

Laurel Village

HVAC System Replacement

April 2025

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Laurel Village HVAC System Replacement

I. Executive Summary

Colorado State University Housing & Dining Services (HDS) seeks to replace existing HVAC systems at Laurel Village (Alpine Hall, Pinon Hall, and the Pavilion), with a traditional 4-pipe fan coil system before the current system's imminent failure. The current HVAC systems include Variable Refrigerant Flow (VRF) with dedicated Energy Recovery Ventilators (ERV's) installed during original construction in 2013 and have proven to be unsafe, inefficient, and unreliable with significant material and equipment failures throughout their life. If these systems are not replaced prior to their failure, these buildings will be unoccupiable.

HDS worked with an engineering consultant, Affiliated Engineers, Inc. (AEI) to evaluate existing system deficiencies and recommend system replacement options and their anticipated costs. Scope of work within this project will include construction of a new utility plant, new building HVAC systems, new HVAC controls, and associated interior, electrical, and structural scopes required. The project shall also include resident room and bathroom light fixture replacements and associated code-required electrical upgrades (i.e., lighting controls, EM lighting, exit signs, etc.).

This project achieves several goals for HDS, primarily in supporting student success and fulfilling **HDS's Vision; *Housing & Dining Service creates a living and learning experience where every resident and guest can thrive.*** Laurel Village provides 682 beds for on-campus housing between Pinon and Alpine halls. In addition to the living and learning communities that reside there, these buildings serve as home for HDS' Conference & Event Services, the Spoke bike shop, office space for HDS staff from Sustainability, Communications, Mountain Campus, University Housing, and Facilities units, reservable meeting space, and office and academic space for the College of Natural Sciences (CNS) and the College of Veterinary Medicine & Biomedical Sciences (CVMBS) residential learning communities.

Most critically, this project will allow HDS to continue to occupy Laurel Village, maintain the living and learning communities, and avoid loss of revenue generating on-campus student housing.

A Design-Build (DB) project delivery method will best appropriate risk and expedite major equipment procurement that is anticipated to have long-lead times. Pending project approval in October 2025, it is estimated that the project will take approximately four years to complete. The project schedule would proceed as follows from Fall 2025 through Summer 2029:

- DB Project Team Procurement: [1]June through October 2025
- Design: October 2025 – May 2027
- Construction
  - Phase I (1 Residence Hall + Pavilion): June 2027 – June 2028
  - *Phase I Ready to Occupy: August 2028*
  - Phase II (1 Residence Hall): June 2028 - June 2029
  - *Phase II Ready to Occupy: August 2029*
- Final Project Completion: August 2029

HDS anticipates the total development project budget for the Laurel Village HVAC System Replacement project will range from **$39.3M - $50M** and will be funded by Housing & Dining Services (HDS) bonds. These cost estimates do not include annual escalation or other material market cost factors such as tariff increases. HDS is prepared to proceed with the Laurel Village HVAC System Replacement project with Board of Governors support.

II. Justification

2.1 HDS Mission

Housing & Dining Services (HDS) is seeking to finance and execute the Laurel Village HVAC System Replacement project, a project focused on addressing critical building system failure to sustain our **Vision and Mission; *Housing &***

[1] RFP was issued in July 2025 to start the procurement of the Design-Build project team. The RFP documents were issued with condition precedent language requiring CSU System Board of Governors (BOG) approval of the project prior to the project award and contract execution, anticipated October 2025.

Dining Service creates a living and learning experience where every resident and guest can thrive, and to provide the foundation for student and guest success by creating inclusive communities where belonging, learning, and relationships are at the heart of our high-quality services.
HDS is responsible for the management, finance, administration, and program development of all University housing facilities, including residence halls and university apartments on the CSU Main Campus, which includes approximately 2.5 million square feet of building space. Buildings are one of our greatest and most critical assets, and it is imperative that HDS maintains these spaces in conditions that are conducive to student success.

Over the last several years, HDS has been investigating our existing buildings, their conditions, their vulnerabilities, and their strengths. With structures ranging in age from 71 years old (1954) to 8 years old (2017), HDS continues to wrestle with degrading building systems and major equipment failures alongside newly discovered design and/or construction defects and the 'normal' daily reactive maintenance that an Owner organization would expect. Laurel Village is among these buildings within HDS' portfolio that, while only 13 years old, has a critical building system approaching imminent failure. If the HVAC systems are not replaced within these buildings in the next few years, they will fail, causing these buildings to be unoccupiable.

2.2 Physical Condition/Functionality of Existing Space

Laurel Village was originally constructed in 2013 and is comprised of 206,000 GSF across Alpine Hall, Pinion Hall, and the Pavilion.

> **Alpine Hall** A residence hall providing 351 revenue generating beds for students and 9 beds for live-in staff. This building is home to the Align Scientific Learning Community (CVMBS), houses HDS' Conference & Event Services team, and provides offices for some Mountain Campus and HDS Facilities staff.
>
> **Pinon Hall** A residence hall providing 312 revenue generating beds for students and 8 beds for live-in staff. This building is home to the Amplify

community, academic and office space for CNS, HDS and DSA Communications and University Housing staff offices.

Pavilion Laurel Village's community building that houses the front desk, mail and package storage and community space for residents. This building also houses the Spoke Bike Shop, reservable space for groups, HDS Sustainability offices and classroom space for Eco Leaders, and additional classroom space for CNS and CVMBS.

The existing HVAC system is a Variable Refrigerant Flow (VRF) with dedicated Energy Recovery Ventilators (ERV's). The systems were installed when Laurel Village was constructed in 2013. Unfortunately, the VRF system has demonstrated significant safety, efficiency, and reliability issues throughout its life. Costs to maintain the system's operation have been immense and frequent system outages repeatedly cause negative impacts to residents' living experiences. Replacement parts are no longer available and consequently, the system will not be able to operate once stocked parts are depleted. HDS hired Affiliated Engineers, Inc., an engineering consultant, to diagnose deficiencies of the existing system and evaluate options and provide recommendations for replacement of the VRF system, including necessary terminal equipment, distribution, and utility plant components. Reference Appendix B for the existing system diagnostics and comprehensive narratives.

2.3 Benefits of Project

While this project is strictly focused on the replacement of a critical building system, the opportunities and benefits are critical and impactful.

1. **Maintain Building Occupancy & Impact on Revenue Streams**

   Laurel Village has the capacity to house 663 students (revenue-generating beds) and 17 staff (non-revenue generating beds) that support this community. This village also supports academic programs for CNS and CVMBS within living and learning communities and classroom space.

   With other capital renewal projects currently underway and their impacts to on-campus housing capacity (Allison Hall Renovation and Addition

taking roughly 400 bed spaces offline from May 2025 through July 2027), HDS does not have the ability to support the 600+ beds elsewhere if Laurel Village's capacity was unavailable and still meet current University enrollment projections. HDS can meet enrollment projections by phasing the HVAC system replacement project to take only one residence hall offline at a time to complete the work.

Improving building conditions and decreasing the amount of reactive work needed, plus increasing efficiency in operating systems and improving overall building performance will decrease annual operating costs for Laurel Village for years to come.

2. **Resident Perceptions - Room & Board Costs**

   Expectations of the residents' living experience and value for their investment are getting harder to meet, seemingly due to the ever-increasing cost of living in this region. By providing an HVAC system that performs reliably throughout the year, we can greatly improve the resident experience, which in turn may make future room and board rate increases more tenable, especially within context of the various room and board options available across our system, the perception of living conditions in newer buildings, and how that translates to resident expectations for perfect and pristine living experiences.

3. **Fulfill HDS' Vision to create a living and learning experience where every resident and guest can thrive.**

   Replacing critical building systems prior to failure and improving the overall condition of the building interiors will support HDS' Vision statement and bring Laurel Village to our standards for future students and staff that will live there. And, by doing so, we will create an environment where all HDS staff can readily support our students and, as other data suggests, increase our students' probability of academic success and graduation. This work will eliminate the consistent interruptions and disruptions in service that current students and staff experience. This work will also reduce the number of work orders that staff need to complete regularly

and provide an environment that is more easily maintainable to the condition expected, taking some strain off these resources.

4. **Reliability, Maintainability, Controllability**

   The proposed improvements will provide the buildings with a traditional HVAC system that will support consistent service to building occupants. These new systems will be much more reliable, maintainable, and efficient. HDS Facilities staff will have the ability to control and monitor HVAC systems remotely, ultimately improving the comfort level, experience, and safety of residents.

5. **Energy Efficiency and Emissions**

   The two replacement system options that will be further assessed within the project are aimed at meeting the following goals, 1) lowest cost of operation, 2) reducing the Energy Use Intensity (EUI) to align with the State of Colorado existing Building Performance mandates, 3) reduce CO2 emissions and allows for eliminating fossil fuel combustion on site.

2.4 Alternatives Analysis

After diligently analyzing the options and recommendations of Affiliated Engineers, Inc., HDS will proceed with assessing the following two options within this project. Reference Appendices B and D for further detail.

1. **Geothermal Plant + Electric Boiler (GSHP + EB)**
   - Thermal Plant: New geothermal system coupled with the existing Moby Arena field, geothermal heat pump plant, hot and chilled water distribution to each building.
   - ERV Replacement: Larger units
   - Terminal Unit Replacement: New 4-pipe Fan Coil Units
   - New 4-pipe hot water and chilled water system

2. **Air Cooled Chiller + Electric Boiler (ACC+EB)**
   - Thermal Plant: New electric boilers sited on the ground within a new utility plant building.

- ERV Replacement: Larger units
- Terminal Unit Replacement: New 4-pipe Fan Coil Units
- New 4-pipe hot water and chilled water system (hydronic heating and cooling)

III. Design Criteria

3.1 Mechanical Narrative

Reference Appendices B-D developed by AEI for comprehensive mechanical narratives including schematic system drawings and equipment selections.

HVAC System Replacements

The project's design and performance goals will target metrics of the State's Building Performance Colorado (BPC) program that may be required, which includes benchmarking requirements and Building Performance Standards (BPS), to help meet state goals to reduce emissions.
https://energyoffice.colorado.gov/bpc

3.2 Design and Construction Standards

Colorado State University Facilities Planning, Design and Construction Standards https://www.fm.colostate.edu/constr_standards/

CSU Housing & Dining Services Design and Construction Standards

CSU Housing & Dining Services takes exceptions to the CSU Facilities Planning, Design and Construction Standards. These documents are meant to serve as supplemental standards for HDS-specific buildings and should be referenced in tandem with the full versions maintained by CSU Facilities Management.

3.3 Inclusivity Standards

The CSU Facilities Planning, Design and Construction Standards include standards for unique space types (i.e., all gender restroom, lactation room,

etc.). https://www.fm.colostate.edu/wp-dev/wp-content/uploads/Chapter-06-Requirements-by-Space-Type-and-Use.pdf

3.4 List of Applicable Codes

Approved building codes and standards have been adopted by the Office of the State Architect and are identified at the link below as the minimum requirements to be applied to all construction projects at state agencies and institutions of higher education owned facilities.
https://osa.colorado.gov/building-codes

IV. Project Schedule, Cost Estimates, Financing

4.1 Project Schedule and Phasing

HDS intends the project to be delivered under a Design-Build (DB) with Guaranteed Maximum Price (GMP) agreement. The scope of work innately carries a lot of risk relative to unforeseen conditions, as well as complexity related to designing and building within an existing structure. Given the major equipment replacements that have anticipated multi-year long-lead times to procure, the DB method allows these types of decisions to be made early in the design process, prior to construction documents being finalized so that the team can purchase that equipment earlier in the overall project schedule. The following is a high-level project milestone schedule.

BOG Project Approval: Anticipated October 2025

Design-Build Project Team Procurement: [2]June - October 2025

- *This timeframe includes developing procurement documents and going through the RFP process.*

[2] RFP was issued in July 2025 to start the procurement of the Design-Build project team. The RFP documents were issued with condition precedent language requiring CSU System Board of Governors (BOG) approval of the project prior to the project award and contract execution, anticipated October 2025.

Design: October 2025 – May 2027

- *This timeframe includes design of the project scope, as well as procurement of long-lead materials and equipment, like major HVAC equipment, electrical transformers and switchgear.*

Construction Phase I (One Residence Hall + Pavilion): June 2027 - June 2028

- *HDS will need to remove FFE from the portion of the building under construction after move-out and before the general contractor can mobilize; this is intended to occur in May 2027.*
- *HDS will also need to determine how this impacts other building occupants and temporarily relocate programs during each construction phase.*
- *Phase I Residence Hall Ready to Occupy: August 2028.*

Construction Phase II (One Residence Hall): June 2028- June 2029

- *HDS will need to remove FFE from the portion of the building under construction after move-out and before the general contractor can mobilize; this is intended to occur in May 2028.*
- *Phase I Residence Hall Ready to Occupy: August 2029.*

Final Project Completion: August 2029

4.2 Cost Estimate/Methodology

HDS anticipates the Laurel Village HVAC System Replacement project total development project budget will be in the range of **$39.3M - $50M.** This range was informed by the engineering consultant, AEI, based on a systems analysis and HDS' preferred system replacement options as outlined below. Final total development project budget was further informed by CSU Facilities Management.

Reference Appendix D for additional cost estimate detail. These cost estimates do not include annual escalation or other material market cost factors such as tariff increases.

4.3 Financing

HDS intends to bond finance this project. HDS has assessed the financial viability of supporting this project along with current financial responsibilities, and other planned project work. HDS is prepared to proceed with the Laurel Village HVAC System Replacement project with Board of Governors support.

V. Appendices

A. Total Development Project Budget
B. Laurel Village HVAC Upgrades Study, prepared by AEI (March 2025)
C. Laurel Village HVAC Upgrades Study-Schematics & Selections, prepared by AEI (March 2025)
D. Laurel Village HVAC Upgrades Study-Narratives and Estimates, prepared by AEI (March 2025)

Laurel Village HVAC System Replacement Development Cost

Project Budget		low (10%)	medium	high (10%)	Remarks
Professional Services					
	Consultants - Architects, Engineers,	$ 1,689,646	$ 1,877,385	$ 2,065,123	5% of Construction
	Advertisements	$ -	$ -	$ -	Flat fee
	CSU Facilities Project Development Fees	$ 774,000	$ 860,000	$ 946,000	Per fee schedule/based off Project subtotal
	Independent Code Review, code insp,	$ 337,929	$ 375,477	$ 413,025	Allowance
	PFA Plan Review	$ 54,576	$ 60,640	$ 66,703	for a $38M construction cost
	Total Professional Services	**$ 2,856,151**	**$ 3,173,501**	**$ 3,490,851**	
Land Acquisition					
	Land purchase and closing costs	$ -	$ -	$ -	No land Acquisition
	Total Land Acquisition		**$ -**		
Construction					
	Terminal unit replacement	$ 19,014,656	$ 22,571,840	$ 24,829,024	
	ERV replacement	$ 1,348,596	$ 1,498,440	$ 1,648,284	Allowance
	Thermal Plant	$ 8,501,809	$ 9,446,454	$ 10,391,099	0
	Distribution infrastructure	$ 2,722,914	$ 3,025,460	$ 3,328,006	
	Buy Clean Colorado Act	$ 904,952	$ 1,005,502	$ 1,106,052	Allowance
	High Performance Certification Program	$ -		$ -	Allowance
	Geoexchange system	$ -		$ 2,828,000	Allowance for additional cost over natural gas system
	Subtotal Construction Costs	**$ 32,492,926**	**$ 37,547,696**	**$ 44,130,466**	
Equipment & Furnishings					
	Fixed Equipment	$ -	$ -	$ -	
	Furniture	$ -	$ -	$ -	
	CSU Telecom / Security coordination	$ -	$ -	$ -	
	CSU Notifier System	$ -	$ -	$ -	CSU fire alarm back to central system
	Total Equipment and Furnishings Costs	**$ -**	**$ -**	**$ -**	**$ -**
Miscellaneous					
	Moving and Relocation Costs	$ -		$ -	Allowance
	Artwork /Signage	$ -		$ -	Allowance
	Total Miscellaneous Costs	**$ -**	**$ -**	**$ -**	**$ -**
	Subtotal Project Cost	**$ 35,349,078**	**$ 40,721,197**	**$ 47,621,317**	**$ -**
Project Development Contingency					
	Project Contingency 5%	$ 1,767,454	$ 2,036,060	$ 2,381,066	
	Total Project Development cost for construction start in 3rdt qtr. 2027	**$ 37,116,531**	**$ 42,757,257**	**$ 50,002,383**	
0	**Total Development $/sf3rd qtr. 2027**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	
Project escalation @5%	to 1st quarter 2028	**$ 38,972,358**	**$ 44,895,120**	**$ 52,502,502**	
Project escalation @7%	to 1st quarter 2029	**$ 41,700,423**	**$ 48,037,778**	**$ 56,177,677**	
Project escalation @7%	to 1st quarter 2030	**$ 44,619,453**	**$ 51,400,423**	**$ 60,110,115**	

***This opinion of probable cost is made on the basis off of the AEI cost estimate, combined with the professional experience of Facilities Management staff. FM cannot guarantee that proposals, bids or actual construction costs will not vary from this cost estimate due to market volatility and supply chain issues at the time of the bid.**

Laurel Village
HVAC Upgrades Study
March 2025

Prepared for:

COLORADO STATE UNIVERSITY

Prepared by:

Affiliated Engineers, Inc.
999 18th Street, Suite 1001N
Denver, CO 80202
Tel 720.580.8510

Executive Summary

Introduction

Laurel Village comprises Alpine Hall, Piñon Hall, and the Pavilion community building. The existing HVAC system is Variable Refrigerant Flow (VRF) providing heating and cooling with dedicated Energy Recovery Ventilators (ERVs) to serve ventilation air. The systems were installed when the building was constructed in 2013. The mechanical systems have demonstrated significant safety, efficiency, and reliability concerns throughout its life.

CSU solicited AEI to develop a solution to provide heating and cooling to the residence halls with a better system, while further understanding the subsequent interiors, electrical, and structural scopes of work required to replace this system. The scope of these services includes budgetary cost estimate, recommended phasing plan and overall schedule for installation.

The new system must adhere to the following parameters:

- Safe and reliable for operators
- Safe and comfortable for occupants
- Easy to maintain
- Aligned with campus energy and emissions goals

Appendices

1. Engineering Schematics and Selections
2. Estimate Narrative and Details
3. Final Presentation
4. Load Summary Powerbi
5. LCCA Powerbi

Recommendations

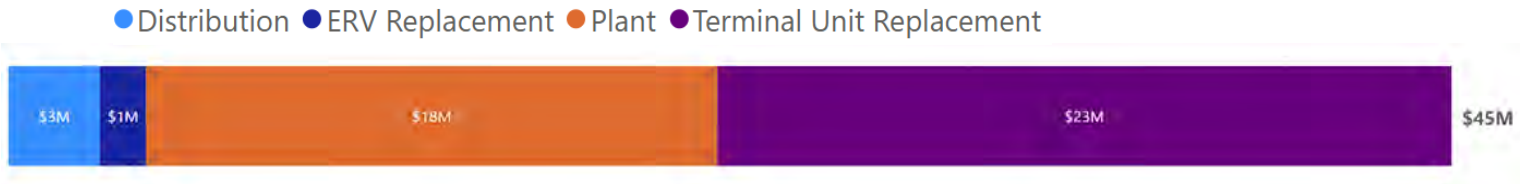
The study recommends replacing the existing VRF system with a 4-pipe hot water and chilled water system. The existing energy recovery ventilators (ERVs) will be replaced to increase outside air intake by 25%, thereby improving indoor air quality and maintaining adequate building pressurization.

The existing district and micro-thermal plants surrounding the site do not have adequate capacity to support Laurel Village, so a new heating hot water and chilled water plant is required to serve the buildings via direct buried thermal piping.

Given system requirements outlined in the project overview, a new geothermal plant coupled with the Moby Arena field is the best option for providing heating and cooling to the village for the following reasons:

- Lowest cost of operation
- This system reduces Laurel Village's energy usage intensity aligning with State of Colorado existing building performance mandates.
- Reduces CO2 emissions and allows for eliminating fossil fuel combustion on site which aligns with CSU's commitment to carbon neutrality by 2040.
- Laurel Village's load profile compliments that of Moby Arena. Combining Laurel Village with Moby allows a substantial reduction in geothermal field size in comparison to a standalone benchmark.
- The fact that the Moby system is operational and meeting design intent gives confidence that expanding this system will be a reliable source of heating and cooling for Housing and Dining.
- The cost premium for the plant is solely due to the field (equipment is at parody with other options studied). The premium cost for geothermal (bores and piping) is a campus asset that can be leveraged by Laurel Village and the district system or other buildings in the future. This system should last 50-100+ years with proper service. The District Energy Masterplan contemplates a district geothermal system which this could help achieve in the future.
- The above grade disruption is less than an air-cooled plant (fitting within an existing mechanical room) and is significantly quieter than an air-cooled plant.

The estimated cost for the new HVAC system is broken down accordingly:



The new geothermal plant replaces the existing VRF source units serving the Pavilion so the Pavilion must be converted first. To provide sufficient load for the plant and commission it properly, one of the other buildings should undergo conversion at the same time. The last building could be converted later (e.g., the following summer).

Geothermal Value Engineering Considerations

One means of reducing the first cost of the geothermal solution may be to only size the geothermal bores and equipment for peak cooling rather than peak heating. This could reduce equipment and field size by approximately 20%. Peak heating would then be met by the geothermal system supplemented by natural gas fired or electric boilers. So long as electrical and piping infrastructure were sized for geothermal peak heating in the future, this strategy could help to reduce first costs while still implementing a full geothermal solution.

Competitively source 6-pipe modular chillers. The study considers the same manufacturer as the Moby System which employes 6-pipe modular Waterfurnace heat pumps. There are many other manufacturers to study with similar technology that may have a lower first cost and features should be weighed when selecting the manufacturer of choice.

The system could also be designed around 4-pipe water to water heat pumps (similar to Trane RTWD). The equipment costs would be significantly lower than 6-pipe modular machines while balancing higher controls and heat exchanger costs for likely cost savings.

AEI recommends studying these options in further detail during schematic design.

Air Source Plant Value Engineering Considerations

CSU may also consider alternative hot water and chilled water generation based on capital constraints. AEI studied the following four alternative air-source plants:

Base Air Source	- Air cooled chiller + NG fired condensing boiler	- ACC+CB
Alt 1	- Air cooled chiller + electric boiler	- ACC+EB
Alt 2	- Air source heat pump + NG fired condensing boiler	- ASHP+CB
Alt 3	- Air source heat pump + electric boiler	- ASHP+EB

Organizing Options from lowest initial capital to highest:

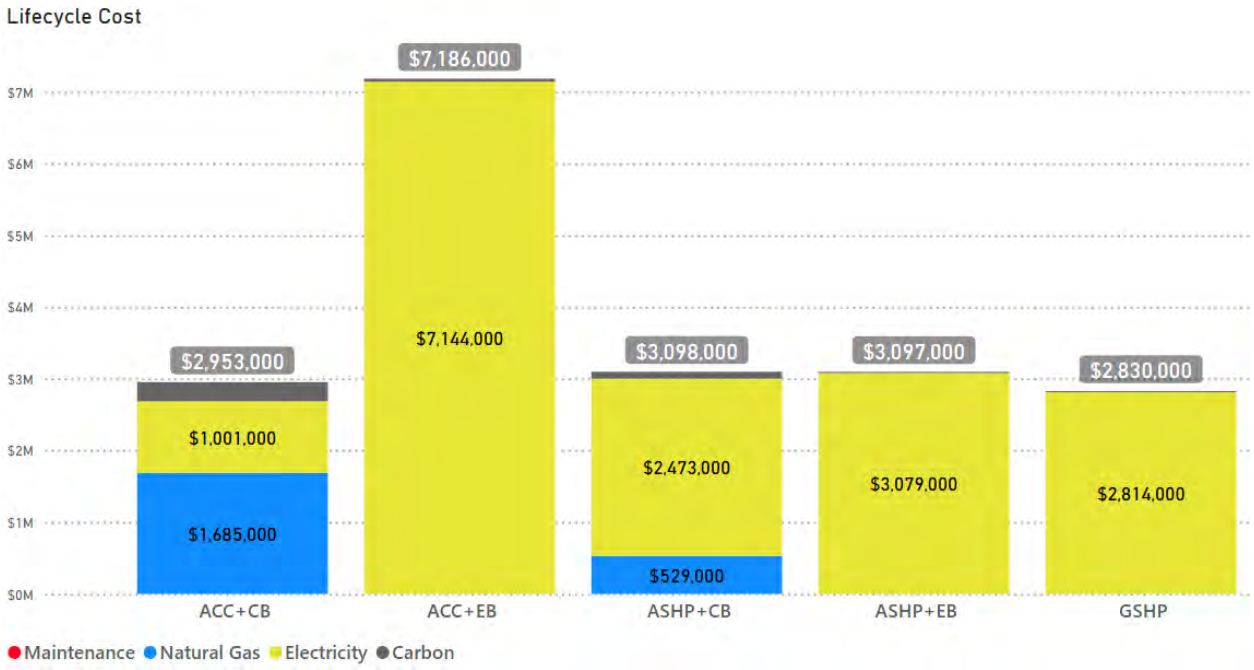
1. Base Air Source: The lowest capital cost option is the Base Air Source case (ACC+CB). Due to the current low cost of natural gas and not considering cost of carbon, this option is comparable operating cost to geothermal.
2. Alt 2: The Alt2 Option (ASHP+CB) cuts carbon emissions by 70% in comparison to the Base Air Source case and is a good balance between first cost savings and combustion reduction.
3. Alt1: Given first costs and operating costs, AEI does not recommend Alt1 (ACC+EB).
4. Alt 3. The all-electric ASHP+EB options meet CSU's sustainability goals for no new combustion on campus but with a higher operating cost than the Base or Alt 2 since heating is electric resistance during the coldest weeks of the winter.

Considering the distance to the Moby field and Laurel Village space constraints, it is not likely that a combination of geothermal and air source cooling is viable as a cost saving measure as the first costs for geothermal savings do not continue to scale downward. The air source options do not financially consider the additional cost of real estate for this option above grade.

First Plant Cost Comparison - 2025



Operating Cost Comparison – 60 Year Life Cycle



Existing HVAC System

Alpine Hall consists of two wings: the east wing includes a basement and four upper floors, while the west wing has five floors. The current HVAC system includes ten Samsung VRF systems and four Greenheck heat recovery air handling units, along with supplementary HVAC equipment.

- East Wing:
    - Served by five Samsung air-cooled heat pumps with a total capacity of 810 MBH cooling and 754 MBH heating. The wing contains 116 Samsung indoor units.
    - Two ERVs provide 8,750 CFM of fresh air and maintain 5,500 CFM of exhaust.
- West Wing:
    - Served by five Samsung air-cooled heat pumps with a total capacity of 718 MBH cooling and 642 MBH heating. The wing contains 133 indoor units.
    - Two ERVs provide 5,250 CFM of fresh air and maintain 3,800 CFM of exhaust.

The Pavilion is a two-story building with two Samsung VRF systems and one Greenheck heat recovery air handling unit.

- Served by three Samsung air-cooled heat pumps with a total capacity of 335 MBH cooling and 276 MBH heating. The building contains 23 Samsung indoor units.
- ERVs provide 3,500 CFM of fresh air and maintain 2,500 CFM of exhaust. The ERV is currently non-operational with ventilation provided via natural circulation.

Piñon Hall consists of two wings: the east wing has five floors, while the west wing has three floors. The HVAC system includes nine Samsung VRF systems and four Greenheck heat recovery air handling units.

- East Wing:
    - Served by six Samsung air-cooled heat pumps with a total capacity of 921 MBH cooling and 931 MBH heating. The wing contains 140 Samsung indoor units.
    - Two ERVs provide 8,750 CFM of fresh air and maintain 6,900 CFM of exhaust.
- West Wing:
    - Served by four Samsung air-cooled heat pumps with a total capacity of 552 MBH cooling and 545 MBH heating. The wing contains 80 indoor units.
    - One ERV provides 4,750 CFM of fresh air and maintains 3,200 CFM of exhaust.



VRF System Deficiencies

- Notable life-safety failures:
    - Fire in Piñon Hall due to a small refrigerant line crack that leaked refrigerant and lubrication oil onto a motor.
    - Hole in one of the terminal boxes within a bedroom leaked the system refrigerant (approx. 150lb) into the space. Fortunately, the event took place while students were not within the space as this could have caused a wrongful death.
- Poor performance in low outdoor temperatures (below 35°F). The VRF of this age was not designed to continuously heat down to design temperatures experienced on campus. The design engineer located the VRF source units in a louvered penthouse to help retain heat and incorporated gas fired unit heaters that are meant to preheat air for the air source heat pump to extract from. This strategy does not keep up during very hot or cold conditions experienced on site. See additional commentary on building heating and cooling assessment.
- Frequent compressor failures and replacements potentially due to poor refrigerant pipe routing and coordination with the manufacturer on refrigerant and oil charges. Hundreds of compressor failures noted.
- Widespread component malfunctions and failures as the equipment is residential grade.
- Installation deficiencies leading to numerous condensate leaks above ceilings.
- Excessive noise from switching boxes located in rooms.
- Inefficient cooling due to evaporator limitations. See additional commentary on heating and cooling assessment.

Building Heating and Cooling Assessment

- Terminal devices were sized for the calculated heat gain and loss based on a 10°F outdoor air temperature.
- The current heating design temperature is 70°F; the proposed design will increase this to 75°F to account for a 25% heating gain on a 0°F day.
- The submitted terminal devices are undersized by approximately 3% compared to scheduled design conditions. This increases to 30% at the proposed design conditions.
- The cooling design temperature is currently 81°F; the proposed design will lower this to 75°F.
- The existing head-end equipment is undersized by 20-30% due to an assumed diversity factor that does not exist under actual conditions.
- When combined with the undersized terminal devices, the head-end equipment is over 50% undersized for optimal design conditions.

Energy Recovery Ventilator Deficiencies

- Tenants have reported concerns regarding ventilation and odors within the buildings.
- The spent ventilation air to the bedrooms is intermixed with ducted toilet exhaust. This leads to challenges maintaining positive building pressurization and leads to odor issues. AEI speculates that the supply and exhaust systems were set up too close to neutral (similar airflow) to recover as much energy from the exhaust as possible [less exhaust than supply means less energy recovery and lower leaving air temperatures when it is cold].
- The ERV must be disabled when it is very cold because the system cannot maintain a high enough leaving air temperature. If the system remains operational, the building is even further unable to meet space setpoint.

- The Pavilion ERV is not functional because access to the gas train and electrical are against the tower wall.

Recommended Solution

AEI recommends sizing terminal devices for the nominal submitted capacity of each fan coil unit (FCU), with further refinement during the detailed design phase. The head-end equipment should be sized to provide heating without relying on a diversity factor. Detailed fan coil replacement plans and estimates provided in the Appendix.

Fan Coil Units

- Four-pipe horizontal FCUs shall be installed to serve the designated spaces.
- Piping and units in dormitory rooms shall be within enclosed soffits.
- Condensate piping will be included, with potential reuse of existing VRF piping risers.
- Controls visibility for terminal operation and environmental conditions.

Price Model Model #	Nominal Capacity			Airflow	COOLING					HEATING				Qty
	Cooling		Heating		EAT	EAT	LAT			EAT	LAT			
	TC	SHC	TC	CFM	DB	WB	DB	EWT	GPM	DB	DB	EWT	GPM	
FCH-02	7500	5100	5500	250	80	67	60.7	42	1.5	70	90	110	1.2	391
FCH-02	11000	7400	6200	285	80	67	59.3	42	2.1	70	90	110	1.6	12
FCH-02	14700	9100	6600	300	80	67	56.4	42	5.2	70	90	110	1.8	18
FCH-04	22000	13800	12400	495	80	67	57.9	42	5.4	70	93	110	3.6	15
FCH-06	25700	16000	13800	530	80	67	53.4	42	5.6	70	94	110	5.6	13
FCH-10	36100	23000	20500	820	80	67	57.2	42	6.2	70	93	110	5.2	11
FCH-10	42000	26400	21000	885	80	67	55.4	42	8.9	70	92	110	4.8	20
FCH-12	50500	32400	25100	1155	80	67	54.9	42	8.6	70	90	110	4.3	11

ERV Replacement

- Replace ERVs with new units that are 25% larger.
    - The additional airflow should work with most existing duct systems and likely increases supply air with exhaust air staying close to its current value to the building can maintain a more positive pressure overall.
    - All systems shall be rebalanced. The engineer of record shall work with CSU to determine if any spaces are being used in a different fashion that the original design (e.g., single bedrooms changing to double or study rooms converted to bedrooms).
    - Existing exhausted spaces that are potentially smelly should be prioritized for more exhaust flow when the building is re-balanced.
    - The ERV shall include a 4-6 row change-over hydronic coil for dehumidification in the summer and heating in the winter.

- Given the difficult maintenance locations, AEI does not recommend direct and indirect evaporative cooling.
- AEI recommends frost control via energy recovery wheel modulation rather than electric pre-heat.
- New ERVs will maintain the same size and weight as the existing ERVs.
- Rebalance the ventilation supply and exhaust system.
- All new ERVs shall be located so that access in manageable for all parts of the unit (e.g., electrical, cleaning coils, filter replacements).

Detailed ERV replacement plans and estimates are detailed in Appendix.

Piping Distribution

- New chilled water (CHW) and hot water (HHW) mains will be routed through each building and connected to FCUs via branch piping and valves.
- Alpine and Piñon Halls will receive new 6" CHW and HHW mains, while Pavilion will receive 3" mains.

Detailed pipe routing plans and estimates are provided in Appendix.

Thermal Plant:

- Nearby campus chilled water and hot water cannot support Laurel Village, and the University is not interested in extending the existing steam system given campus district plans to move away from that system.
- AEI proposes constructing a new room to house a geothermal plant to provide Laurel Village heating and cooling. The geothermal system will expand upon the operating Moby field.
- The mechanical house (60' x 30' x 16') will replace the current mechanical room and trash enclosure.

Detailed plant plans and estimates are provided in Appendix.

Laurel Village
HVAC Upgrades Study
Schematics and Selections
March 2025

Prepared for:

COLORADO STATE UNIVERSITY

Prepared by:

Affiliated Engineers, Inc.
999 18th Street, Suite 1001N
Denver, CO 80202
Tel 720.580.8510

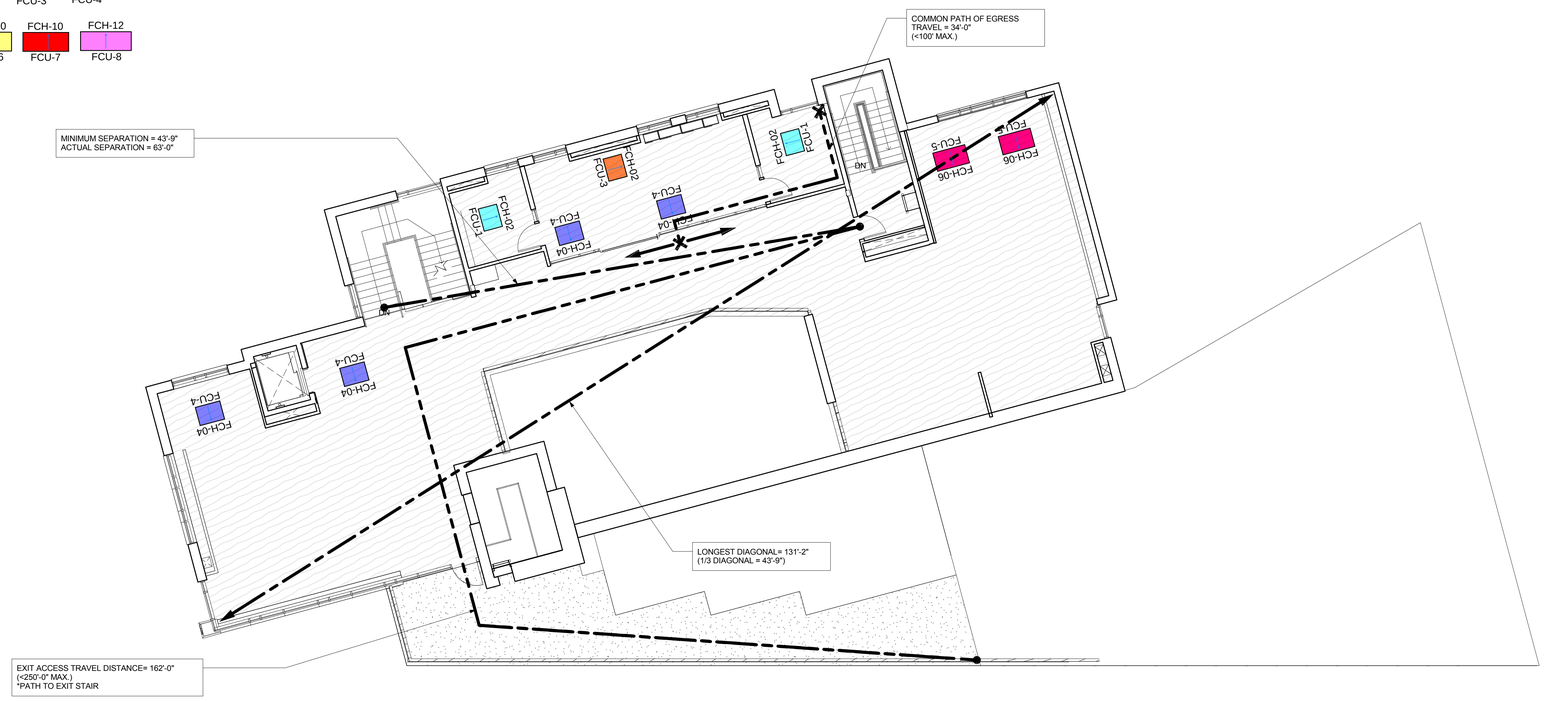
Pavilion

Fan Coils

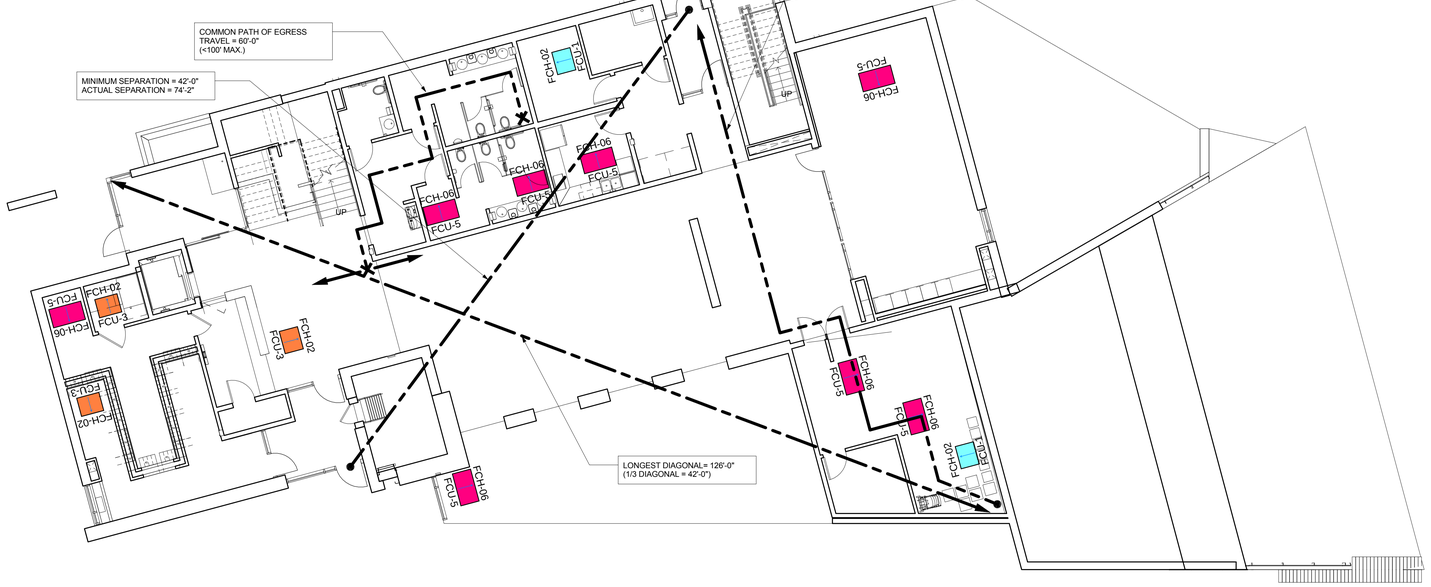
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FCH-06 FCU-5 | FCH-10 FCU-6 | FCH-10 FCU-7 | FCH-12 FCU-8

10



2 LEVEL 2
SCALE: 1/8" = 1'-0"



1 LEVEL 1
SCALE: 1/8" = 1'-0"

EGRESS LEGEND

SYMBOL	DESCRIPTION
✕ - - - -	COMMON PATH OF EGRESS TRAVEL: 30' MAX (GROUP A>50 OCCUPANTS) 75' MAX (GROUP A<50 OCCUPANTS) 100' MAX (GROUP B<NFPA 13)
←✕→	COMMON PATH OF EGRESS TRAVEL: 2 SEPARATE PATHS OF EGRESS TO SEPARATE EXITS
← - - - →	LONGEST OVERALL DIAGONAL DIMENSION
● - - - ●	DISTANCE BETWEEN EXITS (< 1/3 OVERALL DIAGONAL DIMENSION)
● - - - →	EXIT ACCESS TRAVEL DISTANCE

OCCUPANCY	MAXIMUM EXIT TRAVEL DISTANCE	
	NON-SPRINKLERED	SPRINKLERED
A, E, F-1, I-1, M, R, S-1	200'	250'
B	200'	300'
F-2, S-2, U	300'	400'
I-2, I-3, I-4	150'	200'

OCCUPANCY	2 EXITS REQ'D WHEN OCCUPANT LOAD > THAN
A, B, E, F, M, U	49
H-1, H-2, H-3	3
H-4, H-5, I-1, I-3, I-4, R	10
S	29

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DIVISION OF STUDENT AFFAIRS
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t: 970.491.4752

ARCHITECT 4240 ARCHITECTURE INC
3507 RINGSBY CT. SUITE 117
DENVER, CO 80216

CIVIL JVA, INC
25 OLD TOWN SQUARE
FORT COLLINS, CO 80524
t: 303.444.1951

LANDSCAPE RUSSELL + MILLS STUDIOS
141 SOUTH COLLEGE AVENUE #104
FORT COLLINS, CO
t: 970.484.8855

STRUCTURAL KL&A STRUCTURAL ENGINEERS
421 EAST 4TH STREET
LOVELAND, CO 80537
t: 303.384.9910

MECHANICAL ELECTRICAL PLUMBING CATOR, RUMA & ASSOCIATES
869 TABOR STREET
LAKEWOOD, CO 80401
t: 303.232.6200

ACOUSTICAL GEILER & ASSOCIATES, LLC
12355 EAST CORNELL AVENUE
AURORA, CO 80014
t: 303.766.7100

FACADE TECHNISCAN
1873 SOUTH BELLAIRE STREET
SUITE 1400, DENVER, CO 80222
t: 303.329.0535

SUSTAINABILITY AMBIENT ENERGY
130 WEST 5TH AVENUE
DENVER, CO 80204
t: 303.278.1532

Colorado State University
LAUREL VILLAGE
PAVILION - BUILDING #0156
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

PROJECT RECORD 02JAN2015

ISS. #	DESCRIPTION	DATE
	ARCHITECT'S PROJECT NO. :	21093.20
	DESIGNER:	LB
	DRAFTER:	IW / KR
	CHECKER:	MS

KEY PLAN

PAVILION
EGRESS ANALYSIS AND TRAVEL DISTANCE

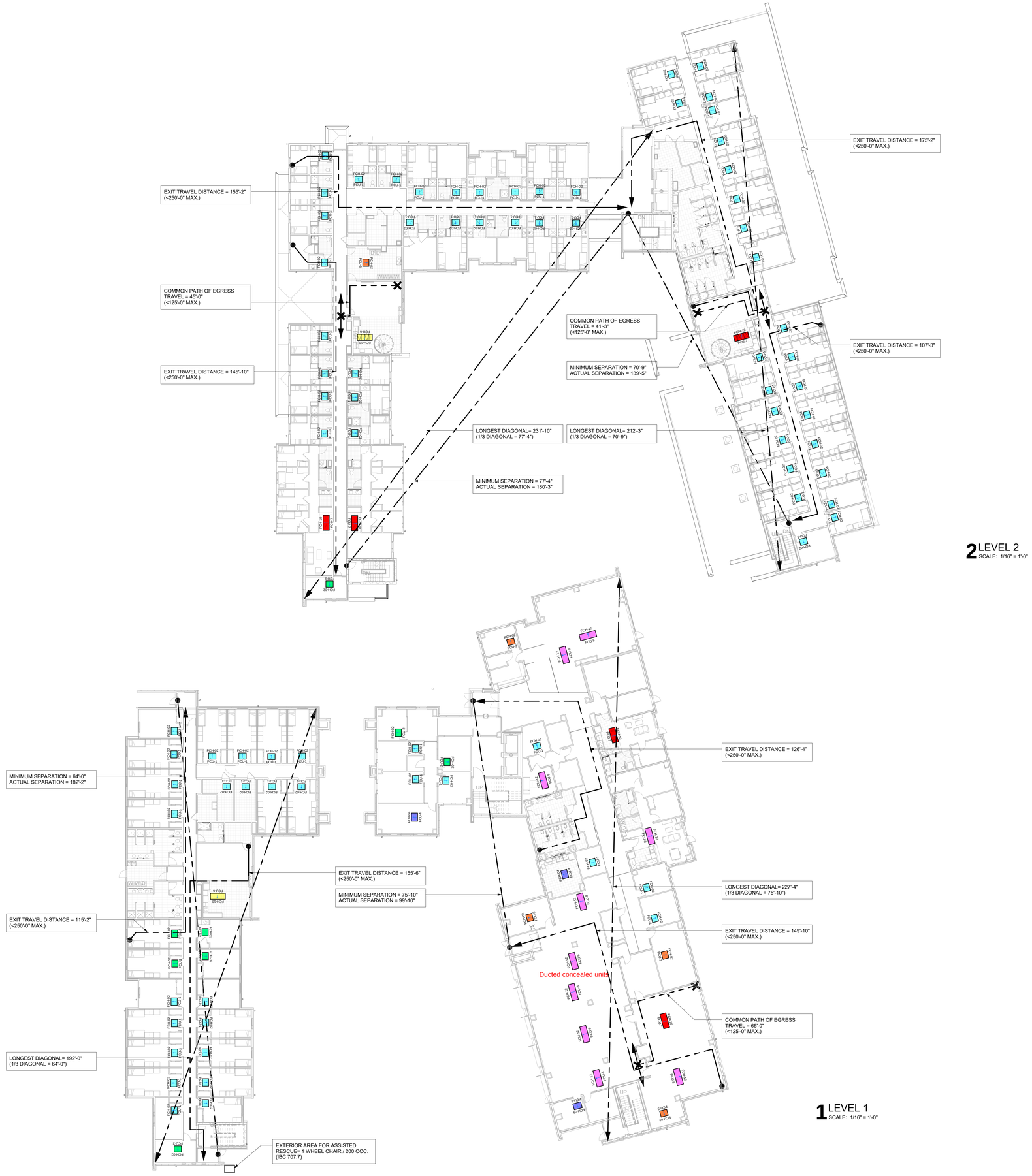
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Piñon

Fan Coils





2 LEVEL 2
SCALE: 1/16" = 1'-0"

1 LEVEL 1
SCALE: 1/16" = 1'-0"

EGRESS LEGEND

SYMBOL	DESCRIPTION
	COMMON PATH OF EGRESS TRAVEL: 75' MAX (TYPCIAL OCCUPANCY) 25' MAX (H OCCUPANCY) 100' MAX (FULLY SPRINKLERED B, F & S OCCUPANCY)
	COMMON PATH OF EGRESS TRAVEL: 2 SEPARATE PATHS OF EGRESS TO SEPARATE EXITS
	OVERALL DIAGONAL DIMENSION
	DISTANCE BETWEEN EXITS (< 1/2 OVERALL DIAGONAL DIMENSION)
	EXIT TRAVEL DISTANCE

OCCUPANCY	MAXIMUM EXIT TRAVEL DISTANCE	
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B	200'	300'
F-2, S-2, U	300'	400'
I-2, I-3, I-4	150'	200'

OCCUPANCY	2 EXITS REQ'D WHEN OCCUPANT LOAD > THAN
A, B, E, F, M, U	49
H-1, H-2, H-3	3
H-4, H-5, I-1, I-3, I-4, R	10
S	29

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CIVIL JVA, INC 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t: 303.444.1951

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FACADE TECHNISCAN 1873 SOUTH BELLAIRE STREET SUITE 1400 DENVER, CO 80222 t: 303.759.0636

SUSTAINABILITY AMBIENT ENERGY 130 WEST 5TH AVENUE DENVER, CO 80204 t: 303.278.1532

Colorado State University
LAUREL VILLAGE
SOUTH BUILDING #0158
CSU PROJECT NO. 11-039
FORT COLLINS, COLORADO 80521

Index Sheet

O	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013

ISS. #	DESCRIPTION	DATE

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DRAFTER:	B.MIXON
CHECKER:	R.HART

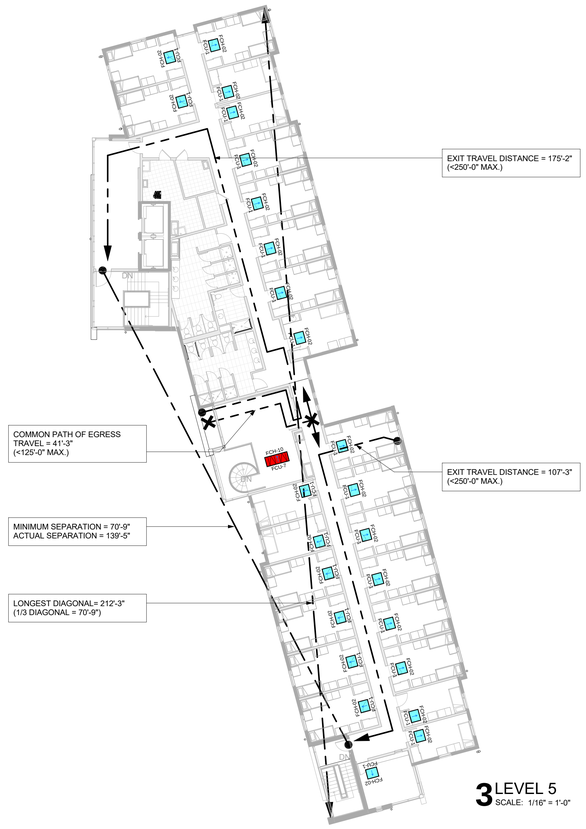
KEY PLAN

SOUTH
EGRESS ANALYSIS AND TRAVEL DISTANCES

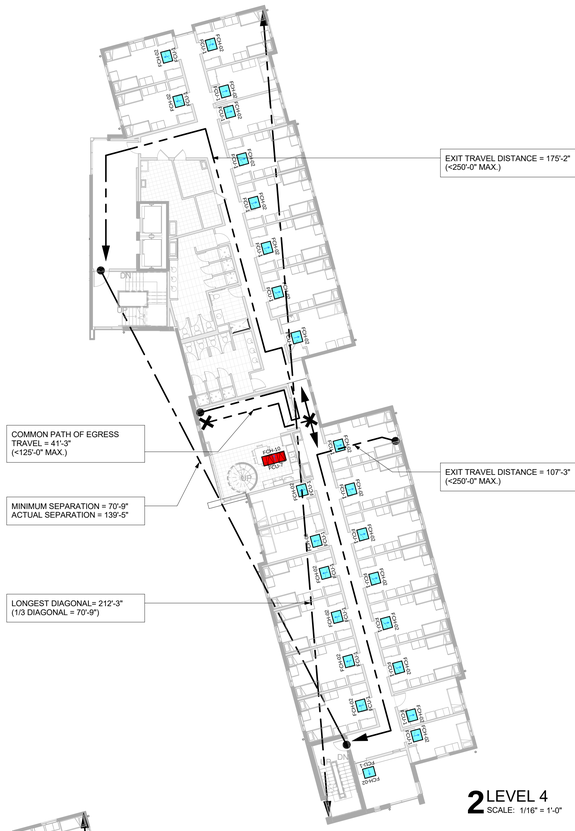
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FCU-9 | FCU-6 | FCU-7 | FCU-8
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3 LEVEL 5
SCALE: 1/16" = 1'-0"



2 LEVEL 4
SCALE: 1/16" = 1'-0"



1 LEVEL 3
SCALE: 1/16" = 1'-0"

EGRESS LEGEND

SYMBOL	DESCRIPTION
	COMMON PATH OF EGRESS TRAVEL: 75' MAX (TYPCIAL OCCUPANCY) 25' MAX (H OCCUPANCY) 100' MAX (FULLY SPRINKLERED B, F & S OCCUPANCY)
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	OVERALL DIAGONAL DIMENSION
	DISTANCE BETWEEN EXITS (< 1/2 OVERALL DIAGONAL DIMENSION)
	EXIT TRAVEL DISTANCE

OCCUPANCY	MAXIMUM EXIT TRAVEL DISTANCE	
	NON-SPRINKLERED	SPRINKLERED
A, E, F-1, I-1, M, R, S-1	200'	250'
B	200'	300'
F-2, S-2, U	300'	400'
I-2, I-3, I-4	150'	200'

OCCUPANCY	2 EXITS REQ'D WHEN OCCUPANT LOAD > THAN
A, B, E, F, M, U	49
H-1, H-2, H-3	3
H-4, H-5, I-1, I-3, I-4, R	10
S	29

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ARCHITECT 4240 ARCHITECTURE INC
3507 Ringsby CT. Suite. 117
Denver, CO 80216

CIVIL JVA, INC
25 OLD TOWN SQUARE
FORT COLLINS, CO 80524
t: 303.444.1951

LANDSCAPE RUSSELL + MILLS STUDIOS
141 SOUTH COLLEGE AVENUE #104
FORT COLLINS, CO 80524
t: 970.484.8855

STRUCTURAL KL&A STRUCTURAL ENGINEERS
421 EAST 4TH STREET
LOVELAND, CO 80537
t: 303.384.9910

MECHANICAL / ELECTRICAL / PLUMBING CATOR, RUMA & ASSOCIATES
869 TABOR STREET
LAKEWOOD, CO 80401
t: 303.382.1920

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12355 EAST CORNELL AVENUE
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t: 303.766.7100

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SUITE 1400
DENVER, CO 80222
t: 303.759.0636

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CSU PROJECT NO. 11-039
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Index Sheet

O	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013

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ARCHITECT'S PROJECT NO. :	21093.20
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DRAFTER:	B.MIXON
CHECKER:	R.HART

KEY PLAN

SOUTH
EGRESS ANALYSIS AND TRAVEL DISTANCES

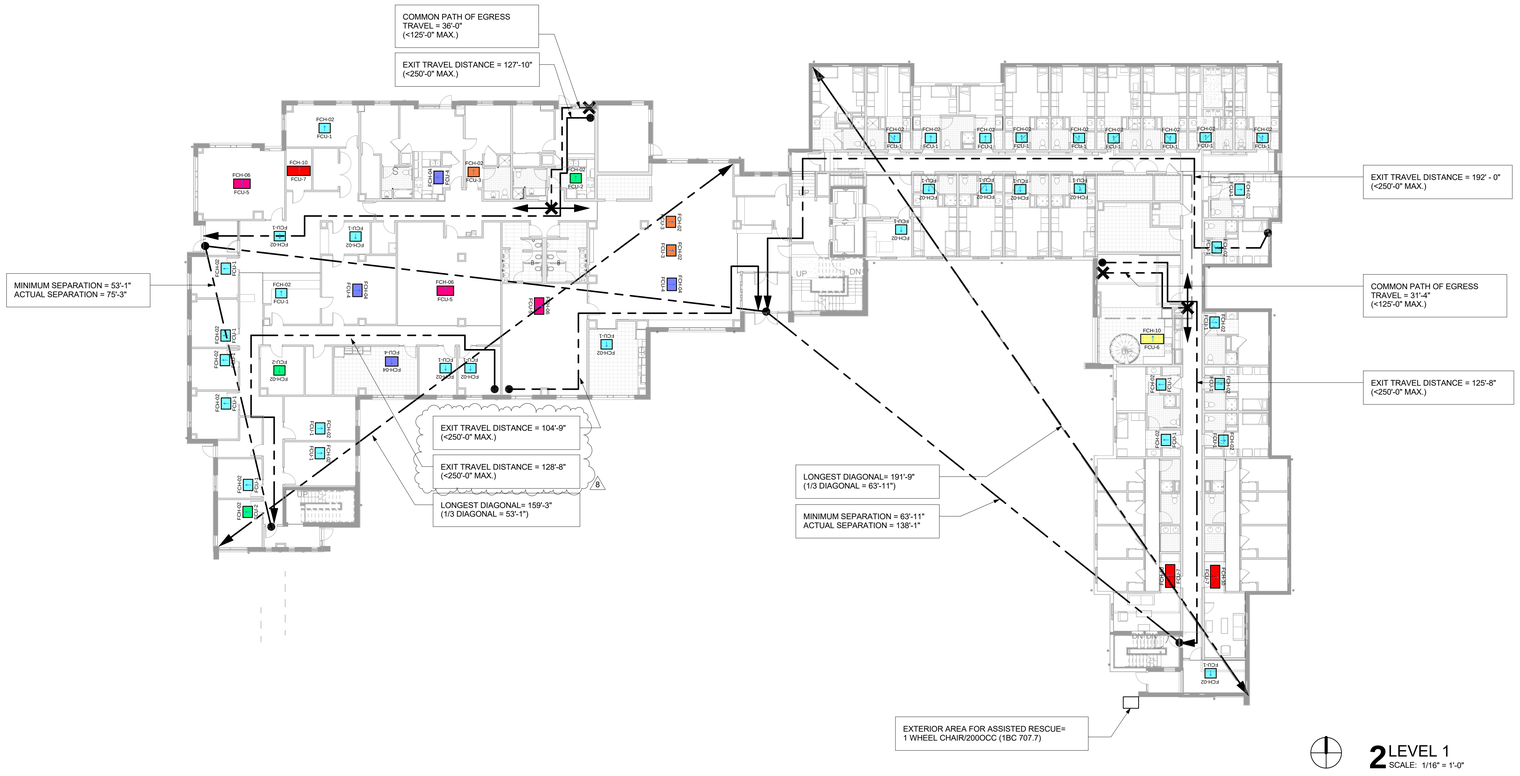
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Alpine

Fan Coils





2 LEVEL 1
SCALE: 1/16" = 1'-0"



1 BASEMENT LEVEL
SCALE: 1/16" = 1'-0"

EGRESS LEGEND

SYMBOL	DESCRIPTION
✕ - - -	COMMON PATH OF EGRESS TRAVEL: 30' MAX (GROUP A > 50 OCCUPANTS) 75' MAX (GROUP A < 50 OCCUPANTS) 75' MAX (GROUP B: NFPA 13R) 100' MAX (GROUP B: NFPA 13) 125' MAX (GROUP R-2; NFPA 13 OR NFPA 13R)
←✕→	COMMON PATH OF EGRESS TRAVEL: 2 SEPARATE PATHS OF EGRESS TO SEPARATE EXITS
←- - -→	LONGEST OVERALL DIAGONAL DIMENSION
●- - -●	DISTANCE BETWEEN EXITS (< 1/3 OVERALL DIAGONAL DIMENSION)
●- - -→	EXIT TRAVEL DISTANCE

OCCUPANCY	MAXIMUM EXIT TRAVEL DISTANCE	
	NON-SPRINKLERED	SPRINKLERED
A, E, F-1, I-1, M, R, S-1	200'	250'
B	200'	300'
F-2, S-2, U	300'	400'
I-2, I-3, I-4	150'	200'

OCCUPANCY	2 EXITS REQ'D WHEN OCCUPANT LOAD > THAN
A, B, E, F, M, U	49
H-1, H-2, H-3	3
H-4, H-5, I-1, I-3, I-4, R	10
S	29

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t: 970.491.4752

ARCHITECT 4240 ARCHITECTURE INC
3507 RINGSBY CT. STE. 117
DENVER, CO 80216

CIVIL JVA, INC
25 OLD TOWN SQUARE
FORT COLLINS, CO 80524
t: 303.444.1951

LANDSCAPE RUSSELL + MILLS STUDIOS
141 SOUTH COLLEGE AVENUE #104
FORT COLLINS, CO 80524
t: 970.484.8855

STRUCTURAL KL&A STRUCTURAL ENGINEERS
421 EAST 4TH STREET
LOVELAND, CO 80537
t: 303.384.9910

MECHANICAL ELECTRICAL PLUMBING CATOR, RUMA & ASSOCIATES
896 TABOR STREET
LAKEWOOD, CO 80401
t: 303.232.6200

ACOUSTICAL / AV GEILER & ASSOCIATES, LLC
12355 EAST CORNELL AVENUE
AURORA, CO 80014
t: 303.766.7100

FACADE TECHNISCAN
1873 SOUTH BELLAIRE STREET SUITE 1400
DENVER, CO 80222
t: 303.329.0535

SUSTAINABILITY AMBIENT ENERGY
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DENVER, CO 80204
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NORTH BUILDING #00157
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CHECKER:	R.HART

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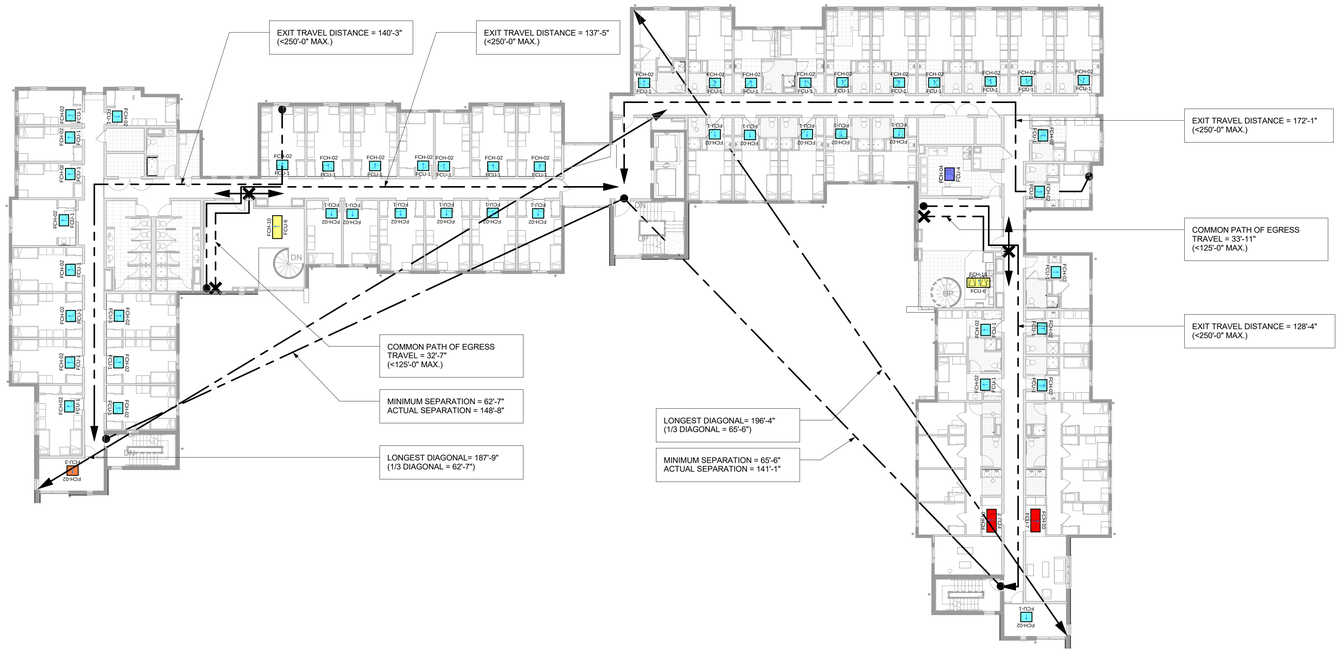
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EGRESS ANALYSIS AND TRAVEL DISTANCES

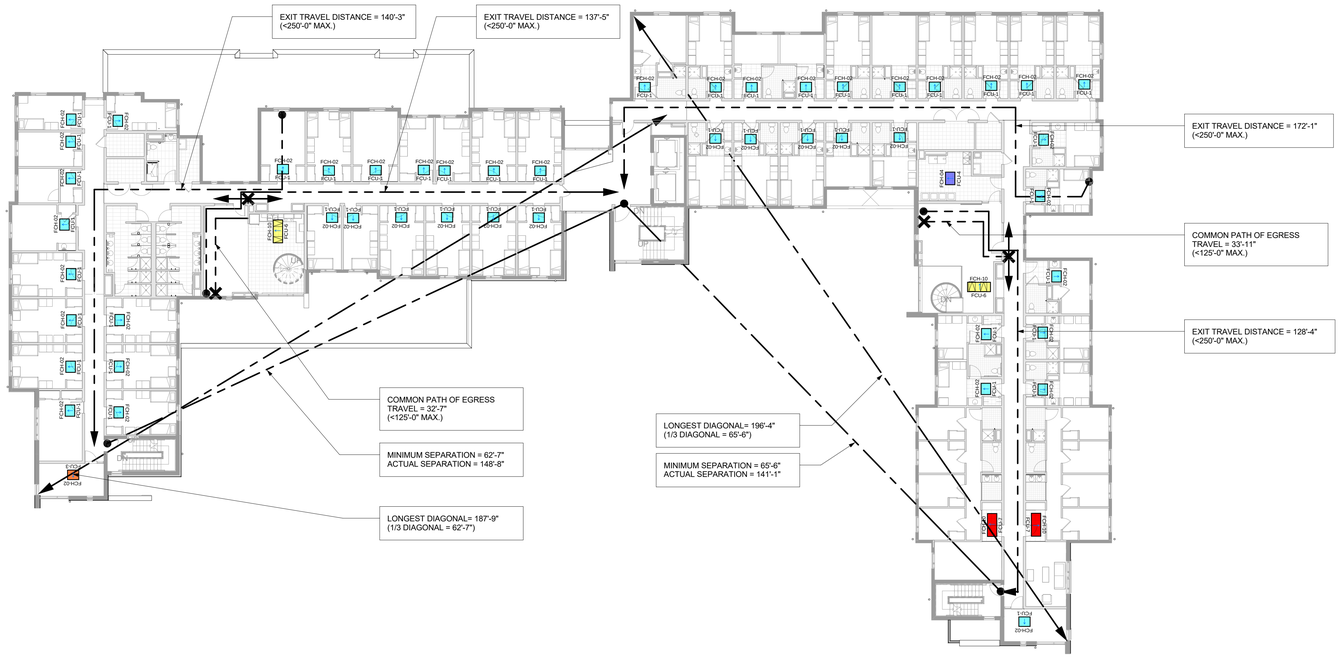
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2 LEVEL 3
SCALE: 1/16" = 1'-0"



1 LEVEL 2
SCALE: 1/16" = 1'-0"

EGRESS LEGEND

SYMBOL	DESCRIPTION
✕ - - -	COMMON PATH OF EGRESS TRAVEL: 30' MAX (GROUP A > 50 OCCUPANTS) 75' MAX (GROUP A < 50 OCCUPANTS) 75' MAX (GROUP B: NFPA 13R) 100' MAX (GROUP B: NFPA 13) 125' MAX (GROUP R-2; NFPA 13 OR NFPA 13R)
✕	COMMON PATH OF EGRESS TRAVEL: 2 SEPARATE PATHS OF EGRESS TO SEPARATE EXITS
● - - - ●	LONGEST OVERALL DIAGONAL DIMENSION
● - - - ●	DISTANCE BETWEEN EXITS (< 1/3 OVERALL DIAGONAL DIMENSION)
● - - - ▶	EXIT TRAVEL DISTANCE

OCCUPANCY	MAXIMUM EXIT TRAVEL DISTANCE	
	NON-SPRINKLERED	SPRINKLERED
A, E, F-1, I-1, M, R, S-1	200'	250'
B	200'	300'
F-2, S-2, U	300'	400'
I-2, I-3, I-4	150'	200'

OCCUPANCY	2 EXITS REQ'D WHEN OCCUPANT LOAD > THAN
A, B, E, F, M, U	49
H-1, H-2, H-3	3
H-4, H-5, I-1, I-3, I-4, R	10
S	29

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Colorado State University

LAUREL VILLAGE
NORTH BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, COLORADO 80521

O BID	16NOV2012
7 FOR CONSTRUCTION	25JAN2013

ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. :	21093.20
DESIGNER:	L.BIEKER
DRAFTER:	M.SNYDER
CHECKER:	R.HART

KEY PLAN

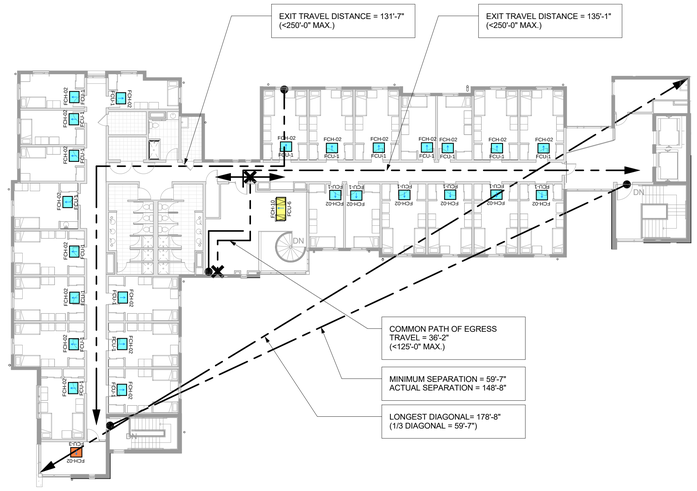
NORTH

EGRESS ANALYSIS AND TRAVEL DISTANCES

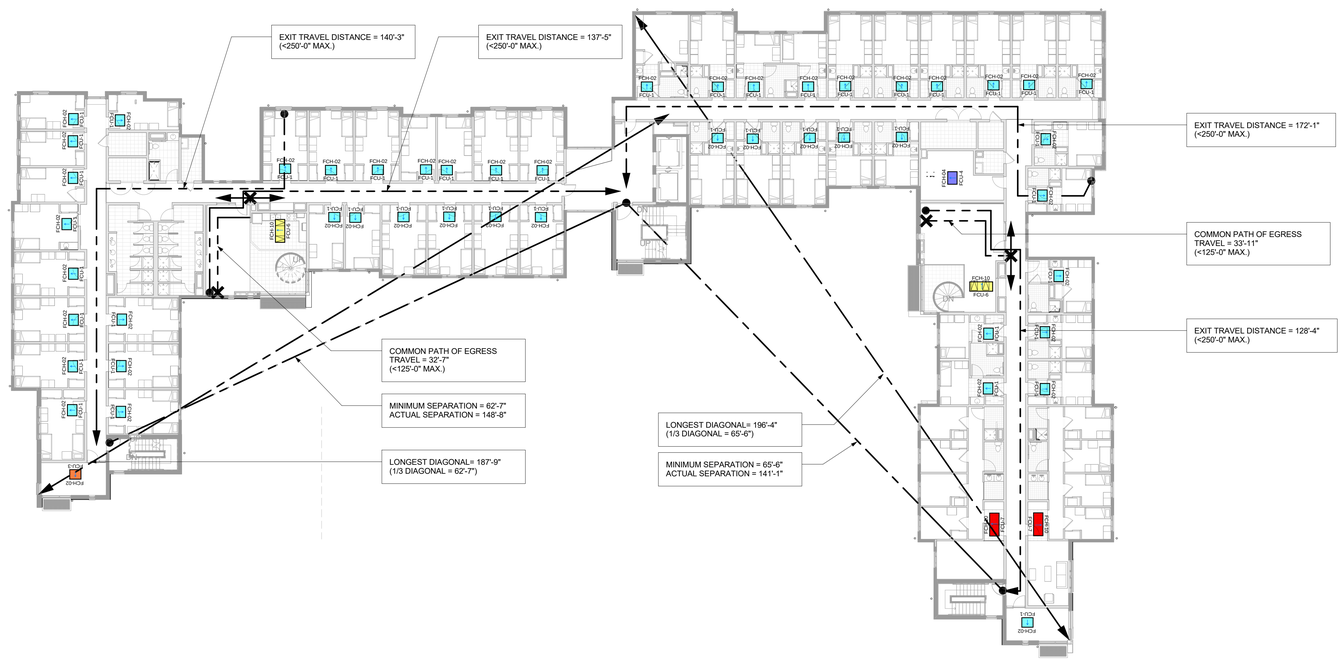
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2 LEVEL 5
SCALE: 1/16" = 1'-0"



1 LEVEL 4
SCALE: 1/16" = 1'-0"

EGRESS LEGEND

SYMBOL	DESCRIPTION
	COMMON PATH OF EGRESS TRAVEL: 30' MAX (GROUP A > 50 OCCUPANTS) 75' MAX (GROUP A < 50 OCCUPANTS) 75' MAX (GROUP B: NFPA 13R) 100' MAX (GROUP B: NFPA 13) 125' MAX (GROUP R-2; NFPA 13 OR NFPA 13R)
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F-2, S-2, U	300'	400'
I-2, I-3, I-4	150'	200'

OCCUPANCY	2 EXITS REQ'D WHEN OCCUPANT LOAD > THAN
A, B, E, F, M, U	49
H-1, H-2, H-3	3
H-4, H-5, I-1, I-3, I-4, R	10
S	29

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OWNER — COLORADO STATE UNIVERSITY, HOUSING AND DINING SERVICES, DIVISION OF STUDENT AFFAIRS, 1005 WEST LAUREL STREET, FORT COLLINS, CO 80523-8045, t: 970.491.4752
ARCHITECT — 4240 ARCHITECTURE INC, 3507 RINGSBY CT. STE. 117, DENVER, CO 80216
CIVIL — JVA, INC, 25 OLD TOWN SQUARE, FORT COLLINS, CO 80524, t: 303.444.1951
LANDSCAPE — RUSSELL + MILLS STUDIOS, 141 SOUTH COLLEGE AVENUE #104, FORT COLLINS, CO 80524, t: 970.484.3855
STRUCTURAL — KL&A STRUCTURAL ENGINEERS, 421 EAST 4TH STREET, LOVELAND, CO 80537, t: 303.384.9910
MECHANICAL, ELECTRICAL, PLUMBING — CATOR, RUMA & ASSOCIATES, 896 TABOR STREET, LAKEWOOD, CO 80401, t: 303.232.6200
ACOUSTICAL / AV — GEILER & ASSOCIATES, LLC, 12355 EAST CORNELL AVENUE, AURORA, CO 80014, t: 303.766.7100
FACADE — TECHNISCAN, 1873 SOUTH BELLAIRE STREET SUITE 1400, DENVER, CO 80222, t: 303.329.0535
SUSTAINABILITY — AMBIENT ENERGY, 130 WEST 5TH AVENUE, DENVER, CO 80204, t: 303.278.1532

Colorado State University
LAUREL VILLAGE
NORTH BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, COLORADO 80521

O	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013

ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. : 21093.20
DESIGNER: L.BIEKER
DRAFTER: M.SNYDER
CHECKER: R.HART

KEY PLAN

NORTH

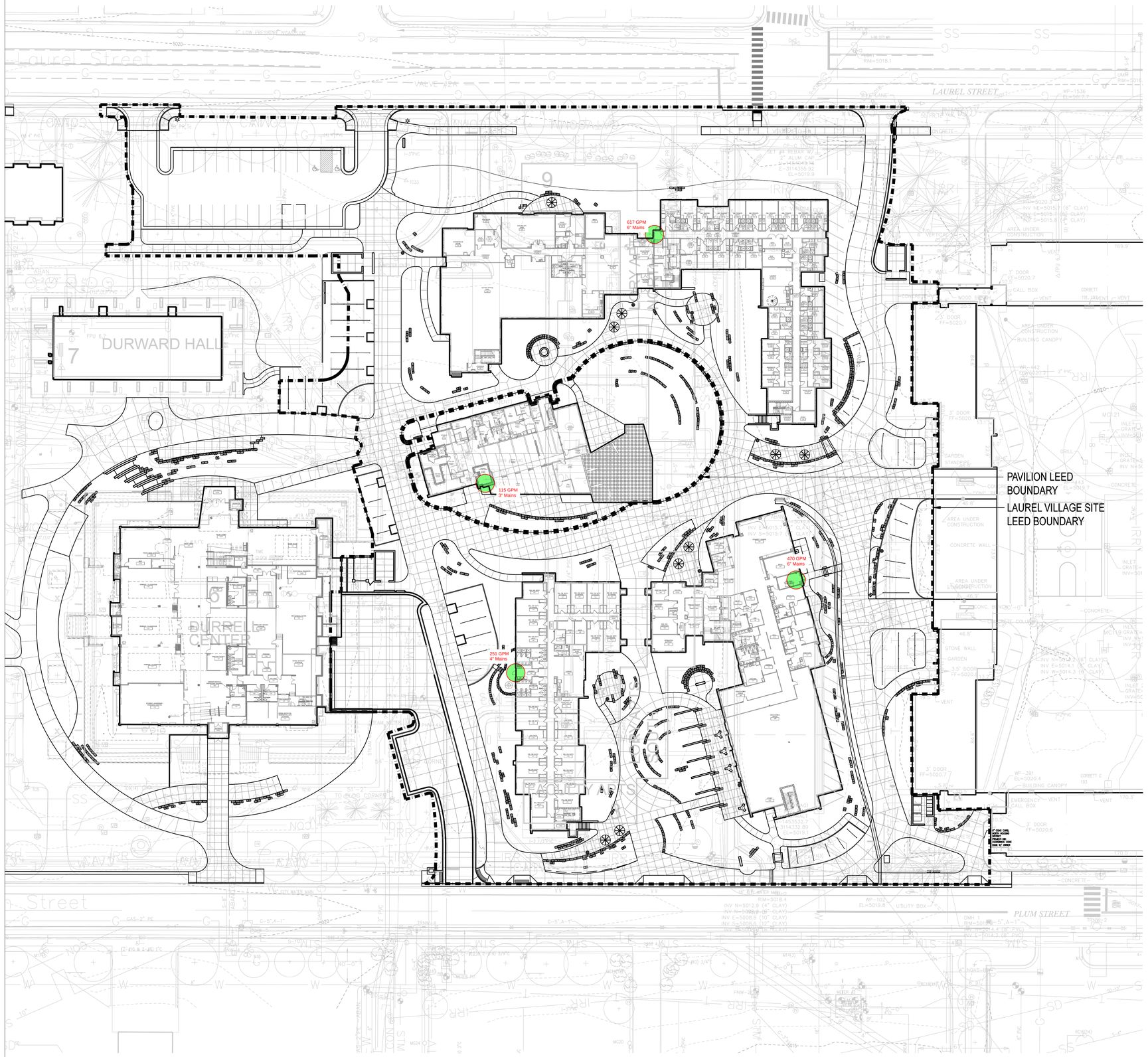
EGRESS ANALYSIS AND TRAVEL DISTANCES

A0.33

1/25/2013 2:44:14 PM

Laurel Village

Site Plan



A LEED BOUNDARIES
SCALE: 1"=30'-0"

30' 0 15' 30' 60' NORTH

4/20/2012 5:18:58 PM

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HOUSING AND DINING SERVICES
DIVISION OF STUDEN AFFAIRS
1005 W. LAUREL ST.
FORT COLLINS, CO 80523-8045
t: 970.491.4752

ARCHITECT 4240 ARCHITECTURE INC
3507 RINGSBY CT. STE. 117
DENVER, CO 80216

CIVIL JVA, INC
25 OLD TOWN SQUARE
FORT COLLINS, CO 80524
t: 303.444.1951

LANDSCAPE RUSSELL + MILLS STUDIOS
141 S. COLLEGE AVE. #104
FORT COLLINS, CO
t: 970.484.8855

STRUCTURAL KL&A STRUCTURAL ENGINEERS
421 E. 4TH ST.
LOVELAND, CO 80537
t: 303.384.9910

MECHANICAL ELECTRICAL PLUMBING CATOR, RUMA & ASSOCIATES
896 TABOR STREET
LAKEWOOD, CO 80401
t: 303.232.6200

ACOUSTICAL GEILER & ASSOCIATES, LLC
12355 E. CORNELL AVE.
AURORA, CO 80014
t: 303.766.7100

FACADE TECHNISCAN
1873 S. BELLAIRE ST. SUITE 1400
DENVER, CO 80222
t: 303.329.0535

SUSTAINABILITY AMBIENT ENERGY
130 W. 5th AVE.
DENVER, CO 80204
t: 303.278.1532

Colorado State University

LAUREL VILLAGE
SITE WORK
CSU PROJECT NO. 11-039
FORT COLLINS, COLORADO 80521

PROJECT RECORD 02JAN2015

ISS. #	DESCRIPTION	DATE

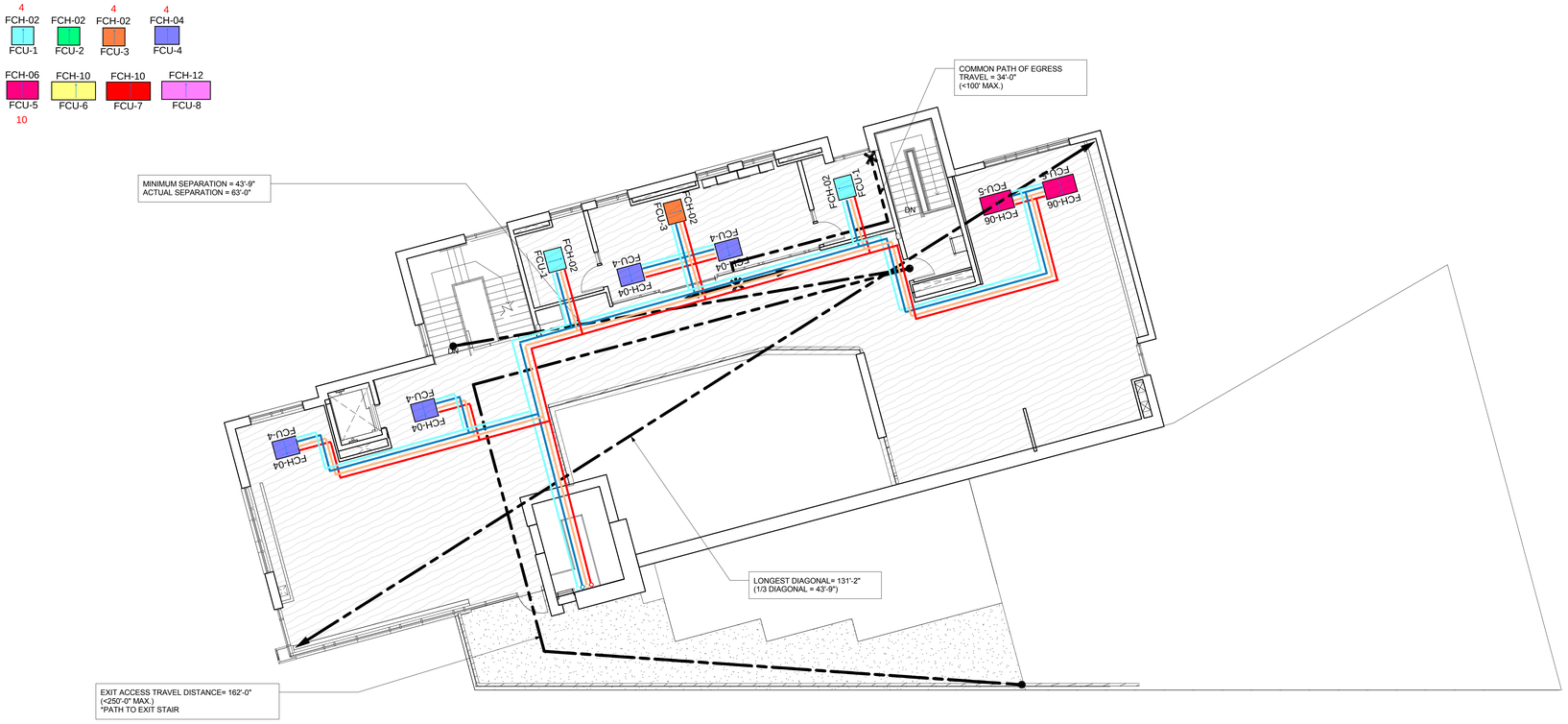
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DESIGNER: CR
DRAFTER: JB
CHECKER:

LEED BOUNDARIES

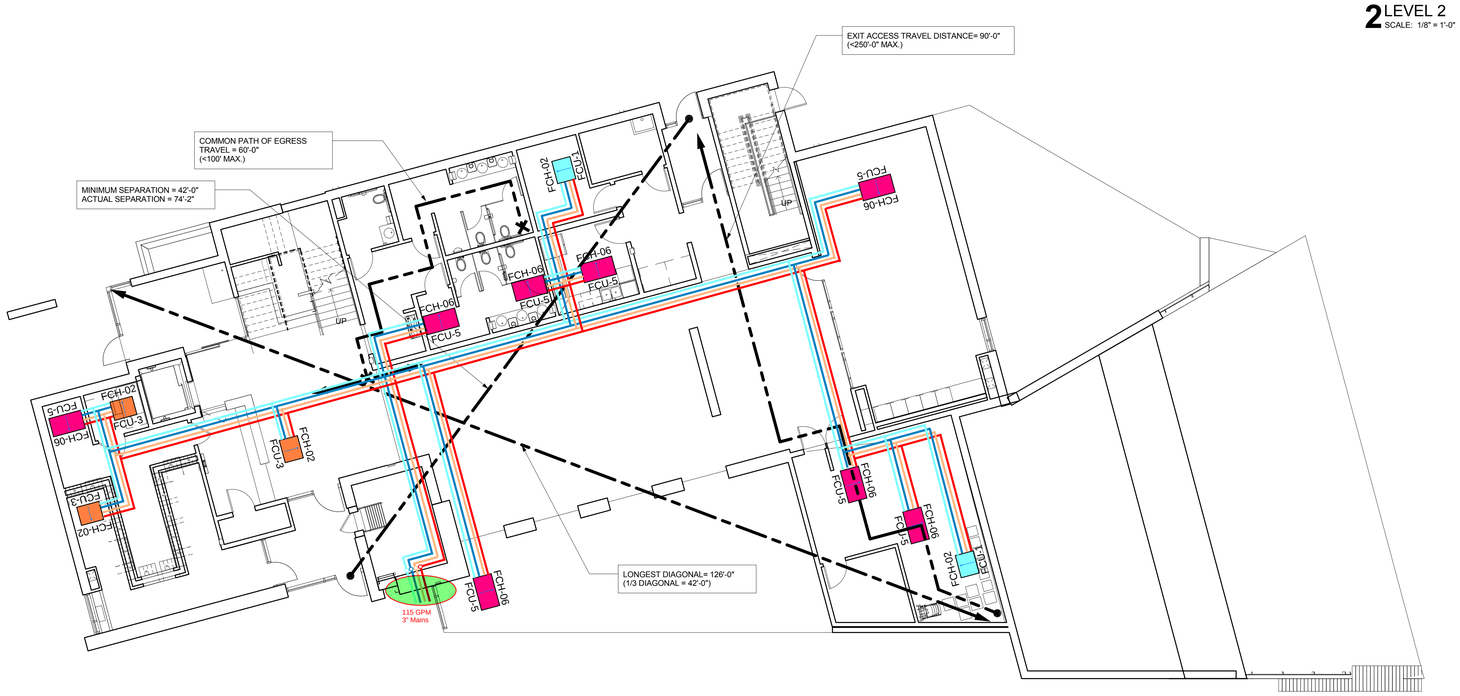
L1.02

Pavilion

Piping



2 LEVEL 2
SCALE: 1/8" = 1'-0"



1 LEVEL 1
SCALE: 1/8" = 1'-0"

EGRESS LEGEND

SYMBOL	DESCRIPTION
	COMMON PATH OF EGRESS TRAVEL: 30' MAX (GROUP A>50 OCCUPANTS) 75' MAX (GROUP A<50 OCCUPANTS) 100' MAX (GROUP B<NFPA 13)
	COMMON PATH OF EGRESS TRAVEL: 2 SEPARATE PATHS OF EGRESS TO SEPARATE EXITS
	LONGEST OVERALL DIAGONAL DIMENSION
	DISTANCE BETWEEN EXITS (< 1/3 OVERALL DIAGONAL DIMENSION)
	EXIT ACCESS TRAVEL DISTANCE

OCCUPANCY	MAXIMUM EXIT TRAVEL DISTANCE	
	NON-SPRINKLERED	SPRINKLERED
A, E, F-1, I-1, M, R, S-1	200'	250'
B	200'	300'
F-2, S-2, U	300'	400'
I-2, I-3, I-4	150'	200'

OCCUPANCY	2 EXITS REQ'D WHEN OCCUPANT LOAD > THAN
A, B, E, F, M, U	49
H-1, H-2, H-3	3
H-4, H-5, I-1, I-3, I-4, R	10
S	29

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t: 970.491.4752

ARCHITECT 4240 ARCHITECTURE INC
3507 RINGSBY CT. SUITE 117
DENVER, CO 80216

CIVIL JVA, INC
25 OLD TOWN SQUARE
FORT COLLINS, CO 80524
t: 303.444.1951

LANDSCAPE RUSSELL + MILLS STUDIOS
141 SOUTH COLLEGE AVENUE #104
FORT COLLINS, CO
t: 970.484.8855

STRUCTURAL KL&A STRUCTURAL ENGINEERS
421 EAST 4TH STREET
LOVELAND, CO 80537
t: 303.384.9910

MECHANICAL ELECTRICAL PLUMBING CATOR, RUMA & ASSOCIATES
869 TABOR STREET
LAKEWOOD, CO 80401
t: 303.232.6200

ACOUSTICAL GEILER & ASSOCIATES, LLC
12355 EAST CORNELL AVENUE
AURORA, CO 80014
t: 303.766.7100

FACADE TECHNISCAN
1873 SOUTH BELLAIRE STREET
SUITE 1400, DENVER, CO 80222
t: 303.329.0535

SUSTAINABILITY AMBIENT ENERGY
130 WEST 5TH AVENUE
DENVER, CO 80204
t: 303.278.1532

Colorado State University
LAUREL VILLAGE
PAVILION - BUILDING #0156
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

PROJECT RECORD 02JAN2015

ISS. #	DESCRIPTION	DATE
ARCHITECT'S PROJECT NO. :		21093.20
DESIGNER:		LB
DRAFTER:		IW / KR
CHECKER:		MS

KEY PLAN

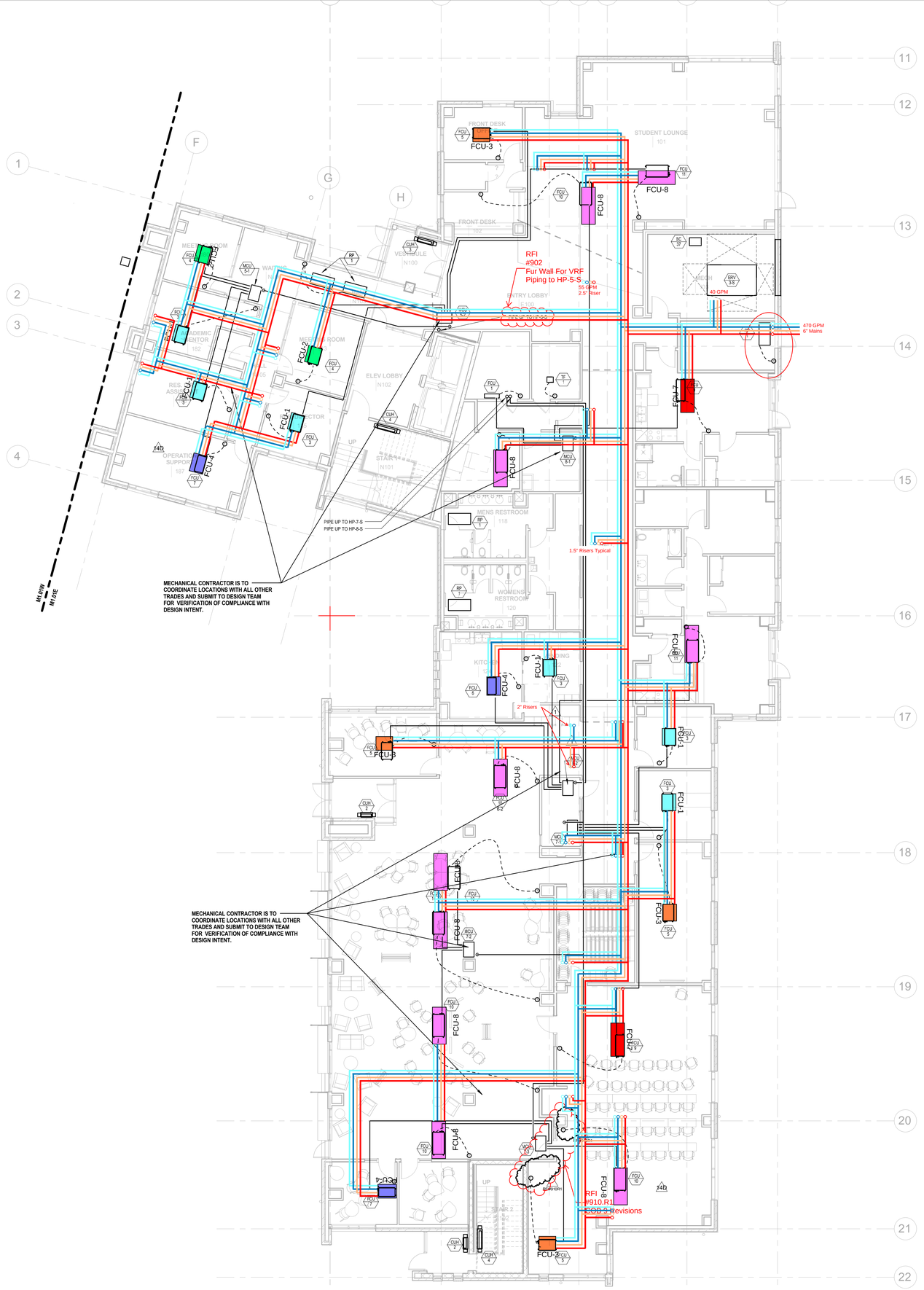
PAVILION
EGRESS ANALYSIS AND TRAVEL DISTANCE

A0.31

12/23/2014 3:38:21 PM

Piñon

Piping



LEVEL 1 HVAC PIPING PLAN - EAST

SCALE: 1/8" = 1'-0"

3/21/2014 9:35:16 AM

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OWNER	COLORADO STATE UNIVERSITY HOUSING AND DINING SERVICES DIVISION OF STUDENT AFFAIRS 1005 W. LAUREL ST. FORT COLLINS, CO 80523-8045 t 970.491.4752
ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
CIVIL	JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951
LANDSCAPE	RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855
STRUCTURAL	KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910
MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
SOUTH
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
1	ADDENDUM 1	4DEC2012
7	FOR CONSTRUCTION	25JAN2013
14D	COB 4D	26JUN2013

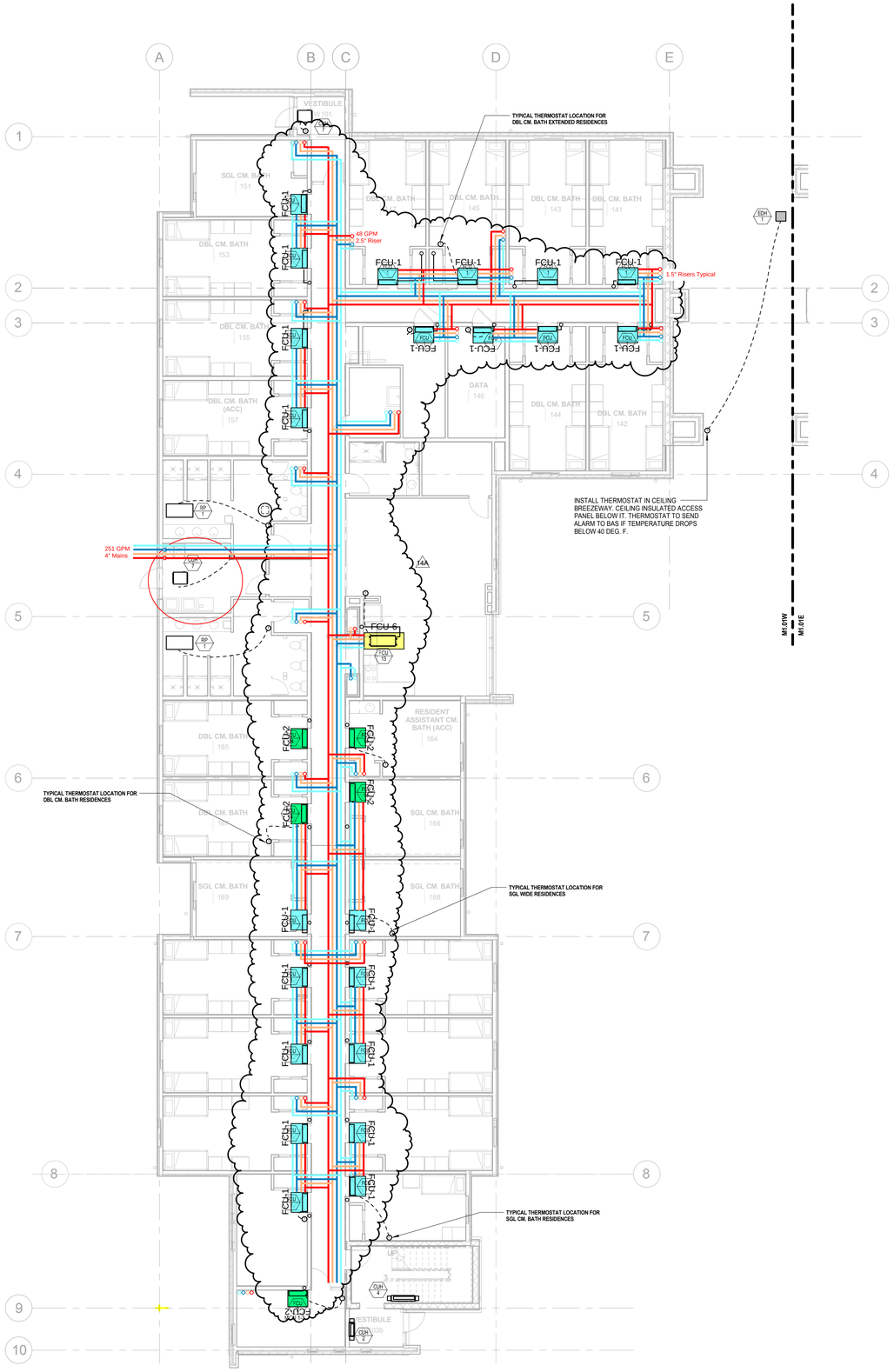
ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. : 21093.20
DESIGNER:
DRAFTER:
CHECKER:

KEY PLAN

SOUTH
LEVEL 1 HVAC PIPING PLAN - EAST

M2.01E



LEVEL 1 HVAC PIPING PLAN - WEST

SCALE: 1/8" = 1'-0"

5/15/2013 3:17:45 PM

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ARCHITECT 4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216

CIVIL JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951

LANDSCAPE RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855

STRUCTURAL KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910

MECHANICAL ELECTRICAL PLUMBING CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200

ACOUSTICAL GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100

FACADE TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535

SUSTAINABILITY AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

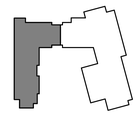
Colorado State University

LAUREL VILLAGE
SOUTH
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013
14A	COB 4A	16MAY2013

ISS. #	DESCRIPTION	DATE

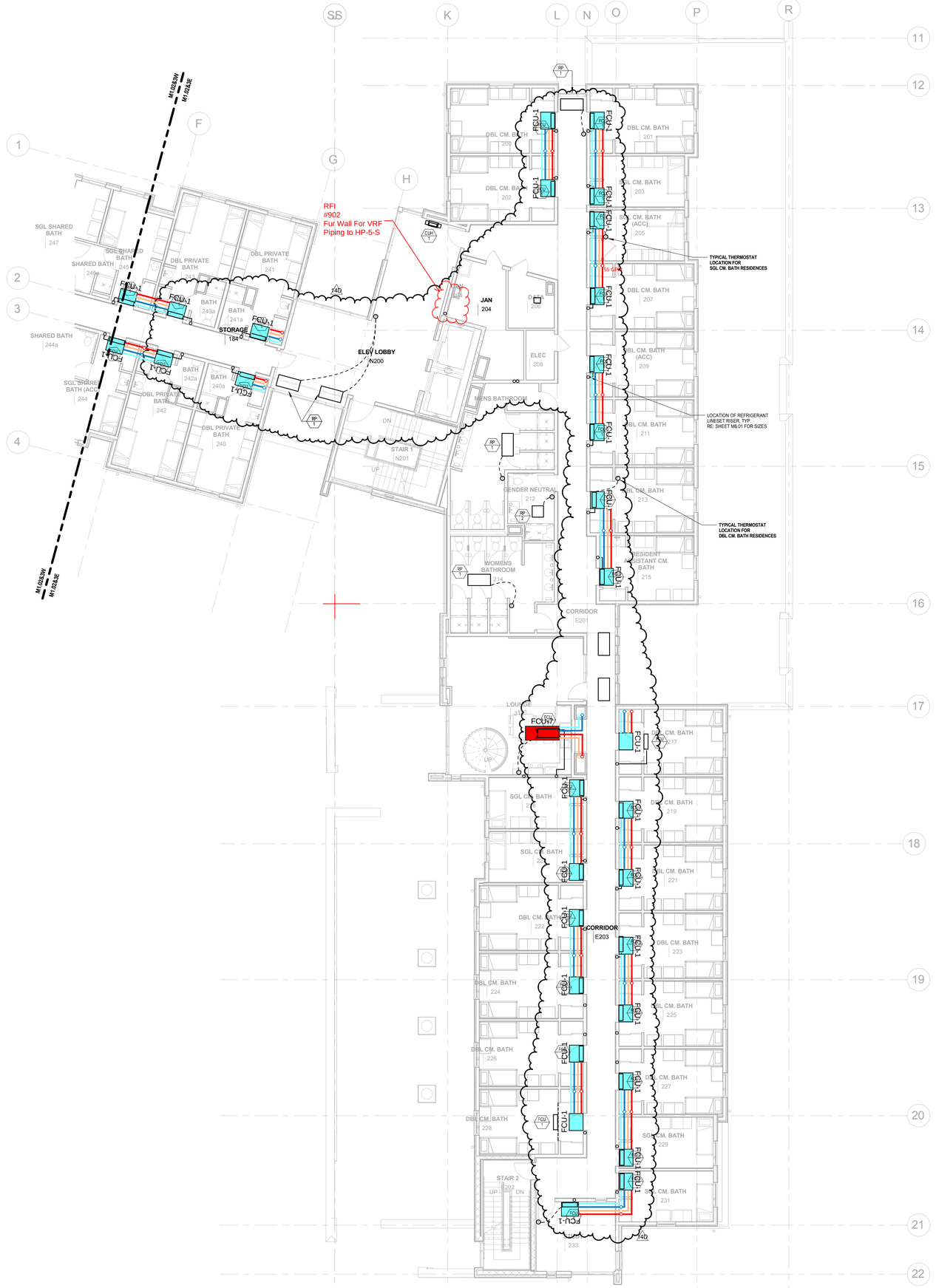
ARCHITECTS PROJECT NO. : 21093.20
DESIGNER:
DRAFTER:
CHECKER:



KEY PLAN

SOUTH
LEVEL 1 HVAC PIPING PLAN - WEST

M2.01W



LEVEL 2 HVAC PIPING PLAN - EAST

SCALE: 1/8" = 1'-0"

6/25/2013 3:58:15 PM

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OWNER	COLORADO STATE UNIVERSITY HOUSING AND DINING SERVICES DIVISION OF STUDENT AFFAIRS 1005 W. LAUREL ST. FORT COLLINS, CO 80523-8045 t 970.491.4752
ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
CIVIL	JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951
LANDSCAPE	RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855
STRUCTURAL	KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910
MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
SOUTH

CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013
14D	COB 4D	26JUN2013

ISS. #	DESCRIPTION	DATE
	ARCHITECT'S PROJECT NO. :	21093.20
	DESIGNER:	
	DRAFTER:	
	CHECKER:	

KEY PLAN

SOUTH
LEVEL 2 HVAC PIPING PLAN - EAST

M2.02E



LEVEL 2 HVAC PIPING PLAN - WEST

SCALE: 1/8" = 1'-0"

5/15/2013 3:17:47 PM

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ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
CIVIL	JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951
LANDSCAPE	RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855
STRUCTURAL	KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910
MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
SOUTH
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

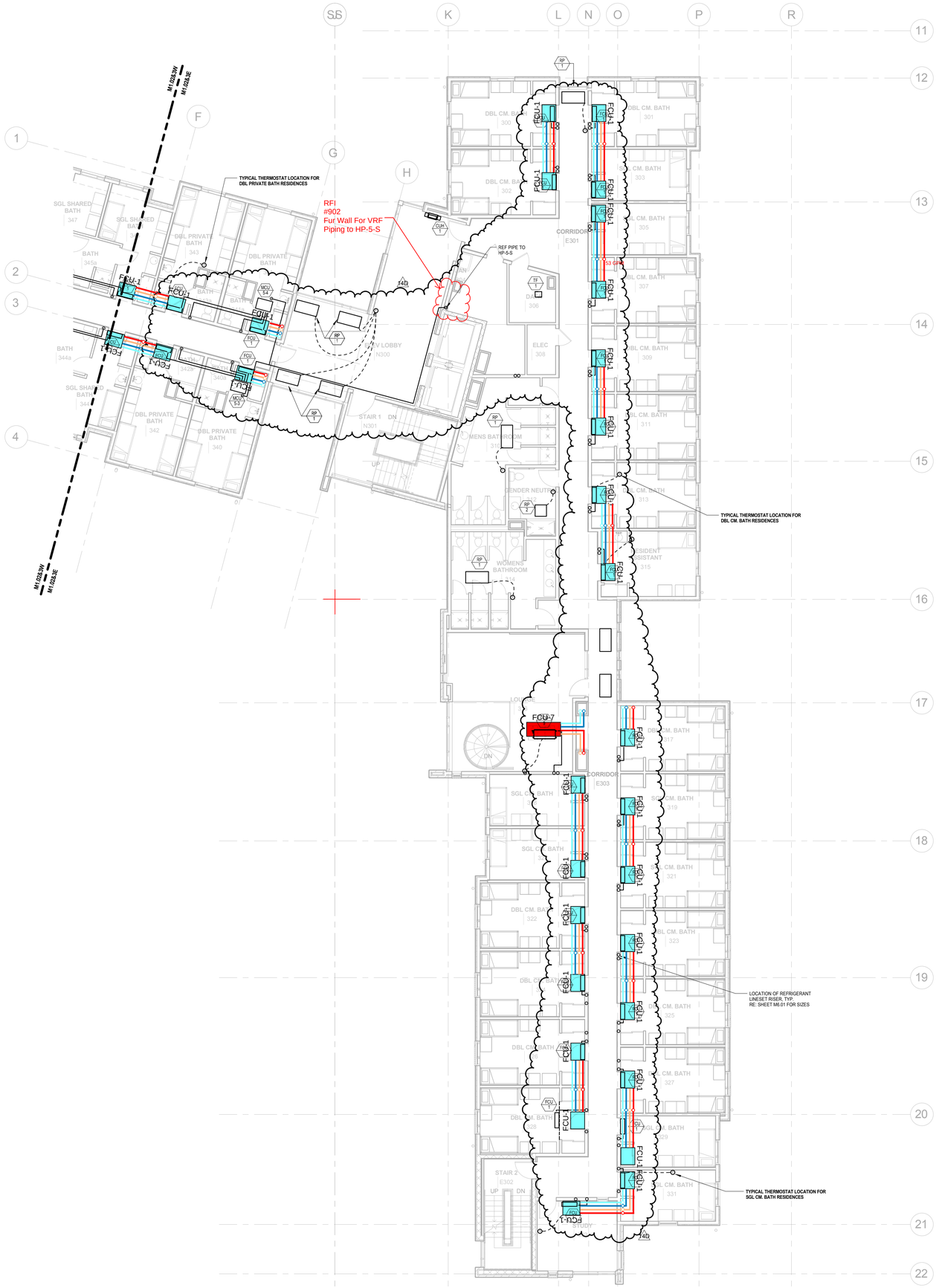
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7	FOR CONSTRUCTION	25JAN2013
14A	COB 4A	16MAY2013

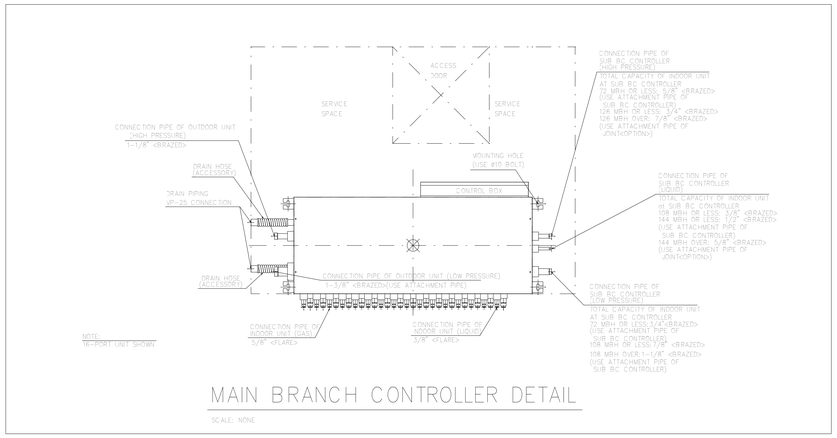
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	CHECKER:	

KEY PLAN

SOUTH
LEVEL 2 HVAC PIPING PLAN - WEST

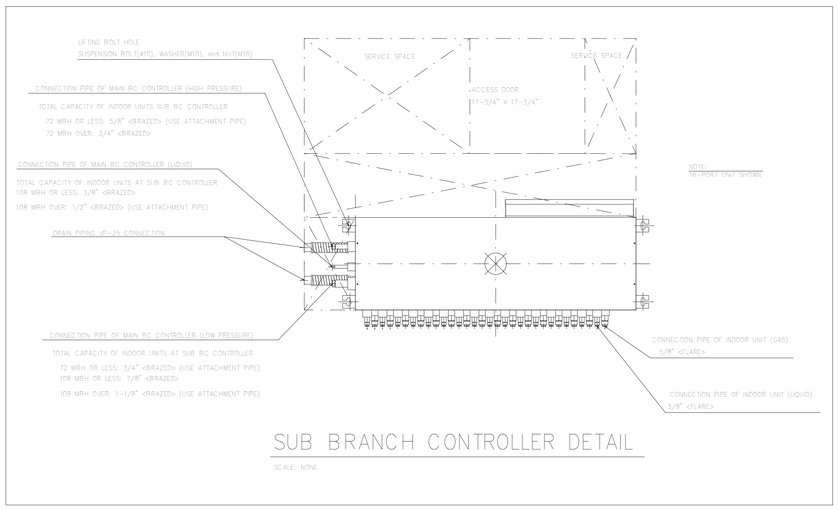
M2.02W


TYPICAL THERMOSTAT LOCATION FOR DBL PRIVATE BATH RESIDENCES
RFI #902 For Wall For VRF Piping to HP-5-S
REF PIPE TO HP-5-S
TYPICAL THERMOSTAT LOCATION FOR DBL CM. BATH RESIDENCES
LOCATION OF REFRIGERANT LINESET RISER, TYP. RE: SHEET M6.01 FOR SIZES
TYPICAL THERMOSTAT LOCATION FOR SGL CM. BATH RESIDENCES
CORRIDOR E301
CORRIDOR E303
STAIR 1
STAIR 2
GENDER NEUTRAL
MENS BATHROOM
WOMENS BATHROOM
LOBBY
DBL PRIVATE BATH
SGL SHARED BATH
DBL CM. BATH
SGL CM. BATH
FCU-1
MV-1
MV-2
MV-3
MV-4
MV-5
MV-6
MV-7
MV-8
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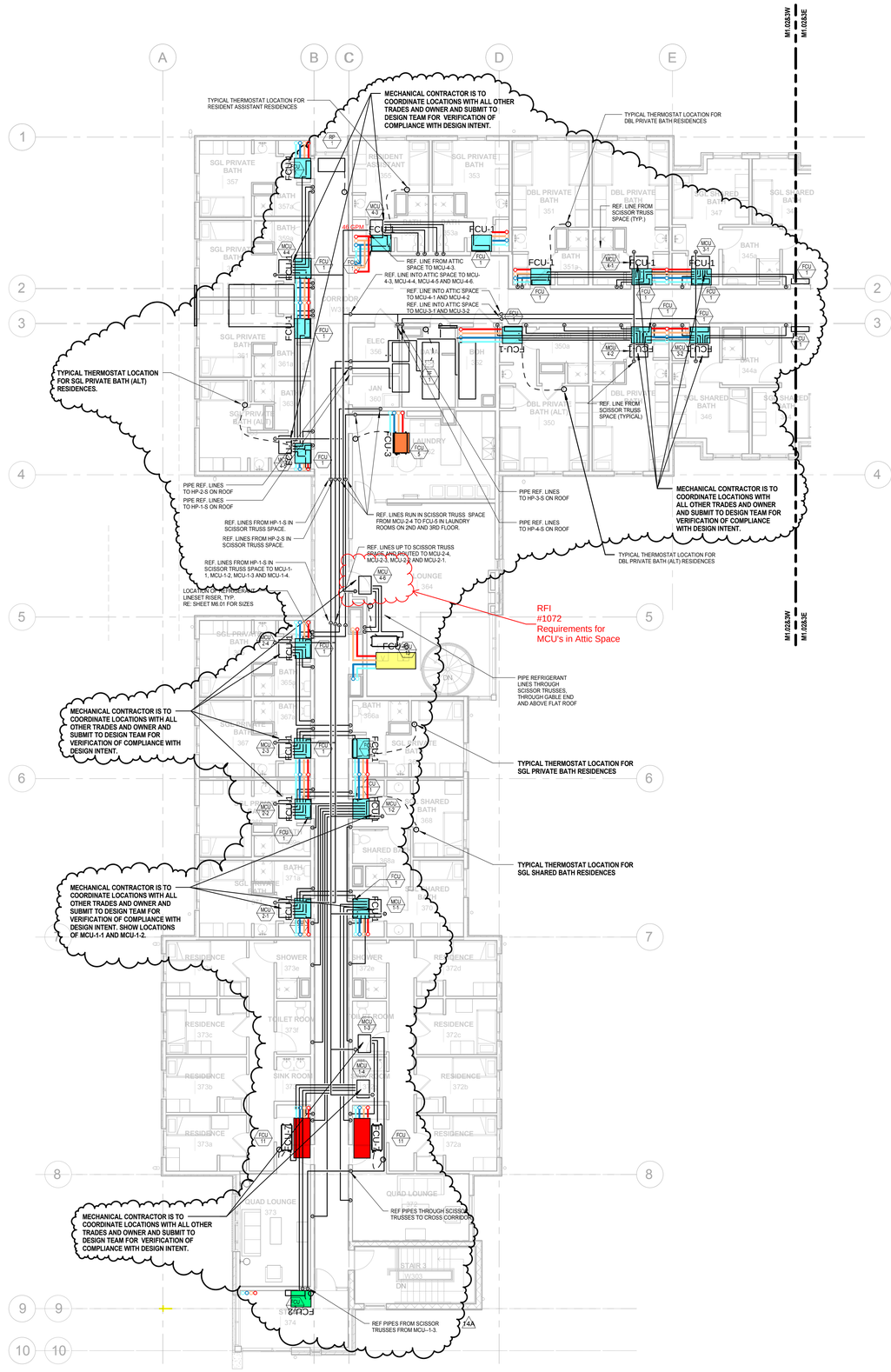
MAIN BRANCH CONTROLLER DETAIL

SCALE: NONE



SUB BRANCH CONTROLLER DETAIL

SCALE: NONE



LEVEL 3 HVAC PIPING PLAN - WEST

SCALE: 1/8" = 1'-0"

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OWNER	COLORADO STATE UNIVERSITY HOUSING AND DINING SERVICES DIVISION OF STUDENT AFFAIRS 1005 W. LAUREL ST. FORT COLLINS, CO 80523-8045 t 970.491.4752
ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
CIVIL	JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951
LANDSCAPE	RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855
STRUCTURAL	KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910
MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
SOUTH
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013
14A	COB 4A	16MAY2013

ISS. #	DESCRIPTION	DATE
	ARCHITECTS PROJECT NO. :	21093.20
	DESIGNER:	
	DRAFTER:	
	CHECKER:	

KEY PLAN

SOUTH
LEVEL 3 HVAC PIPING PLAN - WEST

M2.03W

5/17/2013 9:28:46 AM



LEVEL 4 HVAC PIPING PLAN - EAST

SCALE: 1/8" = 1'-0"

6/25/2013 3:58:22 PM

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ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
CIVIL	JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951
LANDSCAPE	RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855
STRUCTURAL	KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910
MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
SOUTH
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

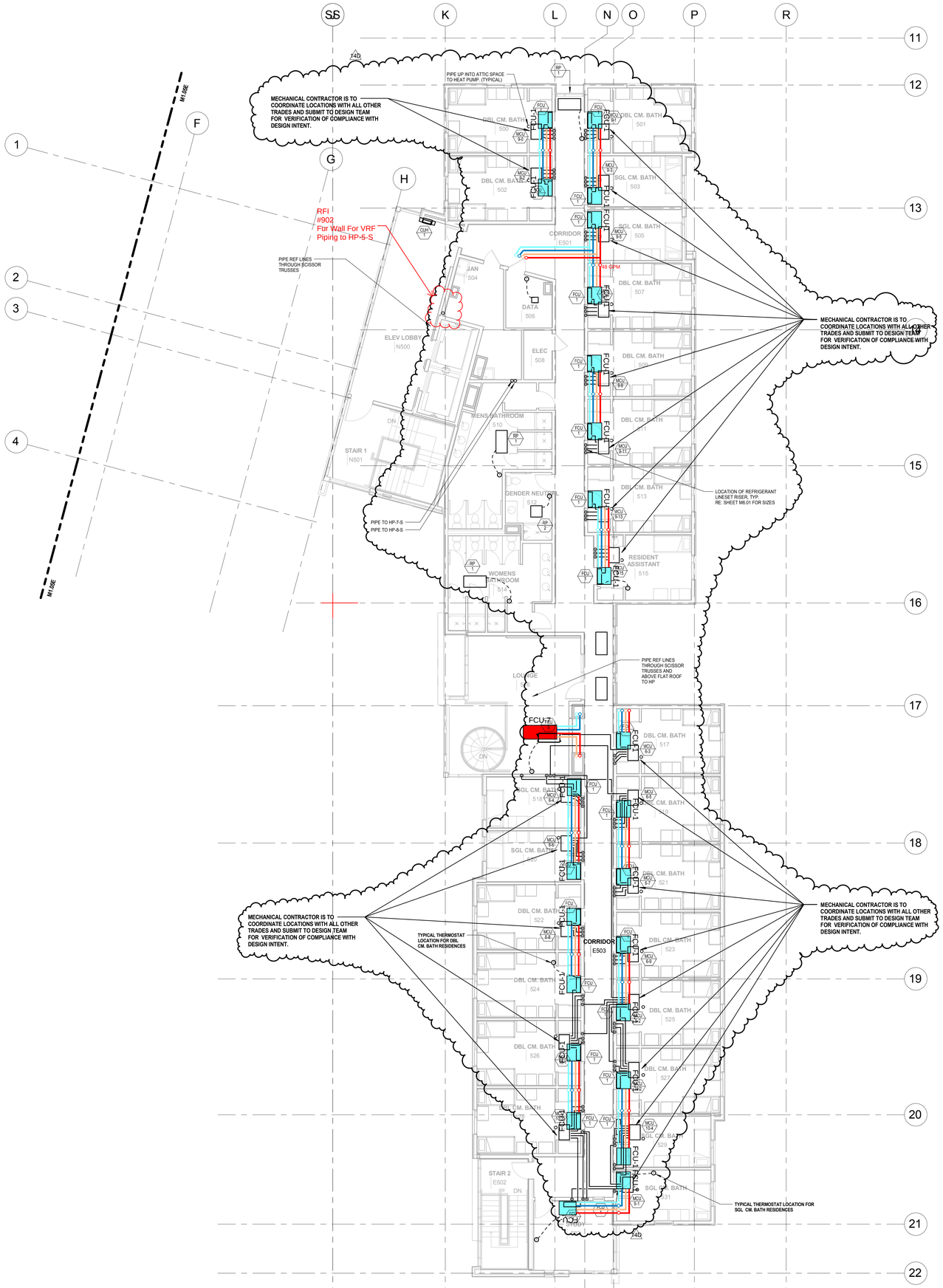
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7	FOR CONSTRUCTION	25JAN2013
14D	COB 4 D	26JUN2013

ISS. #	DESCRIPTION	DATE
	ARCHITECT'S PROJECT NO. :	21093.20
	DESIGNER:	
	DRAFTER:	
	CHECKER:	

KEY PLAN

SOUTH
LEVEL 4 HVAC PIPING PLAN - EAST

M2.04E



LEVEL 5 HVAC PIPING PLAN - EAST

SCALE: 1/8" = 1'-0"

6/25/2013 3:58:25 PM

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OWNER	COLORADO STATE UNIVERSITY HOUSING AND DINING SERVICES DIVISION OF STUDENT AFFAIRS 1005 W. LAUREL ST. FORT COLLINS, CO 80523-8045 t 970.491.4752
ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
CIVIL	JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951
LANDSCAPE	RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855
STRUCTURAL	KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910
MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
SOUTH
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013
14D	COB 4D	26JUN2013

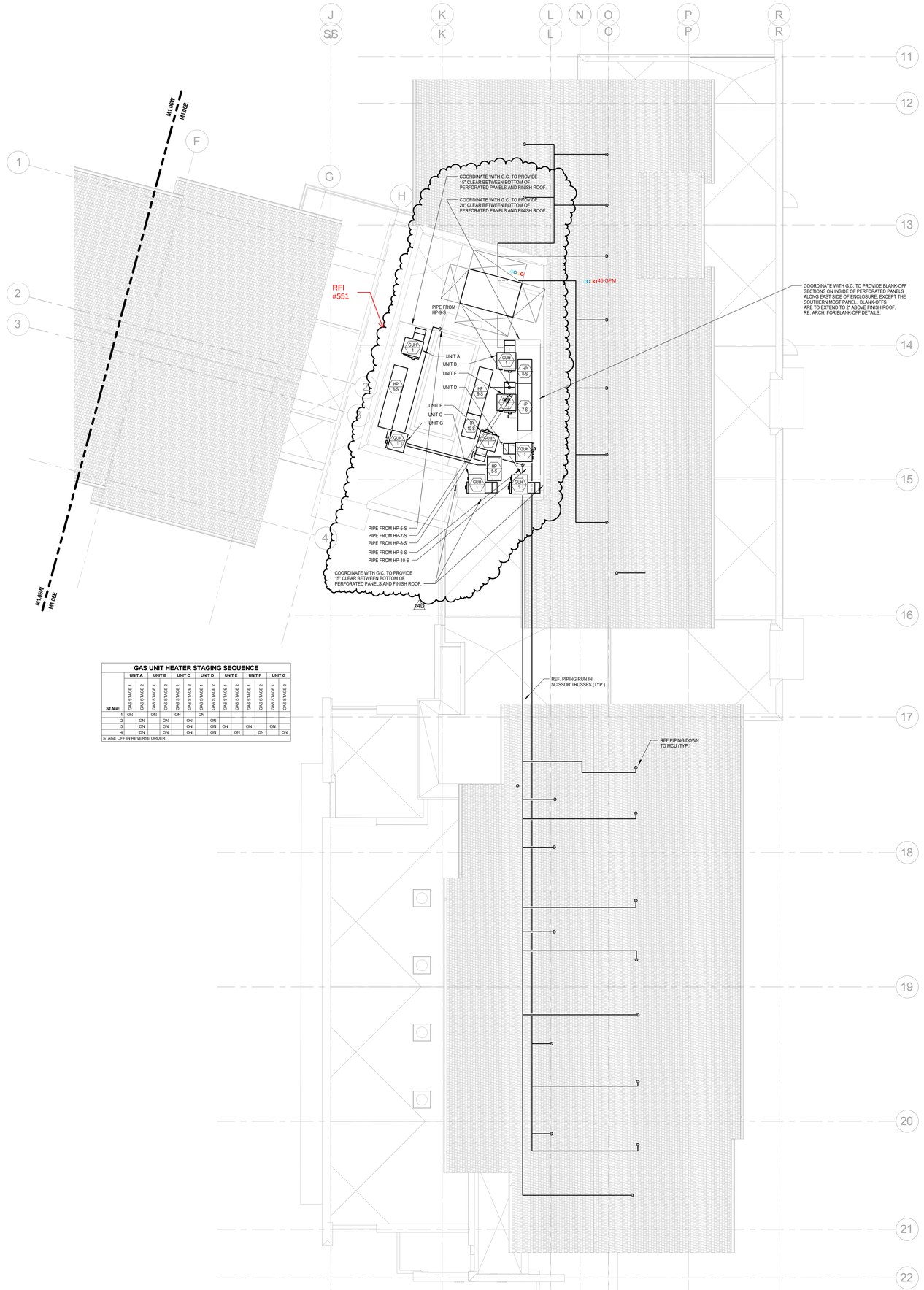
ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. : 21093.20
DESIGNER:
DRAFTER:
CHECKER:

KEY PLAN

SOUTH
LEVEL 5 HVAC PIPING PLAN - EAST

M2.05E



GAS UNIT HEATER STAGING SEQUENCE

STAGE	UNIT A		UNIT B		UNIT C		UNIT D		UNIT E		UNIT F		UNIT G	
	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2
1	ON		ON		ON		ON							
2		ON		ON		ON		ON						
3		ON		ON		ON		ON	ON		ON		ON	
4		ON		ON		ON		ON		ON		ON		ON

STAGE OFF IN REVERSE ORDER

ROOF HVAC PIPING - EAST

SCALE: 1/8" = 1'-0"

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OWNER COLORADO STATE UNIVERSITY HOUSING AND DINING SERVICES DIVISION OF STUDENT AFFAIRS 1005 W. LAUREL ST. FORT COLLINS, CO 80523-8045 t 970.491.4752

ARCHITECT 4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216

CIVIL JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951

LANDSCAPE RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855

STRUCTURAL KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910

MECHANICAL ELECTRICAL PLUMBING CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200

ACOUSTICAL GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100

FACADE TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535

SUSTAINABILITY AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
SOUTH
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013
14D	COB 4 D	25JUN2013

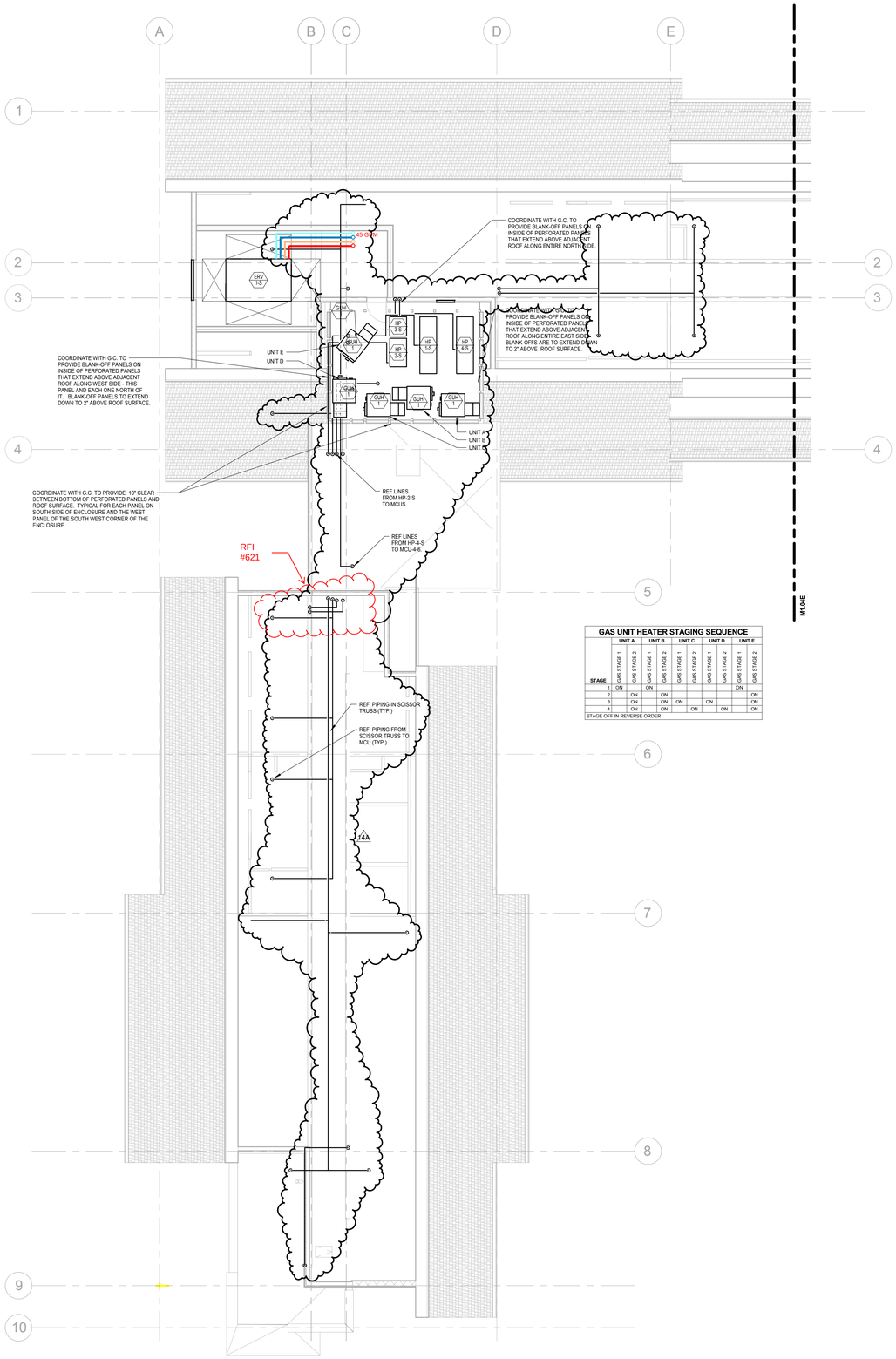
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	ARCHITECT'S PROJECT NO. :	21093.20
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	DRAFTER:	
	CHECKER:	

KEY PLAN

SOUTH
ROOF HVAC PIPING PLAN - EAST

M2.06E

6/25/2013 3:58:31 PM



GAS UNIT HEATER STAGING SEQUENCE

	UNIT A		UNIT B		UNIT C		UNIT D		UNIT E	
STAGE	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2
1	ON		ON					ON		
2		ON		ON						ON
3		ON		ON	ON		ON			ON
4		ON		ON		ON		ON		ON

STAGE OFF IN REVERSE ORDER

ROOF HVAC PIPING - WEST

SCALE: 1/8" = 1'-0"

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ARCHITECT 4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216

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FACADE TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535

SUSTAINABILITY AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
SOUTH
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013
14A	COB 4A	16MAY2013

ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. : 21093.20
DESIGNER:
DRAFTER:
CHECKER:

KEY PLAN

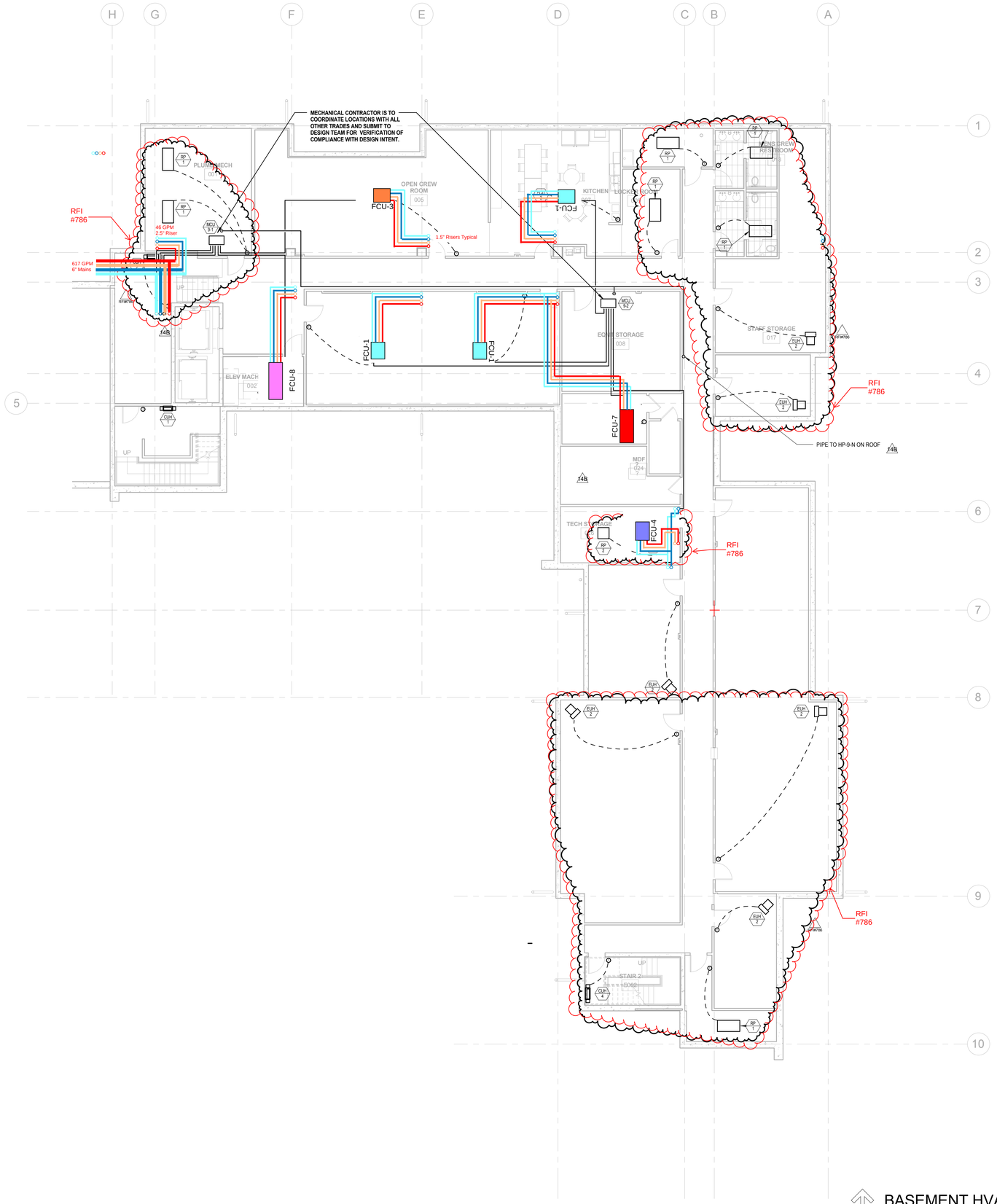
SOUTH
ROOF HVAC PIPING PLAN - WEST

M2.06W

5/15/2013 3:17:51 PM

Alpine

Piping



BASEMENT HVAC PIPING PLAN

SCALE: 1/8" = 1'-0"

1/21/2014 7:32:18 AM

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ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
CIVIL	JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951
LANDSCAPE	RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855
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FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0 BID	16NOV2012
7 FOR CONSTRUCTION	25JAN2013
14B COB 4B	03JUN2013
RFI 786	21JAN2014

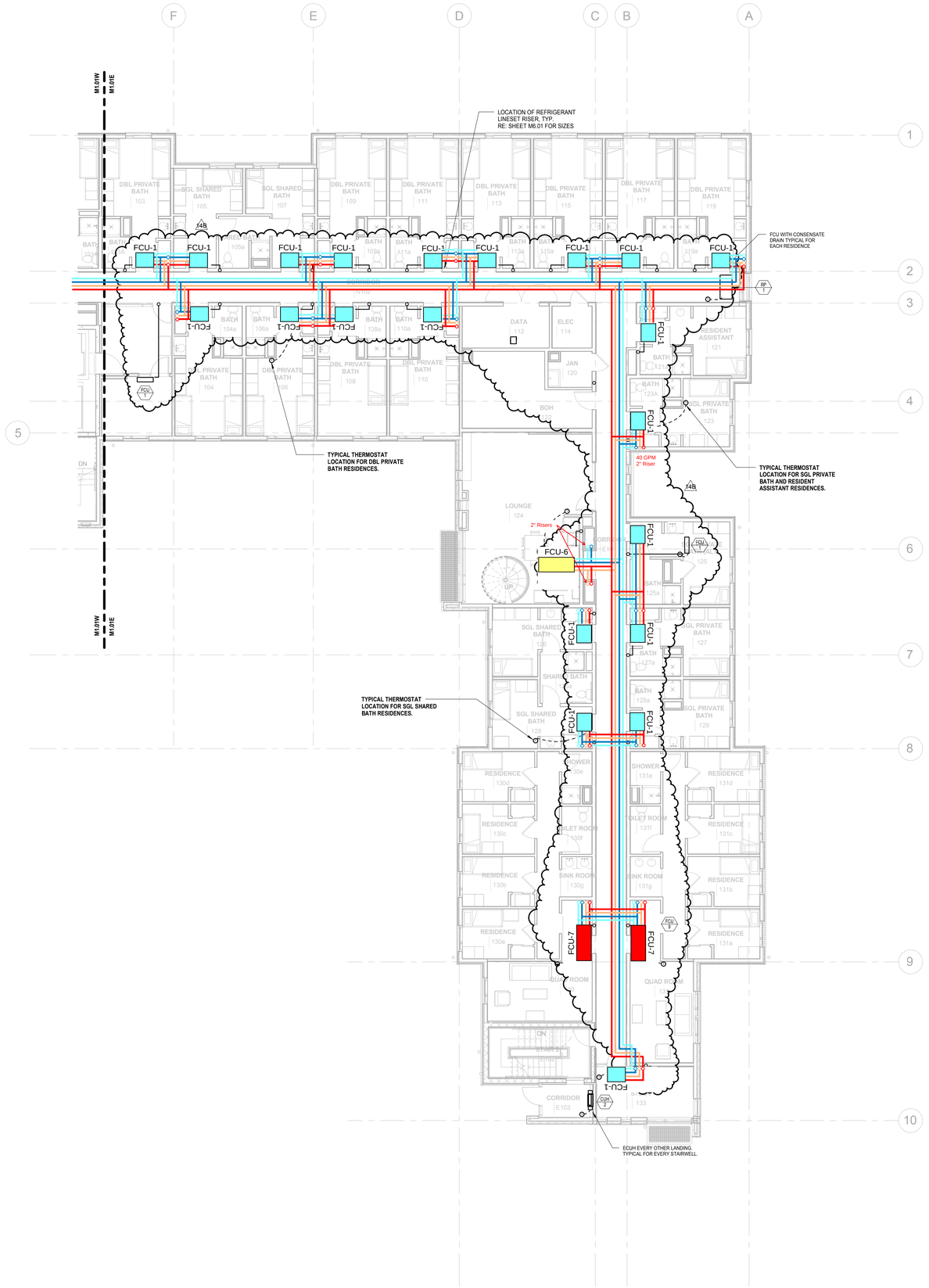
ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. : 21093.20
DESIGNER:
DRAFTER:
CHECKER:

KEY PLAN

BASEMENT LEVEL HVAC PIPING PLAN - EAST

M2.00E



LEVEL 1 HVAC PIPING PLAN - EAST

SCALE: 1/8" = 1'-0"

6/4/2013 1:43:10 PM

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ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
CIVIL	JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951
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MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GELLER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
1	ADDENDUM 1	4DEC2012
7	FOR CONSTRUCTION	25JAN2013
14B	COB 4B	03JUN2013

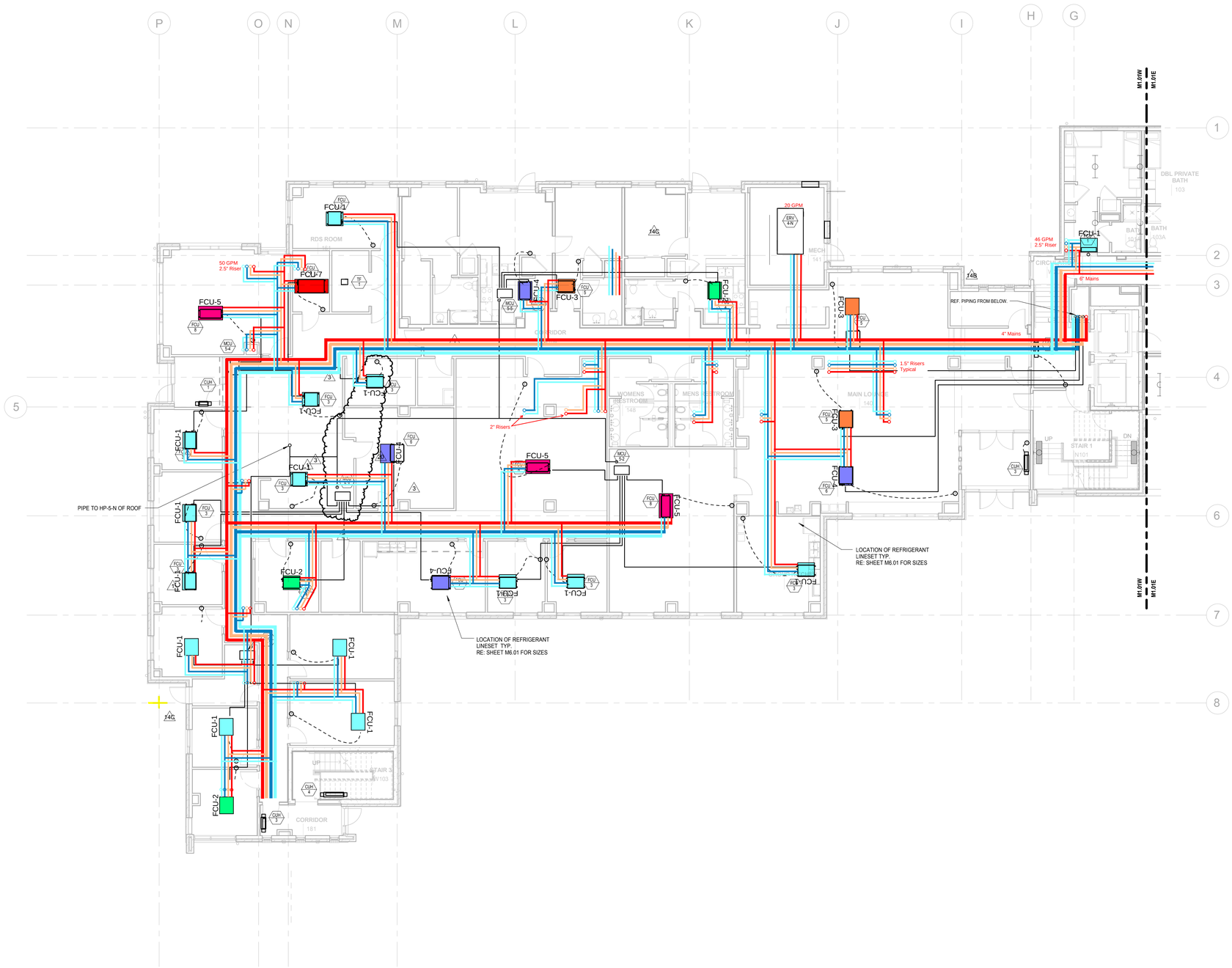
ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. : 21093.20
DESIGNER:
DRAFTER:
CHECKER:

KEY PLAN

LEVEL 1 HVAC PIPING PLAN - EAST

M2.01E



LEVEL 1 HVAC PIPING PLAN - WEST

SCALE: 1/8" = 1'-0"

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ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
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FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
1	ADDENDUM 1	4DEC2012
3	ADDENDUM 3	13DEC2012
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14C	COB 4C	18JUN2013
20	COB 7	27NOV2013

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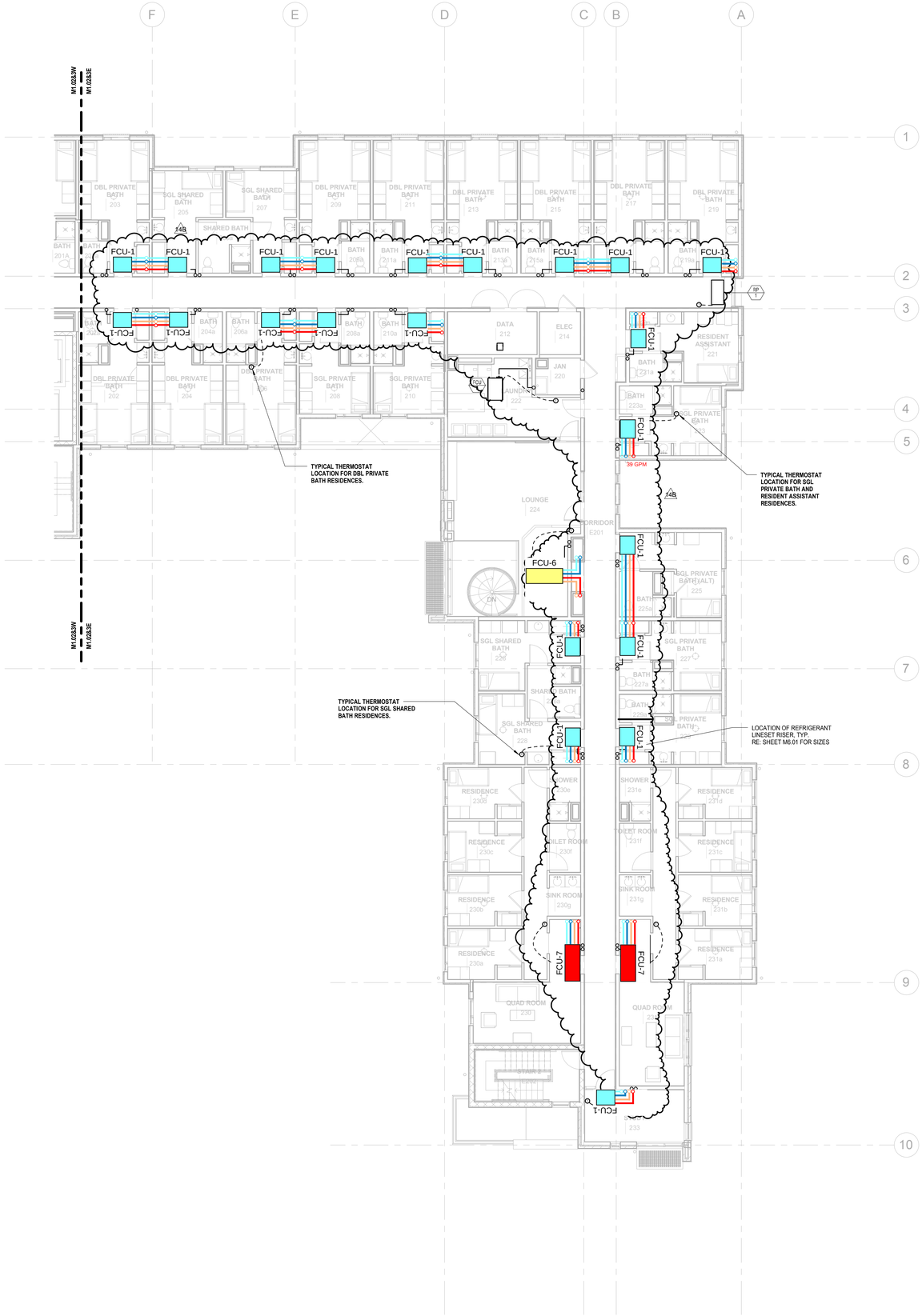
ARCHITECT'S PROJECT NO. : 21093.20
DESIGNER:
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CHECKER:

KEY PLAN

LEVEL 1 HVAC PIPING PLAN - WEST

M2.01W

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ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
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MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
1	ADDENDUM 1	4DEC2012
7	FOR CONSTRUCTION	25JAN2013
14B	COB 4B	03JUN2013

ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. : 21093.20
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KEY PLAN

LEVEL 2 HVAC PIPNG PLAN - EAST

M2.02E

LEVEL 2 HVAC PIPING PLAN - EAST

SCALE: 1/8" = 1'-0"

6/4/2013 1:43:14 PM



LEVEL 2 HVAC PIPING PLAN - WEST

SCALE: 1/8" = 1'-0"

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OWNER	COLORADO STATE UNIVERSITY HOUSING AND DINING SERVICES DIVISION OF STUDENT AFFAIRS 1005 W. LAUREL ST. FORT COLLINS, CO 80523-8045 t 970.491.4752
ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
CIVIL	JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951
LANDSCAPE	RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855
STRUCTURAL	KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910
MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013
14C	COB 4C	18JUN2013

ISS. #	DESCRIPTION	DATE
	ARCHITECT'S PROJECT NO. :	21093.20
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	DRAFTER:	
	CHECKER:	

KEY PLAN

LEVEL 2 HVAC PIPING PLAN - WEST

M2.02W

6/18/2013 4:11:47 PM



LEVEL 3 HVAC PIPING PLAN - EAST

SCALE: 1/8" = 1'-0"

6/4/2013 1:43:18 PM

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ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
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MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

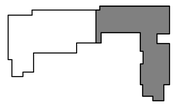
Colorado State University

LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

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1	ADDENDUM 1	4DEC2012
7	FOR CONSTRUCTION	25JAN2013
14B	COB 4B	03JUN2013

ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. : 21093.20
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KEY PLAN

LEVEL 3 HVAC PIPING PLAN - EAST

M2.03E



LEVEL 3 HVAC PIPING PLAN - WEST

SCALE: 1/8" = 1'-0"

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OWNER **COLORADO STATE UNIVERSITY HOUSING AND DINING SERVICES DIVISION OF STUDENT AFFAIRS 1005 W. LAUREL ST. FORT COLLINS, CO 80523-8045** t 970.491.4752

ARCHITECT **4240 ARCHITECTURE INC** 3507 RINGSBY CT. STE. 117 DENVER, CO 80216

CIVIL **JVA, INC.** 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951

LANDSCAPE **RUSSELL + MILLS STUDIOS** 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855

STRUCTURAL **KL&A STRUCTURAL ENGINEERS** 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910

MECHANICAL ELECTRICAL PLUMBING **CATOR, RUMA & ASSOCIATES** 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200

ACOUSTICAL **GEILER & ASSOCIATES, LLC** 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100

FACADE **TECHNISCAN** 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535

SUSTAINABILITY **AMBIENT ENERGY** 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

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7	FOR CONSTRUCTION	25JAN2013
14C	COB 4C	18JUN2013

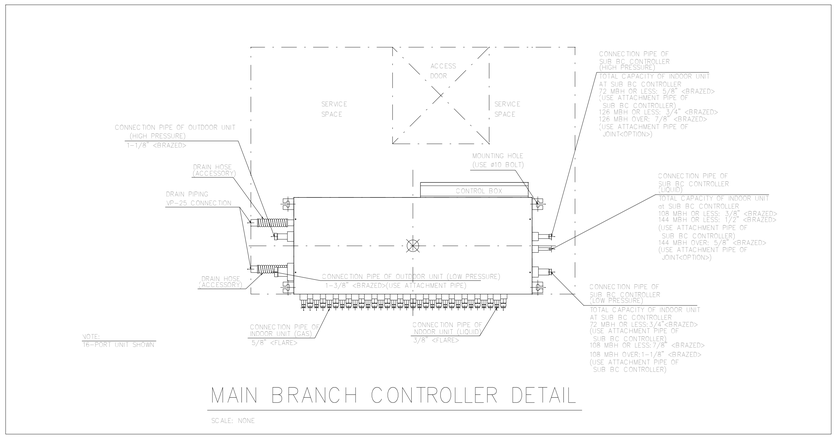
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KEY PLAN

LEVEL 3 HVAC PIPNG PLAN - WEST

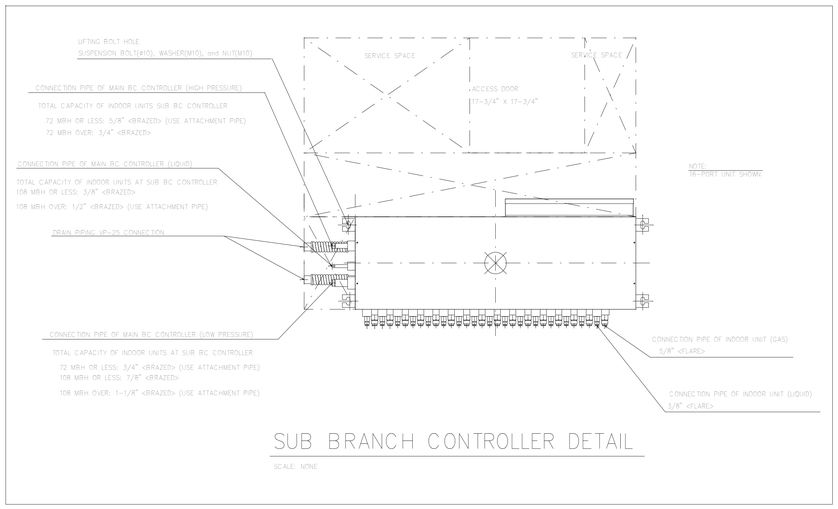
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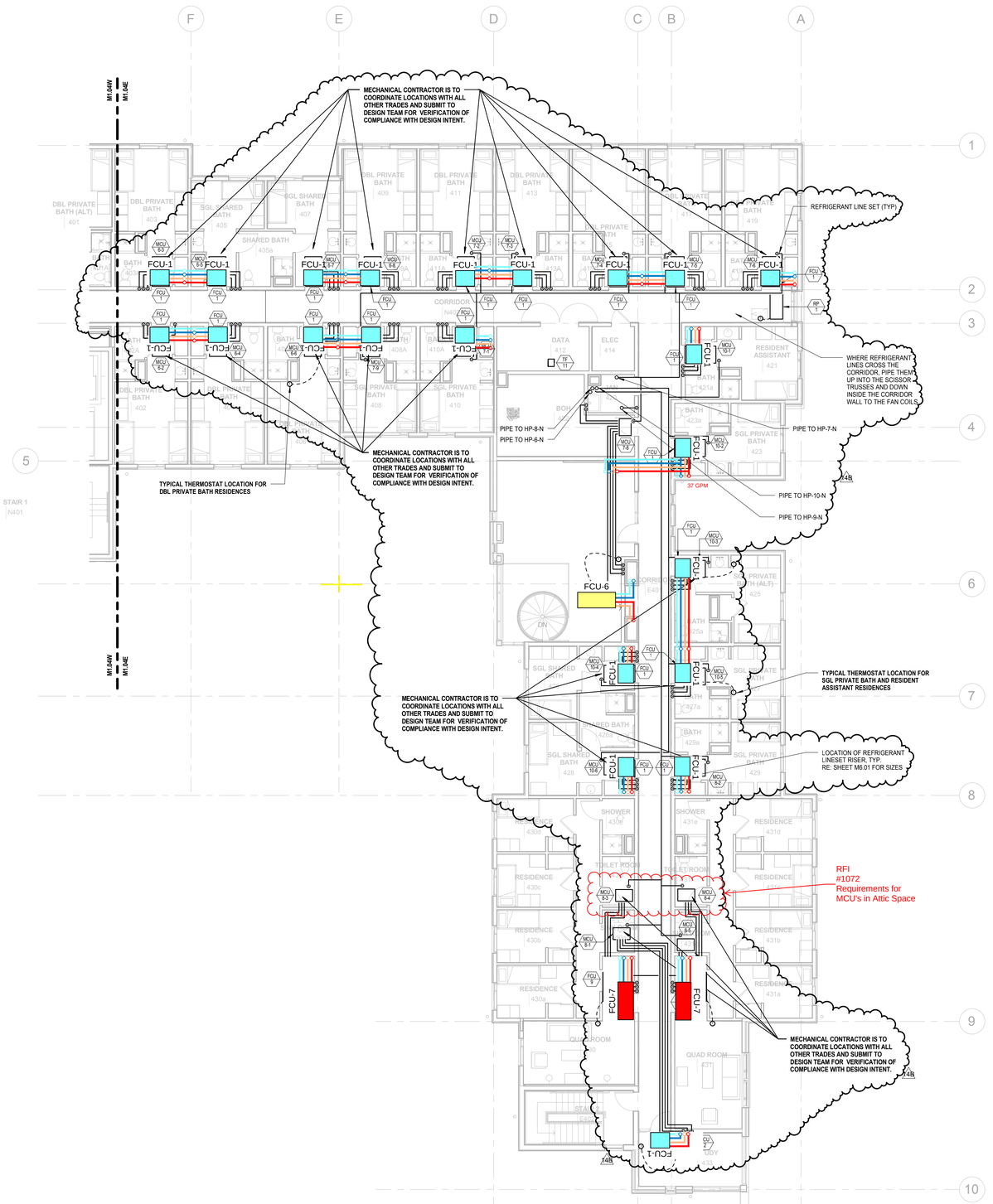
MAIN BRANCH CONTROLLER DETAIL

SCALE: NONE



SUB BRANCH CONTROLLER DETAIL

SCALE: NONE



LEVEL 4 HVAC PIPING PLAN - EAST

SCALE: 1/8" = 1'-0"

6/4/2013 1:43:25 PM

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ARCHITECT 4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216

CIVIL JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951

LANDSCAPE RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855

STRUCTURAL KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910

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ACOUSTICAL GELLER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100

FACADE TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535

SUSTAINABILITY AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
1	ADDENDUM 1	4DEC2012
7	FOR CONSTRUCTION	25JAN2013
14B	COB 4B	03JUN2013

ISS. #	DESCRIPTION	DATE
	ARCHITECT'S PROJECT NO. :	21093.20
	DESIGNER:	
	DRAFTER:	
	CHECKER:	

KEY PLAN

LEVEL 4 HVAC PIPNG PLAN - EAST

M2.04E



LEVEL 4 HVAC PIPING PLAN - WEST

SCALE: 1/8" = 1'-0"

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ARCHITECT	4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216
CIVIL	JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951
LANDSCAPE	RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855
STRUCTURAL	KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910
MECHANICAL ELECTRICAL PLUMBING	CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200
ACOUSTICAL	GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100
FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

Colorado State University

LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013
14C	COB 4C	18JUN2013

ISS. #	DESCRIPTION	DATE

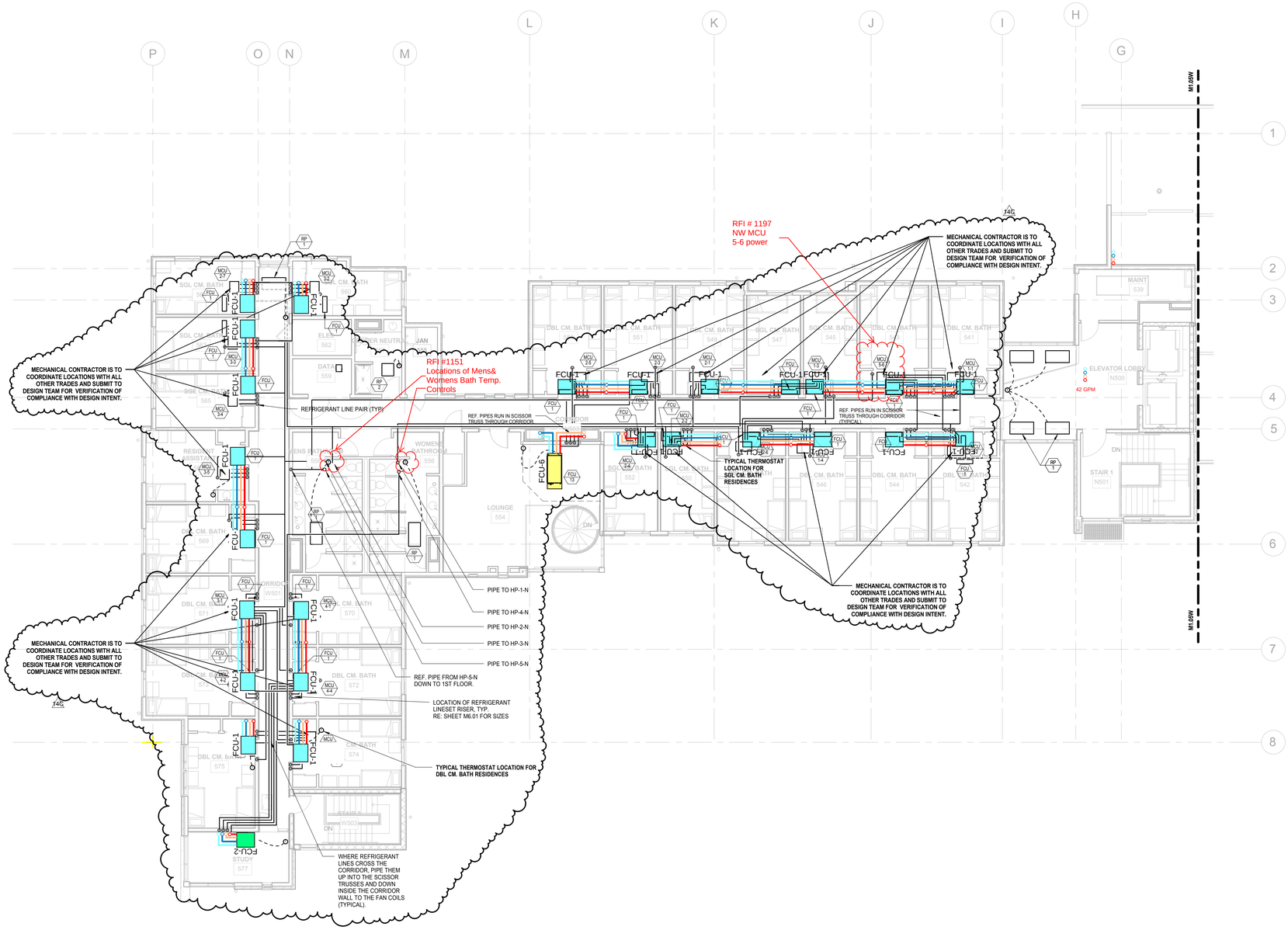
ARCHITECT'S PROJECT NO. : 21093.20
DESIGNER:
DRAFTER:
CHECKER:

KEY PLAN

LEVEL 4 HVAC PIPING PLAN - WEST

M2.04W

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LEVEL 5 HVAC PIPING PLAN - WEST

SCALE: 1/8" = 1'-0"

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LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
1	ADDENDUM 1	4DEC2012
7	FOR CONSTRUCTION	25JAN2013
14C	COB 4C	18JUN2013

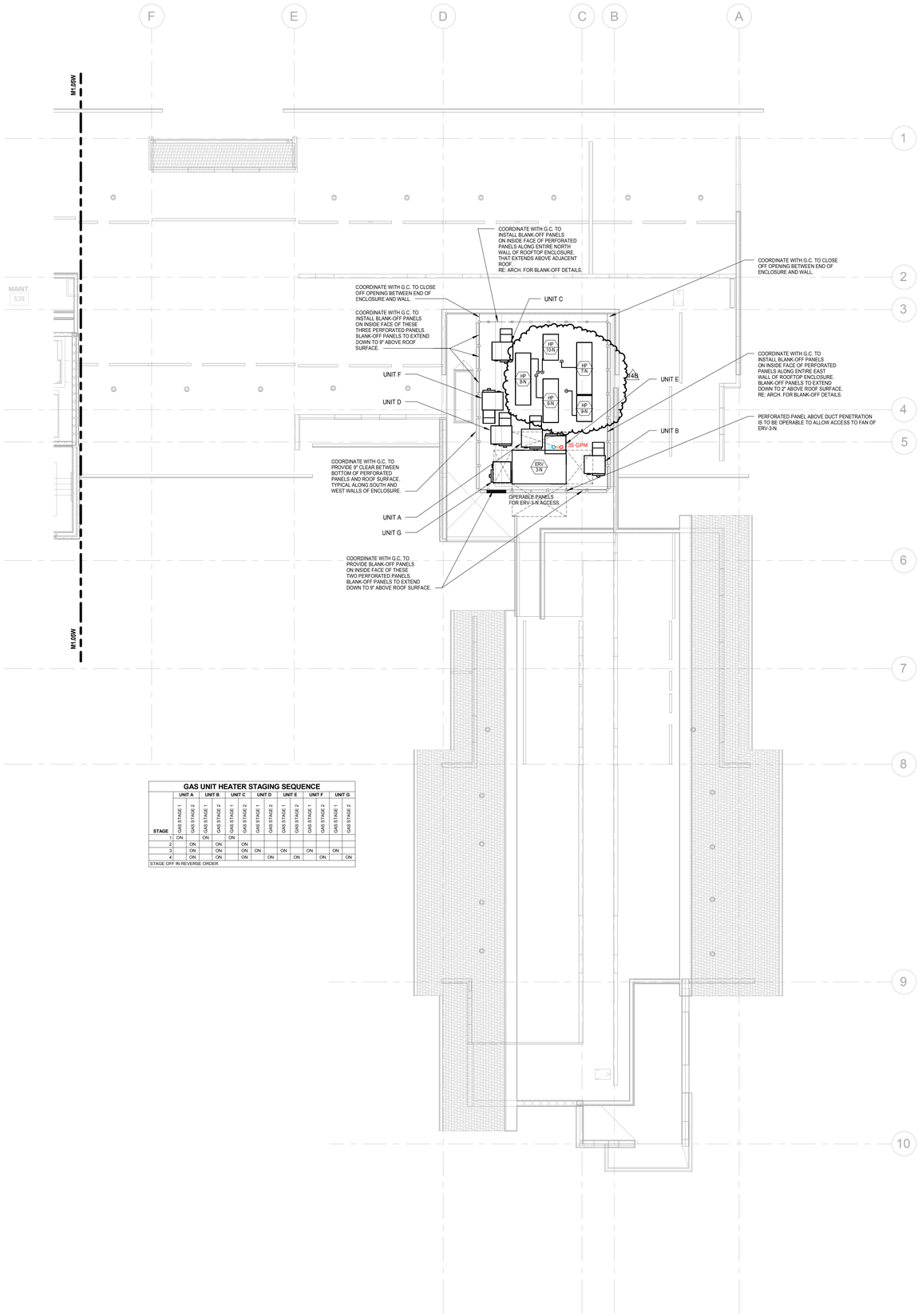
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	ARCHITECT'S PROJECT NO. :	21093.20
	DESIGNER:	
	DRAFTER:	
	CHECKER:	

KEY PLAN

LEVEL 5 HVAC PIPING PLAN - WEST

M2.05W

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GAS UNIT HEATER STAGING SEQUENCE

STAGE	UNIT A		UNIT B		UNIT C		UNIT D		UNIT E		UNIT F		UNIT G	
	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2	GAS STAGE 1	GAS STAGE 2
1	ON		ON		ON									
2		ON		ON		ON								
3		ON		ON		ON	ON		ON		ON		ON	
4		ON		ON		ON		ON		ON		ON		ON
STAGE OFF IN REVERSE ORDER														

LEVEL 5 HVAC PIPING PLAN - WEST

SCALE: 1/8" = 1'-0"

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FACADE	TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535
SUSTAINABILITY	AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

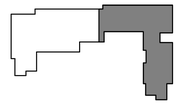
Colorado State University

LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
1	ADDENDUM 1	4DEC2012
7	FOR CONSTRUCTION	25JAN2013
14B	COB 4B	03JUN2013

ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. : 21093.20
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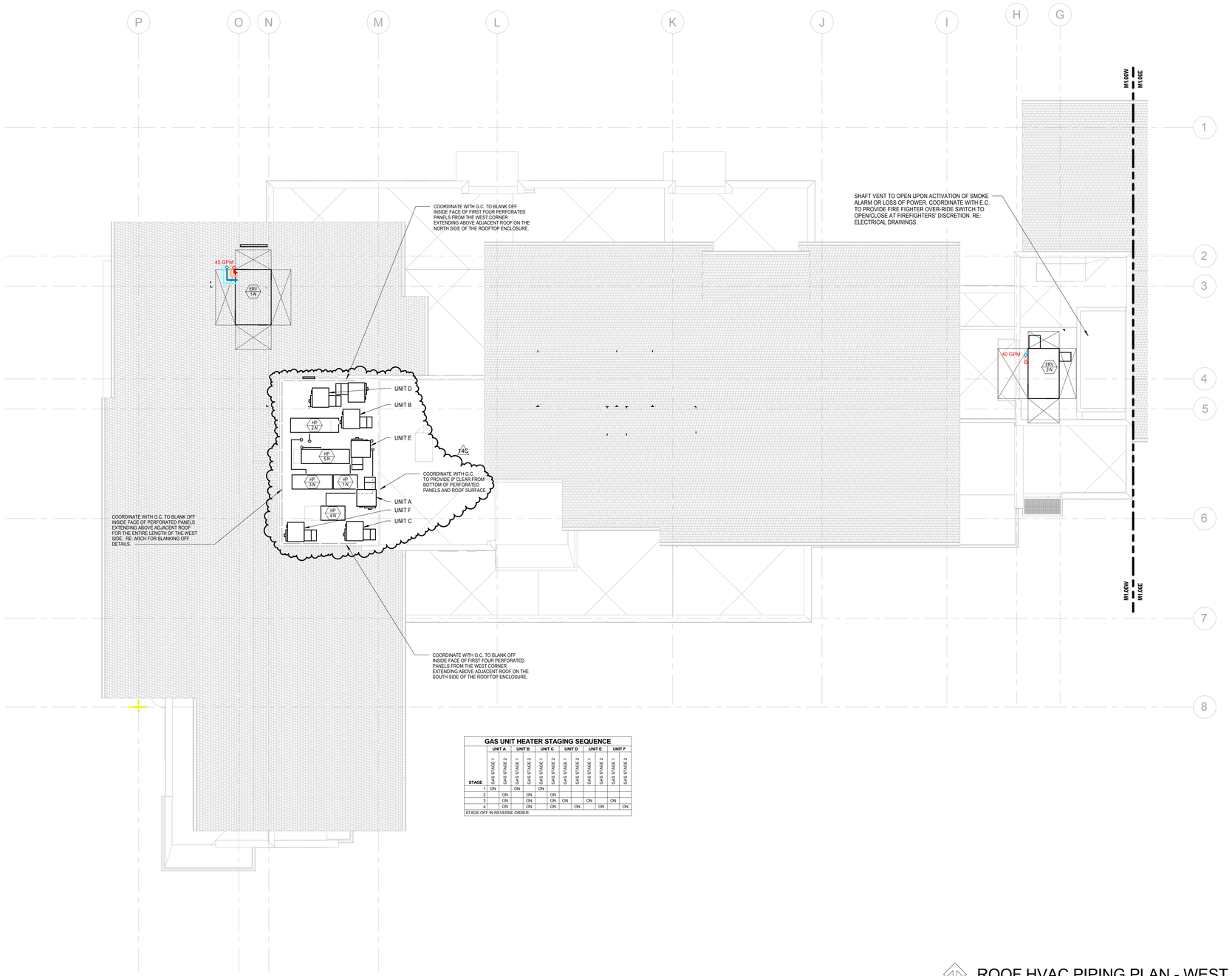


KEY PLAN

ROOF HVAC PIPING PLAN - EAST

M2.06E

6/4/2013 1:43:26 PM



GAS UNIT HEATER STAGING SEQUENCE

STAGE	UNIT A GAS STAGE 1	UNIT A GAS STAGE 2	UNIT B GAS STAGE 1	UNIT B GAS STAGE 2	UNIT C GAS STAGE 1	UNIT C GAS STAGE 2	UNIT D GAS STAGE 1	UNIT D GAS STAGE 2	UNIT E GAS STAGE 1	UNIT E GAS STAGE 2	UNIT F GAS STAGE 1	UNIT F GAS STAGE 2
1	ON		ON		ON							
2		ON		ON		ON						
3		ON		ON		ON	ON		ON		ON	
4		ON		ON		ON		ON		ON		ON

STAGE OFF IN REVERSE ORDER

ROOF HVAC PIPING PLAN - WEST

SCALE: 1/8" = 1'-0"

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ARCHITECT 4240 ARCHITECTURE INC 3507 RINGSBY CT. STE. 117 DENVER, CO 80216

CIVIL JVA, INC. 25 OLD TOWN SQUARE FORT COLLINS, CO 80524 t 303.444.1951

LANDSCAPE RUSSELL + MILLS STUDIOS 141 S. COLLEGE AVE. #104 FORT COLLINS, CO t 970.484.8855

STRUCTURAL KL&A STRUCTURAL ENGINEERS 421 E. 4TH ST. LOVELAND, CO 80537 t 303.384.9910

MECHANICAL ELECTRICAL PLUMBING CATOR, RUMA & ASSOCIATES 896 TABOR ST. LAKEWOOD, CO 80401 t 303.232.6200

ACOUSTICAL GEILER & ASSOCIATES, LLC 12355 E. CORNELL AVE. AURORA, CO 80014 t 303.766.7100

FACADE TECHNISCAN 1873 S. BELLAIRE ST. SUITE 1400 DENVER, CO 80222 t 303.329.0535

SUSTAINABILITY AMBIENT ENERGY 130 W. 5TH AVE. DENVER, CO 80204 t 303.278.1532

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LAUREL VILLAGE
NORTH - BUILDING #0157
CSU PROJECT NO. 11-039
FORT COLLINS, CO 80521

0	BID	16NOV2012
7	FOR CONSTRUCTION	25JAN2013
14C	COB 4C	18JUN2013

ISS. #	DESCRIPTION	DATE
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KEY PLAN

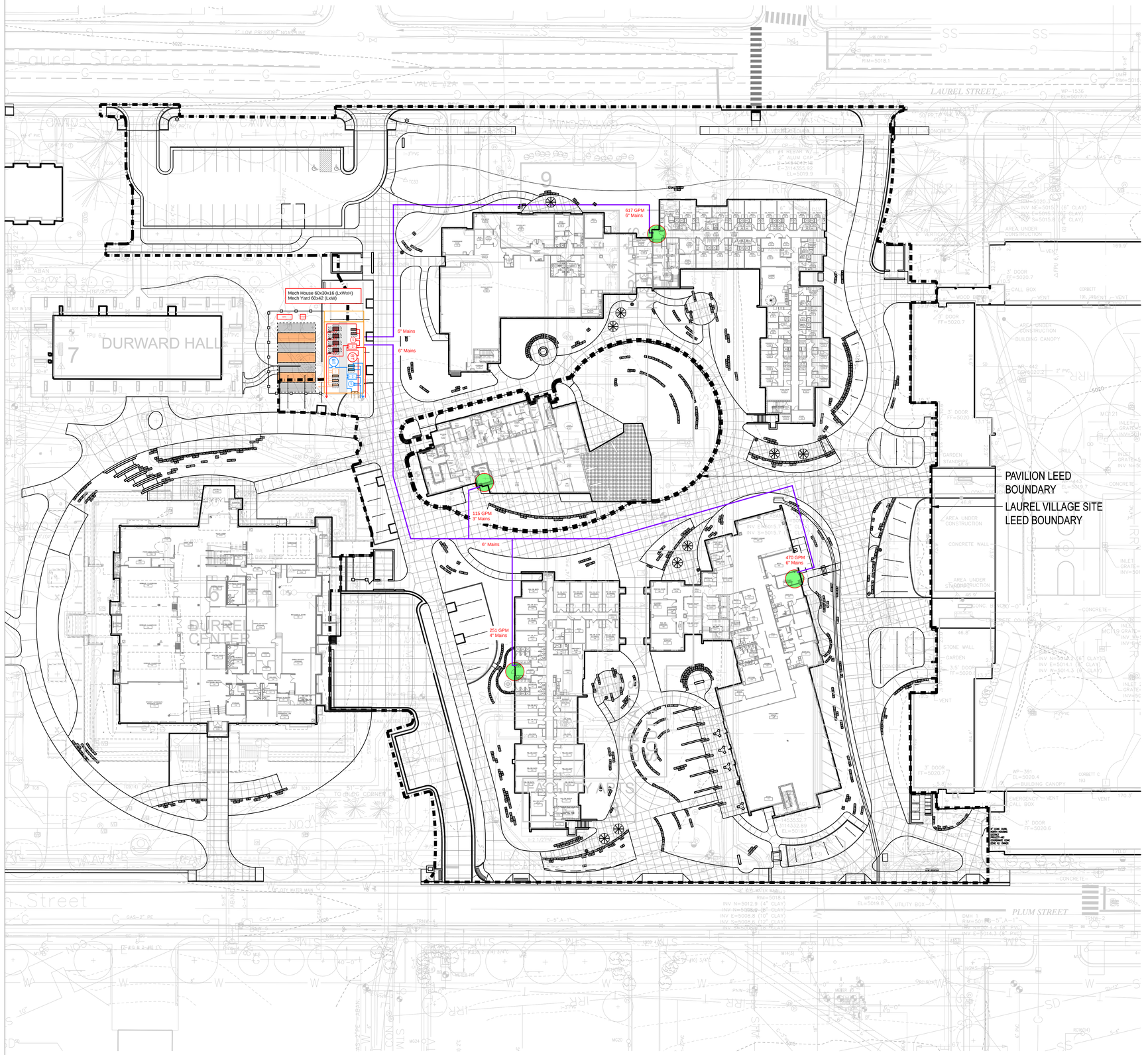
ROOF HVAC PIPING PLAN - WEST

M2.06W

6/18/2013 4:13:58 PM

Site Plan

ASHP and Mech House



A LEED BOUNDARIES
SCALE: 1"=30'-0"

30' 0 15' 30' 60' NORTH

4/20/2012 5:18:58 PM

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SUSTAINABILITY	**AMBIENT ENERGY** 130 W. 5th AVE. DENVER, CO 80204 t: 303.278.1532

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LAUREL VILLAGE
SITE WORK

CSU PROJECT NO. 11-039
FORT COLLINS, COLORADO 80521

PROJECT RECORD 02JAN2015

ISS. #	DESCRIPTION	DATE

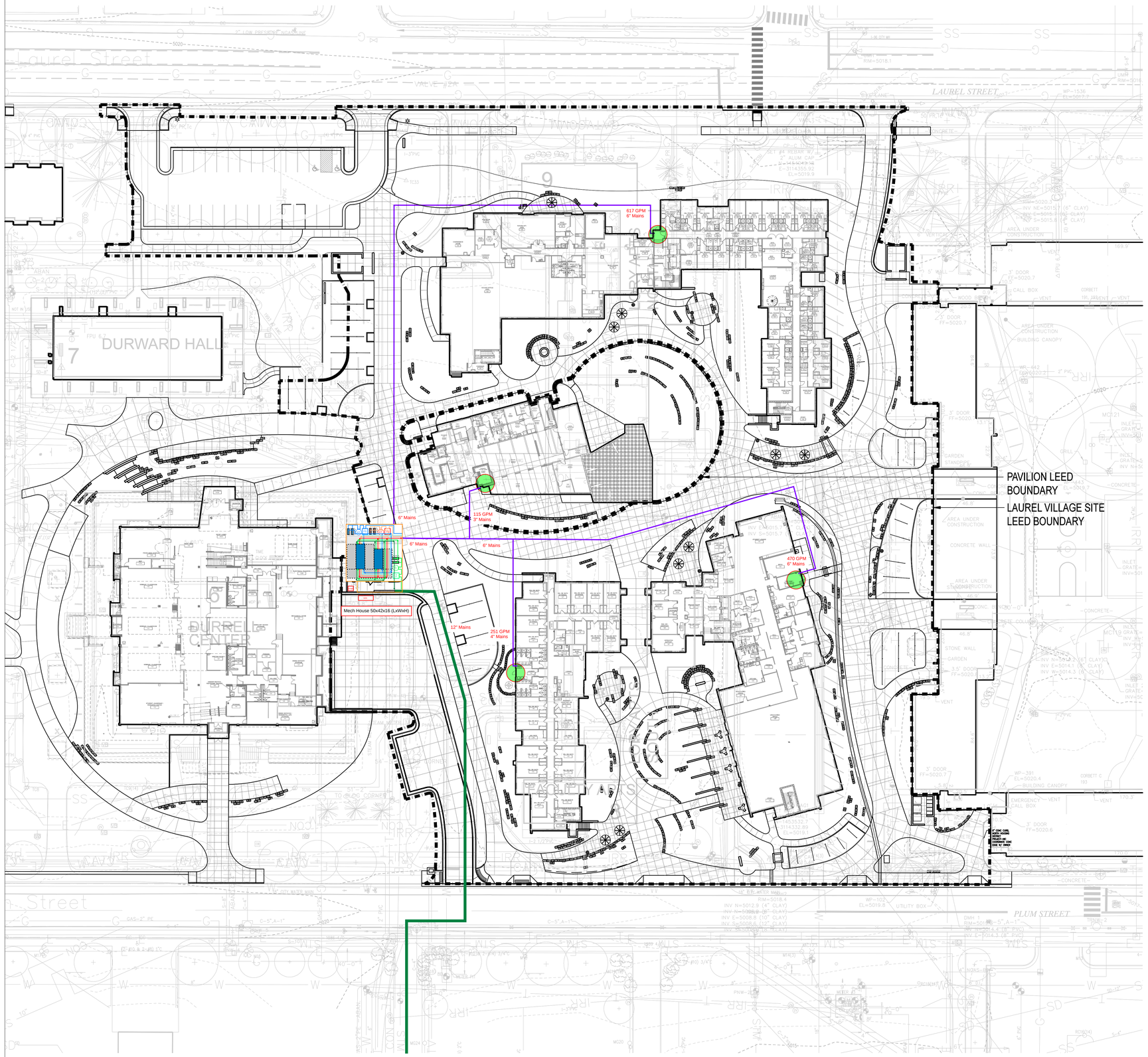
ARCHITECT'S PROJECT NO. :	21097.00
DESIGNER:	CR
DRAFTER:	JB
CHECKER:	

LEED BOUNDARIES

L1.02

Site Plan

Geothermal and Mech House



A LEED BOUNDARIES
SCALE: 1"=30'-0"

30' 0 15' 30' 60' NORTH

4/20/2012 5:18:58 PM

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MECHANICAL ELECTRICAL PLUMBING	**CATOR, RUMA & ASSOCIATES** 896 TABOR STREET LAKEWOOD, CO 80401 t: 303.232.6200
ACOUSTICAL	**GEILER & ASSOCIATES, LLC** 12355 E. CORNELL AVE. AURORA, CO 80014 t: 303.766.7100
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SUSTAINABILITY	**AMBIENT ENERGY** 130 W. 5th AVE. DENVER, CO 80204 t: 303.278.1532

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LAUREL VILLAGE
SITE WORK
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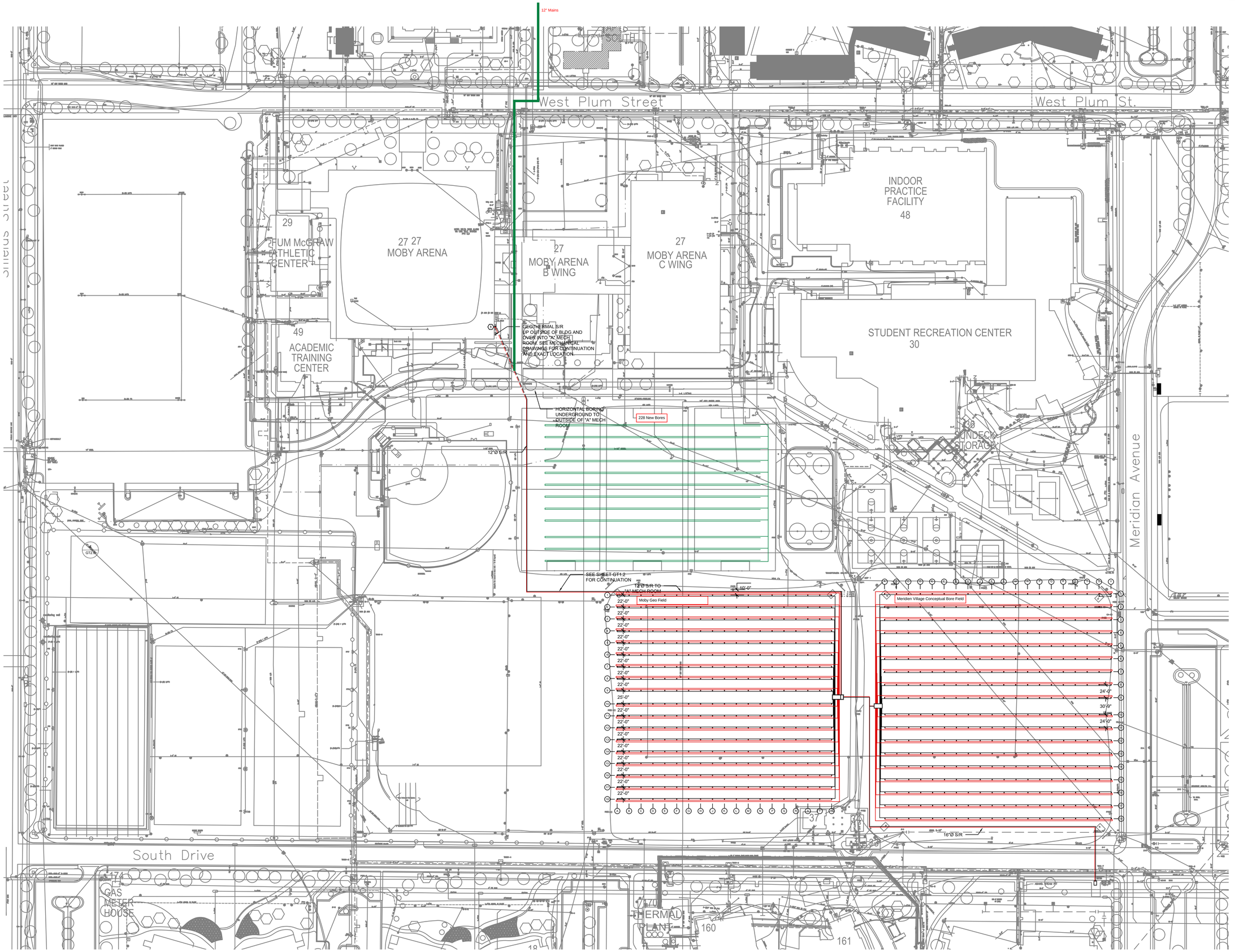
PROJECT RECORD 02JAN2015

ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO. : 21097.00
DESIGNER: CR
DRAFTER: JB
CHECKER:

LEED BOUNDARIES

L1.02



1 OVERALL GEOTHERMAL HEAT EXCHANGER SITE PLAN
1/64" = 1'-0"

GEO-ENERGY SERVICES, LLC
303-531-5292
email: info@geoenergyservices.com

MERIDIAN VILLAGE GEO-EXCHANGE
COLORADO STATE UNIVERSITY
FORT COLLINS, CO

NOT FOR CONSTRUCTION
PRELIMINARY
PRICING
ONLY

NO	ISSUE	DATE

PROJECT C19012001
DATE 04/03/2020
DRAWN EMS

SITE BOREFIELD LAYOUT

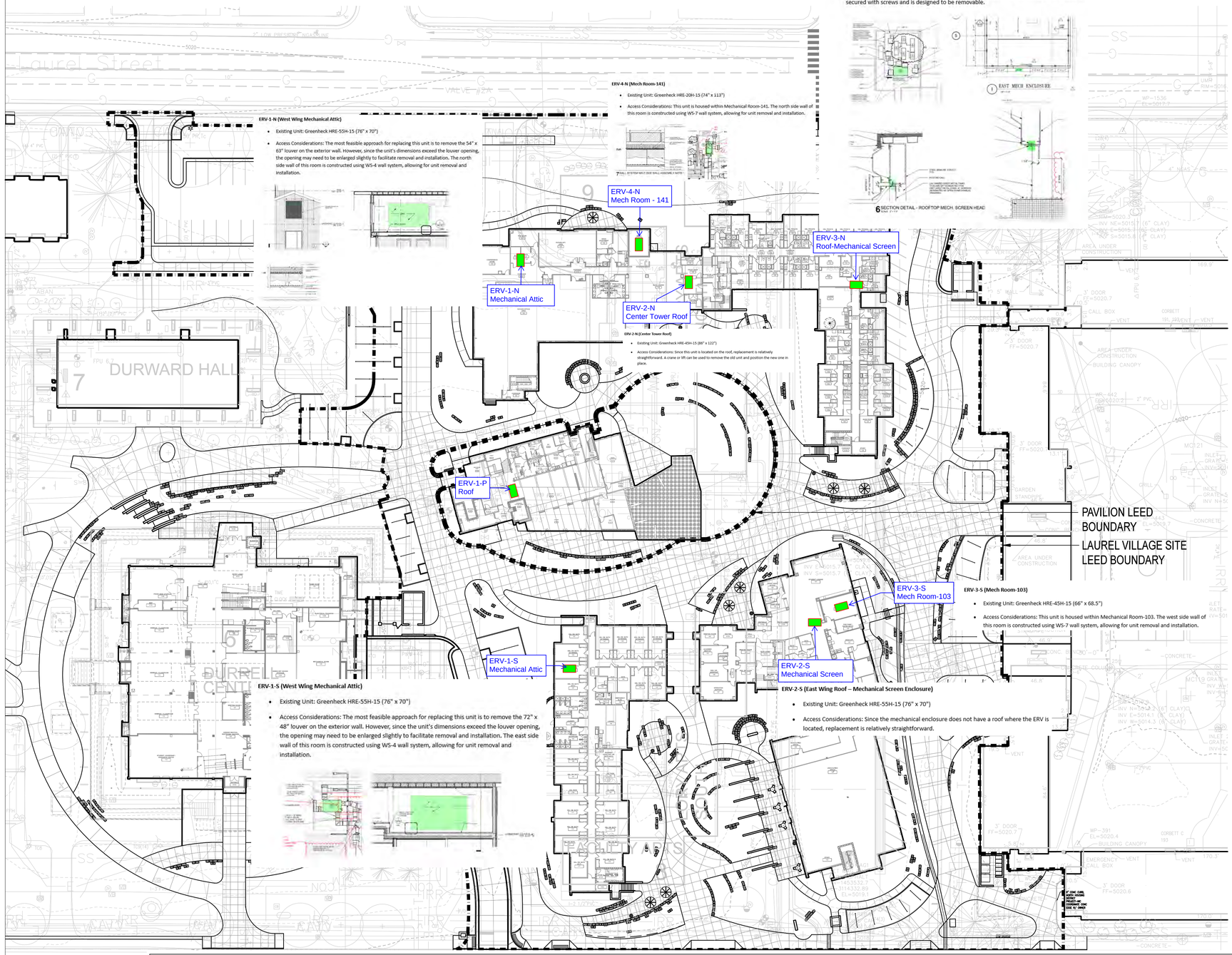
GT1.0

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PLOT DATE: 04/03/2020 10:08:29 AM
PRINTED IN LANDSCAPE

Energy Recovery Ventilator

Plan



ERV-1-N (West Wing Mechanical Attic)

- Existing Unit: Greenheck HRE-55H-15 (76" x 70")
- Access Considerations: The most feasible approach for replacing this unit is to remove the 54" x 63" louver on the exterior wall. However, since the unit's dimensions exceed the louver opening, the opening may need to be enlarged slightly to facilitate removal and installation. The north side wall of this room is constructed using WS-4 wall system, allowing for unit removal and installation.

ERV-4-N (Mech Room-141)

- Existing Unit: Greenheck HRE-20H-15 (74" x 113")
- Access Considerations: This unit is housed within Mechanical Room-141. The north side wall of this room is constructed using WS-7 wall system, allowing for unit removal and installation.

ERV-2-N (Center Tower Roof)

- Existing Unit: Greenheck HRE-45H-15 (86" x 122")
- Access Considerations: Since this unit is located on the roof, replacement is relatively straightforward. A crane or lift can be used to remove the old unit and position the new one in place.

ERV-3-N (West Wing Roof – Mechanical Screen Enclosure)

- Existing Unit: Greenheck HRE-45L-15 (66" x 68.5")
- Access Considerations: According to EAST MECH ENCLOSURE detail drawing (S6.02), the enclosure panels next to the unit provide sufficient clearance for replacement. Each panel is secured with screws and is designed to be removable.

ERV-3-S (Mech Room-103)

- Existing Unit: Greenheck HRE-45H-15 (66" x 68.5")
- Access Considerations: This unit is housed within Mechanical Room-103. The west side wall of this room is constructed using WS-7 wall system, allowing for unit removal and installation.

ERV-1-S (West Wing Mechanical Attic)

- Existing Unit: Greenheck HRE-55H-15 (76" x 70")
- Access Considerations: The most feasible approach for replacing this unit is to remove the 72" x 48" louver on the exterior wall. However, since the unit's dimensions exceed the louver opening, the opening may need to be enlarged slightly to facilitate removal and installation. The east side wall of this room is constructed using WS-4 wall system, allowing for unit removal and installation.

ERV-2-S (East Wing Roof – Mechanical Screen Enclosure)

- Existing Unit: Greenheck HRE-55H-15 (76" x 70")
- Access Considerations: Since the mechanical enclosure does not have a roof where the ERV is located, replacement is relatively straightforward.

RETROFIT HEAT RECOVERY AIR HANDLING UNIT SCHEDULE - ALPINE

BUILDING	DESIG	MFR	MODEL	OVERAL DIMENSIONS W" x L"	CFM AT 4750'	SUPPLY FAN MOTOR HP	SUPPLY FAN ESP IN. W.G	SUPPLY AIR SIDE OF SENSIBLE WHEEL WINTER CONDITIONS ELEC PREHEAT EAT °F	WHEEL LVG AIR °F	SUMMER CONDITIONS ENT AIR °F	LVG AIR °F	CFM AT 4750'	EXHAUST FAN MOTOR HP	EXHAUST FAN ESP IN. W.G	EXHAUST AIR SIDE OF SENSIBLE WHEEL WINTER CONDITIONS ENT AIR °F	LVG AIR °F	SUMMER CONDITIONS ENT AIR °F	LVG AIR °F	HEAT RECOVERY WINTER BTUH	SUMMER BTUH	OA WHEEL EFFICIENCY %	CHANGE-OVER COIL COOLING ENT AIR °F	LVG AIR °F	EWT °F	HEATING ENT AIR °F	LVG AIR °F	EWT °F	OPERATING WEIGHT (LBS)	REMARKS
ALPINE	ERV-1-N	GREENHECK	HRE-55H-15	101 x 133 1/2	5938		2.3	0		100/62		4125		1.2	70		75					100	60	45	0	60	110	3,500	1, 2, 3
ALPINE	ERV-2-N	GREENHECK	HRE-45H-15	86 x 122	5000		2.3	0		100/62		2750		1.2	70		75					100	60	45	0	60	110	2,900	1, 2, 3, 4
ALPINE	ERV-3-N	GREENHECK	HRE-45L-15	86 x 122	4063		2.3	0		100/62		3125		1.2	70		75					100	60	45	0	60	110	2,900	1, 2, 3
ALPINE	ERV-4-N	GREENHECK	HRE-20H-15	74 x 113	2500		2.3	0		100/62		1625		1.2	70		75					100	60	45	0	60	110	1,600	1, 2, 3
PAVILION	ERV-1-P	GREENHECK	HRE-45H-15	86 x 122	4375		2.3	0		100/62		3125		1.2	70		75					100	60	45	0	60	110	2900	1, 2, 3, 4
PINON	ERV-1-S	GREENHECK	HRE-55H-15	101 x 124	5938		2.3	0		100/62		4000		1.2	70		75					100	60	45	0	60	110	3,500	1, 2, 3
PINON	ERV-2-S	GREENHECK	HRE-55H-15	101 x 124	5938		2.3	0		100/62		4750		1.2	70		75					100	60	45	0	60	110	3,500	1, 2, 3, 4
PINON	ERV-3-S	GREENHECK	HRE-45H-15	86 x 122	5000		2.3	0		100/62		3875		1.2	70		75					100	60	45	0	60	110	2,900	1, 2, 3

NOTES:
1- PROVIDE WITH TOTAL HEAT RECOVERY WHEEL.
2- PROVIDE WITH ELECTRIC PREHEAT FOR WHEEL FROST PREVENTION.
3. - PROVIDE WITH MIN. MERV-13 FILTERS.
4 - OUTDOOR UNIT CONSTRUCTION

A LEED BOUNDARIES
SCALE: 1"=30'-0"

30' 0 15' 30' 60' NORTH

4/20/2012 5:18:58 PM

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HOUSING AND DINING SERVICES
DIVISION OF STUDEN AFFAIRS
1005 W. LAUREL ST.
FORT COLLINS, CO 80523-8045
t: 970.491.4752

ARCHITECT 4240 ARCHITECTURE INC
3507 RINGSBY CT. STE. 117
DENVER, CO 80216

CIVIL JVA, INC
25 OLD TOWN SQUARE
FORT COLLINS, CO 80524
t: 303.444.1951

LANDSCAPE RUSSELL + MILLS STUDIOS
141 S. COLLEGE AVE. #104
FORT COLLINS, CO
t: 970.484.8855

STRUCTURAL KL&A STRUCTURAL ENGINEERS
421 E. 4TH ST.
LOVELAND, CO 80537
t: 303.384.9910

MECHANICAL ELECTRICAL PLUMBING CATOR, RUMA & ASSOCIATES
896 TABOR STREET
LAKEWOOD, CO 80401
t: 303.232.6200

ACOUSTICAL GEILER & ASSOCIATES, LLC
12355 E. CORNELL AVE.
AURORA, CO 80014
t: 303.780.7100

FACADE TECHNISCAN
1873 S. BELLAIRE ST. SUITE 1400
DENVER, CO 80222
t: 303.329.0535

SUSTAINABILITY AMBIENT ENERGY
130 W. 5th AVE.
DENVER, CO 80204
t: 303.278.1532

Colorado State University

LAUREL VILLAGE
SITE WORK
CSU PROJECT NO. 11-039
FORT COLLINS, COLORADO 80521

PROJECT RECORD 02JAN2015

ISS. #	DESCRIPTION	DATE

ARCHITECT'S PROJECT NO.: 21097.00
DESIGNER: CR
DRAFTER: JB
CHECKER:

LEED BOUNDARIES

L1.02

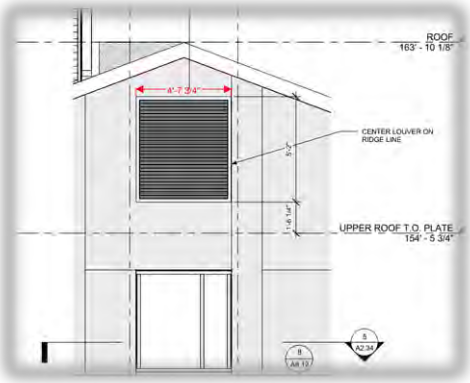
ERV Replacement Plan

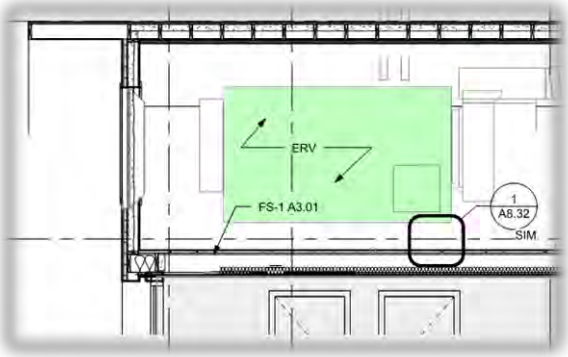
North Building

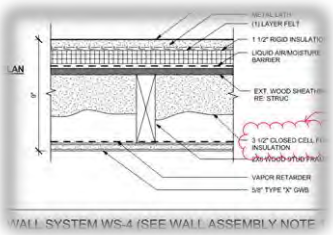
The North Building contains four Energy Recovery Ventilators (ERVs): ERV-1-N, ERV-2-N, ERV-3-N, and ERV-4-N. The process of removing the existing units and installing new replacements requires careful planning to ensure minimal disruption and structural modifications. Below are the details for each ERV location and the recommended approach for replacement:

ERV-1-N (West Wing Mechanical Attic)

- Existing Unit: Greenheck HRE-55H-15 (76" x 70")
- Access Considerations: The most feasible approach for replacing this unit is to remove the 54" x 63" louver on the exterior wall. However, since the unit's dimensions exceed the louver opening, the opening may need to be enlarged slightly to facilitate removal and installation. The north side wall of this room is constructed using WS-4 wall system, allowing for unit removal and installation.

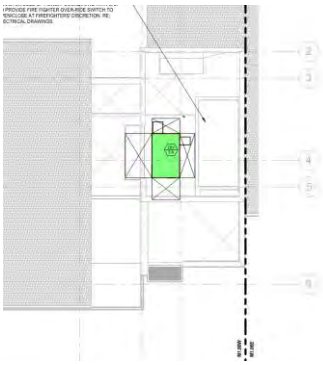






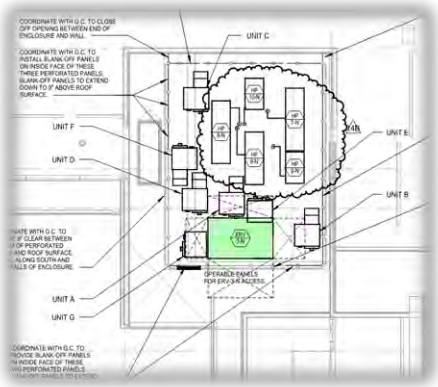
ERV-2-N (Center Tower Roof)

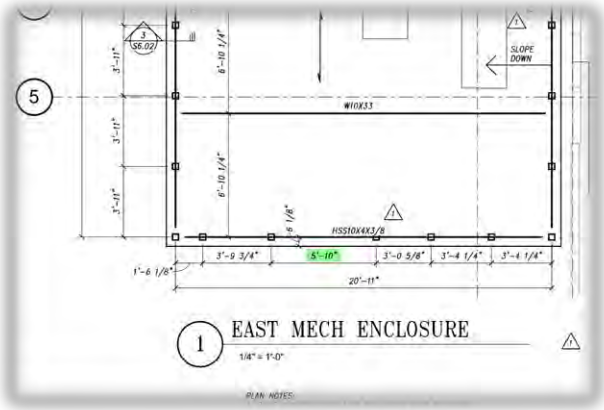
- Existing Unit: Greenheck HRE-45H-15 (86" x 122")
- Access Considerations: Since this unit is located on the roof, replacement is relatively straightforward. A crane or lift can be used to remove the old unit and position the new one in place.

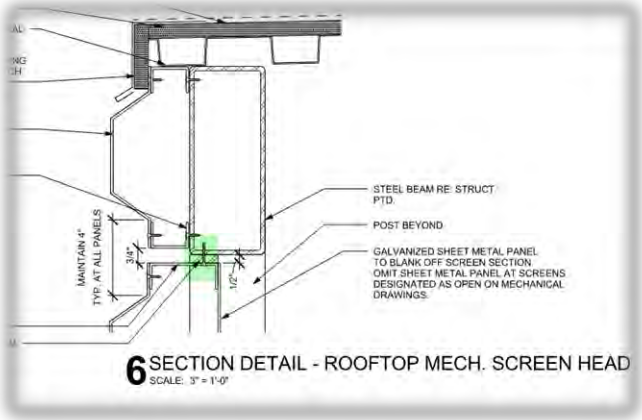


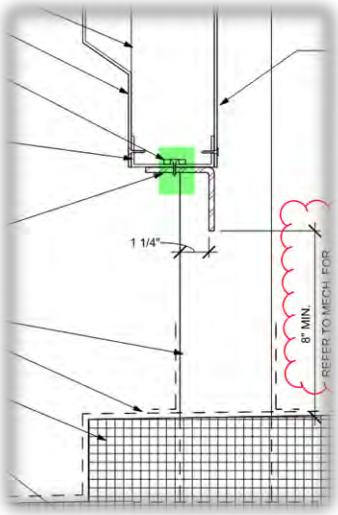
ERV-3-N (West Wing Roof – Mechanical Screen Enclosure)

- Existing Unit: Greenheck HRE-45L-15 (66" x 68.5")
- Access Considerations: According to EAST MECH ENCLOSURE detail drawing (S6.02), the enclosure panels next to the unit provide sufficient clearance for replacement. Each panel is secured with screws and is designed to be removable.



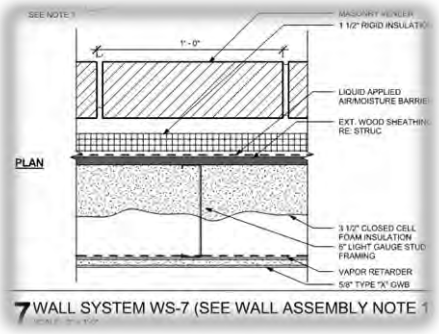


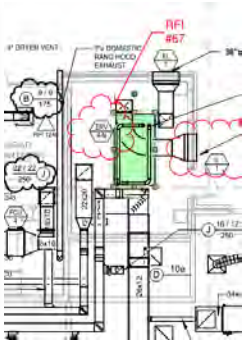




ERV-4-N (Mech Room-141)

- Existing Unit: Greenheck HRE-20H-15 (74" x 113")
- Access Considerations: This unit is housed within Mechanical Room-141. The north side wall of this room is constructed using WS-7 wall system, allowing for unit removal and installation.



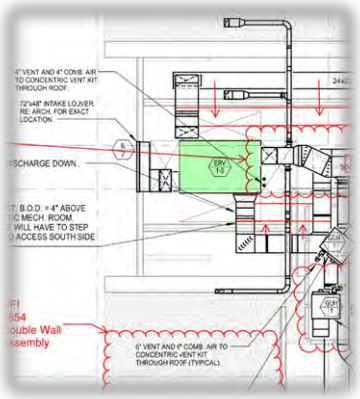


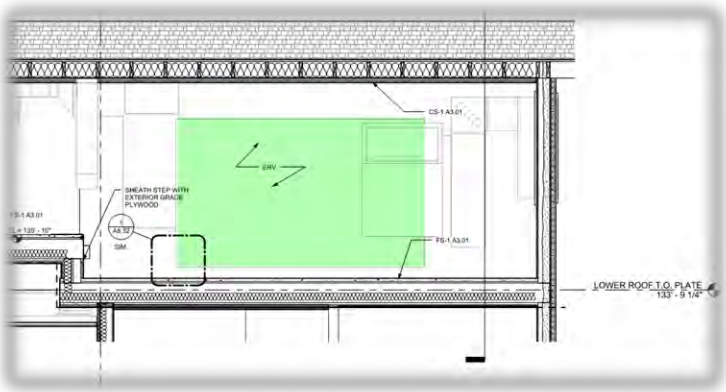
South Building

The South Building contains three Energy Recovery Ventilators (ERVs): ERV-1-S, ERV-2-S, and ERV-3-S. Below are the details for each ERV location and the recommended approach for replacement:

ERV-1-S (West Wing Mechanical Attic)

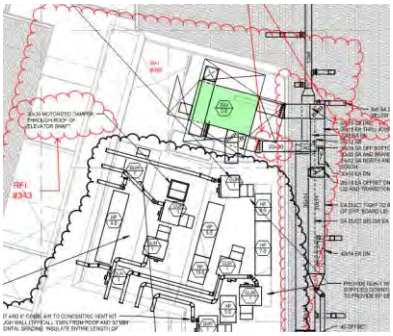
- Existing Unit: Greenheck HRE-55H-15 (76" x 70")
- Access Considerations: The most feasible approach for replacing this unit is to remove the 72" x 48" louver on the exterior wall. However, since the unit's dimensions exceed the louver opening, the opening may need to be enlarged slightly to facilitate removal and installation. The east side wall of this room is constructed using WS-4 wall system, allowing for unit removal and installation.





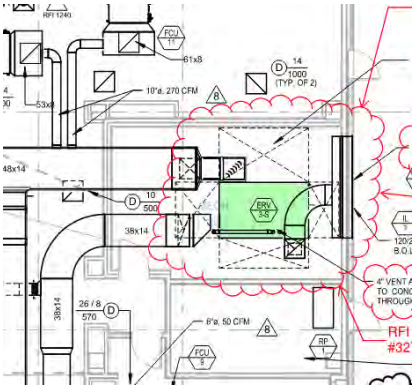
ERV-2-S (East Wing Roof – Mechanical Screen Enclosure)

- Existing Unit: Greenheck HRE-55H-15 (76" x 70")
- Access Considerations: Since the mechanical enclosure does not have a roof where the ERV is located, replacement is relatively straightforward.



ERV-3-S (Mech Room-103)

- Existing Unit: Greenheck HRE-45H-15 (66" x 68.5")
- Access Considerations: This unit is housed within Mechanical Room-103. The west side wall of this room is constructed using WS-7 wall system, allowing for unit removal and installation.



Pavilion

One ERV serves this building. Below is ERV location and the recommended approach for replacement:

ERV-1-P (Roof)

- Existing Unit: Greenheck HRE-45H-15 (66" x 68.5")
- The unit is located on the roof.



Equipment Selections

Fan & Blower Coils Submittals

Date Printed: 55555555
Spec Section: 5 - CCCC

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#	1	5	5	4
I I I I I	HHH	HHH	HHH	HHH
I	5	5	5	4
I I			1H8888	1H8888
)) I I)) I)) I)	555	585	555	455
)))))))))	5015	5015	5015	5055
) I I I) I I)) I	1155V	1155V	1155V	1155V
I I I)	154	154	154	154
I I I	1055	1055	5015	5005
I)	1025	1025	5025	5058
I)	15	15	15	15
) I I I) I)	5H	5H	5H	4H
) I I I)))	1	5	5	5
) I I I))))))	85055	85055	85055	85055
) I I I))))))))))	20055	20055	20055	20055
) I I I)))))))	45055	45055	45055	45055
) I I I) I) I II)))) I)	5084	5054	5018	5041
) I I I)) I I)))))	5055	15055	5025	8015
) I I I)))))	25055	55025	51055	55085
) I I I)))))))))	52055	55055	48055	51045
) I I I))))))	40055	55055	40025	55015
) I I I)) I) I))))) I))	0055	11015	14055	55055
) I I I) I) II))))) I))	4005	0045	5015	15085
) I I I))))))))))	15055	5025	15051	14051
) I I I)) I)	5088	5088	5088	5088
I)) I)	5H	5H	5H	5H
I))))	1	1	1	5
I)))))))	05055	05055	05055	05055
I))))))))	115055	115055	115055	115055
I)) I) I II)))) I)	1010	1054	1004	5021
I))) I I)))))	5055	8055	0025	2055
I))))))	55055	55055	55055	55055
I))))))))	155055	151085	155045	155015
I))))))) I))	5055	2055	2025	15045
I))))))))))))	5055	4005	5085	5005
I))) I)	5088	5088	5088	5088
)))) I	5055	5055	5055	5055

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5 5 55 5 055 8 5: xx

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wl)) l l)			555255245245255255555248	215205255245205255525551
) e))l)	225255555555455405455555	205255505545554554455050	005055255255255505515142	045255255255555255555248
] ll)	455515515555515485455551	515555555555555515425558		
))))l) l l)	455515515555515485455551	515555555555555515425558		

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5 5 55 5 055 8 5: xx

#	5	2	0	8
I I I I I	HHH	HHH	HHH	HHH
I	2	15	15	15
I I	1H8888	1H8888	1H8888	1H8888
)) I I)) I)) I)	555	855	885	1155
)))))))))	5015	5015	5015	5015
) I I I) I I)) I	1155V	1155V	1155V	1155V
I I I)	154	54 154	54 154	54 154
I I I	5055	2	2	0
I)	4058	0055	0055	8005
I)	15	15	15	15
) I I I) I)	5H	5H	5H	5H
) I I I)))	5	5	5	5
) I I I))))))	8505 5	8505 5	8505 5	8505 5
) I I I))))))))))	2005 5	2005 5	2005 5	2005 5
) I I I)))))))	4505 5	4505 5	4505 5	4505 5
) I I I) I) I II)))) I)	5055	2015	8088	8021
) I I I)) I I)))))	5055	11005	5045	11005
) I I I)))))	5102 5	5502 5	5505 5	5502 5
) I I I)))))))))	4805 5	5505 5	4802 5	5505 5
) I I I))))))	5105 5	5500 5	5104 5	5500 5
) I I I)) I) I))))) I))	5500 5	5201 5	4505 5	5505 5
) I I I) I) II))))) I))	1205 5	5505 5	5204 5	5504 5
) I I I)))))))))))	1508 5	1505 5	1504 8	1500 0
) I I I)) I)	5088	5088	5088	5088
I)) I)	5H	5H	5H	5H
I))))	5	5	5	5
I)))))))	0505 5	0505 5	0505 5	0505 5
I)))))))	1150 5 5	1150 5 5	1150 5 5	1150 5 5
I)) I) I II)))) I)	5050	5051	4005	4052
I))) I I)))))	5055	0055	5055	1105 5
I))))))	5405 5	5505 5	5505 5	5505 5
I)))))))	1550 5 5	1550 15	1510 5 5	5801 5
I))))))) I))	1508 5	5505 5	5101 5	5501 5
I)))))))))))	205 5	005 5	2014	5055
I))) I)	5088	5088	5088	5088
)))) I	5055	5055	5055	5055
I	H055	H055	H055	H055
wI)) I I)	215255245225255255554 8	255255245245215585555 45	215255225255255555554 0	245205255055205245585 55
) e)) I)	255205245245585555485 45	055285245245255585555 45	085255255255245215454 0	055055285255255255525 45
] II)				
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5 5 55 5 055 8 5: xx

Performance Notes

Date Printed: 3/3/2025

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.. ,,,, ,,,,,, ,,,, ,,,,, ,,,,,, ,,,,,, ,,,,,,, ,,,, ,,,,,,,,, ,,, ,,,,,,,,,,, ,,,,, ,,,,,,,,, 260, “Sound ,,,,,,, , ,, r,,,,,, ,,,, Moving and Conditioning Equipment,” for ducted discharge and casing radiated configurations.

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.. Blower ,,,,, ,,,,,, ,,,,,, ,,,,,,, ,,,, ,,,,,,,,, ,,, ,,,,,,,,,,, ,,,,, ,,,,,,,,, 260, “Sound ,,,,,,, ,,, r,,,, ,, ,,,, ,,,,,, ,,,, Conditioning Equipment,” for ducted discharge, casing radiated, and free inlet configuration.

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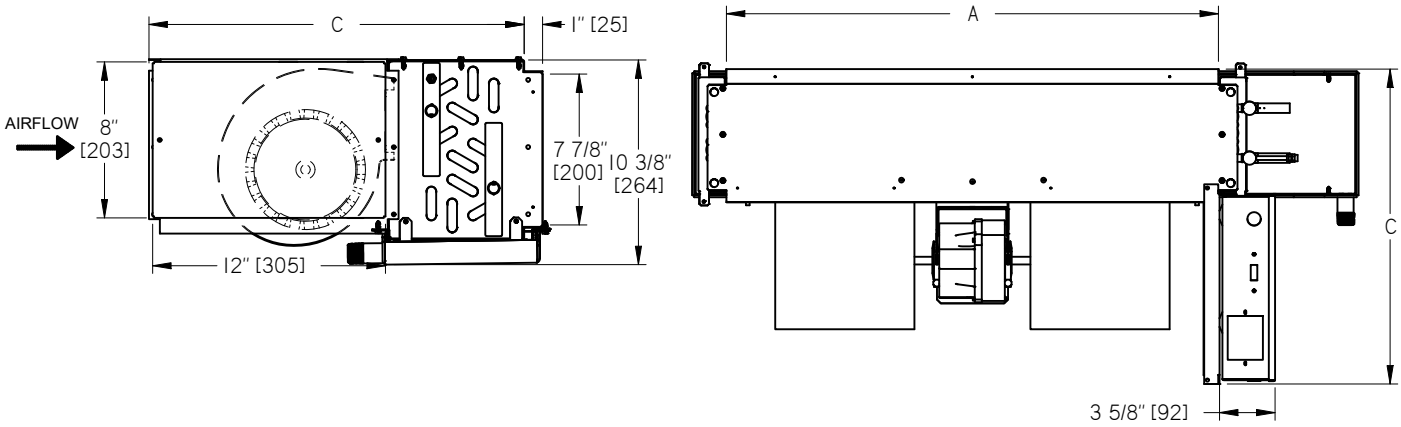
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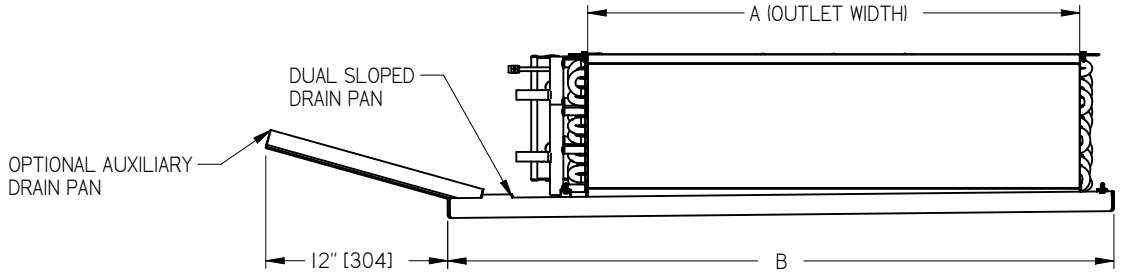
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Submittal Sheet





SIZE	NOMINAL AIRFLOW		A in. (mm)	B in. (mm)	QTY OF BLOWERS	ECM MOTOR			
						HP	TOTAL AMPS		
	CFM	l/s					115V	208/240V	277V
02	200	94	16 (406)	27 3/8 (695)	1	1/4	1.3	0.9	0.8
03	300	142	20 (508)	31 3/8 (797)	1	1/4	1.4	1.0	0.9
04	400	189	26 (660)	37 3/8 (949)	2	1/4	1.5	1.1	1.0
06	600	283	32 (813)	43 3/8 (1102)	2	1/4	2.0	1.4	1.2
08	800	378	40 (1016)	51 3/8 (1305)	2	1/4	3.5	2.3	2.3
10	1000	472	52 (1321)	63 3/8 (1610)	4	1/4 X 2	3.6	2.5	2.0
12	1200	566	60 (1524)	71 3/8 (1813)	4	1/4 X 2	4.2	2.6	2.2

WATER COIL CONFIGURATION	C in. (mm)
COOLING ONLY	19 1/2 (495)
REHEAT OR PREHEAT	23 1/2 (597)

NOTE:

1. ACTUAL NAMEPLATE AMPS MAY VARY BUT WILL NOT EXCEED VALUES SHOWN

2. RH CONTROLS AND WATER COIL SHOWN, HANDING DETERMINED BY LOOKING AT INLET

3. OPPOSITE HAND COIL AND ELECTRICAL ENCLOSURE AVAILABLE

ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT:		FAN COIL **FCH-2-1** **FAN COIL HORIZONTAL CONCEALED**
ENGINEER:	TW	
CUSTOMER:	**274875**	
SUBMITTAL DATE: 3/3/2025	SPEC. SYMBOL:	2022/12/05

Solid Edge

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STANDARD CONSTRUCTION:
- 20 GA. GALVANIZED STEEL CASING
- GALVANIZED HARDWARE
- 1" DISCHARGE DUCT CONNECTION
- INTEGRATED HANGER BRACKETS FOR SUSPENSION
- ELECTRONICALLY COMMUNTATED MOTOR (ECM)

WATER COILS:
- WATER COIL EQUIPPED WITH GALVANIZED STEEL DRAIN PAN EXTERNALLY INSULATED WITH FIBER FREE FOAM
- 3/4" NPT DRAIN CONNECTION
- COILS - 1/2" O.D. COPPER TUBES, ALUMINUM SINE WAVE FINS, 5/8" O.D. CONNECTIONS

UNIT OPTIONS:

ELECTRICAL:
- ☐ 24V TRANSFORMER
- ☐ DISCONNECT SWITCH
- ☐ MOTOR FUSING
- ☐ CONTROL CIRCUIT FUSING

ACCESSORIES:
- ☐ STAINLESS STEEL DRAIN PAN
- ☐ SECONDARY DRAIN
- ☐ AUXILIARY DRAIN PAN
- ☐ OVERFLOW SAFETY SWITCH

- ☐ 3 SPEED PROGRAM (ECM ONLY)
- ☐ MODULATING PROGRAM (ECM ONLY)

COIL CONFIGURATION:

COOLING ONLY:	REHEAT (C/H):	PREHEAT (H/C):
☐ 1 ROW	☐ 2/1 ROW	☐ 1/2 ROW
☐ 2 ROW	☐ 2/2 ROW	☐ 2/2 ROW
☐ 3 ROW	☐ 3/1 ROW	☐ 1/3 ROW
☐ 4 ROW	☐ 3/2 ROW	☐ 2/3 ROW
☐ 5 ROW	☐ 4/1 ROW	☐ 1/4 ROW
	☐ 4/2 ROW	☐ 2/4 ROW
	☐ 5/1 ROW	☐ 1/5 ROW
	☐ 5/2 ROW	☐ 2/5 ROW

ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT:		
ENGINEER:	TW	FAN COIL **FCH-2-1** **FAN COIL HORIZONTAL CONCEALED**
CUSTOMER:	**274875**	
SUBMITTAL DATE: 3/3/2025	SPEC. SYMBOL:	2022/12/05

Solid Edge

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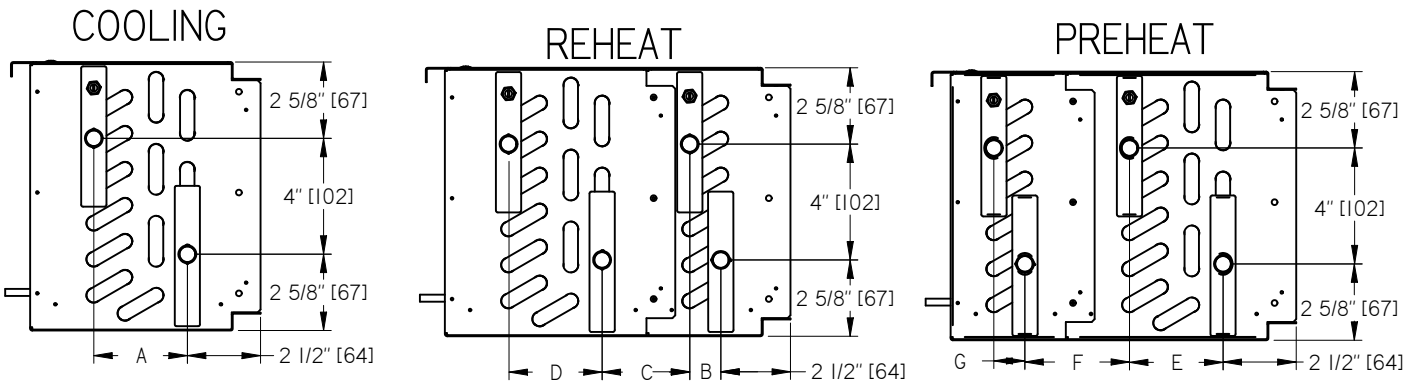
UNIT + COOLING COIL WEIGHT LBS (KG)							
ROW COOLING	SIZE						
	2	3	4	6	8	10	12
2 ROWS	25 (11)	33 (15)	38 (17)	43 (20)	43 (20)	73 (33)	81 (37)
3 ROWS	30 (14)	38 (17)	45 (20)	51 (23)	65 (29)	85 (39)	95 (43)
4 ROWS	35 (16)	44 (20)	52 (24)	59 (27)	74 (34)	97 (44)	109 (49)
5 ROWS	40 (18)	50 (23)	59 (27)	67 (30)	84 (38)	110 (50)	123 (56)

HOT WATER COIL WEIGHT LBS (KG)							
ROW HEATING	SIZE						
	2	3	4	6	8	10	12
1 ROW	3 (1)	4 (2)	5 (2)	6 (3)	7 (3)	8 (4)	9 (4)
2 ROWS	7 (3)	8 (4)	10 (5)	12 (5)	14 (6)	17 (8)	20 (9)

NOTE: ALL COIL WEIGHTS ARE WET

COOLING		REHEAT				PREHEAT			
ROWS	A in. (mm)	ROWS (CW/HW)	B in. (mm)	C in. (mm)	D in. (mm)	ROWS (HW/CW)	E in. (mm)	F in. (mm)	G in. (mm)
2	1 1/8 (29)	2/1	0	4 (102)	1 1/8 (29)	1/2	1 1/8 (29)	1 1/2 (38)	0
		3/1	0	4 (102)	2 1/8 (54)	1/3	2 1/8 (54)	2 1/2 (64)	0
3	2 1/8 (54)	4/1	0	4 (102)	3 1/4 (83)	1/4	3 1/4 (83)	3 5/8 (92)	0
		5/1	0	4 (102)	4 3/8 (111)	1/5	4 3/8 (111)	4 3/4 (121)	0
4	3 1/4 (83)	2/2	1 1/8 (29)	3 (76)	1 1/8 (29)	2/2	1 1/8 (29)	1 1/2 (38)	1 1/8 (29)
		3/2	1 1/8 (29)	3 (76)	2 1/8 (54)	2/3	2 1/8 (54)	2 1/2 (64)	1 1/8 (29)
5	4 3/8 (111)	4/2	1 1/8 (29)	3 (76)	3 1/4 (83)	2/4	3 1/4 (83)	3 5/8 (92)	1 1/8 (29)
		5/2	1 1/8 (29)	3 (76)	4 3/8 (111)	2/5	4 3/8 (111)	4 3/4 (121)	1 1/8 (29)

AIRFLOW



ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT:		
ENGINEER:	TW	FAN COIL **FCH-2-1** **FAN COIL HORIZONTAL CONCEALED**
CUSTOMER:	**274875**	
SUBMITTAL DATE: 3/3/2025	SPEC. SYMBOL:	2022/12/05

Solid Edge

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Issued date	Blank qty	Part qty	Factory order no	Completion date	Sch date	Comment/Tag	Operator Initials

LINE LEGEND

- FACTORY ELECTRICAL CONNECTION
- FIELD ELECTRICAL CONNECTION
- OPTIONAL ELECTRICAL CONNECTION

LEGEND

TB–TB1 – TERMINAL BLOCK
L1 – LINE CONNECTION
G – GROUND; N – NEUTRAL
OPT. – OPTIONAL
ECM – ELECTRICALLY COMMUTATED MOTOR
B.A.S. – BUILDING AUTOMATION SYSTEM
TR – TRANSFORMER
DSW – DISCONNECT SWITCH
FSC – FAN SPEED CONTROL
CCF – CONTROL CIRCUIT FUSE
MFUs – MOTOR FUSE(s)
OFS – OVERFLOW SWITCH

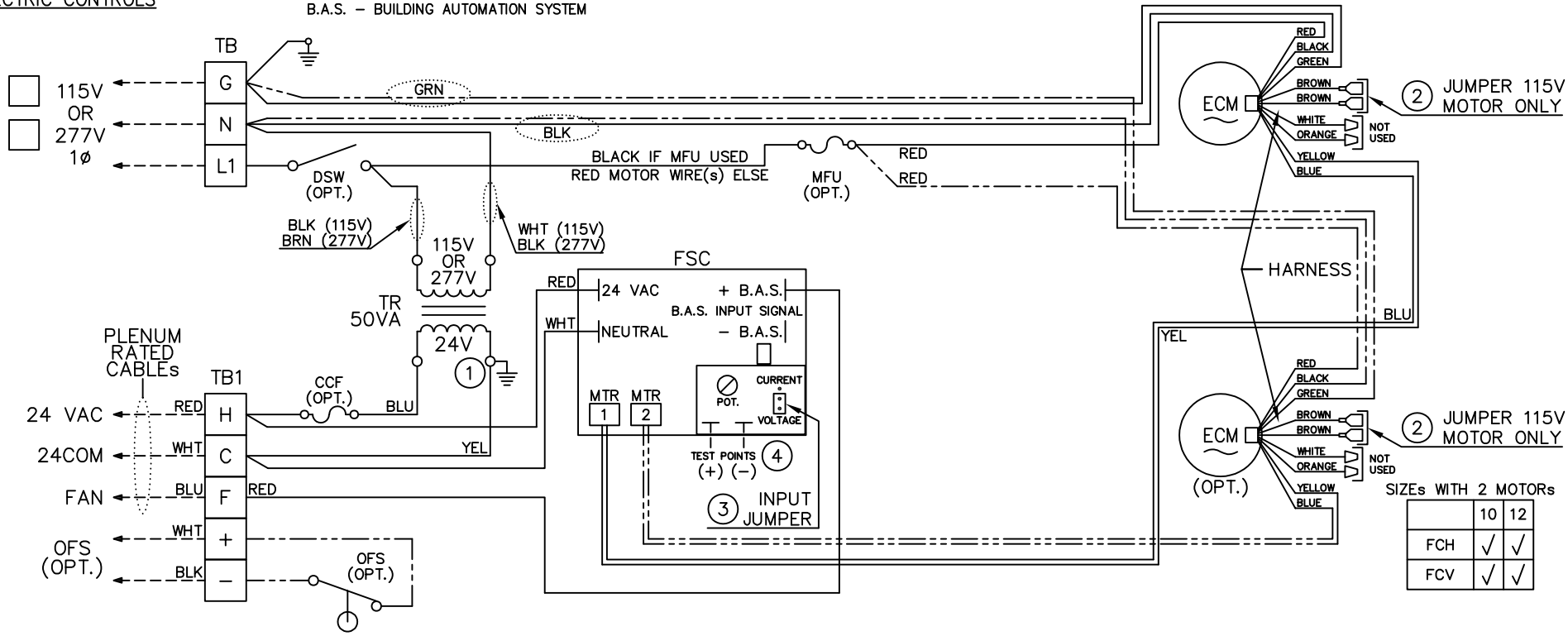
FUSES

1. CCF/MFUs – REPLACE WITH BUSSMAN FNQ RATED 500V, ____ AMP

WIRING NOTES

1. USE COPPER 75 C MIN. RATED SUPPLY WIRE FOR FIELD CONNECTIONS
2. FIELD LOW VOLTAGE WIRING INSULATION MUST HAVE 600V RATING

DDC/ELECTRIC CONTROLS



SIZEs WITH 2 MOTORs

	10	12
FCH	√	√
FCV	√	√

B.A.S. CONTROL

- THE B.A.S. INPUT SIGNAL TO THE SPEED CONTROLLER IS JUMPER SELECTABLE FOR 0–10 VDC OR 0–20 mA (3)
- B.A.S. INPUT SIGNAL TO THE SPEED CONTROL:
  2–10 VDC (4–20 mA) = MIN TO MAX AIRFLOW PER CFM CHARTs
  1–2 VDC (2–4 mA) = B.A.S. FAN OFF
  NO SIGNAL (0–1 VDC, 0–2 mA) = MANUAL SPEED ADJUSTMENT

OPTIONAL EQUIPMENT

MANUFACTURING USE ONLY

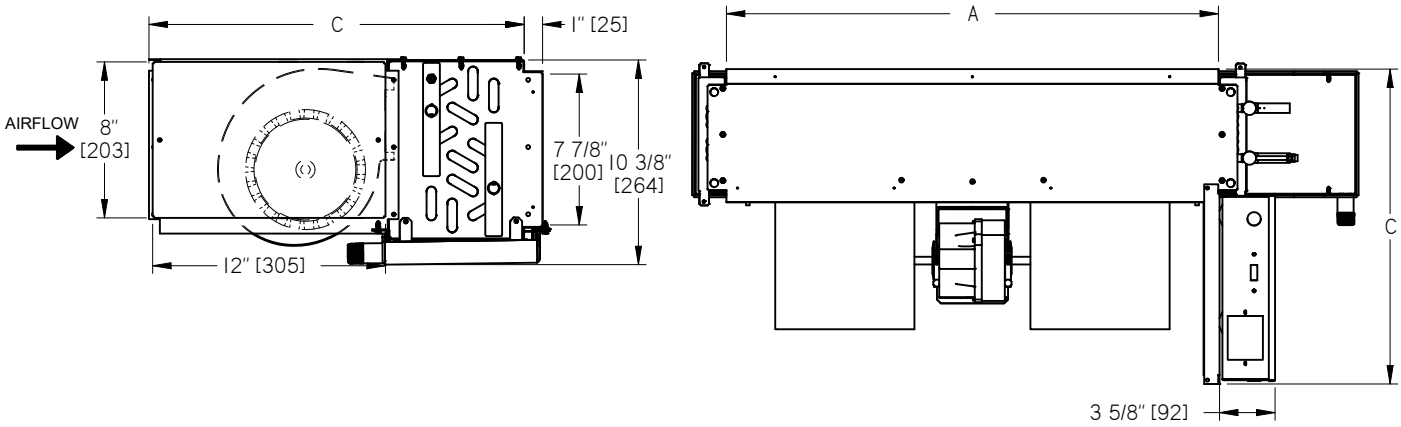
- ☐ SECOND MOTOR
- ☐ OVERFLOW SWITCH (OFS)
- ☐ DISCONNECT SWITCH (DSW)
- ☐ CONTROL CIRCUIT FUSE (CCF)
- ☐ MOTOR FUSEs (MFUs)

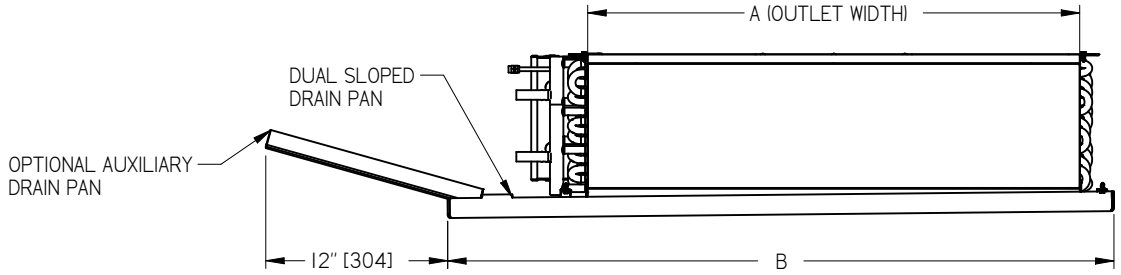
NOTES

- (4) TEST POINTs FOR MONITORING MANUAL SPD. CONTROL SETTING:
  1–4.5 VDC = MINIMUM TO MAXIMUM AIRFLOW AS PER CFM CHARTs
  0–1 VDC = FAN OFF
- (2) JUMPER BETWEEN BROWN WIREs ON MOTOR HARNESS:
  1. REQUIRED FOR 115V MOTORs
  2. MUST BE ABSENT FOR 208V, 240V, AND 277V MOTORs
- (1) SECONDARY SIDE OF THE TRANSFORMER MUST BE GROUNDED WHEN THE PRIMARY VOLTAGE EXCEEDS 150 VAC

ECN				price®	Description	WIRING DIAGRAM FAN COIL or FAN TERMINAL 115 or 277V 1ø, PIKA ECM MOTORs VARIABLE VOLUME
Date				Drawn by: NCW	Scale: NTS	
Revision				Appr'd	Date (yyyy/mm/dd): 2024/05/09	Drawing no.: CXYA7123 / Revision: C / Sheet: 1 of 1

Submittal Sheet





SIZE	NOMINAL AIRFLOW		A in. (mm)	B in. (mm)	QTY OF BLOWERS	ECM MOTOR			
						HP	TOTAL AMPS		
	CFM	l/s					115V	208/240V	277V
02	200	94	16 (406)	27 3/8 (695)	1	1/4	1.3	0.9	0.8
03	300	142	20 (508)	31 3/8 (797)	1	1/4	1.4	1.0	0.9
04	400	189	26 (660)	37 3/8 (949)	2	1/4	1.5	1.1	1.0
06	600	283	32 (813)	43 3/8 (1102)	2	1/4	2.0	1.4	1.2
08	800	378	40 (1016)	51 3/8 (1305)	2	1/4	3.5	2.3	2.3
10	1000	472	52 (1321)	63 3/8 (1610)	4	1/4 X 2	3.6	2.5	2.0
12	1200	566	60 (1524)	71 3/8 (1813)	4	1/4 X 2	4.2	2.6	2.2

WATER COIL CONFIGURATION	C in. (mm)
COOLING ONLY	19 1/2 (495)
REHEAT OR PREHEAT	23 1/2 (597)

NOTE:

1. ACTUAL NAMEPLATE AMPS MAY VARY BUT WILL NOT EXCEED VALUES SHOWN

2. RH CONTROLS AND WATER COIL SHOWN, HANDING DETERMINED BY LOOKING AT INLET

3. OPPOSITE HAND COIL AND ELECTRICAL ENCLOSURE AVAILABLE

ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT:		FAN COIL **FCH-2-1** **FAN COIL HORIZONTAL CONCEALED**
ENGINEER:	TW	
CUSTOMER:	**274875**	
SUBMITTAL DATE: 3/3/2025	SPEC. SYMBOL:	2022/12/05

Solid Edge

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STANDARD CONSTRUCTION:
- 20 GA. GALVANIZED STEEL CASING
- GALVANIZED HARDWARE
- 1" DISCHARGE DUCT CONNECTION
- INTEGRATED HANGER BRACKETS FOR SUSPENSION
- ELECTRONICALLY COMMUNTATED MOTOR (ECM)

WATER COILS:
- WATER COIL EQUIPPED WITH GALVANIZED STEEL DRAIN PAN EXTERNALLY INSULATED WITH FIBER FREE FOAM
- 3/4" NPT DRAIN CONNECTION
- COILS - 1/2" O.D. COPPER TUBES, ALUMINUM SINE WAVE FINS, 5/8" O.D. CONNECTIONS

UNIT OPTIONS:

ELECTRICAL:
- ☐ 24V TRANSFORMER
- ☐ DISCONNECT SWITCH
- ☐ MOTOR FUSING
- ☐ CONTROL CIRCUIT FUSING

ACCESSORIES:
- ☐ STAINLESS STEEL DRAIN PAN
- ☐ SECONDARY DRAIN
- ☐ AUXILIARY DRAIN PAN
- ☐ OVERFLOW SAFETY SWITCH

- ☐ 3 SPEED PROGRAM (ECM ONLY)
- ☐ MODULATING PROGRAM (ECM ONLY)

COIL CONFIGURATION:

COOLING ONLY:	REHEAT (C/H):	PREHEAT (H/C):
☐ 1 ROW	☐ 2/1 ROW	☐ 1/2 ROW
☐ 2 ROW	☐ 2/2 ROW	☐ 2/2 ROW
☐ 3 ROW	☐ 3/1 ROW	☐ 1/3 ROW
☐ 4 ROW	☐ 3/2 ROW	☐ 2/3 ROW
☐ 5 ROW	☐ 4/1 ROW	☐ 1/4 ROW
	☐ 4/2 ROW	☐ 2/4 ROW
	☐ 5/1 ROW	☐ 1/5 ROW
	☐ 5/2 ROW	☐ 2/5 ROW

ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT:		
ENGINEER:	TW	FAN COIL **FCH-2-1** **FAN COIL HORIZONTAL CONCEALED**
CUSTOMER:	**274875**	
SUBMITTAL DATE: 3/3/2025	SPEC. SYMBOL:	2022/12/05

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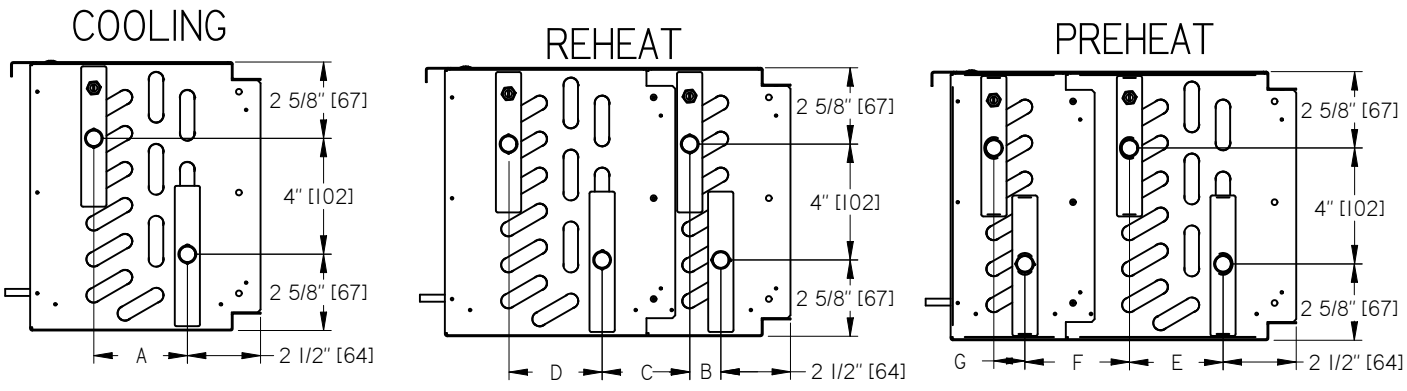
UNIT + COOLING COIL WEIGHT LBS (KG)							
ROW COOLING	SIZE						
	2	3	4	6	8	10	12
2 ROWS	25 (11)	33 (15)	38 (17)	43 (20)	43 (20)	73 (33)	81 (37)
3 ROWS	30 (14)	38 (17)	45 (20)	51 (23)	65 (29)	85 (39)	95 (43)
4 ROWS	35 (16)	44 (20)	52 (24)	59 (27)	74 (34)	97 (44)	109 (49)
5 ROWS	40 (18)	50 (23)	59 (27)	67 (30)	84 (38)	110 (50)	123 (56)

HOT WATER COIL WEIGHT LBS (KG)							
ROW HEATING	SIZE						
	2	3	4	6	8	10	12
1 ROW	3 (1)	4 (2)	5 (2)	6 (3)	7 (3)	8 (4)	9 (4)
2 ROWS	7 (3)	8 (4)	10 (5)	12 (5)	14 (6)	17 (8)	20 (9)

NOTE: ALL COIL WEIGHTS ARE WET

COOLING		REHEAT				PREHEAT			
ROWS	A in. (mm)	ROWS (CW/HW)	B in. (mm)	C in. (mm)	D in. (mm)	ROWS (HW/CW)	E in. (mm)	F in. (mm)	G in. (mm)
2	1 1/8 (29)	2/1	0	4 (102)	1 1/8 (29)	1/2	1 1/8 (29)	1 1/2 (38)	0
		3/1	0	4 (102)	2 1/8 (54)	1/3	2 1/8 (54)	2 1/2 (64)	0
3	2 1/8 (54)	4/1	0	4 (102)	3 1/4 (83)	1/4	3 1/4 (83)	3 5/8 (92)	0
		5/1	0	4 (102)	4 3/8 (111)	1/5	4 3/8 (111)	4 3/4 (121)	0
4	3 1/4 (83)	2/2	1 1/8 (29)	3 (76)	1 1/8 (29)	2/2	1 1/8 (29)	1 1/2 (38)	1 1/8 (29)
		3/2	1 1/8 (29)	3 (76)	2 1/8 (54)	2/3	2 1/8 (54)	2 1/2 (64)	1 1/8 (29)
5	4 3/8 (111)	4/2	1 1/8 (29)	3 (76)	3 1/4 (83)	2/4	3 1/4 (83)	3 5/8 (92)	1 1/8 (29)
		5/2	1 1/8 (29)	3 (76)	4 3/8 (111)	2/5	4 3/8 (111)	4 3/4 (121)	1 1/8 (29)

AIRFLOW



ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT:		
ENGINEER:	TW	FAN COIL **FCH-2-1** **FAN COIL HORIZONTAL CONCEALED**
CUSTOMER:	**274875**	
SUBMITTAL DATE: 3/3/2025	SPEC. SYMBOL:	2022/12/05

Solid Edge

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Issued date	Blank qty	Part qty	Factory order no	Completion date	Sch date	Comment/Tag	Operator Initials

LINE LEGEND

- FACTORY ELECTRICAL CONNECTION
- FIELD ELECTRICAL CONNECTION
- OPTIONAL ELECTRICAL CONNECTION

LEGEND

TB–TB1 – TERMINAL BLOCK
L1 – LINE CONNECTION
G – GROUND; N – NEUTRAL
OPT. – OPTIONAL
ECM – ELECTRICALLY COMMUTATED MOTOR
B.A.S. – BUILDING AUTOMATION SYSTEM
TR – TRANSFORMER
DSW – DISCONNECT SWITCH
FSC – FAN SPEED CONTROL
CCF – CONTROL CIRCUIT FUSE
MFUs – MOTOR FUSE(s)
OFS – OVERFLOW SWITCH

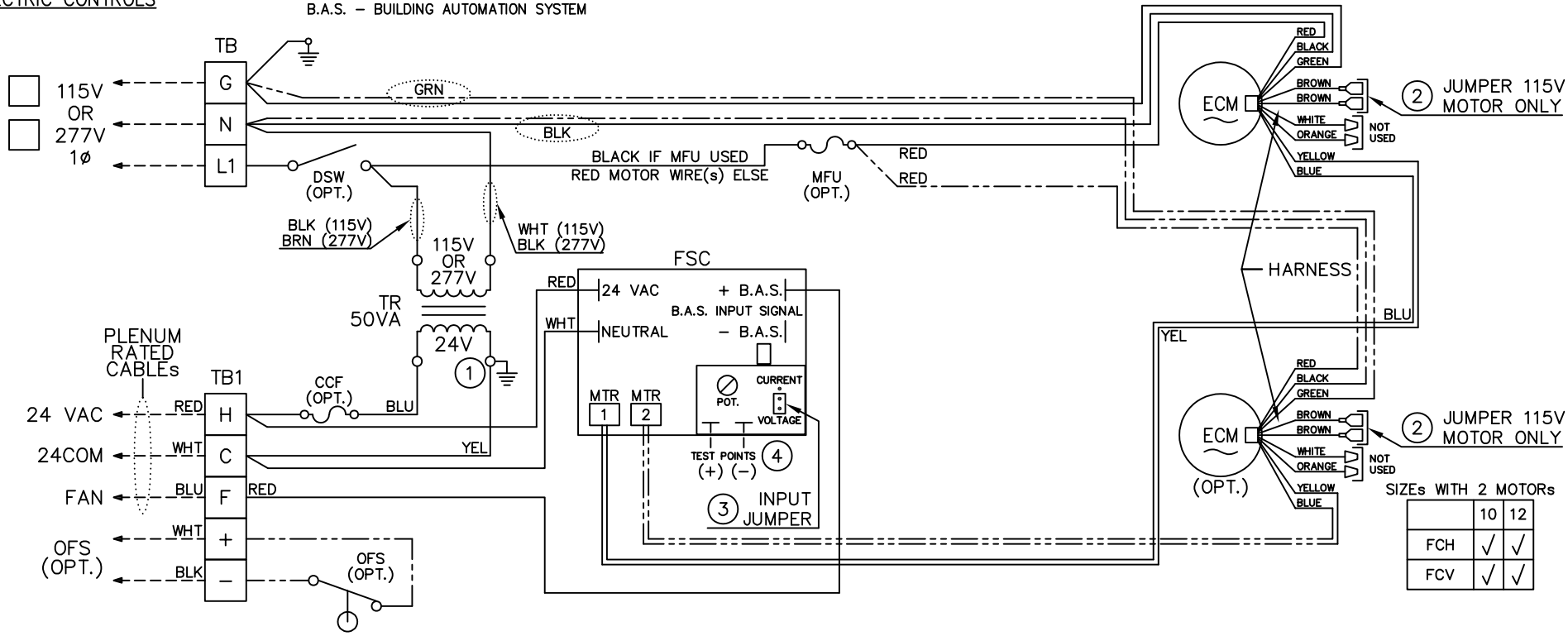
FUSES

1. CCF/MFUs – REPLACE WITH BUSSMAN FNQ RATED 500V, ____ AMP

WIRING NOTES

1. USE COPPER 75 C MIN. RATED SUPPLY WIRE FOR FIELD CONNECTIONS
2. FIELD LOW VOLTAGE WIRING INSULATION MUST HAVE 600V RATING

DDC/ELECTRIC CONTROLS



SIZEs WITH 2 MOTORs

	10	12
FCH	√	√
FCV	√	√

B.A.S. CONTROL

- THE B.A.S. INPUT SIGNAL TO THE SPEED CONTROLLER IS JUMPER SELECTABLE FOR 0–10 VDC OR 0–20 mA (3)
- B.A.S. INPUT SIGNAL TO THE SPEED CONTROL:
  2–10 VDC (4–20 mA) = MIN TO MAX AIRFLOW PER CFM CHARTs
  1–2 VDC (2–4 mA) = B.A.S. FAN OFF
  NO SIGNAL (0–1 VDC, 0–2 mA) = MANUAL SPEED ADJUSTMENT

OPTIONAL EQUIPMENT

MANUFACTURING USE ONLY

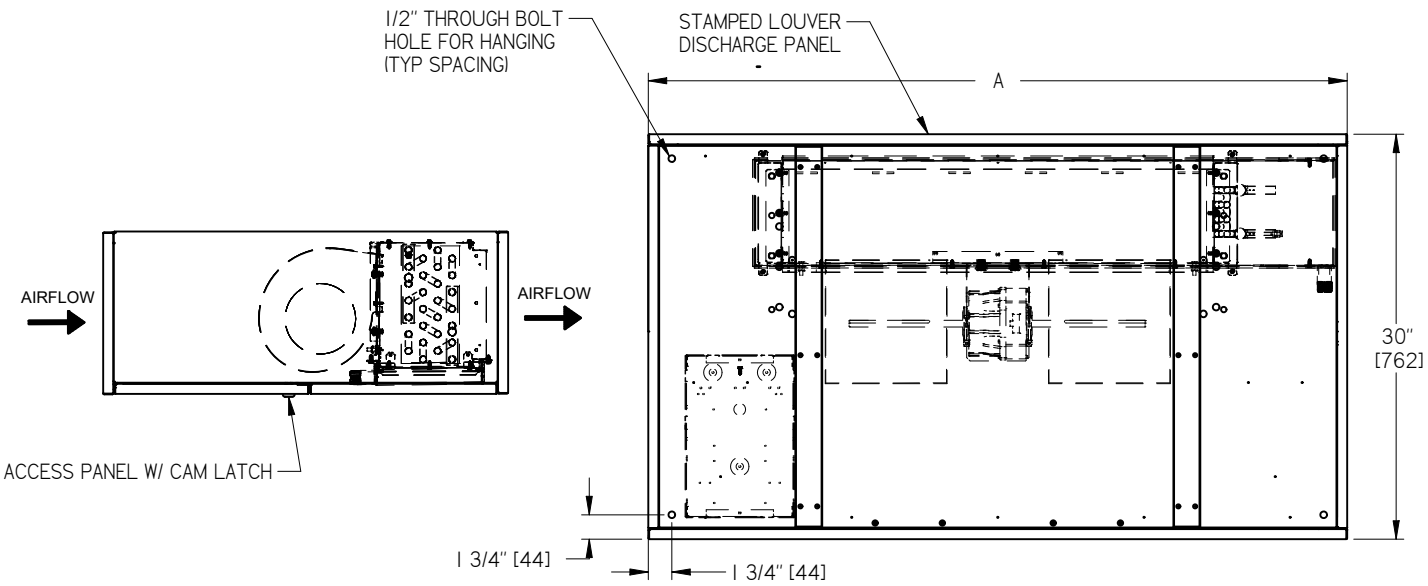
- ☐ SECOND MOTOR
- ☐ OVERFLOW SWITCH (OFS)
- ☐ DISCONNECT SWITCH (DSW)
- ☐ CONTROL CIRCUIT FUSE (CCF)
- ☐ MOTOR FUSEs (MFUs)

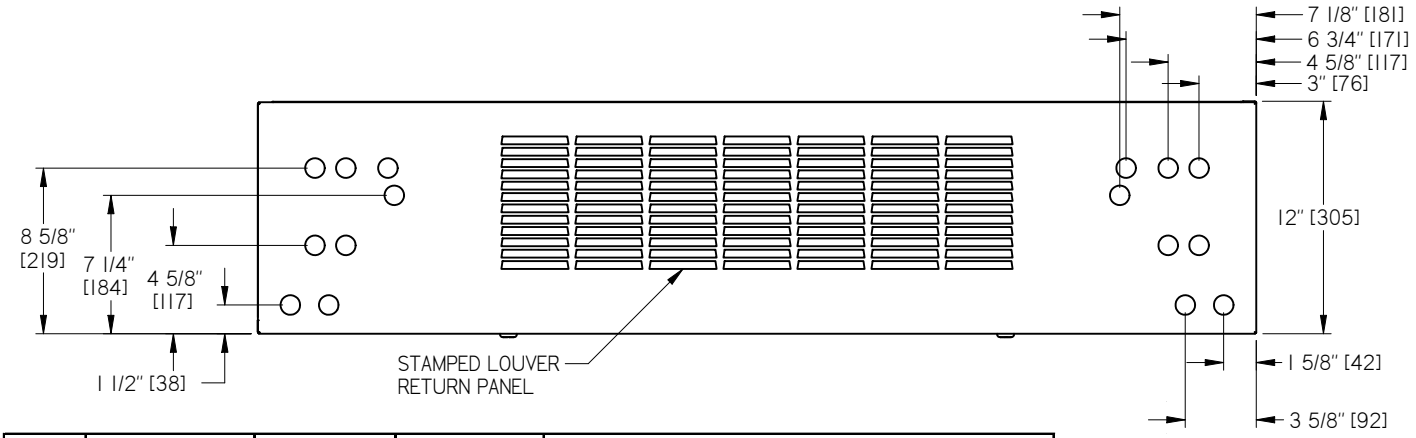
NOTES

- (4) TEST POINTs FOR MONITORING MANUAL SPD. CONTROL SETTING:
  1–4.5 VDC = MINIMUM TO MAXIMUM AIRFLOW AS PER CFM CHARTs
  0–1 VDC = FAN OFF
- (2) JUMPER BETWEEN BROWN WIREs ON MOTOR HARNESS:
  1. REQUIRED FOR 115V MOTORs
  2. MUST BE ABSENT FOR 208V, 240V, AND 277V MOTORs
- (1) SECONDARY SIDE OF THE TRANSFORMER MUST BE GROUNDED WHEN THE PRIMARY VOLTAGE EXCEEDS 150 VAC

ECN				price®	Description	WIRING DIAGRAM FAN COIL or FAN TERMINAL 115 or 277V 1ø, PIKA ECM MOTORs VARIABLE VOLUME
Date				Drawn by: NCW	Scale: NTS	
Revision				Appr'd	Date (yyyy/mm/dd): 2024/05/09	Drawing no.: CXYA7123 / Revision: C / Sheet: 1 of 1

Submittal Sheet





SIZE	NOMINAL AIRFLOW		A in. (mm)	QTY OF BLOWERS	ECM MOTOR			
					HP	TOTAL AMPS		
	CFM	l/s				115V	208/240V	277V
02	200	94	36 (914)	1	1/4	2.1	1.7	1.7
03	300	142	40 (1016)	1	1/4	2.4	1.9	1.9
04	400	189	46 (1168)	2	1/4	2.7	1.8	1.7
06	600	283	52 (1321)	2	1/4	3.5	2.3	2.3
08	800	378	60 (1524)	2	1/4	3.5	2.3	2.3
10	1000	472	72 (1829)	4	1/4 X 2	6.0	3.9	3.7
12	1200	566	80 (2032)	4	1/4 X 2	7.0	4.6	4.6

NOTE:

1. ACTUAL NAMEPLATE AMPS MAY VARY BUT WILL NOT EXCEED VALUES SHOWN

2. RH CONTROLS AND COIL SHOWN, HANDING DETERMINED BY LOOKING AT INLET

3. OPPOSITE HAND COIL AND ELECTRICAL ENCLOSURE AVAILABLE

ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT:		FAN COIL **FCH-2-1 FAN COIL HORIZONTAL REAR RETURN EXPOSED**
ENGINEER:	TW	
CUSTOMER:	274878	
SUBMITTAL DATE: 3/3/2025	SPEC. SYMBOL:	2022/12/05

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STANDARD CONSTRUCTION:
- 18 GA. GALVANIZED STEEL POWDER COATED CASING
- GALVANIZED HARDWARE
- STAMPED LOUVER DISCHARGE AND RETURN GRILLES
- 1/2" THROUGH BOLT HOLE FOR HANGING
- ELECTRONICALLY COMMUNTATED MOTOR (ECM)
- 1" MERV 8 PLEATED FILTER
- INTERNAL INSULATION - FIBERGLASS 1/2" (13mm) THICK

WATER COILS:
- WATER COIL EQUIPPED WITH GALVANIZED STEEL DRAIN PAN EXTERNALLY INSULATED WITH FIBER FREE FOAM
- 3/4" NPT DRAIN CONNECTION
- COILS - 1/2" O.D. COPPER TUBES, ALUMINUM SINE WAVE FINS, 5/8" O.D. CONNECTIONS
- 1 OR 2 ROW HEATING (PRE/REHEAT), 2,3,4,5 ROW COOLING, UP TO 7 TOTAL ROWS

UNIT OPTIONS:

ELECTRICAL:
- ☐ 24V TRANSFORMER
- ☐ DISCONNECT SWITCH
- ☐ MOTOR FUSING
- ☐ CONTROL CIRCUIT FUSING

ACCESSORIES:
- ☐ STAINLESS STEEL DRAIN PAN
- ☐ SECONDARY DRAIN
- ☐ OVERFLOW SAFETY SWITCH
- ☐ FIBER FREE FOAM LINER, 1/2" (13mm)
- ☐ 1" MERV 13 PLEATED FILTER
- ☐ 3 SPEED PROGRAM (ECM ONLY)
- ☐ MODULATING PROGRAM (ECM ONLY)
- ☐ FACTORY MOUNTED VALVE PACKAGE

VALVE PACKAGE:

TCV TYPE:
- ☐ 2 WAY
- ☐ 3 WAY

CONTROL TYPE:
- ☐ ON-OFF
- ☐ FLOAT
- ☐ MODULATING

RETURN SIDE VALVE:
- ☐ AUTOMATIC BALANCING VALVE

SOURCE SIDE VALVE:
- ☐ Y-STRAINER W/ BLOWDOWN AND PT PORTS

COIL CONFIGURATION:

COOLING ONLY:
- ☐ 1 ROW
- ☐ 2 ROW
- ☐ 3 ROW
- ☐ 4 ROW
- ☐ 5 ROW

REHEAT (C/H):
- ☐ 2/1 ROW
- ☐ 2/2 ROW
- ☐ 3/1 ROW
- ☐ 3/2 ROW
- ☐ 4/1 ROW
- ☐ 4/2 ROW
- ☐ 5/1 ROW
- ☐ 5/2 ROW

PREHEAT (H/C):
- ☐ 1/2 ROW
- ☐ 2/2 ROW
- ☐ 1/3 ROW
- ☐ 2/3 ROW
- ☐ 1/4 ROW
- ☐ 2/4 ROW
- ☐ 1/5 ROW
- ☐ 2/5 ROW

ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT:		
ENGINEER:	TW	FAN COIL **FCH-2-1** **FAN COIL HORIZONTAL REAR RETURN EXPOSED**
CUSTOMER:	**274878**	
SUBMITTAL DATE: 3/3/2025 — SPEC. SYMBOL:	2022/12/05	

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UNIT + COOLING COIL WEIGHT LBS (KG)							
ROW COOLING	SIZE						
	2	3	4	6	8	10	12
2 ROW	97 (44)	108 (49)	123 (56)	136 (62)	160 (73)	190 (86)	211 (96)
3 ROW	102 (46)	114 (52)	130 (59)	144 (65)	170 (77)	203 (92)	225 (102)
4 ROW	107 (49)	119 (54)	137 (62)	152 (69)	180 (82)	215 (98)	239 (108)
5 ROW	111 (50)	125 (57)	143 (65)	160 (73)	190 (86)	227 (103)	253 (115)

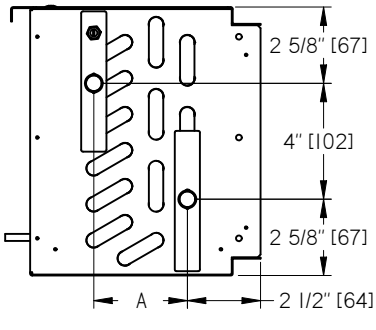
HOT WATER COIL WEIGHT LBS (KG)							
ROW HEATING	SIZE						
	2	3	4	6	8	10	12
1 ROW	3 (1)	4 (2)	5 (2)	6 (3)	7 (3)	8 (4)	9 (4)
2 ROW	7 (3)	8 (4)	10 (5)	12 (5)	14 (6)	17 (8)	20 (9)

NOTE: ALL COIL WEIGHTS ARE WET

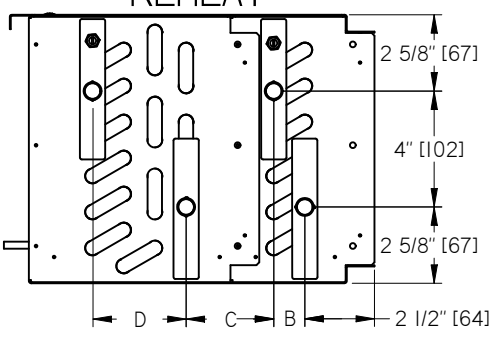
COOLING		REHEAT				PREHEAT			
ROWS	A in. (mm)	ROWS (CW/HW)	B in. (mm)	C in. (mm)	D in. (mm)	ROWS (HW/CW)	E in. (mm)	F in. (mm)	G in. (mm)
2	1 1/8 (29)	2/1	0	4 (102)	1 1/8 (29)	1/2	1 1/8 (29)	1 1/2 (38)	0
		3/1	0	4 (102)	2 1/8 (54)	1/3	2 1/8 (54)	2 1/2 (64)	0
3	2 1/8 (54)	4/1	0	4 (102)	3 1/4 (83)	1/4	3 1/4 (83)	3 5/8 (92)	0
		5/1	0	4 (102)	4 3/8 (111)	1/5	4 3/8 (111)	4 3/4 (121)	0
4	3 1/4 (83)	2/2	1 1/8 (29)	3 (76)	1 1/8 (29)	2/2	1 1/8 (29)	1 1/2 (38)	1 1/8 (29)
		3/2	1 1/8 (29)	3 (76)	2 1/8 (54)	2/3	2 1/8 (54)	2 1/2 (64)	1 1/8 (29)
5	4 3/8 (111)	4/2	1 1/8 (29)	3 (76)	3 1/4 (83)	2/4	3 1/4 (83)	3 5/8 (92)	1 1/8 (29)
		5/2	1 1/8 (29)	3 (76)	4 3/8 (111)	2/5	4 3/8 (111)	4 3/4 (121)	1 1/8 (29)

AIRFLOW

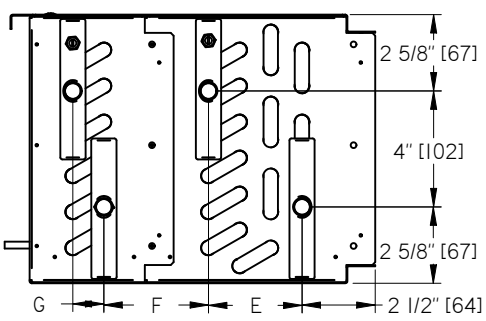
COOLING



REHEAT



PREHEAT



ALL METRIC DIMENSIONS ( ) ARE SOFT CONVERTED. IMPERIAL DIMENSIONS ARE CONVERTED TO METRIC AND ROUNDED TO THE NEAREST MILLIMETER.

PROJECT:		price
ENGINEER:	TW	FAN COIL **FCH-2-1** **FAN COIL HORIZONTAL REAR RETURN EXPOSED**
CUSTOMER:	**274878**	
SUBMITTAL DATE: 3/3/2025 SPEC. SYMBOL:	2022/12/05	

Solid Edge

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Commercial Solutions
Submittal Data
English Language
IP/Metric Units
WeDoGeo Software Submittal Version 1.0

Quote Number:476625
CSU Laurel Village



Line Item #: 1
TruClimate 500 Modular Dual Scroll Chiller (T5) 080 - Banked
(T5HS080SN24AACHNN8GXNNNSSS) (Option 3 - 640T)

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Product List and Accessories

Chiller Type	(Line Item #) Part #	Description	Qty
TruClimate 500 Modular Dual Scroll Chiller (T5)	(#1) 476625-1	TruClimate 500 Modular Dual Scroll Chiller (T5) 080 - Banked (T5HS080SN24AACHNN8GXNNNSSS) (Option 3 - 640T)	8
	(#2) CTS-CHARGE	CHECK-TEST-STARTUP @ SITE CMML	1
	(#3) B8HKG03N	Bypass Header Kit-8"	1
	(#4) 19P685-01	Differential Water Pressure Transducer	1
	(#5) B8HKG03N	Bypass Header Kit-8"	1
	(#6) 19P685-01	Differential Water Pressure Transducer	1
	(#7) B8HKG03N	Bypass Header Kit-8"	1
	(#8) 19P685-01	Differential Water Pressure Transducer	1
	(#9) 29P521-17	8" Header End Cap	6
	(#10) HSCDE1DUXXC	Supervisory Control	1

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Chiller Schedule Application Rating (High Efficiency)

Chilled Water Mode / Hot Water Mode / Simultaneous Mode

Line Item / Tag	Nom. Tons	Chiller Data			Evaporator				Condenser				Electrical	
		FLA	kW Rating	kW/Ton max	GPM	Delta P max	EWT	LWT	GPM	Delta P max	EWT	LWT	Voltage	Max Amp
# 1 (Option 3 - 640T)	80	135.0	58.87 kW	0.7777	134.0 GPM	7.39 PSI	56.00°F	42.03°F	233.9 GPM	22.8 PSI	85.00°F	94.77°F	460/60/3	175
			65.43 kW	0.8934	140.5 GPM	8.04 PSI	40.00°F	30.47°F	123.8 GPM	6.59 PSI	95.00°F	109.50° F		
			68.06 kW	0.4226	130.8 GPM	7.07 PSI	56.00°F	42.68°F	153.3 GPM	9.89 PSI	95.00°F	109.49° F		

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

General Product Scope

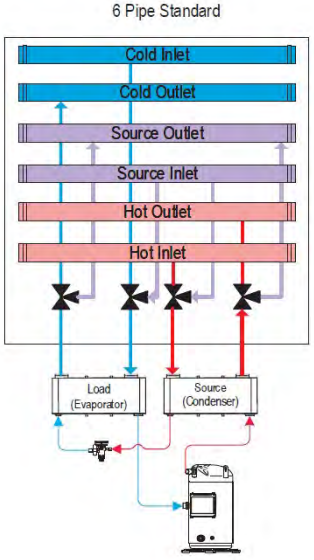
Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T

WaterFurnace Commercial Chiller Product to include module chiller package with the description and components and options detailed in the sections below.

Chiller: TruClimate 500 Modular Dual Scroll Chiller (T5) 080 - Banked (T5HS080SN24AACHNN8GXNNNSSS) (Option 3 - 640T) - 6-Pipe Standard Heat Recovery Chiller

Description: Modular Scroll Chillers configured as follows:

- Standard Features
  - Dual Scroll Compressors using R-454B refrigerant
  - 316 Stainless Steel Brazed Plate Heat Exchangers
  - Sound Attenuation Kits
  - Nominal Tonnage Per Module: 80- tons
- Configuration
  - Electrical: 460/60/3- Voltage with thru door disconnects
  - Controls - BACnet
  - Refrigeration: EEV metering device
  - Water Connections: 6-Pipe Standard header rack (Factory Installed) configurations are 8" (203.2 mm) grooved connections
- Warranty
  - 5-Year All Component Parts Warranty



Pipe Rack Installation
Factory Installed



Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Model Nomenclature - Modular Scroll

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T

1	2	3	4	5-7	8	9	10	11	12	13	14	15	16	17	18-20	21	22	23	24-26
T	5	H	S	020	S	N	2	3	*	*	C	H	N	N	1FC	N	N	N	SSS

Brand
T – TruClimate

Model
5 – 500 Series

Type
H – Heat Recovery Chiller
R – Heat Pump Chiller

Cabinet Configuration
S – Standard

Unit Capacity (Nominal Tons)
020, 030, 040, 050, 060, 070, 080

Compressor Type
S – Single Stage Scroll
L – Lead Variable Speed Scroll

Compressor Feature
N – None

Number of Circuits
2 – Two Circuits

Voltage[2]
3 – 208-230/60/3
4 – 460/60/3
5 – 575/60/3

Vintage
* – Factory Use

Revision
* – Factory Use

Electrical Option
B – Breaker Disconnect (50Ton Variable Speed Only 230V)
C – Fused Disconnect (100kA SCCR)

Control Option
H – Aurora Premium with BACnet

Future Option
N – None

Future Option
N – None

Water Control Option[3]

Configuration	Option		
	2.5"	6"	8"
Standard No Isolation	1FS		
Standard w/ Isolation	1FV		
4 Pipe Standard		6GC	8GC
4 Pipe Reversing		6GM	
4 Pipe Dedicated		6GZ	8GZ
6 Pipe Standard		6GX	8GX
6 Pipe Dedicated		6GW	8GW
Provisions for 4 rev /6 Pipe 6 inch	6FP		
Provisions for 6 pipe 8 inch	8FP		
Provisions for 4 pipe 8 and 6 inch	4FP		

Future Option
N – None

Future Option
N – None

Future Option
N – None

Non-Standard Options
SSS – None

Notes:
1 – "T5H" and "T5R" models available from 20-80 ton.
2 – See electrical availability table for detailed offering by voltage.
3 – Standard no isolation and standard w/ isolation supplied with 2-½" flange connection.
All 4 pipe and 6 pipe options with grooved connection standard, flange conversion available.
All "Provisions" water control options allow the module to be field connected to the specific header rack and with this option the header rack must be purchased separately from the unit. See standalone header rack nomenclature.
"4 Pipe Dedicated" can only be used in conjunction with "6 Pipe Dedicated".
4. Standard control option includes BACnet and standalone control.
5. Lead Variable Speed Scroll Option available only in 20, 30 and 50Ton Heat Recovery Option and in 30Ton Heat Pump option.

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Dual Scroll Modular Chiller Mode Performance Application Rating

6-Pipe Standard Heat Recovery Chiller

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T

Water Loop:
Water Loop Anti-Freeze Type: Propylene Glycol
Water Loop Anti-Freeze %: 25

Header Rack
Pipe Rack Header Diameter Chilled Water Loop: 8 in
Pipe Rack Header Diameter Hot Water Loop: 8 in
Pipe Rack Header Diameter Net Energy Water Loop: 8 in
Pipe Header Connection Type: Grooved

Fouling Factor
Evaporator: 0.000 H·ft2·ºF/Btu
Condenser: 0.000 H·ft2·ºF/Btu



Outside the scope of AHRI Water-Cooled Water-Chilling and Heat Pump Water-Heating Packages Certification Program or not optionally certified, but is rated in accordance with AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI).

Combined units or modular chiller array rating is outside of the scope of the AHRI Water-Cooled Water-Chilling and Heat Pump Water-Heating Packages Certification Program. Individual unit ratings are subject to the governing documents of the AHRI Certification Program.

Unit contains freeze protection fluids in the condenser or in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] and is certified when rated per the Standard with water.

Chilled Water:

Rate Chilled Water By:	Flow
Chilled Water EWT:	56.00°F
Chilled Water Delta T:	13.97 °F
Chilled Water Flow:	134.0 GPM

Rating:	Single:	Bank:
Chilled Water EWT:	56.00°F	
Chiller Capacity:	908.4 MBH	7267.0 MBH
Chiller (Tons):	75.70 Tons	605.6 Tons
Chilled Water LWT:	42.03°F	
Chilled Water Flow:	134.0 GPM	1072.0 GPM
Chilled Water PD:	7.39 PSI	
Chiller kW:	58.87 kW	
Chiller Mode EER:	15.43	
Chiller Mode kW/Ton:	0.7777	

Source Loop:

Rate Source Loop By:	Delta T
Source Loop EWT:	85.00°F
Source Loop Delta T:	10.0 °F
Source Loop Flow:	233.9 GPM

Rating:	Single:	Bank:
Source Loop EWT:	85.00°F	
Source Loop Capacity:	1116.0 MBH	8928.0 MBH
Source Loop (Tons):	92.99 Tons	743.9 Tons
Source Loop LWT:	94.77°F	
Source Loop Flow:	233.9 GPM	1871.0 GPM
Source Loop PD:	22.8 PSI	

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Dual Scroll Modular Hot Water Mode Performance Application Rating

6-Pipe Standard Heat Recovery Chiller

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T

Water Loop:
Water Loop Anti-Freeze Type: Propylene Glycol
Water Loop Anti-Freeze %: 25

Header Rack
Pipe Rack Header Diameter Chilled Water Loop: 8 in
Pipe Rack Header Diameter Hot Water Loop: 8 in
Pipe Rack Header Diameter Net Energy Water Loop: 8 in
Pipe Header Connection Type: Grooved

Fouling Factor
Evaporator: 0.000 H·ft2·ºF/Btu
Condenser: 0.000 H·ft2·ºF/Btu



Outside the scope of AHRI Water-Cooled Water-Chilling and Heat Pump Water-Heating Packages Certification Program or not optionally certified, but is rated in accordance with AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI).

Combined units or modular chiller array rating is outside of the scope of the AHRI Water-Cooled Water-Chilling and Heat Pump Water-Heating Packages Certification Program. Individual unit ratings are subject to the governing documents of the AHRI Certification Program.

Unit contains freeze protection fluids in the condenser or in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] and is certified when rated per the Standard with water.

Hot Water:

Rate Hot Water By:	Delta T
Hot Water EWT:	95.00°F
Hot Water Delta T:	15.0 °F
Hot Water Flow:	123.8 GPM

Rating:	Single:	Bank:
Hot Water EWT:	95.00°F	
Hot Water Capacity:	878.8 MBH	7030.0 MBH
Hot Water (Tons):	73.24 Tons	585.9 Tons
Hot Water LWT:	109.50°F	
Hot Water Flow:	123.8 GPM	990.4 GPM
Hot Water PD:	6.59 PSI	
Hot Water kW:	65.43 kW	
Hot Water COP:	3.936	
Hot Water kW/Ton:	0.8934	

Source Loop:

Rate Source Loop By:	Delta T
Source Loop EWT:	40.00°F
Source Loop Delta T:	10.0 °F
Source Loop Flow:	140.5 GPM

Rating:	Single:	Bank:
Source Loop EWT:	40.00°F	
Source Loop Capacity:	648.6 MBH	5189.0 MBH
Source Loop (Tons):	54.05 Tons	432.4 Tons
Source Loop LWT:	30.47°F	
Source Loop Flow:	140.5 GPM	1124.0 GPM
Source Loop PD:	8.04 PSI	

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Dual Scroll Modular Simultaneous Chiller / Hot Water Mode Performance Application Rating

6-Pipe Standard Heat Recovery Chiller

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T

Water Loop:
Water Loop Anti-Freeze Type: Propylene Glycol
Water Loop Anti-Freeze %: 25

Header Rack
Pipe Rack Header Diameter Chilled Water Loop: 8 in
Pipe Rack Header Diameter Hot Water Loop: 8 in
Pipe Rack Header Diameter Net Energy Water Loop: 8 in
Pipe Header Connection Type: Grooved

Fouling Factor
Evaporator: 0.000 H·ft2·ºF/Btu
Condenser: 0.000 H·ft2·ºF/Btu



Outside the scope of AHRI Water-Cooled Water-Chilling and Heat Pump Water-Heating Packages Certification Program or not optionally certified, but is rated in accordance with AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI).

Combined units or modular chiller array rating is outside of the scope of the AHRI Water-Cooled Water-Chilling and Heat Pump Water-Heating Packages Certification Program. Individual unit ratings are subject to the governing documents of the AHRI Certification Program.

Unit contains freeze protection fluids in the condenser or in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] and is certified when rated per the Standard with water.

Chilled Water:	
Rate Chilled Water By:	Delta T
Chilled Water EWT:	56.00°F
Chilled Water Delta T:	14.0 °F
Chilled Water Flow:	130.8 GPM

Hot Water:	
Rate Hot Water By:	Delta T
Hot Water EWT:	95.00°F
Hot Water Delta T:	15.0 °F
Hot Water Flow:	153.3 GPM

Rating:	**Single:**	**Bank:**
Chilled Water EWT:	56.00°F	
Chiller Capacity:	845.4 MBH	6763.0 MBH
Chiller (Tons):	70.45 Tons	563.6 Tons
Chilled Water LWT:	42.68°F	
Chilled Water Flow:	130.8 GPM	1046.0 GPM
Chilled Water PD:	7.07 PSI	
Simultaneous Mode:		
Simultaneous kW:	68.06 kW	
Simultaneous kW/Ton:	0.4226	
Simultaneous EER:	28.39	
Simultaneous COP:	8.249	

Rating:	**Single:**	**Bank:**
Hot Water EWT:	95.00°F	
Hot Water Capacity:	1087.0 MBH	8696.0 MBH
Hot Water (Tons):	90.60 Tons	724.8 Tons
Hot Water LWT:	109.49°F	
Hot Water Flow:	153.3 GPM	1226.0 GPM
Hot Water PD:	9.89 PSI	

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

General / Dimensional / Electrical - Dual Modular Scroll

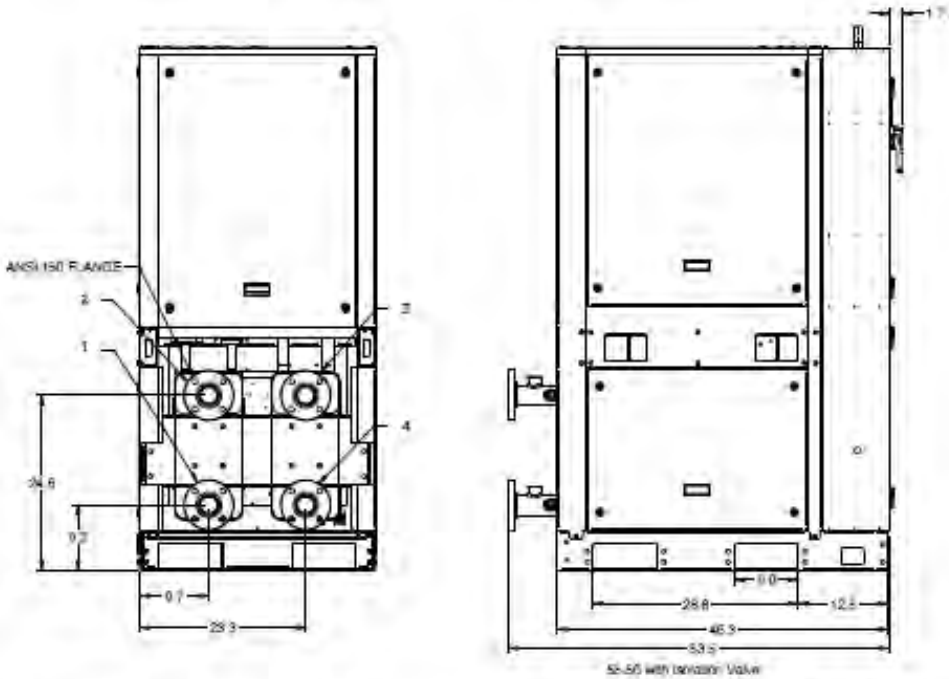
Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T

General:	**Single:**	**Bank:**
Product:	Modular Dual Scroll Chiller	
Base Model Number:	T5HS080SN24AA	
Complete Model Number:	T5HS080SN24AACHNN8GXNNNSSS	
Nominal Tonnage:	80	
Compressor Type:	Scroll	
# of Compressors:	2	
Refrigerant Type:	R-454B	
Refrigerant Charge Per Circuit:	18.4 lbs	294.4 lbs
Water Volume per each Condenser:	6.3 gal	50.4 gal
Water Volume per each Evaporator:	6.8 gal	54.4 gal
Standard Rating Condition:		
Full Load EER:	15.10	
Full Load kW/ton:	0.7940	
IPLV EER:	20.00	
IPLV kW/ton:	0.5760	
Fouling Factor:		
Evaporator:	0.000250 H·ft2·ºF/Btu	
Condenser:	0.000100 H·ft2·ºF/Btu	
Electrical:		
Voltage:	460/60/3	
# of Compressors:	2	
Compressor LRA:	344.0	
Compressor MCC:	106.0	
Compressor RLA:	68.0	
Module FLA:	135.0	1080.0
Module MCA:	152.9	
Module Max Fuse/HACR Breaker:	175	
Dimensions:		
Module Only:	73.3 H x 33 W x 46.6 D - Inches	
Module with Piping Rack Dimensions:	75.1 H x 33 W x 86.7 D - Inches	75.1 H x 272.0 W x 86.7 D Inches
Shipping Weights:		
Module Only:	2139 lbs	
Pipe Rack Only:	1270 lbs	
Module + Pipe Rack:	3409 lbs	
Operating Weight:		
Module + Pipe Rack:	4326.5 lbs	

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Dimensional Data: Modular Units (No Header Rack)



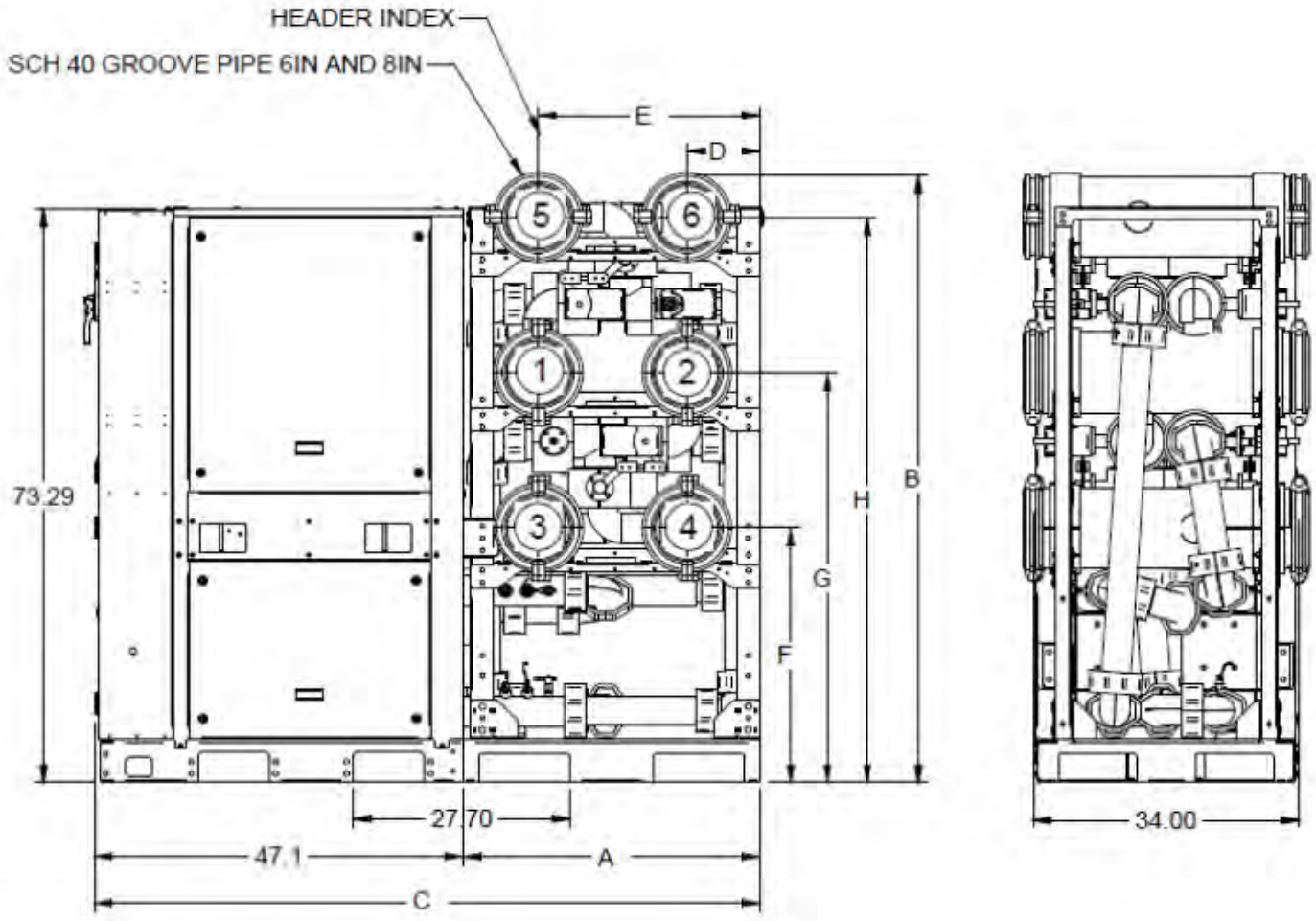
Configuration	Header Index			
	1	2	3	4
4 Pipe Standard (with Reversible Chiller)	Load Outlet	Load Inlet	Source Outlet	Source Inlet

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Dimensional Data: Modular Units (6 Pipe Standard Header Rack)

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T



Configuration	Diameter	A	B	C	D	E	F	G	H
6 Pipe Standard	8 inch	38	77.5	85.1	9.4	28.4	32.5	52.4	72.3
	~~6 inch~~	~~30~~	~~76.5~~	~~77.1~~	~~7.5~~	~~22.5~~	~~30.5~~	~~51~~	~~71.6~~

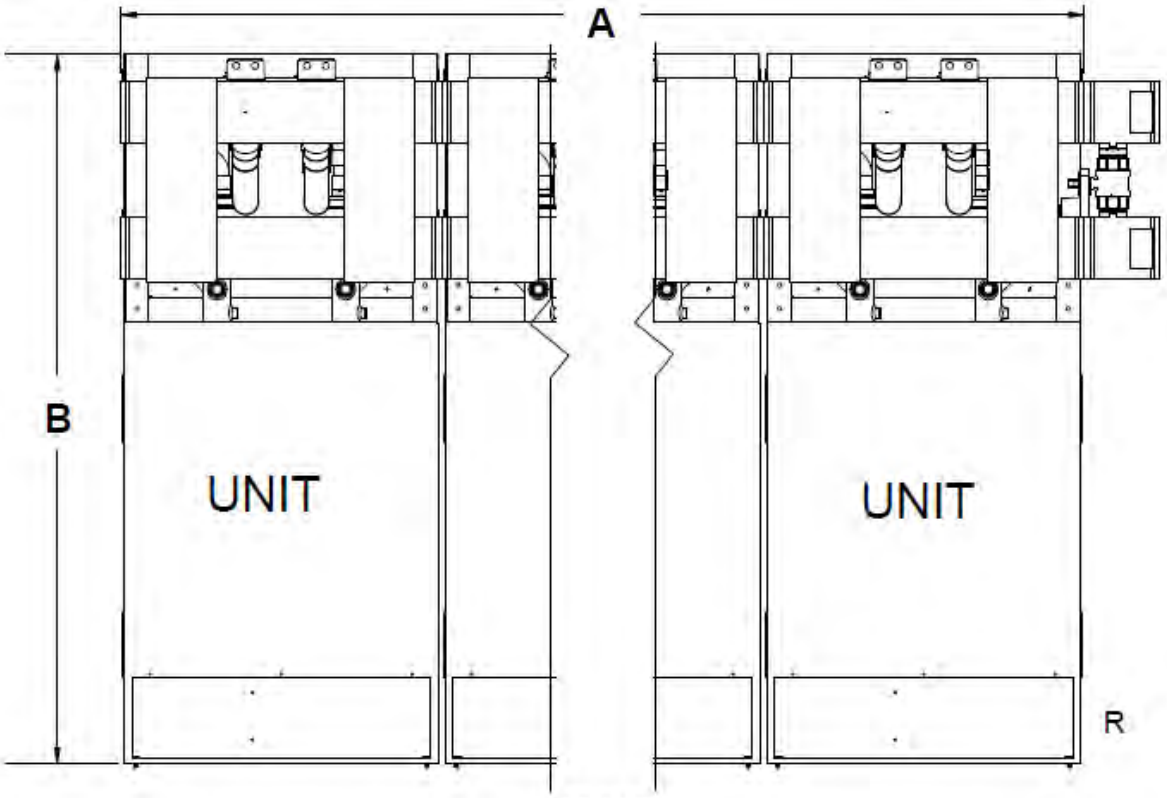
Configuration	1	2	3	4	5	6
6 Pipe Standard	Source Inlet	Source Outlet	Cold Inlet	Cold Outlet	Hot Inlet	Hot Outlet

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Dimensional Data: Bank Units

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T

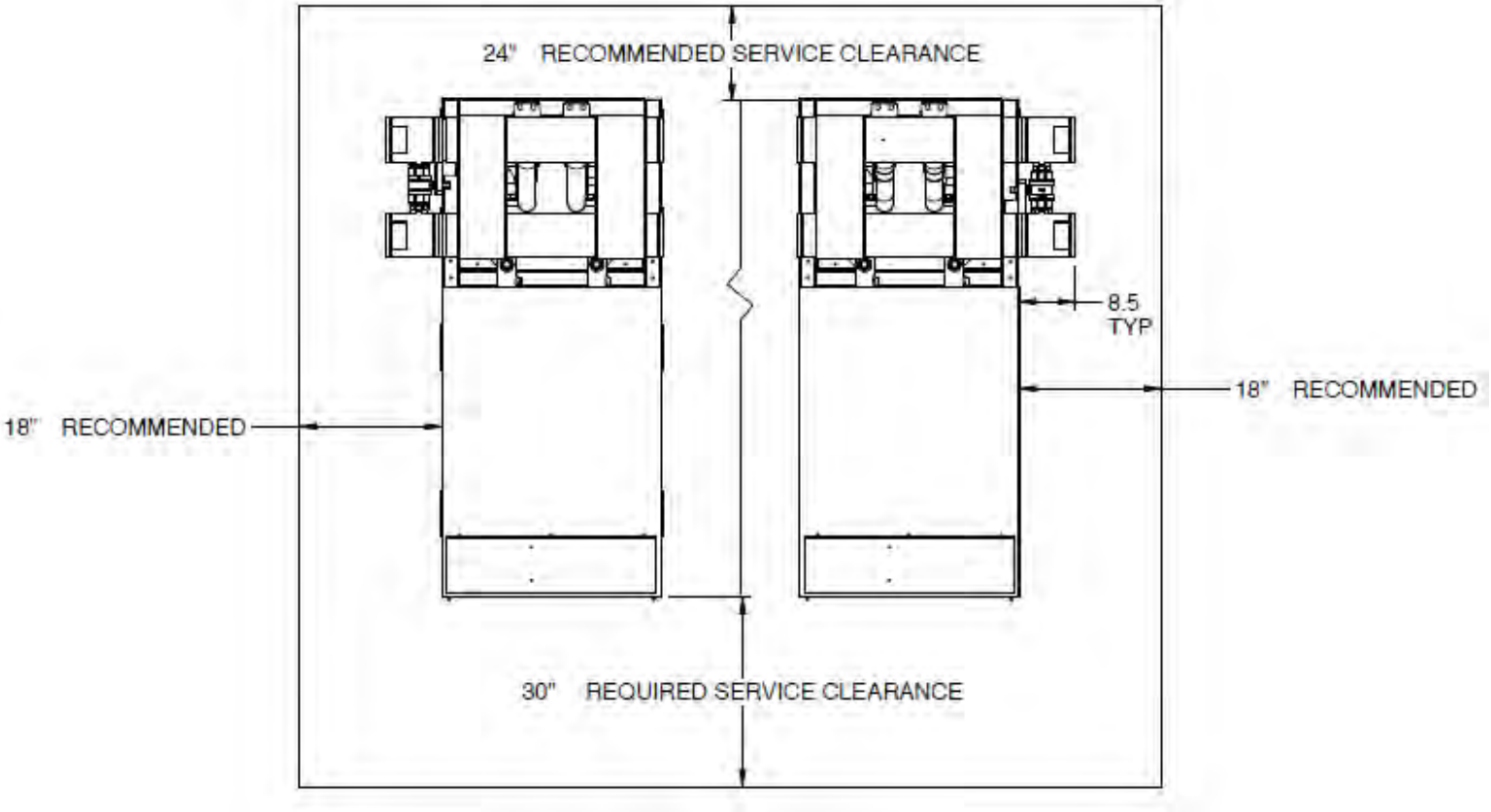


# of Modules	Width	Depth (Water control option 17-19)		
	A	B		
		(6/8)GC	6G(M/X/W)	8G(X/W)
2	68	79.1	79.1	85.3
3	102	79.1	79.1	85.3
4	136	79.1	79.1	85.3
5	170	79.1	79.1	85.3
6	204	79.1	79.1	85.3
7	238	79.1	79.1	85.3
8	272	79.1	79.1	85.3
9	306	79.1	79.1	85.3
10	340	79.1	79.1	85.3

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Dimensional Data: Service Clearance

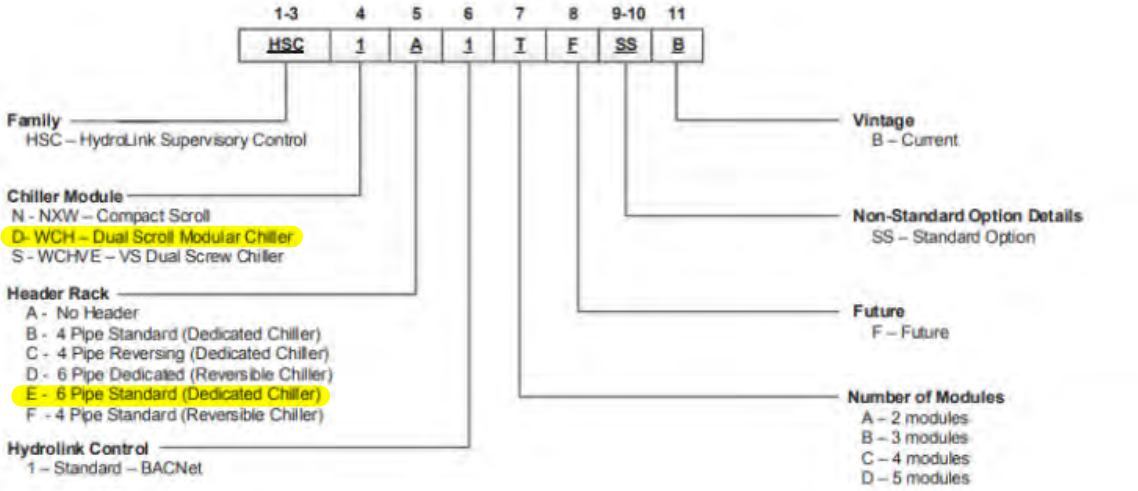


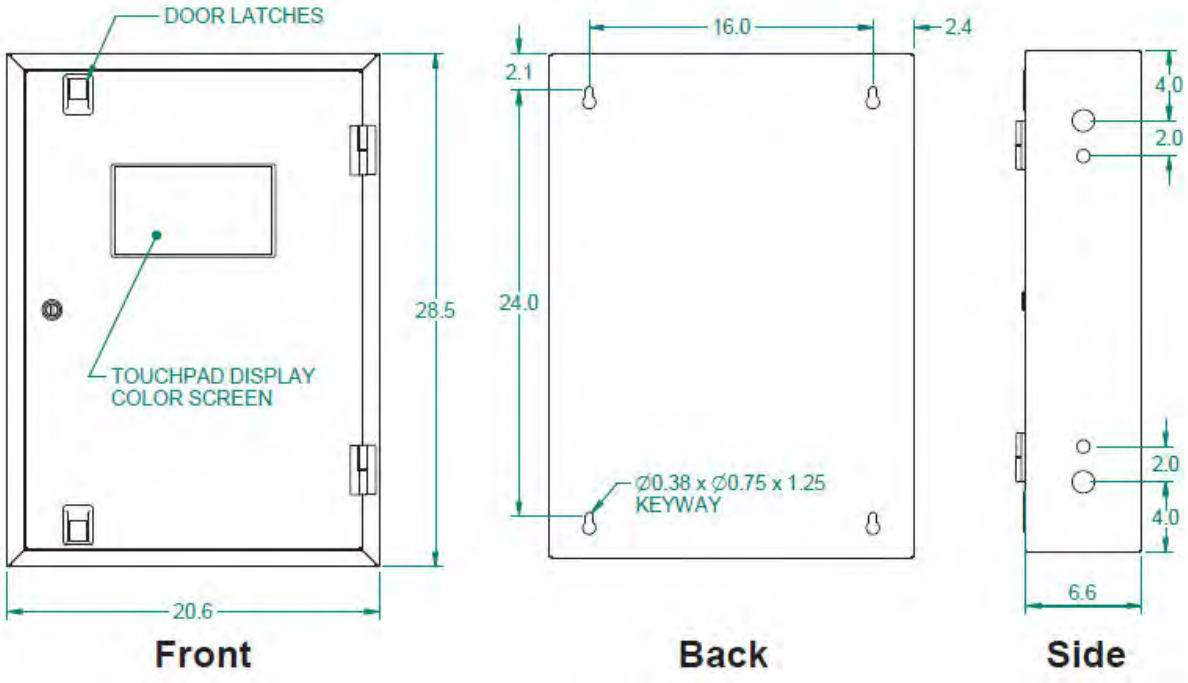
Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

HydroLink Supervisory Control Nomenclature

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T



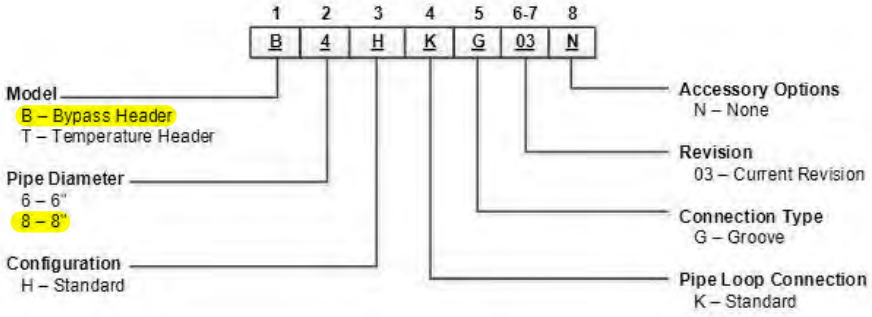


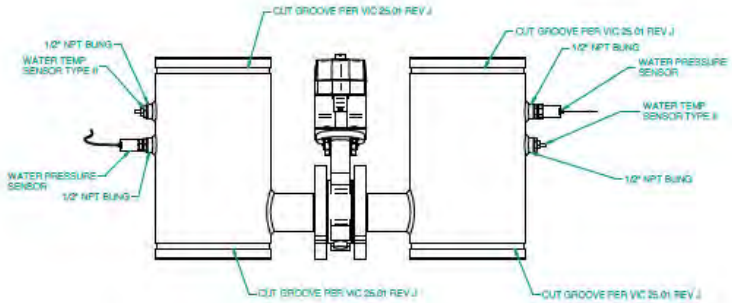
Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

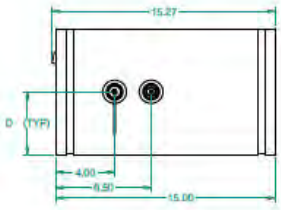
Commercial Solutions

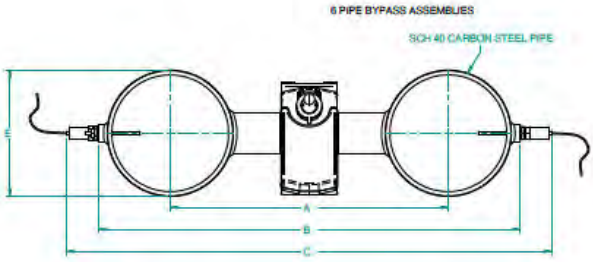
Bypass Header Nomenclature (Accessory)

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T









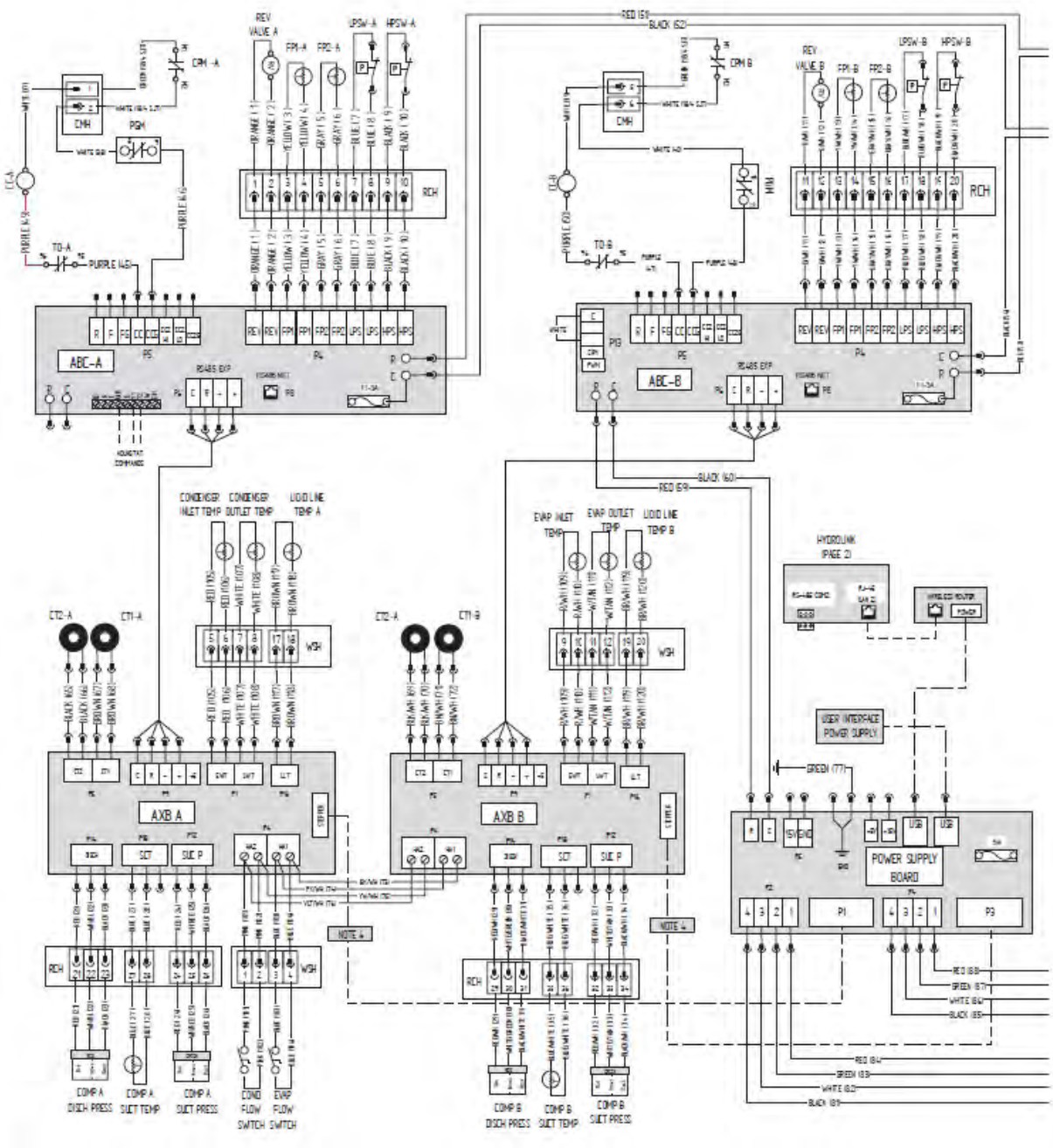
Configuration	A (in)	B (in)	C (in)	D (in)	E (IN)
8 inch	19.0	28.9	33.2	4.3	8.625
6 inch	15.0	24.9	29.2	3.3	6.625

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Wiring Schematics Modular Units

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T

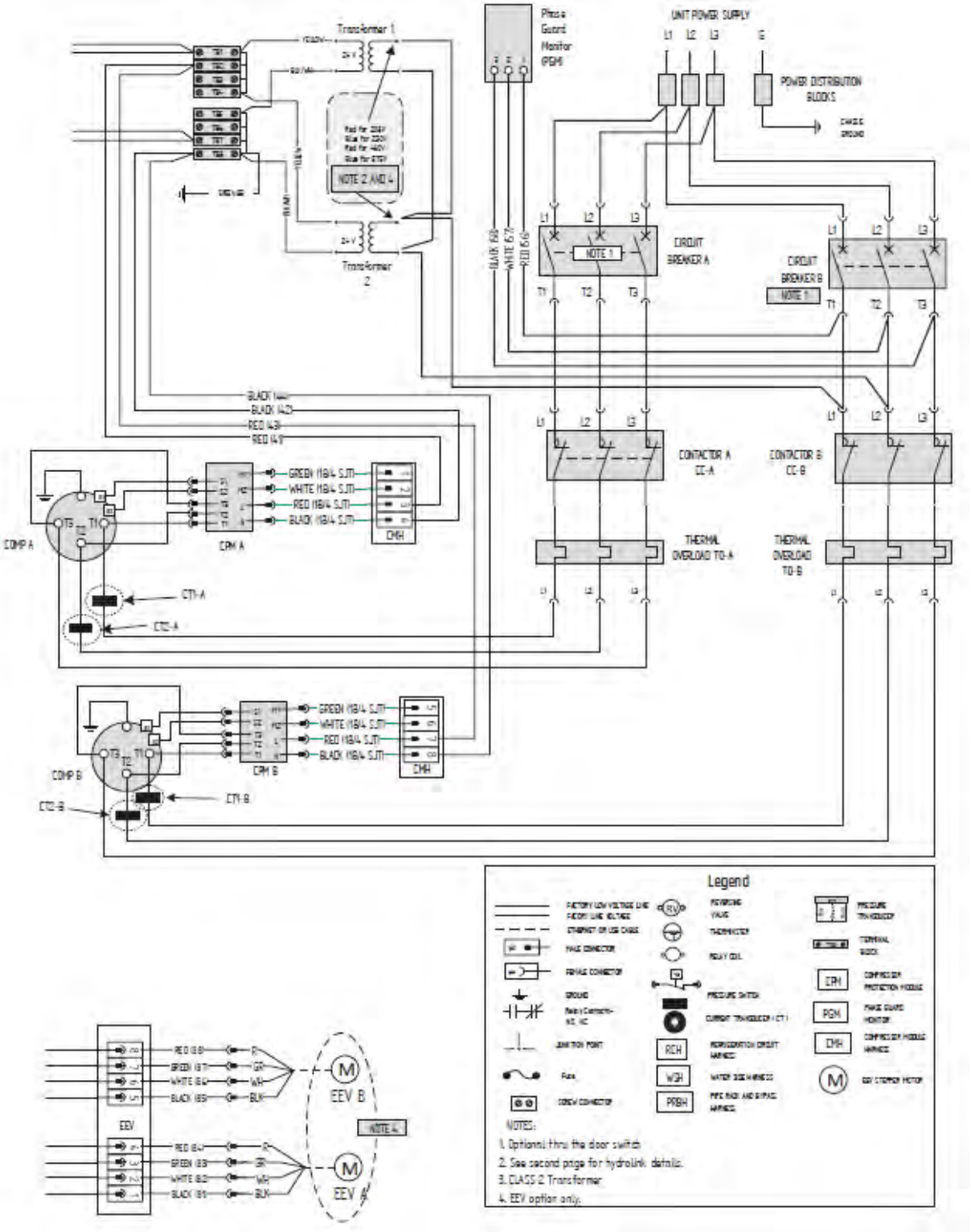


Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Wiring Schematics Modular Units continued

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T

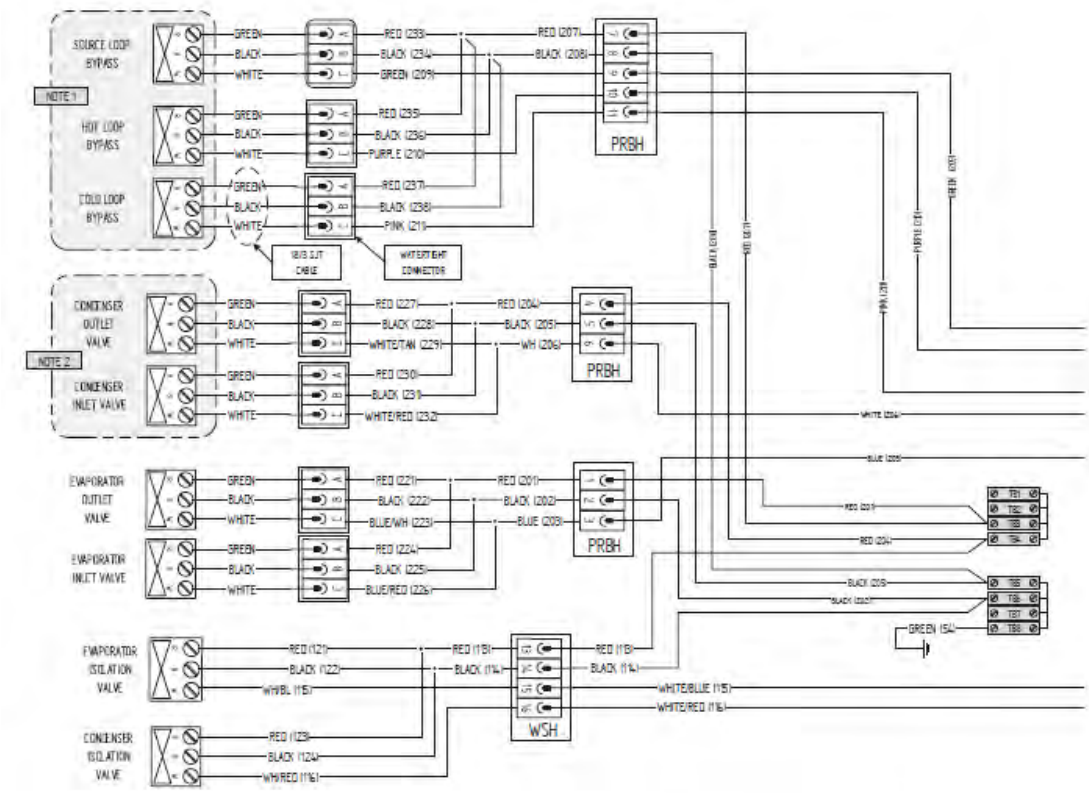


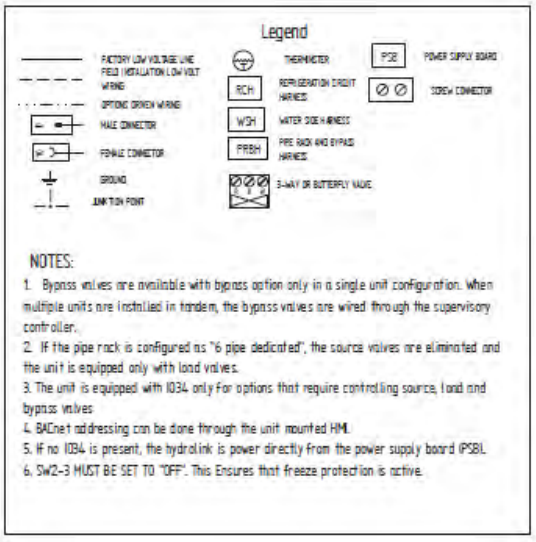
Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

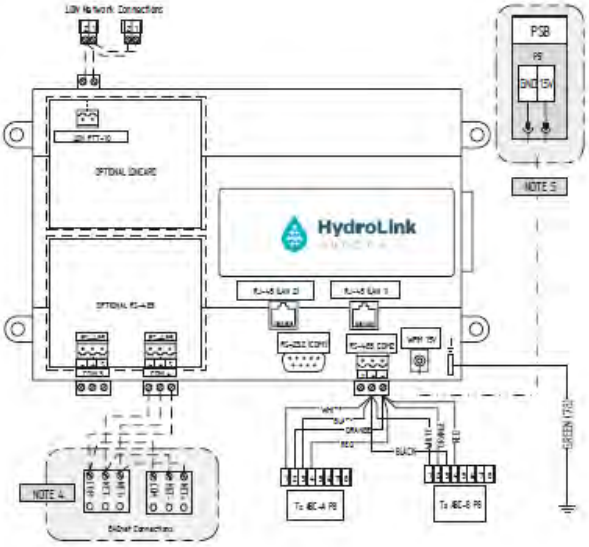
Commercial Solutions

Wiring Schematics Modular Units continued

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T





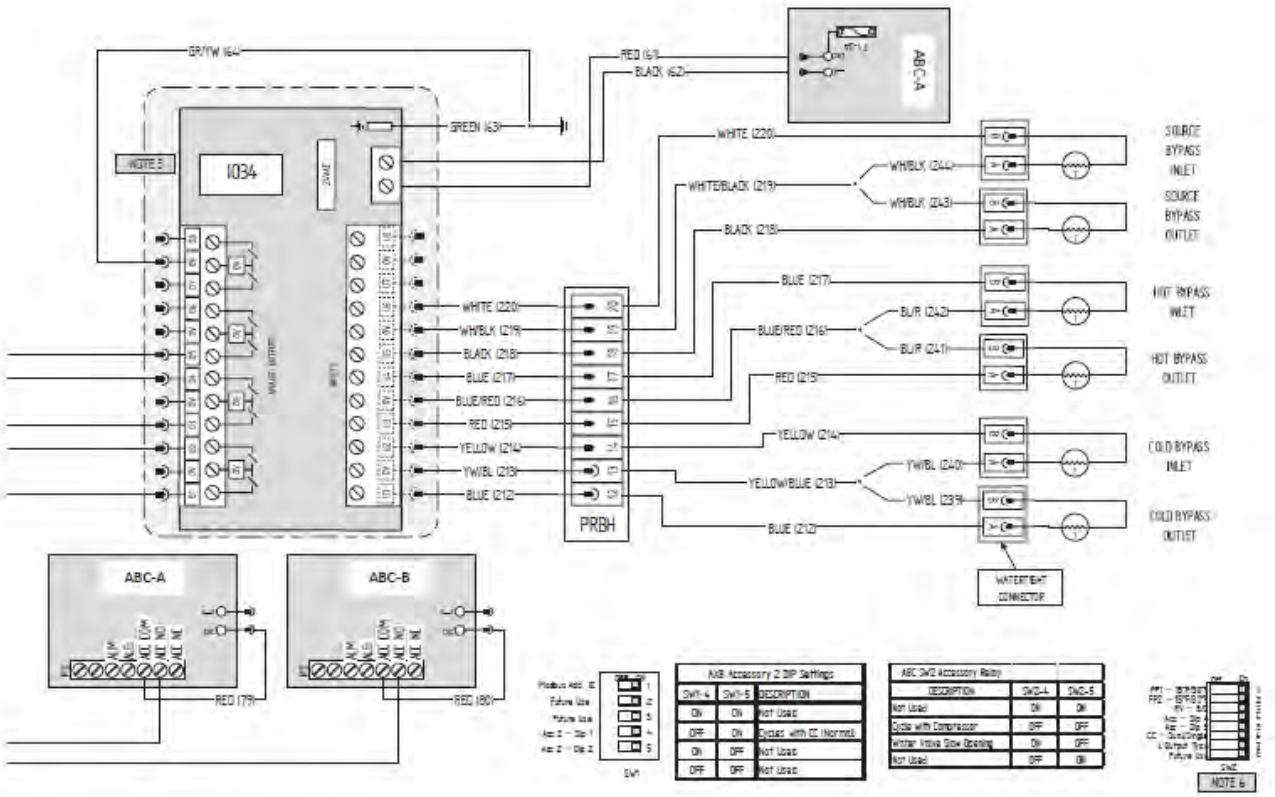


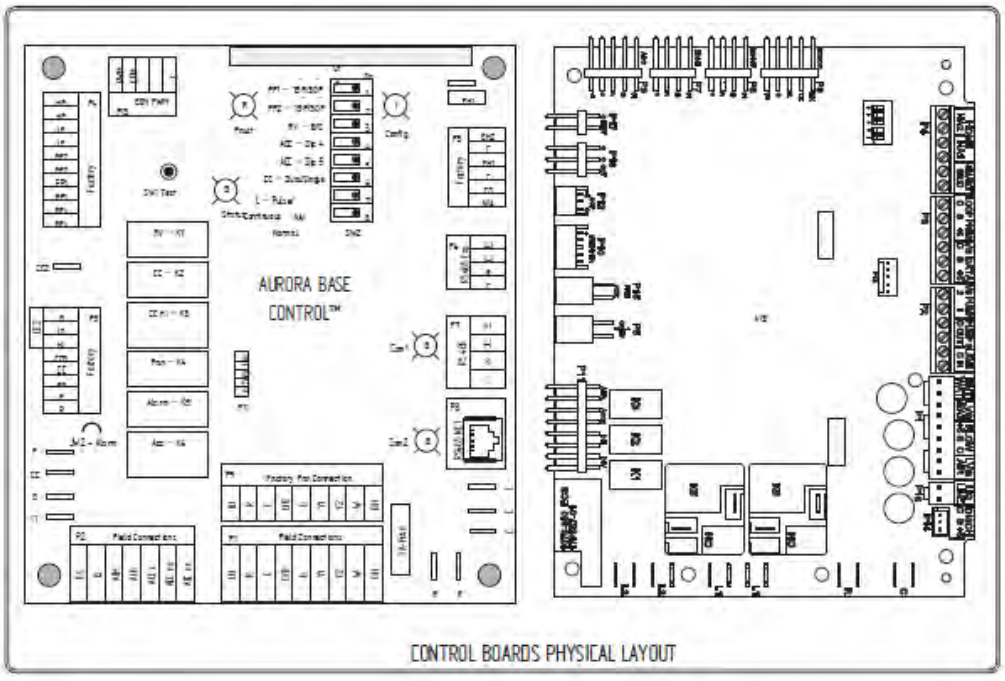
Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Wiring Schematics Modular Units continued

Line Item # 1 / T5HS080SN24AACHNN8GXNNNSSS / Option 3 - 640T





Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Engineering Guide Specifications

PART 1 - GENERAL

SUMMARY
The Modular water cooled chiller shall be a complete unit capable of independent operation. Each unit shall contain microprocessor control for two hermetically sealed, scroll compressors with brazed plate heat exchangers and thermostatic or electronic expansion valves.

PERFORMANCE REQUIREMENTS
Fluid Temperature Performance:
Heat Pump shall be capable of continuous operation over the entire range of conditions as indicated in the engineering performance tables.

SUBMITTALS
Product submittal data shall contain manufacturer's specifications for heat pumps showing dimensions, weights, capacities, performance ratings, electrical characteristics, gauges and finishes of materials and installation instructions.

Submit internal electrical wiring diagrams
Submit Control Diagrams and Specifications

QUALITY ASSURANCE
Liquid source, water-water heat pumps shall be tested, rated, and certified in accordance with the following standards.

- ASHRAE 15 for safety code for mechanical refrigeration.
- ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.
- ASHRAE 90.1 – minimum Energy Efficiency compliance for water-to-water heat pumps.
- Comply with NFPA 70 or National Electric Code (N.E.C)
- Comply with UL 1995 and be nationally recognized with ETL
- Tested in accordance with ARI 550

Each unit shall be run tested at the factory using water. Quality control system shall automatically perform via computer: triple leak check, pressure tests, evacuate and accurately charge system, perform detailed heating and cooling mode tests, and quality cross check all operational and test conditions to pass/fail criteria. Units tested without water flow are not acceptable.

WARRANTY
Standard Warranty: The units shall be warranted by the manufacturer against defects in materials and workmanship for a period of 12 months from startup or 18 months from shipment.

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chillers that fails in materials or workmanship within specified warranty period.

Extended warranties include, but are not limited to, the following:

- Complete heat pump including refrigerant and oil charge.
- Complete compressor and drive assembly.
- Parts only.

PART 2 - PRODUCTS

WATER TO WATER HEAT PUMP EQUIPMENT
Heat pump equipment shall be factory assembled with two refrigerant circuits consisting of scroll compressors, brazed-plate heat exchangers for the evaporator and condenser, microprocessor controls, and safety devices such as refrigerant pressure switches.

Frame & Enclosure
Frame shall be constructed of 8 gauge welded steel with forklift pockets in the bottom channel and threaded weld nuts for lifting points in the top of the frame.

Enclosure shall be factory installed and constructed of heavy-gauge G60 galvanized steel coated with polyester powder coat paint. Paint shall be rated for 1,000 hour of salt spray using ASTM B117. Panels, other than control service door, shall be lined with 1/2" inch thick, foam insulation

Compressor:
1. Hermetically sealed, scroll compressors with factory charged POE or PVE oil.
2. Suction gas cooled motors operate at 3500 rpm protected by internal overload device.
3. Compressors can be operated separately to provide staged capacity for lighter load conditions.
4. Factory mounted with rubber isolation grommets.
5. Acoustically insulated sound blankets are factory installed around the compressor to reduce sound emanating from the compressor.

Heat Exchangers:
1. The water to refrigerant heat exchangers shall be dual circuit, copper-brazed 316 stainless steel channel plates, capable of withstanding 650 psig working pressure on the refrigerant side and 450 psig on the water side. Refrigerant circuits are separate with a common water supply. This provides optimal part load efficiency compared to using two single circuit heat exchangers. Heat exchangers are designed to work as an evaporator and condenser.
2. Heat exchangers are covered with 3/4" closed-cell insulation.
3. Water line connections attached to the heat exchangers are groove type are factory installed with groove coupling and steel pipe nipple.

Refrigerant Components:
1. Unit shall utilize R-410A refrigerant type. All system components shall be rated to appropriate UL standards to handle maximum system pressure.
2. Factory charged, sealed system contains optimal refrigerant quantity.
3. Each refrigerant circuit shall utilize a thermostatic expansion valve (TXV) or EEV with stainless steel sensing bulb and laser welded diaphragm. TXV will control adequate superheat over the stated operating range as indicated in submittal data.
4. Liquid line filter driers are to be factory installed to provide additional system cleanliness.
5. Factory installed service ports for high and low pressure readings.

Contractor: PO: TBD
Engineer:
Project Name: CSU Laurel Village

Commercial Solutions

Engineering Guide Specifications continued

Control Panel

1. Factory installed, wired, and functionally tested at factory before shipment.
2. Single-point power connection, or breaker rotary-type disconnect in control pane of each module.
3. Factory mounted class 2, control power transformer provides nominal 24 VAC and 120 VAC low voltage power supply. Primary to transformer is protected by Class CC fuses.
4. High pressure cut out set at 600 PSIG with manual reset.
5. Low pressure cut out set at 40 PSIG with manual reset.
6. Unit shall have phase loss/reversal for compressor protection.

Controls:

1. The unit shall be controlled using a microprocessor which sequences all functions and modes of operations.
2. Units shall be capable to communicate thru standard DDC protocols such as Lon, and BACnet (MS/TP @ 19,200 Baud Rate).
3. Standalone, non-communicating units are also available that will operate with thermostat, mechanical, or electronic signals. Temperature set mode is capable of controlling to leaving load temperature.
4. The control system shall have the following features:
   - Anti-short cycle time delay of 5 minutes on compressor operation.
   - Start on power up mode
   - Low voltage protection
   - High voltage protection
   - Unit shut down on high or low refrigerant pressures
   - Unit shut down for freeze detection
   - Source and Load heat exchanger freeze detection setpoint selectable for water or antifreeze
   - Automatic intelligent reset

Accessories:

1. Strainers
   - A strainer connection kit shall be available and includes a Y-strainer with self-aligning screen and blow-off port to reduce debris that will enter the heat exchanger. Strainers should be made of a brass body with a 316 stainless steel screen.

PART 3 - EXECUTION

CHILLER INSTALLATION

Install chillers on support structure indicated.

Equipment Mounting: Install chiller on concrete bases using elastomeric pads. Comply with requirements for vibration isolation devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

- Minimum Deflection: 1/4 inch.
- Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
- For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
- Place and secure anchorage devices. Use setting

Unit Overview

Chiller Model	Ascend (TM) Air-Cooled Chiller Model ACS
Unit Nominal Tonnage	230 Nominal Tons
IPLV.IP	17.76 EER (Btu/W-h)
Heating COP	2.210 COP (kW/kW)
Voltage	460V/60Hz/3Phase
Refrigerant	Refrigerant Charge R-454B
Elevation	5000.00 ft
Agency Listing	UL Listed to U.S./Canadian Safety Std
Model Number	ACXA2302EUA*XEXLXNB2XLNX SREX1HBUBXXAA1XXXXONX



Chiller Performance Information

Cooling Mode Capacity	194.5 tons	**Cooling Mode Entering Temperature**	56.00 F
Cooling Mode Efficiency	10.40 EER	**Cooling Mode Leaving Temperature**	42.00 F
IPLV or Application IPLV or NPLV	17.76 EER (Btu/W-h)	**Cooling Mode Design Flow**	351.7 gpm
Cooling Mode Total Power	225.2 kW	**Heat Exchnger Head Loss**	9.88 ft H2O
Ambient Dry Bulb Temperature	90.00 F	**Strainer Head Loss**	1.27 ft H2O
		VPF Min Flow	315.7 gpm

Heating Performance Information

Heating Mode Capacity	1695 MBh	**Heating Mode Entering Temperature**	102.12 F
Heating Mode Efficiency	2.210 COP (kW/kW)	**Heating Mode Leaving Temperature**	115.00 F
Heating Mode Total Power	224.8 kW	**Heating Mode Design Flow**	276.0 gpm
Ambient Dry Bulb Temperature	20.00 F	**Heat Exchnger Head Loss**	3.54 ft H2O
Ambient Wet Bulb Temperature	18.00 F	**Strainer Head Loss**	0.480 ft H2O

Evaporator Information

Evaporator Application	Standard Cooling (Above 40 Deg F)	**Fluid Properties**	
Fouling Factor	0.000100 hr-sq ft-deg F/ Btu	**Fluid Type**	Propylene Glycol
Flow Sense Set Point	Flow Switch Set Point 60	**Fluid Concentration**	30.00 %
		Fluid Freeze Point	9.19 F

Condenser Information

Condenser Application	Standard Ambient	**Number of Fans**	12
Condenser Size	Standard	**Condenser Fin Options**	Copper Round Tube, Aluminum Plate Fin

Electrical Information

Unit Voltage	460V/60Hz/3Phase
Total Power	225.2 kW
Compressor Starter	Across-The-Line-Starter
Incoming Line Connection	Single Point Unit Power Connection
Incoming Line Connection Type	High Fault Rated Circuit Breaker
Short Circuit Current Rating	High Short Circuit Rating
FLA - Condenser Fan (each)	2.50 A
MCA	
Single Point Power	466 A
MOP	
Single Point Power	500. A

RLA	
Compressor 1A	69.00 A
Compressor 1B	69.00 A
Compressor 1C	69.00 A
Compressor 2A	69.00 A
Compressor 2B	69.00 A
Compressor 2C	69.00 A
LRA	
Compressor 1A X-L LRA	389.00 A
Compressor 1B X-L LRA	389.00 A
Compressor 1C X-L LRA	389.00 A
Compressor 2A X-L LRA	389.00 A
Compressor 2B X-L LRA	389.00 A
Compressor 2C X-L LRA	389.00 A

Physical Information

Dimensions		**Weights**		**Charge**	**Circuit 1**	**Circuit 2**
Length	338 in	**Operating**	13311 lb	**Refrigerant**	189.0 lb	189.0 lb
Width	88 in	**Shipping**	13135 lb	**Oil**	7.00 gal	7.00 gal
Height	98 in					

Acoustical Performance

Unit Sound Level	Standard Noise

Sound Power Levels (Lw, in dB, ref1 pW)

Percent Load	**Octave Band Center Frequency (Hz)**								**Overall A-Wtd**
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	

Standard full and part-load rating conditions per AHRI 550/590

Sound Pressure Levels (Lw, in dB, ref1 pW)
10m from center of broad sides of chiller

Percent Load	**Octave Band Center Frequency (Hz)**								**Overall A-Wtd**
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	

Standard full and part-load rating conditions per AHRI 550/590

Standard Rating Performance and Information for LEED Rating

Refrigerant Charge - ckt 1	189.0 lb
Refrigerant Charge - ckt 2	189.0 lb
Rated Refrigerating Capacity	200.1 tons
Rated Cooling Efficiency	10.28 EER (Btu/W-h)
Rated IPLV	17.76 EER (Btu/W-h)
Refrigerating Capacity	194.5 tons
Cooling Efficiency	10.40 EER
Rated Heating Capacity	2506 MBh
Rated Heating COP	2.880 kW/kW
Heating Capacity	1695 MBh
Heating COP	2.210 COP (kW/kW)
Compressor Power	217.7 kW
Fan Motor Power	12.03 kW

Certified in accordance with the AHRI Air-Cooled Water-Chilling Packages Certification Program, which is based on AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI). Heat Pump Water-Heating unit is certified when operating in cooling. Certified units may be found in the AHRI Directory at www.ahridirectory.org. Unit contains freeze protection liquids in the evaporator and is certified when rated per the Standard with water.

ASHRAE 90.1 - 2019

This product meets the minimum efficiency requirements of ASHRAE Standard 90.1 and CANS/CSA C743 for all versions (which are based on AHRI standard rating conditions with water) and, therefore, also meets the LEED "Minimum Energy Performance" prerequisite in the Energy and Atmohphere section.

The LEED Green Building Rating System™, developed by the U.S. Green Building Council, provides indepenent, third-party verification that a building project meets green building and performance measures



Laurel Village
HVAC Upgrades Study
Estimates
March 2025

Prepared for:

COLORADO STATE UNIVERSITY

Prepared by:

Affiliated Engineers, Inc.
999 18th Street, Suite 1001N
Denver, CO 80202
Tel 720.580.8510

Estimate Summary

This appendix includes conceptual narratives of the systems and scope of work associated with this HVAC upgrade and the opinions of probable cost. The estimate does not include escalation and inflationary factors.

Air Source

Building (60x30x16' tall brick façade)
Yard (60x42) decorative 10' architectural louver screenwall
Distribution Piping – See plans for sizing and distribution – PEX similar to Rovanco, PP-R (Polypropylene), or PP-RCT (Random Copolymer Polypropylene) similar to Aquatherm with 1.5" insulation.

- **Base (Air cooled chiller with natural gas boiler)**
  - Cooling (CHWS/R)
    - (3) 180 ton air cooled chillers ***(ACC)*** **($190,000 each)**
    - Primary pump per chiller (330gpm@30ft hd end suction 3hp)
      - All pumps provided with variable frequency drive (VFD)
    - Hydronic specialties
    - Glycol feeder
    - Secondary Pumps per system (600gpm@90ft head end suction 15hp)
    - 1000gal buffer tank per system **($28k each)**
    - Plate and frame heat exchanger per system
    - Hydronic specialties (expansion tank, makeup water assembly)
  - Heating (HWS/R)
    - (4) 2000MBH NG fired condensing boilers **($55k each)**
    - primary pump per boiler (300gpm@20ft hd inline 2 hp)
    - Secondary Pumps per system (600gpm@90ft head end suction 15hp)
    - Hydronic specialties (expansion tank, makeup water assembly)
  - Direct Digital Controls (DDC) Controls
  - Power Distribution
    - Utility: 750kVA pad-mounted transformer with a 480Y/277V, 3 phase, 4-wire secondary voltage and an established grounding conductor provided and installed by the electrical utility company. Separate main service disconnect and meter to be provided per the Utility's standards.
    - Emergency: 500kW, 480Y/277V, 3 phase, 4-wire pad-mounted generator shall provide emergency power to an 800A automatic transfer switch (ATS). The ATS shall be capable of transferring power to the generator when a loss of normal utility power has been sensed.

      Per code requirements, provide a generator docking station or permanently installed camlock connection with an integral manual transfer switch (MTS) is to be provided downstream of the generator so that when the generator is undergoing maintenance, the back-up

power may be provided via a temporary generator. The camlock will need to provided in a location where a temporary generator can connect.

- 800A, 480Y/277V, 3 phase, 4-wire pad-mounted main distribution board to be located downstream of the ATS for providing power to all mechanical and lighting equipment.
- 100A, 208Y/120V, 3 phase surface-mounted panelboard for convenience receptacle loads and mechanical control power requirements. Power to the 100A panelboard to be provided via a 30 kVA step-down transformer.
- Additional panelboards may be required based on number of circuits required for mechanical equipment.
- All electrical equipment is to be rated a minimum of NEMA 3X for exterior environments.

- Power
  - General receptacles shall be provided within 25ft of all mechanical and electrical equipment per local and state code requirements.
  - All exterior receptacles shall be of type ground fault current interrupter (GFCI) and shall be provided with in-use weatherproof covers.
  - Equipment to be replaced within the buildings shall be powered from existing panelboards inside of the building. Routing to new equipment is to reuse existing routing where possible and extend conduit and conductors as necessary.

- Lighting
  - New LED lighting to be provided around all mechanical and electrical equipment within the mechanical house and yard.
  - Lighting shall be controlled with wall switches located at all entrances to the mechanical house and yard. No occupancy controls are to be provided around mechanical or electrical equipment for the safety, health, and wellbeing of maintenance personnel. In spaces where daylighting is provided, such as in the mechanical yard, photocells shall be provided to automatically turn luminaires “off” when daylight is available.

- **Alt1 (Air cooled chiller with electric boiler)**
    - All systems and distribution the same except Heating equipment and Power distribution
        - (4) 600kW electric boilers **($49k each)**
    - Power Distribution
        - Utility: 1500kVA pad-mounted transformer with a 480Y/277V, 3 phase, 4-wire secondary voltage and an established grounding conductor provided and installed by the electrical utility company. Separate main service disconnect switchboard with integrated utility meter to be provided per the Utility's standards.
        - Emergency: 1.5MW, 480Y/277V, 3 phase, 4-wire pad-mounted generator shall provide emergency power to an 2000A automatic transfer switch (ATS). The ATS shall be capable of transferring power to the generator when a loss of normal utility power has been sensed.

          Per code requirements, , provide a generator docking station or permanently installed camlock connection with an integral manual transfer switch (MTS) is to be provided downstream of the generator so that when the generator is undergoing maintenance, the back-up power may be provided via a temporary generator. The camlock will need to provided in a location where a temporary generator can connect.
        - 2000A, 480Y/277V, 3 phase, 4-wire pad-mounted main distribution switchboard to be located downstream of the ATS for providing power to all mechanical and lighting equipment.
        - 100A, 208Y/120V, 3 phase surface-mounted panelboard for convenience receptacle loads and mechanical control power requirements. Power to the 100A panelboard to be provided via a 30 kVA step-down transformer.
        - Additional panelboards may be required based on number of circuits required for mechanical equipment.
        - All electrical equipment is to be rated a minimum of NEMA 3X for exterior environments.
    - Power
        - Same as base
    - Lighting
        - Same as base

- **Alt 2 (Air Source Heat Pump [ASHP] with natural gas boiler)**
  - Cooling
    - (3) 180 ton air source heat pumps **($265,000 each)**
    - Primary pump per chiller (330gpm@30ft hd end suction 3hp)
    - Hydronic specialties
    - Glycol feeder
    - Secondary Pumps per system (600gpm@90ft head end suction 15hp)
    - 3000gal buffer tank per system **($55k each)**
    - Plate and frame heat exchanger per system
    - Hydronic specialties (expansion tank, makeup water assembly)
  - Heating
    - (4) 2000MBH NG fired condensing boilers **($55k each)**
    - primary pump per boiler (300gpm@20ft hd inline 2 hp)
    - Secondary Pumps per system (600gpm@90ft head end suction 15hp)
    - 3000gal buffer tank per system **($55k each)**
    - Plate and frame heat exchanger per system
    - Hydronic specialties (expansion tank, makeup water assembly)
  - DDC Controls
  - Distribution
    - Similar to base case but a different location for the plant will have slightly different routing
  - DDC Controls
    - Same as base
  - Power Distribution
    - Same as base
  - Power
    - Same as base
  - Lighting
    - Same as base
- **Alt 3 (Air Source heat pump with electric boilers)**
  - Cooling
    - Same as Alt2
  - Heating
    - Same as Alt1
  - Distribution
    - Same Alt 2
  - DDC Controls
    - Alt 2
  - Power Distribution
    - Same as Alt1
  - Power
    - Same as base
  - Lighting
    - Same as base

Ground Source
Building (50x42x16' tall brick façade)
Yard (15x42) decorative 10' architectural louver screenwall
Distribution Piping – See plans for sizing and distribution – PEX with 1.5" insulation similar to Rovanco, PP-R (Polypropylene), or PP-RCT (Random Copolymer Polypropylene)

- **Geothermal**
  - Cooling and Heating
    - 2 lineups of (4) 80 ton geothermal heat pumps (GSHP) **$1,248,000**
  - Geothermal
    - Hydronic specialties
    - Glycol feeder
    - (2) pumps (600gpm@90ft head end suction 15hp)
    - Distribution and borefield

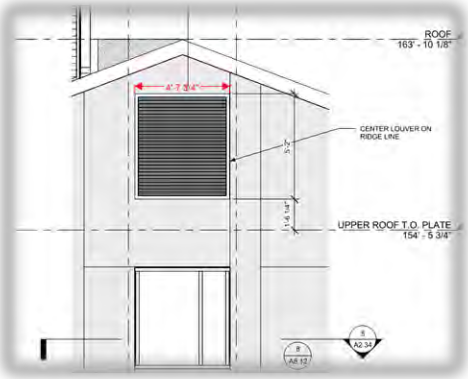
      We'll use an existing study of Meridien Village to estimate the borefield scope:
      *Meridian village is 455k sf with a 20k sf dining facility. Estimated bore field at 400 bores. When interconnected with Moby, that reduces to an additional 310 bores. Carrying forward this estimate, our facility is only 200k sf so assume a linear relationship and we only require (200)/(455+20) 42% of the bore field. There are some fixed costs and assumed at $500k that don't scale like routing pipe to the site and distribution… so $5.3M*0.42+$500k =* **$2.7M**

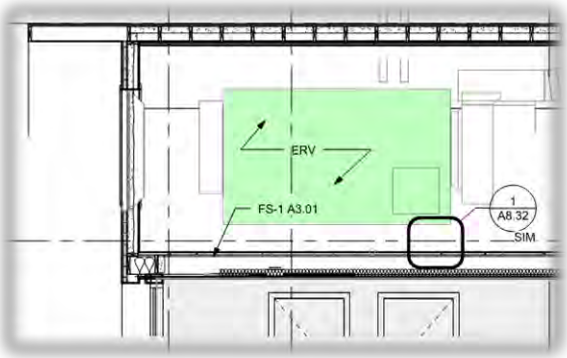
  - Distribution (CHW and HW) – listed typical of each system (e.g., hot water system has 2 pumps)
    - Secondary Pumps per system (600gpm@90ft head end suction 15hp)
    - Hydronic specialties (expansion tank, makeup water assembly)
  - DDC Controls
  - Power Distribution
    - Same as base
  - Power
    - Same as base
  - Lighting
    - Same as base

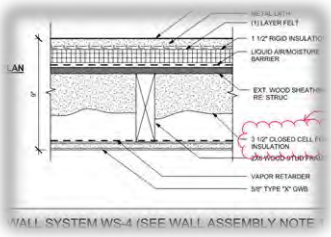
Energy Recovery Ventilator (ERV) Replacement Plan
Alpine ERVs

The North Building contains four Energy Recovery Ventilators (ERVs): ERV-1-N, ERV-2-N, ERV-3-N, and ERV-4-N. The process of removing the existing units and installing new replacements requires careful planning to ensure minimal disruption and structural modifications. Below are the details for each ERV location and the recommended approach for replacement:

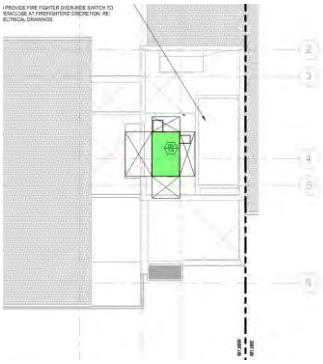
- ERV-1-N (West Wing Mechanical Attic)
  - Existing Unit: Greenheck HRE-55H-15 (76" x 70")
  - Access Considerations: The most feasible approach for replacing this unit is to remove the 54" x 63" louver on the exterior wall. However, since the unit's dimensions exceed the louver opening, the opening may need to be enlarged slightly to facilitate removal and installation. The north side wall of this room is constructed using WS-4 wall system, allowing for unit removal and installation.



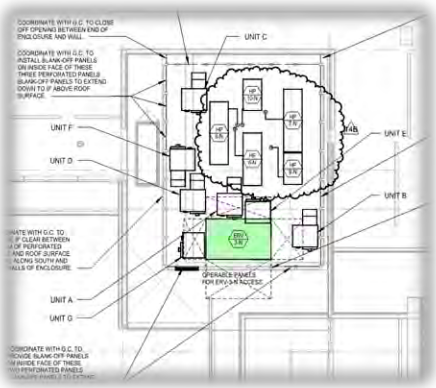


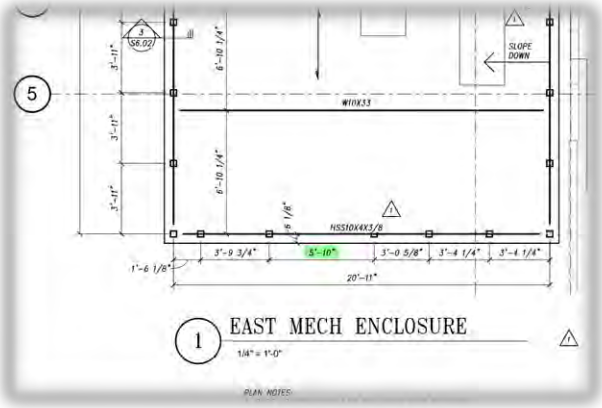


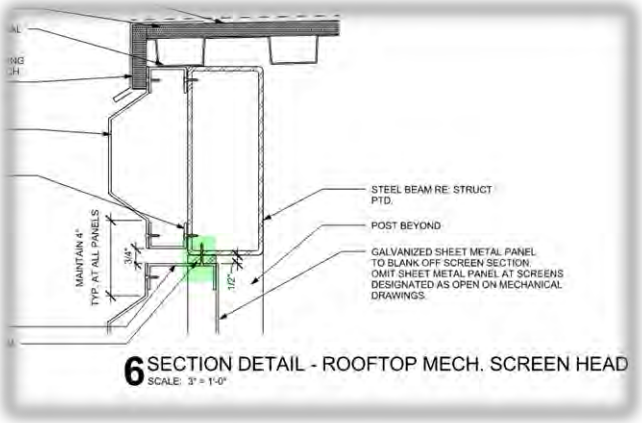
- ERV-2-N (Center Tower Roof)
  - Existing Unit: Greenheck HRE-45H-15 (86" x 122")
  - Access Considerations: Since this unit is located on the roof, replacement is relatively straightforward. A crane or lift can be used to remove the old unit and position the new one in place.

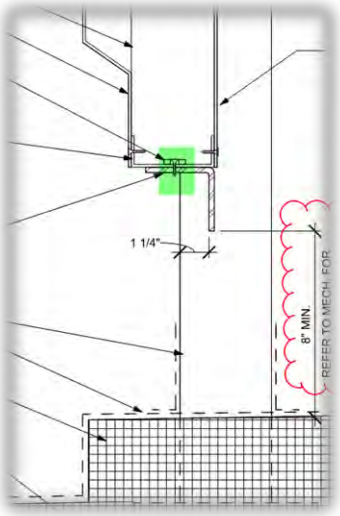


- ERV-3-N (West Wing Roof – Mechanical Screen Enclosure)
  - Existing Unit: Greenheck HRE-45L-15 (66" x 68.5")
  - Access Considerations: According to EAST MECH ENCLOSURE detail drawing (S6.02), the enclosure panels next to the unit provide sufficient clearance for replacement. Each panel is secured with screws and is designed to be removable.

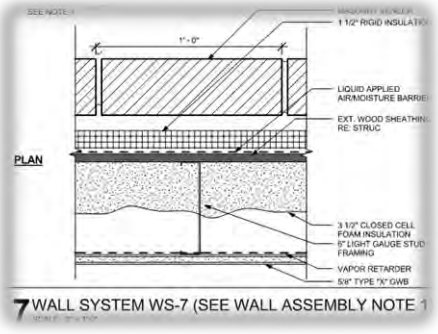


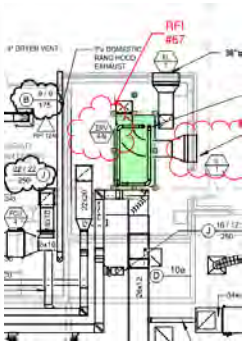






- ERV-4-N (Mech Room-141)
    - Existing Unit: Greenheck HRE-20H-15 (74" x 113")
    - Access Considerations: This unit is housed within Mechanical Room-141. The north side wall of this room is constructed using WS-7 wall system, allowing for unit removal and installation.

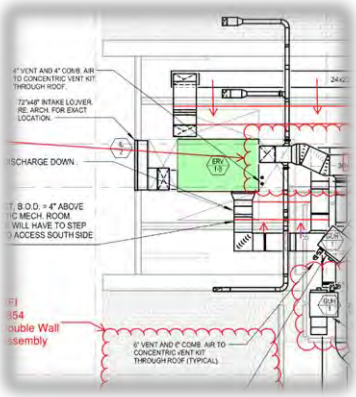
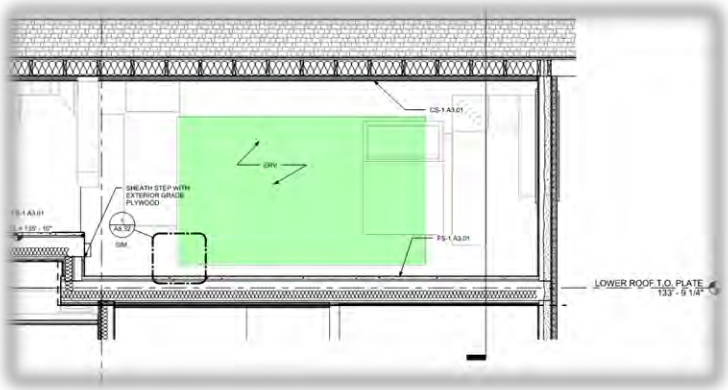




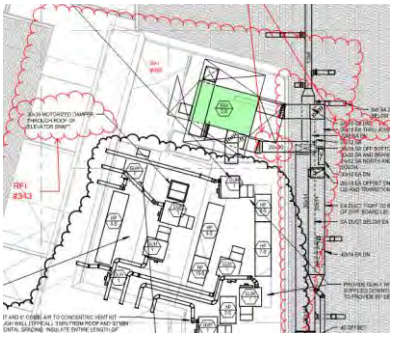
Pinon ERVs

The South Building contains three Energy Recovery Ventilators (ERVs): ERV-1-S, ERV-2-S, and ERV-3-S. Below are the details for each ERV location and the recommended approach for replacement:

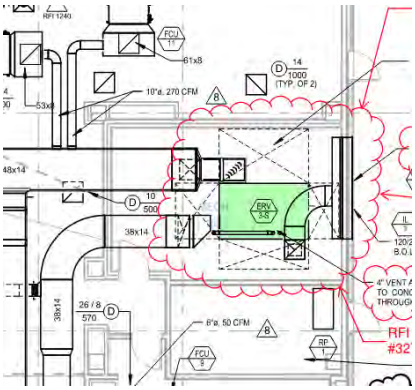
- ERV-1-S (West Wing Mechanical Attic)
    - Existing Unit: Greenheck HRE-55H-15 (76" x 70")
    - Access Considerations: The most feasible approach for replacing this unit is to remove the 72" x 48" louver on the exterior wall. However, since the unit's dimensions exceed the louver opening, the opening may need to be enlarged slightly to facilitate removal and installation. The east side wall of this room is constructed using WS-4 wall system, allowing for unit removal and installation.

- ERV-2-S (East Wing Roof – Mechanical Screen Enclosure)
  - Existing Unit: Greenheck HRE-55H-15 (76" x 70")
  - Access Considerations: Since the mechanical enclosure does not have a roof where the ERV is located, replacement is relatively straightforward.



- ERV-3-S (Mech Room-103)
  - Existing Unit: Greenheck HRE-45H-15 (66" x 68.5")
  - Access Considerations: This unit is housed within Mechanical Room-103. The west side wall of this room is constructed using WS-7 wall system, allowing for unit removal and installation.



Pavilion ERVs

One ERV serves this building. Below is ERV location and the recommended approach for replacement:

- ERV-1-P (Roof)
  - Existing Unit: Greenheck HRE-45H-15 (66" x 68.5")
  - The unit is located on the roof.



Fan Coil Replacement Plan
Pavilion Fan Coils

The scope of work for the Pavilion building includes the demo of existing fan coil units, mode control units, and associated refrigerant piping. The pavilion building does not have ceilings that need to be demolish and replaced. The HHW and CHW pipe mains are to enter the building in 108 Katabatic Cooling Tower and rise to level 2. The risers will serve both level 1 and level 2.

Demolition:

- Demolish existing refrigerant piping serving existing fan coil units (FCUs) and mode control units.
- Demolish existing fan coil units and mode control units.

New Construction:

- Route 3" HHW/CHW mains into the building to serve fan coil units.
- Replace existing VRF fan coil units with new 4-pipe fan coil units. BOD: Price FCH.
    - Replace exposed fan coil units with exposed fan coil units and ducted concealed units with new ducted concealed units.
- Connect new fan coil units to HHW and CHW mains with branch piping and associated valves.

Alpine Fan Coils

The scope of work for Alpine includes the demo of existing fan coil units, mode control units, associated refrigerant piping, and the corridor ceilings on level 1. The HHW and CHW pipe mains are to enter the building in N002 Elev Lobby before rising to level 1. Once the HHW and CHW pipe mains are on level 1 they will run throughout the corridors serving fan coils on level 1 and risers serving fan coils on the levels above.

Demolition:

- Demolish existing ceilings in the corridors of level 1 to allow for additions of new pipe mains.
- Demolish ceilings as required in lounge/study rooms on the upper levels that have ducted concealed fan coil units.
- Demolish existing refrigerant piping serving existing fan coil units and mode control units.
- Demolish existing fan coil units and mode control units.
- Demolish existing closets in dorm rooms that will have pipe risers rising through them.

New Construction:

- Core holes in the floors to allow risers to serve fan coils on the upper levels of the building.
- Route 4" piping mains on the western half of level 1 and 6" piping mains on the eastern half of level 1.
- Route risers serving fan coil units on the upper levels up from level 1 through floor cores.
- Route cooling coil condensate piping down the walls where old refrigerant piping was rising through the building.
- Replace existing VRF fan coil units with new 4-pipe fan coil units. BOD: Price FCH.
    - Connect new fan coil units to HHW and CHW mains with branch piping and associated valves.
    - Build soffits around fan coils in the dorm rooms (typical of FCU1 and FCU2) and replace any demolished closets with new wardrobes. Build a wall around pipe risers to mate with the fan coil soffit.
        - Replace demolished closet with a wardrobe. Wardrobes are only required where a closet is removed so in a typical room that would be demolishing 1 of the 2 closets and one wardrobe. Wardrobe estimate $865 + delivery and install so assume $1100 per wardrobe.
- Replace ceilings in the level 1 corridors.
- Replace ceilings as required in lounge/study rooms on the upper levels that have ducted concealed fan coil units.

Pinion Fan Coils

The scope of work for Pinion includes the demo of existing fan coil units, mode control units, associated refrigerant piping, and the corridor ceilings on level 1. The HHW and CHW pipe mains are to enter the building in 2 locations. 103 Mech and 161 Laundry. Once the HHW and CHW pipe mains are in the building they will run throughout the corridors serving fan coils on level 1 and risers serving fan coils on the levels above. The pipe mains entering the building and running throughout level 1 in 103 Mech serving the eastern half of the building will be 6" pipes and the mains entering 161 Laundry serving the western half of the building will be 4" pipes.

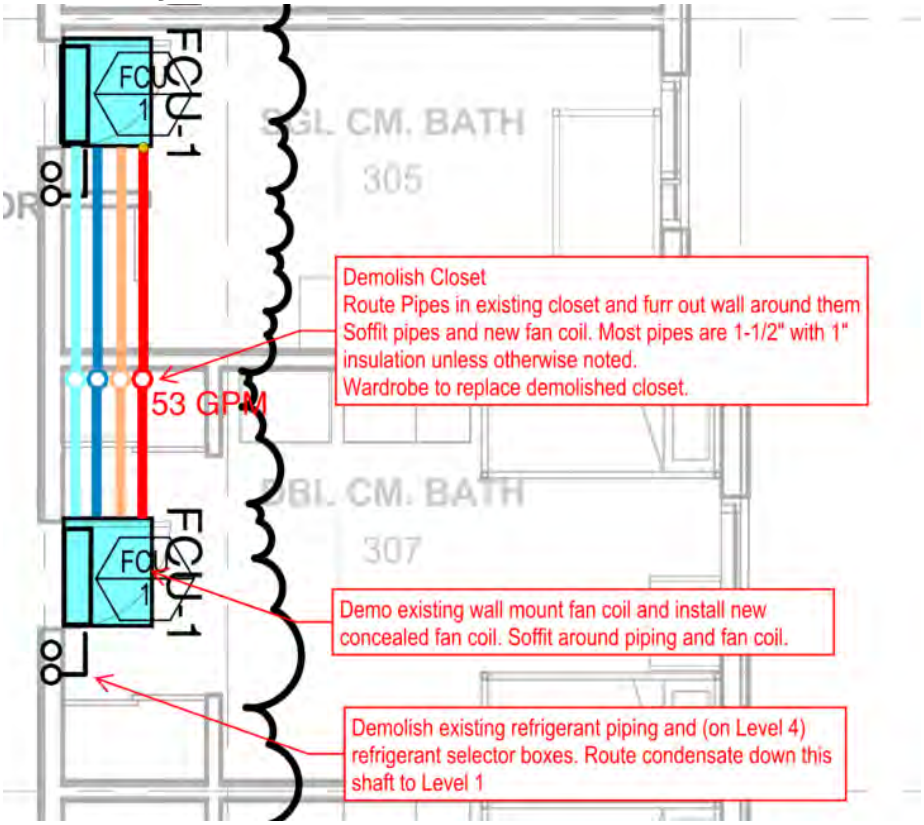
Demolition:

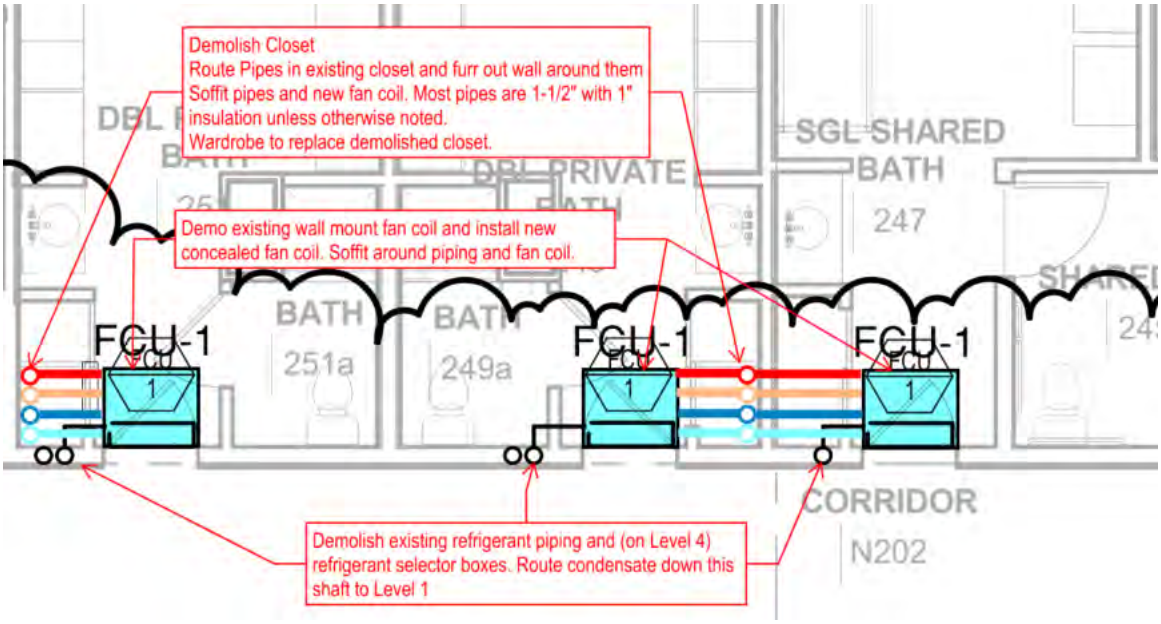
- Demolish existing ceilings in the corridors of level 1 to allow for additions of new pipe mains.
- Demolish ceilings as required in lounge/study rooms on the upper levels that have ducted concealed fan coil units.
- Demolish existing refrigerant piping serving existing fan coil units and mode control units.
- Demolish existing fan coil units and mode control units.
- Demolish existing closets in dorm rooms that will have pipe risers rising through them.

New Construction:

- Core holes in the floors to allow risers to serve fan coils on the upper levels of the building.
- Route 4" piping mains on the western half of level 1 and 6" piping mains on the eastern half of level 1.
- Route risers serving fan coil units on the upper levels up from level 1 through floor cores.
- Route cooling coil condensate piping down the walls where old refrigerant piping was rising through the building.
- Replace existing VRF fan coil units with new 4-pipe fan coil units. BOD: Price FCH.
    - Connect new fan coil units to HHW and CHW mains with branch piping and associated valves.
    - Build soffits around fan coils in the dorm rooms (typical of FCU1 and FCU2) and replace any demolished closets with new wardrobes. Build a wall around pipe risers to mate with the fan coil soffit.
        - Replace demolished closet with a wardrobe. Wardrobes are only required where a closet is removed so in a typical room that would be demolishing 1 of the 2 closets and one wardrobe. Wardrobe estimate $865 + delivery and install so assume $1100 per wardrobe.
    - In every other area replace exposed fan coil units with exposed fan coil units and ducted concealed units with new ducted concealed units.
- Replace ceilings in the level 1 corridors.
- Replace ceilings as required in lounge/study rooms on the upper levels that have ducted concealed fan coil units.

Typical Riser Assembly





Colorado State University

Laurel Village ERV Replacement

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Summary

Inclusive of soft costs

Phasing/Mobilization (5%), General Conditions (10%), Contingency (5.5%)
Design Fees (5%), Construction soft costs [e.g., insurance, PM, permitting] (5%)
CSU Soft Costs [e.g., Admin, Consultant fees, OFE, FLODC, Contingency] (20%)

Buildings Work	Terminal Unit Replacement	ERV Replacement
Pavilion	$ 890,420	$ 161,900
Pinon	$ 10,384,860	$ 671,580
Alpine	$ 11,796,560	$ 664,960

Air Source Plant	Plant	Distribution	Terminal Unit Replacement	ERV Replacement	Total Cost
ACC+NG	$ 9,446,454	$ 3,025,460	$ 23,071,840	$ 1,498,440	**$ 37,042,194**
ACC+Elec	$ 11,813,978	$ 3,025,460	$ 23,071,840	$ 1,498,440	**$ 39,409,718**
ASHP+NG	$ 9,907,054	$ 3,025,460	$ 23,071,840	$ 1,498,440	**$ 37,502,794**
ASHP+Elec	$ 12,041,078	$ 3,025,460	$ 23,071,840	$ 1,498,440	**$ 39,636,818**
Geothermal Plant	$ 17,956,700	$ 2,878,828	$ 23,071,840	$ 1,498,440	**$ 45,405,808**
Replace VRF System at end of life			$ 34,607,760	$ 1,498,440	**$ 36,106,200**

Colorado State University

Laurel Village ERV Replacement

Fort Collins

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Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Summary

Summary

		North	South	Pavillion
General Construction		$ 26,800	$ 26,700	$ -
Mechanical		$ 383,000	$ 359,700	$ 99,500
Controls		$ 32,000	$ 24,000	$ 8,000
Total Construction Cost (Material and Labor)		**$ 441,800**	**$ 410,400**	**$ 107,500**
Phasing - Mobilization/Demobilization	5.0%	$ 22,100	$ 20,500	$ 5,400
General Conditions	10.0%	$ 44,200	$ 41,000	$ 10,800
Contingency	5.5%	$ 24,300	$ 22,600	$ 5,900
Design Fees	5.0%	$ 22,100	$ 20,500	$ 5,400
Construction soft costs (Permit Fees, bonding, insurance, project management)	5.0%	$ 22,100	$ 20,500	$ 5,400
Contractor Soft Costs		**$ 134,800**	**$ 125,100**	**$ 32,900**
Fixed Limit of Design and Construction Cost		**$ 576,600**	**$ 535,500**	**$ 140,400**
CSU Soft costs (Administrative, Consultant Fees, Equipment (Owner Furnished), Construction Costs (Outside FLODC), Owner Contingency)	20.0%	$ 88,360	$ 82,080	$ 21,500
TOTAL DEVELOPMENT BUDGET		**$ 664,960**	**$ 617,580**	**$ 161,900**

Note - all Totals Rounded up to nearest $1k

Colorado State University

Laurel Village ERV Replacement

North

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

General Construction

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	1,100.00	$	1,100
Equipment/Rigging/Material Handling	1	ls	$	2,300.00	$	2,300
Subtotal General Requirements					**$**	**4,000**
Demolition						
Demo/Remove Wall Assembly WS-4 and Louver	64	sf	$	22.50	$	1,440
Demo/Remove Enclosure Panel	78	sf	$	20.00	$	1,560
Demo/Remove Wall Assembly WS-7 and Louver	68	sf	$	27.50	$	1,870
Recycling/Waste Removal	1	ls	$	974.00	$	974
Subtotal Demolition					**$**	**6,000**
General Construction						
Wall Assemblies						
Reconstruct Wall Assembly WS-4	64	sf	$	56.25	$	3,600
Rebuild Enclosure Panels	78	sf	$	50.00	$	3,900
Reconstruct Wall Assembly WS-7	68	sf	$	68.75	$	4,675
Wall Detailing and Finishes- Material and Labor as required for replacement in-kind	1	ls	$	2,435.00	$	2,435
Subtotal General Construction					**$**	**14,700**
Other						
Remediation in Area of Work as Required	1	ls	$	2,100.00	$	2,100
Total Other					**$**	**2,100**
Total General Construction					**$**	**26,800**

Colorado State University

Laurel Village ERV Replacement

North

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	16,700.00	$	16,700
Equipment/Rigging/Material Handling	1	ls	$	33,300.00	$	33,300
Subtotal General Requirements					**$**	**50,000**
Demolition						
Demo/Remove ERV & Associated Material and Controls	4	ea	$	1,250.00	$	5,000
Waste Removal	1	ls	$	1,000.00	$	1,000
Subtotal Demolition					**$**	**6,000**
Sheetmetal						
Curb and Sheetmetal Connections to Existing Distribution	1	ls	$	13,150.00	$	13,150
Subtotal Sheetmetal					**$**	**13,200**
Equipment						
Energy Recovery Unit						
ERV-1-N 5938CFM Energy Recovery Unit	1	ea	$	89,070.00	$	89,000
ERV-2-N 5000CFM Energy Recovery Unit	1	ea	$	75,000.00	$	75,000
ERV-3-N 4063CFM Energy Recovery Unit	1	ea	$	60,945.00	$	61,000
ERV-4-N 2500CFM Energy Recovery Unit	1	ea	$	37,500.00	$	38,000
Subtotal Equipment					**$**	**263,000**
Piping Systems						
Hot Water Piping						
HHWS/R Piping Type L, Copper	80	lf	$	50.00	$	4,000
Fitting Allowance	1	ls	$	2,600.00	$	2,600
Valve Allowance	1	ls	$	3,000.00	$	3,000
Specialty Allowance	1	ls	$	1,800.00	$	1,800
HHWS/R Connections	8	ea	$	250.00	$	2,000
Insulation						
HHWS/R Piping Insulation/Jacket	80	lf	$	15.00	$	1,200
Fitting & Valve Allowance Insulation	1	ls	$	400.00	$	400
Chilled Water Piping						
CHWS/R Piping Type L, Copper	80	lf	$	50.00	$	4,000
Fitting Allowance	1	ls	$	2,600.00	$	2,600
Valve Allowance	1	ls	$	3,000.00	$	3,000
Specialty Allowance	1	ls	$	1,800.00	$	1,800
CHWS/R Connection	8	ea	$	250.00	$	2,000

Colorado State University

Laurel Village ERV Replacement

North

Fort Collins

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Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
Insulation				
CHWS/R Piping Insulation/Jacket	80	lf	$ 15.00	$ 1,200
Fitting & Valve Allowance Insulation	1	ls	$ 400.00	$ 400
Subtotal Piping Systems				**$ 30,000**
Instrumentation & Controls				
Fan Coil Control System - Control Points				See Controls Page
Subtotal Instrumentation & Controls				**$ -**
Electrical				
EC to Disconnect wiring from existing unit and cap safe	4	ea	$ 300.00	$ 1,200
ERV - Reconnect Power Connection	4	ea	$ 600.00	$ 2,400
Subtotal Electrical				**$ 3,600**
Testing				
Testing (Pre, Concurrent, Post)	1	ls	$ 7,700.00	$ 7,700
Total Testing				**$ 7,700**
Other				
Sealing and Firestopping	1	ls	$ 9,500.00	$ 9,500
Total Other				**$ 9,500**
Total Mechanical Systems				**$ 383,000**

Colorado State University

Laurel Village ERV Replacement

North

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Controls

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	1,300.00	$	1,300
Equipment/Rigging/Material Handling	1	ls	$	2,600.00	$	2,600
Subtotal General Requirements					**$**	**4,000**
Demolition			$	-		N/A
Subtotal Demolition					**$**	**-**
Instrumentation & Controls						
ERV Control System - Packaged Control Points						
Hardwired Points (@ 150'lf/ea assumed)						
DI/DO (Digital) Controls Plenum Cable	24	ea	$	400.00	$	9,600
AI/AO (Analog) Controls Plenum Cable	16	ea	$	400.00	$	6,400
Software Programming						
AI/AO (Analog) & DI/DO (Digital) inc Integration & Monitoring @ Existing BAS	40	hrs	$	250.00	$	10,000
Subtotal Instrumentation & Controls					**$**	**26,000**
Electrical			$	-		N/A
Subtotal Electrical					**$**	**-**
Testing						
Testing (Pre, Concurrent, Post)	1	ls	$	2,000.00	$	2,000
Total Testing					**$**	**2,000**
Total Controls					**$**	**32,000**

Colorado State University

Laurel Village ERV Replacement

South

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

General Construction

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	1,100.00	$	1,100
Equipment/Rigging/Material Handling	1	ls	$	2,300.00	$	2,300
Subtotal General Requirements					**$**	**4,000**
Demolition						
Demo/Remove Wall Assembly WS-4 and Louver	70	sf	$	22.50	$	1,575
Demo/Remove Enclosure Panel	65	sf	$	20.00	$	1,300
Demo/Remove Wall Assembly WS-7 and Louver	72	sf	$	27.50	$	1,980
Recycling/Waste Removal	1	ls	$	971.00	$	971
Subtotal Demolition					**$**	**6,000**
General Construction						
Wall Assemblies						
Reconstruct Wall Assembly WS-4	70	sf	$	56.25	$	3,938
Rebuild Enclosure Panels	65	sf	$	50.00	$	3,250
Reconstruct Wall Assembly WS-7	72	sf	$	68.75	$	4,950
Wall Detailing and Finishes- Material and Labor as required for replacement in-kind	1	ls	$	2,427.60	$	2,428
Subtotal General Construction					**$**	**14,600**
Other						
Remediation in Area of Work as Required	1	ls	$	2,100.00	$	2,100
Total Other					**$**	**2,100**
Total General Construction					**$**	**26,700**

Colorado State University

Laurel Village ERV Replacement

South

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	15,600.00	$	15,600
Equipment/Rigging/Material Handling	1	ls	$	31,300.00	$	31,300
Subtotal General Requirements					**$**	**47,000**
Demolition						
Demo/Remove ERV & Associated Material and Controls	3	ea	$	1,250.00	$	3,750
Waste Removal	1	ls	$	750.00	$	750
Subtotal Demolition					**$**	**5,000**
Sheetmetal						
Curb and Sheetmetal Connections to Existing Distribution	1	ls	$	12,650.00	$	12,650
Subtotal Sheetmetal					**$**	**12,700**
Equipment						
Energy Recovery Unit						
ERV-1-S 5938CFM Energy Recovery Unit	1	ea	$	89,070.00	$	89,000
ERV-2-S 5938CFM Energy Recovery Unit	1	ea	$	89,070.00	$	89,000
ERV-3-S 5000CFM Energy Recovery Unit	1	ea	$	75,000.00	$	75,000
Subtotal Equipment					**$**	**253,000**
Piping Systems						
Hot Water Piping						
HHWS/R Piping Type L, Copper	60	lf	$	50.00	$	3,000
Fitting Allowance	1	ls	$	2,000.00	$	2,000
Valve Allowance	1	ls	$	2,300.00	$	2,300
Specialty Allowance	1	ls	$	1,400.00	$	1,400
HHWS/R Connections	6	ea	$	250.00	$	1,500
Insulation						
HHWS/R Piping Insulation/Jacket	60	lf	$	15.00	$	900
Fitting & Valve Allowance Insulation	1	ls	$	300.00	$	300
Chilled Water Piping						
CHWS/R Piping Type L, Copper	60	lf	$	50.00	$	3,000
Fitting Allowance	1	ls	$	2,000.00	$	2,000
Valve Allowance	1	ls	$	2,300.00	$	2,300
Specialty Allowance	1	ls	$	1,400.00	$	1,400
CHWS/R Connection	6	ea	$	250.00	$	1,500

Colorado State University

Laurel Village ERV Replacement

South

Fort Collins

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Opinion of Probable Cost

Mechanical

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
Insulation				
CHWS/R Piping Insulation/Jacket	60	lf	$ 15.00	$ 900
Fitting & Valve Allowance Insulation	1	ls	$ 300.00	$ 300
Subtotal Piping Systems				**$ 23,000**
Instrumentation & Controls				
Fan Coil Control System - Control Points				See Controls Page
Subtotal Instrumentation & Controls				**$ -**
Electrical				
EC to Disconnect wiring from existing unit and cap safe	3	ea	$ 300.00	$ 900
ERV - Reconnect Power Connection	3	ea	$ 600.00	$ 1,800
Subtotal Electrical				**$ 2,700**
Testing				
Testing (Pre, Concurrent, Post)	1	ls	$ 7,300.00	$ 7,300
Total Testing				**$ 7,300**
Other				
Sealing and Firestopping	1	ls	$ 9,000.00	$ 9,000
Total Other				**$ 9,000**
Total Mechanical Systems				**$ 359,700**

Colorado State University

Laurel Village ERV Replacement

South

Fort Collins

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Opinion of Probable Cost

Controls

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
General Requirements				
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$ 1,000.00	$ 1,000
Equipment/Rigging/Material Handling	1	ls	$ 2,000.00	$ 2,000
Subtotal General Requirements				**$ 3,000**
Demolition				
			$ -	N/A
Subtotal Demolition				**$ -**

Colorado State University

Laurel Village ERV Replacement

South

Fort Collins

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Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Controls

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
Instrumentation & Controls						
ERV Control System - Packaged Control Points						
Hardwired Points (@ 150'lf/ea assumed)						
DI/DO (Digital) Controls Plenum Cable	18	ea	$	400.00	$	7,200
AI/AO (Analog) Controls Plenum Cable	12	ea	$	400.00	$	4,800
Software Programming						
AI/AO (Analog) & DI/DO (Digital) inc Integration & Monitoring @ Existing BAS	30	hrs	$	250.00	$	7,500
Subtotal Instrumentation & Controls					**$**	**19,500**
Electrical						
			$	-		N/A
Subtotal Electrical					**$**	**-**
Testing						
Testing (Pre, Concurrent, Post)	1	ls	$	1,500.00	$	1,500
Total Testing					**$**	**1,500**
Total Controls					**$**	**24,000**

Colorado State University

Laurel Village ERV Replacement

Pavillion

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

General Construction

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
General Requirements				
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$ -	$ -
Equipment/Rigging/Material Handling	1	ls	$ -	$ -
Subtotal General Requirements				**$ -**
Demolition				
No Demolition Scope of Work			$ -	$ -
Subtotal Demolition				**$ -**
General Construction				
No Demolition Scope of Work			$ -	$ -
Subtotal General Construction				**$ -**
Other				
				N/A
Total Other				**$ -**
Total General Construction				**$ -**

Colorado State University

Laurel Village ERV Replacement

Pavillion

Fort Collins

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Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	4,300.00	$	4,300
Equipment/Rigging/Material Handling	1	ls	$	8,700.00	$	8,700
Subtotal General Requirements					**$**	**13,000**
Demolition						
Demo/Remove ERV & Associated Material and Controls	1	ea	$	1,250.00	$	1,250
Waste Removal	1	ls	$	250.00	$	250
Subtotal Demolition					**$**	**2,000**
Sheetmetal						
Curb and Sheetmetal Connections to Existing Distribution	1	ls	$	3,300.00	$	3,300
Subtotal Sheetmetal					**$**	**3,300**
Equipment						
Energy Recovery Unit						
ERV-1-P 4375CFM Energy Recovery Unit	1	ea	$	65,625.00	$	66,000
Subtotal Equipment					**$**	**66,000**
Piping Systems						
Hot Water Piping						
HHWS/R Piping Type L, Copper	20	lf	$	50.00	$	1,000
Fitting Allowance	1	ls	$	700.00	$	700
Valve Allowance	1	ls	$	800.00	$	800
Specialty Allowance	1	ls	$	500.00	$	500
HHWS/R Connections	2	ea	$	250.00	$	500
Insulation						
HHWS/R Piping Insulation/Jacket	20	lf	$	15.00	$	300
Fitting & Valve Allowance Insulation	1	ls	$	100.00	$	100
Chilled Water Piping						
CHWS/R Piping Type L, Copper	20	lf	$	50.00	$	1,000
Fitting Allowance	1	ls	$	700.00	$	700
Valve Allowance	1	ls	$	800.00	$	800
Specialty Allowance	1	ls	$	500.00	$	500
CHWS/R Connection	2	ea	$	250.00	$	500
Insulation						
CHWS/R Piping Insulation/Jacket	20	lf	$	15.00	$	300
Fitting & Valve Allowance Insulation	1	ls	$	100.00	$	100
Subtotal Piping Systems					**$**	**8,000**

Colorado State University

Laurel Village ERV Replacement

Pavillion

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
Instrumentation & Controls				
Fan Coil Control System - Control Points				See Controls Page
Subtotal Instrumentation & Controls				**$ -**
Electrical				
EC to Disconnect wiring from existing unit and cap safe	3	ea	$ 300.00	$ 900
ERV - Reconnect Power Connection	3	ea	$ 600.00	$ 1,800
Subtotal Electrical				**$ 2,700**
Testing				
Testing (Pre, Concurrent, Post)	1	ls	$ 2,000.00	$ 2,000
Total Testing				**$ 2,000**
Other				
Sealing and Firestopping	1	ls	$ 2,500.00	$ 2,500
Total Other				**$ 2,500**
Total Mechanical Systems				**$ 99,500**

Colorado State University

Laurel Village ERV Replacement

Pavillion

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Controls

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	300.00	$	300
Equipment/Rigging/Material Handling	1	ls	$	700.00	$	700
Subtotal General Requirements					**$**	**1,000**
Demolition						
see Mechanical for Demolition			$	-	$	-
Subtotal Demolition					**$**	**-**
Instrumentation & Controls						
ERV Control System - Packaged Control Points						
Hardwired Points (@ 150'lf/ea assumed)						
DI/DO (Digital) Controls Plenum Cable	6	ea	$	400.00	$	2,400
AI/AO (Analog) Controls Plenum Cable	4	ea	$	400.00	$	1,600
Software Programming						
AI/AO (Analog) & DI/DO (Digital) inc Integration & Monitoring @ Existing BAS	10	hrs	$	250.00	$	2,500
Subtotal Instrumentation & Controls					**$**	**6,500**
Testing						
Testing (Pre, Concurrent, Post)	1	ls	$	500.00	$	500
Total Testing					**$**	**500**
Total Controls					**$**	**8,000**

Colorado State University

Laurel Village FCU Replacement

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Summary

Summary

		Pavilion	Pinon	Alpine
General Construction		$ 6,500	$ 691,000	$ 766,300
Mechanical		$ 471,000	$ 5,119,200	$ 5,806,500
Controls		$ 114,100	$ 1,090,100	$ 1,265,500
Total Construction Cost (Material and Labor)		**$ 591,600**	**$ 6,900,300**	**$ 7,838,300**
Phasing - Mobilization/Demobilization	5.0%	$ 29,600	$ 345,000	$ 391,900
General Conditions	10.0%	$ 59,200	$ 690,000	$ 783,800
Contingency	5.5%	$ 32,500	$ 379,500	$ 431,100
Design Fees	5.0%	$ 29,600	$ 345,000	$ 391,900
Construction soft costs (Permit Fees, bonding, insurance, project management)	5.0%	$ 29,600	$ 345,000	$ 391,900
Contractor Soft Costs		**$ 180,500**	**$ 2,104,500**	**$ 2,390,600**
Fixed Limit of Design and Construction Cost		**$ 772,100**	**$ 9,004,800**	**$ 10,228,900**
CSU Soft costs (Administrative, Consultant Fees, Equipment (Owner Furnished), Construction Costs (Outside FLODC), Owner Contingency)	20.0%	$ 118,320	$ 1,380,060	$ 1,567,660
TOTAL DEVELOPMENT BUDGET		**$ 890,420**	**$ 10,384,860**	**$ 11,796,560**

Note - all Totals Rounded up to nearest $1k

Colorado State University

Laurel Village FCU Replacement

Pavilion

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

General Construction

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	300.00	$	300
Rigging/Material Handling	1	ls	$	200.00	$	200
Subtotal General Requirements					**$**	**1,000**
Demolition						
Non-Anticipated						N/A
Subtotal Demolition					**$**	**-**
General Construction						
Drywall Patching and Painting	22	ea	$	250.00	$	5,500
Subtotal General Construction					**$**	**5,500**
Other						
						N/A
Total Other					**$**	**-**
Total Mechanical Systems					**$**	**6,500**

Colorado State University

Laurel Village FCU Replacement

Pavilion

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	21,700.00	$	21,700
Rigging/Material Handling	1	ls	$	15,200.00	$	15,200
Subtotal General Requirements					**$**	**37,000**
Demolition						
Demo/Remove FCU & Associated Controls	22	ea	$	350.00	$	7,700
Demo/Remove Mode Control Units	6	ea	$	600.00	$	3,300
Demo/Remove 2>" Ref Piping	1,100	lf	$	5.00	$	5,500.00
Waste Removal	1	ls	$	3,300.00	$	3,300
Subtotal Demolition					**$**	**20,000**
Sheetmetal						
Non-Anticipated					N/A	
Subtotal Sheetmetal					**$**	**-**
Fan Coils						
FCU/FCH-02 4 Pipe 200CFM .5 ton - Ceiling Mounted Cassette	8	ea	$	3,600.00	$	29,000
FCU/FCH-04 4 Pipe 400CFM 1 Ton - Ceiling Mounted Cassette	4	ea	$	4,000.00	$	16,000
FCU/FCH-06 4 Pipe 600CFM 1.5 Ton - Ceiling Mounted Cassette	10	ea	$	4,800.00	$	48,000
Remote Thermostat	22	ea	$	350.00	$	8,000
Subtotal Fan Coils					**$**	**101,000**
Hot Water Piping						
3" HHWS/R Type L, Copper - Riser	40	lf	$	63.00	$	2,520
2" HHWS/R Type L, Copper - Main Branch	660	lf	$	37.50	$	24,750
3/4" HHWS/R Type L, Copper - Branch to Units	440	lf	$	15.00	$	6,600
Fitting Allowance	1	ls	$	22,100.00	$	22,100
Valve Allowance	1	ls	$	25,500.00	$	25,500
Specialty Allowance	1	ls	$	15,300.00	$	15,300
HHWS/R Connection - 3/4"	44	ea	$	100.00	$	4,400
Condensate Connection	22	ea	$	100.00	$	2,200
Condensate - Flexible PVC Piping	22	ea	$	75.00	$	1,650
Clean & Flush	1,140	lf	$	4.00	$	4,560.00
Labeling	1,140	lf	$	2.00	$	2,280.00

Colorado State University

Laurel Village FCU Replacement

Pavilion

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
Insulation				
Hot Water				
HHWS/R 3" Piping Insulation, 1 1/2" Wall Fiberglass	40	lf	$ 15.00	$ 600.00
HHWS/R 2" Piping Insulation, 1 1/2" Wall Fiberglass	660	lf	$ 13.00	$ 8,580.00
HHWS/R 3/4" Piping Insulation, 1 1/2" Wall Fiberglass	440	lf	$ 10.50	$ 4,620
Fitting & Valve Allowance Insulation	1	ls	$ 4,100.00	$ 4,100
Chilled Water Piping				
3" CHWS/R Type L, Copper - Riser	40	lf	$ 63.00	$ 2,520
2" CHWS/R Type L, Copper - Main Branch	660	lf	$ 37.50	$ 24,750
3/4" CHWS/R Type L, Copper - Branch to Units	440	lf	$ 15.00	$ 6,600
Fitting Allowance	1	ls	$ 22,100.00	$ 22,100
Valve Allowance	1	ls	$ 25,500.00	$ 25,500
Specialty Allowance	1	ls	$ 15,300.00	$ 15,300
CHWS/R Connection - 3/4"	44	ea	$ 100.00	$ 4,400
Condensate Connection	22	ea	$ 100.00	$ 2,200
Condensate - Flexible PVC Piping	22	ea	$ 75.00	$ 1,650
Clean & Flush	1,140	lf	$ 4.00	$ 4,560.00
Labeling	1,140	lf	$ 2.00	$ 2,280.00
Insulation				
Chilled Water				
CHWS/R 3" Piping Insulation, 1 1/2" Wall Fiberglass	40	lf	$ 15.00	$ 600.00
CHWS/R 2" Piping Insulation, 1 1/2" Wall Fiberglass	660	lf	$ 13.00	$ 8,580.00
CHWS/R 3/4" Piping Insulation, 1 1/2" Wall Fiberglass	440	lf	$ 10.50	$ 4,620
Fitting & Valve Allowance Insulation	1	ls	$ 4,100.00	$ 4,100
Subtotal Chilled Water Piping & Condensate				**$ 260,000**
Condensate Drain				
CD Piping 1" Type "M" Copper Pipe	545	lf	$ 16.50	$ 8,992.50
Fitting Allowance	1	ls	$ 5,900.00	$ 5,900.00
Clean & Flush	546	lf	$ 5.00	$ 2,730.00
Labeling	546	lf	$ 2.00	$ 1,092.00
Total Condensate Drain Piping				**$ 18,700.00**
Instrumentation & Controls				
Fan Coil Control System - Control Points				See Controls Page
Subtotal Instrumentation & Controls				**$ -**

Colorado State University

Laurel Village FCU Replacement

Pavilion

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
Electrical				
EC to Label FCU"S	22	ea	$ 20.00	$ 440
EC to Disconnect wiring from existing unit and cap safe	22	ea	$ 150.00	$ 3,300
FCU - Reconnect Power Connection	22	ea	$ 300.00	$ 6,600
Subtotal Electrical				**$ 10,400**
Testing				
Testing (Pre, Concurrent, Post)	1	ls	$ 19,500.00	$ 19,500
Total Testing				**$ 19,500**
Other				
Link Seal for 3" Mains into Building	4	ls	$ 400.00	$ 1,600
Core for Mains	4	ea	$ 500.00	$ 2,000
Core/Fire Stopping for Risers	4	ea	$ 200.00	$ 800
Total Other				**$ 4,400**
Total Mechanical Systems				**$ 471,000**

Colorado State University

Laurel Village FCU Replacement

Pavilion

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Controls

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	5,000.00	$	5,000
Rigging/Material Handling	1	ls	$	3,500.00	$	3,500
Subtotal General Requirements					**$**	**9,000**
Demolition						
			$	-		N/A
Subtotal Demolition					**$**	**-**
Instrumentation & Controls						
Fan Coil Control System - Control Points						
Hardwired Points (@ 150'lf/ea assumed)						
DI/DO (Digital) Controls Plenum Cable, Added Condensate Pan High Level	66	ea	$	400.00	$	26,400
AI/AO (Analog) Controls Plenum Cable	88	ea	$	400.00	$	35,200
Software Programming						
AI/AO (Analog) & DI/DO (Digital) inc Integration & Monitoring @ Existing BAS	154	hrs	$	250.00	$	38,500
Subtotal Instrumentation & Controls					**$**	**100,100**
Electrical						
			$	-		N/A
Subtotal Electrical					**$**	**-**
Testing						
Testing (Pre, Concurrent, Post)	1	ls	$	5,000.00	$	5,000
Total Testing					**$**	**5,000**
Total Controlsl Systems					**$**	**114,100**

Colorado State University

Laurel Village FCU Replacement

Pinon

Fort Collins

AEI Project No. 26398-00

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Opinion of Probable Cost

General Construction

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	31,800.00	$	31,800
Rigging/Material Handling	1	ls	$	22,300.00	$	22,300
Subtotal General Requirements					**$**	**55,000**
Demolition						
Demo/Remove Ceiling in Corridors of Level 1. In Lounge/Study Rooms as Required	7500	sf	$	5.00	$	37,500
Demo/Remove Closet: 2.5'x8' Tall Wall and Sliding Door	96	ea	$	250.00	$	24,000
Waste Removal	1	ls	$	12,300.00	$	12,300
Subtotal Demolition					**$**	**74,000**
General Construction						
Drywall Patching and Painting at Each FCU	211	ea	$	250.00	$	52,750
Hallway/Lobby						
Plaster & Gypsum Board	7,500	sf	$	12.50	$	93,750
Ceiling Finishes	7,500	sf	$	2.50	$	18,750
Build Soffit for FCU's as Required						
Soffit:3'x8'	186	ea	$	875.00	$	162,750
Furr Wall for Pipe Riser						
Fur Wall: 5.5'x8'	107	ea	$	1,200.00	$	128,400
Subtotal General Construction					**$**	**456,400**
Furnishings						
Wardrobes	96	ea	$	1,100.00	$	105,600
Subtotal Furnishings					**$**	**105,600**
Other						
					N/A	
Total Other					**$**	**-**
Total Mechanical Systems					**$**	**691,000**

Colorado State University

Laurel Village FCU Replacement

Pinon

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	220,600.00	$	220,600
Rigging/Material Handling	1	ls	$	154,400.00	$	154,400
Subtotal General Requirements					**$**	**375,000**
Demolition						
Demo/Remove FCU & Associated Controls	211	ea	$	350.00	$	73,850
Demo/Remove Mode Control Units	48	ea	$	600.00	$	28,800
Demo/Remove 2>" Ref Piping	11,040	lf	$	5.00	$	55,200.00
Waste Removal	1	ls	$	31,570.00	$	31,570
Subtotal Demolition					**$**	**190,000**
Sheetmetal						
Non-Anticipated					N/A	
Subtotal Sheetmetal					**$**	**-**
Fan Coils						
FCU/FCH-02 4 Pipe 200CFM .5 ton - Ceiling Mounted Cassette	188	ea	$	3,600.00	$	677,000
FCU/FCH-04 4 Pipe 400CFM 1 Ton - Ceiling Mounted Cassette	3	ea	$	4,000.00	$	12,000
FCU/FCH-06 4 Pipe 600CFM 1.5 Ton - Ceiling Mounted Cassette	0	ea	$	4,800.00	$	-
FCU/FCH-010 4 Pipe 1,000CFM 2.5 Ton - Ceiling Mounted Cassette	10	ea	$	5,600.00	$	56,000
FCU/FCH-012 4 Pipe 1,200CFM 3 Ton - Ceiling Mounted Cassette	10	ea	$	6,000.00	$	60,000
Remote Thermostat	211	ea	$	350.00	$	74,000
Subtotal Fan Coils					**$**	**879,000**
Hot Water Piping						
6" HHWS/R Type L, Copper - Riser	200	lf	$	194.00	$	38,800
6" HHWS/R Type L, Copper - Main	580	lf	$	194.00	$	112,520
4" HHWS/R Type L, Copper - Riser	80	lf	$	100.00	$	8,000
4" HHWS/R Type L, Copper - Main	240	lf	$	100.00	$	24,000
3" HHWS/R Type L, Copper - Branch	40	lf	$	63.00	$	2,520
2.5" HHWS/R Type L, Copper - Riser	160	lf	$	50.00	$	8,000
2.5" HHWS/R Type L, Copper - Branch	230	lf	$	50.00	$	11,500
2" HHWS/R Type L, Copper - Riser	200	lf	$	37.50	$	7,500
2" HHWS/R Type L, Copper - Branch	540	lf	$	37.50	$	20,250
1.5" HHWS/R Type L, Copper - Riser	5200	lf	$	27.00	$	140,400
1.5" HHWS/R Type L, Copper - Branch	600	lf	$	27.00	$	16,200
1" HHWS/R Type L, Copper - Branch	170	lf	$	18.25	$	3,103
3/4" HHWS/R Type L, Copper - Branch	2800	lf	$	15.00	$	42,000
Fitting Allowance	1	ls	$	282,700.00	$	282,700
Valve Allowance	1	ls	$	326,100.00	$	326,100
Specialty Allowance	1	ls	$	195,700.00	$	195,700

Colorado State University

Laurel Village FCU Replacement

Pinon

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
HHWS/R Connection - 3/4"	422	ea	$ 100.00	$ 42,200
Condensate Connection	211	ea	$ 100.00	$ 21,100
Condensate - Flexible PVC Piping	211	ea	$ 75.00	$ 15,825
Clean & Flush	11,040	lf	$ 4.00	$ 44,160.00
Labeling	11,040	lf	$ 2.00	$ 22,080.00
Insulation				
Hot Water				
HHWS/R 6" Piping Insulation, 2" Wall Fiberglass	780	lf	$ 23.50	$ 18,330.00
HHWS/R 4" Piping Insulation, 2" Wall Fiberglass	320	lf	$ 21.10	$ 6,752.00
HHWS/R 3" Piping Insulation, 1 1/2" Wall Fiberglass	40	lf	$ 14.00	$ 560.00
HHWS/R 2.5" Piping Insulation, 1 1/2" Wall Fiberglass	390	lf	$ 13.50	$ 5,265.00
HHWS/R 2" Piping Insulation, 1 1/2" Wall Fiberglass	740	lf	$ 13.00	$ 9,620.00
HHWS/R 1.5" Piping Insulation, 1 1/2" Wall Fiberglass	5,800	lf	$ 12.00	$ 69,600.00
HHWS/R 1" Piping Insulation, 1 1/2" Wall Fiberglass	170	lf	$ 11.00	$ 1,870.00
HHWS/R 3/4" Piping Insulation, 1 1/2" Wall Fiberglass	2,800	lf	$ 10.50	$ 29,400
Fitting & Valve Allowance Insulation	1	ls	$ 42,400.00	$ 42,400
Chilled Water Piping				
6" CHWS/R Type L, Copper - Riser	200	lf	$ 194.00	$ 38,800
6" CHWS/R Type L, Copper - Main	580	lf	$ 194.00	$ 112,520
4" CHWS/R Type L, Copper - Riser	80	lf	$ 100.00	$ 8,000
4" CHWS/R Type L, Copper - Main	240	lf	$ 100.00	$ 24,000
3" CHWS/R Type L, Copper - Branch	40	lf	$ 63.00	$ 2,520
2.5" CHWS/R Type L, Copper - Riser	160	lf	$ 50.00	$ 8,000
2.5" CHWS/R Type L, Copper - Branch	230	lf	$ 50.00	$ 11,500
2" CHWS/R Type L, Copper - Riser	200	lf	$ 37.50	$ 7,500
2" CHWS/R Type L, Copper - Branch	540	lf	$ 37.50	$ 20,250
1.5" CHWS/R Type L, Copper - Riser	5200	lf	$ 27.00	$ 140,400
1.5" CHWS/R Type L, Copper - Branch	600	lf	$ 27.00	$ 16,200
1" CHWS/R Type L, Copper - Branch	170	lf	$ 18.25	$ 3,103
3/4" CHWS/R Type L, Copper - Branch	2800	lf	$ 15.00	$ 42,000
Fitting Allowance	1	ls	$ 282,700.00	$ 282,700
Valve Allowance	1	ls	$ 326,100.00	$ 326,100
Specialty Allowance	1	ls	$ 195,700.00	$ 195,700
CHWS/R Connection - 3/4"	422	ea	$ 100.00	$ 42,200
Condensate Connection	211	ea	$ 100.00	$ 21,100
Condensate - Flexible PVC Piping	211	ea	$ 75.00	$ 15,825
Clean & Flush	11,040	lf	$ 4.00	$ 44,160.00
Labeling	11,040	lf	$ 2.00	$ 22,080.00

Colorado State University

Laurel Village FCU Replacement

Pinon

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
Insulation						
Chilled Water						
CHWS/R 6" Piping Insulation, 2" Wall Fiberglass	780	lf	$	23.50	$	18,330.00
CHWS/R 4" Piping Insulation, 2" Wall Fiberglass	320	lf	$	21.10	$	6,752.00
CHWS/R 3" Piping Insulation, 1 1/2" Wall Fiberglass	40	lf	$	14.00	$	560.00
CHWS/R 2.5" Piping Insulation, 1 1/2" Wall Fiberglass	390	lf	$	13.50	$	5,265.00
CHWS/R 2" Piping Insulation, 1 1/2" Wall Fiberglass	740	lf	$	13.00	$	9,620.00
CHWS/R 1.5" Piping Insulation, 1 1/2" Wall Fiberglass	5,800	lf	$	12.00	$	69,600.00
CHWS/R 1" Piping Insulation, 1 1/2" Wall Fiberglass	170	lf	$	11.00	$	1,870.00
CHWS/R 3/4" Piping Insulation, 1 1/2" Wall Fiberglass	2,800	lf	$	10.50	$	29,400
Fitting & Valve Allowance Insulation	1	ls	$	42,400.00	$	42,400
Subtotal Chilled Water Piping & Condensate					**$**	**3,137,000**
Condensate Drain						
CD Piping 1" Type "M" Copper Pipe	2,780	lf	$	16.50	$	45,870.00
Fitting Allowance	1	ls	$	29,900.00	$	29,900.00
Clean & Flush	2,781	lf	$	4.00	$	11,124.00
Labeling	2,781	lf	$	2.00	$	5,562.00
Total Condensate Drain Piping					**$**	**92,500.00**
Instrumentation & Controls						
Fan Coil Control System - Control Points					See Controls Page	
Subtotal Instrumentation & Controls					**$**	**-**
Electrical						
Remove/Reinstall Existing Lighting Fixtures	7,500	sf	$	2.00	$	15,000
EC to Label FCU"S	211	ea	$	20.00	$	4,220
EC to Disconnect wiring from existing unit and cap safe	211	ea	$	150.00	$	31,650
FCU - Reconnect Power Connection	211	ea	$	300.00	$	63,300
Subtotal Electrical					**$**	**114,200**
Testing						
Testing (Pre, Concurrent, Post)	1	ls	$	206,500.00	$	206,500
Total Testing					**$**	**206,500**

Colorado State University

Laurel Village FCU Replacement

Pinon

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
Other				
Link Seal for 6" Mains into Building	4	ls	$ 750.00	$ 3,000
Link Seal for 4" Mains into Building	4	ls	$ 500.00	$ 2,000
Core for Mains	8	ea	$ 500.00	$ 4,000
Core/Fire Stopping for Risers	580	ea	$ 200.00	$ 116,000
Total Other				**$ 125,000**
Total Mechanical Systems				**$ 5,119,200**

Colorado State University

Laurel Village FCU Replacement

Pinon

Fort Collins

AEI Project No. 26398-00

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Opinion of Probable Cost

Controls

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	48,000.00	$	48,000
Rigging/Material Handling	1	ls	$	33,600.00	$	33,600
Subtotal General Requirements					**$**	**82,000**
Demolition			$	-		N/A
Subtotal Demolition					**$**	**-**
Instrumentation & Controls						
Fan Coil Control System - Control Points						
Hardwired Points (@ 150'lf/ea assumed)						
DI/DO (Digital) Controls Plenum Cable, Added Condensate Pan High Level	633	ea	$	400.00	$	253,200
AI/AO (Analog) Controls Plenum Cable	844	ea	$	400.00	$	337,600
Software Programming						
AI/AO (Analog) & DI/DO (Digital) inc Integration & Monitoring @ Existing BAS	1477	hrs	$	250.00	$	369,300
Subtotal Instrumentation & Controls					**$**	**960,100**
Electrical			$	-		N/A
Subtotal Electrical					**$**	**-**
Testing						
Testing (Pre, Concurrent, Post)	1	ls	$	48,000.00	$	48,000
Total Testing					**$**	**48,000**
Total Controls Systems					**$**	**1,090,100**

Colorado State University

Laurel Village FCU Replacement

Alpine

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

General Construction

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	35,300.00	$	35,300
Rigging/Material Handling	1	ls	$	24,700.00	$	24,700
Subtotal General Requirements					**$**	**60,000**
Demolition						
Demo/Remove Ceiling in Corridors of Level 1. In Lounge/Study Rooms as Required	8200	sf	$	5.00	$	41,000
Demo/Remove Closet: 2.5'x8' Tall Wall and Sliding Door	112	ea	$	250.00	$	28,000
Waste Removal	1	ls	$	13,800.00	$	13,800
Subtotal Demolition					**$**	**83,000**
General Construction						
Drywall Patching and Painting at Each FCU	245	ea	$	250.00	$	61,250
Hallway/Lobby						
Plaster & Gypsum Board	8,200	sf	$	12.50	$	102,500
Ceiling Finishes	8,200	sf	$	2.50	$	20,500
Build Soffit for FCU's as Required						
Soffit:3'x8'	195	ea	$	875.00	$	170,625
Furr Wall for Pipe Riser						
Fur Wall: 5.5'x8'	121	ea	$	1,200.00	$	145,200
Subtotal General Construction					**$**	**500,100**
Furnishings						
Wardrobes	112	ea	$	1,100.00	$	123,200
Subtotal Furnishings					**$**	**123,200**
Other						
					N/A	
Total Other					**$**	**-**
Total Mechanical Systems					**$**	**766,300**

Colorado State University

Laurel Village FCU Replacement

Alpine

Fort Collins

AEI Project No. 26398-00

Estimate Issue Date: 3-25-2025

Opinion of Probable Cost

Mechanical

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
General Requirements						
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$	249,700.00	$	249,700
Rigging/Material Handling	1	ls	$	174,800.00	$	174,800
Subtotal General Requirements					**$**	**425,000**
Demolition						
Demo/Remove FCU & Associated Controls	245	ea	$	350.00	$	85,750
Demo/Remove Mode Control Units	52	ea	$	600.00	$	31,200
Demo/Remove 2>" Ref Piping	12,280	lf	$	5.00	$	61,400.00
Waste Removal	1	ls	$	35,670.00	$	35,670
Subtotal Demolition					**$**	**215,000**
Sheetmetal						
Non-Anticipated					N/A	
Subtotal Sheetmetal					**$**	**-**
Fan Coils						
FCU/FCH-02 4 Pipe 200CFM .5 ton - Ceiling Mounted Cassette	215	ea	$	3,600.00	$	774,000
FCU/FCH-04 4 Pipe 400CFM 1 Ton - Ceiling Mounted Cassette	8	ea	$	4,000.00	$	32,000
FCU/FCH-06 4 Pipe 600CFM 1.5 Ton - Ceiling Mounted Cassette	3	ea	$	4,800.00	$	14,000
FCU/FCH-010 4 Pipe 1,000CFM 2.5 Ton - Ceiling Mounted Cassette	18	ea	$	5,600.00	$	101,000
FCU/FCH-012 4 Pipe 1,200CFM 3 Ton - Ceiling Mounted Cassette	1	ea	$	6,000.00	$	6,000
Remote Thermostat	245	ea	$	350.00	$	86,000
Subtotal Fan Coils					**$**	**1,013,000**
Hot Water Piping						
6" HHWS/R Type L, Copper - Riser	200	lf	$	194.00	$	38,800
6" HHWS/R Type L, Copper - Main	500	lf	$	194.00	$	97,000
4" HHWS/R Type L, Copper - Riser	160	lf	$	100.00	$	16,000
4" HHWS/R Type L, Copper - Main	560	lf	$	100.00	$	56,000
3" HHWS/R Type L, Copper - Branch	0	lf	$	63.00	$	-
2.5" HHWS/R Type L, Copper - Riser	240	lf	$	50.00	$	12,000
2.5" HHWS/R Type L, Copper - Branch	120	lf	$	50.00	$	6,000
2" HHWS/R Type L, Copper - Riser	800	lf	$	37.50	$	30,000
2" HHWS/R Type L, Copper - Branch	370	lf	$	37.50	$	13,875
1.5" HHWS/R Type L, Copper - Riser	5880	lf	$	27.00	$	158,760
1.5" HHWS/R Type L, Copper - Branch	520	lf	$	27.00	$	14,040
1" HHWS/R Type L, Copper - Branch	0	lf	$	18.25	$	-
3/4" HHWS/R Type L, Copper - Branch	2930	lf	$	15.00	$	43,950
Fitting Allowance	1	ls	$	316,200.00	$	316,200
Valve Allowance	1	ls	$	364,900.00	$	364,900
Specialty Allowance	1	ls	$	218,900.00	$	218,900

Colorado State University

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Alpine

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Mechanical

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
HHWS/R Connection - 3/4"	490	ea	$ 100.00	$ 49,000
Condensate Connection	245	ea	$ 100.00	$ 24,500
Condensate - Flexible PVC Piping	245	ea	$ 75.00	$ 18,375
Clean & Flush	12,280	lf	$ 4.00	$ 49,120.00
Labeling	12,280	lf	$ 2.00	$ 24,560.00
Insulation				
Hot Water				
HHWS/R 6" Piping Insulation, 2" Wall Fiberglass	700	lf	$ 23.50	$ 16,450.00
HHWS/R 4" Piping Insulation, 2" Wall Fiberglass	720	lf	$ 21.10	$ 15,192.00
HHWS/R 3" Piping Insulation, 1 1/2" Wall Fiberglass	0	lf	$ 14.00	$ -
HHWS/R 2.5" Piping Insulation, 1 1/2" Wall Fiberglass	360	lf	$ 13.50	$ 4,860.00
HHWS/R 2" Piping Insulation, 1 1/2" Wall Fiberglass	1,170	lf	$ 13.00	$ 15,210.00
HHWS/R 1.5" Piping Insulation, 1 1/2" Wall Fiberglass	6,400	lf	$ 12.00	$ 76,800.00
HHWS/R 1" Piping Insulation, 1 1/2" Wall Fiberglass	0	lf	$ 11.00	$ -
HHWS/R 3/4" Piping Insulation, 1 1/2" Wall Fiberglass	2,930	lf	$ 10.50	$ 30,770
Fitting & Valve Allowance Insulation	1	ls	$ 47,800.00	$ 47,800
Chilled Water Piping				
6" CHWS/R Type L, Copper - Riser	200	lf	$ 194.00	$ 38,800
6" CHWS/R Type L, Copper - Main	500	lf	$ 194.00	$ 97,000
4" CHWS/R Type L, Copper - Riser	160	lf	$ 100.00	$ 16,000
4" CHWS/R Type L, Copper - Main	560	lf	$ 100.00	$ 56,000
3" CHWS/R Type L, Copper - Branch	0	lf	$ 63.00	$ -
2.5" CHWS/R Type L, Copper - Riser	240	lf	$ 50.00	$ 12,000
2.5" CHWS/R Type L, Copper - Branch	120	lf	$ 50.00	$ 6,000
2" CHWS/R Type L, Copper - Riser	800	lf	$ 37.50	$ 30,000
2" CHWS/R Type L, Copper - Branch	370	lf	$ 37.50	$ 13,875
1.5" CHWS/R Type L, Copper - Riser	5880	lf	$ 27.00	$ 158,760
1.5" CHWS/R Type L, Copper - Branch	520	lf	$ 27.00	$ 14,040
1" CHWS/R Type L, Copper - Branch	0	lf	$ 18.25	$ -
3/4" CHWS/R Type L, Copper - Branch	2930	lf	$ 15.00	$ 43,950
Fitting Allowance	1	ls	$ 316,200.00	$ 316,200
Valve Allowance	1	ls	$ 364,900.00	$ 364,900
Specialty Allowance	1	ls	$ 218,900.00	$ 218,900
CHWS/R Connection - 3/4"	490	ea	$ 100.00	$ 49,000
Condensate Connection	245	ea	$ 100.00	$ 24,500
Condensate - Flexible PVC Piping	245	ea	$ 75.00	$ 18,375
Clean & Flush	12,280	lf	$ 4.00	$ 49,120.00
Labeling	12,280	lf	$ 2.00	$ 24,560.00

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Alpine

Fort Collins

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Opinion of Probable Cost

Mechanical

Description	Qty	Unit		Unit Labor & Material		Ext Labor & Material
Insulation						
Chilled Water						
CHWS/R 6" Piping Insulation, 2" Wall Fiberglass	700	lf	$	23.50	$	16,450.00
CHWS/R 4" Piping Insulation, 2" Wall Fiberglass	720	lf	$	21.10	$	15,192.00
CHWS/R 3" Piping Insulation, 1 1/2" Wall Fiberglass	0	lf	$	14.00	$	-
CHWS/R 2.5" Piping Insulation, 1 1/2" Wall Fiberglass	360	lf	$	13.50	$	4,860.00
CHWS/R 2" Piping Insulation, 1 1/2" Wall Fiberglass	1,170	lf	$	13.00	$	15,210.00
CHWS/R 1.5" Piping Insulation, 1 1/2" Wall Fiberglass	6,400	lf	$	12.00	$	76,800.00
CHWS/R 1" Piping Insulation, 1 1/2" Wall Fiberglass	0	lf	$	11.00	$	-
CHWS/R 3/4" Piping Insulation, 1 1/2" Wall Fiberglass	2,930	lf	$	10.50	$	30,770
Fitting & Valve Allowance Insulation	1	ls	$	47,800.00	$	47,800
Subtotal Chilled Water Piping & Condensate					**$**	**3,519,000**
Condensate Drain						
CD Piping 1" Type "M" Copper Pipe	3,460	lf	$	16.50	$	57,090.00
Fitting Allowance	1	ls	$	37,200.00	$	37,200.00
Clean & Flush	3,461	lf	$	4.00	$	13,844.00
Labeling	3,461	lf	$	2.00	$	6,922.00
Total Condensate Drain Piping					**$**	**115,100.00**
Instrumentation & Controls						
Fan Coil Control System - Control Points					See Controls Page	
Subtotal Instrumentation & Controls					**$**	**-**
Electrical						
Remove/Reinstall Existing Lighting Fixtures	8,200	sf	$	2.00	$	16,400
EC to Label FCU"S	245	ea	$	20.00	$	4,900
EC to Disconnect wiring from existing unit and cap safe	245	ea	$	150.00	$	36,750
FCU - Reconnect Power Connection	245	ea	$	300.00	$	73,500
Subtotal Electrical					**$**	**131,600**
Testing						
Testing (Pre, Concurrent, Post)	1	ls	$	233,200.00	$	233,200
Total Testing					**$**	**233,200**

Colorado State University

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Alpine

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Opinion of Probable Cost

Mechanical

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
Other				
Link Seal for 6" Mains into Building	4	ls	$ 750.00	$ 3,000
Link Seal for 4" Mains into Building	4	ls	$ 500.00	$ 2,000
Core for Mains	8	ea	$ 500.00	$ 4,000
Core/Fire Stopping for Risers	728	ea	$ 200.00	$ 145,600
Total Other				**$ 154,600**
Total Mechanical Systems				**$ 5,806,500**

Colorado State University

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Alpine

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Opinion of Probable Cost

Controls

Description	Qty	Unit	Unit Labor & Material	Ext Labor & Material
General Requirements				
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$ 55,700.00	$ 55,700
Rigging/Material Handling	1	ls	$ 39,000.00	$ 39,000
Subtotal General Requirements				**$ 95,000**
Demolition				
			$ -	N/A
Subtotal Demolition				**$ -**
Instrumentation & Controls				
Fan Coil Control System - Control Points				
Hardwired Points (@ 150'lf/ea assumed)				
DI/DO (Digital) Controls Plenum Cable, Added Condensate Pan High Level	735	ea	$ 400.00	$ 294,000
AI/AO (Analog) Controls Plenum Cable	980	ea	$ 400.00	$ 392,000
Software Programming				
AI/AO (Analog) & DI/DO (Digital) inc Integration & Monitoring @ Existing BAS	1715	hrs	$ 250.00	$ 428,800
Subtotal Instrumentation & Controls				**$ 1,114,800**
Electrical				
			$ -	N/A
Subtotal Electrical				**$ -**
Testing				
Testing (Pre, Concurrent, Post)	1	ls	$ 55,700.00	$ 55,700
Total Testing				**$ 55,700**
Total Controls Systems				**$ 1,265,500**

Colorado State University
Laurel Village HVAC Upgrade
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Geo Plant w/Ground Source

Opinion of Probable Cost Estimate Summary			Base Case
Construction Cost			
Geo-Thermal Water		$	2,400,000
Chilled Water		$	700,000
Heating Hot Water		$	613,000
Geo Plant		$	4,260,000
Geo-Thermal Field, Distribution to Plant and Tie-in		$	3,957,900
Total Construction Cost (Material and Labor)		**$**	**11,930,900**
Phasing - Mobilization/Demobilization	5.0%	$	596,500
General Conditions	10.0%	$	1,193,100
Contingency	5.5%	$	656,200
Design Fees	5.0%	$	596,500
Construction soft costs (Permit Fees, bonding, insurance, project management)	5.0%	$	596,500
Contractor Soft Costs		**$**	**3,638,800**
Fixed Limit of Design and Construction Cost		**$**	**15,569,700**
CSU Soft costs (Administrative, Consultant Fees, Equipment (Owner Furnished), Construction Costs (Outside FLODC), Owner Contingency)	20.0%	$	2,387,000
TOTAL DEVELOPMENT BUDGET		**$**	**17,956,700**

Note - all Totals Rounded up to nearest $1k

Colorado State University
Laurel Village HVAC Upgrade
Fort Collins, CO
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Geo Plant w/Ground Source

Base Case

Geo-Thermal Water

Opinion of Probable Cost Estimate Summary

Construction Cost

Geo-Thermal Water System (Costs based on $ per Ton x Tons)	**$ per Ton**	**Total 640**
Mobilization & Engineering	$10.00	$6,400.00
Bond	$12.00	$7,680.00
GHW Piping	$80.00	$51,200.00
Water Cooled Chillers 8 (80 Tons)	$2,500.00	$1,600,000.00
GWP-1 & GWP-2 Primary GEO Pump 600 gpm @ 90' hd, 15 hp	$64.38	$41,200.00
Pump Accessories 2 (one for each pump)	$32.19	$20,600.00
VFD - Water Pumps 2 (15 hp each)	$62.50	$40,000.00
Expansion Tank	$13.13	$8,400.00
Air Separator	$10.94	$7,000.00
Make Up Water Assembly	$7.81	$5,000.00
Controls	$560.00	$358,400.00
Supporting Plumbing Work (Includes New Service & Meter)	$133.00	$85,120.00
Supporting Fire Work	$5.00	$3,200.00
Supporting Mechanical Work	$185.00	$118,400.00
Crane & Rigging	$45.00	$28,800.00
Geo-Thermal Water System Total	**$3,750.00**	**$2,400,000.00**

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Geo Plant w/Ground Source

Base Case

Chilled Water

Opinion of Probable Cost Estimate Summary

Construction Cost

Chilled Water System (Costs based on $ per Ton x Tons)	**$ per Ton**	**Total 640**
Mobilization & Engineering	$10.00	$6,400.00
Bond	$12.00	$7,680.00
CHHW Piping	$400.00	$256,000.00
Secondary Chilled Water Pumps 2 (End Suct, 600 gpm @ 90ft hd, 15 hp)	$37.50	$24,000.00
Pump Accessories 2 (one for each pump)	$18.75	$12,000.00
VFD - Water Pumps 2 (15 hp each)	$31.25	$20,000.00
Expansion Tank	$13.13	$8,400.00
Air Separator	$10.94	$7,000.00
Make Up Water Assembly	$7.81	$5,000.00
Controls	$110.00	$70,400.00
Supporting Plumbing Work (Includes New Service & Meter)	$133.00	$85,120.00
Supporting Fire Work	$5.00	$3,200.00
Supporting Mechanical Work	$185.00	$118,400.00
Crane & Rigging	$45.00	$28,800.00
Chilled Water System Total	**$1,094.00**	**$700,000.00**

Colorado State University

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Fort Collins, CO

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Geo Plant w/Ground Source

Base Case

Heating Hot Water

Opinion of Probable Cost Estimate Summary

Construction Cost

Heating Hot Water System (Costs based on $ per BHP x BHP)	**$ per BHP**	**BHP 640**
Mobilization & Engineering	$20.00	$12,800.00
Bond	$30.00	$19,200.00
HHHW Piping	$400.00	$256,000.00
Secondary Chilled Water Pumps 2 (End Suct, 600 gpm @ 90ft hd, 15 hp)	$3.75	$24,000.00
Pump Accessories 2 (one for each pump)	$1.88	$12,000.00
VFD - Water Pumps 2 (15 hp each)	$3.13	$20,000.00
Expansion Tank	$1.31	$8,400.00
Air Separator	$1.09	$7,000.00
Make Up Water Assembly	$0.78	$5,000.00
Controls	$20.00	$12,800.00
Supporting Plumbing Work (Includes New Service & Meter)	$133.00	$85,120.00
Supporting Fire Work	$5.00	$3,200.00
Supporting Mechanical Work	$185.00	$118,400.00
Crane & Rigging	$45.00	$28,800.00
Heating Hot Water System Total	$957.81	**$613,000.00**

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Geo Plant w/Ground Source

Base Case

Geo Plant

Opinion of Probable Cost Estimate Summary

Construction Cost

		$ per Ton	Total 540
General Construction			
CUP (General Construction, MEP/F) Demolition/Modification Allowance		$ 150	$ 81,000
CUP (General Construction, MEP/F) New Plant Construction Allowance		$ 1,170	$ 2,457,000
CUP (General Construction, MEP/F) New Yard Construction Allowance		$ 120	$ 252,000
CUP (General Construction) New Screen wall Construction Allowance		$ 160	$ 228,000
	Electrical System		**$ 3,018,540**

Electrical System (Costs based on $ per Ton x Tons)		**Total All 3 Systems**
Mobilization & Engineering		**$ 18,900**
Bond		**$ 27,700**
Emergency Power Gear & Distribution		**$ 218,900**
Emergency Generator (500kW) Nat Gas		**$ 211,200**
Pad Mounted Transformer		**$ 161,300**
MCC's		**$ 92,200**
Conduit & Ftgs (Below Grade)		**$ 23,100**
Conduit & Ftgs (Above Grade)		**$ 115,200**
Panelboards		**$ 184,400**
Dry Transformers		**$ 69,200**
Wiring Devices		**$ 23,100**
Light Fixtures		**$ 23,100**
Grounding System		**$ 18,500**
Supporting Electrical Work		**$ 36,000**
Crane & Rigging		**$ 17,300**
	Electrical System	**$ 1,240,100**

General Construction/Electrical Infrastructure Total	**$ 7,889**	**$**	**4,260,000**

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Geo Plant w/Ground Source

Geo-Thermal Field and Tie to Plant

Opinion of Probable Cost Estimate Summary

Description	Qty	Units		Unit Matl & Labor W/ O & P		Extended Matl & Labor W/ O & P
Geo Field						
Surface Demolition, Restoration & Erosion Control						
Vehicle & Pedestrian Control						
Marker Barrels w/ Warning Lights	1	ls	$	21,375.00	$	21,380
Total Vehicle & Pedestrian Control					**$**	**21,400**
Landscape Demolition & Protection						
Strip/Remove Existing Native Vegetation	24,574	sf	$	0.55	$	13,520
Remove/Chip Existing Tree - 3" - 4" cal.	10	ea	$	330.00	$	3,300
Remove Existing Material Stockpile	9	cy	$	16.50	$	150
Tree Protection	3	lf	$	8.25	$	30
Total Landscape Demolition & Protection					**$**	**17,000**
Hardscape Demolition & Protection						
Sawcut Hardscape	29	lf	$	8.25	$	240
Demo/Remove Existing Curb & Gutter	43	lf	$	7.15	$	310
Demo/Remove Existing Concrete Sidewalks	235	sf	$	2.48	$	580
Demo/Remove Existing Asphalt Pavement	527	sf	$	1.65	$	870
Remove/Store Existing Benches (inc. Footings)	4	ea	$	192.50	$	820
Strip/Remove Existing Crushed Granite Groundcover	257	sf	$	2.20	$	560
Total Hardscape Demolition & Protection					**$**	**3,400**
Landscape Restoration						
Replace Native Vegetation	24,574	sf	$	1.93	$	47,310
Total Landscape Restoration					**$**	**47,400**

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Geo Plant w/Ground Source

Geo-Thermal Field and Tie to Plant

Opinion of Probable Cost Estimate Summary

Description	Qty	Units		Unit Matl & Labor W/ O & P		Extended Matl & Labor W/ O & P
Hardscape Restoration						
Stabilized Construction Entrance	2,501	sf	$	1.93	$	4,810
Curb & Gutter	43	lf	$	10.73	$	460
Concrete Sidewalks	235	sf	$	5.94	$	1,400
Asphalt Pavement	527	sf	$	4.68	$	2,460
Install Existing Benches (inc. Footings)	4	ea	$	275.00	$	1,180
Crushed Granite Groundcover	257	sf	$	3.03	$	780
Total Hardscape Restoration					**$**	**11,100**
Erosion Control						
Silt Fence	2,658	lf	$	2.20	$	5,850
Inlet Protection	143	sf	$	2.20	$	310
Total Erosion Control					**$**	**6,200**
Total Surface Demolition, Restoration & Erosion Control					**$**	**106,500**
Excavation & Support						
Excavation & Backfill						
Excavation & Backfill (Bore Field Runouts) (6' depth w/ Structural Fill)	6,270	cy	$	40.00	$	250,800
Excavation & Backfill (14" dia. Main Supply/Return) (11' avg. depth W/ Structural Fill)	1,689	cy	$	40.00	$	67,556
Total Excavation & Backfill					**$**	**318,400**
Subtotal Excavation & Support					**$**	**318,400**
Utility Interference Allowance		**10%**			**$**	**31,900**
Total Excavation & Support					**$**	**350,300**
Closed-loop Geo-exchange Field						
Geothermal Wells (Closed Loop)						
500'D Geothermal Well (228) w/ 1 - 1-1/2" HDPE Loop and U-Bend - Fully Grouted (Derived from Contractor Quote of $24.00/lf or $12,000 per bore) - ***Does NOT include Geothermal Bore Permitting***	1	ls	$	1,560,000.00	$	1,560,000
Subtotal Geothermal Wells					**$**	**1,560,000**

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Geo Plant w/Ground Source

Geo-Thermal Field and Tie to Plant

Opinion of Probable Cost Estimate Summary

Description	Qty	Units	Unit Matl & Labor W/ O & P	Extended Matl & Labor W/ O & P
Geothermal Water Bore Field				
12" HDPE Piping (inc. Geo Vault)				
12" GEO Piping HDPE DR 13.5 - Insulated	4,275	lf	$ 69.60	$ 297,540
12" Weld Joint	107	ea	$ 188.50	$ 20,146
Weld Machine	26	days	$ 471.25	$ 12,207
12" GEO 90 Fitting HDPE DR 13.5	11	ea	$ 768.50	$ 8,761
12" GEO Connections to Existing Building	3	ea	$ 1,015.00	$ 2,893
12" Weld Joint	29	ea	$ 188.50	$ 5,372
Weld Machine	5	days	$ 471.25	$ 2,154
12" Butterfly Valve	6	ea	$ 8,011.25	$ 45,664
6" HDPE Piping				
6" GEO Piping HDPE DR 13.5	6,413	lf	$ 11.60	$ 74,385
6" Weld Joint	321	ea	$ 92.80	$ 29,754
Weld Machine	25	days	$ 152.25	$ 3,875
6" GEO 90 Fitting HDPE DR 13.5	34	ea	$ 71.78	$ 2,455
6" GEO Cap Fitting HDPE DR 13.5	11	ea	$ 54.38	$ 620
6" GEO Flange Adapter Fitting HDPE DR 13.5	46	ea	$ 54.38	$ 2,480
6" x 6" x 1-1/4" GEO Tee Fitting HDPE DR 13.5	34	ea	$ 81.35	$ 2,782
6" Weld Joint	148	ea	$ 92.80	$ 13,753
Weld Machine	12	days	$ 152.25	$ 1,791
6" Butterfly Valve	14	ea	$ 2,030.00	$ 28,928
6" Balancing Valve	11	ea	$ 725.00	$ 8,265
4" HDPE Piping				
4" GEO Piping HDPE DR 13.5	1,069	lf	$ 4.93	$ 5,269
4" Weld Joint	53	ea	$ 60.90	$ 3,254
Weld Machine	3	days	$ 68.15	$ 189
4" x 4" x 1 1/4" GEO Tee Fitting HDPE DR 13.5	51	ea	$ 34.58	$ 1,774
4" Weld Joint	103	ea	$ 60.90	$ 6,248
Weld Machine	5	days	$ 68.15	$ 364
3" HDPE Piping				
3" GEO Piping HDPE DR 13.5	570	lf	$ 3.12	$ 1,777
3" Weld Joint	29	ea	$ 47.13	$ 1,343
Weld Machine	1	days	$ 68.15	$ 97
3" x 3" x 1 1/4" GEO Tee Fitting HDPE DR 13.5	26	ea	$ 24.94	$ 640
3" Weld Joint	51	ea	$ 47.13	$ 2,418
Weld Machine	2	days	$ 68.15	$ 140
2" HDPE Piping	0			
2" GEO Piping HDPE DR 13.5	356	lf	$ 2.90	$ 1,033
2" Weld Joint	18	ea	$ 41.33	$ 736
Weld Machine	1	days	$ 60.18	$ 86
2" x 2" x 1 1/4" GEO Tee Fitting HDPE DR 13.5	26	ea	$ 18.20	$ 467

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Laurel Village HVAC Upgrade

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Geo Plant w/Ground Source

Geo-Thermal Field and Tie to Plant

Opinion of Probable Cost Estimate Summary

Description	Qty	Units	Unit Matl & Labor W/ O & P	Extended Matl & Labor W/ O & P
2" Weld Joint	51	ea	$ 41.33	$ 2,120
Weld Machine	2	days	$ 60.18	$ 106
1-1/2" HDPE Piping - Bore Interconnect Piping ONLY (All 1-1/2" Bore piping provided by Boring Contractor)				
1-1/2" GEO Piping HDPE DR 13.5	5,700	lf	$ 1.52	$ 8,678
1-1/2" Weld Joint	143	ea	$ 25.30	$ 3,606
Weld Machine	2	days	$ 61.63	$ 137
1 1/2" GEO Tee HDPE DR 13.5 to Main	490	ea	$ 19.07	$ 9,347
1-1/2" Weld Joint	980	ea	$ 25.30	$ 24,807
Weld Machine	15	days	$ 61.63	$ 944
Additional Labor & Material	0			
Clean & Flush	18,383	lf	$ 0.65	$ 20,000
14" GEO Thrust Block	23	ea	$ 1,232.50	$ 28,101
18" Core Drill	3	ea	$ 398.75	$ 1,136
18" Link Seal for 14" Pipe	3	ea	$ 1,776.25	$ 5,062
Trenching by Others - ***see 'Excavation & Support'***	7,054	lf	$ -	$ -
Testing	1	ls	$ 35,000.00	$ 35,000
Subtotal Geothermal Water Bore Field				**$ 728,800**
Total Closed-loop Geo-exchange Field				**$ 2,288,800**
Total Closed-loop Geo-exchange Field All				**$ 2,745,600**

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Geo Plant w/Ground Source

Geo-Thermal Field and Tie to Plant

Opinion of Probable Cost Estimate Summary

Description	Qty	Units		Unit Matl & Labor W/ O & P		Extended Matl & Labor W/ O & P
Tie to Plant						
Surface Demolition, Restoration & Erosion Control						
Vehicle & Pedestrian Control						
Marker Barrels w/ Warning Lights	1	ls	$	21,375.00	$	21,380
Total Vehicle & Pedestrian Control					**$**	**21,400**
Landscape Demolition & Protection						
Strip/Remove Existing Native Vegetation	24,574	sf	$	0.50	$	12,290
Remove/Chip Existing Tree - 3" - 4" cal.	10	ea	$	300.00	$	3,000
Remove Existing Material Stockpile	9	cy	$	15.00	$	140
Tree Protection	3	lf	$	7.50	$	20
Total Landscape Demolition & Protection					**$**	**15,500**
Hardscape Demolition & Protection						
Sawcut Hardscape	29	lf	$	7.50	$	210
Demo/Remove Existing Curb & Gutter	43	lf	$	6.50	$	280
Demo/Remove Existing Concrete Sidewalks	235	sf	$	2.25	$	530
Demo/Remove Existing Asphalt Pavement	527	sf	$	1.50	$	790
Remove/Store Existing Benches (inc. Footings)	4	ea	$	175.00	$	750
Strip/Remove Existing Crushed Granite Groundcover	257	sf	$	2.00	$	510
Total Hardscape Demolition & Protection					**$**	**3,100**
Landscape Restoration						
Replace Native Vegetation	24,574	sf	$	1.75	$	43,000
Total Landscape Restoration					**$**	**43,000**
Hardscape Restoration						
Stabilized Construction Entrance	2,501	sf	$	1.75	$	4,380
Curb & Gutter	43	lf	$	9.75	$	420
Concrete Sidewalks	235	sf	$	5.40	$	1,270
Asphalt Pavement	527	sf	$	4.25	$	2,240
Install Existing Benches (inc. Footings)	4	ea	$	250.00	$	1,070
Crushed Granite Groundcover	257	sf	$	2.75	$	710
Total Hardscape Restoration					**$**	**10,100**
Erosion Control						

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Geo Plant w/Ground Source

Geo-Thermal Field and Tie to Plant

Opinion of Probable Cost Estimate Summary

Description	Qty	Units		Unit Matl & Labor W/ O & P		Extended Matl & Labor W/ O & P
Silt Fence	2,658	lf	$	2.20	$	5,850
Inlet Protection	143	sf	$	2.20	$	310
Total Erosion Control					**$**	**6,200**
Total Surface Demolition, Restoration & Erosion Control					**$**	**99,300**
Excavation & Support						
Excavation & Backfill						
Excavation & Backfill (14" dia. Main Supply/Return) (11' avg. depth W/ Structural Fill)	1,689	cy	$	40.00	$	67,556
Total Excavation & Backfill					**$**	**67,600**
Subtotal Excavation & Support					**$**	**67,600**
Utility Interference Allowance	**10%**				**$**	**6,800**
Total Excavation & Support					**$**	**74,400**
Direct Bury - New GHWS/R						
2 - 12", 8", 6", 4" & 3" CHWS/R				**Segment Length**		**1,050.00**
				Excavation Width		**6.00**
Excavation/Shoring/Backfill				**Avg. Excavation Depth**		**7.00**
Excavation - 6**'W x 7'D Assumed**	1633.33	cy	$	23.00	$	37,567
Dewatering	6300	sf	$	8.00	$	50,400
Shoring & Bracing	14700	sf	$	12.00	$	176,400
Unsuitable Soil (100% Disposal of Excav.)	1633.33	cy	$	17.00	$	27,767
Backfill Above & Sides of Trench (Engineered Fill)	1633.33	cy	$	29.00	$	47,367
Stone Base	918.75	tn	$	17.00	$	15,619
Subtotal Excavation					**$**	**355,200**
Chilled Water Piping, Insulating & Support						
12" GHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12" HDPE JACKE	2,100	lf	$	160.00	$	336,000
Fitting Allowance	1	ls	$	16,800.00	$	16,800
Valve Allowance	1	ls	$	21,840.00	$	21,840
Piping Specialties Allowance	1	ls	$	16,800.00	$	16,800
Pipe Support Allowance (inc. Pipe Guides and Structural Supports)	105	ea	$	800.00	$	84,000
Flush & Test						
Flush, Clean & Pressure Test	2,100	lf	$	25.00	$	52,500

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Geo Plant w/Ground Source

Geo-Thermal Field and Tie to Plant

Opinion of Probable Cost Estimate Summary

Description	Qty	Units		Unit Matl & Labor W/ O & P		Extended Matl & Labor W/ O & P
Subtotal New Work					**$**	**528,000**
New Geo-Thermal Water - 2 - 12" GHWS/R inc. Directional Bored	**Total Bore Length - 48" Wide**					**110**
Boring Pits						
Boring Pit Excavation ***(20'Wx30'Lx16'D)***	355.56	cy	$	20.00	$	7,110
Boring Pit Dewatering	600	sf	$	4.50	$	2,700
Shoring & Bracing	1600	sf	$	8.75	$	14,000
Unsuitable Soil (100% of Excav.)	355.56	cy	$	15.00	$	5,330
Backfill Boring Pit	320.00	cy	$	25.00	$	8,000
Receiving Pits						
Receiving Pit Excavation ***(15'Wx20'Lx16'D)***	177.78	cy	$	20.00	$	3,560
Receiving Pit Dewatering	300	sf	$	4.50	$	1,350
Shoring & Bracing	1120	sf	$	8.75	$	9,800
Removal of Unsuitable Soil (100% of Excav.)	177.78	cy	$	15.00	$	2,670
Backfill Receiving Pit	160.00	cy	$	25.00	$	4,000
Boring						
24" Horizontal Boring (inc. Casing in Place)	220	lf	$	240.00	$	52,800
Geo-Thermal Water Piping, Fittings, Valves, Insulating & Support						
12" GHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12" HDPE JACKE	220	lf	$	160.00	$	35,200
Fitting Allowance	1	ls	$	3,600.00	$	3,600
Pipe Support Allowance (inc. Pipe Guides and Structural Supports)	1	ls	$	5,280.00	$	5,280
Subtotal Bored Pipe Cost					**$**	**155,400**
Total Boring from Field to New Plant Building					**$**	**1,212,300**
Total Geo Field/Tie to New Plant Building					**$**	**3,957,900**

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Ground Source Site Distribution

Opinion of Probable Cost Estimate Summary

Construction Cost

Construction Cost

		Heating Hot Water	Chilled Water	Total
General Requirements		$ 71,800	$ 71,800	$ 143,600
Sitework		$ 102,300	$ 102,300	$ 204,600
Excavation/Shoring/Backfill		$ 338,300	$ 338,300	$ 676,600
Site Distribution Mains - Direct Bury		$ 403,700	$ 403,700	$ 807,400
Temperature Control		$ 8,074	$ 8,074	$ 16,148
Construction Logistics Allowance		$ 32,296	$ 32,296	$ 64,592
Total Construction Cost (Material and Labor)		**$ 956,470**	**$ 956,470**	**$ 1,912,940**
Phasing - Mobilization/Demobilization	5.0%	$ 47,800	$ 47,800	$ 95,600
General Conditions	10.0%	$ 95,600	$ 95,600	$ 191,300
Contingency	5.5%	$ 52,600	$ 52,600	$ 105,200
Design Fees	5.0%	$ 47,800	$ 47,800	$ 95,600
Construction soft costs (Permit Fees, bonding, insurance, project management)	5.0%	$ 47,800	$ 47,800	$ 95,600
Contractor Soft Costs		**$ 291,600**	**$ 291,600**	**$ 583,300**
Fixed Limit of Design and Construction Cost		**$ 1,248,070**	**$ 1,248,070**	**$ 2,496,240**
CSU Soft costs (Administrative, Consultant Fees, Equipment (Owner Furnished), Construction Costs (Outside FLODC), Owner Contingency)	20.0%	$ 191,294	$ 191,294	$ 382,588
TOTAL DEVELOPMENT BUDGET		**$ 1,439,364**	**$ 1,439,364**	**$ 2,878,828**

Note - all Totals Rounded up to nearest $1k

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Ground Source Site Distribution

Heating Hot Water

Opinion of Probable Cost Estimate Summary

Description	Qty	Units	Unit Matl & Labor W/ O & P	Extended Matl & Labor W/ O & P
General Requirements				
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$ 29,600	$ 29,600
Crane & Rigging	1	ls	$ 42,200	$ 42,200
Subtotal General Requirements				**$ 71,800**
Sitework				
Traffic and Pedestrian Control Allowance	1	ls	$ 6,200	$ 6,200
Erosion Control Allowance	1	ls	$ 3,800	$ 3,800
Utility Locates Allowance	1	ls	$ 3,400	$ 3,400
Surface Demolition Allowance	1	ls	$ 20,900	$ 20,900
Utility Manholes/Pits Allowance	1	ls	$ 9,400	$ 9,400
Utility Demolition Allowance	1	ls	$ 10,300	$ 10,300
Site Restoration Allowance	1	ls	$ 48,300	$ 48,300
Total - Sitework				**$ 102,300**
Direct Bury - New HHWS/R				
2 - 8", 6", 4" & 3" HHWS/R			**Segment Length**	**1,000.00**
			Excavation Width	**6.00**
Excavation/Shoring/Backfill			**Avg. Excavation Depth**	**7.00**
Excavation - **6'W x 7'D Assumed**	1555.56	cy	$ 23.00	$ 35,778
Dewatering	6000	sf	$ 8.00	$ 48,000
Shoring & Bracing	14000	sf	$ 12.00	$ 168,000
Unsuitable Soil (100% Disposal of Excav.)	1555.56	cy	$ 17.00	$ 26,444
Backfill Above & Sides of Trench (Engineered Fill)	1555.56	cy	$ 29.00	$ 45,111
Stone Base	875.00	tn	$ 17.00	$ 14,875
Subtotal Excavation				**$ 338,300**
Heating Hot Water Piping, Insulating & Support				
3" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12” HDPE JACKET	100	lf	$ 60.00	$ 6,000
4" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12” HDPE JACKET	200	lf	$ 90.00	$ 18,000
6" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12” HDPE JACKET	1,700	lf	$ 120.00	$ 204,000
8" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12” HDPE JACKET	0	lf	$ 160.00	$ -
Fitting Allowance	1	ls	$ 11,400.00	$ 11,400
Valve Allowance	1	ls	$ 14,820.00	$ 14,820
Piping Specialties Allowance	1	ls	$ 11,400.00	$ 11,400
Pipe Support Allowance (inc. Pipe Guides and Structural Supports)	100	ea	$ 800.00	$ 80,000
Flush & Test				
Flush, Clean & Pressure Test	2,000	lf	$ 29.00	$ 58,000
Subtotal New Work				**$ 403,700**
Total Site Main Section				**$ 916,100**

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Ground Source Site Distribution

Chilled Water

Opinion of Probable Cost Estimate Summary

Description	Qty	Units	Unit Matl & Labor W/ O & P	Extended Matl & Labor W/ O & P
General Requirements				
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$ 29,600	$ 29,600
Crane & Rigging	1	ls	$ 42,200	$ 42,200
Subtotal General Requirements				**$ 71,800**
Sitework				
Traffic and Pedestrian Control Allowance	1	ls	$ 6,200	$ 6,200
Erosion Control Allowance	1	ls	$ 3,800	$ 3,800
Utility Locates Allowance	1	ls	$ 3,400	$ 3,400
Surface Demolition Allowance	1	ls	$ 20,900	$ 20,900
Utility Manholes/Pits Allowance	1	ls	$ 9,400	$ 9,400
Utility Demolition Allowance	1	ls	$ 10,300	$ 10,300
Site Restoration Allowance	1	ls	$ 48,300	$ 48,300
Total - Sitework				**$ 102,300**
Direct Bury - New CHWS/R				
2 - 8", 6", 4" & 3" CHWS/R			**Segment Length**	**1,000.00**
			Excavation Width	**6.00**
Excavation/Shoring/Backfill			**Avg. Excavation Depth**	**7.00**
Excavation - 6'**W x 7'D Assumed**	1555.56	cy	$ 23.00	$ 35,778
Dewatering	6000	sf	$ 8.00	$ 48,000
Shoring & Bracing	14000	sf	$ 12.00	$ 168,000
Unsuitable Soil (100% Disposal of Excav.)	1555.56	cy	$ 17.00	$ 26,444
Backfill Above & Sides of Trench (Engineered Fill)	1555.56	cy	$ 29.00	$ 45,111
Stone Base	875.00	tn	$ 17.00	$ 14,875
Subtotal Excavation				**$ 338,300**
Chilled Water Piping, Insulating & Support				
3" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12" HDPE JACKET	100	lf	$ 60.00	$ 6,000
4" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12" HDPE JACKET	200	lf	$ 90.00	$ 18,000
6" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12" HDPE JACKET	1,700	lf	$ 120.00	$ 204,000
8" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12" HDPE JACKET	0	lf	$ 160.00	$ -
Fitting Allowance	1	ls	$ 11,400.00	$ 11,400
Valve Allowance	1	ls	$ 14,820.00	$ 14,820
Piping Specialties Allowance	1	ls	$ 11,400.00	$ 11,400
Pipe Support Allowance (inc. Pipe Guides and Structural Supports)	100	ea	$ 800.00	$ 80,000
Flush & Test				
Flush, Clean & Pressure Test	2,000	lf	$ 29.00	$ 58,000
Subtotal New Work				**$ 403,700**
Total Site Main Section				**$ 916,100**

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Fort Collins, CO

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Air Source Site Distribution

Opinion of Probable Cost Estimate Summary

Construction Cost

Construction Cost

		Heating Hot Water	Chilled Water	Total
General Requirements		$ 75,500	$ 75,500	$ 151,000
Sitework		$ 107,500	$ 107,500	$ 215,000
Excavation/Shoring/Backfill		$ 355,200	$ 355,200	$ 710,400
Site Distribution Mains - Direct Bury		$ 424,500	$ 424,500	$ 849,000
Temperature Control		$ 8,490	$ 8,490	$ 16,980
Construction Logistics Allowance		$ 33,960	$ 33,960	$ 67,920
Total Construction Cost (Material and Labor)		**$ 1,005,150**	**$ 1,005,150**	**$ 2,010,300**
Phasing - Mobilization/Demobilization	5.0%	$ 50,300	$ 50,300	$ 100,500
General Conditions	10.0%	$ 100,500	$ 100,500	$ 201,000
Contingency	5.5%	$ 55,300	$ 55,300	$ 110,600
Design Fees	5.0%	$ 50,300	$ 50,300	$ 100,500
Construction soft costs (Permit Fees, bonding, insurance, project management)	5.0%	$ 50,300	$ 50,300	$ 100,500
Contractor Soft Costs		**$ 306,700**	**$ 306,700**	**$ 613,100**
Fixed Limit of Design and Construction Cost		**$ 1,311,850**	**$ 1,311,850**	**$ 2,623,400**
CSU Soft costs (Administrative, Consultant Fees, Equipment (Owner Furnished), Construction Costs (Outside FLODC), Owner Contingency)	20.0%	$ 201,030	$ 201,030	$ 402,060
TOTAL DEVELOPMENT BUDGET		**$ 1,512,880**	**$ 1,512,880**	**$ 3,025,460**

Note - all Totals Rounded up to nearest $1k

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Air Source Site Distribution

Heating Hot Water

Opinion of Probable Cost Estimate Summary

Description	Qty	Units	Unit Matl & Labor W/ O & P	Extended Matl & Labor W/ O & P
General Requirements				
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$ 31,100	$ 31,100
Crane & Rigging	1	ls	$ 44,400	$ 44,400
Subtotal General Requirements				**$ 75,500**
Sitework				
Traffic and Pedestrian Control Allowance	1	ls	$ 6,500	$ 6,500
Erosion Control Allowance	1	ls	$ 4,000	$ 4,000
Utility Locates Allowance	1	ls	$ 3,500	$ 3,500
Surface Demolition Allowance	1	ls	$ 22,000	$ 22,000
Utility Manholes/Pits Allowance	1	ls	$ 9,900	$ 9,900
Utility Demolition Allowance	1	ls	$ 10,800	$ 10,800
Site Restoration Allowance	1	ls	$ 50,800	$ 50,800
Total - Sitework				**$ 107,500**
Direct Bury - New HHWS/R				
2 - 8", 6", 4" & 3" HHWS/R			**Segment Length**	**1,050.00**
			Excavation Width	**6.00**
Excavation/Shoring/Backfill			**Avg. Excavation Depth**	**7.00**
Excavation - **6'W x 7'D Assumed**	1633.33	cy	$ 23.00	$ 37,567
Dewatering	6300	sf	$ 8.00	$ 50,400
Shoring & Bracing	14700	sf	$ 12.00	$ 176,400
Unsuitable Soil (100% Disposal of Excav.)	1633.33	cy	$ 17.00	$ 27,767
Backfill Above & Sides of Trench (Engineered Fill)	1633.33	cy	$ 29.00	$ 47,367
Stone Base	918.75	tn	$ 17.00	$ 15,619
Subtotal Excavation				**$ 355,200**
Heating Hot Water Piping, Insulating & Support				
3" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12” HDPE JACKET	100	lf	$ 60.00	$ 6,000
4" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12” HDPE JACKET	200	lf	$ 90.00	$ 18,000
6" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12” HDPE JACKET	1,800	lf	$ 120.00	$ 216,000
8" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12” HDPE JACKET	0	lf	$ 160.00	$ -
Fitting Allowance	1	ls	$ 12,000.00	$ 12,000
Valve Allowance	1	ls	$ 15,600.00	$ 15,600
Piping Specialties Allowance	1	ls	$ 12,000.00	$ 12,000
Pipe Support Allowance (inc. Pipe Guides and Structural Supports)	105	ea	$ 800.00	$ 84,000
Flush & Test				
Flush, Clean & Pressure Test	2,100	lf	$ 29.00	$ 60,900
Subtotal New Work				**$ 424,500**
Total Site Main Section				**$ 962,700**

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Air Source Site Distribution

Chilled Water

Opinion of Probable Cost Estimate Summary

Description	Qty	Units	Unit Matl & Labor W/ O & P	Extended Matl & Labor W/ O & P
General Requirements				
Site Cleanup, Waste Removal, Temporary Protection, Safety, Signage, Dust Control & Shop Drawings	1	ls	$ 31,100	$ 31,100
Crane & Rigging	1	ls	$ 44,400	$ 44,400
Subtotal General Requirements				**$ 75,500**
Sitework				
Traffic and Pedestrian Control Allowance	1	ls	$ 6,500	$ 6,500
Erosion Control Allowance	1	ls	$ 4,000	$ 4,000
Utility Locates Allowance	1	ls	$ 3,500	$ 3,500
Surface Demolition Allowance	1	ls	$ 22,000	$ 22,000
Utility Manholes/Pits Allowance	1	ls	$ 9,900	$ 9,900
Utility Demolition Allowance	1	ls	$ 10,800	$ 10,800
Site Restoration Allowance	1	ls	$ 50,800	$ 50,800
Total - Sitework				**$ 107,500**
Direct Bury - New CHWS/R				
2 - 8", 6", 4" & 3" CHWS/R			**Segment Length**	**1,050.00**
			Excavation Width	**6.00**
Excavation/Shoring/Backfill			**Avg. Excavation Depth**	**7.00**
Excavation - 6'**W x 7'D Assumed**	1633.33	cy	$ 23.00	$ 37,567
Dewatering	6300	sf	$ 8.00	$ 50,400
Shoring & Bracing	14700	sf	$ 12.00	$ 176,400
Unsuitable Soil (100% Disposal of Excav.)	1633.33	cy	$ 17.00	$ 27,767
Backfill Above & Sides of Trench (Engineered Fill)	1633.33	cy	$ 29.00	$ 47,367
Stone Base	918.75	tn	$ 17.00	$ 15,619
Subtotal Excavation				**$ 355,200**
Chilled Water Piping, Insulating & Support				
3" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12" HDPE JACKET	100	lf	$ 60.00	$ 6,000
4" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12" HDPE JACKET	200	lf	$ 90.00	$ 18,000
6" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12" HDPE JACKET	1,800	lf	$ 120.00	$ 216,000
8" HHWS/R - SDR 11 GREY STRIP AQUATECNIK X FOAM X 12" HDPE JACKET	0	lf	$ 160.00	$ -
Fitting Allowance	1	ls	$ 12,000.00	$ 12,000
Valve Allowance	1	ls	$ 15,600.00	$ 15,600
Piping Specialties Allowance	1	ls	$ 12,000.00	$ 12,000
Pipe Support Allowance (inc. Pipe Guides and Structural Supports)	105	ea	$ 800.00	$ 84,000
Flush & Test				
Flush, Clean & Pressure Test	2,100	lf	$ 29.00	$ 60,900
Subtotal New Work				**$ 424,500**
Total Site Main Section				**$ 962,700**

Colorado State University

Laurel Village HVAC Upgrade

Fort Collins, CO
AEI Project Number: 26398-00
Estimate issue Date: 3/25/2025

Opinion of Probable Cost Estimate Summary

Summary

Central Plant w/Air Source

Construction Cost		Base Case Air cooled chiller with natural gas boiler	Alternate 1 Air cooled chiller with electric boiler	Alternate 2 Air Source Heat Pump with natural gas boiler	Alternate 3 Air Source heat pump with electric boilers
General Construction		$ 2,700,000	$ 2,700,000	$ 2,700,000	$ 2,700,000
Chilled Water System		$ 1,900,000	$ 2,000,000	$ 2,000,000	$ 2,000,000
Heating Hot Water System		$ 683,000	$ 867,000	$ 826,000	$ 1,018,000
Electrical		$ 993,795	$ 2,282,815	$ 1,056,795	$ 2,282,815
Total Construction Cost (Material and Labor)		**$ 6,276,795**	**$ 7,849,815**	**$ 6,582,795**	**$ 8,000,815**
Phasing - Mobilization/Demobilization	5.0%	$ 313,800	$ 392,500	$ 329,100	$ 400,000
General Conditions	10.0%	$ 627,700	$ 785,000	$ 658,300	$ 800,100
Contingency	5.5%	$ 345,200	$ 431,700	$ 362,100	$ 440,000
Design Fees	5.0%	$ 313,800	$ 392,500	$ 329,100	$ 400,000
Construction soft costs (Permit Fees, bonding, insurance, project management)	5.0%	$ 313,800	$ 392,500	$ 329,100	$ 400,000
Contractor Soft Costs		**$ 1,914,300**	**$ 2,394,200**	**$ 2,007,700**	**$ 2,440,100**
Fixed Limit of Design and Construction Cost		**$ 8,191,095**	**$ 10,244,015**	**$ 8,590,495**	**$ 10,440,915**
CSU Soft costs (Administrative, Consultant Fees, Equipment (Owner Furnished), Construction Costs (Outside FLODC), Owner Contingency)	20.0%	$ 1,255,359	$ 1,569,963	$ 1,316,559	$ 1,600,163
TOTAL DEVELOPMENT BUDGET		**$ 9,446,454**	**$ 11,813,978**	**$ 9,907,054**	**$ 12,041,078**

Note - all Totals Rounded up to nearest $1k

Colorado State University

Laurel Village HVAC Upgrade

Fort Collins, CO

AEI Project Number: 26398-00

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Central Plant w/Air Source

Base Case

Opinion of Probable Cost Estimate Summary

Construction Cost

General Construction		$	2,700,000
Chilled Water System		$	1,900,000
Heating Hot Water System		$	683,000
Electrical		$	993,795
Total Construction Cost (Material and Labor)		**$**	**6,276,795**
Phasing - Mobilization/Demobilization	5.0%	$	313,800
General Conditions	10.0%	$	627,700
Contingency	5.5%	$	345,200
Design Fees	5.0%	$	313,800
Construction soft costs (Permit Fees, bonding, insurance, project management)	5.0%	$	313,800
Contractor Soft Costs			**$ 1,914,300**
Fixed Limit of Design and Construction Cost			**$ 8,191,095**
CSU Soft costs (Administrative, Consultant Fees, Equipment (Owner Furnished), Construction Costs (Outside FLODC), Owner Contingency)	20.0%		$ 1,255,359
TOTAL DEVELOPMENT BUDGET			**$ 9,446,454**

Note - all Totals Rounded up to nearest $1k

Colorado State University

Laurel Village HVAC Upgrade

Fort Collins, CO

AEI Project Number: 26398-00

Estimate issue Date: 3/25/2025

Central Plant w/Air Source

Base Case

General Construction

Opinion of Probable Cost Estimate Summary

Construction Cost

	$ per Ton	Total 540
General Construction		
CUP (General Construction, MEP/F) Demolition/Modification Allowance	$150.00	$81,000.00
CUP (General Construction, MEP/F) New Plant Construction Allowance	$1,000.00	$1,800,000.00
CUP (General Construction, MEP/F) New Yard Construction Allowance	$140.00	$353,000.00
CUP (General Construction) New Screen wall Construction Allowance	$230.00	$469,000.00
General Construction Total	**$5,000.00**	**$2,700,000.00**

Colorado State University
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Fort Collins, CO
AEI Project Number: 26398-00
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Central Plant w/Air Source

Base Case

Chilled Water System

Opinion of Probable Cost Estimate Summary

Construction Cost

Chilled Water System (Costs based on $ per Ton x Tons)	$ per Ton	Total 540
Mobilization & Engineering	$10.00	$5,400.00
Bond	$12.00	$6,480.00
Air Cooled Chillers 3 (180 Tons)	$1,270.00	$685,800.00
CHHW Piping	$600.00	$324,000.00
Primary Chilled Water Pumps 3 (End Suct, 330 gpm @ 30ft hd, 3 hp)	$38.89	$21,000.00
Pump Accessories 3 (one for each pump)	$19.44	$10,500.00
VFD - Water Pumps 3 (3 hp each)	$36.25	$19,575.00
Expansion Tank	$15.56	$8,400.00
Air Separator	$12.96	$7,000.00
Glycol Feeder	$9.26	$5,000.00
Glycol	$280.00	$151,200.00
Secondary Chilled Water Pumps 2 (End Suct, 600 gpm @ 90ft hd, 15 hp)	$44.44	$24,000.00
Pump Accessories 2 (one for each pump)	$22.22	$12,000.00
VFD - Water Pumps 2 (15 hp each)	$37.04	$20,000.00
Buffer Tank - 1,000 gal	$51.85	$28,000.00
Heat Exchanger	$185.19	$100,000.00
Expansion Tank	$15.56	$8,400.00
Air Separator	$12.96	$7,000.00
Make Up Water Assembly	$9.26	$5,000.00
Controls	$540.00	$291,600.00
Supporting Plumbing Work (Includes New Service & Meter)	$133.00	$71,820.00
Supporting Fire Work	$5.00	$2,700.00
Supporting Mechanical Work	$185.00	$99,900.00
Crane & Rigging	$45.00	$24,300.00
Chilled Water System Total	**$3,519.00**	**$1,900,000.00**

Colorado State University

Laurel Village HVAC Upgrade

Fort Collins, CO

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Central Plant w/Air Source

Base Case

Heating Hot Water System

Opinion of Probable Cost Estimate Summary

Construction Cost

Heating Hot Water System	$ per	BHP
(Costs based on $ per BHP x BHP)	BHP	240
Nat. Gas Piping	$100.00	$24,000.00
Boilers, Nat Gas Condensing 4 (2,000 MBH, 60 BHP Each)	$650.00	$156,000.00
Stacks & Breeching	$120.00	$28,800.00
Hot Water Piping	$600.00	$144,000.00
Primary Hot Water Pumps 4(300 gpm @ 20ft hd, 2HP)	$120.00	$28,800.00
Pump Accessories 4(one for each pump)	$60.00	$14,400.00
VFD - Hot Water Pumps 4(2 hp each)	$120.00	$28,800.00
Expansion Tank	$40.00	$9,600.00
Air Separator	$30.00	$7,200.00
Secondary Chilled Water Pumps 2 (End Suct, 600 gpm @ 90ft hd, 15 hp)	$2.50	$24,000.00
Pump Accessories 2 (one for each pump)	$1.25	$12,000.00
VFD - Water Pumps 2 (15 hp each)	$2.08	$20,000.00
Expansion Tank	$0.88	$8,400.00
Air Separator	$0.73	$7,000.00
Make Up Water Assembly	$0.52	$5,000.00
Controls	$320.00	$76,800.00
Supporting Plumbing Work (Includes New Service & Meter)	$133.00	$31,920.00
Supporting Fire Work	$5.00	$1,200.00
Supporting Mechanical Work	$185.00	$44,400.00
Crane & Rigging	$45.00	$10,800.00
Heating Hot Water System Total	$2,845.83	**$683,000.00**

Colorado State University

Laurel Village HVAC Upgrade

Fort Collins, CO

AEI Project Number: 26398-00

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Central Plant w/Air Source

Base Case

Electrical

Opinion of Probable Cost Estimate Summary

Construction Cost

Electrical System (Costs based on $ per Ton x Tons)	**Chilled Water** Total Tons 540	**Hot Water** Total BHP 240	**Total Both**
Mobilization & Engineering	$10,800.00	$2,160.00	**$12,960.00**
Bond	$16,200.00	$2,880.00	**$19,080.00**
Emergency Power Gear & Distribution	$102,600.00	$45,600.00	**$148,200.00**
Emergency Generator (500kW) Nat Gas	$216,000.00	$144,000.00	**$360,000.00**
Pad Mounted Transformer	$27,000.00	$19,200.00	**$46,200.00**
MCC's	$43,200.00	$19,200.00	**$62,400.00**
Conduit & Ftgs (Below Grade)	$10,800.00	$4,800.00	**$15,600.00**
Conduit & Ftgs (Above Grade)	$54,000.00	$24,000.00	**$78,000.00**
Panelboards	$86,400.00	$38,400.00	**$124,800.00**
Dry Transformers	$32,400.00	$14,400.00	**$46,800.00**
Wiring Devices	$10,800.00	$4,800.00	**$15,600.00**
Light Fixtures	$10,800.00	$4,800.00	**$15,600.00**
Grounding System	$8,640.00	$3,840.00	**$12,480.00**
Supporting Electrical Work	$16,875.00	$7,500.00	**$24,375.00**
Crane & Rigging	$8,100.00	$3,600.00	**$11,700.00**
Electrical System	$654,615.00	$339,180.00	**$993,795.00**

Colorado State University

Laurel Village HVAC Upgrade

Fort Collins, CO

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Central Plant w/Air Source

Opinion of Probable Cost Estimate Summary			Alternate 1
Construction Cost			
General Construction		$	2,700,000
Chilled Water System		$	2,000,000
Heating Hot Water System		$	867,000
Electrical		$	2,282,815
Total Construction Cost (Material and Labor)		**$**	**7,849,815**
Phasing - Mobilization/Demobilization	5.0%	$	392,500
General Conditions	10.0%	$	785,000
Contingency	5.5%	$	431,700
Design Fees	5.0%	$	392,500
Construction soft costs (Permit Fees, bonding, insurance, project management)	5.0%	$	392,500
Contractor Soft Costs			**$ 2,394,200**
Fixed Limit of Design and Construction Cost			**$ 10,244,015**
CSU Soft costs (Administrative, Consultant Fees, Equipment (Owner Furnished), Construction Costs (Outside FLODC), Owner Contingency)	20.0%		$ 1,569,963
TOTAL DEVELOPMENT BUDGET			**$ 11,813,978**

Note - all Totals Rounded up to nearest $1k

Colorado State University

Laurel Village HVAC Upgrade

Fort Collins, CO

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Central Plant w/Air Source

Alternate 1

Chilled Water System

Opinion of Probable Cost Estimate Summary

Construction Cost

	$ per Ton	Total 540
General Construction		
CUP (General Construction, MEP/F) Demolition/Modification Allowance	$150.00	$81,000.00
CUP (General Construction, MEP/F) New Plant Construction Allowance	$1,000.00	$1,800,000.00
CUP (General Construction, MEP/F) New Yard Construction Allowance	$140.00	$353,000.00
CUP (General Construction) New Screen wall Construction Allowance	$230.00	$469,000.00
General Construction Total	**$5,000.00**	**$2,700,000.00**

Colorado State University

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Fort Collins, CO

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Central Plant w/Air Source

Alternate 1

Chilled Water System

Opinion of Probable Cost Estimate Summary

Construction Cost

Chilled Water System (Costs based on $ per Ton x Tons)	$ per Ton	Total 540
Mobilization & Engineering	$10.00	$5,400.00
Bond	$12.00	$6,480.00
Air Cooled Chillers 3 (180 Tons)	$1,270.00	$685,800.00
CHHW Piping	$665.00	$359,100.00
Primary Chilled Water Pumps 3 (End Suct, 330 gpm @ 30ft hd, 3 hp)	$38.89	$21,000.00
Pump Accessories 3 (one for each pump)	$19.44	$10,500.00
VFD - Water Pumps 3 (3 hp each)	$36.25	$19,575.00
Expansion Tank	$15.56	$8,400.00
Air Separator	$12.96	$7,000.00
Glycol Feeder	$9.26	$5,000.00
Glycol	$280.00	$151,200.00
Secondary Chilled Water Pumps 2 (End Suct, 600 gpm @ 90ft hd, 15 hp)	$44.44	$24,000.00
Pump Accessories 2 (one for each pump)	$22.22	$12,000.00
VFD - Water Pumps 2 (15 hp each)	$37.04	$20,000.00
Buffer Tank - 1,000 gal	$51.85	$28,000.00
Heat Exchanger	$185.19	$100,000.00
Expansion Tank	$15.56	$8,400.00
Air Separator	$12.96	$7,000.00
Make Up Water Assembly	$9.26	$5,000.00
Controls	$550.00	$297,000.00
Supporting Plumbing Work (Includes New Service & Meter)	$133.00	$71,820.00
Supporting Fire Work	$5.00	$2,700.00
Supporting Mechanical Work	$185.00	$99,900.00
Crane & Rigging	$45.00	$24,300.00
Chilled Water System Total	**$3,704.00**	**$2,000,000.00**

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Fort Collins, CO

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Central Plant w/Air Source

Alternate 1

Opinion of Probable Cost Estimate Summary

Heating Hot Water System

Construction Cost

Heating Hot Water System	$ per	BHP
(Costs based on $ per BHP x BHP)	BHP	3200
Nat. Gas Piping	$0.00	$0.00
Boilers, Elec 4 (600 kW, 800 BHP Each)	$50.00	$160,000.00
Stacks & Breeching	$0.00	$0.00
Hot Water Piping	$100.00	$320,000.00
Primary Hot Water Pumps 4(300 gpm @ 20ft hd, 2HP)	$10.00	$32,000.00
Pump Accessories 4(one for each pump)	$5.00	$16,000.00
VFD - Hot Water Pumps 4(2 hp each)	$10.00	$32,000.00
Expansion Tank	$3.00	$9,600.00
Air Separator	$2.00	$6,400.00
Secondary Chilled Water Pumps 2 (End Suct, 600 gpm @ 90ft hd, 15 hp)	$7.50	$24,000.00
Pump Accessories 2 (one for each pump)	$1.25	$4,000.00
VFD - Water Pumps 2 (15 hp each)	$2.08	$6,666.67
Expansion Tank	$0.88	$2,800.00
Air Separator	$0.73	$2,333.33
Make Up Water Assembly	$0.52	$1,666.67
Controls	$30.00	$96,000.00
Supporting Plumbing Work (Includes New Service & Meter)	$13.30	$42,560.00
Supporting Fire Work	$5.00	$16,000.00
Supporting Mechanical Work	$18.50	$59,200.00
Crane & Rigging	$11.25	$36,000.00
Heating Hot Water System Total	$270.94	**$867,000.00**

Colorado State University

Laurel Village HVAC Upgrade

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Central Plant w/Air Source

Alternate 1

Electrical

Opinion of Probable Cost Estimate Summary

Construction Cost

	Chilled Water	Hot Water	
Electrical System	Total Tons	Total BHP	**Total**
(Costs based on $ per Ton x Tons)	540	3200	**Both**
Mobilization & Engineering	$10,800.00	$28,800.00	**$39,600.00**
Bond	$16,200.00	$38,400.00	**$54,600.00**
Emergency Power Gear & Distribution	$324,000.00	$256,000.00	**$580,000.00**
Emergency Generator (1.5 MW) Diesel	$459,000.00	$448,000.00	**$907,000.00**
Pad Mounted Transformer	$37,800.00	$32,000.00	**$69,800.00**
MCC's	$81,000.00	$48,000.00	**$129,000.00**
Conduit & Ftgs (Below Grade)	$10,800.00	$48,000.00	**$58,800.00**
Conduit & Ftgs (Above Grade)	$81,000.00	$64,000.00	**$145,000.00**
Panelboards	$43,200.00	$6,400.00	**$49,600.00**
Dry Transformers	$10,800.00	$6,400.00	**$17,200.00**
Wiring Devices	$10,800.00	$28,800.00	**$39,600.00**
Light Fixtures	$10,800.00	$19,200.00	**$30,000.00**
Grounding System	$3,240.00	$38,400.00	**$41,640.00**
Supporting Electrical Work	$16,875.00	$48,000.00	**$64,875.00**
Crane & Rigging	$8,100.00	$48,000.00	**$56,100.00**
Electrical System	$1,124,415.00	$1,158,400.00	**$2,282,815.00**

Colorado State University

Laurel Village HVAC Upgrade

Fort Collins, CO

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Central Plant w/Air Source

Opinion of Probable Cost Estimate Summary

Alternate 2

Construction Cost

General Construction		$	2,700,000
Chilled Water System		$	2,000,000
Heating Hot Water System		$	826,000
Electrical		$	1,056,795
Total Construction Cost (Material and Labor)		**$**	**6,582,795**
Phasing - Mobilization/Demobilization	5.0%	$	329,100
General Conditions	10.0%	$	658,300
Contingency	5.5%	$	362,100
Design Fees	5.0%	$	329,100
Construction soft costs (Permit Fees, bonding, insurance, project management)	5.0%	$	329,100
Contractor Soft Costs			**$ 2,007,700**
Fixed Limit of Design and Construction Cost			**$ 8,590,495**
CSU Soft costs (Administrative, Consultant Fees, Equipment (Owner Furnished), Construction Costs (Outside FLODC), Owner Contingency)	20.0%		$ 1,316,559
TOTAL DEVELOPMENT BUDGET			**$ 9,907,054**

Note - all Totals Rounded up to nearest $1k

Colorado State University

Laurel Village HVAC Upgrade

Fort Collins, CO

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Central Plant w/Air Source

Alternate 2

General Construction

Opinion of Probable Cost Estimate Summary

0

Construction Cost

	$ per Ton	Total 540
General Construction		
CUP (General Construction, MEP/F) Demolition/Modification Allowance	$150.00	$81,000.00
CUP (General Construction, MEP/F) New Plant Construction Allowance	$1,000.00	$1,800,000.00
CUP (General Construction, MEP/F) New Yard Construction Allowance	$140.00	$353,000.00
CUP (General Construction) New Screen wall Construction Allowance	$230.00	$469,000.00
General Construction Total	**$5,000.00**	**$2,700,000.00**

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Central Plant w/Air Source

Alternate 2

Chilled Water System

Opinion of Probable Cost Estimate Summary

Construction Cost

Chilled Water System (Costs based on $ per Ton x Tons)	$ per Ton	Total 540
Mobilization & Engineering	$10.00	$5,400.00
Bond	$12.00	$6,480.00
Air Source Heat Pumps 3 (2,000 MBH, 180 Tons)	$1,270.00	$685,800.00
CHHW Piping	$665.00	$359,100.00
Primary Chilled Water Pumps 3 (End Suct, 330 gpm @ 30ft hd, 3 hp)	$38.89	$21,000.00
Pump Accessories 3 (one for each pump)	$19.44	$10,500.00
VFD - Water Pumps 3 (3 hp each)	$36.25	$19,575.00
Expansion Tank	$15.56	$8,400.00
Air Separator	$12.96	$7,000.00
Glycol Feeder	$9.26	$5,000.00
Glycol	$280.00	$151,200.00
Secondary Chilled Water Pumps 2 (End Suct, 600 gpm @ 90ft hd, 15 hp)	$44.44	$24,000.00
Pump Accessories 2 (one for each pump)	$22.22	$12,000.00
VFD - Water Pumps 2 (15 hp each)	$37.04	$20,000.00
Buffer Tank - 3,000 gal	$101.85	$55,000.00
Heat Exchanger	$185.19	$100,000.00
Expansion Tank	$15.56	$8,400.00
Air Separator	$12.96	$7,000.00
Make Up Water Assembly	$9.26	$5,000.00
Controls	$560.00	$302,400.00
Supporting Plumbing Work (Includes New Service & Meter)	$133.00	$71,820.00
Supporting Fire Work	$5.00	$2,700.00
Supporting Mechanical Work	$185.00	$99,900.00
Crane & Rigging	$45.00	$24,300.00
Chilled Water System Total	**$3,704.00**	**$2,000,000.00**

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Central Plant w/Air Source

Alternate 2

Heating Hot Water System

Opinion of Probable Cost Estimate Summary

Construction Cost

Heating Hot Water System	$ per	BHP
(Costs based on $ per BHP x BHP)	BHP	240
Nat. Gas Piping	$100.00	$24,000.00
Boilers, Nat Gas Condensing 4 (2,000 MBH, 60 BHP Each)	$920.00	$220,800.00
Stacks & Breeching	$120.00	$28,800.00
Hot Water Piping	$200.00	$48,000.00
Primary Hot Water Pumps 4(300 gpm @ 20ft hd, 2HP)	$120.00	$28,800.00
Pump Accessories 4(one for each pump)	$60.00	$14,400.00
VFD - Hot Water Pumps 4(2 hp each)	$120.00	$28,800.00
Expansion Tank	$40.00	$9,600.00
Air Separator	$30.00	$7,200.00
Secondary Chilled Water Pumps 2 (End Suct, 600 gpm @ 90ft hd, 15 hp)	$2.50	$24,000.00
Pump Accessories 2 (one for each pump)	$1.25	$12,000.00
VFD - Water Pumps 2 (15 hp each)	$2.08	$20,000.00
Buffer Tank - 3,000 gal	$229.17	$55,000.00
Heat Exchanger	$10.42	$100,000.00
Expansion Tank	$0.88	$8,400.00
Air Separator	$0.73	$7,000.00
Make Up Water Assembly	$0.52	$5,000.00
Controls	$400.00	$96,000.00
Supporting Plumbing Work (Includes New Service & Meter)	$133.00	$31,920.00
Supporting Fire Work	$5.00	$1,200.00
Supporting Mechanical Work	$185.00	$44,400.00
Crane & Rigging	$45.00	$10,800.00
Heating Hot Water System Total	$3,441.67	**$826,000.00**

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Laurel Village HVAC Upgrade

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Central Plant w/Air Source

Alternate 2

Electrical

Opinion of Probable Cost Estimate Summary

Construction Cost

Electrical System (Costs based on $ per Ton x Tons)	Total Tons 540	Total BHP 240	**Total Both**
Mobilization & Engineering	$10,800.00	$2,160.00	**$12,960.00**
Bond	$16,200.00	$2,880.00	**$19,080.00**
Emergency Power Gear & Distribution	$102,600.00	$45,600.00	**$148,200.00**
Emergency Generator (500kW) Nat Gas	$216,000.00	$144,000.00	**$360,000.00**
Pad Mounted Transformer	$75,600.00	$33,600.00	**$109,200.00**
MCC's	$43,200.00	$19,200.00	**$62,400.00**
Conduit & Ftgs (Below Grade)	$10,800.00	$4,800.00	**$15,600.00**
Conduit & Ftgs (Above Grade)	$54,000.00	$24,000.00	**$78,000.00**
Panelboards	$86,400.00	$38,400.00	**$124,800.00**
Dry Transformers	$32,400.00	$14,400.00	**$46,800.00**
Wiring Devices	$10,800.00	$4,800.00	**$15,600.00**
Light Fixtures	$10,800.00	$4,800.00	**$15,600.00**
Grounding System	$8,640.00	$3,840.00	**$12,480.00**
Supporting Electrical Work	$16,875.00	$7,500.00	**$24,375.00**
Crane & Rigging	$8,100.00	$3,600.00	**$11,700.00**
Electrical System	$703,215.00	$353,580.00	**$1,056,795.00**

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Central Plant w/Air Source

Opinion of Probable Cost Estimate Summary

Alternate 3

Construction Cost

General Construction		$	2,700,000
Chilled Water System		$	2,000,000
Heating Hot Water System		$	1,018,000
Electrical		$	2,282,815
Total Construction Cost (Material and Labor)		**$**	**8,000,815**
Phasing - Mobilization/Demobilization	5.0%	$	400,000
General Conditions	10.0%	$	800,100
Contingency	5.5%	$	440,000
Design Fees	5.0%	$	400,000
Construction soft costs (Permit Fees, bonding, insurance, project management)	5.0%	$	400,000
Contractor Soft Costs			**$ 2,440,100**
Fixed Limit of Design and Construction Cost			**$ 10,440,915**
CSU Soft costs (Administrative, Consultant Fees, Equipment (Owner Furnished), Construction Costs (Outside FLODC), Owner Contingency)	20.0%		$ 1,600,163
TOTAL DEVELOPMENT BUDGET			**$ 12,041,078**

Note - all Totals Rounded up to nearest $1k

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General Construction

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Construction Cost

	$ per Ton	Total 540
General Construction		
CUP (General Construction, MEP/F) Demolition/Modification Allowance	$150.00	$81,000.00
CUP (General Construction, MEP/F) New Plant Construction Allowance	$1,000.00	$1,800,000.00
CUP (General Construction, MEP/F) New Yard Construction Allowance	$140.00	$353,000.00
CUP (General Construction) New Screen wall Construction Allowance	$230.00	$469,000.00
General Construction Total	**$5,000.00**	**$2,700,000.00**

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Chilled Water System

Opinion of Probable Cost Estimate Summary

Construction Cost

Chilled Water System (Costs based on $ per Ton x Tons)	$ per Ton	Total 540
Mobilization & Engineering	$10.00	$5,400.00
Bond	$12.00	$6,480.00
Air Source Heat Pumps 3 (180 Tons)	$1,270.00	$685,800.00
CHHW Piping	$665.00	$359,100.00
Primary Chilled Water Pumps 3 (End Suct, 330 gpm @ 30ft hd, 3 hp)	$38.89	$21,000.00
Pump Accessories 3 (one for each pump)	$19.44	$10,500.00
VFD - Water Pumps 3 (3 hp each)	$36.25	$19,575.00
Expansion Tank	$15.56	$8,400.00
Air Separator	$12.96	$7,000.00
Glycol Feeder	$9.26	$5,000.00
Glycol	$280.00	$151,200.00
Secondary Chilled Water Pumps 2 (End Suct, 600 gpm @ 90ft hd, 15 hp)	$44.44	$24,000.00
Pump Accessories 2 (one for each pump)	$22.22	$12,000.00
VFD - Water Pumps 2 (15 hp each)	$37.04	$20,000.00
Buffer Tank - 3,000 gal	$101.85	$55,000.00
Heat Exchanger	$185.19	$100,000.00
Expansion Tank	$15.56	$8,400.00
Air Separator	$12.96	$7,000.00
Make Up Water Assembly	$9.26	$5,000.00
Controls	$560.00	$302,400.00
Supporting Plumbing Work (Includes New Service & Meter)	$133.00	$71,820.00
Supporting Fire Work	$5.00	$2,700.00
Supporting Mechanical Work	$185.00	$99,900.00
Crane & Rigging	$45.00	$24,300.00
Chilled Water System Total	**$3,704.00**	**$2,000,000.00**

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Alternate 3

Heating Hot Water System

Opinion of Probable Cost Estimate Summary

Construction Cost

Heating Hot Water System	$ per	BHP
(Costs based on $ per BHP x BHP)	BHP	3200
Nat. Gas Piping	$0.00	$0.00
Boilers, Elec 4 (600 kW, 800 BHP Each)	$50.00	$160,000.00
Stacks & Breeching	$0.00	$0.00
Hot Water Piping	$100.00	$320,000.00
Primary Hot Water Pumps 4(300 gpm @ 20ft hd, 2HP)	$10.00	$32,000.00
Pump Accessories 4(one for each pump)	$5.00	$16,000.00
VFD - Hot Water Pumps 4(2 hp each)	$10.00	$32,000.00
Expansion Tank	$3.00	$9,600.00
Air Separator	$2.00	$6,400.00
Secondary Chilled Water Pumps 2 (End Suct, 600 gpm @ 90ft hd, 15 hp)	$7.50	$24,000.00
Pump Accessories 2 (one for each pump)	$1.25	$4,000.00
VFD - Water Pumps 2 (15 hp each)	$2.08	$6,666.67
Buffer Tank - 3,000 gal	$17.00	$54,400.00
Heat Exchanger	$30.00	$96,000.00
Expansion Tank	$0.88	$2,800.00
Air Separator	$0.73	$2,333.33
Make Up Water Assembly	$0.52	$1,666.67
Controls	$30.00	$96,000.00
Supporting Plumbing Work (Includes New Service & Meter)	$13.30	$42,560.00
Supporting Fire Work	$5.00	$16,000.00
Supporting Mechanical Work	$18.50	$59,200.00
Crane & Rigging	$11.25	$36,000.00
Heating Hot Water System Total	$318.13	**$1,018,000.00**

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Alternate 3

Electrical

Opinion of Probable Cost Estimate Summary

Construction Cost

Electrical System (Costs based on $ per Ton x Tons)	Total Tons 540	Total BHP 3200	**Total Both**
Mobilization & Engineering	$10,800.00	$28,800.00	**$39,600.00**
Bond	$16,200.00	$38,400.00	**$54,600.00**
Emergency Power Gear & Distribution	$324,000.00	$256,000.00	**$580,000.00**
Emergency Generator (500kW) Nat Gas	$459,000.00	$448,000.00	**$907,000.00**
Pad Mounted Transformer	$37,800.00	$32,000.00	**$69,800.00**
MCC's	$81,000.00	$48,000.00	**$129,000.00**
Conduit & Ftgs (Below Grade)	$10,800.00	$48,000.00	**$58,800.00**
Conduit & Ftgs (Above Grade)	$81,000.00	$64,000.00	**$145,000.00**
Panelboards	$43,200.00	$6,400.00	**$49,600.00**
Dry Transformers	$10,800.00	$6,400.00	**$17,200.00**
Wiring Devices	$10,800.00	$28,800.00	**$39,600.00**
Light Fixtures	$10,800.00	$19,200.00	**$30,000.00**
Grounding System	$3,240.00	$38,400.00	**$41,640.00**
Supporting Electrical Work	$16,875.00	$48,000.00	**$64,875.00**
Crane & Rigging	$8,100.00	$48,000.00	**$56,100.00**
Electrical System	$1,124,415.00	$1,158,400.00	**$2,282,815.00**