EASTERN
WASHINGTON UNIVERSITY

Shawn King
Associate Vice President

MEMORANDUM

To:	Darrell Jennings, Capital Budget Analyst, Office of Financial Management
From:	Shawn King, Associate Vice President for Facilities and Planning
Date:	August 14, 2020
Re:	Major Capital Project Proposal – Infrastructure Renewal III – Infrastructure 40000070

Eastern Washington University's major project proposal for OFM project number 40000070 Infrastructure Renewal III in the Infrastructure Category, in accordance with requirements of the Office of Financial Management's 2021-2023 Capital Project Evaluation System.

An electronic copy of this project proposal can be found at the link below:

https://ewueagles.sharepoint.com/:f:/s/cpstorageprime/EsMSy3rEng1ImBv7T54dxAUBe5Ey6i3DaPlaX19B49RrOQ

If you have any questions or issues with the link provided, please let me know.

Best Regards,

2020 PROJECT PROPOSAL CHECKLIST

2021-23 Biennium Four-year Higher Education Scoring Process

INSTITUTION	CAMPUS LOCATION
370 - Eastern Washington University	Cheney, WA
PROJECT TITLE	FPMT UNIQUE FACILITY ID # (OR NA)
Infrastructure Renewal III	40000070
PROJECT CATEGORY	PROJECT SUBCATEGORY
Infrastructure	Major
PROPOSAL IS	
New or Updated Proposal (for scoring)	Resubmitted Proposal (retain prior score)
☒ New proposal ☐ Resubmittal to be scored (more than 2 biennia old or significantly changed)	☐ Resubmittal from 2017-19 biennium ☐ Resubmittal from 2019-21 biennium
CONTACT	PHONE NUMBER
Steve Schmedding	509-359-4205

PROPOSAL CONTENT

- ☒ Project Proposal Checklist: this form; one for each proposal
- ☒ Project Proposal Form: Specific to category/subcategory (10-page limit)
- ☒ Appendices: templates, forms, exhibits and supporting/supplemental documentation for scoring.

INSTITUTIONAL PRIORITY

- ☒ Institutional Priority Form. Sent separately (not in this packet) to: Darrell Jennings.

Check the corresponding boxes below if the proposed project meets the minimum threshold or if the item listed is provided in the proposal submittal.

MINIMUM THRESHOLDS

- ☒ Project is not an exclusive enterprise function such as a bookstore, dormitory or contract food service.
- ☒ Project meets LEED Silver Standard requirements.
- ☒ Institution has a greenhouse gas emissions reduction policy in place in accordance with RCW 70.235.070 and vehicle emissions reduction policy in place per RCW 47.01.440 or RCW 43.160.020 as applicable.
- ☐ Design proposals: A complete predesign study was submitted to OFM by July 1, 2020.
- ☐ Growth proposals: Based on solid enrollment projections and is more cost-effectively providing enrollment access than alternatives such as university centers and distance learning.
- ☐ Renovation proposals: Project should cost between 60 – 80% of current replacement value and extend the useful life of the facility by at least 25 years.
- ☐ Acquisition proposals: Land acquisition is not related to a current facility funding request.
- ☒ Infrastructure proposals: Project is not a facility repair project.
- ☐ Stand-alone, infrastructure and acquisition proposals: is a single project requesting funds for one biennium.

2020 PROJECT PROPOSAL CHECKLIST

2021-23 Biennium Four-year Higher Education Scoring Process

REQUIRED APPENDICES

- ☒ Capital Project Report CBS 002
- ☒ Project cost estimate:
  - CBS 003 for projects between $2 million and $5 million
  - **Excel C-100 for projects greater than $5 million**
- ☐ Degree Totals and Targets template to indicate the number of Bachelors, High Demand and Advanced degrees expected to be awarded in 2021. (Required for Overarching Criteria scoring criteria for Major Growth, Renovation, Replacement and Research proposals).
- ☐ Availability of Space/Campus Utilization template for the campus where the project is located. (Required for all categories/subcategories except Infrastructure and Acquisition proposals).
- ☐ Assignable Square Feet template to indicate program-related space allocation. (Required for Growth, Renovation and Replacement proposals, all categories/subcategories).

OPTIONAL APPENDICES

Attach supplemental and supporting project documentation, *limit to materials directly related to and needed for the evaluation criteria*, such as:

- ☐ Degree and enrollment growth projections
- ☐ Selected excerpts from institutional plans
- ☐ Data on instructional and/or research space utilization
- ☐ Additional documentation for selected cost comparables (acquisition)
- ☐ Selected materials on facility conditions
- ☒ Selected materials on code compliance
- ☐ Tables supporting calculation of program space allocations, weighted average facility age, etc.
- ☐ Evidence of consistency of proposed research projects with state, regional, or local economic development plans
- ☐ Evidence of availability of non-state matching funds
- ☒ Selected documentation of prior facility failures, high cost maintenance, and/or system unreliability for infrastructure projects
- ☐ Documentation of professional assessment of costs for land acquisition, land cleanup, and infrastructure projects
- ☒ Selected documentation of engineering studies, site survey and recommendations, or opinion letters for infrastructure and land cleanup projects
- ☐ Other: Click or tap here to enter text.

I certify that the above checked items indicate either that the proposed project meets the minimum thresholds or the corresponding items have been included in this submittal.

Name: Shawn King | Title: AVP, Facilities and Planning

Signature: [signature] | Date: August 14, 2020

Infrastructure Renewal – III

Infrastructure - Renewal

EASTERN
WASHINGTON UNIVERSITY

2021 – 2023 Capital Budget

Infrastructure
2020 Higher Education Project Proposal Form

2021-23 Biennium Project

INSTITUTION	CAMPUS
Eastern Washington University	**Cheney, Washington**
PROJECT TITLE	
Infrastructure Renewal III - 40000070	

SUMMARY NARRATIVE

- Problem statement

This request includes **sub-sections** entitled **Central Steam Production, Chilled Water Production, Medium Voltage Electrical Distribution,** and **Water Resource Systems**. A heading for each will be included in each specific criteria category for clarity.

Eastern Washington University is requesting $25,518,000 for Infrastructure Renewal III in the Infrastructure category.

Our Fiscal Year 2019-21 (FY) proposal requested $24,959,000 and scored the highest in its category but only about 50% of the request was allocated. In FY 2017-19, regretfully no funds were appropriated to the EWU Infrastructure Master Plan by the legislature. Fortunately during this timeframe, no major failure or significant disruption to the Steam, Chilled Water, or Medium Voltage Electrical systems has occurred. This request builds on the FY 2019-21 request.

Due to the reduced funding allocation over the previous four years some of the FY 2019-21 allocated funds were directed to increasing emergent needs related to our infrastructure. The majority of the funds has gone toward the Infrastructure Master Plan, albeit in at least a piecemeal basis. As an example, time had taken its toll on the existing boiler controls computer system and once received FY 2019-21 funds were immediately made available for the design and installation of a replacement boiler burner management control system. This new system provides a stable operating environment with the latest in industrial direct digital controls (DDC) technology and has become an important component in the modernization of this plant. We estimate the increased boiler efficiencies of between 3% and 5% will save approximately $45,000 to $75,000. See **Appendix G.** In addition, this investment will be compatible with new boiler technology project currently under design.

Authors Note: Our FY 2019-21 biennium budget request included approximately 900 pages of support for the request in the form of appendices containing engineering studies, project plans, specs, repair documentation, estimates, etc. While all of this documentation provided justification to this request and helped it in obtaining the highest score, it was also very cumbersome to the reviewers. This request uses some of the same appendices that have been modified to include only the pages that pertain to the context of the specific sentence in which it is referred to. Links will be provided to each entire appendix document for electronic review.

In 2014 Eastern partnered with mechanical, electrical, and civil professional engineering consultants to examine each major utility system for current condition assessment, lifecycle renewal/replacement, potential energy savings, and sustainable upgrades. The systems that were examined include campus electrical power distribution as well as steam and chilled water production and distribution systems, and domestic water distribution system. Included in this overall study were recommendations for short and long-term actions to reduce potential failures, lower maintenance costs, increase worker safety and improve efficiencies, and to identify potential alternate energy sources for future production of utilities. See **Appendix A**.

N+1 Design - Modern steam and chilled water plants are generally designed, built and operated on the principle of "N+1 redundancy where N = the Number of (boilers or chillers) needed to produce to the required peak heating or cooling load, and +1 represents an additional boiler or chiller to support the load when one of the other, "N" units are off line. This is how the Rozell Central Energy Plant was originally planned. N+1 redundancy is important as it allows for continuous steam or chilled water production meeting campus needs when taking a portion of the plant off-line for scheduled maintenance or other reason. However, due the age of the boilers and chillers currently in use at Rozell, **See Appendix B**, the complete loss of the units shown in appendix B, and an increasing campus heating and cooling loads, the plant does not have the needed redundancy and has very limited flexibility in maintaining the heating or cooling load when switching between remaining operable units.

Needs, Central Steam Production - The Existing Boilers table in Appendix B provides a comparison of Original Rated vs. Actual Safe Operating boiler capacity and a Condition Description for each of the plants boilers. As can be seen in the table and considering safe operating ranges, plant capacity with all currently functional boilers being considered is approximately 50% above current peak loads, at best. This consideration assumes that all four (4) currently functional boilers are operating together in parallel which is not consistent with standard boiler plant operation. Taking any one of the existing boilers out of the equation lowers our maximum capacity to between 74,000 PPH and 101,000 PPH.

This mission critical system has major components that are over fifty years old and many parts are no longer produced further complicating proper maintenance and repair. Although the steam plant is well maintained it should be made very clear that the stability and longevity of our system is very close to being compromised.

Benefits, Central Steam Production – Using FY 2019-21 funds we are currently designing the replacement of both #2 and #3 boilers. Our current mechanical design will install a new boiler sufficient in capacity and appropriate in size given the physical constraints of the plant. The current schedule has us in "Schematic" design and with design continuing through early winter 2021 when the project will be placed into Advertisement and public bidding. Construction is expected to commence in late winter to early spring 2021 with a completion date late 2021. Current estimates of savings with this new boiler replacement is around $65,000 annually. See **Appendix G**. This request focuses on replacing boiler #4 as it is 51 years old. While we are currently designing the first phase of boiler replacement we are evaluating opportunities for making the replacement of boiler #4 less costly. There are several code requirements relating to safety, energy management and sustainability that will be implemented. These upgrades facilitate the departments' requirement of providing the required campus heating for many years into the future in an energy efficient, safe, and consistent manner.

Needs, Chilled Water Production - The **Existing Chillers and Towers** table in **Appendix B** provides a comparison of Original Rated vs. Actual Operating Chiller and Tower capacity and Condition Description for each of the coupled chiller/tower units. As can be seen in the table we are still in need of replacing old and inoperable chillers and towers for the majority of our plant.

Benefits, Chilled Water Production – Our goal is to replace the #4 chiller as it has significant mechanical issues with repair estimates approaching the cost of a new chiller. We would also replace either the #3 or the #5 chiller as well, the other of these two we would simply disassemble and remove from the plant. Our goal for the towers would be to replace #4 and #5 with new larger capacity 1500 ton towers and eliminate #3 tower entirely.

With advancements in technology we can now fit chillers and towers of greater tonnage in the same physical spaces where existing units currently reside. This would put the plant at four new 1500 ton chillers and towers meeting our campus capacity needs with less equipment. These new chillers would be equipped with the same technology and energy saving features as those that were installed in 2017/2018. Energy savings data gathered from the two new chillers installed in 2018 show we will be saving approximately $45,000 annually with these currently in use. **See Appendix G.**

Needs, Medium Voltage Electrical Distribution - University electricians operate, perform preventative maintenance, and make repairs to a 13,200 KvA Medium Voltage Electrical System. The system is aged but fortunately has been well maintained minimizing wear on critical components that are commonly considered out of date by current electrical code. Now is the time for these major components to be replaced. The report identified in **Appendix A** recommended six (6) projects with respect to the electrical system that should be accomplished in order for the electrical system to continue to operate safely, efficiently, and without interruption due to increased loads. As a result of the initial study, the university commissioned the engineering study **Electrical Capacity Upgrade** in August 2016 as this formed the basis for some of the other projects identified in the 2014 report. See **Appendix C.** This study and report provided a "Load Model" validating existing campus loads and the projected load increases related to the new Interdisciplinary Science Center and the needed electrical capacity increase associated with the needed increased chilled water capacity.

Benefits, Medium Voltage Electrical Distribution – As noted in **Appendix C**, using remaining funds provided in the FY 2015-17 Capital request, design was completed and contracts were executed to accommodate the immediate needs of the Interdisciplinary Science Center (ISC) which is currently under construction. Additionally, increased electrical capacity was required to accommodate the increased chilled water needs of the ISC. Attention now is directed at the "Recommendations" section of Appendix C wherein life safety, environmental considerations, code compliance and preventive maintenance issues will be addressed and corrected. The specific projects included in this request are: Medium-voltage Conductor Replacement; Medium-voltage Vacuum Switch Replacement; Medium-voltage Switchgear Adjustments.

These Medium-Voltage projects being referenced are required due to life-safety issues with respect to the components of the existing vacuum switches within the system. The existing switches were installed in 1989 making them approximately 31 years old. The expected useful life of these type of switches is between 15 and 20 years, even assuming optimal conditions this equipment has exceeded its useful life and failures are imminently expected. The gas within these large switches is comprised of SF_6 Sulfur Hexafluoride, a potent greenhouse gas and excellent electrical insulator. Again, due to the reduced funding received in FY 2019-2021 this need still exists. Updating and relocating these switches from our tunnels to the surface will provide energy efficiency, environmental sustainability, increased system longevity, and the latest in life-safety and electrical worker safety features for university electrical shop personnel.

Needs, Water Resource Services – EWU is classified under code by the Washington State Dept. of Ecology (WSDOE) as an industrial user and carries State Waste Discharge Permit #ST-8098 issued by WSDOE. A requirement of the permit is to monitor for flow and chemical constituents of campus effluent so as to more accurately provide the City of Cheney – Waste Water Treatment Facility quantities of effluent, and to better mitigate pollutants leaving the university. The campus domestic water system has been upgraded in large part over the last couple biennia. The last portion of improvements that are required to meet Local/State code is the replacement of existing fire hydrants and installation of new hydrants elsewhere on campus.

Benefits, Water Resource Services – Providing sewer monitoring and sampling stations as designed will give the university and the City of Cheney a better idea of how much sewer EWU is actually sending to the plant daily. Additionally by being able to chemically characterize the effluent the Cheney treatment plant will be better enabled to apply accurate amounts of buffering chemicals during the treatment process. A secondary goal for sewer monitoring improvements is to prove that the university does not produce industrial strength effluent which is the first step in reducing annual permitting costs. Additionally, accurate accounting of flow from the university to the treatment plant should reduce treatment costs applied to the university from the City of Cheney.

- **History of the Project or facility:**

Eastern Washington University's Cheney campus consists of approximately 70 individual buildings comprising almost 3,000,000 gross square feet of academic and student support facilities whereby university-owned infrastructure provide all heating, cooling, electrical, and other building utility needs to these facilities. University plant operators have operated and maintained the boilers (60 years old max) and chillers (22 years max) with great care and as a result the equipment has functioned well beyond their expected lifecycle. However regardless of the professional care and maintenance given to these units, it's time to begin cyclic replacement of the older inefficient boilers, chillers, and electrical components.

This infrastructure includes: Steam generation and distribution (Campus Winter Building Heat); Chilled water production and distribution (Campus Summer Building Air Conditioning and constant cooling for specialty systems); Fire protection and Domestic Water production and delivery (To 70 campus buildings); Sanitary sewer and storm sewer water collection and disposal to the City of Cheney; Central building automation and energy management systems (Energy efficiency and GHG reductions); And, Emergency vehicle access and other campus site improvements required by Code or other Statute (Federal, State and Local Building Code). These infrastructure systems are mission critical to daily life at Eastern Washington University and support the university's primary goal of student success. The Rozell Central Energy Facility is located at the north end of campus and was originally constructed in 1967. This plant is the heart of the campus where all steam heat, chilled water building cooling, and electrical power distribution originate. Once produced, auxiliary systems distribute these services through approximately 3 miles of utility tunnels across campus.

Central Steam Production – The plant is equipped with five (5) high-pressure steam boilers with a total operating capacity of between 95,000 and 145,000 PPH (Pounds Per Hour) at 100psig steam. Once produced the steam is then distributed through a network of tunnels to each of the various campus classroom and office buildings, sports facilities, and residence halls. The university also supplies steam heat to the Washington State Patrol Crime Lab and the Washington State Digital Archives facilities, both of which are based on campus. Steam is used for both space heat and domestic hot water purposes. Because the Rozell steam plant provides domestic hot water for the campus it must operate continuously 24/7/365. According to Rozell steam plant records, the largest campus demand for steam occurred during the winter of 2014 where sub-zero temperatures were experienced for an extended period. Additionally Patterson Hall being recently remodeled was brought back on line increasing campus demand from a 3 year renovation break. The historical peak demand observed during the period above was 75,000 PPH, or "between" 55% to 78% of the existing plant capacity.

Chilled Water Production – The chilled water plant consists of five water-cooled centrifugal chillers located in the lower level of the plant. Three of these chillers were installed in 1996 as a part of a major plant upgrade. Using funds allocated in the FY 2015-17 Capital request, two new chiller packages (AE1484-G4 // Chillers & Towers #'s 1&2) were purchased and installed under construction contracts accomplished in 2017 and 2018, meeting in part a portion of the Master Plan. See **Appendix D (1 to 3a).** Appendix D1 shows plans for a utility tunnel extension to the new

ISC building. Appendix D2 shows plans for a new loading dock and overhead door, making room to accept the new chillers. Appendix D3 are plans for the two new chillers, and Appendix 3a are plans for the needed electrical upgrades. These two new chillers and auxiliary equipment are equipped with the newest in technology which allow for on-demand monitoring and adjustment of all components of the chilling systems and operations. The "state of the art" command and control systems include over 350 new monitoring points on the new chillers which create a very flexible and energy efficient chilled water system, stabilizing system operations while meeting sustainability desires. Part of this project included a major change to the chilled water piping and how the different pieces of equipment may work with one another. Prior to this project, each chiller was coupled to a dedicated cooling tower and set of pumps were solely coupled to that particular chiller and tower. This setup offered no flexibility, and in effect took an entire chiller/tower/pump combination offline when any one of those pieces of equipment required maintenance or repair.

The redesign in 2017/2018 for the plant placed an emphasis on allowing for the greatest flexibility within the major components and operations which eliminates the coupled arrangement of the chillers and towers. A large part of this increased flexibility was addressed through extensive plant re-piping. Due to several technology limitations with the existing chillers and towers (#3, #4, & #5) the contract was not able to be upgraded with the necessary communications upgrades or the energy saving "on demand" flexible power ramping capabilities based on daily campus cooling load demand. At that time the only modifications that could be made to the remaining existing chillers/towers were attributed to re-piping. Much was learned regarding the overall plant stability during the first construction contract and some good design information was subsequently included in that construction contract that will help reduce costs in the next phase of chiller/tower replacement. While AE1484-G4 has increased the overall plant capacity, existing chillers and towers #3, #4, and #5 each have specific issues generally related to the age left in each piece of equipment as is indicated in sections below.

Medium Voltage Electrical Distribution – Electrical power is distributed throughout the campus from its origin at the EWU substation located at the Rozell Central Energy Facility. The City of Cheney's 13,200Y/7620 VAC service provides the electrical power to the two primary meters located just ahead of the campus substation. Within the substation electrical power is segregated and distributed through switchgear to campus buildings by a selective-parallel feeder system (Bus #1, Bus #2, and Feeders 1A, 2A, and 1B, 2B) and routed through the campus by way of the university underground tunnel network which is about 3.5 miles long across campus. Originally constructed beginning in the 1960's the tunnel system contains 27 vacuum switches which allow electric shop personnel the ability to switch between Main Bus #1 or Main Bus #2 depending on conditions. These switches are highly aged and are not code compliant for a couple of reasons: <u>The first reason relates to the switches locations, in the tunnels.</u> EWU electrical shop staff are required to enter the tunnel (a confined space) to operate the switches when adjusting and balancing loads. At the time of installation the switches were code compliant but have since been deemed unsafe for electrical staff due to their physical surroundings and the need to evacuate the tunnel if equipment were to fail during a switching operation. <u>The second reason relates to the actual materials used in the building these switches.</u> Again, at the time of original installation a common insulating material for these below ground switches was SF_6, or Sulfur hexafluoride. This compound is an excellent electrical insulator, but also a potent greenhouse gas with high global warming potential. Studies indicate its concentration in the earth atmosphere is rapidly increasing. During its working cycle, SF_6 decomposes under electrical stress, forming toxic byproducts that are a health threat for working personnel in the event of exposure.

Water Resource Services – Domestic water is provided to the campus through two (2) wells that have been certified through the requirements of the Washington State Department of Health (WSDOH Well Permit #219009). Sanitary sewer water is collected from campus facilities and directed to the City of Cheney sanitary sewer system. The University maintains a State Waste Discharge Permit on file with the Washington State Department of Ecology

(WSDOE State Waste Discharge Permit # ST-8098). Storm water is collected across the campus and directed to the City of Cheney storm sewer system. All new construction meets the project specific requirements of the City of Cheney Building Department review comments.

- University programs addressed or encompassed by the project:

Literally all of the programs on the Cheney campus are reliant on the utilities and infrastructure systems that are described in this request. The central energy plant operations provide all of the heating, cooling, building power, and domestic and sanitary sewer water for use in all of the buildings on campus as well as the Washington State Patrol Crime Laboratory and the Washington State Archives, both located on campus. The various forms of network communications are transported through the tunnel system on campus. Facilities staff operate and maintain all of the various pieces of equipment that are required to deliver these utilities, providing a safe and comfortable academic atmosphere for instruction and other campus activities.

These infrastructure systems are by their very nature tied to each facility, and support every program on campus. Eastern's goal of student success and as an "Institution of Innovation" are fully represented with this project which promotes student success through a safe, healthy, and supportive environment. This Capital Budget Request reflects the additional design effort based on the above noted strategy which was initially requested in the FY 2015-17 Capital Budget Request Cycle. With the partial funding received; a phase of the Master Plan design was accomplished, and construction contracts for some of the infrastructure needing replacement accomplished. This current FY 2021-23 request continues with the work of replacement of major infrastructure required to support the new Interdisciplinary Science Center which is currently under construction, the proposed remodel of the existing Science building, and the proposed new Engineering Building, as well as the other listed project funding needs noted in this proposal.

This funding request aligns with EWU's Academic Strategic Plan 2018-2025, Core Theme: Access + Learning + Completion = Student Success, in that by providing fully functioning, environmentally conditioned, modern facilities students will have the best opportunity for access to centers for learning which, in turn, provides an environment for course completion and student success.

GENERAL CATEGORY SCORING CRITERIA

1. Significant Health, Safety, and Code Issues

a. Identify whether the project is needed to bring the facility within current life safety (including seismic and ADA), energy, utilities, or transportation code requirements.

b. Clearly identify the applicable standard or code, and describe how the project will improve consistency with it. (Provide selected supporting documentation in appendices, and reference them in the body of the proposal.)

Appendix E provides specific code references associated with items a & b above for Central Steam Production, Chilled Water Production, and Medium Voltage Electrical Distribution**. See Appendix E**.

2. Evidence of increased repairs and/or service interruption

Identify prior facility repairs, work order repair history or contractor repair call-outs, increased utility and/or maintenance costs, and/or system unreliability. (Provide selected supporting documentation in appendices, and reference them in the body of the proposal.)

Appendix F contains sections of contracted repair work that has occurred since 2012 related to the Central Steam Plant after which records of work orders performed by facilities personnel between 2007 and 2018. Additionally included in this appendix are the total proposed costs for our existing units #3, #4, and #5 of our Chilled Water Plant system. This work has not been accomplished. The conditions were only found to exist in the first half of 2018. Beyond these cost proposals are closed out work orders related to the chiller system occurring between 2007 and 2018. See **Appendix F:**

3. Impact on Institutional Operations without the Infrastructure Project

Describe how and the extent to which there would be an impact on existing operations and programs. Describe the potential impact on future, already funded or planned construction projects or program needs should this infrastructure project not occur.

All of the systems and operations at the Rozell central energy plant are mission critical to the university simply by the very nature of their existence and relationship to the campus. As noted earlier, most of these systems components are over twenty to fifty (20 to 50) years old with some replacement parts no longer being produced. Although the plant and its systems are well maintained, it should be made clear that the stability and longevity of our systems are very close to being compromised. In the case of a catastrophic failure, the resultant needed capacity of plant systems may not cover existing campus heating or cooling needs and does not meet the anticipated future campus needs.

The lack of infrastructure to support these new/remodeled facilities would greatly affect Eastern's Strategic Plan, our Comprehensive Campus Master Plan, and the ability for Eastern to grow enrollments, increase undergraduate rate in general education and STEM fields, and increase growth in graduate degrees.

Secondly, this project substantially improves existing operations by increasing efficiency in operations, reducing energy consumption and costs, and by providing the opportunity to consider alternate design applications and potentially, alternate fuels for operations. Our engineering professionals have assessed and noted specific areas of each utility that are at or beyond their expected useful life and in need for replacement or major renewal. There are potential failures in these old systems that will be very costly and could affect the university's ability to operate until major emergency repairs were to be made should a failure actually occur.

These projects allow EWU to better be in alignment with the Washington State Greenhouse inventory requirements and by their very nature align well with the President's Climate Commitment policy.

Central Steam Production - The potential impact to campus heating capabilities is wide ranging and dependent on which boiler failed and in what season that failure occurred in. Considering a worst case scenario such as the complete loss of one of the remaining boilers during the middle of January or February with extremely cold temperatures as is the referenced norm. The university would be forced to take emergency measures and contract with a boiler rental company to provide a compatible temporary boiler that could be connected to our system.

These emergency actions will take greater than just a couple weeks simply to sign contracts, coordinate the delivery, setup and provide connectivity where the plant can be able to produce and distribute heat to campus instruction, living and working spaces based on the following:

- Rental steam equipment compatibility, availability and distance from campus.
    - Purchase Order, signed contract, and insurance provisions to resolve prior to rental.
    - Daily rental costs for such equipment can be expected to be somewhere up to $5,000/day not including delivery each way, fuel, chemical treatment and permitting.
- Construction of a temporary tie-in to our permanent steam distribution system.
- During this timeframe and dependent on weather conditions the university may have to shut down.
    - This would have a severe impact on institutional operations.

The impact to the university by having to contract rented temporary heating has other costs as well which cannot be defined until such an emergency situation arises. Beyond this, the origin of the catastrophic event would still need to be repaired/replaced to fully resolve the emergency situation.

Chilled Water Production - The first phase of upgrade to the chilled water plant has provided some stability and longevity to this system, however the upgrade is only partially completed. Temperature sensitive systems such as data storage rooms, the animal vivarium located in the Science building, and other temperature critical systems around campus would be at risk of loss should a catastrophic failure occur. The ability to meet campus cooling loads will be challenged, and replacement with two new chillers was the first step in bringing this system up to date with state of the art, energy efficient equipment and systems. This project is needed to completely enable all opportunities for efficiency and increased capacity within this particular system. Once completed the university will experience many years of efficient operations saving precious State dollars.

Medium Voltage Electrical Distribution – Consistent and stable electrical power to the halls and facilities on campus is essential to the very operation of the university. An unplanned outage from a failure occurring at any of the vacuum switches or within sections of the Medium Voltage (MV) electrical conductor cable may render large portions of the campus without electrical power for an extended period of time. Efforts to minimize this have been accomplished with the recent electrical upgrade projects (**Appendix D**) through revised switching and load balancing. The weakest link(s) in the system are currently at the vacuum switch locations and with some of the aged conductor cable, which provides the "Pathway" around the campus for all electrical power. Along some pathways the impact of a conductor/switch failure is greater with respect to systems with critical power needs, such as the campus datacenter and the vivarium. The cost of repairing an unplanned outage can be several times the cost of planned outages.

Water Resource Services – Most of the domestic water delivery systems have been improved through past biennium funding and only minor projects are needed to complete. However, current fire code requires many more fire hydrants be installed throughout the campus than were originally installed. Additionally many of the existing hydrants have met their lifecycle as well and need replacement. The University maintains a State Waste Discharge Permit on file with the Washington State Department of Ecology (WSDOE State Waste Discharge Permit ST-8098) as a condition of routing sanitary sewer to the City of Cheney treatment system. Conditions of the permit require projects be accomplished to realize potential cost savings in reduced treatment fees. Verification of effluent characteristics and quantities is incumbent on continued permit compliance.

4. Reasonable Estimate

Provide as much detailed cost estimate information as possible, including documentation of professional assessment of costs (may contain opinions of external experts or experienced project management staff from the institution).

Engineering estimates for **Central Steam Production, Chilled Water Production, Medium Voltage Electrical Distribution** and **Water Resource Services** are sequentially located in Appendix G. Also located in this appendix are the results of an efficiency study and actual dollar savings based on power data for the new chillers installed in 2018. This study shows that power consumption so far has been reduced in the chilled water plant by 20% which is a significant reduction in an area of high energy use. An efficiency study and estimated dollar savings for the new boiler being designed is also included. See **Appendix G.**

5. Engineering Study

Identify whether there is a completed comprehensive engineering study, site survey and recommendations, or opinion letter. (Provide referenced supporting documentation in appendices.)

In 2014 when Eastern partnered with mechanical, electrical, and civil professional engineering consultants to examine each major utility system, a condition evaluation report was provided See **Appendix A**. This condition evaluation report formed the basis for more in-depth studies, see descriptions below:

Central Steam Production – A follow on in-depth study of the steam system was commissioned in 2014. The results of this study are contained in the report located in Appendix H. This report identifies plant deficiencies and lists five (5) steam plant projects, and four (4) steam distribution projects which will alleviate the problems identified. See **Appendix H**.

Chilled Water Production – A follow on in-depth study of the chilled water system was also commissioned in 2014 with the results identifying four (4) chiller plant projects and one (1) chilled water distribution project to bring this plant back up to the proper operating level. See **Appendix I**.

Medium Voltage Electrical Distribution – The initial study listed in **Appendix A** provided direction for further study and set out a path for that study. In 2016 EWU commissioned the second study which is identified in **Appendix B** and referenced earlier in this report. Please see **Appendix C** for the findings and recommendations for the needed Electrical Capacity Upgrades.

Water Resource Services – One requirement of EWU's State Waste Discharge Permit #ST-8098 was to provide a Source/Feasibility Study and engineering report that would address how to monitor effluent leaving the campus for flow and chemical constituents in the waste stream. An engineering study and report addressing this requirement was the basis for the campus sewer consolidation project being requested in this proposal. See **Appendix J**.

6. Support by planning

Describe the proposed project's relationship and relative importance to the institution's

a. Campus/Facilities Master Plan or other applicable strategic plan
b. Ongoing academic and/or research program

The current edition (2014) of Eastern Comprehensive Campus Master Plan states that the University's top priorities are the expansion of Eastern's Science Technology Engineering and Math (STEM) programs. The growth and increased graduation rates in these programs tie directly to the construction of the Interdisciplinary Science Center, the remodeled Science building and a new Engineering building. As stated in the engineers report, the current university infrastructure (steam, chilled water, and medium voltage electrical) will not support these new facilities without expansion of these systems. See **Appendices A, C, H & I.**

Eastern's Facilities Master Plan is available at:

https://tinyurl.com/y4vbxn83

Eastern's Strategic Plan "Inspiring the Future" (2012-2017) is available at the following link:

https://in.ewu.edu/strategic-planning/wp-content/uploads/sites/127/2017/03/Strategic-Plan-2012-2017-Inspiring-the-Future.pdf

Eastern's Sustainability Master Plan and American College and University Presidents' Climate Commitment (ACUPCC) Climate Action Plan

In conjunction with State of Washington's requirement for reduction of greenhouse gas emissions and reduction of the university carbon footprint, these projects also align with Eastern's Climate Action Plan and the University Sustainability Master Plan. Those plans can be viewed at the following link:

American College and University President Climate Commitment Climate Action Plan 2012

https://secondnature.org/signatory-handbook/the-commitments/

Eastern's Sustainability Master Plan 2012:

https://in.ewu.edu/facilities/wp-content/uploads/sites/191/2017/01/EWU-Climate-Action-Plan.pdf

7. Resource Efficiency and Sustainability

Document project benefits associated with low-impact stormwater management techniques, improvements in energy and resource conservation, and use of renewable energy source

Central Steam Production - The existing boilers and auxiliary systems were built and installed approximately ten (10) years prior to the creation of the U.S. EPA, at a time when energy conservation and concern for the environment were not a consideration. Boiler technology in the fifty (50) plus years since our boilers were installed has been directed at efficiency and sustainability. The U.S. EPA Office of Air Quality, Planning and Standards has set National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. These standards are contained in 40 CFR Part 63 and form the constraints by which modern boiler fabrication and operation are governed by.

Chilled Water Production - The advancements in chiller and controls technology that were installed during the first phase of construction See **Appendix D** were in part designed to improve energy and resource conservation. The new portions of the plant provide increased flexibility to meet the demands of daily temperature fluctuations through for example, the addition of Variable Frequency Drives (VFD) at all feasible locations. VFD's allow for on demand electrical energy consumption adjustment based on actual system demand thereby saving electrical energy consumption.

Medium Voltage Electrical Distribution – The construction project shown in **Appendix D** fulfilled the selected design for Distribution System Options – Option C from the study **Electrical Capacity Upgrades**. Selecting this option increases system efficiency and improves resource conservation thereby allowing more capacity for improvements. **Medium-voltage Conductor Replacement:** This project will further increase electrical efficiency and resource conservation through improved movement of delivered electrical power by new 15-kv feeder conductor. **Medium-voltage Vacuum Switch Replacement:** This project will further improve resources by replacement of environmentally harming switches placed in close, potentially unsafe tunnels with safe, modern "Air-insulated" switch technology placed in locations complying with current safety and electrical codes. See **Appendix C – Refer to Distribution System Options – Option C and "Recommendations" Section.**

Water Resource Services – By their very nature, modern water resource projects focus on both energy and resource conservation as well as low-impact stormwater management techniques.

The City of Cheney has adopted the Spokane Regional Stormwater Manual (SRSM) as the design document for stormwater system management and guidance. All EWU projects involving stormwater adhere to this document as well.

Appendices

Supporting Reference Data

Appendix A – Campus Infrastructure Renewal 2014

The full document can be viewed at this link:

https://inside.ewu.edu/facilities/2014-ewu-infrastructure-renewal/

APPENDIX A

EASTERN WASHINGTON UNIVERSITY

Campus Infrastructure Renewal

AUGUST 1, 2014

Contents

EXECUTIVE SUMMARY

Eastern Washington University has undertaken this study as the first step to insure that campus infrastructure is able to support the long term growth goals of the University as reflected in the recently updated capital master plan. The report evaluates and makes recommendations for the following systems:

Central Campus Steam Plant	Campus Steam Distribution System
Central Camps Chiller Plant	Campus Chilled Water Distribution System
Campus Energy Management & Control System (EMCS) Network	
Snowmelt System	Potable water
Sanitary sewer	Storm sewer
Irrigation	Medium-voltage electrical
Outside plant communications	Landscaping
Roads, walkways and site lighting	

The recommendations support the sequential implementation of the Comprehensive Campus Master Plan dated September 27, 2013. Schematic-level costs are presented for each recommendation in 2014 dollars. The Master Plan recognizes the significant capital expenditures required to facilitate the University's growth. This study augments the necessary modifications and associated costs required to support that growth.

The suggested infrastructure projects have been grouped in two categories: Those directly affecting the University's capital master plan and those projects which will improve operational efficiencies and maintenance procedures.

MASTER PLAN PROJECT COSTS

CW-1	Sewer System #1	$ 105,000
CW-2	Sewer System #2	$ 100,000
CW-3	Sewer System #3	$ 170,000
CW-4	Sewer System #4	$ 500,000
LI-1	Irrigation Master Control System	$ 175,000
LI-2	Storm System Wastewater Reuse #1	$ 373,000
LI-3	Storm System Wastewater Reuse #2	$ 742,000
LI-4	Storm System Wastewater Reuse #3	$ 715,000
LI-5	Streeter Hall Irrigation Replacement	$ 20,000
LS-1	Pedestrian Safety Improvements: Washington St.	$ 995,000
LS-2	Pedestrian Safety Improvements: ADA	$ 373,000
LS-3	Pedestrian Safety Improvements: Pavers	$ 550,000
SP-1	Repair/Replace Boiler #3	$ 3,500,000
SP-3	Upgrade Boiler Feedwater Pumps	$ 200,000
CP-1	Add Chiller Capacity	$ 3,600,000
CP-2	Upgrade Campus Chilled Water Pumps	$ 200,000
CD-1	Replace West-side Chilled Water Piping	$ 1,000,000
SN-1	Expansion of Snow Melting System Ph 1	$ 2,000,000
SN-2	Expansion of Snow Melting System Ph 2	$ 2,500,000
SN-3	Expansion of Snow Melting System Ph 3	$ 4,000,000
SN-4	Expansion of Snow Melting System Ph 4	$ 2,500,000
SN-5	Expansion of Snow Melting System Ph 5	$ 1,800,000
EL-3	Electrical Switch Replacement	$ 1,800,000
EL-4	Electrical Distribution System Expansion	$ 1,800,000
EL-5	Site Lighting Improvements, Phase 2	$ 3,500,000

MAINTENANCE EFFICIENCES PROJECT COSTS

CR-1	Emergency Vehicle Access #1	$ 60,000
CR-2	Emergency Vehicle Access #2	$ 22,000
CR-3	Emergency Vehicle Access #3	$ 31,000
CR-4	Emergency Vehicle Access #4	$ 40,000
CR-5	Emergency Vehicle Access #5	$ 82,000
CR-6	Emergency Vehicle Access #6	$ 46,000
CR-7	Emergency Vehicle Access #7	$ 240,000
CR-8	Emergency Vehicle Access #8	$ 20,000
CR-9	Emergency Vehicle Access #9	$ 60,000
CR-10	Emergency Vehicle Access #10	$ 30,000
CR-11	Emergency Vehicle Access #11	$ 12,000
SP-2	Boiler Feedwater Stack Economizers	$ 350,000
SP-4	Repair Rozell Heating Plant Boiler Stack	Unknown*
SP-5	Upgrade Natural Gas Service	Unknown**
SD-1	Replace Utility Tunnel Condensate Piping	$ 1,225,000
SD-2	Replace Utility Tunnel Condensate Pumps	$ 200,000
SD-3	Label Utility Tunnel Piping and Valves	$ 150,000
SD-4	Upgrade Piping in Plant Utilities Building	$ 125,000
CP-3	Install VFDs on Chiller Compressors and Cooling Towers	$ 1,250,000
CP-4	Install (2) New Energy Efficient Cooling Towers	$ 450,000
EM-1	Migrate BAS Network to BACnet Network	$ 3,350,000
EL-1	Medium-voltage Electrician	$100,000/year
EL-2	Electrical System Modeling	$ 56,000
EL-6	Optical Fiber Network	$ 2,200,000
Total cost of proposed capital projects:		$43,217,000

* Requires special evaluation of existing conditions to determine scope of work.

** Requires negotiations with service provider to determine feasibility.

The above estimates include the direct costs of materials and labor plus contractor overhead and profit. The estimates do not include escalation, Washington State sales tax, design fees, administrative fees and other "soft" costs.

REPORT APPROACH

This report is the combined efforts of the following design organizations:

Meulink Stauffenberg, Inc. – Mechanical Engineers

David Evans & Associates – Civil Engineers

Michael Terrell - Landscape Architecture, PLLC

NAC|Engineering – Electrical & Communications Engineers.

Also contributing to this report were representatives of the various organizations within the EWU facilities umbrella responsible for operating and maintaining the systems evaluated herein. Their understanding and insight provided a unique perspective regarding the condition and reliability of the existing infrastructure systems.

Design organizations met with respective EWU representatives to tour the campus, review existing conditions, discuss operational problems and brainstorm alternatives. The recommendations in this report are primarily the result of observations by the design organizations and operational information provided by EWU personnel.

STEAM PLANT PROJECTS

SP-1: Replace Boiler #3

Project Description: Replace existing 25,000 pph steam Boiler #3.

- Install a new 40,000 pph high pressure steam boiler with dual fuel (oil & gas) low NOX burner. Install new correctly sized stack economizer (boiler feedwater pre-heater).

Project Justification: The existing steam Boiler #3 has been out of service for a number of years due to several outstanding breakdowns and lack of repair funds. Boiler #3 is almost 50 years old and parts are difficult to find. Despite being maintained in excellent condition over the years by the EWU staff, this boiler is basically near the end of its life expectancy.

Future campus growth will increase expected plant steam loads by over 30%, which will start to impact boiler plant redundancy & operational flexibility. A new boiler will allow plant operation and redundancy to be maintained in to the future. A new boiler would increase steam plant operational efficiencies.

According to the EWU operations staff, the historical peak campus heating load, seen this last winter, is approximately 75,000 lbs/hr.

Based on the anticipated master plan campus growth for the New Science I & II projects, the new Gateway Athletic Project, the expected addition of future campus steam load is approximately 34%. Based on a peak historic load of 75,000 pph, a 34% increase would put the future campus steam load at over 100,000 pph, which is approximately 50% of the steam plant's present total capacity 217,000 pph.

Sequence / Category:

Capital Master Plan.

Cost:

SP-1: $3,500,000

SP-2: Install Boiler Feedwater Stack Economizers on Boilers #2 & #4.

Project Description: Install new boiler feedwater stack economizers on existing steam boilers #2 & #4. This installation would allow these boiler configurations to match boilers #1 & #5, which already have stack economizers in operation.

Project Justification: The existing steam Boilers #2 and #4, which are mostly operated in the shoulder and summer seasons, are not provided with boiler feedwater stack economizers, which are present on the other plant boilers. As a result, the operational efficiencies of these boilers are not a high as is possible, thereby reducing the plant's overall energy efficiency.
Also, because of the different feedwater configuration that these two boilers use, compared to the other boilers, the feedwater pumping loop must be run at differing pressures, which complicates plant operation.
New boiler feedwater stack economizers would increase boiler plant operational efficiencies, and simplify feedwater system operation.

Sequence / Category:
Improve Operational Efficiencies.

Cost:
SP-2: $350,000

SP-3: Upgrade Boiler Feedwater Pumps

Project Description: Replace the aging feedwater tank transfer pumps and upgrade or supplement the undersized Deaerator unit boiler feedwater pumps.

Project Justification: The existing single speed feedwater transfer pumps that provide feeddwater from the condensate return storage tank to the deaerator tank, are old and in questionable condition. This project would replace these pumps with new high efficiency pumps with improved controls for staging and monitoring.

The existing VFD driven boiler feedwater pumps that are part of the deaerator unit were recently installed as part of an energy retrofit to the plant, but, according to the plant operators, are having trouble keeping up with the feedwater demands of the boilers. These newer VFD driven pumps were downsized to 30 hp each, from the original single speed 50 hp feedwater pumps. Capacity reduction is unknown, but appears to be a factor in plant operation, requiring the operators to run the auxiliary steam-driven feedwater pump during peak loads. Redundancy is questionable with this configuration, so it is proposed that the new feedwater pumps be replaced with larger pumps or supplemented with an additional pump.

Sequence / Category:
Capital Master Plan.

Cost:
SP-3: 200,000

SP-4: Repair Rozell Heating Plant Boiler Stack

Project Description: Repair the existing Rozell Heating Plant concrete/masonry boiler stack.

Project Justification: The condition of the existing exterior concrete/masonry boiler stack at the Rozell heating plant is the subject of some concern. According to EWU staff, there is reason to suspect some of the interior lining material has started to fail and/or fall off. Further, it is unknown if the original construction and/or present condition of this stack is up to present seismic standards.
A full analysis of the existing boiler stack condition is not in the scope of this study. Further analysis is recommended.

Sequence / Category:
Maintenance & Repair.

Cost:

SP-4: Unknown (Further study required).

SP-5: Upgrade Natural Gas Service from AVISTA

Project Description: Increase the natural gas supply capacity to the Central Campus Steam Plant from the utility provider, AVISTA.

Project Justification: The existing steam boilers are limited in the amount of natural gas that they are allowed to consume at a given peak instant by agreement with the gas utility provider, AVISTA. Reportedly the high pressure gas supply distribution to the City of Cheney is limited based on AVISTA transmission gas line capacity. This issue is limits the steam boiler plant to a maximum consumption rate of approximately 56,000 lbs/hr, at which point the plant has to supplement its capacity by burning #2 fuel oil (diesel). Because it is not beneficial to fire the boilers on fuel oil due to emission concerns, efficiency reductions and added wear and tear, the ability to fire a greater percentage of the boiler plant on natural gas is desired.

Sequence / Category:

Unknown. Pending the timing of AVISTA natural gas infrastructure upgrades to the City of Cheney.

Cost:

SP-5: Unknown. (Further study required. Capital costs for gas capacity increase to Campus would presumably be paid for by AVISTA as part of their normal growth plans.)

STEAM DISTRIBUTION PROJECTS

SD-1: Replace Utility Tunnel Condensate Piping

Project Description: Replace aging gravity condensate piping system & components in utility tunnels. New piping to be heavier wall thickness, Sched. 80, compared to the existing standard wall Sched. 40 piping presently installed. New steam trap stations and valves would be provided.

Project Justification: Although the existing gravity condensate drainage piping system, that serves the high pressure steam distribution within the utility tunnels, appears to be in good condition and has been well maintained, most of this piping is around 40 years old. Although there have not been reports of major leaks or failures, this piping system is nearing the end of its useful life.

Because the condensate piping system is subjected to more severe service than the steam supply piping, on account of the presence of oxygen and other condensed gases, such as carbolic acid, internal corrosion is much more likely. This leads to premature pipe wall failure and leaks, as well as damage to components, such as valve and steam traps.

Sequence / Category:

Improved Maintenance & Operational Efficiencies.

Cost:

SD-1: $1,225,000

SD-2: Replace Utility Tunnel Electric Condensate Pumps with Steam-Powered Pumps

Project Description: Replace existing simplex type electric condensate pumps in the utility tunnel with new steam-powered condensate pumps.

CHILLED PLANT PROJECTS

CP-1: Add Chiller Plant Capacity, 2,000 tons

Project Description: Install additional 2,000 ton chiller plant capacity.

The following elements would be installed or upgraded:

- New 2000 ton water-cooled centrifugal chiller with VFD drive.
- New 2000 ton induced-draft open cooling tower with VFD drive.
- New chiller (evaporator) pump.
- New condenser water (tower) pump.
- Upgrade/Replace Campus Loop chilled water pumps with new capacity pumps with VFDs.
- Controls.
- Rozell plant expansion, electrical work and ventilation.

Project Justification: The existing Central Campus Chiller Plant has a total capacity of 4,000 tons (3-1000 ton chillers & 2-500 ton chillers), which matching capacity cooling towers and pumps.

According to the EWU operations staff, the historical peak campus cooling load is somewhere between 3,500 tons (per Dumais & Romans in their 2009 *Campus Chilled Water System Study*) and 2,500 tons (per McKinstry in their *2012 Energy Efficiency & Sustainability Report).* In our interview with the EWU staff, they reported a historical peak cooling load of about 3,000 tons, which is the value that is used in our analysis.

Based on the anticipated master plan campus growth for the New Science I & II projects, the new Gateway Athletic Project and the modernization of the legacy residence halls to include air conditioning, the expected addition of campus chilled water load is approximately 40%.

Based on a peak historic capacity of 3,000 tons, a 40% increase would put the future campus load at over 4,200 tons, which is greater than the present total plant capacity of only 4,000 tons.
In order to meet the future cooling needs of the campus growth plan, it will be necessary to add cooling capacity, with sufficient redundancy to allow operational flexibility and to allow for break-downs. At minimum a 1000 ton chiller plant expansion would be needed, although a larger, 2000 ton expansion, as proposed here, would provide a higher degree of redundancy, future growth allowance and flexibility, at only a slightly greater incremental cost.

Sequence / Category:
Capital Master Plan.

Cost:
CP-1: $3,600,000

CP-2: Upgrade Campus Chilled Water Pumps

Project Description: Upgrade campus distribution loop chilled water pumps to increase system capacity and to provide VFD control for each pump.

- Upgrade/Replace Campus Loop chilled water pumps CWP-2 & CWP-3 with new capacity pumps with VFDs. Existing CWP-1 is already controlled by a VFD.
- New Delta Controls.

Project Justification: Depending upon the priority and timing of the above proposed chiller plant expansion, the upgrade of the existing campus distribution pumps may not be necessary, as they are also included in the above scope.
However, until such time as the chiller plant capacity is increased, it would be beneficial to upgrade the existing campus distribution chilled water pumps for two reasons.
First of all, these existing pumps (CWP-2 & 3) are two-speed pumps, without VFD speed/capacity control. Two-speed pumps are not as efficient as pumps that are run with VFDS, and controllability is not as good for varying flow demands.

Secondly, based on the results of the chilled water system flow model that was prepared with this report, there are likely times when the existing campus chilled water distribution piping system is being "under pumped". In other words, it appears at times there may be a shortage of campus chilled water flow to some of the remote buildings. This is indicated by the results of the flow model that suggests that during times of peak historic campus cooling demand, that drop-off pressures (and therefore flows) to many of the buildings is greater than the capacity of the existing pumping plant (based on available flow and head pressures).

The present operational setpoint of 15 psig (35 ft head) pressure differential between the campus supply main and return main, does not seem to produce sufficiently strong flow conditions to necessarily satisfy all flow demands. This condition of possible under-pumping is also indicated by a reported high Delta T (nearly 20 deg. F) on the campus chilled water loop, compared to a design Delta T for most buildings of around 10 deg. F. Further analysis of the chilled water distribution system is needed to better understand the dynamics suggested by the flow model and field observations, however, the recommendation to upgrade the existing chilled water distribution pumps (install VFDs and possibly increase capacity with larger pumps) is still valid.

Sequence / Category:
Capital Master Plan.

Cost:
CP-2: $300,000

CP-3: Install VFDs on the Chiller Compressors and on the (3) 1,000 ton Cooling Towers

Project Description: Upgrade the existing centrifugal chiller compressors to add new VFD drives. Replace the 2-speed fan motors on the (3) largest cooling towers with VFD duty motors and install new VFD drives. Update controls to map drives to building automation system.

Project Justification: Per *McKinstry 2012 Energy Efficiency & Sustainability Report, Item 2.00-ROZ*, analysis: Annual electrical energy savings due to more efficient part load operation of equipment. Better able to match equipment capacity with campus cooling loads.

Sequence / Category:
Improved Operational Efficiencies.

Cost:
CP-3: $1,000,000

CP-4: Install 2 New Energy Efficient Cooling Towers

Project Description: Replace the existing, aging and inefficient 500 ton cooling towers with new, energy efficient, open circuit, induced draft cooling towers, with VFDs on their fan motors.

Project Justification: Per *McKinstry 2012 Energy Efficiency & Sustainability Report, Item 2.40-ROZ*, analysis: The new cooling towers will be sized for supplying 75 deg F water to the chillers during peak load conditions, thereby improving chiller efficiency. Annual electrical energy savings are anticipated.

Sequence / Category:
Improved Operational Efficiencies.

Cost:
CP-4: $500,000

ELECTRICAL & COMMUNICATIONS PROJECTS

EL-1 Medium-voltage Electrician

Project Description: While this proposal is not a capital expenditure, it is seen as an operating necessity. Because the University owns its 15-kV electrical distribution system, it is responsible for operating and maintaining the system. Special procedures and skills are required of electricians responsible for electrical systems greater than 600-VAC. The University should consider filling one of its Electric Shop positions with a licensed electrician experienced in the operation and maintenance of 15-kV, medium-voltage power distribution equipment and circuits.

Project Justification: This proposal is driven by the need for operational efficiencies and worker safety.

Sequence: This proposal should be implemented as soon as possible.

Cost: There is no capital cost associated with this proposal. All costs are operational related to the employment of the specialty electrician.

EL-2 Electrical System Modeling

Project Description: Each time EWU submits a new or remodeled building for electrical plan review, the Department of Labor & Industries requires a load analysis of the entire medium-voltage distribution system associated with the project. EWU should commission an electronic model of the distribution system and should obtain software capable of updating the model as projects are completed on the campus. The model should document information such as load flow and short-circuit information. The model could also contain information related to arc-flash hazard levels which are important for worker safety. Currently, EWU does not have this information available.

Project Justification This proposal is driven by the need for operational efficiencies related to electrical calculations for new capital projects and major renovations to existing facilities. Having an up-to-date model with Arc-Flash data would also improve worker safety.

Sequence: This proposal should be implemented prior to the next major capital project.

Cost: There are no capital costs associated with this proposal. Retaining an engineering firm to prepare the initial model would cost approximately $50,000. Software to maintain the model would cost approximately $6,000. EWU should allocate funds to update the model each time a capital project is executed.

EL-3 Distribution Switching

Project Description: EWU should plan for the eventual replacement of the medium-voltage vacuum switches with above-ground, fusible air switches. Air switches provide a number of advantages over the existing vacuum switches. Because air switches are not insulated with an inert gas, there is no environmental concern as there is with the existing SF_6 insulating gas. Located on concrete pads on grade, air switches provide better worker safety with respect to approach clearances and exit routes. Air switches can be provided in multiple configurations with up to two (2) input/outputs and four (4) branch connections thus increasing the quantity of connection points available on the distribution system.

Project Justification: This proposal is driven by the need of the Master Plan to eventually require more connections to the medium-voltage distribution system. It also addresses worker safety issues and possible future environment restrictions related to the existing insulating gas.

Sequence: The conversion to above-grade air-insulated switches can be accomplished in small increments or as new building projects dictate.

Cost: The cost to implement this proposal for any segment of the campus is obviously proportional to the amount of switches being replaced at any one time. The cost to replace a single vacuum switch with a single above-grade air switch is approximately $70,000. The cost to replace all 27 existing switches is approximately $1,800,000.

EL-4 Distribution System Expansion

Project Description: The existing switchgear feeds the entire campus with four (4) feeders; two (2) 'A' feeders connected to Service #1 and two (2) 'B' feeders connected to Service #2. Each half of the switchgear has provisions for one (1) new circuit breaker. This would allow for the establishment of two (2) 'C' feeders.

Project Justification: Providing a third set of medium-voltage feeders for the campus will support large future loads, such as the proposed science complex and the Gateway project, without adding load to the existing two sets of medium-voltage feeders. This addition to the electrical distribution system will support the Master Plan.

Sequence: The distribution system expansion should occur before or in conjunction with the planned science building project and prior to the Gateway project.

Cost: $1,800,000

EL-5 Site Lighting Upgrade

Project Description: EWU previously developed a master plan for replacing existing site lighting with new, more efficient luminaires. The first phase of the master plan, which was primarily road lighting improvements, has been implemented. This project would continue the implementation of the site lighting master plan which is subdivided into parking lot lighting, plaza and walkway lighting, building perimeter lighting and centralized lighting controls.

Project Justification: Continuing the implementation of the site lighting master plan benefits the University in two ways. New luminaires will save maintenance and operational costs due to higher efficiencies and longer lamp life. Enhanced lighting will also address safety concerns in areas identified as having insufficient lighting levels.

Sequence: Site lighting upgrades can occur when convenient to the University. New site lighting installed as part of new facilities or building renovations should conform to the recommendations of the lighting master plan.

Cost: Costs identified in the lighting master plan are as follows:

Phase 2 $ 3,500,000
Phase 3 $12,000,000
Phase 4 $ 3,500,000

EL-6 Optical Fiber System Upgrade

Project Description: EWU wins and operated an optical fiber, outside-plant system for distributing of voice and data to campus buildings. A separate optical fiber network for acquiring building data and for automated systems control exists on the campus. A

Appendix B – Major Equipment

APPENDIX B

ROZELL CENTRAL ENERGY PLANT MAJOR EQUIPMENT INFORMATION

Existing Boilers – Condition Description and Capacity Ratings

Boiler No.	Year Built/Installed	Original Rated Capacity (PPH)	Safe Operating Capacity (PPH)	Condition Description
1	1974	53,000	32,000	
2	1960	25,000	15,000	Oldest boiler, smallest capacity
~~3~~	~~1966~~	~~30,000~~	~~18,000~~	~~Inoperable since 2008~~
4	1969	45,000	27,000	
5	2001	83,000	42,000**	Natural Gas limits **
Total Rated Capacity		206,000	PPH	
	Safe Operating Capacity		**116,000**	**PPH**

** - Capacity limited by availability and line size of the natural gas service to the Cheney area.

Defining terms:

Original Rated Capacity: The capacity as stated on the boilerplate at the time of fabrication/manufacturer.

Actual Safe Operating Capacity: The safe operating capacity and calculated as 60% of the boiler rated capacity.

****:** - Boiler #5 capacity is limited to the natural gas service line size provided by the utility to the Cheney area and cannot be operated above 50%.

Existing Chillers and Towers – Condition Description and Capacity Ratings

Chiller No.	Year Built/Installed	Manufacturer	Original Rated Capacity (Tons)	Safe Operating Capacity (Tons)	Condition Description
1	2017/2018	York	1,500	1,500	New
2	2017/2018	York	1,500	1,500	New
3	1998	Carrier	1,000	1,000	Operable (22yo)
~~4~~	~~1998~~	~~Carrier~~	~~1,000~~	~~1,000~~	~~Inoperable, out of service~~
5	1998	Carrier	1,000	1,000	Operable (22yo)
Total Rated Capacity			6,000	Tons	
	Actual Safe Operating Capacity			**5,000**	**Tons**

Tower No.	Year Built/Installed	Manufacturer	Original Rated Capacity (Tons)	Safe Operating Capacity (Tons)	Condition Description
1	2017/2018	BAC	1,500	1,500	New
2	2017/2018	BAC	1,500	1,500	New
3	2004	Marley	1,000	1,000	Operable with issues
~~4~~	~~1998~~	~~Marley~~	~~1,000~~	~~1,000~~	~~Down, out of service, needs replacement~~
~~5~~	~~1998~~	~~Marley~~	~~1,000~~	~~1,000~~	~~Down, out of service, needs replacement~~
Total Rated Capacity			6,000	Tons	
	Actual Safe Operating Capacity			**4,000**	**Tons**

Appendix C – Electrical Capacity Upgrade

The full document can be viewed at this link:

https://inside.ewu.edu/facilities/2016-electrical-capacity-upgrade-report/

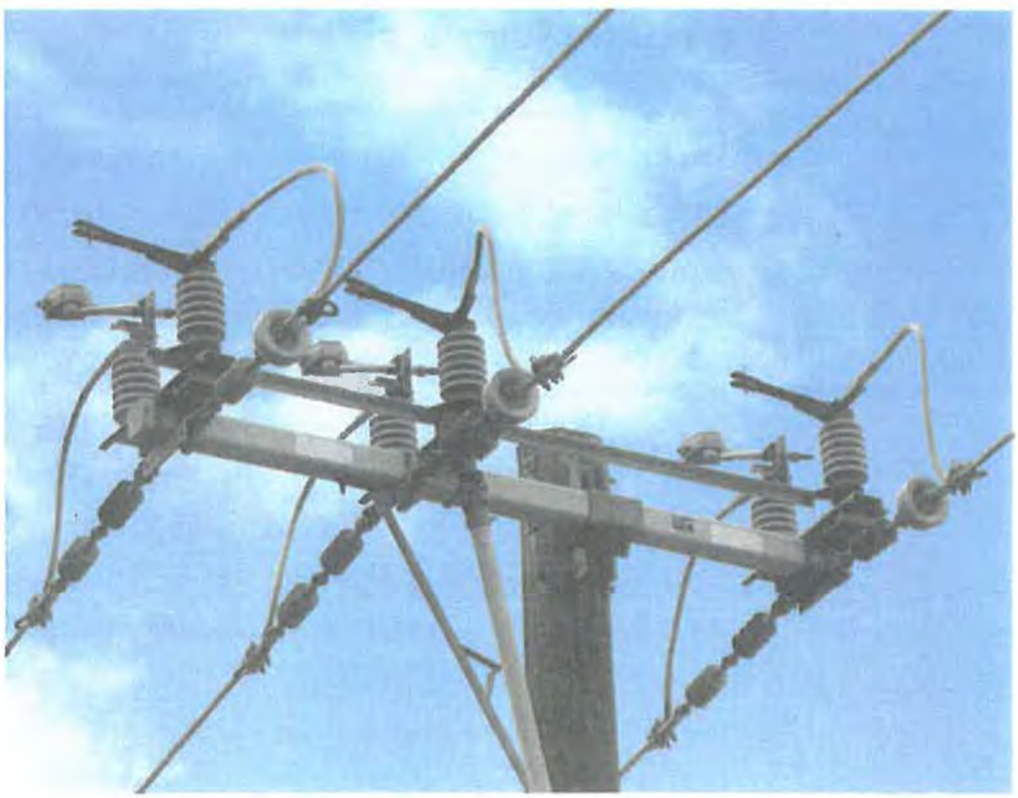
APPENDIX C

NAC ENGINEERING

ELECTRICAL CAPACITY UPGRADE

AE 1483 AE
Eastern Washington University
Cheney, WA

August 12, 2016



1203 West Riverside Avenue, Spokane, WA 99201-1107
509 838 8240 / nacarchitecture.com
Seattle / Spokane / Los Angeles

NAC
ENGINEERING

Purpose

Eastern Washington University has undertaken this analysis and report for three main reasons. First, to address the adequacy of the existing 13.2-kV electrical distribution system to support three major projects currently being planned:

Pence Union Building (PUB) Renovation

Interdisciplinary Science Center (ISC)

Central Chiller Plant Expansion

Secondly, to evaluate the impact of the next 10-years of projected campus growth on the electrical distribution system. Lastly, to address improvements to the campus electrical distribution system to enhance operation, maintenance and worker safety.

Executive Summary

The medium-voltage distribution system at EWU is well maintained and adequately supports the current electrical load. In order to continue to provide a reliable electrical infrastructure, EWU should incorporate the recommendations of this report into its long-range infrastructure planning program. Two proposed capital projects will significantly increase the campus electrical load and actions must be taken to support the increase. As part of an upgrade plan, EWU should incrementally replace existing vacuum switches and 15-kV conductors to enhance future reliability and improve worker safety. EWU should also continue to develop its arc flash safety program. This report discusses existing conditions, expected future loads and recommended actions. The most immediate need is to accommodate the large capital projects planned for the next two years.

effort to estimate the chiller electrical demand, the Bus #1 demand values provided by EWU were subtracted from the City of Cheney demand values.

The following estimated demand values are the result.

Chiller demand:	2,888-kVA
	127-amperes @13,200-VAC

A graph of the resultant is included at the back of this report. The graph closely matches load estimates evaluated in the *Chiller Plant Capacity Upgrade AE1368* report prepared for EWU by MSI Engineers, Spokane, WA.

Electrical System Deficiencies

No significant deficiencies requiring immediate attention were noted. The medium-voltage distribution system appears to be in good condition and has been well maintained. Most of the existing vacuum switches are feeding two pad-mounted transformers, the maximum possible amount. This means that while the campus feeders have spare capacity, portions of the feeder would have to be reconfigured in order to use that capacity. Initiatives have been identified to accommodate load growth, maintain reliability and enhance worker safety. Proactive planning for implementation of the initiatives indicated below will help insure a reliable and safe electrical system.

- Implement one of the options for addressing the additional chiller load.
- Incremental replacement of medium-voltage cable over 20-years old.
- Make recommended changes to the controls and relaying in the medium-voltage switchgear.
- Incremental replacement of medium-voltage vacuum switches.
- Expand the arc flash program to the 480-VAC and 208-VAC systems

Switchgear Relays and Control

The existing medium-voltage switchgear contains electronic relays for providing

All three options will require the City of Cheney to increase the size of the overhead service conductors, particularly those coming from the Cheney Substation located south of the campus. The City of Cheney may require EWU to pay part or all of the costs for increasing the conductor size.

Recommendations

Medium-voltage Conductor Replacement: EWU should plan for the incremental replacement of the 15-kV feeders beginning with the conductors installed in the early 1990's. A proactive approach to conductor replacement will help minimize the possibility of conductor failure interrupting campus service. Conductor replacement should occur in conjunction with the replacement of the vacuum switches as suggested below.

Medium-voltage Vacuum Switch Replacement: EWU should plan for the incremental replacement of the existing 13.2-kV, below-grade vacuum switches with above-grade, air-insulated, pad-mounted switches. Replacing the vacuum switches will significantly improve safety during switch operation be moving switching operations to above grade. Air-insulated switches will eliminate possible environment requirements and constraints that may be imposed in the future. The above-grade switches, when used in conjunction with pad-mounted sectionalizing cabinets offer increased flexibility for distribution system reconfiguration to accommodate future buildings.

Distribution System Capacity Upgrade: EWU should consider implementing Option B as described in the *Medium-voltage Distribution System Options* section above. This option address the needed capacity for the first step of the chiller plant increase and allows the University to plan for the eventual implementation of Option C prior to adding the second chiller load step.

Medium-voltage Switchgear Adjustments: The recommendations of Schneider Electric regarding the automatic transfer system and the protection scheme of the existing medium-voltage switchgear should be considered and

Costs

The following schematic level costs are intended to provide a guide for budgeting future projects. The costs are expressed in year 2016 dollars. Not included in the costs are possible utility connection charges that may be levied by the City of Cheney.

Medium-voltage conductor replacement: $4,000,000

Medium-voltage vacuum switch replacement: $1,600,000

Distribution system capacity upgrade, Option A: $ 100,000
Option B: $ 250,000
Option C: $1,700,000

Medium-voltage switchgear adjustments: $100,000

Arc flash modeling: $400,000

Appendix D – Pub to ISC Utility Tunnel

The full document can be viewed at this link:

https://ewueagles.sharepoint.com/:b:/s/CPEWU/ETW1NLpUEKlKgbWEgsVp68kBEXCJoZEwB6NxpsF_ZnsIxg

PUB TO ISC UTILITY TUNNEL

EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON 99004
PROJECT NO. AE-1484

APPENDIX D

INDEX OF DRAWINGS

DESIGN TEAM

OWNER

EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON 99004
CONTACT: STEVE SCHMEDDING - PROJECT MGR
EMAIL: sschmedding@ewu.edu
PHONE:(509)359-4205

MECHANICAL

MSI ENGINEERS
108 N. WASHINGTON, SUITE 505
SPOKANE, WASHINGTON 99201
CONTACT: BRAD SNOW
EMAIL: brad@msi-engineers.com
PHONE:(509)624-1050

ELECTRICAL

NAC ENGINEERS
1203 W. RIVERSIDE AVE.
SPOKANE, WASHINGTON 99201
CONTACT: NATHAN HAUBER
EMAIL: nhauber@nacarchitecture.com
PHONE:(509)838-8240

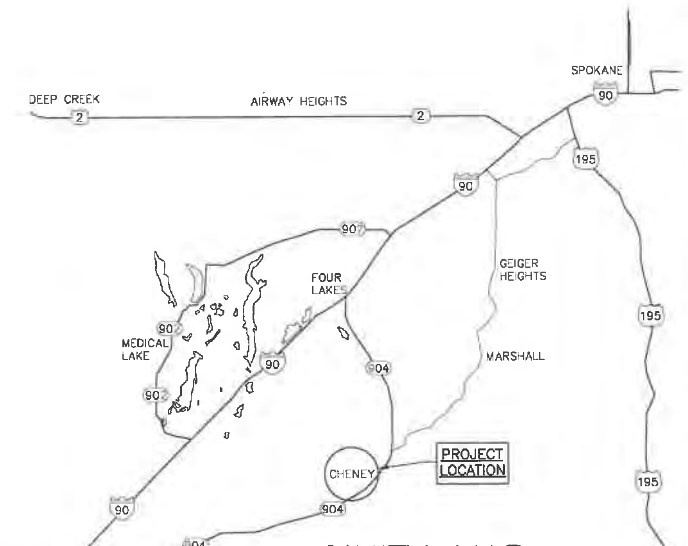
CIVIL

CPL ENGINEERS
801 2ND AVE. SUITE 900
SEATTLE, WASHINGTON 98104
CONTACT: KEN WIERSEMA
EMAIL: kenw@cplinc.com
PHONE:(206)343-0460

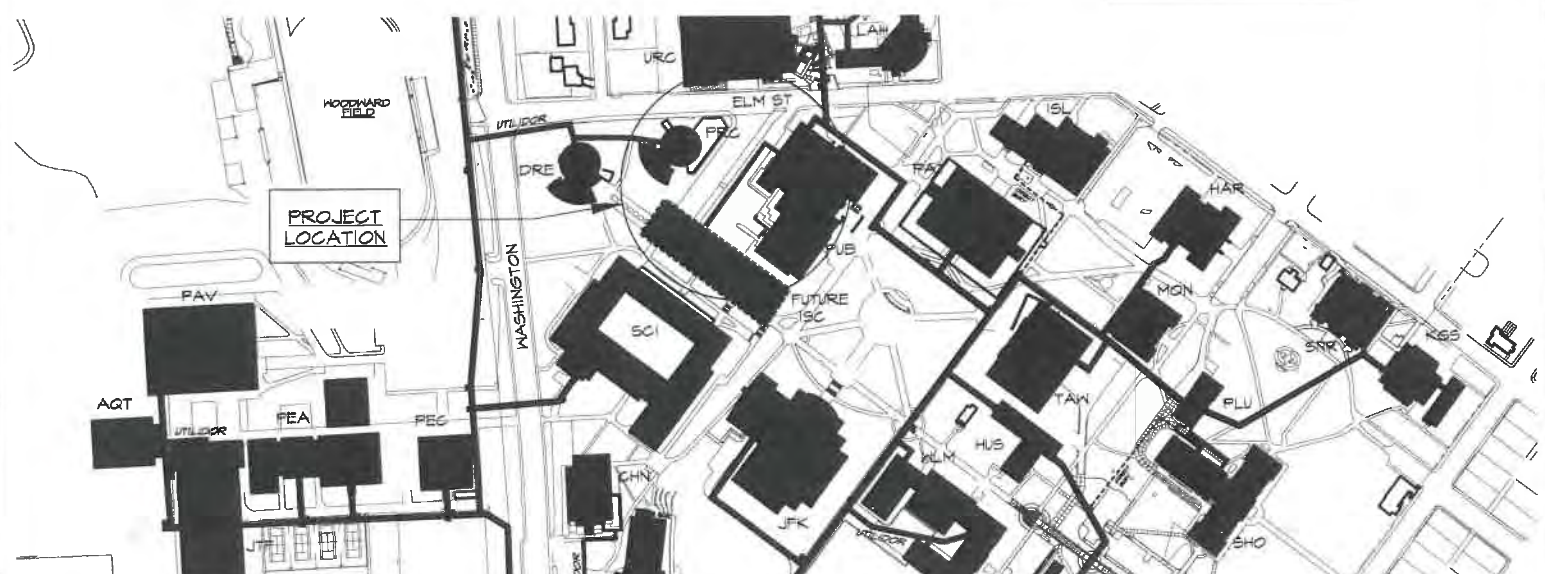
STRUCTURAL

DCI ENGINEERS
707 W. 2ND AVE.
SPOKANE, WASHINGTON 99201
CONTACT: BRIAN PARSONS
EMAIL: bparsons@dci-engineers.com
PHONE:(509)455-4448

WASHINGTON STATE



VICINITY MAP



EWU CAMPUS MAP

100% REVIEW - CONSTRUCTION DOCUMENTS - DEC. 30, 2016

PUB TO ISC UTILITY TUNNEL
EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON

COVER SHEET

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

MEULINK STAUFFENBERG MECHANICAL SYSTEMS

PROJECT NO:	16.31
DRAWN BY:	MRH
CHECKED BY:	JBS
DATE:	12-30-16

G1.0

GENERAL NOTES

1. COORDINATION WITH PUB RENOVATION PROJECT:

   -THE NEW TUNNEL WORK WILL BE CONSTRUCTED WITHIN THE BOUNDARIES OF AN ONGOING SEPARATE CONSTRUCTION PROJECT INVOLVING THE RENOVATION OF THE PENCE UNION BUILDING (PUB). DURING THE TUNNEL CONSTRUCTION WORK, ACCESS TO THE SITE WILL BE SHARED WITH THE PUB CONTRACTOR, WHO SHALL HAVE PRIMARY CONTROL OF THE SITE AND SHALL DESIGNATE ACCEPTABLE WORK STAGING AREAS, LAY-DOWN AREAS, ETC. FOR THE TUNNEL CONTRACTOR.

2. PHASING:

   – IT IS PROPOSED FOR BIDDING PURPOSES THAT THE TUNNEL WORK BE CONSTRUCTED IN A SINGLE PHASE SO AS TO MINIMIZE DISRUPTIONS AND IMPACTS TO THE ONGOING PUB PROJECT AND TO MAINTAIN ADEQUATE SITE WORK FLOW PATHS. OTHER PHASING OPTIONS MAY BE CONSIDERED AFTER THE BID IF DETERMINED TO BE IN THE BEST INTEREST OF THE PUB RENOVATION AND TUNNEL CONTRACTORS.

3. ACCESS TO SITE:

   – ACCESS TO THE SITE WILL GENERALLY BE OFF OF ELM STREET THROUGH THE PUB RENOVATION CONTRACTOR'S CONTROL GATE.

4. LAY-DOWN & STAGING AREAS:

   – LAY-DOWN AND STAGING AREAS FOR THE TUNNEL CONSTRUCTION MATERIALS WILL BE WITHIN THE PUB RENOVATION WORK ZONE AS INDICATED. ADDITIONAL TEMPORARY LAY-DOWN SPACE MAY BE PROVIDED ON AN AS NEED BASIS IN A LOCATION MUTUALLY AGREED UPON BETWEEN CONTRACTORS.

5. JOB TRAILER:

   – A LOCATION FOR A SINGLE JOB TRAILER FOR THE TUNNEL PROJECT WILL BE PROVIDED WITHIN THE PUB RENOVATION SITE AS INDICATED. ALL OTHER JOB TRAILERS AND STORAGE CONTAINERS WILL NEED TO BE LOCATED OFF-SITE IN SUITABLE CAMPUS LOCATIONS DICTATED BY THE EWU FACILITY STAFF.

GENERAL NOTES

6. FENCING & SECURITY:

   – FENCING AND SECURITY OF THE PRIMARY PUB RENOVATION SITE SHALL BE THE RESPONSIBILITY OF THE PUB RENOVATION CONTRACTOR. ADDITIONAL MATERIAL STORAGE FENCING OR SECURITY WITHIN THE PRIMARY PUB SITE SHALL BE AT THE DISCRETION OF, AND PROVIDED BY, THE TUNNEL CONTRACTOR.

7. TRENCH SAFETY & SHORING:

   – THE TUNNEL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL TUNNEL CONSTRUCTION SAFETY MEASURES, EXCAVATION SAFETY FENCING, EXCAVATION SHORING, ETC.

8. OVERBURDEN PILE LOCATION:

   – IT IS EXPECTED THAT ALL EXCAVATED MATERIAL WILL BE HAULED AWAY FROM THE SITE AND DISPOSED OF OFF-SITE IN A LEGAL MANNER. EWU RESERVES THE RIGHT TO HAVE SELECT MATERIAL DUMPED ELSEWHERE ON CAMPUS PROPERTY FOR STOCKPILING PURPOSES.

9. EXCAVATION DEWATERING & DISCHARGE:

   – ALL DEWATERING ACTIVITIES REQUIRED FOR THE TUNNEL CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE TUNNEL CONTRACTOR. DEWATERING TREATMENT AND DISCHARGE SHALL BE AS SPECIFIED.

10. PROTECTION OF EXISTING UTILITIES & STRUCTURES:

    – CARE SHALL BE TAKEN TO PROTECT AND PREVENT DAMAGE TO EXISTING BURIED UTILITIES AND OR STRUCTURES IMPACTED BY THE TUNNEL CONSTRUCTION ACTIVITIES, AND MAY INVOLVE TEMPORARY SHORING, BRACING, ETC. PROTECT ALL ABOVEGROUND STRUCTURES, CURBS, RETAINING WALLS, SIDEWALKS, ETC. FROM DAMAGE DURING CONSTRUCTION, AND REPAIR ANY DAMAGE TO PRE-CONSTRUCTION CONDITION.

11. PARKING:

    – UNLESS COORDINATED IN ADVANCE WITH THE PUB RENOVATION CONTRACTOR, NO ON-SITE PARKING SHALL BE GENERALLY AVAILABLE TO THE TUNNEL CONTRACTOR. OFF-SITE PARKING SHALL BE AVAILABLE TO THE WORKERS BY ARRANGEMENT WITH THE EWU PARKING SERVICES.

GENERAL NOTES

12. RESURFACING:

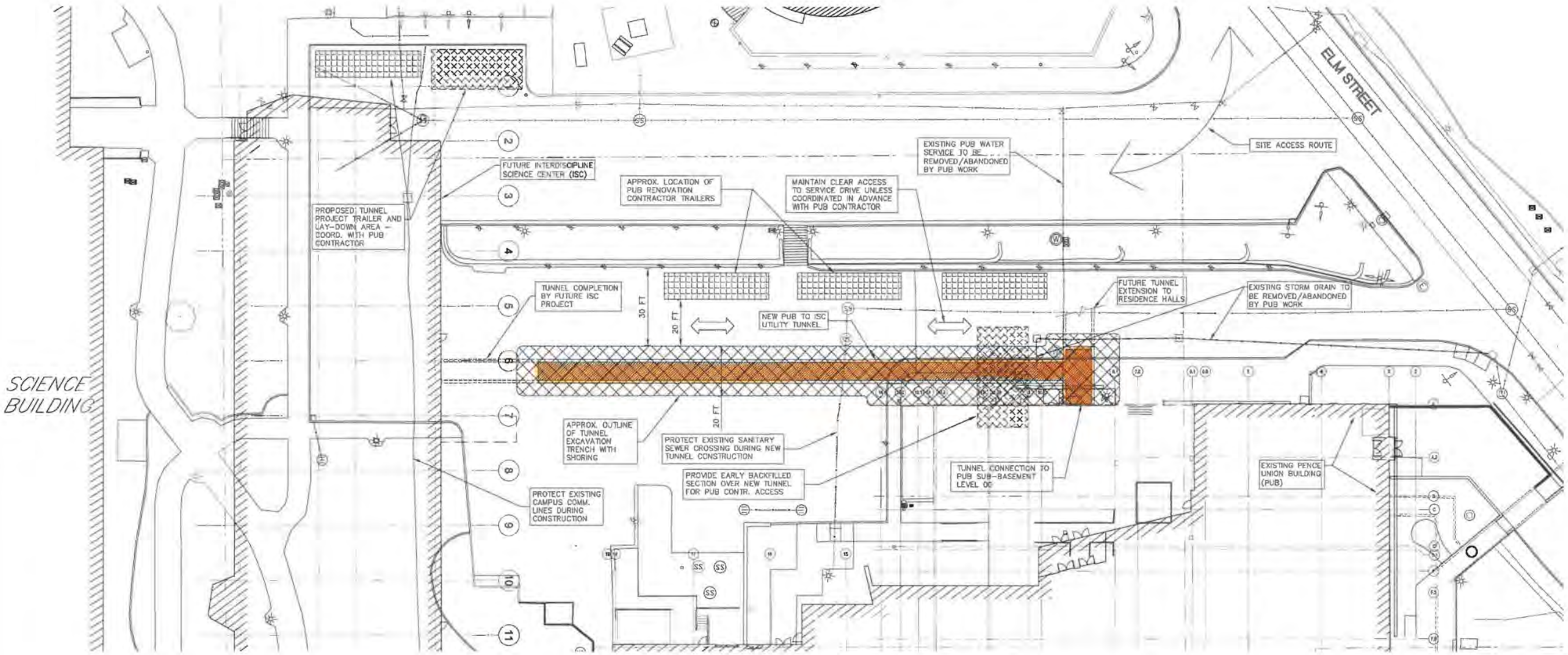
    – SURFACE CONDITIONS SHOWN ON THE DRAWINGS INDICATE FINAL PUB RENOVATION CONFIGURATION FOR CURBS, SIDEWALKS, PAVING, ETC. UNDER THE PUB TO ISC UTILITY TUNNEL PROJECT THE POST TUNNEL CONSTRUCTION WORK SHALL ROUGH-GRADE THE IMPACTED SITE AREA SO AS TO ALLOW FINAL GRADING & FINAL SURFACING BY THE PUB RENOVATION CONTRACTOR.

13. CONSTRUCTION EQUIPMENT ACCESS:

    – COORDINATE ALL CONSTRUCTION EQUIPMENT (EXCAVATORS, DUMP TRUCKS, CRANES, CONCRETE TRUCKS, ETC.) ACCESS AND TIMING WITH THE PUB RENOVATION CONTRACTOR SO AS TO NOT INTERFERE WITH SCHEDULED PUB RENOVATION WORK.

PHASING NOTES

1. THE NEW UTILITY TUNNEL SHALL BE CONSTRUCTED IN IN A SINGLE, TIME LIMITED PHASE SO AS TO MINIMIZE SITE DISRUPTION AND CONFLICTS FOR BUILDING ACCESS TO THE ONGOING PUB RENOVATION PROJECT. SEE THE PROJECT SPECIFICATIONS AND GENERAL CONDITIONS FOR TIME LIMITATIONS AND DEADLINES.
2. ALL TUNNEL EXCAVATION WORK AND CONSTRUCTION WORK SHALL BE DONE IN A MANNER SO AS TO MINIMIZE THE IMPACT FOOTPRINT INVOLVED, INCLUDING THE EXCAVATION LIMITS, VEHICLE TRAVEL PATHS AND THE LAYDOWN AND STAGING AREAS.
3. TO THE EXTENT POSSIBLE, A REASONABLE ACCESS PATHWAY FOR PERSONNEL AND EQUIPMENT (HIGH LIFTS) SHALL BE MAINTAINED (OR AT LEAST MINIMIZE DISRUPTIONS) BETWEEN THE PUB CONTRACTOR'S TRAILERS AND STAGING AREAS (NW OF TUNNEL) AND THE PUB PROJECT WORK AREAS (SE OF TUNNEL). AS SOON AS A SELECT PORTION OF THE TUNNEL CONSTRUCTION IS COMPLETED AND BACKFILLED, THE PUB CONTRACTOR WILL PROVIDE STEEL PLATING OVER A PORTION OF THE EXCAVATION ZONE TO FACILITATE ACCESS TO THE BUILDING. COORDINATE LOCATION AND TIMING WITH THE PUB CONTRACTOR.



0 10 20 40

SCALE 1"=20'

UTILITY TUNNEL OVERALL PLAN AND SITE UTILIZATION

Scale: 1"=20'

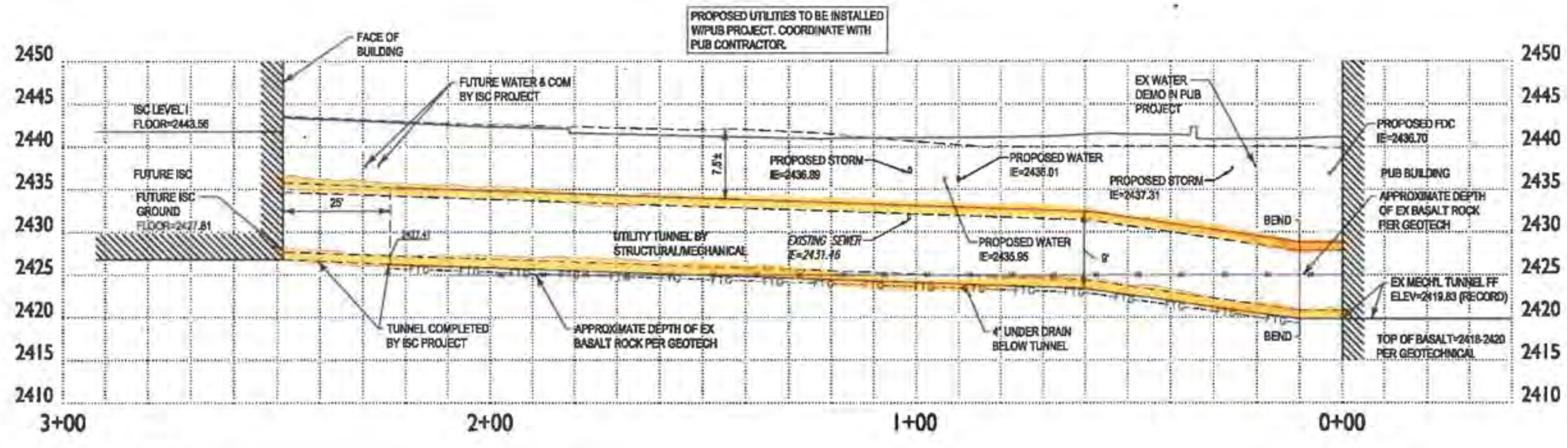
PUB TO ISC UTILITY TUNNEL
EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON

UTILITY TUNNEL OVERALL PLAN AND SITE UTILIZATION

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

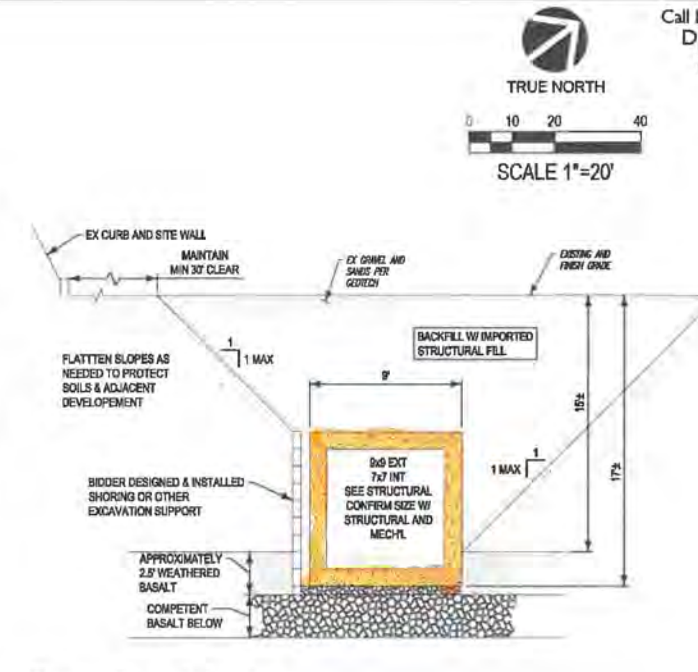
PROJECT NO:	16.31
DRAWN BY:	–
CHECKED BY:	–
DATE:	12-30-16

G2.0



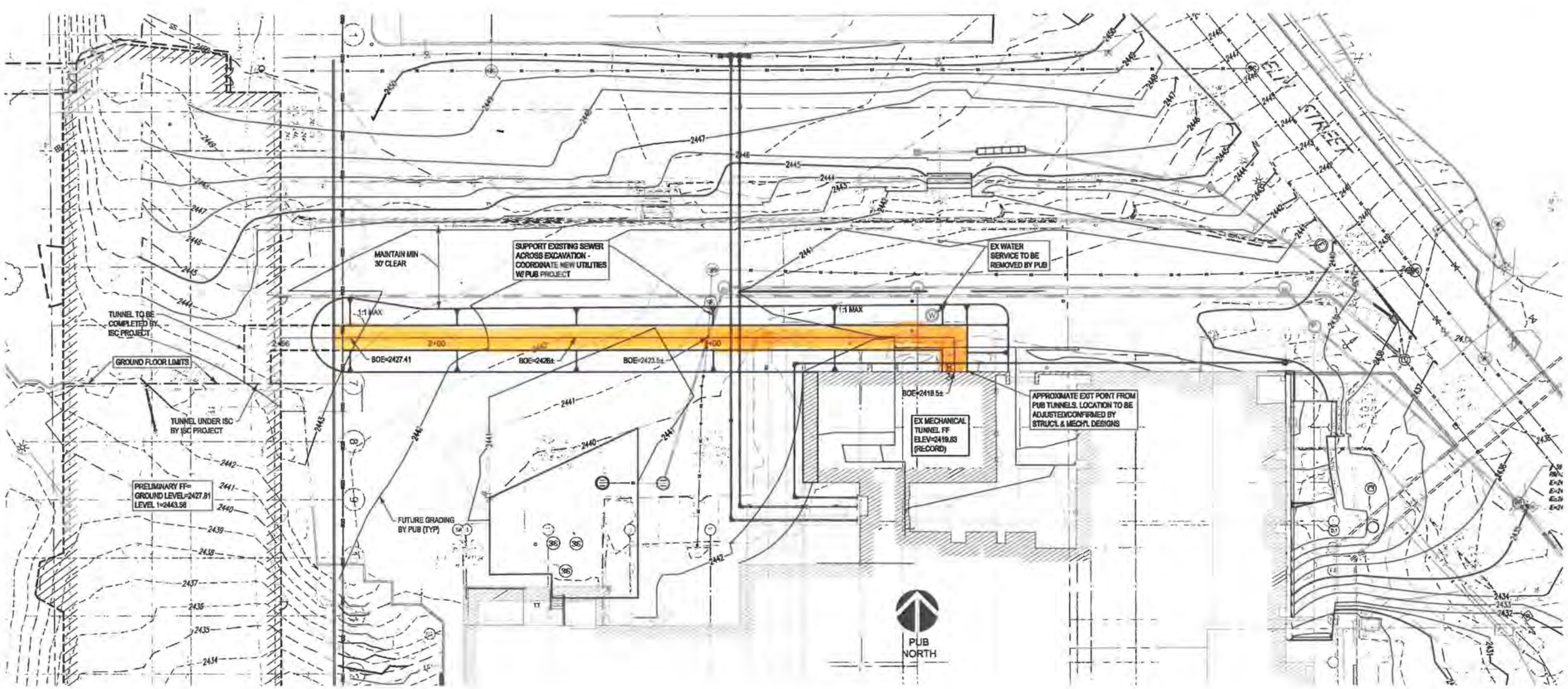
Tunnel Profile

Scale: 1"=10 Vertical 1"=20' Horizontal



Typical Trench Section

Scale: 1" = 5'



Call before you Dig. 8-1-1 or 1-800-424-5555 UNDERGROUND SERVICE (USA)

M E U L I N K S T A U F F E N B E R G I N C . M E C H A N I C A L S Y S T E M S

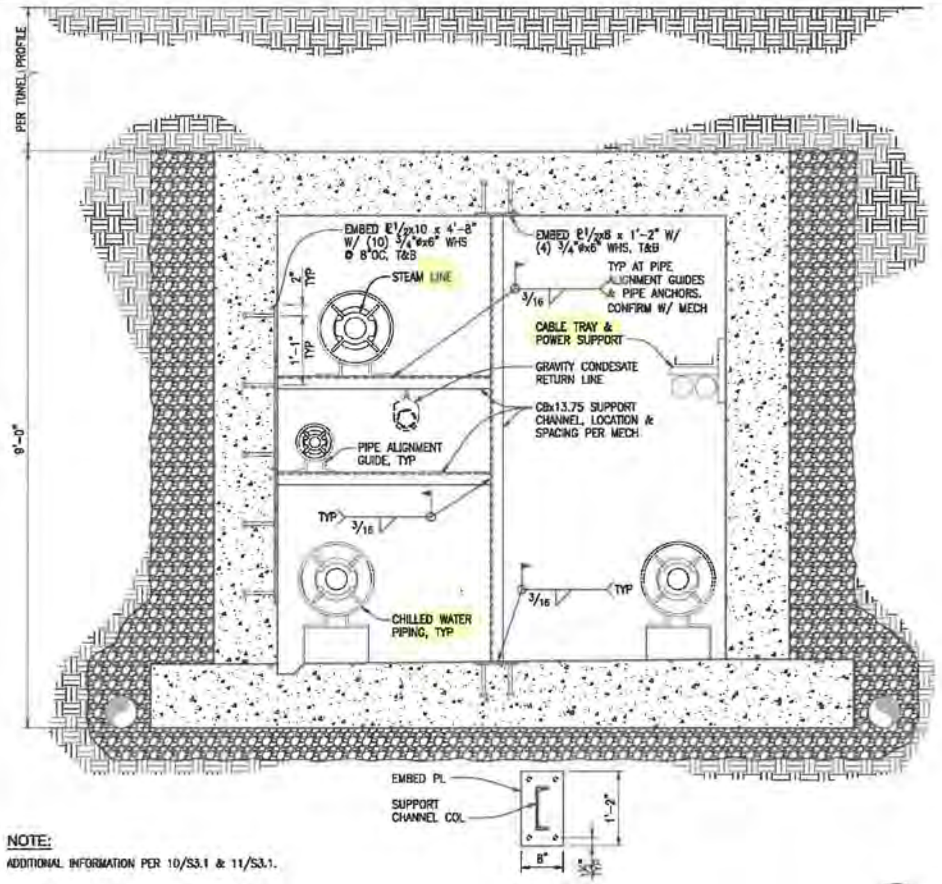
COUGHLINPORTERLUNDEEN
A CONSULTING STRUCTURAL AND CIVIL ENGINEERING CORPORATION
801 SECOND AVENUE - SUITE 900
SEATTLE WA 98104
P: 206/343-0460
F: 206/343-5691

PUB TO ISC UTILITY TUNNEL
EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON

MSI ENGINEERS
108 N. WASHINGTON, SUITE 505
Phone: (509) 624-1050
SPOKANE, WA 99201
Fax: (509) 624-2420

PROJECT NO:	C162348-01
DRAWN BY:	APC
CHECKED BY:	KAW
DATE:	12/14/2016

C1.00
T.E.S.C. Plan



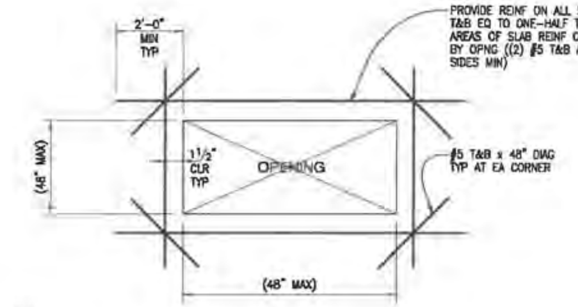
NOTE:

ADDITIONAL INFORMATION PER 10/S3.1 & 11/S3.1.

SUPPORT STANCHIONS

EMBED PLATE

SCALE: 3/4"=1'-0" (1)



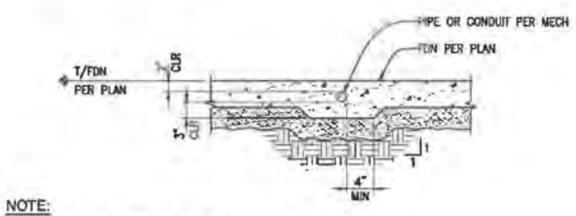
NOTES:

1. ALL OPENINGS WITH A DIMENSION OF 12" OR GREATER SHALL BE TRIMMED WITH REINFORCING.
2. REINFORCING IS IN ADDITION TO ANY REINFORCING INDICATED ON PLANS.
3. WHERE AN ADJACENT OPENING IS CLOSER THAN THE SMALLER OPENING DIMENSION, EXTEND TRIM REINFORCING TO 24" MINIMUM PAST ADJACENT OPENINGS.
4. HOOK REINFORCING AT SLAB EDGE AS REQUIRED.

PLAN - TYPICAL SLAB OPENING REINFORCING AT REINFORCED SLAB

03220

SCALE: NONE (4)



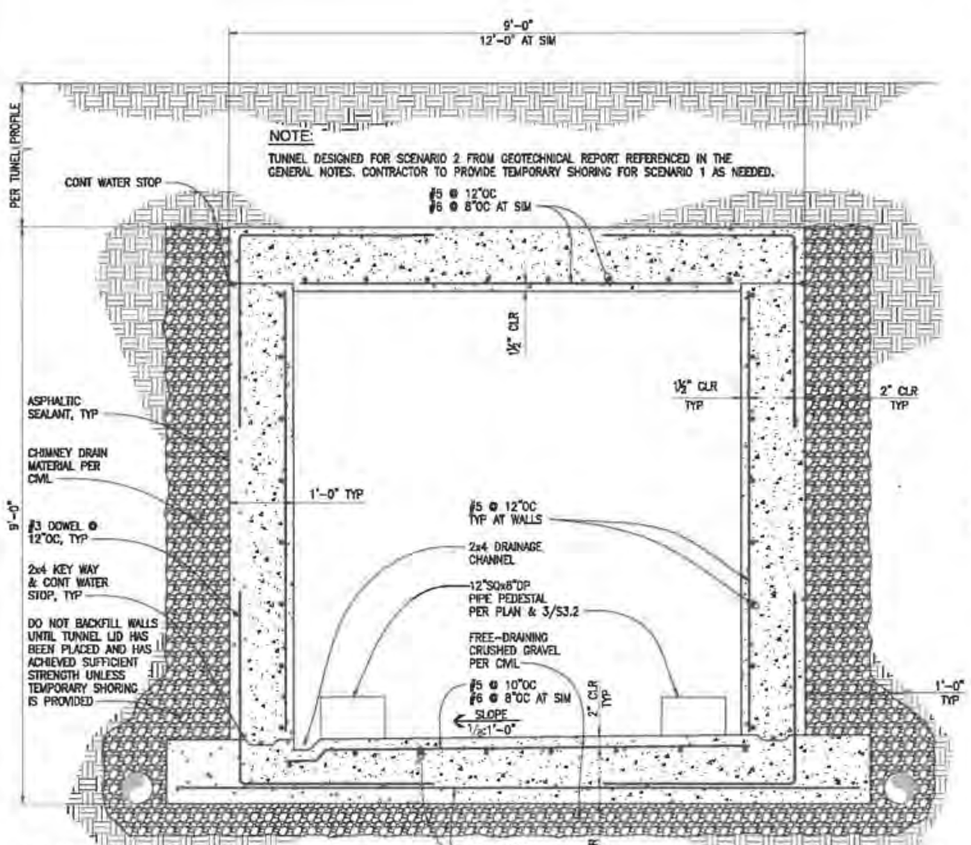
NOTE:

ALUMINUM MATERIALS SHALL NOT BE EMBEDDED IN CONCRETE.

PIPE EMBEDDED IN TUNNEL FOUNDATION

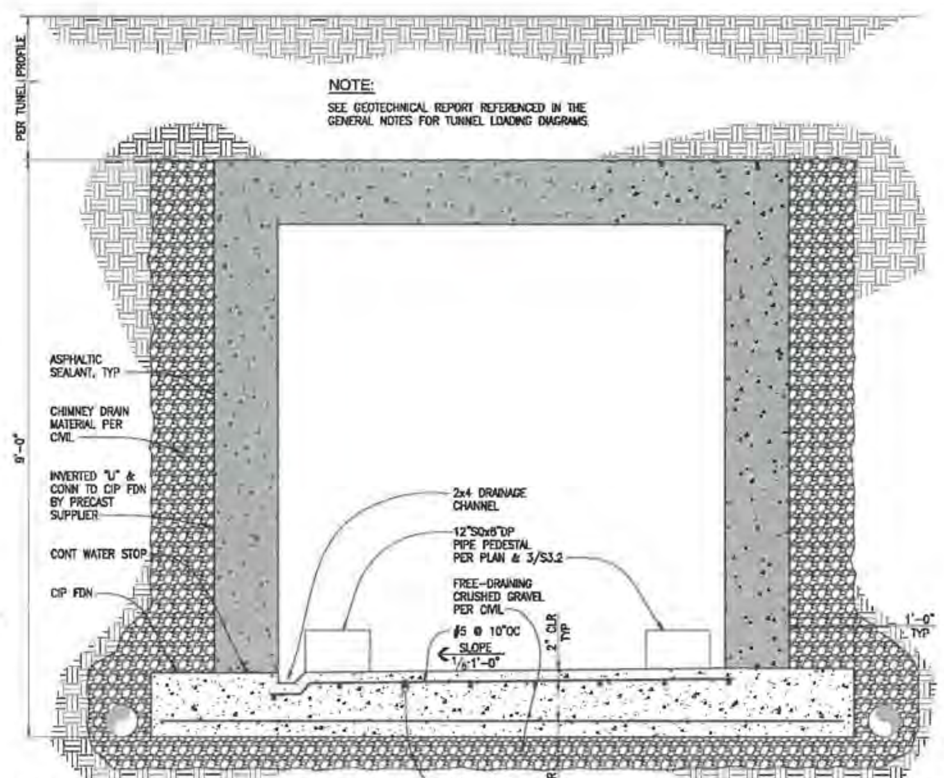
03204M

SCALE: 3/4"=1'-0" (8)



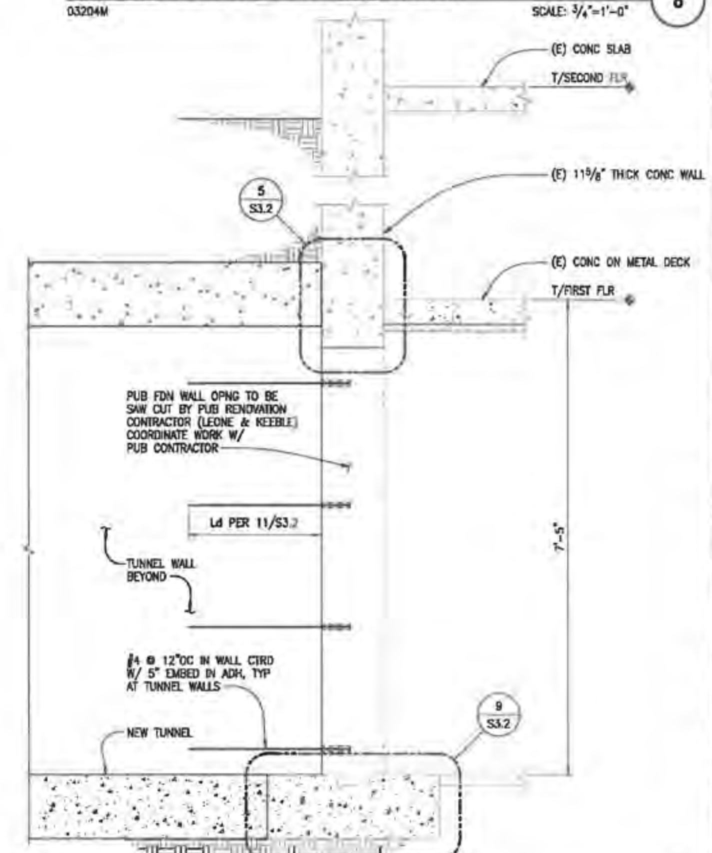
TYPICAL TUNNEL SECTION

SCALE: 3/4"=1'-0" (10)



TYPICAL TUNNEL SECTION-PRECAST OPTION

SCALE: 3/4"=1'-0" (11)



PUB OPENING

SCALE: 3/4"=1'-0" (12)

PROGRESS PRINT (NOT FOR CONSTRUCTION)

These drawings have been released at the request of the client and are not intended for the purposes of bidding, permitting, or construction.

M E U L I N K S T A U F F E N B E R G I N C . M E C H A N I C A L S Y S T E M S

DCI engineers
707 W 2nd Avenue
Spokane, Washington 99201
CIVIL / STRUCTURAL
www.dci-engineers.com

PUB TO ISC UTILITY TUNNEL

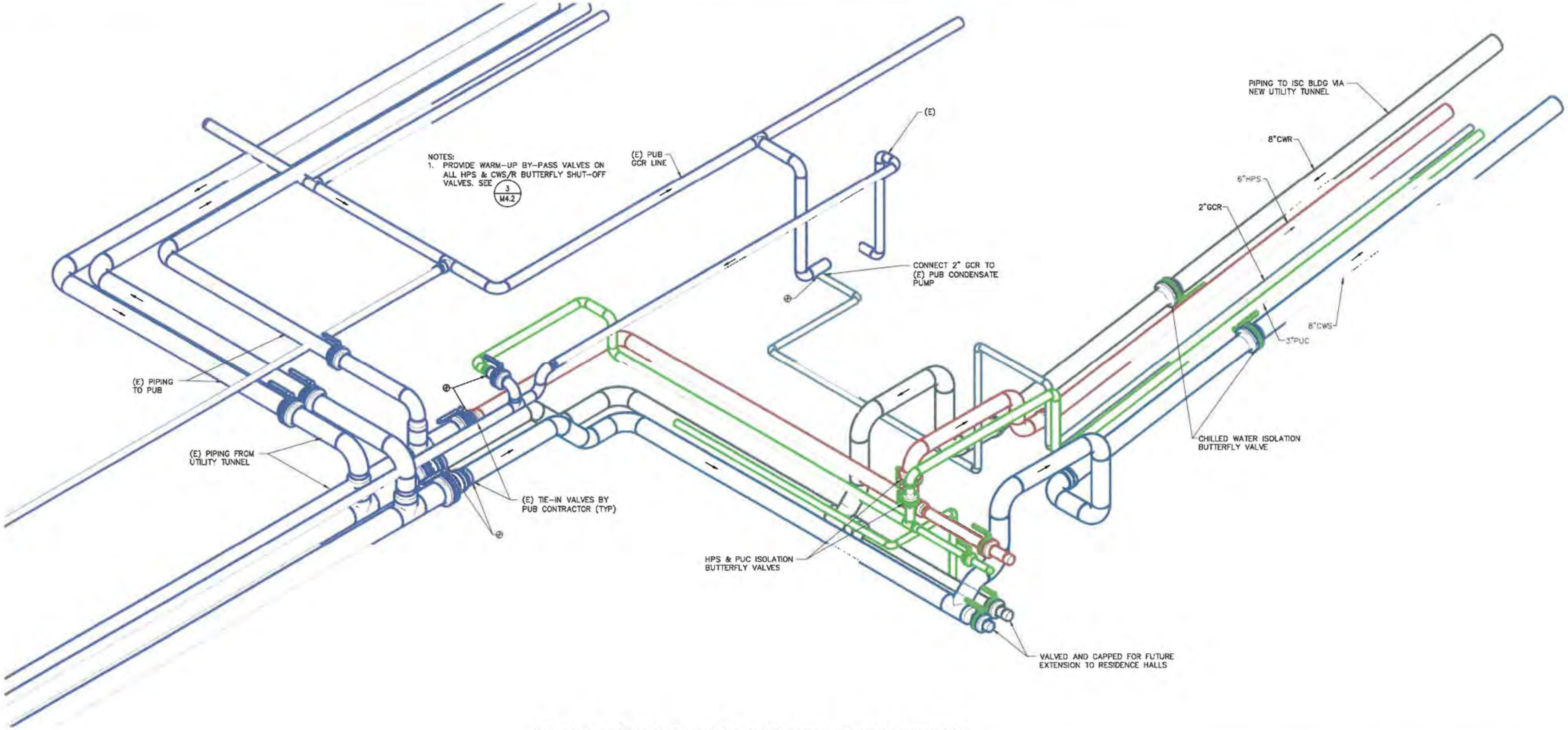
EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON

TUNNEL DETAILS

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

PROJECT NO:	16041-0164
DRAWN BY:	JLP
CHECKED BY:	BJP
DATE:	12-30-2016

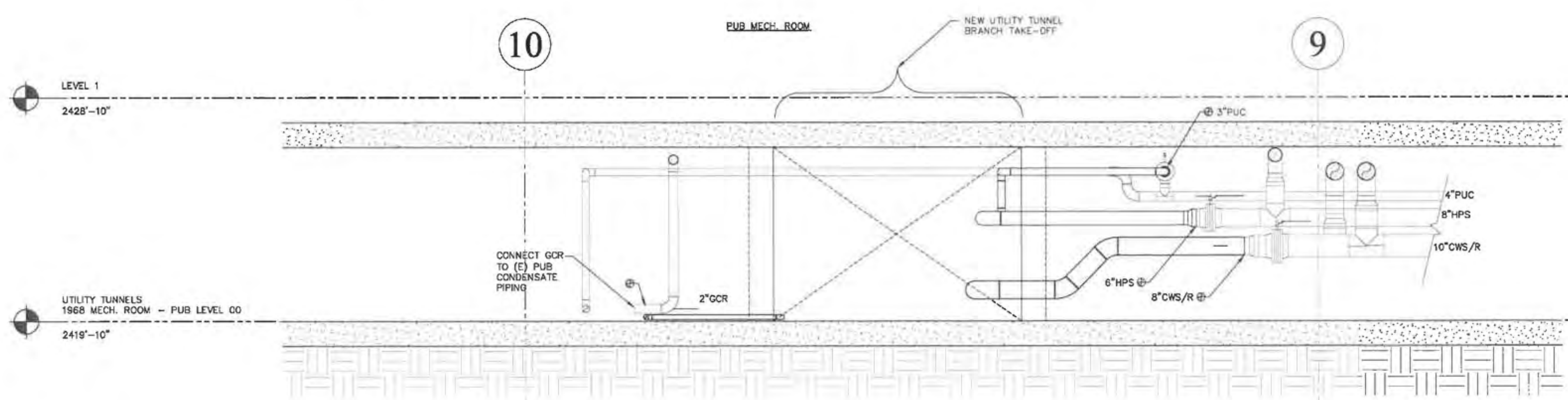
S3.1



1 PUB TO TUNNEL TIE-IN ISOMETRIC PIPING DIAGRAM

Scale: 3/8"=1'-0"

det #:



0 2.5' 5' 10'

SCALE 3/8"=1'-0"

2 PUB PIPING TO TUNNEL SECTION - LOOKING NORTH

Scale: 3/8"=1'-0"

det #:

MEULINK STAUFFENBERG INC. MECHANICAL SYSTEMS

PUB TO ISC UTILITY TUNNEL

EASTERN WASHINGTON UNIVERSITY

CHENEY, WASHINGTON

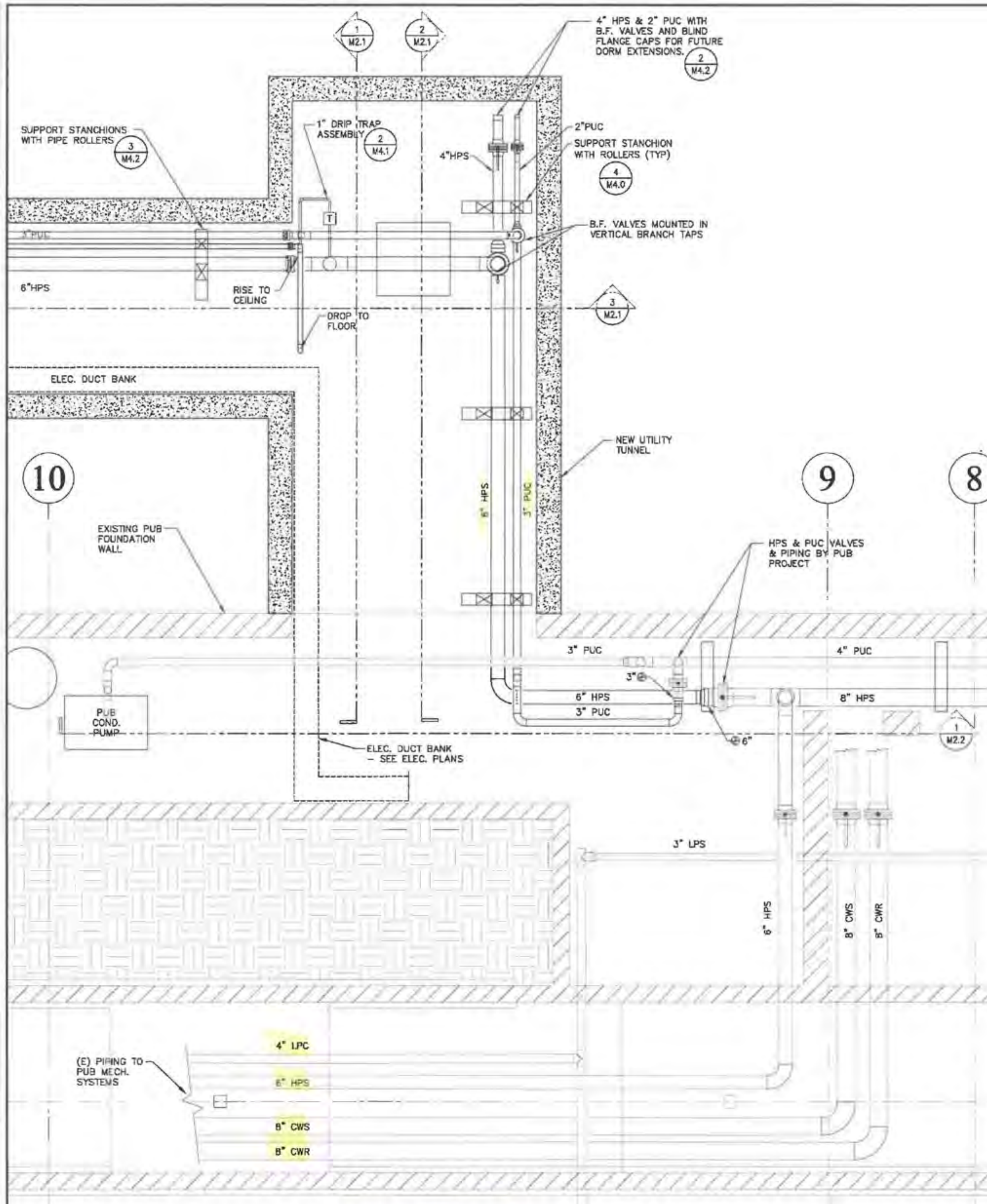
TUNNEL SECTIONS

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

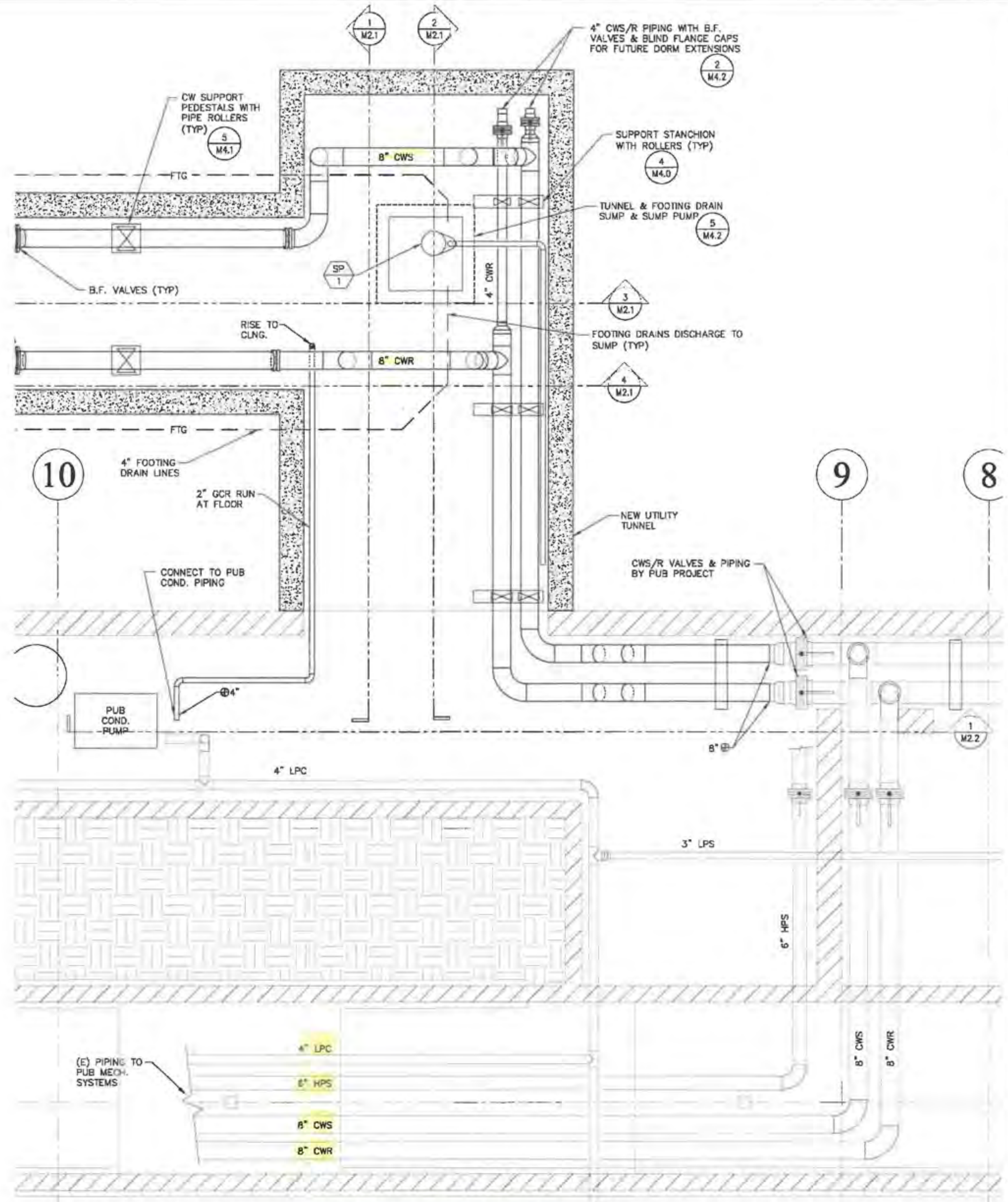
PROJECT NO:	16.31
DRAWN BY:	–
CHECKED BY:	–
DATE:	12-30-15

M2.2

P:\2016\16-31\Cad\16-31 M2-2.dwg on Thu, December 29 2016 at 01:29 PM



1 STEAM PIPING (UPPER LEVEL)



2 CHILLED WATER PIPING (LOWER LEVEL)

NOTES:

1. PIPING SHOWN IN THE PUB TUNNEL LEVEL & INDICATED AS "EXISTING" IS TO BE INSTALLED AS "NEW" BY THE PUB RENOVATION CONTRACTOR AND MAY NOT ACTUALLY BE YET INSTALLED AT THE TIME WHEN THE TUNNEL PIPING WORK IS IMPLEMENT. COORDINATE TIE-IN LOCATIONS WITH THE PUB RENOVATION CONTRACTOR.

0 2.5' 5' 10'
SCALE 3/8"=1'-0"

PUB LEVEL - 00 - UTILITY TUNNEL - PIPING PLANS
Scale: 3/8"=1'-0"

PUB TO ISC UTILITY TUNNEL
EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON

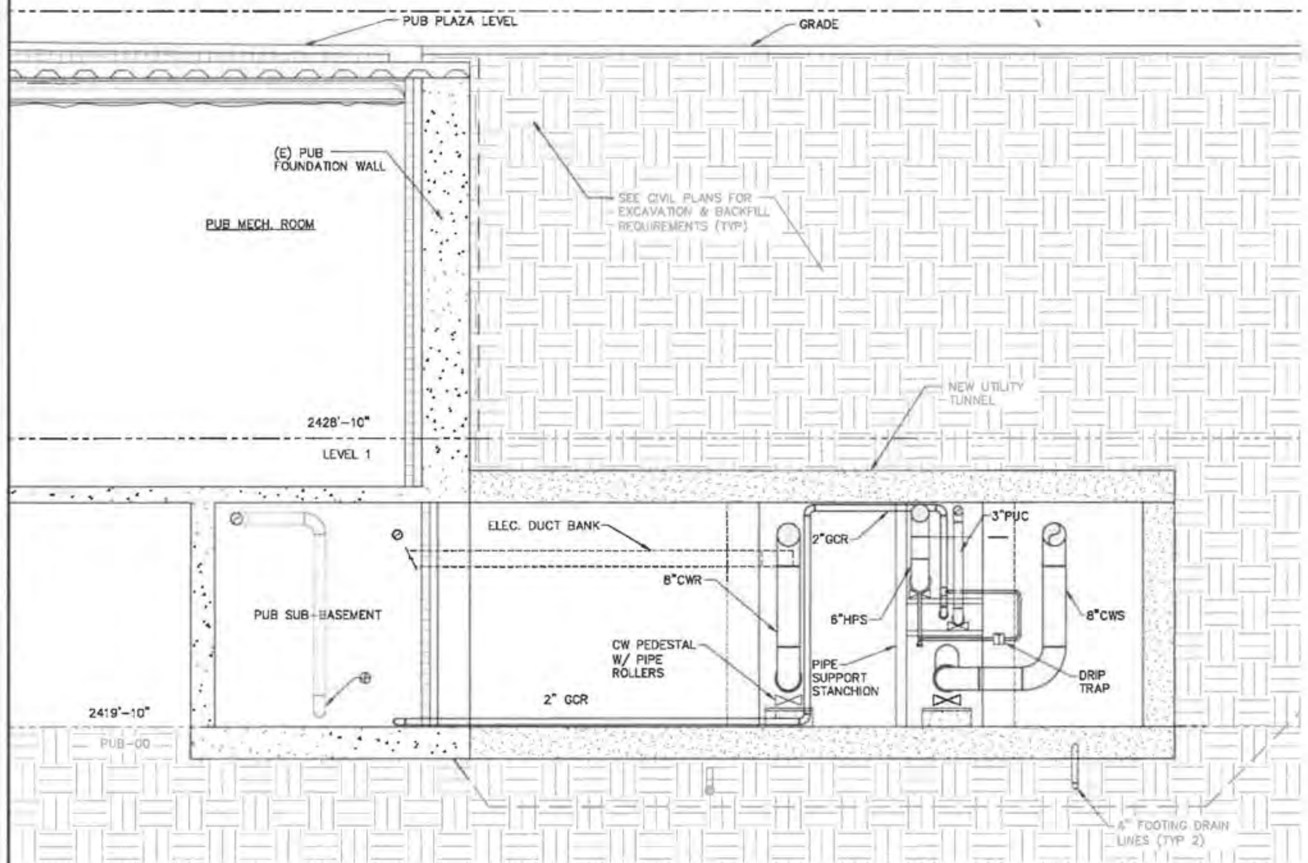
PARTIAL LARGE SCALE TUNNEL PLANS

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

PROJECT NO:	16.31
DRAWN BY:	--
CHECKED BY:	--
DATE:	12-30-16

M2.0

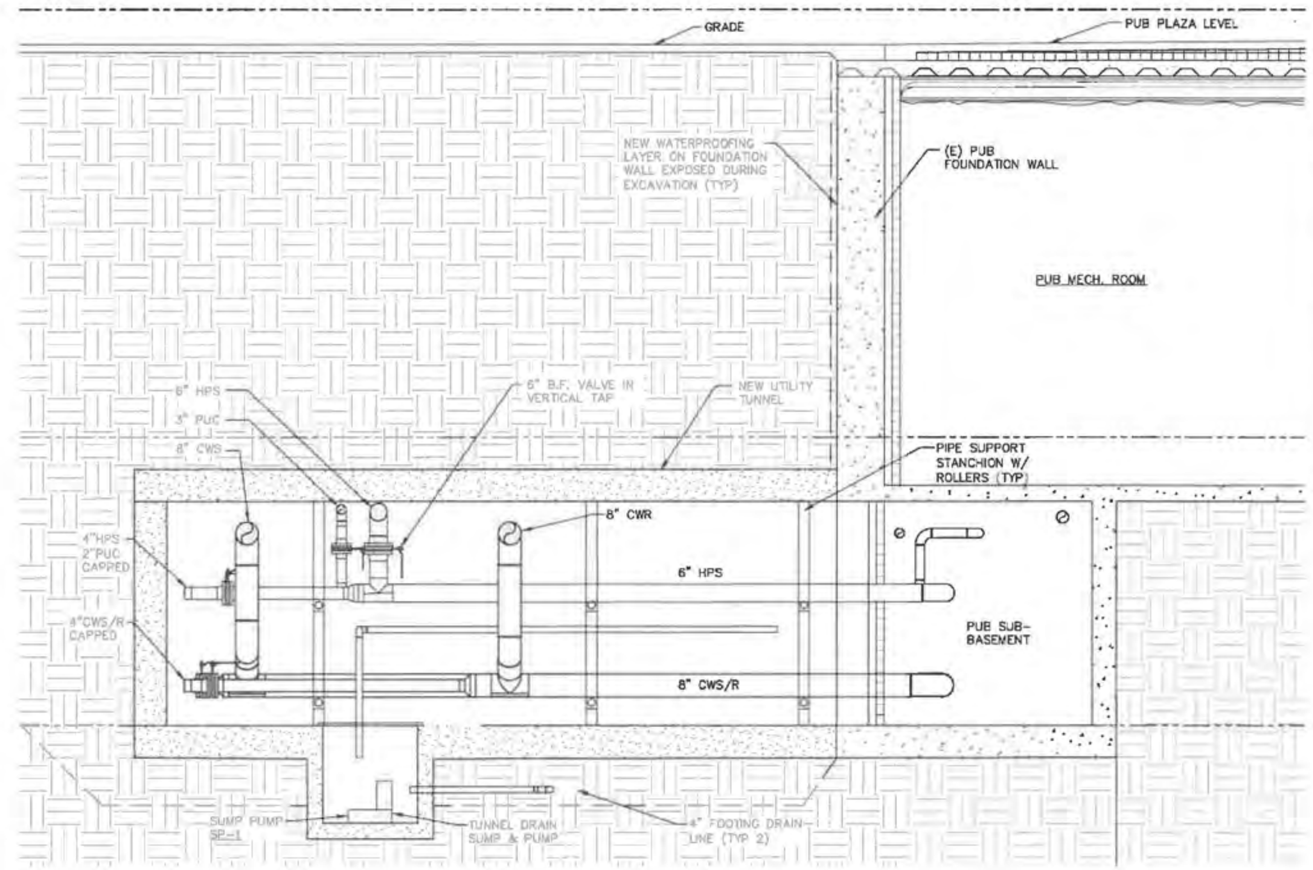
P:\2016\16-31\Cad\16-31 M2-0.dwg on Thu, December 29 2016 at 01:27 PM



1 TUNNEL TIE-IN TO PUB - SECTION - 1

Scale: 3/8"=1'-0"

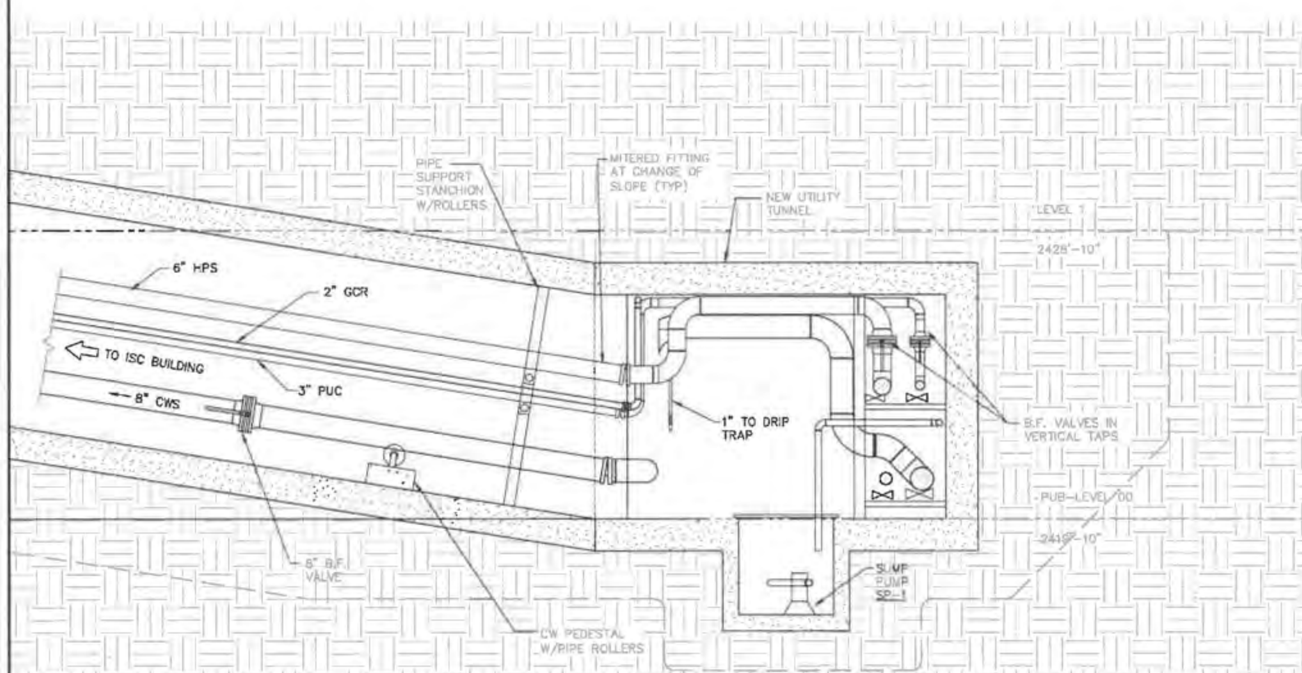
det #:



2 TUNNEL TIE IN PUB - SECTION - 2

Scale: 3/8"=1'-0"

det #:



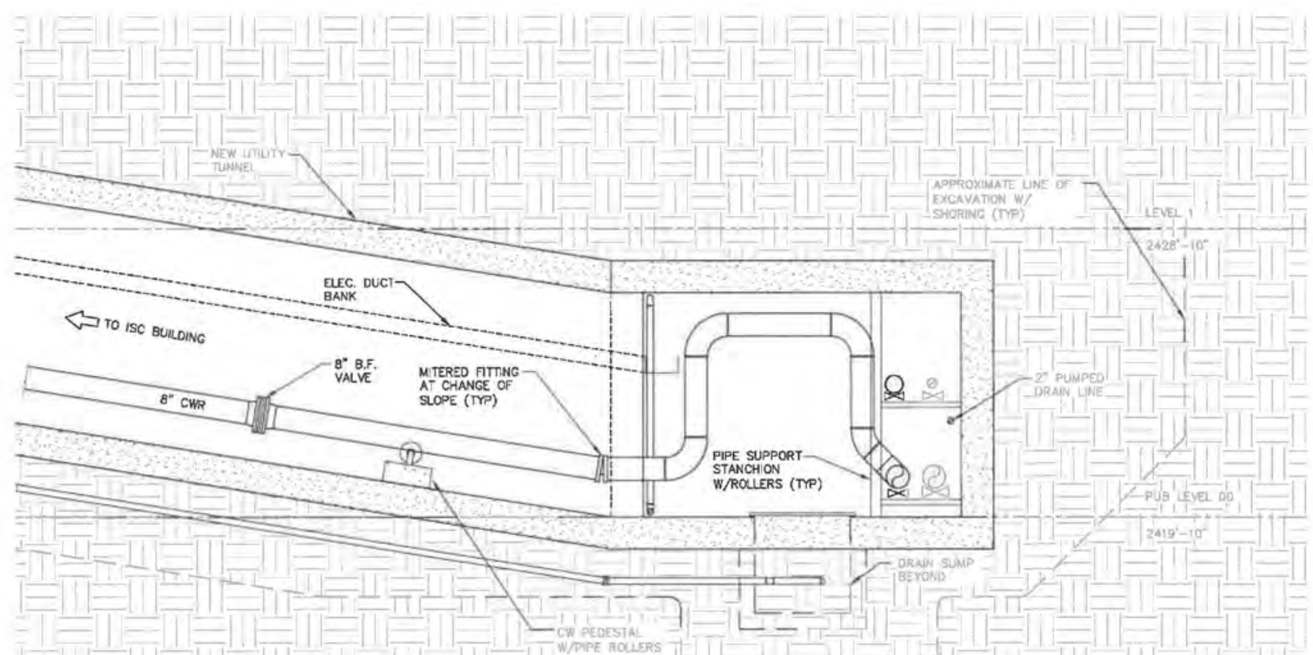
3 TUNNEL CORNER - SECTION - 3

Scale: 3/8"=1'-0"

0 2.5' 5' 10'

SCALE 3/8"=1'-0"

det #:



4 TUNNEL CORNER - SECTION - 4

Scale: 3/8"=1'-0"

det #:

PUB TO ISC UTILITY TUNNEL

EASTERN WASHINGTON UNIVERSITY

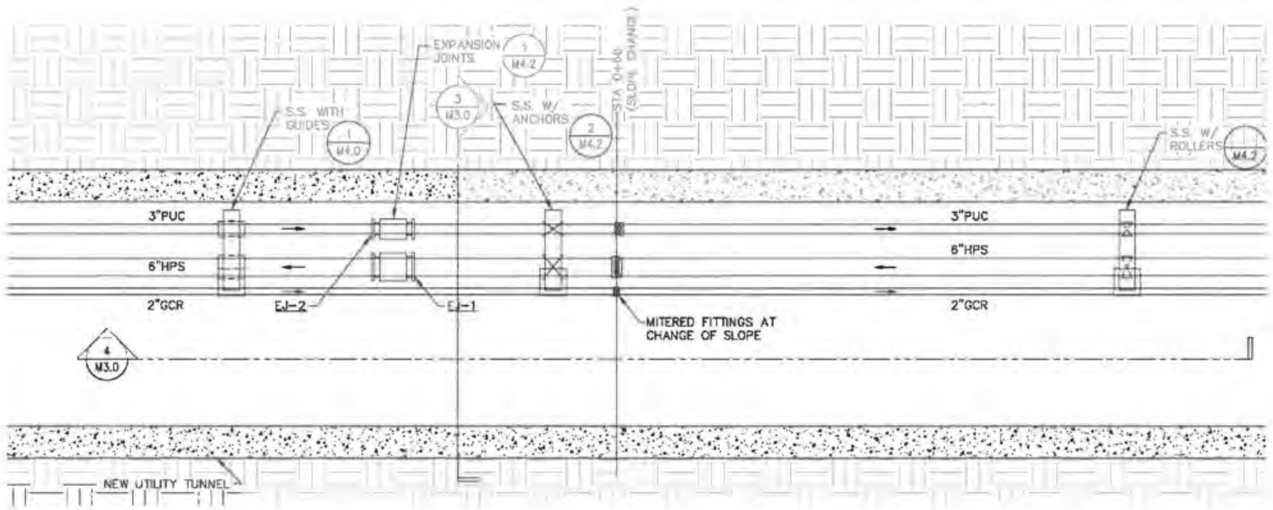
CHENEY, WASHINGTON

TUNNEL SECTIONS

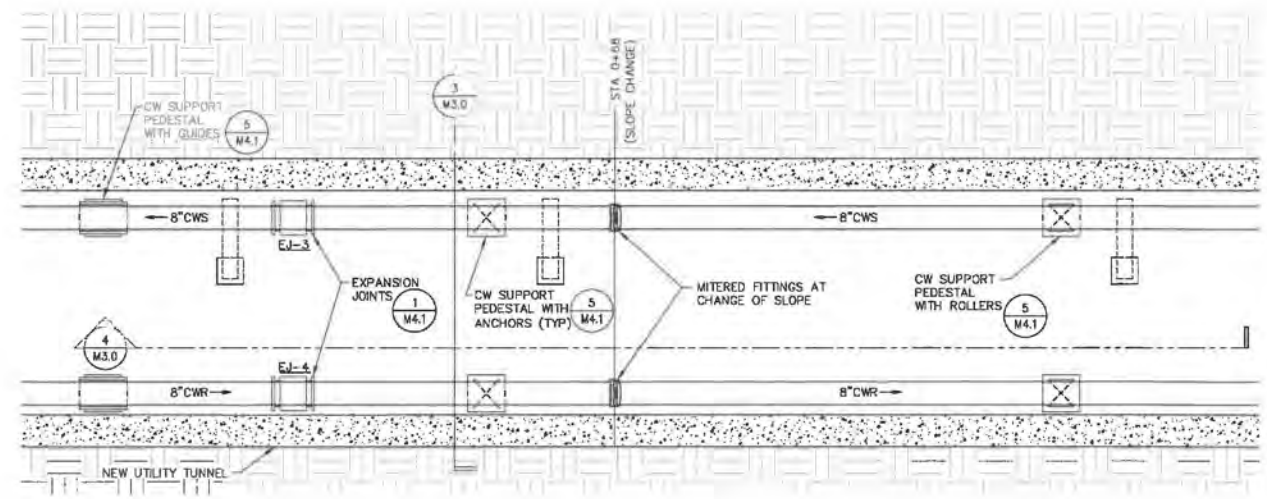
MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

PROJECT NO:	16.31
DRAWN BY:	—
CHECKED BY:	—
DATE:	12-30-16

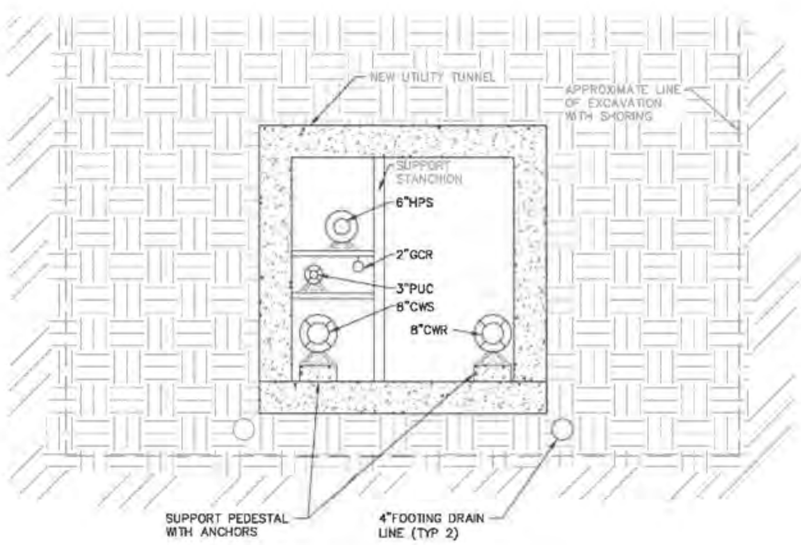
M2.1



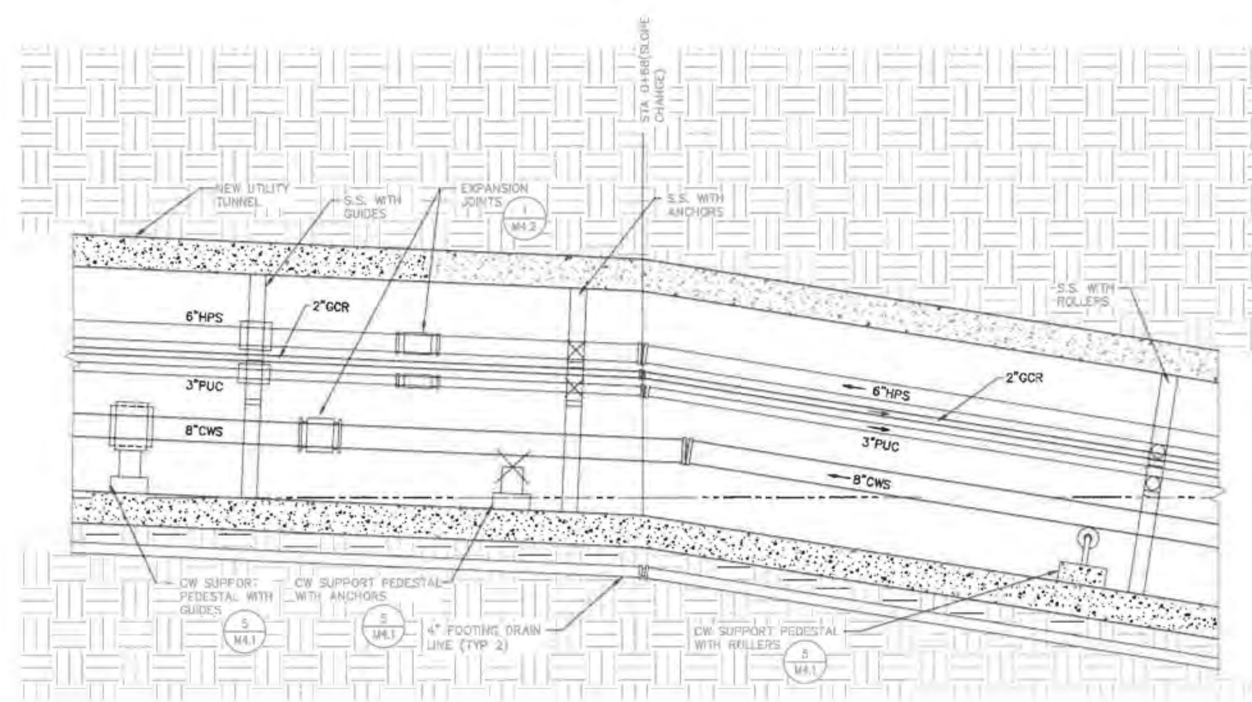
1 UPPER LEVEL PIPING (STEAM)
Scale: 3/8"=1'-0" det #:



2 LOWER LEVEL PIPING (CHILLED WATER)
Scale: 3/8"=1'-0" det #:



3 SECTION
Scale: 3/8"=1'-0" det #:



4 SECTION
Scale: 3/8"=1'-0" det #

0 2.5' 5' 10'
SCALE 3/8"=1'-0"

PUB TO ISC UTILITY TUNNEL
EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON

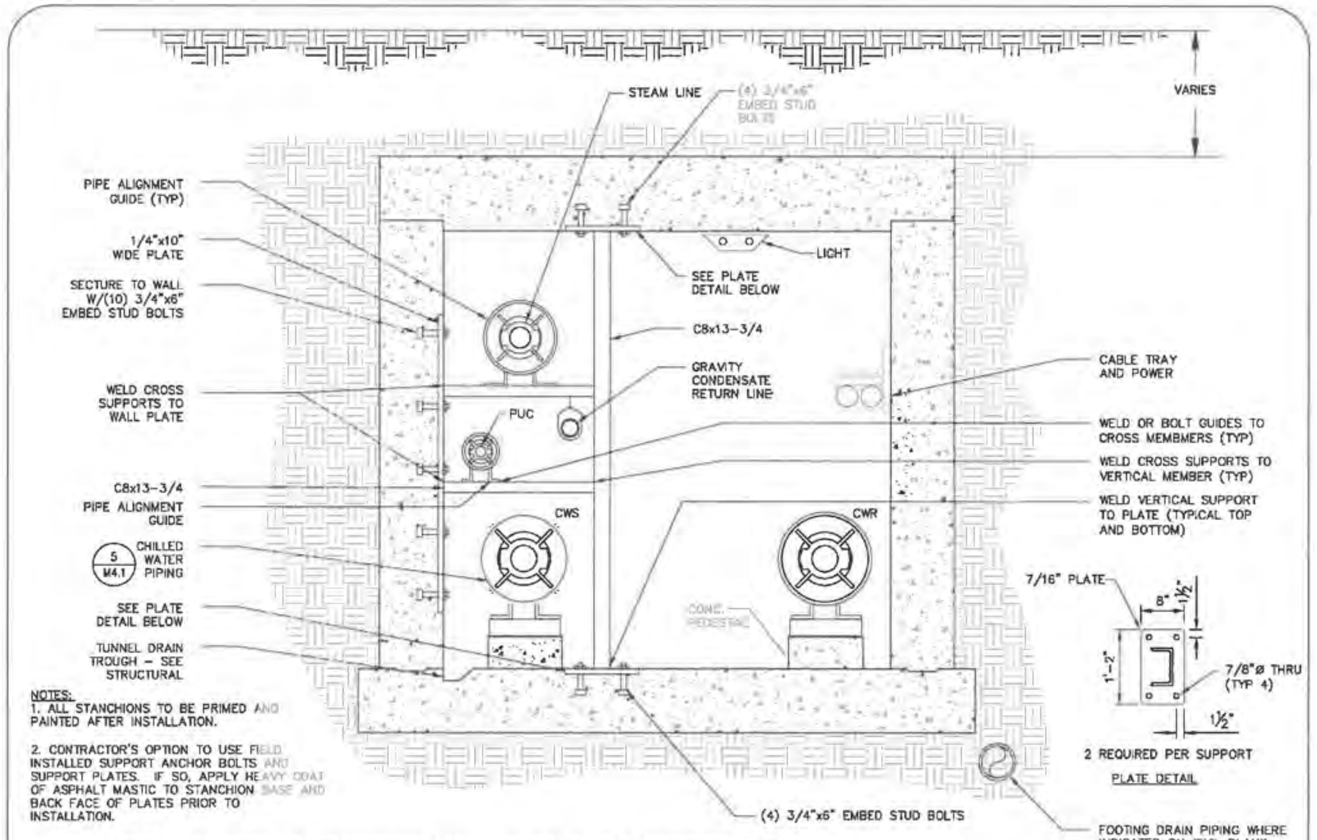
PARTIAL LARGE SCALE
TUNNEL PLANS & SECTION

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

PROJECT NO:	16.31
DRAWN BY:	-
CHECKED BY:	-
DATE:	12-30-16

M3.0

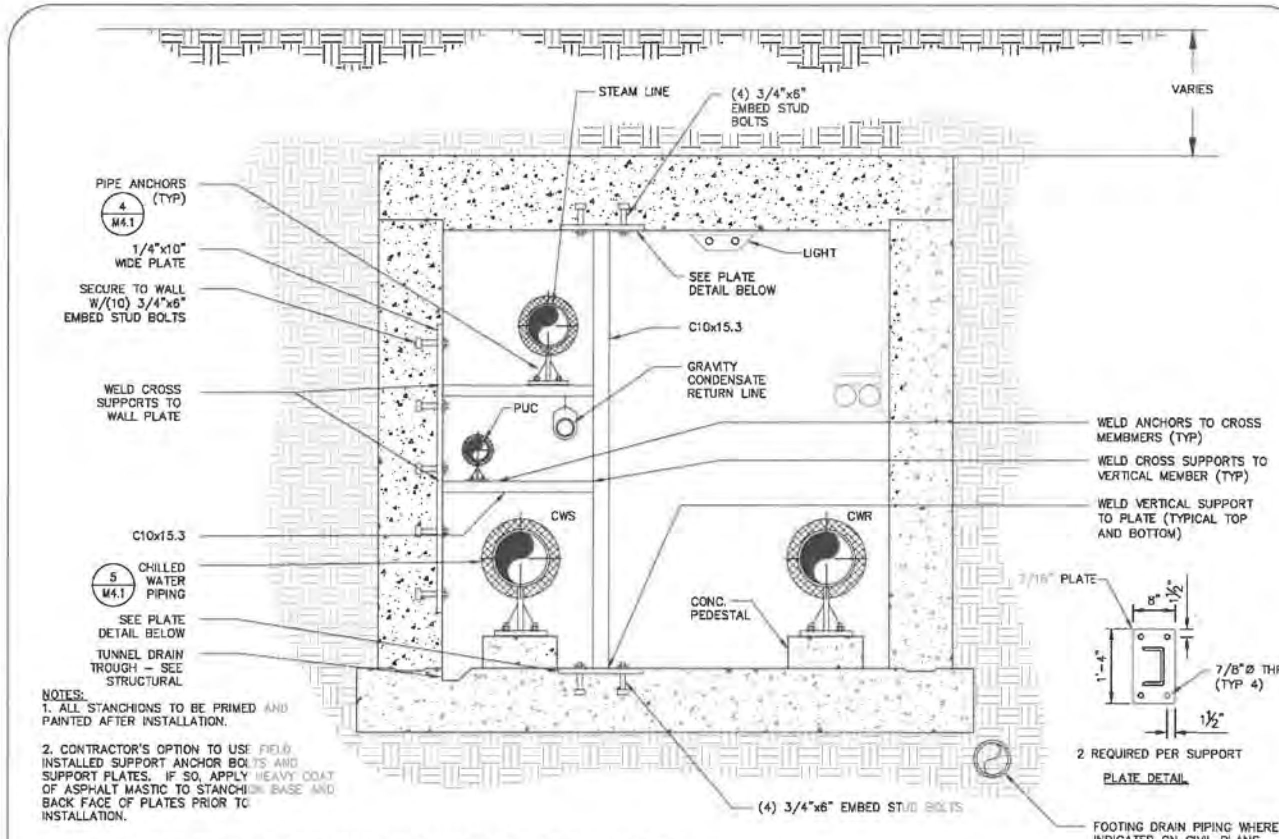
P:\2016\16-31\Cad\16-31 M3-0.dwg on Thu, December 29 2016 at 01:31 PM



NOTES:
1. ALL STANCHIONS TO BE PRIMED AND PAINTED AFTER INSTALLATION.
2. CONTRACTOR'S OPTION TO USE FIELD INSTALLED SUPPORT ANCHOR BOLTS AND SUPPORT PLATES. IF SO, APPLY HEAVY COAT OF ASPHALT MASTIC TO STANCHION BASE AND BACK FACE OF PLATES PRIOR TO INSTALLATION.

1 TYPICAL SUPPORT STANCHION WITH PIPE ALIGNMENT GUIDES

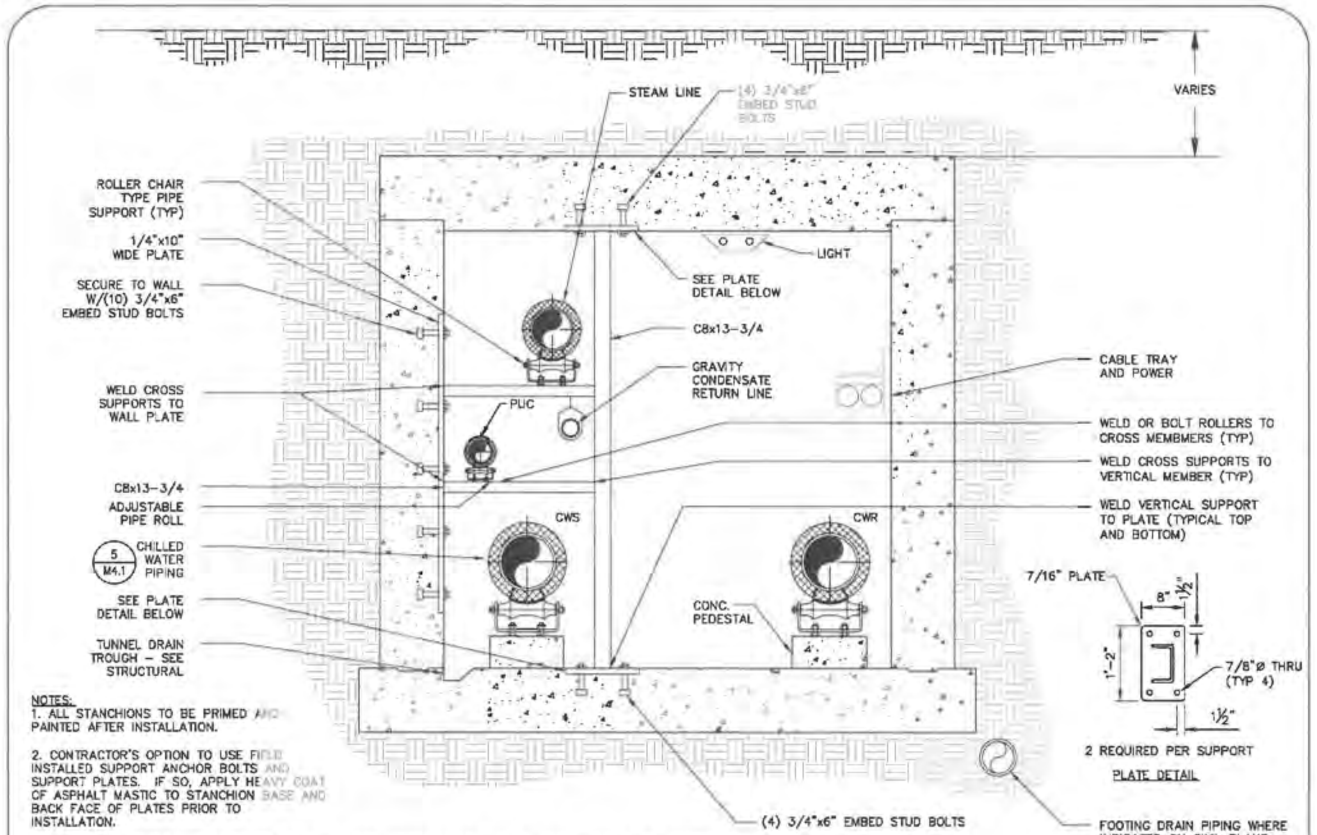
Scale: 3/4" = 1'-0"



NOTES:
1. ALL STANCHIONS TO BE PRIMED AND PAINTED AFTER INSTALLATION.
2. CONTRACTOR'S OPTION TO USE FIELD INSTALLED SUPPORT ANCHOR BOLTS AND SUPPORT PLATES. IF SO, APPLY HEAVY COAT OF ASPHALT MASTIC TO STANCHION BASE AND BACK FACE OF PLATES PRIOR TO INSTALLATION.

2 TYPICAL SUPPORT STANCHION WITH PIPE ANCHORS

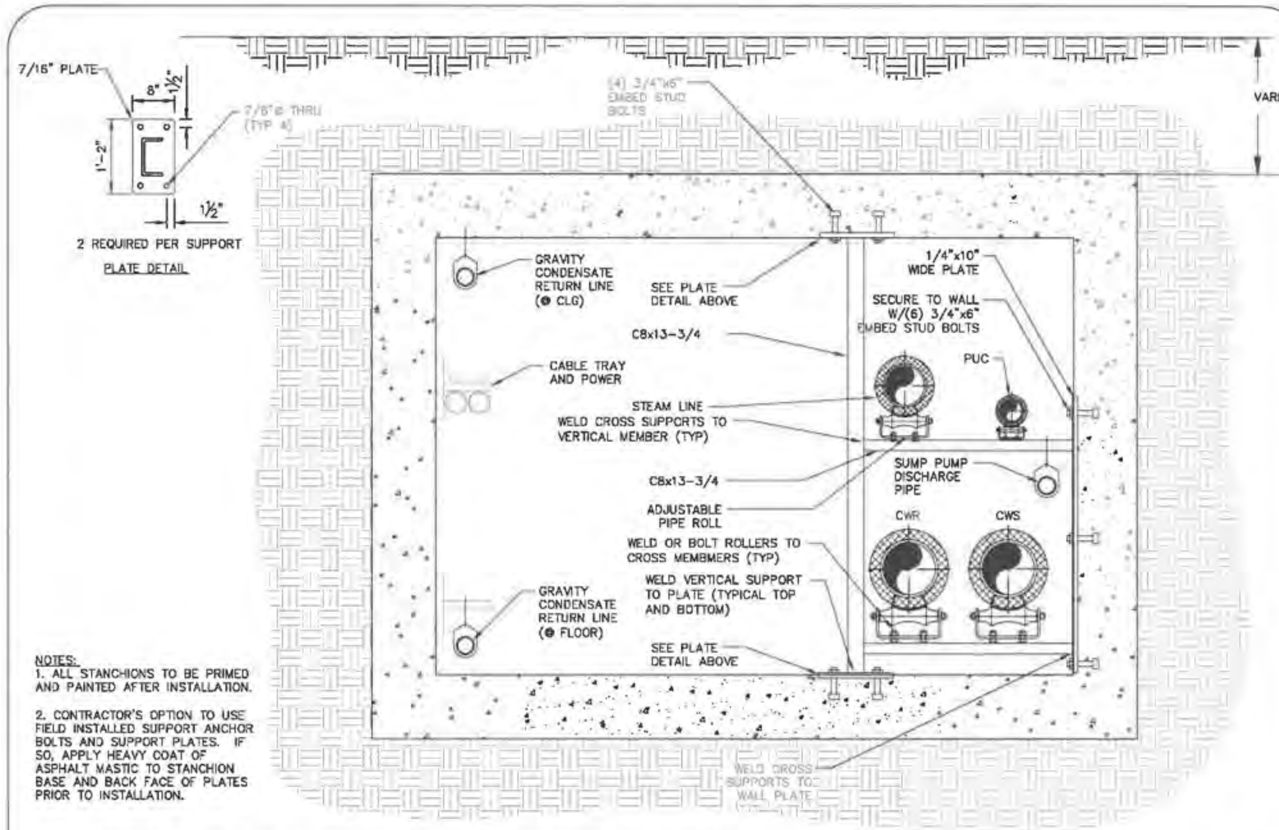
Scale: 3/4" = 1'-0"



NOTES:
1. ALL STANCHIONS TO BE PRIMED AND PAINTED AFTER INSTALLATION.
2. CONTRACTOR'S OPTION TO USE FIELD INSTALLED SUPPORT ANCHOR BOLTS AND SUPPORT PLATES. IF SO, APPLY HEAVY COAT OF ASPHALT MASTIC TO STANCHION BASE AND BACK FACE OF PLATES PRIOR TO INSTALLATION.

3 TYPICAL SUPPORT STANCHION WITH ROLLER TYPE PIPE SUPPORTS

Scale: 3/4"=1'-0"



NOTES:
1. ALL STANCHIONS TO BE PRIMED AND PAINTED AFTER INSTALLATION.
2. CONTRACTOR'S OPTION TO USE FIELD INSTALLED SUPPORT ANCHOR BOLTS AND SUPPORT PLATES. IF SO, APPLY HEAVY COAT OF ASPHALT MASTIC TO STANCHION BASE AND BACK FACE OF PLATES PRIOR TO INSTALLATION.

4 TYPICAL SUPPORT STANCHIONS AT PUB TIE-IN JUNCTION

Scale: 3/4"=1'-0"

PUB TO ISC UTILITY TUNNEL
EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON

LARGE SCALE TUNNEL SECTIONS

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

PROJECT NO:	16.31
DRAWN BY:	—
CHECKED BY:	—
DATE:	12-30-16

M4.0

CHILLED WATER CAPACITY UPGRADE
BP-2 - CHILLER PLANT LOADING DOCK ADDITION

BID PACK - 2

ROZELL CENTRAL ENERGY PLANT

EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON 99004
PROJECT NO. AE-1484-G3

INDEX OF DRAWINGS - BP-2

DESIGN TEAM

OWNER

EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON 99004
CONTACT: STEVE SCHMEDDING - PROJECT MGR
EMAIL: sschmedding@ewu.edu
PHONE:(509)359-4205

MECHANICAL

MSI ENGINEERS
108 N. WASHINGTON, SUITE 505
SPOKANE, WASHINGTON 99201
CONTACT: BRAD SNOW
EMAIL: brad@msi-engineers.com
PHONE:(509)624-1050

ELECTRICAL

NAC ENGINEERS
1203 W. RIVERSIDE AVE.
SPOKANE, WASHINGTON 99201
CONTACT: NATHAN HAUBER
EMAIL: nhauber@nacarchitecture.com
PHONE:(509)838-8240

CIVIL

DCI ENGINEERS
707 W. 2ND AVE.
SPOKANE, WASHINGTON 99201
CONTACT: RYAN BERG
EMAIL: rberg@dci-engineers.com
PHONE:(509)227-6914

STRUCTURAL

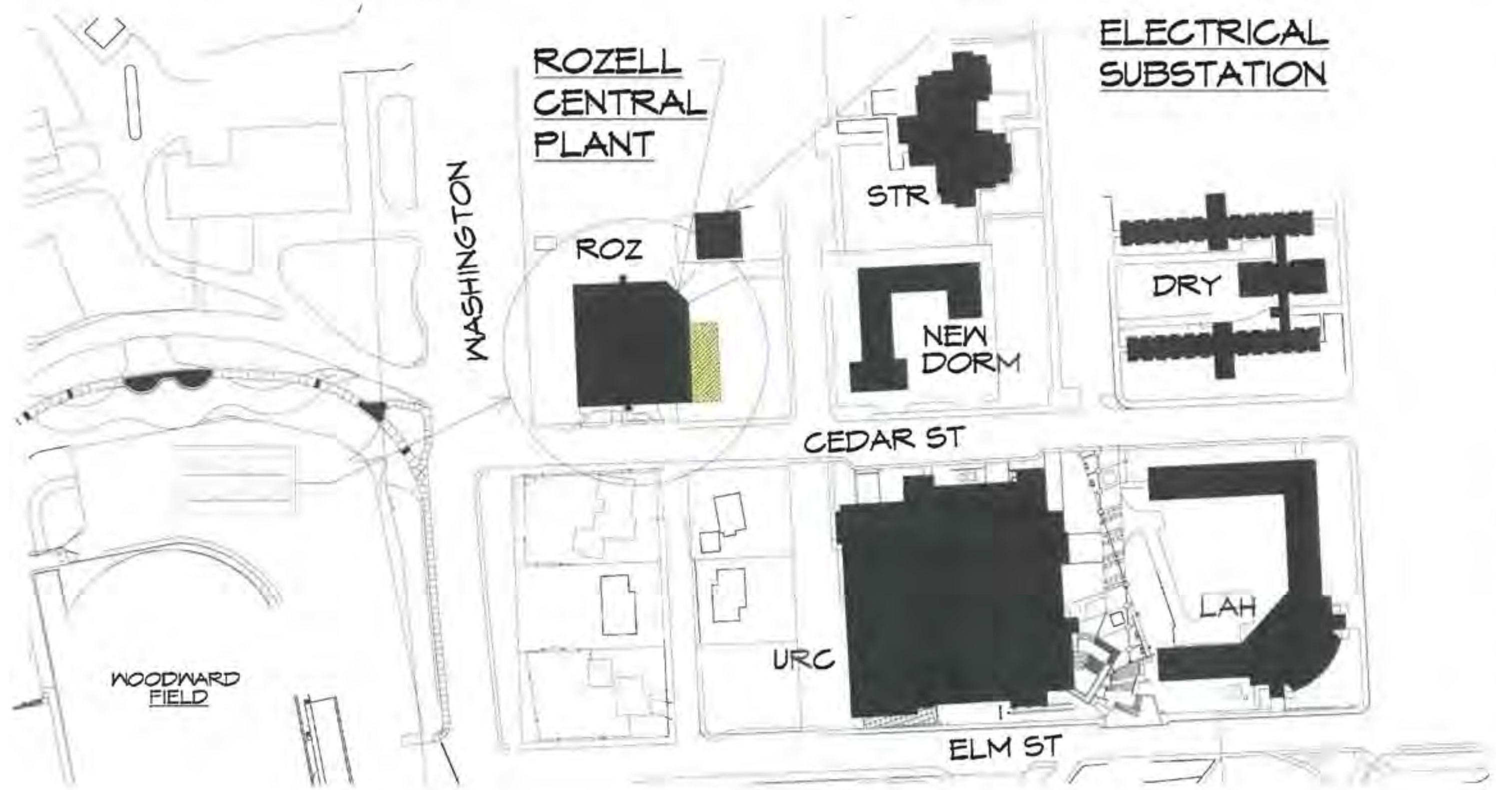
DCI ENGINEERS
707 W. 2ND AVE.
SPOKANE, WASHINGTON 99201
CONTACT: BRIAN PARSONS
EMAIL: bparsons@dci-engineers.com
PHONE:(509)455-4448

ARCHITECTURAL

NAC ARCHITECTURE
1203 W. RIVERSIDE AVE.
SPOKANE, WASHINGTON 99201
CONTACT: DOUG HEYAMOTO
EMAIL: dhayamoto@nacarchitecture.com
PHONE:(509)838-8240

WASHINGTON STATE

VICINITY MAP



EWU CAMPUS MAP

BID SET - MARCH 31, 2017

M E U L I N K   S T A U F F E N B E R G   I N C   -   M E C H A N I C A L   S Y S T E M S

CHILLED WATER CAPACITY UPGRADE
BP-2 - CHILLER PLANT LOADING DOCK ADDITION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

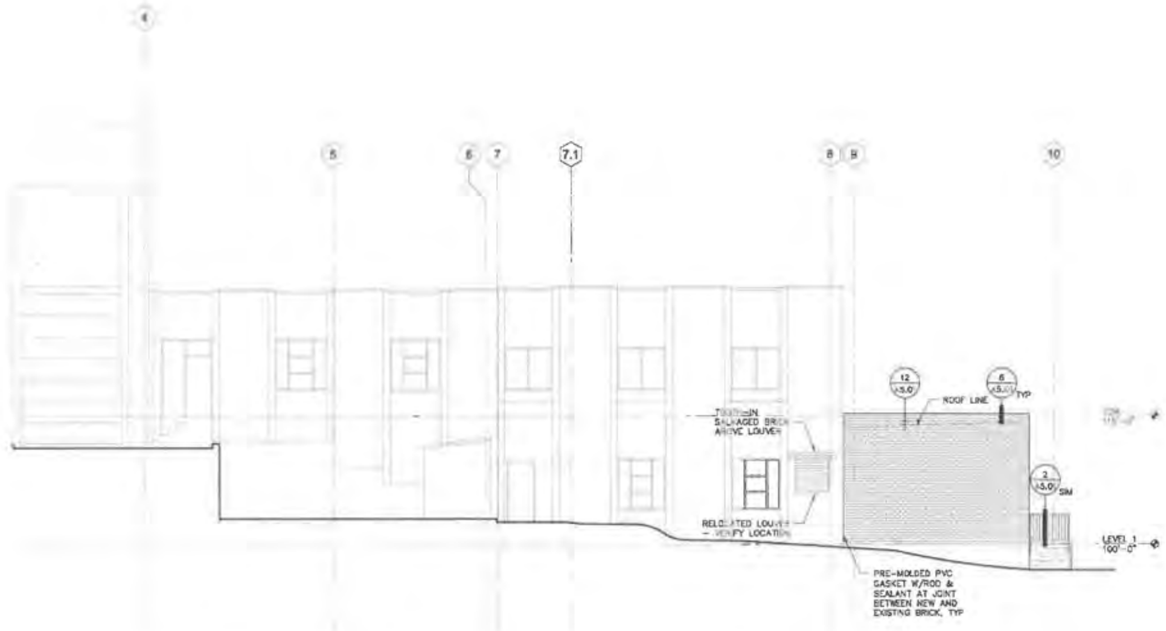
COVER SHEET

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

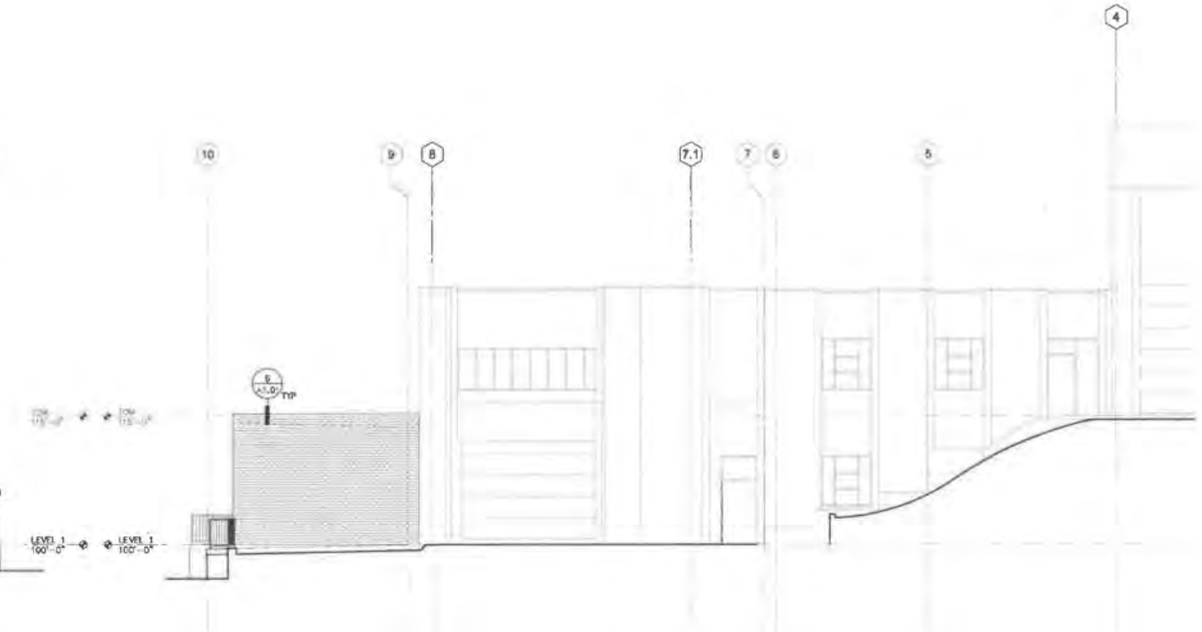
Project number:	16.04
Drawn by:	NAH
Checked by:	JBS
Date:	03/31/17

G2-1.0

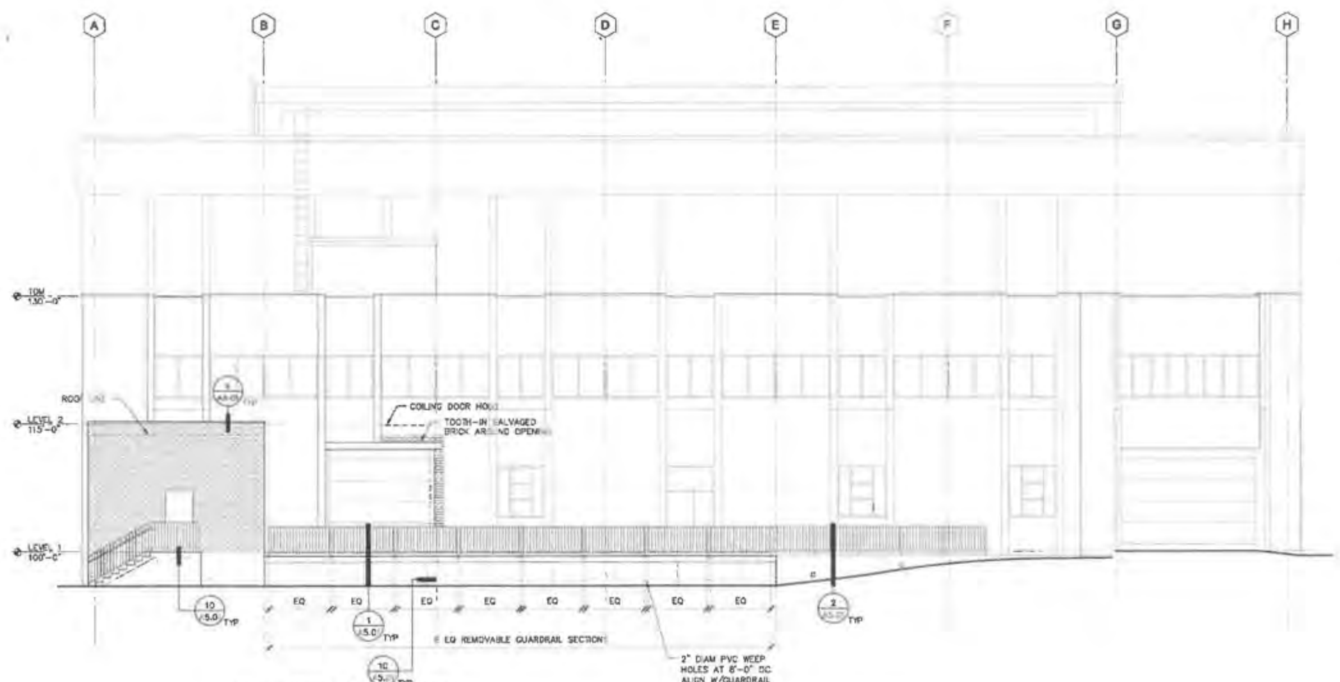
3/29/2017 10:44:02 AM



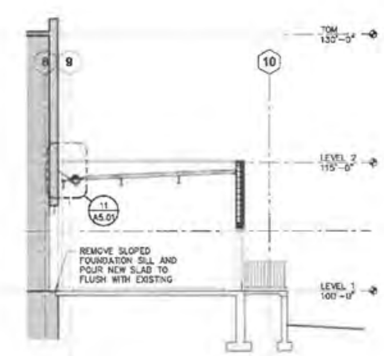
1 SOUTH ELEVATION
Scale: 1/8" = 1'-0"



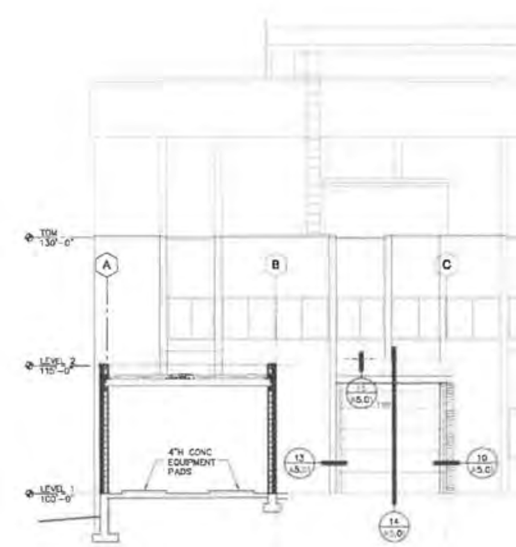
2 NORTH ELEVATION
Scale: 1/8" = 1'-0"



3 EAST ELEVATION
Scale: 1/8" = 1'-0"



4 SECTION - A
Scale: 1/8" = 1'-0"



5 SECTION - B
Scale: 1/8" = 1'-0"

MEULINK STAUFFENBERG INC. MECHANICAL SYSTEMS

REGISTERED ARCHITECT
STATE OF WASHINGTON

No.	Date	Description

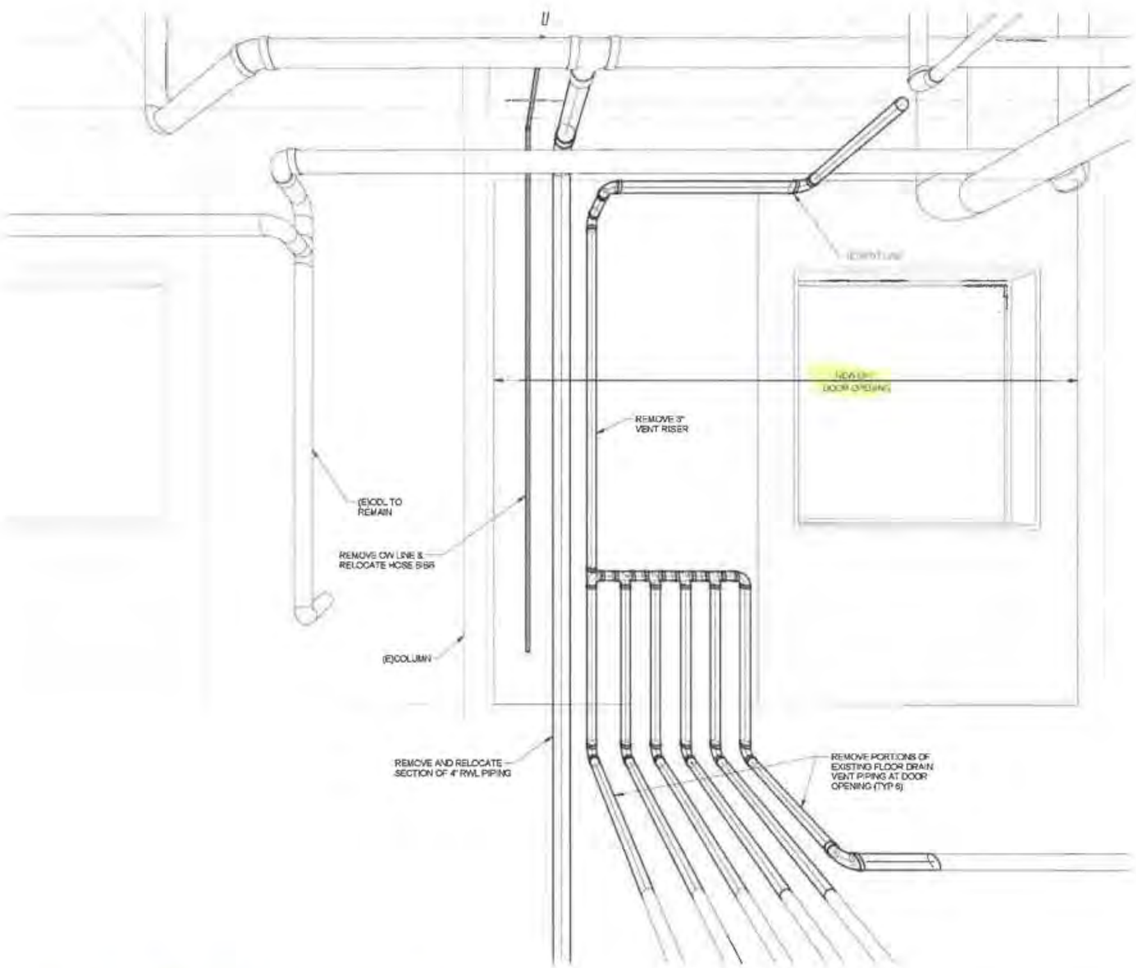
CHILLED WATER CAPACITY UPGRADE
BP-2 - CHILLER PLANT LOADING DOCK ADDITION
ROZELL CENTRAL PLANT - EWU - CHENEY, WA

GROUND FLOOR LOADING PLATFORM

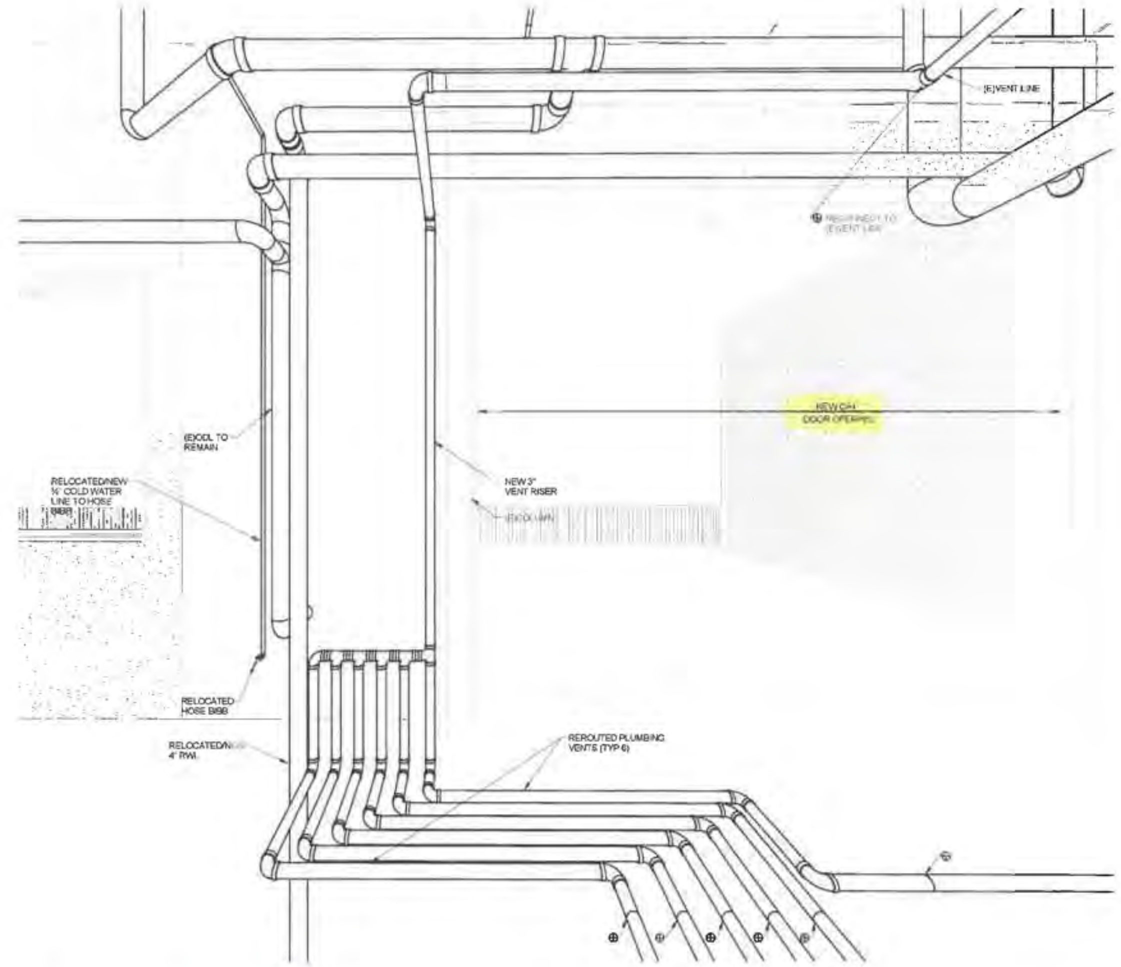
MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

PROJECT NO:	15-04
DRAWN BY:	DRP/KCM
CHECKED BY:	DGH
DATE:	03/31/17

A2-4.01



1 **PIPING DEMOLITION RISER DIAGRAM**
SCALE:



2 **NEW PIPING RISER DIAGRAM**
SCALE:

M E U L I N K   S T A U F F E N B E R G   I N C . - M E C H A N I C A L   S Y S T E M S

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-2 - CHILLER PLANT LOADING DOCK ADDITION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

MECHANICAL & PLUMBING SECTIONS

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

Project number:	16.04
Drawn by:	NAH
Checked by:	JSS
Date:	03/31/17

M2-3.0

3/29/2017 11:08:44 AM

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL ENERGY PLANT

BID PACK - 3

EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON 99004
PROJECT NO. AE-1484-G4


W IN N E

VICIN MAP

INDEX OF DRAWINGS - BP-3

DESIGN TEAM

OWNER

EASTERN WASHINGTON UNIVERSITY
CHENEY, WASHINGTON 99004
CONTACT: STEVE SCHMEDDING - PROJECT MGR
EMAIL: sschmedding@ewu.edu
PHONE:(509)359-4205

MECHANICAL

MSI ENGINEERS
108 N. WASHINGTON, SUITE 505
SPOKANE, WASHINGTON 99201
CONTACT: BRAD SNOW
EMAIL: brad@msi-engineers.com
PHONE:(509)624-1050

ELECTRICAL

NAC ENGINEERS
1203 W. RIVERSIDE AVE.
SPOKANE, WASHINGTON 99201
CONTACT: NATHAN HAUBER
EMAIL: nhauber@nacarchitecture.com
PHONE:(509)838-8240

CIVIL

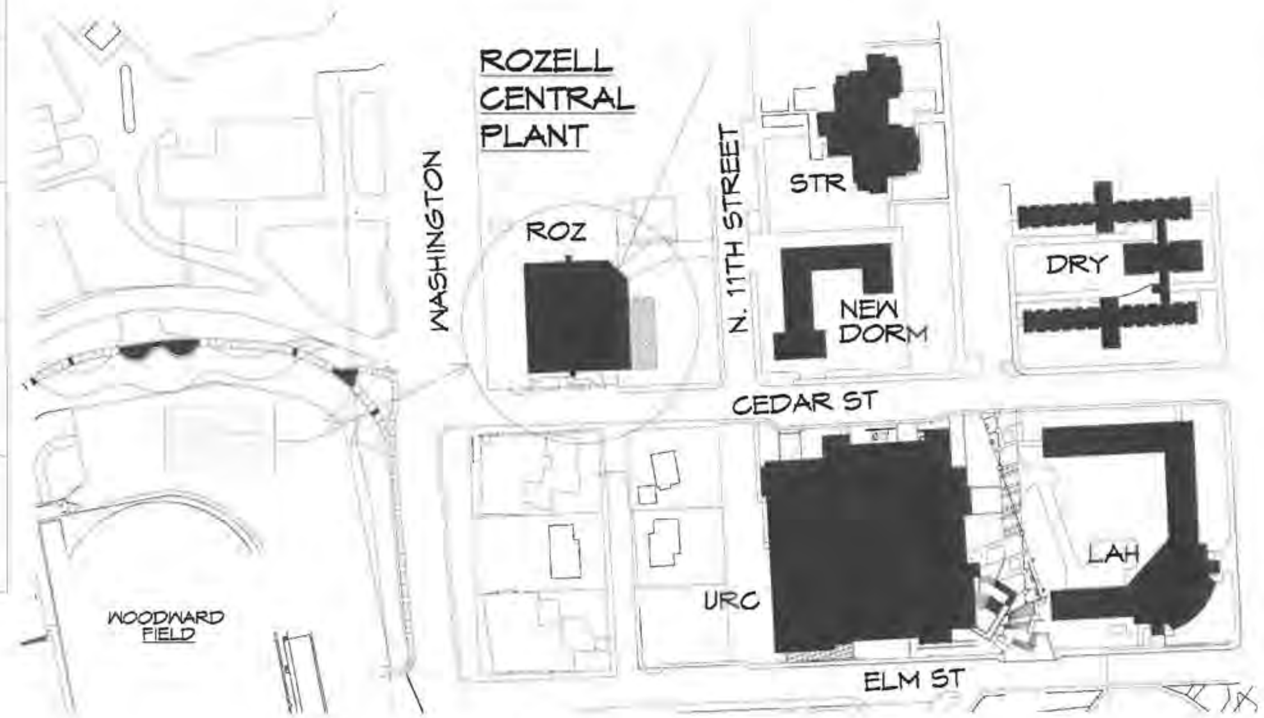
DCI ENGINEERS
707 W. 2ND AVE.
SPOKANE, WASHINGTON 99201
CONTACT: RYAN BERG
EMAIL: rberg@dci-engineers.com
PHONE:(509)227-6914

STRUCTURAL

DCI ENGINEERS
707 W. 2ND AVE.
SPOKANE, WASHINGTON 99201
CONTACT: BRIAN PARSONS
EMAIL: bparsons@dci-engineers.com
PHONE:(509)455-4448

ARCHITECTURAL

NAC ARCHITECTURE
1203 W. RIVERSIDE AVE.
SPOKANE, WASHINGTON 99201
CONTACT: DOUG HEYAMOTO
EMAIL: dhayamoto@nacarchitecture.com
PHONE:(509)838-8240



EWU C PUS MAP

BID SET - JUNE 23, 2017

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA
COVER SHEET

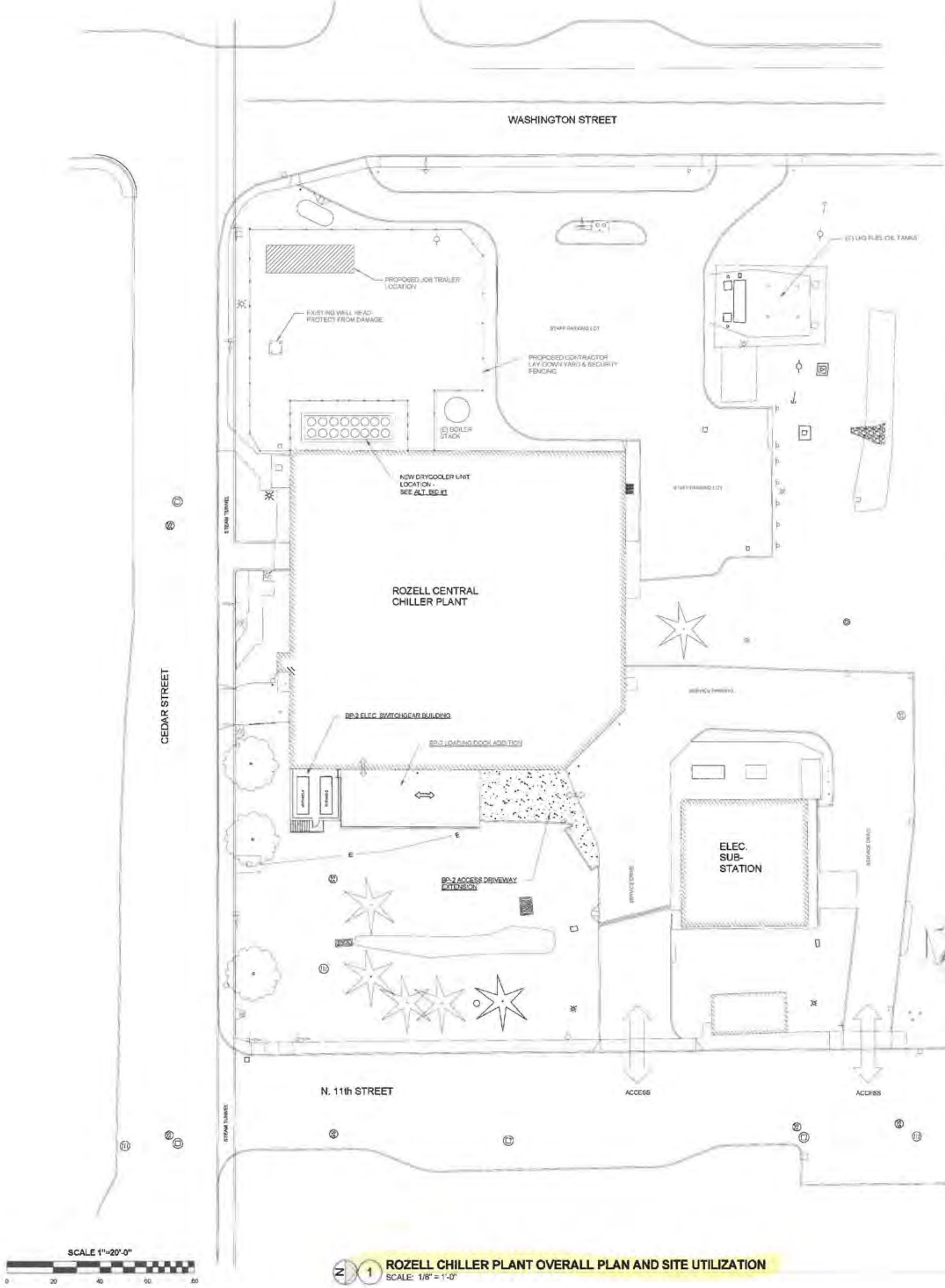
BID SET

MEULINK STAUFFENBERG - MECHANICAL SYSTEMS

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

Project number	16.04
Drawn by	NAH
Checked by	JBS
Date	06/23/17

G3-1.0



1 ROZELL CHILLER PLANT OVERALL PLAN AND SITE UTILIZATION
SCALE: 1/8" = 1'-0"

PHASING NOTES & CRITICAL DEADLINES

1. CRITICAL DEADLINES AND PHASING:

   A) - OCTOBER 1, 2017: EXISTING CHILLER PLANT SHALL REMAIN IN OPERATION UNTIL OCTOBER 1, 2017. PLANT SHUT-DOWN AND FULL DEMOLITION ACTIVITIES SHALL NOT OCCUR UNTIL AFTER THIS DATE. PARTIAL DEMOLITION ACTIVITIES MAY OCCUR PRIOR TO THIS DATE UPON EWU APPROVAL, IF CHILLER PLANT CAPACITY IS NOT IMPACTED.

   B) - APRIL 1, 2018: NEW CHILLER PLANT, OPERATING AT PARTIAL CAPACITY NO LESS THAN 2,000 TONS, SHALL BE ON-LINE AND AVAILABLE FOR CAMPUS COOLING.

   C) - JUNE 1, 2018: NEW CHILLER PLANT, OPERATING AT FULL CAPACITY, 5,000 TONS, SHALL BE ON-LINE AND AVAILABLE FOR CAMPUS COOLING.

   D) - REFER TO THE PROJECT MANUAL GENERAL CONDITIONS REGARDING SUBSTANTIAL COMPLETION REQUIREMENT (FULL AND PARTIAL) AND LIQUIDATED DAMAGE PROVISIONS FOR FAILURE TO MEET REQUIRED PERFORMANCE DEADLINES.

2. NEW LOADING DOCK (BP-2 WORK): USE OF THE NEW LOADING DOCK BEING CONSTRUCTED UNDER BID PACK BP-2 SHALL BE GENERALLY READY FOR USE FOR THE BID PACK BP-3 CHILLER PLANT MODERNIZATION PROJECT. COORDINATE ACCESS WITH BP-2 CONTRACTOR DURING ANY MINOR OVERLAPPING WORK ACTIVITIES.

3. PRE-FABRICATION: THE CONTRACTOR IS ENCOURAGED TO PRE-PURCHASE AND STOCKPILE ON SITE, AS MUCH MATERIAL AND EQUIPMENT AS POSSIBLE SO AS TO EXPEDITE THE NEW INSTALLATION WORK. WHERE PREFABRICATION OF PIPING IS FEASIBLE IT SHALL BE UTILIZED IN ORDER TO ACCELERATE NEW INSTALLATION WORK.

ALTERNATE BID ITEMS

1. ALTERNATE BID ITEMS:

   - THE FOLLOWING LIST IS A BRIEF DESCRIPTION OF THE ALTERNATE BID ITEMS FOR THE PROJECT. REFER TO THE PROJECT DRAWINGS AND SPECIFICATIONS FOR COMPLETE INFORMATION.

ALT. BID #1 - WATERSIDE ECONOMIZER SYSTEM

FURNISH AND INSTALL A NEW DRYCOOLER UNIT, DC-1, DUPLEX DRYCOOLER PUMPS, DCP-1/2, ASSOCIATED AIR SEPARATOR, AS-1, EXPANSION TANK, ET-1, GLYCOL FEEDER, GF-1, AND ALL RELATED PIPING, VALVES, INSULATION, POWER, CONTROLS AND FLUIDS TO PROVIDE FOR A NEW WATERSIDE ECONOMIZER SYSTEM. UNDER THE BASE BID THE BRANCH TAKE-OFF FROM HEAT EXCHANGER HX-2 TO THE DRYCOOLER LOOP SHALL BE VALVED AND CAPPED.

GENERAL NOTES

1. SITE UTILIZATION REQUIREMENTS:

   REFER TO THE PROJECT SPECIFICATIONS FOR FULL PROJECT SITE UTILIZATION AND COORDINATION REQUIREMENTS.

2. PHASING:

   - REFER TO PHASING NOTES AND PROJECT TIMELINE REQUIREMENTS FOR CRITICAL DEADLINES AND COORDINATION ACTIVITIES.

3. ACCESS TO SITE:

   - ACCESS TO THE SITE WILL GENERALLY BE OFF OF CEDAR AND N. 11TH STREETS, AS WELL AS THROUGH THE ROZELL SERVICE DRIVEWAYS. DO NOT BLOCK REGULAR STREET TRAFFIC OR EWU SERVICE TRAFFIC UNLESS APPROVED IN ADVANCE BY EWU AND THE CITY OF CHENEY.

4. LAY-DOWN & STAGING AREAS:

   - LAY-DOWN AND STAGING AREAS FOR THE PROJECT JOB TRAILER AND CONSTRUCTION MATERIALS WILL BE WITHIN ROZELL SITE AREA AS INDICATED.

5. JOB TRAILERS:

   - A LOCATION FOR A SINGLE JOB TRAILER FOR THE PROJECT WILL BE AS INDICATED. ALL OTHER JOB TRAILERS AND STORAGE CONTAINERS WILL NEED TO BE LOCATED WITHIN THE LAY-DOWN AREA, OR ON-STREET PARKING AREAS IF APPROVED BY EWU FACILITY STAFF AND CAMPUS PARKING.

6. STEAM TUNNEL PROTECTION:

   - THE EXISTING UNDER-SIDEWALK STEAM TUNNEL THAT RUNS ALONG CEDAR STREET SHALL BE PROTECTED FROM DAMAGE DUE TO EXCESSIVE WEIGHT VEHICLE OR EQUIPMENT MOVEMENT DURING THE PROJECT. PROVIDE PROTECTIVE STEEL PLATING OR OTHER METHODS AS NECESSARY.

7. SITE PROTECTION AND RESTORATION:

   - THE EXISTING CONDITIONS OF THE PROJECT SITE SHALL BE PROTECTED FROM DAMAGE DUE TO THE CONSTRUCTION ACTIVITIES. WHERE LAWNS, SIDEWALKS, VEGETATION, ETC. ARE DAMAGED DURING CONSTRUCTION, THEY SHALL BE REPAIRED/RESTORED TO ORIGINAL CONDITION PRIOR TO THE END OF THE PROJECT.

8. UNDERFLOOR UTILITIES PROTECTION:

   - EXISTING UNDERFLOOR UTILITIES & CONDUITS IN THE VICINITY OF THE PROJECT FLOOR REMOVAL WORK ARE NOT DOCUMENTED AND SHALL BE CAREFULLY LOCATED BY HAND DIGGING IN THE AFFECTED ARES, AND SHALL BE PROTECTED FROM DAMAGE THROUGHOUT THE COURSE OF THE PROJECT.

9. FLOOR SLAB PROTECTION:

   - PROTECT THE EXISTING ROZELL PLANT FLOOR SLAB AND NEW LOADING DOCK FROM EXCESSIVE LOADING FORCES WHEN REMOVING OLD EQUIPMENT AND INSTALLING NEW EQUIPMENT. PROVIDE PROTECTIVE STEEL PLATING OR OTHER METHODS TO AVOID DAMAGE.

GENERAL NOTES

10. ELECTRICAL GEAR PROTECTION:

    - PROVIDE PROTECTIVE, DUST PROOF, ENCLOSURES/TEMPORARY WALLS AROUND ALL ELECTRICAL GEAR AND DEVICES THAT ARE LOCATED WITHIN THE CHILLER PLANT VICINITY. ENCLOSURES SHALL BE PRESSURIZED WITH CLEAN FILTERED AIR (FROM OUTSIDE) WITH TEMPORARY FANS AND DUCTING.

11. CRANE ACCESS AND STAGING:

    - THE CONTRACTOR SHALL DEVELOP A LIFT PLAN THE SPECIFIC TYPE, SIZE AND CAPACITY CRANE(S) TO BE UTILIZED ON THE PROJECT FOR COOLING TOWER, CHILLER AND MISC. EQUIPMENT REMOVAL AND INSTALLATION. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH THE CITY OF CHENEY AND EWU FOR ALL STREET CLOSURES.

12. OWNER SALVAGE:

    - UNLESS SPECIFICALLY INDICATED OTHERWISE, THE CONTRACTOR SHALL REMOVE ALL ITEMS AND EQUIPMENT INDICATED FOR DEMOLITION AND SHALL DISPOSE OF IN A SAFE AND LEGAL MANNER.

    - SPECIFIC OWNER SALVAGE ITEMS TO BE REMOVED AND TURNED OVER TO THE OWNER SHALL INCLUDE THE FOLLOWING:

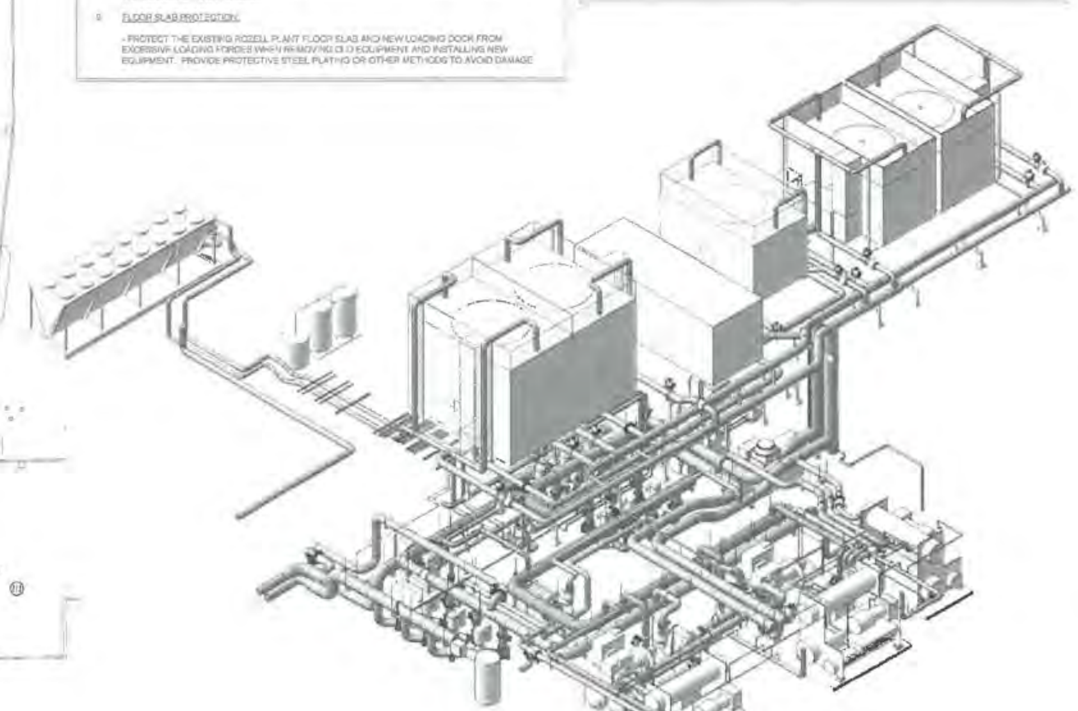
1. SELECT LARGE DIAMETER VALVES AND FITTINGS TO BE IDENTIFIED DURING DEMOLITION WORK.
2. WATER TREATMENT CHEMICAL CONTROLLERS.

13. OWNER FURNISHED EQUIPMENT:

    - THE FOLLOWING EQUIPMENT HAS BEEN PRE-PURCHASED BY THE OWNER (EWU) AND WILL BE DELIVERED TO THE JOB SITE UPON 10-DAY PRIOR NOTICE REQUEST FROM THE INSTALLING CONTRACTOR. UNLESS INDICATED OTHERWISE, OWNER FURNISHED EQUIPMENT WILL BE DELIVERED AND OFF-LOADED TO A DESIGNATED TEMPORARY SITE LOCATION AT THE OWNER'S EXPENSE. APPROPRIATE DUNNAGE TO BE PROVIDED BY THE PROJECT CONTRACTOR. FINAL INSTALLATION (RIGGING, LIFTING, HANDLING, CRANE WORK, ETC.) START-UP AND TESTING OF OWNER FURNISHED EQUIPMENT SHALL BE PROVIDED BY THIS PROJECT CONTRACTOR.

    OWNER FURNISHED EQUIPMENT LIST:

    - CHILLERS: CH-1 AND CH-2
    - COOLING TOWERS: CT-1 AND CT-2
    - TOWER WATER PUMPS: TWP-1, TWP-2, TWP-3
    - CHILLER PUMPS: CHP-1, CHP-2, CHP-3
    - CHILLED WATER PUMPS: CWP-1, CWP-2, CWP-3
    - ELECTRICAL GEAR: CIRCUIT BREAKERS FOR MECH. GEAR AS INDICATED.



M E U L I N K S T A U F F E N B E R G I N C - M E C H A N I C A L S Y S T E M S

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

OVERALL PLAN, PHASING AND GENERAL NOTES

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

Project number:	16.04
Drawn by:	NAH
Checked by:	JBS
Date:	06/23/17

G3-2.0

6/23/2017 11:14:52 AM

PHASING NOTES & CRITICAL DEADLINES

1. CRITICAL DEADLINES AND PHASING:

   A) - OCTOBER 1, 2017: CHILLER PLANT SHALL REMAIN IN OPERATION UNTIL OCTOBER 1, 2017. PLANT SHUT-DOWN AND FULL DEMOLITION ACTIVITIES SHALL NOT OCCUR UNTIL AFTER THIS DATE. PARTIAL DEMOLITION ACTIVITIES MAY OCCUR PRIOR TO THIS DATE, UPON EWU APPROVAL, IF CHILLER PLANT CAPACITY IS NOT IMPACTED.

   B) - APRIL 1, 2018: NEW CHILLER PLANT, OPERATING AT PARTIAL CAPACITY NO LESS THAN 2,000 TONS, SHALL BE ON-LINE AND AVAILABLE FOR CAMPUS COOLING.

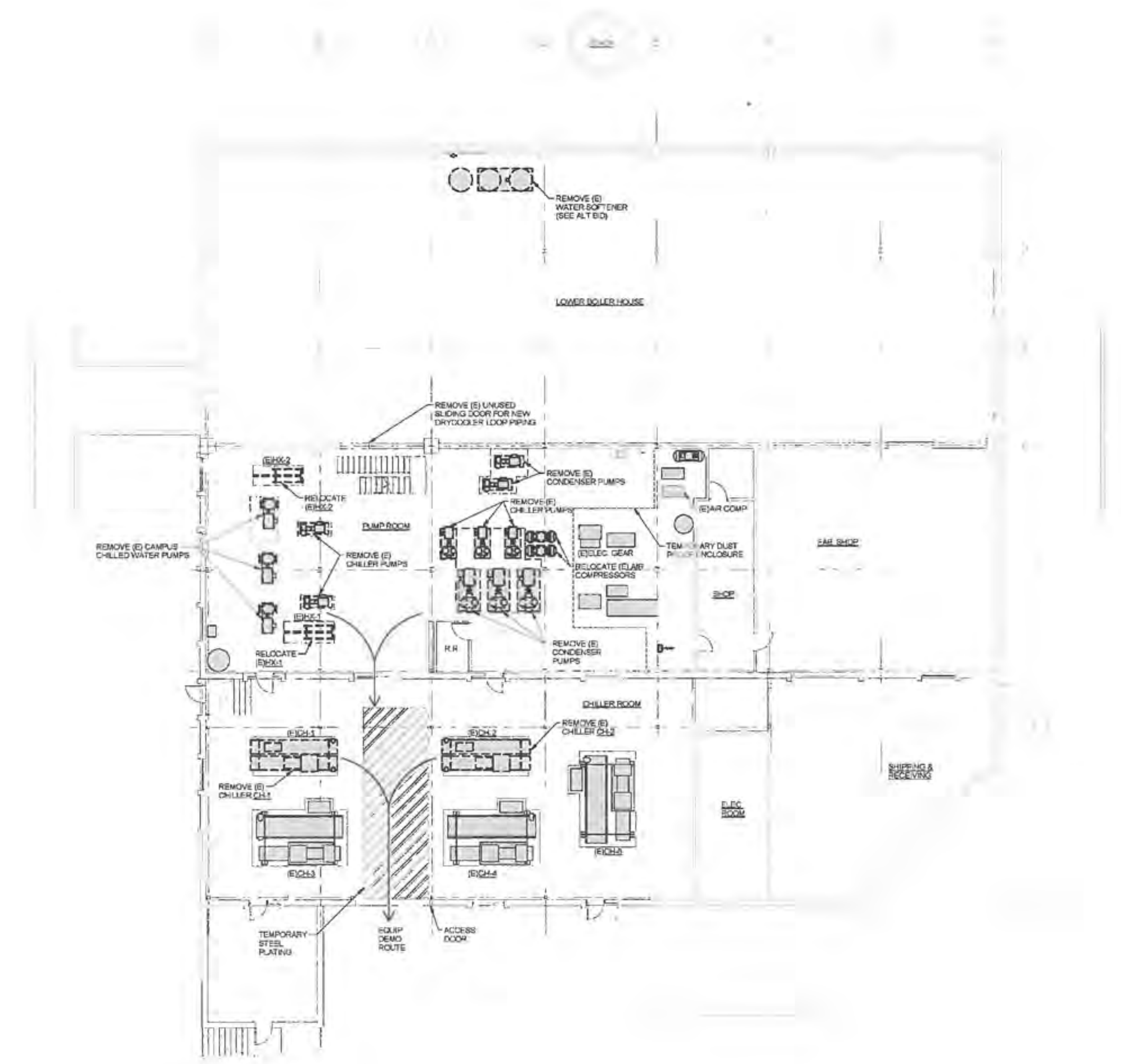
   C) - JUNE 1, 2018: NEW CHILLER PLANT, OPERATING AT FULL CAPACITY, 6,000 TONS, SHALL BE ON-LINE AND AVAILABLE FOR CAMPUS COOLING.

   D) - REFER TO THE PROJECT MANUAL GENERAL CONDITIONS REGARDING SUBSTANTIAL COMPLETION REQUIREMENT (FULL AND PARTIAL) AND LIQUIDATED DAMAGE PROVISIONS FOR FAILURE TO MEET REQUIRED PERFORMANCE DEADLINES.

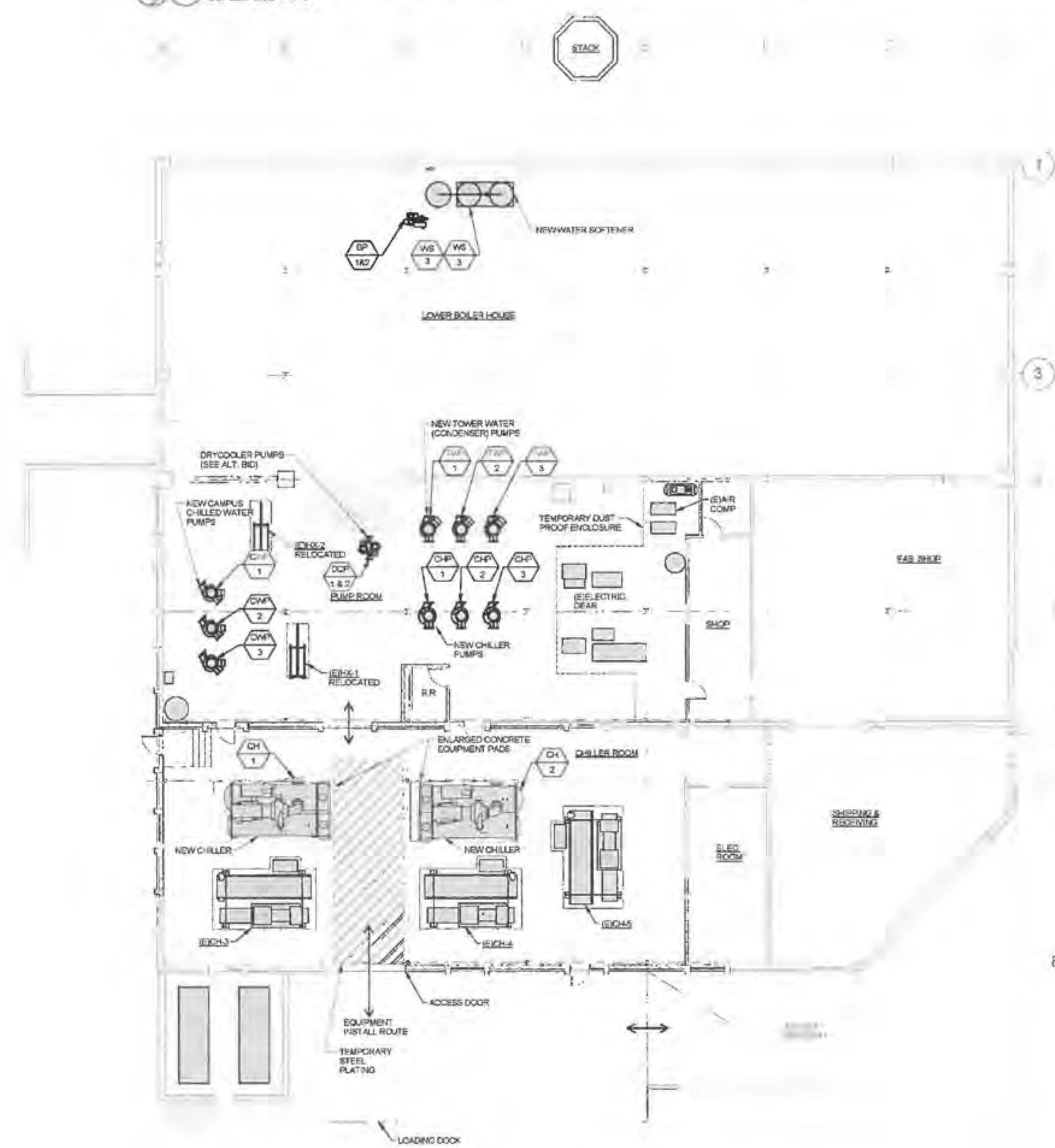
2. NEW LOADING DOCK (BP-2 WORK): USE OF THE NEW LOADING DOCK BEING CONSTRUCTED UNDER BID PACK BP-2 SHALL BE GENERALLY READY FOR USE FOR THE BID PACK BP-3 CHILLER PLANT MODERNIZATION PROJECT. COORDINATE ACCESS WITH BP-2 CONTRACTOR DURING ANY MINOR OVERLAPPING WORK ACTIVITIES.

3. PRE-FABRICATION: THE CONTRACTOR IS ENCOURAGED TO PRE-PURCHASE AND STOCKPILE ON SITE, AS MUCH MATERIAL AND EQUIPMENT AS POSSIBLE SO AS TO EXPEDITE THE NEW INSTALLATION WORK. WHERE PREFABRICATION OF PIPING IS FEASIBLE IT SHALL BE UTILIZED IN ORDER TO ACCELERATE NEW INSTALLATION WORK.

3 PARTIAL 1ST FLOOR/OFFICE LEVEL - OVERALL PLAN - MECHANICAL - NEW WORK
SCALE: 3/32" = 1'-0"



1 GROUND LEVEL - OVERALL PLAN - MECHANICAL DEMOLITION (SEE M3-2.1 THRU M3-2.9 FOR DETAILS)
SCALE: 3/32" = 1'-0"



2 GROUND LEVEL - OVERALL PLAN - MECHANICAL - NEW WORK (SEE M3-3.1 THRU M3-3.5 FOR DETAILS)
SCALE: 3/32" = 1'-0"

M E U L I N K   S T A U F F E N B E R G   I N C   -   M E C H A N I C A L   S Y S T E M S

WILLIAM F. MEULINK — STATE OF WASHINGTON — 28210 REGISTERED PROFESSIONAL ENGINEER

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

GROUND LEVEL - OVERALL PLANS - MECHANICAL NEW & DEMOLITION

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

Project number:	16.04
Drawn by:	NAH
Checked by:	JSB
Date:	06/23/17

M3-1.0

6/23/2017 11:15:15 AM

PHASING NOTES & CRITICAL DEADLINES

1. CRITICAL DEADLINES AND PHASING:

   A) - OCTOBER 1, 2017: CHILLER PLANT SHALL REMAIN IN OPERATION UNTIL OCTOBER 1, 2017. PLANT SHUT-DOWN AND FULL DEMOLITION ACTIVITIES SHALL NOT OCCUR UNTIL AFTER THIS DATE. PARTIAL DEMOLITION ACTIVITIES MAY OCCUR PRIOR TO THIS DATE, UPON EWU APPROVAL, IF CHILLER PLANT CAPACITY IS NOT IMPACTED.

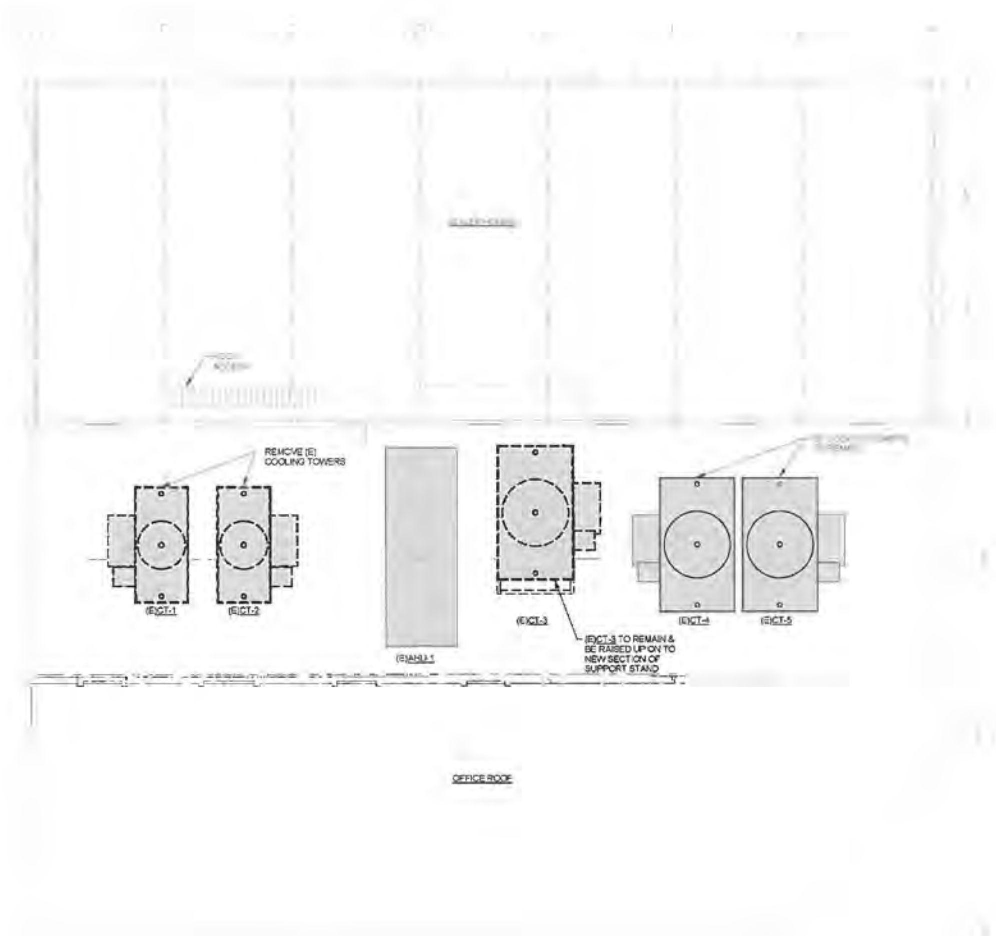
   B) - APRIL 1, 2018: NEW CHILLER PLANT, OPERATING AT PARTIAL CAPACITY NO LESS THAN 2,000 TONS, SHALL BE ON-LINE AND AVAILABLE FOR CAMPUS COOLING.

   C) - JUNE 1, 2018: NEW CHILLER PLANT, OPERATING AT FULL CAPACITY, 6,000 TONS, SHALL BE ON-LINE AND AVAILABLE FOR CAMPUS COOLING.

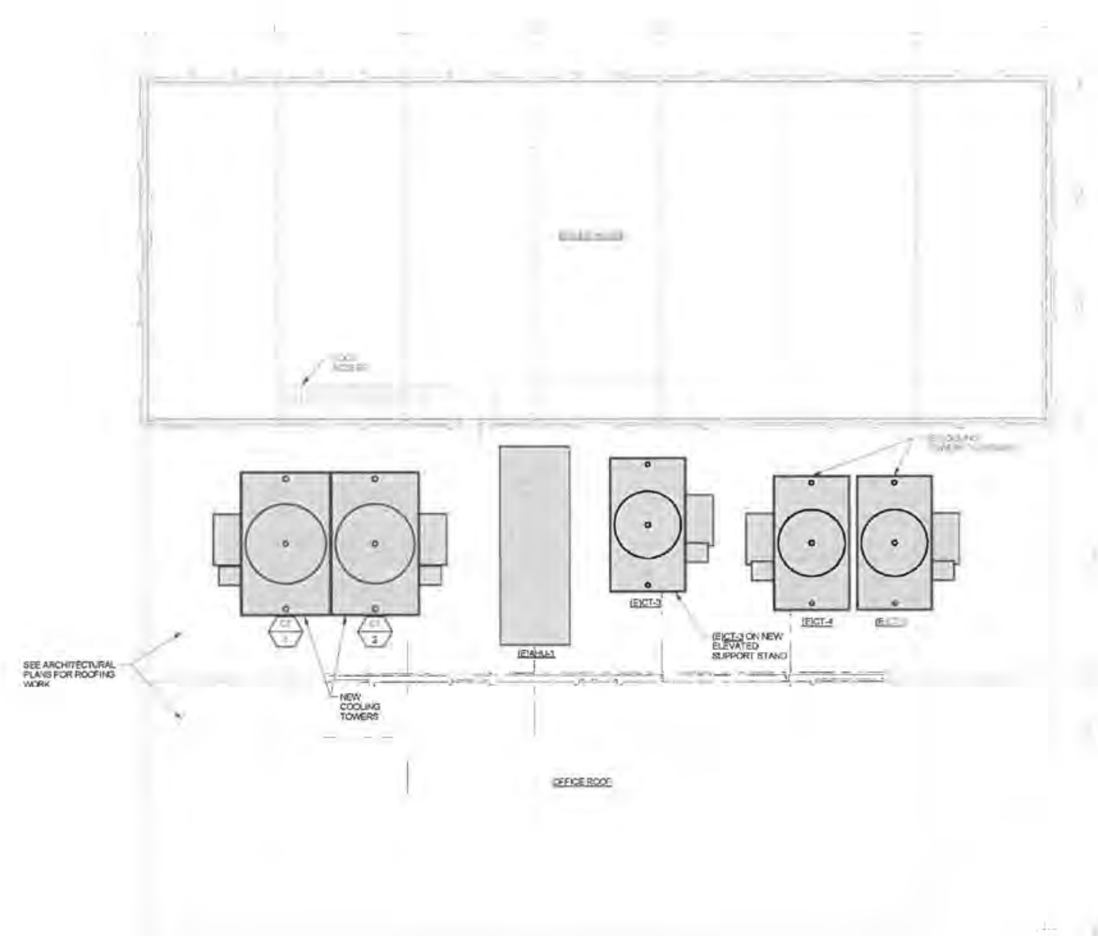
   D) - REFER TO THE PROJECT MANUAL GENERAL CONDITIONS REGARDING SUBSTANTIAL COMPLETION REQUIREMENT (FULL AND PARTIAL) AND LIQUIDATED DAMAGE PROVISIONS FOR FAILURE TO MEET REQUIRED PERFORMANCE DEADLINES.

2. NEW LOADING DOCK (BP-2 WORK): USE OF THE NEW LOADING DOCK BEING CONSTRUCTED UNDER BID PACK BP-2 SHALL BE GENERALLY READY FOR USE FOR THE BID PACK BP-3 CHILLER PLANT MODERNIZATION PROJECT. COORDINATE ACCESS WITH BP-2 CONTRACTOR DURING ANY MINOR OVERLAPPING WORK ACTIVITIES.

3. PRE-FABRICATION: THE CONTRACTOR IS ENCOURAGED TO PRE-PURCHASE AND STOCKPILE ON SITE, AS MUCH MATERIAL AND EQUIPMENT AS POSSIBLE SO AS TO EXPEDITE THE NEW INSTALLATION WORK. WHERE PREFABRICATION OF PIPING IS FEASIBLE IT SHALL BE UTILIZED IN ORDER TO ACCELERATE NEW INSTALLATION WORK.



1 ROOF PLAN - OVERALL PLAN - MECHANICAL DEMOLITION (SEE M3-2.3 FOR DETAILS)
SCALE: 3/32" = 1'-0"



2 ROOF PLAN - OVERALL PLAN - MECHANICAL NEW WORK (SEE M3-3.3 FOR DETAILS)
SCALE: 3/32" = 1'-0"

M E U L I N K S T A U F F E N B E R G I N C - M E C H A N I C A L S Y S T E M S

WILLIAM F. MEULINK — STATE OF WASHINGTON — 26210 — REGISTERED PROFESSIONAL ENGINEER

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

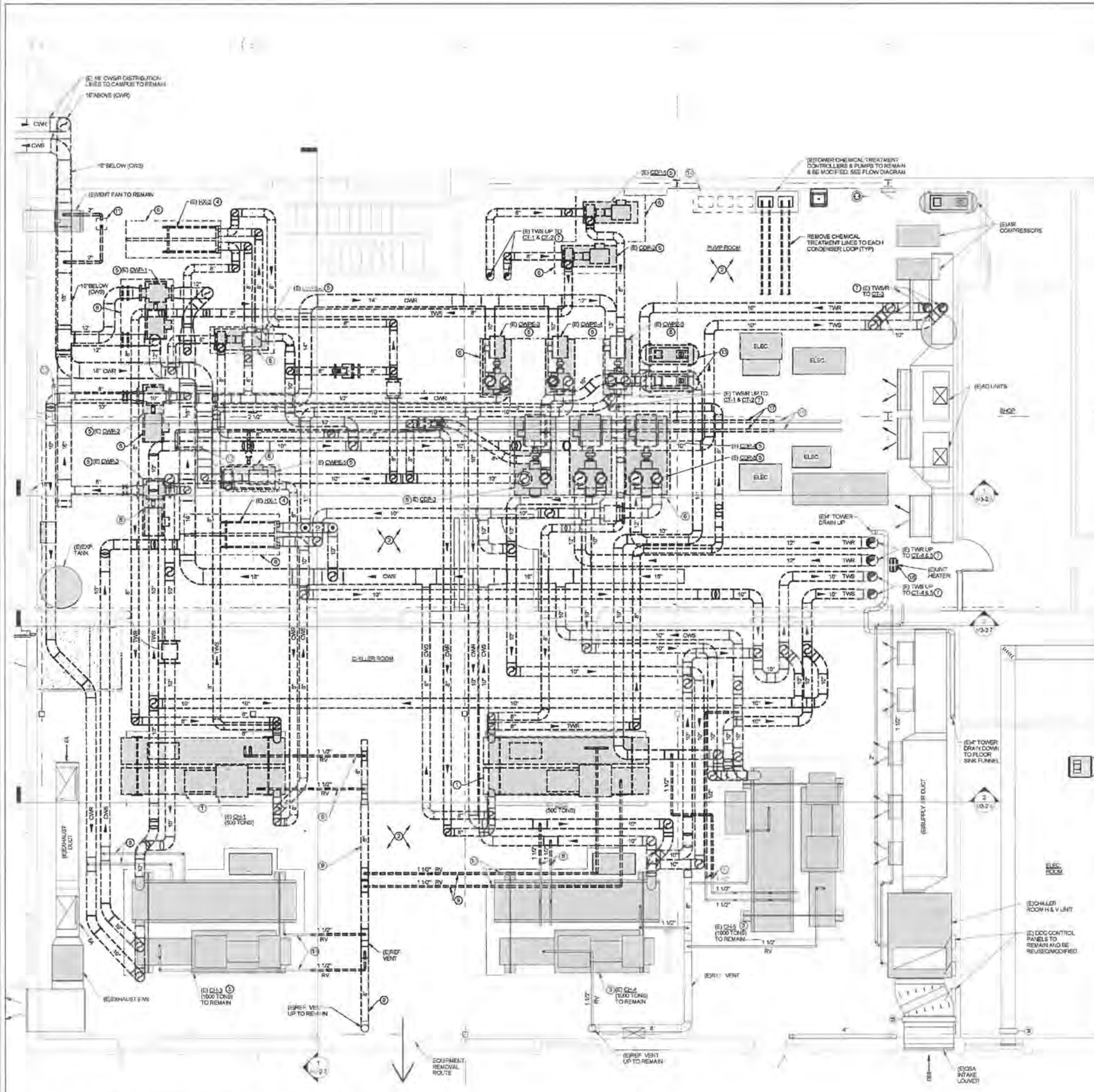
ROOF PLAN - OVERALL PLANS - MECHANICAL NEW & DEMOLITION

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

Project number:	16.04
Drawn by:	NAH
Checked by:	JBS
Date:	06/23/17

M3-1.1

6/23/2017 11:15:20 AM



1 PARTIAL GROUND LEVEL - EAST - HYDRONICS - DEMOLITION
SCALE: 1/4" = 1'-0"

GENERAL DEMO NOTES

1. REMOVE CHILLER PLANT PIPING AND EQUIPMENT AS INDICATED, INCLUDING MISC. AUXILIARY PIPING, VALVES, ETC.
2. WHERE THE EXTENT OF INTENDED DEMOLITION IS NOT CLEAR, CONTACT THE PROJECT ENGINEER FOR DIRECTION BEFORE PROCEEDING.
3. REMOVE ALL ASSOCIATED HANGERS, SUPPORTS, INSULATION, VALVES, GAUGES, INSTRUMENTATION, ETC.
4. NOT ALL EXISTING CONDITIONS ARE INDICATED OR SHOWN, ESPECIALLY ELECTRICAL POWER AND CONTROL CONDUITS. ALL EXISTING PIPING, CONDUITS, WIRING, ETC. SHALL BE PROTECTED FROM DAMAGE DURING DEMOLITION AND INSTALLATION OF NEW WORK. WHERE EXISTING SYSTEM CONFLICT WITH THE INSTALLATION OF NEW WORK, CONTACT THE PROJECT ENGINEER FOR DIRECTION BEFORE PROCEEDING.
5. PRIOR TO DEMOLITION, MARK ALL PIPING, VALVES, EQUIPMENT, ETC. INDICATED TO BE REMOVED, WITH ORANGE SPRAY PAINT, FOR VISUAL VERIFICATION BY A/E, PRIOR TO REMOVAL.
6. REFER ALSO TO SYSTEM FLOW DIAGRAM DEMOLITION ON SHEET M3-2.6.

DEMOLITION NOTES

(1) REMOVE EXISTING 500 TON CHILLERS, CH-1 & CH-2
(2) ALL EXISTING CHILLER PLANT PUMPS, PIPING, VALVES, GAUGES, CONTROL DEVICES, ETC TO BE REMOVED AND REPLACED WITH NEW AS INDICATED ON NEW PLANS.
(3) EXISTING CHILLER CH-3, CH-4 & CH-5 TO REMAIN AND BE REUSED.
(4) EXISTING PLATE & FRAME HEAT EXCHANGER HX-1 & HX-2 TO BE RELOCATED/REUSED.
(5) REMOVE EXISTING CHILLER PLANT PUMPS AND ASSOCIATED VALVES AND DEVICES.
(6) REMOVE EXISTING CONCRETE HOUSEKEEPING PADS.
(7) REMOVE SUPPLY AND RETURN RISERS UP TO COOLING TOWERS.
(8) DISCONNECT & REMOVE PORTIONS OF CHILLER UNIT OIL COOLER CWS & R PIPING AND RECONNECT AS INDICATED ON NEW WORK PLANS.
(9) REMOVE EXISTING REFRIGERANT RELIEF VENT PIPING AND BRANCHES TO CH-1 & CH-2. MAIN VENT TO BE REWORKED AS INDICATED IN NEW WORK PLANS.
(10) RETAIN SECTIONS OF REFRIGERANT RELIEF VENT PIPING SERVING [illegible] FOR RECONNECTION TO NEW VENT PIPING.
(11) DISCONNECT EXISTING COOLING LOOP SIDE-STREAM FILTER UNIT & RETAIN FOR REINSTALLATION WITH NEW SYSTEM.
(12) DISCONNECT EXISTING CWS/R PIPING BRANCH LINES THAT SERVE THE ROZELL AC SYSTEMS. RETAIN & MODIFY FOR RECONNECTION TO NEW SYSTEM.
(13) REMOVE EXISTING AIR COMPRESSOR ASSEMBLIES & AUXILIARIES AND RELOCATE/REINSTALL AS INDICATED ON NEW WORK PLAN.
(14) REMOVE THREE (3) OF THE EXISTING CHEMICAL TREATMENT CONTROLLERS, PUMPS AND MOUNTING STANDS. RETAIN TWO (2) CONTROLLERS FOR RECONNECTION TO NEW SYSTEM.
(15) EXISTING 2 1/2" CWS/R PIPING TO ROZELL HVAC SYSTEMS TO REMAIN.
(16) REMOVE EXISTING UNIT HEATER AND ASSOCIATED PIPING, VALVES & WIRING. CAP PIPING AT BRANCH TAKE-OFFS.
(17) REMOVE & RELOCATE PORTIONS OF EXISTING 2 1/2" CWR/S PIPING TO ACCOMMODATE NEW CHILLER PLANT PIPING. RAISE PIPING TO APPROX. 11'-2" AFF.

MEULINK STAUFFENBERG INC. - MECHANICAL SYSTEMS

WILLIAM F. MEULI... STATE OF WASHINGTON 28210 REGISTERED PROFESSIONAL ENGINEER

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

GROUND FLOOR EAST HYDRONICS - DEMO

BID SET

No.	Date	Description

Project number:	16.04
Drawn by:	NAH
Checked by:	JBS
Date:	06/23/17

M3-2.1

6/23/2017 11:15:33 AM

DEMOLITION NOTES

1. REMOVE EXISTING TWS & TWR PIPE RISERS UP TO CT-4 & 5 ON ROOF. MODIFY RISER FLOOR PENETRATIONS FOR NEW, LARGER, COMBINED TWS/R PIPING AS SHOWN ON NEW WORK PLANS.
2. REMOVE EXISTING PIPING TO JUST BELOW ROOF LEVEL. EXISTING PIPING LOCATED ABOVE OFFICE CEILINGS TO BE ABANDONED IN PLACE.
3. ENLARGE FLOOR OPENING FOR NEW 24" DIAMETER SIZE COOLING TOWER LOOP PIPING RISERS.

1 FIRST FLOOR/OFFICE - HYDRONICS - DEMOLITION
SCALE: 1/4" = 1'-0"

MEULINK STAUFFENBERG INC. - MECHANICAL SYSTEMS
MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE

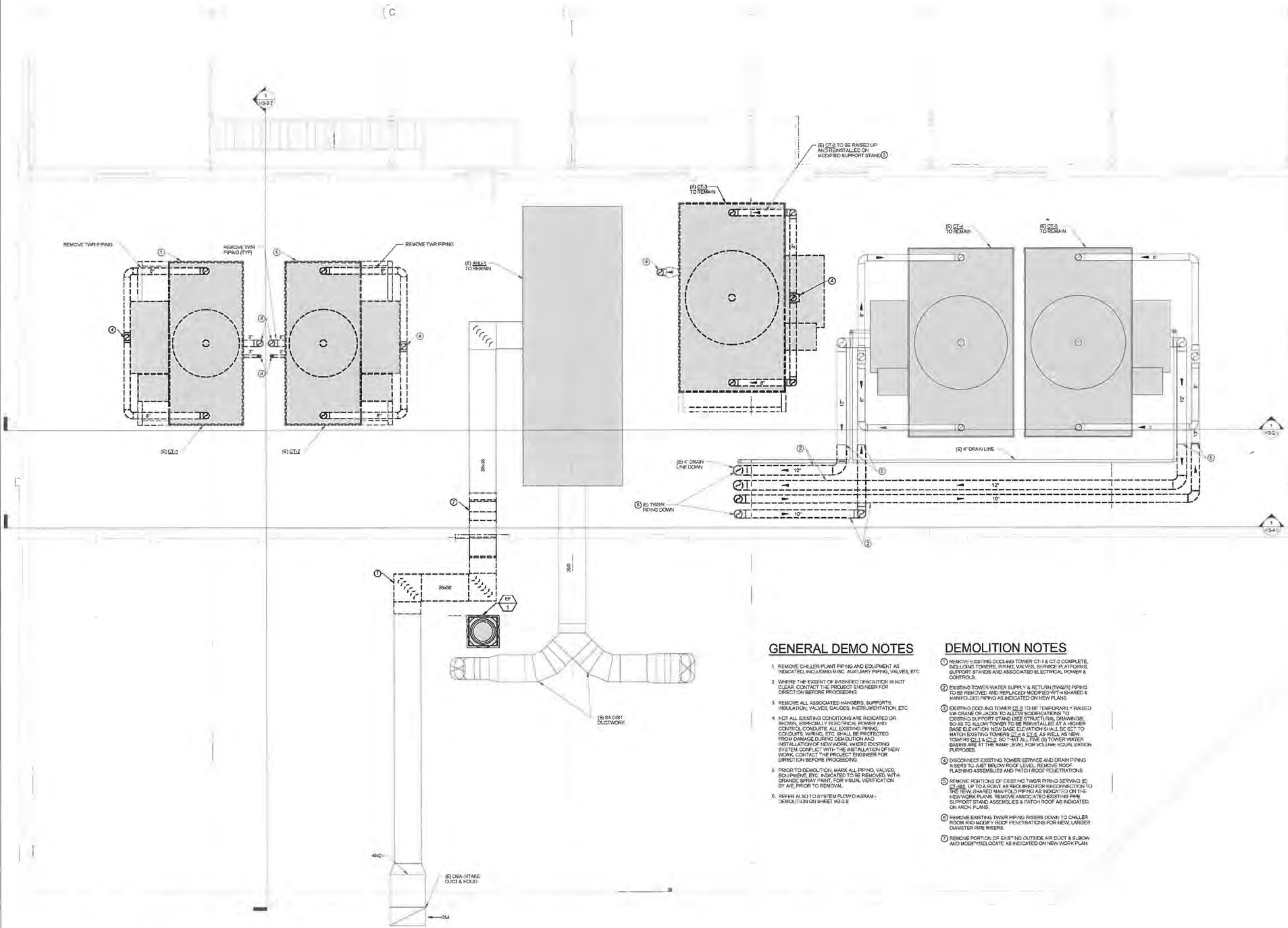
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

FIRST FLOOR/OFFICE HYDRONICS - DEMO

Project number:	16.04
Drawn by:	NAH
Checked by:	JDS
Date:	06/23/17

M3-2.2

9/20/2017 11:15:36 AM



ROOF PLAN EAST - HYDRONICS - DEMOLITION
SCALE: 1/4" = 1'-0"

GENERAL DEMO NOTES

1. REMOVE CHILLER PLANT PIPING AND EQUIPMENT AS INDICATED, INCLUDING MISC. AUXILIARY PIPING, VALVES, ETC
2. WHERE THE EXTENT OF INTENDED DEMOLITION IS NOT CLEAR, CONTACT THE PROJECT ENGINEER FOR DIRECTION BEFORE PROCEEDING.
3. REMOVE ALL ASSOCIATED HANGERS, SUPPORTS, INSULATION, VALVES, GAUGES, INSTRUMENTATION, ETC.
4. NOT ALL EXISTING CONDITIONS ARE INDICATED OR SHOWN, ESPECIALLY ELECTRICAL POWER AND CONTROL CONDUITS. ALL EXISTING PIPING, CONDUITS, WIRING, ETC. SHALL BE PROTECTED FROM DAMAGE DURING DEMOLITION AND INSTALLATION OF NEW WORK. WHERE EXISTING SYSTEM CONFLICT WITH THE INSTALLATION OF NEW WORK, CONTACT THE PROJECT ENGINEER FOR DIRECTION BEFORE PROCEEDING.
5. PRIOR TO DEMOLITION, MARK ALL PIPING, VALVES, EQUIPMENT, ETC. INDICATED TO BE REMOVED, WITH ORANGE SPRAY PAINT, FOR VISUAL VERIFICATION BY A/E, PRIOR TO REMOVAL.
6. REFER ALSO TO SYSTEM FLOW DIAGRAM - DEMOLITION ON SHEET M3-2.8

DEMOLITION NOTES

(1) REMOVE EXISTING COOLING TOWER CT-1 & CT-2 COMPLETE, INCLUDING TOWERS, PIPING, VALVES, SERVICE PLATFORMS, SUPPORT STANDS AND ASSOCIATED ELECTRICAL POWER & CONTROLS.

(2) EXISTING TOWER WATER SUPPLY & RETURN (TWS/R) PIPING TO BE REMOVED AND REPLACED/ MODIFIED WITH SHARED & MANIFOLDED PIPING AS INDICATED ON NEW PLANS.

(3) EXISTING COOLING TOWER CT-3 TO BE TEMPORARILY RAISED VIA CRANE OR JACKS TO ALLOW MODIFICATIONS TO EXISTING SUPPORT STAND (SEE STRUCTURAL DRAWINGS), SO AS TO ALLOW TOWER TO BE REINSTALLED AT A HIGHER BASE ELEVATION. NEW BASE ELEVATION SHALL BE SET TO MATCH EXISTING TOWERS CT-4 & CT-5, AS WELL AS NEW TOWERS CT-1 & CT-2, SO THAT ALL FIVE (5) TOWER WATER BASINS ARE AT THE SAME LEVEL FOR VOLUME EQUALIZATION PURPOSES.

(4) DISCONNECT EXISTING TOWER SERVICE AND DRAIN PIPING RISERS TO JUST BELOW ROOF LEVEL. REMOVE ROOF FLASHING ASSEMBLIES AND PATCH ROOF PENETRATIONS.

(5) REMOVE PORTIONS OF EXISTING TWS/R PIPING SERVING (E) CT-4&5, UP TO A POINT AS REQUIRED FOR RECONNECTION TO THE NEW, SHARED MANIFOLD PIPING AS INDICATED ON THE NEW WORK PLANS. REMOVE ASSOCIATED EXISTING PIPE SUPPORT STAND ASSEMBLIES & PATCH ROOF AS INDICATED ON ARCH. PLANS.

(6) REMOVE EXISTING TWS/R PIPING RISERS DOWN TO CHILLER ROOM AND MODIFY ROOF PENETRATIONS FOR NEW, LARGER DIAMETER PIPE RISERS.

(7) REMOVE PORTION OF EXISTING OUTSIDE AIR DUCT & ELBOW AND MODIFY/RELOCATE AS INDICATED ON NEW WORK PLAN.

WILLIAM F. MEULINK, STATE OF WASHINGTON, 28210, REGISTERED PROFESSIONAL ENGINEER

BID SET

No.	Date	Description

M E U L I N K   S T A U F F E N B E R G   I N C . - M E C H A N I C A L   S Y S T E M S

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

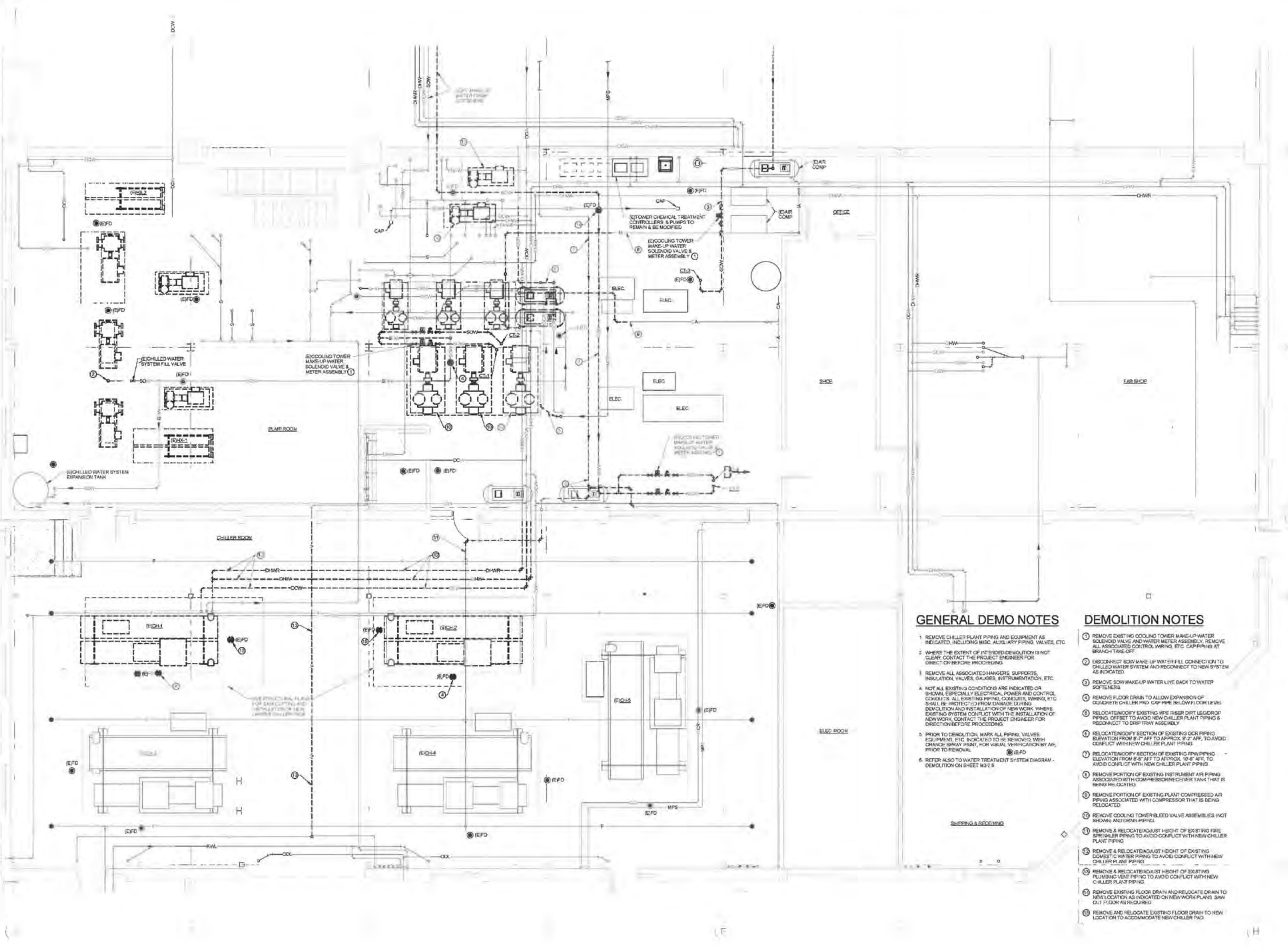
ROOF PLAN EAST HYDRONICS - DEMO

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

Project number	16.04
Drawn by:	MAH
Checked by:	JBS
Date:	06/23/17

M3-2.3

6/23/2017 11:15:47 AM



1 GROUND LEVEL EAST - PLUMBING - DEMOLITION
SCALE: 1/4" = 1'-0"

GENERAL DEMO NOTES

1. REMOVE CHILLER PLANT PIPING AND EQUIPMENT AS INDICATED, INCLUDING MISC. AUXILIARY PIPING, VALVES, ETC.
2. WHERE THE EXTENT OF INTENDED DEMOLITION IS NOT CLEAR, CONTACT THE PROJECT ENGINEER FOR DIRECTION BEFORE PROCEEDING.
3. REMOVE ALL ASSOCIATED HANGERS, SUPPORTS, INSULATION, VALVES, GAUGES, INSTRUMENTATION, ETC.
4. NOT ALL EXISTING CONDITIONS ARE INDICATED OR SHOWN, ESPECIALLY ELECTRICAL POWER AND CONTROL CONDUITS. ALL EXISTING PIPING, CONDUITS, WIRING, ETC. SHALL BE PROTECTED FROM DAMAGE DURING DEMOLITION AND INSTALLATION OF NEW WORK. WHERE EXISTING SYSTEM CONFLICT WITH THE INSTALLATION OF NEW WORK, CONTACT THE PROJECT ENGINEER FOR DIRECTION BEFORE PROCEEDING.
5. PRIOR TO DEMOLITION, MARK ALL PIPING, VALVES, EQUIPMENT, ETC. INDICATED TO BE REMOVED, WITH ORANGE SPRAY PAINT, FOR VISUAL VERIFICATION BY A/E, PRIOR TO REMOVAL.
6. REFER ALSO TO WATER TREATMENT SYSTEM DIAGRAM - DEMOLITION ON SHEET M3-2.5

DEMOLITION NOTES

(1) REMOVE EXISTING COOLING TOWER MAKE-UP WATER SOLENOID VALVE AND WATER METER ASSEMBLY. REMOVE ALL ASSOCIATED CONTROL WIRING, ETC. CAP PIPING AT BRANCH TAKE-OFF.

(2) DISCONNECT SOW MAKE-UP WATER FILL CONNECTION TO CHILLED WATER SYSTEM AND RECONNECT TO NEW SYSTEM AS INDICATED.

(3) REMOVE SOW MAKE-UP WATER LINE BACK TO WATER SOFTENERS.

(4) REMOVE FLOOR DRAIN TO ALLOW EXPANSION OF CONCRETE CHILLER PAD. CAP PIPE BELOW FLOOR LEVEL.

(5) RELOCATE/MODIFY EXISTING MPS RISER DIRT LEG/DROP PIPING. OFFSET TO AVOID NEW CHILLER PLANT PIPING & RECONNECT TO DRIP TRAY ASSEMBLY.

(6) RELOCATE/MODIFY SECTION OF EXISTING GCR PIPING ELEVATION FROM 8'-7" AFF TO APPROX. 9'-2" AFF, TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING.

(7) RELOCATE/MODIFY SECTION OF EXISTING FPW PIPING ELEVATION FROM 8'-8" AFF TO APPROX. 10'-6" AFF, TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING.

(8) REMOVE PORTION OF EXISTING INSTRUMENT AIR PIPING ASSOCIATED WITH COMPRESSOR/RECEIVER TANK THAT IS BEING RELOCATED.

(9) REMOVE PORTION OF EXISTING PLANT COMPRESSED AIR PIPING ASSOCIATED WITH COMPRESSOR THAT IS BEING RELOCATED.

(10) REMOVE COOLING TOWER BLEED VALVE ASSEMBLIES (NOT SHOWN) AND DRAIN PIPING.

(11) REMOVE & RELOCATE/ADJUST HEIGHT OF EXISTING FIRE SPRINKLER PIPING TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING.

(12) REMOVE & RELOCATE/ADJUST HEIGHT OF EXISTING DOMESTIC WATER PIPING TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING.

(13) REMOVE & RELOCATE/ADJUST HEIGHT OF EXISTING PLUMBING VENT PIPING TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING.

(14) REMOVE EXISTING FLOOR DRAIN AND RELOCATE DRAIN TO NEW LOCATION AS INDICATED ON NEW WORK PLANS. SAW CUT FLOOR AS REQUIRED.

(15) REMOVE AND RELOCATE EXISTING FLOOR DRAIN TO NEW LOCATION TO ACCOMMODATE NEW CHILLER PAD.

M E U L I N K   S T A U F F E N B E R G   I N C   -   M E C H A N I C A L   S Y S T E M S

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1350
Fax: (509) 624-2420

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

GROUND FLOOR EAST PLUMBING - DEMO

Project number:	16.04
Drawn by:	NAH
Checked by:	JBB
Date:	06/29/17

M3-2.4

6/29/2017 11:15:54 AM

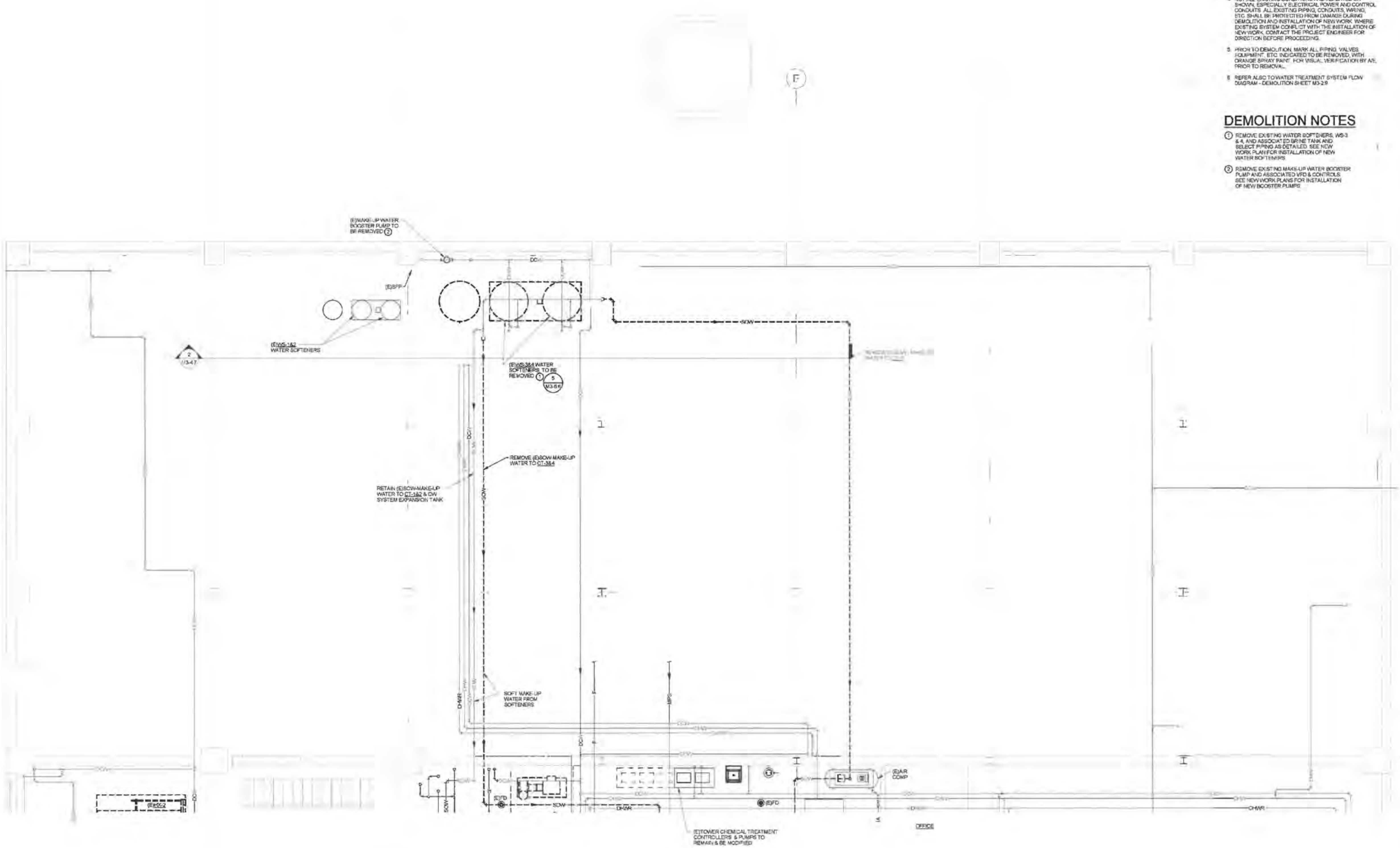
GENERAL DEMO NOTES

1. REMOVE CHILLER PLANT PIPING AND EQUIPMENT AS INDICATED, INCLUDING MISC. AUXILIARY PIPING, VALVES, ETC.
2. WHERE THE EXTENT OF INTENDED DEMOLITION IS NOT CLEAR, CONTACT THE PROJECT ENGINEER FOR DIRECTION BEFORE PROCEEDING.
3. REMOVE ALL ASSOCIATED HANGERS, SUPPORTS, INSULATION, VALVES, GAUGES, INSTRUMENTATION, ETC.
4. NOT ALL EXISTING CONDITIONS ARE INDICATED OR SHOWN, ESPECIALLY ELECTRICAL POWER AND CONTROL CONDUITS. ALL EXISTING PIPING, CONDUITS, WIRING, ETC. SHALL BE PROTECTED FROM DAMAGE DURING DEMOLITION AND INSTALLATION OF NEW WORK. WHERE EXISTING SYSTEM CONFLICT WITH THE INSTALLATION OF NEW WORK, CONTACT THE PROJECT ENGINEER FOR DIRECTION BEFORE PROCEEDING.
5. PRIOR TO DEMOLITION, MARK ALL PIPING, VALVES, EQUIPMENT, ETC. INDICATED TO BE REMOVED, WITH ORANGE SPRAY PAINT, FOR VISUAL VERIFICATION BY A/E, PRIOR TO REMOVAL.
6. REFER ALSO TO WATER TREATMENT SYSTEM FLOW DIAGRAM - DEMOLITION SHEET M3-2.9

DEMOLITION NOTES

(1) REMOVE EXISTING WATER SOFTENERS, WS-3 & 4, AND ASSOCIATED BRINE TANK AND SELECT PIPING AS DETAILED. SEE NEW WORK PLAN FOR INSTALLATION OF NEW WATER SOFTENERS.

(2) REMOVE EXISTING MAKE-UP WATER BOOSTER PUMP AND ASSOCIATED VFD & CONTROLS. SEE NEW WORK PLANS FOR INSTALLATION OF NEW BOOSTER PUMPS.



1 GROUND LEVEL WEST - PLUMBING - DEMOLITION
SCALE: 1/4" = 1'-0"

MEULINK STAUFFENBERG INC. - MECHANICAL SYSTEMS

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

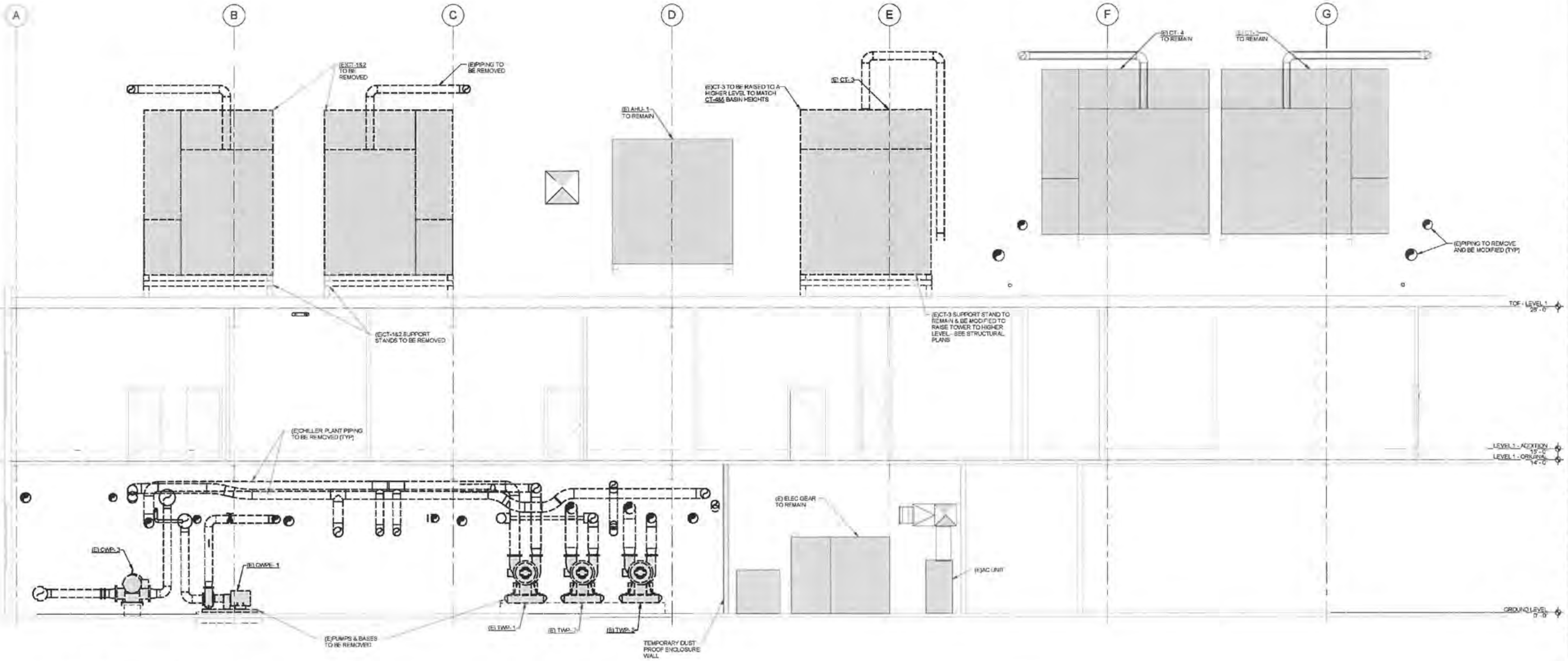
GROUND LEVEL WEST PLUMBING - DEMO

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

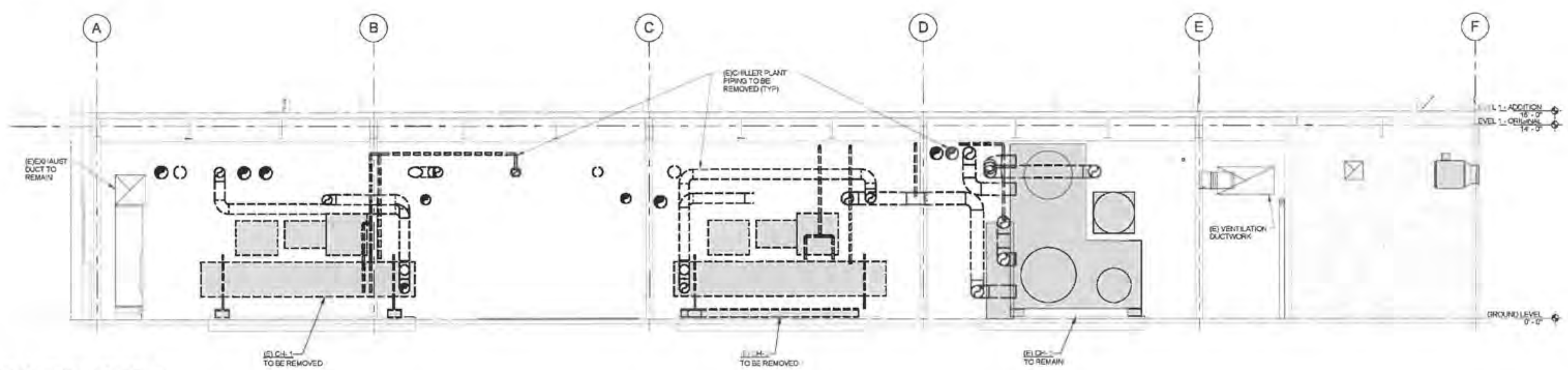
Project number:	16.04
Drawn by:	NAH
Checked by:	JBG
Date:	06/23/17

M3-2.5

9/23/2017 11:16:00 AM



DEMOLITION SECTION - 1
SCALE: 1/4" = 1'-0"



DEMOLITION SECTION - 2
SCALE: 1/4" = 1'-0"

MEULINK STAUFFENBERG INC. - MECHANICAL SYSTEMS

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE

BP-3 - CHILLER PLANT MODERNIZATION

ROZELL CENTRAL PLANT - EWU, CHENEY, WA

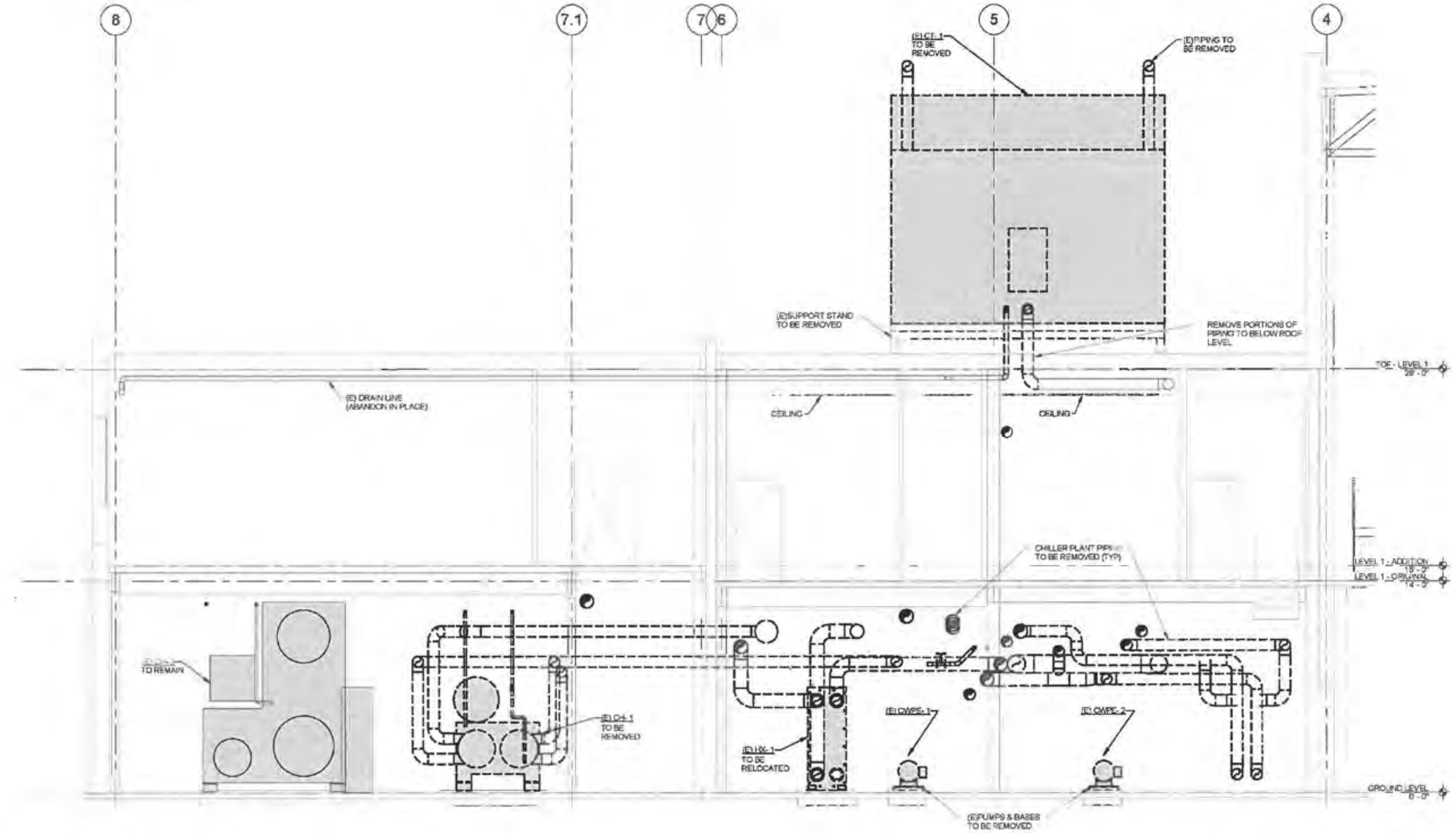
SECTIONS - DEMO

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
Phone: (509) 624-1050
SPOKANE, WA 99201
Fax: (509) 624-2420

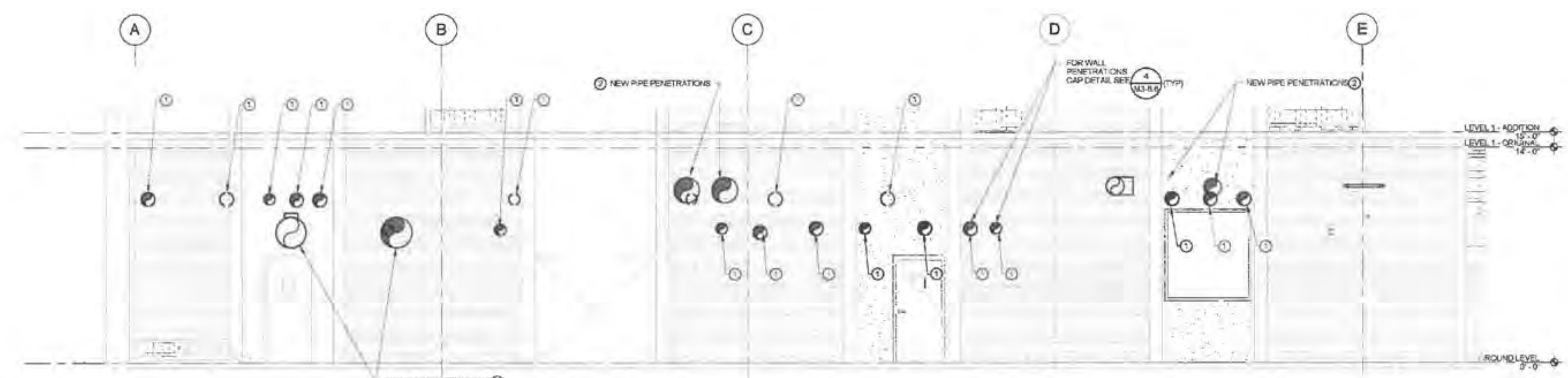
Project number:	16.04
Drawn by:	NAH
Checked by:	JBS
Date:	05/23/17

M3-2.6

5/23/2017 11:16:00 AM



DEMOLITION SECTION - 3
SCALE: 1/4" = 1'-0"



DEMOLITION SECTION - 4
SCALE: 1/4" = 1'-0"

WALL PENETRATION NOTES

1. PATCH EXISTING WALL PENETRATIONS WHERE PIPING IS BEING REMOVED. PROVIDE SQUARE STAINLESS STEEL COVER PLATE ON BOTH SIDES OF WALL TO COVER HOLE & SECURE WALL AT CORNERS
2. SAW-CUT NEW PIPE PENETRATIONS THRU EXISTING WALL AS REQUIRED FOR NEW CHILLER SYSTEM PIPING

MEULINK STAUFFENBERG INC - MECHANICAL SYSTEMS

BID SET

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

SECTIONS - DEMO

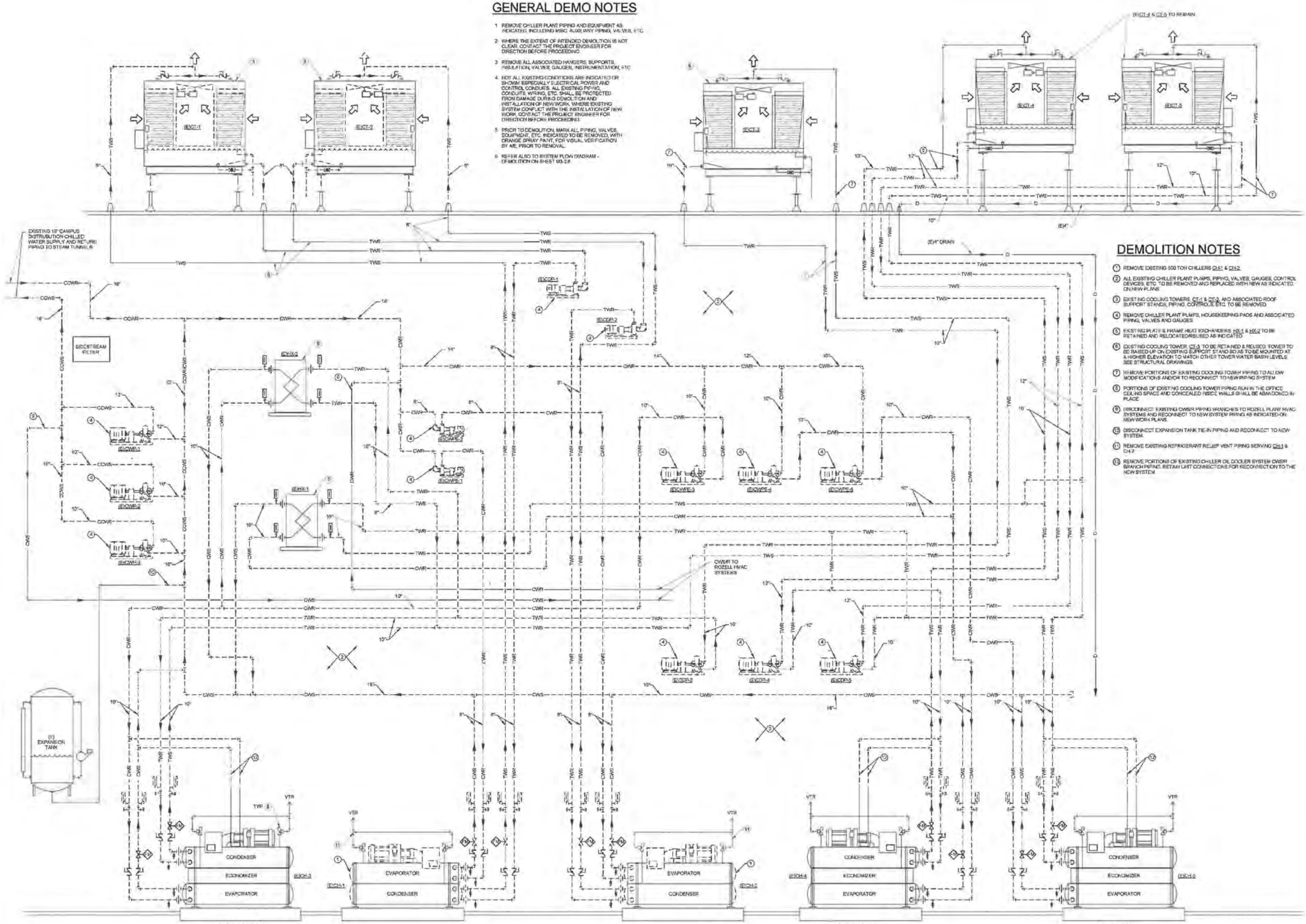
MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1650
Fax: (509) 624-2422

Project number	16.04
Drawn by	NAH
Checked by	JBS
Date	06/23/17

M3-2.7

GENERAL DEMO NOTES

1. REMOVE CHILLER PLANT PIPING AND EQUIPMENT AS INDICATED, INCLUDING MISC. AUXILIARY PIPING, VALVES, ETC.
2. WHERE THE EXTENT OF INTENDED DEMOLITION IS NOT CLEAR, CONTACT THE PROJECT ENGINEER FOR DIRECTION BEFORE PROCEEDING.
3. REMOVE ALL ASSOCIATED HANGERS, SUPPORTS, INSULATION, VALVES, GAUGES, INSTRUMENTATION, ETC.
4. NOT ALL EXISTING CONDITIONS ARE INDICATED OR SHOWN, ESPECIALLY ELECTRICAL POWER AND CONTROL CONDUITS. ALL EXISTING PIPING, CONDUITS, WIRING, ETC. SHALL BE PROTECTED FROM DAMAGE DURING DEMOLITION AND INSTALLATION OF NEW WORK. WHERE EXISTING SYSTEM CONFLICT WITH THE INSTALLATION OF NEW WORK, CONTACT THE PROJECT ENGINEER FOR DIRECTION BEFORE PROCEEDING.
5. PRIOR TO DEMOLITION, MARK ALL PIPING, VALVES, EQUIPMENT, ETC. INDICATED TO BE REMOVED, WITH ORANGE SPRAY PAINT, FOR VISUAL VERIFICATION BY A/E, PRIOR TO REMOVAL.
6. REFER ALSO TO SYSTEM FLOW DIAGRAM - DEMOLITION ON SHEET M3-2.8.



DEMOLITION NOTES

1. REMOVE EXISTING 500 TON CHILLERS CH-1 & CH-2.
2. ALL EXISTING CHILLER PLANT PUMPS, PIPING, VALVES, GAUGES, CONTROL DEVICES, ETC. TO BE REMOVED AND REPLACED WITH NEW AS INDICATED ON NEW PLANS.
3. EXISTING COOLING TOWERS, CT-1 & CT-2, AND ASSOCIATED ROOF SUPPORT STANDS, PIPING, CONTROLS, ETC. TO BE REMOVED.
4. REMOVE CHILLER PLANT PUMPS, HOUSEKEEPING PADS AND ASSOCIATED PIPING, VALVES AND GAUGES.
5. EXISTING PLATE & FRAME HEAT EXCHANGERS, HX-1 & HX-2 TO BE RETAINED AND RELOCATED/REUSED AS INDICATED.
6. EXISTING COOLING TOWER, CT-3, TO BE RETAINED & REUSED. TOWER TO BE RAISED UP ON EXISTING SUPPORT STAND SO AS TO BE MOUNTED AT A HIGHER ELEVATION TO MATCH OTHER TOWER WATER BASIN LEVELS. SEE STRUCTURAL DRAWINGS.
7. REMOVE PORTIONS OF EXISTING COOLING TOWER PIPING TO ALLOW MODIFICATIONS AND/OR TO RECONNECT TO NEW PIPING SYSTEM.
8. PORTIONS OF EXISTING COOLING TOWER PIPING RUN IN THE OFFICE CEILING SPACE AND CONCEALED INSIDE WALLS SHALL BE ABANDONED IN PLACE.
9. DISCONNECT EXISTING CWS/R PIPING BRANCHES TO ROZELL PLANT HVAC SYSTEMS AND RECONNECT TO NEW SYSTEM PIPING AS INDICATED ON NEW WORK PLANS.
10. DISCONNECT EXPANSION TANK TIE-IN PIPING AND RECONNECT TO NEW SYSTEM.
11. REMOVE EXISTING REFRIGERANT RELIEF VENT PIPING SERVING CH-1 & CH-2.
12. REMOVE PORTIONS OF EXISTING CHILLER OIL COOLER SYSTEM CWS/R BRANCH PIPING. RETAIN UNIT CONNECTIONS FOR RECONNECTION TO THE NEW SYSTEM.

1 EXISTING CHILLED WATER & CONDENSER WATER SYSTEM FLOW DIAGRAM - DEMOLITION
Scale: NOT TO SCALE

MEULINK STAUFFENBERG INC - MECHANICAL SYSTEMS

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

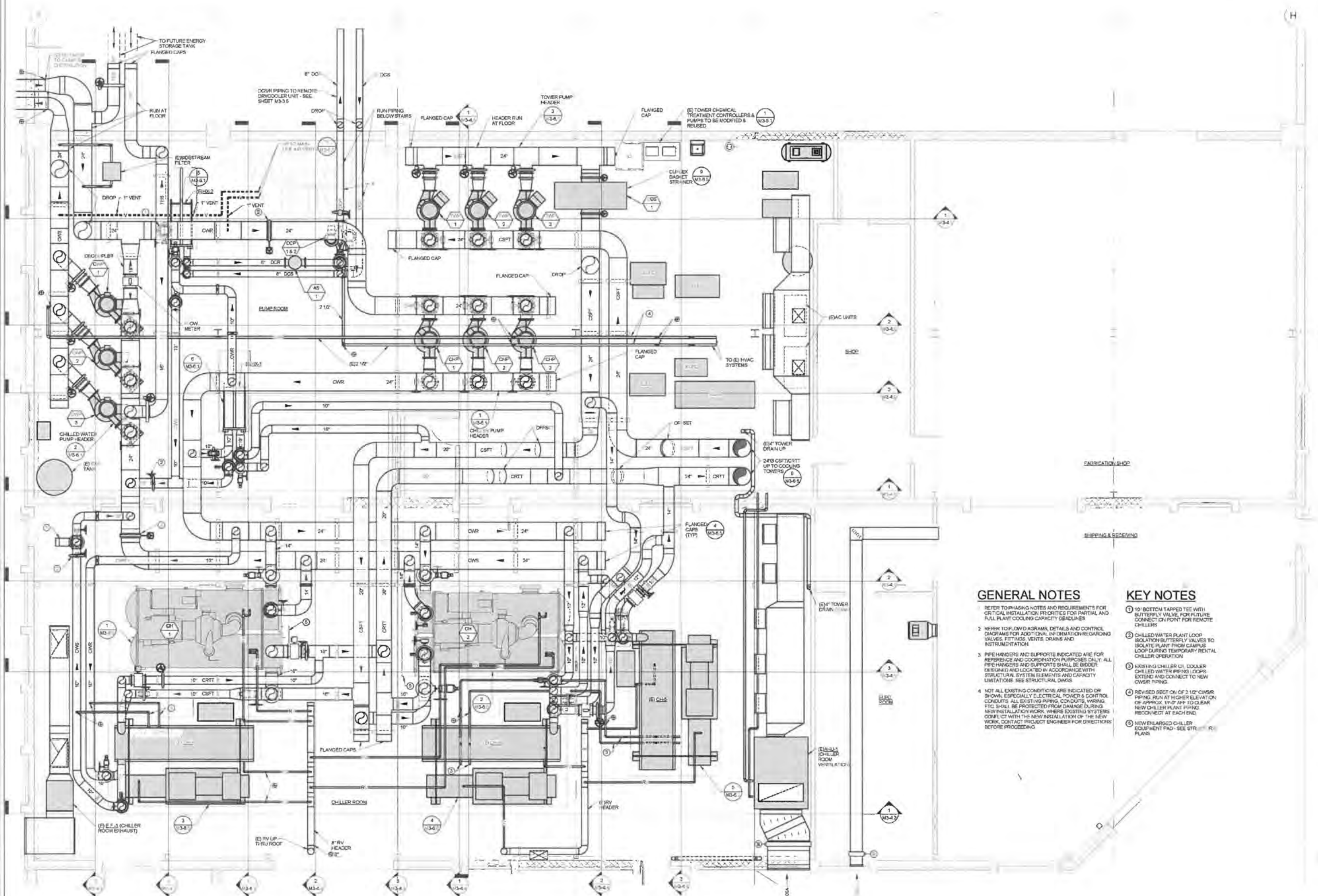
EXISTING CHILLED WATER PIPING DIAGRAM - DEMO

BID SET

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
105 N. WASHINGTON, SUITE 525
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

Project number:	15.04
Drawn by:	NAH
Checked by:	JBS
Date:	04/28/17

M3-2.8



GENERAL NOTES

1. REFER TO PHASING NOTES AND REQUIREMENTS FOR CRITICAL INSTALLATION PRIORITIES FOR PARTIAL AND FULL PLANT COOLING CAPACITY DEADLINES.
2. REFER TO FLOW DIAGRAMS, DETAILS AND CONTROL DIAGRAMS FOR ADDITIONAL INFORMATION REGARDING VALVES, FITTINGS, VENTS, DRAINS AND INSTRUMENTATION.
3. PIPE HANGERS AND SUPPORTS INDICATED ARE FOR REFERENCE AND COORDINATION PURPOSES ONLY. ALL PIPE HANGERS AND SUPPORTS SHALL BE BIDDER DESIGNED AND LOCATED IN ACCORDANCE WITH STRUCTURAL SYSTEM ELEMENTS AND CAPACITY LIMITATIONS. SEE STRUCTURAL DWGS.
4. NOT ALL EXISTING CONDITIONS ARE INDICATED OR SHOWN, ESPECIALLY ELECTRICAL POWER & CONTROL CONDUITS. ALL EXISTING PIPING, CONDUITS, WIRING, ETC. SHALL BE PROTECTED FROM DAMAGE DURING NEW INSTALLATION WORK. WHERE EXISTING SYSTEMS CONFLICT WITH THE NEW INSTALLATION OF THE NEW WORK, CONTACT PROJECT ENGINEER FOR DIRECTIONS BEFORE PROCEEDING.

KEY NOTES

(1) 10" BOTTOM TAPPED TEE WITH BUTTERFLY VALVE, FOR FUTURE CONNECTION POINT FOR REMOTE CHILLERS.

(2) CHILLED WATER PLANT LOOP ISOLATION BUTTERFLY VALVES TO ISOLATE PLANT FROM CAMPUS LOOP DURING TEMPORARY RENTAL CHILLER OPERATION.

(3) EXISTING CHILLER OR COOLER CHILLED WATER PIPING LOOPS. EXTEND AND CONNECT TO NEW CWS/R PIPING.

(4) REVISED SECTION OF 2 1/2" CWS/R PIPING. RUN AT HIGHER ELEVATION OF APPROX. 11'-0" AFF TO CLEAR NEW CHILLER PLANT PIPING. RECONNECT AT EACH END.

(5) NEW ENLARGED CHILLER EQUIPMENT PAD - SEE STR[illegible] PLANS.

1 PARTIAL GROUND LEVEL - EAST - HYDRONICS - NEW
SCALE: 1/4" = 1'-0"

M E U L I N K   S T A U F F E N B E R G   I N C .   M E C H A N I C A L   S Y S T E M S

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

GROUND FLOOR HYDRONICS - NEW

BID SET

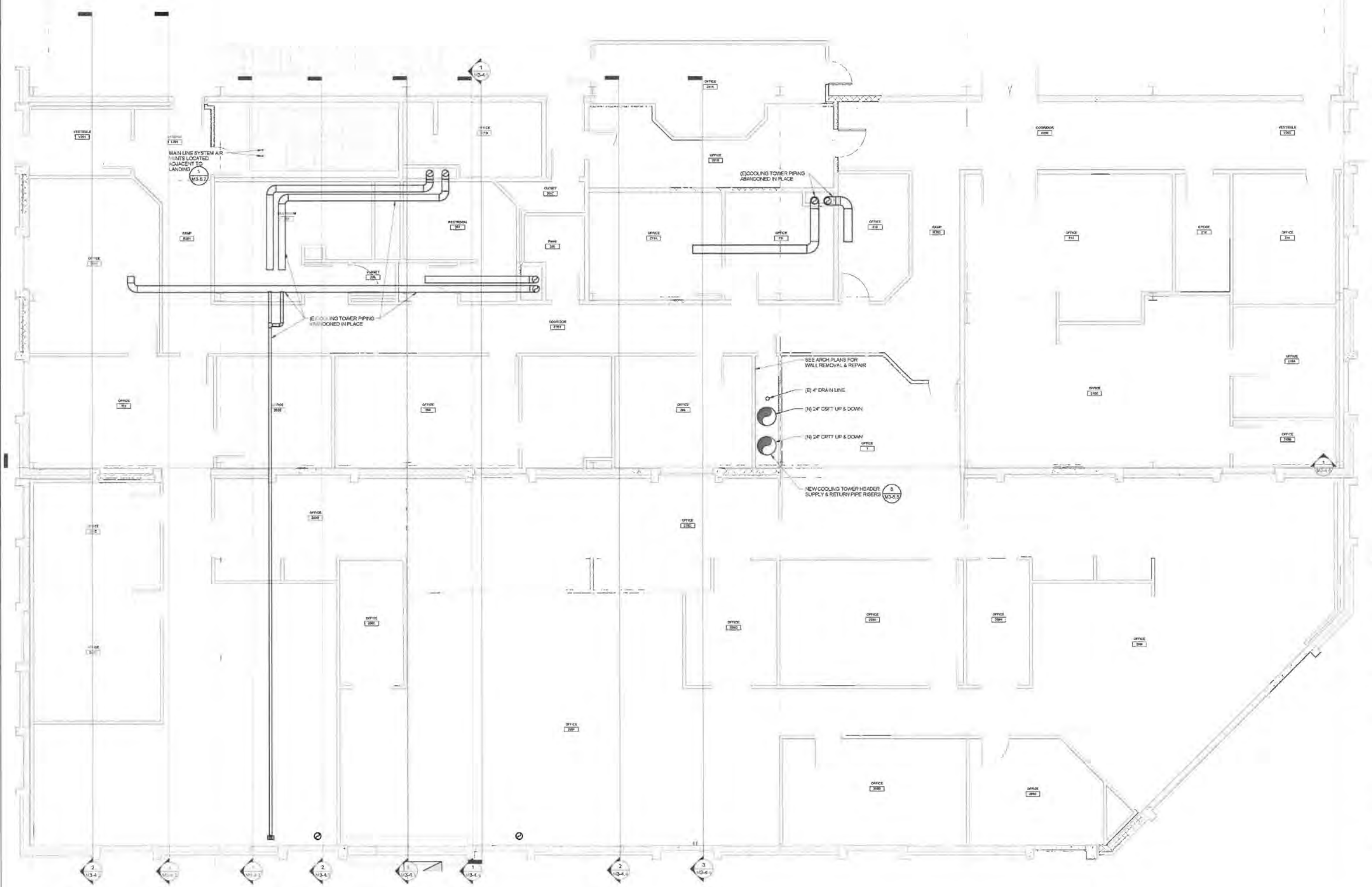
No.	Date	Description

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
Phone: (509) 624-1050
SPOKANE, WA 99201
Fax: (509) 624-2420

Project number	16.04
Drawn by	NAH
Checked by	JBS
Date	06/23/17

M3-3.1

6/23/2017 11:35:41 AM



1 FIRST FLOOR/OFFICE EAST - HYDRONICS - NEW
SCALE: 1/4" = 1'-0"

M E U L I N K   S T A U F F E N B E R G   I N C . - M E C H A N I C A L   S Y S T E M S

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

BID SET

No.	Date	Description

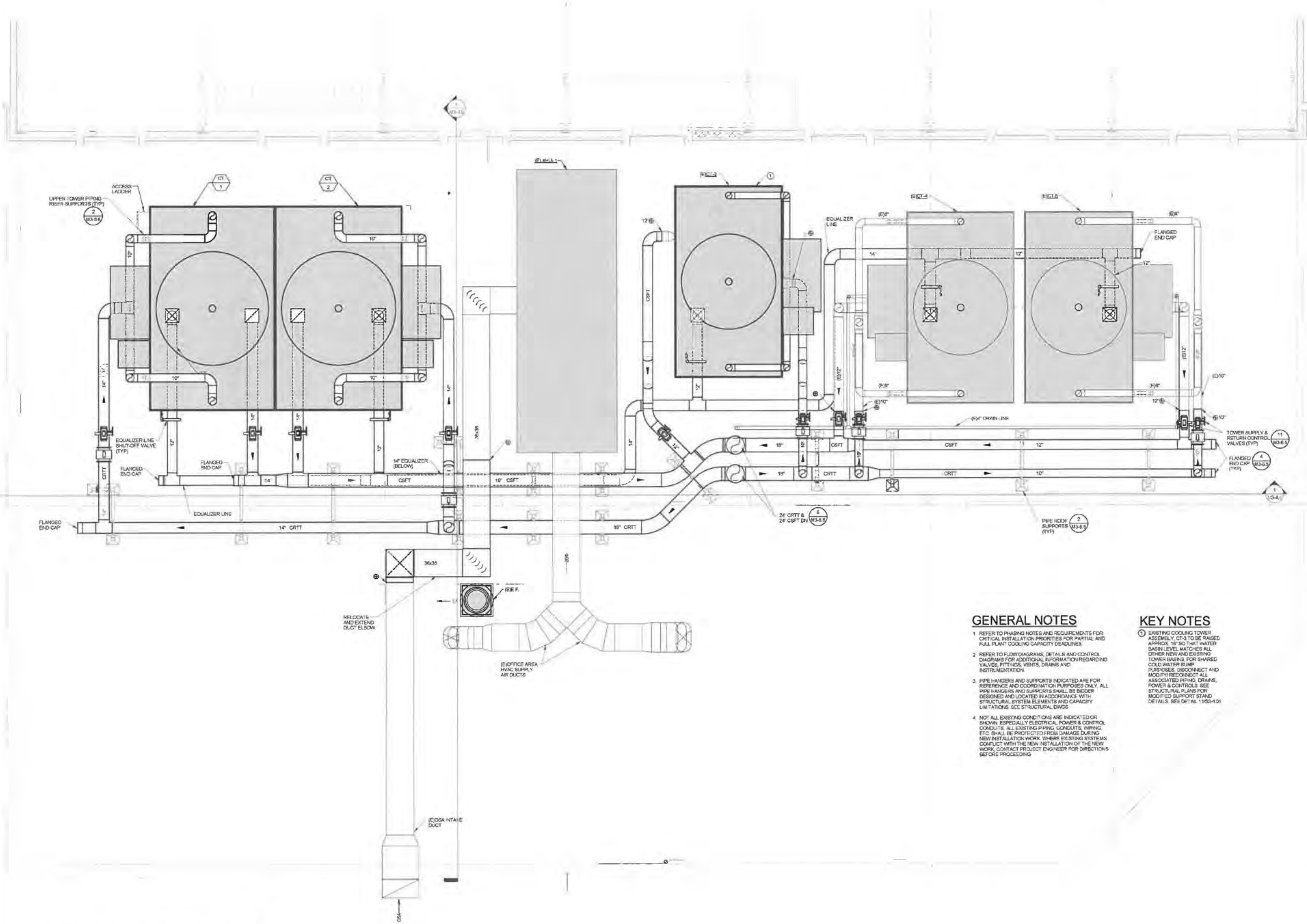
CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

FIRST FLOOR/OFFICE EAST HYDRONICS - NEW

Project number	16.04
Drawn by	NAH
Checked by	JBS
Date	06/23/17

M3-3.2

8/23/2017 11:16:48 AM



1 ROOF PLAN EAST - HYDRONICS - NEW
SCALE: 1/4" = 1'-0"

GENERAL NOTES

1. REFER TO PHASING NOTES AND REQUIREMENTS FOR CRITICAL INSTALLATION PRIORITIES FOR PARTIAL AND FULL PLANT COOLING CAPACITY DEADLINES.
2. REFER TO FLOW DIAGRAMS, DETAILS AND CONTROL DIAGRAMS FOR ADDITIONAL INFORMATION REGARDING VALVES, FITTINGS, VENTS, DRAINS AND INSTRUMENTATION.
3. PIPE HANGERS AND SUPPORTS INDICATED ARE FOR REFERENCE AND COORDINATION PURPOSES ONLY. ALL PIPE HANGERS AND SUPPORTS SHALL BE BIDDER DESIGNED AND LOCATED IN ACCORDANCE WITH STRUCTURAL SYSTEM ELEMENTS AND CAPACITY LIMITATIONS. SEE STRUCTURAL DWGS.
4. NOT ALL EXISTING CONDITIONS ARE INDICATED OR SHOWN, ESPECIALLY ELECTRICAL POWER & CONTROL CONDUITS. ALL EXISTING PIPING, CONDUITS, WIRING, ETC. SHALL BE PROTECTED FROM DAMAGE DURING NEW INSTALLATION WORK. WHERE EXISTING SYSTEMS CONFLICT WITH THE NEW INSTALLATION OF THE NEW WORK, CONTACT PROJECT ENGINEER FOR DIRECTIONS BEFORE PROCEEDING.

KEY NOTES

(1) EXISTING COOLING TOWER ASSEMBLY, CT-3, TO BE RAISED APPROX. 15" SO THAT WATER BASIN LEVEL MATCHES ALL OTHER NEW AND EXISTING TOWER BASINS, FOR SHARED COLD WATER SUMP PURPOSES. DISCONNECT AND MODIFY/ RECONNECT ALL ASSOCIATED PIPING, DRAINS, POWER & CONTROLS. SEE STRUCTURAL PLANS FOR MODIFIED SUPPORT STAND DETAILS. SEE DETAIL 11/S3-4.01

MEULINK STAUFFENBERG INC. - MECHANICAL SYSTEMS

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

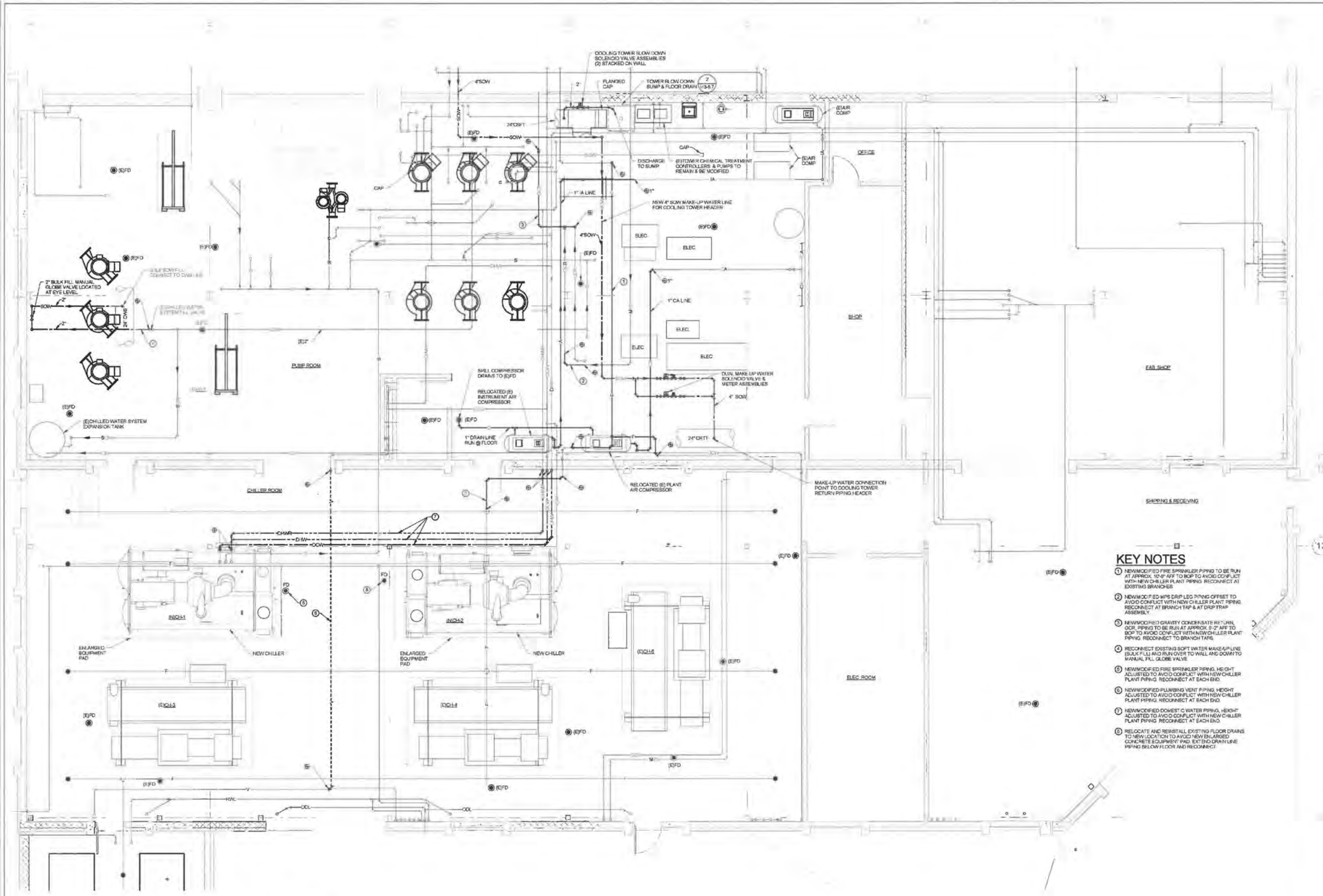
ROOF PLAN EAST HYDRONICS - NEW

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

Project number:	16.04
Drawn by:	NAH
Checked by:	JSS
Date:	06/28/17

M3-3.3

9/23/2017 11:18:57 AM



KEY NOTES

1. NEW/MODIFIED FIRE SPRINKLER PIPING TO BE RUN AT APPROX. 10'-8" AFF TO BOP TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING. RECONNECT AT EXISTING BRANCHES
2. NEW/MODIFIED MPS DRIP LEG PIPING OFFSET TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING. RECONNECT AT BRANCH TAP & AT DRIP TRAP ASSEMBLY.
3. NEW/MODIFIED GRAVITY CONDENSATE RETURN, GCR, PIPING TO BE RUN AT APPROX. 9'-2" AFF TO BOP TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING. RECONNECT TO BRANCH TAPS.
4. RECONNECT EXISTING SOFT WATER MAKE-UP LINE (BULK FILL) AND RUN OVER TO WALL AND DOWN TO MANUAL FILL GLOBE VALVE
5. NEW/MODIFIED FIRE SPRINKLER PIPING, HEIGHT ADJUSTED TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING. RECONNECT AT EACH END.
6. NEW/MODIFIED PLUMBING VENT PIPING, HEIGHT ADJUSTED TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING. RECONNECT AT EACH END.
7. NEW/MODIFIED DOMESTIC WATER PIPING, HEIGHT ADJUSTED TO AVOID CONFLICT WITH NEW CHILLER PLANT PIPING. RECONNECT AT EACH END.
8. RELOCATE AND REINSTALL EXISTING FLOOR DRAINS TO NEW LOCATION TO AVOID NEW ENLARGED CONCRETE EQUIPMENT PAD. EXTEND DRAIN LINE PIPING BELOW FLOOR AND RECONNECT

1 GROUND FLOOR EAST - PLUMBING - NEW
SCALE: 1/4" = 1'-0"

MEULINK STAUFFENBERG INC - MECHANICAL SYSTEMS

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

BID SET

No.	Date	Description

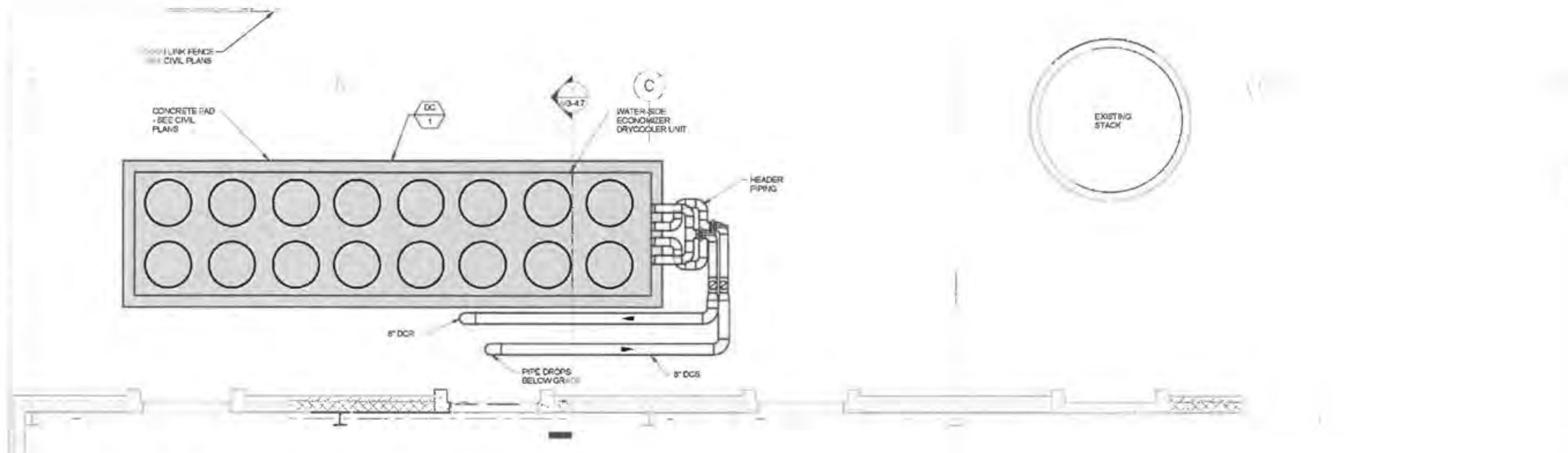
GROUND FLOOR EAST PLUMBING - NEW

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 506 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

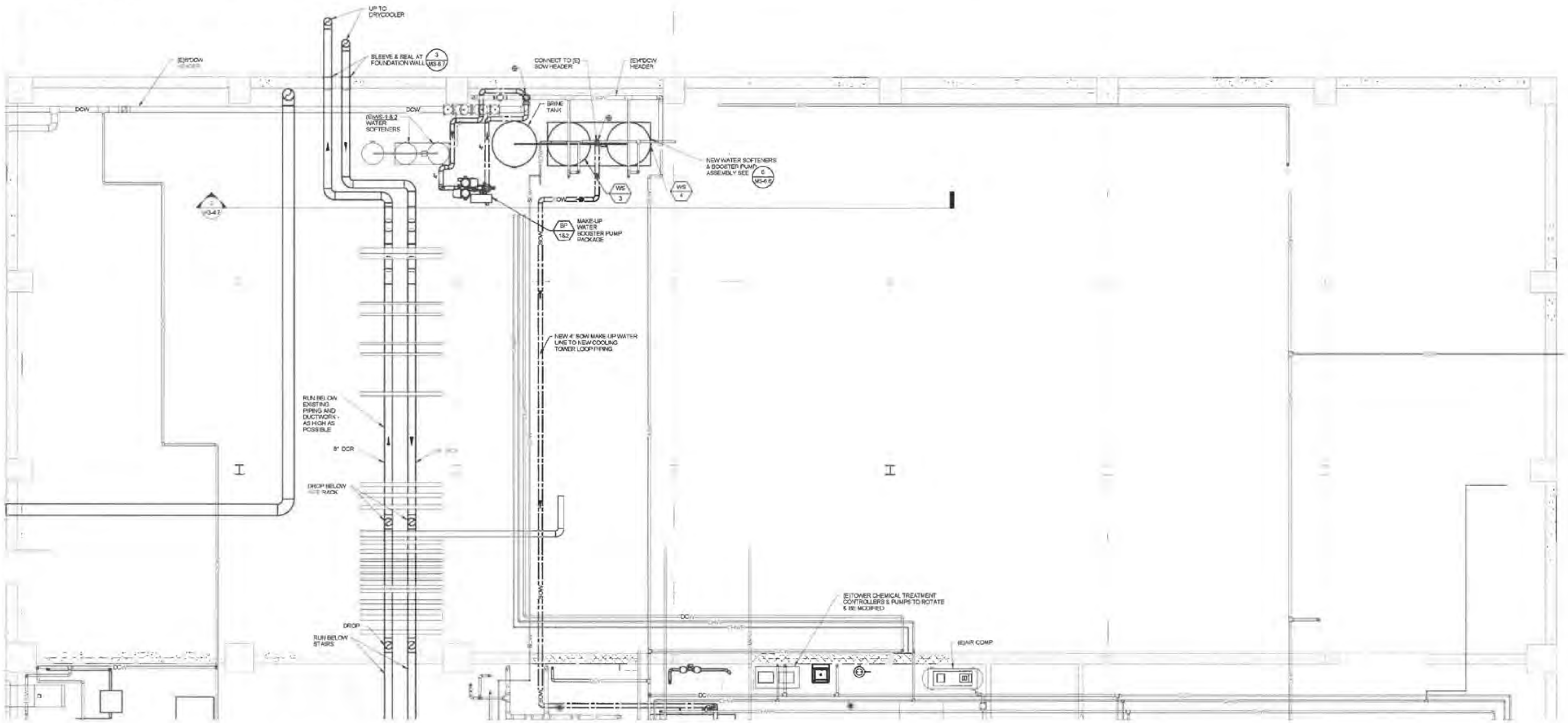
Project number:	16.04
Drawn by:	NAH
Checked by:	JSS
Date:	06/23/17

M3-3.4

6/23/2017 11:17:05 AM



PARTIAL 1ST FLOOR LEVEL WEST - HYDRONICS - NEW
SCALE: 1/4" = 1'-0"



GROUND LEVEL WEST - PLUMBING - NEW
SCALE: 1/4" = 1'-0"

M E U L I N K   S T A U F F E N B E R G   I N C   -   M E C H A N I C A L   S Y S T E M S

BID SET

No.	Date	Description

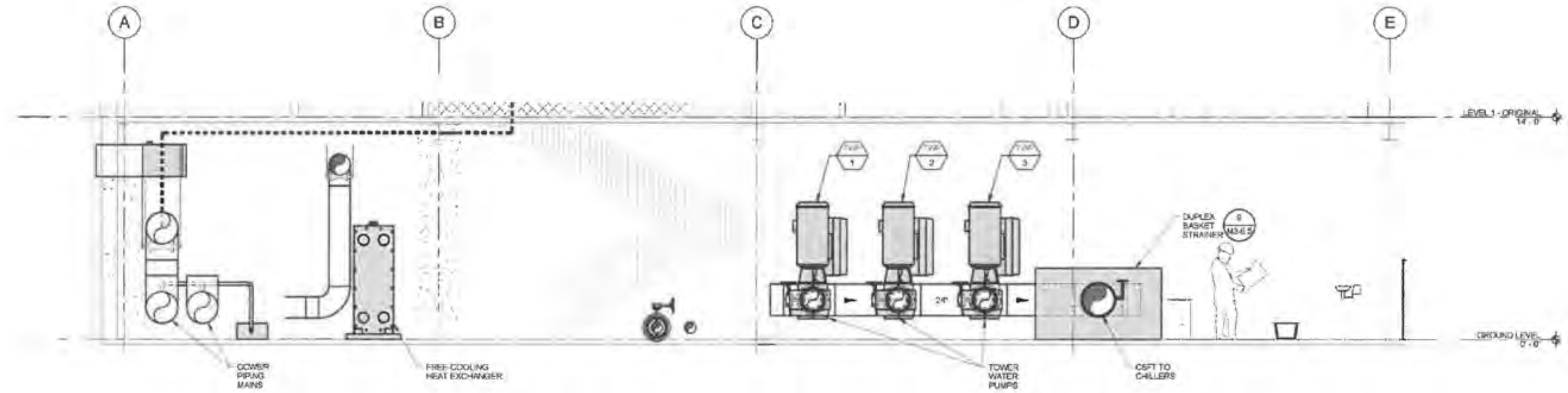
CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

GROUND FLOOR WEST PLUMBING - NEW
1ST FLOOR WEST - HYDRONICS - NEW

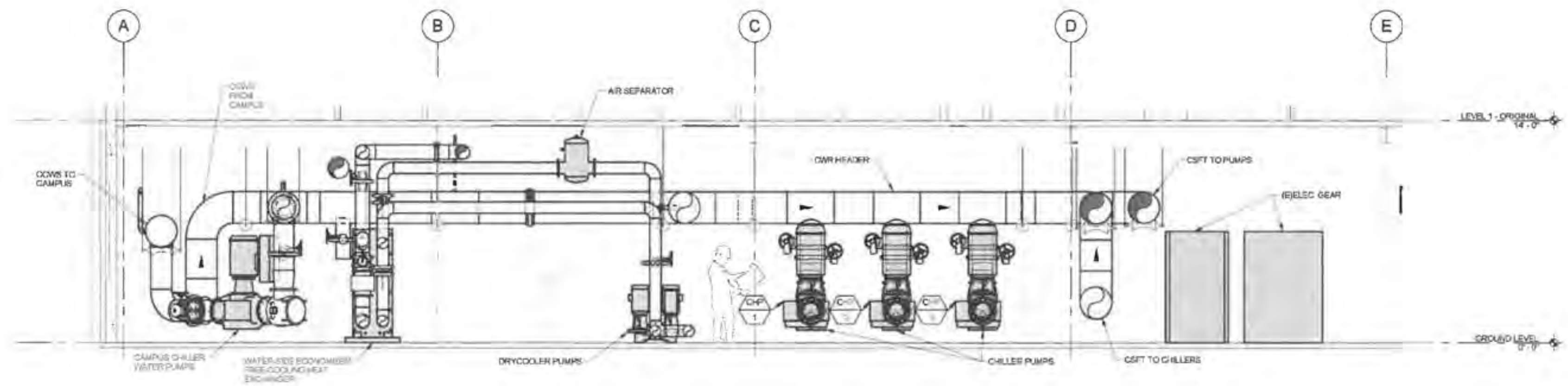
MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

Project number	16.04
Drawn by	NAH
Checked by	JBB
Date	08/22/17

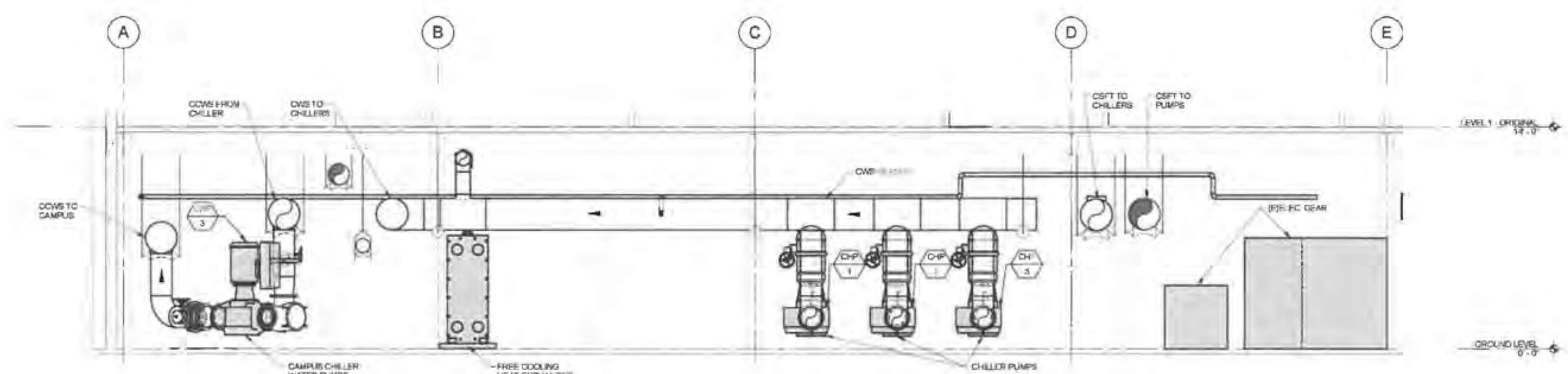
M3-3.5



1 BUILDING SECTION - 1
SCALE: 1/4" = 1'-0"



2 BUILDING SECTION - 2
SCALE: 1/4" = 1'-0"



3 BUILDING SECTION - 3
SCALE: 1/4" = 1'-0"

MEULINK STAUFFENBERG INC. - MECHANICAL SYSTEMS

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

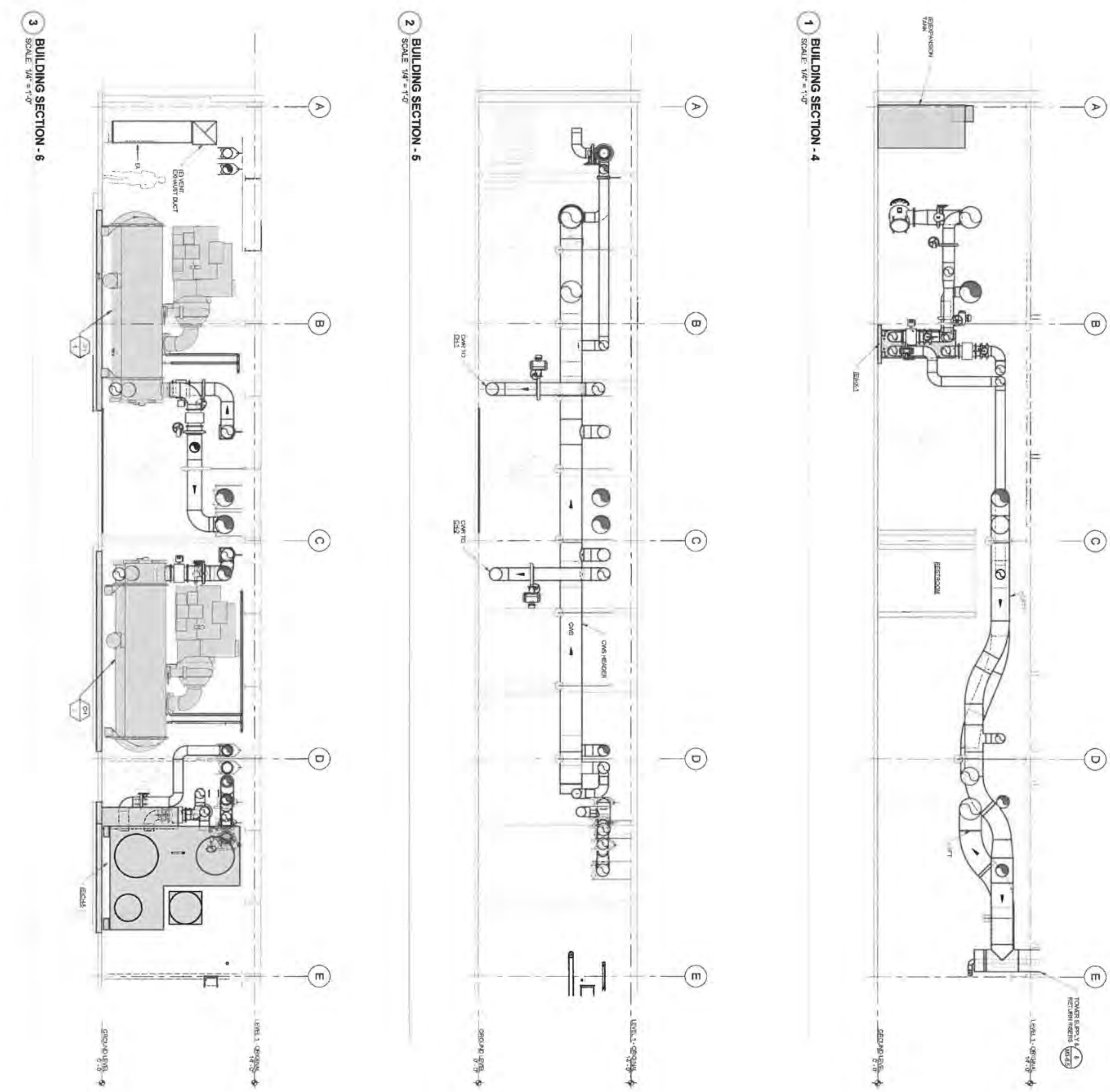
SECTIONS - NEW

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

Project number	16.04
Drawn by:	MAH
Checked by:	JBS
Date:	06/23/17

M3-4.0

6/23/2017 11:17:22 AM



M E U L I N K S T A U F F E N B E R G I N C - M E C H A N I C A L S Y S T E M S

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
Phone: (509) 624-1050
SPOKANE, WA 99201
Fax: (509) 624-2420

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

SECTIONS - NEW

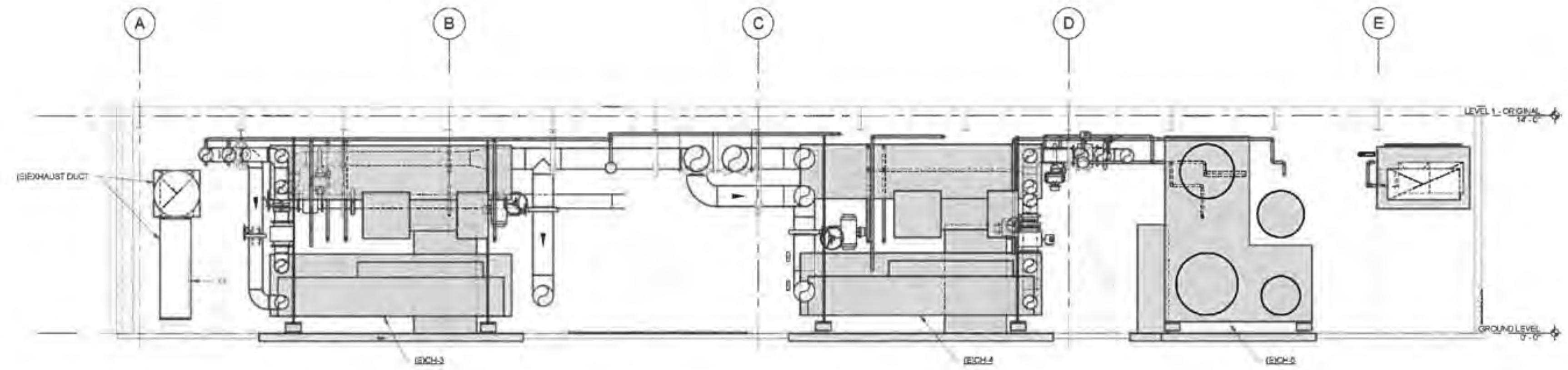
BID SET

No.	Date	Description

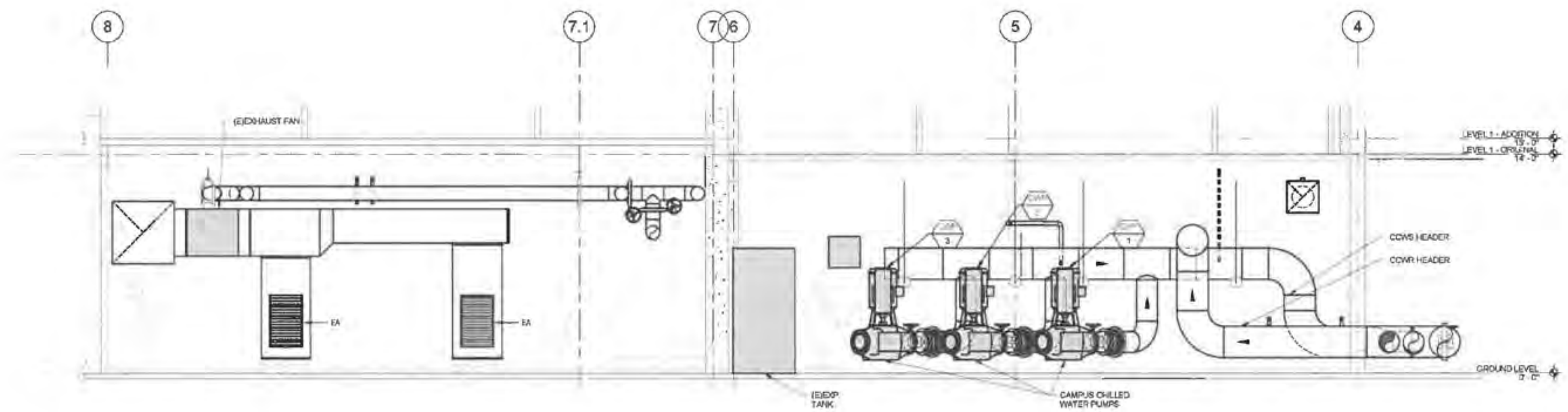
16.04
NAH
JDB
06/23/17

M3-4.1

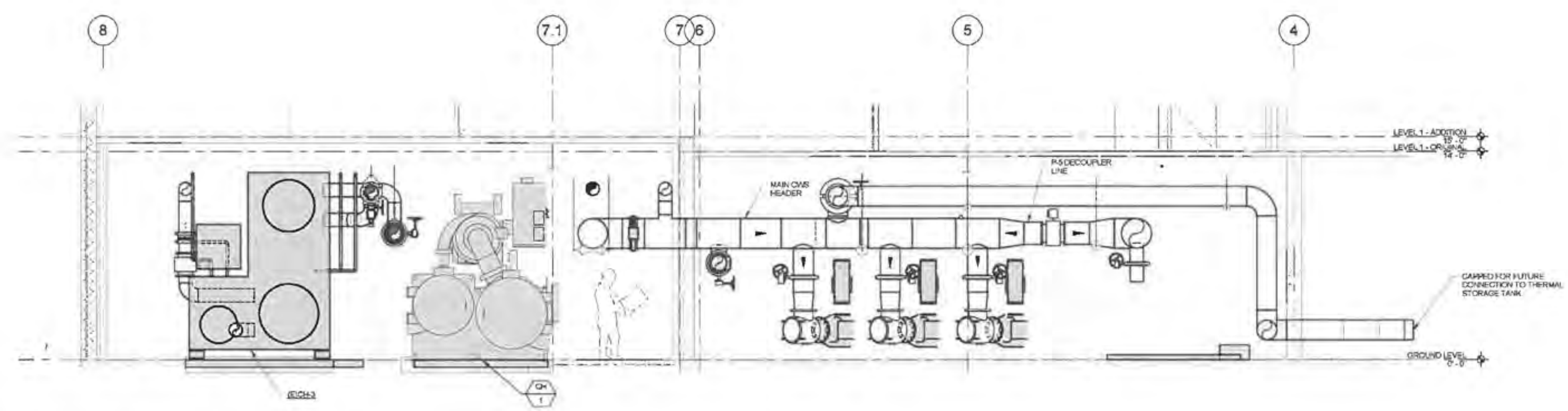
6/23/2017 11:17:20 AM



1 BUILDING SECTION - 7
SCALE: 1/4" = 1'-0"



2 BUILDING SECTION - 8
SCALE: 1/4" = 1'-0"



3 BUILDING SECTION - 9
SCALE: 1/4" = 1'-0"

M E U L I N K S T A U F F E N B E R G I N C - M E C H A N I C A L S Y S T E M S

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

SECTIONS - NEW

BID SET

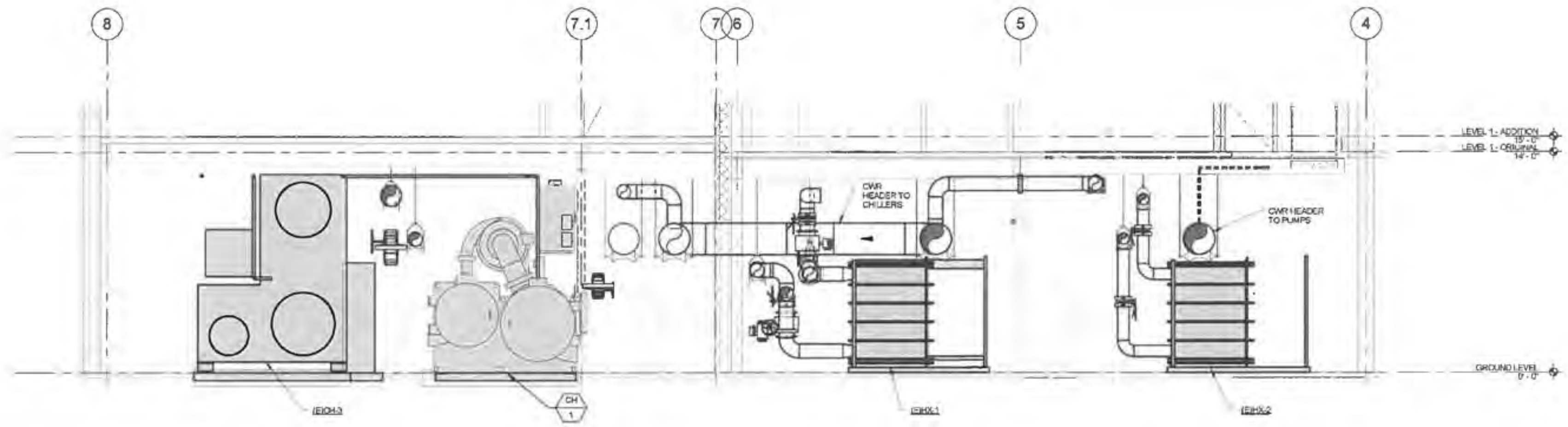
No.	Date	Description

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

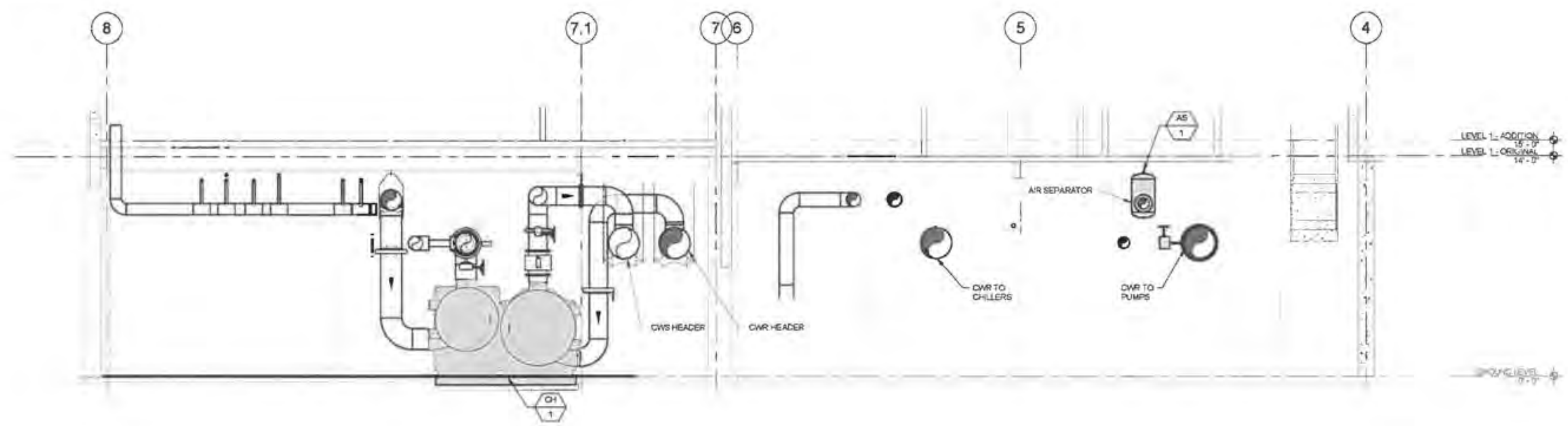
Project number	16.04
Drawn by	NAH
Checked by	JBS
Date	08/25/17

M3-4.2

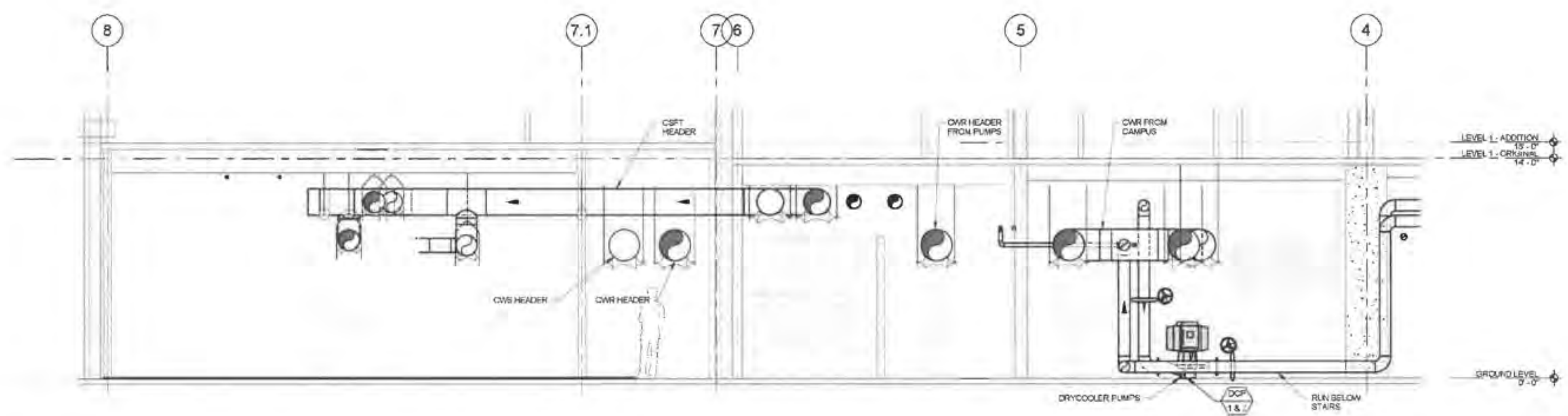
8/23/2017 11:17:40 AM



1 BUILDING SECTION - 10
SCALE: 1/4" = 1'-0"



2 BUILDING SECTION - 11
SCALE: 1/4" = 1'-0"



3 BUILDING SECTION - 12
SCALE: 1/4" = 1'-0"

M E U L I N K S T A U F F E N B E R G I N C - M E C H A N I C A L S Y S T E M S

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

SECTIONS - NEW

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

Project number	16.04
Drawn by	NAH
Checked by	JSS
Date	06/23/17

M3-4.3

6/23/2017 11:17:44 AM

MEULINK STAUFFENBERG INC - MECHANICAL SYSTEMS

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

CHILLED WATER CAPACITY UPGRADE

BP-3 - CHILLER PLANT MODERNIZATION

ROZELL CENTRAL PLANT - EWU, CHENEY, WA

SECTIONS - NEW

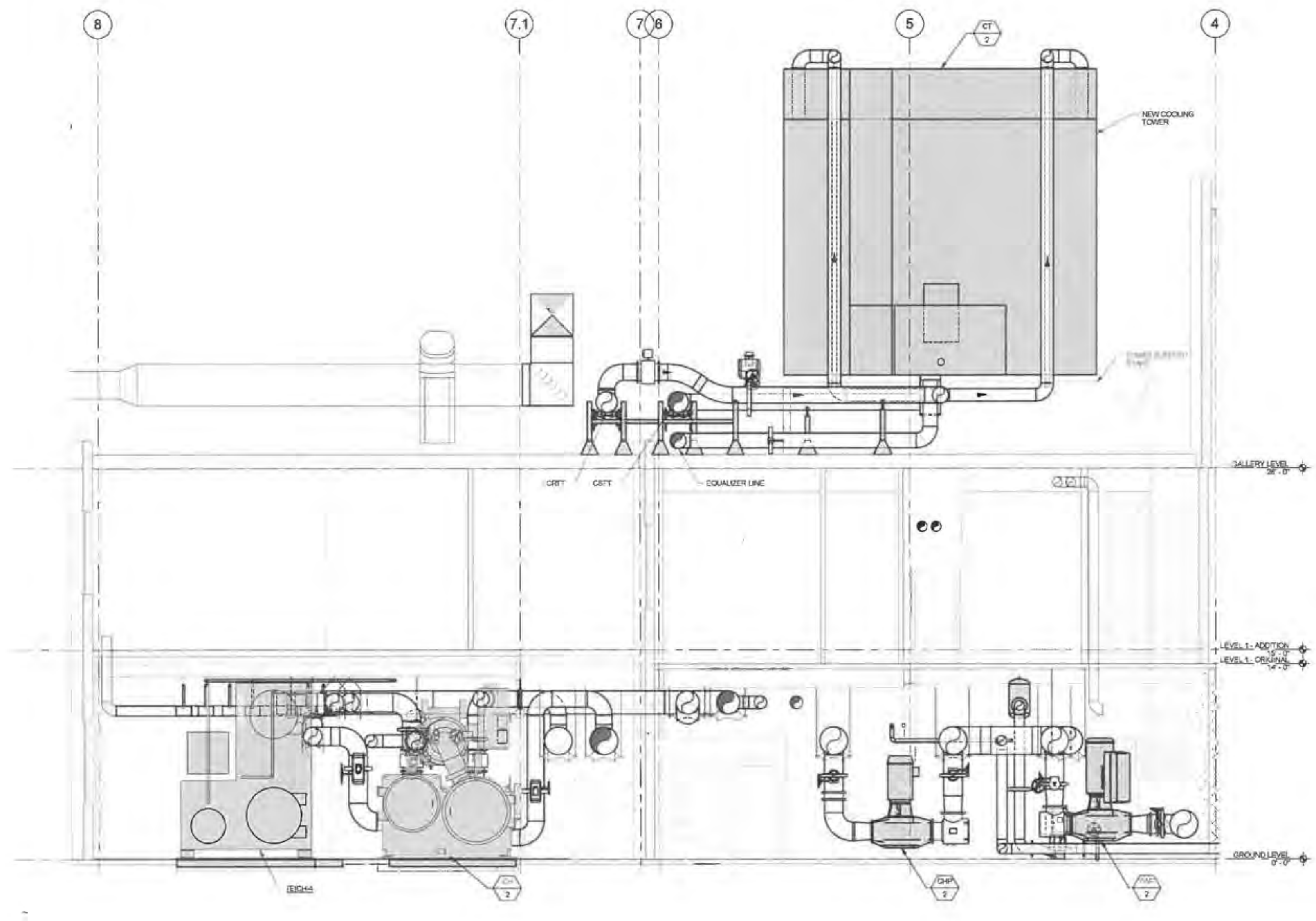
BID SET

No.	Date	Description

Project number: 16.04
Drawn by: NAH
Checked by: JMS
Date: 06/23/17

M3-4.4

6/23/2017 11:17:53 AM



1 **BUILDING SECTION - 16**
SCALE: 1/4" = 1'-0"

M E U L I N K   S T A U F F E N B E R G   I N C - M E C H A N I C A L   S Y S T E M S

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

SECTIONS - NEW

BID SET

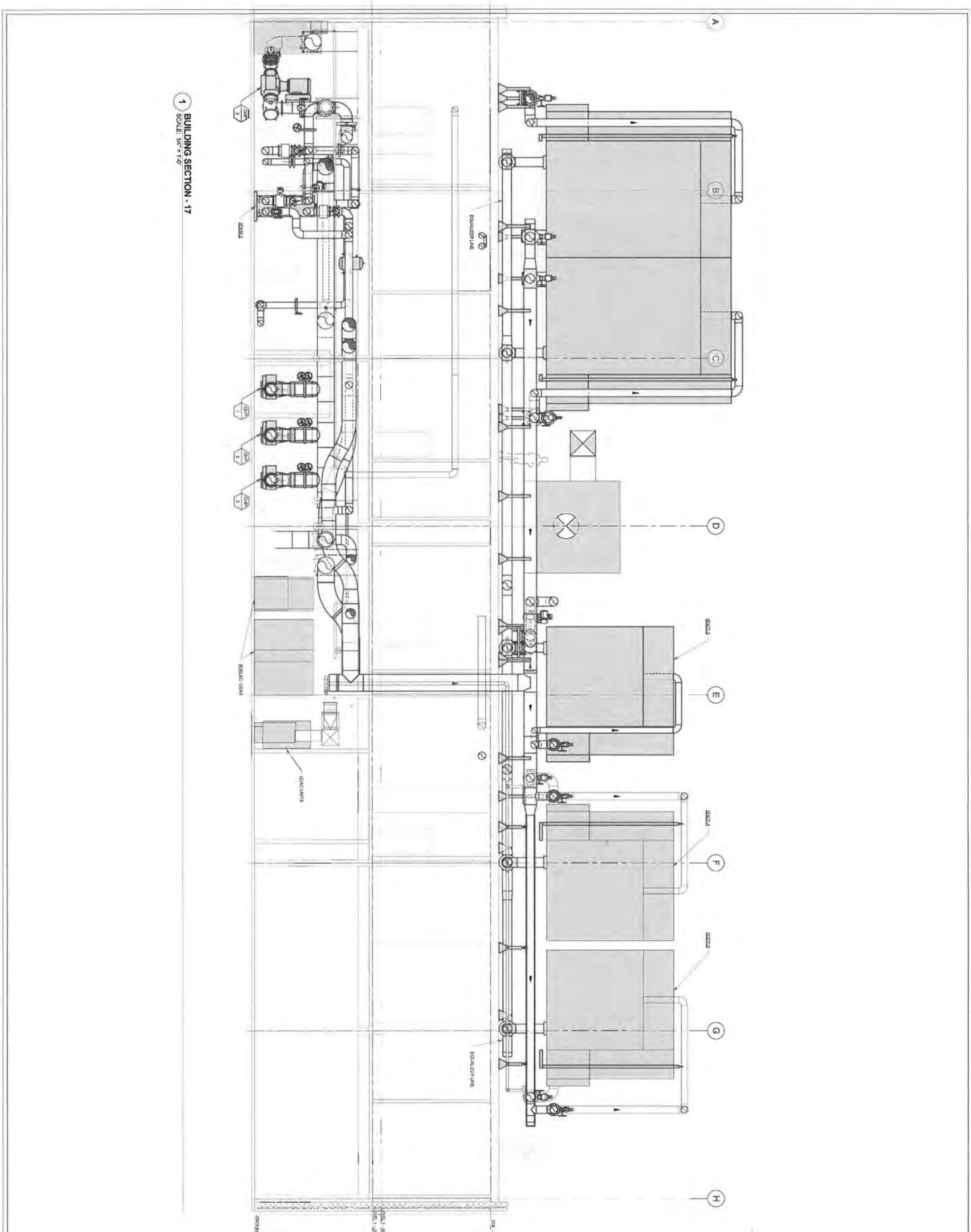
No.	Date	Description

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

Project number:	16.04
Drawn by:	NAH
Checked by:	JBS
Date:	08/23/17

M3-4.5

8/23/2017 11:18:02 AM



MEULINK STAUFFENBERG INC - MECHANICAL SYSTEMS

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
Phone: (509) 624-1050
SPOKANE, WA 99201
Fax: (509) 624-2420

Project Number
Drawn By
Checked By
Date

CHILLED WATER CAPACITY UPGRADE

BP-3 - CHILLER PLANT MODERNIZATION

ROZELL CENTRAL PLANT - EWU, CHENEY, WA

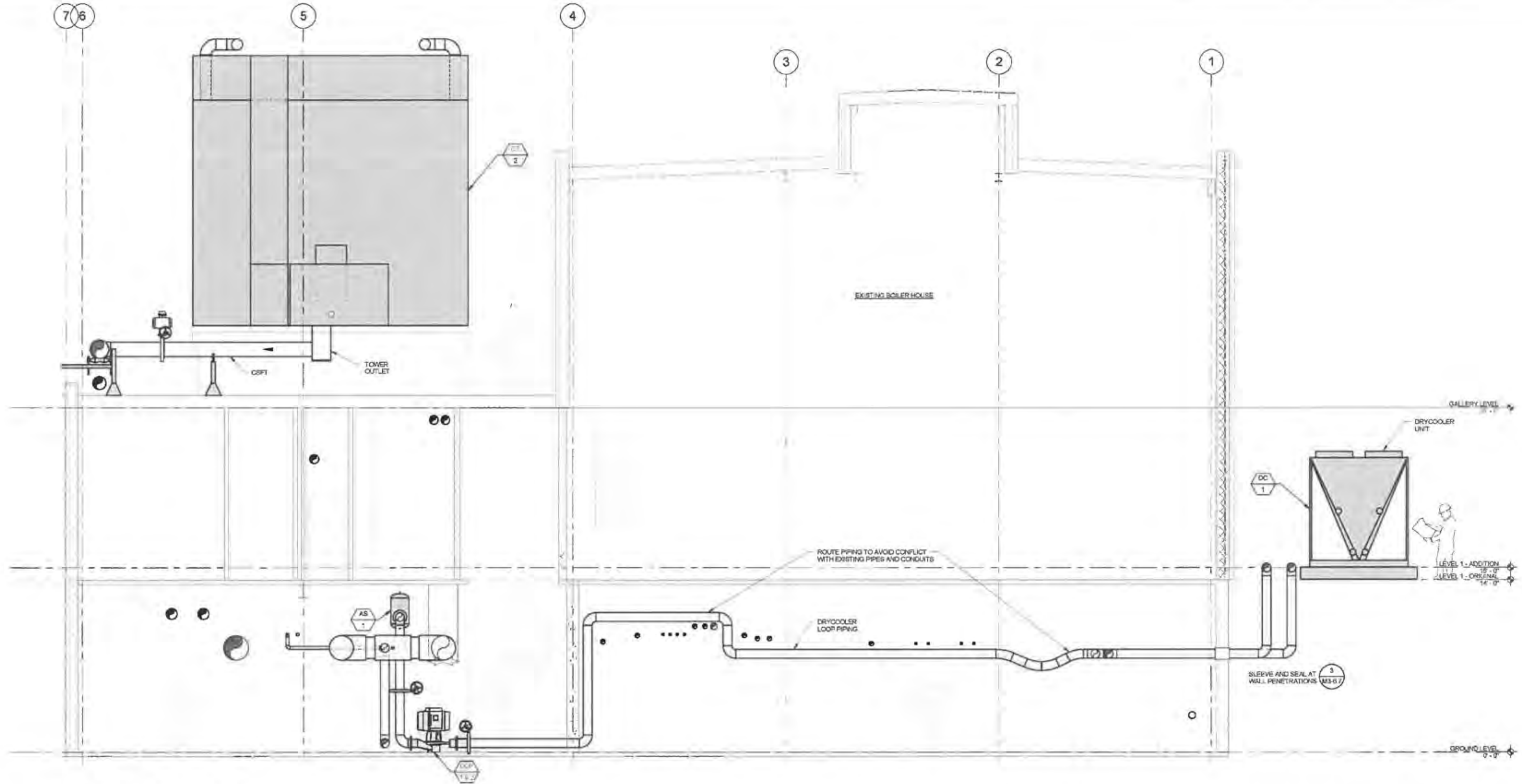
SECTIONS - NEW

BID SET

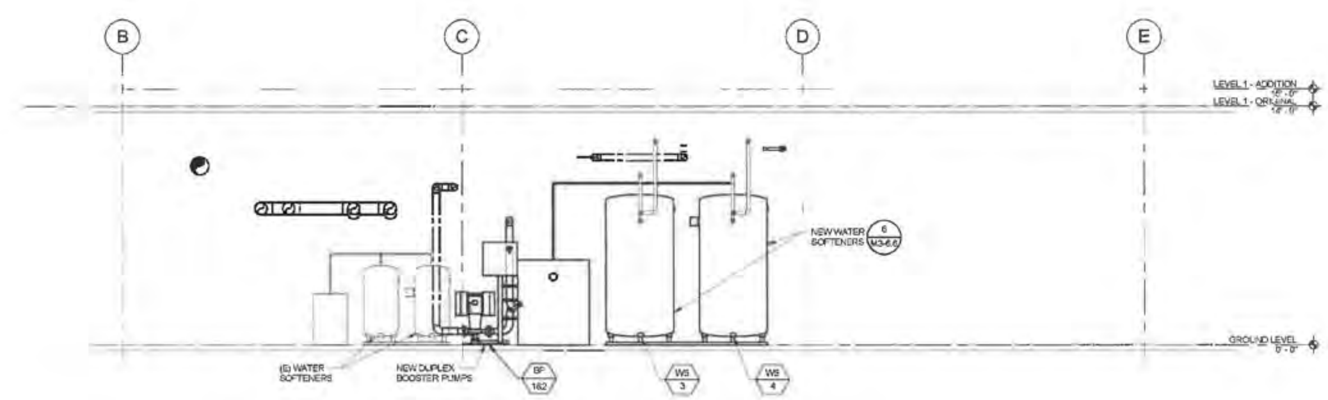
No.	Date	Description

M3-4.6

9/23/2017 11:18:15 AM



BUILDING SECTION - 18
SCALE: 1/4" = 1'-0"



BUILDING SECTION - 19
SCALE: 1/4" = 1'-0"

M E U L I N K   S T A U F F E N B E R G   I N C .   M E C H A N I C A L   S Y S T E M S

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

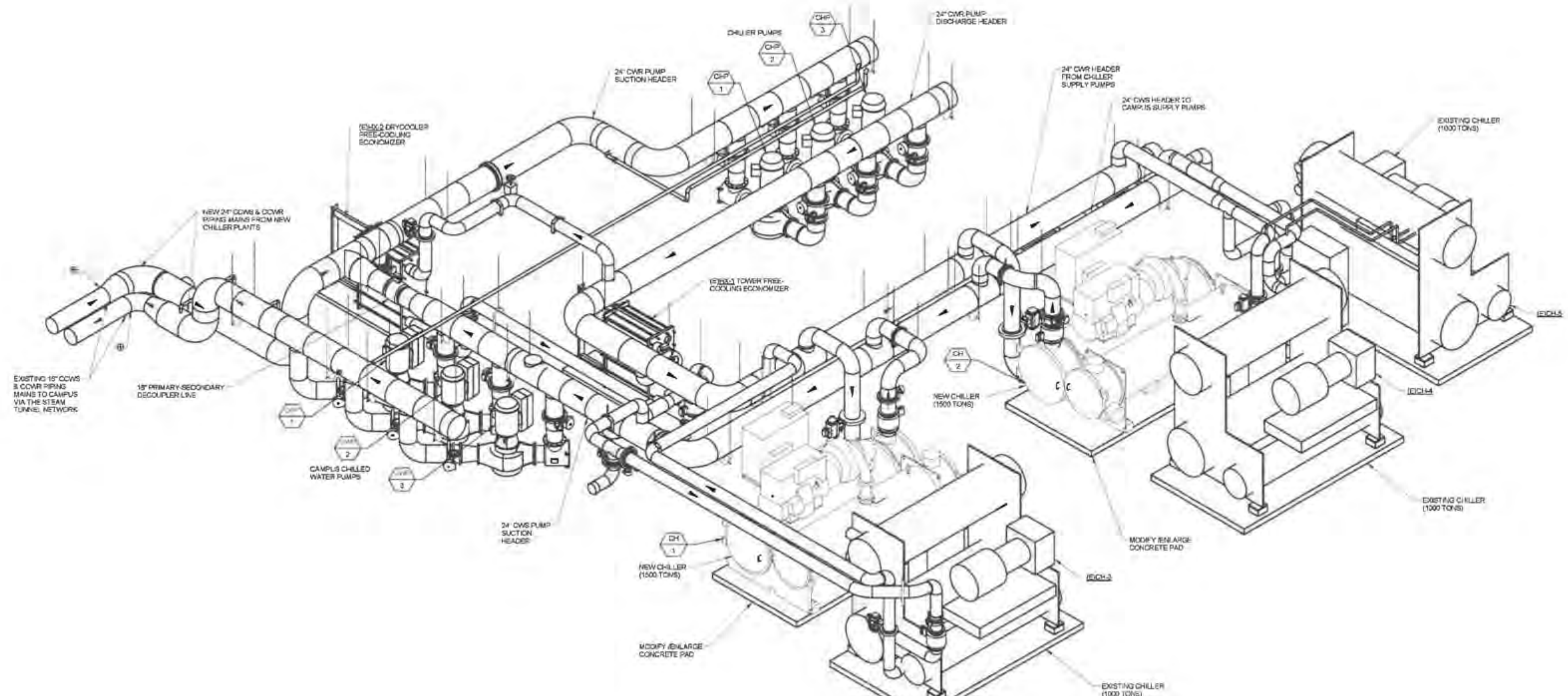
SECTIONS - NEW

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
Phone: (509) 624-1050
SPOKANE, WA 99201
Fax: (509) 624-2420

Project number	16.04
Drawn by	NAH
Checked by	JGS
Date	06/23/17

M3-4.7

6/22/2017 11:18:19 AM



GENERAL NOTES

1. THIS CHILLED WATER ISOMETRIC VIEW IS FOR GENERAL INFORMATION AND OVERALL ORIENTATION PURPOSES. SEE DETAILED FLOOR PLANS, SECTIONS, FLOW DIAGRAMS, DETAILS, ETC. FOR COMPLETE INSTALLATION INFORMATION.

1 CHILLED WATER PIPING ISOMETRIC VIEW
SCALE:

M E U L I N K   S T A U F F E N B E R G   I N C .   M E C H A N I C A L   S Y S T E M S

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

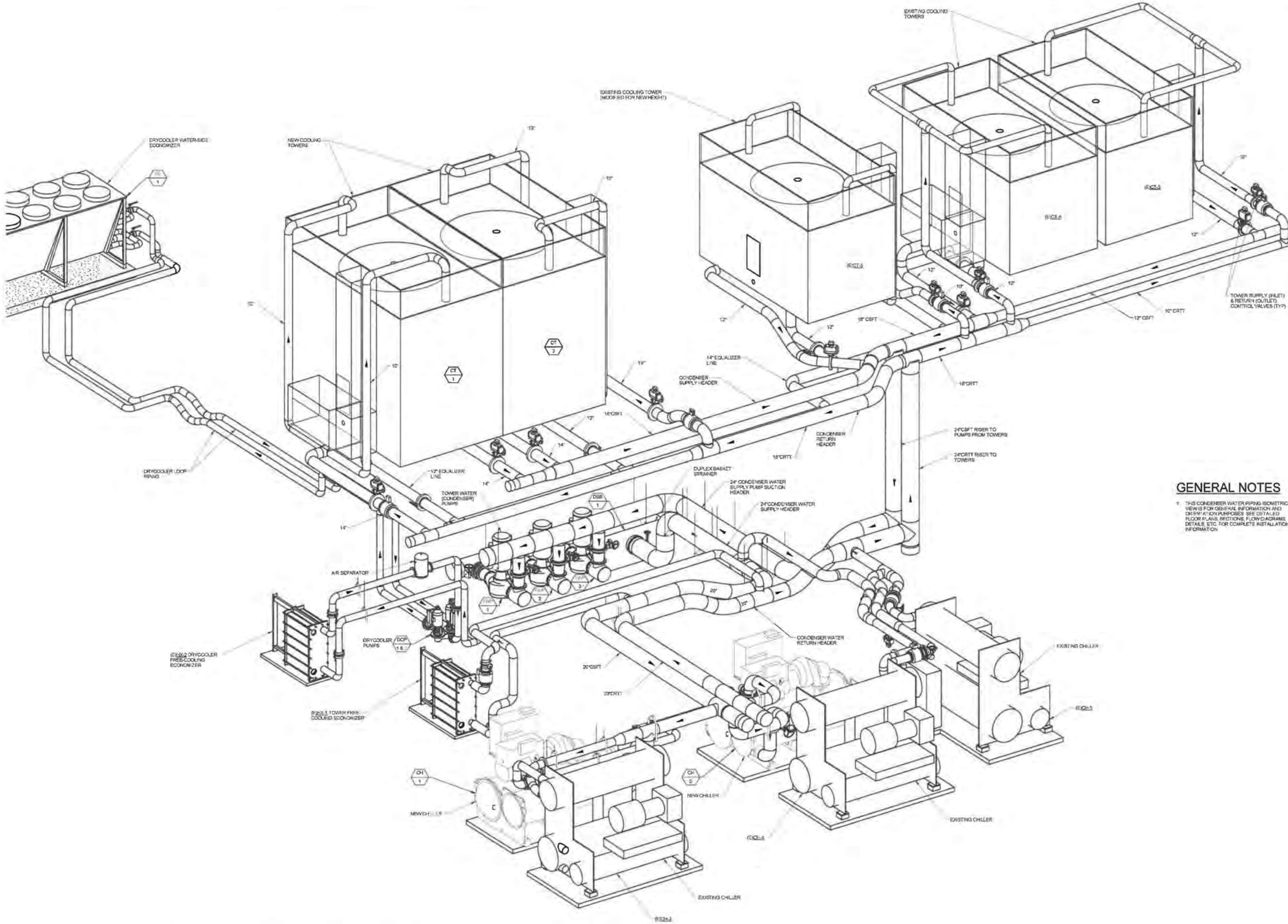
CHILLED WATER PIPING ISOMETRIC VIEW

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

Project number:	16.04
Drawn by:	NAH
Checked by:	JBS
Date:	06/23/17

M3-5.2

6/26/2017 11:16:35 AM



CONDENSER WATER PIPING ISOMETRIC VIEW
SCALE:

GENERAL NOTES

1. THIS CONDENSER WATER PIPING ISOMETRIC VIEW IS FOR GENERAL INFORMATION AND ORIENTATION PURPOSES. SEE DETAILED FLOOR PLANS, SECTIONS, FLOW DIAGRAMS, DETAILS, ETC. FOR COMPLETE INSTALLATION INFORMATION.

M E U L I N K S T A U F F E N B E R G I N C - M E C H A N I C A L S Y S T E M S

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

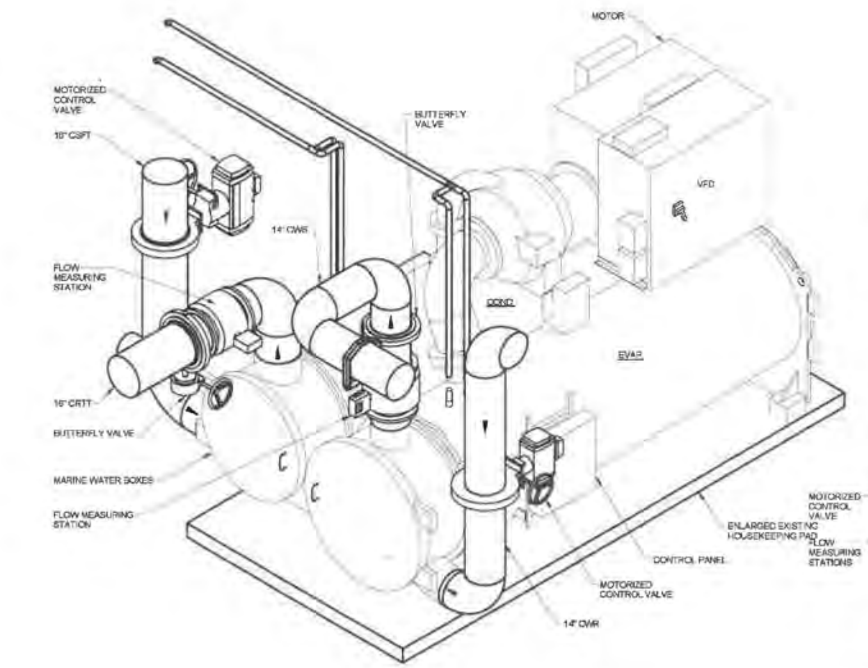
CONDENSER WATER PIPING ISOMETRIC VIEW

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505
Phone: (509) 624-1050
SPOKANE, WA 99201
Fax: (509) 624-2420

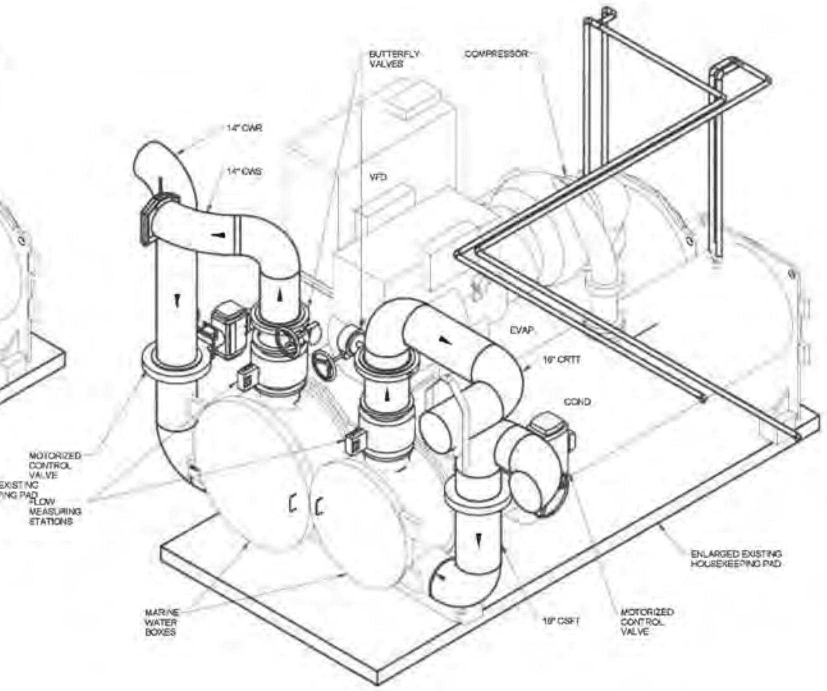
Project number:	16.04
Drawn by:	HAH
Checked by:	JBS
Date:	06/23/17

M3-5.3

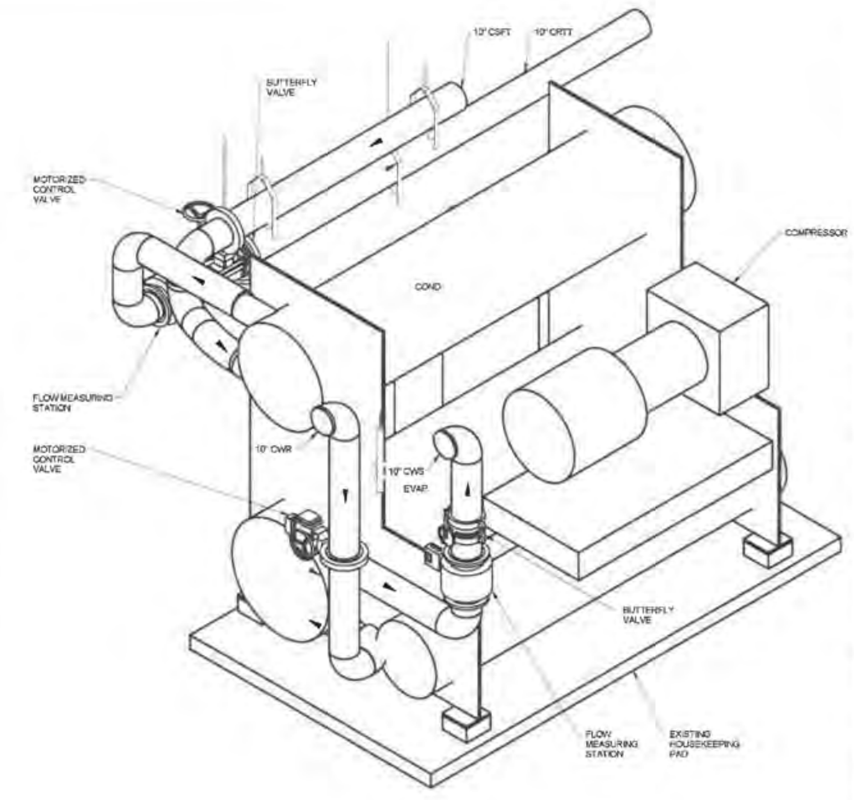
6/23/2017 11:18:41 AM



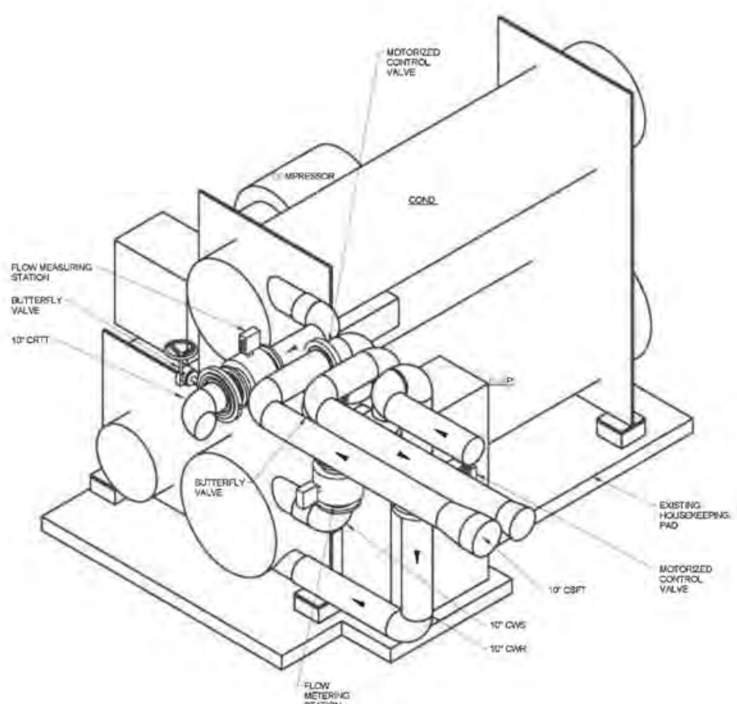
1 **CHILLER - 1 - PIPING**
SCALE:



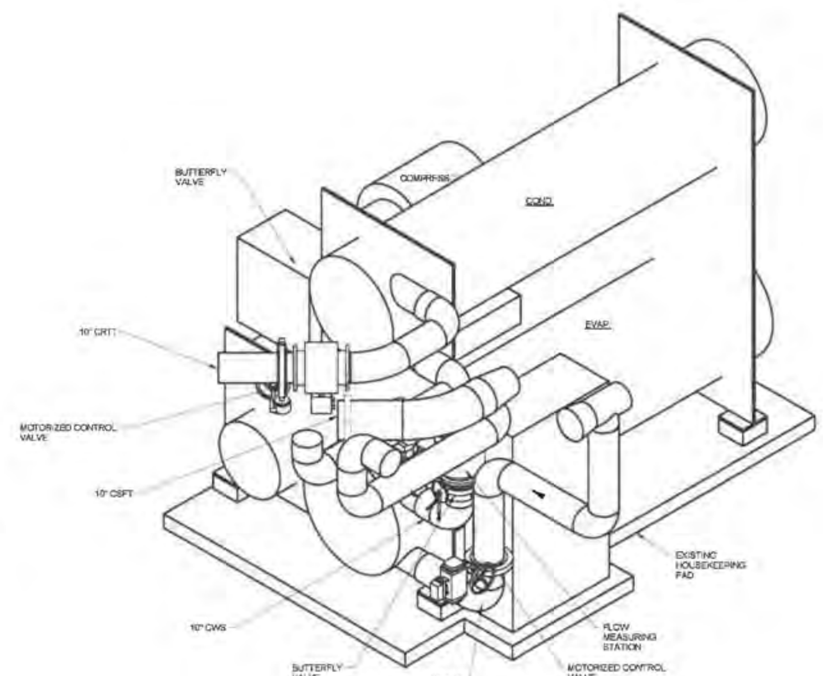
2 **CHILLER - 2 - PIPING**
SCALE:



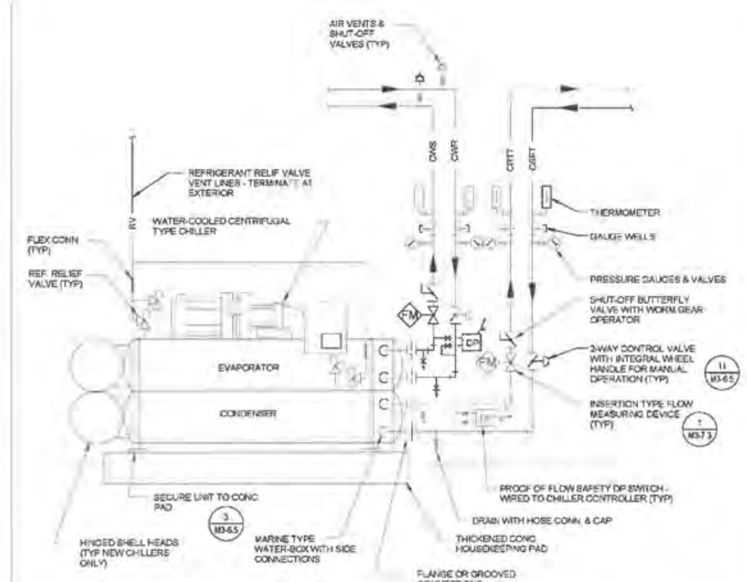
3 **CHILLER - 3 - PIPING**
SCALE:



4 **CHILLER - 4 - PIPING**
SCALE:



5 **CHILLER - 5 - PIPING**
SCALE:



6 **TYPICAL CHILLER PIPING DETAIL**
Scale: NOT TO SCALE

WILLIAM F. MEULINK
STATE OF WASHINGTON
26210
REGISTERED PROFESSIONAL ENGINEER

M E U L I N K S T A U F F E N B E R G I N C - M E C H A N I C A L S Y S T E M S

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

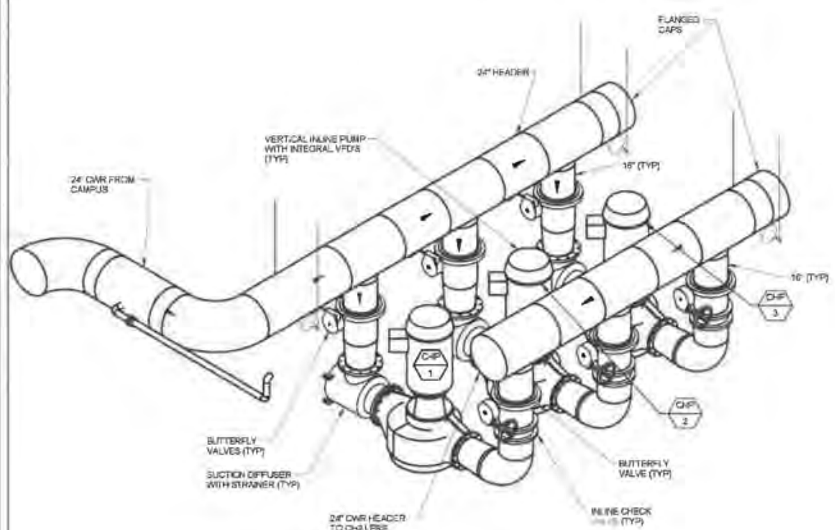
PERSPECTIVES

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
105 N. WASHINGTON, SUITE 505
SPOKANE, WA 99201
Phone: (509) 624-1050
Fax: (509) 624-2420

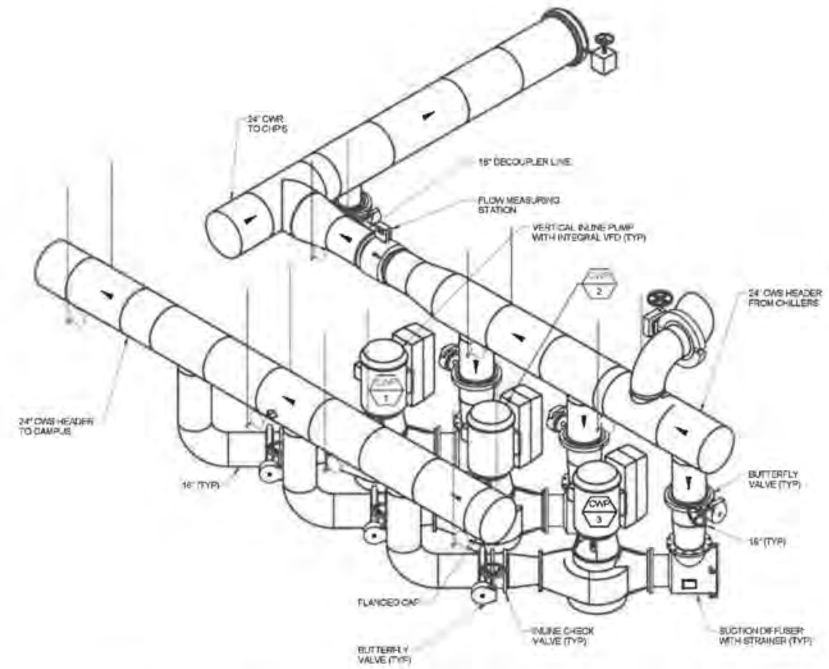
Project number	15.04
Drawn by	NAH
Checked by	JBS
Date	08/23/17

M3-6.0

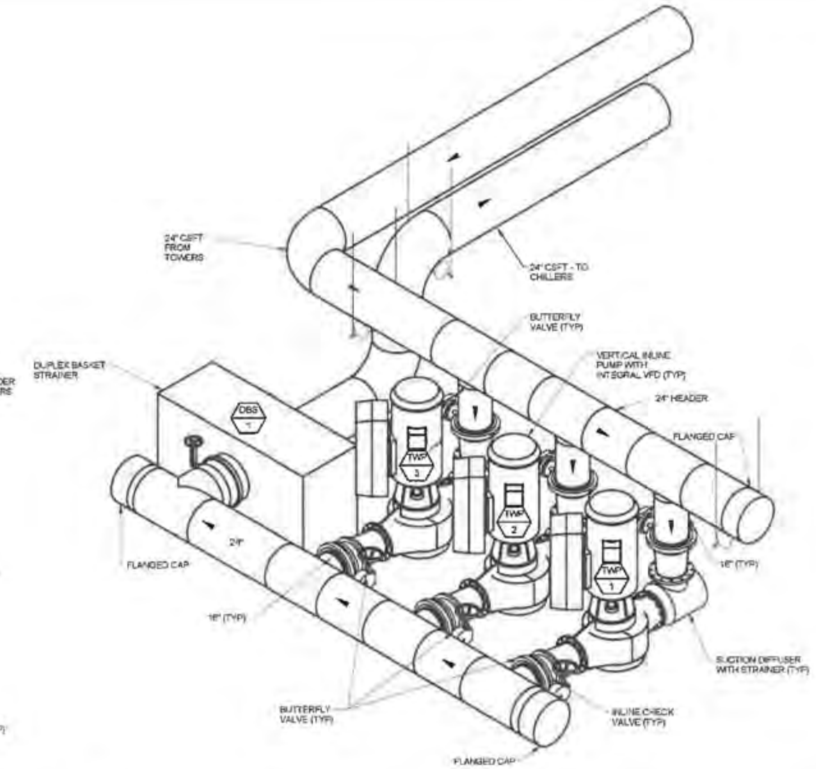
8/25/2017 11:31:52 AM



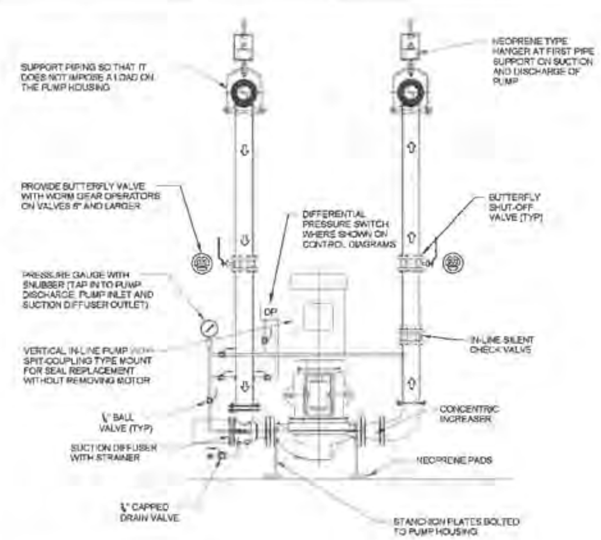
1 **CHILLER LOOP PUMPS - CHP-1, 2, 3 - PIPING**
SCALE:



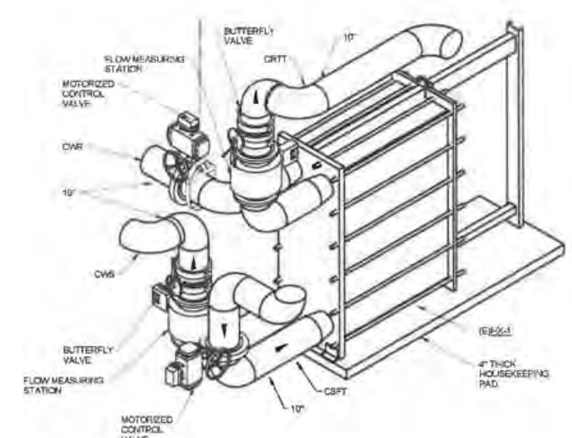
2 **CAMPUS CHILLED WATER PUMPS - CWP-1, 2, 3 - PIPING**
SCALE:



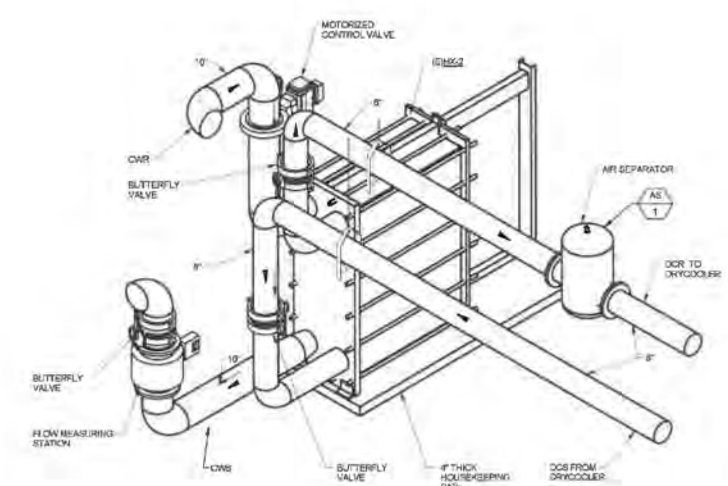
3 **TOWER WATER PUMPS - TWP-1, 2, 3 - PIPING**
SCALE:



4 **VERTICAL IN-LINE PUMP DETAIL**
TO SCALE



5 **HEAT EXCHANGER - HX-1 PIPING**
SCALE:



6 **HEAT EXCHANGER - HX-2 PIPING**
SCALE:

M E U L I N K S T A U F F E N B E R G I N C - M E C H A N I C A L S Y S T E M S

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

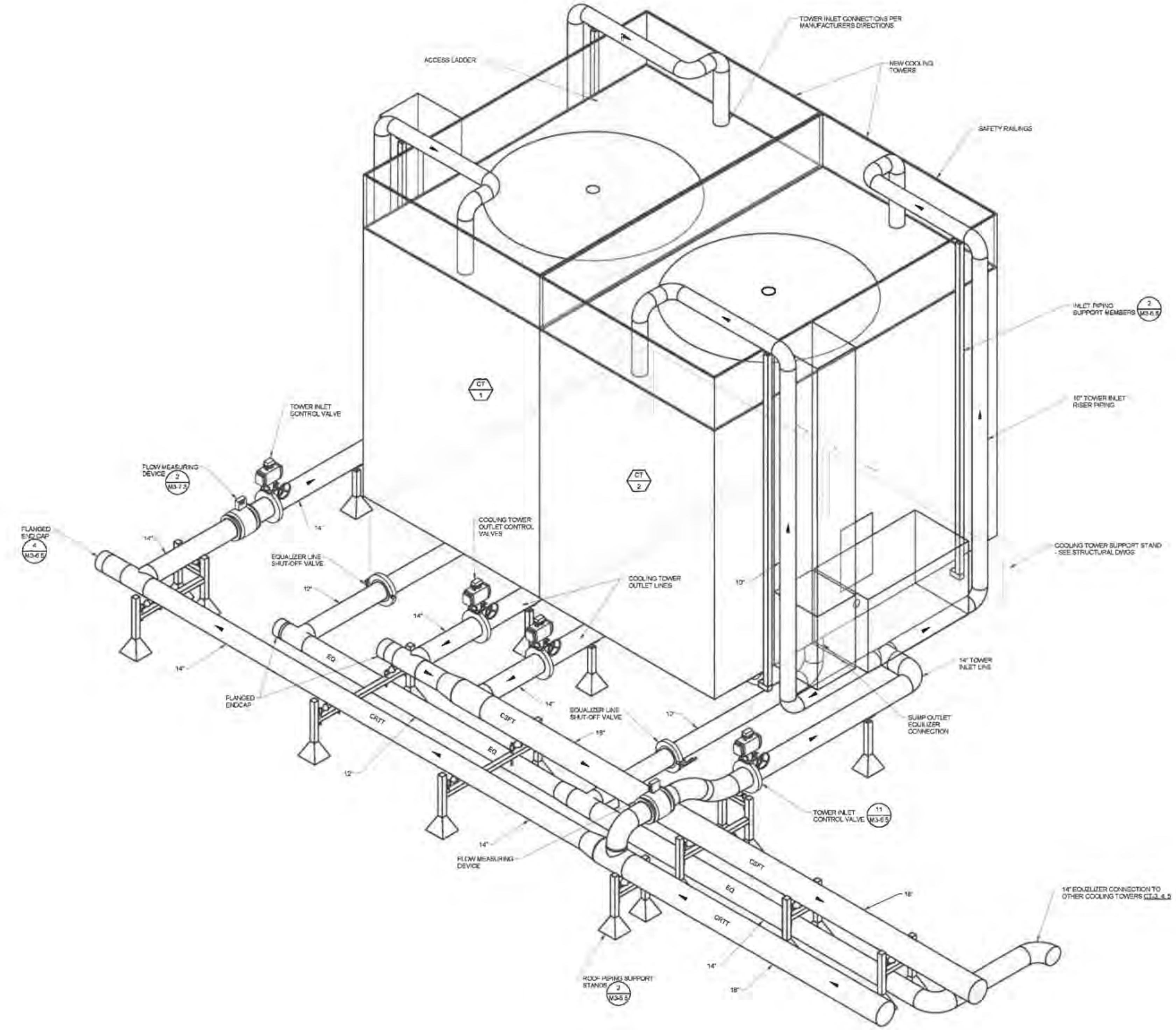
PERSPECTIVES

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

Project number	16.04
Drawn by:	NAH
Checked by:	JBS
Date	08/25/17

M3-6.1

9/23/2017 11:16:55 AM



1 **NEW COOLING TOWERS CT - 1 & 2 - PIPING**
SCALE:

M E U L I N K S T A U F F E N B E R G I N C . - M E C H A N I C A L S Y S T E M S

BID SET

No.	Date	Description

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

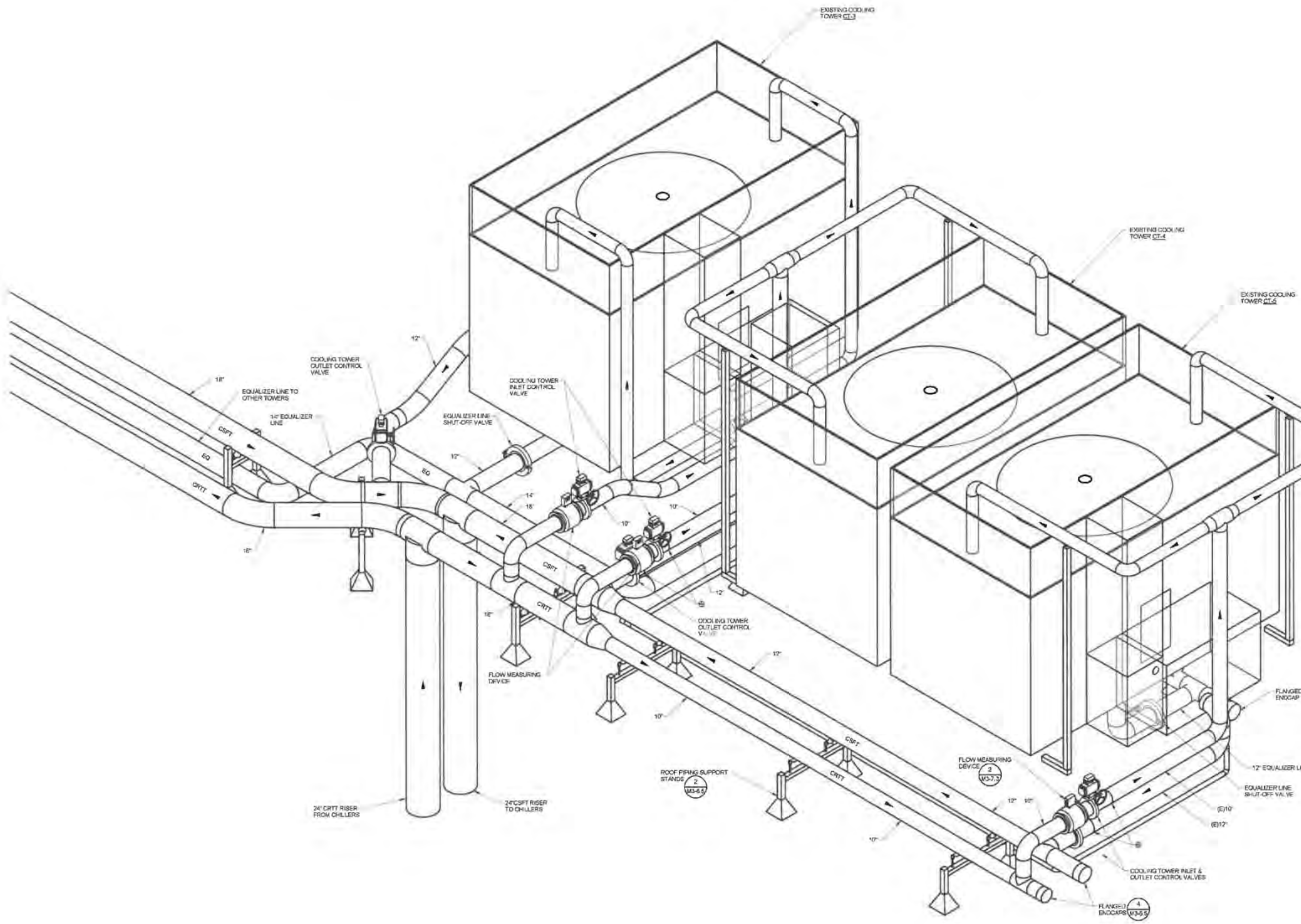
COOLING TOWER PIPING DIAGRAMS

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
105 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

Project number:	16.04
Drawn by:	NAH
Checked by:	JBS
Date:	06/23/17

M3-6.2

6/23/2017 11:15:01 AM



1 **EXISTING COOLING TOWERS CT - 3, 4, & 5 - PIPING**
SCALE:

M E U L I N K   S T A U F F E N B E R G   I N C .   M E C H A N I C A L   S Y S T E M S

BID SET

CHILLED WATER CAPACITY UPGRADE
BP-3 - CHILLER PLANT MODERNIZATION
ROZELL CENTRAL PLANT - EWU, CHENEY, WA

COOLING TOWER PIPING DIAGRAMS

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.
108 N. WASHINGTON, SUITE 505 SPOKANE, WA 99201
Phone: (509) 624-1050 Fax: (509) 624-2420

Project number:	16.04
Drawn by:	NAH
Checked by:	JBS
Date:	09/22/17

M3-6.3

N

VICINITY MAP
Scale: NTS

N

ROZELL CENTRAL PLANT - LOCATION MAP
Scale: NTS

EASTERN WASHINGTON UNIVERSITY ELECTRICAL CAPACITY UPGRADE PROJECT

CHENEY, WASHINGTON

OWNER
EASTERN WASHINGTON UNIVERSITY
CHENEY WA 99004

ELECTRICAL ENGINEER
NAC|ENGINEERING
1203 W RIVERSIDE
SPOKANE WA 99201
509.624.8125

CIVIL ENGINEER
TOSH ENGINEERS
303 E. 2ND AVE
SPOKANE WA 99202
509.622.2986

INDEX OF DRAWINGS

REVISIONS

100% CONSTRUCTION DOCUMENTS

06/14/17

EASTERN WASHINGTON UNIVERSITY
ELECTRICAL CAPACITY UPGRADE
CHENEY, WA

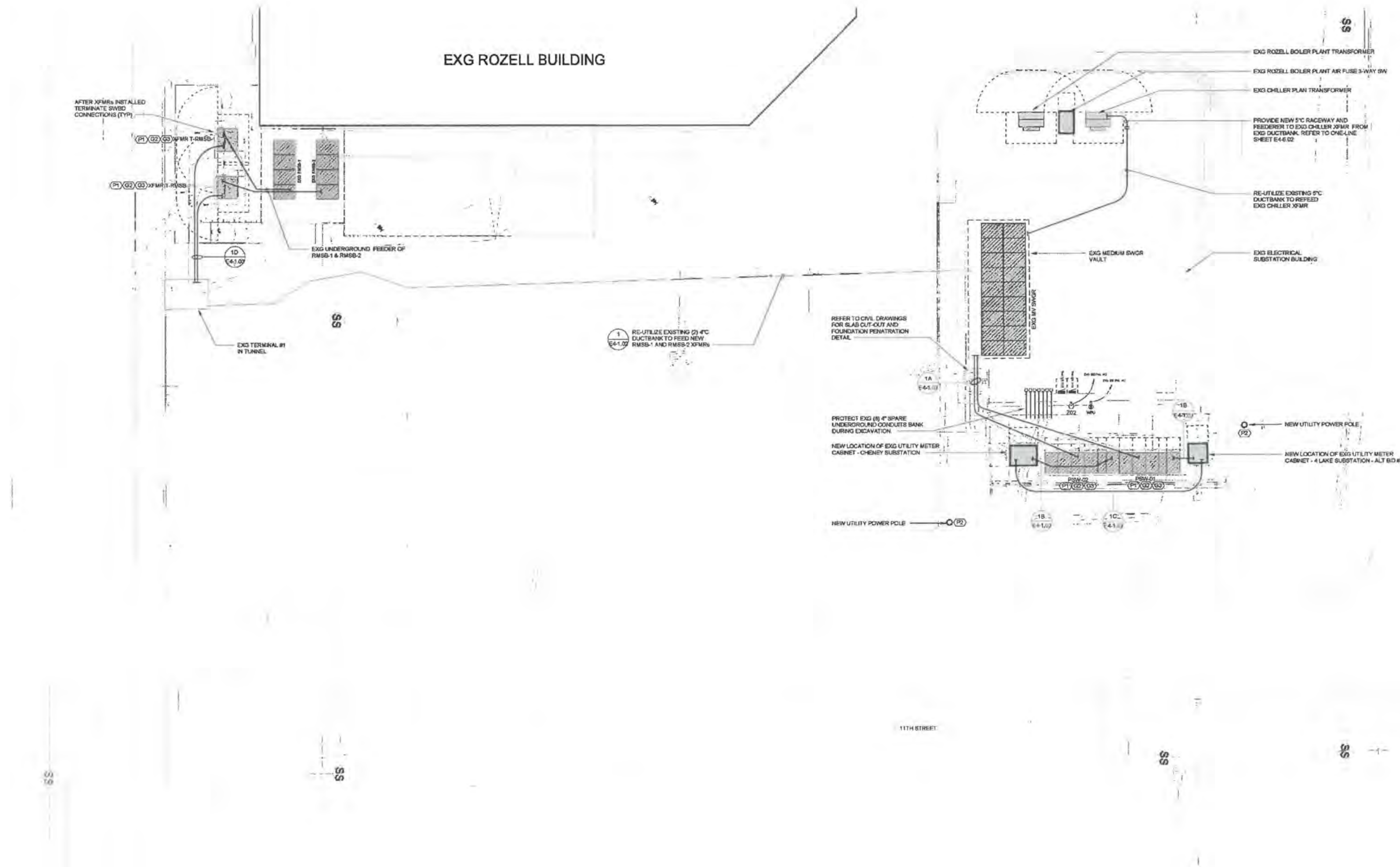
NAC ENGINEERING
nacarchitecture.com
1203 WEST RIVERSIDE AVE
SPOKANE WA 99201

NAC NO 111-15518
DRAWN KVT
CHECKED NBH
DATE 06/14/17

INDEX SHEET

G4-0.01

1 EXISTING DUCTBANK
Scale: NTS



SITE PLAN - ELECTRICAL
Scale 1" = 10'-0"

REVISIONS

100% CONSTRUCTION DOCUMENTS

06/14/17

EASTERN WASHINGTON UNIVERSITY
ELECTRICAL CAPACITY UPGRADE
CHENEY, WA

NAC ENGINEERING
nacarchitecture.com

NAC NO	111-15518
DRAW	KVT
CHECK	NBH
DATE	06/14/17

ELECTRICAL SITE PLAN

E4-1.02

Appendix E – Significant Health, Safety and Code Issues

Appendix E

Significant Health, Safety, and Code Issues:

Sub-Sections:

1. **Central Steam Production**
   a. Issue Addressed: **Heating Public Facilities – Life safety**
      i. Applicable Code: **Local Jurisdiction Model Code IPMC 2015 Section 602.4 Occupiable work spaces:** "Indoor occupiable work spaces shall be supplied with heat during the period **[DATE]** to **[DATE]** to maintain a minimum temperature of 65°F (18°C) during the period the spaces are occupied", meaning the university has a requirement to maintain temperate building environments for daily university operations.
   b. Issue Addressed: **N + 1 Redundancy – Life safety**
      i. Applicable Code: **Local Jurisdiction Model Code IBC 2018 Section 1203.1 Equipment and Systems:** "Interior spaces intended for human occupancy shall be provided with space heating systems capable of maintaining and indoor temperature of not less than 68 F at a point 3 feet above the floor on a design heating day". The project will improve consistency with this code through boiler replacement back to N+1 plant redundancy.
      ii. Applicable Code: **Local Jurisdiction Model Code IMC 2018 Section 309.1 Equipment and Systems:** "Interior spaces intended for human occupancy shall be provided with space heating systems capable of maintaining an indoor temperature of not less than 68 F at a point 3 feet above the floor on a design heating day. The installation of portable space heaters shall not be used to achieve compliance with this code". The project is needed to bring Central Steam Production into compliance with known winter heat loads and allow for maintenance or repair to occur without interruption.
      iii. Applicable Code: **Local Jurisdiction Model Code 2018 IPMC Section 603.1 Mechanical appliances:** "Mechanical equipment shall be capable of performing the intended function", meaning, the age of the boilers intended for replacement currently cannot be maintained and/or repaired to meet this code requirement.
      iv. Applicable Code: **Local Jurisdiction Model Code 2018 IPMC Section 603.1 Mechanical appliances:** "Mechanical equipment shall be capable of performing the intended function", meaning, the lack of redundancy limits the capability to generate medium pressure steam for building space and domestic hot water heating (boiler maintenance, boiler repairs etc.).
   c. Issue Addressed: **Energy Efficiency (Code)**
      i. Applicable Codes: **2015 Washington State Energy Code, Commercial Provisions, Section C403.2.3(5) "Minimum Efficiency Requirements Gas Fired Boilers- Steam- > 2,500,000 BTU/Hr ":** The project will provide new boiler(s) meeting these energy efficiency codes as part of design and construction.

d. Issue Addressed: **Seismic Restraints – Life safety**
    i. Applicable Codes: **Local jurisdiction model code IBC 2018 Section 1613.1 Earthquake Loads:** "Every structure, and portion thereof, including non-structural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Section 1613 or ASCE 7", meaning the existing boilers and auxiliary equipment within the plant are not constructed to this requirement, however the project will improve consistency to this code by requiring all subject equipment installed under the project align with this code.

2. Chilled Water Production

a. Issue Addressed: **N + 1 Redundancy – Life safety**
    i. Applicable Codes: **Local Jurisdiction Model Code 2018 IPMC Section 603.**1 **Mechanical appliances:** "Mechanical equipment shall be capable of performing the intended function", meaning, the lack of redundancy limits the capability to generate chilled water for building air conditioning during all periods (chiller maintenance, chiller repairs etc).

b. Issue Addressed: **Energy Efficiency (Code):**
    i. Applicable Codes: **2015 Washington State Energy Code, Commercial Provisions, Section C403.2.3 HVAC Equipment Performance Requirements:** "Equipment shall meet the minimums requirements of Tables C403.2.3(1) through C403.2.3(9) when tested and rated in accordance with the applicable test procedure.

c. Issue Addressed: **Seismic Restraints – Life safety**
    i. Applicable Codes: **Local jurisdiction model code IBC 2018 Section 1613.1 Earthquake Loads:** "Every structure, and portion thereof, including non-structural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Section 1613 or ASCE 7", meaning the existing chillers and auxiliary equipment within the plant were not constructed to this requirement will be brought up to this code.

3. Medium Voltage Electrical Distribution

a. Issue Addressed: **Electrical Safety of EWU Electrical Shop Workers – Life safety**
    i. The current usage/installation of SF6 (sulfur-hexafluoride) circuit breakers in the EWU utility tunnel system presents (3) operational safety issues addressed in the following codes:
        1. **2017 National Electrical Safety Code (NESC) C2-2017 Section 443:** "Work on Energized Lines and Equipment" Sub-Section J "Gas-Insulated equipment", "By-products resulting from arcing in

Sulfur-Hexafluoride (SF6) gas insulated systems are generally toxic and irritant".

2. **USEPA Office of Air and Radiation – Catalog of Guidelines and Standards for the Handling and Management of Sulfur Hexafluoride (SF_6):** "Catalog list more than 65 references addressing topics related to the safe handling, management, and removal of Sulfur Hexafluoride infused components in the electrical, magnesium processing, and semiconductor industries". The project will improve consistency to the code by safe removal of this greenhouse gas.
3. **2017 National Electrical Safety Code (NESC) C2-2017 Section 12:** "Installation and Maintenance of Equipment", Sub-Section 125 "Working Space about Electric Equipment", Part B "Working Space Over 600 Volts".
4. **OSHA Confined Work Space Definition:** "Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, **underground utility vaults, tunnels**, pipelines, and open top spaces more than 4 feet in depth such as pits, tubs, vaults, and vessels.

4. Water Resource Services

a. Issue Addressed: **Life safety**
   i. Fire Sprinkler Water Service Sizing for Campus Expansion:
      1. Applicable Codes: **2016 NFPA 13 Section 11.1:** Design approaches to meet all Listed Requirements.

b. Issue Addressed: **Utilities issues**
   i. Potable Water Service Sizing for Campus Expansion:
      1. Applicable Codes: **2015 UPC 610.0:** "Size of Potable Water Piping"

Appendix F – Evidence of Increased Repairs

The full document can be viewed at this link:

https://ewueagles.sharepoint.com/:b:/s/CPEWU/EUoTiXtB9q5Ijqx0-gPnoPEBe9TM28iI2mImQv1gjpaFbA

Appendix F

Item 2.

Evidence of increased repairs and/or service interruption:

EVIDENCE OF INCREASED REPAIRS

CENTRAL STEAM PRODUCTION

2012 - 2018

COSTS OF PLANT SYSTEM REPAIRS

AE-1281	**ROZ - STEAM SYSTEM REPAIRS & UPGRADES**	**$725,603.42**
AE-1476	**ROZ – STEAM SYSTEM REPAIRS & UPGRADES**	**$532,177.01**
16-116407	**ROZ – BOILER #5 STRUCTURAL & INDUCER FAN REPAIRS**	**$405,723.00**
AE1257	**ROZ – BOILER FEED WATER PUMP REPLACMENT**	**$653,314.20**
AE1353	**ROZ – OIL TANK REMEDIATION**	**$349,811.08**
	Boiler Repairs Total	**$2,666,628.71**

AE-1281

2013 TO 2014

ROZELL - STEAM PLANT REPAIRS

$725,603.42

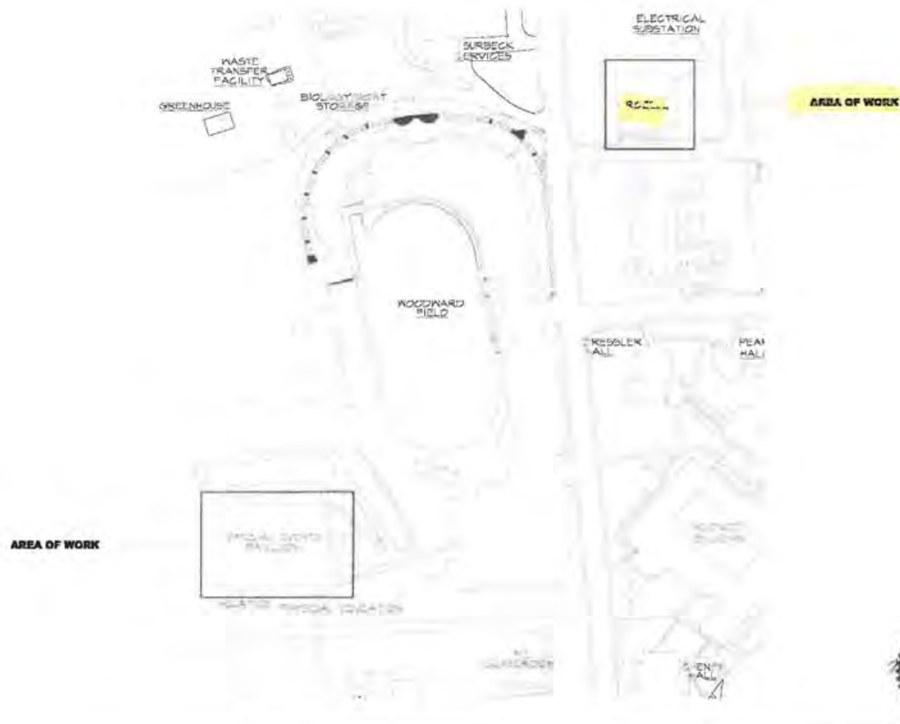
Repair Scope of Work: Replacement of select failing steam valves, pressure control valves, existing piping examination and replacement, nondestructive testing of piping and other systems, rebuild/service DA tank and piping modifications.

STEAM VALVE REPLACEMENTS
EASTERN WASHINGTON UNIVERSITY
CHENEY, WA

STATE PROJECT NUMBER: AE1281
CONTRACTING AGENCY: EASTERN WASHINGTON UNIVERSITY
CONSTRUCTION AND PLANNING SERVICES

COFFMAN ENGINEERS

CEI JOB #12344



DRAWING INDEX

GENERAL

MECHANICAL

REVISIONS

NO.	DATE	DESCRIPTION

COFFMAN ENGINEERS

EASTERN WASHINGTON UNIVERSITY
STEAM VALVE REPLACEMENT

DRAWING TITLE: COVER SHEET

PROJECT NO.: 12344 | SCALE: NOTED | DATE: 08/15/12 | REVISION NO.: 1

DESIGNED BY: MJS | CHECKED BY: MJS | DRAWING NO.: G-001

AE-1281

AE-1476

2015 TO 2017

ROZELL - STEAM PLANT REPAIRS

$532,177.01

Repair Scope of Work: Replacement of select failing steam valves, resize and rebuild boiler feed-water pump suction header, replace condensate transfer pumps and rebuild condensate pump header, nondestructive pressure vessel testing, inspect boiler non-return valves, inspect boiler #5 inducer fan, misc. minor structural upgrades to mitigate structural failures.

WO# 16-116407

2017 TO 2018

ROZELL – BOILER #5 INDUCER FAN AND STRUCTURAL REPAIRS

$405,723.00

Repair Scope of Work: Boiler #5 inducer fan structural failures developed due to a vibration issue. Engineering inspection determined that insufficient super-structure support at time of original construction caused the fan rotating assembly damage. Project included rebuilding the rotating assembly, replacing the pillow block bearings, aligning the shaft, fan, and motor, and balancing the entire assembly. Also the building structural components related to this assembly were engineered and upgraded to handle the dead, live, and vibratory loads of this fan.

AE-1257

2012 TO 2013

ROZELL – BOILER FEEDWATER PUMP REPLACEMENTS AND REPAIRS

$653,314.20

Repair Scope of Work: Replace worn out inefficient boiler plant feed water pumps, provide some redundancy, and add VFD drives for energy savings. This was an emergent need to the boiler operations.

AE-1353

2013 TO 2015

ROZELL – BOILER FUEL TANK REMEDIATION & REPAIR

$349,811.08

<u>Repair Scope of Work:</u> The abandoned underground Bunker C oil tank (UST) removal was a requirement of the university's public water system permit through WSDOH. This first phase had to be accomplished prior to commencing on drilling of a new well for the university. The remediation included removal and disposal of 9,700 gallons of petroleum-impacted soils, removal and disposal of asbestos pipe fittings, as well as cleaning and filling approximately 85,000 gallon UST, cleaning other utility vaults and grading the site.

BOILER REPAIR AND MAINTENANCE SINCE JULY 2007

YEAR	O&M	REPAIR	WORK FOR OTHERS	IMPROVEMENT	GRAND TOTAL
2007	5,856.35	264.11			6,120.46
2008	11,825.93	725.28		17,650.10	30,201.31
2009	7,596.13	13,016.96	107,228.90		127,841.99
2010	18,041.19		281.93	1,778.82	20,101.94
2011	42,823.63		2,448.09	608,427.50	653,699.22
2012	35,663.19		1,844.40	24,166.32	61,673.91
2013	34,967.99		1,181.96	19,030.92	55,180.87
2014	19,669.19		291.80	(2,717.52)	17,243.47
2015	17,760.78			(0.01)	17,760.77
2016	24,580.66	12,960.17	240.51		37,781.34
2017	38,513.53		5,665.83	2,717.50	46,896.86
2018	27,378.04				27,378.04
Grand Total	**284,676.61**	**26,966.52**	**119,183.42**	**671,053.63**	**1,101,880.18**

EVIDENCE OF INCREASED REPAIRS

CHILLED WATER PRODUCTION

2018 TOTAL PROPOSED COSTS FOR EXISTING CHILLERS #3, #4 & #5, AND COOLING TOWERS #3, #4, & #5 REPAIRS

July 19, 2018	**Chiller #4 Motor Rotor Repair Proposal**	**$90,250.00**
May 15, 2018	**Chiller #4 Motor Analysis Proposal**	**$ 4,775.00**
June 25, 2018	**Water Softening System Proposal**	**$ 9,999.00**
June 20, 2018	**Tower #4 & #5 Driveshaft Parts Proposal**	**$ 5,745.00**
May 4, 2018	**Tower #3 Rebuild Parts Proposal**	**$ 1,307.00**
May 14, 2018	**Wonderware Software Renewal**	**$ 8,445.00**
May 5, 2018	**Flow issues on existing chillers**	**$ 3,069.79**
Feb. 1, 2018	**Chiller #3, #4, & #5 Svc & Inspection Proposal**	**$ 4,500.00**
	Chillers & Towers Repairs Total	**$128,100.00**

CHILLER REPAIR AND MAINTENANCE SINCE JULY 2007

YEAR	O&M	REPAIR	WORK FOR OTHE	GRAND TOTAL
2007	5,752.11	191.52	649.16	6,592.79
2008	30,937.29	198,437.55	846.25	230,221.09
2009	25,464.51	8,378.91	485.51	34,328.93
2010	24,157.18	4,766.56	3,922.85	32,846.59
2011	28,295.07		5,702.28	33,997.35
2012	39,980.47	9,086.64	885.84	49,952.95
2013	67,725.49	75,999.23	17,523.77	161,248.49
2014	51,991.32	26,547.36	4,332.80	82,871.48
2015	28,862.15	16,576.36		45,438.51
2016	32,815.86	38,053.71	2,959.62	73,829.19
2017	34,269.62	41,563.76	353.81	76,187.19
2018	22,221.70		372.23	22,593.93
Grand Total	**392,472.77**	**419,601.60**	**38,034.12**	**850,108.49**

Appendix G – Reasonable Estimates

Appendix G

Item 4

Reasonable Estimates

&

Actual and projected savings

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

BOILER PLANT UPGRADE

FY2021-23 Central Steam Production
Reasonable Estimate

Updated Budgetary Cost Estimate:

EWU - Install New Boiler (CP-1056) - Pre-Design Study Budget Level Cost Estimates

Pre-Design Review Adjustments (6-1-20)	CONSTRUCTION COSTS (Includes Const. Contingency & Contractor O&P)	SOFT COSTS (Includes Design Contingency, Sales Tax, Design Fees)	TOTAL PROJECT COSTS
Task-1: Basic Boiler Replacement: TOTAL COST	$ 4,320,538 (75%)	$ 1,420,593 (25%)	$ 5,741,131
Probable Bid Range:	$4.5 M to $5.0 M		
Proposed/Recommended Upgrade Tasks			
Mechanical - Task M-200 Replace Non-Return Valves	$ 136,500	$ 36,637	$ 173,137
Mechanical - Task M-300 Upsize Feedwater Pumps	$ 51,875	$ 13,923	$ 65,798
Mechanical - Task M-400 Replace Feedwater Piping	$ 127,563	$ 41,943	$ 169,505
Mechanical - Task M-500 Install Redundant Hotwell Tank(s)	$ 431,397	$ 141,843	$ 573,240
Mechanical - Task M-600 Replace Water Softeners	$ 64,102	$ 17,205	$ 81,306
Mechanical - Task M-700 Install pH Neutralizer on Process Waste	$ 124,922	$ 48,620	$ 173,542
~~[illegible]~~	~~$ [illegible]~~	~~$ [illegible]~~	~~$ [illegible]~~
Electrical - Task E-200 Replace Swbd FM & FME	$ 122,760	$ 40,364	$ 163,124
Electrical - Task E-300 Replace MCC-GMC	$ 43,356	$ 14,256	$ 57,612
Electrical - Task E-400 Replace Generator ATS	$ 65,943	$ 21,682	$ 87,625
Electrical - Task E-500 Replace UPS & UPS Panel Board	$ 123,604	$ 40,641	$ 164,245
Total Proposed/Recommended Upgrade Costs	$ 1,292,020	$ 417,113	$ 1,709,133
EWU - Install New Boiler Project with Upgrades: TOTALS	$ 5,612,558	$ 1,837,706	$ 7,450,264

Probable Bid Range: $5.5M to $6.5M

Add in Proj. Mgmt, Admin, & other agency costs @ 25%
Probable MACC range: $6.9M to $8.1M
These projections estimate future boiler replacements at this point as well.

USE $8,100,000

MSI ENGINEERS
MEULINK STAUFFENBERG, INC

EWU - Chiller Plant Upgrade
2020 - Proposed Mechanical Upgrades
Budgetary Level Cost Estimates
7/6/2020
MSI# 19-59
By: B. Snow

MECHANICAL SYSTEMS INFRASTRUCTURE UPGRADE BUDGET PRICE SUMMARY

	Budget Cost Estimate
Chiller Plant	
CP-1: Replace Chiller #4 - 1500 tons	$1,255,417
CP-2: Replace Chiller #3 - 1500 tons	$1,255,417
CP-3: Replace Cooling Towers #4 & #5 with new Towers	$823,529
CHILLER PLANT (CP) -	$3,334,364
TPC - MECHANICAL SYSTEMS TOTAL -	$3,334,364
AGENCY PROJECT MANAGEMENT, ADMIN & OTHER COSTS @ 25% -	$833,591
MACC - MECHANICAL SYSTEMS TOTAL -	$4,167,955

MSI ENGINEERS
MEULINK STAUFFENBERG, INC

EWU - Chiller Plant Upgrade
2020 - Proposed Mechanical Upgrades
Budgetary Level Cost Estimates
7/6/2020
MSI# 19.59
By: B. Snow

CHILLED WATER SYSTEM - UPGRADE BUDGET SUMMARY

Chiller Plant (CP)

CP-1: Replace Chiller #4 - 1500 tons

	Unit	Quantity	$/unit	Cost
1500 Ton Water-Cooled Cent. Chiller with VFD - York	ea	1	$500,000.00	$500,000
Demo Ex. Chiller #4	ea	1	$30,000.00	$30,000
Rig & Set - Crane Rental	job	1	$20,000.00	$20,000
Demo Piping & Valves	job	1	$35,000.00	$35,000
New Conc. Pad	ea	1	$15,000.00	$15,000
Chiller Loop Tie-in Piping, Valves & Insulation	job	1	$50,000.00	$50,000
Tower Loop Tie-in Piping, Valves & Insulation	job	1	$50,000.00	$50,000
BAS Upgrades & Control Valves	job	1	$125,000.00	$125,000
Test & Balance, Start-up & Commissioning	job	1	$20,000.00	$20,000
Misc. Piping & Modifications	job	1	$25,000.00	$25,000
Electrical for Chiller Upgrade	job	1	$35,000.00	$35,000
Water Treatment and Cleaning	job	1	$25,000.00	$25,000
			Subtotal	$930,000
	%	20	Design Contigency	$185,917.23
	%	15	G.C. OH&P	$139,500
			CP-1 - TOTAL	**$1,255,417**

CP-2: Replace Chiller #3 - 1500 tons

	Unit	Quantity	$/unit	Cost
1500 Ton Water-Cooled Cent. Chiller with VFD - York	ea	1	$500,000.00	$500,000
Demo Ex. Chiller #4	ea	1	$25,000.00	$30,000
Rig & Set - Crane Rental	job	1	$15,000.00	$20,000
Demo Piping & Valves	job	1	$35,000.00	$35,000
New Conc. Pad	ea	1	$15,000.00	$15,000
Chiller Loop Tie-in Piping, Valves & Insulation	job	1	$50,000.00	$50,000
Tower Loop Tie-in Piping, Valves & Insulation	job	1	$50,000.00	$50,000
BAS Upgrades & Control Valves	job	1	$125,000.00	$125,000
Test & Balance, Start-up & Commissioning	job	1	$20,000.00	$20,000
Misc. Piping & Modifications	job	1	$25,000.00	$25,000
Electrical for Chiller Upgrade	job	1	$35,000.00	$35,000
Water Treatment and Cleaning	job	1	$25,000.00	$25,000
			Subtotal	$930,000
	%	20	Design Contigency	$185,917.23
	%	15	G.C. OH&P	$139,500
			CP-2 - TOTAL	**$1,255,417**

CP-3: Replace Cooling Towers #4 & #5 with new Towers

	Unit	Quantity	$/unit	Cost
Demo Existing Cooling Towers	ea	2	$10,000.00	$20,000
Crane & Rigging	job	1	$20,000.00	$20,000
Induced Draft Open Cooling Towers w/ VFDs - 1500 tons	ea	2	$175,000.00	$350,000
Piping modifications & Connections	ea	2	$35,000.00	$70,000
Roof Structural Support Modifications	ea	1	$30,000.00	$30,000
Test & Balance, Start-up & Commissioning	lot	1	$25,000.00	$25,000
BAS Controls & Control Valves	ea	2	$30,000.00	$60,000
Electrical Upgrades/Connections	ea	2	$17,500.00	$35,000
			Subtotal	$610,000
	%	20	Design Contigency	$122,029
	%	15	G.C. OH&P	$91,500
			CP-3 - TOTAL	**$823,529**

ELECTRICAL UPGRADES

EWU Medium Voltage Electrical Distribution Switch & Conductor Upgrades Estimate

7/13/2018
BY: NBH

NAC ENGINEERING

Campus Switch Upgrades:				
Action Item Description	*Quantity*	*Material Cost*	*Labor Cost*	*Total Cost*
De-energize feeders (one-by-one or batches) - BPA may charge for shut-downs	(28) Possible Shutdowns	$0	$28,000	$28,000
Confirm de-energize (meters or visual open)	(28) Switch locations	$0	$2,800	$2,800
Disconnect bussing/feeders from existing switches	(28) Switch locations	$0	$5,600	$5,600
Sever bussing/feeders and remove from tunnels	(28) Switch locations	$0	$11,200	$11,200
Remove existing switch from tunnels (existing openings or via saw-cutting new holes)	(28) Switch locations	$0	$5,600	$5,600
Pour new pads for each new switch	(28) Switch locations	$14,000	$5,600	$19,600
Provide new above ground switches	(28) New Switches	$560,000	$700,000	$1,260,000
Provide new raceway to/from vaults	(120) LF per Switch (28 switch locations)	$28,000	$84,000	$112,000
Provide new utility vaults for splicing to bussing/feeders	(2) Vaults per Switch (28 switch locations)	$112,000	$168,000	$280,000
Provide excavation for new vaults/raceway	(25) LF per Switch (28 switch locations)	$0	$10,500	$10,500
Provide termination at each new switch	(28) Switch locations	$0	$14,000	$14,000
Provide new labels and location tape	(28) Switch locations	$0	$3,500	$3,500
Training for new systems	Estimated Lot Cost	$0	$50,000	$50,000
Re-energize system (one-by-one or batches) - BPA may charge for shut-downs	(28) Possible Shutdowns	$0	$28,000	$28,000
	Sub Total	$714,000	$1,116,800	$1,830,800
	Design @ 20%	$142,800	$223,360	$366,160
	Construction Contingency	$142,800	$223,360	$366,160
	G.C. Overhead & Profit	$107,100	$167,520	$274,620
	WA Sales Tax (8.8%)	$97,389.60	$152,331.52	$249,721
	Switch Upgrade Final Total*	**$1,300,000**	**$1,900,000**	**$3,200,000**

Due to decreased FY2019-21 funding allocation none of this work was accomplished.

Carry estimated costs into FY2021-23

Campus Conductor Upgrades:				
Action Item Description	*Quantity*	*Material Cost*	*Labor Cost*	*Total Cost*
De-energize feeders (one-by-one or batches) - BPA may charge for shut-downs	(28) Possible Shutdowns	$0	$28,000	$28,000
Remove existing 15KV bussing/feeders for entire campus	(2,250) LF per Switch (28 switch locations)	$0	$453,600	$453,600
Provide new 15KV bussing/feeders for entire campus	(2,250) LF per Switch (28 switch locations)	$1,512,000	$2,268,000	$3,780,000
Provide termination at each new switch	(28) Switch locations	$0	$14,000	$14,000
Hi-Pot (dielectric testing)	Estimated Lot Cost	$0	$10,000	$10,000
GFCI testing	Estimated Lot Cost	$0	$10,000	$10,000
Coordination Study	Estimated Lot Cost	$0	$20,000	$20,000
Re-energize system (one-by-one or batches) - BPA may charge for shut-downs	(28) Possible Shutdowns	$0	$28,000	$28,000
	Sub Total	$1,512,000	$2,831,600	$4,343,600
	Design @ 20%	$302,400	$566,320	$868,720
	Construction Contingency	$302,400	$566,320	$868,720
	G.C. Overhead & Profit	$226,800	$424,740	$651,540
	WA Sales Tax (8.8%)	$206,237	$386,230	$592,467
	Conductor Upgrade Final Total*	**$2,600,000**	**$4,800,000**	**$7,400,000**
	Combined Total	**$3,900,000**	**$6,700,000**	**$10,600,000**

*rounded up to two significant figures

Add in Proj. Mgmt, Admin, & other agency costs @ 25%. **Use $13,250,000**

Actual and projected savings

PREPARED BY: KELLY HARKINS PE
KJH ENGINEERING PLLC 610 EAST 3RD STREET MOSCOW, IDAHO 83843
6-22-20

EASTERN WASHINGTON UNIVERSITY ROZELL CHILLED WATER PLANT UPGRADE EFFICIENCY STUDY

TABLE OF CONTENTS

PART 1 EXECUTIVE SUMMARY

KJH Engineering was contacted by EWU Construction and Planning Services in April of 2020 and asked to furnish an analysis of the overall effect of the operational efficiency of the Rozell chilled water plant attributed to the recent upgrade of chillers, pumps and cooling towers. EWU completed a project during the summer of 2018 involving the demolition of (2) 500-ton constant speed centrifugal Carrier chillers, (2) associated cooling towers, (15) constant speed equipment and campus distribution pumps and all associated piping, electrical service, water treatment and controls. This equipment was replaced with (2) 1500 Ton York YK variable speed centrifugal chillers, (2) Baltimore Air Coil Model S3E-1424-13R induced draft cross flow variable speed cooling towers, (9) parallel piped Armstrong variable speed chiller/cooling tower equipment pumps and campus chilled water distribution pumps, associated piping, electrical service, controls and water treatment. This upgrade raised the plants overall chilled water generation and distribution capacity from 4000 to 6000 Tons.

An alternate bid was accepted and implemented involving the installation of a Dry-Cooler system allowing the plant to generate 210 Tons of chilled water cooling during periods of outside air temperatures less than 32 F to provide a cooling source for any connected campus cooling loads during the winter time. At this time there are no winter time cooling loads but anticipated future example loads: water cooled condensing units, environmental chamber water source cooling, lab instrument cooling and IT computing room cooling.

EWU is in the process of improving their chiller plant pump efficiencies by controlling the (6) equipment pump speeds based upon flow-rate requirements and the (3) campus chilled water distribution pumps based upon the heat transfer requirements of each operating chiller. These new efficiencies cannot be reported here as the improvements will be implemented this summer.

PART 2 MSI ENGINEERS BASELINE EFFICIENCY STUDY

MSI Engineers, a Spokane based mechanical consulting business, performed a chiller plant capacity upgrade pre-design report that included a study of the pre-upgrade efficiency of the previous chilled water plant. Central chilled water plants are typically rated by the kWH consumed per ton of cooling or kWH/TON-Hour or simply kW/Ton. MSI used historical metered electrical data (2014) to compile the total kWH consumed for the cooling season (4,010,086). This kWH data set represents the sum of all operating equipment (chillers, equipment pumps, distribution pumps and cooling tower fans). MSI used chilled water ton hours generated data (2013) to compile the total Ton-Hours campus load for the season at 4,985,555. This leaves the previous plant baseline chilled water efficiency at 0.8 kW/Ton.

PART 3 KJH ENGINEERING PLANT UPGRADE EFFICIENCY STUDY

KJH coordinated with ATS controls (project control contractor) to create a database that calculates and stores the sum total kWH of all applicable operating equipment (chillers, pumps and cooling tower fans). This database also calculates and stores the Ton-Hours of chilled water generated and performs the final kW/Ton efficiency performance objective. KJH collected chiller plant performance data from May 2020 to use for this study. This data set shows the efficiency (kW/Ton) during the hours of operation of the plant for this month (figure 1). The average plant efficiency for the month is 0.61 kW/Ton.

The following shows the overall effect of the chiller plant upgrade towards improving efficiency and actual dollars saved.

- Assuming a 15% increase in campus Ton-Hour load from the MSI 2013 load calculation reflects a current campus annual cooling load of 5,733,388 Ton-Hours.
- The increase in overall plant efficiency is shown by the following:
  - ((0.8 - 0.61) / .8) X 100 = 23.75% increase in efficiency.

- Current electrical utility rate is $0.041/kWH
- Previous annual plant cost at current utility rate:
  - 5,733,388 Ton-Hours X 0.8 kW/Ton X $0.041/kWH = $188,055.00 Annual cost.
- Current Plant cost:
  - 5,733,388 Ton-Hours X 0.61 kW/Ton X $0.041/kWH = $143,392.00 Annual cost.
- Annual savings: $44,663.00

PART 4 Conclusion

The savings shown account for a reduction in kWH alone and do not account for any savings due to a reduction in electrical demand charges. This calculation is outside of the scope of this current study. Further improvement in the overall efficiency is expected once the operational improvements to the equipment and distribution pumps mentioned above are fully implemented.

Kelly J. Harkins PE

EWU CHILLER PLANT MAY 2020 KW/TON EFFICIENCY (91 HOURS OF OPERATING DATA)	
Time Stamp	Total kW per ton - Chiller Tons
2020-05-05T12:00:00	0.57
2020-05-05T13:00:00	0.59
2020-05-05T14:00:00	0.57
2020-05-05T15:00:00	0.58
2020-05-05T16:00:00	0.60
2020-05-08T12:00:00	0.58
2020-05-08T13:00:00	0.59
2020-05-08T14:00:00	0.56
2020-05-08T15:00:00	0.57
2020-05-08T16:00:00	0.69
2020-05-09T15:00:00	0.46
2020-05-09T16:00:00	0.53
2020-05-09T17:00:00	0.70
2020-05-10T10:00:00	0.88
2020-05-10T13:00:00	0.84
2020-05-10T14:00:00	0.73
2020-05-10T15:00:00	0.63
2020-05-10T16:00:00	0.66
2020-05-10T17:00:00	0.69
2020-05-10T18:00:00	0.74
2020-05-11T12:00:00	0.56
2020-05-11T13:00:00	0.58
2020-05-11T14:00:00	0.56
2020-05-11T15:00:00	0.56
2020-05-11T16:00:00	0.59
2020-05-12T13:00:00	0.57
2020-05-12T14:00:00	0.57
2020-05-12T15:00:00	0.60
2020-05-13T13:00:00	0.57
2020-05-13T14:00:00	0.56
2020-05-13T15:00:00	0.60
2020-05-14T14:00:00	0.60
2020-05-14T15:00:00	0.64
2020-05-15T15:00:00	0.60
2020-05-15T16:00:00	0.60
2020-05-16T21:00:00	0.64
2020-05-16T22:00:00	0.58
2020-05-17T15:00:00	0.64
2020-05-19T19:00:00	0.61
2020-05-19T20:00:00	0.69
2020-05-27T14:00:00	0.57
2020-05-27T15:00:00	0.57
2020-05-27T16:00:00	0.56
2020-05-27T17:00:00	0.57
2020-05-27T18:00:00	0.59
2020-05-27T19:00:00	0.61
2020-05-27T20:00:00	0.63
2020-05-28T08:00:00	0.70
2020-05-28T09:00:00	0.59
2020-05-28T10:00:00	0.58
2020-05-28T11:00:00	0.58
2020-05-28T12:00:00	0.60
2020-05-28T13:00:00	0.61
2020-05-28T14:00:00	0.62
Time Stamp	Total kW per ton - Chiller Tonn
2020-05-28T15:00:00	0.61
2020-05-28T16:00:00	0.59
2020-05-28T17:00:00	0.57
2020-05-28T18:00:00	0.57
2020-05-28T19:00:00	0.58
2020-05-28T20:00:00	0.59
2020-05-28T21:00:00	0.61
2020-05-28T22:00:00	0.62
2020-05-28T23:00:00	0.64
2020-05-29T15:00:00	0.57
2020-05-29T16:00:00	0.59
2020-05-29T17:00:00	0.69
2020-05-29T18:00:00	0.70
2020-05-29T19:00:00	0.60
2020-05-29T20:00:00	0.65
2020-05-29T21:00:00	0.59
2020-05-29T22:00:00	0.59
2020-05-29T23:00:00	0.59
2020-05-30T00:00:00	0.60
2020-05-30T01:00:00	0.61
2020-05-30T02:00:00	0.65
2020-05-30T03:00:00	0.65
2020-05-30T04:00:00	0.71
2020-05-30T05:00:00	0.64
2020-05-30T08:00:00	0.58
2020-05-30T09:00:00	0.57
2020-05-30T10:00:00	0.59
2020-05-30T11:00:00	0.58
2020-05-30T12:00:00	0.59
2020-05-30T13:00:00	0.58
2020-05-30T14:00:00	0.58
2020-05-30T15:00:00	0.58
2020-05-30T16:00:00	0.60
2020-05-30T17:00:00	0.61
2020-05-30T18:00:00	0.61
2020-05-30T19:00:00	0.58
2020-05-30T20:00:00	0.58
2020-05-30T21:00:00	0.62
Average KW/Ton	[illegible]

Steve Schmedding, PE
Facilities Engineer/Sr. Project Manager
Construction and Planning Services
Eastern Washington University
101 Rozell
Cheney, WA 99004-2464

June 23, 2020

Re: **Capital Budget Requests**
EWU - Campus Infrastructure Renewal
Steam Plant
Eastern Washington University
Cheney, WA

Dear Steve,

In support of your Capital Budget Request planning efforts for this year, we have prepared the following project information as it relates to improvement in steam plant efficiency, operation and sustainability.

EWU – Rozell Central Steam Boiler Plant:

A) Resource efficiency and sustainability.

CP-1032 – Boiler Plant Controls Upgrade: Project completed March 2020.

Scope: This project involved a complete replacement and upgrade of the entire boiler plant's operating control system. The old control system had become obsolete and replacement parts were becoming unavailable, representing a potential critical failure for the entire EWU campus heating system.

The new boiler plant control system and network utilized open protocols and readily available, non-proprietary components, in order to create a robust and easy to operate and maintain system. This allows for more efficient operation due to easier tuning of the boiler burners and consistent repeatability of set points and tighter load tracking.

Annual fuel costs (natural gas and fuel oil) for the EWU Rozell steam boiler plant operation are approximately $1,500,000 per year. The recently completed boiler controls upgrade project is anticipated to improve plant and boiler efficiencies by 3% to 5%, accounting for annual savings of between $45,000 and $75,000 per year. Additional savings are anticipated due to reductions in annual boiler maintenance costs, as a

108 N. Washington. • Suite 505 • Spokane, WA 99201 • PH:509/624/1050 • FX:509/624/2420

result of the recent replacement of boiler control components and hardware.

CP-1056 – Install New Boiler: In Design. Completion scheduled for late 2021.

Scope: This project will provide for the removal and replacement of the existing obsolete, and decommissioned, Boiler #3, with a new, and larger capacity steam boiler, in the Rozell central boiler plant.

The new, replacement, Boiler #3, will have approximately 75% greater capacity than the failed unit that it is replacing, which will allow the steam plant to utilize a more efficient boiler, with a state-of-art burner, a greater percentage of the time, allowing for enhanced overall plant efficiency. The upgraded burner and boiler design is expected to improve the firing efficiency from the around 75% to over 85% (a 13% improvement).

It is envisioned that the new Boiler #3 will be operated approximately one-third of the time, which would translate into an overall plant efficiency improvement of (1/3 X 13%) = 4.3% overall plant efficiency increase. This translates in to an anticipated annual fuel cost savings of ($1,500,000 X 0.043) = $65,000 per year.

Additional savings are anticipated in reduced plant maintenance and repair costs due to the installation of brand new equipment.

Please do not hesitate to call me or email if you need any more information or if there are any questions.

Regards,

J. Brad Snow, P.E.
MSI Engineers

108 N. Washington, • Suite 505 • Spokane, WA 99201 • PH:509/624/1050 • FX:509/624/2420

Appendix H – Campus Infrastructure Renewal Steam System Evaluation

The full document can be viewed at this link:

https://in.ewu.edu/facilities/wp-content/uploads/sites/191/2020/08/2014-EWU-Steam-System-Evaluation.pdf

APPENDIX H

EASTERN WASHINGTON UNIVERSITY

Campus Infrastructure Renewal

STEAM SYSTEM EVALUATION

August 1, 2014

CAMPUS INFRASTRUCTURE RENEWAL
Project AE1368
STEAM SYSTEM EVALUATION

FOR

EASTERN WASHINGTON UNIVERSITY

Cheney, Washington

By

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

MSI Engineers Inc.
108 N. Washington, Suite 505
Spokane, WA 99201
July 2014
MSI # 14.01

Under Contract to NAC|Engineering

TABLE OF CONTENTS

INTRODUCTION

The following report summarizes the evaluation of the Eastern Washington University, EWU, Central Campus Steam Plant and Campus Steam Distribution piping system with regard to current configuration, condition, capacity, and opportunities for expansion to serve future facilities as envisioned under the 2013 Comprehensive Campus Master Plan.

The goal of this steam system evaluation is to identify deficiencies with the present campus wide infrastructure that should be corrected or upgraded, in order to support the ongoing and long term growth of the campus. This report contains recommendations (potential projects) for correcting the noted infrastructure deficiencies, along with corresponding rough order of magnitude cost estimates for these upgrades, in order to assist EWU in putting together their capital funding requests for the upcoming biennium.

- Replacement schedule based on system age.
- Modification/expansion required to accommodate master plan.
- Modification/renovation required to provide operational efficiencies.

EXISTING CAMPUS STEAM SYSTEM

Rozell Central Campus Steam Heating Plant

The Central Campus Steam Plant is located in the Rozell facility at the north end of campus. The steam plant furnishes high pressure steam, 100 psig, to the majority of the campus building through a network of underground tunnels and shallow utilidors, to provide for the space heating and domestic hot water needs of the campus facilities.

There are five high-pressure (100 psig) steam boilers located in the Rozell Heating Plant. All are capable of firing on either natural gas or No. 2 fuel oil. Natural gas is supplied to the plant by AVISTA. Fuel oil is stored in two 15,000 gallon underground storage tanks, installed inside concrete vaults adjacent to the plant.

Steam Boilers

The Rozell Central Campus Steam Plant consists of the following boilers:

Boiler # 1 — Babcock & Wilcox, Watertube
Natural Gas & #2 Fuel Oil Fired
1,600 Boiler Horsepower
56,000 lb/hr
Built 1974

Boiler # 2 — E. Keeler, Watertube
Natural Gas & #2 Fuel Oil Fired
715 Boiler Horsepower
25,000 lb/hr
Built 1960

Boiler # 3* — Union Iron Works, Watertube (*Not in Service)
Natural Gas & #2 Fuel Oil Fired
715 Boiler Horsepower
25,000 lb/hr
Built 1966

Boiler # 4 — Babcock & Wilcox, Watertube
Natural Gas & #2 Fuel Oil Fired
1,342 Boiler Horsepower
47,000 lb/hr
Built 1969

Boiler # 5 — Nebraska, Watertube
Natural Gas & #2 Fuel Oil Fired
2,542 Boiler Horsepower
89,000 lb/hr
Built 2001

Total Plant Capacity: 217,000 lb/hr*

(*Capacity does not include Boiler #3, which is presently not in service, awaiting repairs)

Boilers #1, #3 and #5 are provided with boiler feedwater stack economizers, used to pre-heat the pre-heat the boiler feedwater using hot stack gases through a heat exchanger.

The newest boiler, #5, is equipped with a low NOX burner. None of the other, older boilers, are equipped with low NOX burners.

These five boilers provide high pressure (approx. 100 psig) steam to a common header. This header has multiple branches that distribute steam to the Rozell steam plant for plant heating and deaerator duty, with a main 12" steam main that feeds out in to the campus utility tunnel for distribution to the University buildings.

Normal Plant operating steam pressure readings are between 110 and 100 psig. For the purposes of modeling and calculations, 100 psig was used. In Spokane, this correlates to an absolute pressure of 113.5 psia.

Boiler Plant Auxiliaries

The central steam boiler plant is supported by several auxiliary pieces of equipment to support the plant operation.

Deaerator; The boiler plant is equipped with a 150,000 pph capacity low pressure deaerator unit, used to deoxygenate and condition the make-up water and feed water. A continuously pumped and pressurized feedwater loop supplies feedwater to the various boilers that utilize modulating feedwater valves for water level maintanence. Three (3) 30 hp vertical multistage feedwater pumps supply the system and are staged and modulated with VFDs for capacity control. A separate, steam-powered boiler feedwater pumps is available and is utilized when steam loads exceed approximately 25,000 pph. Exhaust from the steam-powered pump is directed in to the DA tank.

Feedwater Tank: Located in the lower level of the Rozell plant, the feedwater storage tank receives pumped condensate return from the campus steam distribution system. Condensate return temperatures are typically in the range of 150 deg. F to 160 deg. F. A set of three electric single speed DA feedwater pumps provide continuous pressurized supply to the deaerator tank. Staging of the DA feedwater pumps is semi-automatic based on system demand.

Water Treatment Equipment: The chemical water treatment equipment for the steam boiler plant is also located in the lower level of the plant. Dosing pumps and monitoring devices provide chemical feed of corrosion inhibitors and PH maintenance. Make-up water is pre-treated through an ion exchange water softener plant. The steam distribution system appears to be fairly tight, as condensate return is reported to be fairly efficient, returning approximately 95% of the steam condensate back to the plant. Hence, make-up water levels are minimized.

Boiler Stack

Each steam boiler is provided with uptake breeching that connects to a common stack manifold inside the plant. This manifold is then routed through the west sidewall of the

Rozell facility, where it ties in to a single tall concrete and masonry stack. The interior condition of this stack is unknown, but reports from the EWU maintenance staff suggest some of the lining brick may be deteriorating. A full analysis of this boiler plant stack is beyond the scope of this report, but for the long term viability of the campus steam plant, it is recommended that a full study as to the condition and seismic viability of this stack be commissioned.

Plant Operation

The steam boilers are manually staged by the plant operators depending on weather conditions and campus steam load.

During summer months, the smallest boiler, Boiler #2, is used to support campus building domestic hot water demands, with Boiler #4 kept on hot standby for back up.

During the shoulder seasons, spring and fall, Boilers #1 and #4 are used.

During the winter heating season, Boiler #5 is used as the lead boiler, with either Boiler #1 or #4 used as hot standby or for peaking duty.

Fuel Firing Issues

The steam boilers are capable of firing on either natural gas or No. 2 fuel oil as back-up. Because of present limitations with AVISTA's natural gas supply capacity to the City of Cheney, peak gas consumption to the Rozell Plant is limited by contract to approximately 56,000 pph firing rate. Above this level of consumption gas supply pressures drop off due to other gas demands in the campus neighborhood. At this point the standby boilers, #1 or #4, are fired on No. 2 fuel oil, to handle demand greater than 56,000 pph. It is not desirable to have to fire on fuel oil, due to added wear and tear on the burners, loss of efficiency and stack emission issues.

Until such time as AVISTA addresses their gas supply capacity issue to the City of Cheney, this situation will not change. Timing of such an upgrade is unknown and is in the hands of AVISTA.

Campus Steam Tunnel Distribution System

General:

High pressure steam is delivered to the campus through a piping network that is located mostly within an accessible (walkable) underground concrete utility tunnel, that provides a loop around the campus to serve all the major academic & residence hall buildings. Steam supply and condensate return systems distribute out from the Rozell central plant, through the tunnel network and into the building mechanical spaces. In certain limited cases, the connections from the main tunnel to the buildings, is through shallow, non-accessible, concrete utility trenches, referred to as utilidors. These utilidors generally follow surface sidewalks, and pipes can be accessed by removing the lids of the utilidors if necessary. There are a few instances of direct-buried piping connections from the tunnel to a few of the older buildings.

High pressure steam supply to each building generally terminates at a steam pressure reducing station (PRV), which reduces the steam pressure from 100 psig down to 15 psig, low pressure steam, for distribution within the building. Low pressure steam generally feeds various heating equipment, air handling unit coils, heat exchangers and domestic water heaters. In some buildings the intermediate steam pressure, 60 psig, is used for laundry or cooking equipment.

Pipe Materials & Installation:

It is understood that the steam distribution piping system, supply, pumped return and gravity condensate lines, are constructed of Sched. 40 steel piping. Piping smaller than 2" size is generally threaded, while all piping larger than 2" is welded. Valves are installed with flanges while expansion joints are welded in the pipeline.

The steam piping is generally installed on steel framing, with roller supports, spider alignment guides and inline expansion joints where necessary. Anchors are generally tied directly in to the concrete walls. Steam condensate drip traps are provided at low points, branch take-offs and other drainage points. A dedicated gravity condensate drainage system handles drip traps within the tunnel, with periodic condensate pumps installed to handle the liquid condensate. A separate pump condensate return piping system parallels the steam supply piping. Pumped condensate from each building is delivered in to this line which makes it way back to the feedwater hot well storage tank in Rozell.

Configuration:

The steam distribution piping is configured in a looped manner around the majority of the campus buildings. The west-side loop (known as the HPE loop), exits from Rozell and travels south, parallel to Washington Street, along the edge of the Woodward Field parking lot. The east-side loop (known as the Rozell loop), exits from Rozell, travels east along Cedar Street, turns south to the PUB, bends to the SE to Tawanka, turns to the SW and continues through the central plaza to the Art Complex. Just north of the Communications Building, the east and west loops join together.

There are several notable branches that come off of the looped main:

- HPE Complex Branch
- CEB & Cheney Hall Branch
- WSP & Archives Branch
- Huston & Sutton Branch
- Senior & Kingston Hall Branch

The looped configuration of the HP steam supply main piping allows the steam system to be back-fed from either direction, in the case of maintenance or repair work on any section of the piping. Most pipe branch take-offs have isolation valves on both sides of the branch piping, which allows feed or isolation to occur on either side of the take-off. This provides great flexibility and allows most of the campus to be supplied with steam during service shut-downs on limited sections. Without a looped system, everything downstream from the shut-off point would be without service.

Access:

Access to the utility tunnel is provided in a number of locations. The main entrance, and the beginning of the tunnel, starts in the lower level of the Rozell Plant. Most other major buildings that are connected to the full size tunnel have basement or lower level mechanical rooms with doors that access the tunnel. At a few points along the tunnel route, there are stairway, with doors and surface structures for access or exiting. The original tunnel system also had some manholes with ladders, and a few ventilation turrets with access lids. Most of the manhole lids are sealed or rusted closed.

Age:

The utility tunnel, as well as most of the steam (and chilled water) distribution piping, was constructed in the early 1970s, along with the construction of the new Rozell Central Plant. This plant, and the utility tunnels, replaced the original steam plant (now the PLU bulding) and older direct buried steam distribution system. The tunnel has been expanded over the years to connect new buildings or sections of the campus as growth occurred. Most of the piping in the tunnel is therefore over 40 years old.

Condition:

Despite being over 40 years old, most of the steam supply and condensate return piping systems are in very good condition and have been well maintained. An end-to-end survey of the utility tunnel was conducted and all main branches, tees and major features were photographed for documentation as part of this report.

Most of the main steam supply shut-off valves have been changed from OS&Y gate valves to high performance butterfly valves, which give excellent performance and help to extend the life expectancy of the system. High pressure steam leaks at valves and fittings are virtually non-existent within the tunnel.

Insulation jacketing on the piping and valves was mostly intact and in good condition. Damage due to maintenance or water intrusion appeared minimal.

Capacity:

As part of this analysis, at steam flow model was created for the entire campus steam supply system (see analysis below). This model used information about the existing connected steam loads (PRV stations in each building) and existing steam pipe sizing information, to develop a dynamic tool to help understand steam flow paths through the looped system, and to determine pressure losses from the Rozell Plant to the remote ends of the distribution system.

Both the east and west main loops coming from Rozell are sized as 10" pipes. On the west (HPE) loop, the 10" size continues all the way past the junction to the Art complex, and up to the JFK branch take-off. On the east (Rozell) loop, the 10" pipe continues up to the PUB branch, where is reduces to 8" pipe. This 8" pipe continues in the main tunnel up to the other side of the JFK branch.

Based on historical steam demand diversity for the campus, the steam flow model analysis indicates that the existing 10" & 8" looped steam mains will have sufficient capacity to deliver adequate steam to the campus, including future demands for the expected growth of the Gateway Athletic complex and the Science I & II Buildings. Expected peak pipeline steam velocities do not exceed normal limits and the resultant drop-off pressures to remote building remains manageable.

Tunnel Gravity Condensate System & Pumps:

As noted above, the steam distribution system is provided with a dedicated gravity condensate system to handle drip traps that are located in the tunnel. This is a good design feature as not all campus steam systems have this feature and drip traps are often piped back in to the pumped return lines, which can cause bothersome water hammer and noisy return lines.

The use of electric condensate pumps within the tunnel to collect and return this condensate, is an ongoing issue with the EWU maintenance staff. Electric condensate pumps have issues with the severe conditions experienced in the tunnels, including elevated condensate temperatures that lead to pump seal failure, hot and humid tunnel conditions that impact pump controls and fittings. Maintenance and reliability is an concern for these pumps.

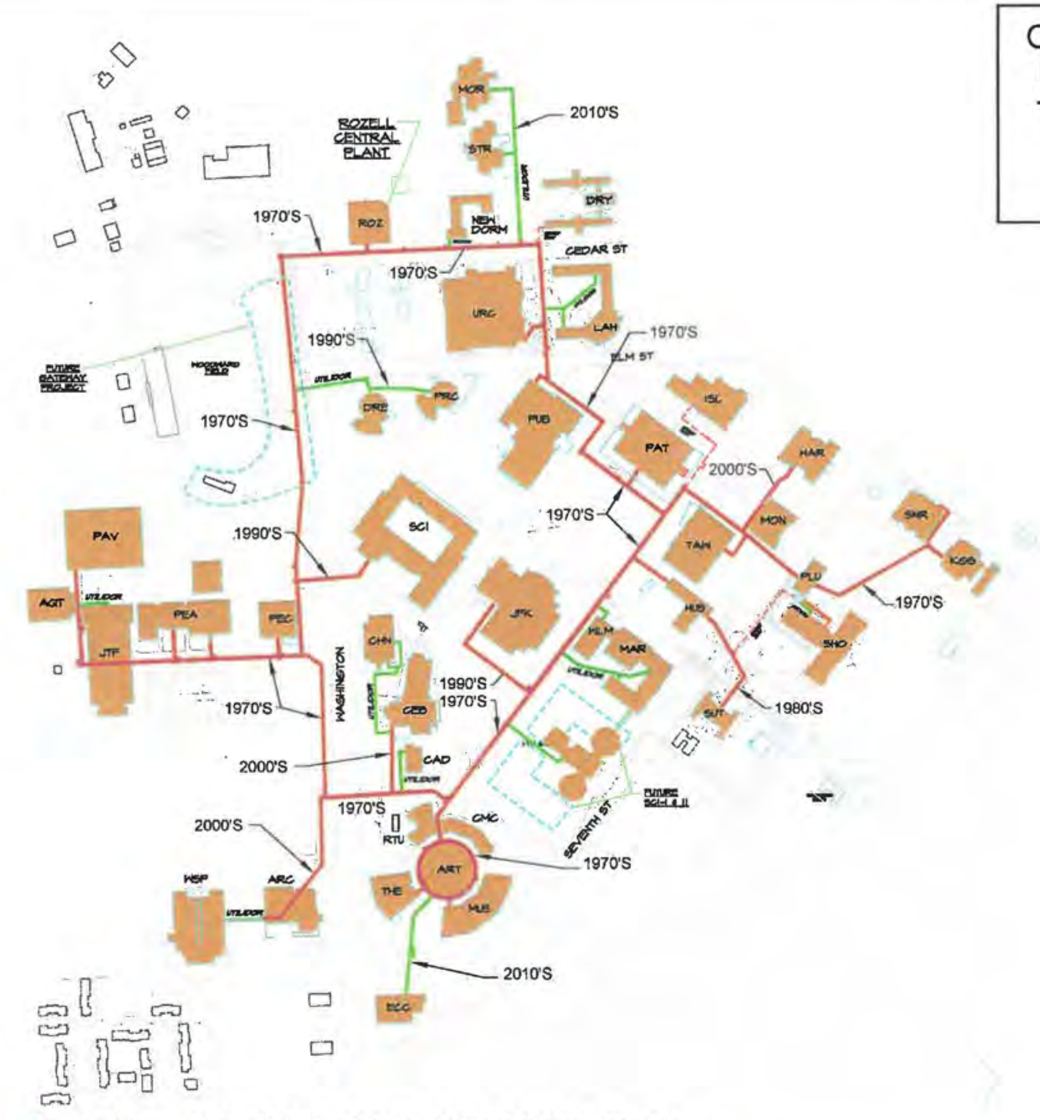
The gravity condensate return piping itself is also a point of concern for possible future failure. Although the present piping appears to be in good condition without reported leaks, it is understood that this piping is standard wall thickness Sched. 40 piping, rather than the more robust Sched. 80 piping. Generally, the heavier wall Sched. 80 piping is used in steam condensate systems to combat the corrosive affects created by the presence of air (oxygen) and carbonic acid (a natural constituent of condensed gases) that occurs in condensate lines. Because the thinner walled piping has been utilized for the gravity condensate piping, the conventional wisdom is that the results of the normal corrosion process has likely accelerated the aging of this pipe (reduced wall thicknesses) to the point that it is a candidate for system-wide replacement.

Life Expectancy:

Based on the observations of the tunnel-wide survey conducted for this report, it appears that the steam supply piping is in good condition without evidence of failures or major leaks. Reports from the EWU maintenance staff indicate that when the piping has been opened for new branch tie-ins or valve work, that the interior of the piping does not show undue corrosion or pitting. Although the majority of the main loop piping is over 40 years, it is reasonable to expect another 15 to 25 years of service life, assuming the same level of care and maintenance in to the future.

Likewise, the pumped condensate return system is also in a condition similar to the supply piping, and being a pressurized system, not subject to effects of condensing steam, it's future life expectancy should also be another 15 to 25 years.

The gravity condensate return piping, as noted above, is more suspect as to its condition, due to the use of thinner walled Sched. 40 piping, and the deteriorating effects of steam condensate action. Without conducting a series of wall thickness field measurement, it is difficult to know to what degree the condensate pipe wall has been degraded, but it is likely much greater that either the supply or pumped lines. Because of that it is reasonable to assume that the gravity condensate piping is nearing the end of its useful life.



TUNNEL CONSTRUCTION KEY

1970'S INDICATES DECADE IN WHICH TUNNEL □ PIPING WAS BUILT

TUNNEL LEGEND

- UTILITY TUNNEL
- UTILIDOR
- DIRECT BURIED PIPE

EWU - OVERALL UTILITY TUNNEL PLAN

N

Scale: 1" = 400'

OVERALL UTILITY TUNNEL PLAN

EASTERN WASHINGTON UNIVERSITY

MSI ENGINEERS

EASTERN WASHINGTON UNIVERSITY
CAMPUS INFRASTRUCTURE RENEWAL
PROJECT AE1368
CHENEY, WASHINGTON

NAC NO	111-13508
FILE	
DRAWN	NAH
CHECKED	JBS
DATE	05-30-2014

M-1

CAMPUS STEAM FLOW MODELING & CALCULATIONS

Purpose & Goals

The existing EWU campus steam distribution system was modeled using commercial flow modeling software, in order to help evaluate and understand existing flow pathways though the campus loop, steam main velocities and drop-off delivery pressures to individual buildings. Several models were created to look at various flow demands in order to help determine if the existing steam distribution system has the capacity to handle future campus growth.

Methodology

Using the computerized flow modeling software tools, and schematic plan representing the campus steam piping network was created. This plan was then populated with information regarding existing pipe sizes, pipe lengths, valves and fittings, in order to give an accurate representation of the system geometry.

Next, the various campus buildings were connected to the model as steam "flow demand" points, representing the steam demand for each building. Basically this is the point where the high pressure steam enters the building at the PRV header. Piping beyond the steam header was not modeled, as the goal of the analysis was to see how much residual steam pressure was available from the campus supply, up to the PRV connection point.

Steam Load Data Source

Available construction drawings for each building were pulled from the EWU drawing library and PRV steam load sizing data was extracted from these plans. PRV station data was generally given as maximum design lbs/hr at the expected upstream and downstream pressures. A number of actual building PRV stations were examined in order to spot-check the accuracy of these drawings. The plans were found to be in general agreement with the field installations, so the modeling inputs for steam load are based the information gathered from the available construction documents.

Diversity

Utilizing only the design peak steam demand for all facilities simultaneously does not take into account the actual dynamics of building occupancy and results in an unrealistically high demand on the Central Campus Steam Plant. For example, occupancy levels often don't reach 100% and can therefore reduce the demand for both heating and hot water. In addition, the peak demand for hot water often does not coincide with the peak demand for heating. On a larger scale, peak demand in a given building is often balanced by a reduction in demand in other facilities as students migrate from the dorms to the classrooms, offices and gyms. This 'diversity' results in an overall demand reduction on the expected central steam plant.

According to the EWU steam plant operators, the largest steam demand ever witnessed by the boiler plant occurred this past February during sub-zero weather. This coincided with the remodeled Patterson Hall coming on line for the first time again in about three years, along with its new exterior snow melt system that was active.

The historical peak demand for the boiler plant was noted as 75,000 lbs/hr.
Based on a total campus connected steam load, the sum of all PRV stations, that is

approximately 234,000 lbs/hr, the 75,000 pph represents a diversified load of 32% (of total capacity). Based on a steam boiler plant total capacity of 217,000 pph, this represents a 35% load of plant capacity.

For steam flow modeling purposes, the diversified peak historic steam load was modeled at 40% of peak connected capacity. This value was selected to be somewhat conservative relative to the historic peak of 32%, and also to allow for unknowns an simplifications used in the modeling assumptions, variations of load diversity within the actual campus network, and a safety factor for extreme weather events.

COMPUTERIZED STEAM FLOW MODEL

Modeling Software

Pipe-Flow Professional, Version 12 (2014) by Engineered Software, Inc., was used to construct a computerized steady-state flow model of the steam distribution system. This software utilizes the Darcy-Weisbach formula with Bernoulli's theorem along with an extensive fluid and hardware properties database to solve complex networks including the effects of temperature, pressure, density, enthalpy, and steam quality. Its algorithms and equation solving techniques permit the program to automatically correct logical errors entered by the user (over-constrained system, reverse flow directions, inverted pressures, mismatched pipe sized, etc). Once the user defines the piping network within the software using actual pipe lengths, sizes, fittings, valves, and controls, the program solves the mass and energy balances and returns the solution along with all corresponding fluid properties.

Modeling Approach

Three (3) basic steam models (cases) were developed for the campus distribution analysis.

Case-1: Maximum Design - 100% Connected Loads

Basically this was an academic exercise to set-up the model for actual diversified loads, and it treated all connected buildings as having 100% steam load demand concurrently, with no system diversity. This model was used to validate that the sum of the connected building loads matched the expected values. The results of the flow are not really applicable to the actual steam system operation, which is highly diversified, but it is interesting to note the high resultant pipeline velocities near Rozell with the flow is maximum, and the steep drop off in delivery pressures throughout the network due to the theoretically undersized piping.

Case-2: Historic Peak - 40% Connected Loads

This model is basically the baseline expected peak steam flow demand for the actual existing campus system, based on the historic peak diversified demand of 40% of connected load (see above for diversity discussion).

Case-3: Future Peak - 40% Connected Loads

This model adds in the future steam loads, for the planned Gateway Athletic complex as well as for the new Science I & II facility, to the historic peak loads of Case-2. The diversified load factor of 40% was used for this model.

STEAM FLOW MODEL RESULTS

See the graphic steam piping network drawings that are included with this report.

Case-1: Maximum Design - 100% Connected Loads

Not applicable. This was the model set-up. See discussion above.

Case-2: Historic Peak - 40% Connected Loads

Pipe Velocities:

Results of the steam flow model for this case show that anticipated peak, diversified steam flows and corresponding velocities in the existing piping network, do not exceed accepted values for good engineering practice. Up to 15,000 fpm (250 fps) maximum velocity for steam mains. Peak velocities occur near Rozell where the combined steam flows are the greatest, with the two main 10" branch loops below 6,000 fpm and the 12" plant main at 7,500 fpm. This indicates, and confirms, adequate pipe sizes for the actual existing historic peak loads for the campus.

Pressure Drops:

Results of the steam flow model for this case show peak drop-off pressures to the hydraulically most remote buildings of about 85 psig (to the ECC building at the south end of the campus), or about a 15 psig loss in the piping network. Most buildings show a supply pressure in the low 90 psi range, or better. This indicates that adequate pressure can be maintained throughout the campus at expected peak flow periods.

Case-2: Future Peak - 40% Connected Loads

Pipe Velocities:

With the addition of more steam load to the model to account for future buildings, the results of the steam flow model for this case again show that anticipated peak, diversified steam flows and corresponding velocities in the future piping network, still do not exceed accepted values for good engineering practice. Up to 15,000 fpm (250 fps) maximum velocity for steam mains.

Future peak velocities occur near Rozell where the combined steam flows are the greatest, with the west side main 10" branch loops around 7,500 fpm and the east side 10" main below 6,000 fpm. The 12" plant main at increases to about 9,000 fpm. This indicates, and confirms, adequate pipe sizes for the anticipated future peak campus steam loads for the campus.

Pressure Drops:

The impact of greater future steam flows for this case show peak drop-off pressures to the hydraulically most remote buildings of about 83 psig (to the ECC building at the south end of the campus), or about a 17 psig loss in the piping network, which is only 2 psig more than the present conditions. Most buildings still show a supply pressure in the upper 80 psig or low 90 psi range. This indicates that adequate delivery pressure can be maintained throughout the existing campus distribution system, even with allowance for future steam loads.

STEAM FLOW MODEL CONCLUSIONS

Steam Distribution Piping Capacity for Future Growth

The existing steam distribution piping is adequately sized to handle the current steam loads plus anticipated future growth.

Boiler Plant Capacity for Future Growth

According to the EWU operations staff, the historical peak campus heating load, seen this last winter, was approximately 75,000 lbs/hr.

Based on the anticipated Master Plan campus growth for the New Science I & II projects, the new Gateway Athletic Project, the expected addition of future campus steam load is approximately 34%. Based on a peak historic load of 75,000 pph, a 34% increase would put the future campus steam load at slightly over 100,000 pph, which is approximately 50% of the steam plant's present total capacity 217,000 pph.

Due to anticipated future campus growth, which will increase expected plant peak steam loads by over 30%, the added loads will start to impact boiler plant redundancy & operational flexibility, especially since existing Boiler #3 is no longer operational. In order to return the boiler plant capacity to full original output, it is recommended that Boiler #3 be either repaired and returned to service, or, due to it's advanced age (over 50 years), be replaced entirely with a new boiler. As such, either a repaired, or new boiler, will allow plant operation and redundancy to be maintained well in to the future. Providing a new boiler, instead of repairing an old boiler, would also increase plant operational efficiencies.

CAMPUS STEAM SYSTEM UPGRADE RECOMMENDATIONS

The existing Central Campus Steam Plant has sufficient spare capacity to handle expected future loads, however, the presence of an aging and broken down boiler somewhat limits the plant's spare capacity and operational flexibility. The high pressure steam distribution piping is mostly run to the campus buildings in a underground tunnel system, which is generally well configured to handle future building connections, and has the advantage of being looped, in order to allow for back-feeding the campus to avoid outages for maintenance or new tie-ins. A computerized flow model of the campus steam network, that was prepared as part of this analysis, indicates that the existing steam supply piping is adequately sized to handle expected future growth. The gravity steam condensate piping system within the utility tunnel network is nearing the end of its life expectancy and is a candidate for replacement.

Proposed Campus Steam System Infrastructure Upgrade Projects:

Steam System Recommended Project Summary List

Project No.	Title	Description	ROM Budget Price
SP	Steam Plant		
SP-1	Replace Boiler #3	Replace out-of-service Boiler #3 with a new 40,000 pph boiler to restore plant capacity & redundancy.	\$3,500,000
SP-2	Install Feedwater Stack Economizers, Boilers #2 & #4	Install boiler feedwater stack economizers on Boilers #2 & #4 to improve system efficiency and to match other boilers.	\$350,000
SP-3	Upgrade Boiler Feedwater Pumps	Replace or supplement the deaerator boiler feedwater pumps to achieve full design capacity of the DA unit.	\$200,000
SP-4	Repair Rozell Boiler Stack	Further investigation recommended to determine if the concrete boiler stack at Rozell is sound for continued operation in to the future.	Unknown. (Further Study Required)
SP-5	Upgrade AVISTA Gas Service Capacity	AVISTA needs to upgrade the natural gas capacity to Cheney and EWU in order to allow maximum firing of the natural gas boilers.	By AVISTA
SD	Steam Distribution		
SD-1	Replace Utility Tunnel Gravity Steam Condensate Piping	Due to age and questionable condition the gravity steam condensate piping in the utility tunnels is due for replacement in order to provide reliability for future service.	\$1,225,000
SD-2	Replace Utility Tunnel Condensate Pumps	The existing electric condensate pumps in the utility tunnel are problematic and should be replaced with more robust steam powered pumps.	\$200,000
SD-3	Label Piping & Identify Branch Take-offs	Utility tunnel piping and branch take-offs are poorly labeled and confusing.	\$150,000

		Adding labels and identifiers will assist with future maintenance and repair work.	
SD-4	Upgrade Piping in PLU & Repurpose Building	The decommissioned space inside the old, original steam plant, which presently serves as a piping junction in the tunnel network, could be better utilized if the piping was modernized/upgraded and the space reorganized.	$125,000

Central Campus Steam Plant (SP)

Overall the existing Central Campus Steam Plant is in good condition, and has been very well maintained, despite running with several boilers that are over 40 years old. Basically the steam plant, and has sufficient capacity to handle the anticipated steam loads for the 10 year master plan growth, but due to one boiler being out of service, redundancy is limited. Several projects have been identified below to provide some added plant reliability/capacity, and to increase system efficiencies.

SP-1: Replace Boiler #3

Description:

Replace existing 25,000 pph steam Boiler #3.

- Replace: Install a new 40,000 pph high pressure steam boiler with dual fuel (oil & gas) low NOX burner. Install new correctly sized stack economizer (boiler feedwater pre-heater).
  (This recommendation is a concurrence of the boiler replacement "1.02-ROZ" as previously suggested by McKinstry in their *2012 Energy Efficiency & Sustainability Report*)

Analysis/Justification:

The existing steam Boiler #3 has been out of service for a number of years due to several outstanding breakdowns and lack of repair funds. Boiler #3 is almost 50 years old and parts are difficult to find. Despite being maintained in excellent condition over the years by the EWU staff, this boiler is basically near the end of its life expectancy.

Future campus growth will increase expected plant steam loads by over 30%, which will start to impact boiler plant redundancy & operational flexibility. A repaired, or new boiler, will allow plant operation and redundancy to be maintained in to the future. A new boiler would increase operational efficiencies.

According to the EWU operations staff, the historical peak campus heating load, seen this last winter, is approximately 75,000 lbs/hr.

Based on the anticipated master plan campus growth for the New Science I & II projects, the new Gateway Athletic Project, the expected addition of future campus steam load is approximately 34%. Based on a peak historic load of 75,000 pph, a 34% increase would put the future campus steam load at over 100,000 pph, which is approximately 50% of the steam plant's present total capacity 217,000 pph.

Sequence / Category:

Capital Master Plan.

Cost:

SP-1: $3,500,000

SP-2: Install Boiler Feedwater Stack Economizers on Boilers #2 & #4.

Description:

Install new boiler feedwater stack economizers on existing steam boilers #2 & #4. This installation would allow these boiler configurations to match boilers #1 & #5, which already have stack economizers in operation.

(This recommendation is a concurrence of the stack economizer installation "1.00-ROZ" as previously suggested by McKinstry in their *2012 Energy Efficiency & Sustainability Report*)

Analysis/Justification:

The existing steam Boilers #2 and #4, which are mostly operated in the shoulder and summer seasons, are not provided with boiler feedwater stack economizers, which are present on the other plant boilers. As a result, the operational efficiencies of these boilers are not a high as is possible, thereby reducing the plant's overall energy efficiency.

Also, because of the different feedwater configuration that these two boilers use, compared to the other boilers, the feedwater pumping loop must be run at differing pressures, which complicates plant operation. New boiler feedwater stack economizers would increase boiler plant operational efficiencies, and simplify feedwater system operation.

Sequence / Category:

Improve Operational Efficiencies.

Cost:

SP-2: $350,000

SP-3: Upgrade Boiler Feedwater Pumps

Description:

Replace the aging feedwater tank transfer pumps and upgrade or supplement the undersized Deaerator unit boiler feedwater pumps.

Analysis/Justification:

The existing single speed feedwater transfer pumps that provide feeddwater from the condensate return storage tank to the deaerator tank, are old and in questionable condition. This project would replace these pumps with new high efficiency pumps with improved controls for staging and monitoring.

The existing VFD driven boiler feedwater pumps that are part of the deaerator unit were recently installed as part of an energy retrofit to the plant, but, according to the plant operators, are having trouble keeping up with the feedwater demands of the boilers. These newer VFD driven pumps were downsized to 30 hp each, from the original single speed 50 hp feedwater pumps. Capacity reduction is unknown, but appears to be a factor in plant operation, requiring the operators to run the auxiliary steam-driven feedwater pump during peak loads. Redundancy is questionable with this configuration, so it is proposed that the new feedwater pumps be replaced with larger pumps or supplemented with an additional pump.

Sequence / Category:

Capital Master Plan.

Cost:

SP-3: $200,000

SP-4: Repair Rozell Heating Plant Boiler Stack

Description:

Repair the existing Rozell Heating Plant concrete/masonry boiler stack.

Analysis/Justification:

The condition of the existing exterior concrete/masonry boiler stack at the Rozell heating plant is the subject of some concern. According to EWU staff, there is reason to suspect some of the interior lining material has started to fail and/or fall off. Further, it is unknown if the original construction and/or present condition of this stack is up to present seismic standards.

A full analysis of the existing boiler stack condition is not in the scope of this study. Further analysis is recommended.

Sequence / Category:

Maintenance & Repair.

Cost:

SP-4: Unknown (Requires Further Study)

SP-5: Upgrade Natural Gas Service from AVISTA

Description:

Increase the natural gas supply capacity to the Central Campus Steam Plant from the utility provider, AVISTA.

Analysis/Justification:

The existing steam boilers are limited in the amount of natural gas that they are allowed to consume at a given peak instant by agreement with the gas utility provider, AVISTA. Reportedly the high pressure gas supply distribution to the City of Cheney is limited based on AVISTA transmission gas line capacity. This issue is limits the steam boiler plant to a maximum consumption rate of approximately 56,000 lbs/hr, at which point the plant has to supplement its capacity by burning #2 fuel oil (diesel).

Because it is not beneficial to fire the boilers on fuel oil due to emission concerns, efficiency reductions and added wear and tear, the ability to fire a greater percentage of the boiler plant on natural gas is desired.

Sequence / Category:

Unknown. Pending AVISTA natural gas infrastructure upgrades to the City of Cheney.

Cost:

SP-5: Unknown. (Further study required. Capital costs for gas capacity increase to Campus would presumably be paid for by AVISTA as part of their normal growth plans.)

Campus Steam Distribution System (SD)

Overall the existing Campus Steam Distribution System is in good condition, and has been very well maintained; despite piping that is mostly over 40 years old. Assuming that the existing distribution system piping, valves, and insulation jacketing is maintained as well in the future, the system should have a life expectancy of at least 15 to 25 more years.

A computerized flow model of the campus steam network, that was prepared as part of this analysis, indicates that the existing steam supply piping is adequately sized to handle expected future growth. Several projects have been identified below to provide ongoing piping system reliability in to the future.

SD-1: Replace Utility Tunnel Condensate Piping

Description:

Replace aging gravity condensate piping system & components in utility tunnels. New piping to be heavier wall thickness, Sched. 80, compared to the existing standard wall Sched. 40 piping presently installed. New steam trap stations and valves would be provided.

Analysis/Justification:

Although the existing gravity condensate drainage piping system, that serves the high pressure steam distribution within the utility tunnels, appears to be in good condition and has been well maintained, most of this piping is around 40 years old. Although there have not been reports of major leaks or failures, this piping system is nearing the end of its useful life.

Because the condensate piping system is subjected to more severe service than the steam supply piping, on account of the presence of oxygen and other condensed gases, such as carbolic acid, internal corrosion is much more likely. This leads to premature pipe wall failure and leaks, as well as damage to components, such as valve and steam traps.

Sequence / Category:

Improve Operational Efficiencies.

Cost:

SD-1: $1,225,000

SD-2: Replace Utility Tunnel Electric Condensate Pumps with Steam-Powered Pumps

Description:

Replace existing simplex type electric condensate pumps in the utility tunnel with new steam-powered condensate pumps.

Analysis/Justification:

The existing simplex type electric condensate pumps, that are situated in various locations throughout the utility tunnel and are used to handle steam distribution condensate loads, are on ongoing point of malfunction and problematic maintenance. These condensate pumps are generally located in hot and wet locations of the tunnel and are subjected to severe service due to the hot condensate that they handle from the high pressure steam drip traps. Seal failures on the pumps are common and electric components do not stand up well to the environmental conditions within the tunnel.

Because of the severe service these tunnel condensate pumps experience, it is recommended that they be replaced throughout the tunnel system with more robust steam powered (non-electric) condensate pump assemblies. Such steam-powered condensate are more or less oversized steam traps and are made of similar materials that can handle steam service, without the weakness inherent in electric motor driven condensate pumps.

Sequence / Category:

Improve Maintenance Efficiencies.

Cost:

SD-2: $200,000

SD-3: Label Piping and Identify Branches & Valves

Description:

The existing steam (and chilled water) distribution piping system, located in the utility tunnel network, is poorly labeled and branch take-offs and valves are not identified. This project would provide better labeling and identification to help with maintenance and troubleshooting activities.

Analysis/Justification:

After spending several days surveying the condition of the existing utility tunnel piping and valving, it is evident that there would be value to the maintenance staff, and to contractors doing future work, if the existing piping system was better labeled and identified. Such labeling could help locate and isolate failures or problem areas, as well as to better direct traffic for repair or new construction. Likewise, there is a certain amount of abandoned devices (mostly electrical wall switches), that provide confusion over the tunnel lighting circuits. These should be removed and the active light switches better identified (as to which section they serve). Branches take-offs to buildings could be better identified, as could routes to exits or manholes.

Sequence / Category:

Improve Maintenance Efficiencies.

Cost:

SD-3: $150,000

SD-4: Upgrade Piping in Plant Utilities Building (PLU) and/or Repurpose the Space

Description:

Upgrade the existing steam and chilled water piping and systems inside the PLU building in order to better configure the space usage for storage or other purposes.

Analysis/Justification:

The existing steam (and chilled water) distribution piping system, located in the old original central campus steam plant, now the Plant Utilities Building (PLU), has been disturbed over time due to the use of much of this building as an ad-hoc storage space. Pipe insulation jacketing is damaged or missing, much of the old piping is deactivated and abandoned in place, and some of the valving appears to be fairly old. There is some old pneumatic controls and abandoned steam piping still in place but deactivated, and nothing is labeled. Filter boxes and other surplus material is stacked on and around the piping. Access is difficult.

Sequence / Category:

Improve Maintenance Efficiencies.

Cost:

SD-4: $125,000

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

EWU - Campus Infrastructure Renewal
Proposed Mechanical Upgrades
Budgetary Level Cost Estimates

7/11/2014
MSI# 14-01
By: B. Snow

STEAM SYSTEMS - INFRASTRUCTURE UPGRADE BUDGET PRICE SUMMARY

	Budget Cost Estimate
Steam Plant	
SP-1: Replace Boiler #3	$3,500,000
SP-2: Install Boiler Feedwater Stack Economizers on Boilers #2 & #4	$350,000
SP-3: Upgrade Boiler Feedwater Pumps	$200,000
SP-4: Repair Rozell Heating Plant Boiler Stack	Unknown
SP-5: Upgrade Natural Gas Service From AVISTA	Unknown
STEAM PLANT (SP) -	$4,050,000
Steam Distribution	
SD-1: Replace Utility Tunnel Steam Gravity Condensate Piping	$1,225,000
SD-2: Replace Utility Tunnel Electric Condensate Pumps with Steam Powered Pumps	$200,000
SD-3: Label Piping & Identify Branches & Valves - Repair Insulation	$150,000
SD-4: Upgrade Piping in PLU Building and/or Repurpose the Space	$125,000
STEAM DISTRIBUTION (SD) -	$1,700,000
STEAM SYSTEM TOTAL -	$5,750,000

MSI ENGINEERS
MEULINK STAUFFENBERG, INC

EWU - Campus Infrastructure Renewal
Proposed Mechanical Upgrades
Budgetary Level Cost Estimates
7/11/2014
MSI# 14-01
By: B. Snow

STEAM SYSTEMS - INFRASTRUCTURE UPGRADE BUDGET PRICE SUMMARY

Steam Plant (SP)

SP-1: Replace Boiler #3

	Unit	Quantity	$/unit	Cost
Demo existing Boiler #3	ea	1	$50,000.00	$50,000
Demo exisisting power and controls	ea	1	$25,000.00	$25,000
Demo existing catwalks	ea	1	$25,000.00	$25,000
Demo existing boiler stack	ea	1	$25,000.00	$25,000
Demo existing boiler piping	ea	1	$25,000.00	$25,000
Remove portion of wall or roof for access	ea	1	$25,000.00	$25,000
New 40,000 pph 250 psi low NOX steam boiler	ea	1	$1,500,000.00	$1,500,000
Set & Install new boiler & crane work	ea	1	$150,000.00	$150,000
Update boiler foundations	ea	1	$75,000.00	$75,000
New boiler service catwalk	ea	1	$75,000.00	$75,000
New stack economizer	ea	1	$75,000.00	$75,000
New boiler stack connections	ea	1	$50,000.00	$50,000
New piping and valving connections	ea	1	$100,000.00	$100,000
New naturgal gas piping	ea	1	$25,000.00	$25,000
New fuel oil piping	ea	1	$50,000.00	$50,000
New controls and instrumentation	ea	1	$100,000.00	$100,000
Power & electrical upgrades	ea	1	$100,000.00	$100,000
Rozell building wall/roof replacement for access	ea	1	$150,000.00	$150,000
Start-up, testing & trouble-shooting	ea	1	$25,000.00	$25,000
Commissioning & Licensing	ea	1	$25,000.00	$25,000
Central Control Wonderware updates	ea	1	$17,308.00	$17,308
			Subtotal	$2,692,308
	%	20	Design Contigency	$538,462
	%	10	G.C. OH&P	$269,231
			SP-1 - Total	**$3,500,000**

SP-2: Install Boiler Feedwater Stack Economizers on Boilers #2 & #4

	Unit	Quantity	$/unit	Cost
Demo portions of existing stacks	ea	2	$15,000.00	$30,000
New 25 kpph stack economizer	ea	1	$35,000.00	$35,000
New 47 kpph stack economizer	ea	1	$60,000.00	$60,000
Install new stack economizers	ea	2	$15,000.00	$30,000
New/modified feedwater piping & control valves	ea	2	$35,000.00	$70,000
Control modifications	ea	2	$15,000.00	$30,000
Start-up & testing	ea	2	$5,000.00	$10,000
Misc.	ea	1	$5,000.00	$5,000
Commissioning	ea	2	$5,000.00	$10,000
			Subtotal	$280,000
	%	15	Design Contigency	$42,000
	%	10	G.C. OH&P	$28,000
			SP- 2 - Total	**$350,000**

SP-3: Upgrade Boiler Feedwater Pumps

	Unit	Quantity	$/unit	Cost
Demo existing hot well transfer pumps	ea	3	$500.00	$1,500
New hot well transfer pumps HWP-1,2,3 - 7.5 hp	ea	3	$10,000.00	$30,000
New VFDs for HWPs	ea	3	$3,500.00	$10,500
Update piping & valves for HWPs	ea	3	$5,000.00	$15,000
New 50 hp boiler feedwater pump (add to ex. 3 pumps)	ea	1	$15,000.00	$15,000

New VFD for FWP - 50 hp	ea	1	$7,500.00	$7,500
Update piping & valves for FWP	ea	1	$15,000.00	$15,000
Misc.	ea	1	$13,000.00	$13,000
Control modifications	ea	4	$7,500.00	$30,000
Electrical connections	ea	4	$2,500.00	$10,000
Start-up & testing	lot	1	$5,000.00	$5,000
Commissioning	lot	1	$7,500.00	$7,500
			Subtotal	$160,000
	%	15	Design Contigency	$24,000
	%	10	G.C. OH&P	$16,000
			SP-3 - Total	**$200,000**

SP-4: Repair Rozell Heating Plant Boiler Stack

Unknown - Requires Further Study	ea	0	$0.00	$0
			Subtotal	$0
	%	0	Design Contigency	$0
	%	0	G.C. OH&P	$0
			SP-4 - Total	**Unknown**

SP-5: Upgrade Natural Gas Service From AVISTA

Unknown - Work to be done by Utility Co.	ea	0	$0.00	$0
			Subtotal	$0
	%	0	Design Contigency	$0
	%	0	G.C. OH&P	$0
			SP-5 - Total	**Unknown**

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

EWU - Campus Infrastructure Renewal
Proposed Mechanical Upgrades
Budgetary Level Cost Estimates
7/11/2014
MSI# 14-01
By: B. Snow

STEAM SYSTEMS - INFRASTRUCTURE UPGRADE BUDGET PRICE SUMMARY

Steam Distribution (SD)

SD-1: Replace Utility Tunnel Steam Gravity Condensate Piping

	Unit	Quantity	$/unit	Cost
Demo existing piping	lf	12,500	$5.00	$62,500
New 1-1/2" (Avg.) Sched. 80 condensate piping	lf	12,500	$35.00	$437,500
Pipe fitting allowance	%	35%		$153,125
Insulation and jacketing	lf	12,500	$7.50	$93,750
Drip traps, valve sets, flex piping, etc.	ea	40	$5,000.00	$200,000
Expansion joints/loops	ea	10	$2,000.00	$20,000
Pressure testing, flushing & cleaning	lot	1	$5,000.00	$5,000
Misc.	ea	1	$8,125.00	$8,125
			Subtotal	$980,000
	%	15	Design Contigency	$147,000
	%	10	G.C. OH&P	$98,000
			SD-1 - Total	**$1,225,000**

SD-2: Replace Utility Tunnel Electric Condensate Pumps with Steam Powered Pumps

	Unit	Quantity	$/unit	Cost
Demo existing electric condensate pumps	ea	10	$250.00	$2,500
Install new pressure powered condensate pumps	ea	12	$7,500.00	$90,000
Modify piping and valving	ea	12	$5,000.00	$60,000
Start-up & testing	ea	12	$625.00	$7,500
			Subtotal	$160,000
	%	15	Design Contigency	$24,000
	%	10	G.C. OH&P	$16,000
			SD- 2 - Total	**$200,000**

SD-3: Label Piping & Identify Branches & Valves - Repair Insulation

	Unit	Quantity	$/unit	Cost
Label steam piping (1 label every 50 ft ±)	ea	500	$25.00	$12,500
Label condensate piping	ea	500	$25.00	$12,500
Label chilled water piping	ea	500	$25.00	$12,500
Label Misc. piping	lot	100	$25.00	$2,500
Label & Tag valves	ea	1,000	$15.00	$15,000
Label/ID plaques for branch take-offs to buildings	ea	50	$200.00	$10,000
Repair misc. insulation & jacketing	lot	1	$25,000.00	$25,000
Repaint sections of pipe jackteing	lot	1	$15,000.00	$15,000
Valve tag schedule data base	ea	1	$1,000.00	$1,000
Repair/replace damaged or missing valve insul. jackets	lot	1	$14,000.00	$14,000
			Subtotal	$120,000
	%	15	Design Contigency	$18,000
	%	10	G.C. OH&P	$12,000
			SD-3 - Total	**$150,000**

SD-4: Upgrade Piping in PLU Building and/or Repurpose the Space

	Unit	Quantity	$/unit	Cost
Demo & cap abandoned piping	ea	1	$5,000.00	$5,000
Replace gate valves with butterfly valves	ea	1	$15,000.00	$15,000
Reroute exisitng branch piping to free-up bldg space	ea	1	$25,000.00	$25,000

Repair/reinsulate & label piping	ea	1	$15,000.00	$15,000
Misc. modifications	lot	1	$25,000.00	$25,000
Rework access catwalks	ea	1	$15,000.00	$15,000
			Subtotal	$100,000
	%	15	Design Contigency	$15,000
	%	10	G.C. OH&P	$10,000
			SD-4 - Total	**$125,000**

Reducing Scope 1 & 2 Emissions

Executive Report

ROZELL BUILDING

The Rozell building contains the central heating and cooling generating equipment for the entire campus.

HEATING PLANT

There are five high-pressure steam boilers located in the central steam plant at Eastern Washington University. All are capable of firing off of natural gas and No. 2 fuel-oil. Boiler #1 is rated at 56,000 lbs/hr, Boiler #2 at 25,000 lbs/hr, Boiler #3 at 25,000 lbs/hr, Boiler #4 at 47,000 lbs/hr, and Boiler #5 at 89,000 lbs/hr. With the exception of boiler #5, which was installed and fired in 2003, all of the boilers are more than fifty years old—and some are more than sixty years old. Boiler #3 broke down three years ago and it remains out of service to this day. Boilers #1, #3, and #5 have boiler feedwater economizers installed in their exhaust stack; Boilers #2 and #4 do not. Typically during the cooling season, only Boiler #2 operates. Boilers #1 and #4 operate during the shoulder seasons and Boiler #5 operates during the peak months of the heating season. Boiler #5 is the only boiler with a low-nitrogen-oxide burner; the other boilers' burners should be upgraded to low-NOx burners as well.

Condensate from the campus is pumped into a large tank in the lower level of the Rozell Building's boiler room. If required, make-up water is introduced into the system with the campus condensate. From this tank the water is then pumped to the De-aerator (DA) tank which is located in the boiler room. From the DA tank the water is then pumped into the respective boilers based on their need, using the dedicated floor-mounted feedwater pumps. These pumps are capable of pumping the water into the boilers directly, as in the case of Boiler #2 or Boiler #4 or into the economizers on Boilers #1 and #5. The boiler feedwater being pumped into the stack economizers must be under an elevated pressure in order to ensure it does not flash off to steam in the heat exchanger in the exhaust stack. After taking the heat out of the exhaust stack gases, the feedwater is then introduced into the boiler.

The facility has three 50-horsepower boiler feedwater pumps, all taken from another system. These well-used pumps have had several seal and impeller failures, sometimes simultaneously, placing the entire feedwater load on the steam turbine pump—which can only operate when the minimum load is 20,000 lb/hr or greater, thus risking complete steam plant shut down.
The methodology in which chemicals are introduced into the steam system should be analyzed as well, as this may produce significant savings in both energy and chemicals.

COOLING PLANT

The University's cooling system is comprised of three 1,000-ton, water-cooled Carrier centrifugal chillers and two 500-ton water-cooled Carrier Centrifugal chillers, producing a total cooling capacity of 4,000 tons. Each chiller has a dedicated primary chilled water pump and condenser water pump, as well as a dedicated cooling tower. All of the towers are induced-draft, open-circuit Marley cooling towers. The three 1,000-ton towers are sized to deliver 85 degree water to the chillers, while the 500-ton towers were originally sized to deliver the water at 85 degrees as well. Due to age, the 500-ton towers can deliver only 88-90 degree water during the peak of the cooling season.

The chilled water distribution system is a primary/secondary, variable-volume pumping system with tertiary pumps at the building or load source. There are three secondary system pumps that serve the campus loop. They are brought online/ offline based on being able to maintain 14 inches Water Column (WC) between the supply and return lines. Only one of the secondary pumps is controlled with a variable-frequency drive, while the other two have two-speed motors. For some reason, the tertiary pumps in the buildings or at the coils are only turned on when the outdoor air temperature reaches 85 to 90 degrees. Peak-season cooling is between 2,300 and 2,400 tons.

There are two plate-and-frame heat exchangers for free cooling. The older unit is approximately fourteen years old and has 300 tons of cooling capacity. The newer unit, installed by McKinstry in 2003, has a cooling capacity of 200 tons. Each unit has a one-degree approach.

AIR DISTRIBUTION SYSTEM

Rozell's office area is served by a variable-volume air handler with VAV boxes and hot water reheat coils. The unit is mounted on the roof of next to the cooling towers. Other constant-volume variable-temperature air handling units serve the boiler room and the refrigeration mechanical room.

Reducing Scope 1 & 2 Emissions

Detailed Report

EASTERN WASHINGTON UNIVERSITY/ROZELL CENTRAL PLANT BUILDING

FIELD NOTES FROM PRELIMINARY ENERGY AUDIT – AUGUST 2010

OVERVIEW

The Rozell Central Heating and Cooling Plant building is a support services facility of Eastern Washington University and is located on the northern side of the EWU campus in Cheney Washington. A preliminary energy audit was conducted on all of the systems in Rozell.

ROZELL CENTRAL PLANT BUILDING

The Rozell Central Plant Building is a two-story brick building which was built in 1970. The latest upgrades and renovations were completed in the 2002 – 2003 time frame. This is a 56,000 square foot facility which houses the Campus's Central Steam Plant and the central chilled water plant. It also houses the university's Construction and Planning Department, as well as the Director of Maintenance and the energy management office and Facilities Information Technology offices. Facilities I.T. is responsible for architecting and administering the support systems and server farm for all of Facilities and Planning. The Central Heating and Cooling Plants provide high pressure steam and chilled water to the Utility Tunnel System that basically brings the steam and chilled water to most buildings on the EWU campus. Condensate return is also brought back from the buildings on campus through the utility tunnel system.

PREVIOUS ENERGY RETROFITS

McKinstry has previously completed retrofits of the Rozell Central Plant building in 2003. At that time McKinstry installed a new 1,000 Ton Open Circuit, Induced Draft Marley Cooling Tower and its associated condenser water pump. McKinstry installed a 200 Ton Plate and Frame heat exchanger, and associated pumps, as well as automating the chilled water plant with Delta Digital Controls. McKinstry also installed a small cooling only fan coil for the UPS systems in the lower level mechanical room. Prior to that, a lighting retrofit was done throughout the building that saw all of the T12 fluorescent lamps and standard ballasts getting retrofitted with T8 Lamps and electronic ballast. The only area of Rozell that still has an opportunity to save energy on lighting is in the Boiler room itself, with the high bay lighting fixtures.

HEATING SYSTEM

There are (5) five high pressure steam boilers located in the central steam plant at EWU. All are capable of firing off of natural gas and No. 2 fuel-oil. Boiler #1 is rated at 56,000 lbs/hr, Boiler #2 at 25,000 lbs/hr, Boiler #3 at 25,000 lbs/hr, Boiler #4 at 47,000 lbs/hr, and Boiler #5 at 89,000. With the exception of boiler #5 which was installed and fired in 2003, all of the boilers range in age from 50 plus years old to 60 plus years old. Three years ago, Boiler #3 had significant issues which caused it to shut down and to this day it has not been brought back on line. Boilers #1, #3, and #5 have boiler feedwater economizers installed in their exhaust stack; boilers #2 and #4 do not. Typically during the cooling season, only boiler #2 operates. Boilers #1 and #4 operate during the shoulder seasons and boiler #5 operates during the peak months of the heating season. Boiler #5 is the only boiler with a Low NOx Burner. The other 4 boilers would be excellent candidates to have their burners swapped out with Low NOx Burners.

Reducing Scope 1 & 2 Emissions

Condensate from around the campus is pumped into a large tank in the lower level of the Rozell Building's boiler room. If required, make up water is introduced into the system with the campus condensate. From this tank the water is then pumped up to the Deaerator tank which is located in the boiler room. From the DA tank the water is then pumped into the respective boilers based on their need using the dedicated floor mounted boiler feedwater pumps. These pumps are capable of pumping the water into the boilers directly, as in the case of Boiler #2 or Boiler #4 or into the economizers on Boilers #1 and #5. The boiler feedwater being pumped into the stack economizers must be under an elevated pressure in order to ensure is doesn't flash off to steam in the heat exchanger in the exhaust stack. After taking the heat out of the exhaust stack gases, the feedwater is then introduced into the boiler.

Currently Eastern Washington University has (3) three 50 HP boiler feedwater pumps, these pumps were taken from another system to be used for the feedwater system. As a result of making use of these (3) three used pumps, there have been several seal and impeller failures which has resulted in simultaneous outages in all (3) three pumps. This has placed the entire feedwater load on the steam turbine pump, a pump that can only operate when the minimum load is 20,000 lb/hr or greater, thus placing the steam plant at risk of being completely shut down.

The way chemical is introduced into the steam system should be analyzed. It has been McKinstry's experience that this usually leads to significant savings from an energy perspective as well as a capital dollars expenditure on less chemicals.

COOLING SYSTEM

The university's cooling system is comprised of (3) 1,000 ton water cooled Carrier centrifugal chillers, and (2) 500 ton water cooled Carrier Centrifugal chillers. In all there is a cooling capacity of 4,000 tons. Each chiller has a dedicated primary chilled water pump and condenser water pump, as well as a dedicated cooling tower. All of the towers are induced draft, open circuit Marley cooling towers. The three 1,000 ton towers are sized to deliver 85 degree water to the chillers, while the (2) 500 ton towers were originally sized to deliver the water at 85 degrees as well. The age of the (2) 500 ton towers and their ability to reject heat to the atmosphere has deteriorated through the years and are only able to deliver 88 to 90 degree water during the peak of the cooling season.

The chilled water distribution system is a primary / secondary variable volume pumping system with tertiary pumps out at the building or load source. There are three secondary system pumps that serve the campus loop. They are brought on / off line based on being able to maintain 14 in. WC between the supply and return lines. Only one of the secondary pumps is controlled with a VFD, while the other 2 are 2-speed motors. For some reason, the tertiary pumps in the buildings or at the coils are only turned on when the outdoor air temperature reaches 85 to 90 degrees.

According to the Plant Supervisor, Kevin Beckwith, told McKinstry that the largest cooling load that the plant personnel see during the peak of the cooling season is approximately between 2,300 tons and 2,400 tons.

There are 2 plate and frame heat exchangers for free cooling. The older of the 2 is approximately 14 years old and has 300 tons of cooling capacity while the newer of the 2 that McKinstry installed in 2003, has a cooling capacity of 200 tons. Each plate and frame heat exchanger has a 1 degree approach.

AIR DISTRIBUTION SYSTEM

The ventilation system serving the office area of Rozell is comprised of a variable volume air handling unit with VAV boxes with hot water reheat coils. This unit is mounted on the roof of the Rozell Building next to the cooling towers.

Reducing Scope 1 & 2 Emissions

SEQUENCE OF OPERATIONS

1. The VAV AHU operates 24/7, and is controlled with Staeffa Digital controls. No night setback or start/stop controls.
2. There is no morning purge, morning warm-up / morning cool-down.
3. It is not known if the air handler has economizer controls or not.

AREAS OF INTEREST

1. Boiler Feed Water Pump Retrofits.
2. Retrofit #3 Boiler that is sized to deliver 40,000 lbs/hr of high pressure steam.
3. Install Boiler Feed Water Economizers on #2 and #4 Boilers.
4. Install Low NOx Burners on Boilers #1, #2, and #4.
5. Retrofit the high bay lighting fixtures in the boiler room with T5HO fixtures.
6. Install VFDs on the chiller compressors, and on the (3) 1,000 ton cooling towers.
7. Install (2) new Cooling Towers with VFDs, sized to deliver 75 degree water during peak loads.
8. Swap out the (2) 2-speed motors with inverter duty ready motors and pumps and control them with VFDs and map them into the Delta Digital Control system.
9. Examine the feasibility of adding another 1,000 Ton Water-Cooled Chiller and corresponding cooling tower with associated pumps.

Efficient & Sustainable Campus Systems

Executive Report

3. Campus Infrastructure

A. BOILER PLANT (BIO-MASS/BIO-DIESEL)

A detailed description of the central heating and cooling plant equipment is in the page 17-18 Rozell Building description.

i. Boiler Plant Biomass/Biodiesel Fuel Switching

McKinstry evaluated the feasibility of switching to Bio-Mass/Bio-Diesel as a secondary fuel source for the existing boilers in the central plant, considering a number of factors in the process:

ii. Fuel Source Reliability – The reliability of the fuel source is high. Contracts for the fuel are usually a year in length. We evaluated two local Bio-Mass/Bio-Diesel fuel suppliers in eastern Washington. At the time of study, the price of Bio-Mass/Bio-Diesel fuel was lower than for #2 fuel oil but higher than for natural gas. The BTU content per gallon on average ranges between 125,000 to 130,000 BTUs per gallon for Bio-Diesel and 135,000 to 137,000 BTUs per gallon for Bio-Mass.

iii. To accommodate the new fuel we would remove and dispose of the old bunker oil tank and associated fuel lines, and we would either convert or replace the boiler burners to burn the new fuel.

B. UPGRADES TO THE EXISTING CENTRAL STEAM PLANT

Given Eastern Washington University's growth plans, McKinstry recommends further analysis to determine the University's future needs for steam plant capacity. As detailed in Table 2, we suggest several plant improvements:

i. Install boiler feedwater economizers on Boilers #2 and #4.
ii. Replace #3 Boiler with a new, more efficient boiler.
iii. Replace the burners on #1, #2 and #4 with low-nitrogen-oxide burners.

C. CENTRAL CHILLED WATER PLANT

The central chilled water plant has 4,000 tons of mechanical cooling capacity and another 500 tons of free cooling capacity through two plate-and-frame heat exchangers. According to plant personnel the peak load during the cooling season on the central chilled water plant is between 2,300 and 2,400 tons.

The chillers and their corresponding cooling towers vary in age. The three 1,000-ton chillers, two 500-ton chillers and their respective cooling towers were all installed in 1996. The third 1,000-ton cooling tower was installed in 2003, and the two 500-ton cooling towers were installed over 25 years ago. Both 500-ton cooling towers have outlived their useful service lives and are becoming inefficient.

D. UPGRADING THE EXISTING CENTRAL CHILLED WATER PLANT'S EFFICIENCY

As outlined in accompanying Table 3, there are several clear options to improve the chilled water plant's efficiency:

i. Install variable-frequency drives (VFDs) on the chiller compressors and cooling tower fans.

ii. Replace the two-speed chilled water pumps with two new pumps and VFDs on the system loop.
iii. Replace both 500-ton towers with energy-efficient, open-circuit, induced-draft, VFD-equipped cooling towers sized to deliver 75-degree water at peak conditions.

E. ADDING CHILLED WATER CAPACITY

After study, it appears that expanding the existing chilled water plant would be preferable to building a second one on campus. Although the University's plans to build Science 1 and Science 2 will increase chilled water needs, some of that new demand will be offset by efficiency improvements in other buildings as they remodeled, such as the Science Building, where much can be done to reduce the cooling load.
Further study is needed to accurately gauge future demand, but our initial recommendation is to enlarge the existing central plant, adding another 1,000-ton water-cooled centrifugal chiller, a 1,000-ton cooling tower and their associated pumps. These costs are presented in Table 3.

F. ADDING A THERMAL STORAGE TANK – Although the need for a thermal storage tank has been studied, more information is needed before recommendations can be made.

In time, a thermal storage tank may prove worthwhile, adding cooling capacity and improving the chilled water system's efficiency. Using the thermal storage tank as a primary source of cooling during the day, while shutting down or reducing use of chillers, is a very energy-efficient way to meet the University's cooling needs. In this scenario, the tank acts like a larger chilled water battery, charging during night when the cost to produce power is less. However, the utility rate that Eastern Washington University pays is not ratcheted as in other regions, which reduces the incentive to build such a system—making cost variables in site selection all the more important. For these reasons, further study would be wise.

Efficient & Sustainable Campus Systems

Detailed Report

Eastern Washington University/Campus Infrastructure

OVERVIEW

This section of the report is dedicated to Eastern Washington University's central heating and cooling plant. Most of the buildings and facilities on campus are served by the central heating and cooling plant. A preliminary energy audit was conducted on August 18, 2010 by McKinstry.

ROZELL CENTRAL PLANT

See write up in section 2 under Rozell Building.

PREVIOUS ENERGY RETROFITS

McKinstry retrofitted the existing boiler feedwater pumps with new vertical turbine feedwater pumps controlled with Variable Frequency Drives. The drive and pumps will be controlled through the ABB/Wonderware Control System.

BOILER PLANT BIOMASS/BIO-DIESEL FUEL SWITCHING

McKinstry evaluated the feasibility of switching to biomass/biodiesel as a secondary fuel source for the existing boilers in the central plant, considering a number of factors in the process:

- Fuel Source Reliability – The reliability of the fuel source is high. Contracts for the fuel are usually a year in length. We evaluated two local biomass/biodiesel fuel suppliers in eastern Washington. At the time of study, the price of biomass/biodiesel fuel was lower than for #2 fuel oil but higher than for natural gas. The BTU content per gallon on average ranges between 125,000 to 130,000 BTUs per gallon for biodiesel and 135,000 to 137,000 BTUs per gallon for biomass.

- To accommodate the new fuel we would remove and dispose of the old bunker oil tank and associated fuel lines, and we would either convert or replace the boiler burners to burn the new fuel.

We suggest further study, as bio-fuels could reduce both carbon emissions and fuel costs. However, the latter depends upon further discussion with bio-fuel suppliers, who insist on confidentiality agreements from McKinstry personnel before committing to prices. If EWU is interested, we will be more than happy to obtain firm fuel quotes.

UPGRADES TO THE EXISTING CENTRAL STEAM PLANT

Given EWU's growth plans, McKinstry recommends further analysis to determine the university's future needs for steam plant capacity. The Facility Improvement Measures detailed in Table 4.2 represent improvements to the plant as it stands today:

- Install boiler feedwater economizers on Boilers #2 and #4.
- Replace #3 Boiler with a new, more efficient boiler.
- Replace the burners on #1, #2 and #4 with Low-NOx burners.

CENTRAL CHILLED WATER PLANT

The central chilled water plant has 4,000 tons of mechanical cooling capacity and another 500 tons of free cooling capacity through two plate-and-frame heat exchangers. According to plant personnel the peak load during the cooling season on the central chilled water plant is between 2,300 and 2,400 tons.

The chillers and their corresponding cooling towers vary in age. The three 1,000-ton chillers, two 500-ton chillers and their respective cooling towers were all installed in 1996. The third 1,000-ton cooling tower was installed in 2003, and the two 500-ton cooling towers were installed over 25 years ago. Both 500-ton towers have outlived their useful service lives and are becoming increasingly energy inefficient. Their original design called for the towers to deliver 85 degree water back to their respective chillers. Currently in their existing condition they are only able to supply 88 degree water back to the chillers.

McKinstry believes there are many ways to improve the efficiency of the chilled water plant and to add capacity in the future:

UPGRADING THE EXISTING CENTRAL CHILLED WATER PLANT'S EFFICIENCY

As outlined in Table 4.2, EWU has several clear options that could make the chilled water plant more efficient:

- Install VFDs on the chiller compressors and cooling tower fans.
- Replace the two-speed chilled water pumps with two new pumps and VFDs on the system loop.
- Replace both 500-ton towers with energy-efficient, open-circuit, induced-draft , VFD-equipped cooling towers sized to deliver 75-degree water at peak conditions.

ADDING CHILLED WATER CAPACITY

After further study, McKinstry concludes that expanding the existing chilled water plant would be preferable to building a second and separate chilled water plant somewhere on the south side of the campus. Although the university's plans to build Science 1 and Science 2 will increase the overall chilled water load, some of that new demand will be offset by efficiency improvements in other buildings as they get remodeled and upgraded with energy efficient systems.

Further study is needed to accurately gauge future demand, but our initial recommendation is to enlarge the existing central plant, adding another 1,000-ton water-cooled centrifugal chiller, a 1,000-ton cooling tower and their associated pumps. These costs are presented in the Table 4.2 for this section.

ADDING A THERMAL STORAGE TANK

Although McKinstry studied the need for a thermal storage tank, we do not believe we yet have enough information to judge its practicality, so we recommend further analysis if EWU is interested. McKinstry has engineered and built this kind of system before at universities in the Pacific Northwest, and can certainly plan, engineer and build this if the university so chooses. However, costs vary depending on the site chosen and the site work required, as such, the cost estimate ranges have not yet been estimated.

In time, a thermal storage tank may prove worthwhile for EWU by adding cooling capacity and energy efficiency. Using the thermal storage tank as a primary source of cooling during the day, while shutting down or reducing use of chillers, is a very energy-efficient way to meet the university's cooling needs. However, the utility rate that EWU pays is not ratcheted as in other regions of the country, which reduces the incentive to build such a system—making cost variables in site selection all the more important. For these reasons, McKinstry recommends further study.

Facility Improvement Measure (FIM) Summary - Rough Order of Magnitude (ROM)

Eastern Washington University
Central Plant + Water + Irrigation
November 17, 2011

LEGEND:
1 - High Priority
2 - Medium Priority
3 - Neutral Priority

[illegible]	[illegible]	[illegible]	[illegible] *	[illegible] *	[illegible]	[illegible]	[illegible] **	[illegible] ***	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14.01-EWU: Campus Wide Water Re-Commissioning	McKinstry proposes to replace all internal plumbing components and recommission all toilets, sinks, urinals, and shower heads in all buildings across campus. New internal components will have variable-flow technology.	Campus	$568,171	$664,477	$41,542	$45,059	$19,170	$0	$568,171	$664,477	8.7	11.6	396	1. Just under 14,900,000 gallons of water saved annually. 2. Reduction of maintenance costs and plumbing fixture upgrade. 3. Increased consistency and performance of the system.	1
18.01-EWU: Campus Wide Irrigation Upgrades	McKinstry proposes to replace all manual irrigation controllers with WeatherTrak controllers and install rain sensors.	Campus	$241,909	$295,667	$3,180	$3,524	$0	$0	$241,909	$295,667	68.6	92.7	19	1. Only deliver the water required for adequate irrigation across the EWU campus. 2. 13,832,200 gallons of water saved through a reduction in irrigation systems operation.	2
1.30-ROZ: Boiler Feed Water Economizers	Boilers #2 and #4 do not have the economizers and thus use more energy when the feed water is pumped into each of the boilers. McKinstry proposes to install boiler feed water economizers into the boiler's exhaust stack.	Russell Central Plant	$173,775	$212,389	$70,381	$77,786	$0	$0	$173,775	$212,389	2.7	3.0	684	1. Significant energy savings. 2. Feed water system can now operate at the same pressure.	1
1.01-ROZ: Low NOx Burners	McKinstry proposes to install new dual fuel Low NOx burners. The primary fuel source will be natural gas while the back up fuel source will be #2 fuel oil.	Russell Central Plant	$1,611,225	$1,980,275	$65,436	$77,334	$0	$0	$1,611,225	$1,980,275	22.2	30.1	162	1. Decrease of pollutants and efficient combustion of fossil fuel.	3
1.02-ROZ: Replace Boiler #3	McKinstry proposes to remove and dispose of the existing 25,000 lb/hr high pressure steam Boiler #3 and replace it with a new energy efficient 40,000 lb/hr high pressure steam boiler. The new boiler will be equipped with a new Low NOx Dual Fuel Burner.	Russell Central Plant	$1,390,314	$1,699,272	$105,000	$117,130	$0	$0	$1,390,314	$1,699,272	11.9	16.0	910	1. Installation of a 40,000 lb/hr boiler that replaces the 25,000 lb/hr boiler that hasn't worked for three years. 2. Replacing a boiler that is over 40 years old with a larger more energy efficient boiler with a Low NOx Burner, and a boiler feed water economizer.	1
2.00-ROZ: VFD Upgrades	McKinstry proposes to furnish and install Variable Frequency Drives on the chillers compressor motors, remove the existing 2-speed motors in the cooling towers, and install inverter duty ready motors and the VFDs for the cooling tower fan motors. The drives and their respective points will be mapped into the existing controls system.	Russell Central Plant	$814,700	$1,007,074	$38,424	$42,468	$0	$19,850	$764,850	$948,134	18.0	24.7	171	1. Making the existing chillers and towers energy efficient. 2. Maximize the cooling efficiency of the entire cooling plant.	1
2.01-ROZ: CHW Pump Upgrades and Reconfiguration	McKinstry proposes to furnish and install new inverter duty ready motors for the (2) secondary chilled water pumps and install the necessary control points and VFDs. The secondary chilled water pumps will be brought on line as the load in the buildings dictate. The lead pump will ramp up to 100% before the next secondary pump is brought on-line.	Russell Central Plant	$74,018	$90,465	$9,105	$10,061	$0	$1,133	$72,885	$89,333	7.2	8.8	59	1. Maximize the cooling efficiency of the chilled water loop pumping system.	1
2.02-ROZ: Install New Chiller and Tower	McKinstry proposes to furnish and install new primary chilled water pumps that are dedicated to their respective chiller. The primary pumps will be piped in parallel. This will allow the horse powers on these pumps to be significantly decreased. McKinstry also proposes to furnish and install new inverter duty ready motors for the (2) secondary chilled water pumps and install the necessary control points and VFDs. The secondary chilled water pumps will be brought on line as the load in the buildings dictate. The lead pump will ramp up to 100% before the next secondary pump is brought on-line.	Russell Central Plant	$1,818,700	$2,222,867	$39,891	$44,090	$0	$46,912	$1,771,788	$2,175,954	40.1	54.5	218	1. This will give EWU a level of redundancy in the future that they may not have today as buildings and facilities are connected to the campus chilled water loop.	3
2.04-ROZ: Install 2 new energy efficient cooling towers	McKinstry proposes to install new energy efficient, open circuit, induced draft cooling towers with VFDs on their fan motors. The new cooling towers will be sized for supplying 75 degree water to the chillers during peak load conditions.	Russell Central Plant	$328,496	$401,495	$11,478	$12,688	$0	$5,917	$322,518	$395,518	25.4	34.5	43	1. This will allow the (2) 500 Ton water cooled chillers to operate efficiently by receiving condenser water at 75 degrees, instead of the 88 degree water they have been receiving. 2. The new energy efficient cooling towers will prolong the life of their corresponding chillers.	1
			$7,031,325	$8,593,041	$385,468	$426,043	$19,170	$113,873	$6,917,452	$8,478,968	15.5	21.0	#REF!		

* Since design cost, audit cost, etc. are distributed among the FIMs, the total project cost will not go up or down by exactly the amounts shown here if a FIM or FIMs are dropped.
** For non recurring operational savings, the values are averaged over the 1 year length of this analysis.
*** Incentives are contingent on final approval and are not guaranteed. Funds are shown for reference only.

Appendix I – Campus Infrastructure Renewal Chilled Water

The full document can be viewed at this link:

https://inside.ewu.edu/facilities/2014-ewu-chilled-waster-system-evaluation/

APPENDIX I

EASTERN WASHINGTON UNIVERSITY

Campus Infrastructure Renewal

CHILLED WATER SYSTEM EVALUATION

August 1, 2014

CAMPUS INFRASTRUCTURE RENEWAL
Project AE1368
CHILLED WATER SYSTEM EVALUATION

FOR

EASTERN WASHINGTON UNIVERSITY

Cheney, Washington

By

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

MSI Engineers Inc.
108 N. Washington, Suite 505
Spokane, WA 99201

July 2014

MSI # 14.01

Under Contract to NAC|Engineering

TABLE OF CONTENTS

INTRODUCTION

The following report summarizes the evaluation of the Eastern Washington University, EWU, Central Campus Chiller Plant and Campus Chilled Water Distribution piping system with regard to current configuration, condition, capacity, and opportunities for expansion to serve future facilities as envisioned under the 2013 Comprehensive Campus Master Plan.

The goal of this steam system evaluation is to identify deficiencies with the present campus wide infrastructure that should be corrected or upgraded, in order to support the ongoing and long term growth of the campus. This report contains recommendations (potential projects) for correcting the noted infrastructure deficiencies, along with corresponding rough order of magnitude cost estimates for these upgrades, in order to assist EWU in putting together their capital funding requests for the upcoming biennium.

- Replacement schedule based on system age.
- Modification/expansion required to accommodate master plan.
- Modification/renovation required to provide operational efficiencies.

EXISTING CAMPUS CHILLED WATER SYSTEM

Rozell Central Campus Chiller Plant

The Central Campus Chiller Plant is located in the Rozell facility at the north end of campus. The chiller plant furnishes chilled water at approximately 45 deg. F, to the majority of the campus building through a network of underground tunnels and shallow utilidors, to provide for the space cooling and air conditioning needs of the campus facilities.

There are five (5) water-cooled centrifugal chillers located in the lower level of the Rozell Central Plant. These chillers were installed in 1996 as part of a major plant upgrade. All chillers utilize environmentally friendly R-134a refrigerant.

Chillers

The Rozell Central Campus Chiller Plant consists of the following five, centrifugal type, single speed, water-cooled chillers:

Chiller # 1 Carrier Model 19 XL 50534 93CP
Water-Cooled, Centrifugal, R-134a
500 Tons
Built 1996

Chiller # 2 Carrier Model 19 XL 50534 93CP
Water-Cooled, Centrifugal, R-134a
500 Tons
Built 1996

Chiller # 3 Carrier Model 19 EX 3133-736DK621 S
Water-Cooled, Centrifugal, R-134a
1,000 Tons
Built 1996

Chiller # 4 Carrier Model 19 EX 3133-736DK621 S
Water-Cooled, Centrifugal, R-134a
1,000 Tons
Built 1996

Chiller # 5 Carrier Model 19 EX 3133-736DK621 S
Water-Cooled, Centrifugal, R-134a
1,000 Tons
Built 1996

Total Plant Capacity: 4,000 Tons

Cooling Towers

Each chiller is coupled to a dedicated matching cooling tower. The plant cooling towers are located on the roof of the Rozell Central Plant. The two smallest towers are original, pre-1996 upgrade vintage, while the two of the other three larger towers are from the 1996 expansion, and one of the other larger towers was installed in about 2009.

The cooling towers for the central plant consist of two (2) original vintage, 500 ton capacity towers and three (3) newer, 1,000 ton capacity towers. All the cooling towers are open type design with induced draft, draw-through propeller fans. Fan motors are all 2-speed type for some capacity control.

Free Cooling Heat Exchangers

The chiller plant is equipped with two (2) plate & frame type heat exchangers that provide partial cooling capacity to the chilled water distribution piping system during shoulder seasons, before the chillers are energized. These heat exchangers are located in the lower level of the Rozell plant, near the pump gallery. Each free cooling heat exchanger is coupled to a cooling tower, in order to provide for indirect heat rejection from the campus chilled water loop, during mild weather, without having to operate the plant's compressorized chillers.

One heat exchanger has a nominal capacity of about 300 tons and was installed in about 1998. The other heat exchanger has a nominal capacity of about 200 tons and was installed in 2003. Each heat exchanger is designed with a 1 deg. F approach. Total free cooling capacity is 500 tons.

Chiller Plant Pumps

Pumps for the chillers and the cooling towers are located in the lower level of the Rozell Central Plant. Condenser water (tower loop) and primary chilled water (evaporator loop) piping for each chiller-tower pair is provided by dedicated single speed pumps. The condenser water pump motors are furnished with soft starters.

The chilled water distribution system is configured at the central plant level as a Primary-Secondary pumping system. The primary chilled water pumps produce flow through the individual chiller evaporator barrels. The secondary chilled water pumps produce flow to the campus chilled water piping network that serves individual buildings. There are three (3) secondary chilled water pumps that supply the campus loop. Two of these pumps have 2-speed motors and the third pump has a VFD drive for capacity control.

The various campus buildings generally utilize tertiary chilled water pumps to supply the cooling coils and other cooling loads at the building level. In some cases the buildings are decoupled from the campus loop with a plate & frame heat exchanger.

Chiller Plant Auxiliaries

Water Treatment Equipment: The chemical water treatment equipment for the open cooling towers plant is located in the lower level of the Rozell plant. Dosing pumps and monitoring devices provide chemical feed of corrosion inhibitors, biodides and PH maintenance. Make-up water is pre-treated through an ion exchange water softener plant. The campus chilled water distribution loop utilizes plain water, rather than a glycol-water anti-freeze solution, which therefore requires that the building system HVAC air coils be drained in the winter. The chilled water distribution system is also chemically treated with corrosion inhibitors and PH controllers.

Chiller Plant Operation

The several chillers, and their corresponding cooling towers and pumps, are manually staged on and off by the plant operators depending on weather conditions and campus cooling load. The chillers are rotated in service based on run times.

Chilled water is generally produced and delivered to the campus at about 45 deg. F. Chilled water return water temperatures vary with load and flow rates, but at times are as warm as about 64 deg. F (a 19 deg. delta T for the campus).

The cooling season generally runs from May through mid October. During the shoulder seasons, when cooling loads are light and the weather is mild, the free cooling heat exchangers are utilized to provide campus loop cooling, before the chillers are energized. Mechanical cooling (chillers) is generally needed whenever the outdoor air temperatures climb above 60 deg. F or so.

Chilled water is delivered to the campus using any number of the three (3) secondary chilled water pumps, depending upon load demands. The largest pumps is rated at about 2800 gpm and is run with a VFD drive at a variable speed/flow to maintain a differential pressure between the campus supply main and the campus return main of about 15 psig (34 ft hd). The other two secondary chilled water pumps are each 2-speed pumps, rated at a nominal 1100/700 gpm. These pumps are staged on as the campus demand increases and are run in conjunction with the VFD drive pump to maintain the differential pressure in the campus loop.

During the winter months, the campus chilled water distribution system is still circulated, but at a greatly reduced flow rate, in order to help keep the distribution piping and valves free from corrosion using the inherent chemistry protection provided by the treated chilled water flow. There are several valved bypasses located at the ends of the tunnel distribution system, that are opened in the winter to help maintain total network circuit flow paths.

Campus Chilled Water Tunnel Distribution System

General:

The chilled water is delivered to the campus through a piping network that is located mostly within an accessible (walkable) underground concrete utility tunnel, that provides a loop around the campus to serve all the major academic & some hall buildings.
Chilled water supply and return piping systems distribute out from the Rozell central plant, through the tunnel network and into the building mechanical spaces. In certain limited cases, the connections from the main tunnel to the buildings, is through shallow, non-accessible, concrete utility trenches, referred to as utilidors. These utilidors generally follow surface sidewalks, and pipes can be accessed by removing the lids of the utilidors if necessary. There are a few instances of direct-buried piping connections from the tunnel to a few of the older buildings.

Chilled water supply to each building is generally routed to the various HVAC system air handling unit and other cooling system coils that are distributed throughout the building. Most air handling unit coils are provided with dedicate tertiary pumps, that provide a boost to the chilled water flow from the plant and help to maintain good heat transfer through the coils. Control valves at each coil regulate the amount of cold, 45 deg. F, chilled water from the central plant, that is consumed by the coil. Warmer return chilled water then exits the building where it returns to the plant via the same utility tunnel network. Depending upon the weather conditions and the type of HVAC system control strategy employed, the coil tertiary pumps are not energized until hot weather, and instead the cooling coils derived their flow from the central plant pumps.

Pipe Materials & Installation:

It is understood that the chilled water supply and return distribution piping system lines, are constructed of Sched. 40 steel piping. Piping smaller than 2" size is generally threaded, while all piping larger than 2" is welded. Valves are installed with flanges while expansion joints are welded in the pipeline.

The chilled water piping is generally mounted on support stands off the tunnel floor, with supply and return lines run on opposite sides. In some cases the piping is installed on steel framing, in common with the steam piping, with roller supports, spider alignment guides and inline expansion joints where necessary. Anchors are generally tied directly in to the concrete walls. All the chilled water piping is insulated, mostly with fiberglass insulation, with jacketing that varies from coated paper ASJ type, to PVC to corrugated metal, depending upon location, age and service locations.

Configuration:

The chilled water distribution piping is configured in a looped manner around the majority of the campus buildings. The west-side loop (known as the HPE loop), exits from Rozell and travels south, parallel to Washington Street, along the edge of the Woodward Field parking lot. The east-side loop (known as the Rozell loop), exits from Rozell, travels east along Cedar Street, turns south to the PUB, bends to the SE to Tawanka, turns to the SW and continues through the central plaza to the Art Complex. Just north of the Communications Building, the east and west loops join together.

There are several notable sub-branches that come off of the looped main:

- HPE Complex Branch
- CEB & Cheney Hall Branch
- WSP & Archives Branch
- Huston & Sutton Branch
- Senior & Kingston Hall Branch

The looped configuration of the chilled water main piping allows the chilled water system to be back-fed from either direction, in the case of maintenance or repair work on any section of the piping. Most pipe branch take-offs have isolation valves on both sides of the branch piping, which allows feed or isolation to occur on either side of the take-off. This provides great flexibility and allows most of the campus to be supplied with chilled water during service shut-downs on limited sections. Without a looped system, everything downstream from the shut-off point would otherwise be without service.

Access:

Access to the utility tunnel is provided in a number of locations. The main entrance, and the beginning of the tunnel, starts in the lower level of the Rozell Plant. Most other major buildings that are connected to the full size tunnel have basement or lower level mechanical rooms with doors that access the tunnel. At a few points along the tunnel route, there are stairway, with doors and surface structures for access or exiting. The original tunnel system also had some manholes with ladders, and a few ventilation turrets with access lids. Most of the manhole lids are sealed or rusted closed.

Age:

The utility tunnel, as well as most of the chilled water (and steam) distribution piping, was constructed in the early 1970s, along with the construction of the new Rozell Central Plant. This plant, and the utility tunnels, replaced the original steam plant (now the PLU bulding) and older direct buried steam distribution system. The tunnel has been expanded over the years to connect new buildings or sections of the campus as growth occurred. Most of the piping in the tunnel is therefore over 40 years old.

Condition:

Despite being over 40 years old, most of the steam supply and condensate return piping systems are in very good condition and have been well maintained. An end-to-end survey of the utility tunnel was conducted and all main branches, tees and major features were photographed for documentation as part of this report.

Most of the main and branch chilled water shut-off valves are butterfly valves with worm gear operators, which give excellent performance and help to extend the life expectancy of the system. Chilled water leaks at valves and fittings are virtually non-existent within the tunnel.

Insulation jacketing on the piping and valves was mostly intact and in good condition. Damage due to maintenance or water intrusion appeared minimal.

Capacity:

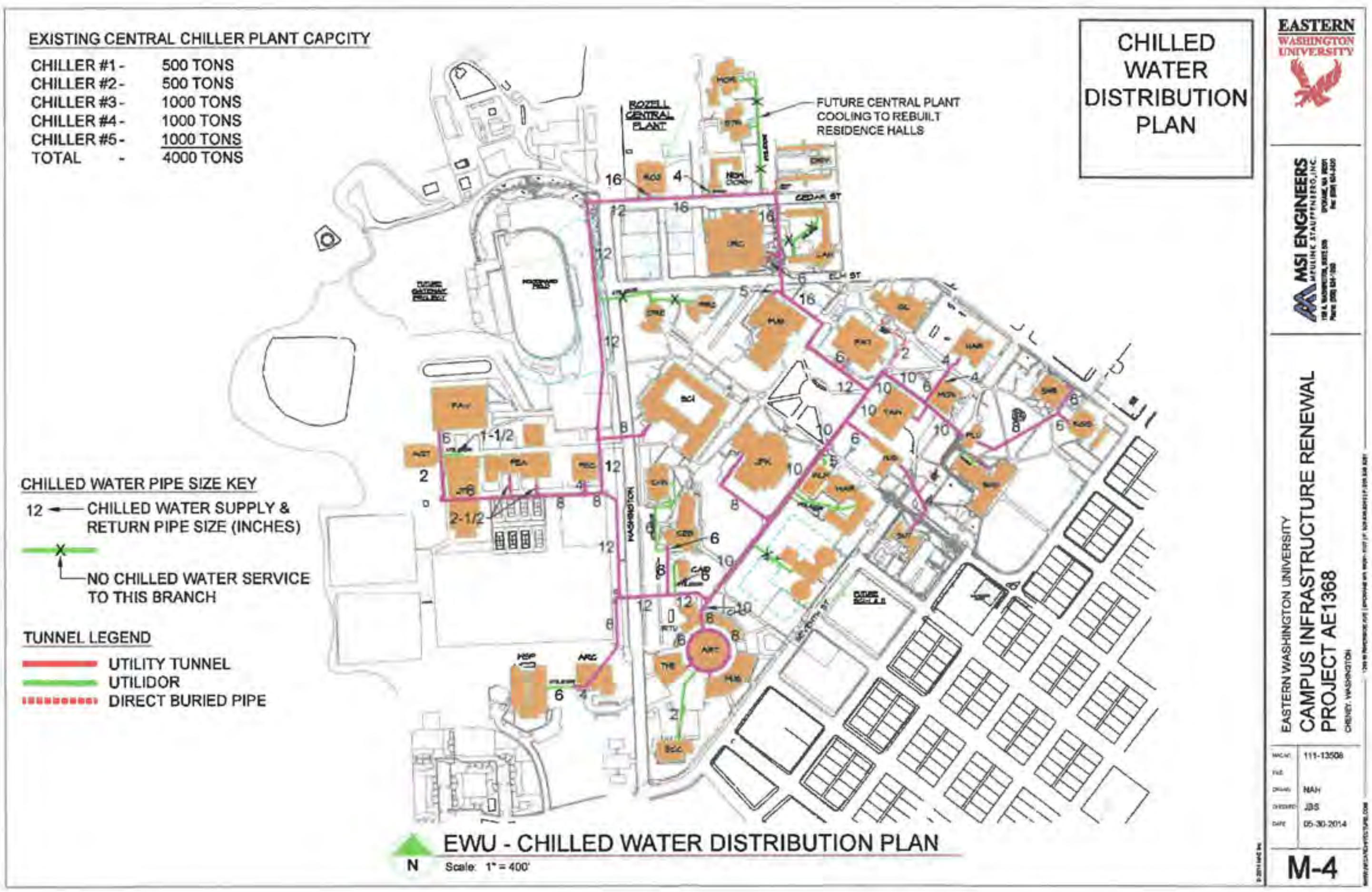
As part of this analysis, at chilled water system flow model was created for the entire campus chilled water distribution system (see analysis below). This model used information about the existing connected chilled water (air handling unit cooling coil loads in each building) and existing chilled water pipe sizing information, to develop a dynamic tool to help understand chilled water flow paths through the looped system, and to determine pressure losses from the Rozell Plant to the remote ends of the distribution system.

The main chilled water supply and return line exit from Rozell as 16" pipes. At the main junction just south of the plant the west (HPE) loop reduces to 12" size continues all the way down t the junction at the Art complex, where it reduces to a 10" pipe up to the east branch tee near Patterson Hall. The east (Rozell) loop stays at a 16" pipe and continues to a point just past the PUB branch, where it reduces to 12" pipe up to tee junction past Patterson. At this point the 10" pipe runs south to JFK Library and to the north and east to the PLU building.

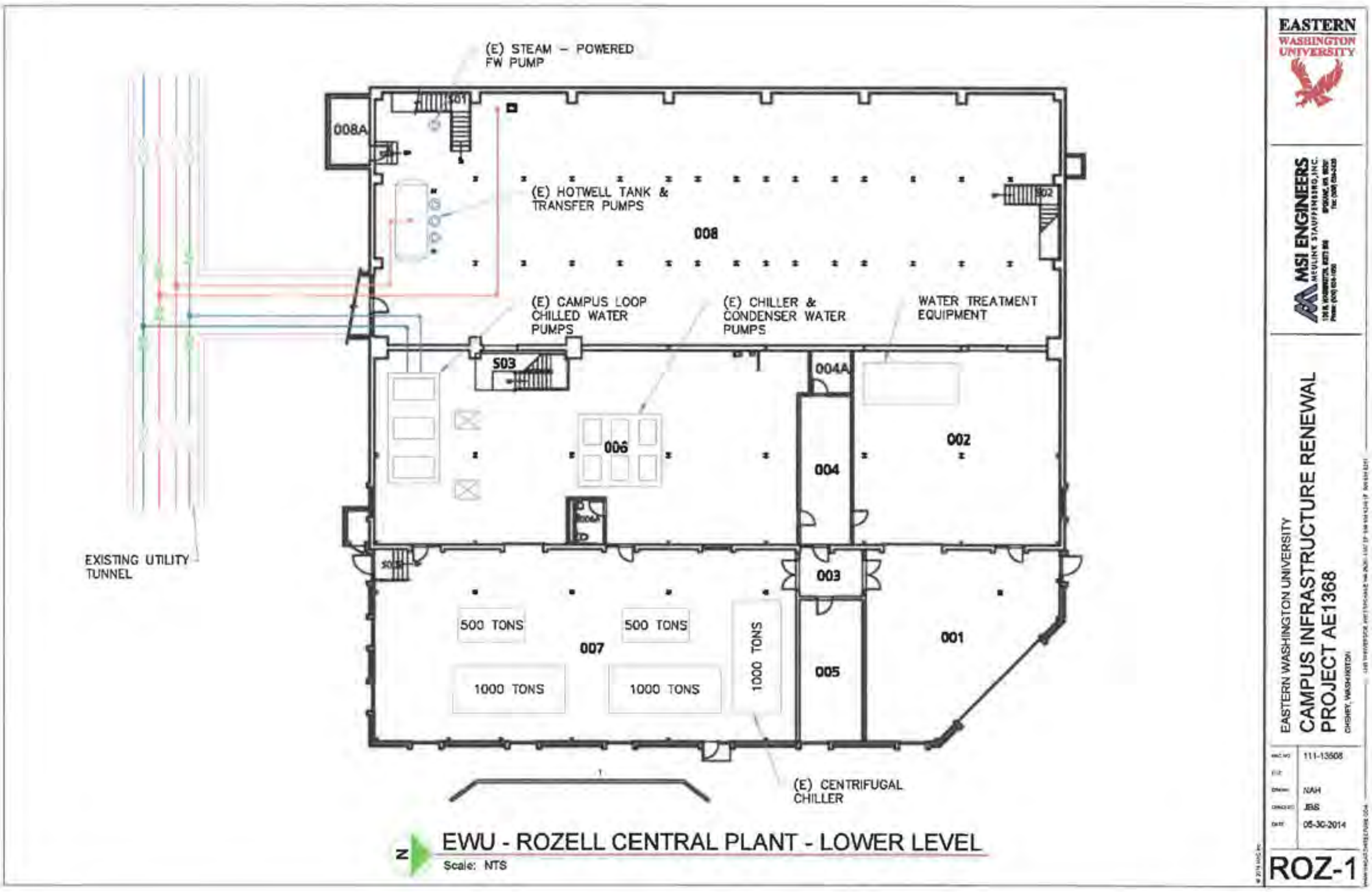
See the discussions and analysis in the flow modeling section for recommendations relative to pipe size and capacity.

Life Expectancy:

Based on the observations of the tunnel-wide survey conducted for this report, it appears that the chilled water supply and return piping is in good condition, and without evidence of failures or major leaks. Reports from the EWU maintenance staff indicate that when the piping has been opened for new branch tie-ins or valve work, that the interior of the piping does not show undue corrosion or pitting. Although the majority of the main loop piping is over 40 years, it is reasonable to expect another 15 to 25 years of service life, assuming the same level of care and maintenance in to the future.

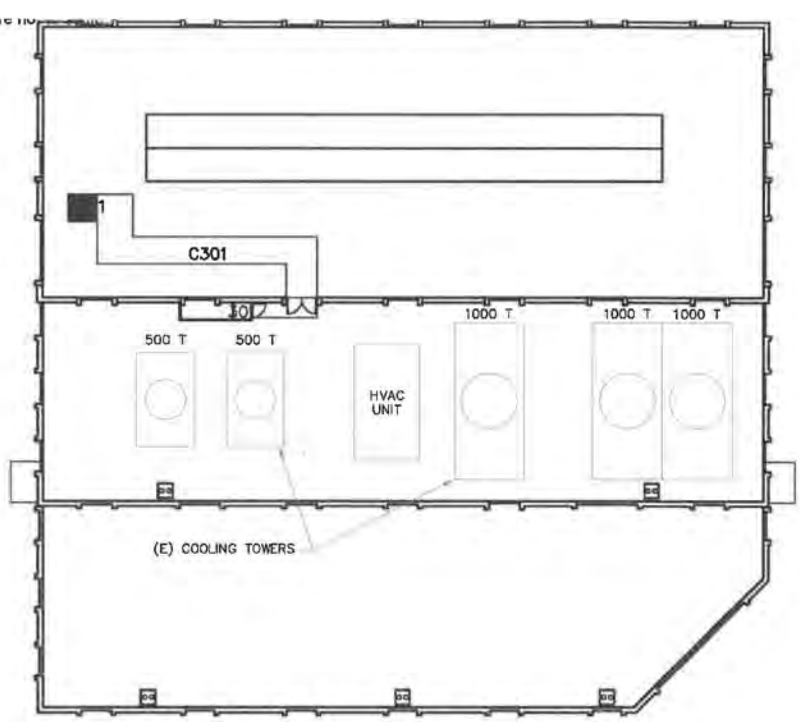


EXISTING CENTRAL CHILLER PLANT CAPCITY
CHILLER #1 - 500 TONS
CHILLER #2 - 500 TONS
CHILLER #3 - 1000 TONS
CHILLER #4 - 1000 TONS
CHILLER #5 - 1000 TONS
TOTAL - 4000 TONS
CHILLED WATER DISTRIBUTION PLAN
EASTERN WASHINGTON UNIVERSITY
ROZELL CENTRAL PLANT
FUTURE CENTRAL PLANT COOLING TO REBUILT RESIDENCE HALLS
CEDAR ST
ELM ST
WASHINGTON
CHILLED WATER PIPE SIZE KEY
12 ← CHILLED WATER SUPPLY & RETURN PIPE SIZE (INCHES)
NO CHILLED WATER SERVICE TO THIS BRANCH
TUNNEL LEGEND
UTILITY TUNNEL
UTILIDOR
DIRECT BURIED PIPE
EWU - CHILLED WATER DISTRIBUTION PLAN
N
Scale: 1" = 400'
MSI ENGINEERS
EASTERN WASHINGTON UNIVERSITY
CAMPUS INFRASTRUCTURE RENEWAL
PROJECT AE1368
CHENEY, WASHINGTON
111-13506
NAH
JBS
05-30-2014
M-4



EWU - ROZELL CENTRAL PLANT - LOWER LEVEL

Scale: NTS



EWU - ROZELL CENTRAL PLANT - ROOF
Scale: NTS

EASTERN WASHINGTON UNIVERSITY

MSI ENGINEERS

EASTERN WASHINGTON UNIVERSITY
CAMPUS INFRASTRUCTURE RENEWAL
PROJECT AE1368
CHENEY, WASHINGTON

111-13508
NAH
JBS
05-30-2014

ROZ-3

CAMPUS CHILLED WATER SYSTEM FLOW MODELING & CALCULATIONS

Purpose & Goals

The existing EWU campus steam distribution system was modeled using commercial flow modeling software, in order to help evaluate and understand existing flow pathways though the campus loop, chilled water main pipe velocities and drop-off delivery pressures to individual buildings. Several models were created to look at various flow demands in order to help determine if the existing chilled water distribution system has the capacity to handle future campus growth.

Methodology

Using the computerized flow modeling software tools, and schematic plan representing the campus steam piping network was created. This plan was then populated with information regarding existing pipe sizes, pipe lengths, valves and fittings, in order to give an accurate representation of the system geometry.

Next, the various campus buildings were connected to the model as individual building chilled water flow demand points, representing the sum total chilled water gpm flow demand for each building. Each building was simplified in to a single chilled water flow demand point, in order to avoid creating an overly complex and confusing network, which would otherwise be the case if all the down steam piping, pumps and individual coils were added to the model for each building. Each building flow demand point was given a nominal pressure drop of 5.0 psig at design flow rates, in order to represent the pressure drop of valves, fittings and other building entrance conditions. Automatic control valves were added in to the model for each building to provide for flow limiting and to allow for diversity to be adjusted.

Chilled Water Load Data Source

Available construction drawings for each building were pulled from the EWU drawing library and chilled water coil capacity and flow data was extracted from these plans. Cooling coil data provided in the 2009 Dumais-Romans *EWU Campus Chilled Water System Study* was also used in this report. Allowances for future building chilled water loads were provided by EWU based on pre-design information, or, in the case of the future cooling for the modernized residence halls, based on an estimate of 500 sq. ft. per ton.

Diversity

Utilizing only the sum of the total connected design peak chilled water demand for all facilities simultaneously, does not take into account the actual dynamics of building occupancy and weather variations, and results in an unrealistically high demand on the Central Campus Chiller Plant. For example, occupancy levels often don't reach 100% and can therefore reduce the demand for air conditioning. On a larger scale, peak demand in a given building is often balanced by a reduction in demand in other facilities as students migrate from the dorms to the classrooms, offices and gyms. This 'diversity' results in an overall demand reduction on the expected central chiller plant.

According to the EWU operations staff, the historical peak campus cooling load is somewhere between 3,500 tons (per Dumais & Romans in their 2009 *Campus Chilled Water System Study*) and 2,500 tons (per McKinstry in their *2012 Energy Efficiency & Sustainability Report*). In our interview with the EWU staff, they reported a historical peak cooling load of about 3,000 tons, which is the value that is used in our analysis.

Based on a total campus connected chilled water load of approximately 5,748 tons, the 3,000 tons represents a diversified load of 52% (of total campus load). Based on a chiller plant total capacity of 4,000 tons, this represents a 75% load of plant capacity.

For chilled water system flow modeling purposes, the diversified peak historic chilled water load was modeled at 50% of peak connected capacity.

COMPUTERIZED CHILLED WATER SYSTEM FLOW MODEL

Modeling Software

Pipe-Flow Professional, Version 12 (2014) by Engineered Software, Inc., was used to construct a computerized steady-state flow model of the steam distribution system. This software utilizes the Darcy-Weisbach formula with Bernoulli's theorem along with an extensive fluid and hardware properties database to solve complex networks including the effects of temperature, pressure, density, enthalpy, and steam quality. Its algorithms and equation solving techniques permit the program to automatically correct logical errors entered by the user (over-constrained system, reverse flow directions, inverted pressures, mismatched pipe sized, etc). Once the user defines the piping network within the software using actual pipe lengths, sizes, fittings, valves, and controls, the program solves the mass and energy balances and returns the solution along with all corresponding fluid properties.

Modeling Approach

Three (3) basic chilled water flow models (cases) were developed for the campus distribution analysis.

<u>Case-1: Maximum Design - 100% Connected Loads</u>

Basically this was an academic exercise to set-up the model for actual diversified loads, and it treated all connected buildings as having 100% chilled water flow load demand concurrently, with no system diversity. This model was used to validate that the sum of the connected building loads matched the expected values. The results of the flow are not really applicable to the actual chilled water system operation, which is highly diversified, but it is interesting to note the high resultant pipeline velocities near Rozell, where total flow is maximum, and the resultant high pumping flow rates and head pressures that would be theoretically necessary to satisfy this full flow system.

<u>Case-2: Historic Peak - 50% Connected Loads</u>

This model is basically the baseline expected peak chilled water flow demand for the actual existing campus system, based on the historic peak diversified demand of 50% of connected load (see above for diversity discussion).

<u>Case-3: Future Peak - 50% Connected Loads</u>

This model adds in the future chilled water loads, for the planned Gateway Athletic complex, the new Science I & II facility, as well as future cooling to the Residence halls, to the historic peak loads of Case-2. The same diversified load factor of 50% was used for this model.

CHILLED WATER SYSTEM FLOW MODEL RESULTS

See the graphic steam piping network drawings that are included with this report.

Case-1: Maximum Design - 100% Connected Loads

Not applicable. This was the model set-up. See discussion above.

Case-2: Historic Peak - 50% Connected Loads

Pipe Velocities:
Results of the chilled water system flow model for this case show that historic peak, diversified chilled flows and corresponding velocities in the existing piping network, do not exceed accepted values for good engineering practice. Velocities up to 10 fps maximum are generally accepted for good engineering practice for general water service piping (ASHRAE Fundamentals). Peak system velocities occur near Rozell where the combined chilled water flows are the greatest, with the west side main 12" at around 8.5 fps and east side main 16" branch at around 6.3 fps. The combined 16" plant main in to Rozell runs around 11.4 fps, which, although over the normal 10 fps maximum, is not really a concern for such a large diameter pipe, which can tolerate elevated velocities due to robust pipe wall thickness. This analysis indicates, and confirms, adequate pipe sizes for the actual existing historic peak loads for the campus.

System Pressure Drops:
Results of the chilled water flow model for this case indicate an overall total loop pressure drop to satisfy all remote flow demands, to be in the range of about 57 ft hd (25 psig) at the campus chilled water secondary pumps. Although this value is based on a simplified network analysis, with many variables that may not be fully understood, it does suggest that the existing campus secondary chilled water pumps may be somewhat under sized.

Case-3: Future Peak - 50% Connected Loads

Pipe Velocities:
With the addition of more chilled water load to the model to account for future buildings, the results of the flow model for this case show that anticipated future peak, diversified chilled water flows and corresponding velocities in the existing piping network, exceed the limits of good engineering practice in portions of the piping network. The existing west side 12" main line will experience considerably greater flow when the Gateway Athletic complex and future air conditioned Residence Halls come on line. Estimated peak flows of around 4,500 gpm in this section of piping will generate velocities around 12.8 fps. Not only is this higher velocity of concern for pipeline erosion issues, but the added flow resistance will create extra head pressure demands on the campus supply pumps. As such this section of 12" piping is a good candidate to be replaced to allow for future growth to this side of the campus loop.

At the same time the flow model shows that the larger 16" east side chilled water main will see flow rates that keep the peak velocities around 8.4 fps, well below the 10 fps maximum. However, the combined flows on the 16" main in to the Rozell plant show peak velocities over 16 fps, well above the usual 10 fps maximum. This analysis suggests that this section of piping should also be considered for replacement with larger piping to allow for future campus growth.

System Pressure Drops:
Results of the chilled water flow model for this future flow case indicate an overall total loop pressure drop to satisfy all remote diversified flow demands, to be in the range of about 175 ft hd (75 psig) at the campus chilled water secondary pumps, at a system flow rate of about 6,400 gpm. Because the existing campus secondary pumps only have a total flow capacity of about 5,000 gpm at 35 ft. hd., this indicates that these pumps will need to be replaced with larger capacity pumps to handle future campus chilled water demands.

Case-3A: Future Peak - 50% Connected Loads - Upsize 12" West Piping to 16"

Due to the results of Case-3 above that indicate that some of the existing chilled water piping will be too small to efficiently handle anticipated future chilled water flows, this model was run as a "what if" case with a larger pipe used on the west side loop, from Rozell to the HPE branch. This larger pipe accommodates the added expected future flow demands of the Gateway Complex and the air conditioned dorms.

Results of this case show pipe velocities in this section dropping below 7 fps and helping to reduce total system pump head pressure down to 85 ft. hd (37 psig).

CHILLED WATER SYSTEM FLOW MODEL CONCLUSIONS

Chilled Water Distribution Piping Capacity for Future Growth

In general, the existing chilled water system distribution piping is adequately sized to handle both the current chilled water flow demands plus anticipated future system growth. However, a portion of the existing west side main 12" piping, that runs from Rozell down Washington Street to the HPE complex, will be somewhat undersized for future growth allowance, and it is recommended that this section of piping be replaced with 16" size pipe.

Also, some of the existing 16" chilled water piping inside the Rozell Chiller Plant could experience excessive flow velocities due to future flow demands, and it is recommended that this piping be replaced or modified as the chiller plant grows to meet future loads (see below).

Chiller Plant Capacity for Future Growth

Due to the anticipated future growth of the campus as envisioned in the current Master Plan, the present 4,000 ton chiller plant will not have sufficient capacity to meet all the future cooling loads.

Based on the anticipated Master Plan campus growth for the New Science I & II projects, the new Gateway Athletic Project and the modernization of the legacy residence halls to include air conditioning, the expected addition of campus chilled water load is approximately 40%. Based on a peak historic capacity of 3,000 tons, a 40% increase would put the future campus load at over 4,200 tons, which is greater than the present total plant capacity of only 4,000 tons.

In order to meet the future cooling needs of the campus growth plan, it will be necessary to add cooling capacity, with sufficient redundancy to allow operational flexibility and to allow for break-downs. At minimum a 1000 ton chiller plant expansion should be planned for, although a larger, 2000 ton expansion would provide a higher degree of redundancy, future growth allowance and flexibility.

CAMPUS CHILLED WATER SYSTEM UPGRADE RECOMMENDATIONS

Overall the existing Central Campus Chiller Plant is in good condition, and has been very well maintained, similar to the steam plant equipment. The chiller plant underwent a major expansion in the mid 1990's and as a result the equipment is generally newer than much of the older steam plant equipment. An analysis of the chiller plant capacity and past load history indicates that, unlike the steam plant, the existing chiller plant will not have sufficient spare capacity to handle the anticipated new cooling loads for the 10 year Master Plan growth. As such, several projects have been identified below to provide added chiller plant cooling capacity, reliability and to increase system efficiencies.

Proposed Campus Chilled Water System Infrastructure Upgrade Projects:

Chilled Water System Recommended Project Summary List

Project No.	Title	Description	ROM Budget Price
CP	Chiller Plant		
CP-1	Add Chiller Plant Capacity, 2000 tons	New 2000 ton water-cooled centrifugal chiller with VFD drive. New induced draft, open cooling tower with VFD drive. New chiller and condenser water pumps with VFD drives. Controls. Rozell Plant expansion, electrical and ventilation.	$3,600,000
CP-2	Upgrade Campus Chilled Water Pumps	Replace three (3) existing secondary chilled water pumps (campus supply) with new VFD driven pumps, with flow and head capacity to handle future loads.	$300,000
CP-3	Install VFDs on Chiller Compressors & on Cooling Towers	Retrofit existing 1000 ton chillers and cooling towers with VFD drives and upgrade controls to improve plant efficiency.	$1,000,000
CP-4	Install 2 New Energy Efficient Cooling Towers	Replace (2) aging 500 ton cooling towers with new induced draft, open type towers with VFD drives, to improve plant efficiency.	$500,000
CD	Chilled Water Distribution		
CD-1	Replace/Upsize a Portion of the 12" West-Side Chilled Water Piping	Replace a portion of the existing 12" west side campus distribution piping with 16" pipe in order to handle future chilled water flow demand.	$1,000,000

Central Camps Chiller Plant (CP)

Overall the existing Central Campus Chiller Plant is in good condition, and has been very well maintained, similar to the steam plant equipment. The chiller plant underwent a major expansion in the mid 1990's and as a result the equipment is generally newer than much of the older steam plant equipment. An analysis of the steam plant capacity and past load history indicates that, unlike the steam plant, the existing chiller plant will not have sufficient spare capacity to handle the anticipated new cooling loads for the 10 year master plan growth. As such, several projects have been identified below to provide added chiller plant cooling capacity, reliability and to increase system efficiencies.

CP-1: Add Chiller Plant Capacity, 2000 tons

Description:

Install additional chiller plant capacity, 2000 tons.

(This recommendation is a concurrence of the chiller plant capacity upgrades "2.02-ROZ" as previously suggested by McKinstry in their *2012 Energy Efficiency & Sustainability Report*, as well as by the recommendations made in 2009 by Dumais & Romans in their *Campus Chilled Water System Study*)

The following elements would be installed or upgraded:

- New 2000 ton water-cooled centrifugal chiller with VFD drive.
- New 2000 ton induced-draft open cooling tower with VFD drive (2-1000 ton towers).
- New chiller (evaporator) pump.
- New condenser water (tower) pump.
- Upgrade/Replace Campus Loop chilled water pumps with new capacity pumps with VFDs.
- Controls.
- Rozell plant expansion, electrical work and ventilation.

Analysis/Justification:

The existing Central Campus Chiller Plant has a total capacity of 4,000 tons (3-1000 ton chillers & 2-500 ton chillers), which matching capacity cooling towers and pumps.

According to the EWU operations staff, the historical peak campus cooling load is somewhere between 3,500 tons (per Dumais & Romans in their 2009 *Campus Chilled Water System Study*) and 2,500 tons (per McKinstry in their *2012 Energy Efficiency & Sustainability Report*). In our interview with the EWU staff, they reported a historical peak cooling load of about 3,000 tons, which is the value that is used in our analysis.

Based on the anticipated master plan campus growth for the New Science I & II projects, the new Gateway Athletic Project and the modernization of the legacy residence halls to include air conditioning, the expected addition of campus chilled water load is approximately 40%.

Based on a peak historic capacity of 3,000 tons, a 40% increase would put the future campus load at over 4,200 tons, which is greater than the present total plant capacity of only 4,000 tons.

In order to meet the future cooling needs of the campus growth plan, it will be necessary to add cooling capacity, with sufficient redundancy to allow operational flexibility and to allow for break-downs. At minimum a 1000 ton chiller plant expansion should be planned for, although a larger, 2000 ton expansion would provide a higher degree of redundancy, future growth allowance and flexibility.

Sequence / Category:
Capital Master Plan Project.

Cost:
CP-1: $3,600,000

CP-2: Upgrade Campus Chilled Water Pumps

Description:

Upgrade campus distribution loop chilled water pumps to increase system capacity and to provide VFD control for each pump.
(This recommendation is similar to the chilled water pump upgrades "2.01-ROZ" as previously suggested by McKinstry in their *2012 Energy Efficiency & Sustainability Report*)

The following elements would be installed or upgraded:

- Upgrade/Replace Campus Loop chilled water pumps CWP-2 & CWP-3 with new capacity pumps with VFDs. Existing CWP-1 is already controlled by a VFD.
- New Delta Controls.

Analysis/Justification:

Depending upon the priority and timing of the above proposed chiller plant expansion, the upgrade of the existing campus distribution pumps may not be necessary, as they are also included in the above scope.

However, until such time as the chiller plant capacity is increased, it would be beneficial to upgrade the existing campus distribution chilled water pumps for two reasons.

First of all, these existing pumps (CWP-2 & 3) are two-speed pumps, without VFD speed/capacity control. Two-speed pumps are not as efficient as pumps that are run with VFDS, and controllability is not as good for varying flow demands.

Secondly, based on the results of the chilled water system flow model that was prepared with this report, there are likely times when the existing campus chilled water distribution piping system is being "under pumped". In other words, it appears at times there may be a shortage of campus chilled water flow to some of the remote buildings. This is indicated by the results of the flow model that suggests that during times of peak historic campus cooling demand, that drop-off pressures (and therefore flows) to many of the buildings is greater than the capacity of the existing pumping plant (based on available flow and head pressures).

The present operational setpoint of 15 psig (35 ft head) pressure differential between the campus supply main and return main, does not seem to produce sufficiently strong flow conditions to necessarily satisfy all flow demands. This condition of possible under-pumping is also indicated by a reported high Delta T (nearly 20 deg. F) on the campus chilled water loop, compared to a design Delta T for most buildings of around 10 deg. F.

Further analysis of the chilled water distribution system is needed to better understand the dynamics suggested by the flow model and field observations, however, the recommendation to upgrade the existing chilled water distribution pumps (install VFDs and possibly increase capacity with larger pumps) is still valid.

Sequence / Category:
Capital Master Plan Project

Cost:
CP-2: $300,000

CP-3: Install VFDs on the Chiller Compressors and on the (3) 1,000 ton Cooling Towers

(This is recommendation " 2.00-ROZ:": per McKinstry in their *2012 Energy Efficiency & Sustainability Report)*

Description:

Upgrade the existing centrifugal chiller compressors to add new VFD drives. Replace the 2-speed fan motors on the (3) largest cooling towers with VFD duty motors and install new VFD drives. Update controls to map drives to building automation system.

Analysis/Justification:

Per McKinstry Analysis: Annual electrical energy savings due to more efficient part load operation of equipment. Better able to match equipment capacity with campus cooling loads.

Sequence / Category:
Improved Operational Efficiencies.

Cost:
CP-3: $1,000,000

CP-4: Install 2 New Energy Efficient Cooling Towers

(This recommendation" 2.40-ROZ:" per McKinstry in their *2012 Energy Efficiency & Sustainability Report)*

Description:

Replace the existing, aging and inefficient 500 ton cooling towers with new, energy efficient, open circuit, induced draft cooling towers, with VFDs on their fan motors.

Analysis/Justification:

Per McKinstry Analysis: The new cooling towers will be sized for supplying 75 deg F water to the chillers during peak load conditions, thereby improving chiller efficiency. Annual electrical energy savings are anticipated.

Priority/Sequence:
Improve Operational Efficiencies.

Cost:
CP-4: $500,000

Campus Chilled Water Distribution System (CD)

Similar to the steam system, the existing Campus Steam Distribution System is in good condition, and has been very well maintained; despite piping that is mostly over 40 years old. Assuming that the existing distribution system piping, valves, and insulation jacketing is maintained as well in the future, the system should have a life expectancy of at least 15 to 25 more years.

A computerized flow model of the campus chilled water distribution system, that was prepared as part of this analysis, indicates that most of the existing chilled water system piping is adequately sized to handle expected future campus growth and added chilled water production capacity. However, a portion of the existing 12" East-side (Washington street) loop piping will reach the limits of good engineering practice for peak flow/velocities, as the future Gateway and upgraded residence hall cooling projects come on line.

CD-1: Replace/Upsize a Portion of the 12" West-Side Chilled Water Piping

Description:

Replace the existing 12" chilled water piping that feeds the west-side (Washington Street) of the campus loop, with 16" size pipe, from the Rozell plant junction, up to the HPE branch, past the existing Science Building. This section of piping will see significantly increased flow demands when the future Gateway and residence hall cooling projects are completed.

Analysis/Justification:

Analysis of the future chilled water flow rates as developed by the computerized flow model, indicates a flow split of roughly 50-50 between the west-side (12") and east-side (16") chilled water loops when accounting for future flow conditions. Under this condition the 12" pipe branch will see a fluid velocity of roughly 50% greater than the 16" branch, and approaching the recommended peak design velocity of 10 feet per second.

Changing this section of piping from 12" to 16" size will reduce expected peak flow velocities to be within normal limits and reduce pumping head pressure requirements.

Sequence / Category:
Capital Master Plan Project.

Cost:
CD-1: $1,000,000

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

EWU - Campus Infrastructure Renewal
Proposed Mechanical Upgrades
Budgetary Level Cost Estimates

7/11/2014
MSI# 14-01
By: B. Snow

CHILLED WATER SYSTEM - INFRASTRUCTURE UPGRADE BUDGET SUMMARY

CHILLED WATER SYSTEMS	Budget Cost Estimate
Chiller Plant	
CP-1: Add Chiller Plant Capacity - 2000 tons	$3,600,000
CP-2: Upgrade (3) Campus Chilled Water Pumps	$300,000
CP-3: Install VFDs on (3) Chillers and Cooling Towers	$1,000,000
CP-4: Replace (2) Aging Cooling Towers with new Towers with VFD Drives	$500,000
CHILLER PLANT (CP) -	$5,400,000
Chilled Water Distribution	
CD-1: Replace Portion of 12" CW Loop Piping with 16" Piping	$1,000,000
CHILLED WATER DISTRIBUTION (CD) -	$1,000,000
CHILLED WATER SYSTEM TOTAL -	$6,400,000

MSI ENGINEERS
MEULINK STAUFFENBERG, INC.

CHILLED WATER SYSTEM - INFRASTRUCTURE UPGRADE BUDGET SUMMARY

Chiller Plant (CP)

CP-1: Add Chiller Plant Capacity - 2000 tons

	Unit	Quantity	$/unit	Cost
2000 Ton Water-Cooled Cent. Chiller with VFD	ea	1	$750,000.00	$750,000
1000 Ton Induced Draft Cooling Tower with VFD	ea	2	$175,000.00	$350,000
4500 gpm chiller pump	ea	1	$30,000.00	$30,000
6000 gpm chiller pump	ea	1	$35,000.00	$35,000
VFD drives for pumps - X hp	ea	2	$20,000.00	$40,000
Chiller Loop Piping, Valves & Insulation	lot	1	$100,000.00	$100,000
Tower Loop Piping, Valves & Insulation	lot	1	$100,000.00	$100,000
Campus Loop Piping Tie-in & Modifications	lot	1	$75,000.00	$75,000
BAS Upgrades	lot	1	$75,000.00	$75,000
Water Treatment System	lot	1	$25,000.00	$25,000
Chiller Plant Addition HVAC & Ventilation	lot	1	$50,000.00	$50,000
Chiller Plant Addition Plumbing	lot	1	$25,000.00	$25,000
Test & Balance, Start-up & Commissioning	lot	1	$50,000.00	$50,000
Mis. Modifications	lot	1	$15,000.00	$15,000
Electrical Upgrades for Chiller Plant Addition	lot	1	$500,000.00	$500,000
4,000 Rozell Plant Addition Construction	sf	4,000	$165.00	$660,000
			Subtotal	$2,880,000
	%	15	Design Contigency	$432,000
	%	10	G.C. OH&P	$288,000
			CP-1 - TOTAL	**$3,600,000**

CP-2: Upgrade (3) Campus Chilled Water Pumps

	Unit	Quantity	$/unit	Cost
Demo Existing Pumps	ea	3	$1,000.00	$3,000
3000 gpm pumps - 100 hp	ea	3	$30,000.00	$90,000
VFD drives for pumps	ea	3	$15,000.00	$45,000
BAS Upgrade	lot	1	$25,000.00	$25,000
Piping, Valving & Insulation Modificaitons	ea	3	$10,000.00	$30,000
Test & Balance, Start-up & Commissioning	lot	1	$25,000.00	$25,000
Misc.	ea	1	$11,500.00	$11,500
Electrical Upgrades/Connections	ea	3	$3,500.00	$10,500
			Subtotal	$240,000
	%	15	Design Contigency	$36,000
	%	10	G.C. OH&P	$24,000
			CP- 2 - TOTAL	**$300,000**

CP-3: Install VFDs on (3) Chillers and Cooling Towers

	Unit	Quantity	$/unit	Cost
Retrofit Existing 1000 ton chillers with VFD drives	ea	3	$225,000.00	$675,000
Install VFDs on Existing Cooling Tower Fan Motors	ea	3	$15,000.00	$45,000
BAS Upgrades	lot	1	$25,000.00	$25,000
Test & Balance, Start-up & Commissioning	lot	1	$25,000.00	$25,000
Electrical Upgrades/Connections	ea	6	$5,000.00	$30,000
			Subtotal	$800,000
	%	15	Design Contigency	$120,000
	%	10	G.C. OH&P	$80,000
			CP-3 - TOTAL	**$1,000,000**

CP-4: Replace (2) Aging Cooling Towers with new Towers with VFD Drives

Demo Existing Cooling Towers	ea	2	$5,000.00	$10,000
Induced Draft Open Cooling Towers w/ VFDs - 500 tons	ea	2	$125,000.00	$250,000
Piping modifications & Connections	ea	2	$25,000.00	$50,000
Roof Structural Support Modifications	ea	1	$30,000.00	$30,000
Test & Balance, Start-up & Commissioning	lot	1	$25,000.00	$25,000
Misc.	ea	1	$25,000.00	$25,000
Electrical Upgrades/Connections	ea	2	$5,000.00	$10,000
			Subtotal	$400,000
	%	15	Design Contigency	$60,000
	%	10	G.C. OH&P	$40,000
			CP-4 - TOTAL	**$500,000**

MSI ENGINEERS
MEULINK STAUFFENBERG, INC

CHILLED WATER SYSTEM - INFRASTRUCTURE UPGRADE BUDGET SUMMARY

Chilled Water Distribution (CD)

CD-1: Replace Portion of 12" CW Loop Piping with 16" Piping

	Unit	Quantity	$/unit	Cost
Demo Existing 12" CHS & CHR Piping	lf	1,500	$25.00	$37,500
New 16" Sched. 40 Welded Steel CHS & CHR Piping	lr	1,500	$315.00	$472,500
Fittings	%	25		$118,125
Valves - Butterfly 16"	ea	10	$5,000.00	$50,000
Pipe Insulation - 2" F.G. ASJ	lf	1,500	$25.00	$37,500
Insulation Jacket & Labels	lf	1,500	$5.00	$7,500
Expansion Joints	ea	12	$2,000.00	$24,000
Rollers & Guides	ea	100	$150.00	$15,000
Anchors	ea	10	$500.00	$5,000
Flush & Fill	lot	1	$5,000.00	$5,000
Misc.	ea	1	$27,875.00	$27,875
			Subtotal	$800,000
	%	15	Design Contigency	$120,000
	%	10	G.C. OH&P	$80,000
			CD-1 - TOTAL	**$1,000,000**

Appendix J – C 100

C-100(2020)

Updated June 2020

Quick Start Guide

GENERAL INFORMATION

1) The C-100(2020) tool was created to align with the estimating application in the Capital Budgeting System (CBS). The intended use is to enable project managers to communicate their project cost estimates to budget officers in the standard format required for capital project budget requests/submittals to OFM.

2) This workbook is protected so that the worksheets within it cannot be moved or deleted in the usual manner. This protection is necessary to ensure that the cost estimate details and formulas align with the estimating application in the Capital Budgeting System.

3) The estimating format to develop the maximum allowable construction cost (MACC) is presented in Uniformat II.

4) Form-calculated costs such as A/E Basic Design Service fees and Agency Project Management costs are dependent on other estimated project costs such as Acquisition, MACC, Equipment, etc.

5) Project estimates generated with this tool are not sufficient for budget request submittals to OFM. Use the Capital Budgeting System to submit capital project budget requests.

6) Contact your assigned OFM Capital Budget Analyst with questions.

OFM Capital Budget Analyst

INSTRUCTIONS

1) Only green cells are available for data entry.

2) Fill in all known cells in the 'Summary' tab prior to moving on to the cost entry tabs A-G.

3) It is recommended, but not required, to fill out cost entry tabs in the following order:

A. Acquisition, C. Construction Contracts, D. Equipment, G. Other Costs, B. Consultant Services, F. Project Management, then E. Artwork.

4) If additional rows are inserted to capture additional project costs, a description must be provided in the Notes column or within Tab H. Additional Notes. Be particularly detailed for additional costs estimated for contingencies and project management.

FORM-CALCULATED COSTS (FEE CALCULATIONS)

1) A/E Basic Design Services: AE Fee % (x) (MACC + Contingency)

2) Design Services Contingency: Contingency % (x) Consultant Services Subtotal

3) Construction Contingency: Contingency % (x) MACC

4) Artwork: 0.5% (x) Total Project Cost

5) Agency Project Management (Greater than $1million): (AE Fee % - 4%) (x) (Acquisition Total + Consultant Services Total + MACC + Construction Contingency + Other Costs)

STATE OF WASHINGTON
AGENCY / INSTITUTION PROJECT COST SUMMARY
Updated June 2020

Agency	Eastern Washington University
Project Name	Infrastructure Renewal III
OFM Project Number	40000070

Contact Information

Name	Shawn King
Phone Number	509-359-6878
Email	sking@ewu.edu

Statistics

Gross Square Feet		MACC per Square Foot	
Usable Square Feet		Escalated MACC per Square Foot	
Space Efficiency		A/E Fee Class	A
Construction Type	Heating and power plan	A/E Fee Percentage	11.57%
Remodel	Yes	Projected Life of Asset (Years)	30
Additional Project Details			
Alternative Public Works Project	No	Art Requirement Applies	No
Inflation Rate	2.38%	Higher Ed Institution	Yes
Sales Tax Rate %	8.90%	Location Used for Tax Rate	Cheney, WA
Contingency Rate	10%		
Base Month	June-20	OFM UFI# (from FPMT, if available)	
Project Administered By	Agency		

Schedule

Predesign Start	October-20	Predesign End	December-20
Design Start	January-21	Design End	June-22
Construction Start	August-21	Construction End	June-23
Construction Duration	22 Months		

Green cells must be filled in by user

Project Cost Estimate

Total Project	**$24,717,996**	Total Project Escalated	**$25,517,929**
		Rounded Escalated Total	**$25,518,000**

State of Washington
AGENCY / INSTITUTION PROJECT COST SUMMARY
Updated June 2020

Agency	Eastern Washington University
Project Name	Infrastructure Renewal III
OFM Project Number	40000070

Cost Estimate Summary

Acquisition			
Acquisition Subtotal	**$0**	**Acquisition Subtotal Escalated**	**$0**

Consultant Services			
Predesign Services	$0		
A/E Basic Design Services	$1,460,576		
Extra Services	$33,000		
Other Services	$656,201		
Design Services Contingency	$214,978		
Consultant Services Subtotal	**$2,364,755**	**Consultant Services Subtotal Escalated**	**$2,454,642**

Construction			
Construction Contingencies	$1,663,218	Construction Contingencies Escalated	$1,746,712
Maximum Allowable Construction Cost (MACC)	$16,632,177	Maximum Allowable Construction Cost (MACC) Escalated	$17,094,552
Sales Tax	$1,628,290	Sales Tax Escalated	$1,676,873
Construction Subtotal	**$19,923,685**	**Construction Subtotal Escalated**	**$20,518,137**

Equipment			
Equipment	$1,247,413		
Sales Tax	$111,020		
Non-Taxable Items	$0		
Equipment Subtotal	**$1,358,433**	**Equipment Subtotal Escalated**	**$1,426,628**

Artwork			
Artwork Subtotal	**$126,955**	**Artwork Subtotal Escalated**	**$126,955**

Agency Project Administration			
Agency Project Administration Subtotal	$944,169		
DES Additional Services Subtotal	$0		
Other Project Admin Costs	$0		
Project Administration Subtotal	**$944,169**	**Project Administation Subtotal Escalated**	**$991,567**

Other Costs			
Other Costs Subtotal	**$0**	**Other Costs Subtotal Escalated**	**$0**

Project Cost Estimate			
Total Project	**$24,717,996**	Total Project Escalated	**$25,517,929**
		Rounded Escalated Total	**$25,518,000**

Cost Estimate Details

Acquisition Costs					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Purchase/Lease					
Appraisal and Closing					
Right of Way					
Demolition					
Pre-Site Development					
Other					
Insert Row Here					
ACQUISITION TOTAL	**$0**		**NA**	**$0**	

Green cells must be filled in by user

Cost Estimate Details

Consultant Services					
Item	Base Amount		Escalation Factor	Escalated Cost	Notes
1) Pre-Schematic Design Services					
Programming/Site Analysis					
Environmental Analysis					
Predesign Study					
Other					
Insert Row Here					
Sub TOTAL	**$0**		**1.0139**	**$0**	Escalated to Design Start
2) Construction Documents					
A/E Basic Design Services	$1,460,576				69% of A/E Basic Services
Other					
Insert Row Here					
Sub TOTAL	**$1,460,576**		**1.0309**	**$1,505,709**	Escalated to Mid-Design
3) Extra Services					
Civil Design (Above Basic Svcs)	$33,000				
Geotechnical Investigation					
Commissioning					
Site Survey					
Testing					
LEED Services					
Voice/Data Consultant					
Value Engineering					
Constructability Review					
Environmental Mitigation (EIS)					
Landscape Consultant					
Electronic Security Consultant					
Audiovisual Consultant					
Lighting Consultant					
Laboratory Consultant					
Acoustical Consultant					
Interior Design					
Elevator Consultant					
Hardware Consultant					
Code Consultant					
Building Envelope Consultant					
Value Engineering Support					
Constructability Participation					
Energy Life Cycle Cost Analysis					
Life Cycle Cost Analysis					
Renovation Design at CEB					
Energy Modeling					
Models & Renderings					
Full Fire Protection Design					
Reimbursable Expenses					
Sub TOTAL	**$33,000**		**1.0309**	**$34,020**	Escalated to Mid-Design
4) Other Services					
Bid/Construction/Closeout	$656,201				31% of A/E Basic Services

HVAC Balancing				
Staffing				
Commissioning Support				
Record Drawings				
Sub TOTAL	**$656,201**	**1.0502**	**$689,143**	Escalated to Mid-Const.
5) Design Services Contingency				
Design Services Contingency	$214,978			
Other				
Insert Row Here				
Sub TOTAL	**$214,978**	**1.0502**	**$225,770**	Escalated to Mid-Const.
CONSULTANT SERVICES TOTAL	**$2,364,755**		**$2,454,642**	

Green cells must be filled in by user

Cost Estimate Details

Item	Base Amount		Escalation Factor	Escalated Cost	Notes
Construction Contracts					
1) Site Work					
G10 - Site Preparation					
G20 - Site Improvements	$140,000				
G30 - Site Mechanical Utilities	$7,070,293				
G40 - Site Electrical Utilities	$9,421,884				
G60 - Other Site Construction					
Other					
Insert Row Here					
Sub TOTAL	**$16,632,177**		**1.0278**	**$17,094,552**	
2) Related Project Costs					
Offsite Improvements					
City Utilities Relocation					
Parking Mitigation					
Stormwater Retention/Detention					
Other					
Insert Row Here					
Sub TOTAL	**$0**		**1.0278**	**$0**	
3) Facility Construction					
A10 - Foundations					
A20 - Basement Construction					
B10 - Superstructure					
B20 - Exterior Closure					
B30 - Roofing					
C10 - Interior Construction					
C20 - Stairs					
C30 - Interior Finishes					
D10 - Conveying					
D20 - Plumbing Systems					
D30 - HVAC Systems					
D40 - Fire Protection Systems					
D50 - Electrical Systems					
F10 - Special Construction					
F20 - Selective Demolition					
General Conditions					
CFCI Equipment					
CFCI Casework and Furnishings					
Escalation Adjustment					
Sub TOTAL	**$0**		**1.0502**	**$0**	
4) Maximum Allowable Construction Cost					
MACC Sub TOTAL	**$16,632,177**			**$17,094,552**	

This Section is Intentionally Left Blank

7) Construction Contingency				
Allowance for Change Orders	$1,663,218			
Additional Allowance for Renovation Portion of Project				
Insert Row Here				
Sub TOTAL	**$1,663,218**	**1.0502**	**$1,746,712**	
8) Non-Taxable Items				
Other				
Insert Row Here				
Sub TOTAL	**$0**	**1.0502**	**$0**	
Sales Tax				
Sub TOTAL	**$1,628,290**		**$1,676,873**	
CONSTRUCTION CONTRACTS TOTAL	**$19,923,685**		**$20,518,137**	

Green cells must be filled in by user

Cost Estimate Details

Equipment					
Item	Base Amount		Escalation Factor	Escalated Cost	Notes
E10 - Equipment	$831,609				
E20 - Furnishings	$415,804				
F10 - Special Construction					
Other					
Insert Row Here					
Sub TOTAL	**$1,247,413**		**1.0502**	**$1,310,034**	
1) Non Taxable Items					
Other					
Insert Row Here					
Sub TOTAL	**$0**		**1.0502**	**$0**	
Sales Tax					
Sub TOTAL	**$111,020**			**$116,594**	
EQUIPMENT TOTAL	**$1,358,433**			**$1,426,628**	

Green cells must be filled in by user

Cost Estimate Details

Artwork					
Item	Base Amount		Escalation Factor	Escalated Cost	Notes
Project Artwork	$0				0.5% of total project cost for new construction
Higher Ed Artwork	$126,955				0.5% of total project cost for new and renewal construction
Other					
Insert Row Here					
ARTWORK TOTAL	**$126,955**		**NA**	**$126,955**	

Green cells must be filled in by user

Cost Estimate Details

Project Management					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Agency Project Management	$944,169				
Additional Services					
Other					
Insert Row Here					
PROJECT MANAGEMENT TOTAL	**$944,169**		**1.0502**	**$991,567**	

Green cells must be filled in by user

Cost Estimate Details

Other Costs					
Item	**Base Amount**		**Escalation Factor**	**Escalated Cost**	**Notes**
Mitigation Costs					
Hazardous Material Remediation/Removal					
Historic and Archeological Mitigation					
Permits, Etc…					
OTHER COSTS TOTAL	**$0**		**1.0278**	**$0**	

Green cells must be filled in by user

C-100(2020)
Additional Notes

Tab A. Acquisition
Insert Row Here

Tab B. Consultant Services
Insert Row Here

Tab C. Construction Contracts
Insert Row Here

Tab D. Equipment
Insert Row Here

Tab E. Artwork
Insert Row Here

Tab F. Project Management
Insert Row Here

Tab G. Other Costs
Insert Row Here

Appendix K – CBS002

370 - Eastern Washington University
Capital Project Request
2021-23 Biennium

*

Version: C1 Eastern Washington University

Report Number: CBS002
Date Run: 8/12/2020 8:52AM

Project Number: **40000070**
Project Title: **Infrastructure Renewal III**

Description

Starting Fiscal Year: 2022
Project Class: Preservation
Agency Priority: 2

Project Summary

Infrastructure Renewal III is the third phase to replace and upgrade infrastructure on Eastern Washington University's Cheney Campus. It includes upgrade to Steam Production and Distribution, Chilled Water Production and distribution, Sanitary and Storm Sewer Management and Medium Voltage Electrical system improvements.

Project Description

What is the problem/opportunity? Identify: priority, underserved people/communities, operating budget savings, public safety improvements & clarifying details. Preservation projects: include information about the current condition of the facility/system.

Out major capital request proposal includes **sub-sections** entitled **Central Steam Production, Chilled Water Production, Medium Voltage Electrical Distribution,** and **Water Resource Systems**. A heading for each will be included in each specific criteria category for clarity.

Eastern Washington University is requesting $25,517,955 for Infrastructure Renewal III in the Infrastructure category.

Eastern's FY2019-21 proposal requested $24,959,000 and scored the highest in its category but only about 50% of the request was allocated. In FY2017-19, regretfully no funds were appropriated to the EWU Infrastructure Master Plan by the legislature. Fortunately during this timeframe, no major failure or significant disruption to the Steam, Chilled Water, or Medium Voltage Electrical systems has occurred. This request builds on the FY2019-21 request.

Due to the reduced funding allocation over the previous four years some of the FY2019-21 allocated funds were directed to increasing emergent needs related to our infrastructure. The majority of the funds has gone toward the Infrastructure Master Plan, albeit in at least a piecemeal basis. As an example, time had taken its toll on the existing boiler controls computer system and once received FY2019-21 funds were immediately made available for the design and installation of a replacement boiler burner management control system. This new system provides a stable operating environment with the latest in industrial direct digital controls (DDC) technology and has become an important component in the modernization of this plant. We estimate the increased boiler efficiencies of between 3% and 5% will save approximately $45,000 and $75,000. In addition, this investment will be compatible with new boiler technology project currently under design.

Eastern Washington University's Cheney campus consists of approximately 70 individual buildings comprising almost 3,000,000 gross square feet of academic and student support facilities whereby university-owned infrastructure provide all heating, cooling, electrical, and other building utility needs to these facilities. University plant operators have operated and maintained the boilers (60 years old max) and chillers (22 years max) with great care and as a result the equipment has functioned well beyond their expected lifecycle. However regardless of the professional care and maintenance given to these units, it's time to begin cyclic replacement of the older inefficient boilers, chillers, and electrical components.

This infrastructure includes: Steam generation and distribution (Campus Winter Building Heat); Chilled water production and distribution (Campus Summer Building Air Conditioning and constant cooling for specialty systems); Fire protection and Domestic Water production and delivery (To 70 campus buildings); Sanitary sewer and storm sewer water collection and disposal to the City of Cheney; Central building automation and energy management systems (Energy efficiency and GHG reductions); And, Emergency vehicle access and other campus site improvements required by Code or other Statute (Federal, State and Local Building Code). These infrastructure systems are mission critical to daily life at Eastern Washington University and support the university's primary goal of student success. The Rozell Central Energy Facility is located at the north end of campus and was originally constructed in 1967. This plant is the heart of the campus where all steam heat, chilled water building cooling, and electrical power distribution originate. Once produced, auxiliary systems distribute these services through approximately 3 miles of utility tunnels across campus.

Significant Health, Safety and Code issues:

Project Number: 40000070
Project Title: Infrastructure Renewal III

Description

-Local Jurisdictional Model Code IPMC 2015 Section 602.4 – Heating Public Facilities
-Local Jurisdictional Model Code IBC 2018 Section 1203.1 N + 1 redundancy
-Local Jurisdictional Model Code IMC 2018 Section 309.1 Equipment and Systems
-Local Jurisdictional Model Code 2018 IPMC Section 603.1 Mechanical Appliances
-2015 Washington Energy Code – Commercial Provisions Section C403.2.3 (5) Minimum and HVAC -Equipment Performance Requirements
-Efficiency Requirements Gas Fired Boilers – Steam greater than 2,500,000 BTU/HR
-Local Jurisdictional Model Code IBS2018 Section 1613.1 - Seismic Restraints
-Electrical Safety of EWU Electrical Shop Workers – The current usage/installation of SF6 (sulfur-hexafluoride) circuit breaker in the EWU utility tunnel presents (3) operational safety issues in the following codes:
1. 2017 National Electrical Safety Code (NESC) C2-2017 Section 443 – Work on Energized Lines and Equipment – Gas Insulated Equipment
2. USEPA Office of Air and Radiation – Catalog of Guidelines and Standards for the Handling and Management of Sulfur Hexafluoride (SF6)
3. 2017 National Electrical Safety Code (NESC) C2-207 Section 12 Installation and Maintenance of Equipment, Working Space over 600 volts
-OSHA Confined Work Space Definition

What will the request produce or construct (predesign/design of a building, additional space, etc.)? When will the project start/end? Identify if the project can be phased, and if so, which phase is included in the request. Provide detailed cost backup.
This request is Major Project Infrastructure funding. This will include design and construction funds for this phase of the project.

This is a multi-biennial phased project that the university has attempted to request over a three biennial process. In each subsequent biennia, the university's request have not been fully approved or appropriated. This has required Eastern to go back and request additional funding and pushed out the project to more than three biennia. With funds we have been appropriated we have made substantial process, at reduced cost in attaining the upgrade of all university infrastructure. We have prioritized this projects to make the biggest positive impact each biennium, even with reduced approved funding.

In 2014 Eastern partnered with mechanical, electrical, and civil professional engineering consultants to examine each major utility system for current condition assessment, lifecycle renewal/replacement, potential energy savings, and sustainable upgrades. The systems that were examined include campus electrical power distribution as well as steam and chilled water production and distribution systems, and domestic water distribution system. Included in this overall study were recommendations for short and long-term actions to reduce potential failures, lower maintenance costs, increase worker safety and improve efficiencies, and to identify potential alternate energy sources for future production of utilities.

How would the request address the problem or opportunity identified in question 1? What would be the result of not taking action?
University infrastructure and central plant are similar to support of a small town our city. These system provide operational function to every building and other facility on campus. If these systems do not operation the university does not operate. The production and distribution of these utilities are a major cost to university operations. The more efficient they are the less cost they generate.

If these systems are not upgraded within the reasonable timeline of their respective live cycles the outcomes could be catastrophic. Even smaller failures and repairs cause disruption to daily campus operations and repair costs are substantial. Replacement of components and systems are the best way to insure that failures are not imminent, systems operate correctly and can be maintained as a reasonable costs to the university.

What alternatives were explored? Why was the recommended alternative chosen? Be prepared to provide detailed cost backup. If this project has an associated predesign, please summarize the alternatives the predesign considered.
Through qualified consultants Eastern Facilities has evaluated a variety of alternatives to system upgrades for the past several biennia. Those studies are a part of our major capital requests and are available as needed for review. The studies review

Project Number: **40000070**
Project Title: **Infrastructure Renewal III**

Description

models that best fit the campus needs and alternatives that fit those needs.

Which clientele would be impacted by the budget request? Where and how many units would be added, people or communities served, etc.
Literally all of the programs on the Cheney campus are reliant on the utilities and infrastructure systems that are described in this request. The central energy plants operations provide all of the heating, cooling, building power, and domestic and sanitary sewer water for use in all of the buildings on campus as well as the Washington State Patrol Crime Laboratory and the Washington State Archives, both located on campus. The various forms of network communications are transported through the tunnel system on campus. Facilities staff operate and maintain all of the various pieces of equipment that are required to deliver these utilities, providing a safe and comfortable academic atmosphere for instruction and other campus activities.

These infrastructure systems are by their very nature tied to each facility, and support every program on campus. Eastern's goal of student success and as an "Institution of Innovation" are fully represented with this project which promotes student success through a safe, healthy, and supportive environment. This Capital Budget Request reflects the additional design effort based on the above noted strategy which was initially requested in the FY2015-17 Capital Budget Request Cycle. With the partial funding received a phase of the Master Plan design was accomplished, and construction contracts for some of the infrastructure needing replacement accomplished. This current FY2021-23 request continues with the work of replacement of major infrastructure required to support the new Interdisciplinary Science Center which is currently under construction, the proposed remodel of the existing Science building, and the proposed new Engineering Building, as well as the other listed project funding needs noted in this proposal.

Does this project or program leverage non-state funding? If yes, how much by source? If the other funding source requires cost share, also include the minimum state (or other) share OF project cost allowable and the supporting citation or documentation.
This request is being made of 057 State Bonded Funds. There are no addition funding sources that are part of this request.

Describe how this project supports the agency's strategic master plan or would improve agency performance. Reference feasibility studies, master plans, space programming and other analyses as appropriate.
This funding request aligns with EWU's Academic Strategic Plan 2018-2025, Core Theme: Access + Learning + Completion = Student Success, in that by providing fully functioning, environmentally conditioned, modern facilities students will have the best opportunity for access to centers for learning which, in turn, provides an environment for course completion and student success.

The current edition (2014) of Eastern Comprehensive Campus Master Plan states that the university's top priorities are the expansion of Eastern's Science Technology Engineering and Math (STEM) programs. The growth and increased graduation rates in these programs tie directly to the construction of the Interdisciplinary Science Center, the remodeled Science building and a new Engineering building. As stated in the engineers report, the current university infrastructure (steam, chilled water, and medium voltage electrical) will not support these new facilities without expansion of these systems.
Eastern's Facilities Master Plan is available at:
http://access.ewu.edu/Documents/Facilities-Planning/PEC_Executive%20Summary_9_27_13revision1-single.pdf

Eastern's Strategic Plan "Inspiring the Future" (2012-2017) is available at the following link:
http://www.ewu.edu/Documents/Strategicplanning/strat_plan_doc_webres.pdf

Does this project include IT related costs, including hardware, software, cloud based services, contracts or staff? If yes, attach IT Addendum.
This project will be using existing IT system already established on campus infrastructure.

If the project is linked to the Puget Sound Action Agenda, describe the impacts on the Action Agenda, including expenditure and FTE detail. See Chapter 12 Puget Sound Recovery) in the 2021-23 Operating Budget Instructions.
This project is not linked to the Puget Sound Action Agenda.

370 - Eastern Washington University
Capital Project Request

2021-23 Biennium

*

Version: C1 Eastern Washington University

Report Number: CBS002
Date Run: 8/12/2020 8:52AM

Project Number: **40000070**
Project Title: **Infrastructure Renewal III**

Description

How does this project contribute to statewide goals to reduce carbon pollution and/or improve energy efficiency? Please elaborate.
This project is designed to address the necessary replacement of infrastructure systems and components that are past their effective lifecycle, are costly to operate because of age and technology, and are at risk of failure. Completion of these projects will update compliance with a variety of state and local jurisdictional requirements including:

· RCW 39.35D High Performance Public Buildings – high efficiency components and systems
· RCW43.19.668; 669; 670; 682 Energy Conservation – high efficiency components and systems
· HB 2311 Greenhouse Gas Emission Limits 2019
· HB 1257 Clean Building for Washington Act 2019
· EWU Facilities Climate Action Plan 2020 update

Is there additional information you would like decision makers to know when evaluating this request?
The university as a whole is a tremendous state asset used for the instruction and education of our student population. The infrastructure is the heart, lungs and circulator system for almost 3,000,000 gross square feet of facilities.

To maintain and upgrade these systems is the university’s responsibility to be good steward of state resources. The requests addressed as the highest priority issues are currently identified and responded to with upgrades and replacement that respond to specific failures and low performing conditions. There are also regulatory requirements associated with the operations of our systems that we must address on a periodic basis to continue to be in compliance.

Unfortunately, the result of taking no action will increase the potential for older systems not to perform as needed in all situation. Without being addressed, critical and key facilities’ operation costs will continue to rise. This include regular preventative and demand maintenance and utility costs associate with lower performing equipment and systems. This impacts the ability to provide a safe, comfortable and accessible campus for all that use it.

Infrastructure projects main goal is to maintain, preserve, and extend the lifecycle of existing state facilities and assets. In most cases these systems or portions of them and the equipment addressed in these request are at the end or past the end of their lifecycle and are in need of upgrading or replacement. System and equipment failure is not a productive alternative due to the damage possible during catastrophic failures. Continuing to apply restricted operating funds to failing equipment and systems is not good use of state resources. Other more cost effective alternatives are always considered due to the lack of available resources. The university evaluates all alternative including deferring the projects to a later date. The analysis is based upon the needs of the university and its academic and student based programs to continue to succeed and meet the goal of our strategic plan.

Location
City: Cheney **County:** Spokane **Legislative District:** 006

Project Type
Infrastructure (Major Projects)

Growth Management impacts
Growth Management is not affected by this project.

Funding

			Expenditures		2021-23 Fiscal Period	
Acct Code	Account Title	Estimated Total	Prior Biennium	Current Biennium	Reapprops	New Approps

370 - Eastern Washington University
Capital Project Request
2021-23 Biennium

*

Version: C1 Eastern Washington University

Report Number: CBS002
Date Run: 8/12/2020 8:52AM

Project Number: 40000070
Project Title: Infrastructure Renewal III

Funding

Acct Code	Account Title	Estimated Total	Expenditures Prior Biennium	Current Biennium	2021-23 Fiscal Period Reapprops	New Approps
057-1	State Bldg Constr-State	35,517,955				25,517,955
	Total	**35,517,955**	**0**	**0**	**0**	**25,517,955**

		Future Fiscal Periods 2023-25	2025-27	2027-29	2029-31
057-1	State Bldg Constr-State	10,000,000			
	Total	**10,000,000**	**0**	**0**	**0**

Operating Impacts

Total one time start up and ongoing operating costs

Capital Project Request

2021-23 Biennium

*

Parameter	Entered As	Interpreted As
Biennium	2021-23	2021-23
Agency	370	370
Version	C1-A	C1-A
Project Classification	*	All Project Classifications
Capital Project Number	40000070	40000070
Sort Order	Project Priority	Priority
Include Page Numbers	Y	Yes
For Word or Excel	N	N
User Group	Agency Budget	Agency Budget
User Id	*	All User Ids

Appendix L – Greenhouse Gas

Eastern Washington University Greenhouse Gas Reduction Policy
March 1, 2020

Purpose: The purpose of the policy is to set forth EWU's commitment to reducing greenhouse gas within the area of campus operations and guide the university towards a collective goal of Washington State government agencies achieving carbon neutrality in 2050. This policy sets the greenhouse gas reduction standards for managing greenhouse gas emissions at Eastern Washington University and brings EWU in line with Washington State Legislation under RCW 70.235.

History: EWU is committed to reducing greenhouse gas emissions and reducing our impact on climate change. EWU is a signatory of the American College and University Presidents Climate Commitment, developed its first campus Sustainability Plan in 2012, and created the Office of Sustainability with the hiring of our first Sustainability Coordinator in 2016. EWU seeks to further these efforts by developing Sustainability focused polices that decrease our carbon footprint and other environmental impacts. In 2020 the Washington State Legislature passed HB 2311 that amends RCW 70.235 and strengthens the State's commitment to reducing greenhouse gas emissions with the goal to become carbon neutral by 2050. This policy is intended to align EWU's commitment to carbon emission reductions with Washington State policy and provide guidance as EWU progresses towards near carbon neutrality.

I. **Policy** – As part of its role as a State agency, EWU will work to meet the statewide greenhouse gas emission limits established in RCW 70.235.020:
- **i.** Year 2030 – Reduce greenhouse gas emissions by 45 % below 2005 levels
- **ii.** Year 2040 – Reduce greenhouse gas emissions by 70 % below 2005 levels
- **iii.** Year 2050 – Reduce greenhouse gas emissions by 95 % below 2005 levels; and support the collective goal of achieving net zero greenhouse gas emissions by the Washington State government agencies as a whole.

II. **Policy Review –** This policy will be reviewed annually and updated to reflect changes in Washington State Legislation as well as Eastern Washington University policies. The EWU Office of Sustainability will be tasked with the annual review and proposing updates to the policy as necessary.

III. **Greenhouse gas monitoring and reporting –** The Office of Sustainability is tasked with tracking greenhouse gas emissions and providing biannual reports to the State Efficiency and Environmental Performance Office at the Department of Commerce. As defined in RCW 70.235.050, these biannual reports will document steps taken in the previous biennium as well as actions planned for the next two biennia and long-term strategies to meet emission reduction targets. Reports will be submitted every two years, beginning in 2022, on June 1st of even numbered years to the Department of Commerce. Additionally, the Office of Sustainability will provide annual greenhouse gas reduction reports to the EWU VP of Business and Finance.