Yearly Heating Loads				

Existing Purchased Energy Loads			
State Complex Purchased Energy Loads (Input):	59280.7	MMBTU	(Calculated Average)
State Complex Average Percent Wood Boiler:	48%		(Calculated Average)
State Complex Average Percent Oil Boiler:	52%		(Calculated Average)
State Complex Purchased Wood Energy Loads (Input):	28454.7	MMBTU	(Calculated)
State Complex Purchased Oil Energy Loads (Input):	30826.0	MMBTU	(Calculated)
Estimated Existing Wood Boiler Efficiency:	55%		(Estimated)
Estimated Existing Oil Boiler Efficiency:	80%		(Estimated)
State Complex Wood Heating Load (Output):	15650.1	MMBTU	(Calculated)
State Complex Oil Heating Load (Output):	24660.8	MMBTU	(Calculated)
State Complex Total Heating Load (Output):	40310.9	MMBTU	(Calculated)
City Hall/Fire Department Purchased Energy Loads (Input):	3,727	MMBTU	(CORE Collected Data)
Estimated Existing Oil Boiler Efficiency:	80%		(Estimated)
City Hall/Fire Department Heating Load (Output):	2,982	MMBTU	(Calculated)
Police Department Purchased Energy Loads (Input):	300	MMBTU	(CORE Collected Data)
Estimated Existing Oil Boiler Efficiency:	80%		(Estimated)
Police Department Heating Load (Output):	240	MMBTU	
Montpelier H.S. Purchased Energy Loads (Input):	7,590	MMBTU	(CORE Collected Data)
Estimated Existing Oil Boiler Efficiency:	80%		(Estimated)
Montpelier H.S. Heating Load (Output):	6,072	MMBTU	(Calculated)
Union Elementary School Purchased Energy Loads (Input):	6,389	MMBTU	(CORE Collected Data)
Estimated Existing Oil Boiler Efficiency:	80%		(Estimated)
Union Elementary School Heating Load (Output):	5,111	MMBTU	(Calculated)
East State School Yearly Purchased Energy Loads (Input):	2,500	MMBTU	(Estimated based on area)
Estimated Existing Oil Boiler Efficiency:	80%		(Estimated)
East State School Heating Load (Output):	2,000	MMBTU	(Calculated)
Total Phase 1 Buildings - Heating Loads (Output):	56715.7	MMBTU	(Estimated/Calculated)
Total Phase 1 Buildings - Peak Heating Loads:	32.58	MMBTUH	(Estimated/Calculated)
Total Final Biomass Buildout Peak Energy Loads:	41	MMBTUH	(Basis of Design)
Total Final Buildout - Peak Energy Loads:	8.42	MMBTUH	(Estimated)
Total Final Buildout - Heating Loads (Output):	14,657.6	MMBTU	(Estimated)
Total Final Buildout Buildings - Heating Loads (Output):	71,373.3	MMBTU	(Calculated)

Appendix E - Project Schedule

Veolia Energy Montpelier Biomass Community Energy Plant

ID		Task Name	Duration	Start	Finish
1		DOE Project	340 days	Tue 7/7/09	Mon 10/25/10
2		**150 Day Go/ No Go Decision**	0 days	Tue 12/1/09	Tue 12/1/09
3		**1.0 Project Management Plan**	811 days	Mon 3/9/09	Mon 4/16/12
4		Project Kick Off	1 day	Tue 3/9/10	Tue 3/9/10
5		1.1 Maintain Project Management Plan	551 days	Mon 3/8/10	Mon 4/16/12
6		1.2 Environmental & Reg Compliance	180 days	Tue 4/17/12	Mon 12/24/12
7		1.4 Prepare Reports & Briefings	13 days	Fri 10/1/10	Tue 10/19/10
8		1.4.1 Inception Report	132 days	Thu 4/15/10	Fri 10/15/10
9		1.4.2 Project Report	524 days	Thu 10/16/08	Tue 10/19/10
10		1.4.3 Final Report	11 days	Tue 10/19/10	Tue 11/2/10
11		**Permitting**	**450 days**	**Tue 12/1/09**	**Mon 8/22/11**
12		Air/ Emissions	180 days	Mon 3/22/10	Fri 11/26/10
13		Local Building/ Zoning	60 days	Mon 9/20/10	Fri 12/10/10
14		Local Act 250, Chapter 79,89	180 days	Wed 9/22/10	Tue 5/31/11
15		ISO NE Interconnection Registration	200 days	Thu 4/1/10	Wed 1/5/11
16		Utility Interconnection Application	180 days	Tue 12/14/10	Mon 8/22/11
17		Execute Financial Agreements	0 days	Tue 12/14/10	Tue 12/14/10
18		Montpelier Board Meeting	1 day	Tue 12/1/09	Tue 12/1/09
19		Zoning Commission	20 days	Thu 5/20/10	Wed 6/16/10
20		**Engineering Design**	**180 days**	**Thu 6/17/10**	**Wed 2/23/11**
21		**Prepurchase Specifications**	**180 days**	**Thu 6/17/10**	**Wed 2/23/11**
22		BioMass Equipment	30 days	Thu 6/17/10	Wed 7/28/10
23		Electrical Equipment	15 days	Thu 6/17/10	Wed 7/7/10
24		60% Design Documents- Plant	60 days	Thu 6/17/10	Wed 9/8/10
25		60% Design Documents- Site Piping	90 days	Thu 6/17/10	Wed 10/20/10
26		100% Design Documents-Oil Plant	20 days	Thu 10/21/10	Wed 11/17/10
27		100% Design Documents-Bio Plant	70 days	Thu 11/18/10	Wed 2/23/11
28		100% Design Documents- Site Piping	60 days	Thu 10/21/10	Wed 1/12/11
29		**2.0 Construction Phasing**	**415 days**	**Thu 7/29/10**	**Wed 2/29/12**
30		Site Piping Distribution System	100 days	Thu 10/21/10	Wed 3/9/11
31		Electrical Service Relocations Phase 1	20 days	Thu 9/9/10	Wed 10/6/10
32		**Construct Oil Plant**	**155 days**	**Thu 7/29/10**	**Wed 3/2/11**
33		Oil Plant Equipment Delivery	60 days	Thu 7/29/10	Wed 10/20/10
34		Civil/Structural	30 days	Thu 11/18/10	Wed 12/29/10
35		Process MEP	30 days	Thu 12/30/10	Wed 2/9/11
36		Electrical Backfeed for Demolition	10 days	Thu 2/10/11	Wed 2/23/11
37		Start Up and Commission Oil Plant	15 days	Thu 2/10/11	Wed 3/2/11
38		Demolition Existing Plant	25 days	Thu 3/3/11	Wed 4/6/11
39		**Construction BioMass Plant**	**415 days**	**Thu 7/29/10**	**Wed 2/29/12**
40		Biomass Equipment Delivery	200 days	Thu 7/29/10	Wed 5/4/11
41		Civil/Structural to Grade	50 days	Thu 3/3/11	Wed 5/11/11
42		Rigging and Setting Boilers/Silos	10 days	Thu 5/12/11	Wed 5/25/11
43		Constuct Bld Watertight	40 days	Thu 5/26/11	Wed 7/20/11
44		Proccess MEP and Building Shell	160 days	Thu 7/21/11	Wed 2/29/12
45		**3.0 Start Up and Commissioning**	**30 days**	**Thu 3/1/12**	**Wed 4/11/12**
46		Biomass Plant	30 days	Thu 3/1/12	Wed 4/11/12
47		District Piping System	5 days	Thu 3/1/12	Wed 3/7/12
48		(6) New Customer ETS Stations	10 days	Thu 3/8/12	Wed 3/21/12



Project: Montpelier 81409
Date: Mon 3/15/10

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Appendix F - Biomass Fuel Availability

Biomass Fuel Availability

Montpelier, Vermont

Prepared for:
Veolia Energy NA

March 2010

Prepared By:

Innovative Natural Resource Solutions LLC

107 Elm Street, Suite 100-G
Portland, ME 04101
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Introduction

This document serves as an independent assessment of wood availability, and factors influencing availability and pricing, for a combined heat and power project in Montpelier, Vermont that is expected to use 12,200 green tons of wood annually, following a traditional seasonal load curve.

Innovative Natural Resource Solutions LLC (INRS) was hired by Veolia Energy NA to compile this report. INRS has experience with the region's forest products industry and loggers, and has a strong working knowledge of existing and potential markets for biomass in the Northeast.

> *INRS believes the information contained in this report to be correct, based upon information sources we deem reliable. Given the dynamic nature of wood markets and biomass, INRS does not warrantee information in this report against all errors. This report contains some predictions, forecasts and forward-looking statements that are based upon the professional knowledge, experience and opinion of INRS. These predictions and forecasts are not guarantees of future events.*

Innovative Natural Resource Solutions LLC

Founded in 1994, Innovative Natural Resource Solutions LLC (INRS) is a full-service consulting firm specializing in the forest industry, natural resource conservation, and renewable energy.

INRS has worked with a number of parties on the development of new biomass energy facilities around the country. The firm is currently working with developers of biomass or biofuel projects in Maine, New Hampshire, New York, New Jersey, Vermont, Massachusetts, Indiana, Virginia, Georgia and California.

A complete description of INRS activities in biomass energy development, including a partial client listing, can be found at www.inrsllc.com

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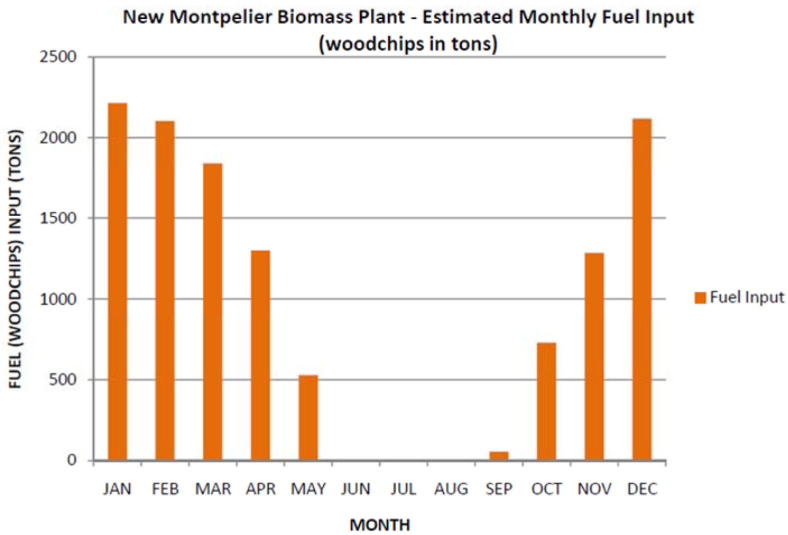
Table of Figures and Tables

Summary

The Montpelier, VT Combined Heat & Power Project is expects to use roughly 12,200 green tons of wood fuel annually, following a traditional heating load curve. This assumes an average moisture content of 45% (varies by season and species) and an average BTU value of 4,625 per pound (9.25 MM per ton); these are typical for biomass in this region.

Figure 1. Anticipated Annual Fuel Use, by Month (Green Tons)



This region of Vermont is heavily forested, with a strong agricultural base as well. The region has a history of "harvesting" natural resources, and a market for low-grade wood fits well into the current marketplace.

Timber growth within 30 miles of Montpelier exceeds harvest levels by over 650,ooo green tons per year with all current and historic markets. The region also has a number of existing major markets for low-grade wood, the closes being large-scale biomass electric plants in Burlington and Ryegate, which use a lower grade and lower cost chip than Montpelier is expected to utilize. There are a number of very small thermal energy users (e.g., schools) that use "bole chips" in proximity to Montpelier; these are of a scale to be viewed as "infrastructure supporting" rather than as competitors.

INRS breaks biomass prices into two components:

- The cost of the diesel used to fell, skid, transport and process a ton of chips; and
- All other components of cost (stumpage fees to a landowner, staff and equipment costs, supplier profit, etc.), referred to as the "wood component".

INRS projects that the "wood component" of bole chips will average $47.00 per green ton in the current heating season, and increase annually by 3.5%. In order to get a final delivered price, 2.1 times the price of gallon of diesel should be added; for example, if diesel averages $3.00 per gallon in 2010, the average delivered cost for bole chips is projected to be $53.30.

Wood Fuel Specification

The Montpelier, Vermont Combined Heat and Power Project expects to use wood fuel that is clean, free of fines and oversized pieces, and delivered via a self-unloading truck. INRS has used the following specifications in understanding this project:

- Clean, 100% wood chips from known sources, free from paint, chemicals, glues, metals, nails, or other non-wood substances. No rotten substances that are evidence of decomposition, no rocks, no dirt (*de minimus* amounts allowed)
- Average moisture content ~45%
- Less than 10% bark, hardwoods and softwoods (including mixed) are acceptable
- Chip size:
    - Minimum 1/8” x 1/8” x 1/8”
    - Maximum 2.5” x 2.5” x ¼”
- Delivery via live-floor (self-unloading) trailer

This is a “bole chip”, produced from harvested roundwood, or a chip from sawmill residue. This specification specifically excludes the oversized pieces, long sticks, and non-wood material (e.g., rocks, etc.) that are associated with “dirty chips” or biomass chips that are used in larger scale biomass electric facilities and derived from chipping of forest residues and whole trees.

Figure 2. Bole Chips for Use in a Biomass Thermal Application.

Existing and Proposed Users of Low-Grade Wood

The area around Montpelier, Vermont has a handful of direct competitors for low-grade wood, though none within a 30-minute drive time. Biomass power plants that are the closest large-scale users of low-grade wood use a product with a much less forgiving specification, and are not necessarily competitors for "bole chips". Pellet mills and pulp mills use a chip close to the specifications discussed above; these are more direct competitors for the Montpelier project.

The figure below shows the location of major competitors for biomass in the region. The tables provide details on each facility.

Figure 3. Major Users of Low-Grade Wood, 30 - 60 - 90 Minute Drive Times

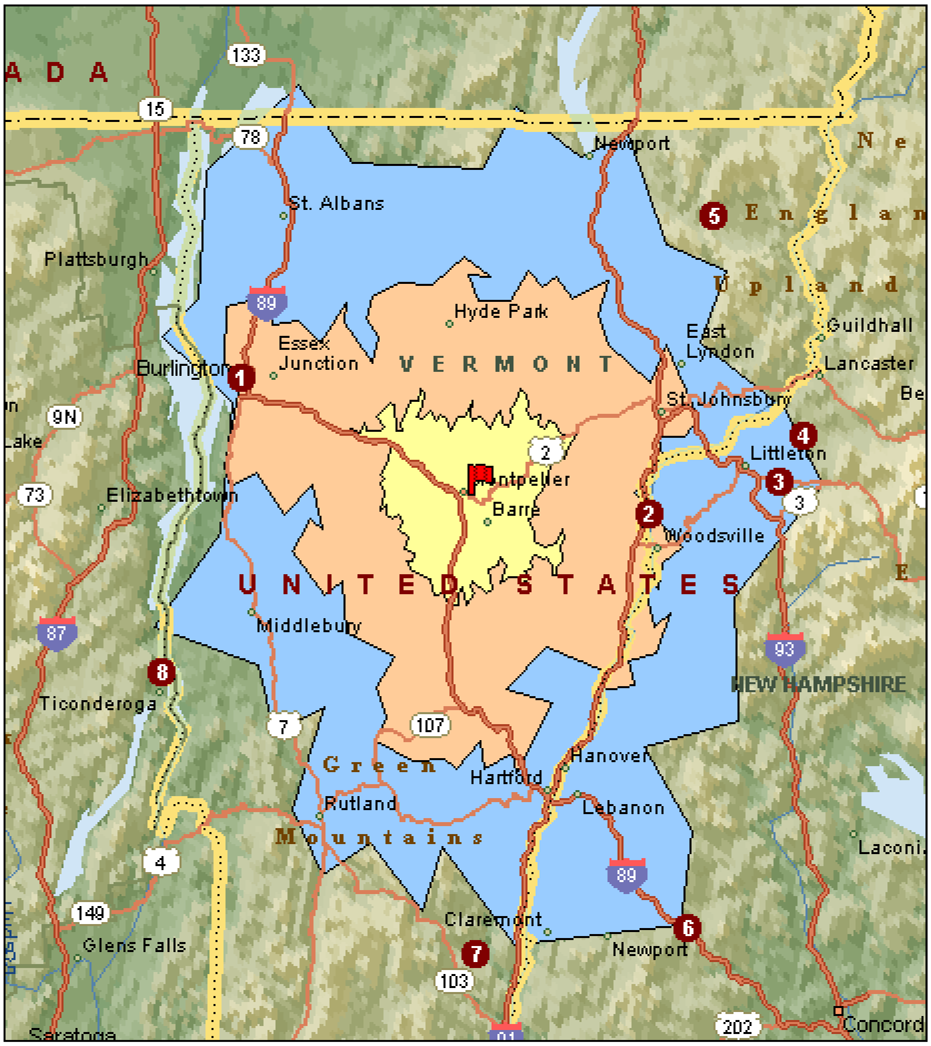


Table 1. Major Competitors, 60 Minute Drive Time

Facility 1	McNeil Station
Location	Burlington, VT
Status	Operating
Product	Electricity
Owner	Burlington Electric
Size	50 MW
Fuel	Whole-tree chips, sawmill residue, some roundwood chipped on-site
Annual Wood Use (est.)	Up to 600,000 green tons
Distance – miles	41 miles
Distance - time	47 minutes

Facility 2	Pinetree – Ryegate
Location	Ryegate, VT
Status	Operating
Product	Electricity
Owner	Suez Energy North America
Size	20 MW
Fuel	Whole-tree chips and sawmill residue
Annual Wood Use (est.)	260,000 green tons
Distance – miles	36 miles
Distance - time	59 minutes

Table 2. Major Competitors, 60 Minute Drive Time

Facility 3	Pinetree – Bethlehem
Location	Bethlehem, NH
Status	Operating
Product	Electricity
Owner	Suez Energy North America
Size	17 MW
Fuel	Whole-tree chips and sawmill residue
Annual Wood Use (est.)	230,000 green tons
Distance – miles	62 miles
Distance - time	1 hours, 17 minutes

Facility 4	DG Whitefield LLC (formerly Whitefield Power & Light)
Location	Whitefield, NH
Status	Operating
Product	Electricity
Owner	Marubeni Sustainable Energy, Inc
Size	13.8 MW
Fuel	Whole-tree chips, sawmill residue
Annual Wood Use (est.)	180,000 green tons
Distance – miles	68 miles
Distance - time	1 hour, 29 minutes

Table 3. Other Proximate Major Competitors

Facility 5	Vermont Biomass Energy Company
Location	Island Pond, VT
Status	Proposed (currently assembling financing)
Product	Wood pellets
Owner	Azur Enterprises, LLC
Feedstock	Roundwood and sawmill chips
Annual Wood Use (est.)	~200,000 green tons
Distance – miles	68 miles
Distance - time	1 hour, 32 minutes

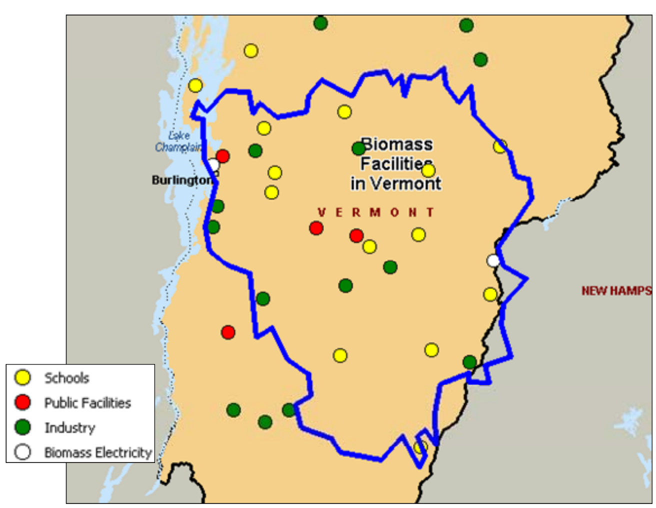
Facility 6	Hemphill Power & Light / DG Springfield
Location	Springfield, NH
Status	Operating
Product	Electricity
Owner	Marubeni Sustainable Energy, Inc
Size	16 MW
Fuel	Whole-tree chips, roundwood chipped on-site and sawmill residue
Annual Wood Use (est.)	200,000 green tons
Distance – miles	87 miles
Distance - time	1 hour, 35 minutes

Facility 7	North Springfield Biomass
Location	North Springfield, VT
Status	Proposed
Product	Electricity
Owner	Winstanley Enterprises, LLC
Size	25 MW
Fuel	Whole-tree chips and sawmill residue
Annual Wood Use (est.)	300,000 green tons
Distance – miles	91 miles
Distance - time	1 hour, 42 minutes

Facility 8	Ticonderoga Mill
Location	Ticonderoga, NY
Status	Operating
Product	Paper (uncoated freesheet)
Owner	International Paper Company
Annual Wood Use (est.)	700,000 green tons of pulpwood (~2/3 hardwood) 80,000 green tons of biomass
Distance – miles	86 miles
Distance - time	1 hour, 44 minutes

While there are few major competitors for wood fuel in the region, Vermont is national leader in the use of biomass for small-scale and community energy projects. The figure below shows the large number of schools, public facilities and industries (e.g., sawmills) in Vermont that use biomass for thermal applications. Many of these are very small-scale users (e.g., under 1,000 green tons per year). This diverse customer base helps support a chipping and delivery infrastructure that the Montpelier project will be able to utilize.

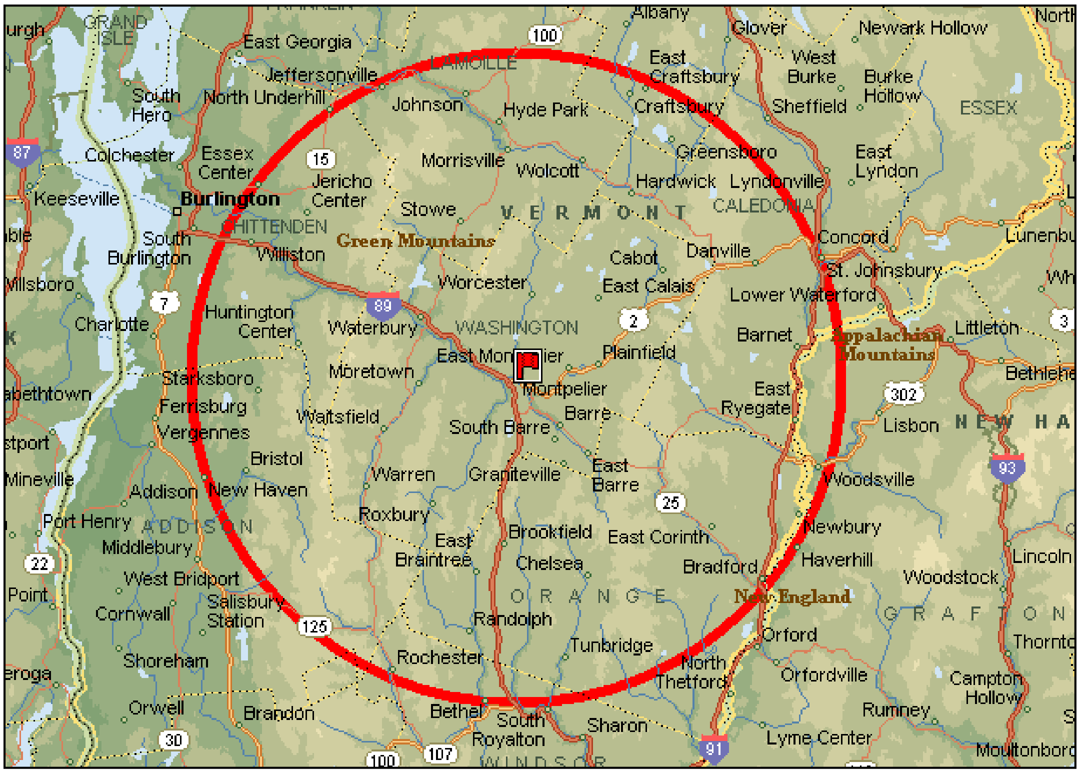
Figure 4. Biomass Energy Installations (60 Minute Drive Time from Montpelier)



Forest Growth and Removals

Using the USDA Forest Inventory & Analysis database, INRS determined the growth and loss (harvest and mortality) for a region within a 30-mile radius of Montpelier, VT. INRS used the most recent complete FIA information, which uses data collected between 2003 and 2008 for Vermont[1].

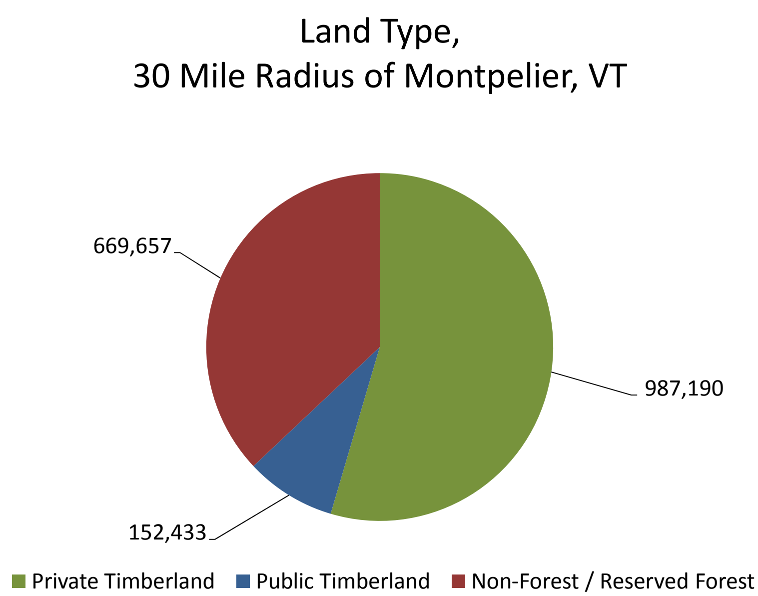
Figure 5. Thirty Mile Radius - Montpelier, VT



[1] USDA Forest Service data is presented in cubic feet. INRS calculated green tons assuming 85 cubic feet of solid wood per cord, and that a green cord of wood weighs 2.6 tons for hardwood and 2.3 tons for softwood.

Of the 1.8 million acres of land that are within a 30 mile radius of Montpelier, VT, roughly 55 percent is private timberland, capable and legally available for growing commercial forest products.

Figure 6. Land Ownership Patterns within 30 Miles of Montpelier, VT (acres)



For purposes of growth and harvest levels, land within the Green Mountain National Forest and other public lands was excluded from the analysis. While timber harvesting does occur on National Forest lands and other public holdings, these lands have historically proven to be shrinking in terms of timber volume sold, and are generally unreliable as a steady source of supply. Any volume of wood that is made available from this federal land base could be used by the facility, and as such the information below should be considered conservative.

With all large markets in place and operating, the 30 miles surrounding Montpelier, VT (exclusive of the Green Mountain National Forest), annual harvest levels exceed harvest levels by nearly 677,000 green tons on private lands.

Table 4. Standing Inventory and Net Growth- Removals for Area within 30 Miles of Montpelier

	Private	**Public**	**All Timberland**
		green tons	
Net Growing Stock - Standing	64,412,222	12,190,177	76,602,399
Net Growth	1,352,819	221,082	1,573,901
Removals	676,109	107,577	783,686
Removals Less Growth	*676,710*	*113,505*	*790,215*

Current and Projected Biomass Prices

Prices for "bole chips" for thermal applications are influenced by a number of factors, including but not limited to:

- Markets for other wood products, including:
  - Sawlogs (stronger markets means more residuals and more harvesting activity)
  - Pulpwood or other low-grade roundwood (strong markets means more competition for material); and
  - Biomass chips (strong markets can have a modest influence on availability; price differential between the two products moderates this market influence);
- The cost of diesel fuel (based on extensive analysis of logging and transport records, INRS estimates that it takes slightly more than 2 gallons of diesel to harvest, skid, de-limb, chip and transport a green tons of chips; this can vary based on distance to market and other factors);
- Short-term weather events, which limit harvesting activities in the woods (e.g., extended rains or spring and fall mud season);

Of these factors, the role of diesel is the most volatile and has the most significant short-term influence.

INRS spoke with eleven potential suppliers, or wood-using facilities, as part of this analysis. Current pricing for bole chips for small-scale seasonal users (less than 2,000 green tons per year) is in the mid to high $50s per green ton. In current market conditions, Montpelier could expect to pay slightly below this level, given the meaningful volume and more consistent wood use offered. The market is generally served by a handful of aggregators and brokers; a number of loggers indicated that the thermal market is too seasonal and requires too much customer attention to be attractive for a firm with woods-based operations. Based on INRS experience, these observations are accurate.

For a 12,200 green tons of bole chips on a seasonal use curve (delivered), $47.00 should be considered as the base price for the wood component of biomass fuel; the total anticipated cost is:

wood component + (2.1 x gallon of diesel) = total delivered cost per green ton

The following table shows what a facility in Montpelier, VT can expect to pay for the purchase of roughly 12,200 green tons of wood annually on a per-ton basis at a variety of diesel costs. These prices do not anticipate the entrance of a major new market for low-grade roundwood or bole chips in close proximity to Montpelier (e.g., a pellet mill - none are announced or expected).

Table 5. Projected Wood Prices at Various Diesel Costs; 2009 - 2014

Heating Year	Wood Component	Diesel Per Gallon									
		$ 2.50	$ 2.75	$ 3.00	$ 3.25	$ 3.50	$ 3.75	$ 4.00	$ 4.25	$ 4.50	$ 4.75
		Delivered Price per Green Ton									
2009 - 2010	$ 47.00	$ 52.25	$ 52.78	$ 53.30	$ 53.83	$ 54.35	$ 54.88	$ 55.40	$ 55.93	$ 56.45	$ 56.98
2010 - 2011	$ 48.65	$ 53.90	$ 54.42	$ 54.95	$ 55.47	$ 56.00	$ 56.52	$ 57.05	$ 57.57	$ 58.10	$ 58.62
2011 - 2012	$ 50.35	$ 55.60	$ 56.12	$ 56.65	$ 57.17	$ 57.70	$ 58.22	$ 58.75	$ 59.27	$ 59.80	$ 60.32
2012 - 2013	$ 52.11	$ 57.36	$ 57.88	$ 58.41	$ 58.93	$ 59.46	$ 59.98	$ 60.51	$ 61.03	$ 61.56	$ 62.08
2013 - 2014	$ 53.93	$ 59.18	$ 59.71	$ 60.23	$ 60.76	$ 61.28	$ 61.81	$ 62.33	$ 62.86	$ 63.38	$ 63.91
2014 - 2015	$ 55.82	$ 61.07	$ 61.60	$ 62.12	$ 62.65	$ 63.17	$ 63.70	$ 64.22	$ 64.75	$ 65.27	$ 65.80

Biomass Harvest Standards

In Vermont, Act 248 requires electric generation facilities to acquire a "certificate of public need", and conditions may be imposed as a result. Vermont has previously required large-scale biomass plants to comply with certain harvest and procurement standards. At both McNeail Station and Ryegate Power, company foresters are required to visit each Vermont-based logging job that supplies that plant and assure that conditions are being met that protect forest regeneration, preserve water quality, protect habitat and account for aesthetics. These facilities, which each have wood use more than twenty times larger than is proposed for Montpelier, have employed forestry staff to meet these standards.

It is not clear what, if any, standards would be imposed on a small, seasonal, efficient user such as the Montpelier Combined Heat & Power project. The state hasn't directly faced this issue in roughly twenty years, and any assessment of what will happen is speculative. Thermal-only users (e.g., schools) do not have such standards to comply with, and the Public Utilities Commission reportedly wants to encourage small, efficient biomass projects. As such, it is entirely possible that no or only minimal harvest standards would be imposed on the Montpelier project; this would add little to no cost. While unlikely, it is possible that standards such as are found at Burlington and Ryegate could be imposed on the Montpelier project; this could add several dollars per ton in compliance costs.

If the project qualifies for the feed-in tariff (which is currently over-subscribed), it will need to provide third-party "performance certification", where the logger / forest / harvest is audited to meet certain environmental criteria. At this time, Performance-based certification is offered only as part of Forest Stewardship Council certification; pricing is presently unavailable, but this would certainly add several dollars or more per ton in compliance costs.