BEFORE THE TENNESSEE REGULATORY AUTHORITY
AT NASHVILLE, TENNESSEE

In Re:	
CARTWRIGHT CREEK, LLC'S PETITION TO AMEND CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO PROVIDE WASTEWATER UTILITY SERVICES;	**No.** 04-00358
and	
CARTWRIGHT CREEK, LLC'S PETITION TO INTERVENE IN TENNESSEE WASTEWATER SYSTEMS, INC.'S PETITION TO AMEND CERTIFICATE OF CONVENIENCE AND NECESSITY.	

PETITION TO AMEND CARTWRIGHT CREEK'S CERTIFICATE OF CONVENIENCE AND NECESSITY
AND
PETITION TO INTERVENE IN TENNESSEE WASTEWATER SYSTEMS, INC.'S PETITION TO AMEND CERTIFICATE OF CONVENIENCE AND NECESSITY

Comes now Cartwright Creek LLC ("Cartwright Creek") and submits this Petition to the Tennessee Regulatory Authority ("TRA") to amend Petitioner's current Certificate of Public Convenience and Necessity ("CCN") to expand its existing wastewater utility services to a planned growth area of Williamson County, Tennessee, commonly known as "PGA 5," pursuant to Tenn. Code Ann. § 65-4-104 and § 65-4-201 and Section 1220-1-1, et seq. of the Rules of Tennessee Regulatory Authority Division of Practice and Procedure. This Petition is predicated upon TRA approval of Cartwright Creek's transfer of authority petition bearing Docket No. 0400307.

Further, Cartwright Creek submits this Petition to the TRA to intervene in Tennessee Wastewater Systems, Inc.'s ("TWS") Petition to Amend Certificate of Convenience and Necessity, Docket No. 04-00289 pursuant to Tenn. Code Ann. § 4-5-310 and § 65-2-107 and Section 1220-1-2.08 of the Rules of Tennessee Regulatory Authority Division of Practice and Procedure.

Intervention

In January 2004, Cartwright Creek originally sought to amend its CCN to include PGA 5 (TRA Docket No. 04-00009). Cartwright Creek withdrew this petition concerning PGA 5 to accomplish the desired transfer of authority to own and operate Cartwright Creek as more fully stated in that petition (TRA Docket No. 04-00307). As evidenced by this the above-captioned petition, Cartwright Creek again seeks to amend its CCN to expand its service area to PGA 5.

On September 13, 2004, TWS filed a petition seeking to amend its CCN to include PGA 5. The petition by TWS directly effects Cartwright Creek's legal rights, privileges, and other legal interests qualifying Cartwright Creek as an intervenor. Cartwright Creek states as grounds for this intervention petition the following grounds in support of Cartwright Creek's petition to amend its CCN.

Petitioner

Cartwright Creek is a Tennessee member-managed limited liability company, licensed to do business in the State of Tennessee. Cartwright Creek adopts and incorporates herein by reference its transfer of authority petition bearing Docket No. 04-00307, together with Exhibit A-C attached thereto, as an concise and non-duplicative

means by which to provide all necessary information and documentation concerning the business entity, its owners, the management of the entity, and Cartwright Creek's ability provide superior wastewater utility services to current Cartwright Creek customers and the future customers of the PGA 5.

Designated Contact

The designated contact for questions regarding this Petition is T. Chad White, Esq , Tune, Entrekin & White, P.C., AmSouth Center, Suite 2100, 315 Deaderick Street, Nashville, TN 37238-2100; 615/244-2770 (Office), 615/244-2778 (Facsimile).

Current CCN

Cartwright Creek was issued its original CCN on March 7, 1975 and has operated a wastewater treatment plant within the Seventh Civil District of Williamson County since that time. Due to the significant number of years that have passed since Cartwright Creek was issued its original CCN, neither Cartwright Creek nor TRA have a copy of this document; however, Cartwright Creek's 1996 petition for rate increase and agreed order related to same contain the date the original CCN was issued as well as the current service area. Also on file with the TRA and available for review is Cartwright Creek's most recent Tariff, which contains a map of Cartwright Creek's current service area boundary.

In compliance with the applicable TRA rules, Cartwright Creek files quarterly reports with the TRA regarding its financial status. Cartwright Creek's extensive history evidences its financial soundness and ability to service its current customers and future customers of PGA 5 successfully, efficiently, and effectively. As demonstrated in Cartwright Creek's transfer of authority petition, Cartwright Creek now has the opportunity to offer its improved

managerial, financial, and technical abilities to provide wastewater services to customers due to the assimilation of the vast experience and expertise brought by Sheaffer International to Cartwright Creek.

PGA 5

Petitioner desires to expand its current facilities to become a wastewater provider in PGA 5 of Williamson County, Tennessee. PGA 5 is not located within the boundaries of any municipality. No municipal utility, utility district, or other private wastewater utility currently provides or has the authority to provide wastewater service in this area. PGA 5 receives water service from the Nolensville/College Grove Utility District, which does not provided wastewater services. Attached as collective Exhibit 1 and incorporated herein by reference are maps of PGA 5. The first map is a portion of the Williamson County Growth Plan as adopted on April 5, 2001, and the second map locates PGA 5 on a Williamson County map showing surrounding municipalities.

As stated above in early 2004, Cartwright Creek initially sought certification regarding PGA 5 (TRA Docket No. 04-00009) at which time Cartwright Creek officially informed the County Mayor for Williamson County, Rogers Anderson, and the appropriate representative of Nolensville/College Grove Utility District of its desire to serve PGA 5. Attached as collective Exhibit 2 and incorporated herein by reference are letters from the offices of the County Mayor and Nolensville/College Grove Utility District confirming that public convenience and necessity require wastewater service in PGA 5, that neither intend to provide wastewater services to PGA 5, and that both support Cartwright Creek's application to expand its service area to include PGA 5.

A public need for wastewater service exists in PGA 5. The initial number of

customers to be provided service is approximately two hundred twenty-five (225). The projected number of customers to be serviced in the area will be in excess of two thousand (2,000). Cartwright Creek acknowledges that the TRA is the governmental entity with the authority to grant this petition to amend its CCN, and Cartwright Creek will adhere to and abide by all applicable policies, rules, and orders of the TRA in the operation of the proposed wastewater utility.

Attached as Exhibit 3 and incorporated herein by reference is the Wastewater Reclamation and Reuse System, Construction Specifications prepared by Sheaffer International, L.L.C. as revised on March 31, 2004. This proposed system is to serve the Waterbridge Planned Development located in PGA 5. Finally, attached as collective Exhibit 4 and incorporated herein by reference are additional construction and operation specifics regarding the Waterbridge Planned Development.

Conclusion

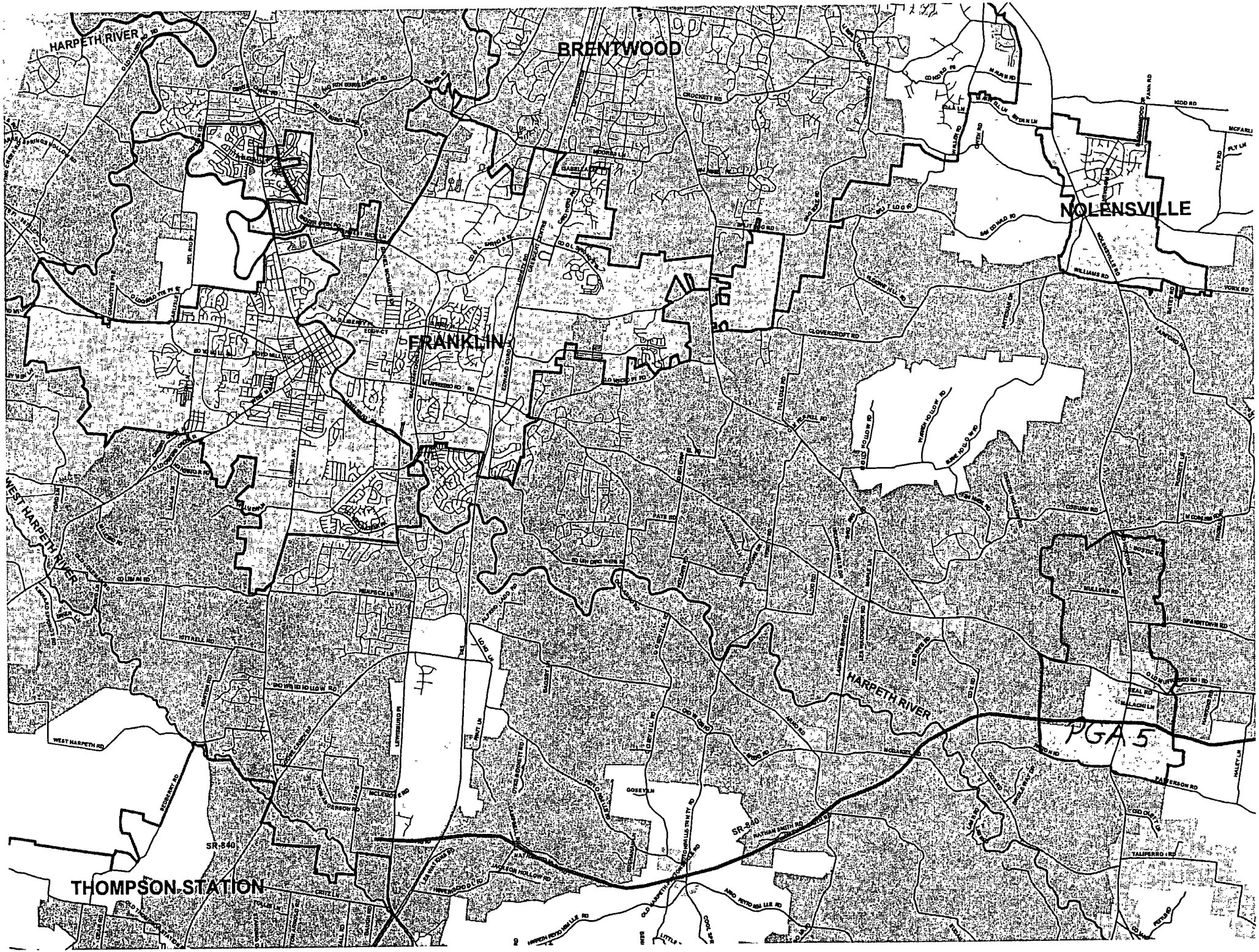
Based upon the foregoing, Cartwright Creek prays that the TRA grant its petition to intervene in the TWS petition concerning PGA 5 and that the TRA grant Cartwright Creek's petition to amend its CCN to expand its existing wastewater services to PGA 5.

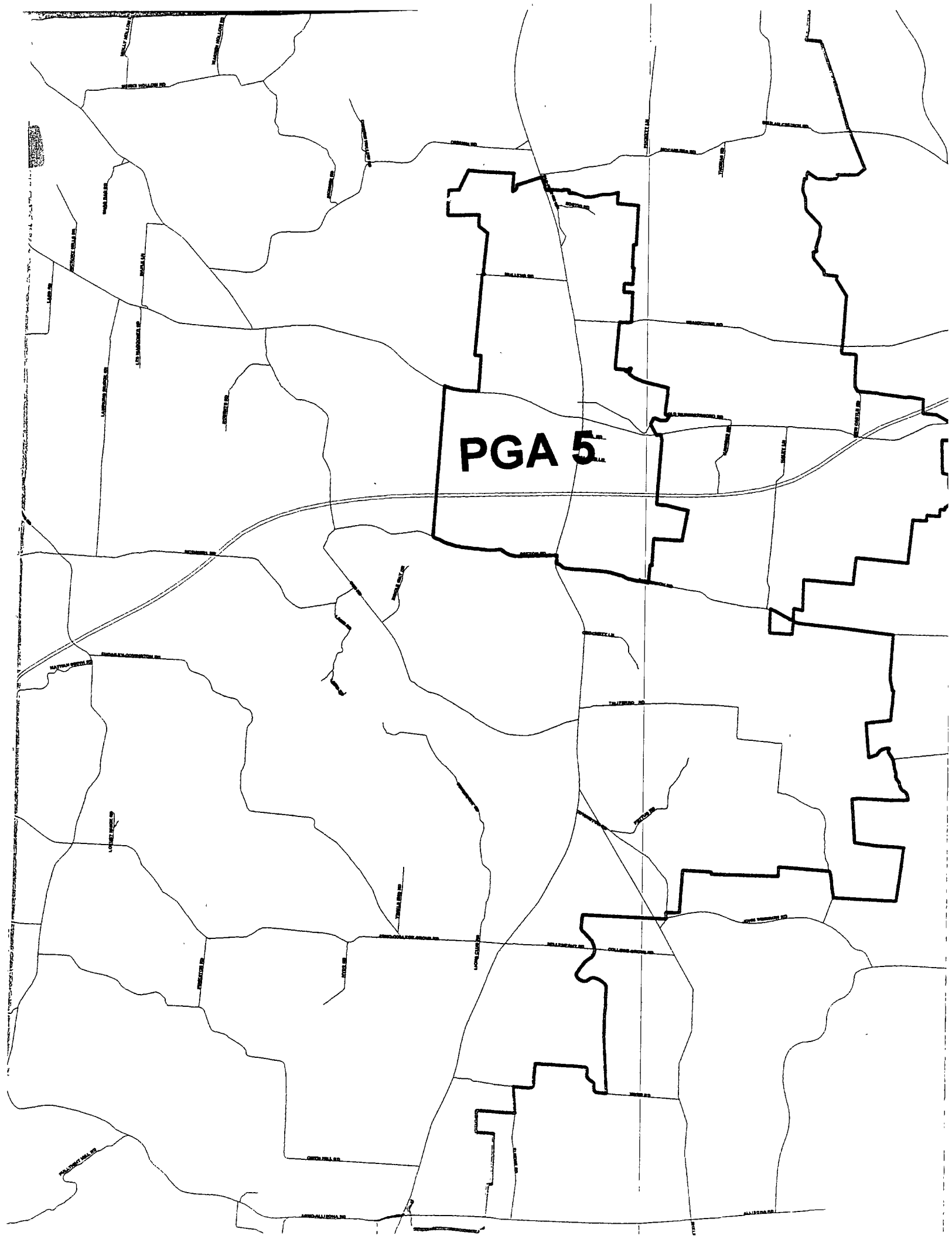
This the 15th day of October, 2004.

Respectfully submitted,

T. Chad White

T. Chad White, B.P.R. No. 21950
Tune, Entrekin, and White, P.C.
AmSouth Center, Suite 2100
315 Deaderick Street
Nashville, TN 37238-2100
615/244-2770 (Office)


HARPETH RIVER
BRENTWOOD
NOLENSVILLE
FRANKLIN
WEST HARPETH RIVER
HARPETH RIVER
THOMPSON STATION
SR-840
SR-840
PGA 5


PGA 5

BRANSTETTER, KILGORE, STRANCH & JENNINGS
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FOURTH FLOOR
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CECIL D BRANSTETTER, SR
C DEWEY BRANSTETTER, JR
RANDALL C FERGUSON
R JAN JENNINGS*
CARROL D KILGORE
DONALD L SCHOLES
JAMES G STRANCH, III
JANE B STRANCH

MARK A MAYHEW
J GERARD STRANCH, IV
JOE P LENISKI, JR

*ALSO ADMITTED IN GA

January 2, 2004

Mr. Tom White
Tune, Entrekin & White P.C.
AmSouth Center Suite 2100
Nashville, TN 37238

Re Request of Cartwright Creek Utility Company, Inc. to Provide Sewer Service within the Boundaries of Nolensville/College Grove Utility District

Dear Tom

I represent Nolensville/College Grove Utility District. The District provides water service within its boundaries in Williamson County, Tennessee. I understand that your client, Cartwright Creek Utility Company, Inc , plans to file an application for a certificate of public convenience and necessity with the Tennessee Regulatory Authority (TRA) to provide sewer service within Planned Growth Area 5 in Williamson County (PGA 5). PGA 5 is located within the District's boundaries

Please be advised that the District does not plan to provide sewer service to PGA 5 and does not object to Cartwright Creek Utility Company, Inc being granted a certificate by the TRA to provide sewer service to PGA 5 The District was aware of the recent request by your client to Rogers Anderson, Williamson County Mayor, for a determination that an additional sewer provider was needed within PGA 5 The District did not oppose your client's request before Mr. Anderson. The request to Mr. Anderson was necessary because the District is authorized to provide sewer service within its boundaries Under T.C A § 7-82-301(a), the District is the exclusive provider of utility services within its boundaries until the public convenience and necessity requires additional service Mr Anderson has now made a finding that an additional sewer provider is necessary

The District did operate a small sewer system within the City of Nolensville until 1998 In 1998 the District entered into an interlocal cooperation agreement with Metro and Brentwood to allow Metro and Brentwood to provide sewer service within the District's boundaries north of Nolensville Metro took over the existing sewer plant the District was operating in Nolensville in 1998. Therefore, the District has not provided sewer service since 1998 PGA 5 is located south of Nolensville in an area not included in the interlocal cooperation agreement with Metro and Brentwood.

If I can provide further information to you on this issue, please let me know

Sincerely yours,

Donald L Scholes

DONALD L SCHOLES

c Charles Strasser

BKSJ File No 92-247

WILLIAMSON COUNTY
Rogers C. Anderson, County Mayor
1320 West Main Street, Suite 125
Franklin, Tennessee 37064
(615) 790-5700, Fax (615) 790-5818

December 5, 2003

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Jason N. Scott, Controller
Cartwright Creek Utility Company
2033 Richard Jones Road
Nashville Tennessee 37215

RE: Request for Permission to Provide Sewer Services
PGA 5 - Williamson County

Dear Mr. Scott:

This correspondence is a revision of the correspondence dated November 18, 2003 in response to objections raised by Mr. Donald Scholes, Attorney for Nolensville/College Grove Utility District.

Pursuant to Tennessee Code Annotated, Section 7-82-201, et. seq. and Tennessee Code Annotated, Section 7-82-301 et. seq., as County Mayor, I have administered two public hearings concerning a request received from Cartwright Creek Utility Company to provide sewer services in the area commonly known and referred to as Planned Growth Area Five located in the Fifth District of Williamson County.

Please accept this letter as notification that after due diligence, consideration of all information provided to me, the support of the Williamson County Commissioners in the Fifth District, and the assertion from Nolensville/College Grove Utility District that it has no future plans of providing sewer services in the area at issue, I have concluded that the public convenience and necessity requires the additional services be provided. Therefore, I respectfully submit to you that the public convenience and necessity requires sewer services in this area and as such Cartwright Creek Utility Company's request should be granted and a certificate of convenience and necessity should be issued.

Sincerely,

Rogers Anderson
County Mayor

RCA/dg

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Waterbridge Planned Development
in
Williamson County Tennessee
Franklin, Tennessee

Wastewater Reclamation and Reuse System

Construction Specifications

October 2003

Revised March 31, 2004

Prepared by
Sheaffer International, L.L.C.
800 Roosevelt Rd.
Bldg. B – Suite 200
GlenEllyn, IL 60137
(630) 446-4080
Fax: (630) 446-4085
Internet: www.sheafferinternational.com

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DIVISION 11 – EQUIPMENT

DIVISION 13 – SPECIAL CONSTRUCTION

DIVISION 15 – MECHANICAL

DIVISION 16 – ELECTRICAL

Section 00030

ADVERTISEMENT FOR BIDS

Part 1 General

1.01 Advertisement for Bids

A. Separate Sealed bids for the construction of the Wastewater Reclamation and Reuse System for the Waterbridge Planned Development will be received by _____, until 7:00 P.M. on _____ and at that time they will be publicly opened and read aloud. Any bid received after that time will be returned unopened.

B. The Contract Documents may be obtained at the offices of Sheaffer International, L.L.C. (Engineer) Monday through Friday between the hours of 8:00 A.M. and 4:00 P.M. for a nonrefundable fee of $____ made payable to Sheaffer International, L.L.C.

C. Proposals may be withdrawn at any time prior to the time of opening of bids, but may not be withdrawn after that time is past.

D. The Owner reserves the right to reject any and all bids or waive any informality in any bid and to accept any bid deemed most advantageous to the Owner.

1.02 Bid Bond

All bids must be accompanied by a cashier's check or a certified check by a responsible bank or by a Bidder's Bond for a sum not less than ten percent (10%) of the aggregate sum of the amount bid in the proposal. The Bid Bond or check shall be forfeited in the event the bidder fails to enter into a Contract with the good and sufficient bond within ten (10) days after the Contract has been awarded to him.

1.03 Contract Security

The successful bidder will be required to furnish a Performance Bond and a Labor and Materials Payment Bond, each in a sum equal to the Contract price, satisfactory to the Owner.

ADVERTISEMENT FOR BIDS

Part 2 Summary of Work

2.01 General

The work consists of furnishing all labor, tools, materials, equipment, and services for construction of the Wastewater Reclamation and Reuse System complete, in working order, and ready for use by Waterbridge Planned Development, Franklin, TN.

Dated: _____
Sheaffer International, Ltd.,
800 Roosevelt Rd., Bldg. B, Suite 200
Glen Ellyn, IL 60137

END OF SECTION 00030

Section 00100

INSTRUCTIONS TO BIDDERS

Part 1 General

1.01 Submission of Bids

A. Bids will be received by _____ until _____ on _____ for the construction of the Wastewater Reclamation and Reuse System – Waterbridge Planned Development.

B. Each sealed envelope containing a bid must be plainly marked on the outside as follows:
"Proposal for Wastewater Reclamation and Reuse System - Waterbridge Planned Development"

C. Bids may be withdrawn at any time prior to the hour of opening bids but no proposals may be withdrawn after the time for opening is passed.

D. The right is reserved to reject any or all bids or waive any informality in any bid and to accept any considered advantageous for "OWNER", hereinafter referred to as the Owner.

1.02 Preparation of Bids

A. Each bid must be completed on the required bid form included in this document and must not be separated from this document. All blank spaces for bid prices on all bid items must be filled in, in ink or typewritten, and the bid must be fully completed and executed when submitted. In the case of a discrepancy between unit prices, when unit prices are required, and the total amount, unit prices shall govern.

B. All addenda issued prior to the opening of bids must be attached to this document.

1.03 Experience of Bidders

Each bidder shall submit, with his bid, a statement of his experience on similar projects.

1.04 Interpretation of Contract Documents

Every request for interpretation of Contract Documents should be in writing, addressed to Sheaffer International, Ltd., 800 Roosevelt Rd., Bldg. B, Suite 200, Glen Ellyn, IL 60137, 630/446-4080, (hereinafter, Engineers) and must be received at least seven days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the Specifications.

INSTRUCTIONS TO BIDDERS

1.05 Bid Bond

Each bid must be accompanied by Cash, a Bank Draft, Certified Check, Cashier's Check, or a Bid Bond in the amount of ten percent (10%) of the amount of the bid. Such Bank Drafts, Checks or Bid Bonds will be returned to all except the three lowest bidders for each contract within fourteen (14) days after the opening of bids

1.06 Construction Period

The Contract time for the completion of the Work is 180 days or a number of days mutually agreed upon in writing between the Contractor and Qwner. The Contractor shall submit, with his bid, a construction schedule with schedules significantly less than 180 days will be favorably weighted during the bid review process.

1.07 Examination of Site and Contract Documents

Bidders shall inform themselves of all conditions under which the Work is to be performed, concerning the site of the Work, the structure of the ground, the obstacles which may be encountered, whether shown on the Contract Drawings or not, and all other relevant matters concerning the Work to be performed, including correctness of any quantities listed in the proposal.

1.08 Soil Boring and Exploration Hole Data

Copies of soil boring and exploration hole data will be made available to prospective bidders for inspection at the Office of the Engineers, but are not a part of the Contract Documents. The Owner makes no representation or warranty regarding the number, location, or depths of borings taken, nor in the accuracy of the information given in the results thereof.

1.09 Manufacturers

Manufacturers named are for the purpose of establishing a certain level of quality and performance. Other manufacturers with equal quality and performance will be considered.

1.10 Material Tests

Attention of bidders is directed to the material tests required on the Project. All laboratory tests shall be made by a testing laboratory acceptable to the Owner. The cost of testing shall be paid for by the Contractor.

1 11 Signing of Proposals

If the bidder is a corporation, the legal name of the corporation shall be set forth together with the signature of the officer or officers authorized to sigh contracts on behalf of the corporation; if bidder is a partnership, the true name of the firm shall be set forth together with the signatures of all the partners; and if the bidder is an individual, his signature shall be inscribed. If signature is by an agent, other than an officer of a corporation or member of a partnership, a Power of Attorney must be on file with the Owner prior to opening bids or submitting bids; otherwise the bid may be disregarded as irregular and unauthorized.

1.12 Filling of proposal

Each bid, properly signed, together with the Bid Security, list of subcontractors, statement of experience of bidder, addenda, and all documents bound therein shall be enclosed in a sealed envelope or package addressed and entitled as specified in the Notice to Bidders. The bid must not be removed from these bound documents.

1.13 Withdrawal of Proposal

Any bid may be withdrawn at any time prior to the hour fixed in the Notice to bidders for the receipt of bids, provided that a request in writing, executed by the bidder or his duly authorized representative, for the withdrawal of such a bid is filed with the Owner prior to the time specified for receipt of bids. The withdrawal of a bid will not prejudice the right of a bidder to file a new bid prior to the hour fixed for the receipt of bids.

1.14 Qualifications of Bidders

It is the intention of the Owner to award the contract only to a bidder who furnishes satisfactory evidence that he has the requisite experience and ability and that he has sufficient capital, facilities, and plant to enable him to prosecute the Work within the time named in the Contract Documents.

1.15 Disqualification of Bidders

More than one bid for the Work described under a Schedule in this Document to be included under a Contract from an individual, firm or partnership, a corporation or an association under the same or different names will not be considered. Reasonable grounds for believing that any bidder is interested in more than one bid for the Work contemplated will cause the rejection of all bids in which such a bidder is interested. If there are reasonable grounds for believing that collusion exists among the bidders, the bids of the participants in such collusion will not be considered.

1 16 Award of Contract

Award of Contracts, if any, will be made within the time limit as stated in this Section. The Owner reserves the right to reject any or all bids.

1.17 Effective Date of Award

If a contract is awarded by the Owner, the award shall be effective when formal notice of such award, signed by the authorized representative of the Owner, has been delivered to the awardee, or mailed to him at the main business address shown in his bid by some officer or agent of the Owner duly authorized to give such a notice.

1.18 Penalty for Collusion

If at any time it shall be found that the person, firm or corporation to whom the Contract has been awarded has, in presenting any bid or bids, colluded with any other party or parties, then the Contract so awarded will be null and void, and the Contractor and his Sureties will be liable to the Owner for all loss or damage that the Owner may suffer thereby, and the Owner may advertise anew for bids for said Work.

1.19 Agreement, Bonds, Insurance

The attention of bidders is specifically directed to the forms of Agreement and Bonds to be executed and types of insurance to be taken out in the event a contract award is made.

1.20 Failure to Execute Agreement and File Required Bonds and Insurance

Failure of a successful bidder to execute the Agreement and file required bonds and insurance within the required time set forth in Section 00300 shall be just cause for the annulment of the award. On failure of a successful bidder to execute the Agreement and file the required bonds and insurance within the required time, he shall forfeit his bid security as agreed as liquidated damages and the bidder, by filing a bid, agrees to this provision.

END OF SECTION 00100

Section 00300

BID FORM

Part 1 General

1.01 Bidder's Proposal

Proposal to "OWNER" for Wastewater Reclamation and Reuse System at Waterbridge Planned Development, Franklin, TN.
Full Name of Bidder: _____

_____

Main Business Address: _____

_____

Place of Business: _____

The undersigned, as Bidder, declares that the only person or parties interested in this Proposal as principals are those named herein; that this Proposal is made without collusion with any other persons, firm or corporation; that he has carefully examined the location of the proposed Work and all the Contract Documents; and that he proposes, and agrees if this Proposal is accepted, that he will contract with the Owner to provide all necessary machinery, tools, apparatus and other means of construction, including utility and transportation services necessary to do all the Work and furnish all the materials and equipment specified or referred to in the Contract Documents in the manner and time therein prescribed, and according to the requirements of the Owner as therein set forth, to furnish the Contractor's Insurance specified in the General Conditions of Contract, and to do all other things required of the Contractor by the Contract Documents, and that he will take in full payment therefor the same set forth in the following Bid Schedule.

Bidder Acknowledges receipt of the following addenda:

_____

_____

_____

No Bidder may withdraw a Bid within 90 days after the actual date of the opening thereof. Should there be any reason the Contract cannot be awarded within the specified period, the time may be extended between the Owner and the Bidder.

If this Proposal is accepted and the undersigned shall fail to enter a contract and to give the Performance Bond and Labor and Materials Payment Bond and a Labor and Materials Payment Bond, each in the amount of 100 percent of the Contract Price, for faithful performance required by the Contract Documents and by law, and to provide all

insurance as required by the Contract Documents within ten (10) days after the date of the Notice of Award of the Contract, the Owner, at its option, may determine that the Bidder has abandoned this Contract and thereupon this Proposal and the acceptance thereof shall be null and void.

1.02 Pricing – Lump Sum

A. Bid Item 1 – Reclamation System

1. Work included:

The Contractor shall furnish all labor, equipment, materials, and do all the work necessary to excavate treatment cells, install piping, pumps, blowers, manholes, chlorination system, controls and electrical system and all necessary appurtenances for a complete operating system.

2. Contract Time:

The Contractor agrees that the Work of this bid item will be substantially complete within _____ calendar days after the date of the Notice to Proceed.

3. Pricing:

Lump Sum price of _____

_____ Dollars.

$ _____

B. Bid Item 2 – Irrigation System

1. Work included·

The Contractor shall furnish all labor, equipment, materials, and do all the work necessary to construct the irrigation system. The work includes all piping, valves, controls, irrigation pumps and all appurtenances for a complete operating system

2 Contract Time:

The Contractor agrees that the Work of this bid item will be substantially complete within _____ calendar days after the date of the Notice to Proceed.

3. Pricing:

Lump sum price of _____

_____Dollars.

$_____

C. Bid Item 3– Total Project Bid Price

1. Work included:

The bidder agrees to perform all construction work as described in the Contract Documents for the total lump sum amount (the lump sum includes all the Work for bid Items A and B, inclusive):

2. Contract Time:

The Contractor agrees that the Work of this bid item will be substantially complete within _____ calendar days after the date of the Notice to Proceed.

3. Lump sum price of _____

_____Dollars.

$_____

1.03 List of Major Equipment

The undersigned states that the following is a full and complete list of the Major Equipment Manufacturers or Suppliers for this project and that such list will not be altered without written consent of the Owner:

Item	Supplier and/or Manufacturer and Address	Delivery Time in Calendar Days
_____	_____	_____
	_____	_____
	_____	_____
_____	_____	_____
	_____	_____

1.04 List of Subcontractors

The undersigned states that the following is a full and complete list of the proposed subcontractors on this project and the class of work to be performed by each, and that such list will not be altered without written consent of the Owner:

	Subcontractor and Address	Class of Work to be Performed	Estimated Percentage of Lump Sum Work Performed by Subcontractor
1.			

BID FORM

	_____	_____	_____
2.	_____	_____	_____
	_____	_____	_____
3.	_____	_____	_____
	_____	_____	_____
4.	_____	_____	_____
	_____	_____	_____
5.	_____	_____	_____
	_____	_____	_____
6.	_____	_____	_____
	_____	_____	_____
7.	_____	_____	_____
	_____	_____	_____

Dated: _____ Bidder: _____

By: _____

END OF SECTION 00300

Section 00500

AGREEMENT

Part 1 General

1.01 If the contractor is a corporation, the legal name of the corporation shall be set forth on the Agreement, together with the signature of the officer or officers authorized to sign Contracts on behalf of the corporation; if Contractor is a partnership, the true name of the firm shall be set forth on the Agreement, together with the signatures of all the partners; and if Contractor is an individual, his signature shall be placed on the Agreement. Signature of Contractor shall also be acknowledged before a Notary Public or other person authorized by law to execute such acknowledgment.

1.02 The name of the signing party or parties must be typewritten or printed under all signatures to the Contract.

1.03 If the Contractor operates as a partnership and the Contract is not signed by each partner, a duly authenticated Power of Attorney must be attached to the Contract, evidencing the signer's (signers') authority to sign such Contract for and in behalf of the partnership.

1.04 If signed by one other than the Contractor, a duly authenticated Power of Attorney must be attached to the Contract, evidencing the signer's authority to execute such Contract for and in behalf of the Contractor.

1.05 Four copies of the Contract Documents will be prepared by the Engineer. Copies of engineering data, special forms, or other documents furnished by the Contractor, which are required to be incorporated in the Contract, shall be supplied.

1.06 All copies will be submitted to the Contractor and the Contractor shall date and execute the Contract Agreement, insert executed copies of the required bonds, insurance certificates, and Power of Attorney, and submit all copies to the Owner.

1.07 The Owner will execute all copies, retain two copies, and forward two copies to the Contractor.

Part 2 Agreement

2.01 This Agreement is entered into this _____ day of _____, 20____ by "OWNER", hereinafter known as "Owner," and _____ doing business as ( ) an individual, or ( ) a partnership or ( ) a corporation; hereinafter known as "Contractor."

2.02 WHEREAS, Contractor has submitted to the Owner his Bidder's Proposal to construct and complete the Project known as the Wastewater Reclamation and Reuse System – Waterbridge Planned Develpoment, and the Contract has been awarded to that Contractor;

AGREEMENT

2.03 NOW, THEREFORE, in consideration of the mutual agreements and covenants hereinafter set forth, the Owner and Contractor agree as follows:

A. The Contractor will commence and fully complete the Project in strict accordance with the Contract Documents, which are annexed to and incorporated into this Agreement, for the sum of _____ dollars ($_____).

B. The Contractor has submitted the required insurance certificates, which are annexed to and incorporated into this Agreement.

C. It shall be distinctly understood by the Contractor that the Agreement is made for the Consideration set forth on the face of the Agreement and that the Contractor shall have by careful examination satisfied himself of the nature and location of the work to be performed, the conformation of the ground, the character of equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and of any and all other matters and conditions which can in any way affect the work under this Contract. No verbal agreement or conversation with any officer, agent or employee of the Owner, either before or after the execution of the Contract, shall affect or modify any of the terms or obligations herein contained.

D. The Contractor will commence the work required by the Contract Documents within 14 calendar days after the date of the notification to proceed and will complete the same within 180 consecutive calendar days from the date of the notification to proceed unless the period for completion is extended otherwise by the Contract Documents. Contractor agrees to pay as liquidated damages, and not as a penalty, the sum of $250 00 for each consecutive calendar day's delay in completing this Contract after expiration of the time herein limited for its completion, including any approved extension of time because of unavoidable delay.

E. The Contractor shall receive as full compensation for the work described herein a sum based on the price submitted in the Bidder's Proposal, which is annexed to and incorporated into this Agreement

Payment shall be made to the Contractor monthly in cash upon certification by the Engineer in the amount of ninety percent (90%) of the work performed and materials on the site. The balance of ten percent (10%) shall be paid the Contractor sixty (60) days after final acceptance of the Project by the Owner.

F. Contractor shall promptly, upon written demand, refund any overpayment received, with due consideration for any adjustments made during the progress of the Project.

AGREEMENT

G. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns .

H. The Contractor (if a Corporation) hereby certifies that it is a _____ Corporation (Foreign Corporation registered to do business in the State of Tennessee).

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this Agreement in (_____) each of which shall be deemed an original on the date first above written.

OWNER:

"OWNER"
By:_____
(Signature)

Name:_____

Title:_____

(Seal)

Attest:

_____
Title: Secretary

Section 00500

AGREEMENT

CONTRACTOR:

_____

By:_____

Title._____

(Seal)

Attest:

_____

Name:_____

Title._____

END OF SECTION 00500

Section 00610

PERFORMANCE BOND

Part 1 General

1.01 PERFORMANCE BOND

_____
(Name of Contractor)

_____
(Address of Contractor)

a _____
(Corporation, Partnership, or Individual)

called Principal and _____
(Name of Surety)

_____
(Address of Surety)

a Corporation organized and existing under the laws of the State of _____, hereinafter called Surety, are held firmly bound unto "OWNER", hereinafter called "Owner," in the penal sum of _____ dollars ($_____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal has entered into a certain written contract with the above named Owner, dated the _____ day of _____, 19____ a copy of which is hereto attached and made a part hereof.

NOW, THEREFORE, IF THE Principal shall well, truly, and faithfully perform its duties, all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term thereof, and any extensions therefor which may be granted by the Owner, with or without notice to the Surety and during the one year guaranty period, and if he shall satisfy all claims and demands incurred under such contract, and shall fully indemnify and save harmless the Owner from all costs and damages which it may suffer by reason of failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED. FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the Work to be performed thereunder or the Specifications accompanying the same shall in any wise affect its obligations on this Bond and it does hereby waive

PERFORMANCE BOND

notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the Work or the Specifications.

IN WITNESS WHEREOF, this instrument is executed in _____ counterparts,
(Number)
each one of which shall be deemed an original, this the _____ day of _____, 19_____.

ATTEST:

_____
(Principal)

_____ By. _____
(Principal Secretary)

_____

(Seal) _____

_____
(Witness as to Principal)

_____
(Address)

_____ _____
(Surety)

ATTEST: By _____
(Attorney-in-Fact)

_____ _____
(Witness as to Surety) (Address)

_____ _____
(Address)

_____

NOTE: Date of Bond must not be prior to date of Contract. If Contractor is Partnership, all partners should execute Bond.

IMPORTANT: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of Illinois

END OF SECTION 00610

Section 00650

INSURANCE

Part 1 General

1.01 REQUIRED INSURANCE

A. Contractor's Insurance

Contractor shall not commence work under this Contract until he has obtained insurance required to fully protect himself, his subcontractors, the Owner and Engineer and others from any or all claims for damages of any kind by his employees, the public, the Owner's and Engineer's employees and any other person, and such insurance has been approved by the Owner, nor shall Contractor allow any subcontractor to commence work on any subcontract or work order until similar insurance required of subcontractor has been so obtained and approved by the Owner.

B. Workmen's Compensation Insurance

1 Contractor shall maintain, during the life of this Contract, Workmen's Compensation Insurance, including Occupational Disease and Employer's Liability Insurance:

a. Statutory· Amounts and coverage as required by Workmen's Compensation Laws

b. Employer's Liability: At least $100,000 each accident

c All States Endorsement

2. In case any work is subcontracted, contractor shall require such subcontractor(s) to provide equivalent Workmen's Compensation Insurance.

C Public Liability and Property Damage Insurance

1. Contractor shall maintain, during the life of this Contract, coverage for directing operations, sublet work, contractual liability and completed operations with limits not less than those stated below

2. Such insurance shall fully protect Contractor from claims for damages for bodily injury, including accidental death, as well as claims for property damage, including loss of use and including fire, explosion, collapse and underground property damage, which may arise from activities under or incidental to the Contract, whether such activities be by Contractor or by any of his subcontractors, or by anyone directly or indirectly employed or otherwise contracted by any of them

a Bodily Injury Liability — $500,000 each occurrence

Personal Injury Liability
Contractual Liability
Contractor's Operations and Protective Coverage

b. Property Damage Liability — $300,000 each occurrence

Contractual Liability
Contractor's Operations and Protective Coverage

Property Damage—Include Broad Form Property Damage. Removed "XCU" Exclusions (explosion, collapse, underground property damage)

D. Comprehensive Liability Insurance

1. Contractor shall maintain, during life of this Contract, Comprehensive Automobile Liability Insurance including coverage for owned, non-owned, and hired vehicles with liability limits not less than:

a. Bodily Injury Liability
$250,000 each person
$500,000 each occurrence

b Property Damage Liability
$200,000 each occurrence

E Excess Liability

Contractor shall maintain, during the life of this Contract, excess liability insurance in the amount of $1,000,000 in addition to the previously mentioned coverages. Such insurance to be on a blanket basis

F. Builder's Risk

1. Contractor shall effect and maintain all risk coverage under a Completed Value "All Risk" type Builder's Risk policy and shall cover all work (including that of all Contractors) in the course of construction, including temporary structures and materials used in the construction process at the site and while awaiting installation. The policy shall be written in an amount equal to 100% of the total sum of all contracts.

2. Coverage shall not extend to:

a. Tools and equipment of Contractor, subcontractors or the Engineer

b. Property owned by employees of Contractor, subcontractors or the Engineer

c Vehicles of any kind

d. Property in storage off the site (Contractor shall insure this risk)

3. The policy shall name the Owner, the Engineer, the General Contractor and all subcontractors as insureds.

G. Owner's Protective

1 Contractor shall effect and maintain, at his expense, Owner's Protective Insurance naming the Owner and the engineer as insureds.

2. Said insurance shall afford the same protection and in the same amounts as required in Public Liability and Property Damage Insurance, 1.1.3 above, to the Owner and Engineer for all claims for bodily injury and property damage arising from ownership of the premises and general supervision or observation of the work, including claims by employees of the Contractor and subcontractors or sub-subcontractors.

3. The obligation of the insurance company under this paragraph shall not extend to the liability of the Engineer, their agents or employees, arising out of:

a. The preparation or approval of maps, drawings, opinions, reports, surveys, designs or specifications

b. The giving or failure to give directions or instructions by the Engineer, their agents or employees, provided the giving or failure to give directions or instructions is the primary cause of the injury or damage

1.02 Special

A. Cancellation of Insurance

All certificates and policies shall indicate that the insuring company will not cancel or materially alter the policies without giving the Owner and Engineer notice in writing thirty (30) days prior to effective date of cancellation or

alteration. In event of such cancellation or alteration notice, Contractor shall obtain alternate insurance coverage in compliance with specification requirements

B Certificate of Insurance

1 Within 14 days after receipt of the Notice of Award, the Contractor shall file with the Engineer a certificate of insurance showing complete coverage of all insurance required by this Section, signed by the insurance companies or their authorized agents, certifying to the name and address of the party insured, the description of the work covered by such insurance, the insurance policy numbers, the limits of liability of the policies, and the dates of their expirations.

2. The Insurance Certificate furnished to the Owner shall state that all subcontractors are named as insureds.

C Evidence of Coverage

For each insurance coverage specified above, Contractor shall provide the Owner with proper evidence of amounts and coverage by an insurance company satisfactory to the Owner

D. Damage Claims

1. The Contractor shall indemnify and hold harmless the Owner and the Engineer and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense

a Is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the work itself), including the loss of use resulting therefrom

b. Is caused in whole or in part by any negligent act or omission of the Contractor, any subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party to whom insurance is afforded pursuant to this paragraph

2 In any and all claims against the Owner or the Engineer or any of their agents or employees by any employee of the Contractor, any subcontractor, anyone directly or indirectly employed by any of them or

anyone for whose acts any of them may be liable, the insurance obligation under this paragraph shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any subcontractor under Workmen's Compensation Acts, disability benefits acts or other employee benefit acts

3. The insurance obligation of the Contractor under this paragraph shall not extend to the liability of the Engineer, his agents or employees, arising out of.

   a. The preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications

   b. The giving of or the failure to give directions or instructions by the Engineer, his agents or employees, provided such giving or failure to give is the primary cause or the injury or damage.

END OF SECTION 00650

Section 00700

GENERAL CONDITIONS

Part 1 General

1.01 Definitions

Words, phrases or other expressions used in the Contract Documents are defined as follows:

A. Addenda: Documents issued prior to the execution of the Agreement which may modify or interpret the Contract Documents.

B. Change Order: A written order to the Contractor authorizing an addition, deletion or revision in the Work or an adjustment in the Contract Price and/or Contract Time.

C. Contract Documents: The Contract, including Advertisement for Bids, Instructions to Bidders, Bid Forms, Performance and other specified security Bonds, Notice of Award, Notice to Proceed, General Conditions, Supplementary Conditions, General Requirements, Technical Specifications, Addenda, Insurance Certificates, and Change Orders. Contract Drawings entitled "Wastewater Reclamation and Reuse System - Waterbridge Planned Development" are also a part of the Contract Documents.

D. Contract Limits. The property line as shown on the Contract Drawings.

E. Date of Award: Date of Award of Contract shall mean the date formal notice of such award, signed by the Owner, has been delivered to the intended awardee.

F. Days or Days: Calendar day or days, unless herein otherwise expressly defined

G. Engineer: Sheaffer International, Ltd

H. Owner: "OWNER", Illinois

I. Resident Engineer: An authorized representative of the Owner assigned to make detailed examinations of any or all portions of the Work or materials thereof.

J. Shop Drawings: All drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by the Contractor, a subcontractor, manufacturer, supplier, or distributor, which illustrate specific portions of the Work.

K Substantial Completion: That date as certified by the Owner when the construction of the project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the Project or specified part can be utilized for the purposes for which it is intended.

GENERAL CONDITIONS

1.02 Drawings and Specifications

A Four copies of the Contract Documents will be furnished to the Contractor without charge upon request, and any additional copies which the Contractor may request will be furnished at the cost of reproduction In addition, one full-scale reproducible copy of each Contract Drawing will be furnished to the Contractor without any charge

B. Drawings and specifications are intended to be cooperative, and where work is called for in one and not in the other, it shall be furnished as though mentioned in both.

C. In case of conflict between the Drawings and Specifications, the Specifications shall govern In case of conflict between the General Requirements and Technical Specifications, the Technical Specifications shall govern Figure dimensions on Drawings shall govern over scale dimensions.

D. These specifications state applicable construction standards and refer to details in the Contract Drawings both of which are to establish minimum construction criteria and product quality. Proposed alternatives will be considered upon submittal of adequate information and documentation of performance and reliability.

E. The Contractor shall maintain, during the progress of the Work, up-to-date copies of all drawings, specifications, and supplementary data, complete with latest revisions thereto. In addition, the Contractor shall maintain a continuous record of all deviations from the drawings and, at the conclusion of the work, shall submit to the Engineer a set of the latest revisions of all drawings and specifications marked to show "as-built" deviations.

F. Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported in writing to the Owner or authorized agent of the Owner. Work done by the Contractor after his discovery of such discrepancies, inconsistencies, or ambiguities, and before resolution by the Engineer, shall be done at the Contractor's risk

1.03 Patents

The Contractor shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights, and save the Owner harmless from loss on account thereof

1.04 Responsibilities of Contractor

Section 00700

GENERAL CONDITIONS

A. Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the Work in accordance with the Contract Documents and all incidental work necessary to complete the Project in an acceptable manner, ready for use, occupancy or operation by the Owner

B. The Contractor shall maintain a competent superintendent who, on behalf of the Contractor, shall have complete charge of all work under the contract. Contractor shall promptly advise the Owner in writing, giving the name, address and telephone number (day and night) of such designated superintendent, and of any changes from time to time in such superintendence

C. The Contractor shall employ on the Work only such persons who are competent and skilled in their assignments. Any employee who obstructs the progress of the Work through incompetence or other means or conducts himself improperly shall be discharged or removed from the Work when so requested by the Engineer.

D. The contractor shall field verify existing conditions and coordinate with the Owner and Engineer. Should latent conditions be discovered, the Contractor shall notify the Owner and Engineer immediately, so that corrective measures may be investigated Should modifications be necessary, the Contractor shall provide the Engineer with adequate advance notice.

E. The Contractor shall from time to time remove all dirt and rubbish resulting from his operations and shall keep the premises clean and free of clutter When his work is complete, he shall at once remove from the premises all tools and machinery belonging to him and all rubbish in connection with his work and render the premises clean and free from all obstructions, delivering the work at completion whole, clean, tight and ready for use, with the grounds in a neat and presentable condition.

F. The Contractor shall submit schedules for construction to the Engineer for review. The use of Critical Path Method charts and diagrams is encouraged.

G The Contractor shall be responsible for the acts and omissions of all of his employees and all subcontractors, their agents and employees and all other persons performing any of the Work under a contract with the Contractor

H. Should any workmanship or materials be needed which are not directly or indirectly set forth in these Specifications or the Drawings, but are nevertheless necessary to the proper execution according to the obvious intent of the Contract Documents, the Contractor shall understand the same to be implied and shall provide for it as fully as if it were specifically described

GENERAL CONDITIONS

I The Contractor shall be held responsible for all the materials furnished and work performed under this Contract and shall protect same from all loss or damage from any cause until the final acceptance thereof.

J The Contractor shall observe and comply with all ordinances, laws, and regulations, and shall protect and indemnify the Owner, the Owner's officers and agents, and the Engineer against any claim or liability arising from or based on any violation of the same.

K. It shall be the Contractor's responsibility to maintain throughout the work sites, a safety and accident prevention program which meets the requirements of Federal, State, and local codes, and of all other authorities having jurisdiction over this work As a supplement to requirements of such authorities, the "Manual Accident Prevention in Construction," published by the Associated General Contractors of America, Inc., is recommended as a guide for safety and accident prevention. Compliance with Safety and Health Regulations by the Department of labor, Chapter XVII of Title 29, Code of Federal Regulations Part 1926 is specifically required

All personnel shall wear hard hats at all times when they are in the work site.

1.05 Guarantee

A The Contractor guarantees that the material and equipment and workmanship herein contracted will be as specified and will be free from defects in workmanship and materials. If, within the guarantee period, the material and equipment or workmanship fails to meet the provisions of this guarantee, the Contractor shall promptly correct any defects, including nonconformance with the Specifications, by adjustment, repair or replacement of all defective parts or materials.

B. Unless otherwise specified, the guarantee period shall begin on the date of final acceptance or the date of initial operation, whichever is later, and the guarantee period shall end one year later

C. If manufacturer's field supervisors are included in the Contract, such supervision shall be furnished by the Contractor without cost for the correction of any defect.

D The Contractor will be given an opportunity to confirm the existence of the defect, but he shall not delay the correction while making such determination.

E. The Contractor shall extend the provision of this guarantee to cover all repaired and replacement parts furnished under the guarantee provisions for a period of one year from the date of their installation

F. If, within 10 days after the Owner gives the Contractor notice of a defect, the Contractor neglects to make, or undertake with due diligence to make the necessary corrections, the Owner is hereby authorized to make the corrections himself, or order the work to be done by a third party, and the costs of the corrections shall be paid by the Contractor

G. In the event of an emergency where, in the judgement of the Owner, the delay resulting from giving formal notice would cause serious damage which could be prevented by immediate action, defects may be corrected by the Owner, or a third party chosen by the Owner, without giving prior notice to the Contractor, and the cost of the corrections shall be paid by the Contractor In the event such action is taken by the Owner, the Contractor will be notified promptly and shall assist whenever possible in making the necessary corrections.

1.06 Liens

A. Contractor expressly agrees to discharge at once all liens, claims, stop notices or attachments which may be filed in connection with the Work and hold Owner and Engineer harmless therefrom. In the event that any monies are payable by the Owner to the Contractor, there may be withheld from such monies an amount equal to 125 percent or the aggregate amount of all liens or claims arising out of the Work hereinunder which may have been filed or levied against the property of the Owner Such amounts are in addition to, and not inclusive of, amounts withheld pursuant to Section 01150, Measurement and Payment, and all such amounts may be withheld until such liens or claims are discharged and satisfied and such stop notices, claims, levies or attachments are released, or may be posted by Owner, in court, at the expense of Contractor, in order to have such liens, claims stop notices, levies or attachments released.

B. The final payment hereunder shall not be payable while any such liens of record remain un-discharged or stop notices, levies claims or attachments remain unsatisfied.

1.07 Subcontracting

A. The Contractor shall not assign or subcontract the work, or any part thereof, without the previous written consent of the Owner, nor shall he assign, by Power of Attorney or otherwise, any of the money payable under this Contract without written consent of the Owner.

B Should any subcontractor fail to perform in a satisfactory manner the work undertaken by him, his subcontract shall be immediately terminated by the Contractor upon notice from the Owner Nothing contained in this Contract shall create any contractual relation between any subcontractor and the Owner

1.08 Engineer's Authority

A. Nothing Contained in the Contract Documents shall create any contractual relationship between the Engineer and the Contractor

B The Engineer shall at all times have access to the Work wherever it is in preparation and progress.

C. The Engineer will be the interpreter of the requirements of the Drawings and Specifications. The Engineer shall not be liable to the Contractor for the result of any interpretation or decision rendered in good faith in such capacity.

D. The Engineer will have authority to reject work which does not conform to the Contract Documents.

E. The Engineer will review and take appropriate action upon Contractor's submittals such as Shop Drawings, Product Data and Samples.

F. The Engineer, along with the Owner, will conduct inspections to determine the dates of Substantial Completion and Final Completion, will receive and review written warranties and related documents required by the Contract and assembled by the Contractor. The Engineer will communicate directly with the Contractor.

1.09 Land and Rights-of-Way

A. Prior to issuance of Notice to Proceed, the Owner will obtain all land and rights-of-way necessary for carrying out and for completion of the Work to be performed pursuant to the Contract Documents, unless otherwise mutually agreed.

B. The Owner will provide to the Contractor information which delineates and describes the land owned and rights-of-way acquired.

C. The Contractor shall provide at his own expense and without liability to the Owner, with the approval of the Owner, any additional land and access thereto that the Contractor may desire for temporary construction facilities or for storage of materials

1.10 Suspension of Work, Termination and Delay

A. Suspension for Convenience

1. The Owner reserves the right to suspend and reinstate execution of the whole or any part or the work without invalidating the provisions of the Contract Orders for suspension or reinstatement of work will be issued by the Owner to the Contractor in writing The time for completion of the

work will be extended for a period equal to the time lost by reason of the suspension.

2. Extra costs and expenses which, in the opinion of the Engineer, are caused by work suspension ordered by the Owner will be paid by the Owner to the Contractor

B. Termination for Convenience

1. The Owner may, for its convenience, terminate work under the Contract in whole or in part at any time by written notice or telegraphic notice to the Contractor. Such notice shall state the extent and effective date thereof the Contractor will, as and to the extent directed, stop work under the Contract and terminate work under order and subcontracts, and take any necessary action to protect property in the Contractor's possession in which the Owner has or may acquire an interest
2. Costs and expenses which, in the opinion of the Engineer, are caused by work termination ordered by the Owner will be paid to the Contractor

C. Delays and Extensions

While time is of the essence of the Contract, the time during which Contractor is actually delayed in the performance of work hereunder by the acts of omission or commission of Owner or of their employees or agents, or by the acts of God, or by the elements which Contractor could not reasonably foresee and provide against, or by other causes beyond Contractor's reasonable control, including without limitation, strikes, boycotts, or like obstructive action by employees or labor organizations, may be added to the agreed time of completion of the Project.

D. Unnecessary Delays, Bankruptcy or Abandonment

1 If at any time the Owner shall be of the opinion that the work is unnecessarily delayed and will not be completed within the time established by the Agreement, the Owner shall notify the Contractor in writing. Should the Contractor not take proper action within fourteen (14) days after the notice to assure the Owner prescribed time, the Owner shall have the right to terminate the Agreement The Contractor shall then stop all work and forfeit all rights under the Agreement.

2 If the work to be done under this Agreement is abandoned by the Contractor, or if the Contractor is adjudged bankrupt, or if a general assignment of his assets is made for the benefit of his creditors, or if at any time the Engineer certifies in writing to the Owner that the Contractor is executing the Agreement in bad faith or otherwise not in accordance with the terms of the Agreement, then the Owner may serve written notice upon

the Contractor and his surety of said Owner's intention to terminate this Contract. Unless within five (5) days after the serving of such notice a satisfactory arrangement is made for continuance, this contract shall terminate.

3. In the event of such termination, the surety will have the right to take over and complete the work, provided that if the surety does not commence performance within 30 days, the Owner may take over and prosecute the work to completion, by contract, or otherwise. The Contractor and his surety shall be liable to the Owner by reason of such prosecution and completion. The Owner may take possession of, and utilize in completing the order, all materials, equipment, tools and plant on the site of the work.

1.11 Defective Workmanship

In the event of failure of the Contractor at any time to perform the work either in whole or part according to the terms hereof, and/or in the event of defective workmanship, and/or materials furnished by Contractor as may be determined by the inspection of the Owner, then the Owner at any time may require Contractor to remedy such failure or defect at no expense to the latter, or may undertake to remedy such failure or defect and deduct from any payments due, or to become due, to Contractor.

1.12 Indemnification

A. The Contractor shall indemnify and hold harmless the Owner, the Engineer, and their agents and employees from and against all claims, including all damages, losses, expenses and attorney's fees arising out of or resulting from the performance of the Work, if these claims are attributable to bodily injury, sickness, disease or death, or to injury to, loss of use of or destruction of tangible property; and is of omission of the Contractor, his subcontractors or his agents or anyone for whose acts any of them are liable.

B. This indemnification obligation shall not be limited by any limitation of the amount or type of damages, compensation or benefits payable by or for the Contractor, his subcontractors, or his agents under workmen's compensation acts, disability benefit acts or other employee benefit acts.

C. The acceptance by the Owner or its representatives of any certification or insurance providing for other coverage than is provided in the Contract Documents to be furnished by the Contractor shall in no event be deemed as a waiver of any of the provisions of the Indemnity Agreement

1.13 Simultaneous Work by Others

The Owner reserves the right to perform, or have performed, in and about the work during the time when the Contractor is performing its work hereunder such other work as Owner may desire and Contractor shall make all reasonable effort to perform its work hereunder in such manner as will enable such other work to be performed without hindrance from Contractor and will make no claim for damage against Owner arising out of such other work or interference therefrom

1 14 Arbitration

A All claims, disputes, and other matters in question arising out of, or relating to, the Contract Documents or the breach thereof, except for claims which have been waived by the making and acceptance of final payment as provided by Section 00500, will be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association. This agreement to arbitrate will be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators will be final, and judgement may be entered upon it in any court having jurisdiction thereof.

B. Notice of the demand for arbitration will be filed in writing with the other party to the Contract Documents and with the American Arbitration Association, and a copy will be filed with the Owner. Demand for arbitration will in no event be made after institution of legal or equitable proceedings based on any claim, dispute or other matter in question, which would be barred by the applicable statute of limitations.

1.15 Time for Completion and Liquidated Damages

A. The date of beginning and the time for completion of the Work are essential conditions of the Contract Documents and the Work embraced shall be commenced on a date specified in the notice to proceed

B The Contractor shall proceed with the Work at such a rate of progress to ensure full completion within the Contract Time It is expressly understood and agreed, by and between the Contractor and the Owner that the Contract Time for the completion of the Work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work during the period such Work is to be performed.

C. If the Contractor shall fail to complete the Work within the Contract Time, or extension of the time granted by the Owner, then the Contractor shall pay to the Owner the amount of liquidated damages and not as penalty as specified in the Bid for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents

D. The Owner will charge the Contractor, and may deduct from the partial and final payment for the Work, all engineering and inspection expenses incurred by the Owner in connection with any Work accomplished after the specified completion date.

E The Contractor will not be charged with liquidated damages or any excess cost when the delay in completion of the Work is due to the following, and the Contractor has promptly given Written Notice of such delay to the Owner

1. To any preference, priority or allocation order duly issued by the Owner

2. To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a Contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather.

3. To any delays of subcontractors occasioned by any of the causes specified in paragraphs 1.15 E(1) and 1.15E(2) of this Section.

1 16 Unexpected Conditions

A. The Contractor shall promptly, and before such conditions are disturbed, except in the event of any emergency, notify the Owner by Written Notice of

1. Physical, including subsurface, conditions at the site differing materially from those indicated in the Contract Documents; or

2. Unknown physical conditions at the site, of unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the Work of the Character provided for the Contract Documents

B. The Owner will promptly investigate the conditions and if he finds that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the Work, an equitable adjustment will be made and the Contract Documents will be modified by a Change Order.

1.17 Assignment

The Contract shall not be assigned, sublet or transferred in whole or in part by the contractor, nor shall the Contractor assign any moneys due or to become due without

prior written consent of Owner, and any attempted assignment hereunder without the previous written consent of the Owner shall be void

END OF SECTION 00700

Section 00800

SUPPLEMENTARY CONDITIONS

Part 1 General

1.01 Manufacturer's Conditions

A The Contractor, through qualified individuals, shall adequately instruct designated employees of the Owner in the operation and care of all equipment supplied and installed by the Contractor hereunder. Certain specific requirements of the Contractor are covered in the Specifications

B The Contractor's price shall include the cost of furnishing a competent and experienced engineer or superintendent who shall represent the manufacturer of Contractor supplied equipment and shall assist the Contractor, when required, to install, adjust and test all equipment in conformity with the Contract Documents. After the equipment is placed in operation, such engineer or superintendent shall make all adjustments and test required by the Owner to ensure that the equipment is in proper and satisfactory operating condition.

C The amount of start-up and instruction time required for Contractor supplied equipment will vary according to the extent and complexity of the Equipment Each manufacturer shall provide adequate time for acceptance of his equipment.

1.02 Datum Plane

All elevations indicated or specified refer to the Mean Sea Level Datum Plane, 1929 General Adjustment, of the United States Coast and Geodetic Survey (USCGS).

1 03 Acceptance of Work

By their signatures on the Contract, Contractor and Owner mutually agree that no payment made under the Contract shall be evidence of the performance of the Contract, either wholly or in part, and that no payment shall be construed to be an acceptance of defective or improper materials.

1 04 Final Acceptance

The Work under this Contract shall be considered accepted by the Owner when all the work including cleaning up, etc., is done and the Engineer shall have prepared a letter of acceptance and the same has been approved by the Owner

Section 00800

SUPPLEMENTARY CONDITIONS

1.05 Attorney's Fees

The Contractor hereby agrees to pay to the Owner all Attorney's fees in all court actions brought by either of them against the other or in which they are both plaintiffs or defendants, and also in court actions involving offsetting claims between Contractor and Owner, because of any doubts, disputes or actions arising out of this Contract, except in the following cases:

A. When the contractor obtains a favorable net judgement against the Owner, after consideration of claims and offsets of Owner which are allowed by the court against Contractor, for breach of the Contract.

B. When the Owner is denied a favorable judgement by a court in any suit against Contractor which may be brought by the Owner

1 06 Temporary Construction

The Contractor shall arrange for and pay all costs for temporary work, including forming, and shall do all forming and anchoring which may be necessary, as well as all excavation, bracing, shoring, and dewatering. All temporary work shall be done in a workmanlike manner and shall and shall be secure and safe.

1 07 Losses from Natural Causes

All loss or damage arising out of the nature of the work, or from the action of the elements, or from floods or overflows, or from groundwater, or from any unusual obstruction or difficulty, or any other natural or existing circumstance, either known or unforeseen, which may be encountered in the prosecution of the work, shall be sustained and borne by the Contractor at his own cost and expense

1.08 Release of Liability

The acceptance by the Contractor of the last payment shall be a release to the Owner, and every officer and agent thereof, from all claims and liability hereunder for anything done or furnished for, or relating to, the work, or for any act or neglect of the Owner or of any other person relating to or affecting the work.

1.09 Contractor to Verify Present Dimensions

Wherever present work is involved, the Contractor shall verify and be responsible for dimensions and for location of pipelines and underground utilities

1 10 Sheeting and Shoring

A The Contractor shall provide sheeting and shoring for the protection of

1. Present structures
2. Structures under construction
3. Present and proposed utilities and pipelines
4. The safety of the men on the site

B. The Contractor shall assume full responsibility for the design and placement of all sheeting and shoring and shall hold the Engineer and Owner harmless against any liability arising out of this work.

1.11 Trees, Plants and Lawn Protection

All trees, shrubs and lawns, except those ordered to be removed, shall be adequately protected by the Contractor. No excavated material shall be placed as to injure such trees or shrubs. Trees, shrubs or lawn areas destroyed by negligence of the Contractor or of his employees shall be replaced by him with new stock of similar size and age, at the proper season, and at the sole expense of the Contractor.

1.12 Damage by Others

If the Contractor's work is damaged by another party not under his supervision or control, the Contractor shall make his claim directly with the party involved. If a conflict or disagreement develops between the Contractor and one of the other contractors concerning the responsibility for damage or loss to the Contractor's work, the conflict shall be resolved as provided in the General Conditions. Such conflict shall not be cause for delay in the restoration of the damaged work. The Contractor shall restore the work immediately and the costs thereof will be assigned pending the resolution of the conflict

1.13 Progress Meetings

The Contractor shall schedule regular periodic meetings to be attended by the Contractor, Engineer, and Owner or their authorized representatives. The progress-meeting schedule shall be established at the pre-construction conference.

1.14 Temporary Utilities

A. The Contractor shall be responsible to provide construction power to meet his construction requirements during the entire term of the Project. The Owner will pay installation costs for the permanent power connection by the Utility. Contractor shall pay all operating costs until final acceptance of the Project by the Owner

B. During the entire term of this Project, the Contractor shall provide telephones as required for his use.

C. The Contractor shall provide and maintain temporary sanitary facilities for his workmen on the project sites during the term of his contract.

D The Contractor shall provide his own temporary water for use during construction.

E. The Contractor shall provide an ample sanitary supply of fresh drinking water for his workmen's ready use and single service cups

F. The Contractor shall provide and maintain a temporary drainage system and pumping equipment as required to keep all of his excavated areas, pits and basins free from water. Pumping and drainage shall be performed in a manner approved by the Engineer so as to avoid endangering any adjacent construction or property.

1 15 Erosion Control and Sedimentation Plans

A Unless otherwise indicated, all vegetative and structural erosion and sediment control practices will be constructed and maintained according to minimum standards and specifications of Williamson County and the State of Tennessee.

B. The plan approving authority must be notified one week prior to the pre-construction conference, one week prior to the commencement of land disturbing activity, and one week prior to the final inspection.

C All erosion and sediment control measures are to be placed prior to or as the first step in clearing.

D A copy of the approved erosion and sediment control plan shall be maintained on the site at all times.

E Prior to commencing land disturbing activities in areas other than indicated on these plans (including, but not limited to, off-site borrow or waste areas), the contractor shall submit a supplementary erosion control plan to the owner for review and approval by the plan approving authority

F. The contractor is responsible for installation of any additional erosion control measures necessary to prevent erosion and sedimentation as determined by the plan approving authority.

G All disturbed areas are to drain to approved sediment control measures at all times during land disturbing activities and during site development until final stabilization is achieved.

H During dewatering operations, water will be pumped into an approved filtering device.

SUPPLEMENTARY CONDITIONS

I. The contractor shall inspect all erosion control measures periodically and after each runoff-producing rainfall event Any necessary repairs or cleanup to maintain the effectiveness of the erosion control devices shall be made immediately.

1 16 Seeding and Mulching

A. All areas to be excavated shall have topsoil stripped and stockpiled away from construction activities. Replaced topsoil on disturbed areas not receiving pavement after construction is complete and prior to seeding.

B. Permanent seeding of slopes and disturbed areas shall be completed within seven (7) days after final grade is obtained. Permanently seeded areas shall be protected during establishment with straw or other mulch.

C. Seed mixture shall be composed by weight:

Kentucky Bluegrass	40%
Kentucky 31 Fescue	40%
Pennlawn Red Fescue	15%
Redtop	5%

Alternative seed mixture may be used with prior approval of Owner

D Run soil test to determine what amount of lime and/or fertilizer is required to assure adequate vegetative cover to prevent erosion.

E. If permanent seeding is not possible, rough grade site and provide temporary seeding as follows:

1. Lightly roughen and loosen soil surface to dept of 2" to 4" by discing or harrowing.

2. Seed According to schedule

Months	Species	Rate lbs/1,000 ft.
March/April August/September October/November	Rye (Secale oereale, Abruzzi variety)	3
May/June July	Weeping Lovegrass (Ergrostis Curvula)	1/16

3. When seeding is not practical, mulch shall be applied in sufficient quantities to retard erosion and stabilize soil

F. Any soil left unprotected from more than 30 days shall be temporarily seeded.

G Sod or rip rap as applicable shall be laid on ditches in locations shown as soon after grading of ditches as possible.

1.17 No Representations to Contractor

It shall be distinctly understood by the Contractor that the Contract is made for the consideration set forth on the face of the Contract and that the Contractor shall have by careful examination satisfied himself as to the nature and location of the work to be performed, the conformation of the ground, the character of the equipment and facilities needed preliminary to and during the prosecution of the work, the general and local conditions, and as to any and all other matters and conditions which can in any way affect the work under this Contract. No verbal agreement or conversation with any officer, agent or employee of the Owner, either before or after the execution of the Contract, shall affect or modify any of the terms or obligations herein contained.

1.18 Notices

All notices required or permitted to be given under this Contract may be given by either party to the other by depositing same in the United States Mail, certified mail with return receipt requested, enclosed in a sealed envelope with first-class postage thereon, fully prepaid, or by telegram, either of which shall be addressed to the respective parties at the address shown in the Contract The address of either party may be changed at any time by written notice to the other of such a change. Any notice in the form of a letter deposited by either party shall be deemed to have been given and received by the other party within twenty-four (24) hours after mailing, as aforesaid. Any notice given by telegram, addressed as above mentioned, shall be deemed to have been given and delivered within twelve (12) hours after the message is submitted to the telegraph company.

1.19 Contract Entire Agreement

The Contract, together with the Drawings and Specifications and other documents referred to therein, shall constitute the entire agreement between the parties and shall supersede all prior negotiations, proposals, and purchase orders, whether written or oral.

1 20 Existing Utilities and Adjacent Structures

A. Various underground and surface structures may be shown on the Contract Drawings including water and gas pipes, sewers, telephone, electrical cables and conduits, drains, culverts, and miscellaneous structures The location of these structures, if plotted on the Drawings, are approximate and are based upon

available maps and drawings, field observations and verbal communications with utility personnel. No attempt to verify the location of said structures has been made by the Engineer. The locations and dimensions where shown do not purport to be absolutely correct, and the information given shall not be construed as representation that such structures will be found or encountered as plotted Other structures or pipelines may also be encountered which are not shown on the Drawings. Contractor shall verify locations, provide the Engineer with adequate advance notice prior to start of work, and shall contact JULIE (1-800-892-0123) 48 hours prior to any excavation.

B. The Contractor shall be entirely responsible for all injuries to water pipes, electric conduits or cables, drains, sewers, gas mains, poles, telephone and telegraph lines, streets, pavements, sidewalks, curbs and gutters, fences, street and highway bridges and culverts, building foundations, retaining walls or other structures of any kind met with during the progress of the Work, and shall be liable for damages to public or private property resulting therefrom

C. The cost of protection, replacement in their original positions and conditions or payment of damages for injuries thereto of pipelines and structures called for on the Drawings or specified shall be deemed included in the Bid Price, or if no specified Item is provided therefor, as part of the overhead cost of the Work, and no additional payment will be made therefor. If the Contractor, through negligence, disturbs or injures existing gas, water, electric, or telephone facilities not required for the performance of the Work, the facilities will be repaired by the utility companies at the sole expense of the Contractor For relocation of any existing utility to facilitate construction, the Contractor will make his own arrangements with the utility companies

1.21 Miscellaneous Conditions

Unless otherwise specified, all installation procedures, including site preparations; excavating and back-filling; pipe laying fitting and joining; manhole installing and waterproofing; equipment pressure and leakage testing; site maintenance during construction and start-up training, operation and maintenance procedures shall be in accordance with the technical specification contained herein.

END OF SECTION 00800

Section 01052

SURVEYS, PERMITS AND REGULATIONS

Part 1 General

1.01 Surveys

A The Owner will furnish all land surveys together with a suitable number of bench marks adjacent to the Work. The Contractor shall provide detailed staking, including line and grade.

B. The Contractor shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance. In the event of any destruction or disturbance of bench marks, reference points and stakes, the Contractor shall promptly notify the Owner of any such destruction or disturbance. The Contractor shall provide such ordinary labor as may be required by the Engineer for the Engineer to check lines and grades, make measurements for payment purposes, and make any other necessary measurements. The Owner shall check all finished grades to verify proper elevations

C. All dimensions and grades shown on the Drawings are believed to be correct, but the Contractor shall verify them at the site and notify the Engineer of any discrepancies found before proceeding with the work; similarly as to final lines and grades established by official surveys, the Contractor shall check the Drawings against such established lines and grades and notify the Engineer of any discrepancies found. In the absence of such notifications, extra work caused by discrepancies shall not entitle the Contractor to extra compensation

1.02 Permits

The Owner shall obtain and pay all associated fees for all Federal and State permits required as a result of the construction activity within the delineated site. The Contractor shall obtain and pay all associated fees for all County and Municipal permits and licenses and any other required by law or regulation to be obtained by the Contractor.

1 03 Regulations

A. All easement agreements will be on file at the Owner's offices. The Contractor shall abide by all easement and right-of-way agreements and requirements in the performance of his work. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor observes that the Contract Documents are at variance therewith, he shall promptly notify the Engineer and Owner in writing, and any necessary changes will be adjusted as provided in Section 01153.

SURVEYS, PERMITS AND REGULATIONS

B. The Contractor shall comply with all applicable laws, building and construction codes and requirements of governmental agencies under whose jurisdiction work is being performed.

C. Unless specifically noted to the contrary, the Contractor shall conform with and test in accordance with applicable sections of the latest revisions of codes and standards designated in the Specifications

D. Conflicts:

1. Between referenced codes and standards: Codes or standards establishing more stringent requirements shall be followed

2. Between referenced codes and standards and Specifications and/or Drawings: the one establishing more stringent requirements shall be followed.

END OF SECTION 01052

Section 01150

MEASUREMENT AND PAYMENT

Part 1 General

1 01 Measurement and Payment - General

A. The unit or lump sum price bid on each item, as stated in the Bid Proposal, shall include furnishing all labor, superintendence, machinery, equipment, and materials, necessary or incidental to complete the various items of work in accordance with the contract Documents and Specifications.

1 02 Payments to Contractor

A. At least 20 days before each monthly progress payment falls due for approval (but not more than once per month), the Contractor shall submit to the Engineer a partial payment estimate filled out and signed by the Contractor covering the Work performed during the period covered by the partial payment estimate and supported by such data as the Engineer may reasonably require Where any specific item(s) in the partial payment estimate is in dispute, the Engineer may delete those costs from the estimate and approve the acceptable portion of the payment request.

B. Payment request for stored materials and/or equipment shall be subject to the following conditions being met or satisfied:

1. The materials and/or equipment shall be received in a condition satisfactory for incorporation in the work

2. The materials and/or equipment shall be stored in such a manner that they will not be damaged due to weather, construction operations, or any other cause.

3 An invoice from the supplier shall be furnished for each item on which payment is requested.

4. The Contractor shall furnish written proof from the supplier of 90 percent payment for the materials and/or equipment no later than 30 days after receipt of payment for same from the Owner. The Owner shall have the right to deduct from the next payment estimate an amount equal to the payment for said materials and/or equipment if reasonable and adequate proof is not submitted.

C The Contractor warrants and guarantees that title to all work, materials, and equipment covered by an application for payment, whether incorporated in the project or not, will pass to the Owner free and clear of all liens, claims, security interests or encumbrances (except 10 percent retention which may be withheld

from suppliers and subcontractors to guarantee completion and performance) upon receipt of payment for same by the Contractor.

D. After receipt of each partial payment estimate, the Engineer will either indicate in writing his approval of payment and present the partial payment estimate to the Owner, or return the partial payment estimate to the Contractor indicating in writing his reasons for refusing to approve payment. In the latter case, the Contractor may make the necessary corrections and resubmit the partial payment estimate.

E. After review and approval of the partial payment estimate by the Owner, the progress payment shall be made available to the Contractor The Owner shall retain ten (10) percent of the amount of each payment claimed

F. The Engineer shall certify the date of substantial completion and that date shall establish the beginning date of the warranty/guarantee period unless a prior date has been established.

1.03 Acceptance of Final Payment as Release

The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner from all claims and all liability to the Contractor for all things done or furnished in connection with this Work and for every act and neglect of the Owner and others relating to or arising out of the Work other than claims in stated amounts as may be specifically expected by the Contractor with the consent of the Owner. Any payment, however, final or otherwise, will not release the contractor or his sureties from any obligations under the Contract Documents or the Performance Bond and Labor and Materials Payment Bond.

END OF SECTION 01150

Section 01153

CHANGE ORDERS

Part 1 General

1.01 Change Orders

A The Contractor agrees that he will do such work as may be required by the Owner for the proper construction of the whole work herein contemplated and will make no claim for extra work unless it shall have been done according to written order from the owner or its duly authorized agent The Contractor shall file with the Engineer, in writing, all claims for extra work done within one month, before the fifteenth (15^{th}) day of the following month, and the failure to file such claims within such time shall be deemed a waiver thereof, and admission that no such claims exits The price of such work shall be based on the price bid for similar work in the Bidder's Proposal, or its actual reasonable cost for labor, equipment, and material as agreed to by the Owner, plus fifteen percent (15%) to cover the cost of overhead and profit, provided that in all cases any such extra work shall have been authorized in writing by the Owner.

B. For each Change Order the Contractor shall submit sufficient cost and pricing data, as described in his subsection to enable the Owner to ascertain the necessity and reasonableness of costs and amounts proposed, and the allowability and eligibility of costs proposed.

C. If directed by the Engineer, the Contractor shall promptly submit an offer, in writing, to do the required work on a lump sum or unity price basis, as specified.

D. For work performed by a subcontractor, the Contractor shall accept as full payment therefor an amount equal to the actual cost to the Contractor of such work, plus a maximum of five (5%) percent of such cost

END OF SECTION 01153

Section 01340

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

Part 1 General

1 01 Shop Drawings, Product Data, and Samples

A The Contractor shall provide Shop Drawings as may be necessary for the prosecution of the Work as required by the Contract Documents The Engineer will promptly review and process all Shop Drawings and samples from the Contractor.

B Drawings submitted on a piecemeal basis covering only parts of the equipment package will be held for checking until entire set of drawings is received

C. The Contractor shall make any indicated corrections on the drawings returned and shall resubmit corrected drawings.

D. The Contractor shall have no claims for damages or extension of time on account of any delay in the work resulting from the rejection of material or from review, revision, and re-submittal of drawings and other data for review by the Engineer.

E. Corrections or comments on the Shop Drawings during the Engineer's review do not relieve the Contractor from compliance with the requirements of the Drawings and Specifications. The Owner or Engineer will not be responsible for errors or omissions on Shop Drawings furnished by the Contractor. The review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; and in performing his work in a safe manner. If the Shop Drawings deviate from the Contract Documents, the Contractor shall advise the Engineer of the deviations, in writing accompanying the Shop Drawings, including the reasons for the deviations, and shall request a deviation from the Contract Documents.

F. Each Shop Drawing shall be dated and shall be identified with the name of the project, the division, if any, the Bid Item number, and the name of the Contractor.

G The Contractor shall submit six copies of all submittals for approval

1.02 Product Quality

To describe product quality for Contractor supplied equipment, one typical manufacturer has been suggested. Other products of equivalent quality will be acceptable. The Contractor shall submit literature, specifications, shop drawings, and operational and maintenance information, as applicable, for review by the Engineer prior to use of said alternate product.

END OF SECTION 01340

Section 01400

INSPECTION AND TESTING

Part 1 General

1.01 Inspection and Testing Services

A. All material and equipment used in the construction of the project will be subject to adequate inspection and testing in accordance with generally accepted standards.

B. The Contractor shall give sufficient advance notice of placing orders to permit tests to be completed before materials are incorporated in the Work.

C The Contractor shall furnish, without charge, such amounts of materials as are needed for tests and shall afford the Owner and/or Engineer such facilities as it may require for collecting and forwarding samples and making inspections.

D The Owner shall provide at his expense the necessary testing services required by the Contract Documents.

E. If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction require any Work to be specifically inspected, tested, or approved by someone other than the Contractor, the Contractor shall give the Engineer timely notice of the readiness for inspection. The Contractor shall then furnish the Engineer with the required certificates of inspection, testing or approval.

F. Neither observations by the Engineer nor inspections, tests or approvals by persons other than the Contractor will relieve the Contractor from his obligations to perform the Work in accordance with the requirements of the Contract Documents.

G. The Owner and Engineer and their representatives will at all times have access to the work and to locations where materials or equipment are being manufactured, stored, or prepared for use under these Contract Documents They shall have full facilities for unrestricted inspection of such materials, equipment, and Work including full access to materials, equipment, and Work including full access to purchasing and engineering information, but not including prices, to the extent of uncovering, testing, or removing portions of the finished Work The Engineer shall be furnished with such information as may be required regarding materials used and the process of manufacture for the various items of equipment. Inspections by the Engineer of equipment or materials during its manufacture will be performed for the Owner solely in an effort to detect discrepancies and defects as early as possible, when they can be most readily corrected, and the Work thereby expedited. No acceptance of equipment or materials will be construed to result from such shop inspections by the Owner or Engineer Any inspections,

tests, or waivers thereof will not relieve the Contractor of responsibility for meeting all requirements of these Contract Documents.

H. In case of disputes between the Contractor and an Owner's Representative as to materials furnished or manner of performing the Work, the Owner's Representative will have authority to reject materials or suspend the Work until the question at issue can be decided by the Owner and Engineer An Owner's Representative is not authorized to revoke, alter, enlarge, relax, or release any requirements of these Specifications, nor to issue instructions contrary to the Drawings and Specifications.

I. If any Work is covered contrary to the request of the Owner or Engineer, it must, if requested by the Engineer, be uncovered for his observation and replacement at the Contractor's expense.

J. If any Work has been covered which the Engineer has not specifically requested to observe prior to its being covered, or if the Engineer considers it necessary or advisable that covered Work be inspected or tested by others, the Contractor, at the Engineer's request, shall uncover, expose or otherwise make available for observation, inspection or testing that portion of the Work in question. The Contractor shall furnish all necessary labor, materials, tools, and equipment required by the Engineer. If it is found that such Work is defective, the Contractor shall bear all the expenses of such uncovering, exposure, observation, inspection, testing and reconstruction. If, however, such Work is not found to be defective, the Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate Change Order will be issued.

K. The Contractor shall give the advance notification of all equipment and field tests to the Engineer and Owner.

END OF SECTION 01400

Section 01540

SECURITY AND PROTECTION

Part 1 General

1.01 Protection of Work and Property

A. The contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work He shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to all employees on the Work who may be affected thereby; all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation or replacement in the course of construction.

B. Until such time as the Work is completed and accepted by the Owner, the Contractor shall assume all liability for damage to, loss or destruction of the Work or such materials or equipment, and Contractor shall, at its expense, repair or replace to the Owner's satisfaction all damage to, loss or destruction of Work or such materials or equipment which results from any cause whatsoever.

C. The Contractor shall at all times consult with and obtain approval of the Owner or his representative for the storage of material, operation of equipment, placing of temporary structures or dispositions of any surplus or waste material upon property of the Owner anywhere outside the limits of construction.

D. The Contractor shall so conduct the Work that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the Work unless he shall have obtained the Owner's written consent thereto and shall have shown his written consent to the Engineer

1.02 Protection of General Public

A. The Contractor shall at all times conduct work in such a manner as to cause the least inconvenience and greatest protection to the general public The Contractor shall furnish and maintain barricades, warning signs, red flags, lights, and temporary passageways as may be necessary to protect the Work and to safeguard the public. The cost of furnishing and maintaining the above facilities shall be incidental to the Contract and no extra compensation will be allowed

B. Throughout the performance of the Work or in connection with this Contract, the Contractor shall construct and adequately maintain suitable and safe crossings over trenches and such detours as are necessary to care for public and private traffic The material excavated from trenches shall be compactly deposited along the sides of the trench or elsewhere in such a manner as shall give as little

inconvenience as possible to the traveling public, to adjoining property owners, to other Contractors, or to the Owner.

C. The Contractor shall at all times provide at least minimum provisions to control noise levels due to construction activities, such as the use of proper mufflers.

1.03 Emergencies

In emergencies affecting the safety of persons or Work or property at the site or adjacent thereto, the contractor, without special instruction or authorization form the Engineer or Owner, shall act to prevent threatened damage, injury or loss

1.04 Applicable Laws and Regulations

A. The Contractor shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction. He shall erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. He shall notify owners of adjacent utilities when prosecution of the Work may affect them The Contractor shall remedy at his expense all damage, injury, or loss to any property or person caused, directly or indirectly, in whole or in part, by the Contractor, or any subcontractor, or anyone for whose acts any of them may be liable, except damage or loss attributable to the fault of the Contract Documents or to the act or omissions of the Owner or the Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly in whole or in part, to the fault or negligence of the Contractor.

B. The Contractor shall observe all rules and regulations of the health department having jurisdiction and shall take precautions to avoid creating unsanitary conditions.

END OF SECTION 01540

Section 01620

STORAGE AND PROTECTION OF MATERIAL AND EQUIPMENT

Part 1 General

1.1 Summary

A. Protect products scheduled for use in the Work by means including, but not necessarily limited to, those described in this Section

B. Related work

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Division 1 – General Requirements of these Specifications.

2. Additional procedures also may be prescribed in other Sections of these Specifications

1.2 Quality Assurance

A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.3 Manufacturers' Recommendations

A. Except as otherwise approved by the Engineer, determine and comply with manufacturer's recommendations on product handling, storage and protection

1.4 Packaging

A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.

1. Maintain packaged materials with seals unbroken and labels intact until time to use.
2. Promptly remove damaged material and unsuitable items from the job site and promptly replace with material meeting the specified requirements, at no additional cost to the Owner

B. The Engineer may reject as non-complying such material and products that do not bear identification satisfactory to the Engineer as to manufacturer, grade, quality, and other pertinent information.

1.5 Storage and Protection

A Contractor shall confine storage of materials to the project site without interfering with the progress of the Work

B Comply with the requirements of this Section for off-site storage

1. The Engineer reserves the right to inspect the off-site storage areas

C. Store equipment and materials in accordance with the manufacturer's instructions.

D. Provide temporary weather tight enclosures to protect products from damage by the elements.

E Protect finished surfaces through which equipment and materials are handled

F. Provide protection for finished floor surfaces in traffic areas prior to allowing equipment or materials to be moved over such surfaces.

G. Maintain finished surfaces clean, unmarred and suitably protected until accepted by the Owner.

H. Do not store plant maintenance equipment, furniture and laboratory equipment on site until they are needed by the Owner of for progress of Work.

1.6 Repairs and Replacement

A In event of damage, promptly make replacements and repairs to the approval of the Engineer and at no additional cost to the Owner.

B. Additional time required to secure replacement and to make repairs will not be considered by the Engineer to justify an extension in the Contract Time of Completion.

END OF SECTION 01620

Section 01730

OPERATION AND MAINTENANCE DATA

Part 1 General

1.01 Requirements Included

A. Compile product data and related information appropriate for Owner's operation and maintenance of products furnished under contract

B. Prepare operating and maintenance data as specified in this section and as referenced in other pertinent sections of Specifications.

C. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

1.02 Quality Assurance

Preparation of data shall be done by personnel:

A Trained and experienced in maintenance and operation of described products.

B. Familiar with requirements of this Section

C. Skilled as a technical writer to the extent required to communicate essential data

D. Skilled as draftsman, competent to prepare required drawings.

1.03 Content of Operation and Maintenance (O&M) Manuals for Equipment and Systems

The O&M manual shall include the following:

A. Name of Contractor, name of responsible principal, address and telephone number

B. Table of Contents, listing each product for which operation and maintenance are required and included

C. List of all products, with name, address and telephone number of the following for each product

1. Subcontractor or installer
2. Maintenance contractor, as appropriate
3. Local source of supply for parts and replacement

D Operating and maintenance requirements for each item

Section 01730

OPERATION AND MAINTENANCE DATA

1.04 Submittal Schedule

A Provide six copies of complete manuals for all furnished equipment to the Engineer

B Submit such bulletins and manuals to the Engineer prior to placement of equipment in operation

END OF SECTION 01730

Section 02100

SITE PREPARATION

1.0 General

1.1 Work Included

1.1 1 The removal of any trees or vegetation as marked on the Drawings shall precede all other work in their vicinity

1.1.2 Topsoil shall be removed and stockpiled in the areas as designated on the Drawings, or as directed by the Engineer.

1.1.3 Unsuitable soil shall be removed and stockpiled

1.1 4 Erosion and sediment control measures shall be provided.

2.0 Products

2 1 Silt Fences and Gravel

Silt fences and gravel, in any sediment basin, complying with the "Standards and Specifications for Soil Erosion and Sediment Control" (EPA) shall be used where shown on the Drawings.

3.0 Execution

3 1 Preparation

3.1.1 Bench marks, monuments and other reference points shall be maintained. If disturbed or destroyed, they shall be reestablished at no cost to the Owner.

3.1.2 The Contractor shall protect trees, shrubs or other features to remain as part of the final landscaping

3.2 Tree Removal

Trees, brush, and other vegetation shall be cut down and removed Stumps and roots shall be removed to a depth of 18 inches below finish grade. The stump holes shall be filled with adjacent soils to bring the ground level at the stump holes to the prevailing grade.

3 3 Topsoil Removal

Topsoil shall be removed from the areas on which the aerated cells, storage reservoir, stockpiles, access roads and other structures are to be located The topsoil shall be stockpiled on the site at the location(s) shown on the Drawings, or as directed by the Engineer

3.4 Removal of Unsuitable Soil

3.4.1 Unsuitable materials, such as peat, highly organic or unsuitable soft soils in the construction areas or borrow areas shall be removed

3.4.2 The Contractor may either stockpile the soil in designated areas and mix it with topsoil to be spread later or haul the material offsite as directed by the Engineer.

3.5 Dewatering

3.5.1 The Contractor shall provide for adequate dewatering of that portion of the project area for which the Contractor is responsible. The Contractor shall submit his dewatering plan to the Engineer for review and approval prior to initiation of construction.

3.5.2 The Contractor shall perform all ditching, pumping, well pointing, construct all wells and drains, and do all other work necessary to keep the site clear of groundwater and stormwater during the progress of the Work, and until the finished Work is safe from injury.

3.5.3 All water pumped or drained from the Work shall be disposed of without damage to adjacent property or other Work under construction. Water shall not be discharged onto streets without adequate protection of the surface at the point of discharge. No water shall be discharged into sanitary sewers. No water containing settleable solids shall be discharged into storm sewers

3.5.4 The Contractor shall provide standby power facilities for those locations where the safety of personnel, machinery, equipment, or construction would be jeopardized due to the interruption of pumping operations.

3.5.5 The Contractor shall provide adequate sediment control devices during the dewatering operations (i.e , sedimentation basins)

3.6 Temporary Construction Access

A gravel access entrance shall be provided according to the local codes and Environmental Protection Agency requirements.

END OF SECTION 02100

Section 02222

EXCAVATION, TRENCHING AND BACKFILLING FOR UNDERGROUND PIPING

Part 1 General

1.01 REFERENCES

The publications listed below form a part of this specification to the extent referenced The publications are referred to in the text by basic designation only

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422 (1963; R 1990) Particle-Size Analysis of Soils

ASTM D 1556(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb /cu. ft)

ASTM D 2167(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D 2487(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2922(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.02 Measurement and Payment

All excavation, trenching, sheeting and bracing, backfilling and other incidental work of this section shall be included in the contract Lump Sum.

1.03 Definitions

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

1.04 SUBMITTALS

Copies of all laboratory and field test reports shall be provided to the Engineer within 24 hours of the completion of the test.

EXCAVATION, TRENCHING AND BACKFILLING FOR UNDERGROUND PIPING

Part 2 Products

2 01 Materials

A. Satisfactory Materials

Satisfactory materials shall consist of any material classified by ASTM D 2487 as GW, GP, and SW.

B. Unsatisfactory Materials

Unsatisfactory materials shall be materials that do not comply with the requirements for satisfactory materials. Unsatisfactory materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 3 inches, and materials classified in ASTM D 2487, as PT, OH, and OL. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

C. Cohesionless and Cohesive Materials

Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are non-plastic.

D. Rock

Rock shall consist of boulders measuring 1/2 cubic yard or more and materials that cannot be removed without systematic drilling and blasting such as rock material in ledges, bedded deposits, unstratified masses and conglomerate deposits, and below ground concrete or masonry structures, exceeding 1/2 cubic yard in volume, except that pavements will not be considered as rock.

E. Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 3 inches in any dimension or as defined by the pipe manufacturer, whichever is smaller

F. Unstable Material

Unstable material shall consist of materials too wet to properly support the utility pipe, conduit, or appurtenant structure

G. Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a No 200 mesh sieve and no less than 95 percent by weight passing the 1 inch sieve. The maximum allowable aggregate size shall be 3 inches, or the maximum size recommended by the pipe manufacturer, whichever is smaller

H. Initial Backfill Material

Initial backfill shall consist of select granular material or satisfactory materials free from rocks 3 inches or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller. When the pipe is coated or wrapped for corrosion protection, the initial backfill material shall be free of stones larger than 3 inches in any dimension or as recommended by the pipe manufacturer, whichever is smaller.

I. Plastic Marking Tape

1. The use of plastic marking tape for identification purpose shall be mandatory for buried hazardous utilities such as electrical conduit, gas line, high pressure nitrogen, high pressure water line, domestic sewage force mains and industrial waste force mains, and industrial sewers carrying hazardous, explosive or toxic waste. Tape shall be used for all plastic or other nonferrous pipes and for ferrous pipes buried to depths such that the top of the pipe is more than 3 feet deep.

2. Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

Table 1. Tape Color

Red:	Electric
Yellow	Gas, Oil, Dangerous Materials
Orange	Telephone, Telegraph, Television. Police, and Fire Communications
Blue	Water Systems
Green	Sewer Systems

EXCAVATION, TRENCHING AND BACKFILLING FOR UNDERGROUND PIPING

Part 3 Execution

3.01 Excavation

Excavation shall be performed to the lines and grades indicated. Rock excavation shall include removal and disposition of material defined as rock in paragraph MATERIALS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 2 feet. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed to maintain the stability of the bottom and sides of the excavation. Unauthorized over excavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Owner.

A. Trench Excavation

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 24 inches plus pipe outside diameter (O D) for pipes of less than 24 inches inside diameter and shall not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Owner.

1. Bottom Preparation

a. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

b Granular backfill cannot be used inside aerated cells, storage reservoirs or sand filters A trench bottom for a pipe to be placed inside an aerated cell, storage reservoir or sand filter requires special preparation The trench bottom ahead of the pipe shall be excavated to the elevation of the pipe centerline The trench ahead of the pipe shall then be excavated as a semi-cylindrical groove to conform to the bottom of the pipe. Each pipe section shall have a bearing in direct contact with an intact, undisturbed, natural soil surface of not less than one-fourth (1/4) of the pipe section's circumference for at least three-quarters (3/4) of its length.

2. Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, such material shall be removed to a depth of 4 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3. Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

B Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. Removal of unstable material shall be as specified above When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

C Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Engineer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly

compacted in such sections.

D. Stockpiles

Stockpiles of satisfactory and unsatisfactory materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Owner.

3.02 Backfilling and Compaction

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils using the Modified Procter procedure, unless otherwise specified.

A. Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 2 feet above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test. The trench shall not be backfilled until all specified tests are performed.

1. Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material

2. Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 6 inches loose thickness

3 Bedding and Initial Backfill

Bedding shall be of the type and thickness shown Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Compaction shall be 95 percent maximum density for cohesionless soils, and 90 percent maximum density for cohesive soils.

4. Final Backfill

a. The remainder of the trench, except for special materials for roadways, railroads and airfields, shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

b Roadways, Railroads, and Airfields Backfill shall be placed up to the elevation indicated Water flooding or jetting methods of compaction will not be permitted

c Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas. Backfill shall be deposited in layers of a maximum of 12 inch loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils Water flooding or jetting methods of compaction will be permitted for granular non-cohesive backfill material Water jetting shall not be allowed to penetrate the initial backfill Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

5 Existing Structures

All underground structures (tunnels, conduits, pipes, etc.) encountered during excavation shall be bedded with compacted select fill material The bedding material shall extend to the bottom of the trench and on each side of the structure to a distance equal to the depth of the trench below the existing structure

6. Backfill in Embankments

Gravel backfill or bedding shall not be used in embankments around aeration ponds, a storage reservoir, or a sand filter. All utility trenches in such embankments shall be backfilled with clay type material compacted in 6 inch lifts to the density specified in Section 02212 (Compacted Fill)

7. Impervious Fill

The top two feet of all trenches in the interiors of any aerated cells, storage reservoirs or sand filters shall be backfilled with impervious fill. This impervious fill shall be compacted in 6 inch lifts to the density specified in Section 02212 (Compacted Fill)

B. Backfill for Appurtenances

After the manhole, catch basin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for a sufficient time period (at least 3 days), backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.03 Special Requirements

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

A. Gas Distribution

Trenches shall be excavated to a depth that will provide not less than 18 inches of cover in rock excavation and not less than 24 inches of cover in other excavation. Trenches shall be graded as indicated.

B. Water Lines

Trenches shall be of a depth to provide a minimum cover of 4 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. For fire protection yard mains, reference shall be made to NFPA 24 for recommended depth of cover.

C. Heat Distribution System

Initial backfill material shall be free of stones larger than 1/4 inch in any dimension.

D. Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 24 inches from the finished grade, unless otherwise indicated

E. Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 18 inches below finished grade unless otherwise shown

3 04 Testing

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Owner.

A. Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Engineer. The first inspection shall be at the expense of the owner. Cost incurred for any subsequent inspection required because of failure of the first inspection will be charged to the Contractor

B Testing of Backfill Materials

Characteristics of backfill materials shall be determined in accordance with particle size analysis of soils ASTM D 422 and moisture-density relations of soils ASTM D 1557. A minimum of one particle size analysis and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

C Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. Field in-place density shall be determined in accordance with any of the following ASTM publications, which are ASTM D 1556, ASTM D 2167, and ASTM D 2922 When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using the sand cone method as described in paragraph Calibration of the ASTM publication ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material

encountered, at intervals as directed by the Engineer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests shall be furnished to the Engineer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Owner.

D. Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to 2 feet above the top of the pipe, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Engineer. Pipe sizes larger than 36 inches shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgment of the Engineer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Owner.

E. Warranty of Work

If any part of the areas that are backfilled settles excessively within a period of one year after the completed work is accepted by the Owner, the required repairs are the Contractor's responsibility. The contractor shall supply all labor and materials required to restore the areas that have settled to an acceptable condition. This includes repairs to pavements and lawns.

END OF SECTION 02222

Section 02444

FENCING

Part 1.0 General

1.1 Work Included

1.1.1 Installation of four-foot wood fence and posts at locations as shown on the Drawings.

1.1.2 Excavation for post bases

1.1.3 Installation of gates and related hardware

Part 2.0 Products

2.1 Wood Fences

2.1.1 Posts shall be 4x4, pressure treated or cedar.

2.1.2 Rails shall be 1x6, pressure treated or cedar.

2.1.3 Gates shall be wood with cross bracing, size as shown on the Drawings.

2.1.4 All hardware and fittings shall be malleable cast iron and hot-dip galvanized.

2.3 Signs

2.3.1 Provide 18" by 12" aluminum signs, one every 200' and attached to fence screen printed with words "Wastewater Treatment Facility Keep Out".

Part 3.0 Execution

3.1 General

3.1.1 Fencing shall be erected with all posts accurately set, plumb and true to line, and with gate hardware left in proper working order.

3.1.2 All nails shall be galvanized.

3.1.3 All hardware shall be properly adjusted, thoroughly secured, and left in perfect working order. Hinges and diagonal bracing in gates shall be secure so they will hang level.

END OF SECTION 02444

Section 02510

ROADWAYS AND PARKING AREAS

Part 1.0 General

1.1 Work Included

Furnish all materials, accessories, equipment, tools, transportation, services, and labor, and perform all operations required to construct the access roads, including drainage culverts, and parking areas for this project, all as shown on the Drawings and herein specified.

1.2 Standards

Construction of all work specified under this section must conform to Standard Specifications for Road and Bridge Construction of the Illinois Department of Transportation, latest revision and referred to herein as the "Standard Specifications".

Part 2.0 Products

2.1 Gravel

Gravel roads and parking areas shall be constructed of coarse aggregate materials consisting of well graded mixtures of selected crushed limestone which is free of clay, loam, dirt, and calcareous or other foreign matter.

2.1.1 Base course gravel shall be well graded three-inch limestone.

2.1.2 Finish course shall conform to the specifications for CA 14 Limestone, with screenings.

2.2 Bituminous Pavement

2.2.1 The eight-inch compacted base course shall be crushed stone or crushed gravel conforming to the Standard Specifications.

2.2.2 Prime coat shall be a bituminous mixture compatible with the materials in the bituminous binder course. Primer shall be grade Mc-30 cut back asphalt.

2 2.3 The two-inch binder course shall be asphalt concrete consisting of coarse and fine aggregates of crushed stone or gravel, mineral fillers with bituminous material proportioned and mixed in accordance with the Standard Specifications.

2.2.4 The one-inch surface course shall be asphalt concrete consisting of coarse and fine aggregates of crushed stone or gravel, mineral fillers and bituminous material proportioned and mixed in accordance with the Standard Specifications.

Part 3.0 Execution

3.1 Gravel Access Roads and Parking Areas

3.1.1 The Contractor shall establish the access road as the construction entrance for the site.

3.1.2 The roadway shall be considered sufficiently compacted at the completion of the embankment construction provided the Contractor has utilized the access road as the haul road for his earth-moving equipment.

3.1.3 Sub-grade shall be evenly graded and re-compacted, if necessary, to the required elevation.

3.1.4 A geo-textile lining specifically designed for the purpose shall be placed under all access roads and parking areas.

3.1.5 The roads and parking areas base course shall be six inches thick. The wearing course shall be two inches thick.

3.2 Bituminous Pavement

3.2.1 The sub-grade preparation shall be done in accordance with the requirements of the Standard Specifications.

3.2.2 Geo-textile fabric shall be used where required by soil conditions.

3.2.3 Construct compacted aggregate base to a depth of eight inches, laid upon the sub-grade, conforming in all respects to the lines and grades shown or as directed.

3.2.4 Bituminous mixtures shall be delivered at a temperature of at least 250 degrees F and shall be placed to the typical section and grade shown on the Drawings.

3.2.5 After the mixture is placed, it shall be given an initial or breakdown rolling with either a three-wheel roller, pneumatic-tired roller, tandem roller, or vibratory roller. The subsequent rollings shall be done in conformance with the requirements of the Standard Specifications.

3.2.6 Apply prime coats to the base course.

3.2.7 Place binder course to a compacted depth of two inches.

3.2.8 Place surface course to a compacted depth of one inch.

3.2.9 The Contractor shall protect all sections of newly placed surface courses from traffic until they have hardened.

3.2.10 At the conclusion of the work and when directed, examine the entire installation of bituminous pavement. Make repairs and replacements as necessary. Leave entire installation solidly compacted, at the correct elevations, smooth, even, ready for service.

END OF SECTION 02510

Section 02660

GEO-MEMBRANE LINER

Part 1 General

1.01 Summary

This section includes specifications and guidelines for manufacturing and installing geomembrane.

1.02 References

Note: Test equipment and procedures are used which enable effective and economical confirmation that the product will conform to specifications based on the noted procedures. Some test procedures have been modified for application to geosynthetics. All procedures and values are subject to change without prior notification.

American Society for Testing and Materials (ASTM)

D 638	Standard Test Method for Tensile Properties of Plastics
D 792	Standard Test Method for Specific Gravity and Density of Plastics by Displacement
D 1004	Test Method for Initial Tear Resistance of Plastic Film and Sheeting
D 1204	Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
D 1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D 1505	Test Method for Density of Plastics by the Density-Gradient Technique
D 1593	Specification for Nonrigid Vinyl Chloride Plastic Sheeting
D 1603	Test Method for Carbon Black in Olefin Plastics
D 1693	Test Method for Environmental Stress-Cracking of Ethylene Plastics
D 3015	Standard Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds
D 4437	Practice for Determining Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes

Federal Test Method Standards - 101 Puncture Resistance

NSF International - Standard 54 Flexible Membrane Liners

1.03 Definitions

Lot: A quantity of resin (usually the capacity of one rail car) used in the manufacture of polyethylene geomembrane rolls. A roll number traceable to the resin lot used will identify the finished roll.

Construction Quality Assurance Consultant: Party, independent from Manufacturer and Installer, that is responsible for observing and documenting activities related to quality assurance during the lining system construction.

Engineer: The individual or firm responsible for the design and preparation of the project's Contract Drawings and Specifications.

Geomembrane Manufacturer: The party responsible for manufacturing the geomembrane rolls.

Geosynthetic Quality Assurance Laboratory (Testing Laboratory): Party, independent from the Owner, Manufacturer, and Installer, responsible for conducting laboratory tests on samples of geosynthetics obtained at the site or during manufacturing usually under the direction of the Owner.

Installer: The party responsible for field handling, transporting, storing, deploying, seaming, seam testing.

Contractor: The party responsible for supporting the installer to coordinate earthwork, offloading, anchor trenches, etc. Contractor responsibilities are identified below in Part 16, Contractor's responsibilities.

Panel: The unit area of geomembrane that will be seamed in the field. A panel is identified as a roll or portion of a roll that is larger than 100 square feet.

Subgrade Surface: The soil layer surface which immediately underlies the geosynthetic material(s).

1.04 Submittals Post-Award

A. Conform to pertinent provisions of Specifications concerning submittals.

B. Furnish the following product data, in writing, to the Engineer prior to installation of the geomembrane material.

1. Certify that geomembrane manufacturer is listed by NSF International

2. Resin Data shall include the following.

a. Certification stating that the resin meets the specification requirements (see Section 9.2).
b. Certification stating all resin is from the same Manufacturer (see Section 9.2)
c. Copy of Quality Assurance/Quality Control certificates issued by geomembrane manufacturer and resin supplier shall be submitted.

3 Geomembrane Roll

a. Certification stating that the resin meets the specification requirements (see Section 9.2)
b. Statement certifying no reclaimed polymer is added to resin (product run may be recycled - see Section 9.2)
c. Copy of quality assurance certificates issued by Geomembrane manufacturer shall be furnished (See Section 9.2)

4. Extrudate resins and/or rod shall be certified that all extrudate is from one Manufacturer, is the same resin type, and was obtained from the same resin supplier as the resin used to manufacture the geomembrane rolls.

C. Furnish the following information to the Engineer and Owner prior to installation

A. Installation layout drawings-Submit drawings showing proposed panel layout including field seams and details. These drawings shall be approved prior to installing the geomembrane. This approval will be for concept only and actual panel placement will be determined by site conditions.
B. Installer's geosynthetic Field Installation Quality Assurance Plan

D. Submittals on a daily basis during installation

1. Subgrade Acceptance Forms
2. All QC Documentation and Field Testing Results (Destructive & Non-Destructive Test Results)

E. Submit the following to the Engineer upon completion of installation

1. Certificate stating the geomembrane has been installed in accordance with the Contract Documents

2. Material and installation warranties

3. As-built drawings showing actual Geomembrane panel placement and seams including typical anchor trench

1.05 Quality Assurance

The Owner will engage and pay for the services of any Geosynthetic Quality Assurance Consultant and Laboratory necessary to monitor geomembrane installation.

1.06 Qualifications

Geomembrane Manufacturer

A. Geomembrane shall be manufactured by one of the following manufacturers (or approved equal).

- GSE Lining Technology, Inc.

B. The manufacturer shall have manufactured a minimum of 1,000,000 square feet of HDPE geomembrane during the last year.

Installer

A. Installation shall be performed by the following installation company (or approved equal).

- GSI (Geo-Synthetics, Inc.), Waukesha, Wisconsin

B. The Installer shall have installed a minimum of 1,000,000 square feet of HDPE geomembrane during the last 2 years.

C. The Installer shall have worked in a similar capacity on at least 5 projects similar in complexity to the project described in the contract documents, and with at least 500,000 square feet of HDPE geomembrane installation on each project.

D. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

E. The Master Welder shall have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for use on this Project.

1.07 Material Labeling, Delivery, Storage, And Handling

A. Labeling - Each roll of geomembrane delivered to the site shall be labeled by the manufacturer. The label shall clearly state the manufacturer's name, product identification, thickness, length, width and roll number. The label shall be found on either of the endcaps, an inside edge of the core, and outside the core.

B. Delivery - The rolls of liner shall be packaged and shipped by appropriate means to prevent damage to the material and to facilitate off-loading

C. Storage - The on-site storage location for geomembrane material should be level, smooth, elevated and dry (not wooden pallets) The storage place should be protected from theft and vandalism, and should be adjacent to the area to be lined. The Contractor shall provide a suitable storage site that will protect the geomembrane from punctures, abrasions, excessive moisture and dirt.

D. Handling - The materials are to be handled so as to prevent damage. Instructions for moving geomembrane rolls shall be provided by the Manufacturer upon request.

1.08 Warranty

A. The material shall be warranted, on a pro-rata basis against manufacturer's defects for a period of 20 years from the date of geomembrane installation.

B. The installation shall be warranted against defects in workmanship for a period of 2 years from the date of geomembrane completion.

1.09 Measurement And Payment

Payment for geomembrane installation will be as per contract unit price per square foot, as measured parallel to liner surface, including designed anchor trench material and is based upon net lined area. Net lined area is defined to be the true area of all surfaces to be lined plus designed burial in all anchor trenches, rubsheets, and sacrificial layers. Prices shall include full compensation for furnishing all labor, material, tools, equipment, and incidentals. Prices also include doing all the work involved in performing geomembrane installation completely as shown on the drawing, as specified herein, and as directed by the Engineer.

1.10 Contractor Responsibilities

The contractor shall fulfill the following responsibilities in association with the installation of the liner.

A. Off load liner
B. Provide storage area on-site for liner material.
C. Provide anchor trench and backfilling for liner.
D. Provide dumpster service for liner installer.
E. Provide approximately 20 tons of sand for sand bags to be filled and used by installer.
F. Provide dewatering of cells until completion of liner installation.

Part 2 Products

Geomembrane

GEO-MEMBRANE LINER

2.01 The material shall be HDPE geomembrane as shown on the drawings.

2.02 Resin

A. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane.

B. Resin types will not be intermixed.

C. Natural resin (without carbon black) shall meet the following additional requirements.

Property	Test Method[1]	HDPE Resin
Density (g/cm^3)	ASTM D 792 (B) or D 1505	0.932 - 0.940
OIT (minutes)	ASTM D 3895 (1 atm, 200 °C)	>100

[1] **All procedures and values are subject to change without prior notification.**

2 03 Geomembrane Rolls

A. A combined maximum total of 1 percent by weight of additives other than carbon black will not be exceeded.

B. Geomembrane shall be free of holes, pinholes, bubbles, blisters, excessive contamination by foreign matter, and nicks and cuts on roll edges.

C. Geomembrane material is to be supplied in roll form. Each roll is to be identified with labels indicating number, thickness, length, width and Manufacturer.

D. All liner sheets produced at the factory shall be inspected prior to shipment for compliance with the physical appearance requirements listed in previous section and be tested by an acceptable method of inspecting for pinholes. If pinholes are located, identified and indicated during manufacturing, these pinholes may be corrected during installation.

2.04 Smooth surfaced geomembrane shall meet the minimum requirements shown in Table 1.1.

2.05 Textured surfaced geomembrane shall meet the minimum requirements shown in Table 1.2. Note that both FrictionFlex® and coextruded textured geomembranes are listed in Table 1.3. The liner type for this particular project shall be smooth.

2.06 Extrudate Rod or Bead

A. Extrudate material shall be made from same type resin as the geomembrane

B. Additives shall be thoroughly dispersed.

C. Extrudate shall be free of contamination by moisture or foreign matter.

Table 1.1: Minimum Values for Smooth HDPE Geomembranes

Property	Test Method	30	40	60	80	100
Minimum Thickness [mil]	ASTM D 751, D 1593 or D 5199	27	36	54	72	90
Density [g/cm^3]	ASTM D 792 (B) or D 1505	0.940	0.940	0.940	0.940	0.940
Carbon Black Content [%]	ASTM D 1603, modified	2 0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 3015	A2	A2	A2	A2	A2
Tensile Properties: (each direction) Strength at Yield [lb/in]	ASTM D 638 Type IV, 2 ipm NSF 54 modified	65	86	130	173	216
Strength at Break [lb/in]		122	162	243	324	405
Elongation at Yield [%]	(1.3" gauge length)	13	13	13	13	13
Elongation at Break [%]	(2.5" gauge length)	560	560	560	560	560
Tear Resistance [lb]	ASTM D 1004	22	30	45	60	75
Puncture Resistance [lb]	FTMS 101, Method 2065	39	52	80	105	130
ESCR [hours]	ASTM D 1693 (B)	1500	1500	1500	1500	1500
Dimensional Stability [% change]	ASTM D 1204 (1 hr. at 100 °C)	± 2	± 2	± 2	± 2	± 2

Table 1.2: Minimum Values for Coextruded Textured HDPE Geomembranes

Property	Test Method	30	40	60	80	100
Minimum Thickness [mil]	ASTM D 751, D 1593, D 5199 or GRI GM8	27	36	54	72	90
Density [g/cm^3]	ASTM D 792 (B) or D 1505	0.940	0.940	0.940	0.940	0.940
Carbon Black Content [%]	ASTM D 1603, modified	2.0	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 3015	A2	A2	A2	A2	A2
Tensile Properties (each direction)[1]	ASTM D 638 Type IV, 2 ipm					
Strength at Yield [lb/in]	NSF 54 modified	65	86	130	173	216
Strength at Break [lb/in]		38	50	75	100	125
Elongation at Yield [%]	(1.3" gauge length)	13	13	13	13	13
Elongation at Break [%]	(2 5" gauge length)	120	120	120	120	120

Tear Resistance [lb]	ASTM D 1004	22	30	45	60	75
Puncture Resistance [lb]	FTMS 101, Method 2065	39	52	80	105	130
ESCR [hours][2]	ASTM D 1693 (B)	1500	1500	1500	1500	1500
Dimensional Stability [% change]	ASTM D 1204 (1 hr. at 100 °C)	± 2	± 2	± 2	± 2	± 2

1 The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variation of test results. Therefore, these tensile properties are minimum average roll values.

2 ESCR for coextruded textured material is conducted on representative smooth membrane samples.

Table 1.3: Minimum Values for FrictionFlex® Textured HDPE Geomembranes

Property	**Test Method**	**40**	**60**	**80**	**100**
Minimum Thickness [mil]	ASTM D 751, D 1593, D 5199 or GRI GM8	36	54	72	90
Density [g/cm^3]	ASTM D 792 (B) or D 1505	0.940	0.940	0.940	0.940
Carbon Black Content [%]	ASTM D 1603, modified	2.0	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 3015	A2	A2	A2	A2
Tensile Properties: (each direction)	ASTM D 638 Type IV, 2 ipm				
Strength at Yield [lb/in]	NSF 54 modified	86	130	173	216
Strength at Break [lb/in]		162	243	324	405
Elongation at Yield [%]	(1.3" gauge length)	13	13	13	13
Elongation at Break [%]	(2.5" gauge length)	500	560	560	560
Tear Resistance [lb]	ASTM D 1004	30	45	60	75
Puncture Resistance [lb]	FTMS 101, Method 2065	52	80	105	130
ESCR [hours]	ASTM D 1693 (B)	1500	1500	1500	1500
Dimensional Stability [% change]	ASTM D 1204 (1 hr. at 100 °C)	± 2	± 2	± 2	± 2

Part 3 EXCUTION

3.01 Equipment

Welding equipment and accessories shall meet the following requirements

A. Gauges showing temperatures in apparatus (extrusion welder) or wedge (wedge welder) shall be present.

B. An adequate number of welding apparati shall be available to avoid delaying work

C. Power source capable of providing constant voltage under combined line load shall be used.

3.02 Deployment

A. Assign each panel a simple and logical identifying code. The coding system shall be subject to approval and shall be determined at the job site.

B. Visually inspect the geomembrane during deployment for imperfections and mark faulty or suspect areas.

C. Deployment of the geomembrane panels shall conform to the following requirements.

1. Unroll geomembrane panels using methods that will not damage geomembrane and will protect underlying surface from damage (i.e., spreader bar - protected equipment bucket).

2. Place ballast (commonly sandbags) on geomembrane that will not damage geomembrane to prevent wind uplift.

3. Personnel walking on geomembrane shall not engage in activities or wear shoes that could damage the geomembrane. Smoking will not be permitted on the geomembrane.

4. Do not allow heavy vehicular traffic directly on geomembrane. Rubber-tired ATV's and trucks are acceptable if wheel contact is less than 6 psi.

5. Protect geomembrane in areas of heavy traffic by placing protective cover over the geomembrane.

D. Sufficient material (slack) shall be provided to allow for geomembrane expansion and contraction.

3.03 Field Seaming

A. Seams shall meet the following requirements.

1. To the maximum extent possible, orient seams parallel to line of slope, i.e., down and not across slope.

2. Minimize number of field seams in corners, odd-shaped geometric locations and outside corners.

3. Slope seams (panels) shall extend a minimum of five-feet beyond the grade break into the flat area.

4 Use a sequential seam numbering system compatible with panel numbering system that is agreeable to the Consultant and Installer.

B. During Welding Operations

Provide at least one Master Welder who shall provide direct supervision over other welders if necessary.

C. Extrusion Welding

1. Hot-air bond adjacent pieces together using procedures that do not damage geomembrane.

2. Purge welding apparatus of heat-degraded extrudate before welding.

3. Clean geomembrane surfaces by disc grinder or equivalent.

D. Hot Wedge Welding

1. Welding apparatus shall be a self-propelled device equipped with an electronic controller (same as Section 9.2) which displays applicable temperatures.

2. Protect against moisture build-up between sheets.

3. Clean seam area of dust, mud, moisture and debris immediately ahead of the hot wedge welder.

E. Trial Welds

1. Perform trial welds on geomembrane samples to verify welding equipment is operating properly.

2. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld.

3. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift.

4. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature.

5. Cut four, one-inch wide by six-inch long test strips from the trial weld. Quantitatively test specimens for peel adhesion, and then for bonded seam strength (shear).

6. A trial weld specimen shall pass when the results shown in Tables 2.1, 2.2 and 2.3 are achieved in both peel and shear test.

    a. The break, when peel testing, occurs in the liner material itself, not through peel separation (FTB)

    b. The break is ductile

7. Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.

F. Seaming shall not proceed when ambient air temperature or adverse weather conditions jeopardize the integrity of the liner installation. Installer shall demonstrate that acceptable seaming can be performed by completing acceptable trial welds.

G. Defects and Repairs

1. Examine all seams and non-seam areas of the geomembrane for defects, holes, blister, undispersed raw materials, and any sign of contamination by foreign matter.

2. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

Table 2.1: Minimum Weld Values for Smooth HDPE Geomembranes

Property	Test Method	30	40	60	80	100	120
Peel strength (fusion & ext.), ppi	ASTM D 4437	49	65	98	130	162	196
Shear strength (fusion & ext.), ppi	ASTM D 4437	61	81	121	162	203	242

Table 2.2: Minimum Weld Values for FrictionFlex® Textured HDPE Geomembranes (GSE HyperFrictionFlex™)

Property	Test Method	30	40	60	80	100	120
Peel strength (fusion & ext.), ppi	ASTM D 4437	49	65	98	130	162	196
Shear strength (fusion & ext.), ppi	ASTM D 4437	61	81	121	162	203	242

Table 2.3: Minimum Weld Values for Coextruded Textured HDPE Geomembranes (GSE HD Textured™)

Property	Test Method	30	40	60	80	100	120
Peel strength (fusion), ppi	ASTM D 4437	44	60	88	115	143	175
Peel strength (extrusion), ppi	ASTM D 4437	31	42	63	84	105	130
Shear strength (fusion & ext), ppi	ASTM D 4437	56	76	113	151	189	226

3.04 Field Quality Assurance

A. General - The Manufacturer, Fabricator and Installer shall participate in and conform to all terms and requirements of the Owner's quality assurance program. The Contractor shall be responsible for assuring this participation Quality assurance requirements are as specified in this Section and in the Field Installation Quality Assurance Manual if it is included in the contract.

B. Field Testing

1. Non-destructively test all field seams over their full length using a vacuum test unit, air pressure (for double fusion seams only), or other approved methods. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.

2. Vacuum Testing:

   a. The equipment shall consist of the following: 1) A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft gasket attached to the bottom, or valve assembly, and a vacuum gauge, 2) A vacuum pump assembly, and 3) A soapy solution.

   b. Test Procedure is performed as follows: 1) Apply soapy solution to the seam. 2) Place vacuum box over the entire wetted seam area, 3) Ensure that a leak-tight seal is created, 4) Apply a vacuum of at least 5 psig, 5) Examine the geomembrane through the viewing window for the presence of soap bubbles for not fewer than ten seconds, and 6) All areas where soap bubbles appear shall be marked and repaired.

3. Air Pressure Testing (for double seam air channel)

   The equipment shall consist of the following: 1) An air pump or tank equipped with pressure gauge capable of generating and sustaining pressure over 30 psi, 2) A sharp, hollow needle, or other approved pressure feed device equipped with a pressure gauge, and 3) A hot air gun or other device to seal the ends of the air channel.

   Test Procedure is performed as follows: 1) Seal both ends of seam to be tested, insert air needle into the air channel, and pressurize to at least 25 psi, 2) If pressure loss exceeds 4 psi or does not stabilize after 5 minutes, locate faulty area and repair, 3) Puncture opposite end of seam to release air. If blockage is present, locate and test seam on both sides of blockage. A pressure gauge at both ends of the seam will also be acceptable, and 4) Remove needle or other approved pressure feed device and seal penetration holes by extrusion welding.

4 Destructive Testing (performed by Consultant with assistance from Installer)

Location and Frequency of Testing: 1) Collect destructive test samples at a frequency of one every 1,000 feet of seamed length and 2) Test locations will be determined after seaming.

Sampling Procedures are performed as follows: 1) Installer shall cut samples at locations designated by the Consultant as the seaming progresses in order to obtain laboratory test results before the geomembrane is covered, and 2) Consultant will number each sample and mark sample number and location on the installation layout drawing.

Installer shall repair all holes in the geomembrane resulting from destructive sampling. Repair and test the continuity of the repair in accordance with these Specifications.

Samples shall be twelve (12) inches wide by minimal length with the seam centered lengthwise Cut a 2-inch wide strip from each end of the sample for field-testing. Cut the remaining sample into two parts for distribution as follows: 1) One portion for the Installer: 12 inches by 12 inches, 2) One portion for Owner's Third Party laboratory testing: 12 inches by 18 inches (maximum), and 3) Additional Samples may be obtained if required.

Testing: 1) Test the 10 strips specified in above paragraph in peel (5 each) and shear (5 each), 2) Test strips shall meet minimum peel and shear value requirements, 3) If any field test sample fails, follow procedures outlined in Section 13.3 below, and 4) For double wedge seam samples, the outside (top) weld is considered to be the primary weld and shall be the weld tested.

C. Failed Seam Procedures

The following procedure shall be used when there is a destructive test failure

The Installer shall follow one of two options: 1) Reconstruct the seam between any two passed test locations or 2) Trace the weld to an intermediate location at least 10 feet minimum or to where seam ends, in both directions from the location of the failed test. Check next seam welded using same welding device if required to obtain additional sample, i.e., if one side of the seam is fewer than 10 feet long Obtain four, one-inch samples at both locations for an additional field test. If the samples pass, then the seam shall be reconstructed or capped between the test sample locations. If any sample fails, the process shall be repeated to establish the zone in which the seam shall be reconstructed.

D. Acceptable seams shall be bounded by two locations from which samples have passed destructive tests.

3.05 Repair Procedures

A. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

B. Repair any portion of unsatisfactory geomembrane or seam area failing a destructive or non-destructive test. Installer shall be responsible for repair of damaged or defective areas. Agreement upon the appropriate repair method shall be decided between the Consultant and the Installer. Procedures available include the following.

1. Patching - Used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter

2. Abrading and Re-welding - Used to repair small seam sections

3. Spot Welding - Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced

4. Capping - Used to repair large lengths of failed seams

5. Flap Welding - Used to extrusion weld the flap (excess outer portion) of a fusion weld in lieu of a full cap

6. Removing the unacceptable seam and replace with new material

C. In addition, the following procedures shall be observed.

1. Surfaces of the polyethylene that are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.
2. All geomembrane surfaces shall be clean and dry at the time of repair.

3. Extend patches or caps at least 6 inches for extrusion weld and 4 inches for wedge weld beyond the edge of the defect, and round all corners of patch material.

D. Repair Verification

1. Number and log each patch repair (performed by Consultant)

2. Non-destructively test each repair using methods specified in this Specification

END OF SECTION 02660

Section 02730

FORCE MAINS AND PIPING

Part 1.0 General

1.1 References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D (1994) Specification for Pipeline Valves (Gate, Plug, Ball, and Check Valves)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53 (1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM C 478 (1994) Pre-cast Reinforced Concrete Manhole Sections

ASTM D 1785 (1993) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

ASTM D 2122 (1990) Determining Dimensions of Thermoplastic Pipe and Fittings

ASTM D 2241 (1993) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

ASTM D 2464 (1993) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2564 (1993) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 2657 (1990) Heat-Joining Polyolefin Pipe and Fittings

ASTM D 2774 (1972; R 1983) Underground Installation of Thermoplastic Pressure Piping

ASTM D 2996 (1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

ASTM D 3035 (1993) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter

ASTM D 3139 (1989, R 1995) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM D 3308 (1991a) PTFE Resin Skived Tape

ASTM D 3350 (1993) Polyethylene Plastics Pipe and Fittings Materials

ASTM D 3517 (1991) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe

ASTM D 4101 (1995a) Propylene Plastic Injection and Extrusion Materials

ASTM F 477 (1993) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1 (1989) Cast Iron Pipe Flanges and Flanged Fittings

ASME B16.3 (1992) Malleable Iron Threaded Fittings, Classes 150 and 300

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105 (1988) Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids

AWWA C110 (1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids

AWWA C111 (1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C115 (1988) Flanged Ductile-Iron Pipe with Threaded Flanges

AWWA C151 (1991) Ductile-Iron Pipe, Centrifugally Cast for Water or Other Liquids

AWWA C200 (1991) Steel Water Pipe 6 In. (150 mm) and Larger

AWWA C203 (1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA C207 (1994) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In.

AWWA C208 (1983; C208a; R 1989) Dimensions for Fabricated Steel Water Pipe Fittings

AWWA C210 (1992) Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines

AWWA C300 (1989) Reinforced Concrete Pressure Pipe, Steel-Cylinder Type, for

Water and Other Liquids

AWWA C301 (1992) Pre-stressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids

AWWA C303 (1987; Errata Jan 1988) Reinforced Concrete Pressure Pipe, Steel Cylinder Type, Pre-tensioned, for Water and Other Liquids

AWWA C500 (1993) Gate Valves for Water and Sewerage Systems

AWWA C508 (1982; C508a) Swing-Check Valves for Waterworks Service, 2 In. Through 24 In. NPS

AWWA C600 (1993) Installation of Ductile-Iron Water Mains and Their Appurtenances

AWWA C900 (1989; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA-TRD/9-92 (1992; Errata Mar 1993) Thrust Restraint Design for Ductile Iron Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-78 (1987; R 1992) Cast Iron Plug Valves, Flanged and Threaded Ends

1.2 Underground Water Main Construction

The Standard Specifications for Water & Sewer Main Construction in Illinois shall govern the construction of underground water mains and associated appurtenances.

Part 2.0 Products

2.1 Pipe and Fittings

Pipe shall conform to the respective specifications and other requirements specified below.

2.1.1 Plastic Pipe

2.1.1.1 Polyethylene (PE) Pipe

PE pipe shall conform to ASTM D 3350 and ASTM D 3035, minimum pressure rating of 100 psi at 73.4 degrees F.

2.1.1.2 Polypropylene Pipe

Polypropylene pipe shall conform to ASTM D 2122 and ASTM D 4101.

2.1.1.3 Polyvinyl Chloride (PVC) Pipe

2.1.1.3.1 PVC pipe and fittings less than 4-inches in diameter shall conform to ASTM D 1785, Schedule 120, or D2241, SDR 32.5, with screw joints, push-on joints, or solvent weld joints.

2.1.1.3.2 PVC pipe and fittings that are 4-inch diameter and larger shall conform to ASTM D 2241, SDR 32.5, or AWWA C900, Class 200, with push-on joints.

2.1.1.3.3 Threaded joints for PVC pipes shall conform to ASTM D 1785.

2 1.1.3.4 Reinforced Plastic Mortar Pressure (RPMP) Pipe

RPMP pipe shall conform to ASTM D 3517. Fittings shall be compatible with the pipe supplied and shall be suitable for working and testing pressures specified for the pipe.

2.1.1.3.5 Reinforced Thermosetting Resin Pipe (RTRP)

RTRP pipe shall conform to ASTM D 2996, 350 psi rated, cast iron pipe dimensions only, with elastomeric gasket joints. Fittings shall conform to AWWA C110, rated 150 psi. When mechanical joint fittings are used, inside sleeves provided by the manufacturer shall be used.

2.1.2 Ductile Iron Pipe

2.1.2.1 Ductile iron pipe shall conform to AWWA C151, working pressure not less than 150 psi, unless otherwise shown or specified.

2.1.2.2 River crossing ductile iron pipe shall conform to AWWA C151, minimum thickness Class 54 with joints in compliance with applicable requirements of AWWA C110.

2.1.2.3 Mechanical fittings for ductile iron pipe shall conform to AWWA C110, rated for 150 psi

2.1.2.4 Push-on fittings for ductile iron pipe shall conform to AWWA C110 and AWWA C111, rated for 150 psi

2.1.3 Steel Pipe

2.1.3.1 Steel pipe, 6 inches diameter and larger, shall conform to AWWA C200.

2.1.3.2 Steel pipe less than 6 inches diameter shall conform to ASTM A 53, standard weight, threaded end, galvanized.

2.1.3.3 Fittings, 6 inches diameter and larger, shall conform to AWWA C200, fabricated in compliance with AWWA C208.

2.1.3.4 Fittings less than 6 inches diameter shall conform to ASME B16.3 (galvanized).

2.2 JOINTS

2.2.1 Polyethylene (PE) Pipe

2.2.1.1 Heat fusion joints for PE pipe shall conform to ASTM D 2657.

2.2.1.2 Flanged joints for PE pipe shall conform to ASME B16.1 or AWWA C207.

2.2.1.3 Mechanical joints for PE pipe shall conform to ASME B16.1.

2.2.2 Polypropylene Pipe

Heat fusion joints for polypropylene pipe shall conform to ASTM D 2657.

2.2.3 Polyvinyl Chloride (PVC) Pipe

2.2.3.1 Screw joint fittings for PVC pipe shall conform to ASTM D 2464, Schedule 80.

2.2.3.2 Push-on joint fittings for PVC pipe shall conform to ASTM D 3139, with ASTM F 477 gaskets.

2.2.3.3 Solvent cement for PVC pipe shall conform to ASTM D 2564.

2.2 3 4 Couplings for use with plain end pipe PVC pipe shall have centering rings or stops to ensure the coupling is centered on the joint.

2.2.4 Ductile Iron Pipe

2.2.4 1 Push-on joints for ductile iron pipe shall conform to AWWA C111.

2.2.4.2 Mechanical joints for ductile iron pipe shall conform to AWWA C111 as modified by AWWA C151.

2.2.4.3 Flanged joints for ductile iron pipe shall conform to AWWA C115.

2.2.5 Steel Pipe

2.2.5.1 Push-on joints for steel pipe shall conform to AWWA C200.

2.2.5.2 Mechanical joints for steel pipe shall conform to AWWA C200.

2 2.5.3 Flanged joints for steel pipe shall conform to AWWA C207.

2.3 VALVES

2.3.1 Gate Valves

Gate valves 3 inches and larger shall conform to AWWA C500. Valves for buried service shall be non-rising stem (NRS), 2 inch square nut operated with joints applicable to the pipe or installation. Buried valves shall be furnished with extension stems comprising socket, extension stem and operating nut, and shall be of an appropriate length to bring operating nut to within 6 inches of grade. One 4 foot "T" handle valve wrench shall be furnished for each quantity of 6 buried valves. Gate valves that are exposed or installed inside shall be outside screw and yoke (OS&Y), hand wheel operated with flange ends unless otherwise indicated. Gate valve operating nuts and hand wheels shall have an arrow and the word "OPEN" cast in raised letters to indicate the direction of opening. Gate valves 14 inches and larger shall be equipped with gearing to reduce operating effort. Gate valves 14 inches and larger installed in horizontal lines in horizontal position with stems horizontal shall be equipped with bronze track, roller and scrapers to support the weight of the gate for its full length of travel. Gate valves 14 inches and larger installed in vertical pipe lines with stems horizontal shall be fitted with slides to assist the travel of the gate assembly.

2.3.2 Check Valves

Check valves shall permit free flow of sewage forward and provide a positive check against backflow. Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. The body shall be iron. The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow shall be directly cast on the body.

2.3.2 1 Ball Check Valves shall be iron body, shall have flanged ends, and shall be the non-slam type Flanges shall be the 125 pound type complying with ASME B16.1. Ball shall be stainless steel unless otherwise specified.

2.3.2.2 Swing Check Valves shall conform to AWWA C508 and shall be iron body, bronze mounted, and shall have flanged ends. Flanges shall be the 125 pound type complying with ASME B16.1.

2.3.3 Air Release Valves

Air release valves shall be designed to permit release of air from an empty pipe during filling and shall be capable of discharging accumulated air in the line while the line is in operation and under pressure. Valves shall be attached by means of threaded pipe connections. Valves shall be vented to the atmosphere.

2.3.3.1 Manual air release valves shall consist of a 3 inch gate valve and 3 inch ductile iron pipe and fittings. The valve shall be installed with its line of flow in the horizontal position.

2.3.3.2 Automatic air release valves shall be of the compound lever type capable of withstanding operating pressures of 150 psi. The valves shall have a 1/2 inch outlet. The body and cover of the valve shall be of iron with a stainless steel float. All internal parts shall be stainless steel or bronze. The valve shall be specifically adapted for use with sewage. Each valve shall be complete with hose and blow-off valves to permit backflushing without dismantling the valve

2.4 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subject to vehicular traffic. Cast iron boxes shall be the extension type with slide type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. The box length shall be adaptable, without full extension, to the depth of cover over the pipe at the valve locations.

2.5 MISCELLANEOUS MATERIALS

Miscellaneous materials shall comply with the following requirements:

2.5.1 Pipe Coatings and Linings

2 5.1.1 Interior linings for steel pipe shall conform to AWWA C203 or AWWA C210

2.5.1.2 Exterior linings for buried steel pipes shall conform to AWWA C203.

2.5.1 3 Exterior linings for exposed steel pipes shall conform to AWWA C210.

2.5.2 Joint Lubricants

Joint lubricants shall be as recommended by the pipe manufacturer.

2.5.3 Bolts, Nuts and Glands

Bolts, nuts and glands shall conform to AWWA C111.

2.5.4 Joint Compound

Joint compound shall be a stiff mixture of graphite and oil or inert filler and oil.

2.5.5 Joint Tape

Joint tape shall conform to ASTM D 3308.

2.5.6 Bond Wire

Bond wire shall be type RHW or USE, Size 1/0 AWG, neoprene jacketed copper conductor shaped to stand clear of the joint.

Part 3.0 EXECUTION

3.1 INSTALLATION

Pipe, pipe fittings, and appurtenances shall be installed at the locations indicated. Excavation, trenching, and backfilling shall be as specified in the Standard Specifications for Water and Sewer Main Construction in Illinois.

END OF SECTION 02730

Section 02900

SEEDING

Part 1 General

1.01 Work Included

Furnish all materials, accessories, equipment, tools, transportation, services, and labor, and perform all operations required to seed all areas areas disturbed during construction including embankment slopes to the high water level on the inside slopes.

Part 2 Products

2.01 Seed

Table 1:

Seeded Plant Types (Continuous Irrigation Not Recommended)	Seed Rates
Grasses:	
Bluebunch wheatgrass (Pseudoroegneria spicata goldar)	5.0 lb/ac
Thick spike wheatgrass (Elymus lanceolatus)	2.0 lb/ac
Great Basin Wild Rye (Elymus cinereus magnar)	2.0 lb/ac
Streambank Wheatgrass (Elymus lanceolatus lanceolatus)	1 0 lb/ac
Sandberg bluegrass(Poa secunda)	1.0 lb/ac
Forbs:	
Blue phlox (Linum perenne)	0.8 lb/ac
Globe mallow (Sphaeralcea munroana)	0.5 lb/ac
Lupine spp. (Lupinus spp.)	0.3 lb/ac
Scarlet globe mallow (Sphaeralcea coccinea)	0.3 lb/ac
Palmer penstemons (Penstemons palermii)	0.8 lb/ac
Firecracker penstemons (Penstemons eatonii)	0.5 lb/ac

2.02 Fertilizer

Plant fertilizer shall be applied with a commercial type approved by Engineer, containing at least 50% organic, slow acting matter with 10% nitrogen, 10% phosphoric acid, and 10% potash by weight, ¼ of nitrogen in the form of nitrates, ¼ in form of ammonia salt and ½ in form of organic nitrogen, or as specified

Following seeding and fertilizer application, all seeded areas shall be covered with mulching followed by a Temporary Erosion Control Blanket.

Part 3 Execution

3.01 Seeding

Seeding shall comply with all applicable local state and federal requirements regarding materials, methods of work, and disposal of excess and waste materials. Dust control shall be exercised. Dampen surfaces as required for dust control. Comply with pollution control regulations of governing authorities. Seeding shall be performed by experienced workers familiar with planting procedures under the supervision of a qualified supervisor. The Contractor warranties all seeded areas and trees to be installed according to specifications, until accepted by Engineer.

3.02 Seeding Preparation

Seeding preparation shall consist of topsoil stripping, excavation to proposed subgrade, preparing the subgrade, furnishing, spreading, and finishing topsoil to a minimum depth of 4 inches. Topsoil may be from on-site stockpiles or from off-site. On-site stockpiled topsoil or off-site topsoil shall be spread to establish a minimum depth of 4 inches. After the required topsoil has been placed and graded, the areas to be seeded shall be thoroughly tilled to a depth of at least 3 inches by disking, harrowing, or other approved methods until condition of soil is acceptable to the Engineer. The Engineer shall determine if the on-site soil is adequate for the seed bed. Seeding shall occur immediately after preparation of bed. Ideally, seeding should occur in spring. The developed landscaped berms and other areas near the treatment cells and storage reservoir of the Modular Reclamation and Reuse System are to be Seeded using a drill installation method. The seed mixture is specified in Table 1.

3.03 Mulching

Place straw mulching on seeded areas within 24 hours after seeding. Straw mulching shall be placed uniformly in a continuous blanket at the rate of 2.5 tons per acre, or 2 bales per 1,000 sq. ft. of area. A mechanical blower may be used for straw mulch application when acceptable to the Engineer. A cellulose fiber or approved equal may be used in aqueous mixture at the rate of 1500 lbs/acre.

3.04 Excelsior Blanket

A Temporary Erosion Control Blanket or Curlex Excelsior Blanket, by American Excelsior Company, or an acceptable equal approved by the Engineer shall be installed over the Seeded and mulched areas within 24 hours after mulching. The Temporary Erosion Control Blanket shall be installed at berm areas as defined on details. Installation shall include preparing the grade to provide a smooth surface, free from obstruction and materials that would prevent contact between the soil and the blanket Install the Temporary Erosion Control Blanket according to manufacturer's recommendations for anchoring edges into trenches, overlapped, and stapling patterns. Staples 8" long or longer shall be used for loose soil conditions. The Blanket shall be rolled along the vertical axis of the berms. Upslope end of Temporary Erosion Control Blanket shall be trenched into berm immediately above high water elevation of Modular Reclamation and Reuse System.

3.05 Watering

Seeded areas shall be watered twice in early spring. Provide hose and lawn watering equipment as required. Thereafter, grasses and seeded areas should not be watered. However, coniferous tree plantings breaks shall be watered by the drip method twice per week or as necessary depending on site conditions.

END OF SECTION 02900

Section 03001

STRUCTURAL CONCRETE

Part 1 General

1.01 Required Work and Materials

A. The Contractor shall provide the labor, all services, materials, tools, formwork, and equipment for the structural concrete required for this project. All requirements of the local building code shall be met.

B. Required materials are cement, sand, crushed stone, gravel, any admixtures, and water.

C. Class B structural concrete (high strength, watertight) shall be used. This concrete shall be used with steel reinforcement for the foundation, floor slab and equipment pads shown on the plans.

The Class B structural concrete shall conform to definite minimum requirements. The 7-day test strength shall be 2,500 psi. The 28-day test strength shall be 4,000 psi. Five gallons of water shall be used for each sack of concrete.

Part 2 Products

2.01 Forms

All forms for concrete construction shall be of metal, plywood, first-class dressed lumber or other approved material. The forms shall be constructed in a professional manner that is satisfactory for the intended function and that conforms to the local building codes. The forms shall be designed so that they can be removed without damaging the surfaces or corners of the concrete. Metal ties or anchorage within the forms shall be equipped with codes, she-bolts, or other devices that permit their removal to a depth of at least one inch without damage to the concrete.

2.02 Steel Reinforcement

A. Reinforcing Bars

All reinforcing bars shall conform to ASTM A615-Grade 40, for #3 and #4 bars.

B Steel Wire

All steel wire shall conform to ASTM A 82, plain, cold-drawn steel.

C. Welded Wire Fabric (WWF)

All welded wire fabric shall conform to ASTM A185, welded steel wire fabric.

D. Supports

Supports for reinforcement shall be wire bar type supports, including bolster, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. All devices shall be galvanized.

2.03 Concrete

A. Ready-mix concrete shall meet the requirements of ASTM C94

B. On-site prepared concrete shall meet the requirements of ASTM C685.

C. Materials

1. Cement used shall be Portland cement acceptable under the current "Standard Specifications for Portland Cement" of ASTM C150, Type 1, or ASTM C150, Type IIA.

2. Sand shall be natural silica sand or manmade (crushed rock) and shall be clean of soil, oil, or any other pollutants. It shall not contain more than 2 percent by weight of finely divided clay.

3. Coarse aggregate shall be natural gravel or broken stone that is clean, strong, and insoluble. The material shall conform to ASTM C33. The maximum size of aggregate shall be 1.5 inches.

4. Water for concrete shall be clean and reasonably clear, free from vegetable matter, salts, and all other pollutants.

Part 3 Execution

3.01 Preparation of Sub-grade

The sub-grade shall be free of sawdust, debris, water, ice, snow, oil, mortar or any other substances that may be deleterious to the concrete. The earth surfaces shall be firm and damp.

3.02 Forms

The forms shall be clean and in good condition at all times. The forms and shoring shall not be disturbed until the concrete has adequately hardened.

3.03 Reinforcing

A. All reinforcing steel shall be accurately placed as shown on the plans. It shall be fastened rigidly so that it cannot be displaced during the construction process.

B. The minimum cover of concrete for reinforcing steel shall conform to the dimensions shown on the plans, which indicate the clear distance from the edge of the reinforcement to the outside edge of the concrete. At all times, the minimum coverage of the concrete over the steel shall be as follows:

1. Concrete cast against and permanently exposed to earth - 3 inches.

2. Minimum coverage –2 inches.

3. The steel mesh shall be centered in the 6 inch concrete slab, with 3 inches of coverage above and below.

3.04 Steel mesh shall overlap at least 6 inches and shall be held in place by bar chains or equal spacers in accordance with ACI 315.

3.05 Bars shall be tied securely at all intersections.

3.06 Expansion Joints

One-half inch thick expansion joint material shall be placed as shown on the plans. One-half inch expansion joints shall be constructed around the outer edge of the floor slab and around the outer edge of each equipment pad.

3.07 Inserts and Sleeves

All pipes, conduit, floor drains and other inserts shall be carefully encased in concrete. Special care shall be taken to place and maintain them in the correct positions and elevations and to compact concrete thoroughly around them to prevent the passage of water.

3.08 Placing Concrete

All concrete shall be placed in accordance with ACI 304, 305, and 306 and local building codes. Concrete shall be laid in a professional manner with due consideration for weather, temperature, ground moisture, cleanliness, and any other factors that could impact the placing process.

3.09 Grouting

A. All areas to be grouted shall be clean and free of oil, grease, dirt, loose debris, and contaminants. All metal components to be in contact with trout shall be de-rusted and free of paint and oils All concrete to come into contact with the grout shall be rough

finished and shall be thoroughly saturated by dampening or soaking prior to placement of grout. Remove excess water from holes and voids.

B. Grout shall be placed under equipment bases and to set anchors or dowels in holes drilled in concrete.

C. Pipes, sleeves, and hardware placed in existing concrete shall be grouted in place

D. All grout shall be mixed and placed in accordance with the manufacturer's directions.

3.10 Curing

In general, the recommendations of ACI Committee 308, "Recommended Practice for Curing Concrete", shall be followed.

END OF SECTION 03001

Section 11260

CHEMICAL METERING SYSTEMS

Part 1 GENERAL

1.01 Work Includes

Furnish and install complete chemical feed systems to include: metering pumps, controls, solution tanks, tubing, valves and all other items necessary. Selection of materials of construction shall be appropriate for sodium hypochlorite.

Chemical metering systems shall be configured and installed as shown on the plans.

Part 2 Materials

2.01 Chemical Metering Pumps

Chemical metering pumps shall be of the positive displacement, non-hydraulic, solenoid-driven, diaphragm-type. Output shall be hot rated at operating temperature, and adjustable while pumps are in operation. Positive flow shall be ensured by (automatically degasifying PVC liquid end), (a minimum of four ball type check valves and a 5 function valve for pressure relief, back pressure, anti-siphon, air bleed and discharge drain). The pump shall be water resistant for outdoor installation, and internally dampened for noise reduction. The pump shall be a Wallace & Tiernan Premia™75 Econo Series.

2.02 Controls

The control panel shall be located opposite the liquid handling end of the pump. Output volume adjustment shall be made by independent dial knobs for stroke length and stroke rate.

2.03 Electronic Drive

To prevent damage to the pump from over heating, the solenoid shall have an automatic reset thermal overload protection. For overpressure conditions, the pump shall automatically stop pulsing when discharge pressure exceeds pump pressure rating by not more than 35%, when pump is at maximum stroke rate.

The electronic circuitry shall be EMI resistant and shall employ a metal oxide varistor for lightning protection. A fuseable link on the pumps printed circuit board shall provide circuit overload protection. Internal wiring between electronic circuit board, solenoid and power shall be quick disconnect terminal at least 3/16" wide.

2.04 Enclosure

The pump drive shall be encased in a water resistant housing constructed of a chemically resistant glass-filled polyester Electronic circuitry shall be mounted at the rear of the pump for maximum protection against chemical intrusion.

2.05 Sodium Hypochlorite Metering System

The system will consist of one chemical metering pump as specified in Part 2.01 with a 5%-100% controllable range and a manually adjustable rate of 0.15 to 3 gph. The pump shall start and stop automatically with the operation of the Irrigation Pump Control System.

The pump suction shall be installed to simultaneously pump from two 30-gallon commercial containers of 12.5% sodium hypochlorite.

END OF SECTION 11260

Section 11300
WATER QUALITY TESTING EQUIPMENT

1.01 General

Water quality parameters including pH, turbidity, and residual chlorine shall be tested weekly. Other parameters shall be tested, as necessary, by a state-certified testing laboratory.

1.02 Products

A. Residual Chlorine Meter

Residual Chlorine shall be tested using the Hach CN 66 Colorimeter, or equivalent.

B. Turbidity

Turbidity shall be tested using the Hach 2100P Turbidimeter, or equivalent.

3.0 Testing Methods

A. Residual Chlorine Testing

Methods for testing Residual Chlorine shall be according to method EPA 330.5

B. Turbidity Testing

Methods for testing Residual Chlorine shall be according to method EPA 180.1

END OF SECTION 11300

Section 13240

AERATION SYSTEM

Part 1 General

1.01 Furnish and install a complete aeration system to include: blowers, valves, piping, aerators, supports and all necessary appurtenances for a complete system.

1.02 A factory trained field engineer will provide advisory service during installation and start-up of equipment.

Part 2 Products

2.01 Blowers shall be Roots model 53 URAI, 15HP, 230-460 Volt, 1 phase, 60 Hz, TEFC motor, 200 scfm @ 11psi (relief valve set at 12 psi).

2.02 Air control valves shall be butterfly type with ductile iron body. Valves shall be suitable for mounting between standard 125# A.N.S.I. flanges. The operators shall be 2" square nut and a single tee handle wrench will be supplied common to all the valves.

2.03 Polyethylene pipe and fittings shall be manufactured from a high-density polyethylene resin classified by ASTM D 1248 as type III, class C, category 5, grade P34; have an ASTM D 3350 cell classification of 335434C and have a designation of PE 3408 by the Plastic Pipe Institute. Polyethylene pipe and fittings shall have a minimum wall thickness equal to SDR 11.

2.04 Polyethylene fittings shall be manufactured by molding and shall have the same or higher pressure rating, composition, and manufacturer as the pipe.

2.05 The static tube aerators shall be 20 cfm units as manufactured by Air-Aqua, Ent., Glenview, IL 60025, (847) 657-9655.

Part 3 Execution

3.01 Installation of the piping system shall insure uniform air distribution in all both basins.

3.02 Joints shall be thermal butt-fused, except where connecting to valves and equipment with flanged or threaded connections that may require future disassembly.

3.03 All air lateral piping shall be supported using stainless steel rod cast in a concrete block. The complete assembly shall have a design load capacity to support the piping

END OF SECTION 13240

Section 13377

FLOW METER

PART 1 - GENERAL

1.1 SUMMARY

A. Provide flow devices as shown on the Drawings, as specified herein and as needed for a complete and proper installation.
   1. One 6 inch flow meter in influent meter manhole.

B. Related work:
   1. Documents affecting work under this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Division 1 -General Requirements of these Specifications.
   2. Comply with the requirements of Division 16 for any electrical work related to work in Division 13.

1.2 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 01340, including calibration information and the manufacturer's detailed specifications.

B. Submit operation and maintenance manuals in compliance with pertinent provisions of Section 01730.

1.3 QUALITY ASSURANCE

A. All flow device units to be provided by one manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01620.

PART 2 - PRODUCTS

2.1 GENERAL

A. Design will be transit time meter capable of detecting water flow in a pipeline

B. Flow sensors to be externally mounted (strap-on) for 6" pipe.

2.2 FLANGED TUBE TRANSIT TIME FLOW METER

A. Provide meter with the following requirements:
   1. Two (2) sensors with 50' of cable.

B. Provide transmitter with the following requirements:
   1. NEMA 4X enclosure.

2. Output signal: two 4-20 mAdc.
3. Three (3) SPDT relays, one (1) RS232 serial port, one (1) RS485 serial port.
4. Internal data logger and software.
5. Display is a.

C. Acceptable manufacturers:
1. Eastech Badger Model 4400
2. Or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water flow devices in accordance with manufacturer's recommendations.

3.2 CALIBRATION

A. Calibrate and program equipment to meet system requirements.

END SECTION 13377

Section 13390

RECORDER

PART 1 - GENERAL

1.1 SUMMARY

A. Provide recorder(s) as shown on the Drawings, as specified herein and as needed for a complete and proper installation.

B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Division 1 -General Requirements of these Specifications.
2. Comply with the requirements of Division 16 for any electrical work related to work in Division 13.

1.2 SUBMITTALS

A. Submit shop drawings in compliance with pertinent provisions of Section 01340, including the manufacturer's detailed specifications.

B. Submit as an integrated system with the equipment and the requirements of Section 13377.

C. Submit operation and maintenance manuals in compliance with pertinent provisions of Section 01730.

1.3 SUPPLIES

A. Provide the following number of spare parts to the Owner that match items specified:
1. Circular charts for each recorder: One-year supply.
2. Disposable pens: One-year supply for each color.

1.4. QUALITY ASSURANCE

A. Provide all equipment by one manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01620.

PART 2 – PRODUCTS

2 1 GENERAL

A. Design microprocessor based circular chart recorder(s) for recording, indicating, and totalizing the process variables.

B. Acceptable manufacturers:
1. Chessel: Model 392.
2 Or equal.

RECORDER

2.2 CIRCULAR CHART RECORDER

A. Provide user configurable microprocessor based circular chart recorder(s) with the following requirements:

1. Case: NEMA 4(X).
2. Mount: Wall mounted.
3. Number of inputs: as required.
4. Input: 4 to 20 mAdc signals.
5. Power requirement: 120 VAC, 60 Hertz.
6. Chart size: Uniform, circular 10-inch diameter.
7. Chart speed: Configurable from 1 to 4096 hours per revolution.
8. Chart configuration: 7-day.
9. Number of pens: as required.
   a. Continuous trace.
   b. Pen type: Fibertip disposable cartridge.
   c. Ink color: Pen 1-blue, pen 2-red, pen 3-green, pen 4-purple.
   d. Configuration method: Keypad.
10. Display:
    a. Vacuum fluorescent digital display.
    b. Displayed process variables are readable in engineering units with channel tag identifiers and programming prompts in plain English.
    c. Displays flow totalization.
11. Totalizer: One assignable integrator for each flow recorder channel, in gallons.

PART 3 -EXECUTION

3.1 INSTALLATION

A. Install recorder(s) in accordance with manufacturer's recommendations.

3.2 CALIBRATION

A. Calibrate and program equipment to meet system requirements.

END OF SECTION 13390

Section 15050

MECHANICAL MATERIALS AND METHODS

Part 1 General

1.1 References

AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D (1994) Specification for Pipeline Valves (Gate, Plug, and Check Valves)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1 (1989) Cast Iron Pipe Flanges and Flanged Fittings

ASME B16.3 (1992) Malleable Iron Threaded Fittings, Classes 150 and 300

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53 (1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM C 478 (1994) Pre-cast Reinforced Concrete Manhole Sections

ASTM D 1784 (1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

ASTM D 3034 (1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

ASTM D 3308 (1991a) PTFE Resin Skived Tape

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105 (1988) Polythene Encasement for Ductile-Iron Piping for Water and Other Liquids

AWWA C110 (1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids

AWWA C111 (1990) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C115 (1988) Flanged Ductile-Iron Pipe with Threaded Flanges

AWWA C151 (1991) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

AWWA C200 (1991) Steel Water Pipe 6 In. (150 mm) and Larger

AWWA C203 (1991) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA C208 (1983; C208a; Rev 1989) Dimensions for Fabricated Steel Water Pipe Fittings

AWWA C210 (1992) Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines

AWWA C500 (1993) Gate Valves for Water and Sewerage Systems

AWWA C508 (1982; C508a) Swing-Check Valves for Waterworks Service, 2 In. Through 24 In. NPS

AWWA C600 (1993) Installation of Ductile-Iron Water Mains and Their Appurtenances

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA-TRD/9-92 (1992; Errata Mar 1993) Thrust Restraint Design for Ductile Iron Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-78 (1987; Rev 1992) Cast Iron Plug Valves, Flanged and Threaded Ends

1.2 Required Work

1.2.1 The work covered under the Contractor's responsibility shall include all supervision, labor, materials, tools, equipment, facilities and services required to complete all piping installations shown on the Drawings. The final product shall be a complete and workable piping system. All accessories, auxiliaries, appurtenances and supports shall be included.

1.2.2 The locations of all materials and equipment shown on the Drawings shall be adjusted as needed to fit the site conditions. The Drawings shall be followed as closely as possible.

Part 2 Products

2.1 Pipe

2 1.1 Polyvinyl Chloride (PVC) Pipe

PVC pipe shall conform to ASTM D 3034, Type PSM with a maximum SDR of 35, sizes 15 inches or less in diameter. PVC pipe shall be certified by the compounder as meeting the requirements of ASTM D 1784, cell Class 12454B. The pipe stiffness shall be greater than or equal to 735/D for cohesionless material pipe trench backfills.

2.1.2 Ductile Iron Pipe

Ductile iron pipe shall conform to AWWA C151. Mechanical fittings for ductile iron pipe shall conform to AWWA C110. Push-on fittings for ductile iron pipe shall conform to AWWA C110 and AWWA C111.

2.1.3 Steel Pipe

Steel pipe, 6 inches diameter and larger, shall conform to AWWA C200. Steel pipe less than 6 inches diameter shall conform to ASTM A 53, standard weight, threaded end, galvanized. Fittings, 6 inches diameter and larger, shall conform to AWWA C200, fabricated in compliance with AWWA C208. Fittings less than 6 inches diameter shall conform to ASME B16.3 (galvanized).

2.2 VALVES

2.2.1 Gate Valves

Gate valves 3 inches and larger shall conform to AWWA C500. Valves for buried service shall be non-rising stem (NRS), 2 inch square nut operated with joints applicable to the pipe or installation. Buried valves shall be furnished with extension stems comprising socket, extension stem and operating nut, and shall be of an appropriate length to bring operating nut to within 6 inches of grade. One 4 foot "T" handle valve wrench shall be furnished for each quantity of 6 buried valves. Gate valves that are exposed or installed inside shall be outside screw and yoke (OS&Y), hand wheel operated with flange ends unless otherwise indicated. Gate valve operating nuts and hand wheels shall have an arrow and the word "OPEN" cast in raised letters to indicate the direction of opening. Gate valves 14 inches and larger shall be equipped with gearing to reduce operating effort. Gate valves 14 inches and larger installed in horizontal lines in horizontal position with stems horizontal shall be equipped with bronze track, roller and scrapers to support the weight of the gate for its full length of travel. Gate valves 14 inches and larger installed in vertical pipe lines with stems horizontal shall be fitted with slides to assist the travel of the gate assembly.

2.2.2 Check Valves

Check valves shall permit free flow forward and provide a positive check against back flow. Check valves shall be designed for a minimum working pressure of 150 psi or as indicated The body shall be iron. The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow

shall be directly cast on the body.

2 2.2.1 Ball Check Valves shall be iron body, shall have flanged ends, and shall be the non-slam type. Flanges shall be the 125 pound type complying with ASME B16.1. Ball shall be stainless steel unless otherwise specified.

2.2.2.2 Swing Check Valves shall conform to AWWA C508 and shall be iron body, bronze mounted, and shall have flanged ends. Flanges shall be the 125 pound type complying with ASME B16.1.

2.3 Valve Boxes

All valve boxes shall be fiberglass, model 1730-18, made by Carson-Brooks Plastics, Ltd. of Glendora, California. Each box shall have an L-bolt locking lid.

2.4 Valve Vaults

Valve vaults shall be pre-cast concrete units conforming to ASTM C 478.

2.5 MISCELLANEOUS MATERIALS

Miscellaneous materials shall comply with the following requirements:

2.5.1 Pipe Coatings and Linings

2.5.1.1 Interior linings for steel pipe shall conform to AWWA C203 or AWWA C210.

2.5.1.2 Exterior linings for buried steel pipes shall conform to AWWA C203.

2.5.1.3 Exterior linings for exposed steel pipes shall conform to AWWA C210.

2 5.2 Joint Lubricants

Joint lubricants shall be as recommended by the pipe manufacturer.

2.5.3 Bolts, Nuts and Glands

Bolts, nuts and glands shall conform to AWWA C111.

2.5.4 Joint Tape

Joint tape shall conform to ASTM D 3308.

2.5.5 Bond Wire

Bond wire shall be type RHW or USE, Size 1/0 AWG, neoprene jacketed copper conductor shaped to stand clear of the joint.

Part 3 Execution

3.1 Installation

Pipe, pipe fittings, and appurtenances shall be installed at the locations indicated. Excavation, trenching, and back filling shall be as specified in Section 02222 EXCAVATION, TRENCHING AND BACK FILLING FOR UNDERGROUND PIPING.

3.1.1 Adjacent Facilities

Installation of force mains and inverted siphons near adjacent facilities shall be as specified in Section 02730 SANITARY SEWERS.

3.1.2 Cutting

Pipe shall be cut in a neat manner with mechanical cutters. Wheel cutters shall be used where practicable. Sharp and rough edges shall be ground smooth and loose material removed from the pipe before laying.

3.1.3 Laying

Except where otherwise authorized, pipe shall be laid with bells facing the direction of laying. Before lowering and while suspended, the pipe shall be inspected for defects. Defective material shall be rejected. Pipe shall be laid in conformance to the following:

3.1.3.1 Ductile iron pipe shall conform to AWWA C600.

3.1.3.2 Steel pipe shall conform to AWWA C600.

3.1.3.3 Polyvinyl chloride pipe shall conform to Manufacturer's instructions.

3.1.4 Jointing

3.1.4.1 Polyvinyl Chloride (PVC) Pipe

Threaded joints for PVC pipe shall be made by wrapping the male threads with joint tape or by applying an approved thread lubricant, then threading the joining members together The joint shall be tightened with strap wrenches which will not damage the pipe and fittings. The joint shall be tightened no more than 2 threads past hand-tight.

Push-on joints for PVC pipe shall be made according to the following instructions. The ends of pipe for push-on joints shall be beveled to

facilitate assembly. Pipe shall be marked to indicate when the pipe is fully seated. The gasket shall be lubricated to prevent displacement. Care shall be exercised to ensure that the gasket remains in proper position in the bell or coupling while making the joint.

Solvent-weld joints for PVC pipe shall conform to the Manufacturer's instructions.

3.1.4.2 Ductile Iron Pipe

Installation of mechanical and push-on type joints for ductile iron pipe shall conform to AWWA C600 and the Manufacturer's instructions. Installation of flanged joints shall conform to the Manufacturer's instructions.

3.1.4.3 Steel Pipe

Screw joints for steel pipe shall be made tight with joint tape or joint compound applied with a brush to the male threads only. Installation of mechanical joints, push-on joints, and flanged joints shall conform to the Manufacturer's instructions.

3.1.5 Coating and Lining

Field coating of non-galvanized steel pipe shall conform to AWWA C203. The applied materials shall be tested by means of a spark-type electrical device in compliance with AWWA C203. Flaws and holidays in the coating or lining of the pipe and the pipe joints shall be repaired such that the repaired areas will be at least equal in thickness to the minimum required for the pipe.

3.1.6 Polyethylene Encasement

Polyethylene encasement shall be in accordance with AWWA C105.

3.1.7 Valves

Prior to installation, valves shall be cleaned of all foreign matter and inspected for damage. Valves shall be fully opened and closed to ensure that all parts are properly operating. Valves shall be installed with the stem in the vertical position.

3.1.8 Valve Boxes

Valve boxes shall be installed over each outside gate valve, unless otherwise indicated. Valve boxes shall be centered over the valve. Fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides or to undisturbed trench face, if less than 4 feet

3.1.9 Valve Vaults

Valve vaults shall be installed as indicated.

3.1.10 Drain Lines

Drain lines shall be installed where indicated. The drain line shall consist of a tee in the main line with a 4 inch diameter branch, a 4 inch diameter elbow, and a 4 inch gate valve.

3.1.11 Thrust Restraint

Plugs, caps, tees and bends deflecting 11-1/4 degrees or more, either vertically or horizontally, shall be provided with thrust restraint. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for ductile-iron pipes, restrained joints.

3.1.11.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than 1 part cement, 2-1/2 parts sand, and 5 parts gravel. This concrete mix shall have a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.11.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed in accordance with DIPRA-TRD/9-92.

3.1.12 Grout

Grout for exterior joint protection on concrete pipes shall be a mix of 1 part Portland cement, 2 parts sand, and of sufficient liquid consistency to flow into the joint recess beneath the diaper Grout for interior joint protection shall be a mix of 1 part Portland cement and 1 part sand. A polyurethane foam loop, impregnated with Portland cement, may be substituted for grout for exterior joints.

3.1.13 Bonded Joints

Where indicated, a metallic bond shall be provided at each joint, including joints made with flexible couplings or rubber gaskets, of ferrous-metallic piping to effect continuous conductivity. The bond shall be of the thermal-weld type.

3.2 Hydrostatic Tests

The pipeline shall be subjected to both a pressure test and a leakage test. The method proposed for disposal of waste water from hydrostatic tests shall be approved by the Engineer. Testing shall be performed by an approved independent testing laboratory or by the Contractor subject to approval. The Engineer shall be notified at least 7 days in advance of equipment tests. The final test report shall be delivered to the Engineer within 30 days of the test.

3.2.1 Pressure Test

After the pipe has been installed, joints completed, thrust blocks have been in place for at least five days, and the trench has been partially back filled, leaving the joints exposed for examination, the pipe shall be filled with water in a manner to expel all air. The pipeline shall be subjected to a test pressure of 100 psi or 150 percent of the working pressure, whichever is greater, for a period of at least one hour. Each valve shall be opened and closed several times during the test. The exposed pipe, joints, fitting, and valves shall be examined for leaks. Visible leaks shall be stopped or the defective pipe, fitting, joints, or valve shall be replaced.

3.2.2 Leakage Test

The leakage test shall be conducted subsequent to or concurrently with the pressure test. The amount of water permitted as leakage for the line shall be placed in a sealed container attached to the supply side of the test pump. No other source of supply will be permitted to be applied to the pump or line under test. The water shall be pumped into the line by the test pump as required to maintain the specified test pressure as described for pressure test for a 2-hour period. Exhaustion of the supply or the inability to maintain the required pressure will be considered test failure. Polyethylene pipe can experience diametric expansion and pressure elongation during initial testing. The manufacturer shall be consulted prior to testing for special testing considerations. Allowable leakage shall be determined by the following formula:

L = NDP/K Where:

L = Allowable leakage in gallons per hour.

N = Number of joints in length of pipeline tested.

D = Nominal diameter of the pipe in inches.

P = Square root of the test pressure in psig.

K = 7400 for pipe materials.

At the conclusion of the test, the amount of water remaining in the container shall be measured and the results recorded in the test report.

3.2.3 Re-testing

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be re-conducted until the results of the tests are within specified allowances without additional cost to the Owner.

END OF SECTION 15050

Section 16050

BASIC ELECTRICAL MATERIALS AND METHODS

Part 1 General

1.1 REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C37.16 (1988; C37.16a) Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors Preferred Ratings, Related Requirements, and Applications Recommendations

ANSI C37.32 (1990) High-Voltage Air Switches, Bus Supports, and Switch Accessories - Schedules of Preferred Ratings, Manufacturing Specifications, and Application Guide

ANSI C80.1 (1990) Rigid Steel Conduit - Zinc Coated

ANSI C82.1 (1985; C82.1A; C82.1b; C82.1c; Rev 1992) Specifications for Fluorescent Lamp Ballasts

ANSI C82.4 (1992) Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

ANSI C119.1 (1986) Sealed Insulated Underground Connector Systems Rated 600 Volts

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.1 (1989) Unified Inch Screw Threads (UN and UNR Thread Form)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48 (1994A) Gray Iron Castings

ASTM A 123 (1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM B 8 (1993) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM B 187 (1994) Copper Bar, Bus Bar, Rod and Shapes

ASTM C 478 (1994) Pre-cast Reinforced Concrete Manhole Sections

ASTM D 709 (1992) Laminating Thermosetting Materials

BASIC ELECTRICAL MATERIALS AND METHODS

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE C2 (1997) National Electrical Safety Code

IEEE C12.1 (1988) Code for Electricity Metering

IEEE C12.4 (1984; Rev 1990) Mechanical Demand Registers

IEEE C12.10 (1987) Electromechanical Watt-hour Meters

IEEE C12.11 (1987) Instrument Transformers for Revenue Metering, 10 kV BIL Through 350 kV (0.6 kV NSV Through 69 kV NSV)

IEEE C37.13 (1990) Low-Voltage AC Power Circuit Breakers Used in Enclosures

IEEE C37.30 (1992) Definitions and Requirements for High-Voltage Air Switches, Insulators, and Bus Supports

IEEE C37.34 (1994) Test Code for High-Voltage Air Switches

IEEE C57.13 (1993) Instrument Transformers

IEEE C62.41 (1991) Surge Voltages in Low-Voltage AC Power Circuits

IEEE Std 48 (1996) Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV

IEEE STD 81 (1983) Guide for Measuring Earth Resistively, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)

IEEE Std 404 (1993) Cable Joints for Use with Extruded Dielectric Cable Rated 5,000 Volts through 46,000 Volts and Cable Joints for Use with Laminated Dielectric Cable Rated 2,500 Volts Through 500,000 Volts

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (1991) Enclosures for Electrical Equipment (1000 Volts Maximum)

NEMA AB 1 (1993) Molded Case Circuit Breakers and Molded Case Switches

NEMA FB 1 (1993) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit and Cable Assemblies

NEMA ICS 1 (1993) Industrial Controls and Systems

NEMA ICS 2 (1993) Industrial Control Devices, Controllers and Assemblies

NEMA ICS 3 (1993) Industrial Systems

NEMA ICS 6 (1993) Enclosures for Industrial Control and Systems

NEMA LE 4 (1987) Recessed Luminaries, Ceiling Compatibility

NEMA MG 1 (1993; Rev 1-1993; Rev 2-1995) Motors and Generators

NEMA MG 10(1994) Energy Management Guide for Selection and Use of Poly-phase Motors

NEMA PB 1 (1990) Panel boards

NEMA PB 2 (1989) Dead-front Distribution Switchboards

NEMA RN 1 (1989) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NEMA SG 6 (1990) Power Switching Equipment

NEMA ST 1 (1988) Specialty Transformers (Except General Purpose Type)

NEMA ST 20 (1992) Dry-Type Transformers for General Applications

NEMA TC 2 (1990) Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80)

NEMA TC 6 (1990) PVC and ABS Plastic Utilities Duct for Underground Installation

NEMA TC 13 (1993) Electrical Nonmetallic Tubing (ENT)

NEMA WC 7 (1993) Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NEMA WC 8 (1993) Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

BASIC ELECTRICAL MATERIALS AND METHODS

NFPA 70 (1996) National Electrical Code

NFPA 101 (1994) Safety to Life from Fire in Buildings and Structures

UNDERWRITERS LABORATORIES (UL)

UL-03 (1996) Electrical Construction Materials Directory

UL 6 (1993; Rev March 1996) Rigid Metal Conduit

UL 20 1995) General-use snap switches

UL 44 (1991; Rev through June 1996) Rubber-Insulated Wires and Cables

UL 50 (1995) Enclosures for Electrical Equipment

UL 67 (1993; Rev through Dec 1993) Panel boards

UL 83 (1991; Rev Through June 1996) Thermoplastic-Insulated Wires and Cables

UL 467 (1993; Rev through August 1996) Grounding and Bonding Equipment

UL 489 (1991; Rev through August 1995) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

UL 508 (1993) Industrial Control Equipment

UL 542 (1994) Lamp holders, Starters, and Starter Holders for Fluorescent Lamps

UL 651 (1995) Schedule 40 and 80 Rigid PVC Conduit

UL 651A (1995) Type EB and A Rigid PVC Conduit and HDPE Conduit

UL 674 (1994; Rev July 1996) Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations

UL 797 (1993; Rev May 1995) Electrical Metallic Tubing

UL 844 (1995) Electric Lighting Fixtures for Use in Hazardous (Classified) Locations

UL 845	(1995) Motor Control Centers
UL 877	(1993; Rev July 1995) Circuit Breakers and Circuit-Breaker Enclosures for Use in Hazardous (Classified) Locations
UL 891	(1994; Rev through Jan 1995) Dead-Front Switchboards
UL 924	(1995; Rev through May 1995) Emergency Lighting and Power Equipment
UL 935	(1995; Rev June 1995) Fluorescent-Lamp Ballasts
UL 1004	(1994; Rev through May 1996) Electric Motors
UL 1029	(1994; Rev Sept 1995) High-Intensity-Discharge Lamp Ballasts
UL 1063	(1993; Rev through October 1994) Machine-Tool Wires and Cables
UL 1570	(1995) Fluorescent Lighting Fixtures
UL 1571	(1991; Rev through March 1995) Incandescent Lighting Fixtures
UL 1572	(1995; Rev May 1996) High Intensity Discharge Lighting Fixtures

1.2 REQUIRED WORK

1.2.1

The work covered under the Contractor's responsibility shall include all supervision, labor, materials, tools, equipment, facilities and services required to complete all electrical installations shown on the Drawings or called for in the Specifications. The final product shall be a complete and workable electrical system. All accessories, auxiliaries, appurtenances and supports shall be included.

1.2.2

The locations of all materials and equipment shown on the Drawings shall be adjusted as needed to fit the site conditions. The drawings shall be followed as closely as possible.

1.2.3

Materials and equipment shall be installed in accordance with NFPA 70, NFPA 101, the recommendations of the manufacturer and as shown on the Drawings.

1.2.4 Identification Nameplates

Major items of electrical equipment and major components shall be permanently marked with an identification name to identify the equipment by type or function and specific unit number as indicated. Designation of motors shall coincide with their designation in the motor control center or panel. Unless otherwise specified, all identification nameplates shall be made of laminated plastic in accordance with ASTM D 709 with black outer layers and a white core. The front of each panel board, motor control center, switch gear, and switchboard shall have a nameplate to indicate the phase letter, corresponding color and arrangement of the phase conductors. The following equipment, as a minimum, shall be provided with identification nameplates:

Minimum 1/4 inch letters - starters, safety switches, motor control centers, equipment enclosures, motors

Minimum 1/8 inch letters - control power transformers, control devices, instrument transformers

1.3 Construction Drawings

1.3.1

The Contractor shall provide design drawings for the proposed electrical system. These drawings shall clearly show the locations and layout of all electrical equipment including lighting. The layout of the electrical conduits shall include all conduits, pull boxes and junction boxes that are required. The required wire sizes and quantities, conduit sizes, and electrical box sizes shall be shown. These drawings shall be submitted for review and approval before any work is done.

1.3.2

The design drawings shall include all details, with complete dimensions, required to construct the electric circuits that are part of this contract. These drawings shall be updated to reflect all changes made in the field.

1.3.3

The Contractor shall date and certify all of the design drawings after all of the work shown on the drawings is completed. This certification shall be understood to mean that all of the work was properly supervised by the Contractor and the drawings were updated to reflect all changes made in the field. Upon completion, all cables, conduits and electrical boxes shall be properly tagged in the field for identification.

1.3.4 The electrical service available on this site is single phase power. The design so the electrical system shall be single phase and all equipment shall be suitable for operation on single phase power.

Part 2 Products

2.1 Conduit and Appurtenances

2.1.1

Ferrous conduit and fittings exposed to weather, buried underground, or exposed at locations where there is threat of mechanical damage shall be rigid steel, heavy-wall type, in compliance with UL 6 and ANSI C80.1. This conduit and fittings shall be hot-dipped galvanized with zinc-coated threads, in compliance with ASTM A 153, ASTM A 123, and UL 797. Metallic conduit fittings and outlets shall comply with UL 514A and NEMA FB 1.

2.1.2

Heavy-wall steel conduit with PVC coating(40 mil) shall be used for installation in chemical environments, in compliance with NEMA RN 1.

2.1.3

Nonmetallic conduit shall be PVC Schedule 80 for concrete encasement, in compliance with NEMA TC 2, NEMA TC 13, UL 651, UL 651A, and NFPA 70, unless otherwise shown on the Drawings.

2.1.4

Rigid conduits installed in dry locations requiring a connection for adjustment or vibration isolation shall be provided with a length of flexible conduit (6 feet or less) at the point of connection. Flexible conduit installed in wet locations, exterior locations, air return ceilings, and at motors shall be liquid-tight type, in compliance with UL 1, UL 360, and UL 1660. Wiring, fixtures, and equipment installed in damp or wet locations shall conform to NFPA 70.

2.1.5

All underground duct shall be rigid PVC in accordance with NEMA TC 6

2.2 Electrical Boxes and Manholes

2.2.1

Pull boxes, junction boxes, and terminal boxes of steel, cast iron, or aluminum shall be furnished as indicated on the Drawings. Boxes installed in damp or wet locations shall be suitable for a wet environment, in conformance with NFPA 70. Aluminum shall not be used in contact with earth or concrete. Ferrous metal hardware shall be

hot-dipped galvanized in accordance with ASTM A 153 and ASTM A 123. All metallic boxes shall comply with IEEE C2, UL 514A, NEMA FB 1, and NFPA 70.

2.2.2

Additional pull boxes which are not shown on the Drawings shall be furnished and installed by the contractor at locations required by local ordinances or the Specification, or to facilitate the installation at no extra cost to the owner.

2.2.3

Where required, boxes with metal barriers, baffles, or separators to isolate dissimilar conductors shall be provided. This work shall be done in accordance with IEEE C2.

2.2.4

All outlet boxes shall be metallic, unless otherwise noted.

2.2.5

Manholes shall be provided as indicated on the Drawings. All manholes shall comply with IEEE C2. Pre-cast-concrete manholes shall have the required strength established by ASTM C 478. Frames and covers shall be made of gray cast iron. Cast iron shall comply with ASTM C 478.

2.3 Wire and Cable

2.3.1

Unless specified or indicated otherwise or required by NFPA 70, all power, lighting, and control wires shall be single conductor, 600 volt, Type XHHW, conforming to UL 44. All conductors shall be copper, solid for No. 10 AWG and smaller, stranded for No. 8 AWG and larger, except that all control cables shall be stranded. Wire Type THHN, suitable for a temperature of 90 degrees Centigrade, conforming to UL 83, shall be used for continuous run fixture wiring.

2.3.2

General purpose signal wires shall be Class 3 low-energy, remote-control and signal circuit type, not less in size than No. 18 AWG. Remote-control and signal circuit wires shall be Type TW, THW, or TF, conforming to UL 83. If signal wires are to be installed outside or in a wet location inside, a type suitable for a wet environment shall be used.

2.3.3

Underground cables where indicated on the Drawings shall have copper conductors and shall be of the proper size and type for the purpose and use indicated All cables shall conform to NFPA 70 and either NEMA WC 7 or NEMA WC 8 Direct buried cables used as service entrance cables shall conform to UL 854 for Type USE

service entrance cable. Other direct buried cable applications shall be single-conductor cable identified for such use and conforming to either NEMA WC 7 or NEMA WC 8. Cable shall be buried a minimum of 18 inches deep.

2.3.4

Special purpose wires for specific applications required by equipment manufacturers shall be provided as required.

2.4 Expansion Fittings

Conduits crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding.

2.5 Terminations

2.5.1

Terminations shall be in accordance with IEEE Std 48, Class 1 or Class 2; of the molded elastomer, wet-process porcelain, pre-stretched elastomer, heat-shrinkable elastomer, or taped type. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations shall be of the outdoor type for all outdoor applications, except that where installed inside outdoor equipment housings which are sealed against normal infiltration of moisture and outside air, indoor, Class 2 terminations are acceptable. Class 3 terminations are not acceptable. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, and armor.

2.5.2

Molded elastomer, wet-process porcelain, pre-stretched, and heat-shrinkable terminations shall utilize factory pre-formed components to the maximum extent practicable rather than tape build-up. Terminations shall have basic impulse levels as required for the system voltage level Leakage distances shall comply with wet withstand voltage test requirements of IEEE Std 48 for the next higher Basic Insulation Level (BIL) level.

2.5.3

Taped terminations shall use standard termination kits providing terminal connectors, field-fabricated stress cones, and rain hoods. Terminations shall be at least 12 5 inches long from the end of the tapered cable jacket to the start of the

terminal connector, or not less than the kit manufacturer's recommendations, whichever is greater.

2.6 Circuit Breakers

2.6.1

Circuit breakers shall have voltage, current and interrupting ratings as indicated. Circuit breakers and their enclosures shall conform to NEMA AB 1 and UL 489. Circuit breakers and their enclosures in hazardous (classified) locations shall conform to UL 877. Low-Voltage-Power type circuit breakers shall conform to IEEE C37.13 and ANSI C37.16.

2.6.2

Circuit breakers shall be of the manually operated, molded case type, in conformance to NEMA AB 1 and UL 489 for non-hazardous locations. The circuit breakers shall be quick-make, quick-break, common trip type, and shall be of automatic trip type unless otherwise specified or indicated on the Drawings. All poles of each breaker shall be operated simultaneously by means of a common handle. The operating handles shall clearly indicate whether the breakers are in an "On", "Off", or "Tripped" position and shall have provisions for padlocking in the "Off" position. Personnel safety line terminal shields shall be provided for each breaker. The circuit breakers shall be products of only one manufacturer, and shall be interchangeable when of the same frame size.

2.6.3

The circuit breakers, of frame sizes and the trip unit ratings as shown on the Drawings, shall be provided with combination thermal and instantaneous magnetic or solid state trip units. The breaker trip units shall be interchangeable and the instantaneous magnetic trip units shall be adjustable on frame sizes larger than 150 amperes. Nonadjustable instantaneous magnetic trip units shall be set at approximately 10 times the continuous current ratings of the circuit breakers. Solid state trip units, where indicated, shall also be adjustable.

2.6.4

Circuit breakers for 460-volt ac circuits shall be rated 600 volts ac, and shall have a UL listed minimum interrupting capacity of 14,000 symmetrical amperes at 600 volts ac.

2.6.5

Circuit breakers for 120-volt ac circuits shall be rated not less than 120/240 volts ac, and shall have a UL listed minimum interrupting capacity of 10,000 symmetrical amperes.

2.6.6

Circuit breakers for 125-volt dc circuits shall be two-pole rated 125/250 or 250 volts dc, and shall have a UL listed minimum interrupting capacity of 5,000 amperes dc.

2 7 Distribution Transformers

Dry type transformers for power and lighting loads shall be furnished with voltage and kVA ratings as indicated on the Drawings. The transformers shall conform to the requirements for general-purpose transformers in NEMA ST 20. Each transformer shall be protected on the primary side with a molded case circuit breaker as indicated on the Drawings.

2.8 Individual Control Transformers

Where 120 volt ac control of contactors is indicated or required, an individual control transformer shall be provided on the line side of the unit disconnect. The control transformers shall be rated 460-120 volts and shall conform to the requirements for control transformers in NEMA ST 1. Control transformers shall have adequate volt-ampere capacity for the control functions indicated. Transformers shall be installed with primary fuses. Except as otherwise indicated on the Drawings, each control transformer shall be provided with a fuse in one secondary lead and shall have the other secondary lead grounded.

2.9 Panel boards, Switchboards and Motor Control Centers

2.9.1

The electrical work for all control centers shall conform to the specifications in Sub-Section 16900.

2 10 Safety Switches

2.10 1

The safety switches shall be manually-operated, heavy duty, 600 volt ac, air-insulated, load interrupter or disconnecting type, as indicated on the Drawings. The safety switches shall be fused or non-fusible, three-pole, single-throw, with quick-make, quick-break mechanisms, as indicated. The safety switches shall conform to the applicable requirements of ANSI C37.32, IEEE C37.30, IEEE C37.34, and NEMA SG 6.

2.10.2

The switch cover shall be interlocked with the switch mechanism to prevent opening when the switch is closed. The switch enclosure shall conform to NEMA 250 and UL 50.

2.11 Connections

All bolts, studs, machine screws, nuts, and tapped holes shall be in accordance with ASME B1.1. All ferrous fasteners shall have rust-resistant finish and all bolts and screws shall be equipped with approved locking devices.

2.12 Lighting

2.12.1

All lighting work shall conform to the specifications in Sub-Division 16500.

2.13 Temperature Control

2.13.1

Space heaters shall be provided where indicated on the Drawings and shall be controlled using an adjustable 50 to 90 degree F. thermostat, magnetic contactor, and a molded-case circuit breaker. The space heaters shall be 250-watt, 240 volt strip elements, operated at 120 volts and shall be wired to terminal blocks for connection to 120-volt single-phase power sources located external to the motor control centers to allow heating when the motors are not energized.

2.13.2

Temperature range shall be 60 degrees F. to 100 degrees F. for ventilation fan. Thermostat types shall be the same as for the space heaters, or as indicated on the Drawings.

2.13.3

Temperature switches for low temperature alarms for a building shall be provided. Temperature range shall be 0 to 75 degrees F. with adjustable differential. These units shall also be used in wet and corrosive locations for unit heater control, or as indicated on the Drawings. Temperature switch types shall be as indicated on the Drawings.

Part 3 Execution

3.1 General

3.1.1

All electrical work shall conform to the requirements of NFPA 70, NFPA 101, and IEEE C2 unless more stringent requirements are indicated herein or shown on the Drawings. The complete installation, including design, workmanship, equipment, and material shall comply with all local, state, and federal laws and ordinances in

effect, and the rules, regulations, and special requirements, if any, of the local electric utility company.

3.1.2

All permits and inspection required shall be obtained and fees paid for by the Contractor.

3.1.3

Locations of conduits, fixtures and equipment shall be adjusted and supported to accommodate the work in accordance with field conditions encountered, anticipating potential interferences.

3.2 Power Service

3.2.1

The contractor shall make arrangements with the utility regarding service entrance requirements and metering equipment and shall install metering equipment and empty conduit for primary service and metering conductors to meet standards and requirements of the utility. Service shall be provided for 230 volt, 3-phase, 60 hz power and 120 volt, 1-phase, 60 hz power.

3.2.2

The power company will furnish and install service transformers, metering transformers and meter.

3.2.3

For underground primary service, underground secondary service, pad-mounted transformer or standard overhead service, the Contractor shall include in his base bid price the utility charges for the work included.

3.3 Grounding

3.3.1

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as phase conductors and green color- coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn copper unless otherwise indicated. Aluminum is not acceptable.

3 3.2

Ground rods shall supplement water piping electrode systems and shall be 3/4 inch diameter solid stainless steel, 10 feet long, of the sectional type. Unless otherwise indicated, ground rods shall be driven into the earth until the tops of the rods are

approximately one foot below the finished grade. All connections shall conform to UL 467.

3.3.3

Ground bus shall be provided in the electrical equipment rooms as indicated. Non-current-carrying metal parts of transformer neutrals and other electrical equipment shall be effectively grounded by bonding to the ground bus. The ground bus shall be bonded to both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Connections and splices shall be of the brazed, welded, bolted, or pressure-connector type, except that pressure connectors or bolted connections shall be used for connections to removable equipment. All connections shall conform to UL 467.

3.3.3.1

All equipment grounding conductors, including metallic raceway systems used as such, shall be bonded or joined together in each wiring box or equipment enclosure. Metallic raceways and grounding conductors shall be checked to assure that they are wired or bonded into a common junction. Metallic boxes and enclosures, if used, shall also be bonded to these grounding conductors by an approved means per NFPA 70 and UL 467. When boxes for receptacles, switches, or other utilization devices are installed, any designated grounding terminal on these devices shall also be bonded to the equipment grounding conductor junction with a short jumper.

3.3.4

Additional electrodes interconnected with grounding conductors shall be provided, to achieve the specified ground resistance. The additional electrodes shall be up to three, 10 foot rods spaced a minimum of 10 feet apart. When additional electrodes are provided and the required ground resistance is still not met, the Engineer shall be notified within two working days.

3.3.5

Grounding and bonding conductors include conductors used to bond transformer enclosures and equipment frames to the grounding electrode system. Grounding and bonding conductors shall be sized as shown, and located to provide maximum physical protection. Bends greater than 45 degrees in ground conductors are not permitted. Routing of ground conductors through concrete shall be avoided. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit so as to provide an opening for the ground conductor, and the opening shall be sealed with a suitable compound after installation.

3.3.6

The resistance of each grounding electrode system shall be measured using the fall-of-potential method defined in IEEE Std 81.

3.4 Duct Lines

3 4.1

Underground ducts for electric feeders, instrumentation wiring, control wiring, and other communications wiring, where shown on the Drawings, shall be rigid PVC. All PVC ducts shall comply with NEMA TC 6. All connections shall be waterproof. All ducts shall be inspected for cleanliness before use and completely cleaned of all moisture, dirt or debris if found to be dirty. All ducts shall be buried at least 18 inches below finished grade. Red dye shall be added in the top concrete mix for concrete enclosed ducts.

3.4.2

After cleaning, the ends of dead-ended ducts shall be protected with standard plastic conduit caps to prevent the entrance of water or other foreign matter.

3.4.3

Duct lines shall be pitched slightly to avoid trapping of condensate. Breather-drain fittings shall be installed at low points.

3.4.4

Concrete encased ducts shall conform to UL 651 Schedule 40 or NEMA TC 6 Type EB. The installation of concrete encased ducts shall comply with NFPA 70 and IEEE C2.

3.5 Trenches and Manholes

3.5 1

Excavation and back filling for trenches and manholes shall be done in accordance with the appropriate Sections in these specifications.

3.5.2

Manholes shall be the type noted on the Drawings and shall be constructed in accordance with the applicable details as noted. Either pre-cast-concrete manholes or cast-in-place monolithic concrete construction shall be used.

3.6 Wiring Methods

3.6.1

Wiring shall conform to NFPA 70, the contract drawings, and the following specifications. Unless otherwise indicated, wiring shall consist of insulated

conductors installed in rigid zinc-coated steel conduit or rigid PVC conduit. Where cables and wires are installed in cable trays, they shall be of the type permitted by NFPA 70 for use in such applications. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified. Wire fill in conduits located in Class I or II hazardous areas shall be limited to 25 percent of the cross sectional area of the conduit.

3.7 Conduit Systems

3.7.1

Conduit systems shall be installed as shown on the Drawings, in an approved and workmanlike manner. Conduit sizes shown are based on use of copper conductors with insulation types as described in paragraph "Wiring Methods" above Steel conduits shall be used when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. PVC conduit or PVC coated steel conduit shall be used in damp, wet or corrosive locations when permitted by NFPA 70 and the conduit is provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. All conduit shall be inspected for cleanliness before use and completely cleaned of all moisture, dirt and debris if found to be dirty.

3.7.1.1

All conduit shall be buried at least 18 inches below finished grade. Where conduit crosses a previous, deeper excavation, it shall be suitably braced to resist movement due to settlement. Where rock or gravel is encountered in the trench, a three-inch deep layer of sand shall be provided for the conduit to rest upon. A three-inch layer of sand shall be placed over the top of all conduit. The remaining backfill shall be placed and compacted in 6 inch layers.

3.7.2

Conduits crossing structural building expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding. Wiring installed in under-floor duct system shall be suitable for installation in wet locations.

3.7.3

Exposed conduits shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Conduits under raised floors and above accessible ceilings shall be considered as exposed installations in accordance with NFPA 70 definitions.

3.7.3.1

Except where otherwise permitted by NFPA 70, conduits inside buildings shall be securely and rigidly fastened in place at intervals of not more than 10 feet and within 3 feet of boxes, cabinets, and fittings, with approved pipe straps, wall brackets, conduit clamps, conduit hangars, threaded C-clamps, beam clamps, or ceiling trapeze.

3.7.3.2

Conduits embedded in concrete shall be blocked and braced in place to prevent displacement during the placement of concrete. Concrete encasement of conduit shall be done in accordance with NFPA 70, IEEE C2, and UL 6.

3.7.4

Conduit shall be pitched slightly to avoid trapping of condensate. Breather-drain fittings shall be installed in boxes or trapped conduit at low points.

3.7.5

Factory-made conduit bends shall be used wherever possible. Field-made bends shall be made with an approved conduit-bending machine. Crushed or deformed conduits shall not be installed. Clogged conduits shall be completely freed of obstructions or shall be replaced.

3.7.6

Minimum size conduit shall be 3/4 inch.

3.7 7

Conduit run in or below any floor slab on grade shall be entirely encased in concrete, in compliance with the applicable requirements of NFPA 70 and IEEE C2. In no case shall conduit be layed in fill below slab.

3.7.8

Flexible metal conduit shall be used for all equipment subject to movement or vibration, as discussed in Sub-Section 2.1.4 above. Flexible conduit connections shall be watertight.

3.7.9

Electric power wiring and communication wiring shall be separated in accordance with IEEE C2.

3 7.10

The contractor shall provide sleeves for conduit as required by job conditions. Sleeves shall not be less than one inch larger than outside diameter of conduit. Sleeves through floors, exterior walls, and equipment room walls shall have the net openings sealed at both ends.

3.8 Wire and Cable

3.8.1

All wiring shall conform to NFPA 70, the contract Drawings, and the following specifications. Unless otherwise specified, wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit, PVC-coated steel conduit or rigid PVC conduit. Where cables and wires are installed in cable trays, they shall be of the type permitted by NFPA 70 for such applications. Wire fill in conduits shall be based on NFPA 70 for the type of conduit and wire insulations specified. Wire fill in conduits located in Class I or Class II hazardous areas shall be limited to 25 percent of the cross sectional area of the conduit.

3.8.2

All underground cable shall be enclosed in duct or conduit buried at least 18 inches below finished grade. All cable insulation shall be 600 volt rated unless otherwise specified or shown on the Drawings. All wiring showing evidence of damaged insulation shall be replaced.

3.8.3

Unless otherwise noted, all cables shall be installed in conduits. Cables in panel boards, switchboards, and motor control centers, and all other control centers shall be installed in wire ways. No more than one power circuit or not more than three lighting circuits are permitted in one conduit.

3.8.4

All terminations shall conform to Sub-Section 2.5 above.

3.8.5

All cable splicing shall be done in an accessible location. Crimping tools and dies shall be approved by the connector manufacturer for use with the type of connector and conductor.

3.8.5.1

Splices, copper conductors, 600 volts and under: Splices in conductors No. 10 AWG and smaller diameter shall be made with an insulated, pressure-type connector. Splices in conductors No. 8 AWG and larger diameter shall be made with a solderless connector and insulated with tape or a heat-shrink type insulating material equivalent to the conductor insulation, not less than the insulation of the original cable.

3 8 5.2

No splices or taps shall be made for any control cable or signal cable. Terminal blocks shall be used for connection of control and signal wires.

3.8 5.3

No splices will be permitted except at approved junction or terminal box points, as required by NFPA 70 or local electrical code for pull lengths. Cable and wire runs shall be looped through pull boxes without cutting and splicing, where possible.

3.8.6

Conductor Identification and Tagging

3.8.6.1

Power, control, and signal circuit identification shall be provided within each enclosure where a tap, splice or termination is made. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation. Phase conductors of low voltage power circuits shall be identified by color coding. Phase identification by a particular color shall be maintained continously for the length of a circuit, including junctions.

3.8.6.2

Color coding shall be used for service, feeder, branch, and ground conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutrals shall be white with colored (not green) stripe. The color coding for three-phase and single-phase low voltage systems shall be as follows:

230/460 volt, 3-phase: Brown (A), orange (B), and yellow (C)

120/240 volt, 1-phase: Black and red.

3.8.6.3

Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Engineer

3.8 6 4

Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings Hand lettering or marking is not acceptable.

3.8.6.5

The following identification marking shall be provided on each circuit breaker, disconnect switch, contactor, motor starter, motor transformer or other major electrical equipment:

1. Feeder name, number, voltage and phase.
2. Item of equipment controlled or supplied.

3.9 Testing

3.9.1

Testing and final acceptance shall conform to the specifications in Sub-Division 16950.

END OF SECTION 16050

Section 16100

SCADA SYSTEM

PART 1- GENERAL

1.1 Scope

Furnish and install a complete SCADA system that meets the criteria.

1.2 Functional description

The system shall provide the following alarms:

1. Blower failure to operate when called for
2. Irrigation pump failure to operate when called for
3. Irrigation control system failures

The system shall include a phone dialer for annunciation of the above alarms

The system shall provide for dial in connection to facilitate system monitoring of:

1. Blower operation
2. Irrigation pump operation
3. Flow meter data reporting
4. Irrigation control system monitoring

1.3 Submittals

Shop drawings in compliance with pertinent sections of Section 01340, including manufacturer's detailed specifications.

Operation and maintenance manuals in compliance with pertinent provisions of Section 01730.

1.4 Delivery and handling

Provide the system to the irrigation system supplier for mounting in the equipment enclosure at their factory.

END OF SECTION 15100

A. S M.
Con Struction Co.
COMMERCIAL & RESIDENTIAL INFRASTRUCTURES
LOT IMPROVEMENTS & LAND DEVELOPMENT

Office: 615.792.6612
Fax: 615.792.6616
Cell: 615.394.0297

2527 Burrowlow Rd • Ashland City, TN • 37015

ESTIMATE

SUBMITTED TO CARBINE DEVELOPMENT **PROJECT NAME** WATERBRIDGE WASTEWATER RECLAMATION & REUSE SYSTEM

DATE 5-21-04

	DISCRIPTION	UNIT	EST. QTY.	UNIT PRICE	TOTAL
A.	EARTHWORK:				
1.	TOPSOIL STRIPPED & STOCKPILED	C.YD.	3500	2.50	8750.00
2.	EXCAVATION	C.YD.	27200	7.25	197,200.00
3.	TOPSOIL REPLACED	C.YD.	1200	4.00	4,800.00
4.	COVER LINER W/CLAY	C.YD.	4,962	4.00	-0-
5	SEED & STRAW & EROSION BLANKET	S.F.	60,000	.32	19,200.00
6.	SEED & STRAW PRIMARY IRRIGATION ZONES	S.F.	620,000	.03	-0-
7.	CONSTRUCTION STAKING	L.S.	1	9800.00	9800.00
8.	SOIL TESTING	L.S.	1	6200.00	6,200.00
9	FINE GRADE	S.YD.	21,000	.35	7350.00
10.	EROSION CONTROL	L.F.	2600	3.00	7,800.00
	SUB TOTAL -				261,100.00
B.	GEO-MEMBRANE LINER:	S.F.	140,854	.87	-0-
C.	FLOW METER IN 4FT. DIA. M.H. - 5FT. DEEP	L.S.	1	11,500.00	11,500.00
D.	AIR RELEASE VALVE IN 6FT. DIA. M.H. - 6FT DEEP	L.S	1	6,500.00	6,500.00
E.	INLET/OUT M.H. # 2 5FT DIA. M.H. - 10FT. DEEP	L.S.	1	6300.00	6300.00
F.	IRRIGATION PUMP IN 6A. DIA M.H. 16.3FT. DEEP	L.S	1	98,500.00	98,500.00
G.	DISINFECTION SYSTEM W/3" TRANSIT PIPE W/REDUCERS BASED ON 80 FT. LENGTH	L.S.	1	39,500.00	39,500.00

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2527 Beaverlow Rd • Ashland City, TN • 37015

ESTIMATE

SUBMITTED TO _____ **PROJECT NAME** _____

DATE _____

	DISCRIPTION	UNIT	EST. QTY.	UNIT PRICE	TOTAL
H.	IRRIGATION SYSTEM	L.S.	1	93,500.00	93,500.00
I.	12 x 12' STORAGE SHED	L.S	1	18,000.00	18,000.00
J.	AERATION SYSTEM W/ BLOWERS & AERATORS	L.S.	1	66,500.00	66,500.00
K.	RECORDER & SCADA SYSTEM	L.S.	1	44,500.00	44,500.00
L.	ALL PIPING FITTINGS, ETC. STARTING BEGINNING @ FLOW METER & ENDING @ IRRIGATION SYSTEM	L.S.	1	25,400.00	25,400.00
M.	STAFF GAUGE	EA	2	5200.00	10,400.00
N.	4 FT. HIGH - 4 PLANK FENCE W/ 2 - 9' MAIN GATES & 1 - 4' GATE	L.F	1600	9.00	14,400.00
O.	GROUNDWATER MONITOR WELL	EA	4	3800.00	15,200.00
	TOTAL PRICE -				$ 311,300.00

Waterbridge

Full Build Out Operating Scenario
3/18/04

Operating Revenue

214 homes x	$33 (3-4 bedrooms) =	$7,062 Monthly		$84,744

Cost of Operation

Labor	Operating Labor					
	4 hours/day, 5 days/week =		0.5 Person			
	Base $50,000		$70,000			$35,000
Power						
	Blowers	10 Hp	7.5 Kw	0 07 /KWhr	$	4,599
	Irr. Pump	15 Hp	11 25 Kw	0 07 /KWhr	$	1,449
	Other	1 Hp	0 75 Kw	0 07 /KWhr	$	460
Hypochlorite (Commercial grade)						
	10 mg/l feed rate		250 gallons/yr	$1 /gallon		$250
Testing and Analytical						
	Quarterly Testing (BOD, TSS, Ammonia)			4 x 500	$	2,000
Other Expenses						
	Insurance				$	7,000
	Vehicle		30 miles round trip 1 x day, 250 days, $0 35/mile		$	2,625
	Mowing				$	2,000
	Phone line for autodialer				$	500
	1/2 cell phone and pager @$100/month				$	600
	Misc. Supplies				$	1,000
			Subtotal Annual Operating Costs		$	57,483

Other Allowances

Reserve Fund for Replacement and Unscheduled Maintenance

Includes: Entire collection system except grinder pumps
Blowers, irrigation pumps, hypo pump
Electrical equipment and instrumentation
Irrigation system, auto valves, nozzles

214 homes	$3.00 /home/month		$	7,704

Grinder PumpsMaintenance				
214 pumps	$40 /pump/yr	$8,560	$	8,560

Billing Allowance Paid to Cartwright Creek

	214 homes	$	1,000
Cartwright Creek Payment			
	12% of revenue	$	10,169
	Subtotal Other Allowances	$	27,433
	Total Annual Cost	$	84,916
	Revenue - Cost	$	(172)

Unaddressed Issues

Property taxes - how much and who pays?

Possibility of Brentwood style inital pump replacement charge of $2000

Assumptions

Operating Labor includes routine mainenance

Operating Labor includes unscheduled maintenance that can be accomplished w/hand tools

Primary and secondary irrigation areas maintained by Cartwright/Sheaffer

Primary and secondary irrigation areas planted with mowable grass

Remainder of green space maintained by others

Cartwright Creek Handles Billing and Collection

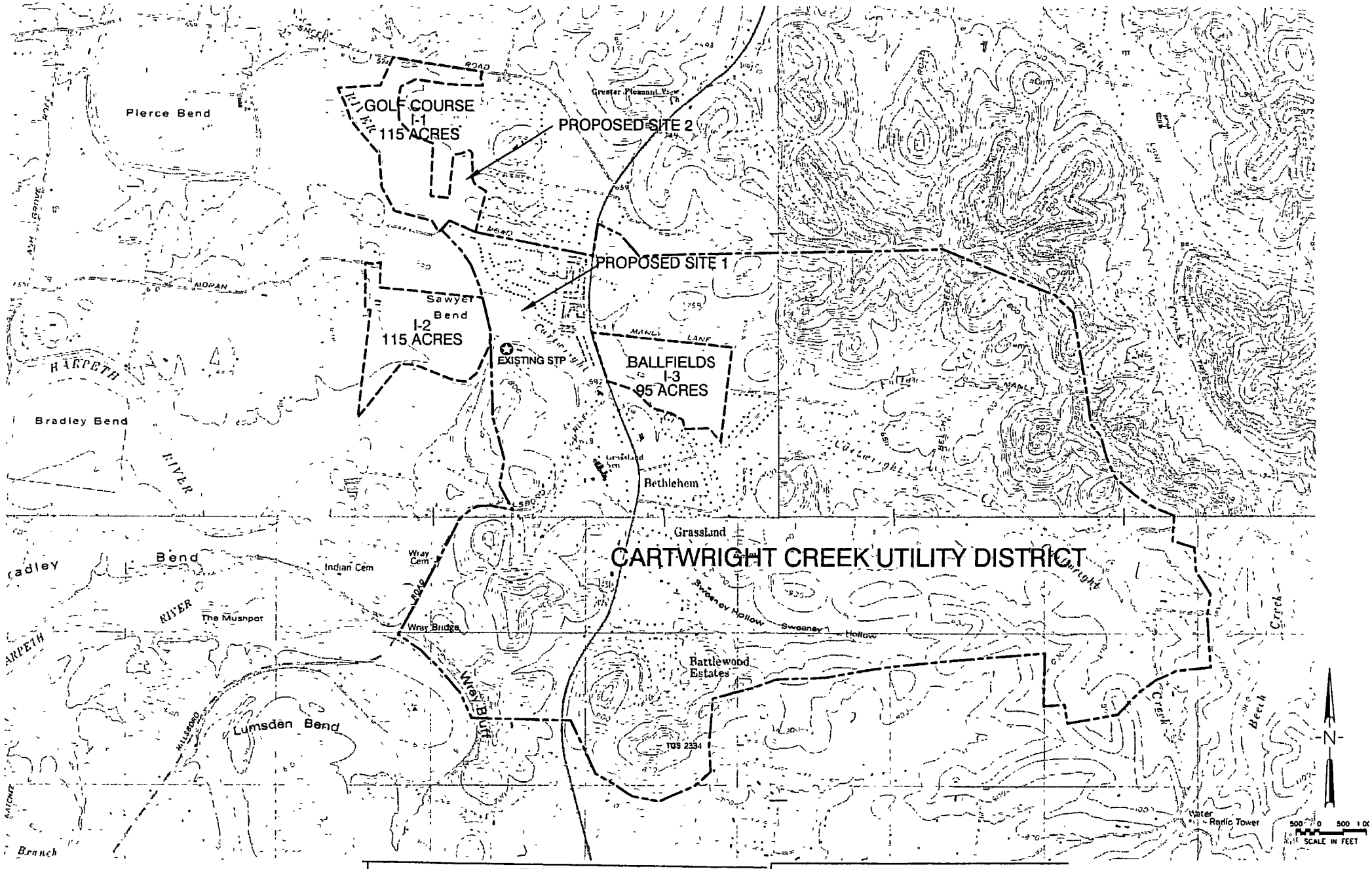
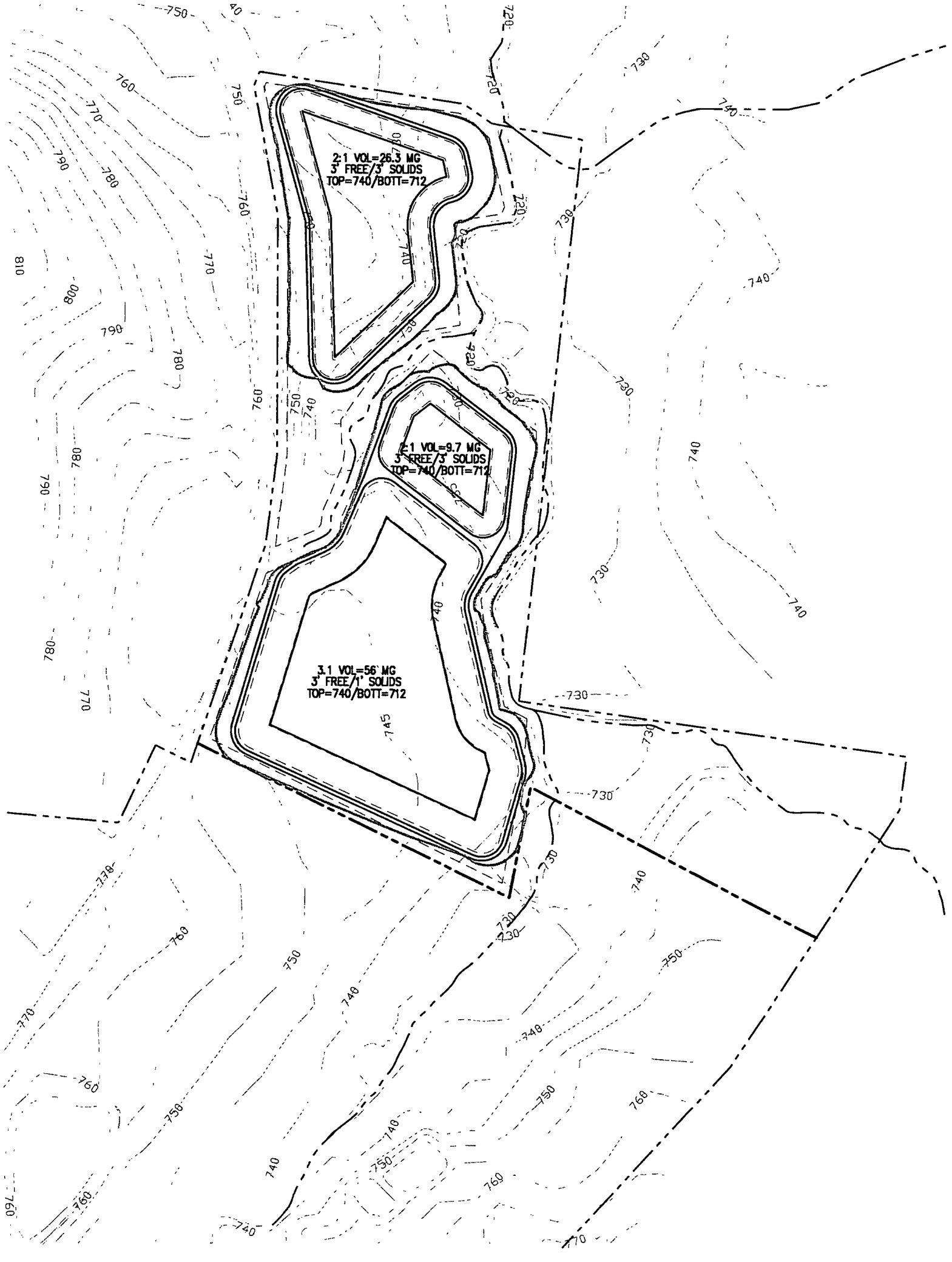
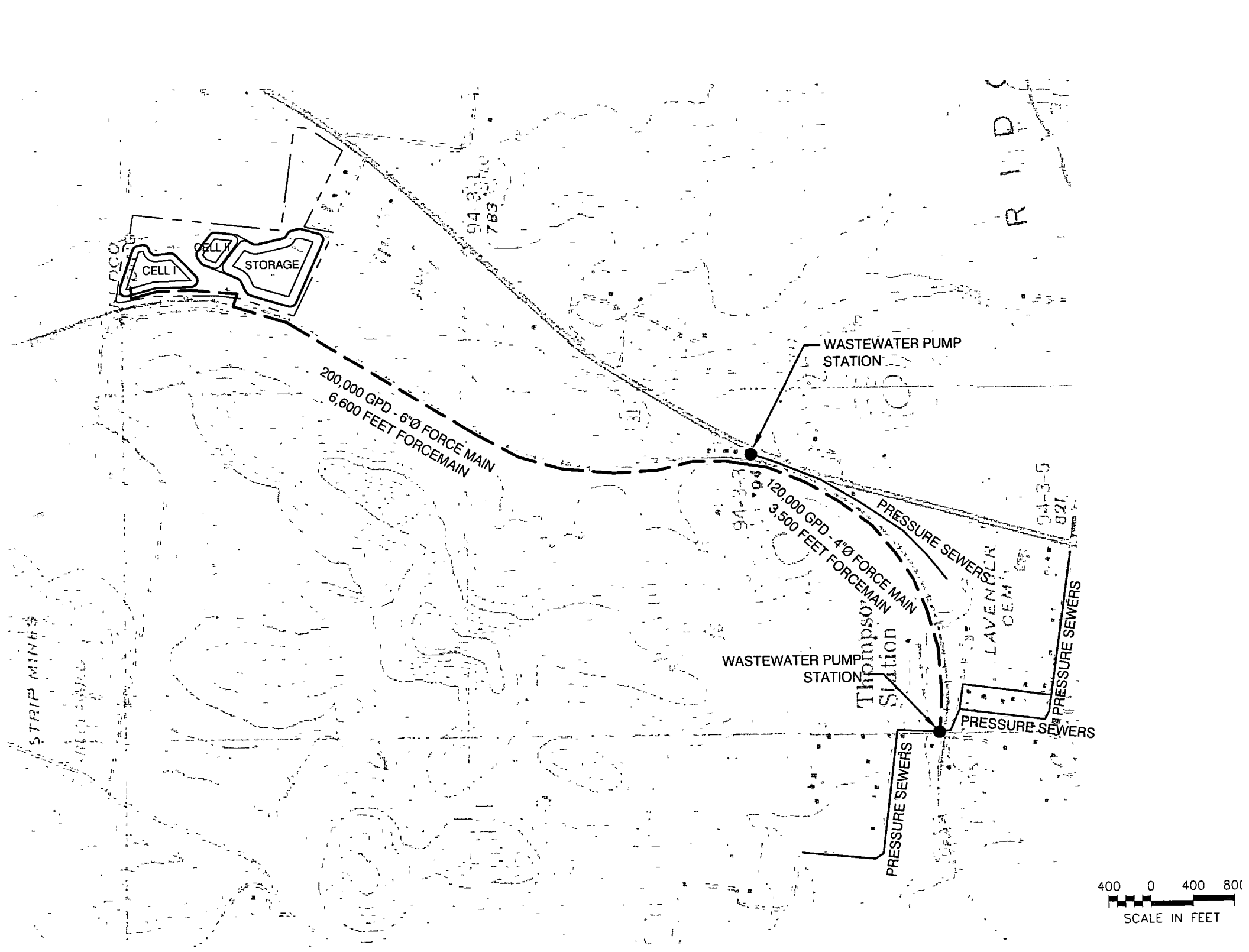
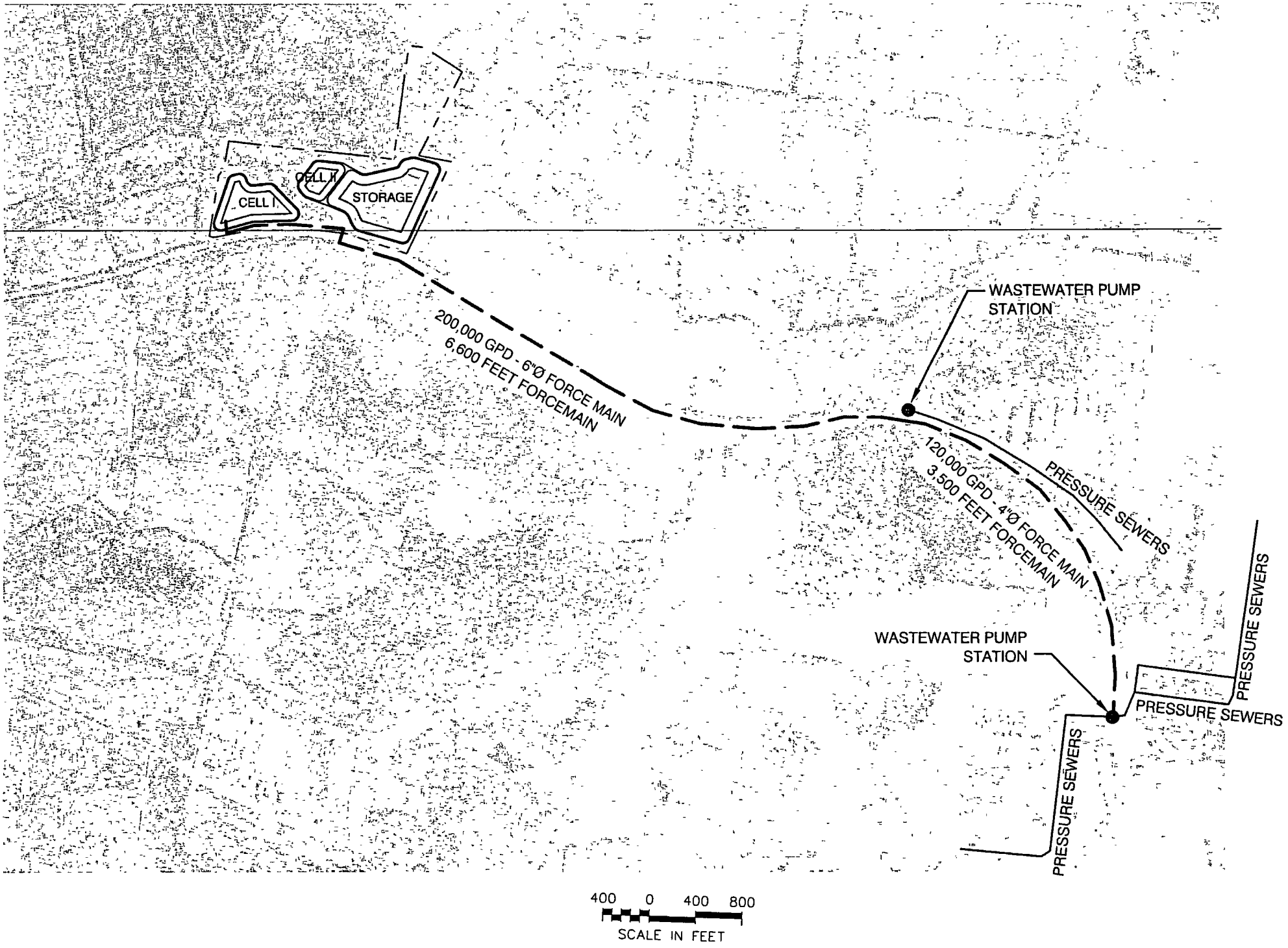


FIGURE 1:
VICINITY MAP
PROPOSED SHEAFFER RECLAMATION & REUSE SYSTEM
CARTWRIGHT CREEK UTILITY DISTRICT
CARTWRITGHT CREEK I – NASHVILLE, TN
APRIL 2004 cartfig.dwg

Sheaffer
INTERNATIONAL LLC


2:1 VOL=26.3 MG
3' FREE/3' SOLIDS
TOP=740/BOTT=712
2:1 VOL=9.7 MG
3' FREE/3' SOLIDS
TOP=740/BOTT=712
3:1 VOL=56 MG
3' FREE/1' SOLIDS
TOP=740/BOTT=712


CELL I
CELL II
STORAGE
200,000 GPD - 6"Ø FORCE MAIN
6,600 FEET FORCEMAIN
WASTEWATER PUMP STATION
120,000 GPD - 4"Ø FORCE MAIN
3,500 FEET FORCEMAIN
PRESSURE SEWERS
WASTEWATER PUMP STATION
PRESSURE SEWERS
PRESSURE SEWERS
PRESSURE SEWERS
400 0 400 800
SCALE IN FEET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PRESSURE SEWERS
PRESSURE SEWERS
PRESSURE SEWERS
400 0 400 800
SCALE IN FEET