CITY OF GRAND ISLAND

Working Together for a Better Tomorrow. Today.

SPECIFICATION PACKAGE

for

URANIUM REMOVAL WATER TREATMENT PLANT – BUILDING CONSTRUCTION

Bid Opening Date/Time
Thursday, September 15, 2011 @ 2:30 p.m.
City of Grand Island, City Hall
100 East 1st Street, P.O. Box 1968
Grand Island, NE 68802-1968

Contact
City of Grand Island – Utilities Department
Platte Generating Station
308/385-5496

Date issued: September 1, 2011

Section 1 –

Advertisement to Bidders
Bid Data Form
Checklist for Bid Submission
General Specifications
Instructions to Bidders
Draft Contract

Uranium Removal Water Treatment Plant –
Building Construction

ADVERTISEMENT TO BIDDERS
FOR
URANIUM REMOVAL WATER TREATMENT PLANT – BUILDING CONSTRUCTION
FOR
CITY OF GRAND ISLAND, NEBRASKA

Sealed bids will be received at the office of the City Clerk, 100 E. First Street, P.O. Box 1968, Grand Island, Nebraska 68802, until Thursday, September 15, 2011 at 2:30 p.m. (local time) for Uranium Removal Water Treatment Plant-Building Construction, FOB the City of Grand Island, freight prepaid. Bids will be publicly opened at this time in the Grand Island City Hall Council Conference Room #1 located on 1st floor of City Hall. Submit an original and three copies. Bid proposal package is also available on-line at www.grand-island.com under Business-City Bid Calendar. Bids received after the specified time will be returned unopened to sender.

The successful bidder will be required to comply with fair labor standards as required by Nebraska R.R.S.73-102 and comply with Nebraska R.R.S. 48-657 pertaining to contributions to the Unemployment Compensation Fund of the State of Nebraska. Successful bidder shall maintain a drug free workplace policy. Every public contractor and his, her or its subcontractors who are awarded a contract by the City for the physical performance of services within the State of Nebraska shall register with and use a federal immigration verification system to determine the work eligibility status of new employees physically performing services within the State of Nebraska.

Each bidder shall submit with the bid a certified check, a cashiers check, or bid bond payable to the City Treasurer in an amount no less than five percent (5%) of the bid price which shall guarantee good faith on the part of the bidder and the entering into a contract within fourteen (14) days at the bid price if accepted by the City. **Your certified check, cashier's check or bid bond must be submitted in a separate envelope attached to the outside of the envelope containing the bid. Each envelope must be clearly marked indicating its contents. Failure to submit the necessary qualifying information in clearly marked and separate envelopes will result in your bid not being opened or considered.** Surety companies authorized to do business in the State of Nebraska must issue bid bonds.

Bids will be evaluated by the Purchaser based on price, schedule, quality, adherence to schedule, plan and specifications, economy and efficiency of operation, experience and reputation of the bidder, ability, capacity, and skill of the bidder to perform contract required and adaptability of the particular items to the specific use intended.

The Purchaser reserves the right to reject any or all bids, to waive irregularities therein, and to accept whichever bid that may be in the best interest of the City, at its sole discretion.

No bidder may withdraw his bid for a period of thirty (30) days after date of bid opening.

RaNae Edwards, City Clerk

Advertised 9/2/11

URANIUM REMOVAL WATER TREATMENT PLANT – BUILDING CONSTRUCTION

BID DATA FORM

CITY OF GRAND ISLAND
GRAND ISLAND, NE

The undersigned bidder, having examined all specifications and other bidding documents, and all addenda thereto, and being acquainted with and fully understanding all conditions relative to the specified materials and equipment, hereby proposes to provide such equipment FOB the City of Grand Island, freight prepaid, at the following price:

ITEM DESCRIPTION	EXTENDED COST
Base Bid:	
Material	$ _____
Labor	$ _____
Applicable Sales tax*	$ _____
Total Base Bid	$ _____

*** If bidder fails to include sales tax in their bid price or takes exception to including sales tax in their bid price, the City will add a 7.0% figure to the bid price for evaluation purposes; however, the City will only pay actual sales tax due.**

☐ By checking this box, Bidder acknowledges that Addenda Number(s) _____ were received and considered in Bid preparation.

☐ By checking this box, Bidder acknowledges the specified completion date of the project is **March 30, 2012.**

According to Nebraska Sales and Use Tax Requirements, Section 1-017, Contractors, check which option you have selected to file with the Nebraska Department of Revenue:

Nebraska law provides a sales and use tax exemption on contractor labor charges for the construction, repair, or annexation of any structure used for the generation, transmission, or distribution of electricity. Separately stated contractor labor would be exempt, all materials are taxable according to the contractor's option.

Option 1 (Section 1-017.05)_____ Option 2 (Section 1-017.06)_____ Option 3 (Section 1-017.07)_____

If the Nebraska sales and use tax election is not filed or noted above, the contractor will be treated as a retailer under Option 1 for sales and use tax purposes.

_____
Bidder Company Name Date

_____
Company Address City State Zip

_____
Print Name of Person Completing Bid Signature

Telephone No._____ Fax No._____

☐ By checking this box, Bidder acknowledges there are Exceptions noted to the bid.
NOTE: Any exceptions to specifications must be fully explained on a separate sheet attached to bid.

CHECKLIST FOR BID SUBMISSION

FOR

URANIUM REMOVAL WATER TREATMENT PLANT – BUILDING CONSTRUCTION]

Bids must be received by the City Clerk before *2:30 P.M. on Thursday, September 15, 2011*.

The following items must be completed for your bid to be considered.

- ❑ A signed original and three copies of the bidding documents.
- ❑ A reference list of at least three projects of similar scope and complexity.
- ❑ A summary of the experience of the service supervisor proposed for this project.
- ❑ Firm lump sum pricing; firm unit pricing in case adjustments are necessary, and breakout of sales tax pricing.
- ❑ A proposed construction schedule.
- ❑ Selection of Nebraska Sales Tax Option.
- ❑ Acknowledgment of Addenda Number(s) _____.
- ❑ Bidders must complete and sign the Bid Data Form provided in these Documents. All blank spaces must be filled in. Bidders shall acknowledge receipt of any Addenda information on the Bid Data Form.
- ❑ A certified check, cashiers check or bid bond in a separate envelope attached to the **outside of the envelope containing the bid**. Each envelope must be clearly marked indicating its contents. Failure to submit the necessary qualifying information in clearly marked and separate envelopes will result in your bid not being opened.

  Please check off each item as completed.

_____ _____

Company Signature

Telephone No. _____ Fax No. _____

CITY OF GRAND ISLAND

Working Together for a Better Tomorrow, Today.

REQUEST FOR BIDS - GENERAL SPECIFICATIONS

The Bid shall be in accordance with the following and with all attached BID DATA and DETAILED SPECIFICATIONS.

All prices are to be furnished and installed FOB, Grand Island, Nebraska. **All prices shall be firm, and shall include all sales and use taxes as lawfully assessed under laws and regulations of the State of Nebraska.** * If bidder fails to include sales tax in their bid price or takes exception to including sales tax in their bid price, the City will add a 7.0% figure to the bid price for evaluation purposes; however, the City will only pay actual sales tax due.

Bids shall include the following on the **outside** of the mailing envelope: **"Uranium Removal Water Treatment Plant-Building Construction".** All sealed bids are due no later than **Thursday, September 15, 2011 at 2:30 p.m. local time**. Submit **an original and three copies** of the bid to:

Mailing Address: City Clerk
City Hall
P. O. Box 1968
Grand Island, NE 68802

Street Address: City Clerk
City Hall
100 E. First Street
Grand Island, NE 68801

Bids will be opened at this time in the City Hall Council Conference Room #1 located on 1st floor of City Hall. Any bid received after the specified date will not be considered. No verbal bid will be considered.

Bids will be evaluated by the Purchaser based on price, schedule, quality, adherence to schedule, plan and specifications, economy and efficiency of operation, experience and reputation of the bidder, ability, capacity, and skill of the bidder to perform contract required and adaptability of the particular items to the specific use intended.

The successful bidder will be required to comply with fair labor standards as required by Nebraska R.R.S.73-102 and comply with Nebraska R.R.S. 48-657 pertaining to contributions to the Unemployment Compensation Fund of the State of Nebraska. Contractor shall maintain a drug free workplace policy. Every public contractor and his, her or its subcontractors who are awarded a contract by the City for the physical performance of services within the State of Nebraska shall register with and use a federal immigration verification system to determine the work eligibility status of new employees physically performing services within the State of Nebraska.

The equipment and materials must be new, the latest make or model, unless otherwise specified. Prior to approving the invoice for payment, the City reserves the right to thoroughly inspect and test the equipment to confirm compliance with specifications. Any equipment or material which does not meet the City's requirements will be returned at vendor's expense for correction. The invoice will be paid after approval at the next regularly scheduled Council meeting and occurring after departmental approval of invoice; the City Council typically meets the second and fourth Tuesday of each month. Invoices must be received well in advance of Council date to allow evaluation and processing time.

Each bidder shall submit with the bid a certified check, a cashiers check, or bid bond payable to the City Treasurer in an amount no less than five percent (5%) of the bid price which shall guarantee good faith on the part of the bidder and the entering into a contract within fourteen (14) days at the bid price if accepted by the City. **Your certified check, cashier's check or bid bond must be submitted in a separate envelope attached to the outside of the envelope containing the bid. Each envelope must be clearly marked indicating its contents. Failure to submit the necessary qualifying information in clearly marked and separate envelopes will result in your bid not being opened or considered.** Surety companies authorized to do business in the State of Nebraska must issue bid bonds.

Successful bidder shall comply with the City's insurance requirements; performance and payment bonds are required for this project as outlined in the Detailed Specifications and Instructions to Bidders.

All bids shall be valid for at least thirty (30) working days after the bid deadline for evaluation purposes.

All bids must be on the bid form and must be signed and dated to be accepted. Please contact Lynn Mayhew at 308-385-5495, for questions concerning this specification.

Platte Generating Station / 1035 W. Wildwood Drive / P.O. Box 1968 / Grand Island, Nebraska 68802-1968
Phone (308) 385-5496 / FAX (308) 385-5353

INSTRUCTIONS TO BIDDERS

1. GENERAL INFORMATION.

   The following instructions outline the procedure for preparing and submitting Bids. Bidders must fulfill all requirements as specified in these Documents.

2. TYPE OF BID.

   Bidders shall be required to submit prices for all items listed in the Bid Data Form.

3. PREPARATION OF BIDS.

   Bidders shall use only the Bid Data Form provided in these Documents. All blank spaces in the Bid Data Form, must be filled in, preferably in BLACK ink, in both words and figures where required. No changes to the wording or content of the forms is permitted. Written amounts shall govern in case of discrepancy between the amounts stated in writing and the amounts stated in figures.

   Prices stated shall be f.o.b. with freight and full insurance paid by Bidder, to the job site located in Grand Island.

   The Bidder shall acknowledge receipt of all addenda in the Bid Data Form. Bids received without acknowledgement or without the Addendum enclosed will be considered informal.

4. SUBMISSION OF BIDS.

   All Bids must be submitted intact not later than the time prescribed, at the place, and in the manner set forth in the ADVERTISEMENT FOR BIDS. Bids must be made on the Bid Data Form provided here in. Each Bid must be submitted intact in a sealed envelope, so marked as to indicate its contents without being opened, and delivered in person or addressed and mailed in conformance with the instructions in the ADVERTISEMENT FOR BIDS.

5. BID SECURITY.

   Bids must be accompanied by cash, a certified check, or cashier's check drawn on a bank which is insured by the Federal Deposit Insurance Corporation, or a bid bond issued by a Surety authorized to issue such bonds in the state where the Work is located, in the amount of 5 percent of the bid amount payable to OWNER. This bid security shall be given as a guarantee that the Bidder will not withdraw his Bid for a period of 30 days after bid opening, and that if awarded the Contract, the successful Bidder will execute the attached Contract and furnish a properly executed Performance Bond and Payment Bond each in the full amount of the Contract price within the time specified.

   The Attorney-in-Fact that executes this bond in behalf of the Surety must attach a notarized copy of his power of attorney as evidence of his authority to bind the Surety on the date of execution of the bond. Where State Statue requires, certification by a resident agent shall also be provided.

6. RETURN OF BID SECURITY.

   Within 15 days after the award of the Contract, the OWNER will return the bid securities to all Bidders whose Bids are not to be further considered in awarding the contract. All other retained bid securities will be held until the Contract has been finally executed, after which all bid securities, other than Bidders' bonds and guarantees which have been fortified, will be returned to the respective Bidders whose Bids they accompanied.

7. BASIS OF AWARD.

   The award will be made by the OWNER on the basis of the Bid from the lowest responsive, responsible Bidder which, in the OWNER's sole and absolute judgment will best serve the interest of the OWNER. All Bids will be considered on the following basis:

Conformance with the terms of the Bid Documents.	Bid price. Cost of installation.

Suitability to project requirements. Responsibility and qualification of Bidder.
Delivery time.

The OWNER reserves the right to reject all Bids, or any Bid not in conformance with the intent of the Bid Documents, and to waive any informalities and irregularities in said Bids.

8. EXECUTION OF CONTRACT.

The successful Bidder shall, within 15 days after receiving notice of award, sign and deliver to the OWNER the Contract hereto attached together with the acceptable bonds as required in these Bid Documents. Within 15 days after receiving the signed Contract with acceptable bond(s) from the successful Bidder, the OWNER's authorized agent will sign the Contract. Signature by both parties constitutes execution of the Contract.

9. PERFORMANCE AND PAYMENT BONDS.

The successful Bidder shall file with the OWNER Performance and Payment Bonds in the full amount (100 percent) of the Contract price, as security for the faithful performance of the Contract and the payment of all persons supplying labor and materials for the Work under this Contract, and to cover all guarantees against defective workmanship or materials, or both, for a period of 1 year after the date of final acceptance of the Work by the OWNER. The Surety furnishing these bonds shall have a record of service satisfactory to the OWNER, be authorized to do business in the State where the OWNER's project is located and shall be named on the current list of approved Surety Companies, acceptable on Federal bonds as published by the Audit Staff, Bureau of Accounts, U.S. Treasury Department.

The Attorney-in-Fact (Resident Agent) who executes these bonds on behalf of the Surety must attach a notarized copy of his power-of-attorney as evidence of his authority to bind the Surety on the date of execution of the bond.

10. TIME OF COMPLETION.

The time of completion of the Work to be performed under this Contract is the essence of the Contract. The time allowed for the completion of the Work is stated in the Bid Data Form.

11. GRATUITIES AND KICKBACKS.

City Code states that it is unethical for any person to offer, give, or agree to give any City employee or former City employee, or for any City employee or former City employee to solicit, demand, accept, or agree to accept from another person, a gratuity or an offer of employment in connection with any decision, approval, disapproval, recommendation, or preparation of any part of a program requirement or a purchase request, influencing the content of any specification or procurement standard, rendering of advice, investigation, auditing, or in any other advisory capacity in any proceeding or application, request for ruling, determination, claim or controversy, or other particular matter, pertaining to any program requirement or a contract or subcontract, or to any solicitation or proposal therefor. It shall be unethical for any payment, gratuity, or offer of employment to be made by or on behalf of a subcontractor under a contract to the prime contractor or higher tier subcontractor or any person associated therewith, as an inducement for the award of a subcontract or order.

12. FISCAL YEAR.

The City of Grand Island, Nebraska operates on a fiscal year beginning October 1st and ending on the following September 30th. It is understood and agreed that any portion of this agreement which will be performed in a future fiscal year is contingent upon the City Council adopting budget statements and appropriations sufficient to fund such performance.

CONTRACT AGREEMENT

THIS AGREEMENT made and entered into by and between **[SUCCESSFUL BIDDER]**, hereinafter called the Contractor, and the **CITY OF GRAND ISLAND, NEBRASKA**, hereinafter called the City.

WITNESSETH:

THAT, WHEREAS, in accordance with law, the City has caused contract documents to be prepared and an advertisement calling for bids to be published for *URANIUM REMOVAL WATER TREATMENT PLANT – BUILDING CONSTRUCTION;* and

WHEREAS, the City, in the manner prescribed by law, has publicly opened, examined, and canvassed the bids submitted, and has determined the aforesaid Contractor to be the lowest responsive and responsible bidder, and has duly awarded to the said Contractor a contract therefore, for the sum or sums named in the Contractor's bid, a copy thereof being attached to and made a part of this contract;

NOW, THEREFORE, in consideration of the compensation to be paid to the Contractor and of the mutual agreements herein contained, the parties have agreed and hereby agree, the City for itself and its successors, and the Contractor for itself, himself, or themselves, and its, his, or their successors, as follows:

ARTICLE I. That the following documents shall comprise the Contract, and shall together be referred to as the "Agreement" or the "Contract Documents";

1. This Contract Agreement.
2. City of Grand Island's Specification for this project.
3. [NAME OF SUCCESSFUL BIDDER] bid signed and dated [DATE OF BID].

In the event of any conflict between the terms of the Contract Documents, the provisions of the document first listed shall prevail.

ARTICLE II. That the contractor shall (a) furnish all tools, equipment, superintendence, transportation, and other construction materials, services and facilities; (b) furnish, as agent for the City, all materials, supplies and equipment specified and required to be incorporated in and form a permanent part of the completed work; (c) provide and perform all necessary labor; and (d) in a good substantial and workmanlike manner and in accordance with the requirements, stipulations, provisions, and conditions of the contract documents as listed in the attached General Specifications, said documents forming the contract and being as fully a part thereof as if repeated verbatim herein, perform, execute, construct and complete all work included in and covered by the City's official award of this contract to the said Contractor, such award being based on the acceptance by the City of the Contractor's bid;

ARTICLE III. That the City shall pay to the Contractor for the performance of the work embraced in this contract and the Contractor will accept as full compensation therefore the sum (subject to adjustment as provided by the contract) of **[DOLLAR AMOUNT] ($00.00)** for all services, materials, and work covered by and included in the contract award and designated in the foregoing Article II; payments thereof to be made in cash or its equivalent in the manner provided in the General Specifications.

The total cost of the Contract includes:

Base Bid:	$	.00
Sales Tax on Materials/Equipment:	$	.00
Sales Tax on Labor:	$	.00
Total	$	.00

The City of Grand Island, Nebraska operates on a fiscal year beginning October 1st and ending on the following September 30th. It is understood and agreed that any portion of this agreement which will be performed in a future fiscal year is contingent upon the City Council adopting budget statements and appropriations sufficient to fund such performance.

ARTICLE IV. The Contractor hereby agrees to act as agent for the City in purchasing materials and supplies for the City for this project. The City shall be obligated to the vendor of the materials and supplies for the purchase price, but the Contractor shall handle all payments hereunder on behalf of the City. The vendor shall make demand or claim for payment of the purchase price from the City by submitting an invoice to the Contractor. Title to all materials and supplies purchased hereunder shall vest in the City directly from the vendor. Regardless of the method of payment, title shall vest immediately in the City. The Contractor shall not acquire title to any materials and supplies incorporated into the project. All invoices shall bear the Contractor's name as agent for the City. This paragraph will apply only to these materials and supplies actually incorporated into and becoming a part of the finished product of the URANIUM REMOVAL WATER TREATMENT PLANT – BUILDING CONSTRUCTION.

ARTICLE V. That the Contractor shall start work as soon as possible after the contract is signed and the required bonds and insurance are approved, and that the Contractor shall deliver the equipment, tools, supplies, and materials F.O.B. Platte Generating Station, and complete the work on or before ***MARCH 30, 2012***.

ARTICLE VI. The Contractor agrees to comply with all applicable State fair labor standards in the execution of this contract as required by Section 73-102, R.R.S. 1943. The Contractor further agrees to comply with the provisions of Section 48-657, R.R.S. 1943, pertaining to contributions to the Unemployment Compensation Fund of the State of Nebraska. During the performance of this contract, the Contractor and all subcontractors agree not to discriminate in hiring or any other employment practice on the basis, of race, color, religion, sex, national origin, age or disability. The Contractor agrees to comply with all applicable Local, State and Federal rules and regulations. The Contractor agrees to maintain a drug-free workplace policy and will provide a copy of the policy to the City upon request. Every public contractor and his, her or its subcontractors who are awarded a contract by the City for the physical performance of services within the State of Nebraska shall register with and use a federal immigration verification system to determine the work eligibility status of new employees physically performing services within the State of Nebraska.

GRATUITIES AND KICKBACKS

City Code states that it is unethical for any person to offer, give, or agree to give any City employee or former City employee, or for any City employee or former City employee to solicit, demand, accept, or agree to accept from another person, a gratuity or an offer of employment in connection with any decision, approval, disapproval, recommendation, or preparation of any part of a program requirement or a purchase request, influencing the content of any specification or procurement standard, rendering of advice, investigation, auditing, or in any other advisory capacity in any proceeding or application, request for ruling, determination, claim or controversy, or other particular matter, pertaining to any program requirement or a contract or

subcontract, or to any solicitation or proposal therefor. It shall be unethical for any payment, gratuity, or offer of employment to be made by or on behalf of a subcontractor under a contract to the prime contractor or higher tier subcontractor or any person associated therewith, as an inducement for the award of a subcontract or order.

[SUCCESSFUL BIDDER]

By_____ Date _____

Title_____

CITY OF GRAND ISLAND, NEBRASKA

By_____ Date _____
Mayor

Attest:_____
City Clerk

The contract is in due form according to law and hereby approved.

_____ Date _____
Attorney for the City

Section 2 –

Contract Drawings and Detailed Specifications

Uranium Removal Water Treatment Plant – Building Construction

Contract Drawings
and
Specifications

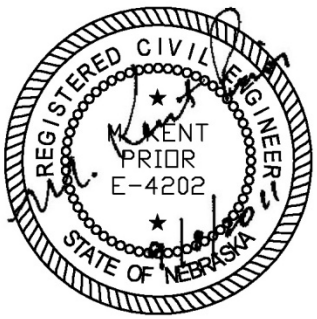
City of Grand Island Utilities Department

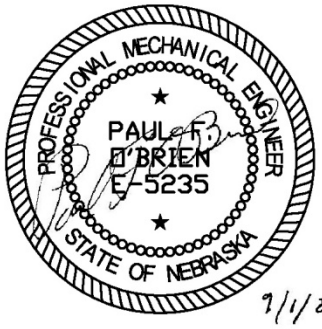
Uranium Removal WTP
Building Construction Package

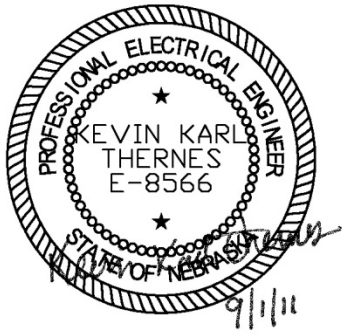
ISSUED FOR BID

HDR PROJECT NO. 145910

SEPTEMBER 1, 2011


REGISTERED CIVIL ENGINEER
M. KENT
PRIOR
E-4202
STATE OF NEBRASKA


PROFESSIONAL MECHANICAL ENGINEER
PAUL F.
O'BRIEN
E-5235
STATE OF NEBRASKA
9/1/2011


PROFESSIONAL ELECTRICAL ENGINEER
KEVIN KARL
THERNES
E-8566
STATE OF NEBRASKA
9/1/11

2011/09/02

Table of Contents

DIVISION 1

GENERAL REQUIREMENTS

2011/09/01

SECTION 01340
SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mechanics and administration of the submittal process for:
      a. Shop Drawings.
      b. Samples.
      c. Miscellaneous submittals.
      d. Operation and Maintenance Manuals.
   2. General content requirements for Shop Drawings.
   3. Content requirements for Operation and Maintenance Manuals.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Sections in Divisions 2 through 16 identifying required submittals.

1.2 DEFINITIONS

A. Shop Drawings:
   1. See General Conditions.
   2. Product data and samples are Shop Drawing information.

B. Operation and Maintenance (O&M) Manuals:
   1. Contain the information required for proper installation and maintenance of building materials and finishes.
   2. Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.

C. Miscellaneous Submittals:
   1. Submittals other than Shop Drawings and O&M Manuals.
   2. Representative types of miscellaneous submittal items include but are not limited to:
      a. Construction schedule.
      b. Concrete, soil compaction, and pressure test reports.
      c. HVAC test and balance reports.
      d. Installed equipment and systems performance test reports.
      e. Manufacturer's installation certification letters.
      f. Instrumentation and control commissioning reports.
      g. Warranties.
      h. Service agreements.
      i. Construction photographs.
      j. Survey data.
      k. Cost breakdown (Schedule of Values).

1.3 SUBMITTAL SCHEDULE

A. Schedule of Shop Drawings:
   1. Submitted and approved within 20 days of receipt of Notice to Proceed.
   2. Account for multiple transmittals under any specification section where partial submittals will be transmitted.

B. Shop Drawings: Submittal and approval prior to 50 percent completion.

C. Operation and Maintenance Manuals and Completed Equipment Record Sheets: Initial submittal within 60 days after date Shop Drawings are approved.

1.4 PREPARATION OF SUBMITTALS

A. General:
1. All submittals and all pages of all copies of a submittal shall be completely legible.
2. Submittals which, in the Engineer's sole opinion, are illegible will be returned without review.

B. Shop Drawings:
1. Scope of any submittal and letter of transmittal:
a. Limited to one (1) Specification Section.
b. Do not submit under any Specification Section entitled (in part) "Basic Requirements" unless the product or material submitted is specified, in total, in a "Basic Requirements" Section.
2. Numbering letter of transmittal:
a. Include as prefix the Specification Section number followed by a series number, "-xx", beginning with "01" and increasing sequentially with each additional transmittal.
b. If more than one (1) submittal under any Specification Section, assign consecutive series numbers to subsequent transmittal letters.
3. Describing transmittal contents:
a. Provide listing of each component or item in submittal capable of receiving an independent review action.
b. Identify for each item:
1) Manufacturer and Manufacturer's Drawing or data number.
2) Contract Document tag number(s).
3) Contract Drawing Section or detail number if appropriate.
4) Specification Article/Paragraph number if appropriate.
5) Unique page numbers for each page of each separate item.
c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.
4. Contractor stamping:
a. General:
1) Contractor's review and approval stamp shall be applied either to the letter of transmittal or a separate sheet preceding each independent item in the submittal.
a) Contractor's signature and date shall be wet ink signature.
b) Shop Drawing submittal stamp shall read "(Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval as stipulated under General Conditions Paragraph 6.17D."
c) Letters of transmittal may be stamped only when the scope of the submittal is one (1) item.
2) Submittals containing multiple independent items shall be prepared with an index sheet for each item listing the discrete page numbers for each page of that item, which shall be stamped with the Contractor's review and approval stamp.
a) Individual pages or sheets of independent items shall be numbered in a manner that permits Contractor's review and approval stamp to be associated with the entire contents of a particular item.
b. Electronic stamps:
1) Contractor may electronically embed Contractor's review and approval stamp to either the letter of transmittal or a separate index sheet preceding each independent item in the submittal.
2) Contractor's signature and date on electronically applied stamps shall be wet ink signature.

5. Resubmittals:
    a. Number with original root number and a suffix letter starting with "A" on a (new) duplicate transmittal form.
    b. Do not increase the scope of any prior transmittal.
    c. Account for all components of prior transmittal.
        1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
            a) Do not include submittal information for items listed with prior "A" or "B" Action in resubmittal.
        2) Indicate "Outstanding-To Be Resubmitted At a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
            a) Obtain Engineer's approval to exclude items.
6. For 8-1/2 x 11 IN, 8-1/2 x 14 IN, and 11 x 17 IN size sheets, provide three (3) copies of each page for Engineer plus the number required by the Contractor.
    a. The number of copies required by the Contractor will be defined at the Preconstruction Conference, but shall not exceed four (4).
    b. All other size sheets:
        1) Submit one (1) reproducible transparency or high resolution print and one (1) additional print of each Drawing until approval is obtained.
        2) Utilize mailing tube; do not fold.
        3) The Engineer will mark and return the reproducible to the Contractor for his reproduction and distribution.
7. Provide clear space (3 IN SQ) for Engineer stamping of each component defined in PREPARATION OF SUBMITTALS – Contractor Stamping.
8. Contractor shall not use red color for marks on transmittals.
    a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
    b. Outline Contractor marks on reproducible transparencies with a rectangular box.
9. Transmittal contents:
    a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.
    b. Identify equipment or material use, tag number, Drawing detail reference, weight, and other Project specific information.
    c. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
    d. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 IN pages.
        1) Indicate exact item or model and all options proposed.
    e. When a Shop Drawing submittal is called for in any Specification Section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the Specification Section.
        1) Arrange data and performance information in format similar to that provided in Contract Documents.
        2) Provide, at minimum, the detail specified in the Contract Documents.
    f. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.
10. Samples:
    a. Identification:
        1) Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, standard Specification Section or Drawing detail reference, color, range, texture, finish and other pertinent data.

2) If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.

b. Include application specific brochures, and installation instructions.

c. Provide Contractor's stamp of approval on samples or transmittal form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.

d. Resubmit samples of rejected items.

C. Miscellaneous Submittals:

1. Prepare in the format and detail specified in Specification requiring the miscellaneous submittal.

D. Operation and Maintenance Manuals:

1. Number each Operation and Maintenance Manual transmittal with the original root number of the associated Shop Drawing.
   a. Identify resubmittals with the original number plus a suffix letter starting with "A."
2. Submittal format:
   a. Interim submittals: Submit one (1) paper copy and one (1) electronic copy until manual is approved.
3. Paper copy submittals:
   a. Submit Operation and Maintenance Manuals printed on 8-1/2 x 11 IN size heavy first quality paper with standard three-hole punching and bound in appropriately sized three-ring (or post) vinyl view binders with clear overlays front, spine and back.
      1) Provide binders with titles inserted under clear overlay on front and on spine of each binder.
         a) As space allows, binder titles shall include, but not necessarily be limited to, Project Name, related Specification Number, Equipment Name(s) and Project Equipment Tag Numbers.
      2) Provide a Cover Page for each manual with the following information:
         a) Manufacturer(s).
         b) Date.
         c) Project Owner and Project Name.
         d) Specification Section.
         e) Project Equipment Tag Numbers.
         f) Model Numbers.
         g) Engineer.
         h) Contractor.
      3) Provide a Table of Contents or Index for each manual.
      4) Use plastic-coated dividers to tab each section of each manual per the manual's Table of Contents/Index for easy reference.
      5) Provide plastic sheet lifters prior to first page and following last page.
   b. Reduce Drawings or diagrams bound in manuals to an 8-1/2 x 11 IN or 11 x 17 IN size.
      1) Where reduction is not practical to ensure readability, fold larger Drawings separately and place in vinyl envelopes which are bound into the binder.
      2) Identify vinyl envelopes with Drawing numbers.
   c. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project.
      1) Delete or cross out information that does not specifically apply to the Project.
4. Operation and Maintenance Manuals for Materials and Finishes:
   a. Building Products, Applied Materials and Finishes:
      1) Include product data, with catalog number, size, composition and color and texture designations.
      2) Provide information for re-ordering custom manufactured products.

b. Instructions for Care and Maintenance:
    1) Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
c. Moisture Protection and Weather Exposed Products:
    1) Include product data listing, applicable reference standards, chemical composition, and details of installation.
    2) Provide recommendations for inspections, maintenance and repair.
d. Additional requirements as specified in individual product specifications.

5. Operation and Maintenance Manuals for Equipment and Systems:
    a. Submission of Operation and Maintenance Manuals for equipment and systems is applicable but not necessarily limited to:
        1) Major equipment.
        2) Equipment powered by electrical, pneumatic or hydraulic systems.
        3) Specialized equipment and systems including instrumentation and control systems and system components for HVAC process system control.
        4) Valves and water control gates.
    b. Equipment and Systems Operation and Maintenance Manuals shall include, but not necessarily be limited to, the following completed forms and detailed information, as applicable:
        1) Fully completed type-written copies of the associated Equipment Record(s), Exhibits C1, C2 and C3, shall be included under the first tab following the Table of Contents of each Operation and Maintenance Manual.
            a) Each section of the Equipment Record must be completed in detail.
                (1) Simply referencing the related manual for nameplate, maintenance, spare parts or lubricant information is not acceptable.
            b) For equipment items involving components or subunits, a fully completed Equipment Record Form is required for each operating component or subunit.
            c) Submittals that do not include the associated Equipment Record(s) will be rejected without further content review.
            d) Electronic copies of the Exhibits may be obtained by contacting the Project Manager.
        2) Equipment function, normal operating characteristics, limiting operations.
        3) Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
        4) Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.
        5) Lubrication and maintenance instructions.
        6) Troubleshooting guide.
        7) Parts lists:
            a) Comprehensive parts and parts price lists.
            b) A list of recommended spare parts.
            c) List of spare parts provided as specified in the associated Specification Section.
        8) Outline, cross-section, and assembly Drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
        9) Test data and performance curves.
        10) As-constructed fabrication or layout Drawings and wiring diagrams.
        11) Instrumentation or tag numbers assigned to the equipment by the Contract Documents are to be used to identify equipment and system components.
        12) Additional information as specified in the associated equipment or system Specification Section.

1.5 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings, Samples and Operation and Maintenance Manuals:
   1. Transmit all submittals to:

      City of Grand Island
      Utilities Department-Platte Generating Station
      1035 West Wildwood Drive, Box 1968
      Grand Island, NE 68802-1968
      Attn: Lynn Mayhew

   2. Utilize two (2) copies of attached Exhibit "A" to transmit all Shop Drawings and samples.
   3. Utilize two (2) copies of attached Exhibit "B" to transmit all Operation and Maintenance Manuals.
   4. All submittals must be from Contractor.
      a. Submittals will not be received from or returned to subcontractors.
      b. Operation and Maintenance Manual submittal stamp may be Contractor's standard approval stamp.
   5. Provide submittal information defining specific equipment or materials utilized on the Project.
      a. Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.

B. Miscellaneous Submittals:
   1. Transmit under Contractor's standard letter of transmittal or letterhead.
   2. Submit in triplicate or as specified in individual Specification Section.
   3. Transmit to:

      City of Grand Island
      Utilities Department-Platte Generating Station
      1035 West Wildwood Drive, Box 1968
      Grand Island, NE 68802-1968
      Attn: Lynn Mayhew

   4. Provide copy of letter of transmittal without attachments to Engineer's Resident Project Representative.
      a. Exception for concrete, soils compaction and pressure test reports.
         1) Transmit one (1) copy of test reports to Resident Project Engineer.
         2) Transmit one (1) copy of test reports to location and individual indicated above for other miscellaneous submittals.

C. Expedited Return Delivery:
   1. Include prepaid express envelope or airbill in submittal transmittal package for any submittals Contractor expects or requires express return mail.
   2. Inclusion of prepaid express envelope or airbill does not obligate Engineer to conduct expedited review of submittal.

D. Fax Transmittals:
   1. Permitted on a case-by-case basis to expedite review when approved by Engineer.
   2. Requires hard copy transmittal to immediately follow.
      a. Engineer will proceed with review of fax transmittal.
      b. Engineer's approval or rejection comments will be recorded and returned on hard copy transmittal.
   3. Provisions apply to both:
      a. Initial transmittal contents.
      b. Supplemental information required to make initial transmittal contents complete.

1.6 ENGINEER'S REVIEW ACTION

A. Shop Drawings and Samples:
   1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
      a. A - FURNISH AS SUBMITTED.
      b. B - FURNISH AS NOTED (BY ENGINEER).
      c. C - REVISE AND RESUBMIT.
      d. D - REJECTED.
      e. E - ENGINEER'S REVIEW NOT REQUIRED.
   2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
      a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned without any action.
   3. In relying on the representation on the Contractor’s review and approval stamp, Owner and Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:
      a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:
         1) Review and approval will be limited to the single item described on the transmittal letter.
         2) Other items identified in the submittal will:
            a) Not be logged as received by the Engineer.
            b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.
            c) Be submitted by the Contractor as a new series number, not as a re-submittal number.
      b. Engineer, at Engineer’s discretion, may revise the transmittal letter item list and descriptions, and conduct review.
         1) Unless Contractor notifies Engineer in writing that the Engineer’s revision of the transmittal letter item list and descriptions was in error, Contractor’s review and approval stamp will be deemed to have applied to the entire contents of the submittal package.
   4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.
      a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.
      b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
   5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
      a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
         1) One (1) copy or the one (1) transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.
            a) Correct and resubmit items so marked.
      b. Items marked "A" or "B" will be fully distributed.
      c. If a portion of the items or system proposed are acceptable, however, the major part of the individual Drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
         1) This is at the sole discretion of the Engineer.
         2) In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."

3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).

6. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.
7. Calculations required in individual Specification Sections will be received for information purposes only, as evidence calculations have been performed by individuals meeting specified qualifications, and will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.
8. Transmittals of submittals which the Engineer considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" Action in a prior submittal, will be returned with Action "E. Engineer's Review Not Required."
9. Samples may be retained for comparison purposes.
    a. Remove samples when directed.
    b. Include in bid all costs of furnishing and removing samples.
10. Approved samples submitted or constructed, constitute criteria for judging completed work.
    a. Finished work or items not equal to samples will be rejected.

B. Operation and Maintenance Manuals:
1. Engineer will review and indicate one of the following review actions:
    a. A - ACCEPTABLE.
    b. B - ~~FURNISH AS NOTED~~ - Not Used.
    c. C - REVISE AND RESUBMIT.
    d. D - ~~REJECTED~~ - Not Used.
2. Acceptable paper copy submittals will be retained with the transmittal form.
3. Deficient submittals (paper copy and/or electronic copy) will be returned along with the transmittal form which will be marked to indicate deficient areas.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

END OF SECTION

1

EXHIBIT A

Shop Drawing Transmittal No. _____-_____

(Spec Section) (Series)

Project Name:		Date Received:	
Project Owner:		Checked By:	
Contractor:	HDR Engineering, Inc.	Log Page:	
Address:	Address:	HDR No.:	
		Spec Section:	
		Drawing/Detail No.:	
Attn:	Attn:	1st. Sub	ReSub.
Date Transmitted:	Previous Transmittal Date:		

Item No.	No. Copies	Description	Manufacturer	Mfr/Vendor Dwg or Data No.	Action Taken*

Remarks:

* The Action designated above is in accordance with the following legend:

A - Furnish as Submitted

B - Furnish as Noted

C - Revise and Submit
1. Not enough information for review.
2. No reproducibles submitted.
3. Copies illegible.
4. Not enough copies submitted.
5. Wrong sequence number.
6. Wrong resubmittal number.
7. Wrong spec. section.
8. Wrong form used.
9. See comments.

D - Rejected

E - Engineer's review not required
1. Submittal not required.
2. Supplemental Information. Submittal retained for informational purposes only.
3. Information reviewed and approved on prior submittal.
4. See comments.

Comments:

By Date

Distribution: Contractor | File | Field | Owner | Other |

(Jun 1990; Revised Jun 1997; Revised Oct 2001, Revised Nov 2007)

EXHIBIT B

O&M Manual Transmittal No. _____-_____

(Spec Section) (Series)

Project Name:		Date Received:
Project Owner:		Checked By:
Contractor:	Owner:	Log Page:
Address:	Address:	HDR No.:
Attn:	Attn:	1st. Sub. ReSub.

Date Transmitted: Previous Transmittal Date:

No. Copies	Description of Item	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks:

To: From:

HDR Engineering, Inc.

Date:

* The Action designated above is in accordance with the following legend:

A - Acceptable, provide one (1) additional paper copy and two (2) electronic copies on CD-ROM for final review.

B - ~~Furnish as Noted~~ - Not Used

C - Revise and Resubmit
This Operation and Maintenance Manual Submittal is deficient in the following area:

1. Equipment Records.
2. Functional description.
3. Assembly, disassembly, installation, alignment, adjustment & checkout instructions.
4. Operating instructions.
5. Lubrication & maintenance instructions.
6. Troubleshooting guide.
7. Parts list and ordering instructions.
8. Organization (binder, binder titles, index & tabbing).
9. Wiring diagrams & schematics specific to installation.
10. Outline, cross section & assembly diagrams.
11. Test data & performance curves.
12. Tag or equipment identification numbers.
13. Inclusion of all components & subcomponents.
14. Other - see comments.

D - ~~Rejected~~ - Not Used

Comments:

By Date

Distribution: Contractor | File | Field | Owner | Other

(Jun 1990; Revised Oct 2001, Revised Nov 2007)

EXHIBIT C1

Equipment Record

Equipment Data and Spare Parts Summary

Project Name	Specification Section:
Equipment Name	Year Installed:
Project Equipment Tag No(s).	
Equipment Manufacturer	Project/ Order No.
Address	Phone
Fax / Web Site / E-mail	
Local Vendor/Service Center	
Address	Phone
Fax / Web Site / E-mail	

MECHANICAL NAMEPLATE DATA

Equip.		Serial No.		
Make		Model No.		
ID No.	Frame No.	HP	RPM	Cap.
Size	TDH	Imp. Sz.	CFM	PSI
Other:				

ELECTRICAL NAMEPLATE DATA

Equip.			Serial No.					
Make			Model No.					
ID No.	Frame No.	HP	V.	Amp.	HZ	PH	RPM	SF
Duty	Code	Ins. Cl.	Type	NEMA	C Amb.	Temp. Rise	Rating	
Other:								

SPARE PARTS PROVIDED PER CONTRACT

Part No.	Part Name	Quantity

RECOMMENDED SPARE PARTS

Part No.	Part Name	Quantity

(Jun 1990; Revised Oct 2001, Revised Nov 2007)

EXHIBIT C2

Equipment Record

Recommended Maintenance Summary

Equipment Description	Project Equip. Tag No(s).

RECOMMENDED BREAK-IN MAINTENANCE (FIRST OIL CHANGES, ETC.)	INITIAL COMPLETION * FOLLOWING START-UP						
	D	W	M	Q	S	A	Hours

RECOMMENDED PREVENTIVE MAINTENANCE	PM TASK INTERVAL *						
	D	W	M	Q	S	A	Hours

* D = Daily W = Weekly M = Monthly Q = Quarterly S = Semiannual A = Annual Hours = Run Time Interval

(Jun 1990; Revised Oct 2001, Revised Nov 2007)

1

EXHIBIT C3

Equipment Record

Lubrication Summary

Equipment Description	Project Equip. Tag No(s).

Lubricant Point

Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point

Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point

Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point

Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point

Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

Lubricant Point

Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

(Feb 1991; Revised Oct 2001, Revised Nov 2007)

1

DIVISION 2

SITE WORK

2011/09/01

SECTION 02110
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Site clearing, tree protection, stripping topsoil and demolition.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02200 - Earthwork.
   4. Section 02260 - Topsoiling and Finished Grading.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing trees and other vegetation to remain against damage.
   1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
   2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
   3. Provide temporary protection as required.

B. Repair or replace trees and vegetation damaged by construction operations.
   1. Repair to be performed by a qualified tree surgeon.
   2. Remove trees which cannot be repaired and restored to full-growth status.
   3. Replace with new trees of minimum 4 IN caliper.

C. Owner will obtain authority for removal and alteration work on adjoining property.

3.2 SITE CLEARING

A. Topsoil Removal:
   1. Strip topsoil to a minimum of 12 IN per recommendation of Soils Report.
      a. Remove heavy growths of grass before stripping.
      b. Stop topsoil stripping sufficient distance from such trees to prevent damage to main root system.
      c. Separate from underlying subsoil or objectionable material.
   2. Stockpile topsoil where directed by Engineer.
      a. Construct storage piles to freely drain surface water.
      b. Seed or cover storage piles to prevent erosion.
   3. Do not strip topsoil in wooded areas where no change in grade occurs.
   4. Borrow topsoil: Reasonably free of subsoil, objects over 2 IN DIA, weeds and roots.

B. Clearing and Grubbing:
   1. Clear from within limits of construction all trees not marked to remain.
      a. Include shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, structures and debris.

2. Grub (remove) from within limits of construction all stumps, roots, root mats, logs and debris encountered.
    a. Totally grub under areas to be paved.
    b. Grubbing in lawn areas:
        1) In cut areas, totally grub.
        2) In fill areas, where fill is less than 3 FT totally grub ground.
        3) Where fill is 3 FT or more in depth, stumps may be left no higher than 6 IN above existing ground surface.

C. Disposal of Waste Materials:
    1. Do not burn combustible materials on site.
    2. Remove all waste materials from site.
    3. Do not bury organic matter on site.

3.3 ACCEPTANCE

A. Upon completion of the site clearing, obtain Engineer's acceptance of the extent of clearing, depth of stripping and rough grade.

END OF SECTION

2011/09/01

SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Earthwork.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C33, Standard Specification for Concrete Aggregates.
      b. D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).
      c. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
      d. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

B. Soils Report:
   1. Geotechnical Investigation:
      a. Geotechnical Exploration
         City of Grand Island Treatment Building
         City of Grand Island Well Field, Grand Island, Nebraska
         August 30, 2011
      b. See Soils Report Section 02200A.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Certifications.
   4. Test reports.

B. Samples:
   1. Submit samples and source of fill and backfill materials proposed for use.
   2. Submit samples and source of borrow materials proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill and Backfill: Selected material approved by Soils Engineer from site excavation or from off site borrow.
   1. Fill and Backfill:
      a. Inorganic CL, CL-ML, ML and/or SC.
      b. Liquid limit: Less than 40.
      c. Plasticity index: Less than 20.

B. Granular Fill Under Building Floor Slabs-On-Grade: Clean, crushed, nonporous rock, crushed or uncrushed gravel complying with ASTM C33 gradation size No. 67, 3/4 IN to No. 4.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect existing surface and subsurface features on-site and adjacent to site as follows:
   1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
   2. Protect and maintain bench marks, monuments or other established reference points and property corners.
      a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
   3. Verify location of utilities.
      a. Omission or inclusion of utility items does not constitute non-existence or definite location.
      b. Secure and examine local utility records for location data.
      c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
      d. Repair damages to utility items at own expense.
      e. In case of damage, notify Engineer at once so required protective measures may be taken.
   4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
      a. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
      b. All repairs to be made and paid for by Contractor.
   5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
   6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
   7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

B. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.

C. Dispose of waste materials, legally, off site.
   1. Burning, as a means of waste disposal, is not permitted.

3.2 SITE EXCAVATION AND GRADING

A. The work includes all operations in connection with excavation, borrow, construction of fills and embankments, rough grading, and disposal of excess materials in connection with the preparation of the site(s) for construction of the proposed facilities.

B. Excavation and Grading: Perform as required by the Contract Drawings.
   1. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
      a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
      b. Perform other layout work required.
      c. Replace property corner markers to original location if disturbed or destroyed.
   2. Preparation of ground surface for embankments or fills:
      a. Before fill is started, remove top soil and existing fill material from the embankment footprint and building area.
      b. Scarify to a minimum depth of 8 IN in all proposed embankment and fill areas.
      c. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
   3. Protection of finish grade:
      a. During construction, shape and drain embankment and excavations.
      b. Maintain ditches and drains to provide drainage at all times.
      c. Protect graded areas against action of elements prior to acceptance of work.
      d. Reestablish grade where settlement or erosion occurs.

C. Borrow:
   1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
   2. Include cost of all borrow material in original proposal.
   3. Fill material to be approved by Soils Engineer prior to placement.

D. Proof-rolling:
   1. After topsoil and existing fill are removed and prior to placing new fill, proof-roll exposed subgrade.
   2. Use fully loaded 25 ton dump truck unless otherwise required by Soils Engineer.
   3. Proof-roll in the presence of the Soils Engineer.
   4. Locate and repair any unstable areas as directed by the Soils Engineer.

E. Construct embankments and fills as required by the Contract Drawings:
   1. Construct embankments and fills at locations and to lines of grade indicated.
      a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
   2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.
      a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of fill or embankment.
      b. Do not place material in layers greater than 8 IN loose thickness.
      c. Place layers horizontally and compact each layer prior to placing additional fill.
   3. Compact by sheepsfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
      a. Control moisture for each layer necessary to meet requirements of compaction.

3.3 USE OF EXPLOSIVES

A. Blasting with any type of explosive is prohibited.

3.4 FIELD QUALITY CONTROL

A. Do not include in bid price the cost of inspection services indicated herein as being performed by the Soils Engineer.

B. Moisture density relations, to be established by the Soils Engineer required for all materials to be compacted.

C. Extent of compaction testing will be as necessary to assure compliance with Specifications.

D. Give minimum of 24 HR advance notice to Soils Engineer when ready for compaction or subgrade testing and inspection.

E. Should any compaction density test or subgrade inspection fail to meet Specification requirements, perform corrective work as necessary.

F. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests.

3.5 COMPACTION DENSITY REQUIREMENTS

A. Obtain approval from Soils Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

B. Provide dewatering system necessary to successfully complete compaction and construction requirements.

C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Soils Engineer.

D. Stabilize subgrade with well graded granular materials as directed by Soils Engineer.

E. All compaction densities to be achieved with soil minimum moisture content between 0 percent and -2 percent of optimum, unless directed otherwise by Soils Engineer.

F. Assure by results of testing that compaction densities comply with the following requirements:

1. Sitework:

LOCATION	COMPACTION DENSITY
Under Paved Areas, Sidewalks and Piping:	
Cohesive soils	95 percent per ASTM D698
Cohesionless soils	85 percent relative density per ASTM D4253 and ASTM D4254
Unpaved Areas:	
Cohesive soils	90 percent of ASTM D698
Cohesionless soils	70 percent relative density per ASTM D4253 and ASTM D4254

2. Structures:

LOCATION	COMPACTION DENSITY
Below top of interior and exterior footings inside the building area.	95 percent per ASTM D698
Above top of interior and exterior footings inside the building area.	95 percent per ASTM D698
Backfill of footings and structures outside the building area that are not under pavement	90 percent per ASTM D698

3. Specific areas:

LOCATION	COMPACTION DENSITY
Outside structures under equipment support foundations	95 percent per ASTM D698
Granular fill under building floor slabs-on-grade	85 percent relative density per ASTM D4253 and ASTM D4254

3.6 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. General:
   1. In general, work includes, but is not necessarily limited to, excavation for structures, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
   2. Obtain fill and backfill material necessary to produce grades required.
      a. Materials and source to be approved by Soils Engineer.
      b. Excavated material approved by Soils Engineer may also be used for fill and backfill.
   3. In this Section of the Specifications, the word "foundations" includes footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil.
   4. In the paragraphs of this Section of the Specifications, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation Requirements for Structures:
   1. General:
      a. Do not commence excavation for foundations for structures until Soils Engineer approves:
         1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
         2) Density and moisture content of site area compacted fill material meets requirements of specifications.
         3) Site has been proof-rolled per Paragraph 3.2.
      b. Engineer grants approval to begin excavations.
   2. Dimensions:
      a. Excavate to elevations and dimensions indicated or specified.
      b. Allow additional space as required for construction operations and inspection of foundations.
   3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
      a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Soils Engineer.
   4. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill.
      a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
      b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a minimum depth of 8 IN and then compact to density stated in this Specification Section before fill material can be placed thereon.
      c. Do not carry excavations lower than shown for foundations except as directed by Soils Engineer or Engineer.

d. If any part of excavations is carried below required depth without authorization, maintain excavation and start foundation from excavated level with granular fill, and no extra compensation will be made to Contractor therefore.

5. Make excavations large enough for working space, forms, dampproofing, waterproofing, and inspection.
6. Notify Soils Engineer and Engineer as soon as excavation is completed in order that subgrades may be inspected.
   a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under equipment support pads, and under retaining wall footings has been inspected and approved by the Soils Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.
   b. Soils Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.
   c. Place fill material, foundations, floor slabs-on-grade, and equipment support pads as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.
   d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.
7. Dewatering:
   a. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
   b. Groundwater shall be maintained at least 1 FT below the bottom of any excavation.
   c. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
   d. Employ dewatering specialist for selecting and operating dewatering system.
   e. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
   f. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
      1) Install groundwater monitoring wells as necessary.
   g. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Subgrade stabilization:
   a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Soils Engineer.
   b. Provide compaction density of replacement material as stated in this specification section.
   c. Loose, wet, or soft materials, when approved by Soils Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
   d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.
   e. Remove and replace frozen materials as directed by Soils Engineer.
   f. Method of stabilization shall be performed as directed by Soils Engineer.
   g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Soils Engineer.

9. Do not place floor slabs-on-grade including equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence slab construction.
    a. Do not place building floor slabs-on-grade including equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40 DegF before structure is completed and heated to a temperature of at least 50 DegF.
10. Protection of structures:
    a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
    b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.
11. Shoring:
    a. Shore, sheet pile, slope, or brace excavations as required to prevent them from collapsing.
    b. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.
12. Drainage:
    a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
    b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.
    c. Provide pumping required to keep excavated spaces clear of water during construction.
    d. Should any water be encountered in the excavation, notify Engineer and Soils Engineer.
    e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.
13. Frost protection:
    a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
    b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.
    c. Protect excavation from frost if placing of concrete or fill is delayed.
    d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.
    e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 DegF.

C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs, Floor Slabs, Equipment Support Pads and Piping:
1. General:
    a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Soils Engineer and compacted to density specified herein.
    b. Surface may be stepped by at not more than 12 IN per step or may be sloped at not more than 2 percent.
    c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Soils Engineer as being free of undesirable material and compacted to specified density.
2. Obtain approval of fill and backfill material and source from Soils Engineer prior to placing the material.
3. Granular fill under floor slabs-on-grade: Place all floor slabs-on-grade on a minimum of 6 IN of granular fill unless otherwise indicated.

4. Fill and backfill placement:
    a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Soils Engineer.
    b. Place fill and backfill material in thin lifts (8 IN maximum loose thickness) as necessary to obtain required compaction density.
    c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
    d. Use hand operated or otherwise approved equipment for filling and backfilling within 6 FT of walls and less than 3 FT above pipes
        1) Compaction equipment exceeding 3000 LBS dead weight shall not be used within 6 FT of the wall as a minimum
        2) Contractor is responsible for method of compaction so as not to damage wall.
    e. Do not place fill and backfill when the temperature is less than 40 DegF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
    f. Use vibratory equipment to compact granular material; do not use water.
5. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content, outside the exterior limits of foundations located around perimeter of structure the following horizontal distance whichever is greater:
    a. As required to provide fill material to indicated finished grade.
    b. 5 FT.
    c. Distance equal to depth of compacted fill below bottom of foundations.
    d. As directed by Soils Engineer.

D. Filling and Backfilling Outside of Structures.
1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
2. Provide material as approved by Soils Engineer for filling and backfilling outside of structures.
3. Fill and backfill placement:
    a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Soils Engineer.
    b. Place fill and backfill material in thin lifts (8 IN maximum loose thickness) as necessary to obtain required compaction density.
    c. Compact material with equipment of proper type and size to obtain density specified.
    d. Use hand operated or otherwise approved equipment for filling and backfilling within 6 FT of walls and less than 3 FT above pipes
        1) Compaction equipment exceeding 3000 LBS dead weight shall not be used within 6 FT of the wall as a minimum
        2) Contractor is responsible for method of compaction so as not to damage wall.
    e. Do not place fill or backfill material when temperature is less than 40 DegF and when subgrade to receive material is frozen, wet, loose, or soft.
    f. Use vibratory equipment for compacting granular material; do not use water.
4. Backfilling against walls:
    a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.
    b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, dampproofing and waterproofing have been completed.
    c. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.

E. Backfilling Outside of Structures Under Piping or Paving:
1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Section.

2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.
3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other sections of these Specifications.

3.7 SPECIAL REQUIREMENTS

A. Erosion Control:
1. Conduct work to minimize erosion of site.
2. Construct stilling areas to settle and detain eroded material.
3. Remove eroded material washed off site.
4. Clean streets daily of any spillage of dirt, rocks or debris from equipment entering or leaving site.

END OF SECTION

1

GSI Geotechnical Services, Inc.
Superior service...practical solutions

GEOTECHNICAL EXPLORATION

CITY OF GRAND ISLAND TREATMENT BUILDING
CITY OF GRAND ISLAND WELL FIELD
GRAND ISLAND, NEBRASKA

GSI JOB NO. 115164

AUGUST 30, 2011

Prepared By:

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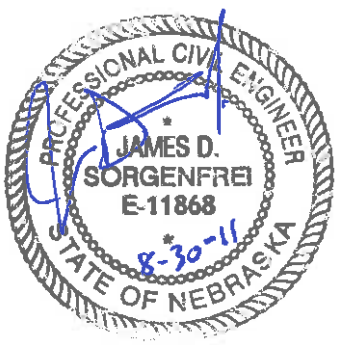

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Nebraska.

James D. Sorgenfrei — Date 8-30-11

My license renewal date is December 31, 2012.
Pages covered by this seal: 1-8, Appendices A & B
Date issued: August 30, 2011

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE THE GEOPROFESSIONAL BUSINESS ASSOCIATION

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GSI Geotechnical Services, Inc.
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GEOTECHNICAL EXPLORATION FOR

CITY OF GRAND ISLAND TREATMENT BUILDING
CITY OF GRAND ISLAND WELL FIELD
GRAND ISLAND, NEBRASKA

GSI JOB NO. 115164

AUGUST 30, 2011

1. INTRODUCTION

1.1 General

This report presents a summary of the findings from our geotechnical exploration for the proposed treatment building to be located at the City of Grand Island well field, in Grand Island, Nebraska. The scope of work was outlined in our proposal dated August 12, 2011. Written authorization was provided by Mr. Lynn Mayhew, with the City of Grand Island, on August 15, 2011.

The purpose of this geotechnical study was to explore subsurface conditions at the proposed site, evaluate the engineering properties of the subsurface materials, and provide soils related recommendations for design and construction of the proposed treatment building.

The scope of services for this exploration did not include a wetlands evaluation, an environmental assessment, or an exploration for the presence of hazardous or toxic materials in the soil, surface water, groundwater, or air within or adjacent to this site. Any statements in this report or on the boring logs regarding odors noted, unusual, or suspicious items, or conditions observed are strictly for the information of our client. If contamination is suspected or is a concern, GSI recommends that the scope of this study be expanded to include an environmental assessment.

The firm of Geotechnical Services, Inc. (GSI) prepared this report. The report was prepared by a professional engineer registered in the State of Nebraska and in accordance with generally accepted soil and foundation engineering practices. This report has been prepared for the exclusive use of the client in accordance with generally accepted geotechnical engineering practices. Recommendations are based on the applicable standards of the profession at the time of this report within this geographic area.

1.2 Project Description

We understand the proposed project involves the construction of a new treatment building at the well field in Grand Island, Nebraska. The building will have a footprint on the order of approximately 1,400 square feet. We understand the proposed building will consist of pre engineered metal framed structure with a concrete slab on grade. We have not been provided with structure loads, but anticipate continuous loads will be on the order of 2 kips per lineal foot and column loads (if any) will be 30 kips or less.

There will be up to 1 foot of fill added to facilitate drainage and level the site.

If any of the above information is changed in the final design, the recommendations presented here should be evaluated and modified, if necessary.

2. FIELD EXPLORATION

The geotechnical exploration included a total of two exploratory borings within the building footprint, extending to depths of 10 and 15 feet. GSI drilled the borings on August 19, 2011, using a CME-45, truck mounted drilling rig advancing 6-inch continuous flight augers.

GSI personnel along with Lynn Mayhew with the City of Grand Island established the boring locations in the field by using a rollatape wheel to measure distances from landmarks at the existing site. The location of the borings in relation to existing and proposed features is indicated on the Boring Location Diagram (Appendix A). The location of the borings should be considered accurate only to the degree implied by the methods used.

Our drill crew obtained four soil samples within the upper 10 feet and generally obtained the remaining samples at 5-foot intervals during the field exploration. Split-barrel samples (designated "S-#" sample) were obtained while performing Standard Penetration Tests (SPT) with a 1 3/8-inch I.D., thick-walled sampler, driven in general accordance with ASTM D1586-84, "*Penetration Test and Split-Barrel Sampling of Soils.*" The "N" value, reported in blows per foot, equals the number of blows required to drive the sampler over the last 12 inches of the sample interval using a 140-pound hammer falling 30 inches. The recovered samples were sealed in plastic containers, labeled, and protected for transportation to the laboratory for further examination, testing, and classification.

The drill crew prepared the field boring logs during the field exploration. The field logs report drilling and sampling methods, sampling intervals, groundwater measurements, and the encountered subsurface conditions.

3. LABORATORY TESTING

The field boring logs were reviewed to outline the depth, thickness, and extent of the soil strata. The samples taken from the borings were examined in our laboratory and visually classified in general accordance with ASTM D2488, "*Description and Identification of Soils (Visual-Manual Procedure).*" A testing program was established to evaluate the engineering properties of the recovered samples. Specific tests that were performed include:

- Water Content (ASTM D2216, "*Laboratory Determination of Water (Moisture) Content of Soil and Rock*")

All tests were conducted in general accordance with current ASTM or state-of-the-practice test procedures. Laboratory test results are presented on the Boring Logs (Appendix B).

Water content tests were used to evaluate the existing moisture state of the soils.

Based on the results of this testing program, the field logs were reviewed and supplemented as presented in Appendix B. The final logs represent our interpretation of the field logs and reflect the additional information obtained from the laboratory testing. Stratification boundaries indicated on the boring logs were based on observations during drilling, an extrapolation of information

obtained by inspecting samples from the borings, and comparisons of similar engineering characteristics. Locations of these boundaries are approximate and the transitions between soil types may be gradual rather than clearly defined.

4. GENERAL SITE CONDITIONS

4.1 Surface Conditions

At the time of the exploration, the terrain was level and consisted primarily of a grass-covered area. The site is located approximately 1½ miles east of South Locust Street along East Wildwood Drive.

4.2 Subsurface Conditions

According to the Soil Survey of Hall County, Nebraska, by the Soil Conservation Service (U.S. Department of Agriculture), the surficial site soils consist of Jansen soils. Jansen fine sandy loam is generally comprised of sandy eolian deposits over loamy alluvium over sandy and gravelly alluvium on nearly level terraces on river valleys.

Although there was some variability in the encountered subsurface conditions, a general soil profile could be developed. The soils encountered within the depths of exploration generally consisted of lean clay underlain by poorly graded sand.

We encountered a developed zone consisting of lean clay in the borings at the surface, extending to depths of approximately ½ to 1 foot below grade. The material was described as brown, slightly moist, lean clay.

We encountered alluvial deposits consisting of poorly graded sand in the borings at depths of approximately ½ to 1 foot below grade, extending to approximately 10 to 15 feet below grade (full depth of exploration). The material was described as light brown, slightly moist to wet, loose to medium dense, fine to coarse grained, poorly graded sand. Laboratory testing performed on this material indicated moisture contents of 5 to 14 percent. SPT Blow Counts "N" ranging from 7 to 17 indicates a loose to dense relative density.

Groundwater observations were made during drilling and after completion of the borings to evaluate groundwater conditions. Groundwater was noted in the test borings at depths of 4 to 5 feet below existing grade during the field exploration. There is uncertainty involved with short-term water level observations in the boreholes. Further, the groundwater level, and the amount and level of any perched water on the site may be expected to fluctuate with variations in precipitation, site grading, drainage, and adjacent land use. Long-term monitoring in piezometers or observation wells would be required to evaluate the potential range of groundwater conditions. Naturally, allowances must be made for the seasonal variation in the water table.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 General

Groundwater was not encountered within the depth of expected excavation and should not be a concern during construction.

5.2 General Earthwork

5.2.1 Site Preparation

In preparing the site for construction, topsoil, surface vegetation, and any other unsuitable material should be removed from beneath structures and any other areas that are to be paved, cut, or receive fill. GSI recommends a minimum removal depth of 12 inches for topsoil. Site preparation should also include relocation or abandonment of existing buried utilities and demolition of hard surfaced areas. Abandoned underground utility lines should either be completely removed or capped and grouted full.

The material to be stripped is characterized as brown, lean clay as indicated on the Boring Logs (Appendix B). This material should either be removed from the site or stockpiled for later use in unpaved non-structural areas. After removal of the surface materials, the subgrade in fill areas should be proofrolled with a heavy roller or loaded tandem axle dump truck. Scarification and recompaction of the subgrade soils may be necessary to provide a suitable subgrade for structural fill placement. Any remaining soft or unsuitable areas should be corrected using the procedures outlined in Sections 5.2.2 and 5.2.3.

5.2.2 Overexcavation and Structural Backfill (General)

If weak or otherwise unsuitable soils are encountered in the bottom of shallow foundation excavations or subgrade areas, implementation of an overexcavation and structural backfill procedure may be necessary. This procedure should completely remove all existing unsuitable soils below foundation bearing level to the depth of overexcavation determined by the geotechnical engineer. The overexcavation should extend laterally 9 inches in all directions for each foot of overexcavated depth and be replaced with new structural backfill.

We recommend new structural backfill soils be free of rubble and organics, and have a USCS of CL, CL-ML, ML, or SC. Our experience with similar projects indicates recycled concrete and crushed rock base aggregate work well for replacement of localized areas of weak or saturated soils. Structural backfill soils should meet the minimum placement requirements outlined in Section 5.2.3.

5.2.3 Earthwork and Excavations

In areas to accept new fill, the top 8 to 12 inches of the ground surface should be scarified and compacted to eliminate a plane of weakness along the contact surface. All import material should be a cohesive soil (lean clay). Cohesive soils should have a liquid limit less than 40, plasticity index less than 20, and contain less than 1.5 percent organic material. The on-site soils are generally suitable for reuse as structural fill at the site after water conditioning as necessary. Fill should be placed in loose lifts of 6 to 8 inches maximum thickness and compacted to meet minimum requirements in Table A.

Water content of fill at the time of compaction should be controlled between optimum and +3 percentage points of optimum water content as determined by the standard Proctor test (ASTM D698). We recommend a technician working under the supervision of a geotechnical engineer from our firm periodically monitor earthwork operations to evaluate compliance with the recommendations in this section.

TABLE A - RECOMMENDED GUIDELINES FOR DEGREE-OF-COMPACTION

Construction Application	Standard Proctor (ASTM D698) Cohesive Soil	Standard Proctor (ASTM D698) Cohesionless Soil	*Relative Density D4253 & D4254 Cohesionless Soil
Building Foundation, Floor Slabs, and Critical Backfill Areas	95%	98%	85%
Backfill Adjacent to Structures Not Supporting Other Structures – Minor Subsidence Possible	90%	95%	70%

*Use Relative Density technique (ASTM D4253 & D4254) where standard Proctor technique (ASTM D698) does not result in a definable maximum dry density and optimum moisture content.

5.2.4 Excavation Slopes

Vertical cuts and excavations may stand for short periods of time, but should not be considered stable in any case. All excavations should be sloped back, shored, or shielded for protection of workers. Trenching and excavation activities should conform to federal and local regulations as a minimum. The soils encountered in the test borings generally classify as a type "C" soil according to OSHA's Construction Standards for Excavations. In general, the maximum allowable slope for shallow excavations of less than 20 feet in a type "C" soil is 1.5H:1V, although other provisions and restrictions may apply. If different soil types are encountered, the maximum allowable slope may be different.

The Contractor is responsible for designing any excavation slopes or temporary shoring. The Contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should, in no case, exceed those specified in federal, state, or local safety regulations, such as OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations.

5.2.5 Construction Observation

Site grading, including proofrolling, replacement or recompaction of material, and placement of fill and backfill, should be observed by a qualified technician from GSI under the direction of a registered professional engineer. The technician should perform nuclear moisture-density tests and make any other observations necessary to assure that the requirements of the specifications are being achieved. GSI requires that observation of construction by the geotechnical engineer of record or his designated representative to complete the design process. Field observation services are viewed as essential and a continuation of the design process. Unless these services are provided, the geotechnical engineer will not be responsible for improper use of recommendations, or failure by others to recognize conditions which may be detrimental to the successful completion of the project.

5.3 Foundations

The selection of an allowable soil bearing pressure for shallow foundation elements must fulfill two requirements. First, the load must be sufficiently less than the ultimate bearing capacity of the foundation to insure stability. Second, the differential settlement must not exceed an amount which will produce adverse behavior of the structure.

To meet the previous criteria, we have explored both the bearing capacity and the load settlement characteristics of the site soils using estimated wall loads of 2 kips per foot and column loads of 30 kips. The bearing capacity is based on a factor of safety of 3.0 against the full dead load plus normal live load. A maximum total settlement of 1 inch and a differential settlement of 3/4 inch are generally considered acceptable and were used in our analysis.

A net allowable soil bearing pressure of 2,000 pounds per square foot (psf) may be used to size the foundations if supported on the light brown, poorly graded sand founded at a depth of 3½ feet below existing grade. The allowable bearing pressure is expressed in terms of the net pressure transferred to the soil.

We recommend that continuous wall and spread column footings should have minimum widths of 16 inches and 24 inches, respectively. In no case should footings be smaller than local code sizes. Exterior footings and footings in unheated areas should be founded at a minimum depth of 3½ feet below surrounding grade to provide frost protection. Interior footings, which will be protected from the effects of frost, should be founded at least 2 feet below finished floor elevation. Local building codes can supersede these frost depths. In addition, all footings should be reinforced with steel reinforcement to span zones of non-uniform soil support.

We recommend that concrete should be placed as soon as practical after footing excavation, with as little disturbance to the bearing soils as possible. All footing excavations should be free of loose soil or debris. If water collects in the excavations, it should be promptly removed to prevent softening of the foundation supporting soil prior to concrete placement. In addition, we recommend all excavations be observed by an engineer from GSI or his designated representative before placement of concrete for the possible presence of unsuitable bearing soils at the base of an excavation.

If shallow foundations are designed and constructed in accordance with the recommendations presented above and the actual loads are not greater than the assumed maximum loads, total settlements are not expected to exceed 1 inch with differential settlements of 3/4 inch or less.

5.4 Floor Slabs

The subgrade should be reworked to a depth of 12 inches and compacted as recommended in Section 5.2.3 immediately prior to concrete placement. Any soft or unsuitable areas should be corrected using the procedures outlined in Sections 5.2.2 and 5.2.3. The floor slab should be independent of any and all structural members and components. The system must be designed as a floor slab that is free to move without damaging the remainder of the building.

We recommend the floor slab, bearing on a well-prepared compacted subgrade as described above and in Section 5.2.3, be designed using a modulus of subgrade reaction (k-value) of 90 pounds per cubic inch (pci).

5.5 Seismic Site Classification

Building code requirements may include design for seismic forces associated with earthquake motions. The project site is classified as Site Class D according to Table 1613.5.2 in the 2006 version of the International Building Code.

5.6 Surface Drainage and Landscaping

The success of the shallow foundation system and slab-on-grade floor system is contingent upon keeping the subgrade soils at a fairly constant water content and by not allowing surface drainage to have a path to the subsurface. Positive surface drainage away from structures must be maintained at all times. Landscaped areas should be designed and built such that irrigation and other surface water will be collected and carried away from foundation elements.

During construction, temporary grades should be established to prevent runoff from entering excavations or footing trenches. Backfill should be placed as soon as concrete structural strength requirements are met and should be graded to drain away from the structures.

The final grade of the foundation backfill and any overlying pavements should have a positive slope away from foundation walls on all sides. A minimum slope of 1 inch per foot for the first 5 to 10 feet is recommended for uncovered surfaces. A minimum slope of 2 percent is recommended for other areas of the site. Irrigation within 10 feet of the foundation should be carefully controlled and minimized.

5.7 Construction Considerations

If construction of the project is to be performed during winter, steps should be taken to prevent the soils under floor slabs, footings, or pavements from freezing. **In no case** should the floor slab, foundations, pavements, or other exterior flat work be placed on frozen or partially frozen materials. Frozen materials should be removed and replaced with a suitable material as described in earlier sections of this report.

6. CLOSING REMARKS

6.1 Limitations

This report is presented in broad terms to provide an assessment of the subsurface conditions and their potential effect on the adequate design and economical construction of the proposed treatment building. The analyses, conclusions, and recommendations contained in this report are based on the site conditions existing at the time of the exploration, the project layout described herein, and the assumption that the information obtained from our two borings is representative of subsurface conditions throughout the site. Any changes in the design or location of the proposed structures should be assumed to invalidate the conclusions and recommendations given in this report until we have had the opportunity to review the changes and, if necessary, modify our conclusions and recommendations accordingly. If subsurface conditions different from those encountered in the exploration are observed during construction or appear to be present beneath excavations, GSI should be advised at once so that the conditions can be reviewed and recommendations reconsidered where necessary. If there is a substantial lapse in time between the submission of this report and the start of construction, or if site conditions or the project layout have significantly changed (due to further development of grading plans, natural causes, or construction operations at or adjacent to the site) it is recommended that this report be reviewed to determine the applicability of our previous conclusions and recommendations.

Our geotechnical exploration and subsequent recommendations address only the design and construction considerations contained in this report. Other details commonly found in structures such as vapor barriers, or slab and foundation wall insulation are not normally within the scope of a geotechnical investigation, but should be given consideration by the designer.

We make no warranty for the contents of this report, neither expressed nor implied, except that our professional services were performed in accordance with engineering principles and practices generally accepted at this time and location.

6.2 Additional Services

We require that GSI be provided the opportunity for a general review of the final design plans and specifications. This is to ensure that earthwork and foundation recommendations have been properly interpreted in the design and specifications. GSI will not be responsible for misrepresentation of this report resulting from partial reproduction or paraphrasing of its contents.

We also require that GSI be retained to provide continuous engineering services during construction of the foundation, excavation, and earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to modify recommendations in the event that subsurface conditions differ from those anticipated. Please review the ASFE document *"Important Information About Your Geotechnical Engineering Report"* located ahead of the Table of Contents for additional information regarding this report.

Respectfully submitted,
Geotechnical Services, Inc.

Prepared by,

James D. Sorgenfrei, P.E.
Project Engineer

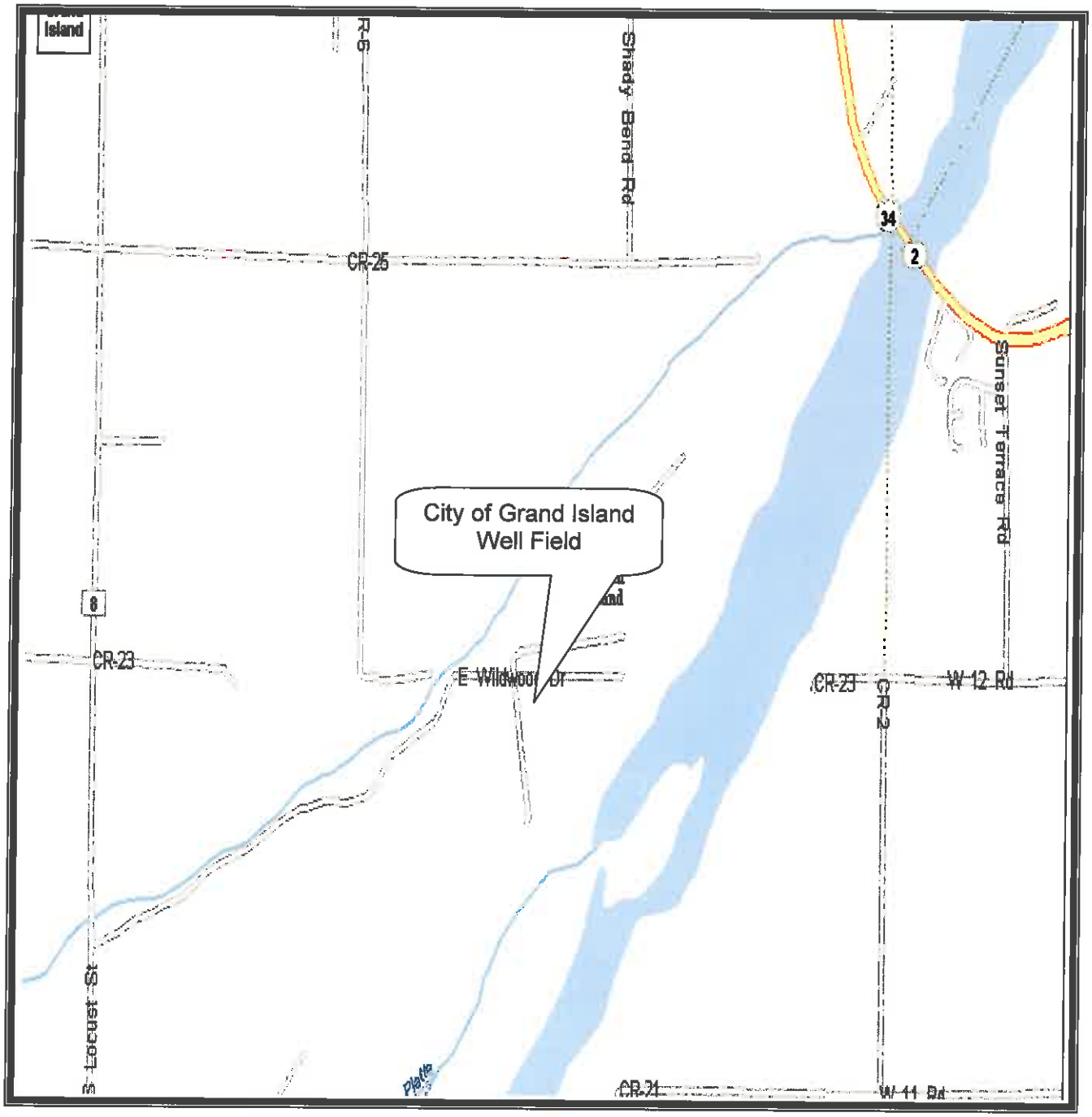
Reviewed by,

Clifford G. Plato, E.I.
Staff Engineer

APPENDIX A

General Vicinity Map

Boring Location Diagram



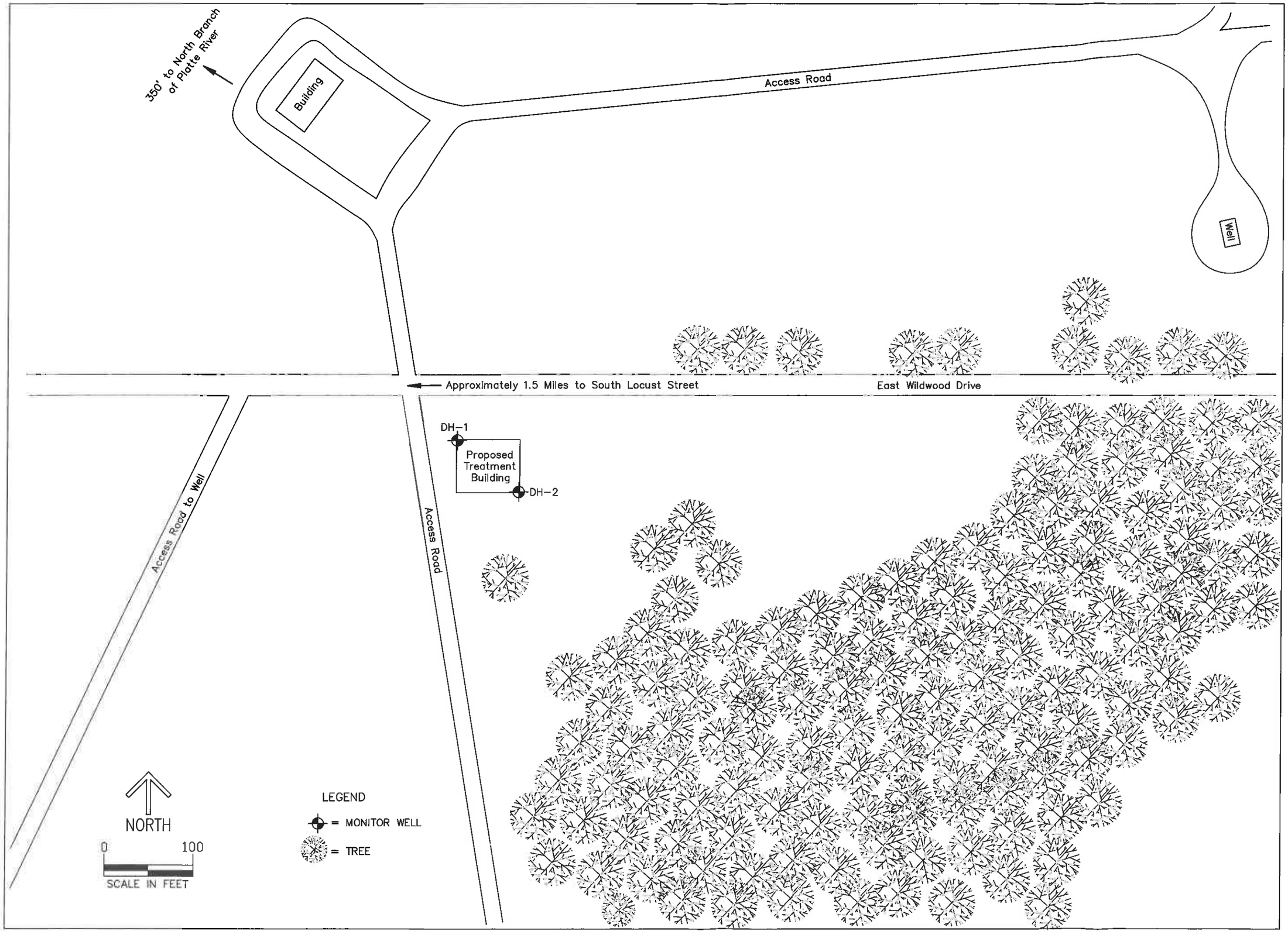
General Vicinity Map

Map obtained from Microsoft Streets & Trips

GSI

2960 N Diers Avenue • Grand Island, Nebraska 68803 • (308) 381-1987

Project	City of Grand Island Treatment Building
Location	Grand Island, Nebraska
Job No.	115164
Date	8/30/11



REVISED/REPRINTED	
DATE	BY

GSI

Geotechnical Services, Inc.
2960 North Diers Avenue
Grand Island, Nebraska

BORING LOCATION DIAGRAM

CITY OF GRAND ISLAND TREATMENT BUILDING
CITY WELL FIELD, EAST WILDWOOD DRIVE
GRAND ISLAND, NEBRASKA

GSI PROJECT#	115164
DRAWN	EAD
CHECKED	JS
DATE	08/25/11
ISSUE #	1
PRINT #	1

APPENDIX B

Boring Logs

Unified Soil Classification System (USCS)

BORING LOG No. DH-1

BORING NO.	LOCATION OF BORING	ELEVATION	DATUM	DRILLER	LOGGER
DH-1	See Boring Location Diagram			Matt Wold	Aaron Kreifels

WATER LEVEL OBSERVATIONS				TYPE OF SURFACE	DRILL RIG
WHILE DRILLING	END OF DRILLING	24 HOURS AFTER DRILLING		Grass	CME-45
				DRILLING METHOD	TOTAL DEPTH
5 Feet	5 Feet	Not Recorded		6 Inch Continuous Flight Augers	15 Feet

DEP FT.	SAMPLE DATA: SAMPLE NO. & TYPE	"N" BLOWS (FT)	% REC	SOIL DESCRIPTION: COLOR, MOISTURE, CONSISTENCY / GEOLOGIC DESCRIPTION & OTHER REMARKS	USCS CLASS	LABORATORY DATA: % MC	DRY DENS. pcf	Qu tsf	DEP FT.
				DEVELOPED ZONE Brown, Slightly Moist, Lean Clay	CL				
				1.0'					
	S-1	7		ALLUVIAL DEPOSITS Light Brown, Slightly Moist, Loose, Poorly Graded Sand, Fine Grained		14.4			
	S-2	17		Medium Dense, Medium to Coarse Grained with Gravel Below a Depth of 3 1/2 Feet		8.5			
5				Wet Below a Depth of 5 Feet					5 ▽
	S-3	14							
					SP				
	S-4	10							
10									10
	S-5	14							
15				15.0'					15
				Bottom of Boring @ 15'					
20									20
25									25
30									30
35									35

GSI Geotechnical Services, Inc.
2960 N. Diers Avenue, Grand Island, NE 68803
(308) 381-1987 Fax (308) 381-2467

PROJECT: City of Grand Island Treatment Building
LOCATION: East Wildwood Drive, Grand Island, NE
JOB NO.: 115164
DATE: 8/19/11

BORING LOG No. DH-2

BORING NO.	LOCATION OF BORING	ELEVATION	DATUM	DRILLER	LOGGER
DH-2	See Boring Location Diagram			Matt Wold	Aaron Kreifels

WATER LEVEL OBSERVATIONS				TYPE OF SURFACE	DRILL RIG
WHILE DRILLING	END OF DRILLING	24 HOURS AFTER DRILLING		Grass	CME-45
				DRILLING METHOD	TOTAL DEPTH
4 Feet	4 Feet	Not Recorded		6 Inch Continuous Flight Augers	10 Feet

DEP FT.	SAMPLE DATA: SAMPLE NO. & TYPE	"N" BLOWS (FT)	% REC	SOIL DESCRIPTION: COLOR, MOISTURE, CONSISTENCY / GEOLOGIC DESCRIPTION & OTHER REMARKS	USCS CLASS	LABORATORY DATA: % MC	DRY DENS. pcf	Qu tsf	DEP FT.
				DEVELOPED ZONE Brown, Slightly Moist, Lean Clay — 0.5'	CL				
	S-1	12		ALLUVIAL DEPOSITS Light Brown, Slightly Moist, Medium Dense, Poorly Graded Sand, Fine Grained		5.3			
5	S-2	9		Loose, Medium to Coarse Grained Below a Depth of 3 1/2 Feet Wet Below a Depth of 4 Feet	SP				5
	S-3	11		Medium Dense Below a Depth of 6 Feet					
10	S-4	12		Bottom of Boring @ 10' — 10.0'					10
15									15
20									20
25									25
30									30
35									35

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LOCATION: East Wildwood Drive, Grand Island, NE
JOB NO.: 115164
DATE: 8/19/11

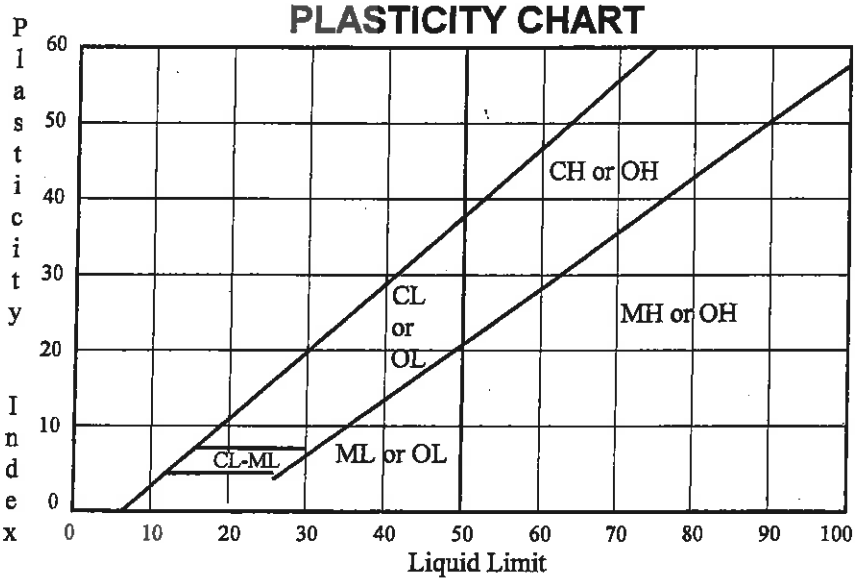
UNIFIED SOIL CLASSIFICATION SYSTEM

GROUP NAME	GROUP SYMBOL	SOIL DESCRIPTION	Comments
Peat	Pt	Highly organic soils	50% or more is smaller than No. 200 sieve
Fat Clay	CH	Clay - Liquid limit > 50% *	
Plastic Silt	MH	Silt - Liquid limit > 50% *	
Lean Clay	CL	Clay - Liquid limit < 50% *	
Silt	ML	Silt - Liquid limit < 50% *	
Silty Clay	CL-ML	Silty Clay *	
Clayey Sand	SC	Sands with 12 to 50 percent smaller than No. 200 sieve *	More than 50% is larger than No. 200 sieve and % sand > % gravel
Silty Sand	SM		
Poorly Graded Sand with Clay	SP-SC	Sands with 5 to 12 percent smaller than No. 200 sieve *	
Poorly Graded Sand with Silt	SP-SM		
Well Graded Sand with Clay **	SW-SC		
Well Graded Sand with Silt **	SW-SM		
Poorly Graded Sand	SP	Sands with less than 5 percent smaller than No. 200 sieve *	
Well Graded Sand **	SW		
Clayey Gravel	GC	Gravels with 12 to 50 percent smaller than No. 200 sieve *	More than 50% is larger than No. 200 sieve and % gravel > % sand
Silty Gravel	GM		
Poorly Graded Gravel with Clay	GP-GC	Gravels with 5 to 12 percent smaller than No. 200 sieve *	
Poorly Graded Gravel with Silt	GP-GM		
Well Graded Gravel with Clay **	GW-GC		
Well Graded Gravel with Silt **	GW-GM		
Poorly Graded Gravel	GP	Gravels with less than 5 percent smaller than No. 200 sieve *	
Well Graded Gravel **	GW		

* See Plasticity Chart for definition of silts and clays.

** See definition for well graded.

PLASTICITY CHART



LEGEND OF TERMS

SAMPLE IDENTIFICATION

U - Undisturbed (shelby tube)
S – Split-barrel/SPT (disturbed)
C - California Sampler
L - Lasky continuous sampler
A - Auger cuttings (sack sample)
B - Bulk sample (auger cuttings)
H - Head-space sample

CONSISTENCY OF COHESIVE SOILS

Unconfined Compressive Strength, Qu, psf

<500	Very Soft
500-1000	Soft
1000-2000	Medium Stiff (Firm)
2000-4000	Stiff
4000-8000	Very Stiff
>8000	Hard

RELATIVE DENSITY OF GRANULAR SOILS

N - blows per foot

0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense

GSI

CLASSIFICATION CRITERIA FOR SANDS AND GRAVELS

Well graded sands (SW) $C_u = D_{60}/D_{10} \geq 6$ and $C_c = (D_{30})^2/(D_{10} \times D_{60}) \leq 3$ and ≥ 1

Well graded gravels (GW) $C_u = D_{60}/D_{10} \geq 4$ and $C_c = (D_{30})^2/(D_{10} \times D_{60}) \leq 3$ and ≥ 1

Boulders	Cobbles	Coarse Gravel	Fine Gravel	Coarse Sand	Medium Sand	Fine Sand	FINES (silt or clay)
Sieve sizes 10"	3"		3/4"	#4	#10	#40	#200

2011/08/24

SECTION 02207
AGGREGATE MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aggregate materials.
   2. Source quality control.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. M147, Materials for Aggregate and Soil-Aggregate.
   2. ASTM International (ASTM):
      a. C33, Standard Specification for Concrete Aggregates.
      b. C136, Method for Sieve Analysis of Fine and Coarse Aggregates.
      c. D2487, Classification of Soils for Engineering Purposes.

1.3 SUBMITTALS FOR REVIEW

A. Samples: Submit, in air-tight containers, 10 LB (4.5 kg) sample of each type of aggregate to testing laboratory with sieve/gradation analysis.

B. Submit in accordance with Section 01340.

1.4 SUBMITTALS FOR INFORMATION

A. Materials Source: Submit name of imported materials suppliers.

PART 2 - PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Type "A"-Granular Embedment Material: Limestone, crushed natural stone; free of clay, shale, organic matter; graded in accordance with ASTM C33, size No. 67 (3/4 IN to #4 sieve).

B. Type "B"-Crushed Rock Foundation Material: Limestone, crushed natural stone; free of clay, shale, organic matter; graded in accordance with ASTM C33, size No. 357 (2 IN to #4 sieve).

C. Crushed Rock surfacing shall be approved by the City of Grand Island and have a gradation of the following:
   1. Total Passing 1-1/2 IN sieve 97 percent (±3 percent).
   2. Total Passing 1/2 IN sieve 5 percent (±5 percent).

D. Gravel Surfacing shall be approved by the City of Grand Island and have a gradation of the following:
   1. Total retained on 1 inch sieve 0 percent.
   2. Total retained on #4 sieve 22 percent (±17 percent).
   3. Total retained o #10 sieve 85 percent (±15 percent).

4. Total retained on #200 sieve 98 percent (±2 percent).

2.2 FINE AGGREGATE MATERIALS

A. Fill Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter, graded in accordance with ASTM C136 Symbol SW or SP; within the following limits:

SIEVE SIZE	PERCENT RETAINED
No. 4	0 to 25
No. 200	93 to 100

B. Effective size between 0.10 mm and 0.30 mm.

2.3 STABILIZED SAND BACKFILL

A. Stabilized sand backfill shall be mixed in the proportions of at least 282 LBS of Portland cement for each cubic yard of sand. Cement, sand (fine aggregate), and water shall be as specified for concrete.

B. Stabilized sand backfill is to be used were required and to fill existing manholes as indicated on the plans

2.4 SOURCE QUALITY CONTROL

A. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with AASHTO M147, ASTM C136, and ASTM D2487.

B. Fine Aggregate Material - Testing and Analysis: Perform in accordance with AASHTO M147, ASTM C136, and ATM D2487.

C. If tests indicate materials do not comply with specified requirements, change material or material source and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 STOCKPILING

A. Stockpile materials on site at locations designated by Engineer and Owner.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

2011/08/31

SECTION 02221
TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation, trenching, backfilling and compacting for all underground utilities.
   2. Water piping (potable, plant, process and nonpotable).
   3. Electrical ductbanks, conduits, and direct burial cables.
   4. All related utility and process appurtenances.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02200 - Earthwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C33, Standard Specification for Concrete Aggregates.
      b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
      c. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
      d. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
      e. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
   4. Submit sieve analysis reports on all granular materials.

B. Miscellaneous Submittals:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Trench shield (trench box) certification if employed:
      a. Specific to Project conditions.

b. Re-certified if members become distressed.
c. Certification by registered professional structural engineer, registered in the state where the Project is located.
d. Engineer is not responsible to, and will not, review and approve.

1.5 PROJECT CONDITIONS

A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.

B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.

D. Verify location of existing underground utilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Material:
1. As approved by Engineer.
a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
b. Moisture content at time of placement: ±3 percent of optimum moisture content as specified in accordance with ASTM D698.

B. Subgrade Stabilization Materials: Provide subgrade stabilization material consisting of well graded gravel.

C. Bedding Materials:
1. As approved by the Soils Engineer.
2. Granular bedding materials:
a. Granular material is generally utilized as follows:
1) PVC embedment.
2) Trench stabilization.
b. Two (2) general gradation classifications used for granular bedding are:
1) Uniformly graded
2) Well graded.
c. ASTM D2321 Class 1B.
1) Well-graded crushed stone.
d. ASTM C33, gradation 67 (3/4 IN to No. 4 sieve) defined below:

Sieve Size	1 IN	3/4 IN	3/8 IN	No. 4	No. 20
Percent Passing by Weight	100	90-100	20-55	0-10	0

3. Flowable fill:
a. Description: Flowable fill shall be a mixture of cement, fly ash, fine sand, water, and air having a consistency which will flow under a very low head.
b. Material characteristics:
1) The approximate quantities of each component per cubic yard of mixed material shall be as follows:
a) Cement (Type I or II): 50 LBS.
b) Fly ash: 200 LBS.
c) Fine sand: 2,700 LBS.

d) Water: 420 LBS.
e) Air content: 10 percent.

2) Actual quantities shall be adjusted to provide a yield of 1 CY with the materials used.
3) Approximate compressive strength should be 85 to 175 psi.
4) Fine sand shall be an evenly graded material having not less than 95 percent passing the No. 4 sieve and not more than 5 percent passing the No. 200 sieve.

PART 3 - EXECUTION

3.1 GENERAL

A. Remove and dispose of unsuitable materials as directed by Soils Engineer to site provided by Owner.

3.2 EXCAVATION

A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Soils Engineer.

B. Excavation for Appurtenances:
1. 12 IN (minimum) clear distance between outer surface and embankment.
2. See Section 02200 for applicable requirements.

C. Groundwater Dewatering:
1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade to allow stabilization, pipe, bedding and backfill material to be placed in the dry, and to maintain a stable trench wall or side slope.
2. Groundwater shall be drawn down and maintained at least 1 FT below the bottom of any trench or manhole excavation prior to excavation.
3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
a. Employ dewatering specialist for selecting and operating dewatering system.
4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
6. Install groundwater monitoring wells as necessary.
7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Cost of groundwater dewatering shall be included in the lump sum price.

D. Trench Excavation:
1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
1) Stabilize excavation to prevent undermining of existing utility and yard piping.
2. Open trench outside buildings, units, and structures:
a. No more than the distance between two (2) manholes, structures, units, or 300 LF, whichever is less.
b. Field adjust limitations as weather conditions dictate.
3. Trenching within buildings, units, or structures:
a. No more than 50 LF at any one time.

4. Any trench or portion of trench, which is opened and remains idle for seven (7) calendar days, or longer, as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
    a. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.
5. Observe following trenching criteria:
    a. Trench size:
        1) Excavate width to accommodate free working space.
        2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

OVERALL DIAMETER OF UTILITY SERVICE	EXCESS DIMENSION
33 IN and less	18 IN

        3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.
        4) Keep trenches free of surface water runoff.
            a) Include cost in Bid.
            b) No separate payment for surface water runoff pumping will be made.

E. Trenching for Electrical Installations:
1. Observe Paragraph 3.2D.
2. Modify for electrical installations as follows:
    a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN but not more than 30 IN wide.
    b. Any length of trench may be opened in exterior locations for trenches which are 12 IN wide or less.
    c. Do not over excavate trench.
    d. Cut trenches for electrical runs with minimum 30 IN cover, unless otherwise specified or shown on Drawings.
    e. See Division 16 for additional requirements.

F. Flowable Fill:
1. Flowable fill shall be:
    a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.
    b. Placed in 4 FT maximum lifts to the elevations indicated.
        1) Allow 12 HR set-up time before placing next lift or as approved by the Engineer.
        2) Contractor shall place flowable fill lifts in such a manner as to prevent flotation of the pipe.
2. Flowable fill shall not be placed on frozen ground.
3. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
4. Conform to appropriate requirements of Specification Section 02200.
5. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 DegF and rising.
6. At the time of placement, flowable fill must have a temperature of at least 40 DegF.
7. Mixing and placing shall stop when the air temperature is 38 DegF or less and falling.
8. Each filling stage shall be as continuous an operation as is practicable.
9. Contractor shall prevent traffic contact with flowable fill for at least 24 HRS after placement or until flowable fill is hard enough to prevent rutting by construction equipment.
10. Flowable fill shall not be placed until water has been controlled or groundwater level has been lowered in conformance with the requirements of Paragraph 3.2C. in this Specification Section.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Over-Excavation:
   1. Backfill and compact to 90 percent of maximum dry density per ASTM D698.
   2. Backfill with granular bedding material as option.

B. Rock Excavation:
   1. Excavate minimum of 6 IN below bottom exterior surface of the pipe or conduit.
   2. Backfill to grade with suitable earth or granular material.
   3. Form bell holes in trench bottom.

C. Subgrade Stabilization:
   1. Stabilize the subgrade when directed by the Owner.
   2. Observe the following requirements when unstable trench bottom materials are encountered.
      a. Notify Owner when unstable materials are encountered.
         1) Define by drawing station locations and limits.
      b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
         1) Replace with subgrade stabilization with no additional compensation.

3.4 BACKFILLING METHODS

A. Do not backfill until tests to be performed on system show system is in full compliance to specified requirements.

B. Carefully Compacted Backfill:
   1. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 IN above top of pipe or conduit.
   2. Comply with the following:
      a. Place backfill in lifts not exceeding 8 IN (loose thickness).
      b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
      c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
      d. Compact each lift to specified requirements.

C. Common Trench Backfill:
   1. Perform in accordance with the following:
      a. Place backfill in lift thicknesses capable of being compacted to densities specified.
      b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
      c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.

D. Water flushing for consolidation is not permitted.

E. Backfilling for Electrical Installations:
   1. Observe Paragraph 3.4B. or C. or when approved by the Engineer.
   2. Modify for electrical installation as follows:
      a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.5 COMPACTION

A. General:
   1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
   2. In no case shall degree of compaction below minimum compactions specified be accepted.

B. Compaction Requirements:
1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.
a. Bedding material:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	75 percent of maximum relative density by ASTM D4253 and ASTM D4254

b. Carefully compacted backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All applicable areas	Cohesive soils	100 percent of maximum dry density by ASTM D698
	Cohesionless soils	75 percent of maximum relative density by ASTM D4253 and ASTM D4254

c. Common trench backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
Under pavements, roadways, surfaces within highway right-of-ways	Cohesive soils	100 percent of maximum dry density by ASTM D698
	Cohesionless soils	60 percent of relative density by ASTM D4253 and ASTM D4254
Under turfed, sodded, plant seeded, non-traffic areas	Cohesive soils	92 percent of maximum dry density by ATM D698
	Cohesionless soils	60 percent of relative density by ASTM D4253 and ASTM D4254

3.6 FIELD QUALITY CONTROL

A. Testing:
1. Perform in-place moisture-density tests as directed by the Owner.
2. Perform tests through recognized testing laboratory approved by Owner.
3. Costs of "Passing" tests paid by Contractor.
4. Perform additional tests as directed until compaction meets or exceeds requirements.
5. Cost associated with "Failing" tests shall be paid by Contractor.
6. Reference to Engineer in this Section will imply Soils Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
7. Assure Owner has immediate access for testing of all soils related work.
8. Ensure excavations are safe for testing personnel.

END OF SECTION

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SECTION 02260
TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Topsoiling and finished grading.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02110 - Site Clearing.
   4. Section 02200 - Earthwork.
   5. Section 02930 - Seeding, Sodding and Landscaping.

C. Location of Work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.2 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Project Data: Test reports for furnished topsoil.

1.3 SITE CONDITIONS

A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:
   1. Original surface soil typical of the area.
   2. Existing topsoil stockpiled under Section 02110.
   3. Capable of supporting native plant growth.

2.2 TOLERANCES

A. Finish Grading Tolerance: ±0.1 FT from required elevations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Correct, adjust and/or repair rough graded areas.
   1. Cut off mounds and ridges.
   2. Fill gullies and depressions.
   3. Perform other necessary repairs.
   4. Bring all sub-grades to specified contours, even and properly compacted.

B. Loosen surface to depth of 2 IN, minimum.

C. Remove all stones and debris over 2 IN in any dimension.

3.2 ROUGH GRADE REVIEW

A. Reviewed by Engineer in Section 02110, Site Clearing.

3.3 PLACING TOPSOIL

A. Do not place when subgrade is wet or frozen enough to cause clodding.

B. Spread to compacted depth of 4 IN for all disturbed earth areas.

C. If topsoil stockpiled is less than amount required for work, furnish additional topsoil at no cost to Owner.

D. Provide finished surface free of stones, sticks, or other material 1 IN or more in any dimension.

E. Provide finished surface smooth and true to required grades.

F. Restore stockpile area to condition of rest of finished work.

3.4 ACCEPTANCE

A. Upon completion of topsoiling, obtain Engineer's acceptance of grade and surface.

B. Make test holes where directed to verify proper placement and thickness of topsoil.

END OF SECTION

2011/08/31

SECTION 02502
CONCRETE PAVEMENT, CURB, SIDEWALK AND STEPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete pavement, curb, sidewalk, and steps.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02200 - Earthwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. M74, Sheet Materials for Curing Concrete.
      b. M148, Liquid Membrane-Forming Compounds for Curing Concrete.
      c. M153, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers (ASTM D1752) for Concrete Paving and Structural Construction.
      d. M171, Sheet Materials for Curing Concrete.
      e. M182, Burlap Cloth Made from Jute or Kenef.
      f. M213, Standard Specification for Preformed Expansion Joint Fillers (ASTM D1751) for Concrete Paving and Structural Construction.
      g. M224, Protective Coatings for Portland Cement Concrete.
      h. M233, Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
   2. American Concrete Institute (ACI):
      a. 211, Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
      b. 214, Recommended Practice for Evaluation of Strength Test Results for Concrete.
      c. 305R, Hot Weather Concreting.
      d. 306R, Cold Weather Concreting.
      e. 316, Standard Specifications for Concrete Pavement and Concrete Bases.
      f. 325, Recommended Practice for the Design of Concrete Pavements.
   3. ASTM International (ASTM):
      a. A185, Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
      b. A615, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (Including Supplementary Requirements S1).
      c. C33, Standard Specification for Concrete Aggregates.
      d. C150, Standard Specification for Portland Cement.
      e. C174, Measuring Length of Drilled Concrete Cores.
      f. C227, Standard Test Methods for Potential Alkali Reaction.
      g. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
      h. C295, Practice for Petrographic Examination of Aggregates for Concrete.
      i. C309, Standard Specification Liquid Membrane-Forming Compounds for Curing Concrete.
      j. D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).

k. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding Bituminous Type).
l. D1752, Standard Specification for Preformed Sponge Rubber and Cork Preformed Expansion Joint Filler for Concrete Paving and Structural Construction.
m. D4253, Standard Test Methods for Maximum Index Density of Soils Using a Vibratory Table.
n. D4254, Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.

4. Federal Specification (FS):
   a. SS-S-1614, Sealants, Joint, Jet-Fuel-Resistant, Hot-Applied for Portland Cement and Tar Concrete Pavements.
   b. TT-P-115, Paint, Traffic (Highway, White and Yellow).
   c. TT-S 00227 E(3), Sealing Compound: Elastomeric Type, Multi-Component (for Calking, Sealing, and Glazing in Buildings and Other Structures.
5. Nebraska Department of Road (NDOR)
   a. NDOR Standard Specifications for Highway Construction: Section 305 – Crushed Rock Base Course.
   b. NDOR Standard Specifications for Highway Construction: Section 307 - Foundation Course.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Mix design(s).
   4. Qualifications of concrete installer.
   5. Drawings detailing all reinforcing.
   6. Scaled cross section detail of crown template with dimensions showing off sets from level line.
   7. Concrete pavement joint pattern for paved areas.
   8. Test reports:
      a. Concrete cylinder test results from field quality control.

B. Samples:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Samples of fabricated jointing materials and devices.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150, Type I or II.

B. Aggregates:
   1. ASTM C33, gradation size #67, 3/4 IN to #4.
   2. Clean, crushed gravel.

C. Water: Potable quality.

D. Admixtures.

E. Reinforcing Bars: ASTM A615, Grade 60.

F. Welded Wire Reinforcement:
   1. ASTM A185.
   2. Flat.
   3. Clean, free from dirt, scale, rust.

G. Preformed Joint Filler:
   1. Non-extruding cork, self-expanding cork, sponge rubber or cork rubber.
   2. AASHTO M153 or AASHTO M213.

H. Hot-Poured Joint Sealing Material:
   1. FS SS-S-1614.

I. Sidewalk Joint Sealant:
   1. Two (2) compound polyurethane.
   2. Class A, Type 1.
   3. Self-leveling.
   4. Non-tracking.
   5. FS TT-S 00227 E(3).

J. Membrane Curing Compound: ASTM C309.

K. Cover Materials for Curing:
   1. Burlap:
      a. AASHTO M182.
      b. Minimum Class 2, 8 0Z material (1 YD x 42 IN).
   2. Polyethylene film.
      a. AASHTO M171.

L. Concrete Treatment:
   1. Boiled linseed oil mixture.
   2. AASHTO M233.

M. Traffic Paint: FS TT-P-115, Type 1 - Alkyd.

N. Forms:
   1. Steel or wood.
   2. Size and strength to resist movement during concrete placement and able to retain horizontal and vertical alignment.
   3. Free of distortion and defects.
   4. Full depth.
   5. Metal side forms:
      a. Minimum 7/32 IN thick.
      b. Depth equal to edge thickness of concrete.
      c. Flat or rounded top minimum 1-3/4 IN wide.
      d. Base 8 IN wide or equal to height, whichever is less.
      e. Maximum deflection 1/8 IN under center load of 1,700 LBS.
      f. Use flexible spring steel forms or laminated boards to form radius bends.

O. Crushed Rock Surfaces:
   1. Crushed rock screenings meeting NDOR crushed rock screenings for base course gradation requirements.
   2. Crushed concrete meeting NDOR crushed concrete foundation course gradation requirements.

2.2 MIXES

A. Mix design to provide 4,000 psi 28-day compressive strength, 1-1/2 IN +1 IN slump, 6 percent air.

PART 3 - EXECUTION

3.1 PREPARATION

A. Subgrade Preparation:
   1. Prepare using methods, procedures, and equipment necessary to attain required compaction densities, elevation and section.
   2. Scarify and recompact top 12 IN of fills and embankments which will be under paved areas.
   3. Remove soft or spongy areas.
   4. Replace with aggregate material.
   5. Compact as described in Section 02200.
   6. Assure moisture content is within limits prescribed to achieve required compaction density.
   7. Following compaction, trim and roll to exact cross section. Check with approved grading template.
   8. Perform density tests on subgrade to determine that subgrade complies with the specification.

B. Loose and Foreign Material: Remove loose and foreign material immediately before application of paving.

C. Appurtenance Preparation:
   1. Block out or box out curb inlets and curb returns.
   2. Provide for joint construction as detailed and dimensioned on Drawings.
   3. Adjust manholes, inlets, valve boxes and any other utility appurtenances to design grade.
      a. Secure to elevation with concrete.
      b. Place concrete up to 5 IN below design grade.
   4. Headers:
      a. Construct at open ends of pavements.
      b. Use same concrete to construct headers as that used in the abutting structure.
      c. Extend header full width of pavement and crown same as pavement.
   5. Clean and oil forms.

3.2 INSTALLATION

A. Forms:
   1. Form support:
      a. Compact soil foundation and cut to grade to support forms and superimposed machine loads.
      b. Use bearing stakes driven flush with bottom of form to supplement support as necessary.
      c. Do not use earth pedestals.
   2. Staking forms:
      a. Joint forms neatly and tightly.
      b. Stake and pin securely with at least three (3) pins for each 10 FT section.
   3. Clean and oil forms prior to placement of concrete.
   4. Set forms sufficiently in advance of work (minimum of 2 HRS) to permit proper inspection.
   5. Previously finished concrete pavement, curb or sidewalk contiguous with new work may serve as side form when specifically approved.

B. Reinforcing:
   1. Locate longitudinal edge bars between 3 and 6 IN from edge of slab.
   2. Lap mats one (1) full space.
   3. Tie end transverse member of upper mat securely to prevent curving.
   4. Lap non-welded bars 12 IN minimum.
   5. Support:
      a. Place bars and heavy mats securely on chairs at called-for height.
      b. Place other fabric on the first of a two-course pour and cover promptly with final pour, or place fabric by a fabric-placer if procedure is reviewed and approved by Engineer.

C. Joints:
1. Hold joint location and alignment to within +1/4 IN.
2. Finish concrete surface adjacent to previously placed slab to within +1/8 IN, with tooled radius of 1/4 IN.
3. Metal keyway joints:
a. Form by installing metal joint strip left in place.
b. Stake and support like side form.
c. Provide dowels or tie bars.
4. Weakened plane joints:
a. Tooled joints:
1) Form groove in freshly placed concrete with tooling device.
2) Groove dimensions shall be 3/8 IN at surface and 1/4 IN at root.
b. Sawed joints:
1) Saw 1/4 IN groove in green concrete.
2) Commence sawing as soon as concrete is hard enough to withstand operation without chipping, spalling or tearing, regardless of nighttime or weather.
3) Thoroughly wet surface to protect membrane cure and recoat afterward.
4) Complete saw cutting before shrinkage stresses cause cracking.
c. Locate at 6 FT intervals.
5. Stake in place load transfer device for expansion joints consisting of dowels:
a. Supporting and spacing means and premolded joint filler as per Drawing details.
b. Located at 48 FT intervals and at all intersection curb returns.
c. Provide preformed joint filler at all junctions with existing curb, sidewalk, steps, or other structures.
6. Install construction joints at end of day's work or wherever concreting must be interrupted for 30 minutes or more.
7. Thoroughly clean and fill joints with joint sealing material as specified.
8. Fill joints without overflowing onto pavement surface.
9. Upper surface of filled joint to be flush to 1/8 IN below finish surface.

D. Place Concrete:
1. Construct driveway openings, ramps, and other features as per Drawing details.

E. Cold and Hot Weather Concreting:
1. Cold weather:
a. Cease concrete placing when descending air temperature in shade falls below 40 DegF.
b. Do not resume until ambient temperature rises to minimum 40 DegF.
c. If placing below 40 DegF is authorized by Engineer, maintain temperature of mix between 60 and 80 DegF.
d. Heat aggregates or water or both.
e. Water temperature may not exceed 175 DegF.
f. Aggregate temperature may not exceed 150 DegF.
g. Remove and replace frost damaged concrete.
h. Salt or other antifreeze is not permitted.
i. Comply with ACI 306R.
2. Hot weather:
a. Cease concrete placing when plastic mix temperature cannot be maintained under 90 DegF.
b. Aggregates or water or both may be cooled.
c. Cool water with crushed ice.
d. Cool aggregates by evaporation of water spray.
e. Never batch cement hotter than 160 DegF.
f. Comply with ACI 305R.

F. Finishing:
1. As soon as placed, strike off and screed to crown and cross section, slightly above grade, so that consolidation and finishing will bring to final Drawing elevations.

2. Maintain uniform ridge full width with first pass of first screed.
3. Pavement and similar surfaces:
    a. Float by longitudinally reciprocating float, passing gradually from edge to edge.
    b. Assure successive advances do not exceed half the length of the float.
    c. Test level of slab with minimum 10 FT straightedge.
    d. Fill depressions with fresh material, consolidate and refinish.
    e. Cut down high areas and retest.
    f. Belt surface with two-ply canvas belt, using transverse strokes while advancing along center line.
    g. Provide final finish by full width burlap or carpet drag, drawn longitudinally.
    h. Keep drag clean to avoid build up and consequent scarring.
    i. Tool pavement edges with suitable edger.
    j. Retest with straightedge and if pavement shows deviation of more than 1/8 IN in 10 FT, remove and replace.
4. Curb and similar surfaces:
    a. Bring curb to grade by running straightedge over steel templates with sawing motion.
    b. Float surface with a wood float to draw cement to surface.
    c. Broom finish after floating.
    d. Tool edges with suitable edger.
    e. Upon removal of forms, fill honeycombed or unevenly filled sections immediately with cement mortar.
    f. Assure that expansion joints are cleared of concrete.
5. Sidewalk, steps, ramps, and similar surfaces:
    a. Test with 6 FT straightedges equipped with long handles and operated from off the sidewalk.
    b. Draw excess water and laitance off from surface.
    c. Float finish so as to leave no disfiguring marks but to produce a uniform granular or sandy texture.
    d. Broom finish after floating.
    e. Tool pavement edges with suitable edger.
    f. Provide exposed aggregate surfaces in areas indicated on the Drawings.
    g. Provide method such as abrasive blasting, bush hammering, or surface retarder acceptable to the Engineer.

G. Curing:
1. Apply membrane curing compound complying with ASTM C309, and in accordance with manufacturer's directions but at a minimum rate of 200 SF per gallon.
2. Apply curing compound within 4 HRS after finishing or as soon as surface moisture has dissipated.
3. Cure for minimum of 7 days.
4. When average daily temperature is below 50 DegF, provide insulative protection of 12 IN minimum thickness loose dry straw, or equivalent, for 10 days.
5. Linseed oil sealant:
    a. For concrete pavement or sidewalk, seal surface with linseed oil.
    b. Apply linseed oil to clean surface as per AASHTO M224 after concrete has cured for 1 month.
    c. Apply first application at minimum rate of 67 SY per gallon.
    d. Apply second application to a dry surface at minimum rate of 40 SY per gallon.

H. Protection of Concrete:
1. Protect concrete surfaces and appurtenances from traffic for minimum of 14 days.
2. Erect and maintain warning signs and lights to direct traffic.
3. Repair or replace parts of concrete surfaces damaged by traffic, or other causes, occurring prior to final acceptance.
4. Protect concrete pavement against public traffic, construction traffic and traffic caused by employees and agents.

5. No equipment shall be driven or moved across concrete surfaces unless such equipment is rubber-tired and only if concrete is designed for and capable of sustaining loads to be imposed by the equipment.
6. Do not drive over new or existing concrete with tracked vehicles and equipment.

I. Opening to Traffic:
1. After 14 days, pavement may, at Owner's discretion, be opened to traffic if job cured test cylinders have attained a compressive strength of 3,000 LBS per square inch when tested in accordance with ASTM standard methods.
2. Prior to opening to traffic, clean and refill joints as required with the specified filler material.

J. Clean Up:
1. Assure clean up work is completed within 2 weeks after pavement has been opened to traffic.
2. No new work will begin until clean up work has been completed, or is maintained within 2 weeks after pavement has been opened to traffic.

K. Pavement Patching:
1. Comply with material and density requirements as mentioned elsewhere in this Specification except provide minimum 6 IN aggregate immediately below the patch.
2. Place pavement patch providing a thickened edge.
3. Assure that patch in plane of "cold" joint has a thickness 6 IN greater than that of the existing pavement.
4. Extend patch under existing pavement for a distance of 6 IN minimum.
5. Fill void under existing pavement with concrete.
6. Undercut existing pavement 6 IN all around patch and to a depth of 6 IN.
7. Prior to placing patch, sawcut edge of existing concrete to 1/4 depth and remove to provide a vertical face for a straight and true joint.

3.3 FIELD QUALITY CONTROL

A. Provide test cylinders for strength testing for each 50 CY of concrete placed.

END OF SECTION

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2011/08/31

SECTION 02930
SEEDING, SODDING AND LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Seeding, sodding and landscape planting:
      a. Soil preparation.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02260 - Topsoiling and Finished Grading.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. AOAC International (AOAC).
   2. ASTM International (ASTM):
      a. D2028, Standard Specification for Cutback Asphalt (Rapid-Curing Type).
      b. D5276, Standard Test Method for Drop Test of Loaded Containers by Free Fall.

B. Quality Control:
   1. Fertilizer:
      a. If Engineer determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of the AOAC.
      b. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.
      c. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Signed copies of vendor's statement for seed mixture required, stating each seed type, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag. The Contractor shall obtain from the seed dealer and furnish to the Utilities Department, an analysis of each type and lot of seed they propose to use. The analysis shall provide complete information on the seed as required by State and Federal seed laws.
      d. Type of herbicide to be used during first growing season to contain annual weeds and application rate.
   3. Certification that each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.

B. Miscellaneous Submittals:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.

2. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Furnish seed in sealed standard containers labeled with producer's name and seed analysis.
   1. Remove from the site seed which has become wet, moldy, or otherwise damaged in transit.

B. Furnish fertilizer uniform in composition, free flowing and suitable for application with approved equipment, delivered to site in bags or other containers, each fully labeled and bearing the name, and warranty of the producer.

1.5 SEQUENCING AND SCHEDULING

A. Installation Schedule:
   1. Show schedule of when lawn type and other grass areas are anticipated to be planted.
   2. Indicate planting schedules in relation to schedule for finish grading and topsoiling.
   3. Indicate anticipated dates Owner will be required to review installation for initial acceptance and final acceptance.

B. Pre-installation Meeting:
   1. Meet with Owner and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Seed Quality:
   1. Fresh, clean, new-crop seed labeled in accordance with USDA Rules and Regulations under the Federal Seed Act in effect on date of bidding.
   2. Provide seed of species, proportions, and minimum percentages of purity, germination and maximum percentage of weed seed as specified.
   3. Approval of all seed for use shall be based on the accumulative total of PLS specified for each phase of work.

B. The seed mixture shall comply with the following as specified for State of Nebraska Area 3B:

SEED TYPE	POUNDS PER ACRES	MINIMUM PERCENT PURITY
Switchgrass, NE 28, Pathfinder, Blackwell, Trailblazer	2	85%
Sideoaks Grama, Buttle, Trailway	2	85%
Blue Grama, NE, KS, CO	1	85%
Big Bluestem, Champ	2	85%
Little Bluestem, Blaze, Camper	1	85%
Intermediate Wheatgrass, Slate, Oahe	3	85%
Western Wheatgrass, Barton, Flintlock	5	85%
Hairy Vetch, 2 x inoculation	3	85%
Alfalfa, Ranger, Travois	0.25	85%

C. Asphalt Binder: Emulsified asphalt per State specifications.

D. Water:
   1. Water free from substances harmful to grass or sod growth.
   2. Provide water from source approved prior to use.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. General:
   1. Limit preparation to areas which will be planted soon after.
   2. Provide facilities to protect and safeguard all persons on or about premises.
   3. Protect existing trees designated to remain.
   4. Verify location and existence of all underground utilities.
      a. Take necessary precaution to protect existing utilities from damage due to construction activity.
      b. Repair all damages to utility items at sole expense.
   5. Provide facilities such as protective fences to protect work from vandalism.
      a. Contractor to be responsible for vandalism until acceptance of work in whole or in part.

B. Preparation for Seeding:
   1. Not more than five (5) days prior to the sowing of seed, the seed bed shall be prepared by loosening the soil to a depth of not less than two (2) inches by discing, harrowing, raking or by other approved means. Several discings, harrowing, or similar means may be required to provide a satisfactory seedbed. Discing, harrowing and raking shall be longitudinal on all slopes.
   2. Existing weed stubble and small weeds shall be cut and partially incorporated into the soil during the seedbed preparation work. All other growth of vegetation what will interfere with seeding operations shall be removed. Extreme care shall be exercised to avoid injury to trees and shrubs.
   3. Prior to applying fertilizer, loosen areas to be seeded with a double disc or other suitable device if the soil has become hard or compacted.
   4. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
   5. Incorporate fertilizer into soil to a depth of at least 2 IN by disking, harrowing, or other approved methods.
   6. Remove stones or other substances from surface which will interfere with seed development.
   7. Grade areas to a smooth, even surface with a loose, uniformly fine texture.
      a. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
      b. Limit fine grading to areas which can be planted soon after preparation.
   8. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.

3.2 INSTALLATION

A. Seeding:
   1. The Contractor shall notify the City at least 48 hours in advance of the time they intend to begin work.
   2. The Contractor shall prepare seed bed, seed and fertilize, and provide protection on slopes.
   3. The grass seed is to be delivered in containers showing analysis of seed mixture, percentage of pure seed, year of production, net weight, and date of packaging and location of packaging.
   4. Fertilizer is to be delivered in waterproof bags showing weight, chemical analysis, and name of manufacturer. Apply fertilizer at a rate of 250 pounds per acre, or as recommended by fertilizer manufacturer, uniformly over all areas to be seeded.

5. Seeing operations shall be performed only during the periods between March 1 and June 1 and between August 1 and December 31 except by express written permission from the City. No work shall be performed during excessively windy weather or when the ground is frozen, wet or otherwise untellable.
6. Do not use seed which is wet, moldy, or otherwise damaged.
7. For seeding, approved mechanical power drawn drills, broadcast type seeder or hydraulic seeders may be used. When drills are used, they shall be equipped with press wheels or drag chains. When broadcast type seeders or hydraulic seeders are used, the seed shall be harrowed with the exception of slopes too steep to operate equipment on. Seeded areas should be packed to reduce evaporation and provide good soil-seed contact.
8. Hydraulic seeding equipment shall include a pump, rated and operated at 100 gallons per minute and at 100 pounds per square inch pressure. The equipment shall have a suitable pressure gauge and a nozzle adapted to the type of work. Storage tanks of irregular shapes shall have a means of estimating the volume used or remaining in the tank.
9. Mechanical power-drawn drills shall have depth bands set to maintain a planting depth of one-half inch to one inch.
10. Growing Media shall be existing topsoil, capable of sustaining vigorous plant growth, not in frozen or muddy condition, containing not less that 6% organic matter, and free from subsoil, slag, clay, stones, lumps, live plants, roots, sticks, noxious weeds, and foreign matter. All contaminated subsoil is to be removed. Cultivate subsoil to a depth of 3 IN with a layer of 6 IN of top soil spread over the area to be seeded. The topsoil is to be cultivated to a depth of 6 IN and raked until smooth. Grade soil to eliminate rough spots and low areas, where ponding may occur. Maintain a uniform smooth grade.
11. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
    a. Resume work only when favorable conditions develop.
12. Lightly rake seed into soil followed by light rolling or cultipacking.
13. Within 48 HRS after sowing the seed, protect seeded areas against erosion by mulching.
    a. Areas to be mulched shall be the same as the seeded area or as otherwise designated by the City. The Contractor shall furnish the necessary equipment, and assistance needed to insure that specified quantities of mulch are being placed. The mulch shall be loose enough to allow sunlight to penetrate and air to slowly circulate, but thick enough to shade the ground, reduce the rate of water evaporation and prevent or reduce water or wind erosion.
    b. Mulch shall be either dry cured native hay or dry threshed grain straw applied at the rate of 2 tons per acre. Hay or straw shall be free from leafy spurge, spotted knapweed, other noxious weeds, and relatively free from all other weeds.
14. The mulch shall be applied with a mulch blowing machine or other approved methods at the rate specified.
15. Immediately following the spreading of the mulch, the material shall be anchored to the soil by a V-type wheel land packer, a soil erosion mulch tiller, or other suitable equipment which will secure the mulch firmly to form soil-binding mulch.

3.3 MAINTENANCE AND REPLACEMENT

A. General:
1. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated below, whichever is the longer.
2. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.
3. Protection of new materials:
    a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain.
    b. Repair and pay for all damaged items.

4. Replace unacceptable materials with materials and methods identical to the original specifications unless otherwise approved by the Engineer.

B. Seeded Lawns:
   1. Maintain seeded lawns: 60 days, minimum, after installation and review of entire project area to be planted.
   2. Maintenance period begins at completion of planting or installation of entire area to be seeded or sodded.
   3. Owner will review seeded or sodded lawn area after installation for initial acceptance.
   4. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, uniform lawn, free of weeds and eroded or bare areas.
   5. Lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas.
      a. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch.
   6. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose.
      a. Anchor as required to prevent displacement.
   7. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.
   8. Replant bare areas using same materials specified.
   9. Owner will review final acceptability of installed areas at end of maintenance period.

END OF SECTION

1

DIVISION 7

THERMAL AND MOISTURE PROTECTION

2011/08/30

SECTION 07900
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sealant work.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

C. Work included consists of but is not necessarily limited to:
   1. Sealing all joints which will permit penetration of dust, air or moisture, unless sealing work is specifically required under other sections.
      a. Work may include the following:
         1) Flashing.
         2) Exterior wall joints.
         3) Masonry control joints, exterior and interior and between masonry and other materials.
         4) Flooring joints.
         5) Isolation joints.
         6) Joints between paving or sidewalks and building.
         7) Concrete construction, control and expansion joints, exterior and interior.
         8) Sawed joints in interior concrete slabs.
         9) Joints at penetrations of walls, floors and decks by piping and other services and equipment.
         10) Exterior and interior perimeters of exterior and interior door and window frames, louvers, grilles, etc.
         11) Thresholds at exterior doors.
         12) Sealing of plumbing fixtures to floor or wall.
         13) Sealing around piping, duct or conduit penetrations through roof, floors, interior and exterior walls.
         14) Other joints where calking, sealant, expanding foam sealant or compressible sealant is indicated.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 302.1R, Guide for Concrete Floor and Slab Construction.
   2. ASTM International (ASTM):
      a. C920, Standard Specification for Elastomeric Joint Sealants.
      b. C1521, Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
   3. National Sanitation Foundation International (NSF).
   4. Underwriters Laboratories, Inc. (UL).

B. Qualifications: Sealant applicator shall have minimum five (5) years experience using products specified on projects with similar scope.

C. Mock-Ups:
1. Before calking work is started, a mock-up of each type of joint shall be calked where directed by the Engineer.
a. The approved mock-ups shall show the workmanship, bond, and color of calking materials as specified or selected for the work and shall be the minimum standard of quality on the entire project.

1.3 DEFINITIONS

A. "Caulk(ing)," "calk(ing)," and "sealant": Joint sealant work.

B. "Interior wet areas": Toilets, showers, laboratories, wet wells and similar areas.

C. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

D. Finish sealant: Sealant material per this specification applied over face of compressible sealant or expanding foam sealant specified, to provide a finished, colored sealant joint.

E. Defect(ive): Failure of watertightness or airtightness.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's installation instructions.
c. Manufacturer's recommendations for joint cleaner, primer, backer rod, tooling and bond breaker.
3. Warranty.
4. Certification from sealant manufacturer stating product being used is recommended for and is best suited for joint in which it is being applied.
5. Certification of applicator qualification.

B. Samples:
1. Cured sample of each color for Engineer's color selection.
2. Color chart not acceptable.

C. Miscellaneous Submittals: See Section 01340 for requirements for the mechanics and administration of the submittal process.

D. Test Results:
1. Provide adhesion test results for each sealant sample providing adhesion results compared to adhesion requirements.
2. Manufacturer's authorized factory representative recommended remedial measure for all failing tests.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original unopened containers with labels intact: Labels shall indicate contents and expiration date on material.

1.6 WARRANTY

A. Material and Labor Warranty:
1. Sealant work free of defects for a period of three (3) years from date of final acceptance.
2. Remove any defective work or materials and replace with new work and materials.
3. Warranty signed jointly by Applicator and sealant manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Polyurethane sealants:
      a. Pecora.
      b. Sika Chemical Corp.
      c. Sonneborn - Rexnord.
      d. Tremco.
   2. Silicone sealants:
      a. General Electric.
      b. Dow Corning Corp.
      c. Tremco.
   3. Polysulfide rubber sealant:
      a. Pecora.
      b. Sonneborn.
      c. Morton Polymer Systems.
   4. Expanding foam sealant:
      a. Macklanburg Duncan.
      b. Convenience Products.
      c. FAI International, Inc.
   5. Polyurea joint filler:
      a. Dayton Superior Specialty Chemical Corporation.
      b. Euclid Chemical Co.
      c. L & M Construction Chemicals, Inc.
      d. Sonneborn.
   6. Backer rod, compressible filler, primer, joint cleaners, bond breaker: As recommended by sealant manufacturer.

2.2 MATERIALS

A. Sealants - General:
   1. Provide colors matching materials being sealed.
   2. Where compound is not exposed to view in finished work, provide manufacturer's color which has best performance.
   3. Nonsagging sealant for vertical and overhead horizontal joints.
   4. Sealants for horizontal joints: Self-leveling pedestrian/traffic grade.

B. Polyurethane Sealant:
   1. One (1) or two (2) components.
   2. Paintable.
   3. Meet ASTM C920 Type S or Type M, Grade NS or P, Class 25, Use NT, T, M, A and O.
      a. Pecora Dynatrol-IXL, Dynatrol II, Urexpan NR-200, NR-201.
      b. Sika Chemical Corporation Sikaflex-1a, Sikaflex-2C NS/SL.
      c. Sonneborn Sonolastic NP-1, NP-II, SL-1 SL-2.
      d. Tremco Dymonic or Dymeric, Vulkem 116,227,45,245.

C. Silicone Sealant:
   1. One (1) component.
   2. Meet ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, O.
      a. General Electric: Silpruf, Silglaze II.
      b. General Electric: Sanitary 1700 sealant for sealing around plumbing fixtures.
      c. Dow Corning: 786 for sealing around plumbing fixtures.
      d. Dow Corning: 790, 795.
      e. Tremco: Spectrem 1, Spectrem 3, Tremsil 600.

3. Mildew resistant for sealing around plumbing fixtures.

D. Joint Cleaner, Primer, Bond Breaker: As recommended by sealant manufacturer.

E. Sealant Backer Rod and/or Compressible Filler:
   1. Closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, nonabsorbent, nonbituminous material recommended by sealant manufacturer to:
      a. Control joint depth.
      b. Break bond of sealant at bottom of joint.
      c. Provide proper shape of sealant bead.
      d. Serve as expansion joint filler.

F. Adhesive, Compressible Sealant: As recommended by sealant manufacturer.

G. Expanding Foam Sealant:
   1. One (1) or two (2) component fire rated moisture cured expanding urethane.
   2. Shall not contain formaldehyde.
   3. Density: Minimum 1.5 pcf.
   4. Minimum 70 percent closed cell content.
   5. R-value minimum 5.0/IN.
   6. Flame spread: Less than 25.
   7. Smoke developed: Less than 25.

H. Polysulfide Rubber Sealant:
   1. One (1) or two (2) component.
   2. Meet ASTM C920.
      a. Pecora Synthacalk GC2+.
      b. Sonneborn - Sonolastic - two-part polysulfide sealant.
      c. Morton Polymer Systems - Thiokol Sealants.

I. Polyurea Joint Filler:
   1. Two (2) component, semi-rigid material for filling control, sawcut and construction joints in interior concrete floors.
      a. Dayton Superior Specialty Chemical Corp. "Joint Fill, Joint Seal, Joint Saver II" as required for condition and recommended by manufacturer.
      b. Euclid Chemical Co. "EUCO QWIK" joint.
      c. L & M Construction Chemicals, Inc. "Joint Tite 750".
      d. Sonneborn "TF-100" control joint filler.
   2. Comply with ACI 302.1R performance recommendations regarding control and construction joints.
   3. Color: Gray.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before use of any sealant, investigate its compatibility with joint surfaces, fillers and other materials in joint system.

B. Use only compatible materials.

C. Where required by manufacturer, prime joint surfaces.
   1. Limit application to surfaces to receive calking.
   2. Mask off adjacent surfaces.

D. Provide joint depth for joints receiving polyurea joint filler in accordance with manufacturer's recommendations.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions and UL requirements.

B. Clean all joints.

C. Make all joints water and airtight.

D. Make depth of sealing compounds, except expanding foam and polyurea sealant, not more than one-half width of joint, but in no case less than 1/4 IN nor more than 1/2 IN unless recommended otherwise by the manufacturer.

E. Provide correctly sized backer rod, compressible filler or compressible sealant in all joints to depth recommended by manufacturer:
   1. Take care to not puncture backer rod and compressible filler.
   2. Provide joint backer rod as recommended by the manufacturer for polyurea joint filler.

F. Apply bond breaker where required.

G. Tool sealants using sufficient pressure to fill all voids.

H. Upon completion, leave calking with smooth, even, neat finish.

I. Where piping, conduit, ductwork, etc., penetrate wall, seal each side of wall opening.

3.3 FIELD QUALITY CONTROL

A. Adhesion Testing:
   1. Perform adhesion tests in accordance with ASTM C1521 per the following criteria:
      a. Chemical containment areas: One (1) test per every 1000 LF of joint sealed.
      b. All other type of joints except butt glazing joints: One (1) test per every 3000 LF of joint sealed.
      c. Manufacturer's authorized factory representative shall recommend, in writing, remedial measures for all failing tests.

3.4 SCHEDULE

A. Furnish sealant as indicated for the following areas:
   1. Exterior areas: Polyurethane.
   2. Interior wet areas: Silicone.
   3. Interior wet, corrosive areas: Polysulfide.
   4. Interior nonwet, corrosive areas: Polyurethane.
   5. Interior nonwet, noncorrosive areas: Polyurethane.
   6. Compressible sealant: Where indicated.
   7. Sealant which will be subject to prolonged contact with or submersion in water (except wastewater and sewage):
      a. Polysulfide or polyurethane: NSF approved for use in potable water tanks.
   8. Penetrations exterior wall above grade:
      a. For non-corrosive areas, provide expanding urethane foam, with polyurethane finish sealant.
      b. For corrosive areas, provide expanding urethane foam, bond breaker and polysulfide finish sealant on corrosive side with polyurethane finish sealant on non-corrosive side.
   9. Sealant exposed to or having the potential of being exposed to concentrated chlorine gas or chlorine liquid: Polysulfide.
   10. Interior concrete floor control joints or sawed joints: Polyurea joint filler.
   11. Sealing around plumbing fixtures: Silicone.
   12. Plastic laminate casework, plastic laminate countertops and solid surface materials: Silicone.

END OF SECTION

1

DIVISION 13

SPECIAL CONSTRUCTION

2011/08/31

SECTION 13101
LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material, design and installation requirements for:
      a. Lightning protection system.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16060 - Grounding.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Lightning Protection Institute (LPI):
      a. 175, Standard of Practice for the Design - Installation - Inspection of Lightning Protection Systems.
   2. National Fire Protection Association (NFPA):
      a. 780, Standard for the Installation of Lightning Protection Systems.
   3. Underwriters Laboratories, Inc. (UL):
      a. 96A, Standard for Installation Requirements for Lightning Protection Systems.

1.3 DEFINITIONS

A. Classification of Buildings per NFPA 780:
   1. Class I: Any commercial, industrial, or residential building less than 75 FT in height.
   2. Class II: Any commercial, industrial, or residential building 75 FT or taller.
   3. Heavy-duty stacks: Any smoke or vent stack with a flue cross-section area greater than 500 SQ IN and a stack height greater than 75 FT.

1.4 SYSTEM DESCRIPTION

A. Provide a complete lightning protection system on the following:
   1. Uranium Removal Water Treatment Building.

1.5 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
      c. Include data sheets that include manufacturer’s name and product model number. Clearly identify all optional accessories.
      d. Acknowledgement that products submitted are in compliance with LPI or UL.
      e. Manufacturer’s delivery, storage, handling and installation instructions.
      f. Equipment installation details.

3. Fabrication and/or layout drawings:
    a. Plan drawing showing type, size, and locations of all lightning protection hardware.
    b. Verification that the installation shall comply with the requirements of, and shall qualify for the UL Master Label Certificate.

B. Miscellaneous Submittals:
    1. UL Master Label Certificate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
    1. A-C Lightning Security, Inc.
    2. Harger Lightning Protection.
    3. Heary Brothers.
    4. National Lightning Protection (NLP).
    5. Robbins Lightning Protection Company.
    6. Thompson Lightning Protection, Inc.

2.2 MATERIALS

A. Standards: NFPA 780, UL 96A.

B. Material for air terminals, main conductors and bonding conductors: Copper or aluminum.

C. Size of air terminals, main conductors and bonding conductors: In accordance with Tables 3-1.1(a) and 3-1.1(b) of NFPA 780.

D. Ground rods: In accordance with Specification Section 16060.

E. Material for conductor fasteners, connector fittings, bonding fittings, conductor splicers and thru-wall or thru-roof assemblies: Cast bronze, brass or copper with bolt pressure connectors.

F. Material for bolts, nuts, and screws: Stainless steel.

G. Raceways: In accordance with Specification Section 16130.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
    1. Design and installation standards: LPI 175, NFPA 780, UL 96A.
    2. Lightning protection material selected shall be compatible with the material of construction for the structure being protected.
    3. Components shall be adhesively fastened to the roof system unless specifically noted otherwise.
        a. Do not mechanically fasten to metal roof panels without written consent of the roofing manufacturer and the Engineer.
        b. Seal all penetrations in accordance with roofing manufacturer's recommended details.

B. Structures and/or Buildings:
    1. The protection system shall utilize Class I or Class II materials as defined by NFPA 780.
    2. The system shall include:
        a. Roof mounted air terminals.
        b. Downleads:
            1) Conductors surface mounted on exterior wall of the structure/building.

c. Ground terminations.
d. Bonding of other grounded structure/building systems.

3. Connect down leads to individual ground rods.
4. Connection to grounding electrode system shall be made in accordance with Specification Section 16060.

3.2 FIELD QUALITY CONTROL

A. Installation shall be performed in accordance with UL and NFPA.

B. The completed installation shall qualify for and receive the UL Master Label Certificate.

C. Provide a nameplate, attached to the structure, which includes the name and address of the Contractor responsible for the installation of the lightning protection system.

END OF SECTION

1

2011/09/01

SECTION 13120
METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal building system.
      a. Building system design.
      b. Building foundation design.
      c. Materials.
      d. Fabrication.
      e. Shipment.
      f. Construction of building foundation.
      g. Setting or erection of building system.
      h. Additional systems, components and devices as specified

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Architectural Manufacturers Association (AAMA)
      a. 621, Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates
   2. American Concrete Institute (ACI):
      a. 301, Specifications for Structural Concrete.
   3. American Institute of Steel Construction (AISC):
      a. 303, Code of Standard Practice for Steel Buildings and Bridges (referred to herein as AISC Code of Standard Practice).
   4. ASTM International (ASTM):
      a. A36, Standard Specification for Carbon Structural Steel.
      b. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
      c. A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
      d. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      e. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      f. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      g. C138, Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
      h. C150, Standard Specification for Portland Cement.
      i. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
      j. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

k. C1363, Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
l. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
m. E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
n. E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
o. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

5. Metal Building Manufacturer's Association (MBMA):
   a. Low Rise Building Systems Manual.
6. National Fire Protection Association (NFPA):
   a. 780, Standard for the Installation of Lightning Protection Systems.
7. Steel Door Institute/American National Standards Institute (SDI/ANSI):
   a. A250.8 (formerly SDI 100), Recommended Specifications for Standard Steel Doors and Frames.
8. Building code:
   a. International Code Council (ICC):
      1) International Building Code and associated standards, 2006 Edition including all amendments, referred to herein as Building Code.
9. Soils Report:
   a. Geotechnical Investigation:

      Geotechnical Exploration
      City of Grand Island Treatment Building
      City of Grand Island Well Field, Grand Island, Nebraska
      GSI Job No. 115164
      August 30, 2011

   b. See Soils Report Section 02200A.

B. Qualifications:
1. Manufacturer's qualifications:
   a. Manufacturer must be member in good standing of the MBMA.
   b. Manufacturer must be an AISC Quality Certified Fabricator in the category of Metal Building Systems (MB).
2. Erector qualification:
   a. Erector (installer) must be approved in writing by metal building manufacturer.
   b. Erector must have minimum of 10 years current experience in erection of similar structures.
3. Manufacturer's Structural, Electrical and Mechanical Engineer:
   a. Registered in the state where project is located.
4. Contractor's foundation Structural Engineer:
   a. Registered in the State where Project is located.

1.3 DEFINITIONS

A. Code: The word code refers to the local Building Code.

B. Erector (installer):
1. Individual(s) actually performing work on site.
   a. Erector and installer are synonymous.

C. Nomenclature as listed in Bibliography of the MBMA Low Rise Building Systems Manual.

D. PVDF: Polyvinylidene fluoride.

1.4 SYSTEM DESCRIPTION

A. Building shall be insulated, rigid frame or beam and column type with vertical walls and gable type roof.
   1. Provide cross bracing or partial frames in the side walls perpendicular to the rigid frame.
   2. Provide exposed fasteners.
   3. Provide STC/MSC standing seam roof construction.

1.5 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. General:
      a. All building and foundation Drawings, including erection drawings, certifications and calculations shall be sealed and signed by a professional Structural Engineer registered in the State of Nebraska.
         1) Provide certification stating calculations provided have been prepared specifically for this Project and that they match and pertain to the Shop Drawings provided.
         2) Provide a summary document as part of the above certification listing the design criteria used for building and foundation including:
            a) Appropriate codes and standards.
            b) Dead loads.
            c) Snow loads.
            d) Live loads.
            e) Wind loads.
            f) Seismic loads.
            g) Equipment loads.
            h) Allowable soil bearing pressure.
         3) Certification to confirm that the foundation design has been properly coordinated with the final metal building design, the Building Code and the Soils Report.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
         1) Manufacturer's erection manual containing all details and methods for installation of building frame, roof system, wall system, and accessories.
         2) Edit to mark out items not used for this installation.
      c. Certification that metal doors meet referenced standards.
   4. Drawings:
      a. Size and location of each component of the building.
         1) Include clearance under structural framing members.
         2) Include cross-section of components.
      b. Fasteners and details of fasteners connecting each component of the building.
      c. Details of anchor bolts, base plates, and all other components fastened to the foundation.
      d. Details of wall panels, roof panels, gutters, downspouts, finishes, flashings, closures, closure strips, trim, calking, and all other miscellaneous components.
      e. Foundation construction Drawings:
         1) Include size, shape, spacing, of concrete and rebar for slabs, foundations, equipment pads and all other associated concrete items.
            a) Provide details for the following:
               (1) Footing size, thickness, depth, reinforcing.
               (2) Perimeter grade wall size, configuration and reinforcing.
               (3) Slab thickness, reinforcing, joint locations and joint details.
               (4) Door stoops and approach slabs.
               (5) Building attachment details to foundation.

(6) Other related details necessary for a complete building with foundation.

2) Indicate soil work required to support foundations, including over excavation and backfill, compaction requirements, material requirements as appropriate.

5. Calculations:
   a. Provide calculations for all building, foundation and slab members and connections.
   b. Perform calculations using the dead load of the members plus the superimposed uniform and concentrated loads indicated in this Specification Section.
   c. List of all design loads and combination of loads for metal building.
   d. Metal building reactions for foundation design.
      1) Include direction, location and magnitude of load, type of load (dead, live, snow, etc.) and reactions from combined load cases.
   e. Calculations will not be reviewed and are submitted for record purposes only.

B. Samples:
   1. Exterior: Color and finish samples of roof and wall panels for Engineer's selection.
   2. Interior: Profile, color and finish samples of liner panel for Engineer's selection
      a. Color chart is not acceptable.

C. Miscellaneous Submittals:
   1. Manufacturer's and Erector's Qualifications.
   2. Manufacturer's approval of erector.

D. Operation and Maintenance Manuals:
   1. See Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

1.6 WARRANTY

A. Manufacturer's standard warranty.

B. Manufacturer's 20 year warranty of factory applied premium paint finish against blistering, chipping, cracking, peeling, or fading of wall and roof panels.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Metal building systems:
      a. Butler Building Systems.
      b. NCI Building Systems.
      c. Nucor Building Systems
      d. American Buildings Co.
      e. Chief Industries, Inc.
      f. Star Building Systems.
   2. Insulation:
      a. Fiberglass batt or blanket.
         1) Owens-Corning Fiberglass Corp.
         2) United States Gypsum Company (USG).
         3) Certainteed.

2.2 MATERIALS

A. Structural Members:
   1. All exposed steel: Painted with manufacturer's standard paint system.
   2. Non-exposed steel: May have manufacturer's standard prime coat paint system only.

B. Anchor Bolts: ASTM A307, ASTM A36 or ASTM F1554 steel. Galvanized.

C. Fasteners:
1. Building frame, girts, and purlins: ASTM A325 or ASTM A307 bolts.
2. Roof and wall panels: Stainless steel.
3. Miscellaneous fasteners: Corrosion resistant.

D. Roof and Wall Panels: Steel.

E. Roof and Wall Liner Panels: Steel.

F. Insulation: Fiberglass.

G. Gutters, Downspouts, and Trim: Same material as wall panels.

H. Closures: Manufacturer's standard.

I. Calking and Sealants: Manufacturer's standard.

J. Reinforced Concrete: Provide in accordance with ACI 301 with the following exceptions:
1. 28-day concrete compressive strength: 4000 psi minimum per ASTM C39.
2. Reinforcing: ASTM A615, Grade 60.
3. Cement: ASTM C150, Type II.
4. Maximum water cement ratio: 0.45.
5. Air content: 5 to 7 percent per ASTM C231, ASTM C173 or ASTM C138.
6. Aggregate: 47B per NDOR.

2.3 ACCESSORIES

A. Wall and Roof Liner Panel: Selected from Manufacturers full line of panels.
1. Minimum 26 gage steel.

B. Metal Pedestrian Doors and Frames:
1. Hollow Metal Doors:
a. General:
1) 1-3/4 IN thick.
2) Fabricate with flush top caps.
a) Thickness and material to match door face.
b) On exterior doors, seal weld top cap to door face and grind smooth and flush.
3) Continuously wire weld all joints and dress, smooth and flush.
4) Galvannealed per ASTM A653, A60 coating.
2. Exterior:
a. Doors 48 IN wide, or less: SDI/ANSI A250.8, Level 3, and physical performance level A, Model 2.
1) Face sheet minimum thickness: 18 GA.
2) Insulated: Minimum R10.
3) Galvannealed and prime coated.
b. Doors over 48 IN but not more than 60 IN wide: SDI/ANSI A250.8, Level 3, and physical performance level A, Model 2.
1) Face sheet minimum thickness: 16 GA.
2) Insulated: Minimum R10.
3) Galvannealed and prime coated.
3. Sizes as indicated on the Drawings.
4. Prepare doors and frames for hardware listed in 3.3 HARDWARE SCHEDULE.
5. Provide building manufacturer's standard opening trim.

C. Hollow Metal Frames:
1. Door frames:
a. Provide 2 IN face at heads and jambs.
b. 26 GA galvannealed steel boxes welded to frame at back of all hardware cutouts.

c. Steel plate reinforcement welded to frame for hinge, strikes, closers and surface-mounted hardware reinforcing.
   1) All plate reinforcement shall meet size and thickness requirements of SDI/ANSI A250.8.
   2) Galvannealed per ASTM A653, minimum A60.
d. Split type frames not acceptable.
e. Conceal all fasteners.
f. Frame thickness:
   1) Minimum thickness for doors 48 IN wide and less: 16 GA.
   2) Minimum thickness for doors over 48 IN wide: 14 GA.

D. Overhead Door:
1. Materials:
   a. Door Panel Face: Galvanized Steel.
   b. Insulation: Foamed-in-place urethane.
      1) CFC and HCFC free.
   c. Weather Stripping: Neoprene or EPDM.
   d. Track: Galvanized Steel.
   e. Fasteners: Same material as door construction.
2. Fabrication:
   a. Doors - General:
      1) Commercial grade steel ASTM A653, G60 galvanized.
      2) Weather stripped on top, bottom, and sides.
      3) Prime painted finish factory baked-on finish.
   b. Track:
      1) ASTM A653, G90 galvanized.
      2) Manufacturer's standard 2 or 3 IN as required for door opening size.
   c. Door Sections:
      1) 1-5/8 IN thick minimum.
      2) 20 GA flush textured outside faces.
      3) EPDM thermal break between sections.
      4) Reinforced for track and hardware assembly.
      5) Galvanized G60 ASTM A653.
      6) Insulated, minimum R13, ASTM C1363.
      7) Provide door similar to Overhead Door Corporation "592 Series" Insulated Steel Door.
   d. Weather Stripping:
      1) Bottom: Flexible EPDM or neoprene weather seal.
      2) Top and sides: Neoprene or EPDM blade type.
      3) Air infiltration: 0.08 cfm/SF of door area at 15 mph wind.
         a) ASTM E283.
   e. Counterbalancing System:
      1) Helical torsion 100,000 cycle springs, fixed to cast anchors, mounted on a single steel torsion rod.
      2) Cable drums to have graduated spiral groove for adjustment and galvanized lift cables with 7:1 safety factor.
   f. Trim Pieces: Material and finish to match door construction.
   g. Wind Load Resistance:
      1) Exterior doors: 30 psf minimum.
      2) ASTM E330.
   h. Operation: Manual operator.
   i. Locking: Slide locks.

E. Building Insulation:
1. Glass or other inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets with vinyl or aluminum foil vapor retarder.
2. Thermal conductivity (k-value at 75 DegF): 0.27.

3. Flame spread: ASTM E84, not greater than 25.
4. Perm rating of vinyl not more than 0.02.
5. Thickness as required to provide R13 in the walls and R19 in the roof.

F. Framed Openings:
1. Provide all necessary subframing to support wall openings for doors, windows, louvers, pipe or duct penetrations, etc.
a. Material gage to be determined by metal building manufacturer for size of opening.
2. Size and location of opening as shown on the Drawings.
3. Jamb, lintel and girts: Factory applied primer coat, if members are not exposed.
a. Metal building manufacturer responsible for providing correct size opening for door size scheduled.
4. Provide manufacturer's standard opening trim.

G. Gutters and Downspouts:
1. Size:
a. Provide minimum 4 x 4 IN gutter and minimum 3 x 5 IN downspout in manufacturer's standard profile best suited for project.
2. Minimum 26 GA steel.
3. Corrosion protection treatment and final finish same as roof panels.
4. Expansion joints: 150 FT maximum spacing but not less than 1 per side of building requiring gutters.
5. Locate/arrange downspouts to avoid drainage on sidewalks, landings, stoops, driveways, etc.

H. Roof Penetration Flashing (Maximum 13 IN DIA):
1. Flashing material: EPDM rubber with an aluminum sealing ring base.
2. Minimum projection above the weather surface of the roof: 8 IN.
3. Configuration of the flanges to match the roof panel.

2.4 BUILDING DESIGN CRITERIA

A. Critical Dimensions:
1. Roof slope shall be 3 IN per FT.
2. Provide minimum clear height of 20 FT at lowest interior structure line.

B. Building Foundation:
1. Design building foundation, piers, anchor bolts for the loads required by the Building Code and the metal building.
2. Where details are not shown on Drawings, design equipment foundations, equipment pads and equipment anchor bolts for equipment load as appropriate.

C. Modifications:
1. Buildings which vary dimensionally from those indicated may be bid providing:
a. Minimum interior dimensions and clear heights are maintained.
b. Door locations and sizes are maintained.
c. Foundation redesign and construction costs are included in Bid.
2. Contractor is responsible for coordinating and incorporating any necessary changes to foundations, mechanical, or electrical systems or to any other building component.
a. Design changes must be approved by Engineer prior to constructing changed item or system.
3. Modifications shall be itemized in a separate attachment to the bid form and the bid price shall include all modifications.
4. Completed building to be free of excessive noise from wind induced vibrations under ordinary weather conditions to be encountered at location of erection, and meet all specified design requirements listed below.

D. Vertical Live Loads:
   1. Roof panels:
      a. 20 psf uniformly distributed live load.
      b. 200 LB concentrated (point) live load (over a 1 x 1 FT area) located at center of maximum roofing (panel) span.
      c. The most severe condition governs.
   2. Roof framing members:
      a. Per Building Code.
      b. Roof framing members do not need to be designed for 50 psf uniform or 200 LB concentrated live loads.
   3. The above loads are in addition to other applicable loads and shall be applied to the horizontal projection of the roof.
   4. The above loads are in addition to the applicable dead loads and shall be applied to the horizontal projection of the roof.
   5. Slab on grade:
      a. 8,000 LB forklift wheel load.
      b. 200 psf uniform distributed load.
      c. The most severe condition governs.
      d. Design and provide slab joints as required to prevent random cracking.

E. Snow Loads:
   1. Design structure for snow loading as set forth in the Building Code.
      a. Project site conditions are as follows:
         1) Basic ground snow: 25 psf.
         2) Minimum Roof Snow load 30 psf.
         3) Design for roof live load per the Building Code.
         4) Importance Factor: 1.1.

F. Wind Loads:
   1. Design structure for wind loading as set forth in the Building Code.
      a. Project site conditions are as follows:
         1) Basic wind speed: 90 mph.
         2) Site exposure: Class C.
         3) Importance factor: 1.15.

G. Seismic (Earthquake) Loads:
   1. Design structure for seismic forces as set forth in the Building Code.
      a. Project site conditions are as follows:
         1) 0.2 Second Spectral Response Acceleration (Ss): 0.13.
         2) 1.0 Second Spectral Response Acceleration (S1): 0.04.
         3) Site Class: D.
      b. Occupancy importance factor: 1.25

H. Auxiliary Loads:
   1. Consider other superimposed loads as part of the design requirements and combine with the normal design (dead, live, seismic and wind) loads as prescribed hereafter.
      a. Roof collateral load:
         1) 10 psf uniform distributed load on roof purlins and frames.

I. Combination of Loads:
   1. The combining of dead, live, wind and seismic loads for design purposes shall be set forth in the Building Code, unless otherwise specified.
   2. Deflection of roof panels not to exceed L/150 of its span when supporting applicable live and dead loads.
   3. Deflection of wall panels not to exceed L/120 of its span under wind load.

2.5 MECHANICAL AND ELECTRICAL REQUIREMENTS

A. Mechanical: Coordinate with mechanical requirements and equipment. See Drawings and Specifications.

B. Electrical: Coordinate with electrical requirements and equipment. See Drawings and Specification Division 16.

2.6 FABRICATION

A. General:
   1. Fabricate building structure, roof and wall panels, accessories and trim in accordance with requirements of AISC and MBMA.
   2. Provide all necessary clips, flashing angles, caps, channels, closures, bases and any other miscellaneous trim required for complete water and airtight installation.
      a. Provide an inside closure at the base of all corrugated panels and an outside closure at the top of all corrugated panels in addition to all other closure strips required.
         1) Closure strips shall be formed to fit the corrugation of the metal panels and shall be securely supported in place.
         2) Closure strips shall fit between corrugated panels and trim or flashing as required to completely separate the interior of the building from the exterior.
      b. Provide flashing at all intersections of wall panels and roof panels, and above all openings in wall and roof panels, in addition to all other flashing required.
         1) Flashing shall be formed to completely contain water on the outside of the building, and shall be watertight and securely fastened in place.
      c. Provide calking at all edges where metal panel trim or flashing is adjacent to the foundation of the building in addition to all other calking required.
         1) Caulk material shall be securely adhered to the foundation and the metal panels trim or flashing.
   3. At door openings and mechanical openings provide additional framing and fasteners as required to structurally replace the wall panel and/or framing displaced.
   4. Frame shall be factory punched to receive all fasteners.
   5. Finishes:
      a. Clean ferrous surfaces of oil, grease, loose rust, loose mill scale, and other foreign substances.
      b. All structural components shall have manufacturer's standard paint coats applied in the shop.
      c. Wall and roof panels:
         1) PVDF based coating with minimum 70 percent resin.
         2) Meet or exceed requirements of AAMA 621
         3) Minimum 1 mil thick on exposed face.
         4) FM Class 1 fire hazard rating.

B. Roof Panels:
   1. 26 GA minimum.
   2. Length: Sufficient to cover entire length of roof slope.
   3. Panel width: Manufacturers standard.
   4. Profile: STC/MSC Standing Seam Roof.
   5. Panel depth: Manufacturer's standard.

C. Wall Panels:
   1. 26 GA minimum.
   2. Galvanized G90 coating.
   3. Factory applied color coating.
   4. Length sufficient to cover entire height of wall.
   5. Panel width: Manufacturer’s Standard.
   6. Profile: Manufacturer's standard.
   7. Panel depth: 1 1/8 IN.

2.7 SOURCE QUALITY CONTROL

A. Testing:
   1. Employ and pay for the services of a qualified independent testing agency to inspect and test all structural steel work for compliance with Contract Documents.
   2. Independent testing agency shall have a minimum of five (5) years performing similar work and shall be subject to Owner's approval.

B. Responsibilities of Testing Agency:
   1. Inspect field welding in accordance with AWS D1.1, Section 6 including the following non-destructive testing:
      a. Visually inspect all welds.
      b. Test 50 percent of full penetration welds and 10 percent of fillet welds with liquid dye penetrant.
      c. Test 20 percent of full penetration welds with ultrasonic or radiographic testing.
   2. Inspect high-strength bolting in accordance with the RCSC Specification for Structural Joints, Section 9.
      a. Inspect while work is in progress.
   3. Inspect structural steel which has been erected.
   4. Prepare and submit test reports to Engineer.
      a. Assist Engineer to determine corrective measures necessary for defective work.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Compact subgrade and backfill in accordance with the Soils Report.

B. Construct concrete foundations and slabs in accordance with ACI 301.

C. Install products in accordance with manufacturer's instructions.
   1. Installed tolerances shall be in accordance with AISC Code of Standard Practice.
      a. Install products straight without bowing, sagging, or warping.
   2. Install all fasteners.
   3. Install base plates on grout bed.
      a. Grout bed to be 1 IN thick unless noted otherwise on the Drawings.

D. Place roof insulation over roof support members.
   1. Tape all joints and tears in vapor barrier with tape recommended by vapor barrier manufacturer.

E. Place wall insulation between girts and wall panels.
   1. Tape all joints and tears in vapor barrier with tape recommended by vapor barrier manufacturer.

F. Fasten roof panels to purlins or secondary support members in accordance with manufacturer's recommendations.

G. Install liner panels in accordance with manufacturer's recommendations.
   1. Completely seal air tight around all building structural members and bracing when these members penetrate the liner panel.

H. Install wall panels to supporting structure with exposed fasteners.
   1. Finish of fasteners to match panel finish.

I. Install door frames, louvers, trim and other miscellaneous items in accordance with manufacturer's instructions and details.

3.2 ADJUSTING AND CLEANING

A. Touch up paint any scratched factory finished surfaces or remove and replace as directed by Engineer.

B. Remove and replace any damaged wall or roof panels, frames, etc., as directed by Engineer.

3.3 HARDWARE SCHEDULE

A. Hardware for all doors:
   1. 1-1/2 PR Hinges: Hager Model BB1199 4-1/2 x 4-1/2 x NPR x 630 (3 FT-0 IN doors).
   2. 2 PR Hinges: Hager Model BB1199 6 x 4-1/2 x NPR x 630 (5 FT-0 IN doors).
   3. Lockset: Corbin/Russwin F13 Entrance or Office function #ML2065 x 2-3/4 IN backset x 630.
   4. Door Closers: ANSI/BHMA A156.4, Grade 1 with full cover x 689 AL x integral stop with 105 degree hold open.
   5. Kick Plate: Each leaf.
      a. ANSI/BHMA A156.6: 0.050 IN thick x 630 IN.
      b. 8 IN high x 2 IN less than door width.
      c. Beveled on all edges.
   6. Threshold: Aluminum 4 IN x 1/2 IN one piece unit.
   7. Weatherseal: Reese #797B.
   8. Sweep: Reese #701C x each leaf.
   9. Surface bolts: Ives SB1630 Series with top and bottom strikes on inactive leaf of pairs of doors.
   10. Weather seal astragal at meeting edges of pairs of doors: Reese 92C each leaf.

END OF SECTION

1

DIVISION 15

MECHANICAL

2011/08/31

SECTION 15605
HVAC: EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Heating, ventilating, and cooling equipment.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 15890 - HVAC: Ductwork.
   4. Section 15970 - Instrumentation and Control For HVAC Systems.
   5. Section 15990 - HVAC Systems: Balancing and Testing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Air Movement and Control Association (AMCA).
   2. Air Conditioning and Refrigeration Institute (ARI).
   3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. HVAC Applications Handbook, Chapter entitled "Sound and Vibration Control."
      b. 20, Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.
      c. 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
   4. Canadian Standards Association (CSA).
   5. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   6. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   7. National Roofing Contractors Association (NRCA).
   8. Underwriters Laboratories, Inc. (UL):
      a. 507, Standard for Electric Fans.
   9. Building code:
      a. International Code Council (ICC):
         1) International Building Code and associated standards, 2009 Edition including all amendments, referred to herein as Building Code.

B. Miscellaneous:
   1. Gage thickness specified herein shall be manufacturer's standard gage for steel and Brown and Sharpe gage for non-ferrous metals.
   2. Corrosion protection of equipment to be as specified herein.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Fabrication and/or layout drawings.
   3. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.

c. Wiring diagrams.
d. Control diagrams.
e. Manufacturer's catalog cuts and technical data.
f. Corrosion-protection information.
g. Fan curves.
h. Sound data.
i. Vibration isolation.
j. Control description.
k. Performance data on all equipment.

4. Certifications:
   a. Provide certification of thickness of corrosion-protection coating.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Vibration isolation assemblies:
      a. Mason.
      b. Vibration Mounting and Controls Co.
   2. Unit heater - electric:
      a. ILG Industries, Inc.
      b. Brasch.
      c. Chromalox.
   3. Wall-mounted centrifugal exhaust fans:
      a. Loren Cook.
      b. Penn Ventilator Co., Inc.

2.2 GENERAL

A. All Manufactured Units:
   1. Factory wired and assembled.
   2. Use fasteners made of same material as unit.
   3. Fabricate motor assemblies and unit housings with vibration isolation assemblies:
      a. Type: As per Table 42, Chapter 47, ASHRAE HVAC Applications Handbook.

2.3 MANUFACTURED UNITS

A. Unit Heater - Electric:
   1. Type: Horizontal.
   2. UL listed for non-rated areas.
   3. Material:
      a. Cabinet: 18 GA steel.
      b. Heating elements: Copper-clad steel.
   4. Fan motors:
      a. Built-in automatic reset overload protection.
   5. Dynamically balanced fan.
   6. Built-in automatic reset cutout protection.
   7. Accessories:
      a. Mounting bracket.
      b. 40 to 90 DegF, 5 DegF differential internal thermostat.

8. Electrical, fan motor, and airflow data as scheduled on Drawings.

B. Wall-Mounted Centrifugal Exhaust Fans:
   1. AMCA certified.
   2. Non-overloading horsepower capabilities.
   3. Materials:
      a. Housing: Spun aluminum.
      b. Wheel: Aluminum.
      c. Drive shaft: Stainless steel.
   4. Backward inclined blades.
   5. Statically and dynamically balanced wheel.
   6. Bearings:
      a. Permanently lubricated ball-bearings.
      b. 200,000 HR average life.
   7. Weathertight compartment for motor and drives.
      a. Separated from airstream.
   8. Motor:
      a. TEFC.
      b. Driver and driven sheaves:
         1) Keyed hub type.
         2) Drive sheaves: Fixed pitch diameter.
         3) Driver:
            a) Shipped with variable pitch diameter sheave.
            b) Fixed pitch diameter size based on approved test and balance reports.
         4) V-belt drives sized for 150 percent motor horsepower.
   9. Vibration isolated motor assembly.
   10. Integral attachment collar.
   11. Accessories:
      a. Aluminum birdscreen.
      b. Backdraft damper: See Specification Section 15890.
   12. Size and capacity as scheduled on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixed pitched drive sheave after sheave has been sized based on accepted test and balance report.

3.2 FIELD QUALITY CONTROL

A. Comply with Specification Section 15990.

3.3 ADJUSTING

A. Install new filters on units which have been running prior to acceptance of Project.

END OF SECTION

1

2011/08/31

SECTION 15890
HVAC: DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. HVAC ductwork and accessories.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 15970 - Instrumentation and Control for HVAC Systems.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Aluminum Association (AA):
      a. DAF 45, Designation System for Aluminum Finishes.
   2. American Architectural Manufacturers Association (AAMA):
      a. 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
   3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. 52, Method of Testing Air Conditioning Devices Used in General Ventilation for Removing Particulate Matter.
   4. ASTM International (ASTM):
      a. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   5. National Fire Protection Association (NFPA).
   6. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
      a. Ducted Electric Heat Guide for Air Handling Systems.
      b. HVAC Duct Construction Standards - Metal and Flexible.
   7. Underwriters Laboratory, Inc. (UL):
      a. 555, Standard for Safety Fire Damper and Ceiling Fire Damper.
      b. 555S, Standard for Safety Leakage Rated Dampers for Use in Smoke Control Systems.
      c. Building Materials Directory.
   8. Building code:
      a. International Code Council (ICC):
         1) International Building Code and associated standards, 2009 Edition including all amendments, referred to herein as Building Code.

B. Qualifications:
   1. Fabricator: Firms regularly engaged in the manufacture of the specific product, of type, size required, whose products have been in use in similar service for not less than three (3) years.
   2. Installers: Firm with at least five (5) years installation experience on products similar to that required for this Project.

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Efficiency ratings per ASHRAE 52 for factory built and assembled filter units.
   3. Scaled ductwork drawings (1/4 IN equals 1 FT) showing duct and accessory layout and support.

B. Operation and Maintenance Manuals:
   1. See Specification Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

C. Miscellaneous Submittal:
   1. Documentation of qualifications for fabricators and installers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Transverse joints (factory fabricated aluminum):
      a. Ductmate Industries, Inc.
   2. Turning vanes:
      a. Ductmate.
      b. Barber - Colman.
      c. Tuttle and Bailey.
   3. Backdraft dampers:
      a. Air Balance.
      b. Ruskin.
      c. American Warming.
   4. Grilles and registers:
      a. Anemostat.
      b. Carnes.
      c. Titus.
   5. Air filters:
      a. American Air Filter.
      b. Farr.
      c. Continental.
   6. Manual (volume) dampers:
      a. Air Balance.
      b. Ruskin.
      c. American Warming.
   7. Temperature control and automatic dampers:
      a. Air Balance.
      b. Ruskin.
      c. American Warming.
   8. Louvers:
      a. Ruskin.
      b. Air Balance.
      c. American Warming.

2.2 COMPONENTS

A. Duct and Fittings (Metallic):
   1. Materials: 3003 H-14 aluminum alloy.
   2. Fabrication:
      a. Minimum sheet material thickness:
         1) Ducts with largest side or diameter to 30 IN: 0.05 IN thick.
         2) Ducts with largest side or diameter greater than 30 IN: 0.08 IN thick.
      b. Utilize SMACNA HVAC Duct Construction Standards for minimum of 2 IN water gage static pressure for the minimum sheet material thickness specified herein.
         1) Heavier gage sheet material may be used with associated reinforcement as an alternate to minimum thickness specified.
         2) Lighter gage sheet material with associated reinforcement shall not be used as an alternate to minimum thickness specified.
      c. Continuously weld seams on factory assembled units.
      d. Transverse joints (Alternate A):
         1) SMACNA T-22 companion flange.
         2) Gasketed.
         3) Rigidity class:
            a) Ducts with largest side or diameter to 30 IN: SMACNA Class D (1-1/2 x 1-1/2 x 1/8 IN angles).
            b) Ducts with largest side or diameter greater than 30 to 54 IN: SMACNA Class H (2-1/2 x 2-1/2 x 3/16 IN angles).
      e. Transverse joints (Alternate B):
         1) Materials and fabrication:
            a) Angles: Aluminum.
               (1) Ductmate 35.
            b) Corners: Aluminum.
               (1) Ductmate DC 35.
            c) Snap cleats: Aluminized or stainless steel.
            d) Gaskets: Closed cell neoprene.
            e) Bolts: Stainless steel.
            f) Sheet metal screws: Self-drilling stainless steel with unthreaded section under head.
         2) Fabrication:
            a) Rigidity class: SMACNA Class H.
            b) 3/8 IN DIA x 1 IN bolts.

B. Supports and Hangers:
   1. Materials:
      a. Support angles: Aluminum or stainless steel.
      b. Hanger rods: Stainless steel.
      c. Anchors: Stainless steel wedge type.
   2. Fabrication: Trapeze type units.

C. Turning Vanes:
   1. Materials: Same as duct.
   2. Fabrication:
      a. Fabricate double vane units.
      b. Pressure drop through elbows: Maximum 20 percent of velocity pressure.

D. Volume Extractors:
   1. Materials:
      a. Mounting bracket: 0.071 IN aluminum.
      b. Movement bar: 0.080 IN aluminum.
      c. Blades: 0.050 IN aluminum.

2. Fabrication:
    a. Gang operated parallel blade, fully adjustable.
    b. Minimum two (2) manually operated adjustment arms.
    c. Rotating shaft: Minimum 3/8 IN SQ.

E. Backdraft Dampers:
1. Material:
    a. 6063 T5 aluminum.
    b. Blade edge seals: Extruded vinyl.
2. Fabrication:
    a. Frame thickness: 0.125 IN minimum.
    b. Blade thickness: 0.070 IN minimum.
    c. Linkage: 1/2 IN tie bars.
    d. Bearings: Synthetic.

F. Air Grille and Register Assembly:
1. Materials:
    a. Assembly: Extruded aluminum.
    b. Gaskets: Sponge rubber.
2. Fabrication:
    a. Supply registers: Two (2) sets individually adjustable louvers.
    b. Exhaust and return registers: 45-degree deflection front blades.
    c. Dampers: Key-operated opposed blade.
    d. Screws, duct collars, and transitions as required.

G. Air Filter Enclosure:
1. Housing:
    a. Factory fabricated.
    b. 16 GA galvanized steel.
    c. Bracing to eliminate racking.
    d. Two-side access doors.
2. Access doors:
    a. 16 GA galvanized steel.
    b. Replaceable positive sealing latches.
    c. Replaceable hinges.
    d. Neoprene door gasket.
    e. Holding frame to door gasket: Polyurethane foam.
3. Tracks:
    a. Field adjustable.
    b. Anodized extruded aluminum.
    c. Polypropylene seal between holding frame and track.
4. Holding frame:
    a. Galvanized steel.
    b. Multiple fastener lances.
    c. Polyurethane foam gasket.
        1) Internally.
        2) Frame sides.
    d. Accommodate nominal 24 x 24 IN or 12 x 24 IN filters without modifications to frame or housing.

H. Air Filters:
1. Materials:
    a. Holding frame: Aluminum.
2. Fabrication:
    a. Factory built and assembled unit.
    b. Efficiency rating as per ASHRAE 52.
    c. 2 IN thickness minimum.

d. Efficiency: 20 percent.
e. Air velocity: 450 FPM maximum.
f. Clean pressure drop: 0.2 IN WG maximum.
g. Size, capacity, and type: As indicated on Drawings.

I. Temperature Control, Automatic and Manually (Volume) Operated Dampers:
1. Material:
a. Body: 6063 T5 aluminum.
b. Seal blade edge: Extruded vinyl.
2. Fabrication:
a. Frame thickness: 0.125 IN minimum.
b. Blades:
1) Two-position damper: Parallel blade.
2) Mixing and volume damper: Opposed blade.
3) Airfoil shape.
4) Maximum 6 IN width.
c. Linkage: Concealed in frame.
d. Axles: 1/2 IN plated steel hex.
e. Bearings: Molded synthetic.
f. Seals:
1) Jamb: Flexible compression type.
g. Control shaft: Removable, 1/2 IN DIA.
h. Air leakage (4 FT SQ damper) at 4 IN WG pressure: 99 cfm maximum.
i. Motors for motor operated damper: See Specification Section 15970.
j. Provide outboard support for operator linkage where damper motor is to be installed outside of duct.
k. Provide stainless steel locking quadrants for manual (volume) dampers.
l. Provide fold out operator mounting bracket where damper motor is to be installed on face of damper or inside duct.
m. Finish: 215 R1 anodized.

J. Louvers:
1. Stormproof.
2. Continuous blade appearance.
3. ASTM B221 extruded aluminum, alloy 6063T5, minimum 0.081 IN thick.
4. Minimum free area: As scheduled.
5. Maximum pressure drop: 0.10 IN of water at 900 fpm at zero water penetration.
6. Bird screen:
a. 1/2 IN SQ mesh.
b. 16 GA aluminum.
c. Install in standard, folded frame.
7. Anchors, fasteners, reinforcing: Aluminum or stainless steel.
8. Finish:
a. AAMA 2605.
b. AA-M10C22A42 dark bronze anodized finish.

2.3 MAINTENANCE MATERIALS

A. Extra Materials:
1. Furnish Owner with the following extra materials:
a. Twelve complete filter media changes for each filter unit.
b. Filter media used during construction is in addition to this requirement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Metal Ductwork:
   1. Install with longitudinal seams sealed for zero leakage.
      a. Welded seams may be used upon acceptance of welded seam samples by Engineer.
   2. Install gaskets at each transverse joint and fasten sections together with bolts.
      a. Tighten for zero leakage.
   3. Install supports and hangers with anchors in accordance with SMACNA HVAC Duct Construction Standards.
   4. Install turning vanes in square elbows:
      a. Unsupported vane length not to exceed 48 IN.
      b. Position vanes at proper angle to meet specified pressure drop.
   5. Install flexible connections at fans:
      a. Locate as close as possible to fan.
      b. Allow 1 IN of slack to prevent vibration transmission.
      c. Install thrust restraints across connectors.
   6. Install access doors where indicated on Drawings and at smoke and fire damper in accordance with NFPA requirements.
   7. Volume extractors:
      a. Install at supply registers, grilles, diffusers and supply branch connections from ducts.
      b. Provide branch duct extensions into main duct above and below extractor when branch duct is narrower than main duct.

B. Dampers:
   1. Install where indicated on Drawings of sizes shown.
   2. Install fire and smoke dampers in ductwork passing through 1 HR or higher fire-rated construction.
      a. Install in wall and floor openings utilizing steel sleeves, angles and other materials following practices required to provide installation in accordance with local Building Codes.

C. Air Grille and Register Assemblies:
   1. Install where shown on Drawings of size and capacities scheduled on Drawings.
   2. Install prime painted grilles and registers in areas where duct work is concealed.
      a. Field paint to match adjacent surface finish.

D. Air Filters:
   1. Install where shown on Drawings of size and capacity scheduled on Drawings.
   2. Do not operate equipment during construction without filters.

END OF SECTION

2011/08/31

SECTION 15970
INSTRUMENTATION AND CONTROL FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Instrumentation and control for HVAC systems.
2. Temperature control.
3. Ventilation control.
4. Heating control.
5. Control wiring.
6. Panels and accessories.
7. Miscellaneous.

B. Related Specification Sections include but are not necessarily limited to:
1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Section 15605 - HVAC: Equipment.
4. Section 15890 - HVAC: Ductwork.
5. Division 16 - Electrical.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
1. ASTM International (ASTM):
   a. D1693, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
2. Instrumentation, Systems, and Automation Society (ISA):
   a. S5.1, Instrumentation Symbols and Identification.
   b. S5.4, Standard Instrument Loop Diagrams.
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
4. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
5. Underwriters Laboratories, Inc. (UL).

B. Miscellaneous:
1. Controls to be in compliance with Specification Section 16010 for NEMA and NFPA 70 enclosure class requirements unless noted or specified otherwise.
2. Unless specifically noted otherwise, components of systems shall be industrial duty suitable for moist, corrosive environments.

1.3 SYSTEM DESCRIPTION

A. Work shall be provided as an integrated operating system.

B. Provide a complete system of automatic temperature control, thermostats, relays, valves, damper operators and other associated controls and appurtenances required to maintain minimum conditions described in detail herein and on Drawings, together with thermometers, gages and other accessory equipment.
1. Assemble control system with complete system of wiring and air piping to fulfill requirements of the Contract Documents.

C. Install system using competent mechanics under direct supervision of control manufacturer.

D. Controls, as set out in "Sequence of Operation," are designed to illustrate operating functions only.
   1. Control sequence shall be considered supplementary to "Sequence of Operation."
   2. These minimum specified items, and any additional controls, not indicated but required to meet performance as outlined in the Contract Documents, shall be furnished and installed at no additional cost to Owner to make a complete system.

E. Sequence of Operation - General:
   1. Sequence of operation indicated illustrates basic operating functions only.
   2. Contractor shall review Drawings and submit complete installation data, including minor details, to provide proper operation in his proposal.
   3. Where an item differs from specifications, control manufacturer shall submit manufacturer's recommendations subject to Engineer's approval.

F. Sequence of Operation – Equipment specific:
   1. Process Building
      a. Electric Unit Heaters (UH-01, UH-02, UH-03, UH-04).
         1) Circuited from panel.
         2) Controlled from individual integral unit mounted thermostat (furnished with unit):
            a) Room temperature below setpoint 55 DegF (adjustable), Unit Heater is “ON”:
               (1) Heating element is energized.
               (2) Fan is “ON”.
            b) Room temperature above setpoint, Unit Heater is “OFF”.
      b. Exhaust Fan (EF-01):
         1) Circuited from panel.
         2) Controlled by HAND-OFF-AUTO located by thermostat.
            a) “HAND”: Fan is “ON”.
            b) “OFF”: Fan is “OFF”.
            c) “AUTO”: Fan is controlled from end switch on MOD-01.
               (1) MOD-01 is proved open: Fan is “ON”.
               (2) MOD-01 is not proved open: Fan is “OFF”.
      c. Motor-operated damper (MOD-01):
         1) Circuited from panel.
         2) Controlled by HAND-OFF-AUTO switch:
            a) “HAND”: Damper is open.
            b) “OFF”: Damper is closed.
            c) “AUTO”: Damper shall be controlled by thermostat .
               (1) Room temperature above thermostat setpoint 85 deg F (adjustable): Exhaust fan is “ON” and dampers open.
               (2) Room temperature below setpoint: Exhaust fan is “OFF” and damper is closed.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Wiring diagrams showing point to point termination with auxiliary interlocks for each item in each control loop.
   3. Information on equipment proposed for use including corrosion protection.
   4. Instrument loop diagrams and word description of loop function for each individual unit controlled including auxiliary interlocks in full compliance with ISA S5.4.
      a. Show components in system and ensure diagrams are in full compliance with ISA S5.1 (Instrumentation Symbols and Identification) and other related ISA standards.

B. Quality Control Submittals:
   1. Secure from equipment manufacturers, detailed and complete control and power wiring diagrams, word descriptions of controls provided as part of the HVAC equipment or equipment interfaced or interlocked thereto, and submit with equipment manufacturer's submittals.
      a. Provide the above information to control manufacturer.

C. Operation and Maintenance Manuals:
   1. See Specification Section 01340 for requirements for:
      a. The mechanics and administration of the submittal process.
      b. The content of Operation and Maintenance Manuals.

1.5 PROJECT CONDITIONS

A. Unless stated otherwise, the environment and air streams will include varying concentrations of the following chemical components:
   1. Condensation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Manufacturer's catalog numbers hereinafter are for reference to type, style, dimension, related items and to establish a standard of quality.
      a. Reference to a manufacturer's number hereinafter does not imply full compliance to these Specifications.
   2. Instrumentation and control systems:
      a. Honeywell.
      b. Johnson Control Co.

2.2 EQUIPMENT

A. Dampers:
   1. Refer to Specification Section 15890.

B. Damper Operators:
   1. Provide operators of proper size and number to secure true throttling or two-position action as required.
   2. Furnish damper operators for installation inside ductwork and attached to frame of damper, or installed outside ductwork and connected to extended shaft as required.
   3. Provide operators for outside air, spring-loaded with sufficient power to assure tight closing of dampers on fan shutdown or in the fail safe position indicated by "Sequence of Controls."
   4. Provide pneumatic operators with aluminum bodies and stainless steel shafts, low friction non-corrosive shaft bearings, piston-type operators with rolling type neoprene diaphragm, and universal mounting bracket.
   5. Electric operators:
      a. Provide operators:
         1) Fully immersed in oil gear train.
         2) Enclosed in closed cast aluminum housing.
      b. As an alternate to 5.a.: Provide operators in NEMA 4X enclosure, Belimo ZS-300.
      c. Provide damper operators with integral spring return motor springs to make controls fail safe in position specified under "Sequence of Controls."
      d. Provide fully modulating operators from proportional electric controllers.
      e. Provide end switches or proportioning controllers permitting simultaneous operation or interlocking with other equipment.

f. Provide separate electrical circuits for damper operators with no more than four (4) operators on a circuit.

6. Coordinate with dampers provided:
   a. Provide damper operators that are rated for the required torque.
   b. If single damper operator can not meet torque requirement, provide sectional dampers to match operator torque.
7. Provide pneumatic operators wherever a pneumatic source can be provided.
   a. Provide for conversion of electric signals for control of pneumatic operators.
8. Use of electric operators shall be limited to small dampers in those applications where it is impractical to provide pneumatic operators and are to be approved by the Engineer.
9. Ensure coordination to provide for the installation of tight closing dampers low leakage type (6 cfm per square foot at 4 IN WC pressure across damper) with compatible dampers, damper operators and related controls.

C. Electric Control Instruments:
   1. Thermostat:
      a. Line voltage.
      b. External tin-plated sensing element.
      c. Minimum 3.5 DegF differential.
      d. Single stage.
         1) Snap switch.
         2) 1 HP rating.
      e. Range: 35 to 100 DegF.
      f. External setpoint adjustment.
      g. Unit illustrated.
         1) Honeywell, Model T631F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements of Division 16.

B. Connect control devices to perform functions indicated and perform in required sequence.

C. In general, locate thermostats for room control immediately inside door, above light switch, unless shown otherwise.
   1. Where light switch is in an entryway to room, locate thermostat on wall within room so it is capable of sensing true space conditions.
   2. Prior to installation, coordinate thermostat location with Engineer.

END OF SECTION

2011/08/30

SECTION 15990
HVAC SYSTEMS: BALANCING AND TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Adjusting, balancing, and testing of all heating, ventilating and air conditioning (HVAC) systems, including the following systems:

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 15605 - HVAC: Equipment.
   4. Section 15890 - HVAC: Ductwork.
   5. Section 15970 - Instrumentation and Control for HVAC Systems.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Associated Air Balance Council (AABC):
      a. National Standards for Total System Balance.
   2. American Industrial Hygiene Association (AIHA):
      a. Z9.5, Laboratory Ventilation.
   3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
      a. HVAC Applications Handbook, Chapter entitled "Laboratories."
      b. HVAC Systems and Equipment Handbook, Chapter entitled "Testing, Adjusting, and Balancing."
   4. National Environmental Balancing Bureau (NEBB):
      a. Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

B. Qualifications:
   1. Work of this Section to be accomplished by an independent testing and balancing firm certified by one (1) of the following:
      a. Associated Air Balance Council (AABC).
      b. National Environmental Balancing Bureau (NEBB).
      c. Other certification entity approved by Engineer.
   2. The independent firm shall not be the same firm as the firm installing the HVAC equipment, nor under contract to the firm installing the equipment.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Certifications:
      a. Letter stating the name and qualifications of the firm proposed.
      b. Evidence that relevant subcontractors have been notified of the requirement to coordinate balance and test elements in the work with the testing and balancing firm.
   3. Report forms:
      a. Procedures and forms to be used in calibrating of test instruments, balancing systems, and recording and reporting test data.

B. Miscellaneous Submittals:
   1. Completed test reports and data forms upon completion of installation, balance and testing of HVAC systems.
      a. Insert recorded information on report forms required by specifications and approved for use on project.
      b. Additional written verification and other related information clearly identifying project, date and specifics of verification.
      c. Utilize report forms similar to those shown in Section V of AABC Standard.
      d. Provide forms typed and signed by the testing and balancing firm.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 PREPARATION

A. Secure approved Shop Drawings of all HVAC equipment.

B. Procedures and Forms:
   1. Submit procedures and forms to be used in calibration of test instruments, balancing systems, and recording and reporting test data.
   2. Obtain approval before beginning balancing and testing.

C. Do not begin balancing and testing until HVAC systems are complete and in full working order.
   1. Place HVAC systems into full operation and continue their operation during each working day of balancing and testing.

D. Provide qualified heating and ventilating Engineer(s) to supervise and perform balancing and testing.

E. Review design Drawings, specifications, approved Shop Drawings and other related items to become thoroughly acquainted with the design of HVAC systems.

F. Check all installed systems against Contract Drawings, Specifications and Shop Drawings to see that system is installed as required.
   1. Report deficiencies to the Engineer.
   2. Report deficiencies to Contractor for remedial action including providing corrective measures required in the function of any part of system to complete balancing.

G. Make necessary adjustments as required to balance the systems.

3.2 FIELD QUALITY CONTROL

A. Balance and Test Air Systems:
   1. Adjust equipment RPM to design requirements.
   2. Report motor full load amperes.
   3. Obtain design CFM at fans.
      a. Make pitot tube traverse of main supply and exhaust ducts within 5 percent.
   4. Test and record system static pressures, suction and discharge.
   5. Obtain design CFM for recirculated air.
   6. Obtain design CFM outside air.
   7. Test and record entering air temperatures, (DB, heating and cooling).
   8. Test and record leaving air temperatures, (DB, heating and cooling).
   9. Test and record leaving air temperatures, (WB, cooling).
   10. Adjust dampers in supply, exhaust and return air ducts to design CFM.
   11. Test diffusers, grilles, and registers as follows:
      a. Adjust to comply with design requirements within 10 percent.

b. Identify location and area of each.
c. Adjust face velocity to establish required CFM.
1) Retest after initial adjustments.
d. Adjust to minimize drafts and to ensure uniform air distribution in all areas.

12. Identify and list size, type and manufacturer of diffusers, grilles, registers, and HVAC equipment.
a. Use manufacturer's ratings on equipment to make required calculations.

13. Adjust and assure that the operation of automatically operated dampers are as specified.
a. Check and calibrate controls.

14. Prepare and submit reports.

END OF SECTION

1

DIVISION 16

ELECTRICAL

2011/08/26

SECTION 16010
ELECTRICAL: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Basic requirements for electrical systems.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Division 16 - Electrical.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. ETL Testing Laboratories (ETL).
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   5. Underwriters Laboratories, Inc. (UL).

B. Where UL test procedures have been established for the product type, use UL or ETL approved electrical equipment and provide with the UL or ETL label.

1.3 DEFINITIONS

A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
   1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
   2. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
   3. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of submittal process.
   2. See individual specification sections for submittal requirements for products defined as equipment.
   3. General requirements:
      a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.

b. Include data sheets that include manufacturer's name and product model number.
   1) Clearly identify all optional accessories.
c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
d. Manufacturer's delivery, storage, handling and installation instructions.
e. Product installation details.
f. See individual specification sections for any additional requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. As required by manufacturer.

B. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
   1. Outdoor areas:
      a. Wet.
   2. Indoor areas:
      a. Dry, except 6 IN above floor and under process piping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to specific Division 16 Specification Sections and specific material paragraphs below for acceptable manufacturers.

B. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

A. Electrical Equipment Support Pedestals and/or Racks:
   1. Approved manufacturers:
      a. Modular strut:
         1) Unistrut Building Systems.
         2) B-Line.
         3) Globe Strut.
   2. Material requirements:
      a. Modular strut:
         1) Galvanized steel: ASTM A123 or ASTM A153.
      b. Mounting hardware:
         1) Galvanized steel.

B. Field touch-up of galvanized surfaces.
   1. Zinc-rich primer.
      a. One (1) coat, 3.0 mils, ZRC by ZRC Products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.

B. Install equipment in accordance with the requirements of:
   1. NFPA 70.
   2. The manufacturer's instructions.

C. In general, conduit routing is not shown on the Drawings.
   1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
   2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.

D. When complete branch circuiting is not shown on the Drawings:
   1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
   2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
   3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
   4. See Specification Section 16120 for combining multiple branch circuits in a common conduit.

E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.

F. Install equipment plumb, square and true with construction features and securely fastened.

G. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.

H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operating and maintenance requirements of other equipment.

I. Device Mounting Schedule:
   1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
      a. Light switch (to center): 48 IN.
      b. Receptacle on exterior wall of building (to center): 18 IN.
      c. Receptacle in non-architecturally finished areas (to center): 48 IN.
      d. Safety switch (to center of operating handle): 54 IN.
      e. Separately mounted motor starter (to center of operating handle): 54 IN.
      f. Pushbutton or selector switch control station (to center): 48 IN.
      g. Panelboard (to top): 72 IN.

J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.

K. Provide electrical equipment support system per the following area designations:
   1. Dry areas:
      a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
      b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
   2. Wet areas:
      a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
      b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.

L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
   1. Do not cut, or weld to, building structural members.
   2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

M. Do not use materials that may cause the walls or roof of a building to discolor or rust.

3.2 FIELD QUALITY CONTROL

A. The protective coating integrity of support structures and equipment enclosures shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   3. Repair surfaces which will be inaccessible after installation prior to installation.
   4. See Specification Section 16130 for requirements for conduits and associated accessories.

END OF SECTION

2011/08/31

SECTION 16060
GROUNDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for grounding system(s).

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.
   4. Section 16120 - Wire and Cable - 600 Volt and Below.
   5. Section 16130 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
   3. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
         1) Article 250, Grounding and Bonding.
   4. Underwriters Laboratories, Inc. (UL):
      a. 467, Grounding and Bonding Equipment.

B. Assure ground continuity is continuous throughout the entire Project.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
         1) Grounding clamps, terminals and connectors.
         2) Exothermic welding system.
      b. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Ground rods and bars and grounding clamps, connectors and terminals:
      a. Burndy.
      b. Harger Lightning Protection.

c. Heary Brothers.
d. Joslyn.
e. Robbins Lightning Protection.
f. Thomas & Betts (Blackburn).
g. Thompson.

2. Exothermic weld connections:
a. Erico Products Inc., Cadweld.
b. Harger Lightning Protection.
c. Thermoweld.

2.2 COMPONENTS

A. Wire and Cable:
1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
2. Insulated conductors: Color coded green, per Specification Section 16120.

B. Conduit: As specified in Specification Section 16130.

C. Ground Bars:
1. Solid copper:
a. 1/4 IN thick.
b. 2 or 4 IN wide.
c. 12 IN long minimum in main service entrance electrical rooms.
2. Predrilled grounding lug mounting holes.
3. Stainless steel or galvanized steel mounting brackets.
4. Insulated standoffs.

D. Ground Rods:
1. 3/4 IN x 10 FT.
2. Copperclad:
a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
b. Corrosion resistant bond between the copper and steel.
c. Hard drawn for a scar-resistant surface.

E. Grounding Clamps, Connectors and Terminals:
1. Mechanical type:
a. Standards: UL 467.
b. High copper alloy content.
2. Compression type for interior locations:
a. Standards: UL 467.
b. High copper alloy content.
c. Non-reversible.
d. Terminals for connection to bus bars shall have two bolt holes.
3. Compression type suitable for direct burial in earth or concrete:
a. Standards: UL 467, IEEE 837.
b. High copper alloy content.
c. Non-reversible.

F. Exothermic Weld Connections:
1. Copper oxide reduction by aluminum process.
2. Molds properly sized for each application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install products in accordance with manufacturer's instructions.

2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250, except where larger sizes are indicated on the Drawings.
3. Remove paint, rust, or other nonconducting material from contact surfaces before making ground connections.
4. Where ground conductors pass through floor slabs or building walls provide non-metallic sleeves.
5. Do not splice grounding conductors except at ground rods.
6. Install ground rods and grounding conductors in undisturbed, firm soil.
    a. Provide excavation required for installation of ground rods and ground conductors.
    b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
    c. Unless otherwise specified, connect conductors to ground rods with compressor type connectors or exothermic weld.
    d. Provide sufficient slack in grounding conductor to prevent conductor breakage during backfill or due to ground movement.
    e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
7. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.

B. Grounding Electrode System:
1. Provide a grounding electrode system in accordance with NFPA 70, Article 250 and as indicated on the Drawings.
2. Grounding conductor terminations:
    a. Ground bars mounted on wall, use compression type terminal and bolt it to the ground bar with two bolts.
    b. Piping systems use mechanical type connections.
    c. Building steel, below grade and encased in concrete, use compression type connector or exothermic weld.
3. Single ground rod grounding system:
    a. Single ground rod system consists of a single ground rod.
    b. Place ground rod a minimum of 10 FT from the structure foundation and 2 FT-6 IN below grade.
    c. Grounding conductor: Bare conductor, sized as indicated on the Drawings.

C. Raceway Bonding/Grounding:
1. All metallic conduit shall be installed so that it is electrically continuous.
2. All conduits to contain a grounding conductor with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
3. NFPA 70 required grounding bushings shall be of the insulating type.
4. Provide double locknuts at all panels.
5. Bond all conduit, at entrance and exit of equipment, to the equipment ground bus or lug.
6. Provide bonding jumpers if conduits are installed in concentric knockouts.
7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.

END OF SECTION

1

2011/08/26

SECTION 16120
WIRE AND CABLE: 600 VOLT AND BELOW

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Building wire.
      b. Control cable.
      c. Wire connectors.
      d. Insulating tape.
      e. Pulling lubricant.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
      a. WC 57/S-73-532, Standard for Control Cables.
      b. WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
   2. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   3. Underwriters Laboratories, Inc. (UL):
      a. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
      b. 467, Standard for Safety Grounding and Bonding Equipment.
      c. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
      d. 486C, Standard for Safety Splicing Wire Connections.
      e. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
      f. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 DEFINITIONS

A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

B. Control Cable: Multi-conductor, insulated, with outer sheath containing building wires, No. 14, No. 12 or No. 10 AWG.

C. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Building wire and control cable:
      a. American Insulated Wire Corporation.
      b. General Cable.
      c. Manhattan/CDT.
      d. Southwire Company.
   2. Wire connectors:
      a. Burndy Corporation.
      b. Buchanan.
      c. Ideal.
      d. Ilsco.
      e. 3M Co.
      f. Teledyne Penn Union.
      g. Thomas and Betts.
      h. Phoenix Contact.
   3. Insulating and color coding tape:
      a. 3M Co.
      b. Plymouth Bishop Tapes.
      c. Red Seal Electric Co.

2.2 MANUFACTURED UNITS

A. Building Wire:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.
   3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
   4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and THHN/THWN-2 insulation.

B. Control Cable:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
   3. Conform to NEMA/ICEA WC 57/S-73-532 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
   4. Number of conductors as required, provided with or without bare ground conductor of the same AWG size.
      a. When a bare ground conductor is not provided, an additional insulated conductor shall be provided and used as the ground conductor (e.g., 6/c No. 14 w/g and 7/c No. 14 are equal).
   5. Individual conductor color coding:
      a. NEMA/ICEA Method 1, Table E-2.
      b. See Part 3 of this Specification for additional requirements.
   6. Conform to NFPA 70 Type TC.

C. Wire Connectors:
1. Twist/screw on type:
a. Insulated pressure or spring type solderless connector.
b. 600 V rated.
c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
d. Phase and neutral conductors: Conform to UL 486C.
2. Compression and mechanical screw type:
a. 600 V rated.
b. Ground conductors: Conform to UL 467.
c. Phase and neutral conductors: Conform to UL 486A.

D. Insulating and Color Coding Tape:
1. Pressure sensitive vinyl.
2. Premium grade.
3. Heat, cold, moisture, and sunlight resistant.
4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.
5. For cold weather or outdoor location, tape must also be all-weather.
6. Color:
a. Insulating tape: Black.
b. Color coding tape: Fade-resistant color as specified herein.
7. Comply with UL 510.

E. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Permitted Usage of Insulation Types:
1. Type THHN/THWN and THHN/THWN-2:
a. Building wire and control cable in non-architectural finished areas.

B. Conductor Size Limitations:
1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.

C. Color Code All Wiring as Follows:
1. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red *	Orange
Phase 3	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

* Orange when it is a high leg of a 120/240 V Delta system.

a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.

b. Conductors larger than No. 6 AWG:
1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
a) Continuous colored outer finish along its entire length.
b) 3 IN of colored tape applied at the termination.
2) Insulated grounding conductor shall be identified by one (1) of the following methods:
a) Continuous green outer finish along its entire length.
b) Stripping the insulation from the entire exposed length.
c) Using green tape to cover the entire exposed length.
3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.

2. Control cables NEMA/ICEA Method 1, Table E-2:
a. When a bare ground is not provided, one (1) of the colored insulated conductors shall be re-identified by stripping the insulation from the entire exposed length or using green tape to cover the entire exposed length.
b. When used in power applications the colored insulated conductors used as phase and neutral conductors may have to be re-identified with 3 IN of colored tape, per the Table herein, applied at the terminations.

D. Install all wiring in raceway unless otherwise indicated on the Drawings.

E. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
1. Where specifically indicated on the Drawings.
2. Where field conditions dictate and written permission is obtained from the Engineer.
3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
4. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway.
a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NFPA 70, including but not limited to:
1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
2) The neutral conductors may not be shared.
3) Up sizing raceway size for the size and quantity of conductors.

F. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
1. Feeder and branch power circuits:
a. Device outlet boxes:
1) Twist/screw on type connectors.
b. Junction and pull boxes and wireways:
1) Twist/screw on type connectors for use on No. 8 and smaller wire.
2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
c. Motor terminal boxes:
1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.

2. Control circuits:
a. Junction and pull boxes: Terminal block type connector.
b. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.

G. Insulating Tape Usage:
   1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
   2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
   3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.

H. Color Coding Tape Usage: For color coding of conductors.

END OF SECTION

1

2011/08/31

SECTION 16130
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Conduits.
      b. Conduit fittings.
      c. Conduit supports.
      d. Outlet boxes.
      e. Pull and junction boxes.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.
   4. Section 16140 - Wiring Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      b. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      c. D2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
      c. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
   3. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
      a. C80.3, Steel Electrical Metallic Tubing (EMT).
      b. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   5. Underwriters Laboratories, Inc. (UL):
      a. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
      b. 360, Standard for Liquid-Tight Flexible Steel Conduit.
      c. 467, Grounding and Bonding Equipment.
      d. 514A, Metallic Outlet Boxes.
      e. 514B, Conduit, Tubing, and Cable Fittings.
      f. 651, Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
      g. 797, Electrical Metallic Tubing - Steel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Rigid non-metallic conduit:
      a. Carlon.
      b. Cantex.
      c. Osburn Associates.
   2. Flexible conduit:
      a. AFC Cable Systems.
      b. Anamet, Inc.
      c. Electri-Flex.
      d. Flexible Metal Hose Company.
      e. International Metal Hose Company.
      f. Triangle PWC Inc.
      g. LTV Steel Company.
   3. Conduit fittings and accessories:
      a. Appleton.
      b. Carlon.
      c. Cantex.
      d. Crouse-Hinds.
      e. Killark.
      f. Osburn Associates.
      g. OZ Gedney Company.
      h. RACO.
      i. Steel City.
      j. Thomas and Betts.
   4. Support systems:
      a. Unistrut Building Systems.
      b. B-Line Systems Inc.
      c. Kindorf.
      d. Minerallac Fastening Systems.
      e. Caddy.
   5. Outlet, pull and junction boxes:
      a. Appleton Electric Co.
      b. Crouse-Hinds.
      c. Killark.
      d. O-Z/Gedney.
      e. Steel City.
      f. Raco.
      g. Bell.
      h. Hoffman Engineering Co.
      i. Wiegmann.
      j. B-Line Circle AW.
      k. Adalet.
      l. Rittal.

2.2 RIGID METALLIC CONDUITS

A. Electrical Metallic Tubing (EMT):
   1. Mild steel with continuous welded seam.
   2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
   3. Internal coating: Baked lacquer, varnish, or enamel for a smooth surface.
   4. Standards: NEMA/ANSI C80.3, UL 797.

2.3 RIGID NON-METALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80):
   1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
   2. Rated for direct sunlight exposure.
   3. Fire retardant and low smoke emission.
   4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 DegC".
   5. Standards: NEMA TC 2, UL 651.

2.4 FLEXIBLE CONDUIT

A. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
   1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
   2. Extruded PVC outer jacket positively locked to the steel core.
   3. Liquid and vaportight.
   4. Standard: UL 360.

2.5 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with EMT:
   1. Connectors:
      a. Straight, angle and offset types furnished with locknuts.
      b. Zinc plated steel.
      c. Insulated gland compression type.
      d. Concrete and raintight.
   2. Couplings:
      a. Zinc plated steel.
      b. Gland compression type.
      c. Concrete and raintight.
   3. Conduit bodies (ells and tees):
      a. Body: Copper free aluminum with threaded hubs.
      b. Standard and mogul size.
      c. Cover:
         1) Screw down type with steel screws.
         2) Gasketed or non-gasketed galvanized steel or copper free aluminum.
   4. Standard: UL 514B.

B. Fittings for Use with FLEX-LT:
   1. Connector:
      a. Straight or angle type.
      b. Metal construction, insulated and gasketed.
      c. Composed of locknut, grounding ferrule and gland compression nut.
      d. Liquid tight.
   2. Standards: UL 467, UL 514B.

C. Fittings for Use with Rigid Non-Metallic PVC Conduit:
   1. Coupling, adapters and conduit bodies:
      a. Same material, thickness, and construction as the conduits with which they are used.
      b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
      c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
   2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
   3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.

2.6 ALL RACEWAY AND FITTINGS

A. Mark Products:
   1. Identify the nominal trade size on the product.
   2. Stamp with the name or trademark of the manufacturer.

2.7 OUTLET BOXES

A. Metallic Outlet Boxes:
   1. Hot-dip galvanized steel.
   2. Conduit knockouts and grounding pigtail.
   3. Styles:
      a. 2 IN x 3 IN rectangle.
      b. 4 IN square.
      c. 4 IN octagon.
   4. Accessories:
      a. Flat blank cover plates.
      b. Barriers.
      c. Box supporting brackets in stud walls.
      d. Adjustable bar hangers.
   5. Standards: NEMA/ANSI OS 1, UL 514A.

B. Cast Outlet Boxes:
   1. Zinc plated cast iron or die-cast copper free aluminum with manufacturers standard finish.
   2. Threaded hubs and grounding screw.
   3. Styles:
      a. "FS" or "FD".
      b. "Bell".
      c. Single or multiple gang and tandem.
   4. Standards: UL 514A.

C. See Specification Section 16140 for wiring devices, wallplates and coverplates.

2.8 PULL AND JUNCTION BOXES

A. NEMA 1 Rated:
   1. Body and cover: 14 GA minimum, galvanized steel or 14 GA minimum, steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
   2. With or without concentric knockouts on four (4) sides.
   3. Flat cover fastened with screws.

B. NEMA 4 Rated:
   1. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
   2. Seams continuously welded and ground smooth.
   3. No knockouts.
   4. External mounting flanges.
   5. Hinged or non-hinged cover held closed with stainless steel screws and clamps.
   6. Cover with oil resistant gasket.

C. Standards: NEMA 250, UL 50.

2.9 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
   1. Material requirements.
      a. Galvanized steel: ASTM A123 or ASTM A153.

B. Single Conduit and Outlet Box Support Fasteners:
   1. Material requirements:
      a. Zinc plated steel.
      b. Stainless steel.
      c. Malleable iron.
      d. Steel protected with zinc phosphate and oil finish.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

A. Shall be in accordance with the requirements of:
   1. NFPA 70.
   2. Manufacturer instructions.

B. Size of Raceways:
   1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
   2. Unless specifically indicated otherwise, the minimum raceway size shall be:
      a. Conduit: 3/4 IN.

C. Field Bending and Cutting of Conduits:
   1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
   2. Do not reduce the internal diameter of the conduit when making conduit bends.
   3. Debur interior and exterior after cutting.

D. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   3. Repair surfaces which will be inaccessible after installation prior to installation.

E. Remove moisture and debris from conduit before wire is pulled into place.
   1. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

F. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

G. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

3.2 RACEWAY ROUTING

A. Raceways shall be routed in the field unless otherwise indicated.
   1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
   2. Run in straight lines parallel to or at right angles to building lines.
   3. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
   4. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.

B. All rigid conduits within a structure shall be installed exposed except as follows:
   1. As indicated on the Drawings.
   2. Buried under floor slabs where shown on the Contract Drawings or with the Engineer's permission.

C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 FT:
   1. Between instrumentation and 600 V and less AC power or control: 6 IN.
   2. Between process, gas, air and water pipes: 6 IN.

D. Conduits shall be installed to eliminate moisture pockets.
   1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.

F. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.

G. Provide all required openings in walls, floors, and ceilings for conduit penetration.

3.3 RACEWAY APPLICATIONS

A. Permitted Raceway Types Per Wire or Cable Types:
   1. Power wire or cables: All raceway types.
   2. Control wire or cables: All raceway types.

B. Permitted Raceway Types Per Area Designations:
   1. Dry areas:
      a. EMT.
   2. Wet areas:
      a. EMT.

C. Permitted Raceway Types Per Routing Locations:
   1. Beneath floor slab-on-grade:
      a. PVC-80.
   2. Through floor penetrations:
      a. PVC-80.
   3. Direct buried conduits and ductbanks:
      a. PVC-80.

D. FLEX-LT conduits shall be install as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.
   1. The maximum length shall not exceed:
      a. 6 FT to light fixtures.
      b. 3 FT to motors.
      c. 2 FT to all other equipment.

3.4 CONDUIT FITTINGS AND ACCESSORIES

A. Rigid non-metallic conduit and fittings shall be joined utilizing solvent cement.
   1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.

B. Terminate Conduits:
   1. In metallic outlet boxes:
      a. EMT: Compression type connector and locknut.
   2. In NEMA 1 rated enclosures:
      a. EMT: Compression type connector and locknut.
   3. In NEMA 12 rated enclosures:
      a. Watertight, insulated and gasketed hub and locknut.
      b. Use grounding type locknut or bushing when required by NFPA 70.
   4. In NEMA 4 rated enclosures:
      a. Watertight, insulated and gasketed hub and locknut.

3.5 CONDUIT SUPPORT

A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
   1. Dry or wet areas:
      a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit clamps.

B. Permitted single conduit support fasteners per area designations and conduit types:
   1. Dry or wet areas:
      a. Material: Zinc plated steel, stainless steel and malleable iron.
      b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.

C. Conduit Support General Requirements:
   1. Maximum spacing between conduit supports per NFPA 70.
   2. Support conduit from the building structure.
   3. Do not support conduit from process, gas, air or water piping; or from other conduits.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

A. General:
   1. Install products in accordance with manufacturer's instructions.
   2. See Specification Section 16010 and the Drawings for area classifications.
   3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
   4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.

B. Outlet Boxes:
   1. Permitted uses of metallic outlet boxes:
      a. Pull or junction box:
         1) Above 10 FT in dry non-architecturally finished areas.
   2. Permitted uses of cast outlet boxes:
      a. Housing of wiring devices surface mounted in non-architecturally finished dry or wet areas.
      b. Pull and junction box surface mounted in non-architecturally finished dry, wet, corrosive and highly corrosive areas.
   3. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 16010.
   4. Set device outlet boxes plumb and vertical to the floor.

C. Pull and Junction Boxes:
   1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
      a. Make covers of boxes accessible.
   2. Permitted uses of NEMA 1 enclosure:
      a. Pull or junction box surface mounted in areas designated as dry in non-architecturally finished areas.
   3. Permitted uses of NEMA 4 enclosure:
      a. Pull or junction box surface mounted in areas designated as wet.

END OF SECTION

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SECTION 16140
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Light switches.
      b. Receptacles.
      c. Device wallplates and coverplates.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.
   4. Section 16130 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. WD 1, General Color Requirements for Wiring Devices.
      c. WD 6, Wiring Devices - Dimensional Requirements.
   2. Underwriters Laboratories, Inc. (UL):
      a. 20, General-Use Snap Switches.
      b. 498, Standard for Attachment Plugs and Receptacles.
      c. 514A, Metallic Outlet Boxes.
      d. 943, Ground-Fault Circuit-Interrupters.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirement for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Light switches and receptacles:
      a. Bryant.
      b. Cooper Wiring Devices.
      c. Hubbell.
      d. Leviton.
      e. Pass & Seymour.

2.2 LIGHT SWITCHES

A. General requirements unless modified in specific requirements paragraph of switches per designated areas or types:
   1. Toggle type, quiet action, Industrial Specification Grade.
   2. Self grounding with grounding terminal.
   3. Back and side wired.
   4. Solid silver cadmium oxide contacts.
   5. Rugged urea housing and one-piece switch arm.
   6. Rated 20 A, 120/277 Vac.
   7. Switch handle color: Ivory.
   8. Types as indicated on the Drawings:
      a. Single-pole.
      b. 3-way.
   9. Standards: UL 20, UL 514A, NEMA WD 6.

B. Dry Non-architecturally Finished Areas:
   1. Coverplate:
      a. Zinc plated malleable iron or galvanized steel.
      b. Single or multiple gang as required.

2.3 RECEPTACLES

A. General requirements unless modified in specific requirements paragraph of receptacles per designated areas:
   1. Straight blade, Industrial Specification Grade.
   2. Brass triple wipe line contacts.
   3. One-piece grounding system with double wipe brass grounding contacts and self grounding strap.
   4. Back and side wired.
   5. Rated 20 A, 125 Vac.
   6. High impact nylon body.
   7. Receptacle body color:
      a. Normal power: Ivory.
   8. Types as indicated on the Drawings:
      a. Normal: Self grounding with grounding terminal.
      b. Ground fault circuit interrupter: Feed-through type with test and reset buttons.
   9. Duplex or simplex as indicated on the Drawings.
   10. Configuration: NEMA 5-20R.
   11. Standards: UL 498, UL 514A, UL 943, NEMA WD 1, NEMA WD 6.

B. Dry Non-architecturally Finished Areas:
   1. Coverplate:
      a. Zinc plated malleable iron or galvanized steel.
      b. Single or multiple gang as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Mount devices where indicated on the Drawings and as scheduled in Specification Section 16010.

C. See Specification Section 16130 for device outlet box requirements.

END OF SECTION

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SECTION 16410
SAFETY SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Safety switches.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. KS 1, Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
   2. Underwriters Laboratories, Inc. (UL):
      a. 98, Enclosed and Dead-Front Switches.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. Provide a table that associates safety switch model number with connected equipment tag number.
      c. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following safety switch manufacturers are acceptable:
   1. Cutler-Hammer.
   2. General Electric Company.
   3. Square D Company.
   4. Siemens.

2.2 SAFETY SWITCHES

A. General:
   1. Non-fusible or fusible as indicated on the Drawings.
   2. Suitable for service entrance when required.
   3. NEMA Type HD heavy-duty construction.

4. Switch blades will be fully visible in the OFF position with the enclosure door open.
5. Quick-make/quick-break operating mechanism.
6. Deionizating arc chutes.
7. Manufacture double-break rotary action shaft and switchblade as one (1) common component.
8. Clear line shields to prevent accidental contact with line terminals.
9. Operating handle (except NEMA 7 and NEMA 9 rated enclosures):
    a. Red and easily recognizable.
    b. Padlockable in the OFF position
    c. Interlocked to prevent door from opening when the switch is in the ON position with a defeater mechanism.

B. Ratings:
1. Horsepower rated of connected motor.
2. Voltage and amperage: As indicated on the Drawings.
3. Short circuit withstand:
    a. Non-fused: 10,000A.
    b. Fused: 200,000A.

C. Enclosures:
1. NEMA 1 rated:
    a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
    b. With or without knockouts, hinged and lockable door.

D. Standards: NEMA KS 1, UL 98.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's instructions and recommendations.

B. Install switches adjacent to the equipment they are intended to serve unless otherwise indicated on the Drawings.

C. Permitted uses of NEMA 1 enclosure:
1. Surface or flush mounted in areas designated dry in non-architecturally finished areas.

END OF SECTION

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SECTION 16441
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Lighting and appliance panelboards.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.
   4. Section 16491 - Low Voltage Surge Protective Devices (SPD).

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. PB 1, Panelboards.
   2. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
   3. Underwriters Laboratories, Inc. (UL):
      a. 50, Standard for Safety Cabinets and Boxes.
      b. 67, Standard for Safety Panelboards.
      c. 489, Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data.
      a. Provide submittal data for all products specified in PART 2 of this Specification:
      b. See Section 16010 for additional requirements.
   3. Fabrication and/or layout drawings:
      a. Panelboard layout with alphanumeric designation, branch circuit breakers size and type, as indicated in the panelboard schedules.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Cutler-Hammer.
   2. General Electric Company.
   3. Square D Company.
   4. Siemens.

2.2 MANUFACTURED UNITS

A. Standards: NEMA PB 1, NFPA 70, UL 50, UL 67.

B. Ratings:
   1. Current, voltage, number of phases, number of wires as indicated on the Drawings.
   2. Panelboards rated 240 Vac or less: 10,000 amp minimum short circuit rating or as indicated in the schedule.
   3. Service Entrance Equipment rated when indicated on the Drawings.

C. Construction:
   1. Interiors factory assembled and designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
   2. Multi-section panelboards: Feed-through or sub-feed lugs.
   3. Main lugs: Solderless type approved for copper and aluminum wire.

D. Bus Bars:
   1. Main bus bars:
      a. Plated aluminum or copper sized to limit temperature rise to a maximum of 65 DegC above an ambient of 40 DegC.
      b. Drilled and tapped and arranged for sequence phasing of the branch circuit devices.
   2. Ground bus and isolated ground bus, when indicated on Drawings: Solderless mechanical type connectors.
   3. Neutral bus bars: Insulated 100 percent rated or 200 percent rated, when indicated on the Drawings and with solderless mechanical type connectors.

E. Enclosure:
   1. Boxes: Code gage galvanized steel, furnish without knockouts.
   2. Trim assembly: Code gage steel finished with rust inhibited primer and manufacturers standard paint inside and out.
   3. Lighting and appliance panelboard:
      a. Trims supplied with hinged door over all circuit breaker handles.
      b. Trims for surface mounted panelboards, same size as box.
      c. Trims for flush mounted panelboards, overlap the box by 3/4 IN on all sides.
      d. Doors lockable with corrosion resistant chrome-plated combination lock and catch, all locks keyed alike.
      e. Nominal 20 IN wide and 5-3/4 IN deep with gutter space in accordance with NEC.
      f. Clear plastic cover for directory card mounted on the inside of each door.

F. Overcurrent and Short Circuit Protective Devices:
   1. Molded Case Type:
      a. General:
         1) Standards: NEMA AB 1, UL 489.
         2) Unit construction.
         3) Over-center, toggle handle operated.
         4) Quick-make, quick-break, independent of toggle handle operation.
         5) Manual and automatic operation.
         6) All poles open and close simultaneously.
         7) Three (3) position handle: On, off and tripped.
         8) Molded-in ON and OFF markings on breaker cover.
         9) One-, two- or three-pole as indicated on the Drawings.
         10) Current and interrupting ratings as indicated on the Drawings.
         11) Bolt on type.
      b. Thermal magnetic type:
         1) Inverse time overload and instantaneous short circuit protection by means of a thermal magnetic element.
         2) Frame size 150 amp and below:
            a) Non-interchangeable, non-adjustable thermal magnetic trip units.

2. Factory installed.

G. Integral surge protective device: See Section 16491.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated on Drawings, in accordance with the NEC, and in accordance with manufacturer's instructions.

B. Support panelboard enclosures from wall studs or modular channels support structure, per Section 16010.

C. Provide each panelboard with a typed directory:
1. Identify all circuit locations in each panelboard with the load type and location served.
2. Mechanical equipment shall be identified by Owner-furnished designation if different than designation indicated on Drawings.

END OF SECTION

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SECTION 16442
MOTOR CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Separately mounted motor starters.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. International Electrotechnical Commission (IEC).
   2. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volt Maximum).
      b. ICS 2, Controllers, Contactors and Overload Relays Rated 600 V.
   3. Underwriters Laboratories, Inc. (UL):
      a. 508, Standard for Industrial Control Equipment.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. See Specification Section 16010 for additional requirements.
   3. Fabrication and/or layout drawings:
      a. Separately mounted combination starters:
         1) Unit ladder logic wiring for each unit depicting electrical wiring and identification of terminals where field devices or remote control signals are to be terminated as indicated on the Drawings and/or loop descriptions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Allen-Bradley.
   2. Cutler Hammer.
   3. General Electric Company.
   4. Square D Company.
   5. Siemens.

2.2 SEPARATELY MOUNTED COMBINATION STARTERS

A. Standards:
   1. NEMA 250, NEMA ICS 2.
   2. UL 508.

B. Enclosure:
   1. NEMA 12 rated:
      a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.
      b. No knockouts, external mounting flanges, hinged and gasketed door.

C. Operating Handle:
   1. With the door closed the handle mechanism allows complete ON/OFF control of the unit disconnect and clear indication of the disconnect status.
   2. Circuit breaker and MCP operators includes a separate TRIPPED position.
   3. Mechanical interlock to prevent to prevent the opening of the door when the disconnect is in the ON position with a defeater mechanism for use by authorized personnel.
   4. Mechanical interlock to prevent the placement of the disconnect in the ON position with the door open with a defeater mechanism for use by authorized personnel.
   5. Padlockable in the OFF position.
   6. Exceptions: NEMA 7 and NEMA 9 enclosures.

D. External mounted overload relay pushbutton.

E. Control Devices:
   1. The following devices are the minimum required unless otherwise indicated on the Drawings:
      a. Three-position switch (HAND-OFF-AUTO).
      b. Red ON indicator light.
   2. Devices will be accessible with the door closed.

F. Control Power Transformer:
   1. 120V secondary.
   2. Fused on primary and secondary side.
   3. Sized for 140 percent of required load.

G. Fault Current Withstand Rating: Equal to the rating of the electrical gear from which it is fed.

H. Motor Starters: See requirements within this Specification Section.

I. Disconnect Switch, Overcurrent and Short Circuit Protective Devices:
   1. Motor circuit protector.
   2. Factory installed.

2.3 MOTOR STARTERS

A. Standards:
   1. NEMA ICS 2.
   2. UL 508.

B. Full Voltage Non-Reversing (FVNR) Magnetic Starters:
   1. NEMA full size rated contactor.
      a. NEMA half sizes and IEC contactors are not permitted.
   2. Double-break silver alloy contacts.
   3. Overload relays:
      a. Ambient compensated, bimetallic type with interchangeable heaters, 24 percent adjustability, single phase sensitivity, an isolated arm contact and manual reset.

2.4 PILOT DEVICES

A. General Requirements:
   1. Standards: NEMA ICS 2, UL 508.
   2. Heavy-duty NEMA 4/13 watertight/oiltight.
   3. Mounting hole: 30.5 mm.
   4. Contact blocks: 10 amp, NEMA A600 rated, number as required to fulfill functions shown or specified.
   5. Legend plate marked as indicated on Drawings or specified.

B. Selector Switches:
   1. Two, three- or four-position rotary switch as required to fulfill functions shown or specified.
   2. Maintained contact type.
   3. Knob or lever type operators.

C. Indicating Lights:
   1. Allowing replacement of bulb without removal from control panel.
   2. Lamp: LED, 120 V or 24 V as required.
   3. Full voltage type.
   4. Push-to-test indicating lights.
   5. Glass lens.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated on the Drawings and in accordance with manufacturer's recommendations and instructions.

B. Mounting height for surface mounted equipment: See Specification Section 16010.

C. Overload Heaters:
   1. Size for actual motor full load current of the connected motor.
   2. For motors with power factor correction capacitors, size to compensate for the capacitors effect on load current.

D. Combination Starter Enclosures:
   1. Permitted uses of NEMA 12 enclosure:
      a. Surface mounted in areas designated as dry.

END OF SECTION

1

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SECTION 16491
LOW VOLTAGE SURGE PROTECTION DEVICES (SPD)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Type 2 SPD - High exposure locations (switchgear, switchboard, panelboard or motor control center), externally mounted.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
      b. C62.41.1, Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits.
      c. C62.41.2, Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
      d. C62.45, Recommended Practice on Surge Testing For Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
   2. Military Standard:
      a. MIL-STD-220B, Method of Insertion-Loss Measurement.
   3. National Electrical Manufacturers Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. LS 1, Low Voltage Surge Protective Devices.
   4. Underwriters Laboratories, Inc. (UL):
      a. 1283, Standard for Electromagnetic Interference Filters.
      b. 1449, Standard for Safety Transient Voltage Surge Suppressors.

B. Qualifications:
   1. Provide devices from a manufacturer who has been regularly engaged in the development, design, testing, listing and manufacturing of SPDs of the types and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
      a. Upon request, suppliers or manufacturers shall provide a list of not less than three (3) customer references showing satisfactory operation.

1.3 DEFINITIONS

A. Clamping Voltage:
   1. The applied surge shall be induced at the 90 degree phase angle of the applied system frequency voltage.
   2. The voltage measured at the end of the 6 IN output leads of the SPD and from the zero voltage reference to the peak of the surge.

B. Let-Through Voltage:
   1. The applied surge shall be induced at the 90 degree phase angle of the applied system frequency voltage.

2. The voltage measured at the end of the 6 IN output leads of the SPD and from the system peak voltage to the peak of the surge.

C. Maximum Continuous Operating Voltage (MCOV): The maximum steady state voltage at which the SPD device can operate and meet its specification within its rated temperature.

D. Maximum Surge Current:
1. The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10 percent deviation of clamping voltage at a specified surge current.
2. Listed by mode, since number and type of components in any SPD may very by mode.

E. MCC: Motor Control Center.

F. Protection Modes: This parameter identifies the modes for which the SPD has directly connected protection elements, i.e., line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), neutral-to-ground (N-G).

G. Surge Current per Phase:
1. The per phase rating is the total surge current capacity connected to a given phase conductor.
a. For example, a wye system surge current per phase would equal L-N plus L-G; a delta system surge current per phase would equal L-L plus L-G.
b. The N-G mode is not included in the per phase calculation.

H. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a 480/277 V system the L-L peak voltage is 679V and the L-N peak voltage is 392 V).

1.4 SUBMITTALS

A. Shop Drawings:
1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
a. Manufacturer's qualifications.
b. Standard catalog cut sheet.
c. Electrical and mechanical drawing showing unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
d. Testing procedures and testing equipment data.
e. Create a Product Data Sheet for each different model number of SPD provided (i.e., Model XYZ with disconnect and Model XYZ without disconnect, each require a Product Data Sheet).
1) Data in the Product Data Sheet heading:
a) SPD Type Number per PART 2 of the Specification.
b) Manufacturer’s Name.
c) Product model number.
2) Data in the Product Data Sheet body:
a) Column one: Specified value/feature of every paragraph of PART 2 of the Specification.
b) Column two: Manufacturer’s certified value confirming the product meets the specified value/feature.
c) Name of the nationally recognized testing laboratory that preformed the tests.
d) Warranty information.
3) Data in the Product Data Sheet closing:
a) Signature of the manufacturer’s official (printed and signed).
b) Title of the official.
4) Date of signature.

1.5 WARRANTY

A. Minimum of a five (5) year Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Standards: IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45, NEMA LS 1, MIL-STD 220B, UL 1283, UL 1449.

2.2 TYPE 2 SPD

A. Product:
   1. Externally mounted next to panelboard.
   2. Hybrid solid-state high performance suppression system.
      a. Do not use suppression system with gas tubes, spark gaps or other components which might short or crowbar the line resulting in interruption of normal power flow to connected loads.
   3. Do not connect multiple SPD modules in series to achieve the specified performance.
   4. Designed for parallel connection.
   5. Enclosure:
      a. Metallic NEMA 4 or 12 for interior locations.
      b. Metallic NEMA 4 or 4X for exterior locations.
   6. Field connection:
      a. Mechanical or compression lugs for each phase, neutral and ground that will accept #10 through #1/0 conductors. OR
      b. Preinstalled lead conductors: Size per manufacturer, length as required with a maximum of 5 FT.
   7. Device monitor:
      a. Long-life, solid state, externally visible indicators and Form C dry contact(s) that monitor the on-line status of each mode of the units suppression filter system or power loss in any of the phase.
      b. A fuse status only monitor system is not acceptable.

B. Operating Voltage: Nominal unit operating voltage and configuration as indicated on the Drawings.

C. Modes of Protection: All modes.
   1. Three phase (delta): L-L, L-G.
   2. Three phase (wye): L-N, L-L, L-G and N-G.
   3. Single phase (2 pole): L-L, L-N, L-G and N-G.
   4. Single phase: L-N, L-G and N-G.

D. Maximum Continuous Operating Voltage: Less than 130 percent of system peak voltage.

E. Operating Frequency: 45 to 65 Hz.

F. Short Circuit Rating: Equal to or greater than rating of equipment SPD is connected to.

G. Maximum Surge Current: 240,000 A per phase, 120,000 A per mode minimum.

H. Minimum Repetitive Surge Current Capacity: 4000 IEEE C High waveform impulses with no degradation of more than 10 percent deviation of the clamping voltage.

I. SPD Protection:
   1. Integral unit level and/or component level overcurrent fuses and sustained overvoltage thermal cutout device.

2. An IEEE C High waveforms shall not cause the fuse to open and render the SPD inoperable.

J. Maximum Clamping Voltages: Dynamic test at the 90 degree phase angle including 6 IN lead length and measured from the zero voltage reference:

		IEEE C62.41		
System Voltage	Test Mode	C High V & I Wave	B Combination Wave	UL 1449
L-L < 250 V	L-L	1470 V	1000 V	800 V
L-N < 150 V	L-N	850 V	600 V	500 V
	L-G	1150 V	800 V	600 V
	N-G	1150 V	800 V	600 V
L-L > 250 V	L-L	2700 V	2000 V	1800 V
L-N > 150 V	L-N	1500 V	1150 V	1000 V
	L-G	2000 V	1550 V	1200 V
	N-G	2000 V	1550 V	1200 V

K. EMI-RFI Noise Rejection: Attenuation greater than 30 dB for frequencies between 100 kHz and 100 MHz.

2.3 SOURCE QUALITY CONTROL

A. SPD approvals and ratings shall be obtained by manufacturers from nationally recognized testing laboratories.

B. The SPD are to be tested as a complete SPD system including:
1. Integral unit level and/or component level fusing.
2. Neutral and ground shall not be bonded during testing.
3. 6 IN lead lengths.
4. Integral disconnect switch when provided.

C. The “as installed” SPD system including the manufacturers recommended circuit breaker, the SPD is connected to, will not open when tested with a IEEE C3 combination waveform.

D. Tests to be performed in accordance with IEEE C62.45:
1. Clamping voltage performance testing using IEEE C62.41 Category waveforms.
2. Single pulse surge current capacity test.
3. Repetitive surge current capacity testing.
4. Spectrum analysis for EMI-RFI noise rejection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Type 2 SPD:
1. Mounting options:
   a. On wall or support structure adjacent to the equipment to be protected with leads routed through conduit. OR
   b. Nipple connection directly to the equipment to be protected.
2. Install leads as short and straight as possible.
3. Maximum lead length: 5 FT.
4. Minimum lead size:
   a. Type 2 SPD: #2 stranded AWG.
5. When conduit connection is used, provide a minimum of four (4) twists per foot in the lead conductors and install in NFPA 70 sized conduit.

6. Connect leads to the equipment to be protected by one (1) of the following means:
    a. Through a circuit breaker or molded case switch mounted in the equipment.
        1) Use manufacturer recommended circuit breaker size.
    b. Directly to the protected equipment bus, when SPD has integral disconnect switch.

END OF SECTION

1

2011/08/31

SECTION 16500
INTERIOR AND EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Interior building lighting fixtures.
      b. Exterior building lighting fixtures.
      c. Lamps.
      d. Ballasts.

B. Related Specification Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Division 3 - Concrete.
   4. Section 16010 - Electrical: Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Federal Communications Commission (FCC):
      a. Code of Federal Regulations (CFR), 47 CFR 18, Industrial, Scientific and Medical Equipment.
   2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   3. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
      a. C82.11, High-Frequency Fluorescent Lamp Ballasts - Supplements.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
      b. 101, Life Safety Code.
   5. Underwriters Laboratories, Inc. (UL):
      a. 924, Standard for Emergency Lighting and Power Equipment.
      b. 935, Standard for Fluorescent-Lamp Ballasts.
      c. 1029, Standard for High-Intensity-Discharge Lamp Ballasts.
      d. 1598, Luminaires.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Specification Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data:
      a. Provide submittal data for all products specified in PART 2 of this Specification Section.
      b. Identify fixtures by Fixture Schedule number.
      c. Fixture data sheet including:
         1) Photometric performance data including candlepower distribution and coefficient of utilization (CU) table.
      d. See Specification Section 16010 for additional requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Lighting fixtures: See Fixture Schedule.
   2. Lamps:
      a. Osram/Sylvania.
      b. General Electric.
      c. Philips.
      d. Venture.
   3. Ballasts: Fixture manufacturer's standard.

2.2 GENERAL REQUIREMENTS

A. All lighting fixtures and electrical components:
   1. UL labeled.
   2. Fixtures complete with lamps and ballasts.

2.3 LIGHT FIXTURES

A. Fluorescent:
   1. UL 1598.
   2. Finish:
      a. Manufacturer's standard polyester, acrylic enamel or epoxy powder coating applied after fabrication.
      b. Manufacturer's standard color.
   3. Prewired and provided with lamps that are properly mated to the ballast operating characteristics.

B. Exit Signs and Emergency Lighting Units:
   1. UL 924, NFPA 101.

2.4 LAMPS

A. Fluorescent:
   1. T8 (265 mA) instant or rapid-start medium bipin lamps.
      a. Correlated color temperature of 3500 degrees Kelvin.
      b. Minimum color rendering index (CRI) of 70.
      c. Minimum initial lumen ratings for each lamp type shall be:
         1) 2800 lumens for 48 IN, 32 watt F32T8 lamp.
   2. T4 twin-tube, quad-tube, and/or triple twin-tube compact fluorescent lamps.
      a. Correlated color temperature of 3500 degrees Kelvin.
      b. Minimum color rendering index (CRI) of 80.
      c. Minimum initial lumen ratings for rapid-start 4-pin triple twin-tube lamps with a GX24q-2 or GX24q-3 base shall be:
         1) 3200 lumens for 6.3 IN, 42 watt CF42TTT lamp.

2.5 BALLASTS

A. Fluorescent High Frequency Electronic Ballasts:
   1. UL 935.
   2. "High Frequency" electronic operating lamps at a frequency of 20 KHz or higher without visible flicker.
   3. Power factor: Greater than 90 percent.
   4. Input current total harmonic distortion (THD) of less than 20 percent.
   5. Lamp current crest factor: Less than 1.7, in accordance with lamp manufacturer's recommendations and NEMA/ANSI C82.11.

6. Instant start with lamps wired in parallel.
7. Support a sustained short to ground or open circuit of any output leads without damage to the ballast.
8. Ballast Factor: Greater than 0.85 per NEMA/ANSI C82.11.
9. Audible noise rating: Class A or better.
10. Operation in ambient temperatures up to 40 DegC (105 DegF) without damage.
11. Light output to remain constant for a line voltage fluctuation of +5 percent.
12. Meet the requirements of the FCC 47 CFR 18, for non-consumer equipment for EMI and RFI.
13. Meet NEMA/ANSI C82.11 standards regarding harmonic distortion.
14. Meet IEEE C62.41 Cat. A for transient protection.
15. Comply with all applicable state and federal efficiency standards.
16. UL listed, Class P.
17. Contain no Polychlorinated Biphenyls (PCB's).

2.6 MAINTENANCE MATERIALS

A. Furnish a minimum of 2 or 10 percent of total of each type and wattage of lamps, whichever is greater.

B. Spare parts are to be stored in a box clearly labeled as to its contents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate fixture types with ceiling construction.
   1. Provide mounting hardware for the ceiling system in which the fixture is to be installed.

B. Provide mounting brackets and/or structural mounting support for wall-mounted fixtures.
   1. Do not support fixture from conduit system.
   2. When fixtures are supported from outlet boxes, install per NFPA 70.
   3. Supports for fixtures mounted on exterior walls shall not be attached to exterior face of the wall.

C. Pendant mounted, open, industrial fluorescent fixtures:
   1. Not in continuous rows, shall be supported by conduit or by approved chains:
      a. Hardwired to ceiling mounted junction box.

D. Install exterior fixtures so that water can not enter or accumulate in the wiring compartment.

E. Ground fixtures and ballasts.

3.2 ADJUST AND CLEAN

A. Replace all inoperable lamps with new lamps prior to final acceptance.

B. Aim all emergency lighting units, so that, the path of egress is illuminated.

END OF SECTION

1

MINIMUM INSURANCE REQUIREMENTS
CITY OF GRAND ISLAND, NEBRASKA

The successful bidder shall obtain insurance from companies authorized to do business in Nebraska of such types and in such amounts as may be necessary to protect the bidder and the interests of the City against hazards or risks of loss as hereinafter specified. This insurance shall cover all aspects of the Bidder's operations and completed operations. Failure to maintain adequate coverage shall not relieve bidder of any contractual responsibility or obligation. Minimum insurance coverage shall be the amounts stated herein or the amounts required by applicable law, whichever are greater.

1. WORKERS COMPENSATION AND EMPLOYER'S LIABILITY

This insurance shall protect the Bidder against all claims under applicable State workers compensation laws. This insurance shall provide coverage in every state in which work for this project might be conducted. The liability limits shall not be less than the following:

Workers Compensation	Statutory Limits
Employers Liability	$100,000 each accident
	$100,000 each employee
	$500,000 policy limit

2. BUSINESS AUTOMOBILE LIABILITY

This insurance shall be written in comprehensive form and shall protect the Bidder, Bidder's employees, or subcontractors from claims due to the ownership, maintenance, or use of a motor vehicle. The liability limits shall be not less than the following:

Bodily Injury & Property Damage	$ 500,000 Combined Single Limit

3. COMPREHENSIVE GENERAL LIABILITY

The comprehensive general liability coverage shall contain no exclusion relative to explosion, collapse, or underground property. The liability limits shall be not less than the following:

Bodily Injury & Property Damage	$ 500,000 each occurrence
	$1,000,000 aggregate

4. UMBRELLA LIABILITY INSURANCE

This insurance shall protect the Bidder against claims in excess of the limits provided under employer's liability, comprehensive automobile liability, and commercial general liability policies. The umbrella policy shall follow the form of the primary insurance, including the application of the primary limits. The liability limits shall not be less than the following:

Bodily Injury & Property Damage	$1,000,000 each occurrence
	$1,000,000 general aggregate

5. ADDITIONAL REQUIREMENTS

The City may require insurance covering a Bidder or subcontractor more or less than the standard requirements set forth herein depending upon the character and extent of the work to be performed by such Bidder or subcontractor.

Insurance as herein required shall be maintained in force until the City releases the Bidder of all obligations under the Contract.

The Bidder shall provide and carry any additional insurance as may be required by special provisions of these specifications.

6. CERTIFICATE OF INSURANCE

Satisfactory certificates of insurance shall be filed with the City prior to starting any work on this Contract**. The certificates shall show the City as an additional insured on all coverage except Workers Compensation. The certificate shall state that thirty (30) days written notice shall be given to the City before any policy is cancelled (strike the "endeavor to" wording often shown on certificate forms). If the bidder cannot have the "endeavor to" language stricken, the bidder may elect to provide a new certificate of insurance every 30 days during the contract. Bidder shall immediately notify the City if there is any reduction of coverage because of revised limits or claims paid which affect the aggregate of any policy.**

Contract Drawings For

CITY OF GRAND ISLAND UTILITIES DEPARTMENT

HDR Engineering, Inc.

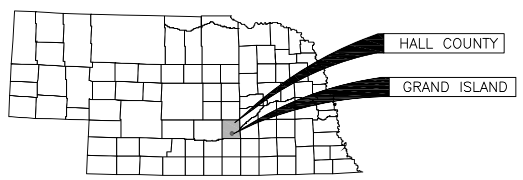
URANIUM REMOVAL WATER TREATMENT PLANT BUILDING CONSTRUCTION PACKAGE

Civil/Architectural/Structural
Process/Mechanical/Electrical

Project No.
145910

Grand Island, Nebraska
September, 2011

CITY OF GRAND ISLAND UTILITIES DEPARTMENT



STATE OF NEBRASKA

LOCATION MAP

NOT TO SCALE

INDEX OF DRAWINGS

APPROVALS:

ENGINEER	DATE
UTILITIES DIRECTOR	DATE
FIRE CHIEF	DATE
PUBLIC WORKS DIRECTOR	DATE

ISSUED FOR BID

September, 1 2011

C:\pwworking\oma\d0739761\00G-00.dwg, Plot, 8/26/2011 8:13:22 PM, jcyboron

A/C	AIR CONDITIONING
A/E	ARCHITECT/ENGINEER
A	AMPERE
AB	ANCHOR BOLT
ABAN	ABANDON
ABC	AGGREGATE BASE COURSE
ABT	ABOUT
AC	ALTERNATING CURRENT
ACK	ACKNOWLEDGE
ACP	ACOUSTIC CEILING PANEL, ASPHALTIC CONCRETE PAVEMENT
ACST	ACOUSTIC
AD	ADDENDUM, AREA DRAIN
ADDL	ADDITIONAL
ADH	ADHESIVE
ADJ	ADJUSTABLE, ADJACENT
AF	AMP FRAME, AMP FUSE
AFF	ABOVE FINISH FLOOR
AFG	ABOVE FINISH GRADE
AGGR	AGGREGATE
AI	AREA INLET, ANALOG INPUT
AIC	AMPS INTERRUPTING CAPACITY
ALIG	ALIGNMENT
ALT	ALTERNATE, ALTITUDE
ALUM	ALUMINUM
AM	ACOUSTICAL MATERIAL
AMB	AMBIENT
ANC	ANCHOR
AO	ANALOG OUTPUT
AP	ACCESS PANEL
APRX	APPROXIMATE
APVD	APPROVED
ARCH	ARCHITECTURAL
ASSY	ASSEMBLY
AT	ACOUSTICAL TILE, AMP TRIP
ATC	ACOUSTICAL TILE CEILING
ATM	ATMOSPHERE
AUTO	AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AVG	AVERAGE
AWG	AMERICAN WIRE GAGE
AWT	ACOUSTICAL WALL TILE
B TO B	BACK TO BACK
BAL	BALANCE
BBD	BULLETIN BOARD
BC	BASE CABINET, BOTTOM CHORD, BOLT CENTER, BOLT CIRCLE
BD	BOARD
BE	BOTH ENDS, BELL END
BF	BOTH FACES, BOTTOM FACE, BLIND FLANGE, BOARD FEET
BITUM	BITUMINOUS
BKG	BACKING
BL	BASE LINE
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BM	BENCHMARK, BEAM
BOC	BACK OF CURB
BOD	BOTTOM OF DUCT
BOG	BOTTOM OF GRILLE
BOL	BOTTOM OF LOUVER, BOLLARD
BOP	BOTTOM OF PIPE
BOR	BOTTOM OF REGISTER
BOT	BOTTOM
BOU	BOTTOM OF UNIT
BP	BASE PLATE
BRG	BEARING
BRGP	BEARING PLATE
BRKT	BRACKET
BS	BOTH SIDES
BTU	BRITISH THERMAL UNIT
BTW	BETWEEN
BTWLD	BUTT WELD
BU	BELL UP, BUILT-UP
BUR	BUILT-UP ROOFING
BW	BOTH WAYS
BYP	BYPASS
C TO C	CENTER TO CENTER
C&G	CURB AND GUTTER
C	CHANNEL SHAPE, CENTIGRADE, CONDUIT
CAB	CABINET
CAP	CAPACITY
CAT	CATALOG, CATALOGIORY
CAV	CAVITY
CB	CATCH BASIN
CCB	CONCRETE BLOCK
CCW	COUNTER CLOCKWISE
CDF	CONTROLLED-DENSITY FILL
CE	CONCRETE EDGE
CER	CERAMIC
CF	CUBIC FEET (FOOT)
CFL	COUNTER FLASHING
CHBD	CHALKBOARD
CHD	CHORD
CHFR	CHAMFER
CHH	COMMUNICATION HANDHOLE
CI	CURB INLET
CIP	CAST-IN-PLACE
CIPB	CONCRETE INTERLOCKING PAVER BALLAST
CIRC	CIRCULATION, CIRCULAR
CJ	CONSTRUCTION JOINT
CKT	CIRCUIT
CL	CENTERLINE, CLASS, CLOSE
CLG	CEILING
CLKG	CAULKING
CLR	CLEAR
CMH	COMMUNICATION MANHOLE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT, CONCRETE OPENING
COL	COLUMN
COM	COMMON
COMB	COMBINATION
COMM	COMMUNICATION
COMP	COMPOSITION, COMPRESSIBLE, COMPOSITE
CON	CONCENTRIC
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS
COOR	COORDINATE
CORR	CORROSIVE, CORRUGATED
CP	CHECKER PLATE, CONTROL POINT
CPLG	COUPLING
CRL	CORROSION-RESISTANT LINING
CSC	COMPRESSION SLEEVE COUPLING
CSK	COUNTERSINK
CSS	CLINIC SERVICE SINK
CT	CERAMIC TILE
CTJ	CONTRACTION JOINT
CTR	CENTER
CTRL	CONTROL
CVT	CULVERT
CU	COPPER, CUBIC
CW	CLOCKWISE
CY	CUBIC YARD
d	PENNY (NAIL MEASURE)
D	DEEP, DIFFUSER, DRAIN
DB	DUCT BANK, DECIBEL, DRY BULB
DBA	DEFORMED BAR ANCHOR
DBL	DOUBLE
DC	DIRECT CURRENT
DEG	DEGREE
DEG C	DEGREE CENTIGRADE
DEG F	DEGREE FAHRENHEIT
DEMO	DEMOLITION
DEP	DEPRESSED
DEPT	DEPARTMENT
DET	DETAIL
DI	DROP INLET, DUCTILE IRON, DIGITAL INPUT
DIA	DIAMETER
DIAG	DIAGONAL, DIAGRAM
DIFF	DIFFERENTIAL, DIFFERENCE
DIM	DIMENSION
DISCH	DISCHARGE
DIST	DISTANCE, DISTRIBUTION
DIV	DIVISION
DL	DEAD LOAD
DMJ	DOUBLE MECHANICAL JOINT
DMPF	DAMP PROOFING
DN	DOWN
DO	DISSOLVED OXYGEN, DIGITAL OUTPUT, DITTO
DP	DEPTH
DPDT	DOUBLE POLE, DOUBLE THROW
DPST	DOUBLE POLE, SINGLE THROW
DS	DOWN SPOUT
DT	DOUBLE TEE, DRIP TRAP ASSEMBLY
DUP	DUPLICATE
DWG	DRAWING
DWL	DOWEL
DWR	DRAWER
E	EAST
EA	EACH, EXHAUST AIR
EC	ELECTRICAL CONTRACTOR
ECC	ECCENTRIC
ED	EQUIPMENT DRAIN
EDB	ELECTRICAL DUCT BANK
EE	EACH END
EF	EACH FACE
EFF	EFFLUENT, EFFICIENCY
EHH	ELECTRICAL HANDHOLE
EIFS	EXTERIOR INSULATION & FINISH SYSTEM
EJ	EXPANSION JOINT
EL	ELBOW, ELEVATION
ELEC	ELECTRICAL
EMBD	EMBEDDED
EMER	EMERGENCY
EMH	ELECTRICAL MANHOLE
ENCL	ENCLOSURE
ENGR	ENGINEER
ENTR	ENTRANCE
EOP	EDGE OF PAVEMENT
EQ	EQUAL
EQUIP	EQUIPMENT
EQUIV	EQUIVALENT
ES	EACH SIDE, EQUAL SPACE, EMERGENCY SHOWER
ESEW	EMERGENCY SHOWER AND EYE WASH
EST	ESTIMATE
EW	EACH WAY, EMERGENCY EYE/FACE WASH
EWC	ELECTRIC WATER COOLER
EWEF	EACH WAY, EACH FACE
EWTB	EACH WAY, TOP AND BOTTOM
EXC	EXCAVATION
EXH	EXHAUST
EXP	EXPANSION, EXPOSED
EXST	EXISTING
EXT	EXTERIOR, EXTERNAL, EXTENSION
F TO F	FACE TO FACE
F&B	FACE AND BYPASS
FAB	FABRICATE
FB	FLOOR BEAM
FBD	FIBERBOARD
FBG	FIBERGLASS
FBM	BOARD FOOT MEASURE
FBO	FURNISHED BY OWNER
FC	FLUSHING CONNECTION
FCA	FLANGED COUPLING ADAPTER
FD	FLOOR DRAIN
FDC	FLEXIBLE DUCT CONNECTION
FDR	FEEDER
FDTN	FOUNDATION
FE	FLANGED END
FEC	FIRE EXTINGUISHER CABINET
FES	FLARED END SECTION
FEXT	FIRE EXTINGUISHER
FF	FAR FACE, FACTORY FINISH, FLAT FACE
FG	FINISHED GRADE
FH	FIRE HYDRANT
FIG	FIGURE
FIN	FINISH
FJT	FLUSH JOINT
FL	FLOW, FLOW LINE
FLEX	FLEXIBLE
FLG	FLANGE
FLOR	FLUORESCENT
FLR	FLOOR
FLS	FLASHING, FLUSH
FN	FENCE
FO	FINISHED OPENING, FIBER OPTIC
FOB	FLAT ON BOTTOM
FOC	FACE OF CONCRETE, FACE OF CURB
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FOT	FLAT ON TOP
FPT	FEMALE PIPE THREAD
FR	FRAME
FRP	FIBERGLASS REINFORCED PLASTIC
FRTM	FIRE RETARDANT TREATED MATERIAL
FS	FLOOR SINK, FAR SIDE
FT	FEET, FOOT
FTG	FOOTING, FITTING
FUR	FURRED, FURRING
FURN	FURNITURE, FURNISH
FUT	FUTURE
FV	FACE VELOCITY
FW	FIELD WELD, FIRE WALL
FWD	FORWARD
FWE	FURNISHED WITH EQUIPMENT
FXTR	FIXTURE
G	GRILLE, GROUND
GA	GAGE (METAL THICKNESS)
GAL	GALLON
GALV	GALVANIZED
GB	GRAB BAR, GRADE BREAK
GC	GROOVED COUPLING
GD	GUARD
GEN	GENERAL
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFMU	GROUND FACE MASONRY UNIT
GG	GUTTER GRADE
GJ	GROOVED JOINT
GL	GLASS
GLB	GLASS BLOCK, GLULAM BEAM
GND	GROUND
GP	GUY POLE
GR	GRADE
GRTG	GRATING
GSB	GYPSUM SHEATHING BOARD
GT	GREASE TRAP
GVL	GRAVEL
GW	GUY WIRE
GWB	GYPSUM WALLBOARD
GYP	GYPSUM HARDBOARD
H	HIGH
HB	HOSE BIBB
HBD	HARDBOARD
HC	HANDICAPPED, HOLLOW CORE, HORIZONTAL CURVE, HORIZONTAL CENTERLINE
HD	HEAD, HOT DIP
HDR	HEADER
HDW	HARDWARE
HEX	HEXAGONAL
HGR	HANGER
HH	HANDHOLE
HID	HIGH-INTENSITY DISCHARGE
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HP	HIGH POINT, HORSEPOWER
HPC	HORIZONTAL POINT OF CURVATURE
HPS	HIGH-PRESSURE SODIUM
HPT	HORIZONTAL POINT OF TANGENCY
HR	HOSE REEL, HOUR
HS	HEADED STUD, HIGH STRENGTH
HSS	HOLLOW STRUCTURAL SHAPE
HT	HEIGHT
HTG	HEATING
HV	HIGH VOLTAGE
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
HWD	HARDWOOD
HWL	HIGH WATER LEVEL
HYD	HYDRAULIC
HZ	HERTZ, CYCLES PER SECOND
ID	INSIDE DIAMETER, INTERIOR DIMENSION
IE	INVERT ELEVATION, FOR EXAMPLE
IF	INSIDE FACE
IH	INTAKE HOOD
IMP	IMPACT
IN	INCH
INC	INCLUDE, INCANDESCENT
INF	INFLUENT
INSTR	INSTRUMENTATION
INSUL	INSULATION
INT	INTERIOR, INTERSECTION
INTR	INTERMEDIATE, INTERIOR
INV	INVERT
IPS	IRON PIPE SIZE
IPT	INTERNAL PIPE THREAD
IR	INSIDE RADIUS, IRON ROD
IRR	IRRIGATION
ISO	ISOMETRIC
JB	JUNCTION BOX
JCT	JUNCTION
JF	JOINT FILLER
JST	JOIST
JT	JOINT
K	KIP
KB	KNEE BRACE
KCMIL	THOUSAND CIRCULAR MILS
KD	KNOCK DOWN
KO	KNOCK OUT
KSI	KIPS PER SQUARE INCH
KW	KILOWATT
L	ANGLE, LENGTH, LAVATORY, LINTEL
LAD	LADDER
LAM	LAMINATE
LATL	LATERAL
LB	LAG BOLT, POUND
LCTB	LIQUID CHALK AND TACK BOARD
LDG	LANDING
LDR	LEADER
LE	LIFTING EYE
LF	LINEAR FOOT
LG	LONG
LH	LEFT HAND
LIN	LINEAR
LIQ	LIQUID
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LMLU	LIQUID MARKER LECTURE UNIT
LNG	LONGITUDINAL
LOC	LOCATION
LP	LOW POINT
LPS	LOW-PRESSURE SODIUM
LR	LONG RADIUS
LT	LEFT
LTD	LIMITED
LTG	LIGHTING
LTL	LINTEL
LTNG	LIGHTNING
LV	LOW VOLTAGE
LVL	LAMINATED VENEER LUMBER
LVR	LOUVER
LW	LIGHTWEIGHT
LWC	LIGHTWEIGHT CONCRETE
LWL	LOW WATER LEVEL
MA	MIXED AIR
MACH	MACHINED
MAINT	MAINTENANCE
MAN	MANUAL
MATL	MATERIAL
MAX	MAXIMUM
MB	MACHINE BOLT
MBR	MEMBER
MC	MECHANICAL CONTRACTOR, MECHANICAL COUPLING, MOMENT CONNECTION
MCB	METAL CORNER BEAD
MCJ	MASONRY CONTROL JOINT
MDMJ	MODIFIED DOUBLE MECHANICAL JOINT
MECH	MECHANICAL
MED	MEDIUM
MFR	MANUFACTURER
MH	MANHOLE, METAL HALIDE
MIN	MINIMUM
MIR	MIRROR
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
ML	MASONRY LINTEL
MLO	MAIN LUGS ONLY
MMB	MEMBRANE
MO	MASONRY OPENING
MOD	MODULAR, MODIFY
MON	MONUMENT
MPT	MALE PIPE THREAD
MRGWB	MOISTURE-RESISTANT GYPSUM WALLBOARD
MS	MOP SINK
MSL	MEAN SEA LEVEL
MT	MOUNT
MU	MASONRY UNIT
MULL	MULLION
MV	MEDIUM VOLTAGE
MW	MONITORING WELL
N	NORTH, NEUTRAL
NA	NOT APPLICABLE
NAT	NATURAL, NATIONAL
NC	NORMALLY CLOSED
NEG	NEGATIVE
NF	NEAR FACE, NON-FUSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN, NUMBER
NOM	NOMINAL
NPS	NOMINAL PIPE SIZE
NPT	NATIONAL PIPE THREAD
NS	NEAR SIDE
NTS	NOT TO SCALE
NWL	NORMAL WATER LEVEL
O TO O	OUT TO OUT
OA	OUTSIDE AIR, OVERALL
OC	ON CENTER
OCPD	OVER CURRENT PROTECTION DEVICE
OD	OUTSIDE DIAMETER
OED	OPEN END DUCT
OF	OUTSIDE FACE, OFFICE FURNISHING
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED OWNER INSTALLED
OG	ORIGINAL GROUND
OH	OVERHEAD
OPNG	OPENING
OPP	OPPOSITE
OPT	OPTIONAL
OR	OUTSIDE RADIUS
ORD	OVERFLOW ROOF DRAIN
ORIG	ORIGINAL
OVFL	OVERFLOW
OVHG	OVERHANG
OZ	OUNCE
P	PAINT
PA	PUBLIC ADDRESS
PAR	PARALLEL, PARAPET
PB	PANIC BAR, PULL BOX
PBD	PARTICLE BOARD
PC	POINT OF CURVE, PIECE, PRECAST
PCC	POINT OF COMPOUND CURVATURE
PCF	POUNDS PER CUBIC FOOT
PCT	PERCENT
PE	PLAIN END
PED	PEDESTAL
PEN	PENETRATION
PERF	PERFORATED
PERM	PERMANENT
PERP	PERPENDICULAR
PF	POWER FACTOR
PFMU	PREFACED MASONRY UNIT
PH	PHASE
PI	POINT OF INTERSECTION
PKG	PACKAGE
PL	PLATE, PROPERTY LINE, PRECAST LINTEL
PLAS	PLASTER
PLAT	PLATFORM
PLBG	PLUMBING
PLF	POUNDS PER LINEAR FOOT
PNEU	PNEUMATIC
POL	POLISH
POS	POSITIVE, POSITION
PP	POLYPROPYLENE, POWER POLE
PRC	POINT OF REVERSE CURVATURE
PREF	PREFINISHED
PREFAB	PREFABRICATED
PRELIM	PRELIMINARY
PREP	PREPARE
PRES	PRESSURE
PRI	PRIMARY
PROP	PROPERTY, PROPOSED
PROT	PROTECTION
PS	PIPE SUPPORT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAGE
PST	PRESTRESSED
PT	POINT, POINT OF TANGENCY
PTN	PARTITION
PVC	POLYVINYL CHLORIDE, POINT OF VERTICAL CURVE
PVMT	PAVEMENT
PWD	PLYWOOD
PWJ	PLYWOOD WEB JOIST
PZ	PIEZOMETER
Q	RATE OF FLOW
QT	QUARRY TILE
QTR	QUARTER
QTY	QUANTITY
QUAL	QUALITY
R&R	REMOVE AND REPLACE
R&S	REMOVE AND SALVAGE
R	RADIUS, REGISTER, RISER
RA	RETURN AIR
RB	RESILIENT BASE, ROCK BERM
RCPT	RECEPTACLE
RD	ROOF DRAIN
REC	RECESS
RECD	RECEIVED
RECT	RECTANGULAR
RED	REDUCER
REF	REFERENCE
REINF	REINFORCING
REM	REMOVE
REQD	REQUIRED
RESIL	RESILIENT
RET	RETAINING, RETURN
REV	REVISION, REVERSE
RF	RESILIENT FLOORING
RFG	ROOFING
RFL	REFLECTED, REFLECTOR
RGH	ROUGH
RGS	RIGID GALVANIZED STEEL
RGS-PVC	PVC COATED RGS
RH	RELIEF HOOD, RIGHT HAND, RELATIVE HUMIDITY
RL	REQUIRED LAP
RLFA	RELIEF AIR
RND	ROUND
RNG	RUNNING
RO	ROUGH OPENING
ROW	RIGHT-OF-WAY
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RSP	ROCK SLOPE PROTECTION
RT	RIGHT
RVT	RESILIENT VINYL TILE
RY	READY
S	SOUTH, SINK
SA	SUPPLY AIR
SAMU	SOUND-ABSORBING MASONRY UNIT
SAN	SANITARY
SB	SPLASH BLOCK
SC	SOLID CORE
SCH	SCHEDULE
SCHEM	SCHEMATIC
SCN	SCREEN
SE	STEEL/ALUMINUM EDGE
SEC	SECONDARY, SECONDS
SECT	SECTION
SEP	SEPARATE
SF	SQUARE FOOT, SILT FENCE
SG	SHEET GLASS, SEALANT GROOVE
SH	SHOWER
SHT	SHEET
SHTG	SHEATHING
SIL	SILENCE
SIM	SIMILAR
SJ	SLAB JOINT
SL	SLOPE, STEEL LINTEL
SLTD	SLOTTED
SLV	SLEEVE
SMLS	SEAMLESS
SOG	SLAB ON GRADE
SP	SOUNDPROOF, STANDPIPE
SPA	SPACING
SPEC	SPECIFICATION
SPLY	SUPPLY
SPST	SINGLE POLE SINGLE THROW
SPT	SET POINT
SQ	SQUARE
SR	SHORT RADIUS
SS	SERVICE SINK
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STIF	STIFFENER
STIR	STIRRUP
STL	STEEL
STOR	STORAGE
STR	STRUCTURAL, STRAIGHT
SUB	SUBSTITUTE
SUC	SUCTION
SUSP	SUSPENDED
SY	SQUARE YARD
SYM	SYMBOL
SYMM	SYMMETRICAL
SYN	SYNTHETIC
SYS	SYSTEM
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
T	TILE, TREAD
TA	TOILET ACCESSORY, TEMPERED AIR
TAN	TANGENT
TBM	TEMPORARY BENCHMARK
TCE	TEMPORARY CONSTRUCTION EASEMENT
TEF	TROWELED EPOXY FLOORING
TEMP	TEMPORARY, TEMPERATURE
THD	THREAD
THK	THICK
THRESH	THRESHOLD
TKBD	TACK BOARD
TOB	TOP OF BOLT, TOP OF BANK, TOP OF BEAM, TOP OF BERM
TOC	TOP OF CURB, TOP OF CONCRETE
TOD	TOP OF DUCT
TOF	TOP OF FOOTING
TOG	TOP OF GRATING
TOL	TOLERANCE, TOP OF LEDGER
TOM	TOP OF MASONRY
TOP	TOP OF PLATE
TOPO	TOPOGRAPHY
TOS	TOP OF SLAB, TOP OF STEEL, TOE OF SLOPE
TOW	TOP OF WALL
TP	TOILET PARTITION, TELEPHONE POLE, TOE PLATE, TRAP PRIMER
TPD	TOILET PAPER DISPENSER
TPG	TOPPING, THROUGH PLATE GIRDER
TR	TRANSOM
TRANS	TRANSITION
TRD	TRENCH DRAIN
TYP	TYPICAL
U	URINAL
UG	UNDERGROUND
ULT	ULTIMATE
UNFN	UNFINISHED
UNO	UNLESS NOTED OTHERWISE
UTIL	UTILITY
V	VENT, VELOCITY, VOLT
VA	VOLT AMPERE
VAC	VACUUM
VAR	VARNISH, VARIABLE, VOLT AMPERES REACTIVE
VB	VAPOR BARRIER, VINYL BASE, VALVE BOX
VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE
VCT	VINYL COMPOSITION TILE, VERTICAL CENTERLINE
VEL	VELOCITY
VENT	VENTILATION
VERT	VERTICAL
VERTS	VERTICAL REINFORCING
VG	VERTICAL GRAIN
VIF	VERIFY IN FIELD
VIN	VINYL
VOL	VOLUME
VPC	VERTICAL POINT OF CURVATURE
VPI	VERTICAL POINT OF INTERSECTION
VPT	VERTICAL POINT OF TANGENCY
VS	VERSUS, VAPOR SEAL
VTR	VENT THROUGH ROOF
VWC	VINYL WALL COVERING
W/	WITH
W/O	WITHOUT
W	WATT, WEST, WIDE, WINDOW, WIRE, WIDE FLANGE BEAM
WB	WOOD BASE
WC	WATER CLOSET, WATER COLUMN
WD	WOOD, WIDTH
WF	WIDE FLANGE, WASH FOUNTAIN
WG	WIRE GLASS, WATER GAGE
WH	WALL HYDRANT, WEEP HOLE
WI	WROUGHT IRON
WL	WATER LEVEL
WLD	WELDED
WM	WIRE MESH
WP	WEATHERPROOF
WS	WATERSTOP, WATER SURFACE
WSCT	WAINSCOT
WT	WEIGHT, WATER TIGHT
WTHP	WATERPROOF, WORKING POINT
WWF	WELDED WIRE FABRIC
XP	EXPLOSION-PROOF
XS	EXTRA STRONG
XSECT	CROSS SECTION
XXS	DOUBLE EXTRA STRONG
YH	YARD HYDRANT
YS	YIELD STRENGTH

GENERAL NOTES:

1. THESE ABBREVIATIONS APPLY TO THE ENTIRE SET OF CONTRACT DRAWINGS.
2. LISTING OF ABBREVIATIONS DOES NOT IMPLY THAT ALL ABBREVIATIONS ARE USED IN THE CONTRACT DRAWINGS.
3. ABBREVIATIONS SHOWN ON THIS SHEET INCLUDE VARIATIONS OF A WORD. FOR EXAMPLE, "MOD" MAY MEAN MODIFY OR MODIFICATION; "INC" MAY MEAN INCLUDED OR INCLUDING AND "REINF" MAY MEAN EITHER REINFORCE OR REINFORCING.
4. SEE INSTRUMENTATION LEGEND SHEET FOR PROJECT-SPECIFIC EQUIPMENT SYMBOLS, EQUIPMENT ABBREVIATIONS, AND PIPING SYSTEM ABBREVIATIONS.

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	9/1/2011	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	
PROJECT NUMBER	145910

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL WATER TREATMENT PLANT

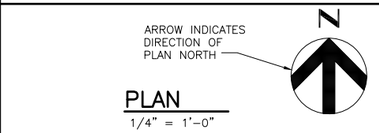
GENERAL ABBREVIATIONS

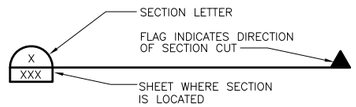
FILENAME	00G-01.DWG
SCALE	NO SCALE
SHEET	00G-01

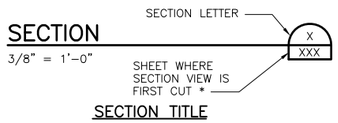
MATERIALS IN PLAN/SECTION

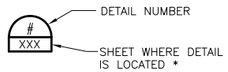
- ACOUSTICAL CEILING TILE (SECTION)
- ASPHALT (PLAN OR SMALL–SCALE SECTION)
- ASPHALT (LARGE–SCALE SECTION)
- BATT INSULATION (SECTION)
- BRICK MASONRY (PLAN AND/OR SECTION)
- CHECKERED PLATE (PLAN)
- CONCRETE (PLAN AND/OR SECTION)
- CONCRETE MASONRY (PLAN AND/OR SECTION)
- DEMOLITION (PLAN AND/OR SECTION)
- EARTH (SECTION)
- FILTER POINT MAT (PLAN)
- FINISHED WOOD (SECTION)
- GLULAM LUMBER (SECTION)
- GRANULAR FILL (SECTION)
- GRATING (SECTION)
- GRATING (PLAN)
- GROUT (SECTION)
- GYPSUM BOARD (SECTION)
- METAL (SECTION)
- ORIENTED STRAND BOARD (SECTION)
- PARTICLE BOARD (SECTION)
- PLYWOOD (LARGE–SCALE SECTION)
- PLYWOOD (SMALL–SCALE SECTION)
- PRECAST CONCRETE (PLAN AND/OR SECTION)
- RIGID INSULATION (SECTION)
- RIPRAP (PLAN AND/OR SECTION)
- SAND (SECTION)
- SOD (SECTION)
- WEEP JOINT MORTAR PROTECTION SYSTEM (SECTION)
- WOOD – CONTINUOUS (SECTION)
- WOOD BLOCKING (SECTION)

GENERAL SYMBOLOGY



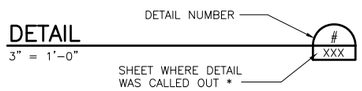


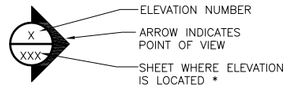


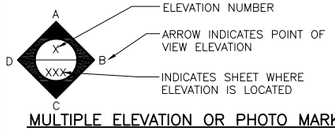


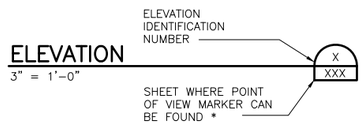
FOR REFERENCING DETAILS INCLUDED IN DRAWING SET.

FOR REFERENCING DETAILS BOUND IN SPECIFICATIONS OR SEPARATE VOLUME.



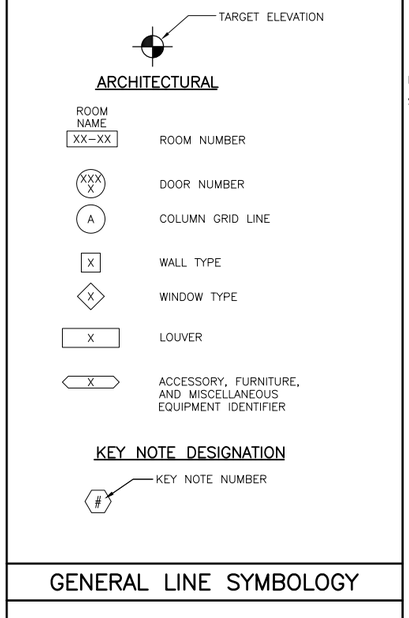




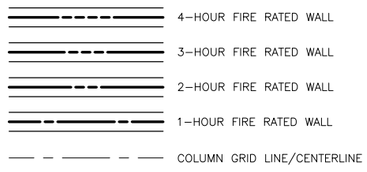


* EXCEPTIONS WHERE THE SHEET NUMBER IS REPLACED BY A DASH (–).

1) FOR COMMON DETAILS, SECTIONS, ELEVATIONS OR DETAILS THAT ARE CUT OR CALLED OUT ON MULTIPLE SHEETS.
2) SECTIONS, ELEVATIONS OR DETAILS THAT ARE LOCATED ON THE SAME SHEET THEY ARE CUT OR CALLED OUT ON.

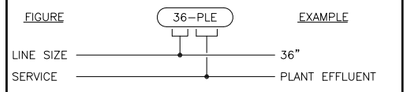


GENERAL LINE SYMBOLOGY



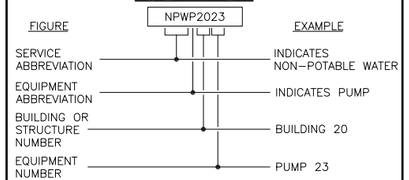
IDENTIFICATION SYMBOLOGY

PIPING

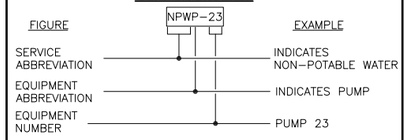


EQUIPMENT IDENTIFICATION

ALTERNATIVE 1



ALTERNATIVE 2



SHEET NAMING CONVENTION

AREA DESIGNATION

TO BE EDITED ON AN A PROJECT BASIS. TO BE DETERMINED BY THE PROJECT MANAGER, THEN ADDED TO THE GENERAL LEGEND.
EXAMPLE:
01 BUILDING OR AREA NAME
02 BUILDING OR AREA NAME
03 BUILDING OR AREA NAME

DISCIPLINE DESIGNATOR & DISCIPLINE ORDER

G	GENERAL
V	SURVEYING/MAPPING
X	DEMOLITION
C	CIVIL
L	LANDSCAPING
U	MULTI–DISCIPLINE
S	STRUCTURAL
A	ARCHITECTURAL
D	PROCESS
M	MECHANICAL (HVAC)
P	PLUMBING
F	FIRE PROTECTION
E	ELECTRICAL
Y	INSTRUMENTATION

DRAWING TYPE DESIGNATOR

0	GENERAL (SYMBOLS, LEGENDS)
1	PLANS
2	ELEVATIONS
3	SECTIONS
4	LARGE SCALE VIEWS
5	DETAILS
6	SCHEDULES AND DIAGRAMS
8	PROFILES
9	3D REPRESENTATIONS

EXAMPLE

GRAVITY THICKENER ARCHITECTURAL SECTION, SHEET 01

0	5				

AREA DESIGNATION

		A			

DISCIPLINE DESIGNATOR

			3		

SHEET TYPE DESIGNATOR

				0	1

SHEET NUMBER

GENERAL NOTES:

1. THIS IS A STANDARD SHEET SHOWING COMMON SYMBOLOGY. ALL SYMBOLS ARE NOT NECESSARILY USED ON THIS PROJECT.
2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE–EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	9/1/2011	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	
PROJECT NUMBER	145910

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

GENERAL LEGEND

0 1" 2"

FILENAME	00G–02.DWG
SCALE	NO SCALE

SHEET **00G-03**

ELECTRICAL LEGEND

- X 20A 3P OR X 100AF 80AT 3P — LOW – VOLTAGE CIRCUIT BREAKER (CB). RATINGS AND NO. OF POLES AS SHOWN. WHEN SPECIFIC TYPE IS REQUIRED, X INDICATES TYPE.
  - TYPES:
  - MCCB – MOLDED CASE
  - ICCB – INSULATED CASE
  - LVP – LOW – VOLTAGE POWER
  - MCP – MOTOR CIRCUIT PROTECTOR (RATING PER CONNECTED LOAD)
- CB — SEPARATELY MOUNTED CIRCUIT BREAKER; SEE ELECTRICAL ONE – LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION
- GFP — GROUND FAULT PROTECTION
- 52 — MEDIUM – VOLTAGE CIRCUIT BREAKER
- FUSE, SIZE, AND NUMBER OF FUSES AS NOTED
- FUSED CUTOUT, CURRENT RATING, FUSE SIZE, AND NUMBER OF POLES AS NOTED
- FUSIBLE SWITCH, CURRENT RATING, FUSE SIZE, AND QUANTITY AS NOTED
- NON–FUSED SWITCH, CURRENT RATING, AND NUMBER OF POLES AS NOTED
- DISCONNECT OR DRAWOUT CONNECTION
- A C B & A C B — MAGNETIC MOTOR STARTER AND SEPARATELY MOUNTED COMBINATION MAGNETIC MOTOR STARTER
- D C & D C — MOTOR CONTROLLER AND SEPARATELY MOUNTED MOTOR CONTROLLER WITH SHORT CIRCUIT PROTECTION AND DISCONNECT
  - MOTOR STARTER AND CONTROLLER SUBSCRIPTS:
  - A – MAGNETIC STARTER NEMA SIZE
  - B – STARTER TYPE
    - NONE – FULL VOLTAGE NON–REVERSING (FVNR)
    - FVR – FULL VOLTAGE REVERSING
    - 2S – TWO SPEED
    - RVAT – REDUCED VOLTAGE AUTO TRANSFORMER
  - C – CONTROL DIAGRAM OR CONTROLS SCHEDULE NUMBER (IF REQUIRED)
  - D – CONTROLLER TYPE
    - VFD – VARIABLE FREQUENCY DRIVE
    - SS – SOLID STATE
- SEPARATELY MOUNTED COMBINATION MOTOR STARTER OR CONTROLLER; SEE ELECTRICAL ONE – LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION
- THERMAL OVERLOAD ELEMENT
- OL — THERMAL OVERLOAD RELAY CONTACT
- DISCONNECT OR SAFETY SWITCH, 30A, 3P, NON–FUSED UNLESS OTHERWISE NOTED
- 7 1/2 OR HP — MOTOR WITH DESIGN HORSEPOWER (WHEN INDICATED)
- G — GENERATOR
- ATS — TRANSFER SWITCH, CURRENT RATING, AND NUMBER OF POLES AS NOTED
  - ATS – AUTOMATIC
  - MTS – MANUAL
- TRANSFORMER
  - △ 3–PHASE, 3–WIRE DELTA CONNECTION
  - 3–PHASE, 4–WIRE GROUNDED WYE CONNECTION
- LP100 208/120V 3Ø, 4W — SWITCHBOARD OR PANELBOARD; NAME, VOLTAGE, PHASE, NUMBER OF WIRES WHEN INDICATED

- 100 KVA — NON–MOTOR LOAD WITH DESIGN KVA, KW, OR AMP
- CPT — CONTROL POWER TRANSFORMER (CPT)
- VOLTAGE TRANSFORMER (VT OR PT)
- CURRENT TRANSFORMER (CT)
- WH — UTILITY WATT–HOUR METER PER UTILITY REQUIREMENTS
- DMP — DIGITAL METERING PACKAGE
- RTM — RUN TIME METER
- GROUND
- LIGHTNING ARRESTER
- SPD — LOW VOLTAGE SURGE PROTECTIVE DEVICE
- ELECTRICAL CONNECTION
- OR OR — NO ELECTRICAL CONNECTION
- SV OR — SOLENOID VALVE
- X Y — CONTROL/RELAY COIL; X INDICATES TYPE, Y INDICATES LOOP NO. WHEN USED
  - TYPES:
  - CR – CONTROL RELAY
  - DP – DEFINITE PURPOSE RELAY
  - LC – LIGHTING CONTACTOR
  - M – MOTOR STARTER
  - PC – PHOTO CELL
  - TC – TIME CLOCK
  - TR – TIMING RELAY
- NORMALLY OPEN CONTACT (N.O.)
- NORMALLY CLOSED CONTACT (N.C.)
- NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS ENERGIZED
- NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS ENERGIZED
- NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS DE–ENERGIZED
- NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS DE–ENERGIZED
- NORMALLY OPEN TEMPERATURE SWITCH; CLOSE ON RISING TEMPERATURE
- NORMALLY CLOSED TEMPERATURE SWITCH; OPEN ON RISING TEMPERATURE
- NORMALLY OPEN FLOW SWITCH; CLOSE ON INCREASING FLOW
- NORMALLY CLOSED FLOW SWITCH; OPEN ON INCREASING FLOW

- NORMALLY OPEN LEVEL SWITCH, CLOSE ON RISING LEVEL
- NORMALLY CLOSED LEVEL SWITCH, OPEN ON RISING LEVEL
- NORMALLY OPEN PRESSURE SWITCH, CLOSE ON INCREASING PRESSURE
- NORMALLY CLOSED PRESSURE SWITCH, OPEN ON INCREASING PRESSURE
- NORMALLY OPEN LIMIT SWITCH, CLOSE ON REACHING LIMIT
- NORMALLY CLOSED LIMIT SWITCH, OPEN ON REACHING LIMIT
- FIELD WIRING EXTERNAL TO CONTROL PANEL
- X — INTERLOCK; X INDICATES TYPE
  - TYPES:
  - E – ELECTRICAL
  - M – MECHANICAL
  - K – KEY
- HAND OFF AUTO XOO OOX — 3 POSITION SELECTOR SWITCH, MAINTAINED CONTACTS; UNLESS OTHERWISE NOTED, 2–POSITION SIMILAR
- NORMALLY OPEN PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED
- NORMALLY CLOSED PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED
- X — INDICATING LIGHT, X INDICATES LENS COLOR
- X — PUSH TO TEST INDICATING LIGHT, X INDICATES LENS COLOR
  - LENS COLORS:
  - R – RED; Y – YELLOW
  - G – GREEN; W – WHITE
  - B – BLUE; A – AMBER
- T — TRANSFORMER
- SS — SELECTOR SWITCH
- PB — PUSHBUTTON
- IC — INSTRUMENTATION/CONTROL DEVICE
- CONTROL PANEL INTEGRAL OR PROVIDED WITH ASSOCIATED EQUIPMENT
- CONTROL PANEL WITH DISCONNECT SWITCH INTEGRAL OR PROVIDED WITH ASSOCIATED EQUIPMENT
- J — JUNCTION OR PULL BOX
- PANELBOARD (250V TO 600V)
- PANELBOARD (LESS THAN 250V)
- ELECTRICAL EQUIPMENT ENCLOSURE: SWITCHBOARD, MOTOR CONTROL CENTER, CONTROL PANEL, OR OTHER EQUIPMENT AS INDICATED
- PC — PHOTOCELL
- Z X Y — CEILING/PENDANT–MOUNTED LUMINAIRE – HID, COMPACT FLUORESCENT, OR INCANDESCENT
- Z X Y — WALL–MOUNTED LUMINAIRE – HID, COMPACT FLUORESCENT, OR INCANDESCENT
- Z X Y — CEILING/PENDANT–MOUNTED FLUORESCENT FIXTURE
- Z X Y — WALL–MOUNTED FLUORESCENT FIXTURE
- Z X Y — CEILING/PENDANT–MOUNTED FLUORESCENT FIXTURE NORMAL/EMERGENCY
- Z X Y — WALL–MOUNTED FLUORESCENT FIXTURE NORMAL/EMERGENCY
- X Y — EMERGENCY LIGHT FIXTURE, 2 ATTACHED HEADS AS SHOWN
- X Y — EMERGENCY LIGHT, REMOTE MOUNTED HEAD

- X Y — DOUBLE–FACED CEILING OR WALL–MOUNTED EXIT LIGHT; DIRECTIONAL ARROWS (IF REQUIRED) AS INDICATED ON PLANS
- X Y — SINGLE–FACED CEILING OR WALL–MOUNTED EXIT LIGHT; DIRECTIONAL ARROWS (IF REQUIRED) AS INDICATED ON PLANS
- X Y — AREA OR ROADWAY LIGHT – POLE–MOUNTED
  - LIGHTING FIXTURE SUBSCRIPTS:
  - X – INDICATES FIXTURE TYPE PER LIGHTING FIXTURE SCHEDULE
  - Y – INDICATES CIRCUIT NUMBER FROM PANELBOARD
  - z – INDICATES CONTROLLING SWITCH (IF REQUIRED)
- $ Y X — TOGGLE SWITCH
  - SUBSCRIPTS:
  - X – INDICATES TYPE
    - NONE – SINGLE POLE
    - 3 – THREE–WAY
    - 4 – FOUR–WAY
    - HP – TOGGLE SWITCH, HORSEPOWER RATED
    - K – KEY SWITCH
    - TE – MANUAL MOTOR STARTER WITH THERMAL ELEMENT
    - P – PILOT LIGHT
    - L – LIGHTED HANDLE
  - Y – INDICATES CONTROLLING SWITCH (IF REQUIRED)
- SPECIAL–PURPOSE RECEPTACLE AS DEFINED ON PLANS
- PLUG–IN RECEPTACLE STRIP, QUANTITY AND SPACING OF RECEPTACLES AS NOTED OR SPECIFIED
- TELECOMMUNICATIONS OUTLET JUNCTION BOX
- X Y — QUAD–DUPLEX RECEPTACLE, TWO NEMA 5–20R UNDER COMMON COVER PLATE
- X Y — DUPLEX RECEPTACLE, NEMA 5–20R
- X Y — SIMPLEX RECEPTACLE, NEMA 5–20R
  - SUBSCRIPTS:
  - X – INDICATES TYPE
    - GFCI – GROUND FAULT CIRCUIT INTERRUPTER
  - Y – INDICATES CIRCUIT NUMBER FROM PANELBOARD
- CONDUIT TURNING UP
- CONDUIT TURNING DOWN
- HOME RUN TO PANEL, 2 #12, 1 #12G IN 3/4"C UNLESS OTHERWISE NOTED
- CIRCUIT RUN BETWEEN DEVICES EXPOSED IN NON–ARCHITECTURALLY FINISHED AREAS; CONCEALED IN ARCHITECTURALLY FINISHED AREAS. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.
- CONDUIT RUN BETWEEN DEVICES CONCEALED IN NON–ARCHITECTURALLY FINISHED AREAS OR UNDER FLOOR SLAB. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.
- CIRCUIT HASH MARKS (WHEN INDICATED); LONG, SHORT, SINGLE DOT, AND DOUBLE DOT REPRESENT PHASE, NEUTRAL, EQUIPMENT GROUND, AND ISOLATED EQUIPMENT GROUND, RESPECTIVELY. #12 IN 3/4" CONDUIT UNLESS OTHERWISE INDICATED.
- CIRCUIT CONTINUATION
- CONDUIT STUBBED OUT AND CAPPED
- XXX — CONDUIT TAG OR CIRCUIT NUMBER – WIRE AND CONDUIT SIZE AS SPECIFIED IN CIRCUIT SCHEDULE ON THE SHEETS
- GROUND CABLE
- GROUND ROD
- FAA — FIRE ALARM ANNUNCIATOR
- FACP — FIRE ALARM CONTROL PANEL
- F — FIRE ALARM MANUAL PULL STATION

- CR — FIRE ALARM CONTROL RELAY
- FS — FIRE ALARM CONTACT, FLOW SWITCH
- TS — FIRE ALARM CONTACT, TAMPER SWITCH
- PS — FIRE ALARM CONTACT, PRESSURE SWITCH
- X AND X — SMOKE AND DUCT DETECTOR
  - SUBSCRIPT:
  - I – IONIZATION TYPE
  - P – PHOTOELECTRIC TYPE
- X — HEAT DETECTOR
  - SUBSCRIPT:
  - R/C – RATE COMPENSATION
  - R/F – COMBINATION RATE OF RISE AND FIXED TEMP
  - R – RATE OF RISE
  - F – FIXED
- X — ALARM BELL
- X — ALARM HORN
- X — ALARM FLASHING LIGHT
- X — ALARM BELL AND FLASHING LIGHT COMBINATION UNIT
- X — ALARM HORN AND FLASHING LIGHT COMBINATION UNIT
  - SUBSCRIPT:
  - NONE – GENERAL ALARM DEVICE
  - F – FIRE ALARM DEVICE

GENERAL NOTES:

1. THIS IS A STANDARD ELECTRICAL SYMBOLOGY SHEET. NOT ALL SYMBOLS MAY BE USED ON THIS PROJECT.
2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE–EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.
3. SEE P&ID LEGEND SHEET FOR PROJECT–SPECIFIC EQUIPMENT SYMBOLS, EQUIPMENT ABBREVIATIONS, AND PIPING SYSTEM ABBREVIATIONS.

HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION
A	9/1/2011	ISSUED FOR BID

PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	
PROJECT NUMBER	145910

CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL WATER TREATMENT PLANT

ELECTRICAL LEGEND

0 1" 2"

FILENAME	00G–0X.DWG
SCALE	NO SCALE

SHEET 00G-03

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COMMUNICATION SYMBOLOGY

- WALL MOUNTED TELEPHONE OUTLET
- WALL MOUNTED DATA OUTLET
- WALL MOUNTED COMBINATION TELEPHONE AND DATA OUTLET
- RECESSED FLOOR MOUNTED TELEPHONE OUTLET
- RECESSED FLOOR MOUNTED DATA OUTLET
- RECESSED FLOOR MOUNTED COMBINATION TELEPHONE AND DATA OUTLET

AUDIO/VISUAL SYMBOLOGY

- TV — TELEVISION OUTLET
- S — CEILING MOUNT SPEAKER
- S X — WALL MOUNT SPEAKER

SPEAKER SUBSCRIPTS:
X – INDICATES HEIGHT

- H — HORN TYPE TRANSDUCER
- VC — VOLUME CONTROL
- PAHE — HEAD END EQUIPMENT
- M — FLOOR MOUNTED MICROPHONE JACK
- M — WALL MOUNTED MICROPHONE JACK

SECURITY SYMBOLOGY

- DOOR POSITION SWITCH
- COMBINATION ELECTRIC DOOR STRIKE AND POSITION SWITCH
- R P — PROXIMITY CARD READER
- R K — PROXIMITY CARD READER WITH KEYPAD
- M — DUAL TECHNOLOGY MOTION DETECTOR
- REQUEST TO EXIT MOTION DETECTOR
- REQUEST TO EXIT PUSH BUTTON
- G — GLASS BREAK DETECTOR
- PTZ — CCTV CAMERA PAN/TILT/ZOOM WHEN INDICATED
- SEC — SECURITY EQUIPMENT CABINET
- R — REMOTE KEYPAD/CONTROL STATION

MASS NOTIFICATION SYMBOLOGY

- EXTERIOR LOCATION HIGH POWER SPEAKER ARRAY (HSPA)
- LOC — LOCAL OPERATING CONSOLE
- TXT — TEXT MESSAGE DISPLAY UNIT
- MNCP — MASS NOTIFICATION SYSTEM CONTROL PANEL
- M — COMBINATION SPEAKER/STROBE NOTIFICATION APPLIANCE
- M — SPEAKER NOTIFICATION APPLIANCE
- M — STROBE NOTIFICATION APPLIANCE
- MS — CEILING MOUNTED SPEAKER
- MS — WALL MOUNTED SPEAKER
- MFCP — COMBINATION MASS NOTIFICATION/FIRE ALARM CONTROL PANEL
- MF — COMBINATION MASS NOTIFICATION/FIRE ALARM SPEAKER NOTIFICATION APPLIANCE
- MF — COMBINATION MASS NOTIFICATION/FIRE ALARM STROBE NOTIFICATION APPLIANCE
- MF — COMBINATION MASS NOTIFICATION/FIRE ALARM STROBE NOTIFICATION APPLIANCE

LENS:
FIRE ALARM – CLEAR
MASS NOTIFICATION – AMBER

EMERGENCY ALARM SYMBOLOGY

- E — ALARM BELL
- E — ALARM HORN
- E — ALARM FLASHING LIGHT
- E — ALARM BELL AND FLASHING LIGHT COMBINATION UNIT
- E — ALARM HORN AND FLASHING LIGHT COMBINATION UNIT

CONTROL SYMBOLOGY

- ELECTRICAL CONNECTION
- OR OR — NO ELECTRICAL CONNECTION
- SV OR — SOLENOID VALVE
- X Y — CONTROL/RELAY COIL; X INDICATES TYPE, Y INDICATES LOOP NO. WHEN USED

TYPES:

CR – CONTROL RELAY	PC – PHOTOCELL
DP – DEFINITE PURPOSE RELAY	TC – TIME CLOCK
LC – LIGHTING CONTACTOR	TR – TIMING RELAY
M – MOTOR STARTER	

- NORMALLY OPEN CONTACT (N.O.)
- NORMALLY CLOSED CONTACT (N.C.)
- NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS ENERGIZED
- NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS ENERGIZED
- NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS DE–ENERGIZED
- NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS DE–ENERGIZED
- NORMALLY OPEN TEMPERATURE SWITCH; CLOSE ON RISING TEMPERATURE
- NORMALLY CLOSED TEMPERATURE SWITCH; OPEN ON RISING TEMPERATURE
- NORMALLY OPEN FLOW SWITCH; CLOSE ON INCREASING FLOW
- NORMALLY CLOSED FLOW SWITCH; OPEN ON INCREASING FLOW
- NORMALLY OPEN LEVEL SWITCH, CLOSE ON RISING LEVEL
- NORMALLY CLOSED LEVEL SWITCH, OPEN ON RISING LEVEL
- NORMALLY OPEN PRESSURE SWITCH, CLOSE ON INCREASING PRESSURE
- NORMALLY CLOSED PRESSURE SWITCH, OPEN ON INCREASING PRESSURE
- NORMALLY OPEN LIMIT SWITCH, CLOSE ON REACHING LIMIT
- NORMALLY CLOSED LIMIT SWITCH, OPEN ON REACHING LIMIT
- MICROPROCESSOR (PLC, RTU, ETC.) OUTPUT
- MICROPROCESSOR (PLC, RTU, ETC.) INPUT
- FIELD WIRING EXTERNAL TO CONTROL PANEL
- X — INTERLOCK; X INDICATES TYPE

TYPES:
E – ELECTRICAL
M – MECHANICAL
K – KEY

- HAND OFF AUTO XOO OOX — 3 POSITION SELECTOR SWITCH, MAINTAINED CONTACTS; UNLESS OTHERWISE NOTED, 2–POSITION SIMILAR
- NORMALLY OPEN PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED
- NORMALLY CLOSED PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED

CONTROL SYMBOLOGY

- X — INDICATING LIGHT, X INDICATES LENS COLOR
- X — PUSH TO TEST INDICATING LIGHT, X INDICATES LENS COLOR

LENS COLORS:

R – RED	Y – YELLOW
G – GREEN	W – WHITE
B – BLUE	A – AMBER

- THERMAL OVERLOAD ELEMENT
- OL (X) — THERMAL OVERLOAD RELAY CONTACT. WHEN SHOWN X INDICATES QUANTITY.
- CPT — CONTROL POWER TRANSFORMER (CPT)
- RTM — RUN TIME METER

FIRE ALARM SYMBOLOGY

- FACP — FIRE ALARM CONTROL PANEL
- FAA — FIRE ALARM ANNUNCIATOR
- F — FIRE ALARM MANUAL PULL STATION
- FS OR — FLOW SWITCH
- TS OR — TAMPER SWITCH
- PS OR — PRESSURE SWITCH
- X AND X — SPOT AND DUCT SMOKE DETECTOR, X INDICATES TYPE

SUBSCRIPT:
I – IONIZATION
P – PHOTOELECTRIC
D – FIRE OR SMOKE DAMPER

- X — HEAT DETECTOR

SUBSCRIPT:
R/C – RATE COMPENSATION
R/F – COMBINATION RATE OF RISE AND FIXED TEMP
R – RATE OF RISE FIXED
F –

- X — FLAME DETECTOR

SUBSCRIPT:
IR – INFRARED
UV – ULTRAVIOLET

- DOOR HOLDER
- F — BELL
- F — HORN/SPEAKER
- F — FLASHING LIGHT
- F — HORN/SPEAKER AND FLASHING LIGHT COMBINATION UNIT
- F — BELL/SPEAKER AND FLASHING LIGHT COMBINATION UNIT

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HDR Engineering, Inc.

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PROJECT ENGINEER	
PROJECT NUMBER	145910

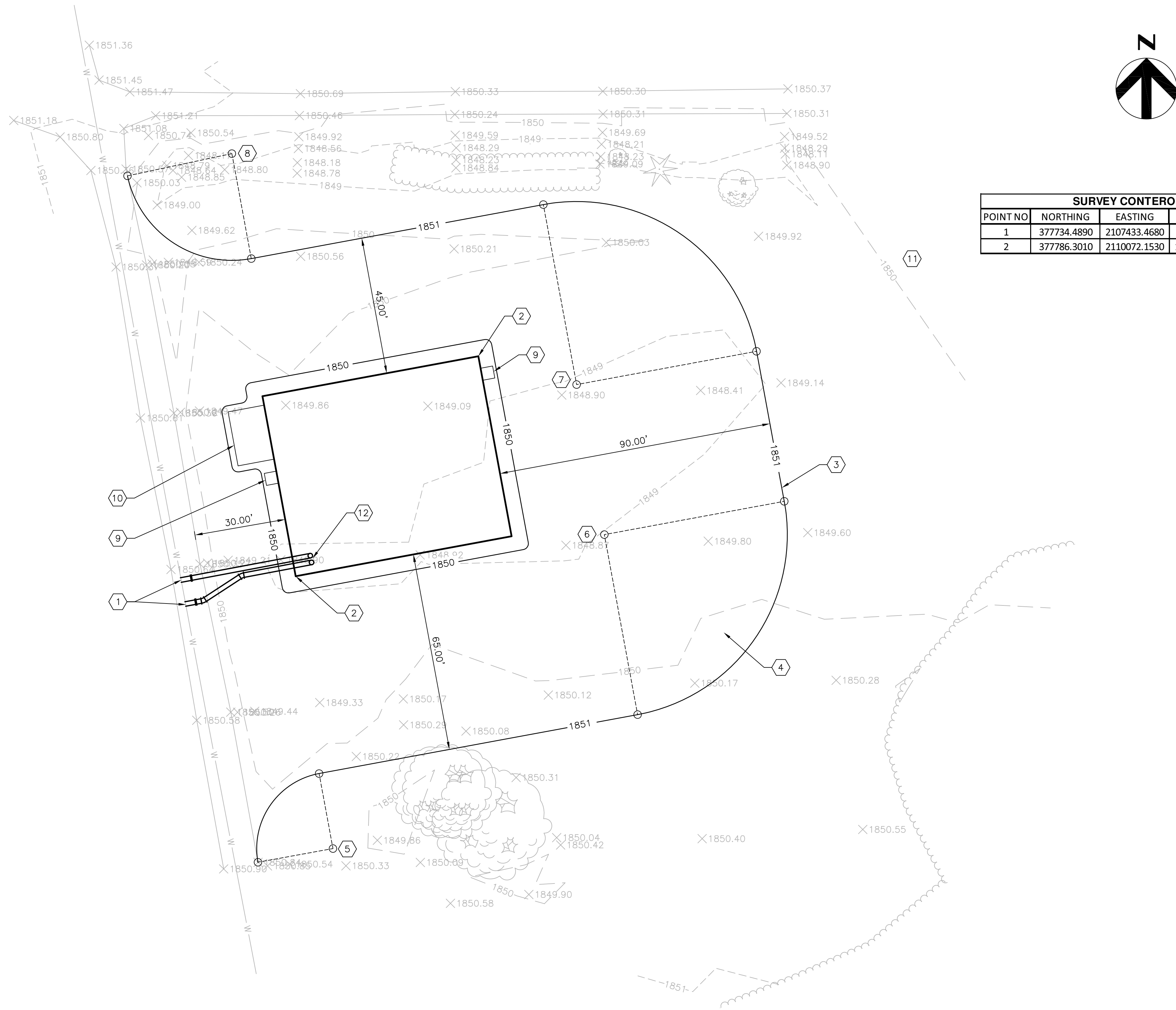
CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

ELECTRICAL LEGEND

0 1" 2"

FILENAME	00G–0X.DWG
SCALE	NO SCALE

SHEET
00G-04



SURVEY CONTEROL POINTS				
POINT NO	NORTHING	EASTING	ELEV	DESC
1	377734.4890	2107433.4680	1850.875	N QTR 11-10-9
2	377786.3010	2110072.1530	18448.431	NE CORNER 11-10-9

KEY NOTES:

1. 18" SUPPLY AND DISCHARGE PIPING BY OTHERS, COORDINATE WITH OWNER
2. BUILDING COORDINATES
   NE CORNER
   N = 377656.8979
   E = 2108017.5456
   SE CORNER
   N = 377584.8069
   E = 2107957.6551
3. TRANSITION FILL TO EXISTING GRADE AT 4:1 SLOPE
4. PROVIDE 3" RECYCLED CONCRETE AGGREGATE, 3/4" – 1 1/2" ø, FULL PERIMETER OF BUILDING TO LIMITS OF 1851 CONTOUR
5. 25' RADIUS
   CENTER POINT
   N = 377495.5407
   E = 2107969.8745
   PC
   N = 377491.0660
   E = 2107945.2782
   PT
   N = 377520.1240
   E = 2107965.3290
6. 50' RADIUS
   CENTER POINT
   N = 377598.436
   E = 2108058.8640
   PC
   N = 377539.4361
   E = 2108069.7733
   PT
   N = 377609.3453
   E = 2108117.8639
7. 50' RADIUS
   CENTER POINT
   N = 377647.6026
   E = 2108049.7729
   PC
   N = 377706.6025
   E = 2108038.8636
   PT
   N = 377658.5119
   E = 2108108.7728
8. 35' RADIUS
   CENTER POINT
   N = 377723.3107
   E = 2107936.7290
   PC
   N = 377716.0143
   E = 2107902.4980
   PT
   N = 377688.8941
   E = 2107943.0927
9. 4'x4' CONCRETE STOOP, SEE BUILDING FLOOR PLAN
10. 12'x18' CONCRETE APPROACH APRON, SEE BUILDING FLOOR PLAN
11. EARTH FILL SOURCED ON SITE ADJACENT TO BUILDING SITE, COORDINATE WITH OWNER
12. SEE BUILDING FLOOR PLAN FOR COORDINATES ON TERMINATION OF SUPPLY AND DISCHARGE PIPING BY OTHERS

SITE PLAN (1)

SCALE: 1" = 20'

HDR

HDR Engineering, Inc.

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PROJECT ENGINEER	
PROJECT NUMBER	145910

CITY OF GRAND ISLAND

UTILITIES DEPARTMENT

URANIUM REMOVAL
WATER TREATMENT PLANT

SITE PLAN

0 1" 2"

FILENAME	00C–01.dwg
SCALE	1" = 20'

SHEET 00C-01

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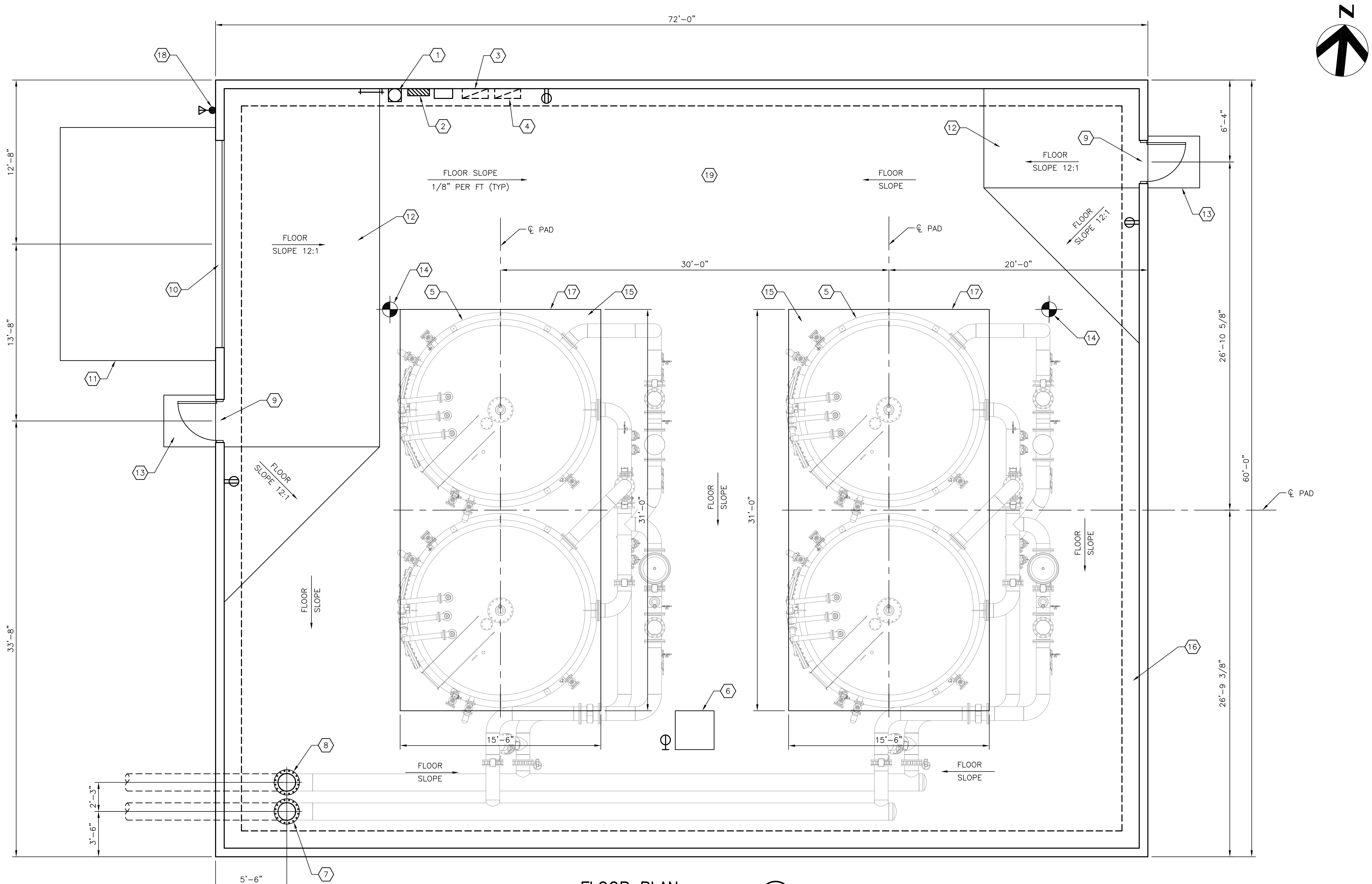

FLOOR PLAN

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

GENERAL NOTES:

1. THIS DRAWING REPRESENTS OWNER'S MINIMUM REQUIREMENTS AND DOES NOT CONSTITUTE A COMPLETE DESIGN. REFER TO SPECIFICATIONS FOR DESIGN CRITERIA AND OTHER MATERIAL AND EQUIPMENT REQUIREMENTS.

KEY NOTES:

1. ELECTRICAL METER BASE INSTALLED BY CONTRACTOR. COORDINATE WITH SERVICE PROVIDER. SEE ELECTRICAL PLAN
2. POWER PANEL, SEE ELECTRICAL PLAN
3. RTU PROVIDED BY OWNER AND INSTALLED BY CONTRACTOR
4. WRT CONTROLLER PANEL PROVIDED AND INSTALLED BY OTHERS, CONTRACTOR PROVIDE CONDUIT TO PANEL, SEE ELECTRICAL PLAN, COORDINATE LOCATION OF CONDUIT WITH WRT DRAWINGS TO BE PROVIDED
5. WRT TREATMENT EQUIPMENT AND PIPING SHOWN FOR REFERENCE, INSTALLED BY OTHERS
6. 3' X 3' X 3' CONCRETE SUMP INTEGRAL WITH CONCRETE FLOOR, PROVIDE 1 1/2" ALUMINUM GRATING COVER WITH 1 3/4" SUPPORT ANGLES AROUND PERIMETER OF OPENING, SLOPE CONCRETE FLOOR TO DRAIN TO SUMP LOCATION
7. 12" DIP SUPPLY PIPING, BY OTHERS COORDINATE WITH OWNER
8. 12" DIP DISCHARGE PIPING, BY OTHERS COORDINATE WITH OWNER
9. 3' X 7' PASSAGE DOOR, SEE SPECIFICATION 13120
10. 16' X 16' OVERHEAD HEAD, SEE SPECIFICATION 13120
11. 18' X 12' X 6" CONCRETE APPROACH APRON WITH REINFORCING
12. CONCRETE SLOPE FROM TOP OF BUILDING FOUNDATION TO FINISHED FLOOR, SLOPE 12:1 WITH 1 1/2" DEPRESSED VERTICAL EDGE AT FLOOR ELEVATION SHOWN TO POUR CONCRETE FILL AGAINST
13. 4' X 4' X 5" CONCRETE STOOP WITH REINFORCING
14. CONCRETE FLOOR ELEVATION 1850.50
15. 15'-6" X 31'-0" WRT EQUIPMENT PAD, ELEVATION 1851.87, CONTRACTOR CONFIRM PAD SIZE WITH OWNER AND WRT EQUIPMENT SUPPLIER
16. SEE GENERAL CONFIGURATION DETAIL FOR TOP OF FOOTING REQUIREMENTS. PROVIDE WATER STOP BETWEEN FLOOR SLAB AND VERTICAL FACE OF FOOTING WALL, PROVIDE SEALED JOINT
17. PROVIDE WATER STOP AND SEALED JOINT FOR FULL PERIMETER OF EQUIPMENT PAD
18. LOCATION OF RADIO ANTENNA SUPPLIED BY OWNER AND INSTALLED BY CONTRACTOR, SEE ELECTRICAL PLAN
19. CONCRETE FLOOR DEPRESSED FROM TOP OF FOUNDATION MINIMUM 1'-0" FOR CONTAINMENT PROTECTION

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HDR Engineering, Inc.

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PROJECT MANAGER	K PRIOR
PROJECT ENGINEER	
PROJECT NUMBER	145910

CITY OF GRAND ISLAND

UTILITIES DEPARTMENT

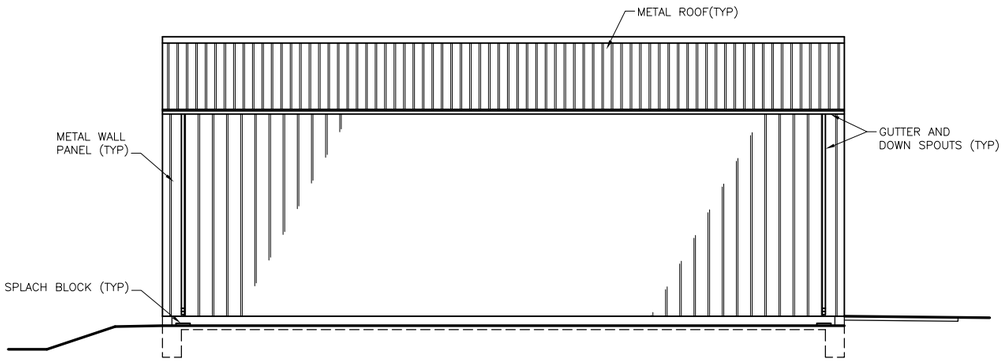
URANIUM REMOVAL
WATER TREATMENT PLANT

FLOOR PLAN

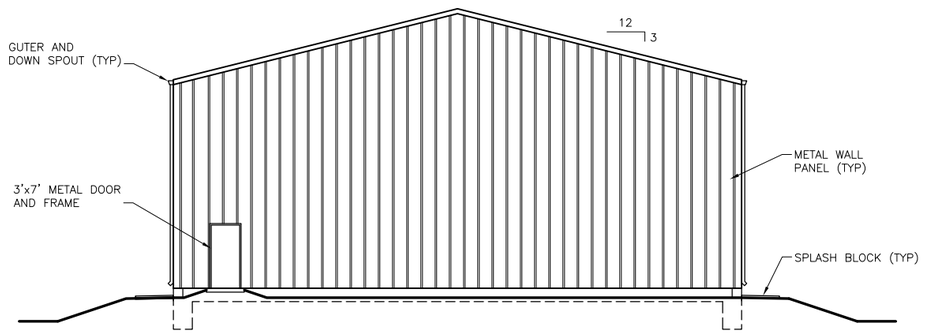
0 1" 2"

FILENAME	00A-01.dwg
SCALE	1/4" = 1'-0"

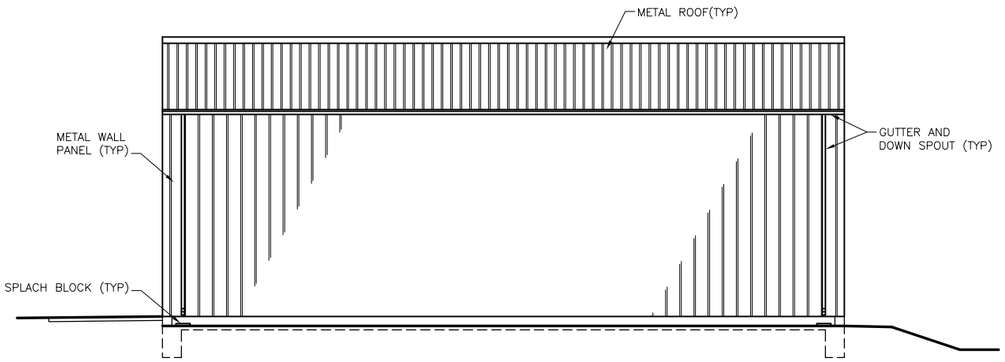
SHEET 00A-01



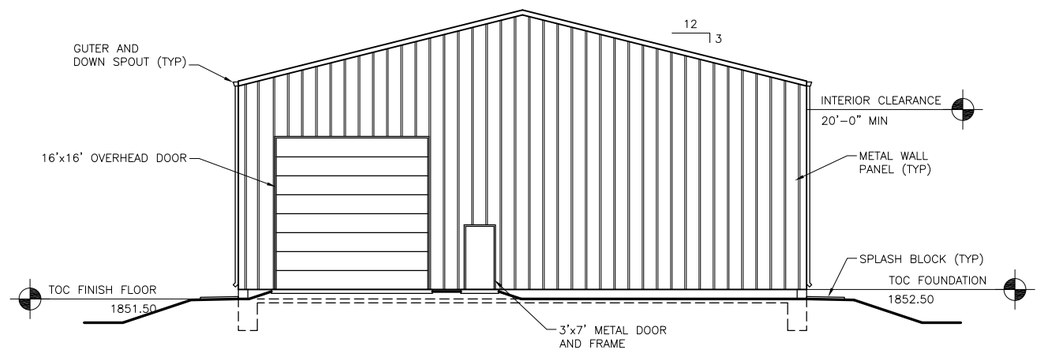
NORTH ELEVATION 1
SCALE: 1/8" = 1'-0"



EAST ELEVATION 2
SCALE: 1/8" = 1'-0"



SOUTH ELEVATION 3
SCALE: 1/8" = 1'-0"



WEST ELEVATION 4
SCALE: 1/8" = 1'-0"

HDR Engineering, Inc.

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A	-9/1/2011	-ISSUED FOR BID

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CITY OF GRAND ISLAND
UTILITIES DEPARTMENT
URANIUM REMOVAL
WATER TREATMENT PLANT

EXTERIOR ELEVATIONS

0 1" 2"

FILENAME	00A-01.dwg
SCALE	1/4" = 1'-0"

SHEET 00A-02

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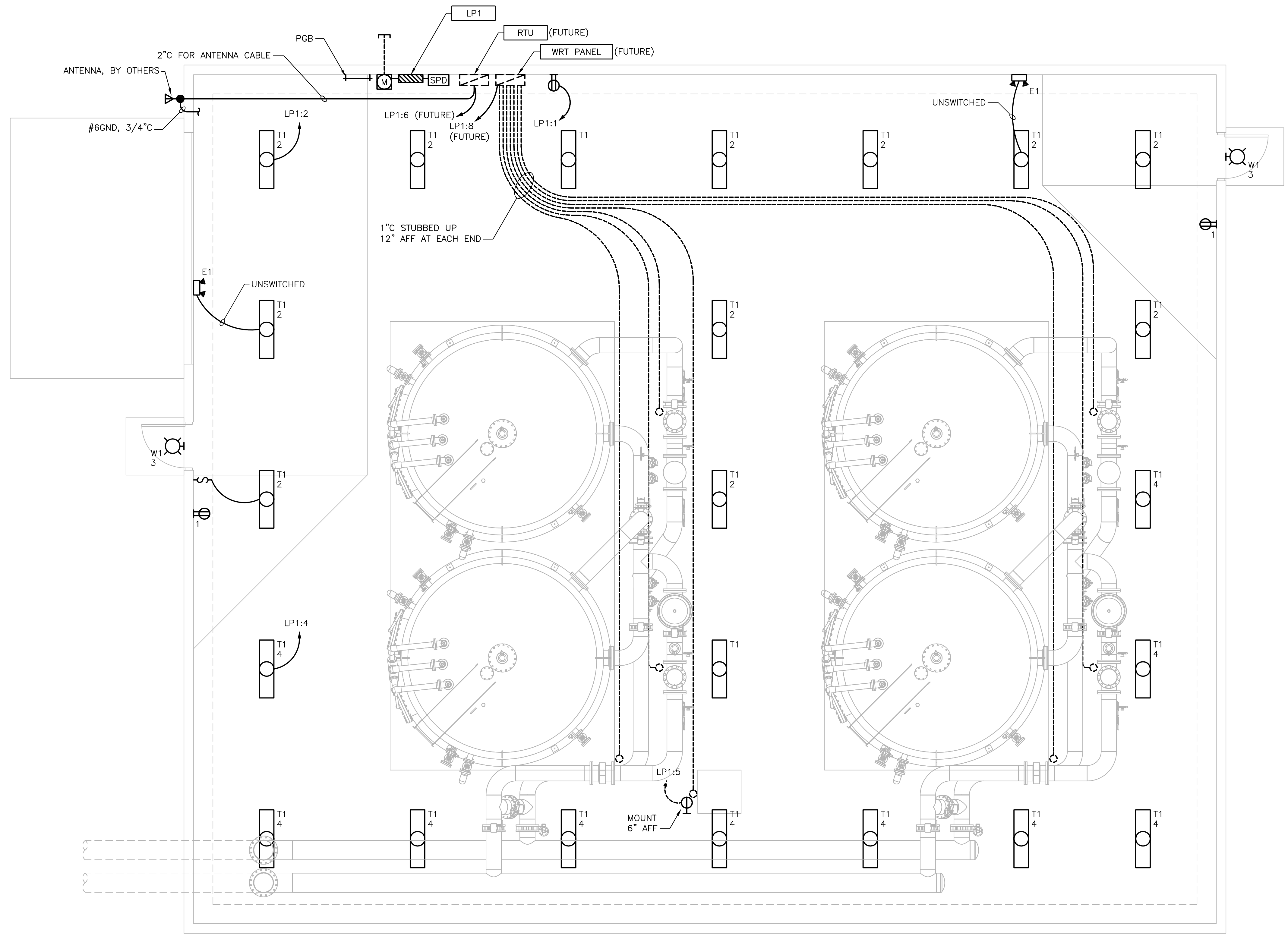

FLOOR PLAN

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

ISSUE	DATE	DESCRIPTION
A	9/1/2011	ISSUED FOR BID

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PROJECT MANAGER	K PRIOR
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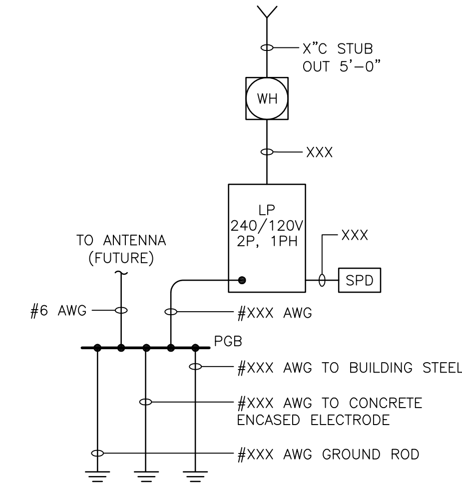
CITY OF GRAND ISLAND

UTILITIES DEPARTMENT

URANIUM REMOVAL
WATER TREATMENT PLANT

MECHANICAL AND ELECTRICAL
FLOOR PLAN

FILENAME	00U-01.dwg
SCALE	1/4" = 1'-0"
SHEET	00U-01



GROUNDING DIAGRAM

NO SCALE

GROUND SYSTEM DETAIL NOTES:

1. ABREVIATIONS: PGB – 12" LONG POWER GROUNDING BAR.
2. ALL CONDUCTOR SIZES BASED ON COPPER.
3. SEE SECTION 16060–GROUNDING FOR ADDITIONAL REQUIREMENTS.

LUMINAIRE SCHEDULE

DWG ID TYPE	DESCRIPTION	MANUFACTURER AND LUMINAIRE TYPE	LAMP			BALLAST	FIXTURE		MOUNTING		NOTES
			TYPE	QTY	WATTS		VOLTS	VA	TYPE	HEIGHT	
E1	INDUSTRIAL STEEL EMERGENCY LIGHTING HOUSING: STEEL PAINTED TAN BATTERY: SEALED MAINTENANCE-FREE LEAD-CALCIUM	LITHONIA ELT125 SERIES	INCANDESCENT	2	12	NA	120	12	WALL	6'-8"	
T1	HEAVY-DUTY INDUSTRIAL TURRET WITH WIREGUARD. HOUSING: STEEL PAINTED WHITE. REFLECTOR: SOLID (NO UP LIGHT)	LITHONIA AF SERIES	FO32/T8	4	32	ELECTRONIC	120	124	CHAIN	20'-0"	
W1	WALL-MOUNTED LUMINAIRE. LENS: TEMPERED GLASS. REFLECTOR: HYDROFORMED. HOUSING: BLACK PAINTED ALUMINUM. CONTROL: PHOTOELECTRIC CELL	LITHONIA TWF1 SERIES	42TRT CFL	1	42	ELECTRONIC	120	42	WALL	8'-0"	

NOTES:
1. MOUNTING HEIGHT TO BE MEASURED FROM BOTTOM OF FIXTURE.
2. SUBMITTAL SHALL INCLUDE ALL REQUIRED FITTINGS AND A SKETCH OF THE INSTALLATION.

PANELBOARD NO: **LP1**

VOLTAGE:	240/120	**BUS RATING (A):**	100	**ENCLOSURE:**	NEMA 1
PHASE:	1	**MAIN OC DEVICE:**	100/2	**MOUNTING:**	SURFACE
WIRE:	3+GND	**INTERRUPTING RATING (KA):**	10		
200% NEUTRAL:	NO	**SERVICE ENTRANCE LABEL:**	YES		

CKT NO.	DESCRIPTION	CONNECTED LOAD (VA) LTS	REC	MECH	MISC	OCP AMPS	P		OCP AMPS	P	CONNECTED LOAD (VA) LTS	REC	MECH	MISC	DESCRIPTION	CKT NO.
1	RECEPTACLES		540			20	1	A	20	1	1,488				LIGHTING	2
3	EXTERIOR LTS	85				20	1	B	20	1	1,364				LIGHTING	4
5	SUMP PUMP					20	1	A	20	1					RTU	6
7								B	20	1					WRT PANEL	8
9								A								10
11								B								12
13								A								14
15								B								16
17								A								18
19								B								20
21								A								22
23								B								24
25								A								26
27								B								28
29								A								30

LOAD SUMMARY

	LTS	REC	MECH	MISC	SPARE	TOTAL			PHASE BALANCE	
CONNECTED LOAD (KVA)	2.9	0.5	0.0	0.0	---	3.5	240	LINE-TO-LINE VOLTS	PHASE A (KVA)	2
DEMAND FACTOR	1.25	NEC	1.00	1.00	20%	---	14	CONNECTED AMPS	PHASE B (KVA)	1
DESIGN LOAD (KVA)	3.7	0.5	0.0	0.0	0.7	4.9	20	DESIGN AMPS		

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CITY OF GRAND ISLAND

UTILITIES DEPARTMENT

URANIUM REMOVAL
WATER TREATMENT PLANT

MECHANCIAL, ELECTRICAL & STRUCTURAL DETAILS AND SCHEDULES

0 1" 2"

FILENAME	00U–02.dwg
SCALE	1/4" = 1'–0"

SHEET 00U-02