

2018-2019

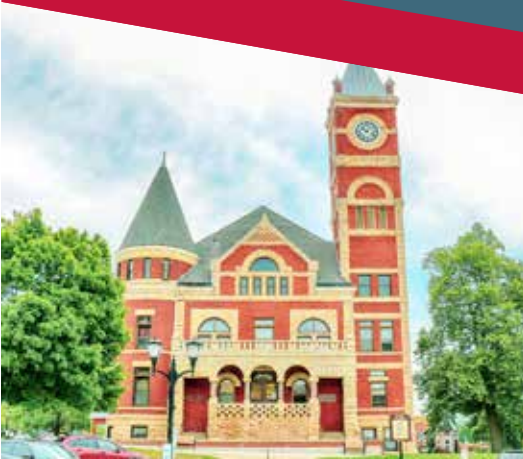
FINAL REPORT

UniverCity Year

Better • Places • Together

Juda School renewable energy generation

CIVIL ENGINEERING 578: SENIOR CAPSTONE DESIGN



DATE: December 4, 2018

TO: Scott Anderson, HS Math & Engineering Instructor
Juda Public Schools
2346 Engineering Hall
1415 Engineering Drive
Madison, WI 53706

FROM: BeEco Engineering
1415 Engineering Drive
Madison, WI 53706

**SUBJECT: Final Design Report - Engineering Services for Solar/Wind/Geothermal
Energy Generation at the Juda School District**

Dear Scott Anderson:

Enclosed are the final design documents for the solar and geothermal energy systems at Juda School. BeEco Engineering, in partnership with the Morgridge Center for Public Service at the University of Wisconsin-Madison, is grateful to have been selected to develop a design for a renewable energy system for the passionate Juda community.

The attached documents include contract and bid documents, technical specifications, an opinion of probable cost, a project schedule, as well as other relevant considerations that were made and calculations that were completed. To fully assess the design, BeEco Engineering conducted applicable structural, construction, environmental, hydraulic, and geotechnical analyses. Additionally, construction drawings for both the solar energy system and geothermal energy system have been developed. Designs for a solar energy system and a vertical-borehole geothermal energy system have been finalized to best suit the needs of Juda School. Not only does the final design meet Juda's energy production goals, but it is also economically viable and will diversify Juda School's renewable energy portfolio.

On behalf of all team members, we thank you for choosing BeEco Engineering to design the renewable energy system for Juda School. We look forward to the project progression into the construction stage. If there are further questions, comments, or concerns regarding the attached deliverables, please contact our project manager.

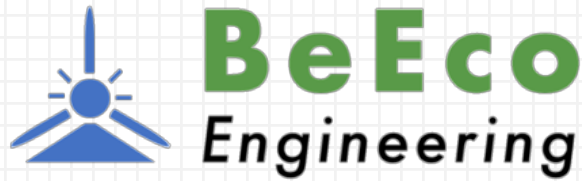
Sincerely,

BeEco Engineering

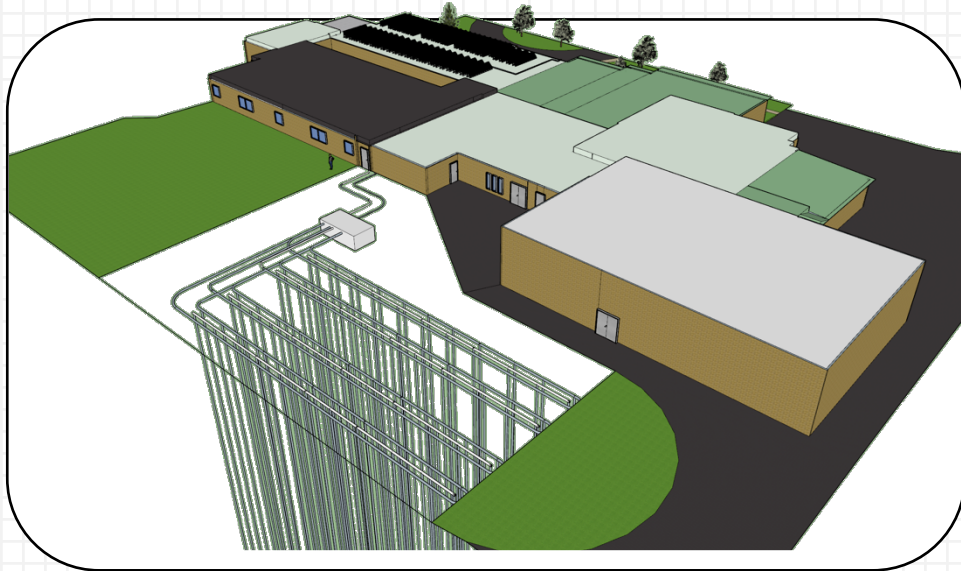




BeEco
Engineering



in conjunction with



Juda School Renewable Energy Generation

Final Design Report
December 4, 2018

Prepared by
BeEco Engineering
1415 Engineering Drive
Madison, WI 53706

Prepared for
Scott Anderson
Juda Public Schools
2346 Engineering Hall
1415 Engineering Drive
Madison, WI 53706



DISCLAIMER

The concepts, drawings and written materials provided here were prepared by students in the Department of Civil & Environmental Engineering at the University of Wisconsin-Madison as an activity in the course Civ Engr 578 – Senior Capstone Design/ GLE 479 – Geological Engineering Design. These do not represent the work products of licensed Professional Engineers. These are not for construction purposes.

Executive Summary

Project Background and Summary of Project Needs

Juda School, located in a small town with a population of 357 in southcentral Wisconsin, teaches grades Pre-K through 12th grade (**Figure 1A & 1B**). In recent years, the school has made great strides in developing a more sustainable school by upgrading to efficient fixtures and installing 36 rooftop solar panels. Juda School has requested for BeEco Engineering to design a renewable energy system capable of offsetting current energy consumption costs by 25%. Annually, Juda School uses approximately 39,000 cubic feet (CCF) of natural gas for heating purposes and 615,000 kWh of electricity. In 2017, Juda School spent nearly \$100,000 on energy. Reducing this annual expense by 25% will significantly reduce the school's environmental footprint. The client also requested a payback period of 7 years or less. Lastly, the client expressed interest in using the renewable energy system to create learning opportunities for students.

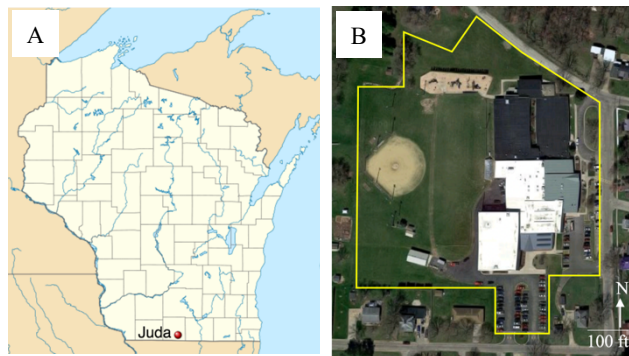


Figure 1. A) Juda, Wisconsin and B) School property lines.

Design Constraints

The final design is constrained by economic, environmental, social, political, ethical, health and safety, and constructability factors. The client has limited funds and thus, it is necessary that the design is economically viable. A goal of renewable energy generation is to reduce environmental impact; a constraint of the project may exist if the design harms the environment in any way. Social, political, and ethical concerns are also present with respect to public acceptance of the renewable energy system. Along with the concern for the safety of all personnel who will be involved in construction activities, there is also a need to develop a design that is isolated from the children who may be near the system. Lastly, constructability is a constraint because the geothermal field will require earthwork.

Final Design

BeEco Engineering developed a design that integrates a 75-ton geothermal energy system – which includes 44, 350-foot vertical wells – with a 71 kWdc photovoltaic solar array system – which includes 264 south-facing ballasted solar panel modules (**Figure 2A & 2B**). This design would offset Juda School's energy costs by 40% by producing 98,000 kWh and reducing the school's consumption of natural gas by 28,000 CCF annually. BeEco Engineering team members used their expertise in structural, environmental, construction, hydraulic, and geotechnical engineering to analyze the design.

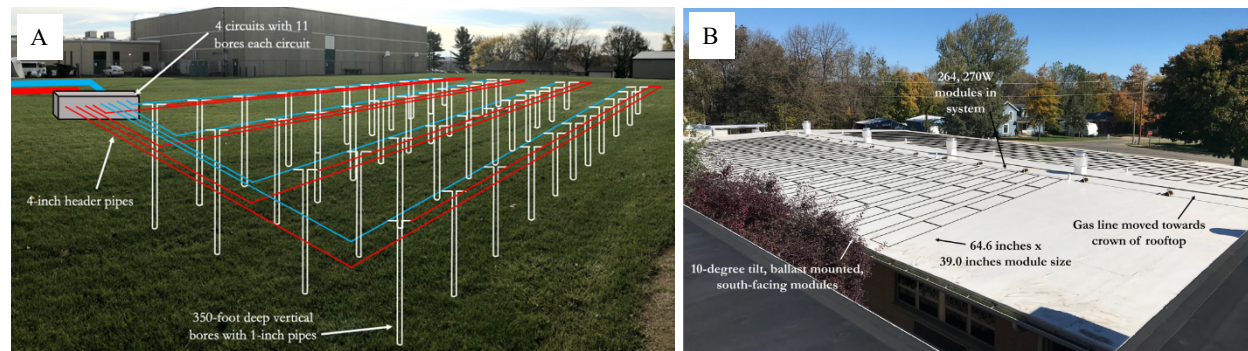


Figure 2. Schematic of final design A) geothermal system (facing southeast) and B) solar system (facing northeast).

Structural Engineering

The structure that will support the solar array was built in 1956, a time when structures were built to support a snow load of 30 psf. Current codes only require 20 psf for snow load. Therefore, the solar panels can weigh up to 10 psf, but the proposed system would only add approximately 5.2 psf of load. The structural analysis of the roof-mounted array also accounted for loading due to wind. The proposed solar array will be installed using a ballast mounting technique, which is ideal because it eliminates rooftop penetration. A schematic of a typical ballast system is shown in **Figure 3**.

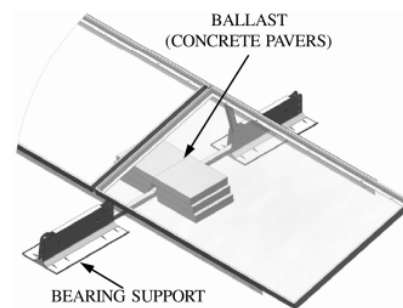


Figure 3. Illustration of ballast mounting technique.

Environmental Engineering

BeEco Engineering assessed the potential burden on the environment and emissions associated with the stages of both the solar array's life-cycle and the geothermal system's life-cycle, which were assumed to be 30 years and 50 years, respectively. A cradle to grave assessment was completed and the amount of energy required for the whole life cycle of the solar system and geothermal system were found to be approximately 280,000 MJ and 110,000 MJ, respectively. BeEco Engineering also found that this design would reduce the school's emissions by approximately 8,200 tons of CO₂ annually.

Construction Engineering

The site staging and sequence of construction was established for the proposed design. The vertical well geothermal system will be installed in the field west of the school, which is easily accessible. The staging areas for both systems and the geothermal access route is shown in **Figure 4**.

Hydraulic Engineering

To appropriately size the geothermal system, an analysis of the system's flow rates was conducted acknowledging anticipated head losses. This allowed BeEco Engineering to correctly size all pipes in the system and determine the most appropriate pump for the system flow. The total flow rate required for the 75-ton system is 225 gallons per minute (gpm). As illustrated in **Figure 5**, header pipes (HDPE DR-11, 4-inch diameter) will route water to and from the 4 circuits of 11 geothermal wells each. The header pipes merge in a vault located below the ground surface. From the vault, the heated water is routed into the school and to the mechanical room in the basement where heat pumps will be located. The recommended heat pump model is Trane Axiom High Efficiency Water Source Heat Pump, each of which can accommodate a flow rate of 57 gpm, so four total heat pumps will be needed.



Figure 4. Construction sites and staging areas.

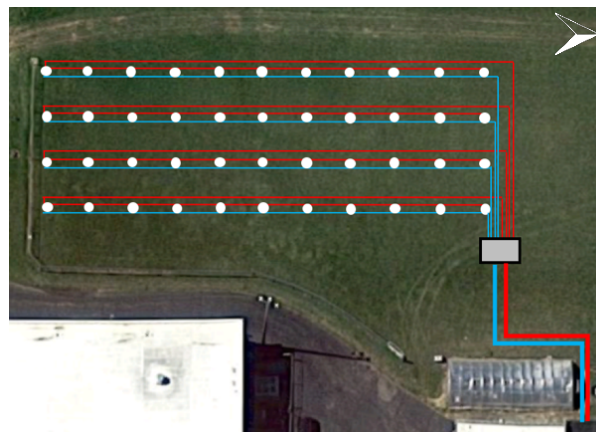


Figure 5. Aerial view of geothermal well system.

Geotechnical Engineering

BeEco Engineering utilized three Wisconsin DNR well logs to estimate subsurface conditions at Juda School. These well logs – all located within 1,300 feet of Juda School – showed a clay layer overlaying a clay with sand and gravel layer overlaying a sandstone layer. Furthermore, the water table was observed at a depth between 25 and 30 feet. A complete geotechnical analysis is still necessary for a more thorough, accurate design.

Codes and Standards

The final design proposed by BeEco Engineering adheres to codes and standards related to zoning, worker safety, electrical standards, ethics, and more. Although not an all-inclusive list, relevant codes and standards include the following: Green Country Code Title 4, NEC Article 690, OSHA §1926.500, SPS 371, Wisconsin Administrative Code NR 812, and NSPE Code of Ethics.

Construction Schedule

Prior to installation of the geothermal system, materials will be procured. A more detailed geothermal site investigation will be completed by June 16, 2019. After verifying subsurface conditions and mobilization, construction of the 44-well geothermal system will begin on July 22, 2019 and continue for 63 days until August 23, 2019. Concurrent to the geothermal construction system is the solar array installation. Solar module installation is contingent on the relocation of a gas line on the roof surface, which is scheduled for June 3, 2019. The construction schedule for the solar systems is broken down into similar stages: procurement, mobilization, and installation. Procurement of materials and equipment will last 60 days from April 11, 2019 to June 9, 2019. After a week of mobilization, installation of the solar modules and inverters will begin on June 17, 2019 and last 1 week until June 23, 2019. After this is complete, electrical retrofitting, which includes installation of the utility disconnect, a step-down transformer, an AC combiner panel, and interconnection, will take 2 weeks from June 24, 2019 to July 3, 2018. A system-wide electrical shutdown is scheduled for July 5, 2019. The construction of the entire project will be completed on August 29, 2019.

Opinion of Probable Cost

The cost estimate for final design is outlined in **Table 1**. Implementation of the proposed geothermal energy system and photovoltaic solar panel array will lead to annual savings of approximately \$39,000. The initial costs of the geothermal system and solar system are \$117,000 and \$479,000, respectively, totaling to approximately \$596,000. BeEco Engineering has explored funding incentives available for the client and proposes the implementation of a power purchase agreement (PPA) where an investor would pay for the initial costs of the solar system. Juda School could apply to the Renewable Energy Competitive Incentive Program

Table 1. Cost summary for initial design.

	Solar Array	Geothermal System	Total no Funding
Annual Avoided Costs	\$11,000	\$28,000	\$39,000
Initial Costs	\$117,000	\$479,000	\$596,000
Modules	\$36,000	-	\$36,000
Inverters	\$6,000	-	\$6,000
Mounting	\$13,000	-	\$13,000
Electrical Infrastructure	\$13,000	-	\$13,000
Installation	\$33,000	-	\$33,000
Ground Loop	-	\$200,000	\$200,000
Vertical Borehole	-	\$139,000	\$139,000
Heat pumps	-	\$81,000	\$81,000
Vault	-	\$12,000	\$12,000
Professional Fees	\$7,000	\$30,000	\$37,000
Contingency	\$9,000	\$17,000	\$26,000
O&M	\$600	\$100	\$700

offered by the Focus on Energy Organization. If selected for this program, the geothermal system costs could be offset by approximately \$29,000. Using this both of these funding methods, the initial costs of the system for the client decrease to \$450,000 and has a payback period of 13 years.





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1.0 DOA DFD Upfront Documents



**MANUAL FOR PREPARATION OF GENERAL PRIME CONTRACTOR (GPC)
SPECIFICATIONS
FOR
PROJECTS THAT HAVE A CONSTRUCTION BUDGET GREATER THAN \$185,000
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This form can be made available in alternate formats to individuals with disabilities upon request.

GUIDE FOR DIVISION 1

**Renewable Energy Generation System at Juda School
Juda School
Juda School District
JUDA, WI**

GPC (General Prime Contractor) BID DOCUMENT

Division Project No. **18-0001**

12/04/2018

FOR
THE STATE OF WISCONSIN
DEPARTMENT OF ADMINISTRATION
DIVISION OF FACILITIES DEVELOPMENT
STATE OF WISCONSIN ADMINISTRATION BUILDING - 7TH FLOOR
101 EAST WILSON STREET - P.O. BOX 7866
MADISON, WISCONSIN 53707

By

BeEco Engineering, 1415 Engineering Drive, Madison, WI 53706, (608) 333-3137

Morgridge Center for Public Service, 716 Langdon Street, Madison, WI 53706, (608) 263-2432

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1 **GPC INVITATION TO BID** (Rev 11/2017)
2 DIVISION OF FACILITIES DEVELOPMENT

3
4 **Renewable Energy Generation System at Juda School**
5 **Juda School**
6 **Juda School District**
7 **JUDA, WI**
8
9

10
11 Division Project No. **18-0001**
12

13 **BID OPENING for MEP BIDDERS: 2:00 P.M., 01/07/19**

14 **BID OPENING for GENERAL PRIME CONTRACTOR BIDDERS: 2:00 P.M., 01/07/19**
15

16 OWNER: State of Wisconsin, Department of Administration, Division of Facilities Development,
17 hereinafter termed DFD.
18

19 **NOTICE: Effective January 1, 2014, all potential bidders must be certified by DOA prior to submitting**
20 **bids on state construction projects over \$50,000.** All bids received from contractors who are not certified
21 will be rejected. Contractor certification applications and instructions for completing the form may be
22 obtained from the DOA Website DFD Contractor Certification page:
23 <http://www.doa.state.wi.us/category.asp?linkcatid=857&linkid=125&locid=4> or upon request from DFD--
24 email dfdcertification@wisconsin.gov.
25

26 **This project is being let using a new single prime bidding and contracting process.** DFD will publicly
27 bid the applicable mechanical, electrical, plumbing, and fire protection (MEP) divisions of work **first**. Within
28 5 days of the MEP bid opening, DFD will identify a lowest, qualified, responsible, certified bidder in each
29 applicable MEP division of work. These successful MEP bids must be included in all general prime contractor
30 bids received. No later than 5 days after DFD identifies the successful MEP bids, DFD will publicly open
31 general prime contractor bids. **General prime contractor bids that do not include the successful MEP**
32 **bids will be rejected.** The state will enter into a single contract with the lowest, qualified, responsible,
33 certified general prime contractor and this general prime contractor will enter into subcontracts with the
34 successful MEP bidders.
35

36 Sealed bids will be received at the State of Wisconsin Administration Building, 7th Floor, 101 East Wilson
37 Street, Madison, Wisconsin 53703, before the time indicated above.. The bidder is responsible for the sealed
38 bid being delivered to the indicated location for receipt stamping before the time specified for the bid opening.
39 Third party delivery is entirely at the bidder's risk.
40

41 In general the work consists of **installing a 264-module solar panel array on the northeastern section of**
42 **the rooftop at Juda School. These modules will be south-facing, tilted at a 10-degree angle, and**
43 **supported by a ballast system. In addition, the work will include installing a 75-ton geothermal system.**
44 **This system will be located in the field west of Juda School and consist of 44 vertically-drilled wells.**
45 **These wells will be drilled to a 350-foot depth and be arranged in a 4 by 11 grid system. These systems**
46 **will connect to the existing infrastructure at Juda School.]**
47
48

49 Bidding documents (drawings, specifications, and addenda) may be obtained only as electronic files (in PDF
50 format): as a downloadable file from the Division's Projects Bidding website (see website address below)
51 and/or on compact discs or DVD by ordering from the Construction Project Bidding Opportunities webpage.
52 Bidding documents may also be seen at various Builders' Exchanges. Additional project bidding information,
53 including plan holders lists are available on the Division of Facilities Development public website:

1 <http://www.doa.state.wi.us/divisions/facilities-development>. After opening the web page, select Current
2 Construction Project Bidding Opportunities at the bottom of the screen.

3
4 Bidder shall identify the division of work they are bidding on when requesting Bidding Documents online.

5
6 **Base Bid will be received for: A single lump sum bid for All Work.**

7
8 No deposit is required to obtain documents for bidding purposes.

9
10 Bid Guarantee in the amount of 10% of the Bid must accompany each bid submitted.

11
12 Contract offer and construction phase records will be processed electronically on the WisBuild™ DFD
13 Information System.

14
15 **The 2017-2019 Wisconsin State Budget (2017 Wisconsin Act 59) repealed Wisconsin's prevailing**
16 **wage laws. Effective September 23, 2017, state prevailing wage requirements on state building**
17 **projects no longer apply. These changes take effect for projects advertised for bid after September**
18 **23, 2017. This change does not affect the Federal Davis Bacon Act requirements.**

19
20
21 Bidding Documents will be available online immediately upon the project being advertised for bid.

22
23 ***

GPC INSTRUCTIONS TO BIDDERS (Rev 11/2017)

Division Project No. **18-0001**

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1. DEFINITIONS

(a) "Mechanical, electrical, or plumbing subcontractor" ("MEP Subcontractor") is a contractor that performs mechanical (Heating, Ventilating, and Air Conditioning), electrical, plumbing, or fire protection (fire suppression) work for the Project, and enters into a contract with the General Prime Contractor to perform their division of work.

(b) "Qualified bidder" means a contractor that the department certifies under Wis. Stat. s. 16.855(9m)(b)1.

(c) "Qualified responsible bidder" means a contractor who is a qualified bidder and who is a responsible bidder.

(d) "Responsible bidder" means a contractor that the department certifies under Wis. Stat. s. 16.855(9m)(b)2.

(e) "Single prime contracting" means bidding and contracting through a process in which only a general prime contractor has a contractual relationship with the state and all mechanical, electrical, or plumbing subcontractors are identified by the department and are subcontractors to the General Prime Contractor.

(f) "General Prime Contractor" is a contractor that enters into a contract with the state to perform all work as required by the Contract Documents and enters into contracts with subcontractors including MEP Subcontractors identified by DFD.

(g) "Non-MEP Subcontractor" is a subcontractor to a General Prime Contractor in divisions of work other than mechanical, electrical, plumbing, and fire protection. This includes suppliers and installers to the General Prime Contractor.

(h) "Subcontractor" is all subcontractors on a project. This includes MEP Subcontractors, subcontractors to the MEP Subcontractors, and Non-MEP Subcontractors.

(i) "Contractor" is all contractors working on a project regardless of contractual relationship. This includes the General Prime Contractor, MEP Subcontractors, Non-MEP Subcontractors, and all Subcontractors, regardless of tier of subcontract.

2. GENERAL

Time for bid opening shall be the prevailing central standard or daylight saving time in force at Madison, Wisconsin, on the date set forth in the Invitation to Bid.

All potential bidders must be certified by DOA prior to submitting bids on state construction projects over \$50,000. All bids received from contractors who are not certified will be rejected. Contractor certification applications and instructions for completing the form may be obtained from the DOA Website DFD Contractor Certification page:

<http://www.doa.state.wi.us/category.asp?linkcatid=857&linkid=125&locid=4> or upon request from DFD--email dfdcertification@wisconsin.gov.

This project is being let using a new single prime bidding and contracting process. DFD will publicly bid the applicable mechanical, electrical, plumbing, and fire protection (MEP) divisions of work first. Within 5 days of the MEP bid opening, DFD will identify a lowest, qualified, responsible, certified bidder in each applicable MEP division of work. These successful MEP bids must be included in all general prime contractor bids received. No later than 5 days after DFD identifies the successful MEP bids, DFD will publicly open general prime contractor bids. General prime contractor bids that do not include the successful MEP bids will be rejected. The state will enter into a single contract with the lowest, qualified, responsible, certified general prime contractor and this general prime contractor will enter into subcontracts with the successful MEP bidders. If a project does not include any mechanical, electrical, plumbing, or fire protection divisions of work, DFD will bid one bid package for all work to general prime contractors.

DFD will issue an addendum if a successful MEP bid is withdrawn or rejected after the MEP Subcontractors have been identified but before the General Prime Contractor bid opening. This addendum will include a revised list of successful MEP bids that must be included in General Prime Contractor bids and will move the General Prime Contractor bid opening five days later to allow bidders sufficient time to update their bids based on the revised MEP list.

Before submitting a bid, the Bidder shall examine all of the Bidding and Contract Documents listed in the Table of Contents of these specifications. The successful Bidder will be required to do all work which is shown on the drawings, mentioned in the specifications or reasonably implied as necessary to complete the contract for this project.

The Bidder shall visit and examine the site to become acquainted with the adjacent areas, means of approach to the site, conditions of actual job site, and facilities for delivering, storing, placing, and handling of materials and equipment.

Failure to visit the site or failure to examine any and all Bidding and Contract Documents will in no way relieve the successful Bidder from the necessity of furnishing any materials or equipment, or performing any work, that may be required to complete the work in accordance with the Bidding and Contract Documents. Neglect of above requirements will not be accepted as reason for delay in the work or additional compensation.

1 All bidders shall have established and diligently maintained a satisfactory safety program, and if eligible for
2 Experience Modification Rating (EMR), must have a rating of 1.20 or less as established by the Wisconsin
3 Compensation Rating Bureau (WCRB) or the National Council on Compensation Insurance (NCCI).

4 **3. DRAWINGS AND SPECIFICATIONS**

6 The drawings and specifications that form a part of this contract, as stated in Article 3 of the General
7 Conditions, are listed in the Table of Contents of these specifications.

9 Complete sets of Contract Documents for all trades will be issued to all Bidders, irrespective of the category
10 of work to be bid on, in order that all Bidders may be familiar with the work of other trades as they affect
11 their bid.

13 **4. INTERPRETATION**

14 No verbal explanation or instructions will be given in regard to the meaning of the drawings or specifications
15 during the bid period. Bidders shall bring inadequacies, omissions or conflicts to the Architect/Engineer's
16 attention at least ten (10) days before the date set for bid opening. Prompt clarification will be supplied to
17 all bidders of record by addendum.

19 Failure to so request clarification or interpretation of the drawings and specifications will not relieve the
20 successful Bidder of responsibility. Signing of the contract will be considered as implicitly denoting that the
21 Contractor has thorough understanding of the scope of work and comprehension of the contract documents.

23 Neither the Architect/Engineer nor DFD will be responsible for verbal instructions.

25 **5. MANDATORY PRE-BID DOA CERTIFICATION**

26 All potential bidders must become certified as qualified and responsible bidders **before** they can bid on
27 state projects over \$50,000. The criteria for determining certification of qualified and responsible bidders
28 are itemized in Wis. Stat. s. 16.855(9m). If DFD determines that more experience is necessary for a
29 particular project, DFD may include additional requirements.

31 **6. BID GUARANTEE**

32 A bid bond prepared on the Bid Bond Form bound herein, payable to the State in the amount not less than
33 10% of the maximum bid shall accompany each bid as a guarantee. A bank certified check or a cashier's
34 check may accompany each bid as a guarantee pursuant to Wis. Stat. s. 779.14(1m)(c)2.b. and 779.14(1s).
35 Failure to enter into the contract with the state (including failure to obtain certificate of insurance and separate
36 100% performance and 100% payment bonds) may result in forfeiture of the Bid Bond. The company issuing
37 the Bonds must be licensed to do business in Wisconsin.

39 Any bid which is not accompanied by a bid guarantee will not be accepted and will not be read at the bid
40 opening.

42 All checks tendered as bid guarantee, except those of the three lowest bidders, will be returned to their makers
43 within three (3) days after bid opening. All such retained checks will be returned immediately upon execution
44 of the contract between the General Prime Contractor and the state.

46 **7. WITHDRAWAL OF BIDS**

47 Prior to the time fixed for bid opening, bids may be withdrawn by written request from the Bidder, without
48 prejudice to the right of the Bidder to file a new bid. Withdrawn bids will be returned unopened.

50 After the bid has been opened, negligence on the part of the Bidder in preparing their bid confers **no** right for
51 withdrawal of the bid without penalty.

53 If a bid contains an error, omission, or mistake, the bidder may limit liability to the amount of their bid
54 guarantee by giving DFD written Notice, within seventy-two (72) hours of the bid opening, of their intent

not to execute the contract with the state. If no such notice is given, DFD reserves the right to obtain the amount of the difference in bid price between the low bidder and the next low bidder.

8. CONTRACT FORM

These specifications include a copy of the contract the successful Bidder is required to enter into with the state. Bidders shall read and understand the conditions contained in this contract. The successful Bidder will be offered a contract through WisBuild to the contact provided by the bidder on the Bid Form.

9. CONTRACT INTERESTS BY STATE PUBLIC OFFICIALS

In accordance with section 19.45(6) of the Wisconsin Statutes, no state public official, member of a state public official's immediate family, nor any organization with which the state public official or a member of the official's immediate family owns or controls at least 10% of the outstanding equity, voting rights, or outstanding indebtedness may enter into any contract or lease involving a payment or payments of more than \$3,000 within a twelve (12) month period, in whole or in part derived from state funds unless the state public official has first made written disclosure of the nature and extent of such relationship or interest to the board and to the department acting for the state in regard to such contract or lease. Any contract or lease entered into in violation of this subsection may be voided by the state in an action commenced within three (3) years of the date on which the ethics board, or the department or officer acting for the state in regard to the allocation of state funds from which such payment is derived, knew or should have known that a violation of this subsection had occurred. This subsection does not affect the application of s.946.13.

10. MINORITY BUSINESS ENTERPRISE AND DISABLED VETERAN-OWNED BUSINESS INVOLVEMENT

“Minority Business Enterprise” (MBE) means: a business certified by the Wisconsin Supplier Diversity Program under Wis. Stat. s. 16.287(2).

“Disabled Veteran–Owned Business” (DVB) means: a business certified by the Wisconsin Supplier Diversity Program under Wis. Stat. s. 16.283(3).

In awarding construction contracts, the Department of Administration shall attempt to ensure that 5 percent of the total amount expended in each fiscal year is awarded to contractors which are minority businesses, as defined under Wis. Stat. s. 16.75(3m)(a). The General Prime Contractor Bidder shall make every effort to award a minimum of 15% of the work to minority business enterprises (MBE) involvement for all projects within 60 mile radius of Milwaukee and 5% for projects located elsewhere.

In awarding construction contracts, the Department of Administration shall attempt to ensure that at least 1 percent of the total amount expended each fiscal year is awarded to contractors that are disabled veteran-owned businesses.

In order to assist the department in these endeavors we strongly encourage General Prime Contractors to use MBEs and DVBs.

General Prime Contractor Bidders shall submit a “Form A Affidavit of Compliance – Minority Business Enterprise and Disabled Veteran-Owned Business Provision” with their bid or within seven days of the general prime contractor bid opening. This form should indicate the percentage of MBE/DVB participation commitment. Submission of a completed Affidavit of Compliance is an element of responsiveness. Failure to submit this completed form within the above time limits may be considered unresponsiveness and may result in contract award to the next apparent low bidder. All MEP Subcontractor Bidders shall also make every effort to encourage MBE and DVB involvement.

Every General Prime Contractor will be required to submit a report to DFD, on a monthly basis and upon completion of the contract, which identifies the Minority Business Enterprises and Disabled Veteran-Owned Business to whom work was directly subcontracted and the value of said work. Subcontractors, material suppliers, etc. under contract to a subcontractor of a General Prime Contractor may not be used for reporting

purposes under this paragraph without prior approval of the Wisconsin Supplier Diversity Program office. A MBE/DVB monthly report form will be sent to the Bidder after the Notice to Proceed is issued.

For assistance in identifying DOA certified MBE and DVB companies, please contact the Department of Administration Supplier Diversity Program at: DOABDMBD@wisconsin.gov, or by telephone at: (608)267-9550, or visit their website at: <http://www.doa.wi.gov/Divisions/Enterprise-Operations/Supplier-Diversity-Program>.

11. SUBSTANCE ABUSE PREVENTION

Mission/Purpose: The State of Wisconsin recognizes and supports drug-free workplace programs as an important element in the national strategy to reduce the devastating effects of drug and alcohol abuse in our society. The State requires contractors, subcontractors, suppliers and vendors to establish and enforce drug-free workplace policies and programs that conform to Sec 103.503 of the Wisconsin Statutes.

Statement: The possession, use of, distribution or purchase of illegal drugs, or use of alcohol at work by any employee on State of Wisconsin construction job sites, is strictly prohibited.

The terms of this Substance Abuse Program Statement shall cover all construction personnel who are working on State of Wisconsin job sites. This includes employees of all Contractors, Subcontractors, contractor suppliers, and their employees working at the job site.

General Prime Contractor's and Subcontractor's Written Program: Each General Prime Contractor and Subcontractor shall have in place a written Substance Abuse Program conforming to Sec 103.503(3) of the Wisconsin Statutes.

In addition, representatives of the State who believe that any General Prime Contractor's or Subcontractor's employee may be under the influence of alcohol or drugs shall, where deemed appropriate, contact the General Prime Contractor's or Subcontractor's appropriate management/supervision authority and request that appropriate action be taken. The General Prime Contractor's or Subcontractor's employer shall immediately remove an employee who is suspected of being under the influence of illegal drugs or alcohol shall be immediately removed from the job site.

Procedures for testing and handling of positive drug tests shall be in compliance and consistent with State and Federal laws.

Costs of Substance Abuse Programs and Testing: The cost associated with the development, implementation and enforcement of Substance Abuse Programs and any testing required shall be the responsibility of each individual General Prime Contractor and Subcontractor for their respective employees working on the job site. The State will not be responsible for any cost of substance abuse testing, rehabilitation or medical reviews related to substance abuse.

The General Prime Contractor and Subcontractors shall indemnify and hold the State harmless from any damages or other costs incurred that are related to the implementation or enforcement of any substance abuse policy or program.

12. METHOD OF AWARD - RESERVATION

General prime contractor bids that do not include the successful MEP bids identified by DFD will be rejected.

The general prime contract will be awarded based on the following, as long as the cost does not exceed the amount of project funds available:

The lowest dollar amount is submitted by a qualified, responsible, certified bidder on a SINGLE BASE BID for all work comprising the project.

Should a qualified, responsible, certified minority business enterprise or disabled veteran-owned business submit a bid that is no more than 5% higher than the apparent low bid, the Contract may be awarded to the minority business enterprise or disabled veteran-owned business.

Firms wishing to be considered for the 5% bidding preference must be certified as a minority business enterprise or disabled veteran-owned business by the Wisconsin Supplier Diversity Program and so indicate in the space provided on the Bid Form that preference is requested.

DFD reserves the right to reject any and all bids, or to waive any informality in any bid, or to accept any bid which will serve the best interests of the State.

Unit Prices and Informational Bids will not be considered in establishing low bidder.

13. SECURITY FOR SEPARATE 100% PERFORMANCE AND SEPARATE 100% PAYMENT

Bidder is required to furnish separate 100 % performance and 100 % payment bonds to the benefit of the Department of Administration as the sole obligee. These bonds shall be delivered to the State with the signed contract. The Surety Company shall be licensed to do business in Wisconsin. The Bond must be dated the same date or subsequent to the date of the Contract.

A certified copy of power of attorney shall be provided by the Surety Company showing that the agent who signs the Bond has the power of attorney to sign for the Surety Company. This power of attorney must be signed by the Secretary or Assistant Secretary of the company and not by an attorney-in-fact. The power of attorney must bear the same or later date as the bond.

If the Bidder is a partnership or a joint venture, a certified list providing the names of individuals constituting the partnership or joint venture must be furnished. The Contract itself may be signed by one partner of the partnership, or one partner of each firm comprising the joint venture, but the separate Performance and Payment Bonds must be signed by all of the partners.

If the Bidder is a corporation, a current certified copy of the resolution or other official act of the directors of the corporation must be submitted showing that the person who signs the contract is authorized to sign contracts for the corporation. The corporate seal must be affixed to the resolution, contract, and separate performance and payment bonds. If the Bidder's corporation has no seal, the above documents must include a statement or notation to the effect that the corporation has no seal.

14. TAXES

The Bidder shall include in the bid, all Sales, Consumer, Use and other similar taxes required by law.

In accordance with section 71.80(16)(a), Wis. Stats., SURETY BOND; NONRESIDENT CONTRACTOR. "All nonresident persons, whether incorporated or not, engaging in construction contracting in this state as contractor or subcontractor and not otherwise regularly engaged in business in this state, shall file a surety bond with the department (Wisconsin Department of Revenue MS 5-77 Attn: Non-Resident Surety Bonds, 2135 Rimrock Rd., Madison, WI 53713, telephone (608)266-2776) payable to the department of revenue, to guarantee the payment of income taxes, required unemployment compensation contributions, sales and use taxes and income taxes withheld from wages of employees, together with any penalties and interest thereon. The amount of the bond shall be 3% of the contract or subcontract price on all contracts of \$50,000 or more..."

15. SUBMISSION OF BIDS

All bids shall be submitted on the standard Bid Forms and only bids that are made on the Bid Forms will be considered. The entire Bid Form including the Addendum Receipt/Signature page, the Bid Bond Form, (if used), and other supporting documents (if any), shall be filled out and submitted in the manner specified hereinafter. SPECIFICATIONS SHALL NOT ACCOMPANY BID.

No bids for any subdivision or any subclassification of this work, except as indicated, will be accepted. Any conditional bid, amendment to the Bid Form or appendant thereto, the inclusion of any correspondence,

written or printed matter, unsolicited material or data, or details of any nature other than the information specifically called for, will disqualify the Bid. Telecommunication alterations to the bid will not be accepted.

Space is provided on the Bid Form for General Prime Contractor's single bid. Appropriate insertions are as follows: numerals indicating the cost of the work, \$0 if there is no cost for the work, or the words 'No Bid' if the bidder is not intending to bid the work. Blank space(s) will be considered the same as 'No Bid'.

Bidders shall submit a Single Base Bid for all the work.

Spaces are also provided on the Bid Form for General Prime Contractor's to list the successful MEP Subcontractors bids included in the General Prime Contractor's single base bid.

General prime contractor bids that do not include the successful MEP bids identified by DFD will be rejected.

Any addendum issued during the time of bidding shall become a part of the Contract Documents. Bidders shall acknowledge receipt of such addendum in the appropriate space provided on the Bid Form. Bid will be rejected if receipt of an addendum applicable to the award of contract has not been acknowledged on the Bid Form.

All Bidders are encouraged to submit their bids using the **SEALED BID** envelope label that is provided within the specifications. DFD is not responsible for bids not clearly labeled as required. Bids shall be signed, sealed, and delivered to the place indicated in the Invitation to Bid before the time designated in the Invitation to Bid. All bids shall be identified with the Project Name, Project Number, Project Location, Category of Work being bid on, Bid Date, and the Name and Address of Bidder. **Delivery to a post office box does not constitute receipt of a bid.**

Bidder shall be responsible for the sealed bid being delivered to the place designated for the bid opening before the time specified. Bids received after the time indicated in the Invitation to Bid will be rejected and returned to Bidder unopened.

Bid will be considered invalid and will be rejected if it has not been signed by the Bidder.

Bids will be rejected if the bidder is not certified by DOA in the division(s) of work they bid on and/or if their bid amount exceeds their certification threshold in that division of work.

16. BASE BID

Base Bids shall be received as follows:

SINGLE BASE BID FOR ALL THE WORK.

Base Bid No. 1. All Work, as per specification Divisions 2 thru 33, applicable provisions of Division 1 and related drawings.

General prime contractor bids that do not include the successful MEP bids identified by DFD will be rejected.

17. INFORMATIONAL BIDS

None.

18. UNIT PRICES

Unit prices requested on the Bid Form shall be given and, if included in the General Prime Contract, will be used for additions to or deductions from amount of work required under the Contract. Unit prices shall include all costs of materials, labor, insurance, taxes, overhead and profit.

DFD reserves the right to reject any unit prices as given in the bid if they are considered excessive or unreasonable, or to accept any or all of the unit prices that may be considered fair and reasonable. If any unit price is rejected, the work governed by such unit price, if required, shall be treated as specified in General Conditions, Article entitled "Changes in the Work".

The Bidder shall refer to the Bid Form and the applicable technical section to determine the basis of unit measure and the detailed information related to each unit price item requested.

The GPC shall list a **total** unit price for each item requested on the Bid Form. The **total** unit price listed should be calculated by adding the unit price included with the MEP bid to the cost of any GPC work required for that item.

19. STATED ALLOWANCES

The Bidder shall include the following cash allowances in the bid:

None.

20. SUBCONTRACTORS

GENERAL PRIME CONTRACTOR SUBCONTRACT WITH MEP SUBCONTRACTORS:

The successful General Prime Contractor will offer a subcontract to the successful MEP Subcontractors identified by DFD and included in the General Prime Contractor's bid. This subcontract between a General Prime Contractor and a MEP Subcontractor must include a scope of work clause identical to the scope of work clause included in the Bid Documents and the contract between the General Prime Contractor and the state. A General Prime Contractor and an MEP Subcontractor may not enter any agreement in connection with bids submitted that would alter or affect the scope or price of the contracts entered into. This prohibition does not apply to DFD change orders that result in changes to the plans or specifications, or to back charges allowed by the contract.

The General Prime Contractor must base the Project Schedule on the schedule that the MEP Subcontractors and General Prime Contractors bid on (in the specifications or bid instructions), unless otherwise agreed to by the MEP Subcontractor.

As the work progresses under any MEP subcontract for construction of a project, the General Prime Contractor shall, upon request of a subcontractor, pay to the subcontractor an amount equal to the proportionate value of the subcontractor's work properly completed, less retainage. The retainage shall be an amount equal to not more than 5 percent of the subcontractor's work completed until 50 percent of the subcontractor's work has been completed. At 50 percent completion, no additional amounts may be retained, and partial payments shall be made in full to the subcontractor unless the department certifies that the subcontractor's work is not proceeding satisfactorily. At 50 percent completion or any time thereafter when the progress of the subcontractor's work is not satisfactory, additional amounts may be retained but the total retainage may not be more than 10 percent of the value of the work completed. Upon substantial completion of the subcontractor's work, any amount retained shall be paid to the subcontractor, less the value of any required corrective work or uncompleted work. All payments the General Prime Contractor makes under this paragraph shall be within 7 calendar days after the date on which the General Prime Contractor receives payment from the department.

The contract entered into between the General Prime Contractor and an MEP Subcontractor must contain all of the following clauses:

Scope of Work. The MEP Subcontractor scope of work is identical to the General Prime Contractor scope of work included in these bidding and contract documents. By submitting and signing a bid, all bidders have examined all of the Bidding Documents listed in the Table of Contents of the project specifications. The successful bidders will be required to do all work which is shown on the

drawings, mentioned in the specifications, or reasonably implied as necessary to complete the division of work bid for this project.

Prompt Payment. (general prime contractor) shall pay (mechanical, electrical, or plumbing subcontractor) in accordance with section 16.855(19)(b), Wisconsin stats, for work that has been satisfactorily completed and properly invoiced by (mechanical, electrical, or plumbing subcontractor). A payment is timely if it is mailed, delivered, or transferred to (mechanical, electrical, or plumbing subcontractor) by the deadline under section 16.855(19)(b), Wisconsin stats. If (mechanical, electrical, or plumbing subcontractor) is not paid by the deadline in this contract, (general prime contractor) shall pay interest on the balance due from the eighth day after the (general prime contractor) receives payment from the Department of Administration for the work for which payment is due and owing to (mechanical, electrical, or plumbing subcontractor), at the rate specified in section 71.82, Wisconsin stats., compounded monthly.

A (mechanical, electrical, or plumbing subcontractor) that receives payment as provided under this contract and that subcontracts with another entity shall pay those subcontractors, and be liable for interest on late payments to those subcontractors, in the same manner as the (general prime contractor) is required to pay the (mechanical, electrical, or plumbing subcontractor) under this contract.

Insurance and Bonds. (mechanical, electrical, or plumbing subcontractor) shall not commence work under this contract until it has obtained all necessary insurance required of (mechanical, electrical, or plumbing subcontractor) in the contract between the (general prime contractor) and the Department of Administration. (mechanical, electrical, or plumbing subcontractor) shall provide a separate 100 percent performance bond and a separate 100 percent payment bond to the benefit of the (general prime contractor) as the sole named obligee. Original bonds shall be given to the (general prime contractor) and a copy shall be given to the Department of Administration no later than 10 days after execution of this contract.

Indemnification. To the fullest extent permitted by law, (mechanical, electrical, or plumbing subcontractor) shall defend, indemnify, and hold harmless (general prime contractor) and its officers, directors, agents, and any others whom (general prime contractor) is required to indemnify under its contract with the department, and the employees of any of them, from and against claims, damages, fines, penalties, losses, and expenses, including but not limited to attorney fees, arising in any way out of or resulting from the performance of the work under this contract, but only to the extent such claim, damage, fine, penalty, loss, or expense: (1) is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of property, including but not limited to loss of use resulting therefrom and is caused by the negligence, or acts or omissions, of (mechanical, electrical, or plumbing subcontractor), its subcontractors, any of their employees, and anyone directly or indirectly employed by them or anyone for whose acts they may be liable, or (2) as related to such claims, damages, fines, penalties, losses, and expense of or against (general prime contractor), results from or arises out of the negligence of the (general prime contractor) or other fault in providing general supervision or oversight of the work of (mechanical, electrical, or plumbing subcontractor) or (3) as related to claims, damages, fines, penalties, losses, and expense against the Department of Administration, arises out of the department's status as owner of the project or project site.

In addition (mechanical, electrical, or plumbing subcontractor) shall defend, indemnify, and hold harmless (general prime contractor) and its officers, directors, agents, and any others (general prime contractor) is required to indemnify under its contract with the department, and the employees of any of them, from any liability, including liability resulting from a violation of any applicable safe place act, that (general prime contractor) or the state incurs to any employee of (mechanical, electrical, or plumbing subcontractor) or any third party where the liability arises from a derivative claim from said employee, when the liability arises out of the failure of the (general prime contractor) or the state to properly supervise, inspect, or approve the work or work area of (mechanical, electrical, or plumbing subcontractor), but only to the extent that the liability arises out of the acts or omissions of (mechanical, electrical, or plumbing subcontractor), its employees, or

anyone for whom (mechanical, electrical, or plumbing subcontractor) may be liable, or from (mechanical, electrical, or plumbing subcontractor's) breach of its contractual responsibilities or arises out of (general prime contractor's) negligence or other fault in providing general supervision or oversight of (mechanical, electrical, or plumbing subcontractor's) work or arises out of the Department of Administration's status as owner of the project or project site. In claims against (general prime contractor) or the state by an employee of (mechanical, electrical, or plumbing subcontractor) or its subcontractors or anyone for whose acts (mechanical, electrical, or plumbing subcontractor) may be liable, the indemnification obligation of this paragraph is not limited by a limitation on amount or type of damage, compensation, or other benefits payable by or for the (mechanical, electrical, or plumbing subcontractor) subcontractors under workers compensation act. Except as identified above, the obligations of (mechanical, electrical, or plumbing subcontractor) under this indemnification do not extend to the liability of (general prime contractor) and its agents or employees arising out of (1) preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs, or specifications; (2) the giving of or failure to give directions or instructions by the (general prime contractor) or the Department of Administration or their agents or employees provided the giving or failure to give is the cause of the injury or damage; or (3) the acts or omissions of other subcontractors.

Retainage. Retainage shall occur and be in amounts and on a schedule equal to that in the contract between (general prime contractor) and the Department of Administration.

MEP AND NON-MEP SUBCONTRACTORS:

Bidders shall submit a completed Request for Subcontractor Approval (Form DOA-4225) with their bid or within seven days of the general prime contractor bid opening. The Request for Subcontractor Form shall also include, to the extent practicable, a list of their suppliers furnishing materials for the project. Submission of a completed Request for Subcontractor Approval form is an element of responsiveness. Failure to submit this completed form within the above time limits will be considered unresponsiveness and may result in contract award to the next apparent low bidder. Refer to Article 11 of the General Conditions for further information.

21. COMMENCEMENT AND COMPLETION

The successful General Prime Contractor Bidder must agree to commence the work on or before a date to be specified in a written "Notice to Proceed" issued by the state and to fully complete all the work within **200** consecutive calendar days thereafter. Completion time will be converted to a specific date at the time the "Notice to Proceed" is issued. Refer also to General Conditions, Article entitled "Time for Completion of the Project."

The General Prime Contractor must base the Project Schedule on the schedule that the MEP Subcontractors and General Prime Contractors bid on (in the specifications or bid instructions), unless otherwise agreed to by the MEP Subcontractor. These milestones will be incorporated into the master project schedule after the Notice to Proceed is issued. The schedule must include, but is not limited to, the following milestone categories as they apply to the project:

Start Date (Month/Year)	End Date (Month/Year)	Schedule Milestones
06/2019		Solar and Geothermal Site Mobilization
06/2019	08/2018	Geothermal Well Drilling
06/2019	06/2019	Solar Rooftop Preparation
06/2019	06/2019	Installation of Rooftop Modules and Inverters
06/2019	06/2019	Solar Site Utilities
06/2019	07/2019	Step-down Transformer Installation
	07/2019	Solar Array Substantial Completion
08/2019	08/2019	Geothermal Integration with Existing Infrastructure
08/2019	08/2019	Field Backfill and Restoration
	08/2019	Geothermal Substantial Completion

1 **22. WisBuild™ DFD INFORMATION SYSTEM**

2 Contract offer and construction phase records including Questions, Requests for Information, Construction
3 Bulletins, Proposals, Change Orders, Schedule of Values, and Requests for Payment will be processed
4 electronically on the WisBuild™ DFD Information System. Other construction phase records and
5 applications will be implemented, as they become available.
6

7 Successful Bidders shall have available for use within 72 hours of the bid date and maintain over the course
8 of the construction phase, from date of Notice-to-Proceed through receipt of Final Payment, an Internet
9 connection to access and utilize the WisBuild™ DFD Information System.
10

11 **23. WORK BY THE STATE**

12 The following work will be accomplished by DFD or will be let under separate contracts and will not be
13 included under the General Prime Contract:
14

- 15
- 16
- 17 • ASBESTOS ABATEMENT - Removal of building materials identified as asbestos-containing
18 materials (ACM) that will be disturbed by renovation work, including ACM thermal system
19 insulation, ACM spray applied and trowel applied surfaces, cement-asbestos products, ACM
20 flooring and associated ACM flooring mastics and friable miscellaneous ACM. (See General
21 Requirements, HAZARDOUS SUBSTANCES for regulatory requirements, materials testing
22 results, and General Prime Contractor's responsibility regarding ACM.)
23

24 ***

BID FORM – GENERAL PRIME CONTRACTOR (GPC) (Rev 11/2017)
DIVISION OF FACILITIES DEVELOPMENT
s.16.855 Wis. Stats.

Renewable Energy Generation System at Juda School
Juda School
Juda School District
Juda, WI

Division Project No. **18-0001**

General Prime Contractor (GPC) Bid Opening: 2:00 P.M., January 7th, 2019

To: State of Wisconsin, Department of Administration, Division of Facilities Development

(a joint venture)

(a corporation)

(a partnership)

We _____ (an individual)
(Cross out inapplicable)

Of _____
Street City County State Zip

hereby agree to execute a contract with the Division of Facilities Development (DFD) and a subcontract with all successful MEP Bidders identified by DFD and listed in this bid, and to furnish satisfactory separate 100% Performance Bond and 100% Payment Bond in the amount specified no later than ten (10) days of the contract offer, and to provide all labor and material required for the construction of the project designated above, for the prices hereinafter set forth, in strict accordance with the Contract Documents prepared by **BeEco Engineering (1415 Engineering Drive, Madison, WI 53706)** for DFD and dated **12/04/18**.

WisBuild™ Data Information System Contact Instructions:
(For use by DFD to offer contract and activate WisBuild™ accounts to the successful bidders)

Contact name: _____

Telephone Number: _____

Email address: _____

FAX Number: _____

IMPORTANT: BEFORE SUBMITTING YOUR BID, PLEASE VERIFY THAT:

1. You have been **certified by DOA as a qualified and responsible bidder** for the amount of your bid within the division(s) of work being bid.
2. You have **entered all Bid amounts in numeric characters** (Example: \$9,999);
3. You have **acknowledged receipt of all addenda**;
4. You have **signed the Bid Form**
5. You have **included a valid Bid Guarantee** for not less than 10% of the value of the bid as either:
 - a) a Bid Bond signed by the contractor and surety and with a Power of Attorney attached, **or**
 - b) a Cashier's Check or Bank Check pursuant to Wis stats. s. 779.14(1m)(c)2.b. and 779.14(1s).A Company or Personal Check will not be accepted.

SINGLE BASE BID - GENERAL PRIME CONTRACTOR

ALL WORK

BASE BID NO 1. ALL WORK required to fully complete the project in accordance with the Contract Documents,

for the sum of (\$_____)

Enter bid amount in numeric characters only (Example: \$9,999). See Instructions to Bidders 'Article 16 Submission of Base Bids' for detailed instructions.

UNIT PRICES (listed below are for additions to or deductions from amount of work required under the contract. See Instructions to Bidders 'Article 19 Unit Prices' for detailed instructions.) (Applicable to Base Bid No. 1)

Item	Unit Price
------	------------

\$_____	Per
---------	-----

Enter bid amount in numeric characters only (Example: \$9,999).

Base Bid No. 1 includes the bids from the following successful MEP Subcontractors identified by DFD for the mechanical, electrical, plumbing, and fire protection divisions of work in this project. The General Prime Contractor shall enter into subcontracts with these MEP Subcontractors:

Fire Suppression Base Bid No. 2:

Identified Subcontractor: _____

Amount: _____

Plumbing Base Bid No. 3:

Identified Subcontractor: _____

Amount: _____

Heating Ventilating and Air Conditioning Base Bid No. 4:

Identified Subcontractor: _____

Amount: _____

Electrical Base Bid No. 5:

Identified Subcontractor: _____

Amount: _____

INFORMATIONAL BID NO. 1-IA, For accounting purposes only, the following lump sum amount has been included in Base Bid No. 1

(\$_____)

Enter bid amount in numeric characters only (Example: \$9,999).

1 COMMENCEMENT AND COMPLETION OF CONTRACT WORK
2 The undersigned agrees, if awarded the contract, to enter into a subcontract with the MEP Bidders identified
3 by DFD, and to commence the Contract work on or before a date to be specified in a written Notice to
4 Proceed, and to complete the work in accordance with the project schedule in the Instructions to Bidders.
5
6 ADDENDUM RECEIPT
7 We acknowledge receipt of the following Addenda:
8
9 Addendum No. _____ Date _____
10
11 Addendum No. _____ Date _____
12
13 Addendum No. _____ Date _____
14
15 Addendum No. _____ Date _____
16
17 PRIOR TO SIGNING, BIDDERS' ATTENTION IS DIRECTED TO INSTRUCTIONS TO BIDDERS TO
18 AVOID THE POSSIBILITY OF INVALIDATING THIS BID.
19
20 BY SIGNING THIS BID FORM, THE BIDDER ATTESTS TO PERSONAL KNOWLEDGE OF THE
21 FOLLOWING:
22

- | | |
|----|---|
| 1. | Bidder is <u>certified</u> by DOA as a qualified and responsible bidder for the amount of the bid submitted, within the division(s) of work being bid. |
| 2. | In accordance with Wis. Stats. 16.855 (13) and (14) and ARTICLE 21 of these Bidding Documents, Bidder agrees to enter into a subcontract with the successful MEP Subcontractors identified by DFD. |
| 3. | Bidder has examined the drawings and specifications, carefully prepared the bid form, and has reviewed all forms in detail before submitting bid; and bidder, or the agents, officers, or employees thereof, have not, either directly or indirectly, entered into any agreement, bid rigging, bid rotation, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with this bid. |
| 4. | That all work will be performed at the Bidder's own proper cost and expense, that the Bidder will furnish all necessary materials, labor, tools, machinery, apparatus, and other means of construction in the manner provided in the applicable specifications, and at the time stated in the contract. |

23
24
25
26 _____
27 (Firm Name)
28
29 (Seal, if bid is by a corporation) _____
30 (Bidder's Printed Name)
31 Date: _____ By _____
32 (Signature of Bidder)
33
34 [] Place an "X" in the box if Bidder is certified as a minority business enterprise or disabled veteran-
35 owned business by the Wisconsin Supplier Diversity Program and wishes to be considered for the
36 5% bidder preference.

2.0 Contract Forms

From:

IMPORTANT: BEFORE SUBMITTING YOUR BID, PLEASE VERIFY THAT:

1. You have been **certified by DOA as a qualified and responsible bidder** for the amount of your bid within the division(s) of work being bid.
2. You have **entered all Bid amounts in numeric characters** (Example: \$9,999);
3. You have **acknowledged receipt of all addenda**;
4. You have **signed the Bid Form**
5. You have **included a valid Bid Guarantee** for not less than 10% of the value of the bid as either:
 - a) a Bid Bond signed by the contractor and surety and with a Power of Attorney attached, **or**
 - b) a Cashier's Check or Bank Check pursuant to Wis. Stat. s. 779.14(1m)(c)2.b. and 779.14(1s). A Company or Personal Check will not be accepted.

SEALED BID

Project Name	Renewable Energy Generation System at Juda School
Project No.	18-0001
Location	Juda School District, Juda, WI
Bid Category	Renewable Energy System
Bid Date	February 3rd, 2019

To: **Department of Administration
Division of Facilities Development
101 E. Wilson Street, 7th Floor
Madison, WI 53703**

(Complete and securely tape to exterior of sealed envelope)

Left Blank



GENERAL PRIME CONTRACTOR (GPC) BID BOND

KNOW ALL PEOPLE BY THESE PRESENTS, that _____
(a corporation of the State of _____) (individual), (partnership) (hereinafter referred to as the
"Principal"), and _____, a corporation of the State of _____

Name of Surety

(hereinafter referred to as the "Surety"), are held and firmly bound unto the State of Wisconsin, for Department of Administration, Division of Facilities Development (hereinafter referred to as "DFD"), in the penal sum of ten percent (10%) of the amount of the total bid or bids of the Principal herein accepted by DFD, for the payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The conditions of this obligation are such that, whereas the Principal has submitted, or is about to submit, to the State of Wisconsin a certain bid, including the related combined bids attached hereto and hereby made a part hereof, to enter into a Contract in writing for _____

Type of Work

for the _____
Project

- (1) If said bid is rejected by DFD, then this obligation shall be void; or
- (2) If said bid is accepted by DFD and the Principal shall execute and deliver a Contract in the form specified by DFD (properly completed in accordance with said bid) and shall furnish a separate 100% performance bond for the Principal's faithful performance of said Contract, and a 100% payment bond for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void; or
- (3) If said bid is accepted by DFD and the Principal shall fail to execute and deliver the Contract and the performance and payment bonds noted in (2) above, all within the time specified or any extension thereof, the Principal and Surety agree jointly and severally to forfeit to DFD the penal sum mentioned above, it being understood that the liability of the Surety for any and all claims hereunder shall in no event exceed the penal sum of this obligation as stated. Notice will be given by DFD to the Principal and Surety of intent to request payment of all or any part of the penal sum, a minimum of 7 calendar days before making demand of payment. Payment of the penal sum by the Surety and its bond shall be received by DFD within 72 hours following demand by DFD.

The Surety, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which DFD may accept such bid, and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, on the day and year set forth below.

SEAL:

Principal

Date

By: _____

SEAL:

Name of Surety

Date

By: _____

NOTE TO SURETY AND PRINCIPAL: The bid submitted, which this bond guarantees, may be rejected if the following instrument is not attached to this bond: Power of Attorney showing that the agent of Surety is currently authorized to execute bonds on behalf of the Surety, and in the amounts referenced above.



DESIGNATION OF CONFIDENTIAL AND PROPRIETARY INFORMATION

The attached material submitted in response to Bid/Proposal #_____ includes proprietary and confidential information which qualifies as a trade secret, as provided in s. 19.36(5), Wis. Stats., or is otherwise material that can be kept confidential under the Wisconsin Open Records Law. As such, we ask that certain pages, as indicated below, of this bid/proposal response be treated as confidential material and not be released without our written approval.

Prices always become public information when bids/proposals are opened, and therefore cannot be kept confidential.

Other information cannot be kept confidential unless it is a trade secret. Trade secret is defined in s. 134.90(1)(c), Wis. Stats. as follows: "Trade secret" means information, including a formula, pattern, compilation, program, device, method, technique or process to which all of the following apply:

1. The information derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use.
2. The information is the subject of efforts to maintain its secrecy that are reasonable under the circumstances.

We request that the following pages not be released

Section	Page #	Topic

IN THE EVENT THE DESIGNATION OF CONFIDENTIALITY OF THIS INFORMATION IS CHALLENGED, THE UNDERSIGNED HEREBY AGREES TO PROVIDE LEGAL COUNSEL OR OTHER NECESSARY ASSISTANCE TO DEFEND THE DESIGNATION OF CONFIDENTIALITY.

Failure to include this form in the bid/proposal response may mean that all information provided as part of the bid/proposal response will be open to examination and copying. The state considers other markings of confidential in the bid/proposal document to be insufficient. The undersigned agrees to hold the state harmless for any damages arising out of the release of any materials unless they are specifically identified above.

 Name - Authorized Representative

 Signature - Authorized Representative

 Company Name

 Date

This form can be made available in accessible formats upon request to qualified individuals with disabilities.



Form A — Affidavit of Compliance Minority Business Enterprise (MBE) / Disabled Veteran-Owned Business (DVB) Provisions

Project Title _____

Project Location _____ Project No. _____

The State of Wisconsin has an active Diversity Business Initiative. The purpose of this initiative, in the interest of fairness and equity, is to encourage increased voluntary expenditure of State construction dollars by prime contractors under subcontracts with MBE / DVB firms. **Please refer to the checklist on page 2 of this form which is provided to assist you in this effort.**

To that end, the bidder's commitment for MBE participation on this project is _____% and DVB participation is _____%.

The State of Wisconsin, Department of Administration, Division of Facilities Development reserves the right to reject and disqualify any bidder who does not include this completed form and who fails to comply with the State's bid requirements as outlined in the bid specifications.

I, the apparent low bidder, acknowledge, understand and agree to comply with my commitment for MBE/DVB participation on this contract including submission of all information required.

I attest that, to the best of my knowledge, all of the above information is true and correct.

Dated (mm/dd/ccyy) _____

Authorized Signature

Printed Name

Title

Company Name

Telephone Number

State of _____

County of _____

On this _____ day of _____, 20____, I confirm that _____
Bidder's Name

came before me and signed the document for the purposes stated.

I witness, and set my hand and official stamp or seal.

Notary Public

County, State of _____

My Commission expires _____, 20____

“Good Faith Effort” To Obtain Minority Business Enterprise / Disabled Veteran-Owned Business Participation

All “Yes” boxes must be checked to ensure that a “Good Faith Effort” has been made to obtain MBE participation.

- Have you checked the State of Wis. Minority Business/Disabled Veteran-Owned Business directories?
doa.wi.gov ☐ Yes ☐ No
- Have you made an early (prior to bidding) contact with the Supplier Diversity Program office to solicit their assistance in getting MBE/DVB participation on the project? Tel. (608) 267-7806; Fax (608) 267-0600; email domingoe.leguizamon@wisconsin.gov ☐ Yes ☐ No
- Have you provided MBE/DVB firms adequate project information about plans, specifications and requirements pertaining to their work? ☐ Yes ☐ No
- Have you communicated with any MBE/DVB that performs the type of services needed for the project and was there any follow-up? ☐ Yes ☐ No
- Was MBE/DVB participation advertised (newspaper, radio, etc.) for this project? (You may be asked to submit evidence.) ☐ Yes ☐ No
- Did you contact any MBE/DVB trade associations to assist in locating MBE/DVBs or have you made contact with any MBEs/DVBs that may not yet be certified by the State? (You may be asked to verify.) ☐ Yes ☐ No
- Have you determined if there are other possible opportunities for MBE/DVB participation such as suppliers, haulers, etc. or using a group of MBEs/DVBs jointly? ☐ Yes ☐ No
- Have you considered creating a plan of action with the assistance of the Supplier Diversity Program office to ensure that future contracts can have MBE/DVB participation and meet the construction requirements and goals of the State? (These plans may include mentoring, technical support and other innovative opportunities.) ☐ Yes ☐ No
- Did you negotiate in good faith? (You may be asked to verify.) ☐ Yes ☐ No



REQUEST FOR SUBMITTAL APPROVAL

Project Name _____ DFD Project No. _____
Contractor Name _____ Contractor Phone No. _____
Subcontractor/Supplier Name _____ Specification Section No. _____

- a. This Submittal is made under the provisions of the General Conditions of the Contract Documents. The Contractor makes an express warranty to DFD, by express affirmation, that if installed into or made a part of this project, the work which forms the basis of this Submittal will conform to the design requirements of the Contract Documents.
- b. It is the purpose of this Submittal to describe the goods proposed for use by the Contractor and to demonstrate conformance of that description to the Contract Documents.
- c. At the time of this submission, the Contractor acknowledges awareness that the purpose of this Submittal is to obtain DFD's authorization to use this Work for purposes of Contract Document compliance by the Contractor, and further, that DFD, in doing so, relies upon the skill, judgment and integrity of the Contractor to insure that this submitted Work complies with requirements of the Contract Documents. Contractor hereby acknowledges that it has, through the use of its own resources, found and selected the Work submitted herewith and that the Work submitted is usable for the purpose of being fit and suitable in the final construction under this Contract Documents.
- d. Notwithstanding any provision of this Contract Documents to the contrary, the Contractor hereby notifies DFD that the following features of the Submittal MAY NOT BE IN CONFORMANCE with Contract Document requirements, but nevertheless asks approval thereof. (Contractor shall include brief, specific description of each potential nonconformity. If NONE, Contractor shall so state.)

1.

2.

3.

4.

☐ Check if additional page(s) of potential nonconformity are attached.

Signed _____
Contractor's Authorized Representative _____ Date _____

Note: Contractors are required to copy and use this form as a cover sheet accompanying all submittals, as described in the General Conditions of the Contract Documents. All pages of submittals are to be consecutively numbered, with a front index page listing the total sequence of pages included.

This form can be made available in accessible formats to qualified individuals with disabilities upon request.



Request for Subcontractor Approval

Contractor Name		Project Title
Street Address	PO Box	Location
City	State	ZIP + 4
Contact Person	Phone Number	DFD Project Manager
Prime Contractor Business Certification <input type="checkbox"/> MBE* <input type="checkbox"/> DVB*		Contract Amount \$

The use of any subcontractors for this project must have prior approval by DFD.

☐ Revised Form _____

☐ **No Subcontractors will be used on this project**

Subcontractor Name / Phone Contact Person / Email	City, State	Type of Work/Service	Estimated Contract Amount	MBE*	DVB*
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>

* MBE Minority Business Enterprise / DVB Disabled Veteran-Owned Business

☐ Additional Pages Attached

Prepared By:

Signature Date (mm/dd/ccyy)

Printed Name

Title

For DFD Use Only

Screened By Date (mm/dd/ccyy)

- ☐ Subcontractors Approved
☐ Subcontractors Approved Except as Noted

Project Manager Date (mm/dd/ccyy)



PERFORMANCE BOND (100%)

This Surety Bond instrument is hereby executed to guarantee performance of a proposed contract between the herein named Principal and the State, dated _____, 20__, a copy of which is hereto attached and made a part hereof, herein called "Contract," for the construction of

Project Title _____

Project Location _____

Project Number _____ Contract For _____ work.
All, General, HVAC, Roofing, Etc.

KNOW ALL PEOPLE BY THESE PRESENTS That _____
Name of Contractor

of _____ as contractor, herein called "Principal", and _____
City and State Name of Surety

_____ of _____ as Surety, herein called
City and State

"Surety", are held firmly bound to the State of Wisconsin, for the Department of Administration, Division of Facilities Development herein called "the Owner", in the amount of \$_____ for the faithful performance of the Contract as hereinafter set forth. For the payment of which, well and truly to be made, we bind ourselves, our heirs, successors, executors, and administrators, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that if the said bounded Principal shall promptly and faithfully perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of the Contract, in all respects, and within the time prescribed in the Contract (or as such time may be extended as provided in the Contract), and shall indemnify and save harmless the Owner, its officers, employees and agents against any direct or indirect damages of every kind and description that shall be suffered or claimed to be suffered in connection with or arising out of the performance of the Contract by Principal or its subcontractors, and shall in all respects perform the Contract according to law, then this obligation shall be void; otherwise it shall be and remain in full force and effect.

FURTHER, that no final settlement between the Owner and the Principal shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

FURTHER, that no change, extension of time, alteration or addition to the work to be performed, or amount of, the Contract shall in any way affect Principal's or Surety's obligations on this bond, and Surety does hereby waive notice of any change, extension of time, alterations or additions thereunder.

PROVIDED, FURTHER, that the undersigned states that pursuant to express authority the corporate seal affixed to this instrument is the seal of this surety company, that the seal was affixed and this instrument was executed for and on behalf of this surety company; that authority has not been revoked by this surety company; that this instrument was executed as the free act and deed of this surety company; that the certificate of authority from the Commissioner of Insurance showing authority of this surety company to transact business in the State of Wisconsin has been obtained and will be provided to the Owner upon request; and further, that this surety bond was written through an agent duly licensed as such on the date thereof.

IN WITNESS WHEREOF, this instrument is executed this the _____ day of _____, 20____.

FOR THE PRINCIPAL

By _____
Corporate Secretary Signature
(Seal)

President, Partner or Individual Signature
Witnessed by _____

Witnessed by _____
Two witnesses must attest above signatures.

FOR THE SURETY

By _____
*Corporate Secretary Signature
(Seal)

Attorney in Fact or Authorized Officer

Street or PO Box

City, State and Zip Code

Telephone Number

Email Address
(This email address will be used to notify Surety of Project Start Date)

ACKNOWLEDGEMENT

STATE OF _____)
) ss
COUNTY OF _____)

I, _____, a Notary Public of said County and State, do hereby certify that _____
_____, Attorney-in-Fact or authorized officer of _____,
Name of Surety

who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, appeared before me this day in person and acknowledged that he/she signed, sealed and delivered said instrument for and on behalf of _____, for the uses
Name of Surety
and purposes therein set forth.

Given under my hand and notarial seal at my office at _____, _____, in said county,
City State

this _____ day of _____, 20____, A.D.

Notary Public

My commission expires _____

This Performance Bond is

APPROVED

Administrator, Division of Facilities Development

* If signatory is a corporation, Secretary of corporation shall attest, otherwise leave blank.



PAYMENT BOND (100%)

This Surety Bond instrument is hereby executed to guarantee payment of certain amounts related to a proposed contract between the herein named Principal and the State, dated _____, 20__, a copy of which is hereto attached and made a part hereof, hereinafter called "Contract," for the construction of

Project Title _____

Project Location _____

Project Number _____ Contract For _____ work.
All, General, HVAC, Roofing, Etc.

KNOW ALL PEOPLE BY THESE PRESENTS That _____
Name of Contractor

of _____ as contractor, herein called "Principal", and _____
City and State Name of Surety

_____ of _____ as Surety, herein called
City and State

"Surety", are held firmly bound to the State of Wisconsin, for the Department of Administration, Division of Facilities Development herein called "the Owner", in the amount of \$_____ for the payment of all claims, costs, charges and other amounts arising in connection with, or related to, the Contract as hereinafter set forth. For the payment of which, well and truly to be made, we bind ourselves, our heirs, successors, executors, and administrators, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that if the said bounded Principal shall promptly make payment pursuant to Section 779.14 of the Wisconsin Statutes to all persons who supply labor and material to said project in the prosecution of the work arising in connection with, or related to, the Contract, and shall pay all other just debts, dues and demands incurred in the performance of the Contract, and shall indemnify and save harmless the Owner, its officers, employees and agents against any direct or indirect damages of every kind and description that shall be suffered or claimed to be suffered as the result of Principal's failure to pay any amounts in connection with, or related to, the Contract, then this obligation shall be void; otherwise it shall be and remain in full force and effect.

FURTHER, labor performed and materials furnished, used or consumed in making the public improvement or performing the public work, include, without limitation because of enumeration, fuel, lumber, building materials, machinery, vehicles, tractors, equipment, fixtures, apparatus, tools, appliances, supplies, electric energy, gasoline, motor oil, lubricating oil, greases, state imposed taxes, premiums for worker's compensation insurance and contributions for unemployment compensation.

FURTHER, that no final settlement between the Owner and the Principal shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

FURTHER, that no change, extension of time, alteration or addition to the work to be performed, or amount of, the Contract shall in any way affect Principal's or Surety's obligations on this bond, and Surety does hereby waive notice of any change, extension of time, alterations or additions thereunder.

PROVIDED, FURTHER, that the undersigned states that pursuant to express authority the corporate seal affixed to this instrument is the seal of this surety company, that the seal was affixed and this instrument was executed for and on behalf of this surety company; that authority has not been revoked by this surety company; that this instrument was executed as the free act and deed of this surety company; that the certificate of authority from the Commissioner of Insurance showing authority of this surety company to transact business in the State of Wisconsin has been obtained and will be provided to the Owner upon request; and further, that this surety bond was written through an agent duly licensed as such on the date thereof.

IN WITNESS WHEREOF, this instrument is executed this the _____ day of _____, 20____.

FOR THE PRINCIPAL

By _____
Corporate Secretary Signature
(Seal)

President, Partner or Individual Signature
Witnessed by _____

Witnessed by _____
Two witnesses must attest above signatures.

FOR THE SURETY

By _____
*Corporate Secretary Signature
(Seal)

Attorney in Fact or Authorized Officer

Street or PO Box

City, State and Zip Code

Telephone Number

Email Address
(This email address will be used to notify Surety of Project Start Date)

ACKNOWLEDGEMENT

STATE OF _____)
) ss
COUNTY OF _____)

I, _____, a Notary Public of said County and State, do hereby certify that _____
_____, Attorney-in-Fact or authorized officer of _____,
Name of Surety

who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, appeared before me this day in person and acknowledged that he/she signed, sealed and delivered said instrument for and on behalf of _____, for the uses
and purposes therein set forth. Name of Surety

Given under my hand and notarial seal at my office at _____, _____, in said county,
City State

this _____ day of _____, 20____, A.D.

Notary Public

My commission expires _____

This Payment Bond is

APPROVED

Administrator, Division of Facilities Development

* If signatory is a corporation, Secretary of corporation shall attest, otherwise leave blank.



CONSTRUCTION CONTRACT

Date _____

Project No. _____

Contract No. _____

THIS AGREEMENT is between the State of Wisconsin by its Department of Administration, represented by its Division of Facilities Development, herein called "DFD", and _____
doing business as _____,
of the City of _____ and State of _____ hereinafter called "CONTRACTOR".

WITNESSETH: That for and in consideration of the payments and arrangements hereinafter mentioned, to be directed by DFD, the CONTRACTOR will commence and complete the construction described as follows:

hereinafter called the "Project", for the sum of _____ Dollars (\$ _____ .00)
and all other work in connection therewith, under the terms as stated in the Contract Documents; and at the CONTRACTOR's own proper cost and expense to furnish all materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the said Project in accordance with the conditions and prices stated in the Bid Form, Bidding and Contract Requirements, the drawings which include all maps, plats, plans, and other drawings and printed or written explanatory matter thereof, and the technical portion of the specifications therefor; as prepared by _____
herein called the A/E, and as enumerated in the Specification's Table of Contents, all of which are made a part hereof and collectively evidence and constitute the Contract Documents.

The CONTRACTOR hereby agrees to commence work under this Contract on or after a date to be specified in a written "Notice to Proceed" and to complete this work by _____.

DFD agrees to have the CONTRACTOR paid in current funds for the performance of the contract subject to additions and deductions, as provided in the General Conditions of the Contract, and to authorize payments on account thereof as provided in the Article entitled, "Payments to Contractor" of the General Conditions.

DFD has the delegated power and duty pursuant to Sec. 16.85(l), to act on all matters and for all purposes under this Contract; including additions and modifications therein incorporated.

IN WITNESS WHEREOF, DFD and the CONTRACTOR have executed this contract.

(Seal)	CONTRACTOR	<i>Contractor Firm Name</i>	
		<i>Address</i>	
		<i>State, City Zip</i>	
		By _____	_____
			Signature Date
		_____ Printed Name	
_____	Secretary of Corp.	_____ Title	
_____	Witness	_____ Employer Number (FEIN) or Social Security Number	

This Contract is not valid or effectual for any purpose until executed by all parties, and no work is authorized until the CONTRACTOR has been given Notice to Proceed by DFD.

APPROVED (if Contract is over \$150,000)

Administrator, Division of Facilities Development Date

Governor of Wisconsin Date

Note: If Contractor is a corporation, Secretary should attest. In accordance with current Federal IRS Regulations, all service provider entities are required to submit either their Employer Number or Social Security Number in order to receive payment for services rendered. The State of Wisconsin requests Tax ID numbers for all entities providing either goods or services, to facilitate approved payments to vendors in accordance with certain State Statutes and/or Administrative Rules.



GENERAL CONDITIONS OF THE GENERAL PRIME CONTRACTOR CONTRACT

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1. CONTRACT ADMINISTRATION

- A. The intention of the Contract Documents is to include all labor, materials, and equipment necessary for the completion of the Work in accordance with the standard of quality established by the Contract Documents and within the allowable time period specified.
- B. The General Prime Contractor shall attend a Pre-Construction Meeting, which will be scheduled by DFD. DFD shall designate DFD'S "PROJECT REPRESENTATIVE" at the Project Pre-Construction Meeting. This person is delegated authority to act on behalf of DFD, unless the Contract Documents specifically identify another party responsible for DFD Work activities. It is the intent of DFD to provide, to the extent possible, a single point of contact and communication for the General Prime Contractor to facilitate efficient, timely, and cost cost-effective completion of the Work.
- C. The General Prime Contractor shall employ, and specifically assign to the Project, a construction superintendent or foreman, experienced in Work of the character required by the Contract Documents. This person shall be delegated authority to act on behalf of the General Prime Contractor, and shall be, to the extent possible, a single point of contact and communication for DFD and all Subcontractors to facilitate efficient, timely, and cost-effective completion of the Work.
- D. DFD will periodically schedule progress meetings. At each such progress meeting, the parties will discuss the above-mentioned items, cooperate with others to assure successful completion of the Work, and help to quickly resolve problems which arise.

2. DEFINITIONS

THE FOLLOWING TERMS AS USED IN THE CONTRACT DOCUMENTS ARE DEFINED AS FOLLOWS:

- A. "ADDENDUM" means a written or graphic instruction which clarifies, amends, or interprets the Bidding Documents.
- B. "A/E" and "ARCHITECT/ENGINEER" means a person, partnership, corporation, or other business organization under Contract with DFD to prepare drawings and specifications, to advise DFD, to provide DFD with design services, and in certain cases, to perform inspection and review for the sole benefit of DFD during construction.
- C. "BIDDING AND CONTRACT REQUIREMENTS" means all items as described in Division 1 including "Bidding Requirements," "Contract Forms," "General Conditions," "Supplementary General Conditions," "General Requirements."
- D. "CONTRACT DOCUMENTS" means collectively, all documents listed in the Table of Contents of this Specification, the Drawings, Addenda, Change Orders, Notice to Proceed, and any changes in the Work approved by DFD and General Prime Contractor before the execution of the Contract.
- E. "CONTRACTOR" means any individual, firm, corporation, or other non-governmental organization which, in cooperation with other Contractors and persons, performs Work required by the Contract Documents. "Contractor" is all contractors working on a project regardless of contractual relationship. This includes the General Prime Contractor, MEP Subcontractors, Non-MEP Subcontractors, and all Subcontractors, regardless of tier of subcontract. The term "Contractor" does not include the State or the A/E.
- F. "DAMAGES FOR UNTIMELY PERFORMANCE" means a predetermined monetary amount to be paid to the State, based on anticipated real costs which the State will incur, due to the General Prime Contractor's failure to complete the Work within the allowable time identified in the Contract Documents.
- G. "DELAY" means an event that causes an increase in the duration of the Project, or that changes the sequence of the Work or individual Work activities, thereby preventing completion of the Project within the time period specified in the Contract Documents.
- H. "DFD" means Division of Facilities Development. (See "OWNER").

- I. "DFD'S PROJECT REPRESENTATIVE" means the person or persons' delegated authority to act on behalf of DFD. Such person or persons may be the employees of DFD, or Consultants hired to perform the activities and responsibilities of DFD. "DFD's Project Representative" will be designated in writing at the Pre-Construction Meeting. DFD reserves the right to change its designated Project Representative at any stage of the Work, upon prior written notice to the General Prime Contractor.
- J. "DRAWINGS" means the graphic and pictorial portions of the Contract Documents, showing the design, type of construction, location, dimension and character of the Work to be provided by the General Prime Contractor, generally including, but not limited to plans, elevations, sections, details, schedules, diagrams, notes and portions of Specification.
- K. "EQUALS" means material, equipment or methods proposed and warranted by the General Prime Contractor as being equivalent to essential attributes of the material, equipment or method specified in the Contract Documents, and approved by DFD.
- L. "EXTENDED AND UNABSORBED OVERHEAD COSTS" means extended and unabsorbed overhead costs and related damages calculated pursuant to the original and modified Eichleay formulas adopted and recognized by the Armed Services Board of Contract Appeals and the United States Court of Appeals for the Federal Circuit.
- M. "FIELD ORDER" means changes in the Work made by DFD through use of direction, instruction, interpretation, determination, or any other mode or manner.
- N. "GENERAL PRIME CONTRACTOR" means the individual, firm, corporation, or other non-governmental organization that enters into a contract with the state to perform all work as required by the Contract Documents and enters into contracts with subcontractors including MEP Subcontractors identified by DFD. The term "General Prime Contractor" does not include the State or the A/E.
- O. "MECHANICAL, ELECTRICAL, OR PLUMBING SUBCONTRACTOR" ("MEP SUBCONTRACTOR") is any individual, firm, corporation, or other non-governmental organization that performs mechanical (Heating, Ventilating, and Air Conditioning), electrical, plumbing, or fire protection (fire suppression) work for the Project, and is identified by DFD as the successful MEP Subcontractor to enter into a contract with the General Prime Contractor to perform their division of work described in the contract documents.
- P. "NON-MEP SUBCONTRACTOR" means any subcontractor to a General Prime Contractor in divisions of work other than mechanical, electrical, plumbing, and fire protection. "Non-MEP Subcontractor" includes suppliers and installers to the General Prime Contractor.
- Q. "SUBCONTRACTOR" means all subcontractors on a project. "Subcontractor" includes MEP Subcontractors, subcontractors to the MEP Subcontractors, and Non-MEP Subcontractors.
- R. "NOTICE TO PROCEED" means a written notice provided by DFD to the General Prime Contractor authorizing the General Prime Contractor to proceed with the Work and establishing the date for completion of the Work.
- S. "OWNER" means the State of Wisconsin, Department of Administration, Division of Facilities Development, herein termed "DFD." DFD exercises the powers and duties prescribed by Wis. Stats. §§ 16.85 and 16.855.
- T. "PROJECT" means the total and complete construction of the Work required by the Contract Documents.
- U. "PROJECT SCHEDULE" means a graphic and written analysis of activity duration and sequencing, which is required for successful completion of the Project within the time period identified in the Contract Documents.
- V. "SHOP DRAWINGS" means drawings, diagrams, illustrations, schedules, performance charts, brochures, catalog data, and other data or samples specially prepared or provided by the General Prime Contractor, a Subcontractor including MEP Subcontractor Non-MEP Subcontractor, or Material Supplier to illustrate some portion of the Work. The terms "SHOP DRAWINGS" and "SUBMITTALS" may be used interchangeably in the Contract Documents.

- W. "SPECIFICATIONS" means the Volume assembled for the Work which typically includes the Bidding and Contract Requirements, forms, and Technical Sections.
- X. "STATE" means the State of Wisconsin and its officers, employees, agents, divisions, bureaus, commissions, boards, authorities, and universities, colleges, and other institutions of higher learning.
- Y. "SUBMITTALS" means the terms "SUBMITTALS" and "SHOP DRAWINGS" may be used interchangeably in the Contract Documents. Refer to the definition of "SHOP DRAWINGS" contained herein.
- Z. "SUBSTANTIAL COMPLETION" means the stage in the progress of the Work when DFD determines that the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Project, or designated portion thereof, can be occupied and used for its intended purpose.
- AA. "SUBSTITUTIONS" means the use of material or equipment not specified in the Contract Documents, but that the General Prime Contractor proposes and warrants as suitable for the use intended and conforms to all other physical, functional, and performance requirements of the Contract Documents.
- BB. "SURETY" means a person or entity licensed to do business in the State of Wisconsin, who provides separate Performance Bonds and Payment Bonds to a General Prime Contractor to indemnify the State against all damages suffered by failure of the General Prime Contractor to perform the Work and to pay all lawful claims of Subcontractors, Material Suppliers, and laborers.
- CC. "WORK" means the plant, labor, materials, service, supplies, equipment, and other facilities and items comprising the whole of the Contract Documents.

3. CONTRACT DOCUMENTS

- A. The Contract Documents as defined in Article 2 shall form a part of this Contract. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all.
- B. The technical provisions of this Contract are set forth in the Specifications. The Specifications are complemented by the "Drawings" which may also be referred to as the "Plans." The Specifications and Drawings for this Contract are complementary and are to be so interpreted, unless that interpretation is so clearly erroneous as to defy the intent of the parties.
- C. The General Prime Contractor's bid price shall include complementary interpretation, and the performance of all Work which;
 - 1. in accordance with industry standards, customary practice, or by reasonable inference are details of Work that are necessary as part of the construction, operation, and coordination and interface of the Work;
 - 2. would necessarily be readily apparent to one skilled in the trades; or,
 - 3. a competent and experienced contractor would recognize as part of its responsibility.
- D. The failure of the General Prime Contractor to include in its bid the Work as defined in Paragraph 3.B. shall not relieve the General Prime Contractor from performing such Work and it shall be performed as if fully and correctly set forth and described in the Drawings and Specifications.
- E. Periodically, DFD may provide the General Prime Contractor additional instructions and drawings necessary to perform the Work. DFD shall make a good faith effort to coordinate such instructions and drawings with the Contract Documents, preparing them so they can be reasonably interpreted as a part thereof.

4. CONFLICTING CONDITIONS

- A. DFD shall take all reasonable steps to assure that the Contract Documents are as accurate as possible, and provide information which, in the opinion of DFD, is necessary in preparing bids and constructing the Project. However, it is mutually understood that discrepancies or conflicts in the Contract Documents may be identified, in which case:
 - 1. Amendments and addenda take precedence over the Specifications;
 - 2. The Specifications take precedence over the Drawings;
 - 3. Stated dimensions take precedence over scaled dimensions;
 - 4. Large-scale detail drawings take precedence over small-scale drawings;
 - 5. Schedules take precedence over other data on the plans.
- B. Notwithstanding the above order of precedence, any clearly stated requirement of duties of the General Prime Contractor shall control over any rule of contract interpretation which might otherwise place those duties in conflict with other provisions of the Contract, and such duties shall be included in the General Prime Contractor's bid.
- C. The failure to inquire about any ambiguity in any provision of the Contract Documents which would be reasonably apparent to any bidder knowledgeable and skilled in the Work required by the bid shall grant DFD the right to interpret that ambiguity.
- D. Where the terms "A/E," "Architect/Engineer," "Architect," or "Engineer" are used in technical Sections of the Specifications, the General Prime Contractor shall understand that actions indicated to be accomplished by such named parties are actions which are solely as the professional technical advisor and consultant to DFD and such actions thus require final approval by DFD.
- E. In the event of any conflict between the terms of this Contract and any provision of law, the provision of law shall control and the parties hereto shall not be free to Contract contrary to law.

5. CONTRACT SECURITY

- A. The General Prime Contractor shall furnish a Performance Bond in an amount equal to one hundred percent (100%) of the Contract price, and a Payment Bond in an amount equal to one hundred percent (100%) of the Contract price, as security for the faithful performance of this Contract, payment of all persons performing labor or furnishing materials for the Project, and payment of all other debts incurred in the performance of the Work.
- B. The Performance Bond and Payment Bond Forms that the General Prime Contractor is required to execute are bound into the Specifications. Before the Construction Contract can be executed, the Performance Bond and Payment Bond must be delivered to and approved by DFD. Such approval will be predicated on prior satisfactory performance of a Surety.

6. SAFETY AND ACCIDENT PREVENTION

- A. The General Prime Contractor shall provide and maintain a Work environment and procedures which will:
 - 1. Safeguard the public and State personnel and agents, property, material, supplies, and equipment exposed to General Prime Contractor and all Subcontractors including, MEP Subcontractors and Non-MEP Subcontractors operations and activities;
 - 2. Avoid interruptions of user agency operations and delays in Contract completion dates; and,
 - 3. Control costs in the performance of this Contract.
- B. For these purposes, the General Prime Contractor shall:

1. Provide appropriate safety barricades, signs, and signal lights;
 2. Comply with any safety requirement published by any governmental authority with jurisdiction over the site, including Federal, State, or local jurisdictions;
 3. Ensure that any additional measures which are reasonably necessary for the purposes stated are taken.
- C. The General Prime Contractor shall strictly comply with, and bear full responsibility for, any safety procedure set forth in the Contract Documents. In the absence of such compliance, the General Prime Contractor shall be responsible for indemnification of the State for any cost or expense, including legal fees. At the discretion of DFD, the General Prime Contractor may also be subject to termination of the Contract for default.
- D. If DFD becomes aware of any noncompliance by the General Prime Contractor or any Subcontractor, with the safety conditions of this Contract or of any condition caused by the General Prime Contractor or any Subcontractor, which poses a serious or imminent danger to the health or safety of the public or to State personnel, DFD's Project Representative shall notify the General Prime Contractor orally, with written confirmation, and direct immediate initiation of corrective action. This Notice, when given to the General Prime Contractor or the General Prime Contractor's Representative at the Work site, shall be deemed sufficient notice of noncompliance and that corrective action is required. After receiving the Notice, the General Prime Contractor shall immediately take corrective action. If the General Prime Contractor fails or refuses to promptly take corrective action, DFD may issue an order stopping all or part of the Work until satisfactory corrective action has been taken. The General Prime Contractor shall not be entitled to an equitable adjustment of the Contract price or an extension of the performance schedule by reason of the issuance of any stop Work order under this Article 6.
- E. The General Prime Contractor shall cause this Article 6, including this Paragraph E., with appropriate changes in paragraph designation, to be incorporated in all MEP Subcontracts and Non-MEP Subcontracts, regardless of tier.

7. PROTECTION OF WORK AND PROPERTY

- A. The General Prime Contractor shall at all times safely guard State property and adjacent property from injury, loss, release of hazardous or toxic materials, or damage in connection with the Contract Documents or the performance of the Work hereunder. The General Prime Contractor shall replace or make good any damage, loss, or injury caused as a result of failure to comply with Contract Documents. This contract provision shall be incorporated into the contracts between the General Prime Contractor, MEP Subcontractors, and Non-MEP Subcontractor.
- B. In case of an emergency which threatens loss or injury of property, or safety of life, the General Prime Contractor will be allowed to act, without previous instructions from DFD, in a diligent manner. The General Prime Contractor shall notify DFD immediately thereafter. Any claim for compensation by the General Prime Contractor due to such extra Work shall be promptly submitted to DFD for approval as provided for in Article 18 of the General Conditions.
- C. In the event of temporary suspension of Work, or during inclement weather, or whenever DFD shall direct, the General Prime Contractor shall carefully protect all Work and materials against damage or injury from the weather. This contract provision shall be incorporated into the contracts between the General Prime Contractor, MEP Subcontractors, and Non-MEP Subcontractors. If, in the opinion of DFD, any Work or materials have been damaged or injured by reason of failure on the part of the General Prime Contractor Subcontractors including MEP Subcontractor or Non-MEP Subcontractors to protect the Work, such materials shall be removed and replaced at the expense of the General Prime Contractor.
- D. The General Prime Contractor shall promptly, and without prior demand by DFD, remedy and repair any damage caused by the General Prime Contractor and all Subcontractors, suppliers, and vendors to completed or partially completed construction or to property of DFD or other Subcontractors

8. PERMITS, REGULATIONS, UTILITIES, AND TAXES

- A. The General Prime Contractor shall procure all permits, licenses, and approvals necessary for the execution of this Contract and performance of the Work, and shall provide evidence of such permits, licenses, and approvals at the Pre-Construction Meeting or before commencement of the Work.
- B. Where Contract Documents require abatement of asbestos containing materials, prior written Notice to the State of Wisconsin, Department of Natural Resources is required. The General Prime Contractor shall provide evidence of such Notice prior to commencement of the Work.
- C. Work under this Contract shall be in compliance with all applicable state laws, codes, and regulations relating to environmental quality and safety, the performance of the Work, the protection of adjacent property, and the maintenance of passageways, guard fences, or other protective facilities. Such Work shall not be subject to the ordinances or regulations (except land use zoning) of the municipality in which the construction takes place, including ordinances or regulations relating to materials used, permits, supervision of construction or installation, payment of permit fees, or other restrictions of any nature whatsoever. DFD shall be notified by the General Prime Contractor of any Notices of noncompliance or violation associated with Work required by the Contract Documents.
- D. The General Prime Contractor shall pay all Sales, Consumer, Use, and other similar taxes required by law assessed to or arising out of the construction of the Project.
- E. If the General Prime Contractor believes that any of the Work required by the Contract Documents is in violation of any State law, code, rule, or regulation, the General Prime Contractor shall promptly notify DFD. Upon such notification, DFD will determine whether corrective action is required and make such changes, if any, at no additional cost to the General Prime Contractor provided such violation was not caused by the General Prime Contractor or a Subcontractor including, a MEP Subcontractors, or a Non-MEP Subcontractors.
- F. Charges for water, sewer, and other utility connections made by municipalities will be paid by the State. Payment for use of such services and utilities before Substantial Completion shall be in accordance with provisions of the General Requirements of the Contract.

9. STATE RESPONSIBILITY FOR THE SITE

- A. Prior to start of construction, the State shall furnish all land and rights-of-way necessary for the carrying out and completion of the Work to be performed under this Contract.
- B. DFD will furnish to the General Prime Contractor site, topography, and property surveys which DFD reasonably believes necessary for the execution of the Work.
- C. DFD, upon receipt of the Notice set forth in Paragraph 10.E., shall promptly investigate the site conditions reported by the General Prime Contractor to determine whether the conditions discovered differ materially from those indicated in the Contract Documents, are of an unknown and unusual nature which could not have been discovered by a reasonable site investigation by the General Prime Contractor as required by the Contract Documents, or which differ materially from those ordinarily encountered and generally recognized as being inherent in the Work of the character required by the Contract Documents at the site where Work is to be performed.
- D. DFD shall act on any General Prime Contractor Notice, as described in Paragraph 10.E. of the General Conditions, as soon as practicable, but in no case later than ten (10) working days after the receipt of such Notice. If DFD determines that the conditions reported by the General Prime Contractor differ materially from those indicated in the Contract Documents, or are of an unknown and unusual nature which could not have been discovered during a reasonable site investigation by the General Prime Contractor, then to the extent established by the General Prime Contractor and approved by DFD, DFD shall authorize an increase or decrease in the cost or time required for performing any part of the Work under this Contract.
- E. No request by the General Prime Contractor for an equitable adjustment to the Contract under this Article 9 shall be allowed, unless the General Prime Contractor gives proper Notice, which is a CONDITION PRECEDENT to any liability on the part of the State.

- F. In no event shall any claim by the General Prime Contractor for equitable adjustment to the Contract for differing site conditions be allowed if presented after final payment under this Contract is made.

10. GENERAL PRIME CONTRACTOR RESPONSIBILITY FOR CONDITIONS AT THE SITE

- A. The General Prime Contractor is responsible for and hereby acknowledges that it has taken the steps reasonably necessary to prepare a bid which includes the costs for Work, the requirement for which would reasonably be known to a competent contractor, in overcoming normal subsurface conditions at the site where the Work is to be performed and in order to accomplish the Work described in the Contract Documents. Additionally, the General Prime Contractor certifies that it has investigated the site and satisfied itself as to the general and local conditions which affect the Work or its cost, including, but not limited to:
 - 1. Conditions bearing upon transportation, disposal, handling, and storage of materials;
 - 2. The availability of labor, water, electric power, and roads or access;
 - 3. Uncertainties of weather, river stages, tides, or similar physical conditions at the site;
 - 4. The conformations and conditions of the ground; and
 - 5. The character of facilities and equipment as represented by the Contract Documents.
- B. The General Prime Contractor also acknowledges that it has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, and information included in the Contract Documents.
- C. Any failure of the General Prime Contractor to take the actions described and acknowledged in this Article 10 will not relieve the General Prime Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the Work, or for proceeding to successfully perform the Work without additional expense to the State.
- D. The State assumes no responsibility for any erroneous conclusions or interpretations made by the General Prime Contractor based on the information made available by DFD. If an analysis of such data is only meaningful to a person skilled in the geotechnical sciences, then the General Prime Contractor is responsible for, and certifies that it has obtained, such an analysis or has otherwise decided that the data is understandable by it, as presented. The State assumes no responsibility for any understanding reached or representation made concerning conditions which can affect the Work by any of its officers, representatives, or agents before the execution of this Contract, unless that understanding, or representation is expressly stated in the Contract Documents.
- E. If the General Prime Contractor discovers, in the performance of the Work, a subsurface or latent physical condition at the site, including but not limited to possible environmental contamination or hazardous substances, which it did not discover pursuant to this Article 10, then the General Prime Contractor shall promptly, and before the condition is disturbed, give written Notice to DFD. Such Notice shall be subject to the procedures and limitations set forth in Article 20 hereof, entitled "Notice Requirements. The General Prime Contractor shall disclose in such Notice all the facts and circumstances then known to it, including the impact of such condition on the price, time, or quality of the Work remaining to be done.

11. SUBCONTRACTS

- A. The General Prime Contractor must subcontract with all successful MEP Subcontractors identified by DFD. The General Prime Contractor may enter into subcontracts for work other than MEP Subcontractor work, if subcontractors are approved by DFD through the Request for Subcontractor Approval Form. However, the election to subcontract Work shall not relieve the General Prime Contractor from responsibility or liability which it has assumed under this Contract. The General Prime Contractor shall remain liable to the same extent that its liability would attach, as if the Work had been performed by the General Prime Contractor's own employees. If the Specifications require or otherwise designate only one Subcontractor or source of supply for Work required under the Contract Documents, the General Prime Contractor's failure to acquire suitable Contract arrangements with such Subcontractor or source of

supply shall not excuse the General Prime Contractor from full responsibility and liability for any failure or default of such source of supply.

- B. All Non-MEP Subcontractors are subject to DFD approval. DFD may request, or the General Prime Contractor may provide, any of the following information to substantiate the proposed Subcontractors' qualifications or ability to perform the Work. DFD shall consider such information when reviewing the qualifications of proposed Subcontractors to determine whether such qualifications serve the best interests of the Project.
 - 1. The amount of experience completing similar Work to that required by the Contract Documents;
 - 2. The quality of Work the proposed Subcontractor has provided on past Projects;
 - 3. The extent of available staffing and financial resources of the proposed Subcontractor;
 - 4. The General Prime Contractor's intended method of monitoring the proposed Subcontractor's Work;
 - 5. The level of supervision of the Subcontractor's Work which the General Prime Contractor will provide;
 - 6. Any other information regarding the proposed Subcontractor's ability to complete the Work.
- C. Bidders shall submit a completed Request for Subcontractor Approval Form with their bid or within seven days of the general prime contractor bid opening. Submission of a completed Request for Subcontractor Approval Form is an element of responsiveness. Failure to submit this completed form within the above time limits will be considered unresponsiveness and may result in contract award to the next apparent low bidder. When no Subcontractors are anticipated, the General Prime Contractor shall give DFD notice of this fact on the Form within the time limits noted above.
- D. The General Prime Contractor shall not replace any DFD identified or approved Subcontractor or material supplier without written approval of DFD. Any General Prime Contractor request for replacement of a Subcontractor previously approved by DFD shall include the reason(s) for such replacement and all documentation necessary to substantiate such change.
- E. The General Prime Contractor agrees, to the extent practicable, to maintain a list of all Subcontractors and suppliers performing labor or furnishing materials for the project.
- F. The General Prime Contractor shall be fully responsible for all acts and omissions of all Subcontractors and shall be responsible for scheduling and coordinating the Work of all Subcontractors, including MEP Subcontractors, Non-MEP Subcontractors and material suppliers.
- G. Nothing herein shall be construed to create any express or implied Contractual relationship between DFD and any of the General Prime Contractor's MEP Subcontractors, Non-MEP Subcontractors, suppliers or vendors.
- H. Notwithstanding Paragraphs 11.C. and 11.D., the General Prime Contractor shall insert the following mandatory provisions in all subcontracts with Subcontractors s:
 - 1. All provisions of this Article 11
 - 2. Article 26 - Payments to General Prime Contractor
 - 3. Article 27 - Payments by General Prime Contractor
 - 4. Article 32 - Nondiscrimination/Affirmative Action
 - 5. Article 33 - Minimum Wages

The General Prime Contractor shall include the mandatory provisions in Article 12 MEP SUBCONTRACTORS in all MEP subcontracts.

12. MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION (MEP) SUBCONTRACTORS

- A. The General Prime Contractor will offer a subcontract to the successful MEP Subcontractors identified by DFD and included in the General Prime Contractor's bid. This subcontract between a General Prime Contractor and a MEP Subcontractor must include a scope of work clause identical to the scope of work clause included in the Bid Documents and the contract between the General Prime Contractor and the state (see item D below). A General Prime Contractor and an MEP Subcontractor may not enter any agreement in connection with bids submitted that would alter or affect the scope or price of the contracts entered into. This prohibition does not apply to DFD change orders that result in changes to the plans or specifications, or to back charges allowed by the contract. The General Prime Contractor shall base its project schedule on the schedule in the specifications or bid instructions unless otherwise agreed to by the MEP Subcontractor.
- B. **Pursuant to Wis. Stat. §16.855 (14m)(a), The contract entered into between the General Prime Contractor and an MEP Subcontractor must contain all of the following clauses:**

Prompt Payment. (general prime contractor) shall pay (mechanical, electrical, or plumbing subcontractor) in accordance with section 16.855(19)(b), Wisconsin stats, for work that has been satisfactorily completed and properly invoiced by (mechanical, electrical, or plumbing subcontractor). A payment is timely if it is mailed, delivered, or transferred to (mechanical, electrical, or plumbing subcontractor) by the deadline under section 16.855(19)(b), Wisconsin stats.

If (mechanical, electrical, or plumbing subcontractor) is not paid by the deadline in this contract, (general prime contractor) shall pay interest on the balance due from the eighth day after the (general prime contractor) receives payment from the Department of Administration for the work for which payment is due and owing to (mechanical, electrical, or plumbing subcontractor), at the rate specified in section 71.82, Wisconsin stats., compounded monthly. A (mechanical, electrical, or plumbing subcontractor) that receives payment as provided under this contract and that subcontracts with another entity shall pay those subcontractors, and be liable for interest on late payments to those subcontractors, in the same manner as the (general prime contractor) is required to pay the (mechanical, electrical, or plumbing subcontractor) under this contract.

Insurance and Bonds. (mechanical, electrical, or plumbing subcontractor) shall not commence work under this contract until it has obtained all necessary insurance required of (mechanical, electrical, or plumbing subcontractor) in the contract between the (general prime contractor) and the Department of Administration. (mechanical, electrical, or plumbing subcontractor) shall provide a separate 100 percent performance bond and a separate 100 percent payment bond to the benefit of the (general prime contractor) as the sole named obligee. Original bonds shall be given to the (general prime contractor) and a copy shall be given to the Department of Administration no later than 10 days after execution of this contract.

Indemnification. To the fullest extent permitted by law, (mechanical, electrical, or plumbing subcontractor) shall defend, indemnify, and hold harmless (general prime contractor) and its officers, directors, agents, and any others whom (general prime contractor) is required to indemnify under its contract with the department, and the employees of any of them, from and against claims, damages, fines, penalties, losses, and expenses, including but not limited to attorney fees, arising in any way out of or resulting from the performance of the work under this contract, but only to the extent such claim, damage, fine, penalty, loss, or expense: (1) is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of property, including but not limited to loss of use resulting therefrom and is caused by the negligence, or acts or omissions, of (mechanical, electrical, or plumbing subcontractor), its subcontractors, any of their employees, and anyone directly or indirectly employed by them or anyone for whose acts they may be liable, or (2) as related to such claims, damages, fines, penalties, losses, and expense of or against (general prime contractor), results from or arises out of the negligence of the (general prime contractor) or other fault in providing general supervision or oversight of the work of (mechanical, electrical, or plumbing subcontractor) or (3) as related to claims, damages, fines, penalties, losses, and expense against the Department of Administration, arises out of the department's status as owner of the project or project site.

In addition (mechanical, electrical, or plumbing subcontractor) shall defend, indemnify, and hold harmless (general prime contractor) and its officers, directors, agents, and any others (general prime contractor) is required to indemnify under its contract with the department, and the employees of any of them, from any liability, including

liability resulting from a violation of any applicable safe place act, that (general prime contractor) or the state incurs to any employee of (mechanical, electrical, or plumbing subcontractor) or any third party where the liability arises from a derivative claim from said employee, when the liability arises out of the failure of the (general prime contractor) or the state to properly supervise, inspect, or approve the work or work area of (mechanical, electrical, or plumbing subcontractor), but only to the extent that the liability arises out of the acts or omissions of (mechanical, electrical, or plumbing subcontractor), its employees, or anyone for whom (mechanical, electrical, or plumbing subcontractor) may be liable, or from (mechanical, electrical, or plumbing subcontractor's) breach of its contractual responsibilities or arises out of (general prime contractor's) negligence or other fault in providing general supervision or oversight of (mechanical, electrical, or plumbing subcontractor's) work or arises out of the Department of Administration's status as owner of the project or project site. In claims against (general prime contractor) or the state by an employee of (mechanical, electrical, or plumbing subcontractor) or its subcontractors or anyone for whose acts (mechanical, electrical, or plumbing subcontractor) may be liable, the indemnification obligation of this paragraph is not limited by a limitation on amount or type of damage, compensation, or other benefits payable by or for the (mechanical, electrical, or plumbing subcontractor) subcontractors under workers compensation act.

Except as identified above, the obligations of (mechanical, electrical, or plumbing subcontractor) under this indemnification do not extend to the liability of (general prime contractor) and its agents or employees arising out of (1) preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs, or specifications; (2) the giving of or failure to give directions or instructions by the (general prime contractor) or the Department of Administration or their agents or employees provided the giving or failure to give is the cause of the injury or damage; or (3) the acts or omissions of other subcontractors.

Retainage. Retainage shall occur and be in amounts and on a schedule equal to that in the contract between (general prime contractor) and the Department of Administration.

- C. Pursuant to Wis. Stat. § 16.855(19)(b), Retainage between General Prime Contractor and MEP Subcontractors is governed as follows:

As the work progresses under any MEP subcontract for construction of a project, the general prime contractor shall, upon request of a subcontractor, pay to the subcontractor an amount equal to the proportionate value of the subcontractor's work properly completed, less retainage. The retainage shall be an amount equal to not more than 5 percent of the subcontractor's work completed until 50 percent of the subcontractor's work has been completed. At 50 percent completion, no additional amounts may be retained, and partial payments shall be made in full to the subcontractor unless the department certifies that the subcontractor's work is not proceeding satisfactorily. At 50 percent completion or any time thereafter when the progress of the subcontractor's work is not satisfactory, additional amounts may be retained but the total retainage may not be more than 10 percent of the value of the work completed. Upon substantial completion of the subcontractor's work, any amount retained shall be paid to the subcontractor, less the value of any required corrective work or uncompleted work. All payments the general prime contractor makes under this paragraph shall be within 7 calendar days after the date on which the general prime contractor receives payment from the department.

- D. Pursuant to Wis. Stat. § 16.855(14m)(b), the MEP Subcontracts must include a scope of work clause that is identical to the scope of work clause on which the MEP Subcontractor bid. The following Scope of Work language shall be included in the contracts between the General Prime Contractor and MEP Subcontractors:

Scope of Work. The MEP Subcontractor scope of work is identical to the General Prime Contractor scope of work included in these bidding and contract documents. By submitting and signing a bid, all bidders have examined all of the Bidding Documents listed in the Table of Contents of the project specifications. The successful bidders will be required to do all work which is shown on the drawings, mentioned in the specifications, or reasonably implied as necessary to complete the division of work bid for this project.

13. SCHEDULING AND COORDINATION OF WORK

- A. The General Prime Contractor has the full and complete responsibility for the accomplishment of all Work within the specified time indicated in the Contract Documents, except where the Contract Documents explicitly and specifically place a limited duty for completion on the State.
- B. DFD and the General Prime Contractor hereby commit themselves to good faith negotiation, coordination, and cooperation to assure the timely completion of the Project. By accepting this Contract, the General Prime Contractor agrees that scheduling, coordination, and monitoring activity for All Work will be placed under the direct control and supervision of a person experienced in construction scheduling, means and methods. If such experience and knowledge must be obtained by Contracting with a separate scheduling consultant, the entire cost of such consultant shall be borne by the General Prime Contractor. Additionally, the General Prime Contractor fully agrees to cooperate in all respects with all Subcontractors, including MEP Subcontractors, Non-MEP Subcontractors, and suppliers to provide all data required, and shall coordinate the activities of its own Work forces and the Work forces of the Subcontractors, in such manner and at such time as to not cause a delay in the Project.
- C. The General Prime Contractor and the State shall be given the opportunity to schedule its own Work as conveniently as is consistent with the overall needs of the Project Schedule.
- D. The General Prime Contractor shall afford the State and any other parties performing Work on the Project, reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities at the site.
- E. The Project Schedule shall incorporate all activities, events, and milestones required for successful Project completion within the allowable time for completion specified in the Contract Documents. The General Prime Contractor shall prepare a breakdown of all Work activities or events, whether the activities are to be performed by the General Prime Contractor's own forces, those of Subcontractors, including MEP Subcontractors and Non-MEP Subcontractors, or the State, indicating the proposed duration and sequencing of such activities for successful completion of the Project within the allowable time specified in the Contract Documents. The General Prime Contractor shall also identify whether any Work activity or event is dependent on the Work of its own forces or with those of the State. The failure to list any activity or to perform any other duty required by or incident to that required by these General Conditions shall not be the basis of a claim for adjustment of any provision of this Contract, or of any other type of claim whatsoever.
- F. The General Prime Contractor shall, within fourteen (14) calendar days from the Notice to Proceed, develop and publish a Project Schedule for the first sixty (60) calendar days of the Project. The completed Project Schedule, for all Work activities through Project completion, shall be developed and published within this sixty (60) day period. **Pursuant to 16.855 (14m)(d), the General Prime Contractor must base this Project Schedule on the schedule that the MEP Subcontractors and General Prime Contractors bid on (in the specifications or bid instructions), unless otherwise agreed to by the MEP Subcontractor.** No provision of this Contract shall be construed to relieve the General Prime Contractor of this requirement. Monthly updates of the schedule shall be developed, analyzed and published and each subsequent update shall include a breakdown of major activities to be performed by each separate Contractor or entity, and all activities required for development, monitoring, and updating the Project Schedule.
- G. If the General Prime Contractor's Work depends upon construction or operations by the State, the General Prime Contractor shall, prior to proceeding with that portion of the Work, promptly give Notice to DFD of any apparent deficiencies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the General Prime Contractor to so report shall constitute an acknowledgment that the State's completed or partially completed construction is fit and proper to receive the General Prime Contractor's Work, except as to defects not then reasonably discoverable.
- H. The General Prime Contractor shall identify forthwith any critical event which will require DFD to act or to refrain from acting, or critical time periods within which the State must complete activities or Work for which DFD is responsible under the Contract. Timely Notice of any such identified event or time period shall be given to DFD. The giving of such Notice is a CONDITION PRECEDENT to the creation of any duty of DFD to take any action or to refrain from taking any action. The failure of the General Prime Contractor to give such Notice forthwith shall

thereafter bar and preclude any claim by the General Prime Contractor for adjustment of any Contract provision or claim predicated on the breach of any obligation by DFD.

- I. Where any Work activity required for completion of the Project, is completed in less time than that required, anticipated, or otherwise allowed by the Project Schedule, the unused time, hereinafter called Float, shall belong to the Project, to be used by the General Prime Contractor as the Project needs determine, including but not limited to providing additional time for completion of any other Work activities required for completion of the Project. Float shall not be considered owned, subject to the exclusive use, or management by any of the interested participants. No claim against DFD or the General Prime Contractor shall be made by any party for the loss of Float time.
- J. The General Prime Contractor shall be independently responsible for resolving any time related matters with Subcontractors, including MEP Subcontractors, Non-MEP Subcontractors, suppliers, or others who may furnish supplies or services on the Project, as a result of Contractual relations with the General Prime Contractor. No liability shall attach to the State, for the failure of any party to carry out the coordination and scheduling responsibilities which they have assumed under this Article 13.
- K. The General Prime Contractor is hereby put on Notice that failure to furnish data or cooperate in good faith is a MATERIAL BREACH OF CONTRACT and may be the basis for a Termination for Default under the procedures set forth in these General Conditions. In such cases DFD, in addition to, and not in lieu of the right to termination for default, may acquire the services of a scheduling specialist to perform any such duties and charge the cost thereof to the General Prime Contractor. In the event that DFD is required to acquire any replacement scheduling services, the General Prime Contractor shall conform to any revised schedule resulting therefrom.
- L. In addition to the criteria set forth in these General Conditions, the full and complete performance of duties required to be performed under this Article 13, is a CONDITION PRECEDENT to the right of the General Prime Contractor to payment of any sums due.. In the event of any delays by the General Prime Contractor or other breach hereof which gives rise to penalties and/or damages to the State, then in any such event DFD may offset such penalties and damages against the sums due or to become due the General Prime Contractor hereunder.
- M. The bonds furnished to secure these commitments shall be applicable to each and every one of these time and scheduling commitments and may be enforced by any person or entity who is entitled to enforce the bonds as a matter of law and who is damaged as a result of breach of these commitments by the General Prime Contractor on the Project to which these provisions apply. The State shall not be responsible for the default of the General Prime Contractor and the remedies of any damaged party shall be limited to an action by the damaged party against the defaulting General Prime Contractor and/or its bonding company, in addition to any other coverage for the bond.
- N. The General Prime Contractor is cautioned that the reporting requirements specified in or for the Schedule Requirements, are in addition to any such similar requirements set forth in the Articles hereof entitled, "REPORTS, RECORDS AND DATA", "QUALITY CONTROL & INSPECTION, and "NOTICE".
- O. In the event it becomes necessary to interpret this Article 13, the construction or interpretation shall strive to achieve the purpose for which this Article 13 was designed to accomplish, i.e. timely, effective and efficient performance of the Work under the Contract within the allowable time identified in the Contract Documents, and at no extra cost or inconvenience to any party, if at all possible.

14. GENERAL PRIME CONTRACTOR'S OBLIGATIONS AND SUPERINTENDENCE

- A. The General Prime Contractor shall provide and pay for all materials, labor, tools, equipment, transportation, and superintendence necessary to execute, complete, and deliver the Work within the specified time.
- B. Where technically and economically feasible, the General Prime Contractor shall use the least hazardous materials, equipment, and processes to execute the Work. If materials are used which are considered an OSHA hazardous material, the General Prime Contractor shall comply with all OSHA rules and regulations.
- C. No materials or supplies which are to become part of the Work shall be purchased by the General Prime Contractor or by any Subcontractor, including MEP Subcontractor or Non-MEP Subcontractor subject to any chattel mortgage, conditional sale contract, or other agreement by which a security interest is retained by the seller. Upon Substantial

Completion of the Work, good title to all materials and supplies incorporated into the Work shall be conveyed to the State, free and clear of all liens and encumbrances.

- D. General Prime Contractor's obligation for inspection and quality control shall be as provided for in Article 15, entitled "QUALITY CONTROL & INSPECTION", of these General Conditions.
- E. General Prime Contractor's obligation for scheduling of Work and coordination with other entities performing Work required for the completion of the Project shall be as provided for in Article 13, entitled "SCHEDULING AND COORDINATION OF WORK", of these General Conditions.
- F. Any Work necessary to be performed after regular working hours, on Sundays, or Legal Holidays, and for which the General Prime Contractor is responsible, shall be performed without additional expense to the State.
- G. The General Prime Contractor shall furnish, erect, maintain, and remove such temporary Works as identified in the General Requirements of the Contract.
- H. The General Prime Contractor shall give continuous personal superintendence to the Work and its performance at the site, or shall employ a construction superintendent or foreman, experienced in Work of the character covered by the Contract Documents, who shall have full authority to act for the General Prime Contractor.
- I. The presence and observation of the Work by DFD's Project Representative shall not relieve the General Prime Contractor of any obligations.
- J. The premises and surrounding area shall be kept reasonably free from accumulation of waste material or rubbish as specified in the General Requirements of the Contract.
- K. Unused and discarded materials shall be managed or disposed of as specified in the General Requirements of the Contract.
- L. If, in the opinion of DFD, the actions or Work of an employee of the General Prime Contractor or a Subcontractor, including MEP Subcontractor or Non-MEP Subcontractor are judged to be unsatisfactory, careless, incompetent, unskilled, in violation of any environmental or safety standards, or otherwise objectionable, the employee shall be removed from the Project or other corrective action taken upon Notice from DFD.

15. QUALITY CONTROL & INSPECTION

- A. The General Prime Contractor shall, except where a provision of the Contract Documents explicitly states to the contrary, have the full, complete, and absolute responsibility and obligation for insuring that the Work performed by the General Prime Contractor and Subcontractors, including MEP Subcontractors, and Non-MEP Subcontractors strictly conforms to the requirements set forth in the Contract Documents. The General Prime Contractor shall maintain an adequate inspection and quality control system and shall perform such inspections as will ensure that the Work performed under this Contract conforms to the requirements of the Contract Documents.
- B. At the Pre-Construction Meeting, the General Prime Contractor shall provide DFD a full description of the General Prime Contractor's quality control and inspection system and method of implementation.
- C. Prior to the start of significant on-site work by any trade, DFD's Project Representative, the General Prime Contractor's Superintendent and the Subcontractor's foremen, including the MEP Subcontractor foremen and Non-MEP Subcontractors' foremen, shall conduct a pre-installation conference. The purpose of the meeting is to review and discuss Contract requirements applicable to the work, samples required, level of quality necessary, and find answers to any questions that may arise. Such meeting is in addition to regularly-scheduled progress meetings and will be arranged on-site by DFD's Project Representative.
- D. The General Prime Contractor shall maintain complete inspection records and test data to ensure that quality of the Work is in strict compliance with the terms of the Contract Documents. These records shall be available to DFD's Project Representative at all reasonable times and places. The doctrine of "substantial conformity" to the quality

requirements of the Contract Documents, shall have no application, unless DFD accepts the Work in accordance with Paragraph 15.F

- E. DFD reserves the right to conduct its own quality assurance verification, and to observe, inspect, and /or conduct tests relative to General Prime Contractor and Subcontractor performance. If, when conducting its own quality assurance program, DFD determines that the Work or a portion thereof does not comply with requirements of the Contract Documents, DFD shall attempt to notify the General Prime Contractor of such deficiencies as soon as practicable. However, DFD's exercise of rights under this provision does not:
 - 1. Relieve the General Prime Contractor of the responsibility for providing adequate inspection and quality control measures or the proper documentation of the occurrence of the events required to be tested or monitored in the performance of the Work required by the Contract Documents; and shall provide no basis for waiver or estoppel claims to be asserted against the State;
 - 2. Relieve the General Prime Contractor of responsibility for damage to or loss of the material before acceptance;
 - 3. Constitute or imply acceptance on the part of DFD;
 - 4. Affect the continuing rights of the State after acceptance of the completed Work, except as specifically stated to the contrary, in the Contract Documents.
- F. The presence or absence of DFD's Project Representative does not relieve the General Prime Contractor from any Contract requirement. If the General Prime Contractor desires waiver of any technical or Contract requirement or any other deviation from the strict requirements of the Contract Documents, a specific request for such waiver or deviation must be made to DFD's Project Representative for consideration.
- G. The General Prime Contractor shall, without charge, replace or correct Work found not to conform to the Contract Document requirements, unless in the public interest, DFD agrees to accept the non-conforming Work with an appropriate adjustment in the Contract price thereof. Such acceptance of non-conforming Work shall, whether the determination is to be made at the time of final completion or during the performance of Work, be based upon a determination by DFD that the deviation from Contract Document requirements does not adversely affect the integrity of completed Work.
- H. When DFD directs the General Prime Contractor to replace or correct rejected Work and the General Prime Contractor fails to take such action within the time period identified by DFD, DFD may:
 - 1. Terminate this Contract for default under Article 29, hereof entitled "DFD'S RIGHT TO TERMINATE CONTRACT", or
 - 2. Suspend or stop the Work under Article 28, hereof entitled "DFD'S RIGHT TO SUSPEND, STOP, OR COMPLETE WORK".
- I. If, before acceptance, DFD decides to examine already completed Work by removing it, or removing other Work to expose it, the General Prime Contractor shall promptly furnish all necessary facilities, labor, and material necessary to accomplish the examination. If the Work is found to be defective or non-conforming in any material respect due to the fault of the General Prime Contractor or Subcontractor, or otherwise fails, in the judgment of DFD, to meet the requirements set forth in Paragraph 15.F., the General Prime Contractor shall be responsible for all costs associated with replacement or repair of the defective Work, including the costs of removing or tearing the Work out and satisfactory reconstruction. However, if the Work is found to meet Contract requirements, DFD shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the Work was thereby delayed, an extension of time.
- J. Costs caused by defective construction shall be borne by the General Prime Contractor.
- K. Unless otherwise specified in the Contract, DFD shall accept, as reasonably as practicable after completion and inspection, all Work completed under the Contract or that portion of the Work which DFD determines can be accepted separately.

16. SUBMITTALS

- A. The General Prime Contractor shall submit at the Pre-Construction Meeting a register listing all known submittals required for the project.
- B. When the General Prime Contractor makes a "Submittal" to describe how it will fulfill its responsibility under this Contract by submitting Shop Drawings, Samples, Cuts, Catalogues, Models, Mockups, or other preliminary information, the following provisions shall apply:
 - 1. THE GENERAL PRIME CONTRACTOR NOTES THE CONSPICUOUS NATURE OF THIS ARTICLE and agrees that these provisions are material provisions and are to be enforced, in the event of controversy, in such a manner as to place upon the General Prime Contractor the full, complete, and total responsibility for the submittal's conformance with the requirements of this Contract, and suitability or usability of preliminary submissions by the General Prime Contractor, without regard to any DFD action or failure to act;
 - 2. All Submittals and supporting information shall be delivered to a party designated by DFD, who shall act on any such Submittal within ten (10) working days or notify the General Prime Contractor in writing, of the time required for such action if greater than the aforementioned ten (10) day period. Such designation shall take place at the Project Pre-Construction Meeting. Review of the Submittals for conformance with requirements of the Contract Documents shall be completed by the party responsible to DFD for Project design. A copy of all such submittal and transmittal forms shall also be sent to DFD's Project Representative;
 - 3. The General Prime Contractor shall make submittals in a timely fashion to assure completion of the entire Project within the allowable time specified in the Contract Documents. The timing of such Submittals shall be subject to the provisions of Paragraphs 13.C. and 13.H.;
 - 4. Each Submittal by the General Prime Contractor shall contain the cover page included in the Specifications. Such cover page shall be signed by a representative of the General Prime Contractor responsible for review of the Submittal to assure compliance with requirements of the Contract Documents.
- C. Submittals shall be provided in response to requests for submittals by DFD, or whenever required by the Contract Documents.
- D. If the General Prime Contractor submits for approval items which do not strictly comply with the design requirements of Contract Documents, the General Prime Contractor shall provide all engineering or design information necessary for complete evaluation of the Submittal by DFD. If it is determined by the General Prime Contractor or DFD that the services of a professional consultant, engineer or architect are required to provide such information, the General Prime Contractor shall acquire such services at its own expense.
- E. If the General Prime Contractor believes that requirements of the Contract Documents are in conflict with the manufacturer's recommended method of installation or application of specified materials, products, or systems, the General Prime Contractor shall indicate such possible conflicts at the time of submittal.

17. EQUALS AND SUBSTITUTIONS

- A. It is not the intention of DFD to limit or restrict competition by the use of any "Brand Name", reference to a particular manufacturer, process, technique, catalog number or other identifying information. Such proprietary specifications or use of "Brand Names" are intended to establish a level of quality or the minimum essential requirements to which the General Prime Contractor must conform, unless more explicit restrictions are stated to apply.
- B. When the Contract Documents list performance or functional characteristics in connection with Work to be performed, these characteristics are mandatory for reasons of design. Use of any "Equal" or "Substitution" shall be subject to the prior written approval of DFD.
- C. Material, equipment, or processes offered for use as an "Equal" or "Substitution" may be proposed by the General Prime Contractor in writing. Such proposals shall guarantee the proposed "Equal" or "Substitution" to be capable of

performing the duties of the originally specified material, equipment, or process. DFD shall respond to any such proposal as soon as practicable, but in no case later than seven (7) working days after receipt of such proposal.

- D. It shall be the sole responsibility of the General Prime Contractor to provide all documentation, regardless of type or quantity, to clearly establish the qualifications of items proposed as "Equals" or "Substitutions" under this Article 17. If the value of the "Equal" or "Substitution" is less than the item specified in the Contract Documents, then an equitable reduction of the price of the Contract shall be made.
- E. When "Equals" or "Substitutions" are approved by DFD and incorporated into the Project by the General Prime Contractor, all costs incurred to 1) correct deficiencies in items, 2) provide for installation or hookup, or 3) to achieve performance specified in the Contract Documents, will be borne by the General Prime Contractor.
- F. Any substitute material or equipment installed by the General Prime Contractor without approval of DFD shall be subject to immediate removal and all costs required to conform to the Contract Documents shall be borne by the General Prime Contractor.
- G. The General Prime Contractor shall assume all liability and responsibility for any changes in the Work or additional Work required to accommodate use of proposed and approved "Equals" or "Substitutions." DFD's approval of such "Equals" or "Substitutions" does not relieve the General Prime Contractor from the obligation to pay all additional costs resulting from their inclusion in the Work, even if additional costs or Work become apparent after execution of the change or installation of the "Equal" or "Substitution." The General Prime Contractor's liability shall include payment of any additional costs incurred by the State, made necessary by, or directly connected to, such changes.

18. CHANGES IN THE WORK

- A. Except in cases of emergency, no changes in the Work required by the Contract Documents may be made by the General Prime Contractor without having prior approval of DFD.
- B. DFD may at any time, without invalidating the Contract and without Notice to Sureties, order changes in the Work by written Change Order or Field Order. Such changes may include additions and/or deletions.
- C. Where DFD desires to make changes in the Work through use of written Change Order, the following procedures shall apply:
 - 1. If requested by DFD, the General Prime Contractor shall prepare and submit a detailed proposal, including all cost and time adjustments to which the General Prime Contractor believes it will be entitled if the change proposed is incorporated into the Contract. DFD shall be under no legal obligation to issue a Change Order for such proposal;
 - 2. The parties shall attempt in good faith to reach agreement on the adjustments needed to the Contract to properly incorporate the proposed change(s) into the Work. In the event that the parties agree on such adjustments, DFD may issue a Change Order and incorporate such changes and agreed to adjustments, if any;
 - 3. In some instances, it may be necessary for DFD to authorize Work or direct changes in Work for which no final and binding agreement has been reached and for which unit prices are not applicable. In such cases the following shall apply:
 - a. Upon written request by DFD, the General Prime Contractor shall perform the proposed Work;
 - b. The cost of such changes shall be determined in accordance with subparagraph 18.I.3..
 - c. In the event agreement cannot be accomplished as contemplated herein, DFD may authorize the Work to be performed by State forces or to hire others to complete the Work. Such action on the part of the State shall not be the basis of a claim by the General Prime Contractor for failure to allow it to perform the changed Work.

- D. Where changes in the Work are made by DFD through use of a Field Order, the General Prime Contractor shall as soon as practicable, and in no case later than ten (10) working days from the receipt of such order, unless another time period has been agreed to by both parties, give DFD written Notice, stating:
1. The date, circumstances and source of the Field Order; and,
 2. The cost of performing Work described by such Order, if any; and,
 3. Effect of the order on the required completion date of the Project, if any.
- E. The giving of each Notice by the General Prime Contractor as prescribed by this Article 18, shall be a CONDITION PRECEDENT to liability of the State for payment of any additional costs incurred by the General Prime Contractor in implementing changes in the Work. Under this Article 18, no order or statement of the State shall be treated as a Change Order, or shall entitle the General Prime Contractor to an equitable adjustment of the terms of this Contract or damages for costs incurred by the General Prime Contractor on any activity for which the Notice was not given.
- F. In the event Work is required due to an emergency as described in Article 7.B., the General Prime Contractor must request an equitable adjustment as soon as practicable, and in no case later than ten (10) working days of the commencement of such emergency.
- G. All General Prime Contractor requests for equitable adjustment shall be submitted to DFD's Project Representative in written form. Such requests shall set forth with specificity the amount of and reason(s) for the proposed adjustment and shall be accompanied by supporting information and documents. The review, resolution, and payment of such requests shall be governed by Article 30.
- H. No adjustment of any kind shall be made to this Contract, if asserted by the General Prime Contractor for the first time, after the date of final payment.
- I. When DFD makes changes in the Work through written Change Order or Field Order, an amount to be added to or deducted from the Contract shall, at the sole discretion of DFD, be calculated using one of the following methods:
1. By unit prices stated in the Contract Documents or subsequently agreed upon by DFD and the General Prime Contractor; or
 2. By a lump sum agreed upon by the General Prime Contractor and DFD, which includes and is limited to the following:
 - a. **LABOR:** Actual labor rate includes the base rate, taxes, insurance and fringe benefits required by agreement or custom. Unit labor is the labor time anticipated to be expended to install the corresponding unit of actual materials, as taken from the appropriate column of a DFD pre-approved current national manual of labor units. Labor cost is the labor hours approved by DFD multiplied by the DFD pre-approved composite hourly labor rates;
 - b. **MATERIAL:** Actual material cost is the amount paid or to be paid by the General Prime Contractor for materials, supplies and equipment entering permanently into the Work, including cost of transportation and applicable taxes. This cost shall be substantiated by the Vendor/Supplier's verified invoices/quotes or by using a DFD approved current national pricing service, lowest column price, multiplied by 0.75. The cost shall not exceed the usual and customary cost for such items available in the geographical area of the project. DFD shall have the option of using either or both methods of substantiation to determine the cost to be used;
 - c. **LARGE TOOLS AND MAJOR EQUIPMENT:** Large tools and major equipment are those with an initial cost greater than \$1,000, whether from the General Prime Contractor or other sources. Allowable rental rate is the lesser of the General Prime Contractor's actual rental schedule pre-approved by DFD or a DFD-approved nationally accepted manual of equipment rental rates, lowest column price, multiplied by 0.75. The rental rate shall not exceed the usual and customary amount for such items available in the geographical area of the project. Tool and equipment use time allowed is only for the

extra Change Order work. Rental cost is the above tool and equipment time approved by DFD multiplied by the DFD pre-approved rental rates also described above. When large tools and equipment needed for Change Order work are not already at the job site, the actual labor cost to get them there is also reimbursable;

- d. BOND COST: The cost is the actual rate paid for the performance and payment bonds;
 - e. SUBCONTRACTOR COSTS: Subcontractor costs (including MEP Subcontractor and Non-MEP Subcontractor costs) are for those subcontracted specialties required to complete the Change Order work, with maximum markups as outlined hereinafter;
 - f. OVERHEAD AND PROFIT ALLOWANCE: The maximum allowable markup for overhead and profit markup on Change Order proposals shall not exceed 15 percent total. The General Prime Contractor markup of change order work done by Subcontractors shall not exceed 7 ½ percent. When the value of a Change Order proposal exceeds \$30,000, a declining scale will be used to negotiate the allowable combined overhead and profit margin. Where Change Order proposals involve a credit only, a reasonable allowance for overhead and profit are properly included as part of the downward adjustment for a deductive change exceeding \$15,000. The amount of such allowance is subject to negotiation.
 - g. EXCLUSIONS: All other Change Order expenses are part of the overhead and profit allowance which are not reimbursable as separate items and include the following:
 - (1) CHANGE ORDER PREPARATION: All costs associated with the processing of the Change Order are included in the overhead and profit allowance;
 - (2) DESIGN, ESTIMATING, AND SUPERVISION: All such efforts, unless specifically requested by DFD as additional Work to be documented as a Change Order proposal or portion thereof, is included in the overhead and profit allowance;
 - (3) INSTALLATION LAYOUT: The layout required for the installation of material and equipment, and installation design, is the responsibility of the General Prime Contractor and is included in the overhead and profit allowance;
 - (4) SMALL TOOLS AND SUPPLIES: The cost of small hand tools with an initial cost of \$1,000 or less, along with consumable supplies and expendable items such as drill bits, saw blades, gasoline, lubricating or cutting oil, and similar items, is included in the overhead and profit allowance;
 - (5) GENERAL EXPENSE: The general expense, which is those items that are a specific job cost not associated with direct labor and material, is included in the overhead and profit allowance;
 - (6) RECORD DRAWINGS: The preparation of record or as-built drawings required is included in the overhead and profit allowance;
 - (7) OTHER COSTS: a) All association dues, assessments, and similar items are included in the overhead and profit allowance. b) All education, training, and similar items are included in the overhead and profit allowance. c) All drafting and/or engineering, unless specifically requested by DFD as additional Work to be documented as a Change Order proposal or portion thereof, is included in the overhead and profit allowance. d) All other cost items such as, but not necessarily limited to, review, coordination, estimating, and expediting, relative to Change Order proposals, are associated with field and office supervision and are included in the overhead and profit allowance.
3. By segregating the cost for Work performed and monitoring such costs. These costs shall be recorded daily, reported as a part of the General Prime Contractor's daily report procedure, and certified by DFD's Project Representative. Such costs shall be limited to those identified in subparagraph 18.I.2., except that actual rather than estimated labor expended and material installed shall be used in determining the cost adjustment.
- J. The General Prime Contractor shall provide DFD with costs for all proposed Change Orders as outlined in the "Procedures for the Change Order Proposal" document, to be provided by DFD to the General Prime Contractor at the Pre-construction meeting. Typical labor rates to be used shall be provided by the General Prime Contractor to DFD no later than submittal of the first payment request.

- K. The completion date is determined by DFD. The schedule, however, is the responsibility of the General Prime Contractor. Time extensions for extra Work will be considered when a schedule analysis shows that the Change Order places the Work beyond the completion date stated in the Notice To Proceed. Unless the cumulative time extensions for extra Work places the Work beyond the original completion time specified in the Instructions to Bidders, all extended overhead costs are included in the overhead and profit allowance. If significant scope changes occur which places the extra Work beyond the original completion time specified in the Instructions to Bidders, actual additional costs will be considered in accordance with Article 30, CLAIMS.

19. REPORTS, RECORDS AND DATA

- A. The General Prime Contractor shall submit to DFD's Project Representative daily Work activity reports for each day on which Work is performed by any employee or entity for which the General Prime Contractor is responsible. Such reports shall include all relevant data concerning the progress of Work activities the General Prime Contractor and Subcontractors are responsible for and the effect of that activity on the time of performance of the Contract or the cost thereof.
- B. Daily Work activity reports shall be completed and signed by the General Prime Contractor's Job Superintendent or other on-site representative authorized by the General Prime Contractor to make such reports, who shall be personally responsible for assuring that each such report is current, accurate and complete. The signature of the General Prime Contractor's representative shall constitute a warranty to DFD that, after suitable inquiry, to the best of their knowledge and belief, all such data is current, accurate and complete as of the date of the report.
- C. The General Prime Contractor shall submit to DFD's Project Representative schedules of quantities and costs, progress schedules, wage rates, reports, estimates, invoices, records and other data as DFD may request concerning Work performed or to be performed under this Contract if DFD determines such information is needed to substantiate Change Order proposals, claims, or to resolve disputes.

20. NOTICE REQUIREMENTS

- A. Except as otherwise expressly provided in the Contract Documents, all notices, demands and other communications that are required to be made or delivered to DFD shall be signed by or on behalf of the General Prime Contractor, and shall be deemed fully made and effective immediately upon presentation to DFD's Project Representative or the deposit thereof in the United States mail, postage prepaid and addressed to DFD's Project Representative.
- B. The General Prime Contractor's presentation to DFD's Project Representative or mailing of such Notice to DFD's Project Representative is a CONDITION PRECEDENT to any liability of DFD for any actual or alleged breach of DFD's contractual obligations hereunder. The General Prime Contractor's failure to give such written Notice in the manner and time prescribed by the Contract Documents shall result in the waiver of any and all claims, demands and causes of action that the General Prime Contractor may have against DFD arising from or in connection with the actual or alleged breach.

21. TIME FOR COMPLETION OF THE PROJECT

- A. It is hereby understood and mutually agreed, by and between the General Prime Contractor and DFD that the time for completion of the Work required by the Contract Documents is an ESSENTIAL CONDITION of this Contract.
- B. The General Prime Contractor agrees that the Work required by the Contract Documents will be prosecuted regularly and diligently at a rate of progress that will ensure its full completion within the time specified in the Contract Documents. It is expressly understood and agreed, by and between the General Prime Contractor and DFD, that the specified time period for completion of the Work described in the Contract Documents is a reasonable time for the completion of the Work, taking into consideration the average weather conditions and usual industrial conditions prevailing in the locality in which the Work is to be completed.
- C. When events occur which, in the opinion of the General Prime Contractor, prevent completion of the Project within the time period allowed by the Contract Documents, the General Prime Contractor shall request an extension of the specified time for completion. Such request shall include the reasons for delay, the amount of time extension being

requested, and any cost(s) associated with the delay. All such requests shall be made in writing and delivered to DFD's Project Representative within ten (10) working days from the beginning of such delay, or within ten (10) working days from the time when the circumstance with potential for delay becomes reasonably known to the General Prime Contractor, whichever is earlier. DFD shall act on such requests as soon as practicable and notify the General Prime Contractor of DFD's decision.

- D. If any activity is delayed, or anticipated to be delayed, thereby delaying the completion of the entire Project, the General Prime Contractor shall have the right to take action as may be necessary to recapture any delay. Such action shall include, but not be limited to:
 - 1. Increase in staffing
 - 2. Increase in shifts, hours of Work, or number of days of Work
 - 3. Use of available float
 - 4. Changing the sequence of Work activities
- E. Costs caused by delays or improperly timed activities shall be borne by the party responsible therefor, and Change Orders, as deemed appropriate by DFD, shall be issued in accordance with Article 18 of these General Conditions.
- F. Costs for acceleration of Work activities to allow completion of the Project in less time than that allowed by the Contract Documents shall be borne by the party requesting such acceleration or early completion. No claim for delay shall be valid against DFD for compensation for delayed completion which extends completion beyond the early finish date, but which does not continue beyond the stated time for completion as set forth in the Contract.
- G. Where abnormal weather conditions may have substantially contributed to the delay of Project completion, such determination shall only be made by DFD upon written request by the General Prime Contractor, and by comparing the total season in which such weather occurs with the average of the previous five years. Where DFD determines that weather has substantially delayed Work, thereby delaying completion of the Project within the time specified in the Contract Documents, DFD shall extend the allowable time for completion an amount equal, in the opinion of DFD, to the delay caused by such weather conditions. Extension(s) in the allowable time for completion, when granted by DFD as a result of abnormal weather conditions, shall not be cause for any request for additional compensation by the General Prime Contractor.
- H. Where, under the Contract, DFD extends the amount of time specified for completion of the Project, the new time limit fixed by such extension shall be the essence of this Contract.
- I. Time extensions and associated adjustments in the Contract Documents which are implemented by, or based on Change Orders and Field Orders for which an overhead allowance would otherwise be permitted hereunder, shall not include any allowance for extended and unabsorbed overhead costs.
- J. Permitting the Work or any part of it to continue after the time fixed for its completion, or after the date to which the time for completion may have been extended, shall in no way operate as a waiver on the part of DFD, of any of DFD's rights under the Contract or a waiver of any default by the General Prime Contractor.
- K. If the General Prime Contractor fails to complete the Work within the time specified in the Contract and such failure is due to reasons which were not beyond the reasonable control of the General Prime Contractor or if the General Prime Contractor fails to complete the Work within the time specified in the Contract and fails to make the written request as provided for in Paragraph 21(C), then in any such event the General Prime Contractor shall pay to DFD actual damages. When such damages can be reasonably predetermined, the amount will be indicated in the Supplementary General Conditions.
- L. If DFD terminates the Contract, or suspends or stops Work in accordance with Paragraphs 28.B. or 29.A. due to the fault of the General Prime Contractor, the damages described in Paragraph 22.M shall be assessed for each day (or any part thereof) such Work is stopped on the Project. If DFD does not elect to terminate the Contract or to suspend or stop the Work, the damages shall be assessed for each day of delay in Substantial Completion.

- M. Nothing contained herein shall be construed as limiting the right of the State to recover actual damages sustained as a result of any delay by the General Prime Contractor which exceed the amounts specified in the Supplementary General Conditions.
- N. DFD may, at its discretion, waive damages due the State, or any portion thereof.

22. USE AND POSSESSION PRIOR TO COMPLETION

- A. DFD shall have the right to authorize possession or use of any completed or partially completed part of the Work. Before the State takes possession or uses any part of the Project:
 - 1. DFD and the General Prime Contractor shall prepare a list of items of Work remaining to be performed or corrected on those portions of the Project that the State intends to take possession of or use;
 - 2. Failure to include on this list any item of Work clearly required to be performed by the General Prime Contractor shall not relieve the General Prime Contractor of responsibility for complying with the terms of the Contract;
 - 3. The State's possession or use shall not be deemed an acceptance of any Work under the Contract Documents.
- B. While the State has such possession or use, the General Prime Contractor shall be relieved of the responsibility for loss or damage to the Work resulting from the State's possession or use.

23. SUBSTANTIAL COMPLETION

- A. Prior to the General Prime Contractor's request for final inspection by DFD, the General Prime Contractor shall conduct an inspection to determine if building systems are functional, Work activities complete, and the Work product is in strict accordance with the requirements of the Contract Documents. If, in the course of this inspection, items are identified which are in need of repair, replacement, correction, or completion, the General Prime Contractor shall make every attempt to complete or correct those items prior to any request for DFD inspection of the Work or Certification of Substantial Completion.
- B. When the General Prime Contractor considers that the Work, or a designated portion thereof, is Substantially Complete, the General Prime Contractor shall provide written Notice and Request for Inspection to DFD. Such Notice shall include a list of all known incomplete and non-conforming work along with a schedule for completing each item as appropriate. Upon the receipt of the General Prime Contractor's Notice, DFD will make an inspection to determine whether the Work or designated portion thereof is Substantially Complete. If, during such inspection, DFD identifies items not complete, in need of correction, replacement, or otherwise not in accordance with the requirements of the Contract Documents, the General Prime Contractor shall complete or correct such items. After completion of such punch list items, the General Prime Contractor may request subsequent inspection by DFD.
- C. When in the judgment of DFD the Work, or designated portion thereof is Substantially Complete, DFD will prepare a Certificate of Substantial Completion, establishing the responsibilities of the State and General Prime Contractor for security, maintenance, heat, utilities, damage to the Work, and insurance.
- D. Where items have been identified which are not complete or are in need of correction DFD may, at its sole discretion declare the Work, or designated portion thereof Substantially Complete, noting such deficiencies. In such case, the Certificate of Substantial Completion shall fix the time within which the General Prime Contractor shall finish all items not completed or corrected.
- E. At the time DFD declares the Work or designated portion thereof Substantially Complete, the General Prime Contractor may request payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents.

24. FINAL COMPLETION AND FINAL PAYMENT

- A. Prior to Request for Final Payment, the General Prime Contractor shall provide a Certification that all debts and claims against this Project have either been paid in full or otherwise satisfied and give final evidence of release of all liens against the Project, the State, and all proceeds payable hereunder. The General Prime Contractor shall certify upon such payment request that the data contained therein is current, accurate, and complete. General Prime Contractor shall permit, if requested by DFD, the final inspection to be jointly conducted by the General Prime Contractor and DFD's Project Representative. The General Prime Contractor shall give Notice at least 72 hours in advance of the time set for final inspection.
- B. Upon completion of the project and before receiving final payment for work on the project, the General Prime Contractor shall file with DFD an affidavit stating that the General Prime Contractor has complied fully with Section 103.49(4r) Wis. Stat. and that the General Prime Contractor has received an affidavit from each of the General Prime Contractor's agents, MEP Subcontractors, and Non-MEP Subcontractors stating that they also have complied fully with Wis. Stat. § 103.49(4r).
- C. As a CONDITION PRECEDENT to Final Payment, all corrective action to remedy deficiencies in the Work required by Contract Documents and Work identified on the punch list must have been completed. In addition, where required by Contract Documents, all training of the user agency's staff in the proper operation and maintenance of the Work shall have been completed, Operating and Maintenance Manuals and Instructions as well as drawings marked up to reflect "as built" conditions must have been transmitted to DFD's Project Representative, and all Warranty certificates signed and presented for DFD acceptance.
- D. When to the satisfaction of DFD the Work has been completed, and is of the quality required by the Contract Documents, DFD may authorize payment of all sums then due the General Prime Contractor. Receipt of the final payment, as provided for herein shall constitute a waiver of any and all claims against the State arising out of, under, or incident to the Work performed under the Contract.
- E. If the General Prime Contractor fails to submit a Request for Final Payment or make satisfactory arrangements with DFD within thirty (30) calendar days of notification, no further payments will be made and the Contract will be closed. The last Request for Certification for Payment will be considered the Final Payment under the terms and conditions of the Contract.
- F. The authorizing of Final Payment by DFD shall constitute the final acceptance of the Work but shall not constitute a waiver of any claims by DFD including, but not limited to the following:
 - 1. Outstanding lien claims or claims for liens;
 - 2. Defective Work which was specifically identified before the making of final payment;
 - 3. Defects which result from the General Prime Contractor's failure to perform the Work in strict accordance with the Contract Documents;
 - 4. Any warranty or guarantee required by the Contract Documents;
 - 5. Any other right surviving the State as to which the General Prime Contractor was specifically given notice before or during the final inspection and final payment process;
 - 6. Rights surviving to the State as a matter of law.

25. WARRANTIES

- A. The General Prime Contractor Warrants to DFD that all materials and supplies used in the Work are free from all liens, claims, or encumbrances, and good title to materials and supplies is retained by the General Prime Contractor and shall be conveyed to DFD on or before the date of Substantial Completion.

- B. The General Prime Contractor Warrants to DFD that all materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will strictly conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective.
- C. Printed, signed copies of Manufacturer's warranties, which are required by the Contract Documents, shall be presented to DFD prior to approval of final payment.
- D. All warranties, including manufacturer's warranties and General Prime Contractor warranties, shall take effect on the date of Substantial Completion and shall remain in effect for a period of one (1) year thereafter, unless Contract Documents specifically require a different warranty period.
- E. If any part of the Work is declared Substantially Complete by DFD, and the user agency takes possession of that portion of the Work before completion of the entire Project, the warranty for that portion of the Work shall continue for a period of one (1) year from the date of Substantial Completion for that portion of the Work, unless Contract Documents specifically require a different warranty period.
- F. The General Prime Contractor shall remedy, at the General Prime Contractor's expense, any defect in the Work. In addition, the General Prime Contractor shall remedy, at the General Prime Contractor's expense, any damage to State owned or controlled real or personal property, when the damage is the result of:
 - 1. The General Prime Contractor's failure to conform to Contract Document requirements; or
 - 2. Any defect in equipment, material, Workmanship, or design furnished by the General Prime Contractor or Subcontractors regardless of tier.
- G. The General Prime Contractor shall warrant any Work restored or replaced due to damage caused in fulfilling the terms and conditions of this Article 25, or during performance of any Work required by the Contract Documents. The General Prime Contractor's warranty with respect to Work repaired or replaced will run for one (1) year from the date of Substantial Completion of said repair or replacement.
- H. DFD shall notify the General Prime Contractor, in writing, within a reasonable time after discovery of any failure, defect, or damage.
- I. If, after the receipt of Notice of a claim under this warranty, the General Prime Contractor fails to remedy any failure, defect, or damage within a time judged reasonable by DFD, DFD shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage, at the General Prime Contractor's expense.
- J. All warranties under this Contract or in any related to this contract, express or implied, shall be obtained for and shall be subject to direct enforcement by DFD. The General Prime Contractor shall provide in each subcontract, or other purchase agreement, for the assignment to DFD of all such warranties and for the right of enforcement by DFD. In addition, if necessary the General Prime Contractor shall:
 - 1. Obtain for the State's benefit all warranties that would be given in normal commercial practice;
 - 2. Require all warranties to be executed, in writing, for the benefit of the State, if so directed by DFD;
 - 3. Enforce all warranties for the benefit of the State, if directed to do so by DFD;
 - 4. Obtain for the State's benefit all warranties given by any Subcontractor, at any tier, if such warranty is in excess of the one (1) year warranty period set forth herein.
- K. Unless a defect is caused by the negligence of the General Prime Contractor or Subcontractors at any tier, the General Prime Contractor shall not be liable for the repair of any defects of material or design furnished by the State.
- L. This warranty shall not limit the State's rights under Articles entitled:

1. Article 15 - "QUALITY CONTROL & INSPECTION"
 2. Article 26 - "PAYMENTS TO GENERAL PRIME CONTRACTOR"
 3. Article 27 - "PAYMENTS BY GENERAL PRIME CONTRACTOR"
- M. Defects in design or manufacture of equipment specified by DFD on a "Brand Name" basis shall not be included in this warranty. In this event, the General Prime Contractor shall require any Subcontractor manufacturers, or suppliers to execute their warranties, in writing, directly to DFD.

26. PAYMENTS TO GENERAL PRIME CONTRACTOR

- A. Payments to the General Prime Contractor under the Contract Documents will be made as provided for in Wis. Stat. § 16.855(19)(a), as the Work progresses on this Project. Payment requests will be processed monthly, except for special circumstances approved by DFD. The General Prime Contractor must perform all of the conditions required for payment and must have met the obligations which are necessary to qualify for any partial payments.
1. No General Prime Contractor whose Work is deficient or whose Work fails to conform to the quality standards set forth in the Contract Documents shall be entitled to interim, progress or partial payments;
 2. As a CONDITION PRECEDENT to entitlement to payment, the General Prime Contractor shall, at the request of DFD, submit satisfactory evidence to establish that the sum set forth in any application for payment represents the "Proportionate Value" of Work completed;
 3. The General Prime Contractor shall certify each request for payment as being a true, accurate, and complete statement of account as of the date on which the certificate was made, and that the stated sums are then earned and payable to the General Prime Contractor;
 4. The General Prime Contractor shall certify that it holds clear title to all property of every description which serves as the basis for the application for payment. General Prime Contractor warrants that title to any such property is being transferred to the State free and clear of all liens. If requested by DFD, the General Prime Contractor shall produce satisfactory evidence of transfer of title from suppliers and Subcontractors, including MEP Subcontractors or Non-MEP Subcontractors, to the General Prime Contractor, without reservation, or with adequate waiver of lien. These payments may include any fabricated or manufactured materials and components specified, previously paid for by General Prime Contractor and delivered to the site, properly stored, and suitable for incorporation into the Work embraced in the Contract;
 5. All material and Work, title to which has been transferred to the State as a result of the making of a partial payment, shall become the sole property of the State. Nothing in this Article shall be construed as relieving the General Prime Contractor from the risk of loss or damage to any such property. The General Prime Contractor shall have the sole responsibility for obtaining proper insurance on, as well as the responsibility for the care and protection of materials and Work upon which payments have been made. The General Prime Contractor shall be responsible for the restoration of any damaged Work. Nothing herein shall operate as a waiver of the rights of DFD to require fulfillment of all of the terms of the Contract.
 6. As soon as possible after the notice to proceed is received, the General Prime Contractor shall submit to DFD's Project Representative a cost breakdown of the proposed values for work to be performed, as prescribed by the Contract Documents and in the detail requested by DFD. The cost breakdown items shall reflect actual work progress stages as closely as feasible which, if approved by DFD, will become the basis for construction progress payments.
- B. All requests for payment shall be submitted to DFD's Project Representative. To expedite payment of sums due under the Contract, the General Prime Contractor and DFD's Project Representative shall, where possible, jointly review any such request for payment at the site, inspecting the Work, if necessary to determine the validity of the request or modifications to the request which are necessary to accurately represent the value of Work completed in accordance with the Contract Documents.

- C. The General Prime Contractor shall furnish any and all accounting records requested by DFD to validate all or any part of any request for payment. The General Prime Contractor shall maintain these accounting records for a period of three (3) years from the date DFD authorizes final payment.
- D. For the purposes of this Article 26, requests for payment may include any fabricated or manufactured materials or components specified, previously paid for by the General Prime Contractor and delivered to the Work site, or properly stored and suitable for incorporation in the Work embraced in the Contract Documents. The General Prime Contractor shall identify the method of storage for such materials and shall complete an "Off-site Storage Agreement" form which is available from DFD. Proper evidence of insurance shall be presented to protect the interest of the State. If payment is intended to be requested for any off-site storage items, such items shall be listed as separate lines in the request and certification for payment, cost breakdown.
- E. If separate prices are set forth in the Contract Documents for identifiable items of Work, payment for such prices shall be made at the time of completion of those items of Work. Payment under this Paragraph (E) shall be an interim payment until the time of Final Payment and acceptance of the Work by DFD.
- F. As the work progresses under the general prime contract for construction of a project the department, from time to time, shall grant to the General Prime Contractor an estimate of the amount and proportionate value of the work properly completed, which shall entitle the contractor to receive the amount, less the retainage, from the proper fund. The retainage shall be an amount equal to not more than 5% of the estimate until 50% of the work has been completed. At 50% completion, no additional amounts shall be retained, and partial payments shall be made in full to the contractor unless the department certifies that the job is not proceeding satisfactorily. At 50% completion or any time thereafter when the progress of the work is not satisfactory, additional amounts may be retained but in no event shall the total retainage be more than 10% of the value of the work completed. Upon substantial completion of the work, any amount retained shall be paid to the General Prime Contractor, less the value of any required corrective work or uncompleted work. For the purposes of this section, estimates may include any fabricated or manufactured materials and components specified, previously paid for by General Prime Contractor and delivered to the work or properly stored and suitable for incorporation in the work embraced in the contract.

Nothing herein shall preclude DFD from deducting from any request for payment such amounts as will properly represent the value of Work which fails to meet the quality standards of the Contract Documents or which the General Prime Contractor fails to complete.

- G. In the event DFD receives Notice from any person, Subcontractor, or other third party, that the Contractor has failed to pay such person(s) for Work performed in accordance with the Contract Documents, the Contractor shall, at the request of DFD, and in no more than 10 calendar days, provide all documentation DFD believes necessary to determine whether such payment is due, or reasons for non-payment of disputed amounts. In the event DFD determines the claim to be valid and payment is due, or in the absence of aforementioned documentation, DFD may authorize direct payment of any unpaid bills, withholding from the General Prime Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such claims until satisfactory documentation is furnished that all liabilities have been fully discharged or reasons for non-payment of disputed amounts are provided by the General Prime Contractor. In no event shall these provisions be construed to impose any obligations upon the State to either the General Prime Contractor or the General Prime Contractor's Surety.
- H. In paying any unpaid bills of the General Prime Contractor relating to the Work, the State shall be deemed the agent of the General Prime Contractor, and any payment so made by the State shall be considered as a payment made under the Contract by the State to the General Prime Contractor for its account and the State shall not be liable to the General Prime Contractor for any such payment made in good faith.
- I. The General Prime Contractor agrees to indemnify and hold the State harmless from all claims growing out of lawful demands of Subcontractors (including MEP Subcontractors and Non-MEP Subcontractors), laborers, Workers, mechanics, material persons, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the performance the Work required by Contract Documents.
- J. The General Prime Contractor shall, at DFD's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived.

27. PAYMENTS BY GENERAL PRIME CONTRACTOR

- A. Please see Article 12 for specific information regarding Prompt Payment from General Prime Contractors to MEP Subcontractors and the specific Prompt Payment clause that must be inserted into the contract between General Prime Contractors and MEP Subcontractors.
- B. Not more than seven (7) calendar days following the receipt of each Payment authorized by DFD, the General Prime Contractor shall make payment to each and every person, Subcontractors, (including MEP Subcontractors, and Non-MEP Subcontractors), or entity who furnished goods or services for the progress of the Work on the Project, the value of which goods or services were included in the General Prime Contractor's "Request and Certification for Payment" under Article 26 of the General Conditions, or who by law or Contract payment is due upon the receipt of the payment most recently received from the State. The General Prime Contractor shall insert a provision in all subcontracts requiring payment in the manner herein specified. The General Prime Contractor shall also require Subcontractors to include a like provision in all contracts with their subcontractors or suppliers, regardless of tier.
- C. Upon request of DFD, satisfactory evidence of payment under this Article 27 shall be furnished to DFD forthwith.
- D. Please see Article 12 for specific information regarding retainage on contracts between General Prime Contractors and MEP Subcontractors. In short, retainage on an MEP Subcontract shall occur and be in amounts and on a schedule equal to the retainage schedule in the contract between the General Prime contractor and the State.
- E. Nothing herein shall preclude the General Prime Contractor from deducting from any request for payment such amounts as will properly represent the value of Work which fails to meet the quality standards of the Contract Documents or which the MEP Subcontractor fails to complete.

28. DFD'S RIGHT TO SUSPEND, CORRECT, OR COMPLETE WORK

- A. DFD may order the General Prime Contractor, in writing, to suspend or delay all or any part of the Work of the General Prime Contractor for the period of time that DFD determines appropriate for the convenience of the State.
 - 1. If the General Prime Contractor determines that the cost of the Work is altered by such suspension, or the time for completion of such Work is altered or delayed, the General Prime Contractor shall provide Notice to DFD of any such costs or delay;
 - 2. Such Notice shall be made within ten (10) calendar days of the order to stop or suspend Work;
 - 3. Provision of such Notice to DFD shall be a CONDITION PRECEDENT to any State liability for increased costs, delay, or time extension.
- B. In the event that any of the Work in progress, or Work already completed by the General Prime Contractor, Subcontractors, including MEP Subcontractors, or Non-MEP Subcontractors, is determined by DFD to be of substandard quality, defective, or otherwise in violation of requirements of the Contract Documents, or in the event that the General Prime Contractor fails or refuses to complete Work required by the Contract Documents, DFD may serve written Notice upon the General Prime Contractor requiring that corrective action be taken by the General Prime Contractor to remedy, correct, complete, or replace such Work.
 - 1. The General Prime Contractor shall have ten (10) calendar days after the serving of such Notice within which to take corrective action or to make arrangements judged satisfactory by DFD for the corrections to be made. The Contract shall terminate in accordance with the provisions of Paragraph 29.A. of the General Conditions if corrective action is not taken or other arrangements, judged satisfactory by DFD, are not made by the General Prime Contractor;
 - 2. If the General Prime Contractor fails within the ten (10) calendar day period after receipt of written Notice to commence and continue correction of such default or neglect with diligence and promptness, DFD may order the General Prime Contractor to stop the Work or any portion thereof until the cause for such order has been

eliminated. DFD may then, without prejudice to other remedies DFD may have, correct such deficiencies through whatever means necessary;

3. The cost of any corrective action, replacement, or repair shall be chargeable to the General Prime Contractor and its Surety. In such cases DFD may deduct from payments then or thereafter due the General Prime Contractor the cost of correcting such deficiencies, compensation for the State's additional services, and expenses made necessary by such default, neglect, or failure. Such action by the State shall not prevent the State from recovery of other damages or penalties sustained as a result of the General Prime Contractor's default or neglect. If payments then or thereafter due the General Prime Contractor are not sufficient to cover such amounts, the General Prime Contractor and its Surety shall pay the difference to the State;
 4. If, after suspension of the Work, it is determined that the General Prime Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the State under Paragraph 29.B.
- C. The right of DFD to stop or suspend the Work shall not give rise to a duty on the part of DFD to exercise this right for the benefit of the General Prime Contractor or any other person or entity.
- D. DFD may exercise any and all rights or remedies provided for herein, by law or in equity, either concurrently or singly in its sole discretion.

29. DFD'S RIGHT TO TERMINATE CONTRACT

- A. In the event that any of the provisions of this Contract, including time for completion, are violated by the General Prime Contractor, DFD may serve written Notice upon the General Prime Contractor and the Surety of its intention to terminate this Contract, including the reasons for such intention to terminate. The General Prime Contractor shall have ten (10) calendar days after the serving of such Notice within which to cease the default or violation, to take corrective action, or to make arrangements judged satisfactory by DFD for the corrections to be made. Contract shall terminate upon expiration of the said ten (10) calendar day period if corrective action is not taken by the General Prime Contractor.
1. In the event of termination of the Contract, DFD shall immediately serve Notice thereof upon the Surety and the General Prime Contractor, and the Surety shall have the right to take over and perform the Contract subject to DFD's approval;
 2. The Surety shall take over and perform the Contract without need for further agreement with DFD. All Subcontractors shall be subject to approval of DFD in accordance with Article 11. DFD will not consider a General Prime Contractor or a subsidiary of a General Prime Contractor whose contract was terminated as a qualified, responsible Subcontractor.
 3. Within ten (10) calendar days after the serving of such Notice of termination, the Surety shall provide DFD with a comprehensive plan for completion of the Work required by the Contract Documents. Such plan must include performance of the Work within a time period acceptable to DFD. In the absence of such a plan, DFD may take possession of materials, appliances, and facilities as may be on the site of the Work, and complete the Work by whatever means necessary;
 4. All costs for completion of the Work and any additional damages sustained by the State thereby shall be at the expense of the General Prime Contractor and its Surety.
- B. Notwithstanding any contrary provision of the Contract or these General Conditions, DFD shall also have the right, exercisable by it in its sole discretion, to terminate this Contract at any time without cause following the expiration of thirty (30) calendar days after written Notice to the General Prime Contractor. In such event, the General Prime Contractor shall be paid for all Work performed to the effective date of termination, and any "Reimbursable Expenses" outstanding as of the date of termination. The term "Reimbursable Expenses" shall include the cost of personal property or materials which meet requirements of the Contract Documents and have been purchased by the General Prime Contractor for incorporation into the Work but not yet incorporated therein; lease payments due to an unaffiliated third party lessor for equipment provided to the Project, where the lease term extends beyond the

termination date of this Contract and the General Prime Contractor is unable to terminate said lease; and other costs approved by DFD. Reimbursable Expenses do not include lost profits or payments due to Subcontractors, including MEP Subcontractors or Non-MEP Subcontractors for any period of time subsequent to termination of the Contract. Upon payment of the Reimbursable Expenses, the General Prime Contractor shall deliver to the State any materials or personal property for which said payment has been made.

- C. The right of DFD to terminate the Contract shall not give rise to a duty on the part of DFD to exercise this right for the benefit of the General Prime Contractor or any other person or entity.
- D. DFD may exercise any and all rights or remedies provided for herein, by law or in equity, either concurrently or singly in its sole discretion.

30. CLAIMS

- A. The General Prime Contractor shall be barred from asserting or pursuing any claims, demands, and causes of action against the State unless the General Prime Contractor complies with the following requirements:
 - 1. First, the General Prime Contractor shall present its claim to DFD's Project Representative who shall have twenty-one (21) calendar days after presentation of the claim to act thereon or notify the General Prime Contractor in writing of the additional time required for such action if greater than the aforementioned twenty-one (21) day period. Failure by DFD's Project Representative to so act within the aforesaid period of time shall constitute a rejection of the General Prime Contractor's claim;
 - 2. If the General Prime Contractor's claim is rejected by DFD's Project Representative, the General Prime Contractor may appeal it in writing to the Administrator of Division of Facilities Development. Any such appeal shall be made within twenty-one (21) calendar days after it is rejected by DFD's Project Representative. If no such appeal is made, the decision of DFD's Project Representative shall become final and binding and the General Prime Contractor shall waive its right to pursue the claim further;
 - 3. If the General Prime Contractor files a timely appeal of the decision of DFD's Project Representative, the Administrator of the Division of Facilities Development shall act on the General Prime Contractor's claim within fourteen (14) calendar days or notify the General Prime Contractor in writing, of the time required for such action if greater than the aforementioned fourteen (14) day period. Failure by the Administrator of the Division of Facilities Development to so act within the aforesaid period of time shall constitute a rejection of the claim;
 - 4. If the General Prime Contractor's claim is rejected by the Administrator of the Division of Facilities Development, the General Prime Contractor shall, as a CONDITION PRECEDENT to filing suit against the State, comply with the two-step claims resolution procedure set forth in Wis. Stat. §§ 16.007,775.01.
- B. Any judicial action relating to the construction, interpretation, or enforcement of the Contract Documents including without limitation, the General Prime Contractor's claims, demands, and causes of action for additional construction costs, delay damages, and other amounts owed hereunder, shall be brought and venued in the Dane County Circuit Court in Madison, Wisconsin. The General Prime Contractor hereby consents to personal jurisdiction in that venue, and waives any defenses that the General Prime Contractor otherwise might have relating thereto.
- C. The General Prime Contractor hereby waives its right to a jury trial in connection with any judicial action or proceeding that may arise by and between the State and the General Prime Contractor concerning the construction, interpretation, or enforcement of the Contract Documents including, without limitation, any claims, demands, or causes of action that the General Prime Contractor hereafter may assert against the State for additional construction costs, delay damages, and other amounts.
- D. The General Prime Contractor shall proceed diligently with the performance of the Work, as directed by DFD, pending the final decision of DFD's Project Representative, the Administrator of the Division of Facilities Development, the State Claims Board, the Legislature, and any subsequent judicial action or appeal.

- E. It is recognized by DFD and General Prime Contractor that performance of DFD's duties may require or cause the interruption or suspension of the Work for periods other than the reasonable time allowed under Article 28. In the event of such interruption or suspension, DFD and the General Prime Contractor shall negotiate in good faith in an effort to agree upon the additional construction costs and other amounts, if any, that shall be paid the General Prime Contractor because of the interruption or suspension of Work. Anything in the Contract Documents to the contrary notwithstanding, however, it is expressly understood and agreed that:
1. The total amount recoverable by and payable to the General Prime Contractor shall be limited to an amount equal to the sum of:
 - a. The additional construction costs and other amounts actually incurred by the General Prime Contractor because of DFD's actions and omissions; plus
 - b. A maximum overhead and profit allowance equal to fifteen (15) percent of the sum of additional construction costs and other amounts.
 2. Overhead costs for extended or unabsorbed overhead shall not be used as the basis for calculating or determining the amount of any additional construction costs or other amounts recoverable by or payable to the General Prime Contractor; and
 3. By entering into this Contract with DFD, the General Prime Contractor hereby waives any rights that it otherwise might have to pursue recovery of overhead costs for extended or unabsorbed overhead from DFD.
- F. DFD and the General Prime Contractor shall act in good faith to efficiently and fairly resolve claims and disputes arising under the Contract in order to avoid wherever possible, formal legal proceedings.

31. INSURANCE

- A. The General Prime Contractor shall not commence Work under this Contract until the General Prime Contractor has obtained all the insurance required under this Paragraph 31.A. Such insurance must be approved by DFD. The company providing the insurance must be lawfully authorized to do business in Wisconsin and/or be approved by DFD with a minimum A.M. Best rating of (A-). The General Prime Contractor shall provide the following insurance:
1. Worker's Compensation Insurance:
 - a. The General Prime Contractor shall procure and maintain during the life of this Contract, and shall require all Subcontractors, including MEP Subcontractors and Non-MEP Subcontractors, to maintain, Worker's Compensation Insurance as required by State of Wisconsin Statutes and any applicable Federal Act coverage such as the Longshoremen's and Harbor Workers Act, the Jones Act or the Admiralty Act for all employees engaged in Work associated with the Project under this Contract. Minimum coverage is listed in paragraph 31.A.5.
 - b. The General Prime Contractor shall procure and maintain during the life of this Contract, and shall require all Subcontractors, including MEP Subcontractors and Non-MEP Subcontractors, to maintain, Employer's Liability Insurance. Minimum coverage is listed in paragraph 31.A.5.
 2. Commercial General Liability Insurance and Excess Liability-Umbrella:
 - a. The General Prime Contractor shall maintain during the life of this Contract, and until two years after completion of this Contract, Commercial General Liability Insurance, including Products and Completed Operations for all claims that might occur in carrying out the Contract. Minimum coverage is listed in paragraph 31.A.5. Such coverage shall be of the "occurrence" type form.
 - b. The General Prime Contractor's Commercial General Liability and Umbrella Insurance shall apply to the provisions of indemnity obligations under Section 37 of these General Conditions.

- c. Such Commercial General Liability coverage shall include employees of the General Prime Contractor as insureds.
 - d. The General Prime Contractor shall require Subcontractors to procure and maintain Commercial General Liability Insurance and Excess Liability equal to that required in subparagraph 31.A.2.a. The General Prime Contractor shall require each MEP Subcontractor to procure and maintain Commercial General Liability and Umbrella Insurance equal to that required in subparagraph 31.A.2.a. However, the General Prime Contractor may insure the activities of the Non-MEP Subcontractor(s) in the General Prime Contractor's policy. The General Prime Contractor's policy shall include coverage for Independent Contractors.
3. Auto Liability Insurance:
- a. The General Prime Contractor shall procure and shall maintain during the life of the Contract Commercial Automobile Liability Insurance for all owned, non-owned, and hired vehicles that are used in carrying out the Contract. Minimum coverage is listed in paragraph 31.A.5.
 - b. The General Prime Contractor shall require each Subcontractor, including MEP Subcontractors and Non-MEP Subcontractors, to procure and maintain Commercial Auto Liability Insurance equal to that required in paragraph 31.A.3.a of the General Conditions.
4. The minimum required limits do not represent the coverage and limits necessary to protect the General Prime Contractor. The limits should not be construed in any way to limit the General Prime Contractor's liability to the State.

5. Minimum Limits Required:

TYPE	Limits
Commercial General Liability	\$1,000,000 General Aggregate (applies per project)
	\$1,000,000 Products Aggregate
	\$1,000,000 Personal Injury
	\$1,000,000 Each Occurrence
	\$50,000 Fire Damage
	\$5,000 Medical Expense Per Person
Automobile Liability	\$1,000,000 Combined Single Limit
Excess Liability Umbrella	\$5,000,000 Each Occurrence
	\$5,000,000 Aggregate

Worker's Compensation/Employers Liability Insurance

- 1. State: Statutory to all states the work is being performed;
 - 2. Federal: As Applicable;
 - 3. All Employees, partners, individuals, any managers on project site must be included for coverage.
6. The Commercial General Liability and Umbrella policies described in paragraph 31.A.2. of the General Conditions shall include the State as an Additional Insured as respects the activities carried out under this Contract. Additional coverage on the General Prime Contractor's Umbrella policy can be used to make up the required limits.
7. Proof of Insurance: The General Prime Contractor shall provide a certificate of insurance to DFD from a company lawfully authorized to do business in the State of Wisconsin indicating coverage is in place at the limits set forth in this Article. The insurer shall give DFD thirty (30) day notice of cancellation or changes in coverage. The insurance certificate shall be provided before commencement of the Contract. If the General Prime Contractor is self-insured, audited financial records will need to be provided that clearly demonstrate the

financial ability to cover losses up to the limits of insurance required. The General Prime Contractor shall also be required to disclose deductibles or Self-Insured Retention's (SIR).

8. Commercial General Liability and Auto Liability carried under Article 31 shall contain a provision making it primary and non-contributory to any other coverage available to the State.
- B. The State shall purchase and maintain, in a company or companies lawfully authorized to do business in the State of Wisconsin, Builder's Risk insurance in the amount of, at least, the initial Contract sum as well as subsequent modifications thereto for the entire Work at the site on a replacement cost basis.
1. Property Insurance shall include insurance for physical loss or damage to the Work, temporary buildings, and equipment or material consumed in the construction of the Work.
 2. Off-Site and Transit Coverage: Upon the request of the General Prime Contractor and written approval of DFD, the Property Insurance policy, subject to policy terms, definitions, and conditions, will provide a \$250,000 limit for materials and/or Work stored off the site or in transit. It is the General Prime Contractor's responsibility to insure materials and/or Work in excess of this amount. The State will not be responsible for materials or completed Work under the care, custody, and control of the manufacturer prior to delivery;
 3. Deductible: The property insurance shall be written with a deductible sum of no more than \$10,000 for each occurrence. If the Contract value is less than \$1,000,000 and the loss is attributable to the General Prime Contractor, a Subcontractor, including MEP Subcontractor or Non-MEP Subcontractor, a \$5,000 deductible per occurrence will apply. The risk of loss within the deductible amount will be borne by the General Prime Contractor;
 4. Loss of Use Insurance: The State, at DFD's option, may maintain such property insurance as will insure the State against loss of use of the State's property due to fire or other hazards, however caused. Except as set forth in section C.2. below, DFD waives all rights of action against the General Prime Contractor for loss of use of the State's property, including consequential losses due to fire or other hazards covered by the Property Insurance described in subparagraph 31.B.1
 5. Policy Review: A copy of the property insurance policy or policies may be obtained pursuant to the Public Records and Property Provisions of the Wisconsin State Statutes.
- C.
1. The State and General Prime Contractor waive all rights against each other and shall require its insurers to waive any rights of subrogation or recovery, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this Article 31 or other property insurance applicable to the Work. The policies shall provide such waivers of subrogation by endorsement or otherwise, except as set forth in C.2. below. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise; did not pay the insurance premium directly or indirectly; and whether or not the person or entity had an insurable interest in the property damaged. This waiver shall be effective only to the extent any policy of insurance is not impaired thereby. This contract provision shall be incorporated into the contracts between the General Prime Contractor, MEP Subcontractors, and Non-MEP Subcontractors.
 2. DFD retains the right to subrogate against General Prime Contractor, Subcontractors including MEP Subcontractor and Non-MEP Subcontractor(s), up to \$1,000,000 per occurrence, for damage to property, including loss of use thereof, provided said property damage is to work performed by other parties and provided said General Prime Contractor's, Subcontractors' including MEP Subcontractors', and Non-MEP Subcontractors', negligence contributed in any way to said damage. This contract provision shall be incorporated into the contracts between the General Prime Contractor and Subcontractors, including MEP Subcontractors, and Non-MEP Subcontractors.

32. NONDISCRIMINATION/AFFIRMATIVE ACTION

- A. In connection with the performance of Work under this Contract, the General Prime Contractor agrees not to discriminate against any employee or applicant for employment because of age, race, religion, color, handicap, sex,

physical condition, developmental disability as defined in Wis. Stat. §51.01(5), sexual orientation, national origin, or any other basis prohibited by law. This provision shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training. Except with respect to sexual orientation, the General Prime Contractor further agrees to take affirmative action to ensure equal employment opportunities. This contract provision shall be incorporated into the contracts between the General Prime Contractor, MEP Subcontractors, and Non-MEP Subcontractors.

- B. Contracts with a value of thirty thousand dollars (\$50,000) or more require the General Prime Contractor to submit a written affirmative action plan acceptable under Wisconsin Statutes and Administrative Code. An exemption occurs from this requirement if the General Prime Contractor has a Work force of less than thirty (50) employees. The General Prime Contractor is responsible for obtaining affirmative action compliance from MEP Subcontractors and Non-MEP Subcontractors. Instructions on satisfying these requirements will be sent with the Notice to Proceed. Technical assistance regarding this Article 32 is available from the Wisconsin Office of Contract Compliance, telephone (608) 266-5462.
- C. The General Prime Contractor should establish and take appropriate initiatives to reach goals and timetables for minority and female utilization which shall be based on appropriate work force, demographic, or other relevant data which shall cover construction projects or construction contracts performed in specific geographical areas. The goals shall be applicable to the General Prime Contractor's, MEP Subcontractor's, or Non-MEP Subcontractor's entire work force which is working in the area covered by the goals. The goals are established and are as follows:

County	Women Goal	Minority Goal
Adams/Juneau/Monroe/Vernon	12%	2%
Ashland/Bayfield/Douglas/Price	9%	6%
Barron/Sawyer/Washburn	13%	4%
Brown	11%	9%
Buffalo/Jackson/Pepin/Trempealeau	12%	5%
Burnett/Polk	11%	2%
Calumet/Winnebago	11%	3%
Chippewa/Rusk	12%	2%
Clark/Taylor	16%	2%
Columbia	12%	2%
Crawford/Grant/Richland	14%	2%
Dane	9%	9%
Dodge	12%	3%
Door/Kewaunee/Manitowoc	13%	3%
Dunn/Eau Claire	11%	3%
Florence/Forest/Marinette/Oconto	13%	2%
Fond du Lac	11%	4%
Green/Iowa/LaFayette	13%	1%
Green Lake/Marquette/Waushara	10%	4%
Iron/Oneida/Vilas	9%	3%
Jefferson	12%	4%
Kenosha	7%	10%
La Crosse	10%	4%
Langlade/Lincoln/Menominee/Shawano	11%	7%
Marathon	12%	4%
Milwaukee	10%	29%
Outagamie	10%	5%
Ozaukee	8%	3%
Pierce/St Croix	12%	2%
Portage	13%	3%
Racine	8%	13%

Rock	11%	7%
Sauk	10%	2%
Sheboygan	14%	5%
Walworth	10%	8%
Washington	9%	3%
Waukesha	7%	4%
Waupaca	11%	2%
Wood	12%	2%
Source: Combined Occupation Distribution: 2000 Census		

- D. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom a General Prime Contractor has a collective bargaining agreement, to refer to either minorities or women shall excuse the General Prime Contractor's required initiatives under these specifications.
- E. The General Prime Contractor agrees to post in conspicuous places, available for employees and applicants for employment, a notice to be provided by the State that sets forth the provisions of this Article 32.
- F. Failure to comply with the conditions of this Article 32 may result in the General Prime Contractor becoming declared an "ineligible" General Prime Contractor, termination of the Contract, or withholding of payment.

33. MINIMUM WAGES

- A. Wage determinations, when required by Federal Law, are listed in the Supplementary General Conditions.
- B. The specified federal wage rates are minimum rates only, and DFD will not consider any claims for additional compensation made by the General Prime Contractor because of payment by the General Prime Contractor of any wage rate in excess of the applicable rate contained in this Contract. Any disputes in regard to the payment of wages in excess of those specified in this Contract shall be adjusted by the General Prime Contractor.
- C. Failure to comply with the conditions of this Article 33 may result in the General Prime Contractor becoming declared an "ineligible" Contractor, termination of the Contract, or withholding of payment.

34. ASSIGNMENTS

- A. The General Prime Contractor shall not assign the whole or any part of this Contract or any moneys due or to become due hereunder without the prior written consent of DFD. In case the General Prime Contractor assigns all or any part of any moneys due or to become due under this Contract, the instrument of assignment shall contain an Article substantially to the effect that it is agreed that the right of the assignee in and to any moneys due or to become due to the General Prime Contractor shall be subject to prior claims of all persons, firms, and corporations for services rendered or materials supplied for the performance of the Work called for in this Contract and subject to the terms of this Contract and claims of offset by the State.
- B. On the date of Substantial Completion, the General Prime Contractor shall assign to the State all warranties and guarantees of labor or material incorporated into the Work which are provided by third party vendors, suppliers, manufacturers, and Subcontractors, including MEP Subcontractors or Non-MEP Subcontractors.

35. ANTITRUST AGREEMENT

The General Prime Contractor and the State recognize that in actual economic practice, overcharges resulting from antitrust violations are in fact usually borne by the State. Therefore, the General Prime Contractor hereby assigns to the State any and all claims for such overcharges as to goods and materials purchased in connection with this Contract, except as to overcharges which result from antitrust violations commencing after the price is established under this Contract and any Change Order thereto.

36. INDEMNIFICATION

- A. To the fullest extent permitted by law, and in addition to any other indemnification provisions provided for herein, the General Prime Contractor shall indemnify and hold harmless the State, the A/E and its agents and employees and any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is (1) attributable to bodily injury, sickness, disease or death, or to injury to or destruction of property, including loss of use resulting therefrom, and (2) is caused in whole or in part by acts or omissions of the General Prime Contractor, a Subcontractor thereof, a MEP Subcontractor, a Non-MEP Subcontractor thereof, anyone directly or indirectly employed by any of them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this section.
- B. The obligations of the General Prime Contractor under this indemnification shall not extend to the liability of the State, the A/E and its agents or employees thereof arising out of (1) preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by DFD, or the A/E or its agents or employees thereof provided such giving or failure to give is the cause of the injury or damage.

37. GENERAL PRIME CONTRACTOR PERFORMANCE EVALUATION

- A. The General Prime Contractor acknowledges that following completion of the Work, DFD's Project Representative will evaluate the General Prime Contractor's performance under and pursuant to this Contract. Such evaluation may take place after Substantial Completion or after Final Completion of the Work, as determined by DFD's Project Representative. The purpose of such evaluation includes, but is not limited to, determining whether or not the General Prime Contractor responsibly performed its Contractual obligations and whether or not the best interests of the State were promoted thereby.
- B. DFD shall provide a copy of any such performance evaluation to the General Prime Contractor, as soon as practicable after completion of such evaluation.
- C. The General Prime Contractor may appeal results of the General Prime Contractor's performance evaluation completed by DFD's Project Representative by submitting a request for performance review to the Administrator of the Division of Facilities Development. Any such request must include the reasons for such request, and documentation necessary to substantiate the General Prime Contractor's claim that initial performance evaluation was inappropriate or otherwise in error. The Administrator shall notify the General Prime Contractor of the results of this review as soon as practicable.
- D. DFD reserves the right to waive the results of such performance evaluation(s) if, in the opinion of DFD, corrective action has been taken to remediate substandard performance, events beyond the control of the General Prime Contractor resulted in substandard performance, or the best interests of the State will be served.
- E. The General Prime Contractor acknowledges and agrees that such evaluation(s) may be used by DFD pursuant to Wis. Stat. § 16.855(9m) when determining whether the General Prime Contractor is a "qualified responsible bidder" for future Project(s); provided, however, any such evaluation made more than five (5) years prior to the submission of any such subsequent bid shall not be considered in any event.
- F. The General Prime Contractor acknowledges and agrees that all such evaluations so prepared by DFD shall constitute "open public records" available for inspection and copying as provided for by law.

1 **SUPPLEMENTARY GENERAL CONDITIONS** (Rev 11/2017)

2 Division Project No. **18-0001**

3
4 **INDEX**

- 5
6 1. Definitions
7 2. Insurance
8 3. Time For Completion of the Project
9 4. Schedule of Occupational Classifications and Minimum Hourly Wage Rates (REPEALED)

10
11 1. **DEFINITIONS**

12 General Conditions, Article 2.B. shall be supplemented with the following:

13
14 Architect/Engineer (A/E) for this project: **BeEco Engineering**
15 **1415 Engineering Drive, Madison, WI 53706, (608) 333-3137**
16

17
18 2. **INSURANCE**

19 General Conditions, Article 31.A.(4), shall be supplemented with "special hazard" coverage as follows:

20
21 "General Prime Contractor's, MEP Subcontractor's and Subcontractor's Public Liability and Property
22 Damage Insurance shall provide adequate protection against the following special hazards, unless provided
23 as part of Comprehensive General Liability coverage: loading and unloading; excavating; filling; drilling;
24 blasting; explosions; demolition; underpinning; elevator; hoist. Coverages shall be in the amounts specified
25 in Article 31 of the General Conditions."
26

27 3. **TIME FOR COMPLETION OF THE PROJECT**

28
29 This project shall be completed and commissioned by August 29th, 2019. Failure to meet the final completion
30 date for this project shall result in liquidated damages of \$1000.
31

32 4. **SCHEDULE OF OCCUPATIONAL CLASSIFICATIONS AND MINIMUM HOURLY**
33 **WAGE RATES (REPEALED)**

34 **The 2017-2019 Wisconsin State Budget (2017 Wisconsin Act 59) repealed Wisconsin's prevailing**
35 **wage laws. Effective September 23, 2017, state prevailing wage requirements on state building**
36 **projects no longer apply. These changes take effect for projects advertised for bid after September**
37 **23, 2017. This change does not affect the Federal Davis Bacon Act requirements.**

SUPPLEMENTARY GENERAL CONDITIONS (Rev 11/2017)

Division Project No. **18-0001**

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1. Definitions
2. Surveys, Permits, Regulations and Taxes
3. Withholding of Payments
4. Insurance
5. Contract Security
6. Subcontracts
7. Nondiscrimination/Affirmative Action
8. Minimum (Prevailing) Wages – Additional Federal Contracting Requirements
9. Additional General Conditions
10. Time for Completion of the Project
11. Schedule of Occupational Classifications and Minimum Hourly Wage Rates (REPEALED)

1. DEFINITIONS

General Conditions, Article 2.B. shall be supplemented with the following:

Architect/Engineer (A/E) for this project: **BeEco Engineering**
1415 Engineering Drive, Madison, WI 53706, (608) 333-3137

General Conditions, Article 2. shall be supplemented with the following definition:

2. PERMITS, REGULATIONS, UTILITIES AND TAXES

General Conditions, Article 8.C.: Where reference is made to State laws, rules and regulations supplement the phrase with the words, "and Federal".

3. WITHHOLDING OF PAYMENTS

General Conditions, Article 26.F., add a new sentence as follows after the last sentence:

" DFD may withhold from the General Prime Contractor so much of the accrued payments as may be considered necessary to satisfy any liability of any General Prime Contractor or Subcontractor for liquidated damages under Article 38 hereof entitled "Contract Work Hours Standards Act Overtime Compensation (40 USC 3701-3703)".

4. INSURANCE

General Conditions, Article 31.A.(4) shall be supplemented with "special hazard" coverage as follows:

"General Prime Contractor's, MEP Subcontractor's and Subcontractor's Public Liability and Property Damage Insurance shall provide adequate protection against following special hazards, unless provided as part of Comprehensive General Liability coverage: loading and unloading; excavating; filling; drilling; blasting; explosions; demolition; underpinning; elevator; hoist. Coverages shall be in the amounts specified in Article 31 of the General Conditions."

5. CONTRACT SECURITY

General Conditions, Article 5.B., Add to the second sentence the following words: "and the Federal Government."

1 **6. SUBCONTRACTS**

2 General Conditions, Article 11. shall be supplemented with the following additional articles to be inserted in
3 all subcontracts:
4

5 "Articles 38 through 42 inclusive, respectively entitled: Contract Work Hours Standards Act - Overtime
6 Compensation (40USC 3701-3703), Payrolls and Basic Records, Compliance with Copeland Regulations,
7 Contract Termination-Debarment and Certification of Nonsegregated Facilities."
8

9 General Conditions, Article 11, add new paragraph "I" as follows:
10

11 "I. The General Prime Contractor may utilize the services of only those Subcontractors who have not
12 been disqualified under existing Federal laws and regulations from participating in Federally assisted
13 construction project."
14

15 **7. NONDISCRIMINATION/AFFIRMATIVE ACTION**

16 General Conditions, Article 32, shall be supplemented and modified as follows:
17

18 Supplement Paragraph B with a new subparagraph as follows:
19

20 "1) The General Prime Contractor shall send to each labor union or representative of workers with
21 which he has a collective bargaining agreement or other contract or understanding, a notice to be
22 provided, advising the labor union or workers' representative of the Contractor's commitments under
23 Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the
24 notice in conspicuous places available to employees and applicants for employment."
25

26 Add new paragraphs G through I as follows:
27

28 "G. The General Prime Contractor shall comply with all provisions of Executive Order No. 11246
29 of September 24, 1965, and of the rules, regulations and relevant orders of the Secretary of Labor.
30

31 H. The General Prime Contractor shall furnish all information and reports required by the
32 referenced documents, rules, regulations and relevant orders stated in Article 33 and shall permit
33 access to its books, records and accounts by appropriate agencies of the State and Federal
34 Governments and by the Secretary of Labor for purposes of investigation to ascertain compliance
35 with such laws, rules, regulations and orders.
36

37 I. The General Prime Contractor shall include all of Paragraphs A through F inclusive in every MEP
38 Subcontract, Subcontract or purchase order unless exempted by rules, regulations or orders of the
39 Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24,
40 1965, so that such provisions shall be binding upon each MEP Subcontractor, Subcontractor or
41 vendor. The General Prime Contractor shall take such action with respect to any MEP
42 Subcontractor, Subcontractor or vendor as the appropriate agency of the Federal or State
43 Government may direct as a means of enforcing such provisions, including sanctions for
44 noncompliance: provided, however, that in the event that the General Prime Contractor becomes
45 involved in, or is threatened with, litigation with an MEP Subcontractor, Subcontractor or vendor
46 as a result of such direction by the appropriate agency of the Federal Government, the General Prime
47 Contractor may request the United States to enter into such litigation to protect the interests of the
48 United States."
49

50 **8. MINIMUM (PREVAILING) WAGES – ADDITIONAL FEDERAL CONTRACTING**
51 **REQUIREMENTS**

52 General Conditions, Article 33, add new Paragraphs "F through J" as follows:
53

1 "F. All mechanics and laborers employed or working directly upon the site of the work shall be paid
2 unconditionally, and not less often than once a week, and without subsequent deduction or rebate on any
3 account [except such payroll deductions as are permitted by the Copeland Regulations (29 Code of Federal
4 Regulations, Part 3)], the full amounts due at time of payment computed at wage rates not less than the
5 aggregate of the basic hourly rates and the rates of payments, contributions, or costs for any fringe benefits
6 contained in the wage determination decision of the Secretary of Labor which is attached hereto and made a
7 part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor
8 of Subcontractor and such laborers and mechanics, and the wage determination decision shall be posted by
9 the General Prime Contractor at the site of the work in a prominent place where it can easily be seen by the
10 workers.

11
12 G. The General Prime Contractor may discharge its obligation under paragraph 33. to workers in any
13 classification for which the wage determination decision contains:

14
15 1) Only a basic hourly rate of pay, by making payment not less than such basic hourly rate, except as
16 otherwise provided in the Copeland Regulations (29 CFR, Part 3); OR

17
18 2) Both a basic hourly rate of pay and fringe benefit payments, by making payment in cash, by
19 irrevocably making contributions pursuant to a fund, plan or program for and/or by assuming an enforceable
20 commitment to bear the cost of bona fide fringe benefits contemplated by the Davis-Bacon Act, or by any
21 combination thereof. These fringe benefit payments can be discharged only by making contributions to the
22 same type or types of fringe benefits listed in the applicable determination. Contributions made, or costs
23 assumed, on other than a weekly basis shall be considered as having been constructively made or assumed
24 during a weekly period to the extent that they apply to such period. Where a fringe benefit is expressed in a
25 wage determination in any manner other than as an hourly rate and the General Prime Contractor pays a cash
26 equivalent or provides an alternative fringe benefit, it shall furnish information with his payrolls showing
27 how it determined that the cost incurred to make the cash payment or to provide the alternative fringe benefit
28 is equal to the cost of the wage determination fringe benefit. In the event of disagreement between or among
29 the interested parties as to an equivalent of any fringe benefit, the State shall submit the question together
30 with its recommendation through the appropriate Federal agency to the Secretary of Labor for final
31 determination.

32
33 H. The assumption of an enforceable commitment to bear the cost of fringe benefits listed in the wage
34 determination decision forming a part of the Contract may be considered as payment of wages only with the
35 approval of the Secretary of Labor pursuant to a written request by the General Prime Contractor. The
36 Secretary of Labor may require the General Prime Contractor to set aside assets, in a separate account, to
37 meet its obligations under any unfunded plan or program.

38
39 I. The State shall require that any class of laborers or mechanics which is not listed in the wage
40 determination and which is to be employed under the General Prime Contractor shall be classified or
41 reclassified conformably to the wage determination and a report of the action taken shall be sent to the
42 appropriate Federal agency. If the interested parties cannot agree on the proper classification or
43 reclassification of a particular class of laborers or mechanics to be used, the State shall submit the question
44 together with its recommendations through the appropriate Federal agency to the Secretary of Labor for final
45 determination.

46
47 J. In the event it is found by the State that any laborer or mechanic employed by the General Prime
48 Contractor, MEP Subcontractor or any Subcontractor directly on the site of the work has been or is being
49 paid at a rate of wages less than the rate of wages required by Article 33., the State may (a) by written notice
50 to the General Prime Contractor terminate its right to proceed with the work, or such part of the work as to
51 which there has been a failure to pay said required wages, and (b) prosecute the work to completion by
52 General Prime Contractor or otherwise, whereupon such General Prime Contractor and its sureties shall be
53 liable to the State for any excess costs occasioned thereby."

1 **9. ADDITIONAL GENERAL CONDITIONS**

2 Add new Articles "38 through 42" to the General Conditions as follows:

3
4 **38. CONTRACT WORK HOURS STANDARDS ACT - OVERTIME COMPENSATION**

5
6 (40 United States Code 327-330)

7 A. The General Prime Contractor shall not require or permit any laborer or mechanic in any work-week
8 in which it is employed on any work under this Contract to work in excess of 40 hours in such work-week
9 on work subject to the provisions of the Contractor Work Hours Standards Act unless such laborer or
10 mechanic receives compensation at a rate not less than one and one-half times its basic rate of pay for all
11 such hours worked in excess of 40 hours in such work-week. The "basic rate of pay" as used in this provision
12 shall be the amount paid per hour, exclusive of the General Prime Contractor's contribution or cost for fringe
13 benefits, and any cash payment made in lieu of providing fringe benefits, or the basic hourly rate contained
14 in the wage determination, whichever is greater.

15
16 B. In the event of any violation of the provisions of Article 38.A. above, the General Prime Contractor
17 shall be liable to any affected employee for any amounts due. Such liquidated damages shall be computed
18 with respect to each individual laborer or mechanic employed in violation of the provisions of Article 38.A.
19 in the sum of \$10 for each calendar day on which such employee was required or permitted to be employed
20 on such work in excess of the standard work-week of 40 hours without payment of the overtime wages
21 required by Article 38.A.

22
23 **39. PAYROLLS AND BASIC RECORDS**

24 A. The General Prime Contractor shall maintain payrolls and basic records relating thereto during the
25 course of the work and shall preserve them for a period of three (3) years thereafter for all laborers and
26 mechanics working at the site of the work. Such records shall reference the project and contain the name and
27 address of each employee, its correct classification, rate of pay (including rates of contributions for, or costs
28 assumed to provide, fringe benefits), daily and weekly number of hours worked, deductions made and actual
29 wages paid. Whenever the General Prime Contractor has obtained approval from the Secretary of Labor as
30 provided in Article 33.F., it shall maintain records which show the commitment, its approval, written
31 communication of the plan or program to the laborers or mechanics affected, and the costs anticipated or
32 incurred under the plan or program.

33
34 B. The General Prime Contractor shall obtain and preserve copies of payrolls of all MEP
35 Subcontractors and Subcontractors as required for the General Prime Contractor's own records. Provide a
36 signed statement if directed indicating that the payrolls are correct and complete, that the wage rates contained
37 therein are not less than those determined by the Secretary of Labor, and that the classifications set forth for
38 each laborer or mechanic conform with the work it performed. Retaining of the "Weekly Statement of
39 Compliance" required under this Contract and the Copeland Regulations of the Secretary of Labor (29 CFR,
40 Part 3) shall satisfy the requirement for providing of the above statement. The General Prime Contractor
41 shall also preserve a copy of any approval by the Secretary of Labor with respect to fringe benefits which is
42 required by Article 33.G.

43
44 C. The General Prime Contractor shall make the records required under Articles 39.A. and 39.B.
45 available for inspection by authorized representatives of the State Agency, the State, the appropriate Federal
46 agency and the U.S. Department of Labor, and shall permit such representatives to interview employees
47 during working hours on the job.

48
49 D. The General Prime Contractor shall certify to the State Agency, the State of Wisconsin, the
50 appropriate Federal agency and the U.S. Department of Labor that the wages paid are in compliance with the
51 wage rate requirements of the contract.

52
53 E. The General Prime Contractor shall submit electronic copies of the payroll records (copy of payroll
54 checks) to the State of Wisconsin's DFD Construction Representative who shall review same for compliance

1 with the wage rate requirements of the contract. This shall be done each time the Contractor makes
2 application for payment. Approval of payment shall be made upon review of compliance.
3

4 40. COMPLIANCE WITH COPELAND REGULATIONS

5 The General Prime Contractor shall comply with the provisions of the Copeland "Anti-kickback Act" (18
6 U.S.C. 874) as supplemented in Department of Labor regulations (29 CFR, Part 3). This Act provides that
7 each General Prime Contractor, MEP Subcontractor or Subcontractor shall be prohibited from inducing, by
8 any means, any person employed in the construction, completion or repair of public work, to give up any
9 compensation to which it is otherwise entitled. In addition, the Weekly Statement of Compliance required
10 by these Regulations shall also contain a statement that the fringe benefits paid are equal to or greater than
11 those set forth in the minimum wage decision.
12

13 41. CONTRACT TERMINATION - DEBARMENT

14 A breach of General Conditions Articles 11, 26, 33, 38, 39, 40, respectively entitled "Subcontracts",
15 "Payments to Contractor", "Minimum Wages", "Contract Work Hours Standards Act - Overtime
16 Compensation (40 USC 327-330)", "Payrolls and Basic Records", and "Compliance with Copeland
17 Regulations", may be grounds for termination of the Contract and for debarment as provided in 29 CFR 5.6.
18

19 42. CERTIFICATION OF NONSEGREGATED FACILITIES

20 (Applicable to Contracts and Subcontracts exceeding \$10,000 that are not exempt from the provisions of
21 Article 32, "Nondiscrimination/Affirmative Action".)
22

23 A. By entering into an agreement related to the work described in the Contract Documents the General
24 Prime Contractor, MEP Subcontractor or Subcontractor certifies that it does not maintain or provide for its
25 employees any segregated facilities at any of his establishments, and that it does not permit its employees to
26 perform their services at any location under its control where segregated facilities are maintained. The
27 General Prime Contractor, MEP Subcontractor or Subcontractor agrees that a breach of this certification is a
28 violation of General Conditions Article 32 "Nondiscrimination/Affirmative Action". As used herein, the
29 term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants
30 and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking
31 fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees on
32 the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. The General
33 Prime Contractor further agrees that (except where it has obtained identical certifications from proposed MEP
34 Subcontractors and Subcontractors for specific time periods) it shall obtain identical certifications from
35 proposed Subcontractors prior to provisions of the "Nondiscrimination/Affirmative Action" clause; that it
36 shall retain such certifications in its files; and that it shall forward the following notice to such proposed MEP
37 Subcontractors and Subcontractors (except where the proposed MEP Subcontractors and Subcontractors have
38 submitted identical certifications for specific time periods):
39

40 "NOTICE TO PROSPECTIVE MEP SUBCONTRACTORS AND SUBCONTRACTORS OF
41 REQUIREMENT FOR CERTIFICATIONS OF NONSEGREGATED FACILITIES"
42

43 A Certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32 Federal Register 7439,
44 May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior
45 to the award of a Subcontract exceeding \$10,000 that is not exempt from the provisions of Article 32
46 "Nondiscrimination/Affirmative Action". The Certification may be submitted either for each Subcontract or
47 for all Subcontracts during a period, i.e., quarterly, semi-annually or annually.
48

49 B. The penalty for making false statements in Certifications required by Article 42.A. is prescribed in
50 18 USC 1001.
51

52 **10. TIME FOR COMPLETION OF THE PROJECT**
53

1 This project shall be completed and commissioned by August 29th, 2019. Failure to meet the final completion
2 date for this project shall result in liquidated damages of \$1000 per day.
3

4 **11. SCHEDULE OF OCCUPATIONAL CLASSIFICATIONS AND**
5 **MINIMUM HOURLY WAGE RATES (REPEALED)**
6

7 **The 2017-2019 Wisconsin State Budget (2017 Wisconsin Act 59) repealed Wisconsin's prevailing**
8 **wage laws. Effective September 23, 2017, state prevailing wage requirements on state building**
9 **projects no longer apply. These changes take effect for projects advertised for bid after September**
10 **23, 2017. This change does not affect the Federal Davis Bacon Act requirements.**

11 ***
12
13

1 **SUBMITTAL LOG** (Rev 11/2017)

2 If necessary for the project, insert the PDF version of the Submittal Log (original is an Excel Spreadsheet),
3 as edited for the specific project, in this location of the specification manual.

4

DIVISION 1 - GENERAL REQUIREMENTS (Rev 11/2017)

Division Project No. **18-0001**

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1. DEFINITIONS

In this document, the following terms are defined as:

- (a) "Mechanical, electrical, or plumbing subcontractor" ("MEP Subcontractor") is a contractor that performs mechanical (Heating, Ventilating, and Air Conditioning), electrical, plumbing, or fire protection

(fire suppression) work for the Project, and enters into a contract with the General Prime Contractor to perform their division of work.

(b) "Qualified bidder" means a contractor that the department certifies under Wis. Stat. s. 16.855(9m)(b)1.

(c) "Qualified responsible bidder" means a contractor who is a qualified bidder and who is a responsible bidder.

(d) "Responsible bidder" means a contractor that the department certifies under Wis. Stat. s. 16.855(9m)(b)2.

(e) "Single prime contracting" means bidding and contracting through a process in which only a general prime contractor has a contractual relationship with the state and all mechanical, electrical, or plumbing subcontractors are identified by the department and are subcontractors to the General Prime Contractor.

(f) "General Prime Contractor" is a contractor that enters into a contract with the state to perform all work as required by the Contract Documents and enters into contracts with subcontractors including MEP Subcontractors identified by DFD.

(g) "Non-MEP Subcontractor" is a subcontractor to a General Prime Contractor in divisions of work other than mechanical, electrical, plumbing, and fire protection. This includes suppliers and installers to the General Prime Contractor.

(h) "Subcontractor" is all subcontractors on a project. This includes MEP Subcontractors, subcontractors to the MEP Subcontractors, and Non-MEP Subcontractors.

(i) "Contractor" is all contractors working on a project regardless of contractual relationship. This includes the General Prime Contractor, MEP Subcontractors, Non-MEP Subcontractors, and all Subcontractors, regardless of tier of subcontract.

2. GENERAL

All articles in these General Requirements are applicable to all Divisions and Sections of the Work included herein. The Conditions of the Contract, General and Supplementary General Conditions, and these General Requirements shall apply with equal force and effect to the General Prime Contractor and all Subcontractors engaged in this work.

Contractor or the Contractor's authorized representative must be present to accept delivery of all equipment and material shipments. DFD's representatives will not knowingly accept, unload or store anything delivered to the site for the Contractor's use. Inadvertent acceptance of delivered items by any representative or employee of the State shall not constitute acceptance or responsibility for any of the materials or equipment. It is the Contractor's responsibility to assume liability for equipment or material delivered to the job site.

3. SPECIAL SITE CONDITIONS

Confine all operations, equipment, apparatus and storage of materials, to the immediate area of work to the greatest possible extent. Contractor shall ascertain, observe and comply with all rules and regulations in effect on the project site, including but not limited to parking and traffic regulations, use of walks, security restrictions and hours of allowable ingress and egress. Any special traffic control during construction involving lane closures shall be in accordance with the federal standard, Manual of Uniform Traffic Control Devices.

The Contractor shall take all measures necessary to become acquainted with the location of underground service, utilities, structures, etc., which may be encountered or be affected by the Contractor's work, and shall be responsible for damage caused by neglect to provide proper precautions or protection. As a minimum to become acquainted with such underground appurtenances, the Contractor shall: 1) Observe existing

1 conditions visible at the site immediately prior to commencement of work; 2) Review available site plans
2 incorporated in the contract documents and/or provided by the DFD Project Representative; 3) Final check
3 with the DFD Project Representative for additions to or changes from conditions indicated on site plans for
4 the facility; and 4) Obtain input from the “one-call system”, the organization composed of all suppliers of
5 utilities/services to or from the site.

6
7 Information pertaining to existing conditions that are described in the specifications or appear on the drawings
8 is based on available records. While such data has been collected with reasonable care, there is no expressed
9 or implied guarantee that conditions so indicated are entirely representative of those actually existing. This
10 information is provided to inform the Contractor of known, existing conditions so that due diligence is taken
11 by the Contractor to avoid damage. Where site observation or documents indicate existing underground
12 utilities/services in close proximity (within four feet horizontally and/or four feet vertically) to necessary new
13 construction work, the Contractor shall be responsible to test, probe or otherwise determine exact locations
14 so as to prevent damage to such utilities/services.

15
16 Existing pipes, electrical work, and all other utilities encountered, which may interfere with new work, shall
17 be re-routed, capped, cut off, or replaced by the Trades having jurisdiction, in accordance with the Bidding
18 and Contract Documents.

19
20 Foundations are designed for soil pressure indicated. Because of variation in bearing capacity of the ground,
21 some foundations may have to be revised after excavation has been completed. DFD’s Project
22 Representative’s approval to proceed with foundation work must be obtained before concrete is poured.
23 Changes in the work due to revisions of foundations because of unsatisfactory soil conditions will be classed
24 as additional work.

25
26 [Note to Architect/Engineer: In accordance with Wisconsin Statute 182.0175(2), the architectural,
27 mechanical and electrical designers are responsible to determine the location and condition of existing
28 systems and components and indicate how existing systems and components are to be re-routed, protected
29 from, and/or connected to the proposed work. The designers must use this information to appropriately revise
30 the Division 1-General Requirements master specifications provided by Division of Facilities Development
31 stated herein.

32
33 This section must include specific information about occupancy and scheduling for systems shutdown and
34 how they affect this work. Information must also be given disclosing the location and condition of anything
35 required to make these connections possible. For example: are there isolation valves where they are needed
36 and if so, do they work? Everything possible must be done to eliminate unknowns from the bidding
37 documents.

38
39 These things are part of the discovery and planning process for design and must be covered adequately in the
40 documents to facilitate intelligent bidding and to avoid arguments and delays during construction. The
41 designer may need to utilize the “one-call system” or a private locator service to facilitate this discovery and
42 planning process.]

43 44 **4. INSPECTION OF SURFACES**

45 Contractor shall obtain complete data at the site and inspect surfaces that are to receive the Work before
46 proceeding with fabricating, assembling, fitting or erecting any work under this contract.

47
48 Contractor shall notify DFD's Project Representative in writing in case of discrepancies between existing
49 work and drawings, and of any defects in such surfaces that are to receive the Contractor's work. DFD's
50 Project Representative will evaluate the notice and direct what remedial action will be taken.

Starting of work implies acceptance of existing work or the work of others. Removal and replacement of work applied to defective surfaces, in order to correct defects, shall be done at the expense of the Contractor who applied work to defective surfaces.

5. HAZARDOUS SUBSTANCES - ASBESTOS, LEAD AND POLYCHLORINATED BIPHENYLS (PCB'S)

Airborne asbestos fibers, lead, and PCB compounds, if encountered, have been determined to be hazardous to one's health. Compliance with all possible applicable regulations is the Contractor's responsibility. Contractor shall not provide or install any product that contains any amount of asbestos or PCB. See General Requirements, CLEANING AND WASTE DISPOSAL for disposal of hazardous waste, if encountered.

ASBESTOS

Contractor's attention is directed to WAC NR 447, WAC DHS 159 and the Occupational Safety and Health Act (OSHA) in general, part 1926.1101--ASBESTOS in particular. Contractor is responsible for compliance with all applicable regulations when the work includes fastening to or coring through Asbestos Containing Materials (ACM) and disturbance of asbestos containing caulking and adhesives. The Contractor is responsible for removal and disposal of Category I non-friable ACM that will be disturbed by the work.. Unless otherwise indicated, all caulking, sealants, glazing compounds, gaskets, asphalt roofing materials, damp proofing and miscellaneous adhesives are assumed to contain asbestos and are considered to be Category I non-friable ACM as defined in NR 447. Waste material containing Category I non-friable ACM, is regulated as Construction and Demolition (C&D) waste and may be disposed of at a Department of Natural Resources (DNR) approved C & D waste landfill. If Contractor's work methods cause non-friable ACM to become friable, the Contractor is responsible for the disposal of the friable asbestos waste at a landfill specifically approved by DNR to accept friable asbestos. A copy of the signed waste manifest for the disposal of all friable asbestos waste shall be provided to DFD prior to request for final payment.

The regulations referenced above require removal of friable ACM and Category II non-friable ACM prior to demolition of a building. Category I non-friable ACM does not need to be removed from a building prior to demolition if the waste generated from the demolition is taken to a DNR approved C & D waste landfill. If the contractor chooses to recycle building materials from a building to be demolished, the contractor is responsible for removal and disposal of all Category I non-friable ACM in accordance with applicable regulations prior to demolition. If the contractor's demolition methods will cause non-friable ACM to become friable, the contractor is responsible for removal and disposal of all Category I non-friable ACM in accordance with applicable regulations prior to demolition.

The following building materials have been identified to be ACM.

The following building materials have been identified to be non-ACM.

Lead Based Paint

Paint and glazed finishes on tile and masonry units is assumed to contain lead. The Contractor is responsible for compliance with Occupational Safety and Health Act (OSHA) in general and particularly to 29 CFR 1910 (LEAD STANDARD) and to CFR 1926 (LEAD EXPOSURE IN THE CONSTRUCTION INDUSTRY). Dispose of refuse containing lead based paint or contaminated with lead by the demolition process in conformance with State of Wisconsin Hazardous Waste Regulations set forth by the Department of Natural Resources and in conformance with OSHA and EPA recommended worker safety requirements.

PCB'S

Contractor's attention is directed to Wisconsin Administrative Code, Chapter NR 157 relative to PCB's. Refer to Division 26, Electrical within these specifications for work involving PCB's.

1 **6. SOIL TEST BORINGS**

2 Test borings have been made and boring data has been provided; however, these records do not form a part
3 of the Contract Documents, but are provided for information only.
4

5 Neither the Architect/Engineer nor DFD guarantee continuity of conditions indicated at the boring locations.
6

7 Contractor must interpret the soil boring data and be satisfied as to the materials to be excavated and materials
8 upon which fill or other materials may be placed.
9

10 **7. MUTUAL RESPONSIBILITY**

11 Contractor(s) shall coordinate the work with adjacent work and shall cooperate with all other trades to
12 facilitate the general progress of the work. Each trade shall afford all other trades every reasonable
13 opportunity for the installation of their work and for the storage of their material. In no case will the
14 Contractor(s) be permitted to exclude from the premises or work, any other Contractor or employees thereof,
15 or interfere with any other Contractor in the executing or installation of their work.
16

17 Contractor(s) shall arrange the work and dispose of materials so as not to interfere with the work or storage
18 of materials of others and each shall join their work to that of others in accordance with the intent of the
19 drawings and specifications.
20

21 All Contractors shall work in cooperation with the General Prime Contractor and with each other, and fit
22 their work into the structure as job conditions may demand. All final decisions as to the right-of-way and
23 run of pipe, ducts, etc., shall be made by DFD at prearranged meetings with responsible representatives of
24 the Contractors involved.
25

26 **8. PROJECT MEETINGS**

27 Project meetings will be held at the time designated by DFD. Contractor, when requested, shall attend these
28 meetings. If the principal of the firm does not attend meetings, a responsible representative of the Contractor
29 who can bind the Contractor to a decision at the meetings shall attend.
30

31 The Architect/Engineer or a representative thereof will write a report covering all items discussed and
32 decisions reached and copy of such report distributed to all parties involved.
33

34 **9. SLEEVES AND OPENINGS**

35 Each Contractor requiring sleeved openings shall furnish all sleeves required for their penetrations whether
36 or not they responsible for providing the respective openings. Contractors furnishing sleeves to others for
37 installation shall do this in a timely manner so as not to impede the project schedule.
38

39 Openings shown on the structural and/or architectural drawings shall be the responsibility of the General
40 Prime Contractor. Sleeves furnished by other contractors for openings shown on the structural and/or
41 architectural drawings shall be installed by the General Prime Contractor.
42

43 Openings that are required and are not shown on the structural and/or architectural drawings shall be the
44 responsibility of the contractor requiring the openings. The contractor requiring the opening shall install
45 sleeves for these openings or cut openings as needed (including floor openings within chases).
46

47 Individuals skilled in such work shall accomplish installation of sleeves and openings.
48

49 Each Contractor shall be responsible for coordinating locations of their sleeves with work of other trades.
50

51 Each Contractor who requires sleeves and/or openings shall submit through the General Prime Contractor,
52 to DFD's Project Representative for review and approval, layout drawings of all such required sleeves and/or
53 openings. Sleeve and opening layout drawings shall be received by DFD a minimum of two weeks prior to

1 installation of the sleeves and openings. Sleeve and opening sizes and locations shall be dimensioned from
2 column lines and floor elevations or from a point of reference approved by DFD.
3

4 **10. CUTTING AND PATCHING**

5 Provisions of Article 9. Sleeves and Openings herein, cover the work involved for providing and installing
6 sleeves and openings.
7

8 Cutting and patching required to access work in existing walls, in chases, above inaccessible ceilings, below
9 floors, etc., shall be by the Contractor who requires the access, unless shown in the bid documents otherwise
10 or noted otherwise.
11

12 The Contractor shall do all cutting, or fitting of the work as required to make its several parts fit together, or
13 to receive the work of others, as shown or reasonably implied by the drawings or specifications, or as may
14 be directed by DFD. Holes cut in exterior walls and/or roofs shall be waterproofed.
15

16 The Contractor who cuts for required access to work shall also be responsible for patching. Where cutting
17 and patching is required, Contractor shall hire individuals skilled in such work to do cutting and patching.
18

19 Except where specifically identified, the Contractor who removes or relocates building components which
20 leave a remaining opening shall be responsible for patching the opening., Where building components are
21 removed by the Asbestos abatement Contractor on behalf of a contractor, the Contractor on whose behalf the
22 components are removed shall be responsible for patching the remaining opening.
23

24 Patching includes repairing openings to match adjacent construction and painting the surface to match
25 existing. Painting means covering the entire wall where patching is to be done to nearest break point or
26 corner unless indicated to be done by other trades.
27

28 Contractor shall not endanger any work by cutting, digging or otherwise and shall not cut or alter the work
29 of others without their consent.
30

31 Do not pierce beams or columns without permission of DFD and then only as directed in writing. If any
32 ductwork, piping, conduit, etc. is required through walls or floors where no sleeve has been provided, use a
33 core drill or saw cut to prevent damage and structural weakening.
34

35 Wherever any material, finish, or equipment, is damaged, the skilled trade shall accomplish the repair or
36 replacement, in that particular work and the cost shall be charged to the party responsible for the damage.
37 DFD reserves the right to disallow any means and/or methods that, in the opinion of DFD, are harmful to
38 and/or not in the best interest of preserving the improvements receiving the work.
39

40 **11. MANUFACTURER'S DIRECTIONS**

41 Contractors shall apply, install, connect, erect, use, clean and condition manufactured articles, materials, and
42 equipment as recommended by the manufacturer, unless specified to the contrary. The manufacturer's latest
43 recommendations at the time of bidding shall be used.
44

45 **12. LAYOUT**

46 The General Prime Contractor shall immediately upon entering the site for purpose of beginning work, locate
47 general reference points and take such action as is necessary to prevent their destruction. Each Contractor
48 shall lay out its work and be responsible for all lines, elevations and measurements of the building and other
49 work executed under its Contract. Each Contractor must exercise proper precaution to verify dimensions on
50 the drawings before laying out work and will be held responsible for any error resulting from failure to
51 exercise such precaution.
52

1 Using datum furnished by the State, the lot lines and present levels have been established as shown on the
2 drawings. Other grades, lines, levels and benchmarks, shall be established and maintained by each
3 Contractor, who shall be responsible for them.

4
5 As work progresses, the General Prime Contractor shall lay out on forms and floor, the locations of all
6 partitions, walls and fix column centerlines as a guide to all trades.

7
8 The General Prime Contractor shall make provision to preserve property line stakes, benchmarks, or datum
9 point. If any are lost, displaced or disturbed through neglect of any Contractor, Contractor's agents or
10 employees, the Contractor responsible shall pay the cost of restoration.

11
12 Each Contractor shall verify grades, lines, levels, locations and dimensions as shown on drawings and report
13 any errors or inconsistencies to DFD's Project Representative before commencing work. Starting of work
14 by each Contractor shall imply acceptance of existing conditions.

15 16 **13. SUPERVISION**

17 The General Prime Contractor shall take complete charge of the work under this contract and coordinate the
18 work of all Trades on the project.

19 20 **14. FIELD OFFICES**

21 Field offices shall not be necessary for the duration of the project.

22 23 **15. STAIRS AND SCAFFOLDS**

24 The General Prime Contractor shall:

25
26 Furnish and maintain equipment such as temporary stairs, fixed ladders, ramps, chutes, runways and the like
27 as required for proper execution of work by all trades, and shall remove them on completion of the work.

28
29 Erect permanent stair framing as soon as possible. Provide stairs with temporary treads, handrails, and shaft
30 protection.

31
32 Contractors requiring scaffolds shall make arrangements with and compensate the General Prime Contractor
33 for scaffolding, or shall provide their own and remove them upon completion of the work.

34
35 Each Contractor shall underlay its interior scaffolds with planking to prevent uprights from resting directly
36 on the floor construction.

37 38 **16. HOISTS, ELEVATORS OR CRANES**

39 Each separate contractor shall provide and pay for its own hoist/crane or other apparatus necessary for
40 unloading/setting or moving their equipment and materials. Installation and removal of equipment for this
41 activity must be accounted for in the Project Schedule.

42
43 Equipment and operations for this activity shall comply with applicable Department of Safety and
44 Professional Services and OSHA requirements. No material hoist may be used to transport personnel unless
45 it meets Department of Safety and Professional Services and OSHA requirements for that purpose.

46
47 Contractors shall provide any protection required, temporary or long term, to prevent damage to work in
48 place or in progress. When hoisting activity results in such damage, the responsible contractor shall pay for
49 cleaning, repair or replacement of material or equipment as determined by DFD.

50
51 Equipment, that imposes loads of any kind on work in place, shall not be erected without agreement from
52 DFD.

1 At their own discretion, two or more contractors may agree to use common hoisting facilities. Under such
2 arrangements, the allocation of costs, access and scheduling and all other details of the agreement are the
3 responsibility of the contractors involved.

4
5 Existing elevators may be used on a limited basis with DFD's permission and agreement. Costs of warranty
6 extensions and additional service work required will be paid by the using contractor. Appropriate protection
7 must be provided by the using contractor and that contractor shall be responsible for any structural,
8 mechanical or finish damage to the elevator and its parts and to adjoining building finishes and components.

10 **17. SIGNS**

11 No individual advertising signs, plaques or credits, temporary or permanent, will be permitted on the building
12 or premises, except the name of the Contractor on Contractor's office or material shed.

14 **18. FENCE**

15 The General Prime Contractor shall provide a neat appearing protective fence where indicated on the
16 drawing, constructed of standard studded T-Posts of sufficient length for line posts and spaced not to exceed
17 8'-0" apart. Corner posts and gate posts are to be galvanized steel pipe of not less than 2 1/2" o.d. and shall
18 be properly braced. A 4-foot high wooden snow fence shall be securely fastened to the supports. Plastic
19 fencing is not acceptable. The snow fence shall project 4" above the fence posts. Provide gates, properly
20 constructed and braced, complete with hinges, hasps, and padlocks in number and location required for proper
21 control, delivery and distribution of material and equipment. Gate posts shall be adequately back tied and
22 anchored to insure a rigid installation. All protective fencing shall be maintained in an upright, orderly
23 fashion throughout the construction schedule. In areas where existing trees are to be protected, the area inside
24 the protective fencing shall not be used for any purpose related to construction activities, such as material
25 storage, vehicle parking, portable toilets, or other disruptive activities that would result in damage of any
26 kind to the site inside the fence.

28 **19. ROADWAY**

29 The General Prime Contractor may build a temporary roadway for delivery of materials at the Contractor's
30 own expense and maintain it until completion of construction or until service drives are installed. Where
31 possible, build temporary roadway within the confines of the new roadway and allow others to use it at no
32 cost. Any gravel topping used for temporary roadway shall be at least 6" below finished elevation of
33 permanent drives. If temporary roadway is not intended to be converted to a permanent road, all road
34 materials shall be removed upon termination of access need, and the confines of the temporary roadway shall
35 be repaired to match adjacent area.

37 **20. TOILETS**

38 The General Prime Contractor shall provide and maintain sanitary temporary toilets, located where directed
39 by DFD's Project Representative, in sufficient number required for the force employed. The toilets shall
40 comply with International Building Code Chapter 29 on Plumbing Systems. Toilets shall be self-contained
41 chemical type.

42
43 As soon as conditions will allow, the Plumbing Trade shall provide temporary toilets within the building,
44 where directed, and equip the room with at least two temporary water closets and one temporary lavatory,
45 each with connections to cold water and sanitary sewer. The General Prime Contractor shall provide a
46 temporary wood enclosure with doors; remove when directed.

47
48 After directed by DFD's Project Representative, the Plumber shall remove the temporary fixtures and replace
49 them with permanent fixtures.

50
51 After temporary toilet accommodations are provided within the building, the General Prime Contractor shall
52 remove the temporary outside toilets.

1 The General Prime Contractor shall maintain the temporary toilets in a sanitary condition at all times and
2 shall supply toilet paper until completion of the job.

3
4 Contractor should arrange with state agency to use nearby existing toilet facilities. Toilets used by
5 workmen shall be kept clean and sanitary at all times.

6 7 **21. TELEPHONES**

8 It is expected that each contractor have access to their own cell phone for their own use. No additional
9 telephone service will be provided

10 11 **22. WATER SUPPLY**

12 The General Prime Contractor shall supply all water required for construction and other purposes until the
13 permanent water supply system is accepted and in operation.

14
15 Immediately after award of contract, the Plumbing Trade shall make arrangements for temporary connections
16 and extension of existing water service facilities. As soon as possible, the Plumbing Trade shall install the
17 permanent main into the building and provide a temporary gate valve, extend piping, provide temporary
18 water meter, and provide two 3/4" hose bibbs on each floor, located where directed. Permanent risers may
19 be used for temporary service. Provide two 3/4" hose bibbs outside of the building at suitable locations for
20 construction purposes where directed.

21
22 The Plumbing Trade shall supply, maintain the installation, and remove it when directed by DFD's Project
23 Representative. The General Prime Contractor shall provide necessary patching of surfaces and structure
24 after such temporary service is removed.

25
26 The General Prime Contractor shall prevent waste of water and shall maintain valves, connections, and hoses
27 in perfect condition, at all times. Trades shall provide their own hose or piping from hose bibbs.

28
29 The Contractor shall pay cost of water used.

30
31 Immediately after award of contract, the Plumbing Trade shall make arrangements to begin underground
32 sewer work and shall complete sewer work, including backfilling required, as soon as possible.

33
34 Contractor should arrange with state agency to use nearby existing water service. Toilets and slop sinks
35 used by workmen shall be kept clean and sanitary at all times.

36 37 **23. TEMPORARY ELECTRICAL WORK**

38
39 The General Prime Contractor shall make all arrangements with the local utility company for metered
40 electrical service, pay for the installation of all temporary service to utility point of termination shown on
41 drawings, and upon completion of project, pay for removal of temporary service. The General Prime
42 Contractor shall patch surfaces and structure after services have been removed. The service shall be 120/208
43 volt, 3 phase, 4 wire, 200 amps.

44
45 If a Contractor contemplates the use of equipment that requires a different voltage or greater capacity than
46 that specified, then that Contractor must arrange with Utility for this additional service and pay for installation
47 of the service and the necessary additional switches and wiring required.

48
49 The meter shall be taken out in the General Prime Contractor's name.

50
51 The General Prime Contractor shall pay for all electrical energy consumed for construction purposes for all
52 trades including temporary offices, for operation of ventilating equipment, for heating of building, and for
53 testing and operating of all equipment. The General Prime Contractor shall continue to pay for energy used
54 until substantial completion even though equipment has been connected to the permanent wiring.

Any Trade that has a temporary office shall provide and pay for installation of temporary service for lighting of such temporary office.

The Electrical Trade shall provide meter base and wiring to point of utility termination, provide main fused service switch, and fused or breaker distribution panel(s). The Electrical Trade shall also provide, at no cost to others, all lamps, wiring, switches, sockets and similar equipment required for temporary system until substantial completion. Upon completion of the project, the Electrical Trade shall remove the temporary system.

The temporary lighting system shall be sufficient to enable all trades to safely complete their work and to enable DFD's Project Representative to check all work as it is being done. Illumination shall be 5 foot-candles minimum in all areas and, in addition, shall meet or exceed the requirements of 29 CFR 1926.56 Illumination (OSHA regulations).

Provide at least one duplex outlet for small power tools for each 400 square feet of floor space, 120 volt single phase. Circuits shall be 20 ampere, single pole.

In accordance with the latest issue of the National Electrical Code, all temporary electrical circuits for construction purposes shall be equipped with combination ground fault interrupter and circuit breakers meeting the requirements of UL for Class A, Group 1 devices. The ground fault interrupter portion shall be solid state type, insulated and isolated from the breaker mechanism. A test button shall be provided for checking the device. The breaker mechanism shall provide overload and short circuit protection and shall be operated by a toggle switch with overcenter switching mechanism so that contact cannot be held closed.

All Trades shall furnish their extension cords and lamps other than those furnished for general lighting.

All Trades and other separate Contractors shall be allowed to use the service provided for general lighting and fractional horsepower hand tools at no cost.

The General Prime Contractor shall be compensated by those requiring three phase and single-phase energy used for equipment other than fractional horsepower hand tools. Arrangements shall be made with the General Prime Contractor before construction equipment is used.

The General Prime Contractor shall post the cost rates at start of construction. Rates may be posted on an hourly use basis or energy may be submetered at the General Prime Contractor's option, but shall be based upon a fair and reasonable estimate of the cost of power used as billed by the Utility.

Those trades requiring lighting or other electrical service outside of building shall pay for the installation and removal of service, maintenance charges, and energy consumed.

Trades requiring voltage other than basic temporary system specified, three phase power, or a special single phase run, for operation of construction equipment or testing shall make their own arrangements with the General Prime Contractor for cost of energy used, and the Electrical Trade for the cost of installation, and removal when no longer required.

Heating and Ventilating Trade shall provide wiring, equipment and connections for portable or temporary heating units.

The Electrical Trade shall expedite the work under this contract in such a manner that the permanent power wiring system and panels will be installed and connected to permanent heating and ventilating equipment in time to operate and test this equipment when the building has been closed sufficiently to permit the use of portions of heating and ventilating system for temporary heating during construction. Permanent wiring and

connections may be used at permanent equipment; however, the use of the permanent system during construction shall in no way waive any part of the guarantee period.

After Substantial Completion of the permanent electrical system and building wiring, permanent receptacles may be used during finishing work. Permanent wiring for lighting fixtures, switches and receptacles shall be installed only after all masonry and plastering has been completed, but this wiring shall not be used for motors larger than fractional HP or for welding equipment. Circuits for larger motors and welding equipment may be provided with special circuits to mains of electrical panels at the expense of those trades requiring them, provided that special permission is obtained from DFD's Project Representative and the installation is made by skilled electricians.

24. COLD WEATHER PROTECTION

All heating and protective covering, required to protect the work from injury due to freezing and moisture during the construction period and prior to enclosure of the building, shall be classed as COLD WEATHER PROTECTION. Such protection shall be provided and paid for by the General Prime Contractor.

Heat required to protect materials from injury due to freezing during the construction period and prior to enclosure, shall be provided by means of portable heating units intended for this purpose.

All heating units must be approved types. Proper ventilation must be provided. The use of temporary units whose product of combustion will damage fresh concrete, mortar or other building materials, will not be allowed. Use of coke or oil salamanders is prohibited.

If electrical power is required for oil or gas portable heating units, it may be taken from the available temporary power source and paid for by the General Prime Contractor.

Heating units and the area surrounding the units shall be kept in a clean and safe condition.

25. ENCLOSURE

Before the building, or portion thereof, can be considered enclosed, the General Prime Contractor shall have advanced the construction of the building to conform with the following requirements.

The exterior walls should be erected to full thickness and height shall extend to the top of the horizontal level which encloses the space intended to receive heat. If erection of full thick walls is not feasible, erection of back-up wall only will be accepted if approved weatherproofing of back-up materials is provided to avoid damage to back-up materials.

The horizontal slab, which will serve as the overhead enclosure of the spaces to receive heat (whether it be the roof slab or intermediate floor slab), shall have all openings covered with closures capable of sustaining any loads imposed thereon. The entire overhead enclosure shall be made weatherproof.

Provide approved translucent material for temporary enclosure of window openings if they have not been glazed. Plain or reinforced polyethylene film or other suitable translucent material will be acceptable, provided it is installed in or on a well fitting rigid wood frame and kept in good repair. This means of temporary enclosure shall be used for other minor openings in walls.

Construct temporary walls as required to protect contents and to separate the interior enclosed sections from the interior open section of the building during construction. Temporary wall enclosure shall consist of plywood panels, at least 3/8" thick, fastened to wood framework, consisting of 2 x 4 studs spaced 24" o.c., securely spiked to wood plates, top and bottom. Provide intermediate girts between studs as required for fastening of plywood. Temporary walls must provide protection from dirt, dust, and drafts.

Provide exterior doors with hinges, self-closing device, and locks.

1 Make suitable provisions for passage of air to permit proper drying out of the building.

2
3 At end of day's work, securely close temporary enclosures. Padlock exterior doors. The General Prime
4 Contractor shall supervise effectiveness of enclosures.

5
6 Where reference is made to a "portion of the building", it is intended to mean definable areas of the building
7 such as a group of floor levels or an entire wing of the building. It is not intended to require a room-by-room
8 or erratic piece-meal enclosure operation, but shall provide for an orderly expansion of large adjacent or
9 related areas to be enclosed which are advantageous to the progress of the work and approved by DFD's
10 Project Representative.

11 12 **26. TEMPORARY HEAT**

13 All heating required after enclosure of the building up to substantial completion shall be classified as
14 TEMPORARY HEAT. Enclosure is defined in preceding Article.

15
16 It shall be the responsibility of the General Prime Contractor to see that every precaution is used to prevent
17 unnecessary escape of heat.

18
19 For installations where central plant steam or central plant hot water will be used for permanent heating, the
20 State will furnish all steam or hot water required for temporary heat at no cost to the Contractor. (Condensate
21 shall be wasted until it is determined by DFD's Project Representative that condensate is of a quality suitable
22 for return to the central plant. When such determination is made all condensate shall be returned to the State's
23 system). It is the responsibility of the heating trade to connect to the existing steam or hot water source.

24
25 For installations that are not connected to central plant steam or central plant hot water, the General Prime
26 Contractor shall pay the fuel costs for temporary heat for both permanent heating systems used for temporary
27 heat and/or temporary heating systems used for temporary heat.

28
29 The General Prime Contractor shall pay for all electrical energy consumed for temporary heat.

30
31 The Heating Trade shall provide one of the following systems or a combination thereof, for furnishing
32 temporary heat:

33
34 Permanent heating system may be used for temporary heating. If permanent system is used, the Heating
35 Trade shall install in their permanent location heating coils or connectors as approved by DFD, with controls
36 to maintain temperatures required. Temporary filters shall be used in the permanent system. Provide bases,
37 shields, etc., around heating elements to prevent too rapid drying of adjacent concrete, masonry or plaster.
38 Relocation of some of the permanent heating system equipment may be required during construction to
39 prevent interference with new construction. Temporary units may be installed in such areas during the time
40 permanent equipment is not operating due to relocation

41
42 If permanent system is not operable and the building is enclosed and heating is required, the Heating Trade
43 may furnish and install a temporary hot water heating system. Where applicable, steam supply piping, heat
44 exchanger, and condensate pump shall be installed. Temporary heating system shall consist of horizontal
45 type "Unit Heaters". Provide unit heaters as required to maintain temperatures specified hereinafter. Each
46 unit shall be installed complete with valve on supply branch and on return, electric line voltage room
47 thermostat to cycle the fan motor, and necessary supply and return piping. Temporary piping shall be run to
48 units on each floor. Return piping shall be run from each unit to common return main terminating at heat
49 exchanger in equipment room. Where applicable, the Heating Trade shall provide a temporary steam prv
50 station and condensate return pump if permanent installation is not ready for operation at the time temporary
51 heat is required. All steam supply piping shall be properly pitched and dripped, and piping shall be sized in
52 accordance with ASHRAE pipe sizing tables.

1 If permanent system is not operable and the building is enclosed and heating is required, the Heating Trade
2 may furnish and install a temporary low pressure steam heating system. The temporary heating system shall
3 consist of horizontal type steam unit heaters. Provide unit heaters as required to maintain temperatures
4 specified hereinafter. Each unit shall be installed complete with gate valve on steam supply branch, float and
5 thermostat trap on return, electric line voltage room thermostat to cycle the fan motor and necessary steam
6 supply and condensate return piping. Temporary steam piping shall be run to units on each floor. Condensate
7 return piping shall be run from each unit to a common return main terminating at the permanent condensate
8 pump in condensate return system. The Heating Trade shall provide a temporary steam prv station and
9 condensate return pump if permanent installation is not ready for operation at the time temporary heat is
10 required. All steam supply piping shall be properly pitched and dripped, and piping shall be sized in
11 accordance with ASHRAE pipe sizing tables.
12

13 The distribution piping of the permanent heating system may be utilized for supply and return to unit heaters
14 on each floor in lieu of temporary piping, provided approved connections, controls and protection of such
15 piping is maintained.
16

17 If the permanent air system is used during temporary heating period, temporary filters shall be provided in
18 the system and they shall have efficiency equal to the permanent filters. The return air ductwork shall be
19 protected from construction dirt by temporary filters placed over return openings.
20

21 If the Heating Trade does not have one of the above systems in operation by the time the building is enclosed,
22 then the Heating Trade shall provide, maintain and supervise the operation of temporary portable units with
23 necessary automatic controls to provide required temperatures. Current required may be taken from the
24 temporary electrical service. See "Temporary electrical Installation". Cost of fuel to operate portable units
25 shall be paid by the General Prime Contractor.
26

27 All electrical wiring required for temporary heating units shall be furnished and installed by Heating Trade,
28 from temporary wiring service. Electrical wiring to permanent equipment used for temporary heating that
29 has been mounted in its permanent location shall be wired by trades skilled in that work.
30

31 The use of open salamanders as portable heating units will not be approved. All portable temporary heating
32 units shall be properly ventilated to prevent combustion gases from remaining in the heating area.
33

34 The Heating Trade must ascertain if heating equipment will operate on the temporary electrical service
35 available. If service is insufficient to operate equipment, Heating Trade shall make other arrangements.
36

37 The Heating Trade shall be responsible for the proper adjustment and maintenance of the system, and shall
38 supervise and be responsible for the operation of the system used for temporary heating until State occupies
39 the building. Supervision shall include periodic checking of operation as required.
40

41 A minimum temperature of 45 degrees and a maximum temperature of 60 degrees for the building shall be
42 maintained by the Heating Trade, except for a period of at least ten days prior to the placing of interior
43 woodwork and throughout the placing of this and other finish, varnishing, painting, etc., and until substantial
44 completion to provide sufficient heat to insure a temperature in the spaces involved of not less than 70 degrees
45 nor more than 80 degrees.
46

47 The temporary heating system shall be removed by the Heating Trade after the permanent heating system
48 has been installed and operating. Surfaces and structure shall be patched as required. Temporary heating
49 equipment shall be relocated by the Heating Trade as required during construction to prevent interference
50 with new construction.
51

52 At completion of construction work or when temporary heat is no longer required, Heating Trade must repair
53 any damage done to permanent equipment during temporary heating period and also perform the necessary

1 cleaning of all ducts and equipment. The Heating Trade shall provide permanent filters to the complete
2 satisfaction of DFD.

3 4 **27. FIRE PROTECTION**

5 The General Prime Contractor shall provide and maintain in working order during the entire construction
6 period, a minimum of three (3) fire extinguishers on each floor level, including basement of the building, and
7 one (1) in temporary office. Extinguishers shall be nonfreeze type such as A-B-C rated dry chemical, of not
8 less than 10-pound capacity each. In addition, any Subcontractor who maintains an enclosed shed on the site
9 shall provide and maintain, in an accessible location, one or more similar nonfreezing type fire extinguisher
10 in each enclosed shed.

11
12 Fire alarm systems and fire suppression systems shall be kept in service during construction. The General
13 Prime Contractor shall impair system operability only as necessary to avoid false alarms, false activations or
14 damage and where required to complete construction activities. The General Prime Contractor is responsible
15 for the first responder cost of repeat false alarms.

16
17 Where systems are impaired, provide a fire protection impairment program in compliance with NFPA 25,
18 NFPA 72, NFPA 101, IFC Chapter 9 and the Authority Having Jurisdiction (AHJ) including the following:

- 19 • Written notification to DFD's Construction Representative, the Agency Impairment Coordinator
20 (to be assigned at the preconstruction meeting), first responders and the fire department of the dates,
21 times and extent of system impairments and system restorations and description of contractor actions
22 minimizing risk.
- 23 • Temporary bagging or removal of smoke detectors during the work day with restoration of smoke
24 detectors at end of the work day.
- 25 • Confirmation that systems are fully operational at the end of the work day before leaving the job
26 site.
- 27 • An approved fire watch or other approved procedures where systems are disabled beyond the work
28 day or where required by the DFD Project Representative, the Agency Impairment Coordinator, first
29 responders or the fire department.
- 30 • Tags indicating which system or system component has been impaired placed at each fire
31 department connection, affected control valve and alarm panel. Remove tags after restoration.
- 32 • Tags listing temporary fire alarm notification procedures on all non-functional fire alarm devices
33 including pull stations, automatic detectors and audio/visuals. Remove tags after restoration.
- 34 • Daily log of system impairments and restorations.

35 36 **28. WATCHPERSONS**

37 Watchpersons will not be furnished by the State. The Contractor shall provide such precautionary measures,
38 to include the furnishing of watchpersons if deemed necessary, to protect persons and property from damage
39 or loss where the Contractor's work is involved.

40 41 42 **29. STORAGE OF MATERIALS**

43 Contractor shall confine equipment, apparatus, storage of materials and operations to limits indicated on the
44 drawings or by specific direction of DFD's Project Representative and shall not bring material onto the site
45 until they are needed for the progress of the work.

46
47 The storage of materials on the grounds and within the building shall be in strict accordance with the
48 instructions of DFD's Project Representative. Storage of materials within the building shall at no time exceed
49 the design carrying capacity of the structural system.

50
51 Provide and maintain watertight storage sheds on the premises where directed, for storage of materials that
52 might be damaged by weather. Sheds shall have wood floors raised at least 6" above the ground.

53
54 All materials affected by moisture shall be stored on platforms and protected from the weather.

1
2 All materials shall be stored in a manner that prevents release of hazardous material to the environment.
3

4 All hazardous materials, including motor fuels, shall be properly handled and contained to prevent spills or
5 other releases. The General Prime Contractor shall develop and maintain a contingency plan to provide
6 emergency response, containment, and cleanup of spills of hazardous materials resulting from contract
7 activities. All spills and releases shall be reported to DFD as soon as possible.
8

9 During the construction of this building, materials, construction sheds, and earth stockpiles shall be located
10 so as not to interfere with the installation of the utilities nor cause damage to existing lines.
11

12 The Contractor shall allot space to others for storage of their materials, and erection of their sheds.
13

14 Should it be necessary at any time to move material sheds or storage platforms, the Contractor shall move
15 same at the Contractor's expense, when directed by DFD's Project Representative.
16

17 The State assumes no responsibility for materials stored in building or on the site. The Contractor assumes
18 full responsibility for damage due to the storage of materials.
19

20 Repairing of areas used for placing of sheds, offices, and for storage of materials shall be done by the
21 Contractor.
22

23 **30. PROTECTION OF FINISHED CONSTRUCTION**

24 Contractor shall assume the responsibility for the protection of all finished construction under the Contract
25 and shall repair and restore any and all damage of finished work to its original state.
26

27 Wheeling of any loads over any type of floor, either with or without plank protection, will be permitted only
28 in rubber tired wheelbarrows, buggies, trucks or dollies.
29

30 Where structural concrete is also the finished surface, care must be taken to avoid marking or damaging those
31 surfaces.
32

33 **31. PROTECTION IN GENERAL**

34 All structures and equipment shall be constructed, installed and operated with guards, controls and other
35 devices in place.
36

37 Temporary pumps required for pumping water from building excavation or from building proper shall be
38 provided by the General Prime Contractor, including temporary connections. Plumbing Trade shall install
39 permanent sump basins and piping where and when required. Permanent sump pumps shall not be installed
40 until building is substantially complete and when approved by DFD's Project Representative. The General
41 Prime Contractor shall remove temporary pumps and connections when approved by DFD's Project
42 Representative.
43

44 The General Prime Contractor shall:
45

46 Provide, erect and maintain all required planking, barricades, guard rails, temporary walkways, etc., of
47 sufficient size and strength necessary for protection of stored material and equipment; paved surfaces, walks,
48 curbs, gutters and drives; streets adjacent to or within project area; adjoining property and all project work to
49 prevent accidents to the public and the workmen at the job site.
50

51 Notify adjacent property owners if their property interferes with the work so that arrangements for proper
52 protection can be made.
53

1 Provide and maintain proper shoring and bracing to prevent earth from caving or washing into the building
2 excavation. Provide temporary protection around openings through floors and roofs, including elevator
3 openings, stairwells, and edge of slabs.

4
5 Provide and maintain proper shoring and bracing for existing underground utilities, sewers, etc., encountered
6 during excavation work, to protect them from collapse or other type of damage until such time as they are to
7 be removed, incorporated into the new work, or can be properly backfilled upon completion of new work.

8
9 Provide protection against rain, snow, wind, ice, storms, or heat to maintain all work, materials, apparatus,
10 and fixtures, incorporated in the work or stored on the site, free from injury or damage. At the end of the
11 day's work, cover all new work likely to be damaged. Remove snow and ice as necessary for safety and
12 proper execution of the work.

13
14 Protect the building and foundations from damage at all times from rain, ground water and back-up from
15 drains or sewers. Provide all equipment and enclosures as necessary to provide this protection.

16
17 Damaged property shall be repaired or replaced in order to return it to its original condition. Damaged lawns
18 shall be replaced with sod.

19
20 Protect materials, work and equipment, not normally covered by above protection, until construction
21 proceeds to a point where the general building protection of the area where located, dispenses with the
22 necessity therefore. Protect work outside of the building lines such as trenches and open excavations, as
23 specified above.

24
25 Take all necessary precautions to protect the State's property as well as adjacent property, including trees,
26 shrubs, buildings, sanitary and storm sewers, water piping, gas piping, electric conduit or cable, etc., from
27 any and all damage which may result due to work on this project.

28
29 Repair work outside of property line in accordance with the requirements of the authority having jurisdiction.

30
31 Repair any work, damaged by failure to provide proper and adequate protection, to its original state to the
32 satisfaction of DFD or remove and replace with new work at the Contractor's expense.

33
34 Protect trees indicated on the drawings to remain and trees in locations that would not interfere with new
35 construction, from all damage. Do not injure trunks, branches, or roots of trees that are to remain. Do cutting
36 and trimming only as approved and as directed by DFD's Project Representative.

37
38 The value of trees destroyed or damaged will be charged against the account of the Contractor responsible
39 for the damage in an amount equal to the expense of replacing the trees with those of similar kind and size,
40 but not to exceed \$1000.00 for any one tree.

41 42 **32. CLEANING AND WASTE DISPOSAL**

43 Contractor shall be responsible for all cleaning required within the technical sections of the specifications
44 governing work under the Contractor's jurisdiction as well as for keeping all work areas, passageways, ramps,
45 stairs and all other areas of the premises free of accumulation of surplus materials, rubbish, debris and scrap
46 which may be caused by the Contractor's operations or that of the Subcontractors.

47
48 Remove rubbish, debris and scrap promptly upon its accumulation and in no event later than the end of each
49 week.

50
51 Combustible waste shall be removed immediately or stored in fire resistive containers until disposed of in an
52 approved manner.

1 No burning of rubbish or debris will be allowed at the site. Rubbish, debris and scrap shall not be thrown
2 through any window or other opening, or dropped from any great height; it shall be conducted to the ground,
3 to waiting truck(s) or removable container(s) by means of approved chutes or other means of controlled
4 conveyance.

5
6 Form and scrap lumber shall have all nails withdrawn or bent over; shall be neatly stacked, placed in trash
7 bins, or removed from the premises.

8
9 Spillages of oil, grease or other liquids which could cause a slippery or otherwise hazardous situation or stain
10 a finished surface shall be cleaned up immediately.

11
12 Waste materials removed from the site shall be managed by the contractor and disposed of in accordance
13 with all applicable laws, regulations, codes, rules, and standards. Materials that meet the definition of a
14 hazardous waste (Wis. Admin. Code NR 600) shall be disposed through the State's hazardous waste service
15 contract (Posted on Vendornet <https://vendornet.wi.gov/Contracts.aspx>; search for "hazardous wastes
16 service"), unless otherwise directed in writing by DFD. The Contractor shall prepare all hazardous wastes
17 for transport and disposal. Arrangements for disposal shall be coordinated through DFD's Project
18 Representative. Charges for transport and disposal of hazardous waste by the State's hazardous waste service
19 contractor will be paid directly by the State. Other materials such as soil, debris, sludge, water, etc. generated
20 by project activities which may contain constituents exceeding federal, state, or local environmental cleanup
21 standards must not be removed from the site, or treated and disposed on site without prior written approval
22 of DFD. DFD will provide a list of acceptable offsite disposal or treatment facilities for disposal by
23 Contractor. Other unused or discarded materials may be treated as solid waste. Facilities for recycle, disposal
24 or landfill of such items shall be approved by DFD prior to removal from the site.

25
26 Dust, dirt and other foreign matter shall be removed completely from all internal surfaces of all mechanical
27 and electrical units, cabinets, ducts, pipes, etc.

28
29 Dirt, soil, fingerprints, stains and the like, shall be completely removed from all exposed finished surfaces.

30
31 General Prime Contractor shall wash all glass immediately prior to the occupancy of this project. Work shall
32 include the removal of labels, paint splattering, glazing compound and sealant. Surfaces shall include mirrors
33 and both sides of all glass in windows, borrowed lights, partitions, doors and side lights.

34
35 Broken, scratched or otherwise damaged glass shall be replaced by the General Prime Contractor.

36
37 In addition to the above, the General Prime Contractor shall be responsible for the general "broom" cleaning
38 of the premises and for expediting all of the cleaning, washing, waxing and polishing required within the
39 technical sections of the specifications governing work under this Contract. The General Prime Contractor
40 shall also perform "final" cleaning of all exposed surfaces to remove all foreign matter, spots, soil,
41 construction dust, etc., so as to put the project in a complete and finished condition ready for acceptance and
42 use intended.

43
44 If rubbish and debris is not removed, or if surfaces are not cleaned as specified above, DFD reserves the right
45 to have said work done by others and the related cost(s) will be deducted from monies due the Contractor.

46 47 **33. OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS**

48 Contractor shall provide DFD with two (2) sets of the O&M data for each device, piece of equipment and
49 assembly furnished and/or installed under this contract. Format shall be paper, indexed and labeled and bound
50 in three-ring binders. In addition to the hard copies provide electronic (PDF) copies of the O&M manuals to
51 the AE. Also include, the electronic media (CD or flash drive) in 3 hole vinyl holders in binders.

52 The O&M manuals shall include the following:

- 53 • Table of Contents

- 1 • Contact information (including emergency contact number) for installing contractor, original vendor
- 2 manufacturer and service provider
- 3 • Copy of approved submittals
- 4 • As-built control drawings and sequences of operations
- 5 • Catalog data or literature with correct model number checked
- 6 • Manufacturer's installation and operation instructions including start-up, break-in, shutdown,
- 7 seasonal, emergency and special operation procedures
- 8 • Manufacturer's maintenance instructions including procedures and instructions for problem
- 9 corrections, preventive maintenance, testing, alignment, adjustment and repair
- 10 • Complete parts list in an exploded view diagram of the equipment
- 11 • Construction Verification Checklists
- 12 • Inspection and testing reports
- 13 • Maintenance records indicating maintenance performed by contractor prior to substantial
- 14 completion
- 15 • Equipment warranties including terms and conditions and date of inception (substantial completion)
- 16 and date of expiration
- 17 • List of special tools or testing equipment required for the operation, testing or maintenance of the
- 18 equipment
- 19 • For items assembled by the Contractor for special functions, write operating and maintenance
- 20 instructions

21
22 Contractor shall submit to A/E for review, make revisions noted by A/E and provide final O&M data for
23 A/E's review 30 business days prior to training. Any revisions or changes to the systems and/or equipment
24 post delivery of the final O & M data submittal must be submitted to A/E as an addendum within 30 days
25 of the revision or change.
26

27 **34. TESTS AND ADJUSTMENTS**

28 The complete installation consisting of the several parts and systems and all equipment installed according
29 to the requirements of the Contract Documents, shall be ready in all respects for use by the User Agency and
30 shall be subjected to a test at full operating conditions and pressures for normal conditions of use.
31

32 Contractor shall make all necessary adjustments and replacements affecting the work which is necessary to
33 fulfill DFD's requirements and to comply with the directions and recommendations of the manufacturer of
34 the several pieces of equipment, and to comply with all codes and regulations which may apply to the entire
35 installation. Contractor shall also make all required adjustments to comply with all provisions of the drawings
36 and specifications.
37

38 **35. LOOSE AND DETACHABLE PARTS**

39 Contractor shall retain all loose and small detachable parts of apparatus and equipment furnished under this
40 Contract, until completion of the work and shall turn them over to DFD's Project Representative designated
41 to receive them. Contractor shall obtain from DFD an itemized receipt thereof in triplicate. Contractor shall
42 retain one copy of receipt for their files and attach the other two to request for final payment for the work.
43

44 **36. EROSION CONTROL AND STORM WATER MANAGEMENT**

45 In accordance with state law, where applicable, and what the Department of Administration believes to be
46 good soil conservation practices and pollution prevention, the General Prime Contractor shall be governed
47 by the following:
48

49 The General Prime Contractor hereby covenants to maintain all project grounds, public streets and associated
50 areas, including fill areas in a manner consistent with state laws and the general policy to conserve soil and
51 soil resources, and to control and prevent soil erosion and to control and prevent siltation into waters of the
52 state. This clause is to be liberally construed to further the above stated objectives. The following shall
53 include, but not limit areas in which control is to be executed:
54

1 Erosion Control Plan: Implement the erosion control plan developed for the project and maintain erosion
2 control practices throughout the construction period. Modifications to the erosion control plan, addressing
3 phases of construction shall be the responsibility of the General Prime Contractor. Erosion control practices
4 that are compromised as the result of construction activity shall be returned to their functioning state by the
5 end of the current work day. Where applicable, erosion control practices shall comply with Chapters NR 151
6 and 216, Wis. Adm. Code.

7
8 Minimum Stripping: Limit stripping of sod and vegetation and limit land disturbance to an area and a time
9 period that will expose bare soil to least possibility of erosion that construction requirements will allow.

10
11 Stockpiling: Materials, including soil, shall be stored and protected in a manner that will prevent runoff of
12 material from the stockpiles into streets, drainage facilities, storm sewer systems, or waters of the state in the
13 event of rain.

14
15 Soil Erosion and Erodible Materials: Take positive measures to prevent soil erosion from the construction
16 area and areas disturbed by construction activities by employing such means as seed and mulch, mulches,
17 intercepting embankments and berms, sedimentation basins, ditch checks, riprap, erosion mats, silt fence,
18 approved polyacrylamides, inlet protection, or other temporary erosion control devices or methods.

19
20 Record Keeping: Maintain a copy of the current erosion control plan on site. Maintain maintenance records
21 and inspection logs on-site for erosion control and storm water management practices. Contractor shall
22 provide project representative with a weekly maintenance and inspection report.

23
24 Street Maintenance: Control the tracking of soil onto street and paved surfaces to a minimum. Any such
25 tracking shall be removed no less than on a daily basis.

26
27 Storm Water Management: Practices installed for post-construction storm water management shall be
28 protected during construction activity, and in the event that their intended function becomes compromised
29 during construction activity, shall be restored and/or repaired according to Chapters NR 151 and 216, Wis.
30 Adm. Code, for post-construction storm water management.

31
32 Erosion control and storm water management practices shall be installed and maintained in accordance with
33 the WDNR approved technical standards available at the following website:
34 <http://dnr.wi.gov/org/water/wm/nps/stormwater/techstds.htm>

35
36 Responsibility and authority for inspections are vested in the Department of Administration through the
37 Division of Facilities Development.

38
39 Responsibility and authority for maintaining records for NR 216 is the responsibility of the General Prime
40 Contractor.

41 42 **37. AIR QUALITY MANAGEMENT**

43 In accordance with the Department of Administration's air quality management practice on Ozone Action
44 Days, all contractors shall reduce or limit emissions and particulate matter that adversely affect air quality.

45
46 The General Prime Contractor shall establish the action plan, in cooperation with other contractor(s),
47 concerning implementation of air quality management on Ozone Action Days. This plan shall include
48 suspending work or modifying operations for all activities related to ozone, volatile organic compounds
49 (VOC) and nitrogen oxide emissions. These work activities include but are not limited to the following:

50 Limit equipment and vehicle refueling to after 6 pm.

51 Limit use of gasoline-powered vehicle and equipment.

52 Limit excessive idling of diesel-powered vehicle and equipment.

53 Limit large scale painting with VOC.

54 Limit large scale asphalt roofing and paving.

1 Limit and/or control all dust creating activities.

2

3 For information on air quality readings on Ozone Action Days refer to:

4

1-866-324-5924; or

5

<http://www.dnr.state.wi.us/org/aw/air/wisards/state.htm>

6

7 **38. CONSTRUCTION WASTE MANAGEMENT**

8

See Section 01 74 19 – Construction Waste Management.

9

10 **39. GUARANTEE DOCUMENTS**

11

Upon Substantial Completion of project, the Contractor shall submit such written guarantees and bonds to DFD for presentation to the User Agency. Furnish guarantees in triplicate unless otherwise indicated.

12

13

14

40. RECORD DOCUMENTS

15

On a suitable set of Contract Documents, the contractor is to maintain a daily record of changes and deviations from the contract. All buried or concealed piping, conduit, or similar items shall be located by dimensions and elevations on the record drawings.

16

17

18

19

The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.

20

21

22

Once during the month the Contractor shall present, at the project, the job copy showing variations and changes to date to the Architect/Engineer and DFD Project Representative for their review.

23

24

25

At substantial completion of the project, the Contractor shall transmit the marked up as-built documents to the Architect/Engineer and copy the DFD Project Representative on the transmittal of the documents. The A/E will incorporate the contractor marked up as-built drawings into the record drawings.

26

27

28

29

30

In addition to providing marked up drawings to the AE, the contractor shall provide (when available) electronic drawing drawings for all contractor generated drawings to the AE. Drawing shall include but not be limited to:

31

32

33

- Contractor coordinated BIM models
- Fabrication, erection and installation drawings for:
 - Ductwork and piping
 - Steel
 - Concrete
 - Special process systems
 - Lighting controls
 - Audio Visual
 - Telecommunications
- DSPS approved submittals for:
 - Fire Protection
 - Fire Alarm
 - Structural
 - Elevator

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1 PREPARATION OF ADDENDA

(Rev 11/2017)

2 The Addendum, like all other documents to the Contract, must follow a certain format and contain the
3 necessary information which will clearly identify it with the Contract Documents and to be made a part
4 thereof.

6 The Addendum shall have a heading which provides the Addendum number, date of issue, project title,
7 location, and project number. The bid closing time and date shall always be included in the Addendum. A
8 standard paragraph will then follow which stipulates the purpose of the Addendum.

10 The body of the addendum should consist of four parts AS APPLICABLE: Changes to Bidding
11 Requirements, Changes to Conditions of Contract, Changes to Specifications and Changes to Drawings.
12 Should one or more of these parts not be changed, do not include that part's title in the addendum.

14 Addendum change items must refer to a specific document within the project manual or drawings and shall
15 be listed in the Addendum in the same numerical sequence as they occur in the original documents. Each
16 addendum item should be identified by a unique, consecutive number (1, 2, 3, etc.).

18 Items referencing specifications shall include the following, in the order listed: Section number and title,
19 page number, line number, and then pertinent information concerning the item being changed.

21 Items referencing drawings shall include the following, in the order listed: Drawing Sheet Number; word
22 description of item being changed such as 1st Floor plan, Door Schedule, North elevation, etc.; detail or
23 section number; followed by description of change.

25 Closing on the Addendum shall consist of the title block for the Architect/Engineer and for the Division of
26 Facilities Development. A sample Addendum is appended to this manual.

28 Holding addendum information for consolidation into one large addendum is not desired. The
29 Architect/Engineer shall endeavor to release addenda in sufficient time for Bidders to review and incorporate
30 into their bids. Bidders are requested to bring inadequacies, omissions or conflicts to Architect/Engineer's
31 attention. **THE A/E SHALL SUBMIT THE ADDENDUM TO DFD AT LEAST 10 DAYS PRIOR TO**
32 **BID OPENING.** The addendum will then be issued by DFD no less than 7 days prior to Bid Opening.
33 Approval from DFD must be obtained to waive this requirement. If this requirement is waived, and the
34 addendum is issued less than 7 days prior to bid opening, it shall contain an extension of the bid opening date
35 for no less than 7 days from the present bid opening date.

36 Any change to the Bid Form by addendum shall require that the complete corrected Bid Form be reissued
37 rather than only reference the changes to be made. The corrected Bid Form shall have a heading to read:
38 "REVISED BID FORM" and have page numbers C-1(REV), C-2(REV), etc.

40 Addenda are to be submitted electronically following the bidding documents' electronic process. Drawings
41 are to be completed per the DFD CAD Standards Manual. Addenda Submittal Exception - The PDF text
42 and drawings shall be incorporated into one PDF document even if large full format drawings are required.
43 The complete PDF addenda shall then be submitted to the DFD SharePoint site previously indicated. The
44 files shall be named according to file naming standards.

46 DFD will issue an addendum if a successful MEP bid is withdrawn or rejected after the MEP Subcontractors
47 have been identified but before the General Prime Contractor bid opening. This addendum will include a
48 revised list of successful MEP bids that must be included in General Prime Contractor bids and will move
49 the General Prime Contractor bid opening five days later to allow bidders sufficient time to update their bids
50 based on the revised MEP list.



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3.0 Technical Specifications

SECTION 23 21 13.33
GROUND-LOOP HEAT-PUMP PIPING

PART 1 - GENERAL

1.01 SUMMARY

- A. Ground loop heat exchange systems, where shown on the Drawings and Schedules, shall include the following:
 - 1. Crosslinked polyethylene (PEXa) piping.
 - 2. Distribution manifold(s) with balancing and flow control valves where required.
 - 3. Pipe-to-manifold national pipe thread fittings.
 - 4. Cold-expansion fittings using metal compression sleeves.
 - 5. Electrofusion fittings.
 - 6. Supervision and field engineering required for the complete and proper function of the system.

1.02 RELATED SECTIONS

- A. Section 23 21 23 – Hydronic Pumps
- B. Section 31 20 00 – Earth Moving: Excavation and Backfill

1.03 REFERENCES

- A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.
- B. ASHRAE – American Society of Heating, Refrigerating, and Air-Conditioning Engineers
 - 1. Ground-Source Heat Pumps: Design of Geothermal Systems for Commercial and Institutional Buildings (Textbook by Kavanaugh and Rafferty)
- C. ASTM – American Society for Testing and Materials
 - 1. ASTM D2513 – Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
 - 2. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing
 - 3. ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
 - 4. ASTM F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
 - 5. ASTM F2080 – Standard Specification for Cold-Expansion Fittings With Metal Compression-Sleeves for Cross-Linked Polyethylene (PEX) Pipe
- D. CEN – European Committee for Standardization (Comité Européen de Normalisation)
 - 1. EN 1555-3 – Plastic piping systems for the supply of gaseous fuels. Polyethylene (PE). Fittings
- E. CSA – Canadian Standards Association
 - 1. CSA B137.5 – Cross-Linked Polyethylene (PEX) Tubing Systems for Pressure Applications
 - 2. CSA C448 – Design and Installation of Earth Energy Systems
- F. DIN – German Institute for Standardization (Deutsches Institut für Normung)
 - 1. DIN 16892 – Crosslinked high-density polyethylene (PE-X) pipes - General quality requirements and testing
 - 2. DIN 16893 – Crosslinked high-density polyethylene (PE-X) pipes – Dimensions
- G. IGSHPA – International Ground Source Heat Pump Association
 - 1. Closed-Loop / Ground Source Heat Pump Systems, Design and Installation Standards
- H. ISO – International Organization for Standardization

1. ISO 15875-1 – Plastic piping systems for hot and cold water installation - Crosslinked polyethylene (PE-X) - Part 1: General
2. ISO 15875-2 – Plastic piping systems for hot and cold water installation - Crosslinked polyethylene (PE-X) - Part 2: Pipes
3. ISO 15875-3 – Plastic piping systems for hot and cold water installation - Crosslinked polyethylene (PE-X) - Part 3: Fittings
4. ISO 9001 – Quality Management Systems - Requirements
5. ISO 14531-2 – Plastic pipes and fittings - Crosslinked polyethylene (PE-X) pipe systems for the conveyance of gaseous fuels. Fittings for heat-fusion joining

1.04 DEFINITIONS

- A. “The closed-loop portion [ground loop heat exchange] of a ground source heat pump system consists of a long plastic pipe buried below the earth’s surface. This plastic pipe is buried in the ground, or ground coupled, to allow heat transfer between the fluids and the earth. The heat pump transfers thermal energy to and from the closed, buried pipe and the building’s thermal load. The system consists of a closed-loop buried pipe, a water source heat pump, and an air [or water] distribution system for directing heated or cooled air [or water] to specific locations in the building.” (IGSHPA Installation Guide, p1).
- B. Crosslinked polyethylene, or PEX is a modified polyethylene material, typically high-density polyethylene (HDPE), which has undergone a change in the molecular structure using a chemical or a physical process whereby the polymer chains are permanently linked to each other. This crosslinking of the polymer chains results in improved performance properties such as elevated temperature strength, chemical resistance, environmental stress crack resistance (ESCR), slow crack growth (SCG) resistance, toughness and abrasion resistance. Crosslinking also makes PEX a “semi-thermoset” polymer, providing excellent long-term stability.

This specification requires PEX to be designated as PEXa and be manufactured by the high-pressure peroxide method.

1.05 SUBMITTALS

- A. Comply with Section 01 33 00, Submittal Procedures. Approval and/or acceptance of all submittals is required prior to fabrication.
- B. Product Data: Submit manufacturer's Technical Manual, submittal forms, catalog cuts, brochures, specifications, and installation instructions. Submit data in sufficient detail to indicate compliance with the contract documents.
 1. Submit manufacturer's instructions for installation.
 2. Submit data for equipment, fittings, fasteners and associated items necessary for the installation of the piping and manifolds.
- C. Submit computer-generated ground loop heat exchange system design indicating total pipe required, ground loop configuration (i.e. borehole, single pipe horizontal, slinky, horizontal, etc), pipe diameter, borehole or trench separation, ground thermal conductivity and diffusivity, and entering and leaving water temperatures. Ground loop heat exchange design calculations shall be performed on industry recognized software.
- D. Drawings: Provide plans drawn to scale for all installation areas.
 1. Indicate dimensions, descriptions of materials, general construction, component connections, and installation procedures.
 2. Indicate design, schematic layout of system, including equipment, critical dimensions and piping/slab penetration details as well as details for protecting exposed PEXa piping.
- E. Maintenance Instructions: Submit instructions for maintenance.

1.06 QUALITY ASSURANCE

- A. Comply with Section 01 43 00, Quality Assurance.

- B. Manufacturer: Must be a company specializing in the Work of this Section with a minimum of 5 years documented experience.
- C. Pipe shall be manufactured in a facility whose quality management system is ISO 9001 certified.
- D. Pipe and fittings shall be IGSHPA approved.
- E. Pipe and U-bends shall be certified to CSA C448 by a third-party certification body.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Section 01 60 00, Product Requirements.
- B. Deliver and store piping and equipment in shipping containers with labeling in place.
 - 1. Pipe shall be kept in original shipping packaging until required for installation.
- C. Store piping and equipment in a safe place, dry, enclosed, under cover, in a well-ventilated area.
 - 1. Do not expose pipe to ultraviolet light beyond exposure limits recommended by manufacturer.
 - 2. Protect piping and manifolds from entry of contaminating materials. Install suitable plugs in open pipe ends until installation.
 - 3. Where possible, connect pipes to assembled manifolds to eliminate possibility of contaminants and cross-connections.
 - 4. Piping shall not be dragged across the ground or other surfaces, and shall be stored on a flat surface with no sharp edges.
- D. Protect materials from damage by other trades.
- E. Pipe shall be protected from oil, grease, paint, direct sunlight and other elements as recommended by manufacturer.

1.08 WARRANTY

- A. Provide manufacturer's standard written warranty.
 - 1. The pipe manufacturer shall warrant the crosslinked polyethylene pipe to be free from defects in material and workmanship for a period of twenty-five (25) years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

- A. RAUGEO™ Ground Loop Heat Exchange System for geothermal applications as manufactured by REHAU Construction LLC, 1501 Edwards Ferry Road, NE; Leesburg, VA 20176; email: rehau.mailbox@rehau.com; website: na.rehau.com; upon whose products and equipment these specifications are based.
- B. Or approved equal.

2.02 PIPING

- A. Ground loop heat exchange pipe shall be high-density crosslinked polyethylene manufactured using the high-pressure peroxide method of crosslinking (PEXa). Pipe shall conform to (a) ASTM F876 and (b) CSA B137.5 and (c) CSA C448 or (d) ISO 15875-1:2003, 15875-2:2003 or (e) DIN 16892 and 16893
- B. Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180°F (690 kPa @ 82°C) temperature, and 160 psi gauge pressure at 73.4°F temperature (1,103 kPa @ 23°C).
- C. Horizontal Heat Exchanger:
 - 1. The minimum bend radius for cold bending of the pipe shall be no less than five (5) times the outside diameter. Bends tighter than this minimum shall require the use of a bending template, as supplied by the pipe manufacturer, and hot air.

D. Vertical Borehole Heat Exchanger:

1. The vertical borehole heat exchanger tip shall be manufactured of one continuous pipe, with no joints in the borehole or shall be manufactured from coated stainless steel components manufactured to the ASTM F2080 standard.
2. The vertical borehole heat exchanger shall be a single U-bend or a double U-bend system, consisting of 2 single U-bend pipes attached together.
3. The vertical borehole heat exchanger tip shall be covered in a GRP resin or a rubber coating.

2.03 FITTINGS

- A. All buried fittings shall be of a permanent design.
- B. Cold-expansion compression-sleeve fittings shall conform and be third-party certified to ASTM F2080, and CSA B137.5.
- C. Cold-expansion compression-sleeve fittings shall be manufactured of brass or stainless steel and shall be supplied by the piping manufacturer as part of a proven cataloged system.
- D. All electrofusion fittings intended for ground loop heat exchange applications shall conform to ASTM F1055 or EN 1555-3.

2.04 MANIFOLDS

- A. Material: Distribution manifolds shall be manufactured of brass or polypropylene and be supplied by the piping manufacturer as a part of a proven cataloged system.
- B. Brass manifolds shall be produced from extruded brass round pipe with tapped holes for connections, and be pre-assembled by the manufacturer. 100% of manifolds used shall have been air tested by the manufacturer with no indication of leaks.
- C. Polypropylene manifolds shall be produced from extruded polypropylene SDR 11 pipe containing a fiber layer to restrict thermal expansion. Holes shall be tapped for connections. Outlet ports shall be fusion welded onto the body of the manifold, with integrated fittings for connection to the borehole field. Fusion welding shall be done in a factory setting to ensure quality of the manifold. Manifold shall be supplied by the manufacturer with all components pressure tested and with no indication of leaks.
- D. Balancing Manifolds
 1. Where required by design, manifolds shall be equipped with supply and return manifold isolation valves, integral thermometer and manometer housings, and air vent/fill ports.
 2. Where required by design, each circuit shall be supplied with circuit isolation valves, integral visual flow gauges and brass cold expansion compression-sleeve fittings to connect to IGSHPA-approved PEXa pipe.

PART 3 - EXECUTION

3.01 ACCEPTABLE INSTALLERS

- A. Installation shall be performed by qualified laborers trained in the procedures of ground loop heat exchange systems and have IGSHPA certification.

3.02 EXAMINATION

- A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Beginning of installation means acceptance of existing conditions.

3.03 THERMAL CONDUCTIVITY TEST

- A. Soil thermal conductivity test shall be performed according to IGSHPA Closed-Loop / Geothermal Heat Pump Systems, Design & Installation Standards, 2008.

3.04 PREPARATION

- A. Coordinate with related trades and manufacturer's recommendations with regard to installation in conjunction with:
 - 1. Drilling
 - 2. Excavation
 - 3. Pipe fusion
 - 4. Heat pump location

3.05 INSTALLATION

- A. Install in accordance with manufacturer's published installation manual and/or published guidelines and final shop drawings.
- B. Mount manifolds in the locations previously prepared or in previously installed cabinets, if used. Manifolds shall be mounted as level as possible, with the venting device on the uppermost section.
- C. Route piping in an orderly manner, according to layout and spacing shown in final shop drawings.
- D. At connections and fittings, use a plastic pipe cutter to ensure square and clean cuts, and join pipes immediately or cap ends of pipe to seal from contaminants. Where compression-sleeve fittings are installed within the ground, they shall be wrapped in a heat-shrink material approved by the manufacturer.
- E. Piping that shall pass through expansion joints shall be covered in protective polyethylene convoluted sleeving (flexible conduit) extending 15 inches (40 cm) on each side of the joint. Sleeving shall be secured on pipe to prevent movement during installation of thermal mass.
- F. Where piping exits the thermal mass, a protective conduit shall be placed around the pipe, with the conduit extending a minimum of 6 inches (15 cm) into the floor and exiting by a minimum of 6 inches (15 cm). For penetrations at manifolds, use rigid PVC bend guides secured in place to prevent movement.
- G. At the time of installation of each circuit of pipe, connect the pipe to the correct manifold outlet and record pipe length for balancing. If manifold is not installed, cap the end of the pipe and label the pipe's circuit numbers along with S for supply and R for return. Connect pipes to manifold as soon as possible and record circuit lengths. Circuits shall be labeled to indicate circuit length and serviced area.

3.06 FIELD QUALITY CONTROL

- A. Filling, Testing & Balancing: Tests of ground loop heat exchange systems shall comply with authorities having jurisdiction, and, where required, shall be witnessed by the building official.
- B. Pressure gauges used shall show pressure increments of 1 psig and shall be located at or near the lowest points in the distribution system.
- C. Air Test
 - 1. Charge the completed, yet unconcealed pipes with air at a minimum of 40 psig.
 - 2. Do not exceed 150 psig.
 - 3. Use liquid gas detector or soap solution to check for leakage at manifold connections.
- D. Water Test
 - 1. Purge air from pipes.
 - 2. Charge the completed, yet unconcealed pipes with water.
 - 3. Take necessary precautions to prevent water from freezing.
 - 4. Check the system for leakage, especially at pipe joints.
- E. Perform a preliminary pressure test pressurizing the system to the greater of 1.5 times the maximum operating pressure or 100 psig for 30 minutes.

1. As the piping expands, restore pressure, first at 10 minutes into the test and again at 20 minutes.
 2. At the end of the 30-minute preliminary test, pressure shall not fall by more than 8 psig from the maximum, and there shall be no leakage.
- F. After successfully performing the preliminary test, perform the main pressure test immediately.
1. The main pressure test shall last 2 hours.
 2. The test pressure shall be restored and shall not fall more than 3 psig after 2 hours.
 3. No leakage shall be detected.

3.07 PROTECTION

- A. Protect installation throughout construction process until date of final completion.
- B. Replace components that cannot be repaired.

END OF SECTION

SECTION 23 21 23
HYDRONIC PUMPS
BASED ON DFD MASTER SPECIFICATION DATED 06/01/2018

PART 1 – GENERAL

SCOPE

This section includes specifications for water pumps used for HVAC applications. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS

- Base Mounted Centrifugal Pumps
- In-Line Centrifugal Pumps
- Horizontal Turbine Pumps
- Vertical Turbine Pumps
- Water Source Heat Pump

PART 3 - EXECUTION

- Installation
- Construction Verification Items
- Functional Performance Testing
- Agency Training

RELATED WORK

Section 01 91 01 or 01 91 02 – Commissioning Process
Section 23 05 13 - Common Motor Requirements for HVAC Equipment
Section 23 08 00 – Commissioning of HVAC

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Include data concerning dimensions, capacities, materials of construction, ratings, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

Pump curves shall identify design point of operation.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA

Pump sizes, capacities, pressures and operating characteristics shall be as scheduled.

Pumps shall meet or exceed operating efficiencies scheduled.

Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard, and other accessories specified. Statically and dynamically balance all rotating parts. Provide flanged connections on all pumps unless specified otherwise. Service or repair of base mounted pumps shall not require breaking piping connections or removal of motor.

Where a pump is specified for parallel operation, the scheduled conditions are for that pump with both pumps operating; i.e., total system flow rate is twice that scheduled for a single pump. When only one of the parallel pumps is operating, the operating point of that pump must fall within the manufacturer's recommended operating range.

Provide pump with a motor sized for non-overloading over the entire pump curve. Motors to be 1750 rpm unless specified otherwise.

Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

Test all pumps, clean and paint before shipment. The manufacturer shall certify all pump ratings.

All pumps to operate without excessive noise or vibration.

After completion of balancing, provide replacement of impellers, or trim impellers to provide specified flow at actual pumping head, as installed.

Furnish one spare seal and casing gasket for each pump to user agency.

PART 2 – PRODUCTS

BASE MOUNTED CENTRIFUGAL PUMPS

MANUFACTURERS:

Allis Chalmers, Aurora, Bell and Gossett, Taco, Peerless, Pacific, Armstrong, Grundfos, or approved equal.

TYPE:

Horizontal shaft, single stage, single or double suction, split casing, 175 psig working pressure at operating temperature of 225°F continuous, 250°F intermittent.

CASING:

Cast iron with suction and discharge gauge ports, renewable bronze wear rings, vent and drain plugs, flanged suction and discharge connections.

IMPELLER:

Bronze, hydraulically and dynamically balanced, keyed and locked to pump shaft, and protected by a replaceable bronze shaft sleeve.

BEARINGS:

Oil or grease lubricated ball or roller bearings.

SHAFT:

Alloy steel with copper, bronze, or stainless steel shaft sleeve.

SEAL:

Carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.

DRIVE:

Flexible spacer type coupling or coupling with extended hub to allow for pump service. Provide guard for shaft/coupling assembly.

BASEPLATE:

Cast iron or fabricated steel with integral drain rim.

IN-LINE CENTRIFUGAL PUMPS

MANUFACTURERS:

Bell and Gossett, Armstrong, Thrush, Taco, Grundfos, Aurora, or approved equal.

1 TYPE:

2 Single stage, direct connected, resiliently mounted motor for in-line mounting, oil lubricated, 175 psig
3 maximum working pressure at operating temperature of 225 ° F. continuous, 250 ° F. intermittent.

4
5 CASING:

6 Cast iron or stainless steel; flanged suction and discharge connection; with plugged taps for vent, drain,
7 suction and discharge gauges.

8
9 IMPELLER:

10 Brass or bronze, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

11
12 BEARINGS:

13 Two, oil lubricated bronze sleeves or ball bearings capable of being greased.

14
15 SHAFT:

16 Stainless steel or carbon steel with stainless steel or bronze sleeve, integral thrust collar.

17
18 SEAL:

19 Mechanical type, carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating
20 temperature.

21
22 DRIVE:

23 close coupled.

24
25 **HORIZONTAL TURBINE PUMPS**

26
27 MANUFACTURER:

28 Aurora, Pacific (Paco), Roth, Grundfos, or approved equal.

29
30 TYPE:

31 Pumps to be base mounted, split case, double suction, single stage type with cast iron casing and bronze trim.
32 Casing shall be suitable for 300 psig working pressure, with vent and drain taps.

33
34 Pump shall be flexible connected to the motor and shall have a minimum of two grease lubricated ball or
35 roller bearings. Flexible coupling shall have bushings keyed to the shaft. Pump and motor shall have a
36 common base.

37
38 SHAFT:

39 Construct pump shaft of stainless steel.

40
41 SEALS:

42 Furnish mechanical seals with carbon steel rings and ceramic seats.

43
44 **VERTICAL TURBINE PUMPS**

45
46 MANUFACTURERS:

47 Bell & Gossett, Fairbanks Morse, Peerless, Aurora, Simmons, Layne & Bowler, Peabody Floway, Grundfos,
48 or approved equal.

49
50 TYPE:

51
52 SHAFT:

53 Construct pump shaft and pump column shaft of stainless steel.

54
55 SEALS:

56 Furnish mechanical type shaft seals with carbon steel rings and ceramic seats.

57
58 **WATER SOURCE HEAT PUMP**

59
60 Provide one water source heat pump assembly. Pump shall have a capacity of 75 gpm.

61
62 MANUFACTURERS:

63 Trane or approved equal.

1 TYPE:

2 Per Trane mechanical specifications: "Equipment shall be completely assembled, piped, internally wired,
3 fully charged with R-410A, and test operated at the factory. A controls field interface terminal strip, and all
4 safety controls shall be furnished, installed and tested by the unit manufacturer. The unit shall be certified
5 and rated in accordance with ANSI/AHRI/ASHRAE/ISO 13256-2.

6
7 The system's water inlet and outlet for the source and load-side connections shall be female NPT composed
8 of copper. Service and caution labels shall be placed on the unit in their appropriate locations."

9
10 PUMP MODULE:

11 Per Trane mechanical specifications: "The pump module shall consist of either a single or dual 1/6 hp cast
12 iron pump and a brass 3-way shut off valve. The pump module kits shall contain the necessary components
13 for the installation, operation and maintenance of the water circuit of a closed-loop distributed pumping
14 application."

15
16 REFRIDGERANT CIRCUITS:

17 Per Trane mechanical specifications: "The refrigerant circuit shall contain a thermal expansion device.
18 Service pressure ports shall be factory supplied on the high and low pressure sides for easy refrigerant
19 pressure or temperature testing."

20
21 REFRIGERANT TUBING:

22 Per Trane mechanical specifications: "The refrigerant tubing shall be 99% pure copper. This system shall be
23 free from contaminants and conditions such as drilling fragments, dirt and oil."

24
25 REVERSING VALVE:

26 Per Trane mechanical specifications: "The reversing valve shall be a pilot operating, sliding piston type with
27 a replaceable, encapsulated magnetic coil. The reversing valve shall be energized in the cooling cycle."

28
29 WATER-TO-REFRIGERANT HEAT EXCHANGERS

30 Per Trane mechanical specifications: "The water-to-refrigerant heat exchanger shall be of a high quality,
31 co-axial coil for maximum heat transfer. The source-side heat exchanger shall be constructed of copper
32 with an option of cupro-nickel. The load-side heat exchanger shall be constructed of copper. Both heat
33 exchangers shall be deeply fluted to enhance heat transfer and minimize fouling and scaling. The coil shall
34 have a working pressure of 650 psig on the refrigerant side, and 400 psig on the waterside."

35
36
37 **PART 3 – EXECUTION**

38
39 **INSTALLATION**

40
41 Install all pumps in strict accordance with manufacturer's instructions. Access/service space around pumps
42 shall not be less than minimum space recommended by pump manufacturer.

43
44 Support piping adjacent to pump such that no weight is carried on pump casings.

45
46 Decrease from line size at pump connections with suction diffusers where specified, long radius reducing
47 elbows or concentric reducers/increasers in the vertical piping, and eccentric reducers/increasers for
48 horizontal piping. Install eccentric reducers/increasers with the top of the pipe level

49
50 All valves and piping specialties must be full line size as indicated on the drawings

51
52 Lubricate pumps before startup.

53
54 Install a full line size spring loaded check valve and balancing valve in the pump discharge piping. At
55 contractor's option, combination shut-off, check, balancing valve may be substituted instead of separate
56 valves. Reference section 23 05 23.

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Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

FUNCTIONAL PERFORMANCE TESTING

Contractor is responsible for utilizing the functional performance test forms supplied under specification Section 23 08 00 in accordance with the procedures defined for functional performance testing in Section 01 91 01 or 01 91 02.

AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

END OF SECTION

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SECTION 31 10 00
SITE CLEARING
BASED ON DFD MASTER SPECIFICATION DATED 02/17/2016

PART 1 - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to clear and grub the site of existing vegetation as required in these specifications and on the drawings. Included are the following topics:

PART 1 - GENERAL

Scope
Related Work
Clearing Limits

PART 2 - MATERIALS

Not Used

PART 3 - EXECUTION

General
Cutting
Removal Methods
Grubbing

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Related work specified elsewhere:

Section 30 05 00 – Common Work Results For All Exterior Improvements
Section 31 13 00 – Selective Tree and Shrub Removal and Transplanting
Section 31 13 16 - Selective Tree and Shrub Protection and Trimming
Section 31 20 00 – Earthmoving
Section 31 25 00 – Erosion Control

CLEARING LIMITS

Confine clearing and grubbing operations to the limits as indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by the Owner's Project Representative. Clearing and grubbing operations shall not extend past the property line or easement line without prior approval of the DFD Project Representative.

PART 2 - MATERIALS

Not Used

PART 3 - EXECUTION

GENERAL

Limits of clearing and grubbing shall be as shown on drawings. When selective pruning and removal is specified, limit work to only those plants or limbs shown on the drawings or detailed in the specifications.

Remove and dispose of trees, stumps, roots, brush, vegetation, debris, and other items that interfere with new construction as shown on the drawings.

1 To minimize erosion, limit heavy equipment travel only to areas that are necessary to complete clearing and
2 grubbing operations.

3
4 Repair damaged erosion control features immediately.

5 6 **CUTTING**

7
8 Fell and prune trees in manner so as not to damage adjacent structures, site features or other plants not
9 scheduled for removal.

10
11 If trees scheduled to remain are injured notify DFD Project Representative.

12
13 When pruning, limit removal only to those limbs shown on drawings or that which is necessary to complete
14 other site work.

15
16 When pruning, make cuts near trunk, but beyond branch collar. If no branch collar is present, make a
17 vertical cut near where the limb meets the trunk. Do not cut branch collar. Application of tree paint is not
18 necessary for pruning trees as designated on the drawings unless otherwise noted.

19
20 Prevent the spread of oak wilt by treating all cut surfaces and abrasions sustained between April 1 and
21 October 1 on healthy oak trees and saplings with a thorough application of tree paint immediately upon
22 discovering a wound. Between these dates, also paint the cut surfaces of the stumps of all healthy oak trees
23 and saplings immediately after cutting, whether remaining in place or grubbed.

24
25 Use sharp tools and make clean cuts.

26 27 **REMOVAL METHODS**

28
29 Unless the drawings specify otherwise, the Contractor owns all trees, brush and debris removed from the
30 site. All cleared material shall be disposed of offsite unless otherwise specified on the drawings or agreed
31 upon by the Owner and DFD Project Representative prior to any clearing and grubbing taking place.

32
33 Clearing and grubbing debris shall be disposed of at facilities designed to accept the material that is being
34 disposed. Follow all local, state and federal regulations.

35 36 **GRUBBING**

37
38 Grubbing operations may be completed by removal of stump section or by grinding.

39
40 Remove stumps, logs, roots, other organic matter located within proposed building excavations completely.

41
42 Remove stumps, logs, roots, other organic matter located within proposed pavements and structures to the
43 depth indicated:

44
45 Walks: 24 inches below subgrade

46 Roads and drives and parking areas: 36 inches below subgrade

47 Concrete slabs: 24 inches below subgrade

48 Lawn areas: 12 inches

49 Footings and foundations for signs, lights, etc.: 18 inches below footing base

50
51 Depressions resulting from grubbing operations shall be backfilled in accordance with Section 31 20 00 –
52 Earthwork.

53
54 **END OF SECTION**

SECTION 31 20 00
EARTHMOVING
BASED ON DFD MASTER SPECIFICATION DATED 09/01/2015

PART 1 - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to complete earthwork required in these specifications and on the drawings. Included are the following topics:

PART 1 - GENERAL

Scope
Related Work
Reference Standards
Quality Assurance
Submittals
Quantities

PART 2 - MATERIALS

Earth Fill
Granular Fill
Structural Fill

PART 3 - EXECUTION

- General
- Topsoil Removal
- Excavation
- Placing and Compacting Material
- Grading
- Grading Around Trees
- Soil Stabilization
- Clean Up

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Related work specified elsewhere:

Section 30 05 00 – Common Work Results For All Exterior Improvements

Section 31 10 00 – Site Clearing

Section 31 23 16.13 – Trenching

Section 31 23 16.16 – Structure Excavation for Minor Structures

Section 31 23 16.26 – Rock Removal

Section 31 25 00 – Erosion Control

Section 32 91 13 – Soil Preparation

REFERENCE STANDARDS

American Society for Testing and Materials (ASTM):

D422-63	Standard Test Method for Particle Size Analysis of Soils
D4318	Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³)
D1140	Standard Test Methods for Determining the Amount of Material Finer than 75-um (No. 200) Sieve in Soils by Washing

1	D1557	Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified
2		Effort (56,000 ft-lbf/ft ³)
3	D2922	Standard Test Methods for Density of Soil and Soil-Aggregate In-Place by Nuclear
4		Methods (Shallow Depth)
5	D3017	Standard Test Method for Water Content of Soil and Rock In-Place by Nuclear Methods
6		(Shallow Depth)
7	D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a
8		Vibratory Table
9	D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-
10		Aggregate by Nuclear Methods (Shallow Depth)
11	D6913	Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve
12		Analysis
13	E329	Standard Specification for Agencies Engaged in Construction Inspection, Testing, or
14		Special Inspection

QUALITY ASSURANCE

The Contractor shall conduct sampling, testing, and analysis as required by this section and elsewhere in the Contract Documents either by retaining the services of an independent construction materials testing consultant or with internal certified testers. The materials testing personnel shall meet the requirements of ASTM E329.

The Contractor's construction materials testing personnel shall complete material testing as outlined in Table 31 20 00 -1.

Table 31 20 00 -1

Material	Test Required	Test/Sample Frequency
Structural Fill	<i>D422 Standard Test Method for Particle Size Analysis of Soils</i>	<i>1 test/500 CY placed</i>
Existing Soil	<i>D5334 Standard Method for Determination of Thermal Conductivity</i>	1 test/project area

SUBMITTALS

Provide samples of each type of soil or aggregate proposed for use on the project. Samples shall consist of a minimum of 50 pounds of soil.

Provide copies of all material testing reports completed for the project within 48 hours of completing the individual tests. Along with each individual test result, provide a running spreadsheet of all individual test results.

QUANTITIES

Finished topsoil depth shall be as specified in Section 32 91 13 – Soil Preparation or as shown on the drawings.

Contractor shall be solely responsible for determining all earthwork quantities based on the existing and proposed elevations provided on the drawings. Any geotechnical investigations provided by the Owner apply only to those locations that the data was collected, and may not be indicative of conditions elsewhere on the site. The Contractor is responsible for collecting any additional geotechnical or survey data he deems necessary to complete an accurate estimate of earthwork quantities.

If onsite grading, excavation and borrow operations do not provide enough suitable material for fill areas, Contractor shall coordinate and pay for excavation, transport and placement of imported material meeting

the specifications of the contract documents. If excavation results in excess materials, Contractor shall coordinate and pay for loading, transport and offsite disposal of excess materials.

Contractor shall notify the DFD Project Representative immediately if geotechnical information, existing grades, or proposed grades shown on the drawings appears to be inaccurate.

PART 2 - MATERIALS

EARTH FILL

Use clean material consisting of inorganic soil or a mixture of inorganic soil and rock, stone or gravel. The material shall be free of topsoil, sod, stumps, wood, asphalt, concrete, debris, and other deleterious material. The maximum dimension of any material shall not exceed 2' in any direction.

GRANULAR FILL

Clean material meeting the requirements of "Grade 1" or "Grade 2" granular backfill as defined in WisDOT Section 209.2.1.

STRUCTURAL FILL

Clean material meeting the requirements of "Structure Backfill" as defined in WisDOT Section 210.2.1.

PART 3 - EXECUTION

GENERAL

Complete earthwork excavation for elevation changes, utility trenches, minor structures and building foundations in accordance with this section and the following applicable sections:

- Section 31 23 16.13 - Trenching
- Section 31 23 16.16 - Structure Excavation for Minor Structures

Rock excavation shall be completed in accordance with Section 31 23 16.26 - Rock Removal

TOPSOIL REMOVAL

Comply with erosion control requirements of Section 31 25 00 – Erosion Control and as shown on the plan relative topsoil removal and storage.

Complete clearing and grubbing work as required by the Contract Documents and as specified in Section 31 10 00 – Site Clearing.

Coordinate topsoil stockpile locations with Owner and other contractors working onsite.

Remove all topsoil from proposed locations of buildings, structures, roads, walks and other paved areas. Also, remove topsoil from proposed lawn or turf areas where the proposed elevation exceeds the existing elevation by 1' or greater, or where fill will be placed.

Stockpile reusable topsoil for use in restoration. Salvaged topsoil shall not be removed from the site without prior approval of the DFD Project Representative.

Do not excavate, grade or work topsoil in frozen or muddy condition.

Minimize compaction of topsoil to the extent possible.

EXCAVATION

Excavate to the elevations shown on the drawings. Allow for placement of fill, base course, pavements, and topsoil as required by the drawings and other Contract Documents.

Transfer lines and grades as shown on the drawings.

Excavate areas to provide positive drainage. Contractor shall notify the DFD Project Representative immediately if the final proposed elevations shown on the drawings do not provide drainage away from buildings, structures, roads, walks and other paved areas.

Remove excess and spoil material from the site in a timely fashion.

Do not excavate below design grades without prior authorization by the DFD Project Representative.

PLACING AND COMPACTING MATERIAL

Place material in fill areas only after all topsoil has been removed.

Place fill to the elevations shown on drawings; allow for placement of base course, pavements and topsoil as required by the drawings and other Contract Documents.

Fill type shall be as indicated on Table 31 20 00 -2, or as shown on the drawings.

Do not place fill on areas consisting of organic soil, debris or soft and yielding material.

Do not place fill on frozen or muddy areas.

Moisture condition subgrade as necessary to provide a firm surface prior to placing fill.

Place fill in horizontal lifts having thickness as shown on Table 31 20 00 - 2.

Compact fill material as required by Table 31 20 00 - 2 for given use.

Moisture condition fill material as necessary to achieve density required for given use.

Place and compact backfill so as to minimize settlement and avoid damage to walls, utility lines and other work in place. Place backfill simultaneously on both sides of free-standing structures.

It is the responsibility of the Contractor to provide all necessary compaction equipment and other grading equipment that may be required to obtain the specified compaction. Compaction of controlled backfill by travel of grading equipment will not be considered adequate for uniform compaction. Hand guided vibratory or tamping compactors will be required whenever controlled backfill may be placed adjacent to walls, footings, and columns or in confined areas.

GRADING

Grading shall include areas necessary to establish new grades as required, additional areas disturbed by construction activities, storage, equipment including all trenching, where excess fill is deposited and where cutting is required.

New grades are designed to produce desired configuration of site and do not represent a balance between cut and fill.

Excavated materials shall be disposed of by contractor at a suitable off-site location. Contractor shall be responsible for securing suitable disposal site(s) and for all off-site disposal costs.

Grades not indicated shall be uniform levels or slopes between point elevations as shown. Adjust all grades as necessary to provide positive drainage away from structures.

Grades for earthwork shall not deviate from established elevations, as shown in excess of 1 inch unless otherwise directed by DFD Project Representative.

Do all cutting, filling, compacting fill, rough grading required to bring entire project to within respective base course elevations or 6 inches below finished topsoil elevations.

GRADING AROUND TREES

Limit excavation, filling and grading near trees or other vegetation to the extent possible. When tree roots are encountered, cut roots cleanly and squarely.

For trees within the grading limits that are to remain, install tree protection fencing as noted in the drawings.

SOIL STABILIZATION

Notify the DFD Project Representative if a solid subgrade cannot be established through drying and grading.

CLEAN UP

Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary deposit of excavated earth. Remove all surplus material, tools and equipment.

Thoroughly clean all drainage ways, roads, parking lots, sidewalks, and paved surfaces and remove and dispose of all debris and mud.

END OF SECTION

SECTION 32 91 13
SOIL PREPARATION
Based On DFD Master Specification Dated 02/17/2016

PART 1 - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment and supervision necessary to provide and prepare soil for seeding, sodding, and landscape planting. Included are the following topics:

PART 1 - GENERAL

- Scope
- References
- Submittals
- Quality Assurance

PART 2 - MATERIALS

- Topsoil
- Organic Soil Amendments
- Fertilizer
- Lime

PART 3 - EXECUTION

- Subgrade Soil Preparation
- Placing Topsoil
- Organic Soil Amendments and pH Adjustment
- Fertilizer

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Section 32 92 00 – Plants

Section 32 92 18 – Seeding

Section 32 92 23 – Sodding

REFERENCE STANDARDS

WISDOT SSHSC	Standard Specifications for Highway and Structure Construction
Section 625.2	Standard Specifications for Highway and Structure Construction
Section 629.3.1	Standard Specifications for Highway and Structure Construction
S100 Compost	Wisconsin Department of Natural Resources (DNR) Specification
ASTM D5268-07	Standard Specification for Topsoil Used for Landscaping
USDA Agricultural Handbook No. 60	Diagnosis and Improvement of Saline and Alkali Soils

SUBMITTALS

Provide product data, including applicable analytical data, for soil amendments including:

- Organic Compost
- Fertilizer

Provide copies of all quality assurance testing reports.

Material Test Reports: For standardized ASTM D 5268 topsoil [existing native surface topsoil] [existing in-place surface soil] [and] [imported or manufactured topsoil]

QUALITY ASSURANCE

The Contractor shall retain the services of an independent testing firm to conduct sampling, testing and analysis of salvaged and imported soil and amendments as required by this section and elsewhere in the Contract Documents. The materials testing consulting Architect/Engineer shall be subject to approval by the Owner.

Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

Testing methods and written recommendations shall comply with USDA's Handbook No. 60.

The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. A minimum of **three** representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.

Report suitability of tested soil for turf and plant growth.

Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.

Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

Collection of soil specimens shall be complete in accordance with accepted practices, and shall be subject to approval by the Owner.

PART 2 - PRODUCTS

TOPSOIL

Clean salvaged or imported material capable of passing the 1" sieve and meeting the requirements of Section 625.2(1) of the Standard Specifications for Highway Construction. The material shall be free of rocks, gravel, wood, debris, and of noxious weeds and their seeds.

Naturally fertile, agricultural soil, capable of sustaining vigorous growth, of uniform composition throughout, without admixtures of subsoil, free of clay, stones larger than 1" inch diameter, roots, trash and debris of any kind, supplied by Contractor at his/her expense, and subject to approval by the Architect/Engineer and DFD Construction Representative.

ORGANIC SOIL AMENDMENTS

Organic Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through **3/4-inch** sieve; soluble salt content of **[5 to 10]** deciSiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. Organic Matter Content: **[50 to 60]** [] percent of dry weight.

Organic Compost: Compost meeting Wisconsin DNR S100 Compost Specification.

FERTILIZER

All fertilizers shall be delivered fully labeled according to applicable regulations, bearing name, trade name or trademark of producer, along with producer's warranty. Application amounts of fertilizer and lime will be governed by the recommendations of the soil test.

Fertilizer: Granular, non-burning product composed of not less than fifty (50) percent organic slow-acting, guaranteed analysis professional fertilizer. Commercial fertilizer shall conform to Wisconsin State Statutes, Section 94.64, and meet the standards of the Wisconsin Department of Agriculture as to registration and labeling. Fertilizer shall be specified in the contract documents as to composition, but is subject to revision to suit project site conditions.

LIME

1 Lime material shall meet the requirements of Section 629.2.2 of the Standard Specifications for Highway
2 Construction.

3 4 **PART 3 - EXECUTION**

5 6 **SUBGRADE SOIL INSPECTION**

7
8 Examine the sub-grade condition and that all drainage requirements have been met. Remove all debris and
9 unsuitable material present.

10 11 **SUBGRADE SOIL PREPARATION**

12
13 Remove or mow all vegetation to a height 3". Remove all rocks, debris, and litter that will prevent
14 compliance with topsoil and seeding specifications. Final grade area to within 2" of subgrade elevations.
15 Till or disc the subsoil to a depth of 2"-4" to allow aeration. Areas shall be graded to a smooth uniform
16 surface plane with loose, uniformly fine texture. All areas shall be rolled and raked to remove ridges and
17 fill depressions and ready for final topsoil or planting mixture application. Areas shall be restored if eroded
18 or otherwise disturbed after grading.

19 20 **PLACING TOPSOIL OR PLANTING MIXTURE**

21
22 Planting Mixture:

23 Ratio of Loose Compost to Topsoil by Volume: [1:4] [1:3] [1:2] parts native topsoil from project site to
24 organic compost. Conform to alternate mixes as specified for beds of certain ornamental plants. All mixing
25 shall be done by mechanical means subject to the approval of the Architect/Engineer.

26
27 Place topsoil/planting mixture to achieve final grades indicated on the Drawings, allowing for settlement.
28 Place to the depth shown on the Drawings. If no depth is shown provide a minimum of 6" of topsoil.

29
30 If topsoil/planting mixture depths are greater than 6" then the topsoil shall be installed in lifts. Moisten the
31 soil surface between lifts at a rate of two gallons of water per square foot. Allow water to thoroughly
32 percolate through and settle and dry before rolling and placing the next lift.

33
34 Place and spread the specified planting mixture to the correct depths adjusting for the difference between
35 seed, sod or planting bed finished grade.

36
37 Do not apply topsoil to saturated or frozen subgrades.

38 39 **ORGANIC SOIL AMENDMENTS AND pH ADJUSTMENT**

40
41 Provide lime or other organic soil amendments as recommended soil analysis. If topsoil has been
42 determined acceptable by a soil test, no amendments are needed.

43
44 Uniformly apply lime and organic soil amendments, and incorporate into the top 4"-6" of soil by tilling or
45 discing.

46 47 **FERTILIZER**

48
49 Fertilizer shall be applied in accordance with the requirements of Section 629.3.1 of the Standard
50 Specifications for Highway Construction.

51
52 **END OF SECTION**

SECTION 48 14 00
SOLAR ENERGY ELECTRICAL POWER GENERATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, connection, testing, and commissioning of solar energy electrical power generation systems.
- B. The requirements of this Section apply to all sections of Division 48 related to solar energy electrical power generation systems.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS: General construction practices.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES: Submittals.
- C. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS: General requirements for commissioning.
- D. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- E. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Requirements for low-voltage conductors.
- F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and requirements for providing a low impedance path for possible ground fault currents.
- G. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Requirements for boxes, conduits, and raceways.
- H. Section 26 08 00, COMMISSIONING OF ELECTRICAL SYSTEMS: Requirements for commissioning the electrical system, subsystems, and equipment.
- I. Section 26 29 21, ENCLOSED SWITCHES AND CIRCUIT BREAKERS: Requirements for enclosed disconnect switches.

1.3 DEFINITIONS

- A. Unless otherwise specified or indicated, electrical and electronics terminology used in these specifications, and on the drawings, shall be as defined in IEEE 100 CD.
- B. Unless otherwise specified or indicated, solar energy conversion and solar photovoltaic energy system terminology used in these specifications, and on the drawings, shall be as defined in ASTM E772.

1.4 QUALITY ASSURANCE

- A. Products and Services pertaining to this specification shall comply with Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Solar Energy Electrical Power Generation System installer(s) shall demonstrate that they have successfully installed at least four projects within the past five years that, in aggregate, equal or exceed the size of the proposed project. References shall be provided for each of the referenced qualified projects.

- C. Supports and racking for solar photovoltaic system designs shall be prepared under the seal of a licensed Professional Structural Engineer (PE). Where applicable, such as roof top installations, the engineer shall also provide adequate review and structural analysis of the existing structure that will be supporting the proposed solar photovoltaic system. Among the documents that shall be submitted by the engineer are environmental loading analyses (including wind, snow, hail, and where applicable, seismic) and the rack and substrate's ability to withstand these environmental forces. In the instance where the rack is installed on the ground, adequate information shall be presented to demonstrate the earth's ability to support the proposed design.
- D. If the system will be a tracking system, the mechanical and control systems shall be approved by the using entity. Preference shall be given to closed or hybrid-open/closed logic control for the tracking system.
- E. If paralleling arrangement is desired, the system shall have anti-islanding capability such that it is incapable of exporting power to the utility distribution system in the absence of utility power. Paralleling must be approved by serving electric utility. Provide written correspondence from the utility confirming its requirements.
- F. Investigate whether the Resident Engineer, Contracting Officer's Representative (COR), or local environmental entities require environmental impact studies which may include, but are not limited to, effects upon wildlife. The Contractor shall determine which entity has jurisdiction over environmental matters and shall make appropriate inquiry and comply with all applicable regulations.
- G. Investigate any other local ordinances that may apply to installation of a solar energy electrical generating system in the proposed location. Bring any conflicts with the drawings and specifications to the attention of the, Resident Engineer, COR.
- H. Warranties: The solar energy electrical generating system shall be subject to the terms of FAR Clause 52.246-21, except that the warranty period shall be as noted for the items below:
 - 1. Solar photovoltaic modules and inverter: 10 year manufacturer's warranty against defects in materials and workmanship.
 - 2. Power output: 25 year manufacturer's power output warranty, with the first 10 years at 90% minimum rated power output and the balance of the 25 years at 80% minimum rated power output.
 - 3. Existing roof: Notify warrantor of existing roofing system on prior to beginning work and on completion of work, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at project closeout.

1.5 SUBMITTALS

- A. Where proposed system shall be a Net Meter project, prepare appropriate applications and submittals to the Resident Engineer. Where proposed system shall be connected before the serving electric utility's meter and tied directly to the grid, prepare appropriate applications and submittals to the Resident Engineer COR. In all cases, the serving electric utility may have a requirement for further electrical studies, which may include or not be limited to power factor analysis, short circuit protection studies, grid wiring adequacy, or capacities of upstream equipment. If such requirements exist and are required by the serving electric

utility, these requirements shall be fulfilled by the Contractor. Provide written documentation confirming the utility's approval of the interconnection of the solar energy electrical power generation system with the utility system.

B. Submittals shall comply with paragraph, SUBMITTALS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
 - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, wiring and connection diagrams, accessories, and nameplate data.
 - c. Include shop drawings for foundations and other support structures.
2. Product Data:
 - a. Include detailed information for components of the solar energy electrical generation system.
 1. Wiring.
 2. Inverter.
 3. Photovoltaic modules.
 4. Rack and support assemblies.
 5. Instrumentation.
 6. Switchgear.
 7. DC and AC disconnects.
 8. Combiner boxes.
 9. Monitoring systems including appropriate interfacing with existing facility data collection systems.
3. Manuals:
 - a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 1. Safety precautions.
 2. Operator restart.
 3. Startup, shutdown, and post-shutdown procedures.
 4. Normal operations.
 5. Emergency operations.
 6. Environmental conditions.
 7. Preventive maintenance plan and schedule.
 8. Troubleshooting guides and diagnostic techniques.
 9. Wiring and control diagrams.
 10. Maintenance and repair procedures.
 11. Removal and replacement instructions.
 12. Tracking systems (where applicable).

13. Spare parts and supply list.
 14. Parts identification.
 15. Testing equipment and special tool information.
 16. Warranty information.
 17. Testing and performance data.
 18. Contractor information.
- b. If changes have been made to the maintenance and operating manuals originally submitted, then submit updated maintenance and operating manuals two weeks prior to the final inspection.
4. Certifications: Two weeks prior to final inspection, submit the following.
 - a. Certification by the manufacturers of all major items of the solar energy electric generation system that the system conforms to the requirements of the drawings and specifications, and that they have jointly coordinated and properly integrated their equipment and controls to provide a complete and functional installation.
 - b. Certification by the Contractor that the solar energy electric generation system has been properly installed, adjusted, tested, commissioned, and warrantied. Contractor shall make all necessary field measurements and investigations to ensure that the equipment and assemblies meet contract requirements.
 5. Estimated Annual Power Output: Submit calculated annual power output for each of the proposed solar photovoltaic systems. Provide independent calculations for each fixed, single-axis tracking, or double-axis tracking system.
- C. If equipment submitted differs in arrangement from that shown on the drawings, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract and acceptable to the Resident Engineer.
 - D. Submittals and shop drawings for independent but related items shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group. Final review and approval will be made only by groups.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):

E772-15	Standard Terminology of Solar Energy Conversion
E1038-15	Standard Test Method for Determining Resistance of Photovoltaic Modules to Hail by Impact with Propelled Ice Balls
- C. Institute of Electrical and Electronics Engineers (IEEE):

100 CD-13	The Authoritative Dictionary of IEEE Standards Terms
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- 519-14Recommended Practices and Requirements for Harmonic Control in
Electric Power Systems
- 937-07Recommended Practice for Installation and Maintenance of Lead-Acid
Batteries for Photovoltaic (PV) Systems
- 1013-07Recommended Practice for Sizing Lead-Acid Batteries for Stand-Alone
Photovoltaic (PV) Systems
- 1361-14Guide for Selection, Charging, Test and Evaluation of Lead-Acid
Batteries Used in Stand-Alone Photovoltaic (PV) Systems
- 1526-03Recommended Practice for Testing the Performance of Stand-Alone
Photovoltaic Systems
- 1547-03Standard for Interconnecting Distributed Resources with Electric Power
Systems
- 1561-07Guide for Optimizing the Performance and Life of Lead-Acid Batteries
in Remote Hybrid Systems
- 1562-07Guide for Array and Battery Sizing in Stand-Alone Photovoltaic (PV)
Systems
- 1661-07Guide for Test and Evaluation of Lead-Acid Batteries Used in
Photovoltaic (PV) Hybrid Power Systems
- D. International Code Council (ICC):
 - IBC-15International Building Code
 - IFC-15International Fire Code
- E. National Electrical Manufacturer's Association (NEMA):
 - 250-14Enclosures for Electrical Equipment (1,000 Volts Maximum)
- F. National Fire Protection Association (NFPA):
 - 70-17National Electrical Code (NEC)
- G. Underwriters Laboratories (UL):
 - 6-07Electrical Rigid Metal Conduit – Steel
 - 94-13Tests for Flammability of Plastic Materials for Parts in Devices and
Appliances; Ed 6
 - 797-07Electrical Metallic Tubing – Steel
 - 969-17Standard for Marking and Labeling Systems
 - 1242-14Standard for Electrical Intermediate Metal Conduit – Steel
 - 1703-02Standard for Flat-Plate Photovoltaic Modules and Panels
 - 1741-10Standard for Inverters, Converters, Controllers and Interconnection
System Equipment for Use with Distributed Energy Resources

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide materials to fabricate functioning photovoltaic system in accordance with ASTM, IEEE, NEMA, NFPA, and UL, as specified in this section, and as shown on the drawings.
- B. Factory-prefabricated solar equipment packages which include photovoltaic modules, batteries or other energy storage, inverters, and controls and which meet the requirements of this section are acceptable.

2.2 GROUNDING

- A. All applicable components of the solar energy electrical power generating system must be grounded per latest NEC requirements.
- B. DC Ground-Fault Protector:
 - 1. Shall be listed per UL 1703.
 - 2. Shall comply with requirements of the NEC.

2.3 PHOTOVOLTAIC ARRAY CIRCUIT COMBINER BOX

- A. Shall be listed to UL 1741.
- B. Shall include internal overcurrent protection devices with dead front.
- C. Shall be contained in non-conductive NEMA Type 4X enclosure.
- D. Up to 48 volts DC: Shall use UL-listed DC breakers that meet NEC requirements for overcurrent protection.
- E. Up to 600 volts DC, paralleling system: Shall use fuses instead of breakers.
- F. Ground and pole-mounted arrays shall have a separate combiner box mounted to the pole itself.
- G. Where applicable, combiner box shall be a disconnecting combiner box.

2.4 SWITCH/DISCONNECTING MEANS

- A. Shall be UL-listed, in accordance with the NEC, as shown on the drawings, and as specified.
- B. Utility External Disconnect Switch (UEDS): Refer to Resident Engineer, as several states do not require UEDS for small solar photovoltaic systems if the inverter provides the same function per NEC. Coordinate requirements with serving electric utility.

2.5 WIRING SPECIALTIES

- A. Direct Current Conductors:
 - 1. If Exposed: Shall be USE-2, UF (inadequate at 60°C [140°F]), or SE, 90°C [194°F] wet-location rated and sunlight-resistant (usually for tracking modules).
 - 2. If in Conduit: Shall be RHW-2, THWN-2, or XHHW-2 90°C [194°F], wet-location rated.
- B. Conduits and Raceways:
 - 1. Shall use steel conduit listed per UL 6, UL 1242, UL 797 (as appropriate), except for tracking modules. Weathertight EMT installations shall be allowed for DC wiring in weather-protected areas.
 - 2. Shall use expansion joints on long conduit runs.
 - 3. Shall not be installed on photovoltaic modules.
- C. Enclosures subject to weather shall be rated NEMA 3R or better.

- D. Cable Assemblies and Junction Boxes:
 - 1. Shall be UL-listed.
 - 2. Shall be rated to 5VA flammability per UL 94.
- E. Prohibited Wiring Materials: Those which are not UL-listed, or listed materials used in environments outside those covered in their listing.

2.6 DC-AC INVERTER

- A. Shall be listed to UL 1741.
- B. Shall comply with IEEE 519 and IEEE 1547.
- C. Shall be listed per FCC Part 15 Class A.1.
- D. Shall have stand-alone, utility-interactive, or combined capabilities.
- E. Shall include maximum power point tracking (MPPT) features.
- F. Shall include anti-islanding protection if paralleling arrangement is required.

2.7 SOLAR PHOTOVOLTAIC (PV) MODULES

- A. Minimum Performance Parameters as per IBC 1509.7.4, IRC M2302.3, UL 1703.
- B. Photovoltaic Panel Types:
 - 1. Monocrystalline: Listed to UL 1703.
 - 2. Polycrystalline: Listed to UL 1703.
 - 3. Thin-Film/Flexible: Listed to UL 1703.
 - 4. Building-Integrated & Solar Shingles: Listed to UL 1703.
- C. Module and System Identification
 - 1. Module or Panel:
 - a. Listed to UL 969 for weather resistance.
 - b. Listed to UL 1703 for marking contents and format.
 - 2. Main Service Disconnect: per NEC.
 - 3. Identification Content and Format: per NEC.
 - 4. Identification for DC Conduit, Raceways, Enclosures, Cable Assemblies, and Junction Boxes: IFC 605.
 - 5. Identification for Inverter: per NEC.
- D. Bypass diodes shall be built into each PV module either between each cell or each string of cells.
- E. Other Components: per UL 1703.
- F. Hail Protection: Compliant with testing procedure per ASTM E-1038.
- G. Lightning Protection: Shall ground according to manufacturer instructions per UL 1703.
- H. Access, Pathways, and Smoke Ventilation: Per IFC 605.3, access and spacing requirements must be observed in order to: ensure access to the roof, provide pathways to specific areas of the roof, provide for smoke ventilation opportunities area, and, where applicable, provide emergency access egress from the roof.
- I. Fire Classification:

1. IBC 1505.8 for building-integrated photovoltaic and solar shingles.
2. IBC 1509.7.2: Although not technically enforceable, every effort shall be made to ensure the solar photovoltaic module is not combustible.

2.9 COLLECTOR SUPPORTS

- A. Wind Resistance Requirement:
 1. For rack-mounted: per IBC 1509.7.1.
 2. For building-integrated photovoltaic and solar shingles: IBC 1507.17.3.
- B. Mechanical Load Requirement: per UL 1703.
- C. Ground and Pole Mount:
 1. Foundations shall be designed by a licensed Professional Structural Engineer (PE).
 2. Where possible, combiner boxes shall be mounted directly to the pole itself.

2.10 INSTRUMENTATION

- A. Meters: If applicable and system is grid-connected, use net smart meter provided by the serving electric utility.
- B. Sensors:
 1. Temperature sensor shall be a component in the MPPT control system.
 2. May install additional data acquisition sensors to measure irradiance, wind speed, and ambient and PV module temperatures. Any additional sensors shall require a conduit separate from the current conductor conduit.
- C. Data logger/Monitoring System: Shall be a packaged system capable of string-level monitoring or in the case of micro-inverters, capable of monitoring and logging an individual module's information.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install the solar photovoltaic system in accordance with the NEC, this section, and the printed instructions of the manufacturer.
- B. Prior to system start-up, ensure no copper wire remains exposed with the exception of grounding wire as allowed in certain circumstances per manufacturer's instructions.
- C. Wiring Installation: Workers shall be made aware that photovoltaic modules will be live and generating electricity when there is any ambient light source and shall take appropriate precautions. Utilize on-site measurements in conjunction with engineering designs to accurately cut wires and layout before making permanent connections. Locate wires out of the way of windows, doors, openings, and other hazards. Ensure wires are free of snags and sharp edges that have the potential to compromise the wire insulation. All cabling shall be mechanically fastened. If the system is roof-mounted it shall have direct current ground fault protection according to NEC. Ensure breakers in combiner box are in the off position (or fuses removed) during combiner box wiring.
- D. Instrumentation: Install instruments as recommended by the manufacturer. Locate control panels inside a room accessible only to qualified persons.

- E. Building-Integrated Photovoltaic Installations: Building-integrated photovoltaic modules/shingles shall be installed in accordance with the manufacturer's installation instructions.
- F. Rack-Mounted Photovoltaic Installations: Rack-mounted photovoltaic modules shall be installed in accordance with the manufacturer's installation instructions.
- G. Ground and Pole-Mounted Photovoltaic Installations: If structure is used as equipment grounding conductor, ensure compliance with NEC. Wiring shall not be readily accessible.
- H. Tracking System Installations: Disconnect shall be within sight of the tracking motor.
- I. Provide safety signage per NEC.
- K. Remove, replace, patch, and repair existing roofing materials and surfaces cut or damaged during installation of the solar energy electrical power generation system, by methods and with materials so as not to void existing roofing system warranty. Notify roof warrantor before proceeding.

3.2 FIELD QUALITY CONTROL

- A. Field Inspection: Perform in accordance with manufacturer's recommendations. Prior to initial operation, inspect the solar energy electrical power generation system for conformance to drawings, specifications, and NEC. In addition, include the following:
 - 1. Visual Inspection and Tests:
 - a. Compare equipment nameplate data with specifications and approved shop drawings.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Verify required area clearances.
 - d. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
 - e. Verify the correct operation of all sensing devices, alarms, and indicating devices.
 - f. Verify that all cable entries from top of junction boxes are sealed per junction box rating.
 - g. Verify all connections and integrity of printed circuit boards in all applicable junction boxes.
- B. Tests: Provide equipment and apparatus required for performing tests. Correct defects disclosed by the tests and repeat tests. Conduct tests in the presence of the Resident Engineer.
 - 1. Module String Voltage Test: Prior to connecting wiring to the combiner box, use a digital multi-meter to ensure each series string's polarity is correct.
 - 2. Operational Tests: Perform tests in accordance with the manufacturer's written recommendations. Tests for stand-alone systems shall be performed per IEEE 1526.

3.3 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the solar photovoltaic electrical power generation system is in good operating condition and properly performing the intended function.

3.4 COMMISSIONING

- A. Comply with the requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

- B. If the system is grid-tied, the Contractor shall coordinate with the serving electric utility to establish an interconnection agreement.
- C. Connect the solar photovoltaic electrical power generation system to the serving electric utility grid only after receiving prior approval from the utility company.
- D. Only qualified personnel shall connect the solar photovoltaic electrical power generation system to the serving electric utility grid.

3.5 INSTRUCTION

- A. A complete set of operating instructions for the solar photovoltaic electrical power generation system shall be laminated or mounted under acrylic glass and installed in a frame near the equipment.
- B. Furnish the services of a factory-trained technician for one, 4-hour training period for instructing personnel in the maintenance and operation of the solar photovoltaic electrical power generation system, on the date requested by the Resident Engineer.

---END---

5.0 Project Schedule

Prior to installation of the geothermal system, materials will be procured. A more detailed geothermal site investigation will be completed by June 16, 2019. After verifying subsurface conditions and mobilization, construction of the 44-well geothermal system will begin on July 22, 2019 and continue for 63 days until August 23, 2019. Concurrent to the geothermal construction system is the solar array installation. Solar module installation is contingent on the relocation of a gas line on the roof surface, which is scheduled for June 3, 2019. The construction schedule for the solar systems is broken down into similar stages: procurement, mobilization, and installation. Procurement of materials and equipment will last 60 days from April 11, 2019 to June 9, 2019. After a week of mobilization, installation of the solar modules and inverters will begin on June 17, 2019 and last 1 week until June 23, 2019. After this is complete, electrical retrofitting, which includes installation of the utility disconnect, a step-down transformer, an AC combiner panel, and interconnection, will take 2 weeks from June 24, 2019 to July 3, 2019. A system-wide electrical shutdown is scheduled for July 5, 2019. The construction of the entire project will be completed on August 29, 2019.

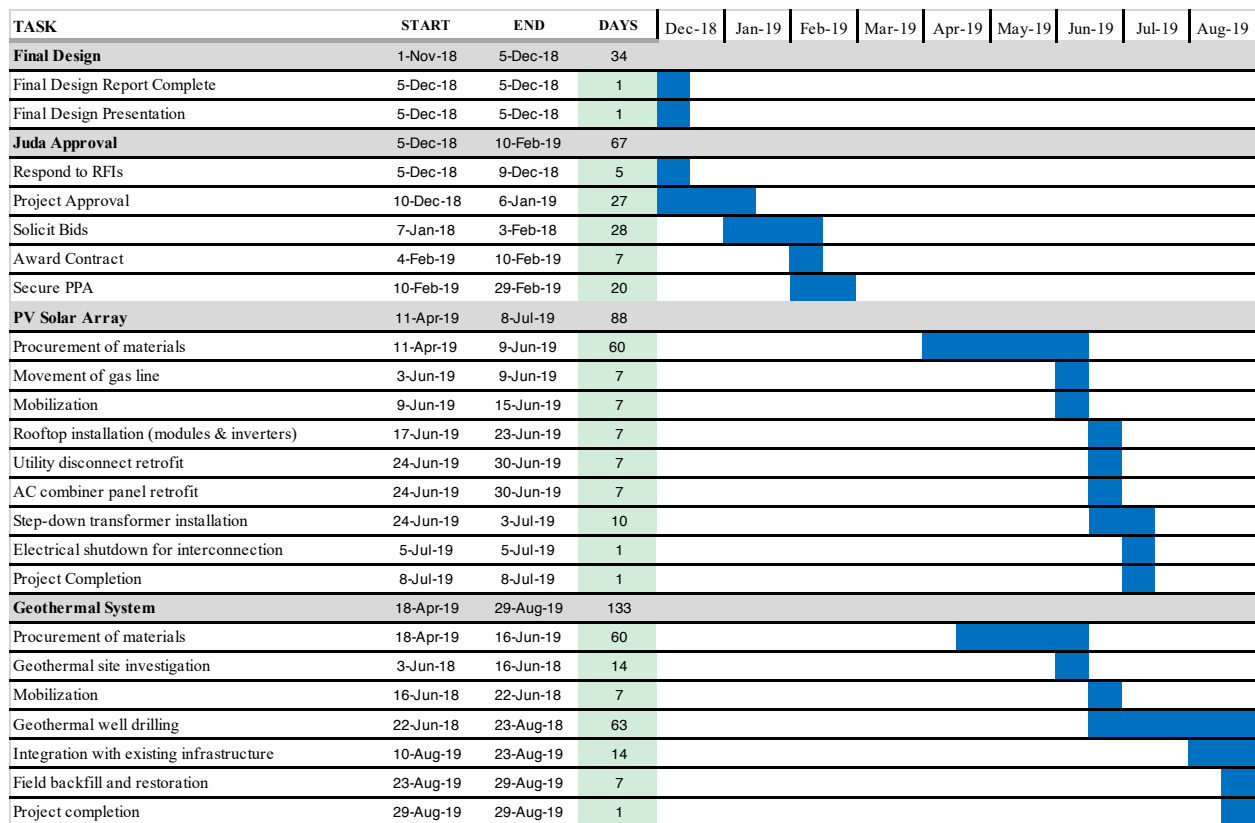


Figure 2. Project Schedule for PV Solar Array and Geothermal System.

4.0 Opinion of Probable Cost

Table 1 shows an estimated cost for the entire geothermal system and solar array. It is important to note that this estimate does not include the funding options that BeEco has explored. It was also assumed that this two-part renewable energy system does not consider the time value of money. Without considering funding options, the proposed project would cost \$596,000 and lead to an annual savings of \$39,000 in energy expenses.

Additionally, a contingency of 5% was built into the initial cost estimates of both the geothermal installation and solar installation. This contingency will account for any delays in construction schedule, mostly due to the drilling of the vertical wells for the geothermal system. This contingency can be so low do to the straightforward nature of installing these systems for specialized contractors hired for this work.

Table 1. Estimate of probable cost before funding.

	Solar Array	Geothermal System	Total without Funding
Annual Energy Output	98,000 kWh	28,000 CCF	98,000 kWh + 28,000 CCF
Annual Avoided Costs	\$11,000	\$28,000	\$39,000
Initial Costs	\$117,000	\$479,000	\$596,000
Modules	\$36,000	-	\$36,000
Inverters	\$6,000	-	\$6,000
Mounting	\$13,000	-	\$13,000
Electrical Infrastructure	\$13,000	-	\$13,000
Installation	\$33,000	-	\$33,000
Ground Loop	-	\$200,000	\$200,000
Vertical Borehole	-	\$139,000	\$139,000
Heat pumps	-	\$81,000	\$81,000
Vault	-	\$12,000	\$12,000
Professional Fees	\$7,000	\$30,000	\$37,000
Contingency	\$9,000	\$17,000	\$26,000
Operation and Maintenance	\$600	\$100	\$700

4.1. Funding Options

BeEco Engineering understands the financial hurdle of the system for Juda School. For this reason, we took it upon ourselves to research funding options that are available.

4.1.1. Power Purchase Agreement

Due to the fact the Juda School is not a taxable institution, the school is unable to take advantage of the tax incentives associated with installing a solar array on a residential or commercial building. For this reason, BeEco looked at funding options the solar array to minimize the upfront cost. Through our research, the help of our mentor Casey Joyce, and help from his coworkers at SunPeak, BeEco recommends that Juda School enter into a Power Purchase Agreement (PPA).

A PPA will completely cover the upfront cost of the solar array that will be implemented at Juda School. This is made possible by the desire for companies with a tax appetite looking to reduce their annual taxes. **Figure 1** shows a schematic of this process in complete. The basics of a PPA is, a company will pay for the solar array, the installation costs, and maintenance costs associated so that they receive the tax incentives from the government. Then, once the solar array is built, the company will act as a utility to Juda School. By charging Juda School for the energy produced by the array, the company will make back the initial investment. The school is still saving money because the charged rate is lower than the rate they currently pay by Alliant Energy. The biggest incentive of a PPA for Juda School is the fact that a PPA would eliminate all initial costs. The school can negotiate the ability to buyout the solar array at a reduced price at the end of the agreed upon timeframe. After the PPA has been contracted, Juda School could own the solar array. This will reduce the total initial cost of the project from \$596,000 to \$479,000. An ideal candidate for a PPA would be a solar development company, most likely the one that will be installing the solar array on the school. The solar developer has a large stake in the solar array functioning properly and efficiently so that they can make back the initial investment through the PPA. The maintenance of a solar array is covered by the investor in the majority of PPAs and since a solar developer is well equipped to maintain a solar array throughout its lifetime it makes an even better investor.

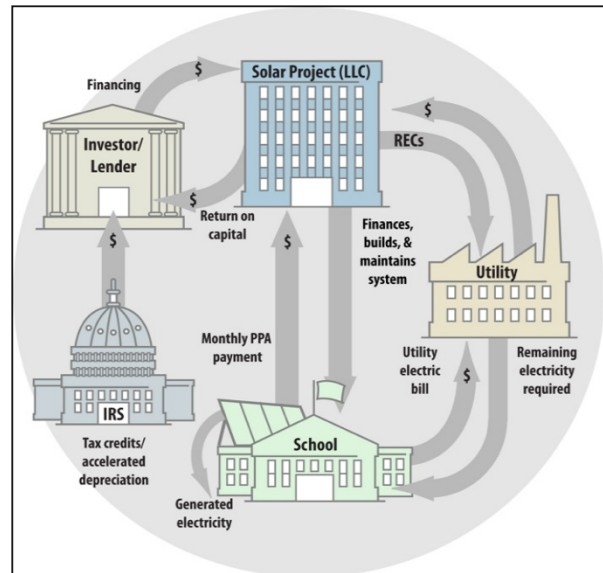


Figure 1. Summary of Power Purchase Agreements.

4.1.2. Focus on Energy

Focus on Energy is a Wisconsin based incentive program designed to help subsidize the cost of constructing renewable energy systems or making energy sustainability upgrades to an existing building. BeEco Engineering spoke with representatives from Focus on Energy and discovered a program called Renewable Energy Competitive Incentive Program (RECIP). RECIP can subsidize the cost of proposed geothermal system at Juda School through the submittal of an application that is due in January. This program will refund up to one dollar per therm of energy that the geothermal system is proposed to make within the first year. For the Juda School geothermal system this could be up to \$29,000. While this is only about 5% of the initial cost of the geothermal system, it is possible that there are similar funding opportunities available for geothermal systems that have not been discovered yet. After a subsidy of \$29,000 is factored into the initial cost of the geothermal system, the total initial cost of the geothermal system and solar array decreases from \$479,000 to \$450,000.

4.1.3. Payback Period

With the funding sources taken into account for geothermal and solar, the initial cost of the system would decrease from \$596,000 to \$450,000. This new initial cost would yield a simple payback period of 13 years. Although this is not as low as BeEco Engineering had hoped, this is an extremely reasonable payback period. Other systems of similar scale have higher payback periods but were still constructed due to the long anticipated lifetime of the systems. For example, the Fitchburg library, which installed 52 vertical wells had an anticipated payback period of approximately 30 years.



BeEco
Engineering

6.0 Engineering Applications

6.1. Structural Analysis

The dead load of this system includes the solar panels, racking, and ballast stones. The weight of each solar panel is 40.8 lbs. Since our array is 264 modules and spans over 6,560 square feet, the dead load of the panels in lbs/ft² can be calculated.

$$\frac{264 \text{ modules} * 40.8 \frac{\text{lbs}}{\text{module}}}{6,560 \text{ ft}^2} = 1.64 \frac{\text{lbs}}{\text{ft}^2} \quad (1)$$

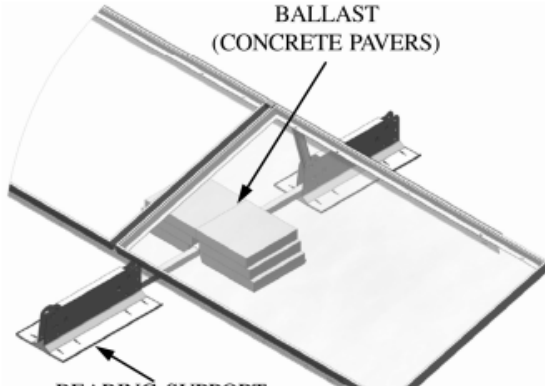


Figure 3. Typical ballast system to attach solar panels to a roof.

The total dead load of the racking and ballast stones, like the one recommended for Juda School, is approximately 3.5 lbs/ft². Therefore, the total dead load of the solar array is approximately 5.2 lbs/ft². The structure that will support the solar array was built in 1956. Building codes at this time required that the structure be built to support a snow load of 30 lbs/ft². Current load codes only require an extra 20 lbs/ft² for snow load. This leaves an extra load of 10 lbs/ft² that can support the solar array, and the 5.2 lbs/ft² of dead load is well below this limit.

The structural analysis of the roof-mounted array must also account for loading due to wind. The solar array at Juda School will be installed using a ballast mounting technique, which is common for roofs. The panels will be angled at 10 degrees and are on a relatively flat roof, with a pitch of only three degrees. A schematic of a typical ballast system is shown in **Figure 3**. This means that the resistance to uplift and sliding is provided by the weight of the concrete paver. Most pressure acts perpendicularly to the panel and for sloped panels the forces consist of both vertical lift and horizontal drag. Wind gusts will cause a peak pressure over a few adjacent modules even though average pressure will be lower over the rest of the array. The solar array will need to redistribute pressure peaks throughout the array.

Wind loads on roof-mounted solar arrays are more complicated because ASCE standards do not explicitly address solar arrays. This presents an issue for PV solar installation, because the design of a system to withstand wind loads often comes down to the structural engineer's interpretation of the building codes and standards. ASCE 7-10 for wind loads does not explicitly apply to solar arrays, but the same framework can be used. Design wind pressure p is defined as:

$$p = q_h(GC_p - GC_{pi}) \quad (2)$$

where q_h = velocity pressure (lbs/ft²), GC_p = exterior pressure coefficient and GC_{pi} = interior pressure coefficient.

Pressure coefficients can usually be found in tables, but there are no tabulated values for solar arrays. Since our array has such a small pitch, little space will be created between the module and roof, so it could be classified as an "open building" ($GC_{pi} = 0$). The space created could also be considered a

“partially enclosed building” ($GC_{pi} = 0.55$). The PV solar array will be somewhere in between these two values and a value of $GC_{pi} = 0.3$ is generally used.

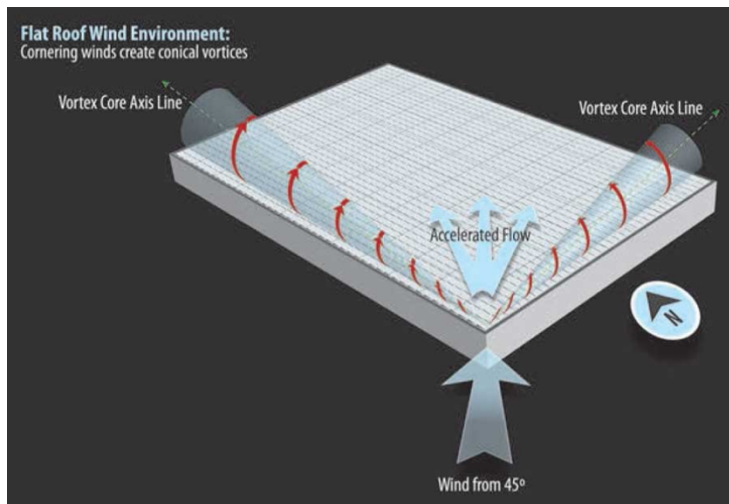


Figure 4. Conical vortices caused by wind hitting a rooftop.

School is not a square, the array in the study is similar (12 degrees) to the array proposed for Juda School (10 degrees). Therefore, it is assumed that **Figure 5** is an accurate representation of the wind effects on the solar array at Juda School. These figures show that larger GC_p coefficients are produced at the corners due to conical vortices.

The correct external pressure coefficient is more difficult to determine. Tests have shown that the worst wind loads on large low-slope roofs occur when wind hits the corners. When wind hits the corners, the flow will separate at an angle between 10 and 20 degrees along the edge of the roof which can be seen in **Figure 4**. Therefore, wind loads on PV arrays are greatest on the corners and edges of the roof. **Figure 4** shows GC_p values of a moderately tiled array (10 – 15 degrees) on a $6h \times 6h$ roof, where h is the building height gathered from wind tunnel testing. Although the roof at Juda

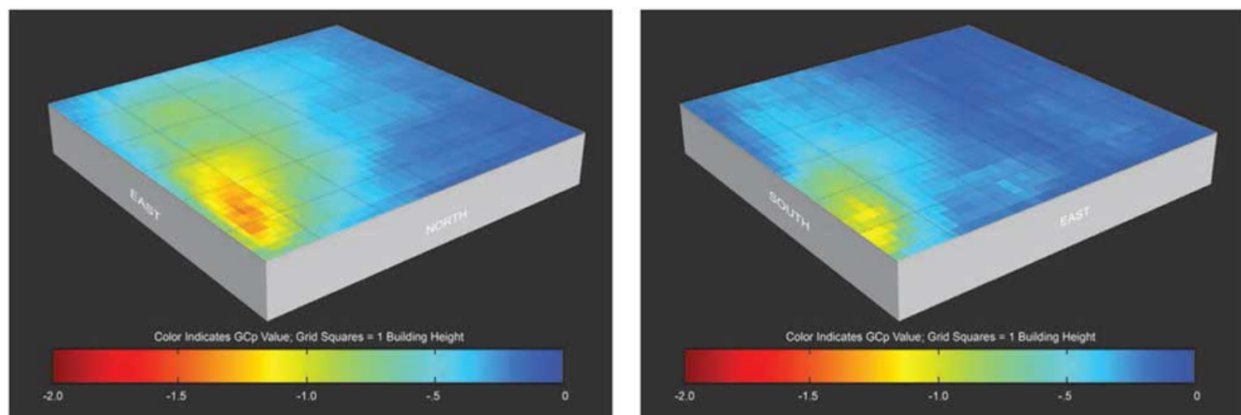


Figure 5. Wind effect on GC_p value, notice how the value is more at the corner of the roof.

For the array installed at Juda School, wind tunnel testing done by the manufacturer is required to ensure the array can withstand the wind load. Method 3 of ASCE 7-05 includes requirements for wind tunnel testing. This will require a model of the building, slope, row spacing, and height above the roof all to scale. In order to get an accurate wind load assessment that considers the mounting and geometry of the array, building height, roof conditions and wind conditions, wind tunnel testing should be done by the manufacturer prior to installation.

6.2. Environmental Analysis

It is important to understand the environmental impacts of the geothermal and solar system as it will be installed at Juda School for at least 25 years. This analysis will consist of a life cycle analysis (LCA) and the amount of CO₂ avoided for a geothermal source loop made of high-density polyethylene (HDPE) and a PV solar array separately. Environmental concerns with these systems will also be addressed.

An LCA of a geothermal ground source heat pump system (GSHP) was conducted by the University of Western Macedonia. The LCA follows standards set by the International Organization for Standardization (ISO). The GSHP in this study breaks down the emissions released of gathering the raw materials, transportation, cement, drilling, the poly propylene glycol running through the system, and operation. As this system is slightly smaller than the one at Juda School, it is estimated that the emissions associated with the geothermal system at Juda School will be about 5 times more; these values are listed in **Table 1**. According to this study the main effects these pollutants will have is contributing to global acidification. The effects of the emissions are counteracted by the CO₂ avoided by using a GSHP system. Juda School will avoid about 6,300 tons of CO₂ over the lifetime of the system.

Table 2: Air emissions released during life cycle of GSHP system.

Stages	Emissions (tn)								
	CO ₂	HCFC ₂₂	SO ₂	NO _x	N ₂ O	CH ₄	VOC	CO	HC ^a
Raw Matters	25950.65		160.15	103.1	0.8	0.469	1.645	9.525	
Transport	1.59			3.35			0.0378		
Cement	4534.35		0.0645	16.125					
Drilling	49			103			1.15		
Refrigerant	303.2	0.1516							
Operation	2124		38.4	3				0.45	0.12
Total	32962.79	0.1516	198.6145	228.575	0.8	0.469	2.8328	9.975	1.98

a	Hydrocarbon (HC)
b	Particulate Matter (PM)

The largest environmental concern with the geothermal system is the potential for the ground water to be contaminated if the wells are not grouted properly. WIDNR states that any well drilled must be grouted within 24 hours with approved grouting materials to prevent contamination. The ground temperature could also be altered, as could any aquifers in the area; this could decrease water quality and hydraulic conductivity of the soil.

Nanyang Technological University conducted an LCA on silicon solar panels and found that 2.94 MJ of energy was used per kWh produced by the PV solar array. With this information, a simple calculation can be done to analyze the input energy of the PV solar array at Juda School over its lifetime.

$$2.94 \frac{MJ}{kWh} * 97654 kWh = 280,000 MJ \text{ of energy needed} \quad (3)$$

This number includes the energy required to mine the materials, install the system, and the eventual retirement of the system. This is offset by the amount of CO₂ avoided by installing this system which is about 1,920 tons.

6.3. Construction Analysis

Construction of this project can begin after the design is approved by Juda School and contractors are selected. BeEco learned from the students and faculty members at Juda School that the baseball diamond is infrequently used. This means that construction of the solar array and geothermal system can occur concurrently during the summer when school is not in session. Not having as many people present on site will help to minimize any noise disturbances and promote safety.

Before installing the geothermal system, a more thorough soil investigation will need to be conducted. This is necessary to verify the assumed subsurface conditions and an *in situ* thermal conductivity test will be done to verify assumed values. This is expected to be completed by June 16, 2019. After the procurement of necessary materials and mobilization of drilling equipment, installation of the source loop can begin. Construction of the 44 wells will begin on July 22, 2019 and last until August 23, 2019. All wells will be drilled and grouted per Wisconsin DNR standards. Grout types required by the DNR such as bentonite will be used, and boreholes will be backfilled and grouted within 24 hours of being drilled. Each header pipe from the four circuits will be connected into the buried vault, which will have only two pipes, a source and return, which will go into the school to the boiler room. This will help to minimize the number of pipes that need to be routed through the school. Once the source loop has been placed, the field will be refilled and graded to the initial conditions. The supply and return pipes will need to be routed through the ceiling within the school, which will be invasive. However, since this work is being done during the summer, there will be no disturbance to the students. The necessary water and heat pumps will be installed in the existing boiler room and existing pipe infrastructure will be used to distribute the heated fluid throughout the school.

Concurrent to the geothermal borehole drilling, construction of the rooftop solar array can take place. Solar module installation is contingent upon the relocation of the gas line. The gas line should be moved to the middle of the roof so that it lies in the planned walkway. This will provide more space for continuous modules. Procurement of materials will take 60 days from April 11, 2019 to June 9, 2019. Mobilization will last a week before the solar modules and the inverter can be installed on June 17, 2019. Installation will last one week until June 23, 2019. The solar array will be installed using a ballast mounting system, which eliminates the need to drill holes into the roof surface. This will decrease the amount of noise disturbance during installation. After the solar array is installed on the rooftop the additional electrical equipment will be added. This includes the installation of a utility disconnect, a step-down transformer, an AC combiner panel, and interconnection. This will take two weeks total and will be completed July 3, 2019. A critical day in the construction of the solar array will be the system-wide electrical shutdown, which is scheduled for July 5, 2019. The construction of the entire project, solar array and geothermal system, will be completed August 29, 2019.

Due to the concurrent construction of the geothermal system and the solar array, two separate staging areas will be needed. Seen in **Figure 6**, the yellow areas represent the construction sites and the blue areas are the staging areas for each construction site. As well, a transportation route is depicted using the blue arrows on the south side of the school. This parking lot and driveway will serve as a way for the equipment and machinery for geothermal installation, such as drill rigs and excavators, to be able to reach the geothermal construction site.

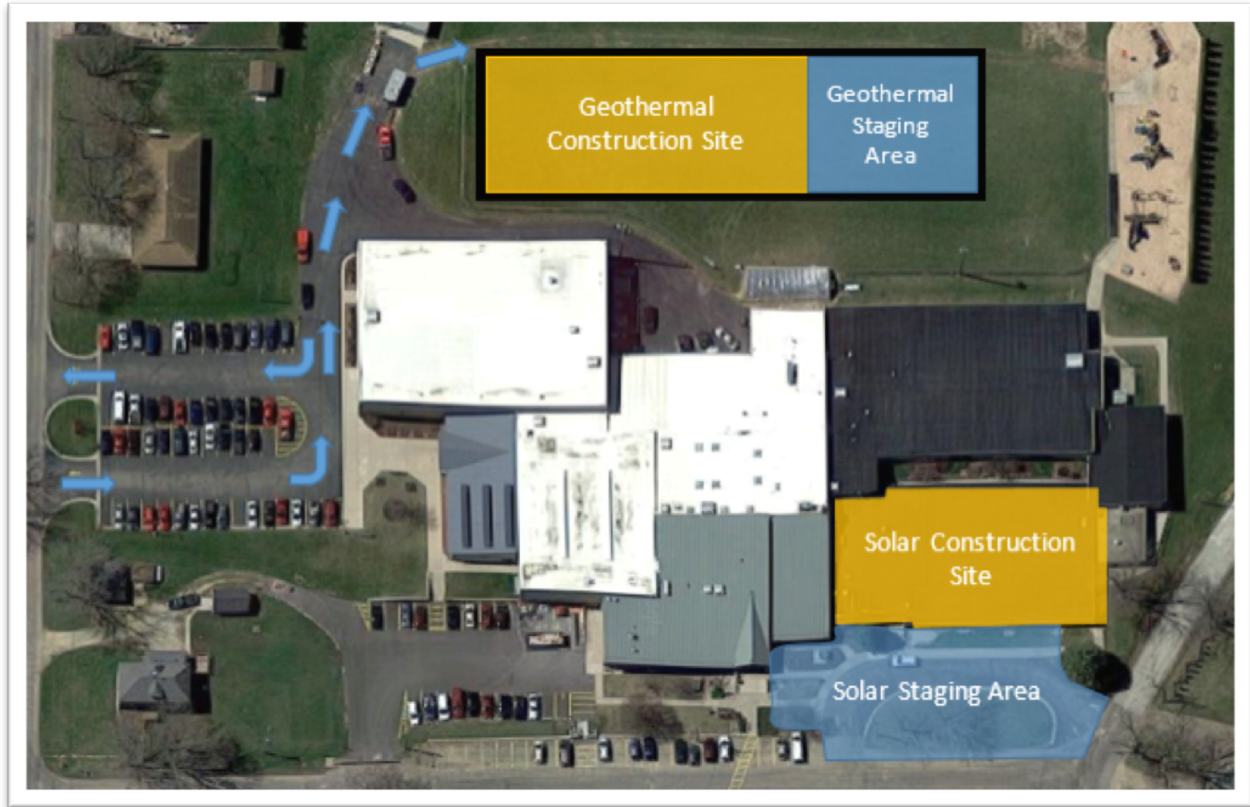


Figure 6. Construction staging diagram.

6.4. Hydraulic Analysis

To appropriately size the geothermal system, an analysis of the system's flow rates was conducted acknowledging anticipated head losses. The source loop is a closed-loop circulating-fluid system that is filled a 75% water and 25% polypropylene glycol solution. This fluid has no contact with the soil or groundwater and is continuously re-circulated through the interlinked high-density polyethylene (HDPE) pipes. As graphically illustrated in **Figure 7**, as fluid travels through the pipes the flow rate decreases; to match this decrease, smaller diameter pipes are to be used further from the vault. Pipe segments' corresponding diameters, flow rates, and head losses are summarized in **Table 3**. The values were obtained using a reference table on anticipated head loss for HPDE pipes (**Table 4**). **Table 4** was established using the Hazen Williams equation for fluid flow in pipes:

$$h_f = R_f \cdot Q^{n_f} = \frac{10.68 \cdot L}{C^{1.852} \cdot D^{4.87}} \cdot Q^{1.852} \quad (4)$$

where L is the pipe length in m, C is the Hazen-Williams factor, D is the inner piper diameter in m, Q is the pipe flow in m³/s, and R is the hydraulic radius in m

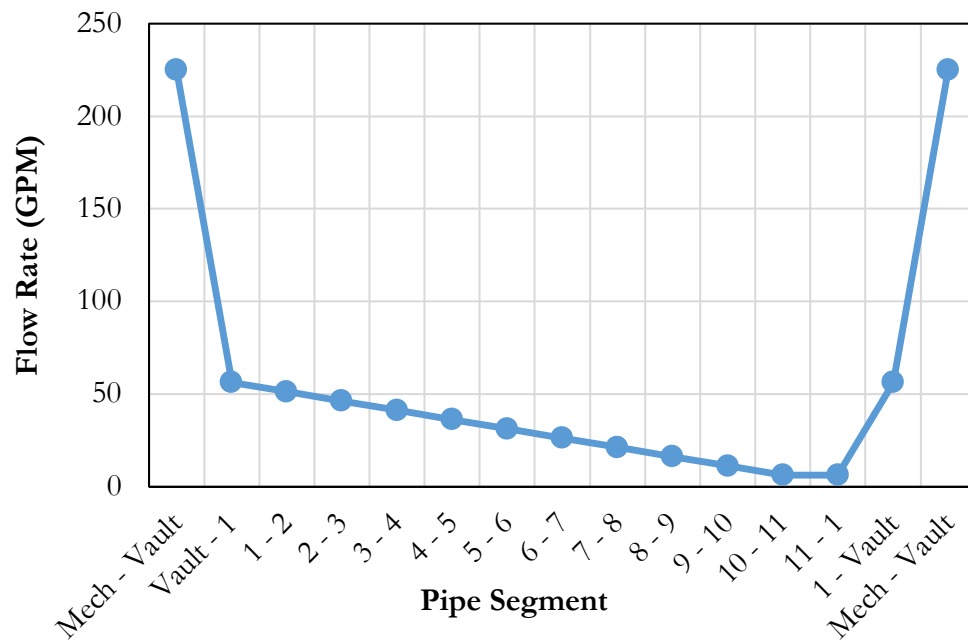


Figure 7. Flow rate as a function of pipe segment.

Table 3. Calculated head loss and flow values for one circuit containing 11 vertical boreholes.

Head Loss for 20% Propylene Glycol by Volume at 40F							
	Pipe Run	Flow rate (GPM)	Pipe	Length (ft)	Nom Size (in)	hl/100	hl (ft)
Circuit 1	MECH-VAULT	225	HDPE DR-11	270	4	2.6	7.02
	VAULT - A1	56.25	HDPE DR-11	60	4	0.2	0.12
	A1-A2	51.14	HDPE DR-11	15	3	0.7	0.105
	A2-A3	46.02	HDPE DR-11	15	3	0.7	0.105
	A3-A4	40.91	HDPE DR-11	15	3	0.4	0.06
	A4-A5	35.80	HDPE DR-11	15	2	2.45	0.3675
	A5-A6	30.68	HDPE DR-11	15	2	1.8	0.27
	A6-A7	25.57	HDPE DR-11	15	2	1.35	0.2025
	A7-A8	20.45	HDPE DR-11	15	2	0.9	0.135
	A8-A9	15.34	HDPE DR-11	15	1.5	2.1	0.315
	A9-A10	10.23	HDPE DR-11	15	1.5	1	0.15
	A10-A11	5.11	HDPE DR-11	15	1	2	0.3
	A11-A1'	5.11	HDPE DR-11	700	1	2	14
	A1'-VAULT	56.25	HDPE DR-11	210	4	0.2	0.42
	VAULT-MECH	225	HDPE DR-11	270	4	2.6	7.02
						Total Head Loss	30.59

Table 4. Friction loss table for HDPE pipe.

Head Loss / 100 Feet Pipe Due to Friction (C = 150)														
C = 150 for High Density Polyethylene Pipe (HDPE)														
Flow (GPM)	Pipe Diameter (Inch)													
	½"	¾"	1"	1-¼"	1-½"	2"	2-½"	3"	4"	5"	6"	8"	10"	12"
0.5	0.8	0.1												
1	2.9	0.4	0.1											
2	10.5	1.5	0.4	0.1										
3	22.2	3.1	0.8	0.3	0.1									
4	37.9	5.3	1.3	0.4	0.2									
5	57.2	7.9	2.0	0.7	0.3	0.1								
10		28.6	7.1	2.4	1.0	0.2	0.1							
15		60.6	14.9	5.0	2.1	0.5	0.2	0.1						
20			25.4	8.6	3.5	0.9	0.3	0.1						
30			53.8	18.2	7.5	1.8	0.6	0.3	0.1					
40			91.7	30.9	12.7	3.1	1.1	0.4	0.1					
50				46.7	19.2	4.7	1.6	0.7	0.2	0.1				
60				65.5	26.9	6.6	2.2	0.9	0.2	0.1				
70				87.1	35.8	8.8	3.0	1.2	0.3	0.1				
80					45.9	11.3	3.8	1.6	0.4	0.1	0.1			
90					57.0	14.1	4.7	2.0	0.5	0.2	0.1			
100					69.3	17.1	5.8	2.4	0.6	0.2	0.1			
150						36.1	12.2	5.0	1.2	0.4	0.2			
200						61.6	20.8	8.5	2.1	0.7	0.3	0.1		
250						93.0	31.4	12.9	3.2	1.1	0.4	0.1		
300							44.0	18.1	4.5	1.5	0.6	0.2	0.1	
400							74.8	30.8	7.6	2.6	1.1	0.3	0.1	
500								46.5	11.5	3.9	1.6	0.4	0.1	0.1
600								65.2	16.1	5.4	2.2	0.5	0.2	0.1
700								86.7	21.4	7.2	3.0	0.7	0.2	0.1
800									27.4	9.2	3.8	0.9	0.3	0.1
900									34.0	11.5	4.7	1.2	0.4	0.2
1000									41.3	13.9	5.7	1.4	0.5	0.2
1200									57.9	19.5	8.0	2.0	0.7	0.3
1500									87.5	29.5	12.1	3.0	1.0	0.4
2000										50.3	20.7	5.1	1.7	0.7
3000											43.8	10.8	3.6	1.5
4000											74.6	18.4	6.2	2.6
5000												27.8	9.4	3.9

From the mechanical room to the vault water travels through 4-inch diameter HDPE header pipes. The grid system and associated piping network is illustrated in **Figure 8**. As water travels further down each circuit the flow is decreasing, which is accommodated by decreasing pipe segment diameter sizes. Ultimately, each of the four circuits have header pipes that lead to the underground vault, where the flow can be transferred to only two pipes, a supply and return, that go into the building to the mechanical room. Consolidating the piping network in a vault prior to entering the building helps to minimize the number of pipes that need to be routed through the school. The vault also contains pressure, flow, and temperature sensors to measure the fluid in the header pipes. The vault is buried underground but is accessible from the ground level through a manhole as shown in **Figure 9**.

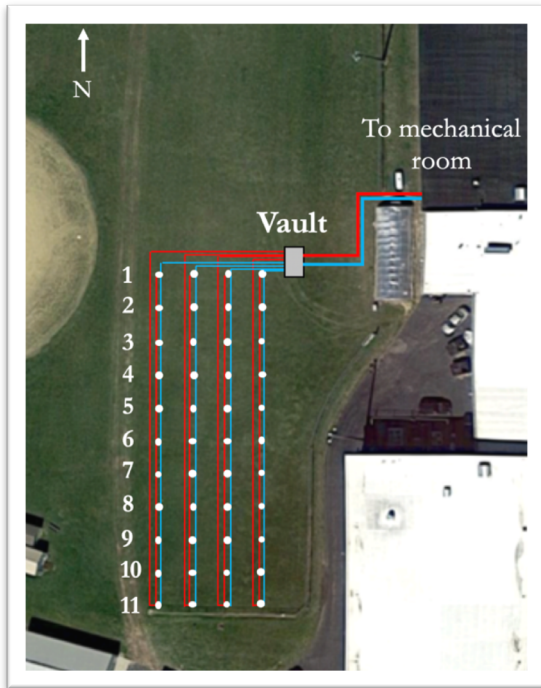


Figure 8: Aerial view of geothermal well system.



Figure 9: Underground vault where header pipes converge.

Knowing the flow rates was also essential for BeEco Engineering to determine the most appropriate pump for the system. The total flow rate required for the 75-ton system is 225 gallons per minute (gpm). One possible heat pump model is the Trane Axiom High Efficiency Water Source Heat Pump. Several features of this unit are summarized in **Table 5**. This heat pump has both a heating and cooling circuit and operates at 57 gpm on the source side. Since the total system flow is 225 gpm, 4 heat pumps will be needed to achieve a 225 gpm flow rate. The heat pumps are placed in parallel with one unit ramping up at a time as the load increases. This helps increase efficiency and lessen the amount of electricity the heat pumps are using.

Table 5. Trane Axiom High Efficiency Water Source Heat Pump unit overview.

Unit Overview	
Water Source Heat Pump Model	EXWE2404
Unit Configuration	Water to Water
Nominal Capacity	20-ton
Refrigeration Circuit	Heating & cooling circuit
Source Side Fluid Type	Propylene glycol
Fluid Flow Rate	57.0 gpm

The fluid pumped to the mechanical room will heat the school using the school's existing hydronic heating coils. Within the mechanical room there will be two pumps that are moving the solution between the mechanical room and the source loop. Since it was not feasible for BeEco Engineering to determine the thermal load of each area of the building, it is difficult to determine how much fluid will need to be sent to different areas throughout the school. Therefore, our design focuses on the source loop side and heat pump selection, with the general knowledge that existing infrastructure can be used in the school. A schematic of the geothermal piping network is shown in **Figure 10**.

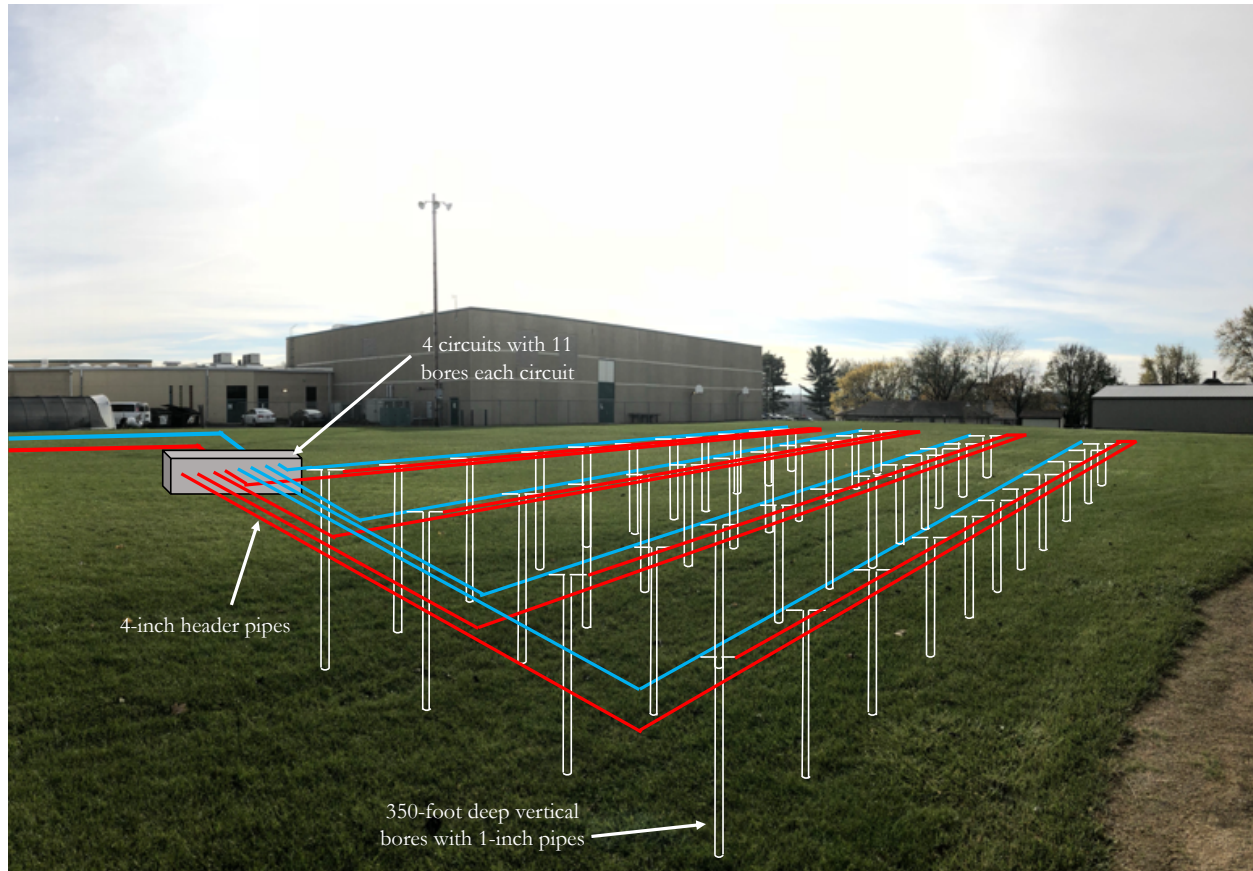


Figure 10. Schematic of 75-ton vertical-borehole geothermal system.

7.0 ABET Calculations

7.1. Differential Equations for Geothermal Heat Pumps

A major component of a geothermal renewable energy system is the ground coupled heat pump, which circulates poly propylene glycol through vertical pipes. This approach capitalizes on the subsurface's consistent temperature and transfers heat from the subsurface to heat or cool. Unfortunately, the heat pump requires energy to operate. This can be quantified using the relative efficiency, or coefficient of performance (COP) seen below.

$$COP = \frac{Q}{W} \quad (5)$$

where Q is the heat supplied or removed and W is the work consumed by the heat pump. Another common metric used to assess the efficiency of a heat pump is the energy efficiency ratio (EER):

$$EER = \frac{\text{output energy in BTU}}{\text{input electrical energy in Watt} - \text{hour}} \quad (6)$$

To most efficiently harness the earth's heat, mathematical models can be used to understand the subsurface temperature. One of the first models was developed in 1882; this model uses geological characteristics of the earth and considers the effect distance and time since start have on temperature:

$$u(r, t) - u_0 = \frac{q_1}{4\pi k} \int_{\frac{r^2}{4at}}^{\infty} \frac{e^{-x}}{x} dx \quad (7)$$

where r is the distance from the line-source and t is the time since the start; $u(r, t)$ is the temperature at distance r and time t ; u_0 is the initial temperature; q_1 is the heating rate per length of line source; k is the thermal conductivity of the ground; and a is the thermal diffusivity of the ground. Unfortunately, this model ignores the flux along the surface of the ground and down the borehole. To account for this, Eskilson modified the model to account for borehole length. In his model, soil is assumed to be homogeneous with constant boundary conditions:

$$\frac{\partial^2 u}{\partial r^2} + \frac{\partial u}{\partial r^2} + \frac{\partial^2 u}{\partial z^2} = \frac{\partial u}{\partial t} \quad (8)$$

$$u(r, 0, t) = u_0 \quad (9)$$

$$u(r, z, 0) = u_0 \quad (10)$$

$$q_1(t) = \frac{1}{H} \int_D^{D+H} 2\pi r \frac{\delta u}{\delta r} dz \quad (11)$$

where H is the borehole length and D is the uppermost part of the borehole. Equation 7 can be solved using differential equations to determine the temperature distribution of a borehole:

$$u_b - u_0 = \frac{q_1}{2\pi k} g\left(\frac{t}{t_s}, \frac{r_b}{H}\right) \quad (12)$$

7.2. Calculus of Solar Panel Power and Energy Generation

Solar array systems successfully convert light energy into electrical energy. Power is the rate at which energy is produced or consumed:

$$P = \frac{dE}{dt} \quad (13)$$

Therefore, using the fundamental theorem of calculus, the total energy transformed between times a and b can be calculated by integrating the power over this time period:

$$E = \int_a^b P dt \quad (14)$$

The intensity of solar radiation on a surface is equal to the sine of the angle A of elevation of the sun above the horizon. This logic explains why the most energy can be obtained when the sun is directly overhead and $A=\pi/2$. The total energy harnessed over a period of time is then the following:

$$E = \int_{t_0}^{t_1} \sin(A) dt \quad (15)$$

The angle of elevation of the sun directly above the horizon can be calculated using the following formula:

$$\sin(A) = \cos(l) \sqrt{1 - \sin^2(\alpha) \cos^2\left(\frac{2\pi T}{365}\right)} \cdot \cos\left(\frac{2\pi t}{24}\right) + \sin(l) \sin(\alpha) \cos\left(\frac{2\pi T}{365}\right) \quad (16)$$

where A is the angle of elevation of the sun above the horizon, l is the latitude, α inclination of the earth's axis (23.5° or 0.41 radians), T is the time of year in days from the first day of summer (June 21), t is the time of day in hours from noon.

7.3. Chemistry of Solar Panels

This design proposes the implementation of 264 Zhongli Talesun Solar TP660P-270W solar panels. These panels are composed of polycrystalline silicon (Si); metallurgical grade Si can be commercially produced through the reaction of high-purity silica with wood, charcoal, and coal in an electric arc furnace at a temperature higher greater than $1,900^\circ\text{C}$. At this temperature the carbon will reduce the silica to silicon, illustrated by the following reactions:



The liquid silicon produced via these reactions is collected at the bottom of furnace. To avoid the accidental formation of silicon carbide (SiC), the concentration of SiO₂ should be kept high so that any SiC that forms can react with SiO₂:



This silicon can then be used in the construction of solar panels. Silicon has four of eight valence electrons, making it the ideal element for covalent bonding with other silicon atoms. The covalent bonds formed between silicon atoms create a lattice structure. With a crystalline lattice structure, there are few free-floating electrons, so impurities are added to the silicon crystal structure to add extra electrons, which are necessary for electricity generation. By adding an impurity to the silicon lattice structure, the electronegativity is altered, and the silicon surface is transformed into a conductor of electricity. Different elements can be integrated into the lattice structure like phosphorus, which forms a “n-type material”, and boron, which creates a “p-type material” (**Figure 11A, 11B and 11C**). If the materials are layered, an electric field is created. When sunlight hits the solar panel surface, the light photon energy excites electrons and causes them to travel from the p-material surface to the n-material surface across the electric field, and thus the movement of electrons across the layers produce electricity (**Figure 12**).

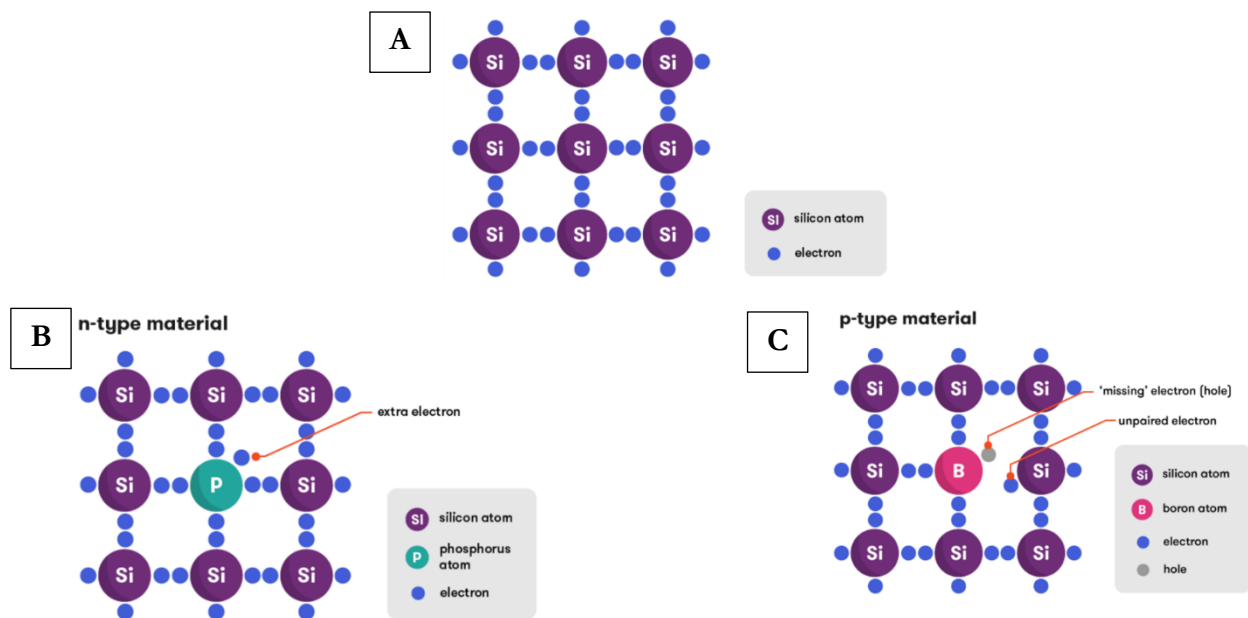


Figure 11. A) Lattice structure formed by covalent bonds between silicon atoms B) Introduction of phosphorus into silicon lattice structure C) Introduction of boron into silicon lattice structure.

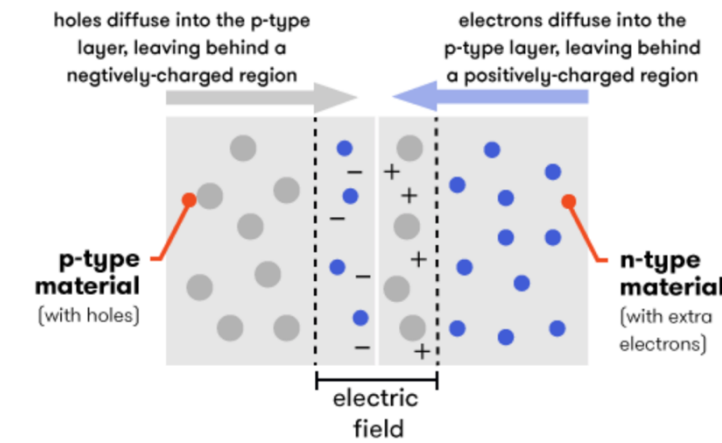


Figure 12. An electric field is created where the p-type material and n-type material meet, allowing for electricity

7.4. Biology of Geothermal Site Restoration

The biology component of the proposed design is minimal, the geothermal system implementation will disturb the landscape, however the only existing vegetation on the property is grass. BeEco Engineering values retaining the usability and green space. Post-construction of the geothermal renewable energy system, the property will require a restoration of the grass field west of the school building. A similar project was recently completed at the City of Fitchburg library. **Figure 13A** depicts the project during construction and **Figure 13B** shows the restored land surface post-construction.

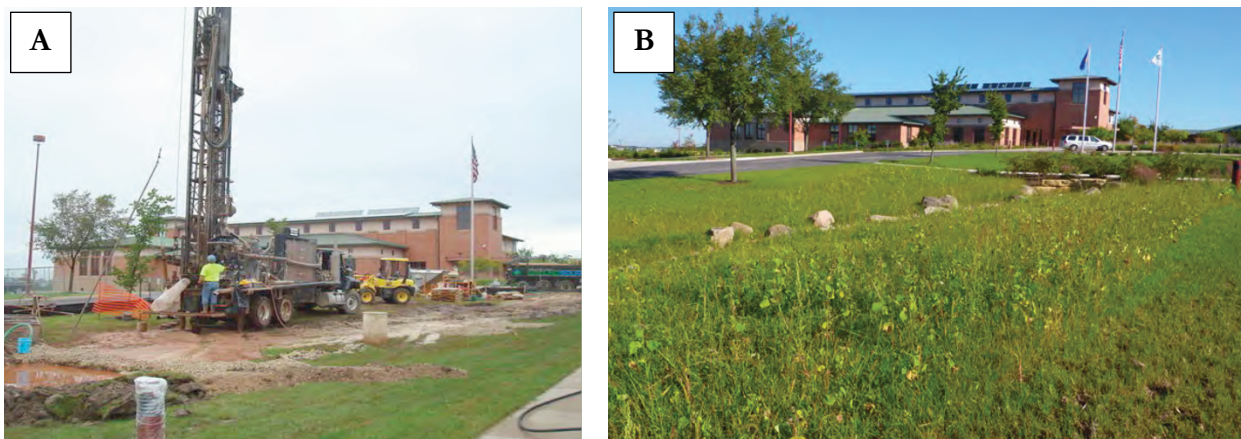


Figure 13. A) The drilling of boreholes at City of Fitchburg library B) Post-construction restoration of the land surface.

7.5. Geology Considerations for Geothermal Energy Systems

Understanding the geology of the Juda School property is fundamental in the design of the geothermal energy system. The proposed design involves the implementation of 44 vertical wells, each reaching a depth of 350 ft. BeEco Engineering used geotechnical data from local well-logs to understand the subsurface characteristics at the Juda School property. These well-logs only provide information to a depth of 150 ft; however, BeEco Engineering obtained a Thickness map of the St. Peter Sandstone in Southern and Eastern Wisconsin (**Figure 14**). The map indicates that the St. Peter Sandstone formation reaches a depth between 300 ft and 350 ft in this geographic region, which suits the needs of this project.

Additionally, BeEco Engineering contacted a project manager with Sam's Well Drilling Inc. who recommended using vertical wells between 300 ft and 400 ft deep so that most of the well was in the St. Peter's Sandstone. This sandstone has a higher thermal conductivity (2.1 to $3.86 \text{ W m}^{-1} \text{ K}^{-1}$) than the brown and blue clay layers ($1.1 \text{ W m}^{-1} \text{ K}^{-1}$) which means less wells at a deeper depth can be installed. The information provided by Sam's Well Drilling Inc. and the St. Peter Sandstone map aided BeEco Engineering in determining of the most appropriate vertical bore hole depth. Prior to construction further *in-situ* tests would need to be completed to verify the geological features of the site.

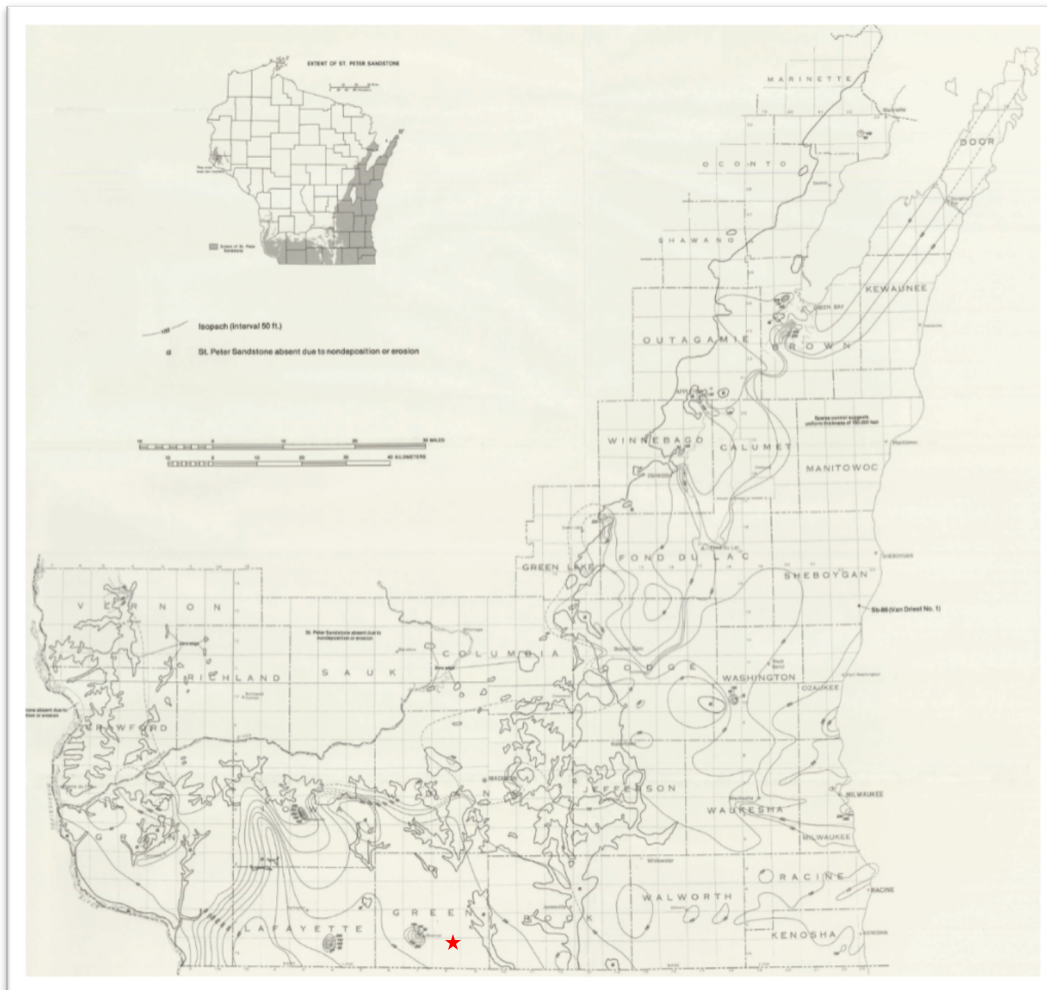


Figure 14. Thickness map of the St. Peter Sandstone in Southern and Eastern Wisconsin; Juda designated by the star.

Appendix I: Calculations

Power Generation Calculations

Cost Reduction Needed to Offset Energy Expenses by 25%

Knowns:

- 2017 Gas Expenses = \$25,127
- 2017 Electricity Expenses = \$71,505
- Total Energy expenses = \$96,632

With a 25% Reduction in energy expenses:

$$\text{New annual energy expenses} = 0.25 \cdot \$96,632 = \$72,474$$

$$\text{Renewable energy system must save} = \$96,632 - \$72,474 = \$24,158$$

Energy Reduction Needed to Offset Energy Expenses by 25%

Electricity Reduction only (Solar and Wind):

- August 2017 – August 2018 Cost of Electricity = \$0.10884/kWh

$$\text{kWh to produce} = \frac{\$24,158/\text{year}}{\$0.10884/\text{kWh}} = 222,000 \text{ kWh/year}$$

Gas Reduction only (Geothermal):

- 2017 Cost of Gas = \$0.71564/CCF

$$\text{CCF to produce} = \frac{\$24,158/\text{year}}{\$0.71564/\text{CCF}} = 33,800 \frac{\text{CCF}}{\text{year}}$$

Geothermal Economic Calculations

(GI) Annual Avoided Costs / “Gross Income”

System was designed to heat for the coldest month

$$GI_{geo} = \text{amount spent heating} + \text{amount spent cooling}$$

$$GI_{geo} = \$20,186 + (35\% \cdot 33\% \cdot 615,000 \text{ kWh} \cdot 0.10884 \frac{\$}{\text{kWh}})$$

$$GI_{geo} = \$20,186 + \$7,731$$

$$GI_{geo} = \$27,917$$

Assumptions: It was assumed that 35% of the school's electricity bill is spent on running the 11 air conditioners. It was then assumed that 33% of the AC distribution system was able to be connected to the geothermal distribution, thus offsetting those electrical costs.

(IC) Initial Costs

$$IC_{geo} = \sum Initial\ costs$$

$$Capital\ Equipment = Ground\ Loop + Vertical\ Borehole + Heat\ Pumps + Vault$$

$$Capital\ Equipment = \$200,000 + \$139,000 + \$81,000 + \$12,000$$

$$**Capital\ Equipment = \$437,000**$$

$$IC_{geo} = Capital\ Equipment + Professional\ Fees + Contingency$$

$$IC_{geo} = \$437,000 + 0.07(\$437,000) + 0.05(\$437,000)$$

$$**IC_{geo} = \$479,000**$$

Assumptions: Professional fees were assumed to be 7% of initial installation and equipment costs and contingency was assumed to be 5%.

Source:

S. Kavanaugh, M. Green, and K. Mescher, "This article was published in ASHRAE Journal," 2012.

(AC) Annual Costs

$$AC_{geo} = \sum Operation\ and\ maintenance\ costs$$

$$AC_{geo} = Operation\ and\ Maintenance$$

$$**AC_{geo} = \$109\ per\ year**$$

Solar Economic Calculations

(GI) Annual Avoided Costs / "Gross Income"

During PPA:

$$GI_{solar} = 97,654\ kWhr \cdot 20\% \cdot 0.10884 \frac{\$}{kWhr}$$

$$**GI_{solar} = \$2,125**$$

After PPA expiration:

$$GI_{solar} = 97,654\ kWhr \cdot 0.10884 \frac{\$}{kWhr}$$

$$**GI_{solar} = \$10,628**$$

(IC) Initial Costs of Solar

Capital Equipment = Modules + Inverters + Electrical Infrastructure + Installation

Capital Equipment

$$\begin{aligned} &= 71.28 \text{ kWDC} \left(500 \frac{\$}{\text{kWDC}} \right) + 71.28 \text{ kWDC} \left(75 \frac{\$}{\text{kWDC}} \right) \\ &+ 71.28 \text{ kWDC} \left(\frac{\$175}{\text{kWDC}} \right) + 71.28 \text{ kWDC} \left(\frac{\$181}{\text{kWDC}} \right) + 71.28 \text{ kWDC} \left(\frac{\$463}{\text{kWDC}} \right) \end{aligned}$$

$$\mathbf{Capital\ Equipment = \$99,364}$$

IC_{solar} = Capital Equipment + Professional Fees + Contingency

$$IC_{solar} = \$99,364 + 0.07(\$99,364) + 0.05(\$99,364)$$

$$\mathbf{IC_{solar} = \$117,000}$$

Assumptions: Professional fees were assumed to be 7% of initial installation and equipment costs and contingency was assumed to be 5%.

(AC) Annual Costs

$$AC_{solar} = \sum \text{Operation and maintenance costs} = \$600$$

Geothermal System and Solar Array Combined

Payback Period

$$PP_{geo+solar} = 6 \text{ years} + \frac{IC_{geo} - 6 \text{ years}(GI_{geo} + GI_{solar(PPA)} - AC_{geo})}{GI_{geo} + GI_{solar(no PPA)} - AC_{geo} - AC_{solar}}$$

$$PP_{geo+solar} = 6 + \frac{\$479,000 - 6 \cdot (\$28,000/\text{yr} + \$2,125/\text{yr} - \$109/\text{yr})}{(\$27,917/\text{yr} + \$10,628/\text{yr} - \$109/\text{yr} - \$600/\text{yr})}$$

$$\mathbf{PP_{geo+solar} = 13.8 \text{ years}}$$

IRR

$$IRR_{geo+solar} = \frac{GI_{geo} + GI_{solar}}{IC_{geo} + IC_{solar}}$$

$$IRR_{geo+solar} = \frac{\$27,917/\text{yr} + \$10,628/\text{yr}}{\$479,000 + \$117,000} \cdot 100\%$$

$$\mathbf{IRR_{geo+solar} = 6.5\%}$$

Appendix II: Geotechnical Report

DATE: December 4, 2018

TO: Scott Anderson, HS Math & Engineering Instructor
Juda Public Schools
2346 Engineering Hall
1415 Engineering Drive
Madison, WI 53706

FROM: BeEco Engineering
1415 Engineering Drive
Madison, WI 53706

**SUBJECT: Geotechnical Report
Renewable Energy Generation System at the Juda School District**

Dear Scott Anderson:

Enclosed is the geotechnical report for the renewable energy generation system at the Juda School District. BeEco Engineering has used Google Earth, Wisconsin DNR well logs, Synergy Renewable System, LLC's Small Wind Site Assessment Report, and Lauren L Meyer's UW-Madison 2013 master thesis to characterize subsurface soil and groundwater conditions. The purpose of this report is to communicate these findings, determine conclusions based on these findings, and make recommendations regarding the feasibility and design of the proposed system.

If there are further questions, comments, or concerns regarding this geotechnical report, please contact our team at BeEco Engineering.

Sincerely,

BeEco Engineering

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2.3 Surface Conditions	I3
2.4 Subsurface Conditions	I4
3. Conclusions	I4
4. Recommendations	I4
Well Logs:	I6

1. Introduction

1.1. Purpose and Scope

BeEco Engineering has prepared this geotechnical report for the design of a renewable energy generation system at Juda School. This report will include a description of both the site and the project components, site investigation findings, conclusions determined from these findings, and recommendations based on the conclusions. However, it is important to recognize data uncertainty: Because BeEco Engineering does not have access to the information/resources necessary to conduct a complete analysis, additional investigations may be required for the chosen design.

For construction of this report, BeEco Engineering has utilized the following resources:

- Google Earth
- Wisconsin Department of Natural Resources (DNR) well logs
- Synergy Renewable Systems, LLC's Small Wind Site Assessment Report (2012)
- Lauren L. Meyer's thesis at University of Wisconsin-Madison on "Thermophysical Properties of Wisconsin Rocks for Application in Geothermal Energy" (2013)

1.2 Project Location

The Juda School is located in Green County, WI in southcentral Wisconsin (Figure 1A). This school is situated on top of a knoll, meaning it sits at a higher elevation relative to the surrounding area, over a 10.3-acre plot of land. Figure 1B illustrates the property line of the school as well as the potential areas for implementation of a solar array, wind turbine(s), and a geothermal field.

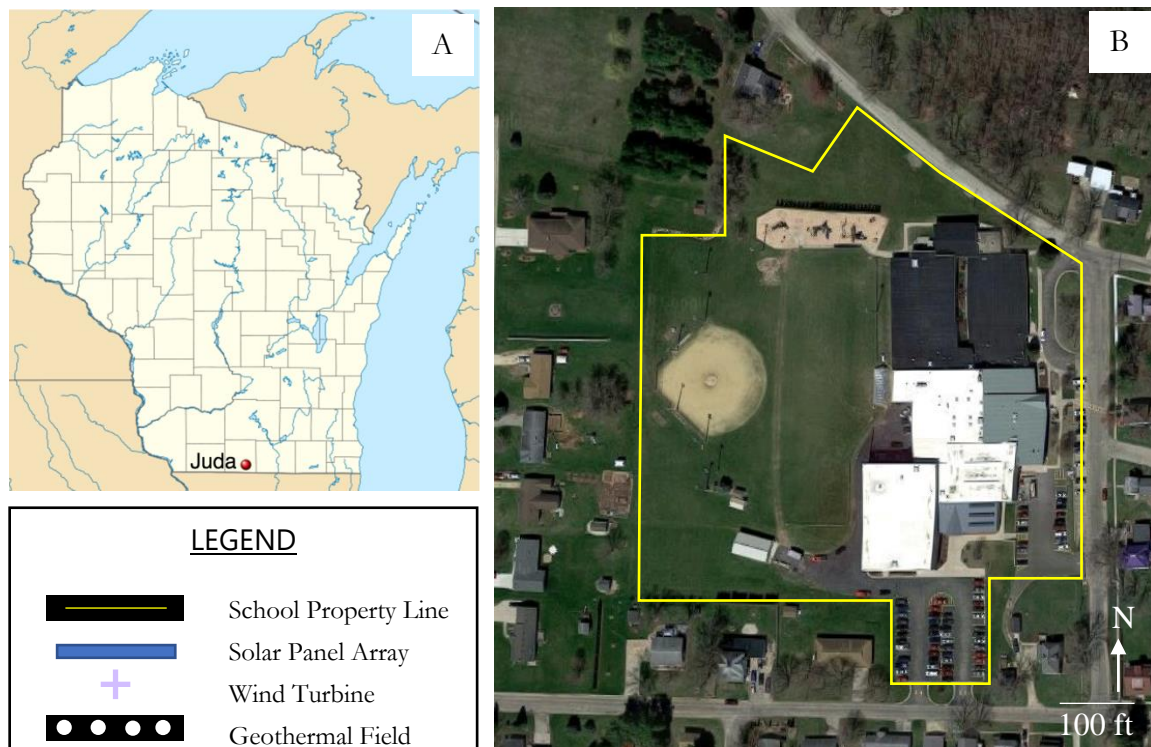


Figure B1. A) Location of Juda in Green County, WI (source: Wikipedia). B) Juda School District; property lines and the potential locations for each system are noted (source: Google Earth).

The proposed system at the Juda School District involves a solar array system and a geothermal system. For each system, the following geotechnical-related components must be considered:

Solar Array

The proposed location of the solar array, is to be on top of the school's rooftop; because the solar array system will not be influenced by surface nor subsurface conditions, it will not be discussed in detail for this report.

Geothermal System

The proposed geothermal system will consist of 92 vertically-drilled wells that reach a depth of approximately 200 ft. Subsurface conditions – specifically the geology, thermal conductivity of soils, groundwater – must be considered and analyzed to determine the feasibility of drilling the wells and effectiveness of this system.

2. Findings

2.1 Field Exploration

Our field exploration consisted of analyzing 3 well logs obtained from the Wisconsin DNR in the Town of Juda. Because of their close proximity to the Juda School (as described in this section), these three wells will be used to approximate the subsurface conditions at the school. As such, the findings will only be estimations of the true soil and groundwater conditions.

2.2 Well Logs

A total of 3 wells and their descriptions were observed. The first well, WI Unique Well No. MS758, was constructed in 1998; the second well, No. WX127, was constructed in 2012, and the third well, No. OJ628 was constructed in 2001. These wells are located approximately 723 ft (220 m), 985 ft (300 m), and 1,265 ft (385 m), respectively, from the Juda School. The locations for each of these wells are shown in Figure B2.

These well logs were used to determine the soil profile and the water table depth. Geologic and driller's descriptions were provided for each soil found in the profile. Depths for these wells range from 140 ft to 150 ft.



Figure B2. Locations of wells MS758, WX127, and OJ628 in Juda. These wells, which are all located within 1,300 ft from the Juda School, go to depths up to 150 ft (source: Google Earth).

2.3 Surface Conditions

According to Synergy Renewable Systems, LLC's Small Wind Site Assessment Report, the site has an elevation of approximately 894 ft. The field west of the school is relatively level (Figure B3,(A)), while the area north of the school and beyond the playground has a 14-degree slope (Figure B3 (B)). This field, which partly consists of a baseball field, is mostly covered in grass and also has sand/clay in the baseball diamond. A playground is present in the area northwest of the school. Beyond the baseball field and playground are residential houses. These observed features are labelled in Figure B3.

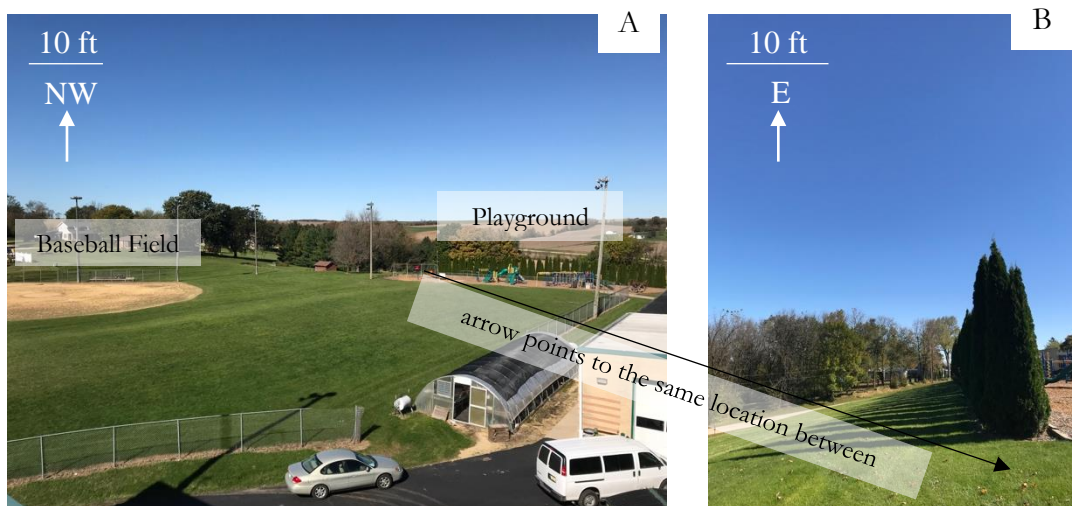


Figure B3. Surface conditions at the Juda School. A) View of the field west of the school; looking to the northwest. B) View of the area north of the playground, showing the slope; looking to the east.

2.4 Subsurface Conditions

Geology

The well logs show a relatively consistent soil profile from well to well. In general, the top unit ranges in depth from about 0 to 15 ft and consists of a clayey material, tan to brown in color. The next unit is a tan to brown sand/clay mixed with gravel, cobbles, boulders, and stones, and its depth ranges from 8 to 70 ft. Going deeper in the soil profile is a blue clay, with varying degrees of gravel, cobble, boulder, and stone-mixing, and has a depth ranging from 15 to 114 ft. The last unit observed is St. Peter sandstone, with depths ranging from 101 to 150 ft. It is assumed that this unit continues to depths beyond 150 ft, to a. Overall, the soil profile is generally as follows: a clay layer, overlaying a clay with sand and gravel layer, overlaying a sandstone layer.

Thermal Conductivity of Soils

Meyer's master's thesis on the thermophysical properties of Wisconsin rocks was used to estimate the thermal conductivity of the units, specifically the sandstone unit, at the Juda School. This thesis states the range of thermal conductivity values of sandstone, in $\text{W m}^{-1} \text{K}^{-1}$, from literature as 2.1 to 3.5 and from testing as 2.59 to 3.86. The estimated range, therefore, for the thermal conductivity of sandstone found at Juda School is 2.1 to 3.86 $\text{W m}^{-1} \text{K}^{-1}$.

Groundwater Conditions

A static water level was observed in each of the three wells. For wells MS758 and WX127, the two wells closer to the school, this static water level was seen at a depth of 27 ft. For well OJ628, the level was 3 ft. Fluctuations in each well's static water level may occur, however, as a result of other factors (i.e. rainfall). Because wells MS758 and WX127 are closer to the school, it will be assumed the water table at the site is observed at a depth of 25 to 30 ft.

3. Conclusions

The conclusions for this report are based on the findings and are specific to the relevant, geotechnical-related components of the system. Again, however, it is important to note data uncertainty and recognize that this report details only estimations of the subsurface conditions. These findings suggest that the design and construction of the solar array and geothermal system is feasible.

In general, the wind turbine will require a shallow foundation, resting over the shallow clayey, sandy layers. The recommended geothermal system will consist of 44 vertical wells that reach depths of 350 ft and into the sandstone layer.

4. Recommendations

These components, again, include the foundation necessary for the wind turbine and the wells in the geothermal system.

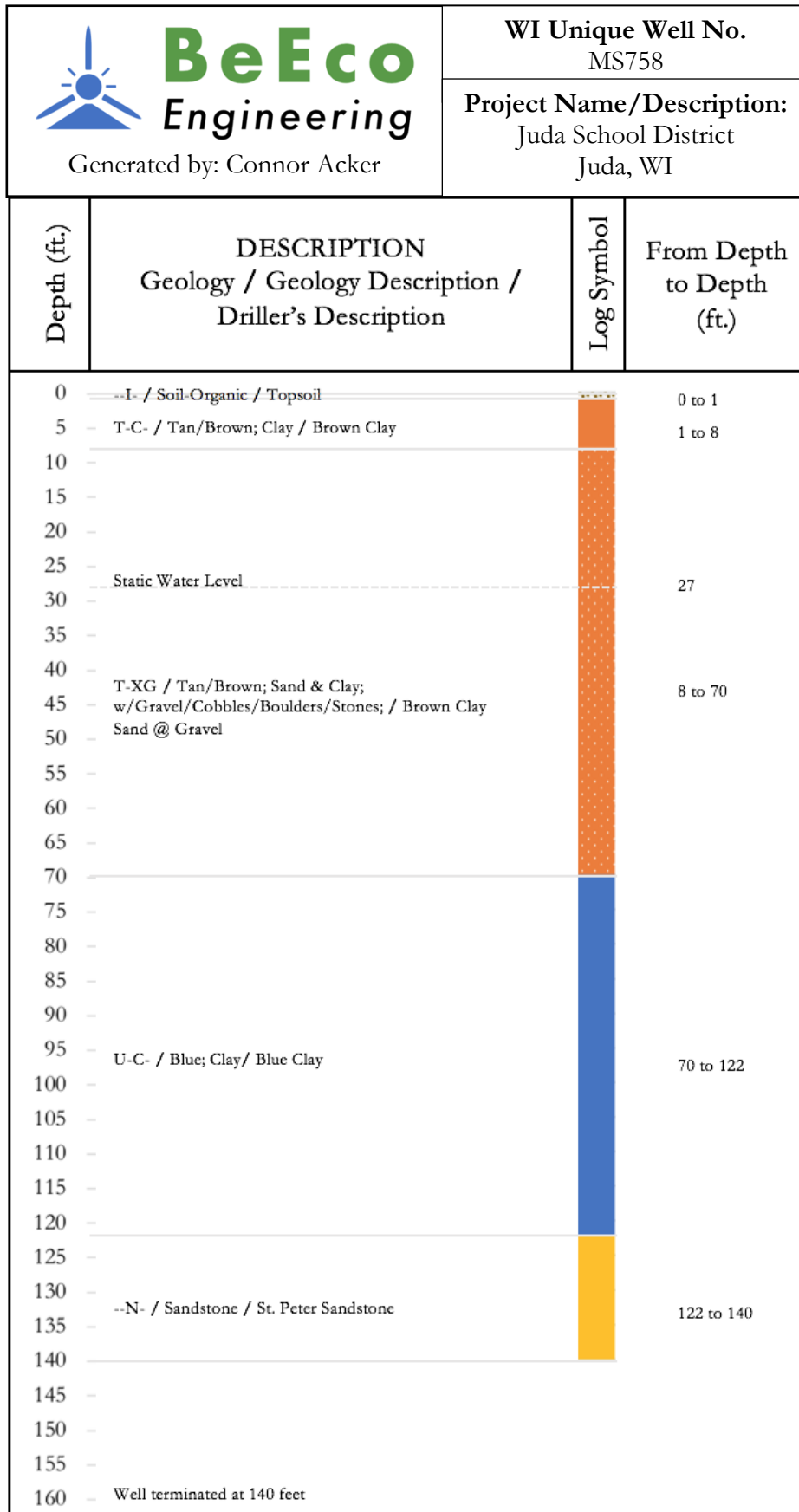
Geothermal System

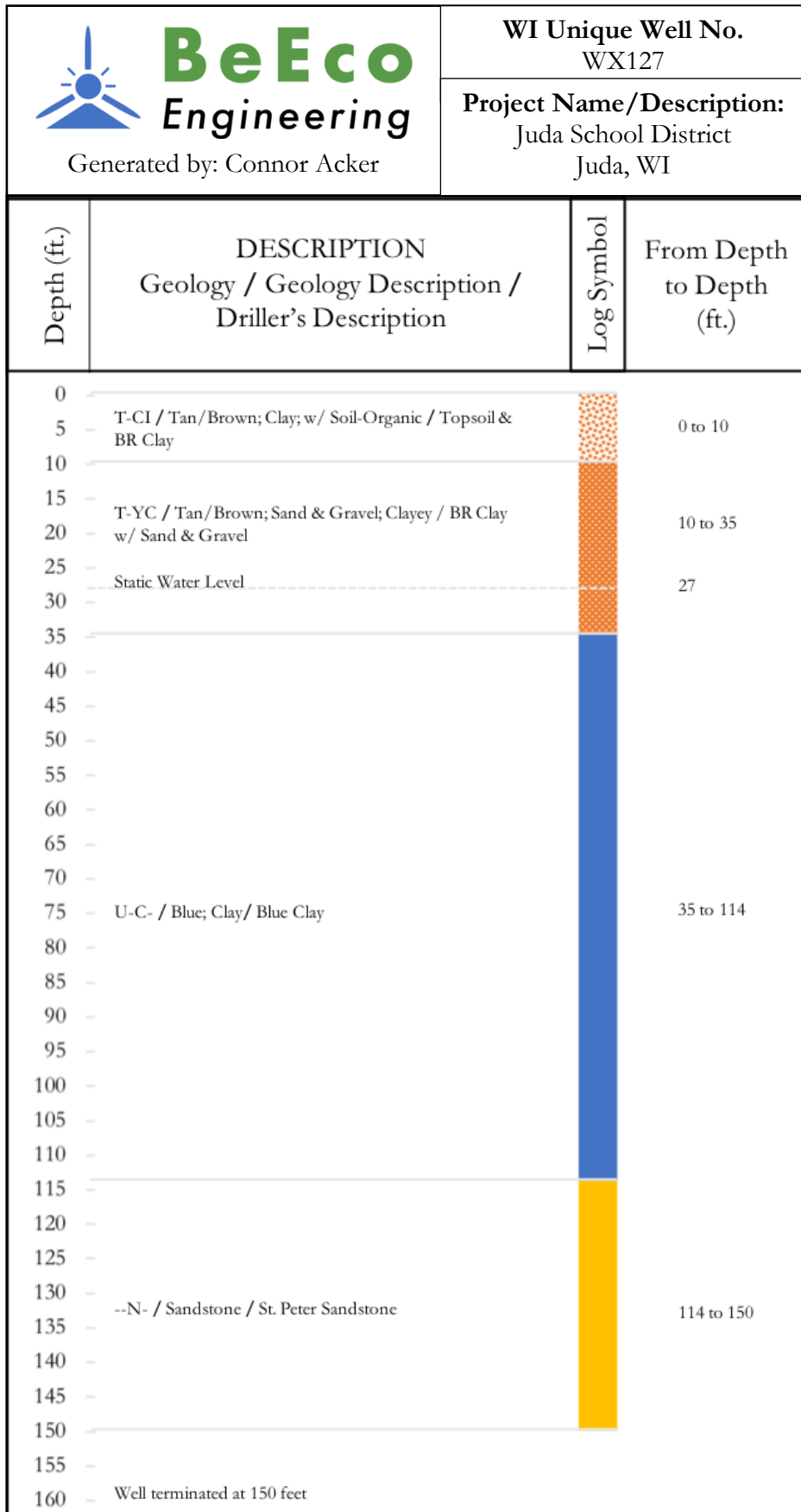
Based on the available land space, we recommend that the geothermal system consists of vertical rather than horizontal wells. Furthermore, we recommend a well depth of 350 ft, such that the wells will mostly reside in the sandstone layer (as it assumed this layer reaches depths of around 350 ft). This recommendation is based on the fact that the thermal conductivity of sandstone – which

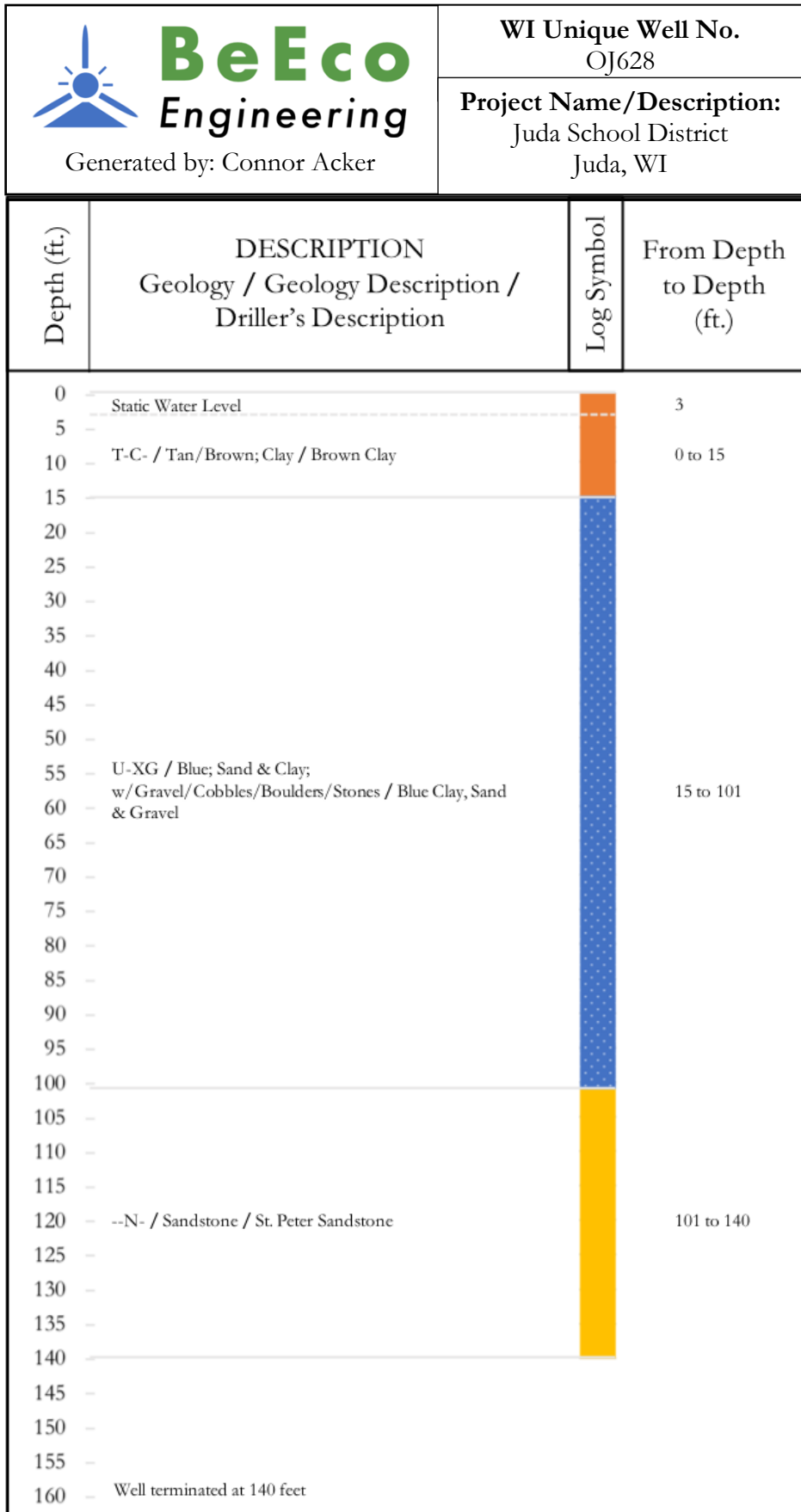
ranges from 2.1 to 3.86 W m⁻¹ K⁻¹ – is higher than that of clay. Casing the wells is also recommended in order to prevent colder water from above from seeping into the wells, which would reduce the efficiency of the system. Grout is also recommended in order to prevent contamination to and from the geothermal from groundwater and drinking wells.

Safety

Throughout the entire construction process, safety precautions must be followed. Beyond standards defined by OSHA and other groups, precautions with subsurface utilities – including pipes and electrical wires – must also be followed. Safety must remain paramount throughout the design.









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Appendix III: Renderings



Figure 1. Oblique view of Juda School renewable energy system, looking northeast.



Figure 2. Rendering of the 44-vertical borehole geothermal energy system, looking east.

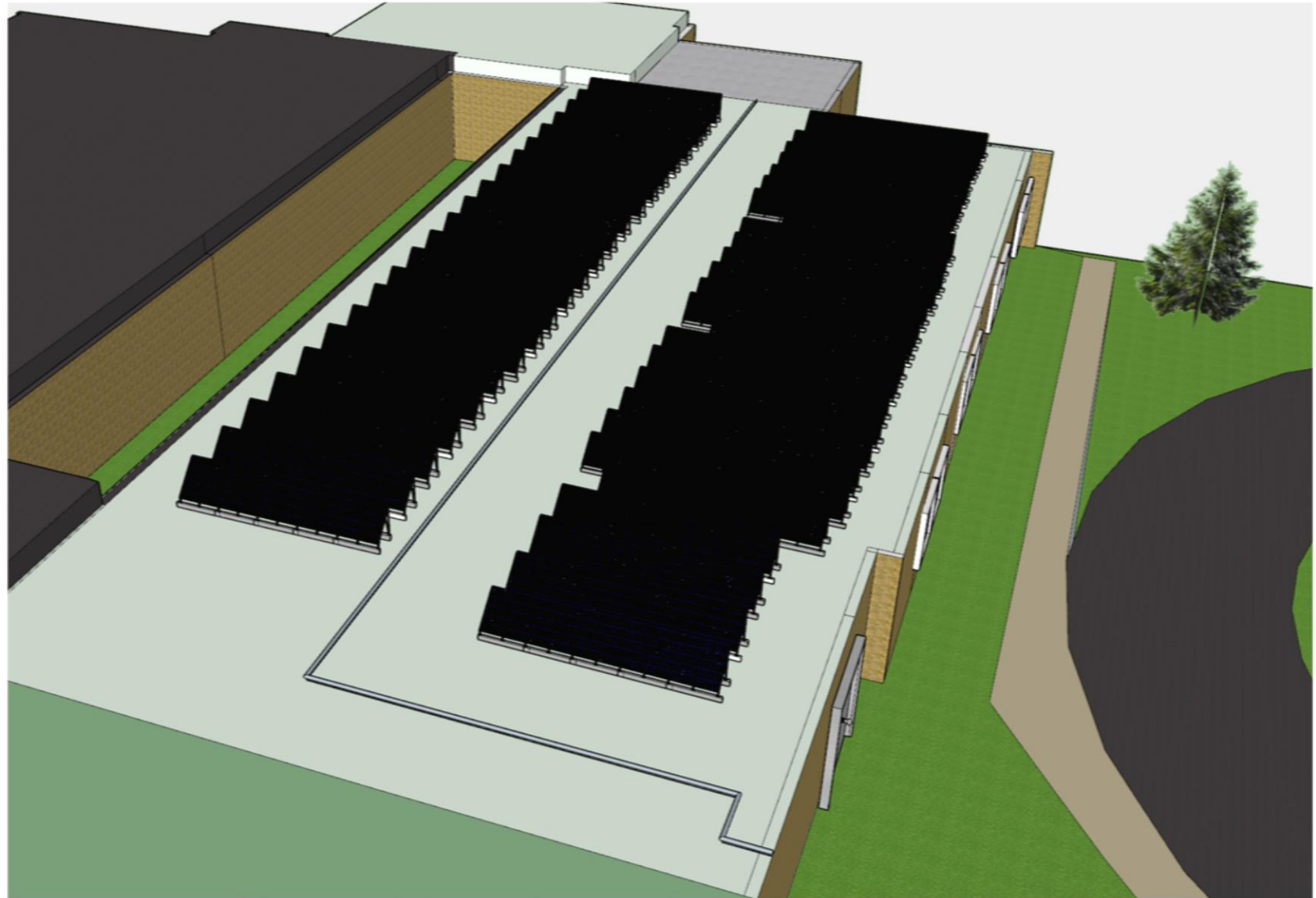


Figure 3. Rendering of the 264 solar module photovoltaic solar energy system, looking northwest.



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INDEX TO DRAWINGS	
NUMBER	TITLE
G001	Title Sheet / Site Plan
G101	Renewable Energy System Overview
G102	Staging Plan
C101	Solar Array Overview
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C104	Section Thru Module
C201	Geothermal System Overview
C202	Single Circuit Cross Section
C203	Borehole Detail
C204	Vault Detail
C205	Mechanical Room Schematic

Renewable Energy Generation System at
JUDA SCHOOL
N2385 Spring Street
Juda, WI 53550



Juda, WI

AREA MAP

100,000 ft



Renewable Energy Generation System

PROJECT LOCATION MAP

500 ft

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Design Partner: SunPeak, Madison, WI

Renewable Energy Generation System at
JUDA SCHOOL
N2385 Spring Street
Juda, WI 53550

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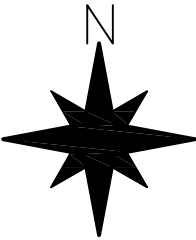
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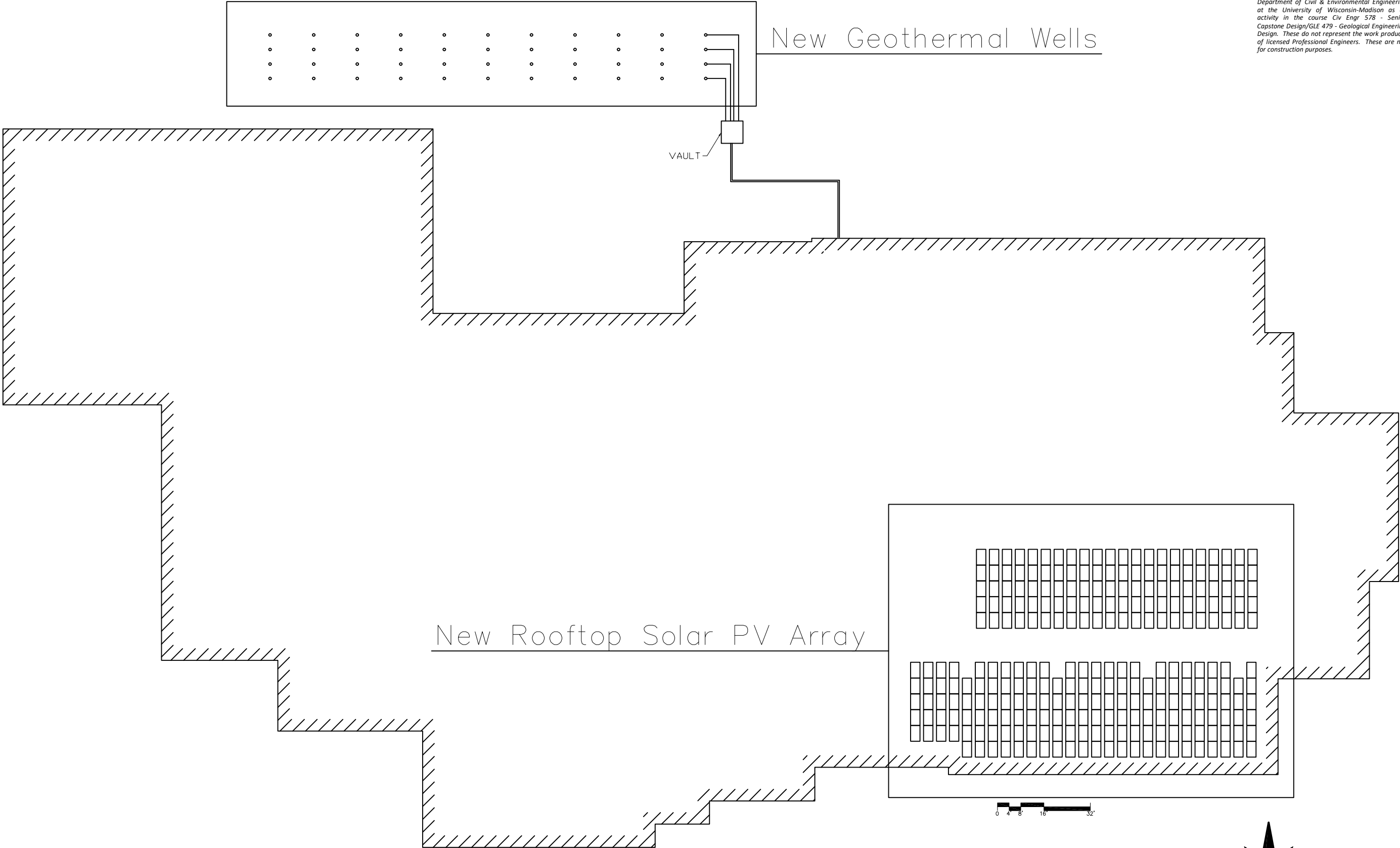
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4 December 2018

Title Sheet
/ Site Plan

Sheet
G001





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Design Partner: SunPeak, Madison, WI

Renewable Energy Generation System at
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N2385 Spring Street
Juda, WI 53550

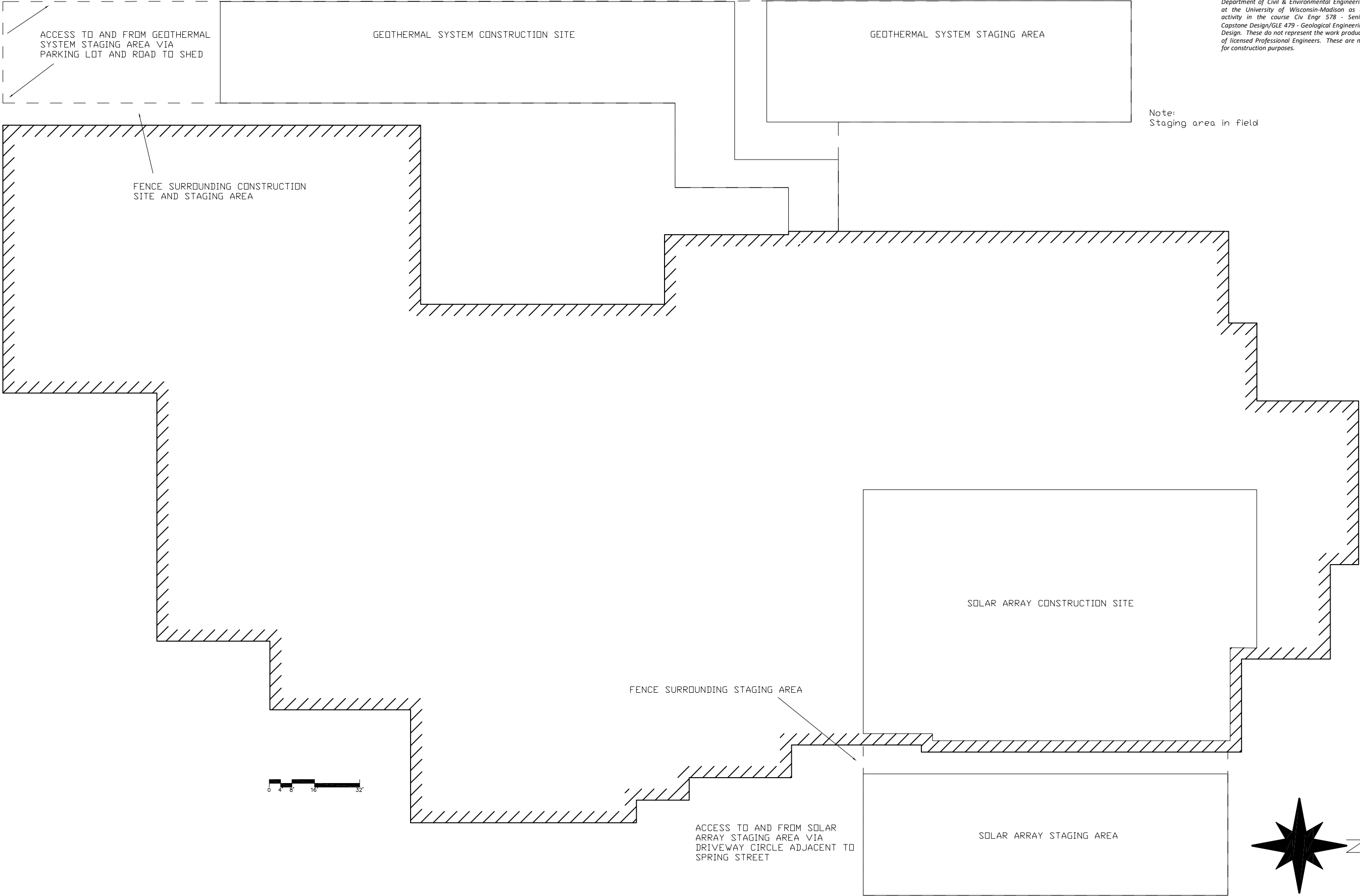
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Renewable
Energy
System
Overview
Sheet
G101



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Design Partner: SunPeak, Madison, WI

Renewable Energy Generation System at
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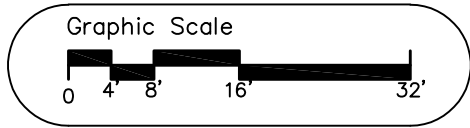
PROJECT NO.: 18-0001

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Staging Plan

Sheet
G102

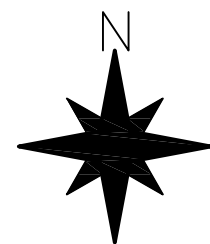




1 = Vent Pipe
2 = Existing HVAC Equip.

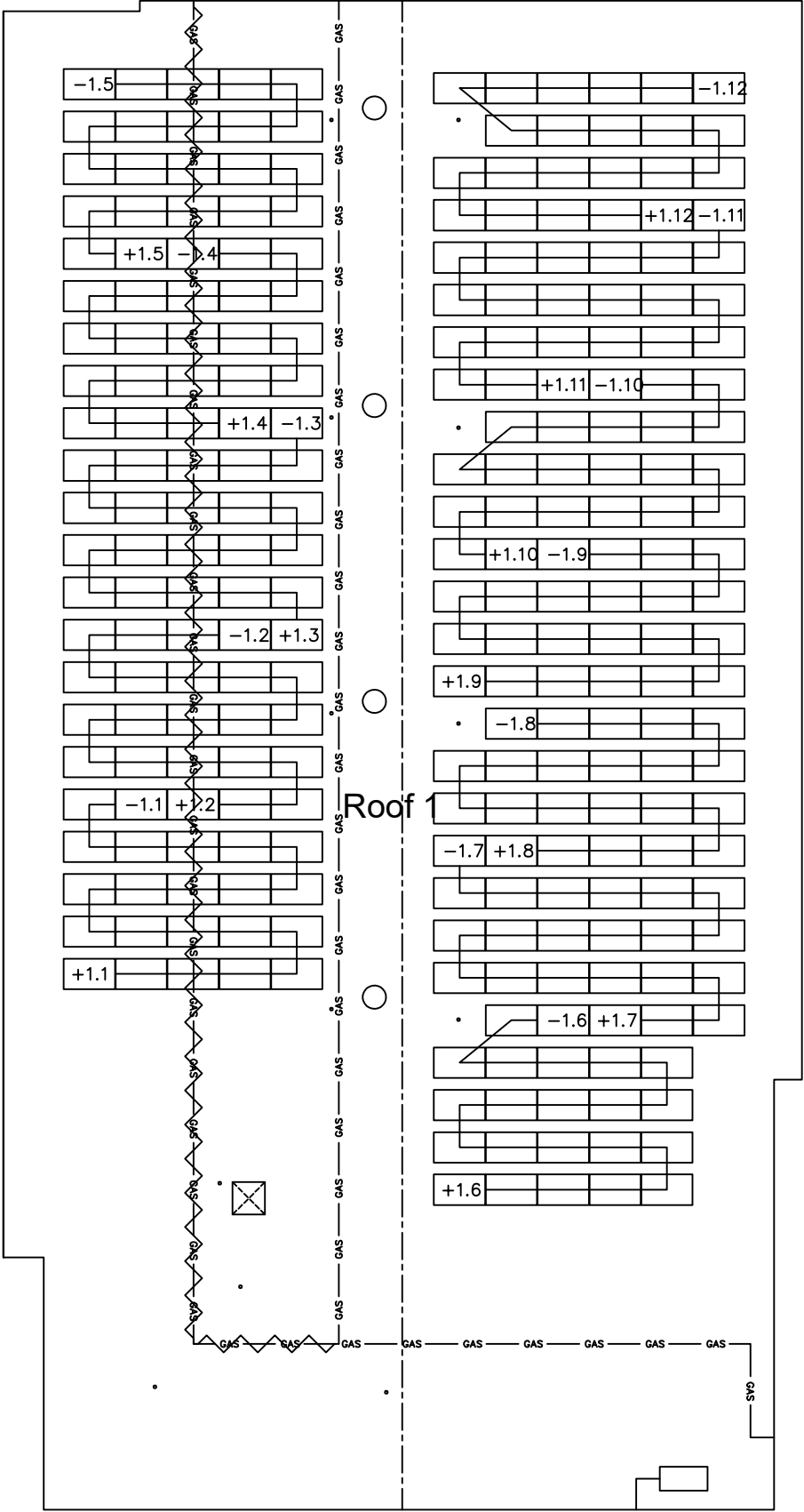
- NOTES:
- All strings wired (22) modules each
 - String conductors to junction boxes shall be Type XLP or equal
 - Conductors in conduit shall be Type THHN/TWHM-2

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Design Partner: SunPeak, Madison, WI

Renewable Energy Generation System at JUDA SCHOOL N2385 Spring Street Juda, WI 53550				This drawing and all parts thereof, is the exclusive property of BeEco & SunPeak LLC, Madison, Wisconsin and may not be reproduced in whole or part without written permission.	
REVISIONS					
SYN	DESCRIPTION	DRWN	APP'D.	DATE	
PROJECT NO.: 18-0001					
SCALEscale				ISSUE DATE: 4 December 2018	
Module Layout Plan					
Sheet C102					



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Design Partner: SunPeak, Madison, WI

Renewable Energy Generation System at
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Juda, WI 53550

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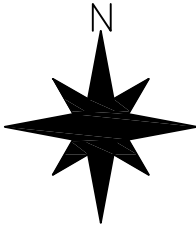
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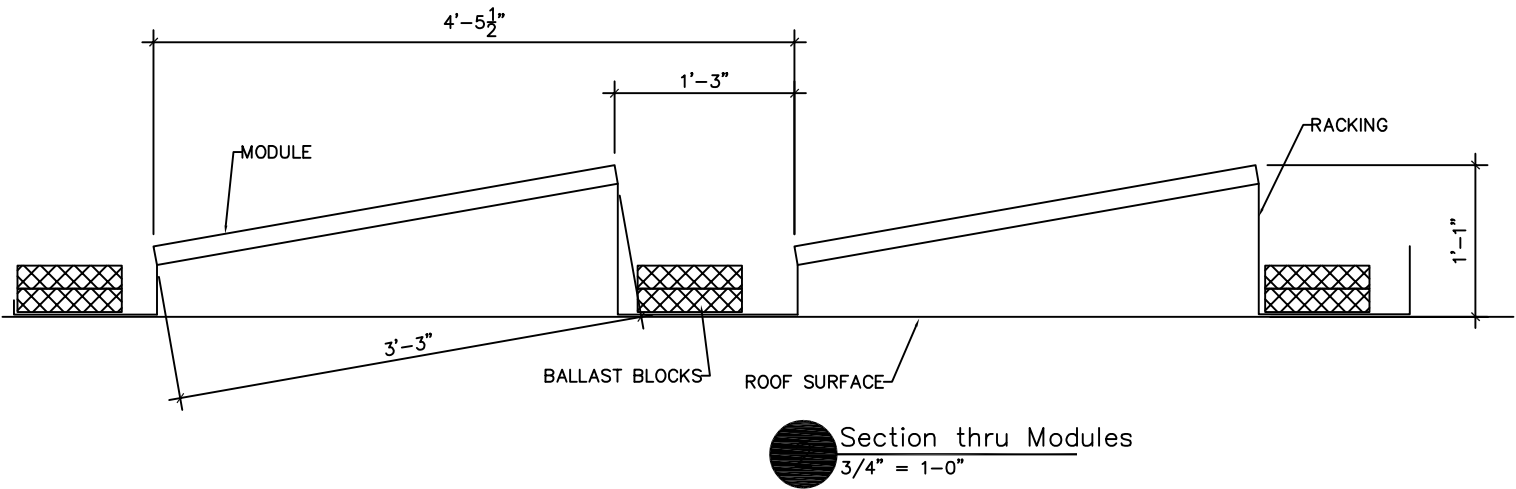
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String Plan

Sheet
C103





Section thru Modules
3/4" = 1'-0"

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Design Partner: SunPeak, Madison, WI

Renewable Energy Generation System at
JUDA SCHOOL
N2385 Spring Street
Juda, WI 53550

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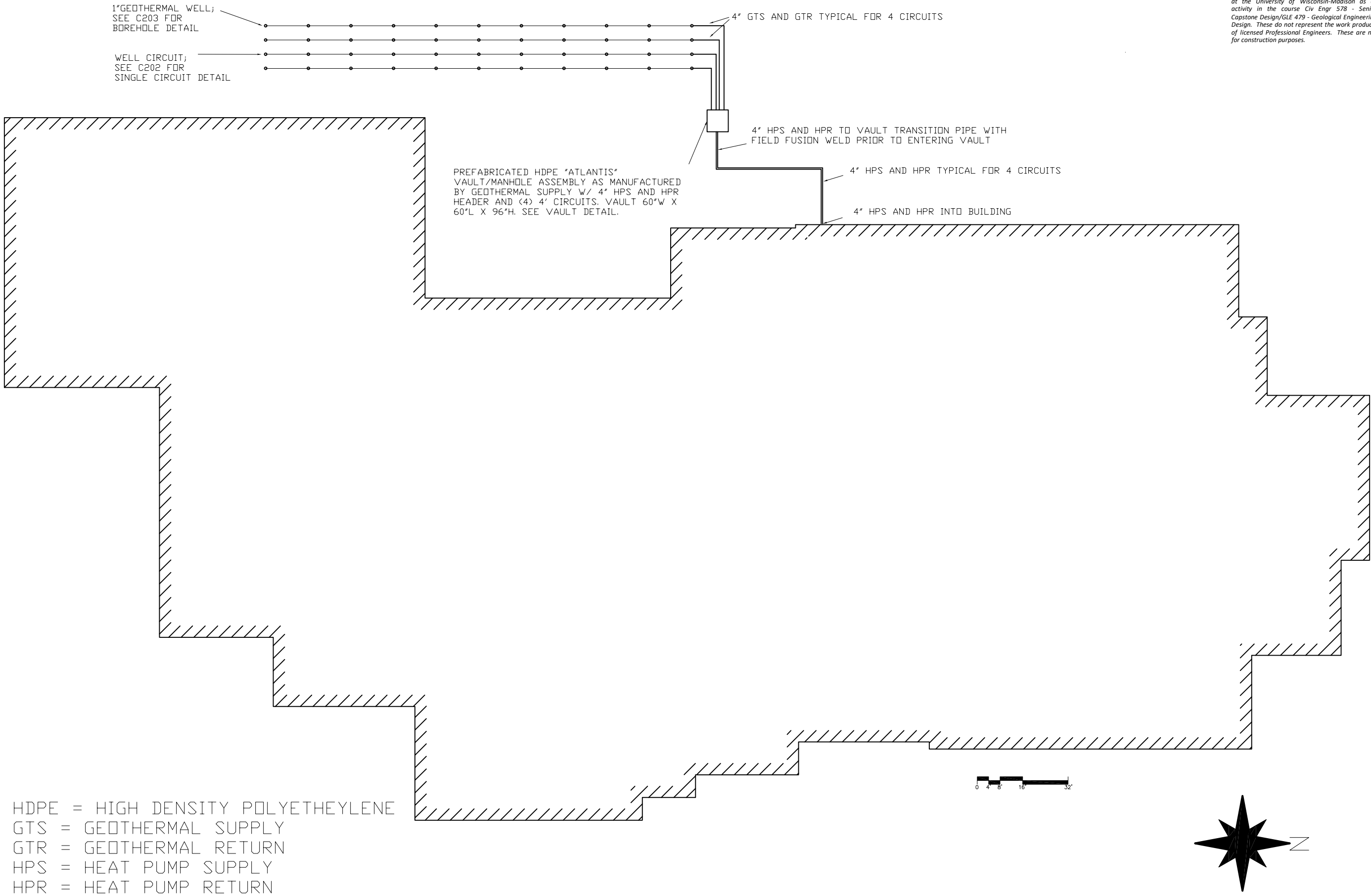
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SYM	DESCRIPTION	DRWN	DATE

PROJECT NO.: 18-0001

SCALEscaleISSUE DATE:
4 December 2018

Section Thru
Modules

Sheet
C104



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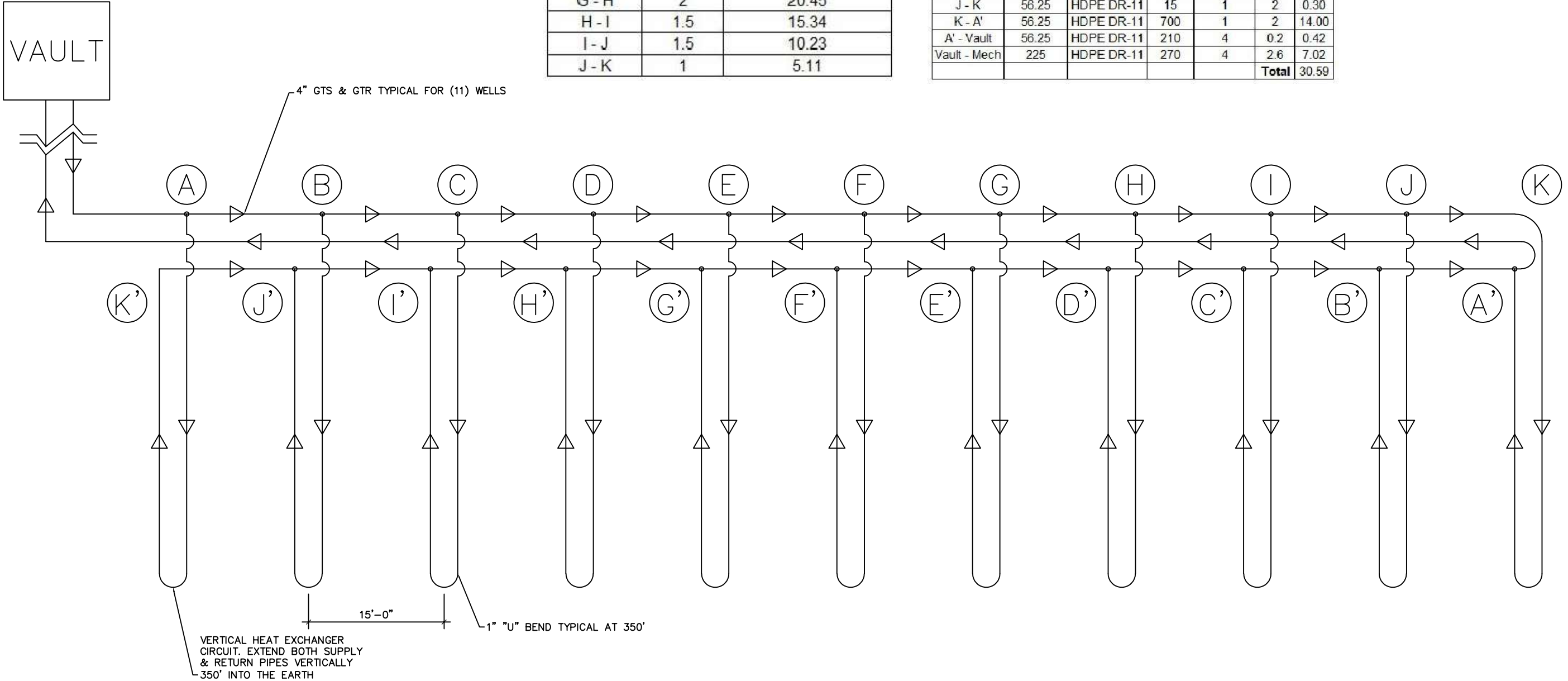
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PROJECT NO.: 18-0001

SCALE: 1" = 8' ISSUE DATE: 4 December 2018

Geothermal
System
Overview

Sheet
C201



- NOTES:
- K'-A' IS A MIRROR IMAGES A-K
 - DISTANCE FROM VAULT TO "A" IS ASSUMED TO BE APPROX. 60'
 - DISTANCE FROM MECH. RM. TO VAULT IS ASSUMED TO BE APPROX. 270'

Reverse - Return Section Details		
Pipe Run	Nom Size (in)	Operating Flow Rate (GPM)
Vault - A	4	56.25
A - B	3	51.14
B - C	3	46.02
C - D	3	40.91
D - E	2	35.80
E - F	2	30.68
F - G	2	25.57
G - H	2	20.45
H - I	1.5	15.34
I - J	1.5	10.23
J - K	1	5.11

Head Loss for 20% Propylene Glycol by Volume at 40F (Circuit 1)						
Pipe Run	Flow Rate (GPM)	Pipe	Length (ft)	Nom Size (in)	hl/100	hl (ft)
Mech - Vault	225	HDPE DR-11	270	4	2.6	7.02
Vault - A	56.25	HDPE DR-11	60	4	0.2	0.12
A - B	56.25	HDPE DR-11	15	3	0.7	0.11
B - C	56.25	HDPE DR-11	15	3	0.7	0.11
C - D	56.25	HDPE DR-11	15	3	0.4	0.06
D - E	56.25	HDPE DR-11	15	2	2.5	0.37
E - F	56.25	HDPE DR-11	15	2	1.8	0.27
F - G	56.25	HDPE DR-11	15	2	1.4	0.20
G - H	56.25	HDPE DR-11	15	2	0.9	0.14
H - I	56.25	HDPE DR-11	15	1.5	2.1	0.32
I - J	56.25	HDPE DR-11	15	1.5	1	0.15
J - K	56.25	HDPE DR-11	15	1	2	0.30
K - A'	56.25	HDPE DR-11	700	1	2	14.00
A' - Vault	56.25	HDPE DR-11	210	4	0.2	0.42
Vault - Mech	225	HDPE DR-11	270	4	2.6	7.02
Total						30.59

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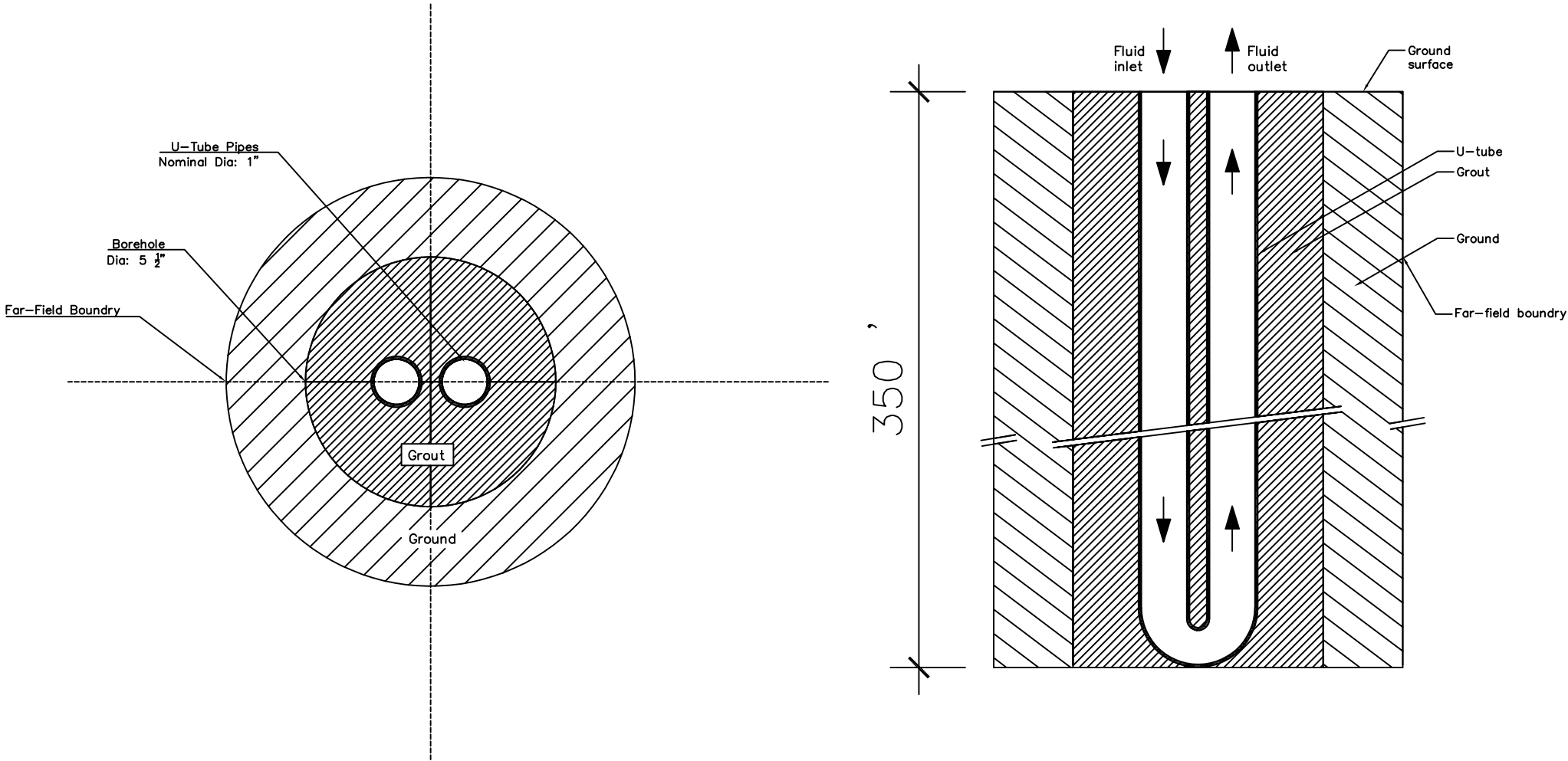
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SYM	DESCRIPTION			

PROJECT NO.: 18-0001

SCALE: No scale ISSUE DATE: 4 December 2018

Single Circuit
Cross
Section

Sheet
C202



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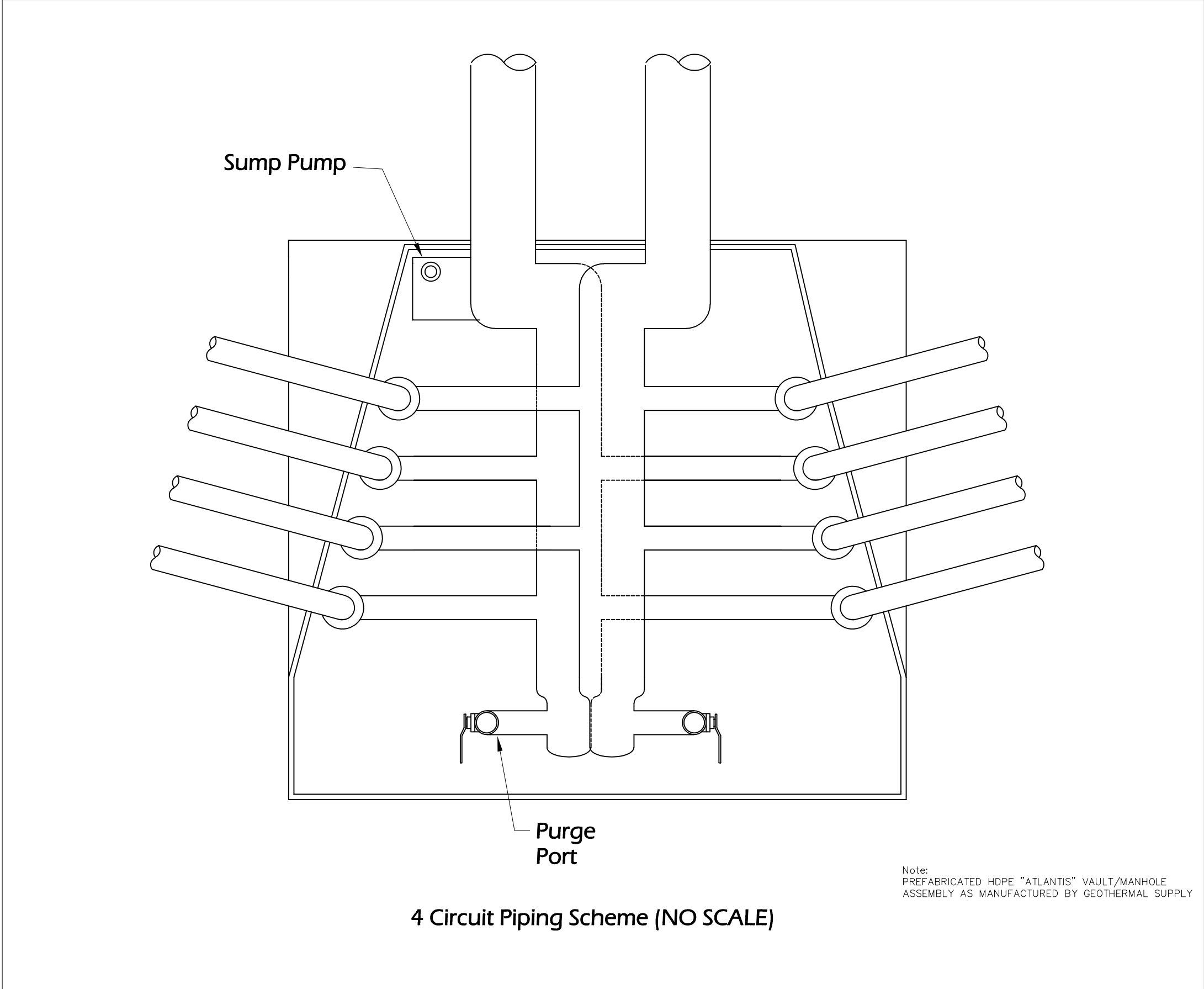
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SYM	DESCRIPTION	DRWN	DATE

PROJECT NO.: 18-0001

SCALEscaleISSUE DATE:
4 December 2018

Borehole
Detail

Sheet
C203



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Design Partner: SunPeak, Madison, WI

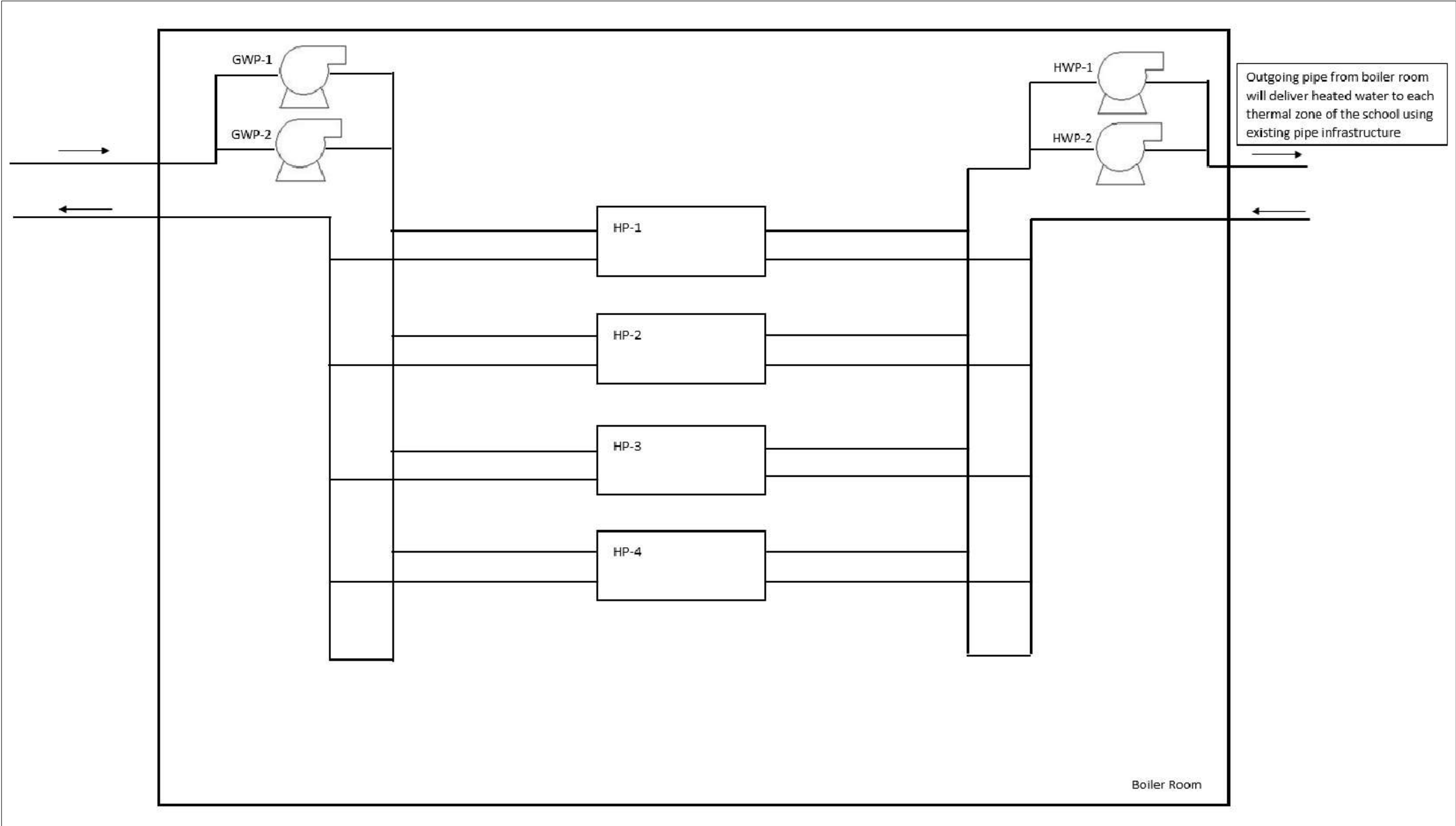
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SCALE		Scale				

Vault Detail

Sheet
C204



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Mechanical
Room
Schematic

Sheet
C205

About UniverCity Year



UniverCity Year is a three-phase partnership between UW-Madison and one community in Wisconsin. The concept is simple. The community partner identifies projects that would benefit from UW-Madison expertise. Faculty from across the university incorporate these projects into their courses, and UniverCity Year staff provide administrative support to ensure the collaboration's success. The results are powerful. Partners receive big ideas and feasible recommendations that spark momentum towards a more sustainable, livable, and resilient future. Join us as we create **better places together**.



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