

FEASIBILITY STUDY

for the

CITY OF MONTPELIER DISTRICT ENERGY CHP SYSTEM

Prepared for:



Veolia Energy North America
99 Summer Street
Boston, MA

February 12, 2010
30% DRAFT ISSUE

Prepared and Submitted by:

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In conjunction with



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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.

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.

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:

- Identify 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

The bounds of this study were conveyed to RGV by the project team and are assumed to be givens for this project. This study is based on the following assumptions/givens.

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 total capacity of the electrical cogeneration portion of the plant is to be 1.8 million kWh.

Existing Conditions

Existing State Capitol Complex Boiler Plant

Permitting and Environmental Review Considerations

Background

This document supports the Vanderweil 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.

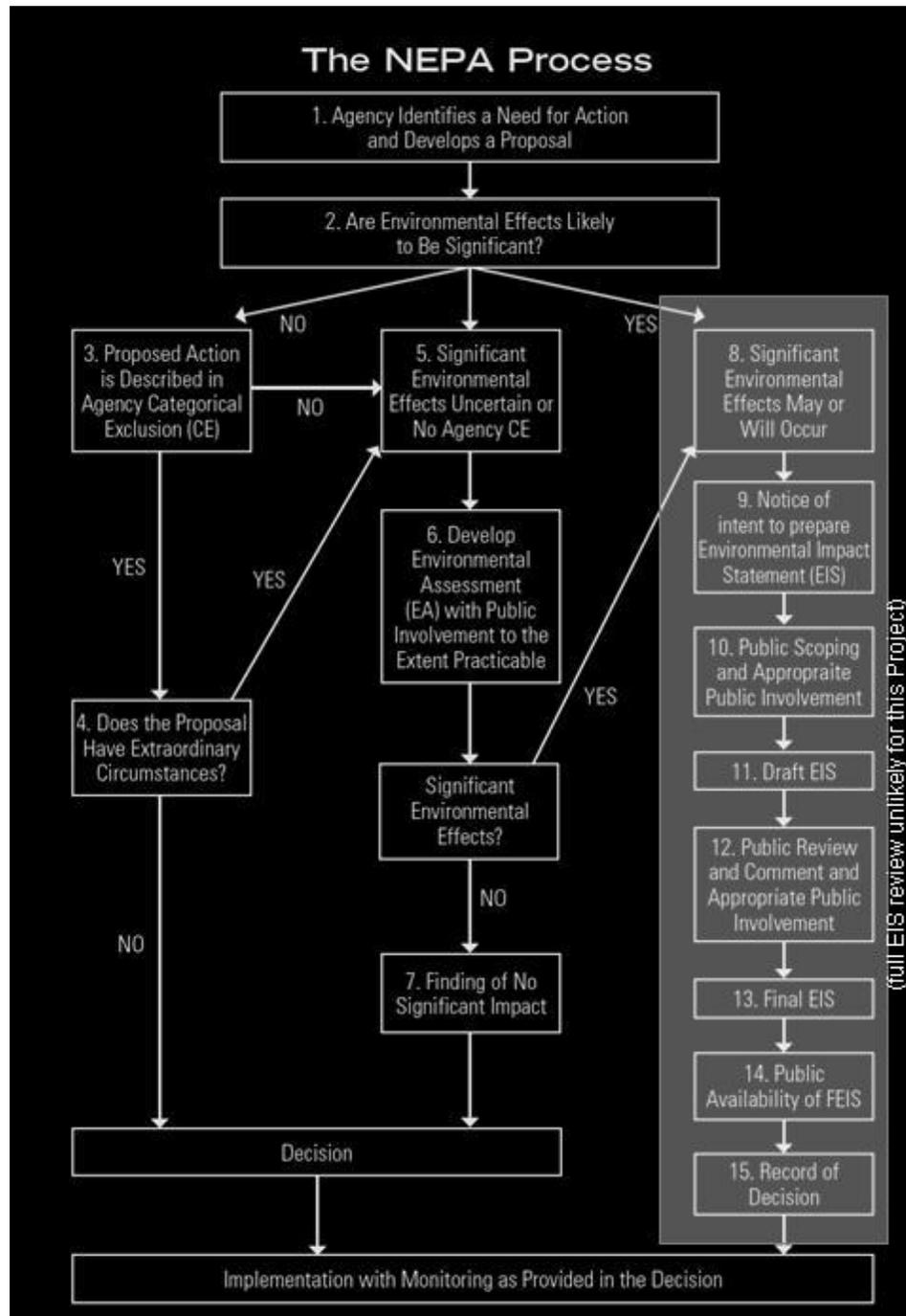
Land Use/ Siting Review Processes

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 below¹:

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



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 do 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 (NO _x)	0.22 pounds per million British Thermal Units (lb/MMBtu)
Particulate Matter (PM)	0.01 lb/MMBtu*
Sulfur Dioxide (SO ₂)	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 (PM_{2.5}) will be regulated. Most recent approvals have similar limits for PM₁₀ and PM_{2.5}.

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.

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 NO_x 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 (HMSE). Those below the action levels do not need HMSE 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 floodproofing 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 stormwater 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 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 a 33 buildings (including 18 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.

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. Based on our preliminary analysis, we believe that this is a reasonable and attainable goal for the CHP sizing. Since there is no summer steam load for the connected systems, the CHP portion of the project would be sized at approximately 400 kW steam turbine backpressure generator that would operate approximately 6 months of the year in order to attain the 1.8 million kWh proposed load.

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.

Proposed Plant Layout

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

The new plant would be separated into two separate buildings, one for the biomass boilers and chip storage 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.

The biomass boiler system would consist of two (2) 600-HP wood chip burning boilers.

The oil burning boiler system would consist of two (2) 400-HP #6 oil-fired boilers.

The proposed total size of the wood chip storage for the new biomass boiler system is 800 tons, and would allow for the biomass boilers running at full capacity for a period of 5 days.

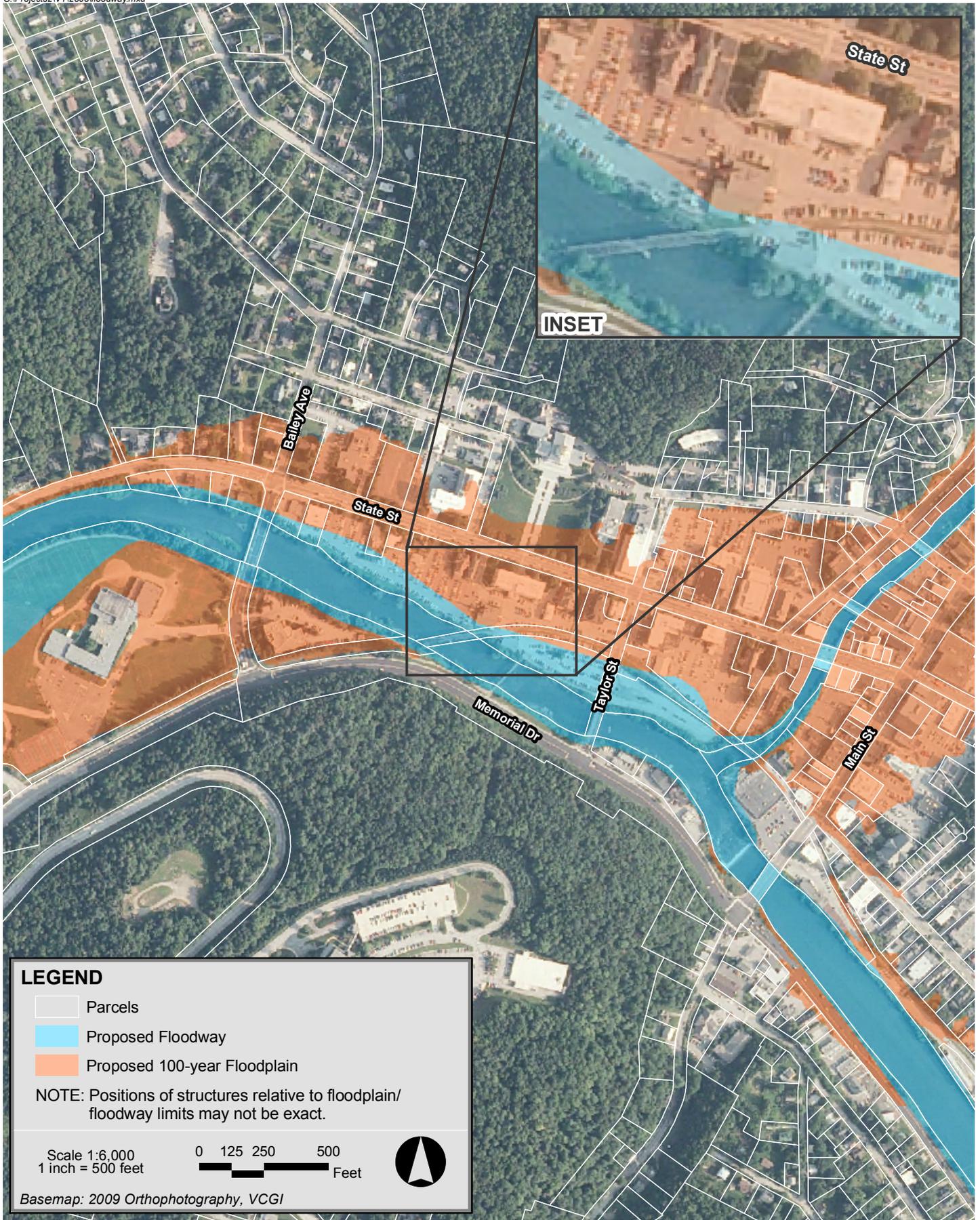
Proposed Distribution Piping Layout

The proposed piping distribution piping layout for the initial phase of the plant would consist of two (2) separate runs, designated as Phase 1A and Phase 1B on the GIS sketch included in Appendix A.

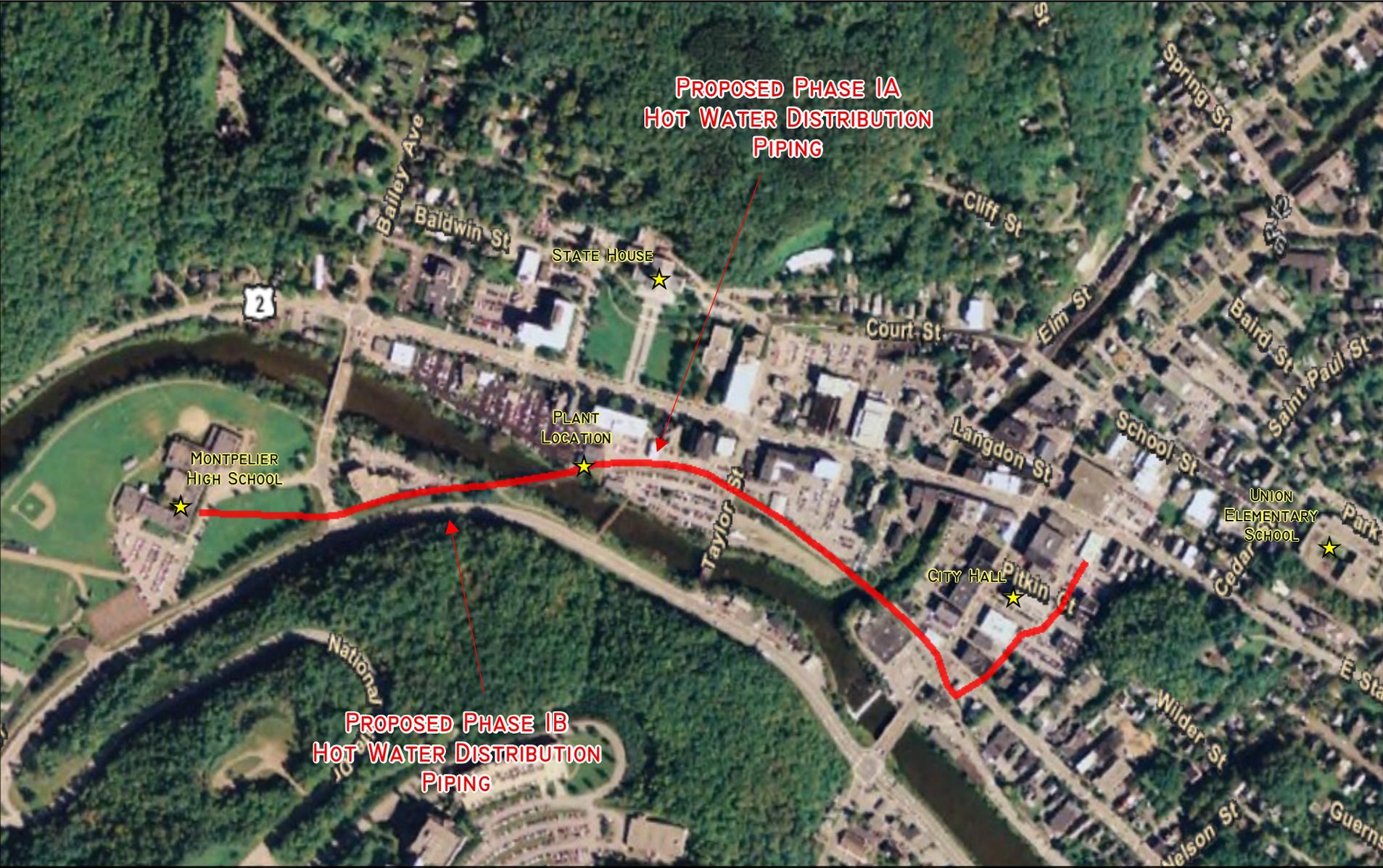
The Phase 1A piping run would extend to the east and would parallel the existing railroad tracks, crossing the Winooski River at the existing railroad bridge. The piping run would extend across Main Street, and turn north, terminating in the vicinity of the Montpelier City Hall. The proposed Phase 1A piping run could be extended further to the north to pick up additional loads from larger heating loads such as the Union Elementary School and East State School.

The Phase 1B piping run 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.

Appendix A - GIS Sketches



Montpelier CHP Montpelier, Vermont

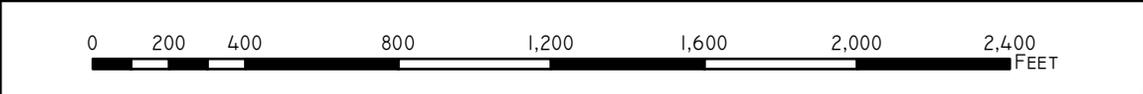


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1 IN = 500 FEET



PROPOSED PHASE I
HOT WATER PIPING DISTRIBUTION



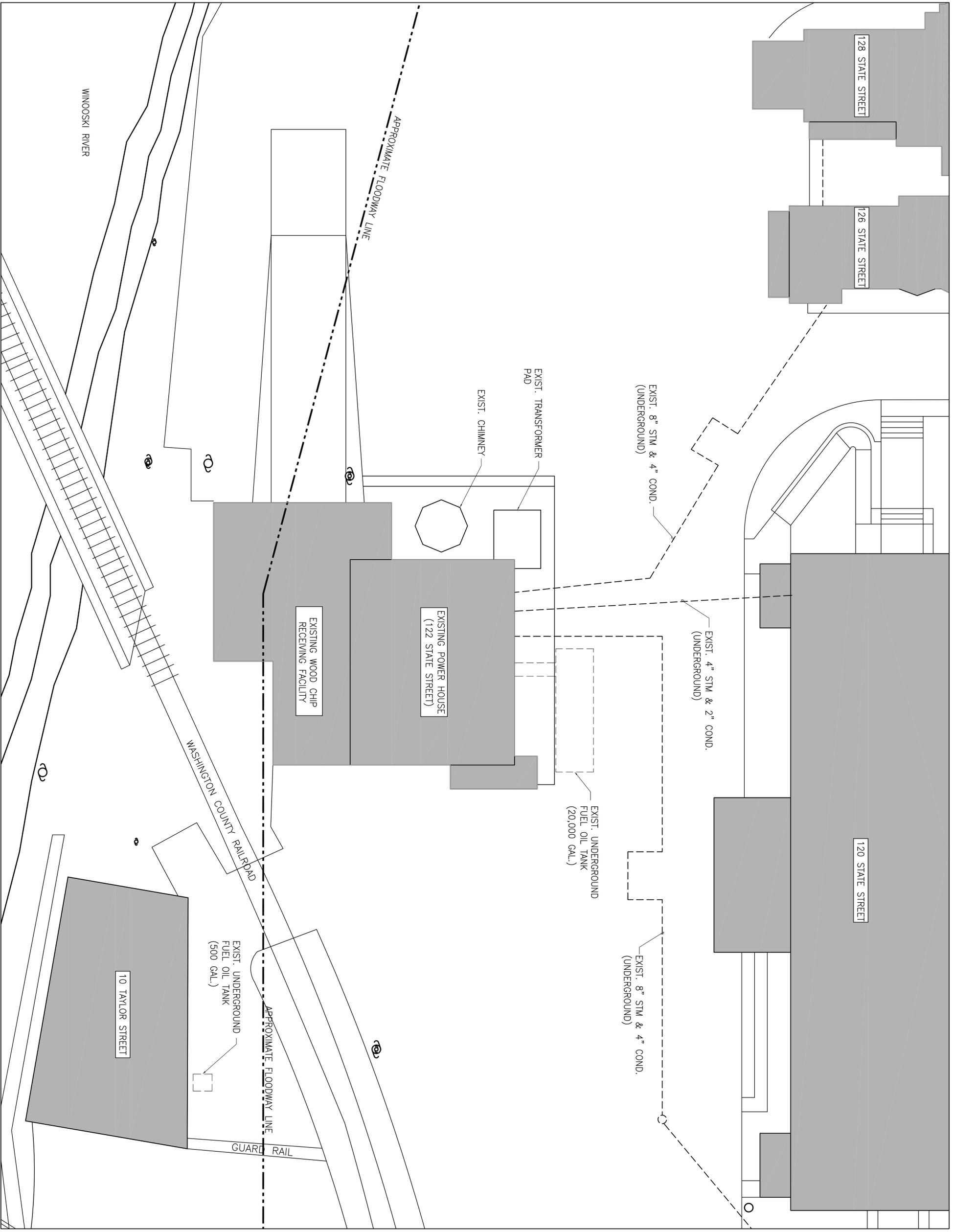
- POINTS OF INTEREST
- PROPOSED HOT WATER PIPE



BASEMAP DATA SOURCE: ESRI ONLINE

Appendix B - Process Flow Sketches

Appendix C - Layout Drawings



PROGRESS ISSUE
30% DRAFT - 02/12/10

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Checked by: CH

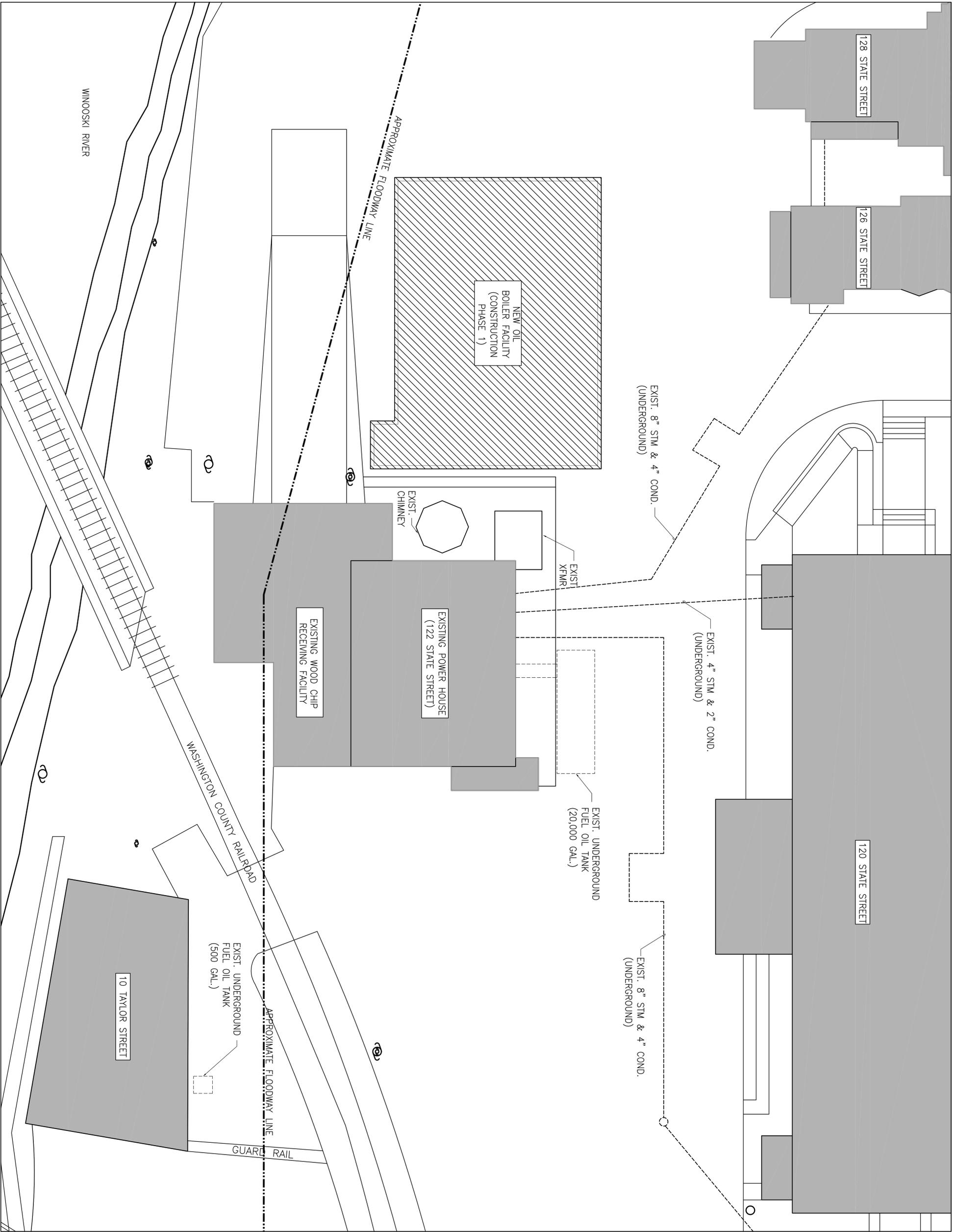
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EXISTING
SITE PLAN

M-01



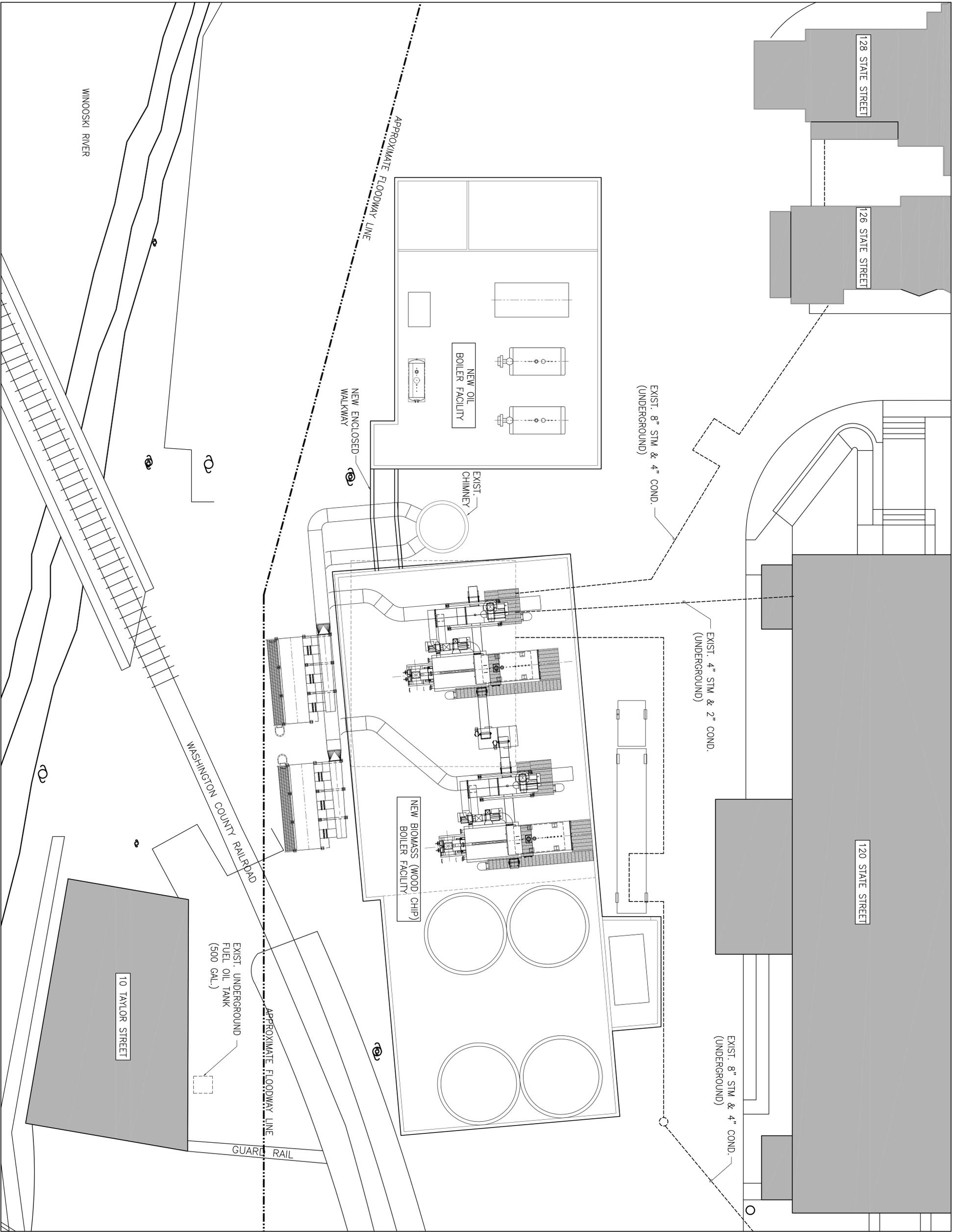
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PROPOSED
SITE PLAN
PHASE 1

M-02A



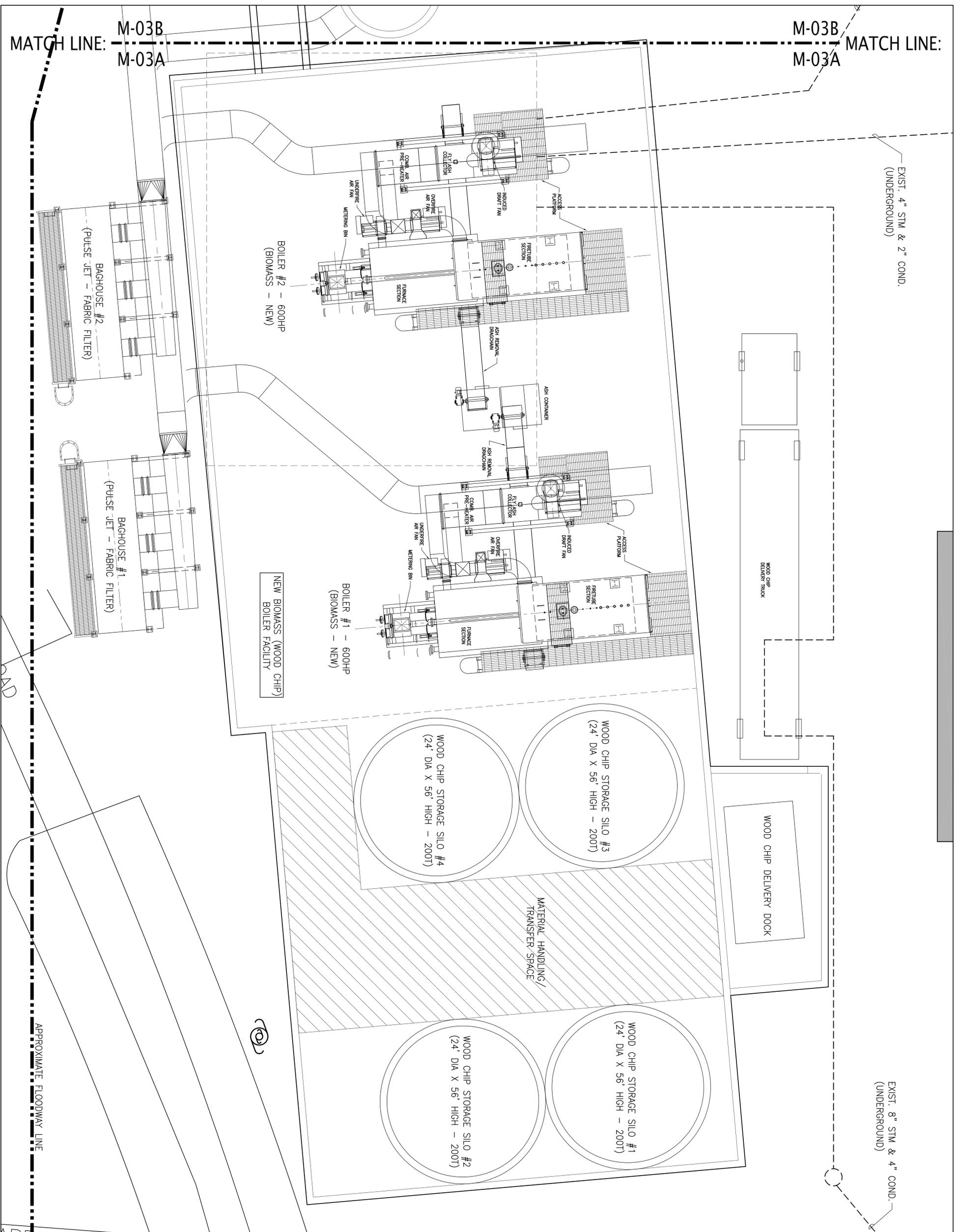
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**PROPOSED
 SITE PLAN
 FINAL BUILD-OUT**

M-02B



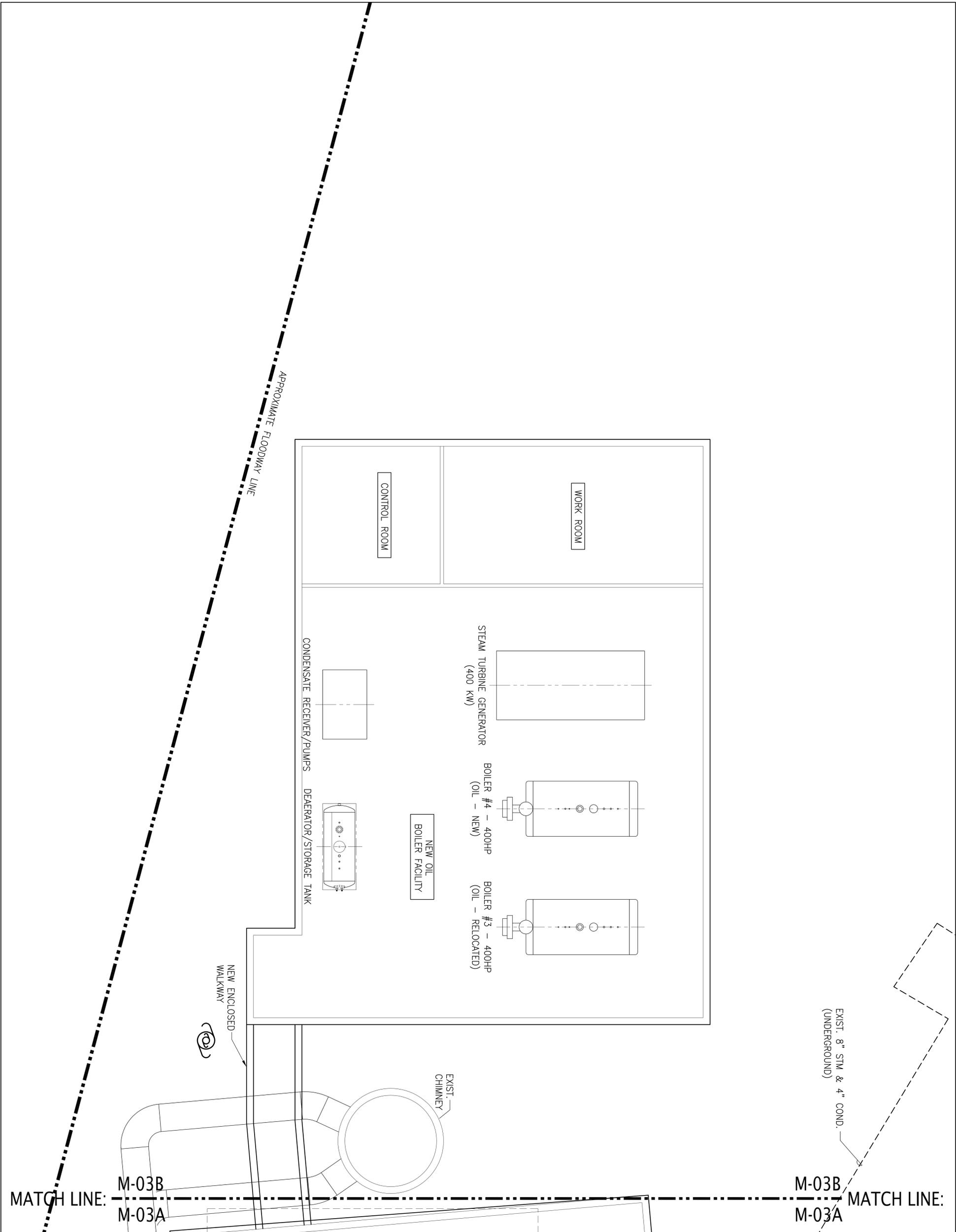
PROGRESS ISSUE
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VANDERWELL
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Job Number: 2551300 | Sheet of
Drawn by: PH
Checked by: CH
Date of Original: 02-12-10
Revised:

Scale: -
Project:
PROPOSED MECHANICAL
GENERAL ARRANGEMENT
PLAN A

M-03A



MATCH LINE: M-03B
M-03A

MATCH LINE: M-03B
M-03A

PROGRESS ISSUE
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PROPOSED MECHANICAL
GENERAL ARRANGEMENT
PLAN B

M-03B

Appendix D - Calculations



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	Estimated Peak H	Page1	2/15/2010

Calculation Sheet

Topic: Proposed Phase 1 - 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
City of Montpelier	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	ated Heating I	Page1	2/15/2010

Calculation Sheet

Topic: Phase 1 - Estimated Yearly Heating Loads

<u>Existing Purchased Energy Loads</u>		
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:	50%	(Estimated)
Estimated Existing Oil Boiler Efficiency:	75%	(Estimated)
State Complex Wood Heating Load (Output):	14227.4 MMBTU	(Calculated)
State Complex Oil Heating Load (Output):	23119.5 MMBTU	(Calculated)
State Complex Total Heating Load (Output):	37346.8 MMBTU	(Calculated)
City Hall/Fire Department Purchased Energy Loads (Input):	3,727 MMBTU	(CORE Collected Data)
Estimated Existing Oil Boiler Efficiency:	75%	(Estimated)
City Hall/Fire Department Heating Load (Output):	2,795 MMBTU	(Calculated)
Police Department Purchased Energy Loads (Input):	300 MMBTU	(CORE Collected Data)
Estimated Existing Oil Boiler Efficiency:	75%	(Estimated)
Police Department Heating Load (Output):	225 MMBTU	
Montpelier H.S. Purchased Energy Loads (Input):	7,590 MMBTU	(CORE Collected Data)
Estimated Existing Oil Boiler Efficiency:	75%	(Estimated)
Montpelier H.S. Heating Load (Output):	5,693 MMBTU	(Calculated)
Union Elementary School Purchased Energy Loads (Input):	6,389 MMBTU	(CORE Collected Data)
Estimated Existing Oil Boiler Efficiency:	75%	(Estimated)
Union Elementary School Heating Load (Output):	4,792 MMBTU	(Calculated)
East State School Purchased Energy Loads (Input):	2,500 MMBTU	(Estimated based on area)
Estimated Existing Oil Boiler Efficiency:	75%	(Estimated)
East State School Heating Load (Output):	1,875 MMBTU	(Calculated)
Total Phase 1 Buildings - Heating Loads (Output):	52726.3 MMBTUH	(Estimated/Calculated)
Total Phase 1 Buildings - Peak Heating Loads:	32.58 MMBTUH	(Estimated)
Total Final Biomass Buildout Peak Energy Loads:	41 MMBTUH	(Basis of Design)
Total Phase 1B Peak Energy Loads:	8.42 MMBTUH	(Estimated)
Total Phase 1B Buildings - Heating Loads (Output):	13626.6 MMBTU	(Estimated)
Total Final Buildout Buildings - Heating Loads (Output):	66353.0 MMBTU	(Calculated)