Rubin & Hays

ATTORNEYS AT LAW

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CHARLES S. MUSSON
W. RANDALL JONES
CHRISTIAN L. JUCKETT

March 15, 2017

RECEIVED

MAR 20 2017

Public Service Commission

Dr. Talina Mathews
Executive Director
Public Service Commission
P.O. Box 615
Frankfort, Kentucky 40602

Case No. 2017-00138

Re: Bronston Water Association Water Project - KRS 278.023

Dear Dr. Mathews:

Enclosed please find the original and ten (10) copies of the Application of Bronston Water Association for an Order approving increased rates, construction financing and issuing a Certificate of Public Convenience and Necessity pursuant to KRS 278.023.

Also enclosed are eleven (11) copies of the exhibits required pursuant to 807 KAR 5.069, and **the Preliminary and Final Engineering Reports, of which two copies are enclosed and a CD with the Plans and Specifications**.

If you need any additional information or documentation, please let us know.

Sincerely,

Rubin & Hays

By
W. Randall Jones

WRJ:jlm
Enclosures

cc: Deron S. Byrne, P.E.
Mr. Carter Stewart, Bronston Water Association
Mr. Clay McKnight, USDA, Rural Development

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

THE APPLICATION OF THE BRONSTON WATER ASSOCIATION FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY TO CONSTRUCT, FINANCE AND INCREASE RATES PURSUANT TO KRS 278.023	)))))	**) Case No. 2017-00138**

APPLICATION

This Application of the Bronston Water Association, Inc. ("Applicant"), respectfully shows:

1. That the Applicant is a non-profit water association of Wayne and Pulaski Counties, Kentucky, created and existing under and by virtue of Chapter 273 of the Kentucky Revised Statutes.

2. That the post office address of Applicant is:

Bronston Water Association, Inc.
c/o Ms. Vickie Ramsey, Office Manager
2013 Highway 90
Bronston, Kentucky 42518
Phone: (606) 561-5209
Fax: (606) 561-0102
email address: bronstonwater@gmail.com

3. That Applicant, pursuant to the provisions of KRS 278.023, seeks (i) a Certificate of Public Convenience and Necessity ("CPCN"), permitting Applicant to construct a waterworks improvement project (the "Project"); (ii) an Order approving increased water rates; and (iii) approval of the proposed plan of financing said Project.

4. That the Project consists of the (i) installation of approximately 21,760 linear feet of water line and associates appurtenances; and (ii) construction of a 500,000 gallon ground storage water tank.

5. That Applicant proposes to finance the construction of the Project through (i) the issuance of a $1,380,000 promissory note; and (ii) a USDA, Rural Development ("RD") grant in the amount of $458,000. Applicant has a commitment from RD to purchase said $1,380,000 note

maturing over a 40-year period, at an interest rate not to exceed 1.875% per annum as set out in the RD Letter of Conditions, as amended, filed herewith as an Exhibit.

6. That Applicant does not contemplate having the Project constructed with any deviation from minimum construction standards of this Commission.

7. That Applicant files herewith the following Exhibits pursuant to 807 KAR 5:069, Section 2 in support of this Application:

A. Copy of RD Letter of Conditions, as amended (**Exhibit "A"**).

B. Copy of RD Letter of Concurrence in Contract Award (**Exhibit "B"**).

C. Copy of Preliminary Engineering Report, Final Engineering Report and certified bid tabulations.

D. Certified statement from the President of Applicant **(Exhibit "C")**, based upon statements of the Engineers for Applicant, concerning the following:

(1) The proposed plans and specifications for the Project have been designed to meet the minimum construction and operating requirements set out in 807 KAR 5:066 Section 4(3) and (4); Section 5(1); Sections 6 and 7; Section 8(1) through (3); Section 9(1) and Section 10.

(2) All other state approvals or permits have been obtained;

(3) The proposed rates of Applicant shall produce the total revenue requirements recommended in the engineering reports; and

(4) Setting out the dates when it is anticipated that construction will begin and end.

8. That Applicant has complied with the "public postings" requirement of 807 KAR 5:069, Section 3(1)(a) and (b) by posting a copy of the Notice of Proposed Rate Change (the "Notice") (i) at its place of business; and (ii) within five (5) business days of the date this Application is submitted to the Commission, on it's website (www.bronstonwater.com) along with a hyperlink to the location on the Commission's website where the case documents are available. Applicant has also arranged for the publication, prior to or at the same time this Application is filed, of the Notice pursuant to 807 KAR 5:069, Section 3(2) in the newspapers of general circulation in Applicant's service area. Said Notice sets out the content requirements of 807 KAR 5:069, Section 3(4). A copy of said Notice is filed herewith as **Exhibit "D"**. Applicant shall file with this Commission no later than fifteen (15) days from the date this Application was initially filed, an affidavit and tearsheet from the publisher as required by 807 KAR 5:069 Section 3(3)(b).

9. That the foregoing constitutes the documents necessary to obtain the approval of this Commission in accordance with Section 278.023 of the Kentucky Revised Statutes and in accordance with the "Filing Requirements" specified in 807 KAR 5:069, Section 2.

WHEREFORE, Applicant, the Bronston Water Association, Inc., asks that the Public Service Commission of the Commonwealth of Kentucky grant to Applicant the following:

a. A Certificate of Public Convenience and Necessity permitting Applicant to construct a water system improvements project.

b. An Order approving the financing arrangements made by Applicant, viz., (i) the issuance of a $1,380,000 promissory note at an interest rate not to exceed 1.875% per annum; and (ii) an RD grant in the amount of $458,000.

c. An Order approving the proposed water rates as set out in Section 29 of the RD Letter of Conditions, as amended, filed herewith as an Exhibit.

Bronston Water Association, Inc.

By: _____
President
Board of Directors

_____
W. Randall Jones, Esq.
Rubin & Hays
Counsel for Applicant
Kentucky Home Trust Building
450 South Third Street
Louisville, Kentucky 40202
Phone: (502) 569-7534
Fax: (502) 569-7555
wrjones@rubinhays.com

COMMONWEALTH OF KENTUCKY)
) SS:
COUNTY OF PULASKI)

The undersigned, Carter Stewart, being duly sworn, deposes and states that he is the President of the Board of Directors of the Bronston Water Association, Inc., Applicant, in the above proceedings; that he has read the foregoing Application and has noted the contents thereof; that the same is true of his own knowledge, except as to matters which are therein stated on information or belief, and as to those matters, he believes same to be true.

IN TESTIMONY WHEREOF, witness the signature of the undersigned on this March 10, 2017.

Carter Stewart

Carter Stewart, President
Bronston Water Association, Inc.

Subscribed and sworn to before me by Carter Stewart, President of the Board of Directors of the Bronston Water Association, Inc., on this March 10, 2017.

My Commission expires: 12/17/17.

Victoria Ramsey

Notary Public

USDA

United States Department of Agriculture

March 2, 2016

Charles Cassada, President
Bronston Water Association, Inc.
P.O. Box 243
Bronston, Kentucky 42518

Dear Mr. Cassada:

This letter establishes conditions which must be understood and agreed to by you before further consideration may be given to the application. The loan/grant will be administered on behalf of the Rural Utilities Service (RUS) by the State and Area office staff of USDA Rural Development. Any changes in project cost, source of funds, scope of services or any other significant changes in the project or applicant must be reported to and approved by USDA Rural Development, by written amendment to this letter. Any changes not approved by Rural Development shall be cause for discontinuing processing of the application. It should also be understood that Rural Development is under no obligation to provide additional funds to meet an overrun in construction costs.

This letter is not to be considered as loan or grant approval or as a representation as to the availability of funds. The docket may be completed on the basis of a RUS loan not to exceed $1,380,000; and a RUS grant not to exceed $458,000.

Project Description – funds will be used to replace approximately 5.2 miles of 6 and 3 inch water line demolition and replacement of an existing 500,000 gallon tank.

If Rural Development makes the loan, the interest rate will be the lower of the rate in effect at the time of loan approval or the rate in effect at the time of loan closing, unless the applicant otherwise chooses. The loan will be considered approved on the date a signed copy of Form RD 1940-1, "Request for Obligation of Funds," is mailed to you.

Please complete and return the attached Form RD 1942-46, "Letter of Intent to Meet Conditions," if you desire that further consideration be given to your application.

The "Letter of Intent to Meet Conditions" must be executed within three weeks from the date of this letter or it becomes invalid unless a time extension is granted by Rural Development.

If the conditions set forth in this letter are not met within 240 days from the date hereof, Rural Development reserves the right to discontinue the processing of the application. In signing Form RD 1942-46, "Letter of Intent to Meet Conditions," you are agreeing to complete the following as expeditiously as possible:

1. Number of Users and Their Contribution:

   There shall be 1792 water users, of which 1780 are existing users and 12 are new users. The Area Director will review and authenticate the number of users prior to advertising for construction bids.

2. Grant Agreement:

   Attached is a copy of RUS Bulletin 1780-12, "Water and Waste System Grant Agreement," for your review. You will be required to execute a completed form at the time of grant closing.

3. Drug-Free Work Place:

   Prior to grant closing, the Association will be required to execute Form AD-1049, "Certification Regarding Drug-Free Workplace Requirements (Grants) Alternative I - For Grantees Other Than Individuals."

4. Repayment Period:

   The loan will be scheduled for repayment over a period not to exceed 40 years from the date of the Promissory Note. Principal payment will not be deferred for a period in excess of two years from the date of the Promissory Note. The Association may be required to adopt a supplemental payment agreement providing for monthly payments of principal and interest so long as the Promissory Note is held or insured by RUS. Monthly payments will be approximate amortized installments.

5. Recommended Repayment Method:

   Payments on this loan shall be made using the Preauthorized Debit (PAD) payment method. This procedure eliminates the need for paper checks and ensures timely receipt of RD loan payments. To initiate PAD payments, Form RD 3550-28, "Authorization Agreement for Preauthorized Payments," should be signed by the Association to authorize the electronic withdrawal of funds from your designated bank account on the exact installment payment due date. The Area Director will furnish the necessary forms and further guidance on the PAD procedure.

6. Reserve Accounts:

   Reserves must be properly budgeted to maintain the financial viability of any operation. Reserves are important to fund unanticipated emergency maintenance, pay for repairs, and assist with debt service should the need arise.

   The Association will be required to deposit $430 per month into a "Funded Debt Reserve Account" until the account reaches $51,600. The deposits are to be resumed any time the account falls below the $51,600.

   The required monthly deposits to the Reserve Account and required Reserve Account levels are in addition to the requirements of the Association's prior loan resolutions.

The monthly deposits to the Reserve Account are required to commence with the first month of the first full fiscal year after the facility becomes operational.

The Association also needs to fund an account for short-lived assets by depositing a sum of $3,635 monthly to the account. The funds in the short-lived asset account may be used by the Association as needed to replace or add short-lived assets in the Association's water system.

7. Security Requirements:

The loan will be secured by a real estate mortgage, a financing statement, and a pledge of gross water revenue, in the Loan Resolution and Financing Statement.

8. Land Rights and Real Property:

The Association will be required to furnish satisfactory title, easements, etc., necessary to install, maintain and operate the facility to serve the intended users. The pipelines will be on private rights-of-way where feasible. Easements and options are to be secured prior to advertising for construction bids.

9. Organization:

The Association will be legally organized under applicable KRS, which will permit them to perform this service, borrow, or repay money.

The Association must maintain a current registration of their Dun and Bradstreet Data Universal Numbering System (DUNS) number in SAM.gov (System for Award Management) in order to receive federal loan and/or grant financial assistance. This registration must be updated/renewed at least annually.

10. Business Operations:

The Association will be required to operate the system under a well-established set of resolutions, rules and regulations. A budget must be established annually and adopted by the Association after review by Rural Development. At no later than loan pre-closing, the Association will be required to furnish a prior approved management plan to include, as a minimum, provisions for management, maintenance, meter reading, miscellaneous services, billing, collecting, delayed payment penalties, disconnect/reconnect fees, bookkeeping, making and delivering required reports and audits.

11. Conflict of Interest Policy:

Prior to obligation of funds, you will certify in writing that your organization has in place an up-to-date written policy on conflict of interest. The policy will include, at a minimum: (1) a requirement for those with a conflict/potential conflict; (2) a prohibition of interested members of the applicant's governing body from voting on any matter in which there is a conflict, and (3) the specific process defining how the governing body will manage identified or potential conflicts.

You must also submit a disclosure of planned or potential transactions related to the use of Federal funds that may constitute or present the appearance of personal or organizational conflict of interest. Sample conflict of interest policies may be found at the National Council of Nonprofits website, https://www.councilofnonprofits.org/tools-resources/conflict-of-interest, or in Internal Revenue Service Form 1023, Appendix A, "Sample Conflict of Interest Policy," at http:www.irs.gov/pub/irs-pdf/i1023.pdf. Though these examples reference non-profit corporations, the requirement applies to all types of Agency borrowers.

Disclosure must be in the form of a written letter signed and dated by the applicant's official. A negative disclosure of the same format is required if no conflicts are anticipated.

Assistance in developing a conflict of interest policy is available through Agency-contracted technical assistance providers if desired.

12. Accounts, Records and Audits:

The Association will be required to maintain adequate records and accounts and submit annual budgets and year-end reports (annual audits)/statistical and financial reports, quarterly and annually, in accordance with subsection 1780.47 of RUS Instruction 1780.

The Association shall be required to submit a copy of its audit agreement for review and concurrence by Rural Development prior to pre-closing the loan.

13. Accomplish Audits for Years in Which Federal Financial Assistance is Received:

The Association will accomplish audits in accordance with OMB Circular A-133, during the years in which federal funds are received. The Association will provide copies of the audits to the Area Office and the appropriate Federal cognizant agency as designated by OMB Circular A-133.

14. Insurance and Bonding:

The following insurance and bonding will be required:

A. Adequate Liability and Property Damage Insurance including vehicular coverage, if applicable, must be obtained and maintained by the Association. The Association should obtain amounts of coverage as recommended by its attorney, consulting engineer and/or insurance provider.

B. Worker's Compensation - The Association will carry worker's compensation insurance for employees in accordance with applicable state laws.

C. Fidelity Bond - The Association will provide Fidelity Bond Coverage for all persons who have access to funds. Coverage may be provided either for all individual positions or persons, or through "blanket" coverage providing protection for all appropriate employees and/or officials. The amount of coverage required for all RUS loans is $167,000.

D. Real Property Insurance - The Association will obtain and maintain adequate fire and extended coverage on all structures including major items of equipment or machinery located in the structures. The amounts of coverage should be based on recommendations obtained by the Association from its attorney, consulting engineer and/or insurance provider. Subsurface lift stations do not have to be covered except for the value of electrical and pumping equipment therein.

E. Flood Insurance - The Association will obtain and maintain adequate coverage on any facilities located in special flood and mudslide prone areas.

15. Planning and Performing Development:

A. The engineer should not be authorized to commence work on final plans and specifications until a determination has been made that the project can be planned and constructed within the estimated cost shown in paragraph "25" of this letter. The engineer may then proceed to develop final plans and specifications to be completed no later than 210 days from this date, and prepare bid documents. The Area Director is prepared to furnish the necessary guide to follow so as to keep the project plans and documents within our guidelines and requirements. The project must be constructed by the design/bid/build method of construction. The project should not be advertised for construction bids until all easements and enforceable options have been obtained, and total funds are committed or available for the project.

B. The following documents will be submitted to Rural Development for review and must be concurred in by Rural Development prior to advertisement for construction bids:

1. Final plans, specifications and bid documents.
2. Applicant's letter on efforts to encourage small business and minority - owned business participation.
3. Legal Service Agreements.
4. Engineering Agreements.

Revision in these documents will be subject to Rural Development concurrence. Any agreements, contracts, etc. not reviewed and approved by Rural Development will not be eligible for payment from project funds or revenues from facilities financed by this Agency.

16. Civil Rights & Equal Opportunity:

You should be aware of and will be required to comply with other federal statute requirements including but not limited to:

A. Section 504 of the Rehabilitation Act of 1973:

Under Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), no handicapped individual in the United States shall, solely by reason of their handicap, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Rural Development financial assistance.

B. Civil Rights Act of 1964:

All borrowers are subject to, and facilities must be operated in accordance with, Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d et seq.) and Subpart E of Part 1901 of this Title, particularly as it relates to conducting and reporting of compliance reviews. Instruments of conveyance for loans and/or grants subject to the Act must contain the covenant required by paragraph 1901.202(e) of this Title.

C. The Americans with Disabilities Act (ADA) of 1990:

This Act (42 U.S.C. 12101 et seq.) prohibits discrimination on the basis of disability in employment, state and local government services, public transportation, public accommodations, facilities, and telecommunications. Title II of the Act applies to facilities operated by state and local public entities that provide services, programs, and activities. Title III of the Act applies to facilities owned, leased, or operated by private entities that accommodate the public.

D. Age Discrimination Act of 1975:

This Act (42 U.S.C. 6101 et seq.) provides that no person in the United States shall, on the basis of age, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.

E. Limited English Proficiency (LEP) under Executive Order 13166:

LEP statutes and authorities prohibit exclusion from participation in, denial of benefits of, and discrimination under Federally-assisted and/or conducted programs on the ground of race, color, or national origin. Title VI of the Civil Rights Act of 1964 covers program access for LEP persons. LEP persons are individuals who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English. These individuals may be entitled to language assistance, free of charge. You must take reasonable steps to ensure that LEP persons receive the language assistance necessary to have meaningful access to USDA programs, services, and information your organization provides. These protections are pursuant to Executive Order 13166 entitled, "Improving Access to Services by Persons with Limited English Proficiency" and further affirmed in the USDA Departmental Regulation 4330-005, "Prohibition Against National Origin Discrimination Affecting Persons with Limited English Proficiency in Programs and Activities Conducted by USDA."

Rural Development financial programs must be extended without regard to race, color, religion, sex, national origin, marital status, age, or physical or mental handicap.

17. Closing Instructions:

The Office of General Counsel, our Regional Attorney, will be required to write closing instructions in connection with this loan. Conditions listed therein must be met by the Association.

18. Compliance with Special Laws and Regulations:

The Association will be required to conform to any and all state and local laws and regulations affecting this type project.

19. Treatment Plant and System Operator:

The Association is reminded that the system operator must have an Operator's Certificate issued by the State.

20. Prior to Pre-Closing the Loan, the Association Will Be Required to Adopt:

A. Form RD 1942-8, "Resolution of Members or Stockholders."

B. Form RUS Bulletin 1780-28, "Loan Resolution Security Agreement."

C. Form RD 400-1, "Equal Opportunity Agreement."

D. Form RD 400-4, "Assurance Agreement."

E. Form AD-1047, "Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transaction."

F. Form RD 1910-11, "Applicant Certification Federal Collection Policies for Consumer or Commercial Debts."

G. RD Instruction 1940-Q, Exhibit A-1, "Certification for Contracts, Grants and Loans."

H. RUS Bulletin 1780-22, "Eligibility Certification."

21. Refinancing and Graduation Requirements:

The Association is reminded that if at any time it shall appear to the Government that the Association is able to refinance the amount of the RUS indebtedness then outstanding, in whole or in part, by obtaining a loan from commercial sources at reasonable rates and terms, upon the request of the Government, the Association will apply for and accept such loan in sufficient amount to repay the Government.

22. Commercial Interim Financing:

The Association will be required to use commercial interim financing for the project during construction for the RUS loan portion of the financing, if available at reasonable rates and terms.

Before the loan is closed, the Association will be required to provide Rural Development with statements from the contractor, engineer and attorneys that they have been paid to date in accordance with their contract or other agreements and, in the case of the contractor, that he has paid his suppliers and sub-contractors.

23. Disbursement of Project Funds:

A construction account for the purpose of disbursement of project funds (RUS) will be established by the Association prior to start of construction. The position of officials entrusted with the receipt and disbursement of RUS project funds will be covered by a "Fidelity Bond," with USDA Rural Development as Co-Obligee, in the amount of construction funds on hand at any one time during the construction phase.

For each "construction account" as established, if the amount of RUS loan and grant funds plus any applicant contributions or funds from other sources to be deposited into the account are expected to exceed $250,000 at any time, the financial institution will secure the amount in excess of $250,000 by pledging collateral with the Federal Reserve Bank in an amount not less than the excess in accordance with 7 CFR, 1902.7(a).

During construction, the Association shall disburse project funds in a manner consistent with subsection 1780.76 (e) of RUS Instruction 1780. Form RD 1924-18, "Partial Payment Estimate," or similar form approved by Rural Development, shall be used for the purpose of documenting periodic construction estimates, and shall be submitted to Rural Development for review and acceptance. Prior to disbursement of funds by the Association, the Board of Directors shall review and approve each payment estimate. All bills and vouchers must be approved by Rural Development prior to payment by the Association.

Form RD 440-11, "Estimate of Funds Needed for 30-Day Period Commencing _____," will be prepared by the Association and submitted to Rural Development in order that a periodic advance of federal cash may be requested.

Borrowers receiving federal loan and/or grant funds by EFT will have funds directly deposited to a specified account at a financial institution with funds being available to the recipient on the date of payment. The borrower should complete Form SF-3881, "Electronic Funds Transfer Payment Enrollment Form," for each account where funds will be electronically received. The completed form(s) must be received by Rural Development at least thirty (30) days prior to the first advance of funds.

Monthly audits of the Association's construction account records shall be made by Rural Development.

24. Disbursement of Grant Funds:

The RUS funds will be advanced as they are needed in the amount(s) necessary to cover the RUS proportionate share of obligations due and payable by the Association. Grant funds, upon receipt, must be deposited in an interest bearing account in accordance with 7 CFR part 3019 (as applicable). Interest earned on grant funds in excess of $250 (as applicable) per year will be submitted to RUS at least quarterly.

25. Cost of Facility:

Breakdown of Costs:

Development		$ 1,438,850
Legal and Administrative		25,000
Engineering		120,000
Interest		18,000
Environmental		22,000
Inspections		74,000
Contingencies		140,150
	TOTAL	$ 1,838,000

Financing:

RUS Loan		$ 1,380,000
RUS Grant		458,000
	TOTAL	$ 1,838,000

26. Construction Completion Timeframe:

All projects are required to be completed and all funds disbursed within five years of obligation. If funds are not disbursed within five years of obligation, you must submit a written waiver request with adequate justification of extenuating circumstances beyond your control for an extension of time. Any additional requests for waivers beyond the initial extension will be submitted through the State Office to the Assistant Administrator for concurrence decision.

27. Use of Remaining Project Funds:

After providing for all authorized costs, any remaining project funds will be considered to be RUS grant funds and refunded in proportion to participation in the project. If the amount of unused project funds exceeds the grants, that part would be RUS loan funds.

28. Proposed Operating Budget:

You will be required to submit to Rural Development a copy of your proposed annual operating budget that supports the proposed loan repayment prior to this agency giving you written authorization to proceed with the bidding phase. The operating budget should be based on a typical year cash flow, subject to completion of this project in the first full year of operation. Form RD 442-7, Operating Budget, or similar form may be utilized for this purpose.

29. Rates and Charges:

Rates and charges for facilities and services rendered by the Association must be at least adequate to meet cost of maintaining, repairing and operating the water system and meeting required principal and interest payments and the required deposits to debt service and/or depreciation reserve.

Water rates will be at least:

5/8" Meter

First	1,500	gallons @ $	20.75. - Minimum Bill.
All Over	1,500	gallons @ $	7.12. - per 1,000 gallons.

1" Meter

First	5,000	gallons @ $	43.68. - Minimum Bill.
All Over	5,000	gallons @ $	7.12. - per 1,000 gallons.

2" Meter

First	20,000	gallons @ $	115.66. - Minimum Bill.
All Over	20,000	gallons @ $	7.12. - per 1,000 gallons.

4" Meter

First	50,000	gallons @ $	268.06. - Minimum Bill.
All Over	50,000	gallons @ $	7.12. - per 1,000 gallons.

28. Water Purchase Contract:

The Association will submit a Water Purchase Contract for approval by Rural Development before advertising for construction bids. If the contract is not on Form RD 442-30, "Water Purchase Contract," the contract will require approval by our Regional Attorney. The contract must meet the requirements of subsection 1780.62 of RUS Instruction 1780.

29. Vulnerability Assessment/Emergency Response Plan (VA/ERP):

The Agency requires all financed water and wastewater systems to have a VA/ERP in place. Borrowers with existing systems must provide a certification that a VA/ERP has been completed prior to advertising for bids. The documents are not submitted to the Agency for VA/ERP requirements throughout the life of the loan.

30. Floodplain Construction:

The Association will be required to pass and adopt a Resolution or amend its By-Laws whereby the Association will deny any water service to any future customer wishing to build on or develop property located within a designated floodplain.
If a customer or developer requests service for construction in a designated floodplain, the customer or developer must provide evidence and a justification for approval by the

Association and Rural Development officials that there are no other alternatives to construction or development within the designated floodplain. The community must be a participant in the National Flood Insurance Program (NFIP) and the customer or developer must obtain the required permits prior to the tap on restrictions being waived.

31. Division of Water (DOW) Health & Sanitary Certification:

The Median Household Income (MHI) for the Association's service area qualifies this project for the poverty interest rate. A certification from the Division of Water stating this project will remove a health or sanitary problem will be required. This certification must be obtained prior to loan pre-closing.

32. Mitigation Measures:

A. The project shall be in compliance with all requirements noted in the Governor's Office for Local Development letter dated February 19, 2015, from Ms. Lee Nalley.

B. The design and construction shall be in compliance with the requirements of the U.S. Fish and Wildlife Service as requested by letter dated March 30, 2015, and signed by Virgil Lee Andrews, Jr., Field Supervisor.

C. The line design and construction shall be accomplished in a way that will leave flood plains and farmland without effect after construction is complete. The Army Corps of Engineers Nationwide Permit No. 12 applies to all floodplain and wetland utility line construction.

D. Any excavation by Contractor that uncovers a historical or archaeological artifact shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the State Historic Preservation Officer (SHPO).

E. The design and construction shall be in compliance with all local, state and federal environmental statutes, regulations and executive orders applicable to the project.

F. Best Management Practices shall be incorporated into the project design, construction, and maintenance.

33. Final Approval Conditions:

Final approval of this assistance will depend on your willingness, with the assistance of all your co-workers, to meet the conditions of this letter in an orderly and systematic manner. Then too, final approval will depend on funds being available.

If you desire to proceed with your application, the Area Director will allot a reasonable portion of time to provide guidance in application processing.

Sincerely,

THOMAS G. FERN
State Director

Enclosures

cc: Area Director - London, Kentucky
Lake Cumberland ADD – Russell Springs, Kentucky
Winter R. Huff - Monticello, Kentucky
Monarch Engineering - Lawrenceburg, Kentucky
PSC - ATTN: Jeff Derouen - Frankfort, Kentucky

USDA

United States Department of Agriculture

Rural Development

Kentucky State Office

771 Corporate Drive,
Suite 200
Lexington, KY
40503

Voice 859.224.7300
Fax 855.661.8335
TTY 859.224.7422

February 28, 2017

Carter Stewart
Bronston Water Association, Inc.
P.O. Box 243
Bronston, Kentucky 42518

Re: Letter of Conditions Dated March 2, 2016

Dear Mr. Stewart:

This letter shall serve as Amendment No. 1 to the Letter of Conditions dated March 2, 2016. The purpose of this amendment is to revise the rates and charges and make other editorial changes in accordance with current Rural Utilities Service (RUS) instructions.

Paragraph numbered "29" is revised to read as follows:

"29. Rates and Charges:

Rates and charges for facilities and services rendered by the Association must be at least adequate to meet cost of maintaining, repairing and operating the water system and meeting required principal and interest payments and the required deposits to debt service and/or depreciation reserve.

Water rates will be at least:

5/8" Meter

First	1,500	gallons @ $ 21.14. - Minimum Bill.
All Over	1,500	gallons @ $ 7.38. - per 1,000 gallons.

1" Meter

First	5,000	gallons @ $ 44.98. - Minimum Bill.
All Over	5,000	gallons @ $ 7.38. - per 1,000 gallons.

2" Meter

First	20,000	gallons @ $120.86. - Minimum Bill.
All Over	20,000	gallons @ $ 7.38. - per 1,000 gallons.

4" Meter

First	50,000	gallons @ $281.06. - Minimum Bill.
All Over	50,000	gallons @ $ 7.38. - per 1,000 gallons.

All other provisions of the referenced Letter of Conditions remain in full force and unchanged.

Sincerely,

JEFF JONES
Acting State Director

cc: Area Director - London, Kentucky
Lake Cumberland ADD – Russell Springs, Kentucky
Winter R. Huff - Monticello, Kentucky
Monarch Engineering - Lawrenceburg, Kentucky
PSC - ATTN: Talina Mathews - Frankfort, Kentucky

USDA
United States Department of Agriculture

Rural Development

Kentucky State Office

771 Corporate Drive,
Suite 200
Lexington, KY
40503

Voice 859.224.7300
Fax 859.224.7425
TTY 859.224.7422

February 17, 2017

SUBJECT: Bronston Water Association
2017 Water System Improvements
Contract Award Concurrence

TO: Area Office
London, Kentucky

Based on the bids received and the recommendation of the consulting engineer, Rural Development concurs in the award of subject contract to the low bidder on line work, Cumberland Pipeline, in the amount of $469,886, and the low bidder on the tank contract, Caldwell Tanks, Inc., in the amount of $548,000.

If you have any questions, please contact Julie Anderson, State Engineer, at (859) 224-7348.

Jeffrey Jones
Acting State Director
Rural Development

cc: Monarch

Randy Jones

CERTIFICATE OF PRESIDENT OF BRONSTON WATER ASSOCIATION, INC. AS TO STATEMENT REQUIRED BY SECTION 2(6) OF 807 KAR 5:069

I, Carter Stewart, hereby certify that I am the duly qualified and acting President of the Board of Directors of the Bronston Water Association, Inc., and that said Association is in the process of arranging to finance the construction of extensions, additions and improvements to the existing waterworks system of the Association (the "Project"), in cooperation with the Engineers for the Association, Monarch Engineering, Inc., Lawrenceburg, Kentucky.

Based on information furnished to me by said Engineers for the Association, I hereby certify as follows:

1. That the proposed plans and specifications for the Project have been designed to meet the minimum construction and operating requirements set out in 807 KAR 5:066, Section 4(3) and (4); Section 5(1); Sections 6 and 7; Section 8(1) through (3); Section 9(1) and Section 10.

2. That all other state approvals and/or permits have already been obtained.

3. That the rates of the Association shall produce the total revenue requirements set out in the engineering reports.

4. That it is now contemplated that construction of the Project will begin on or about May 11, 2017, and will end on or about February 11, 2018.

IN TESTIMONY WHEREOF, witness my signature this March 10, 2017.

Carter Stewart
President
Bronston Water Association, Inc.

STATE OF KENTUCKY)
) SS
COUNTY OF PULASKI)

Subscribed and sworn to before me by Carter Stewart, President of the Board of Directors of the Bronston Water Association, Inc., on this March 10, 2017.

Victoria Ramsey
Notary Public
In and For Said State and County

(Seal of Notary)

MY COMMISSION EXPIRES 12/17/17

NOTICE OF PROPOSED RATE CHANGE

In accordance with the requirements of the Kentucky Public Service Commission ("PSC") as set out in 807 KAR 5:069, Section 3, notice is hereby given to the customers of the Bronston Water Association ("Association") of a change in water rates for users of the Association's water system. The changes in water rates are required by the U.S. Department of Agriculture, acting through Rural Development ("RD") in connection with a loan by RD to the Association in the principal amount of $1,380,000 to be evidenced by the issuance by the Association of its promissory note in such amount, which RD has agreed to purchase provided the Association meets certain conditions of RD, including revising the water rates as set forth below:

Current Monthly Rates

5/8 x ¾ inch Meter		Monthly Rate
First	1,500 gallons	$17.93 Minimum Bill
Over	1,500 gallons	7.11 per 1,000 gallons

1 inch Meter		Monthly Rate
First	5,000 gallons	$41.77 Minimum Bill
Over	5,000 gallons	7.11 per 1,000 gallons

2 inch Meter		Monthly Rate
First	20,000 gallons	$117.65 Minimum Bill
Over	20,000 gallons	7.11 per 1,000 gallons

4 inch Meter		Monthly Rate
First	50,000 gallons	$277.85 Minimum Bill
Over	50,000 gallons	7.11 per 1,000 gallons

Proposed Monthly Water Rates

	5/8 x ¾ inch Meter	New Monthly Rate	Dollar Change	% Change
First	1,500 gallons	$21.14 Minimum Bill	$3.21	18.00%
Over	1,500 gallons	7.38 per 1,000 gallons	0.27	3.80%

	1 inch Meter	New Monthly Rate	Dollar Change	% Change
First	5,000 gallons	$44.98 Minimum Bill	$3.21	7.70%
Over	5,000 gallons	7.38 per 1,000 gallons	0.27	3.80%
	2 inch Meter	New Monthly Rate	Dollar Change	% Change
First	20,000 gallons	$120.86 Minimum Bill	$3.21	2.73%
Over	20,000 gallons	7.38 per 1,000 gallons	0.27	3.80%
	4 inch Meter	New Monthly Rate	Dollar Change	% Change
First	50,000 gallons	$281.06 Minimum Bill	$3.21	1.15%
Over	50,000 gallons	7.38 per 1,000 gallons	2.19	3.80%

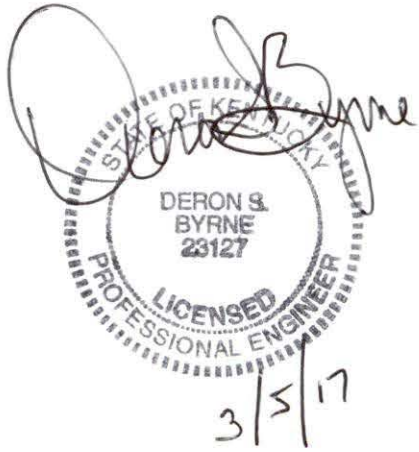
The proposed monthly water rates shall be effective for water sold after the date of the final approving Order of the PSC, which Order is expected to be issued no later than 30 days of the filing of the Application. The amount of average usage for all customers in the calendar year 2016 was 3,200 gallons per month thus generating an average monthly billing based on current rates of $30.01. The proposed monthly rates will increase the average monthly billing to $33.69 for an impact of $3.68 or 12.26%. The Application for approval of the rate change has been filed with the PSC and may be examined during normal business hours at the following locations: (i) Bronston Water Association Office, 2013 Highway 90, Bronston, KY 42518; (ii) PSC, 211 Sower Boulevard, Frankfort, Kentucky, Monday through Friday, 8:00 a.m. to 4:30 p.m., E.T.; and (iii) via the PSC website at http://psc.ky.gov. Comments regarding the Application may be submitted to the PSC via its website or by mail to PSC, P.O. Box 615, Frankfort, Kentucky 40602.

The proposed rates are required under the terms of an agreement between the Association and RD and KRS 278.023 does not grant the PSC any discretionary authority to modify or reject any portion of the agreement between the Association and RD, or to defer the issuance of all necessary orders to implement the terms of the agreement. The RD loan proceeds will be used in conjunction with a $458,000 RD grant to finance the costs of the (i) installation of approximately 21,760 linear feet of water line and associated appurtenances and (ii) construction of a 500,000 gallon ground storage water tank. Signed: Carter Stewart, President, Bronston Water Association.

PRELIMINARY ENGINEERING REPORT FOR THE BRONSTON WATER ASSOCIATION 2017 WATER SYSTEM IMPROVEMENTS: CONTRACT 1 -GREEN HILL ESTATES & CEDAR HILL HTS. CONTRACT 2 - 500,000 GALLON GROUND WATER STORAGE TANK REPLACEMENT

JANUARY 2015
REVISED DECEMBER 2015
REVISED FEBRUARY 2017

Monarch Engineering, Inc.



PRELIMINARY ENGINEERING REPORT
FOR THE
BRONSTON WATER ASSOCIATION
2017 WATER SYSTEM IMPROVEMENTS:
CONTRACT 1 -GREEN HILL ESTATES & CEDAR HILL HTS.
CONTRACT 2 - 500,000 GALLON GROUND WATER STORAGE
TANK REPLACEMENT

JANUARY 2015
REVISED DECEMBER 2015
REVISED FEBRUARY 2017

PRELIMINARY ENGINEERING REPORT

BRONSTON WATER ASSOCIATION
2017 WATER SYSTEM IMPROVEMENTS:
CONTRACT 1 -GREEN HILL ESTATES & CEDAR HILL HTS.
CONTRACT 2 - 500,000 GALLON GROUND WATER STORAGE TANK REPLACEMENT
PULASKI COUNTY, KENTUCKY

I. GENERAL

This Preliminary Engineering Report is intended to analyze the proposed water system replacements and improvements that are being planned by the Bronston Water Association to serve residential customers in Pulaski County with potable drinking water. The project includes the construction of 11,300 LF of 6-inch water line to replace an existing 3-inch water line in the Green Hill Estates area; 3,600 LF of 6-inch water line and 8,400 LF of 3-inch water line to replace existing 6-inch and 3-inch water lines in the Cedar Hill Heights area; 4,180 LF of 3-inch water line to replace existing 3-inch water lines along Old Schoolhouse Road and Denny Lane, all of Bronston, Kentucky. The project also consists of the replacement of an existing 500,000 gallon ground water storage tank

II. PROJECT PLANNING AREA

The proposed water line replacements and improvements will take place along the Green Hill Estates area, Cedar Hill Heights area, Old Schoolhouse Road, and Denny Lane. The majority of the project involves the replacement of approximately 16,180 LF of an existing 6-inch and 3-inch deteriorating water lines, and 11,300 LF of undersized water line.

The proposed water tank replacement will take place along the Kentucky Highway 90 area. The majority of the project involves the demolition of an existing 500,000 gallon ground water storage tank and the erection of a 500,000 gallon ground water storage tank. The proposed site for the water storage tank is in the exact location of the existing 500,000 gallon ground water storage tank.

It is not anticipated that a significant growth pattern will emerge as a result of the implementation of a water line replacement but rather that the standard of living for those residents will be greatly improved. It is anticipated that 159 homes will be immediately affected by the water line replacement and improvements project, and approximately 1,700 homes affected by the water storage tank replacement. The proposed service area is shown on the attached maps.

III. EXISTING FACILITIES

The Bronston Water Association owns and operates the water distribution system that serves nearly the entire rural portion of southwest Pulaski County and portions of northeast Wayne County. The Association purchases all water for resale from the City of Monticello which has more than sufficient water treatment capacity to serve the proposed improvement. A contract amendment has been agreed upon to allow for the purchase of unlimited water.

IV. NEED FOR THE PROJECT

The replacement of the existing water lines that are deteriorating and/or undersized with new upgraded water lines will help distribute ample water to the areas which currently are experiencing continuous water leaks. These leaks are difficult to find at times which requires a number of days to find leading to low water pressure, storage tanks draining, and taste problems.

The replacement of the 500,000 gallon ground water storage tank in the Kentucky Highway 90 area is proposed based on the failure sealant and coating product of the interior of the tank. The glass-lined ground storage tank will require a major overhaul in the form of some major interior surface repair and panel replacement due to sealant and coating failure. Due to the cost involved in the repair of the structure, and the Association's desire to continue to maintain an adequate level of service that will continue into the future, the best alternative is that which will replace the structure with a new painted steel tank.

V. ALTERNATIVES CONSIDERED

Based on the need for potable water due to the continued demand for service and also the growth within the project area, the Bronston Water Association must take the necessary steps to continue to provide service as required by the Kentucky Division of Water and the Kentucky Public Service Commission. The final project scope determination was centered on meeting existing and future customer demands without significantly burdening the Association's ability to meet its current and future financial obligations.

Considering the unsuitable condition of the existing water lines scheduled to be replaced through this project, there are no other technically feasible alternatives to correct the situation. If this association could take no action, this would however result in costly regular repairs and an unsuitable conditions for the existing residents being served by the water lines.

The primary alternatives explored was the replacement of additional sections of problematic water lines along Frazier Chapel Road and Kentucky Highway 1568 off of Kentucky Highway 90 in Wayne County, and Twin Rivers Circle and Woodland Grove Road off of Kentucky Highway 790 east of Bronston. The inclusion of these additional line replacements would have incorporated the construction of an additional 25,200 L.F. of 3" water line and appurtenances into the project. Similar to the existing mains in the Green Hill Estates area, Cedar Hill Heights

area, Old Schoolhouse Road, and Denny Lane, the condition of the existing lines along Frazier Chapel Road, Kentucky Highway 1568, Twin Rivers Circle, and Woodland Grove Road are poor, primarily due to substandard construction practices during the original installation. Accordingly, the lines are subject to frequent breaks, leaks and other emergency repair situations. It was determined that this additional work should be delayed so to decrease the debt service impact of the project. However, all or a portion may be completed if the as-bid construction cost of the project are less than anticipated herein.

VI. PROPOSED PROJECT

The proposed project consists of the construction of 11,300 LF of 6-inch water line to replace an existing 3-inch water line in the Green Hill Estates area and 3,600 LF of 6-inch water line and 8,400 LF of 3-inch water line to replace an existing 6-inch and 3-inch water lines in the Cedar Hill Heights area of Bronston, Kentucky. In addition, the project will include the replacement of approximately 3,200 LF of 3-inch water line along Old Schoolhouse Road and the replacement of approximately 980 LF of 3-inch water line along Denny Lane. In addition, the proposed project consists of the replacement of a 500,000 gallon water storage tank with a new 500,000 gallon water storage tank. An itemized cost estimate is included in this report and it outlines all of the individual construction items along with their associated unit costs. A summary cost estimate summarizes all of the project costs and outlines the funding scheme for the project which is also included in this report.

The project cost has been estimated to be $1,838,000 and it is to be financed by a grant from USDA Rural Development for $458,000 and a loan from USDA Rural Development for $1,380,000.

VII. CONCLUSIONS AND RECOMMENDATIONS

Based on the desperate need for the residents in these communities to have a potable water supply, it is recommended that the Bronston Water Association take the steps necessary to develop the potable water system so that this unhealthy situation can be resolved. The Bronston Water Association is the only major supplier of potable water in and around these areas and their system is situated such that these improvements as proposed can be made without adversely affecting service to their existing customers.

FINAL PROJECT BUDGET
BRONSTON WATER ASSOCIATION
PULASKI & WAYNE COUNTIES, KENTUCKY
2017 WATER SYSTEM IMPROVEMENTS
FEBRUARY 2, 2017

PROPOSED PROJECT COSTS

CONTRACT 1 - WATER LINE REPLACEMENTS	$469,886.60
CONTRACT 2 - 500,000 GALLON GROUND STORAGE TANK	548,000.00
DEVELOPMENT TOTAL	$1,017,886.60
CONTINGENCY	101,795.07
ENGINEERING DESIGN	89,879.39
CONSTRUCTION INSPECTION	56,798.07
PRELIMINARY ENGINEERING REPORT	10,000.00
ADDITIONAL ENGINEERING	10,000.00
ENVIRONMENTAL ASSESSMENT	22,000.00
LEGAL & ADMINISTRATION	25,000.00
INTEREST	18,000.00
2017 WATER SYSTEM IMPROVEMENTS - PHASE A (ATTACHED)	486,640.87
TOTAL PROJECT COSTS	**$1,838,000.00**

PROJECT FUNDING

USDA RURAL DEVELOPMENT LOAN (75%)	$1,380,000.00
USDA RURAL DEVELOPMENT GRANT (25%)	458,000.00
TOTAL PROJECT FUNDING	**$1,838,000.00**

FINAL COST ESTIMATE
BRONSTON WATER ASSOCIATION
WAYNE COUNTY, KENTUCKY
GREEN HILL ESTATES WATER LINE REPLACEMENT
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	6-Inch PVC SDR 21 Water Line	11,300 LF	$11.44	$129,272.00
2	Free Bore for 6-Inch WL	100 LF	18.00	1,800.00
3	6-Inch Gate Valve	2 EA	690.00	1,380.00
4	2-Way Flush Hydrant	2 EA	3,538.59	7,077.18
5	Connection	3 EA	1,347.00	4,041.00
6	Meter Reconnection	41 EA	299.00	12,259.00
7	3/4-Inch Service Tubing	2,020 LF	6.29	12,705.80
		Subtotal		**$168,534.98**

FINAL COST ESTIMATE
BRONSTON WATER ASSOCIATION
PULASKI COUNTY, KENTUCKY
CEDAR HILL HEIGHTS WATER LINE REPLACEMENTS
SUNSET DR, WALNUT DR, SYCAMORE DR, SOUTHPORT LN, & FORREST RIDGE RD
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	6-Inch PVC SDR 21 Water Line	3,600 LF	$11.44	$41,184.00
2	3-Inch PVC SDR 21 Water Line	8400 LF	10.07	84,588.00
3	Bore & Case For 6-Inch Water Line	120 LF	145.00	17,400.00
4	Bore & Case For 3-Inch Water Line	70 LF	149.00	10,430.00
5	6-Inch Gate Valve	3 EA	690.00	2,070.00
6	3-Inch Gate Valve	4 EA	509.00	2,036.00
8	2-Way Flush Hydrant	3 EA	3,538.58	10,615.74
9	Connection	7 EA	1,347.00	9,429.00
10	Meter Reconnection	80 EA	299.00	23,920.00
11	3/4-Inch Service Tubing	3,250 LF	6.29	20,442.50
		Subtotal		**$222,115.24**

FINAL COST ESTIMATE
BRONSTON WATER ASSOCIATION
PULASKI COUNTY, KENTUCKY
OLD SCHOOLHOUSE ROAD WATER LINE REPLACEMENT
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	3-Inch PVC SDR 21 Water Line	3,200 LF	$10.07	$32,224.00
2	Bore & Case For 3-Inch Water Line	40 LF	149.00	5,960.00
4	3-Inch Gate Valve	2 EA	509.00	1,018.00
5	2-Way Flush Hydrant	1 EA	3,538.59	3,538.59
6	Connection	2 EA	1,347.00	2,694.00
7	Meter Reconnection	3 EA	299.00	897.00
9	3/4-Inch Service Tubing	740 LF	6.29	4,654.60
		Subtotal		**$50,986.19**

FINAL COST ESTIMATE
BRONSTON WATER ASSOCIATION
PULASKI COUNTY, KENTUCKY
DENNY LANE WATER LINE REPLACEMENT
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	3-Inch PVC SDR 21 Water Line	980 LF	$10.07	$9,868.60
2	Bore & Case For 3-Inch Water Line	50 LF	149.00	7,450.00
3	3-Inch Gate Valve	2 EA	509.00	1,018.00
4	2-Way Flush Hydrant	1 EA	3,538.59	3,538.59
5	Connection	2 EA	1,347.00	2,694.00
6	Meter Reconnection	6 EA	299.00	1,794.00
7	3/4-Inch Service Tubing	300 LF	6.29	1,887.00
		Subtotal		**$28,250.19**

FINAL COST ESTIMATE
KENTUCKY HIGHWAY 90
CONTRACT 2 - 500,000 WATER STORAGE TANK REPLACEMENT
BRONSTON WATER ASSOCIATION
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	TOTAL COST
1	Foundation Concrete	1 LS	$128,000.00
2	Steel Tank Structure & Erection	1 LS	282,380.00
3	Tank Coating System	1 LS	77,620.00
4	Tank Disenfection	1 LS	5,000.00
5	Chain Link Fence	1 LS	14,000.00
6	Site Work	1 LS	9,000.00
7	Yard Piping & Appurtenances	1 LS	32,000.00
	SUBTOTAL		$548,000.00

PRELIMINARY COST ESTIMATE
BRONSTON WATER ASSOCIATION
PULASKI COUNTY, KENTUCKY
2017 WATER SYSTEM IMPROVEMENTS PHASE A
FEBRUARY 2017

PROPOSED PROJECT COSTS

DEVELOPMENT	$387,200.00
CONTINGENCY	38,645.35
ENGINEERING DESIGN (8.83%)	34,189.76
CONSTRUCTION INSPECTION (5.58%)	21,605.76
ENVIRONMENTAL ASSESSMENT	5,000.00
TOTAL PROJECT COSTS	**$486,640.87**

PRELIMINARY COST ESTIMATE
BRONSTON WATER ASSOCIATION
FRAZIER CHAPEL ROAD WATER LINE REPLACEMENT
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	3-Inch Water Line	8,800 LF	$10.00	$88,000.00
2	Bore & Case for 3-Inch WL	50 LF	150.00	7,500.00
3	3-Inch Gate Valve	4 EA	500.00	2,000.00
4	2-Way Flush Hydrant	2 EA	3,500.00	7,000.00
5	Connection	4 EA	1,500.00	6,000.00
6	Meter Reconnection	27 EA	300.00	8,100.00
7	3/4-Inch Service Tubing	675 LF	7.20	4,860.00
		Subtotal		**$123,460.00**

PRELIMINARY COST ESTIMATE
BRONSTON WATER ASSOCIATION
KENTUCKY HIGHWAY 1568 WATER LINE REPLACEMENT
FEBRUARY 2017

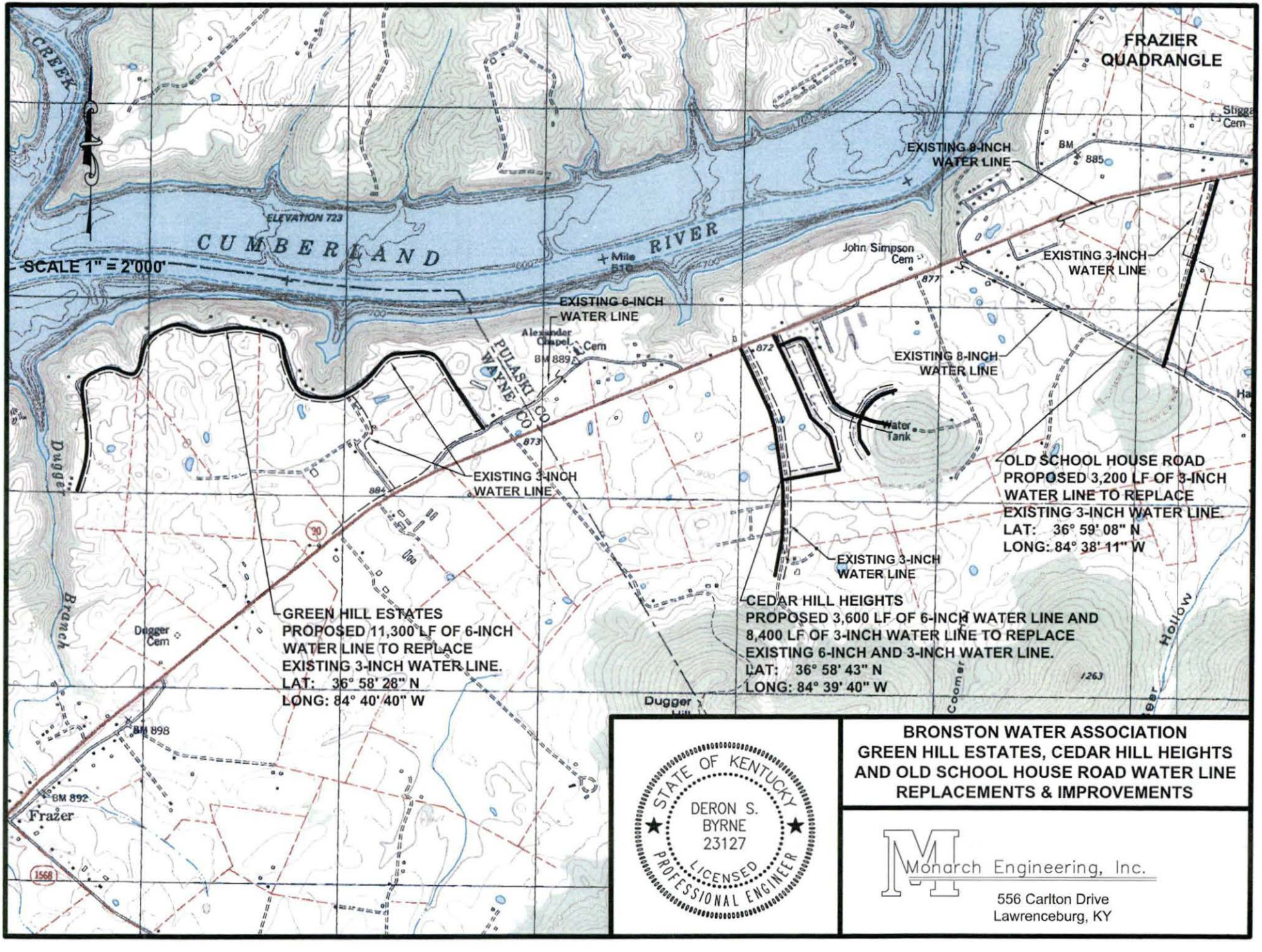
ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	3-Inch Water Line	11,200 LF	$10.00	$112,000.00
2	Bore & Case for 3-Inch WL	50 LF	150.00	7,500.00
3	3-Inch Gate Valve	3 EA	500.00	1,500.00
4	2-Way Flush Hydrant	2 EA	3,500.00	7,000.00
5	Connection	1 EA	1,500.00	1,500.00
6	Meter Reconnection	38 EA	300.00	11,400.00
7	3/4-Inch Service Tubing	950 LF	7.20	6,840.00
		Subtotal		**$147,740.00**

PRELIMINARY COST ESTIMATE
BRONSTON WATER ASSOCIATION
TWIN RIVERS CIRCLE WATER LINE REPLACEMENT
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	3-Inch Water Line	3,200 LF	$10.00	$32,000.00
2	Bore & Case for 3-Inch WL	100 LF	150.00	15,000.00
3	3-Inch Gate Valve	4 EA	500.00	2,000.00
4	2-Way Flush Hydrant	2 EA	3,500.00	7,000.00
5	Connection	2 EA	1,500.00	3,000.00
6	Meter Reconnection	28 EA	300.00	8,400.00
7	3/4-Inch Service Tubing	700 LF	7.20	5,040.00
		Subtotal		**$72,440.00**

PRELIMINARY COST ESTIMATE
BRONSTON WATER ASSOCIATION
WOODLAND GROVE ROAD WATER LINE REPLACEMENT
FEBRUARY 2017

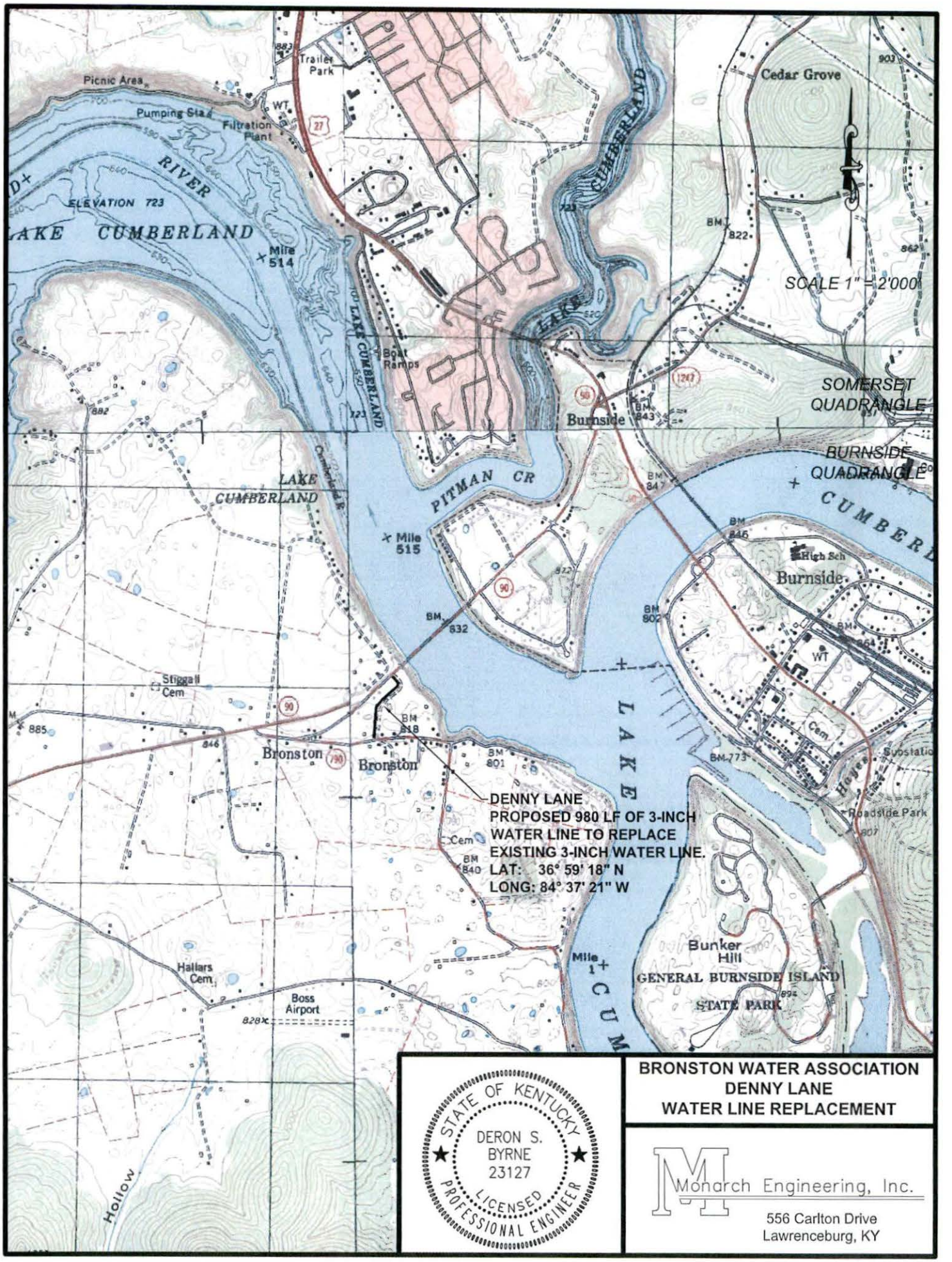
ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	3-Inch Water Line	2,000 LF	$10.00	$20,000.00
2	Bore & Case for 3-Inch WL	50 LF	150.00	7,500.00
3	3-Inch Gate Valve	1 EA	500.00	500.00
4	2-Way Flush Hydrant	1 EA	3,500.00	3,500.00
5	Connection	1 EA	1,500.00	1,500.00
6	Meter Reconnection	22 EA	300.00	6,600.00
7	3/4-Inch Service Tubing	550 LF	7.20	3,960.00
		Subtotal		**$43,560.00**



STATE OF KENTUCKY
DERON S. BYRNE
23127
LICENSED PROFESSIONAL ENGINEER

BRONSTON WATER ASSOCIATION
GREEN HILL ESTATES, CEDAR HILL HEIGHTS AND OLD SCHOOL HOUSE ROAD WATER LINE REPLACEMENTS & IMPROVEMENTS

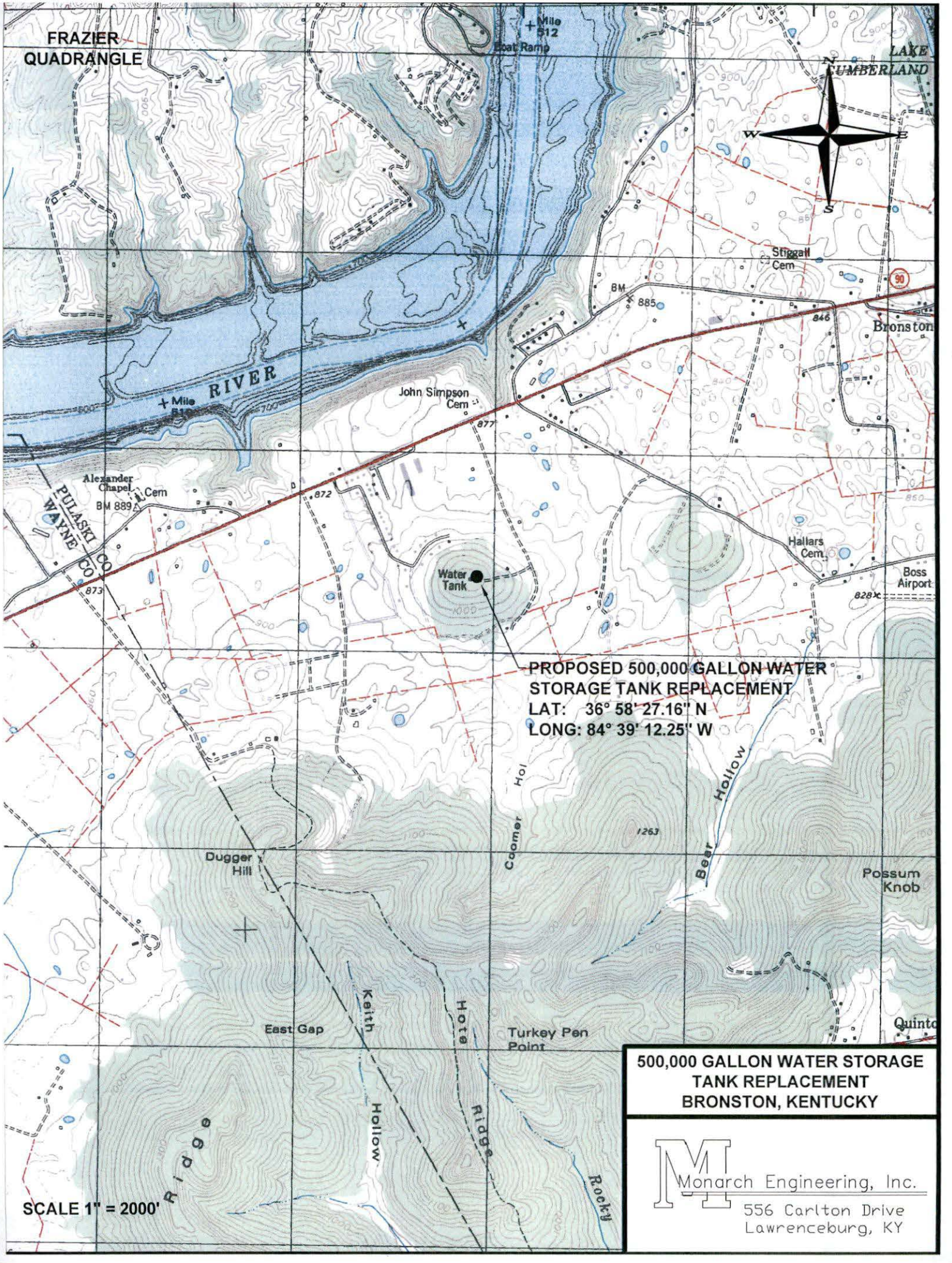
Monarch Engineering, Inc.
556 Carlton Drive
Lawrenceburg, KY



STATE OF KENTUCKY
DERON S. BYRNE
23127
LICENSED PROFESSIONAL ENGINEER

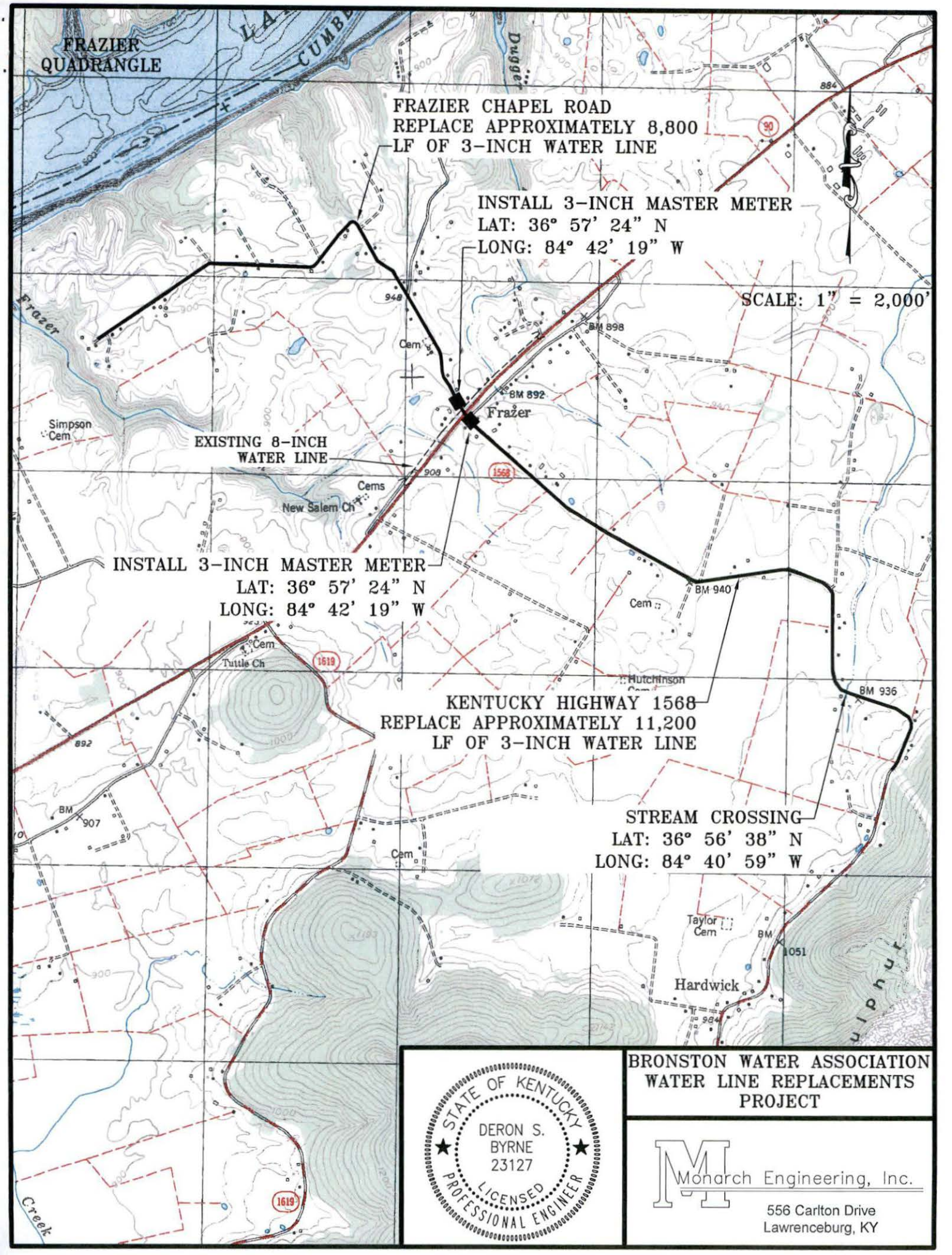
BRONSTON WATER ASSOCIATION
DENNY LANE
WATER LINE REPLACEMENT

Monarch Engineering, Inc.
556 Carlton Drive
Lawrenceburg, KY



500,000 GALLON WATER STORAGE TANK REPLACEMENT BRONSTON, KENTUCKY

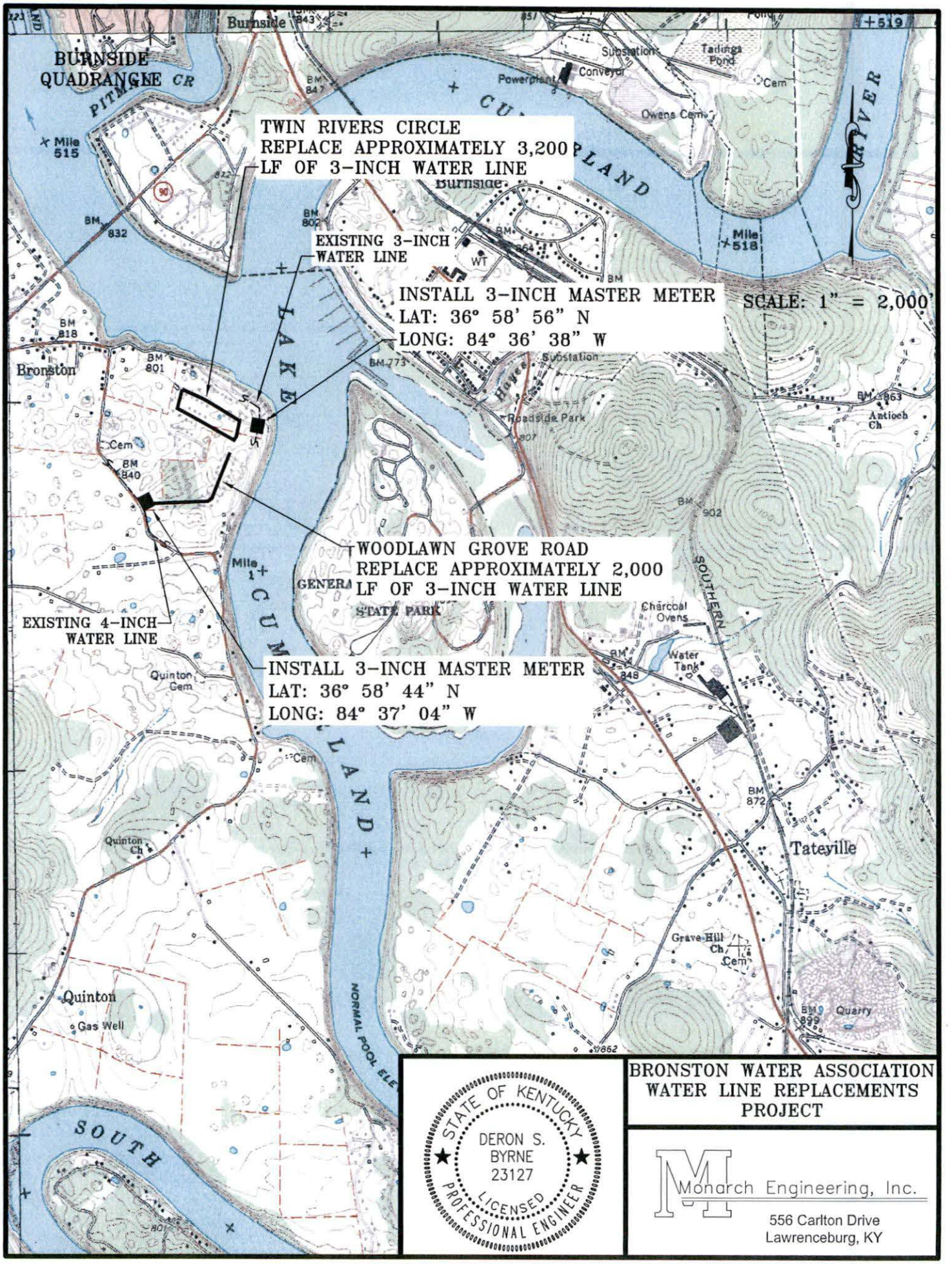
Monarch Engineering, Inc.
556 Carlton Drive
Lawrenceburg, KY



STATE OF KENTUCKY
DERON S. BYRNE
23127
LICENSED PROFESSIONAL ENGINEER

BRONSTON WATER ASSOCIATION
WATER LINE REPLACEMENTS PROJECT

Monarch Engineering, Inc.
556 Carlton Drive
Lawrenceburg, KY



STATE OF KENTUCKY
DERON S. BYRNE
23127
LICENSED PROFESSIONAL ENGINEER

BRONSTON WATER ASSOCIATION WATER LINE REPLACEMENTS PROJECT

Monarch Engineering, Inc.
556 Carlton Drive
Lawrenceburg, KY

FINAL ENGINEERING REPORT

RECEIVED
MAR 20 2017
Public Service Commission

2017 WATER SYSTEM IMPROVEMENTS:
CONTRACT 1 -GREEN HILL ESTATES & CEDAR HILL HTS.
CONTRACT 2 - 500,000 GALLON GROUND WATER STORAGE TANK REPLACEMENT

for the

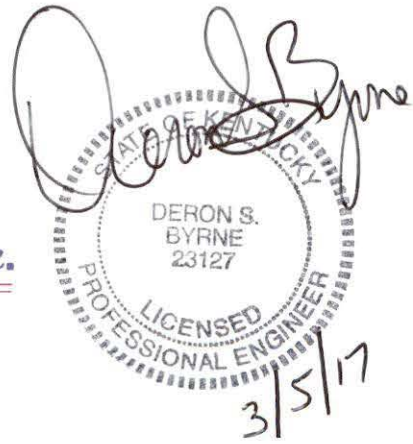
BRONSTON WATER ASSOCIATION

Project financed by:

U.S.D.A. RURAL DEVELOPMENT

February 3, 2017

Monarch Engineering, Inc.



FINAL ENGINEERING REPORT

2017 WATER SYSTEM IMPROVEMENTS:
CONTRACT 1 -GREEN HILL ESTATES & CEDAR HILL HTS.
CONTRACT 2 - 500,000 GALLON GROUND WATER STORAGE
TANK REPLACEMENT

for the

BRONSTON WATER ASSOCIATION

Project financed by:

U.S.D.A. RURAL DEVELOPMENT

February 3, 2017

Monarch Engineering, Inc.

February 3, 2017

Mr. Carter Stewart, President
Bronston Water Association
2013 Highway 90
PO Box 243
Bronston, Kentucky 42518

Re: Bronston Water Association
2017 Water System Improvements Project:
Contract 1 - Green Hill Estates & Cedar Hill Heights Water Line Replacements
Contract 2 – 500,000 Gallon Ground Water Storage Tank Replacement
RD Loan: $1,380,000.00
RD Grant: $ 458,000.00

Dear Mr. Stewart:

On February 2, 2017 bids were received by the Bronston Water Association for Water Line Replacements and a 500,000 Gallon Ground Water Storage Tank Replacement. Nine bids were submitted on Contract 1 - Green Hill Estates & Cedar Hill Heights Water Line Replacements project and the lowest bid was by Cumberland Pipeline, LLC located in Russell Springs, Kentucky for an amount of $469,886.60. Three bids were submitted with one bid being rejected due to plans were purchased by one party and bid by another party on Contract 2 - 500,000 Gallon Ground Water Storage Tank Replacement project. The lowest bid was submitted by Caldwell Tanks, Inc. located in Louisville, Kentucky for an amount of $548,000.00. The total combined amount results in a total construction cost of $1,017,886.60. This total construction cost would be within the total project budget as shown on the attached Final Project Budget. A copy of the summarized bid tabulation of all bids received is attached along with a final project budget.

In reviewing the Letter of Conditions dated March 2, 2016, the amount of funds available for development is $1,838,000.00. As indicated in the attached Final Project Budget, the total "as-bid" project costs are within the amount of allocated financing. Proceeding with a contract award to both low bidders would allow contingency funds in the amount of $588,435.94. Therefore, based on the competitive nature of the bids received, and the necessity of the proposed improvements, we recommend that the Bronston Water Association consider awarding a contract to Cumberland Pipeline, LLC for an amount of $469,886.60 for the Green Hill Estates & Cedar

Hill Heights Water Line Replacements project, and also to Caldwell Tanks, Inc. in the amount of $548,000.00 for the 500,000 Gallon Ground Water Storage Tank Replacement project. This recommendation is contingent upon approval by USDA Rural Development and the Kentucky Public Service Commission.

Given the substantial amount of contingency funds which are likely to remain following completion of the project, the inclusion of an additional project water line replacements and improvements phase should be considered. Gauging from preliminary discussions, it is recommended that all or a portion of these funds be used towards the replacement of water lines along Frazier Chapel Road, Kentucky Highway 1568, Twin Rivers Circle, and Woodland Grove Road. This recommendation is based on the deterioration and continuous leak maintenance of these existing water lines. In any case, further discussion regarding the use of the remaining funds should be undertaken between Bronston Water Association's management and Board of Directors. Please note that any additional improvements will require approval from both USDA Rural Development and the Kentucky Public Service Commission.

Sincerely,

Deron S. Byrne, P.E.
Project Engineer

/dsb

cc: Clay McKnight
USDA Rural Development, London

Julie Anderson
USDA Rural Development, Lexington

FINAL PROJECT BUDGET
BRONSTON WATER ASSOCIATION
PULASKI & WAYNE COUNTIES, KENTUCKY
2017 WATER SYSTEM IMPROVEMENTS
FEBRUARY 2, 2017

PROPOSED PROJECT COSTS

CONTRACT 1 - WATER LINE REPLACEMENTS	$469,886.60
CONTRACT 2 - 500,000 GALLON GROUND STORAGE TANK	548,000.00
DEVELOPMENT TOTAL	$1,017,886.60
CONTINGENCY	101,795.07
ENGINEERING DESIGN	89,879.39
CONSTRUCTION INSPECTION	56,798.07
PRELIMINARY ENGINEERING REPORT	10,000.00
ADDITIONAL ENGINEERING	10,000.00
ENVIRONMENTAL ASSESSMENT	22,000.00
LEGAL & ADMINISTRATION	25,000.00
INTEREST	18,000.00
2017 WATER SYSTEM IMPROVEMENTS - PHASE A (ATTACHED)	486,640.87
TOTAL PROJECT COSTS	**$1,838,000.00**

PROJECT FUNDING

USDA RURAL DEVELOPMENT LOAN (75%)	$1,380,000.00
USDA RURAL DEVELOPMENT GRANT (25%)	458,000.00
TOTAL PROJECT FUNDING	**$1,838,000.00**

PRELIMINARY COST ESTIMATE
BRONSTON WATER ASSOCIATION
PULASKI & WAYNE COUNTIES, KENTUCKY
2017 WATER SYSTEM IMPROVEMENTS PHASE A
FEBRUARY 2017

PROPOSED PROJECT COSTS

DEVELOPMENT	$387,200.00
CONTINGENCY	38,645.35
ENGINEERING DESIGN (8.83%)	34,189.76
CONSTRUCTION INSPECTION (5.58%)	21,605.76
ENVIRONMENTAL ASSESSMENT	5,000.00
TOTAL PROJECT COSTS	**$486,640.87**

PRELIMINARY COST ESTIMATE
BRONSTON WATER ASSOCIATION
FRAZIER CHAPEL ROAD WATER LINE REPLACEMENT
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	3-Inch Water Line	8,800 LF	$10.00	$88,000.00
2	Bore & Case for 3-Inch WL	50 LF	150.00	7,500.00
3	3-Inch Gate Valve	4 EA	500.00	2,000.00
4	2-Way Flush Hydrant	2 EA	3,500.00	7,000.00
5	Connection	4 EA	1,500.00	6,000.00
6	Meter Reconnection	27 EA	300.00	8,100.00
7	3/4-Inch Service Tubing	675 LF	7.20	4,860.00
		Subtotal		**$123,460.00**

PRELIMINARY COST ESTIMATE
BRONSTON WATER ASSOCIATION
KENTUCKY HIGHWAY 1568 WATER LINE REPLACEMENT
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	3-Inch Water Line	11,200 LF	$10.00	$112,000.00
2	Bore & Case for 3-Inch WL	50 LF	150.00	7,500.00
3	3-Inch Gate Valve	3 EA	500.00	1,500.00
4	2-Way Flush Hydrant	2 EA	3,500.00	7,000.00
5	Connection	1 EA	1,500.00	1,500.00
6	Meter Reconnection	38 EA	300.00	11,400.00
7	3/4-Inch Service Tubing	950 LF	7.20	6,840.00
		Subtotal		**$147,740.00**

PRELIMINARY COST ESTIMATE
BRONSTON WATER ASSOCIATION
TWIN RIVERS CIRCLE WATER LINE REPLACEMENT
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	3-Inch Water Line	3,200 LF	$10.00	$32,000.00
2	Bore & Case for 3-Inch WL	100 LF	150.00	15,000.00
3	3-Inch Gate Valve	4 EA	500.00	2,000.00
4	2-Way Flush Hydrant	2 EA	3,500.00	7,000.00
5	Connection	2 EA	1,500.00	3,000.00
6	Meter Reconnection	28 EA	300.00	8,400.00
7	3/4-Inch Service Tubing	700 LF	7.20	5,040.00
		Subtotal		**$72,440.00**

PRELIMINARY COST ESTIMATE
BRONSTON WATER ASSOCIATION
WOODLAND GROVE ROAD WATER LINE REPLACEMENT
FEBRUARY 2017

ITEM NO.	DESCRIPTION	QUANTITY	UNIT COST	TOTAL COST
1	3-Inch Water Line	2,000 LF	$10.00	$20,000.00
2	Bore & Case for 3-Inch WL	50 LF	150.00	7,500.00
3	3-Inch Gate Valve	1 EA	500.00	500.00
4	2-Way Flush Hydrant	1 EA	3,500.00	3,500.00
5	Connection	1 EA	1,500.00	1,500.00
6	Meter Reconnection	22 EA	300.00	6,600.00
7	3/4-Inch Service Tubing	550 LF	7.20	3,960.00
		Subtotal		**$43,560.00**

MONARCH ENGINEERING, INC.
556 Carlton Drive
Lawrenceburg, KY 40342
Phone (502) 839-1310
Fax (502) 839-1373

BID TABULATIONS
BRONSTON WATER ASSOCIATION
2017 WATER SYSTEM IMPROVEMENTS:
CONTRACT 1
GREENHILL ESTATES & CEDAR HILL HEIGHTS
WATER LINE REPLACEMENTS
PULASKI AND WAYNE COUNTIES, KENTUCKY
BID DATE: FEBRUARY 2, 2017 @ 11:00 A.M. LOCAL TIME

ITEM NO.	DESCRIPTION	QUANTITY	Cumberland Pipeline, LLC 4129 Highway 379 Russell Springs, KY 42642		D & H Contracting Co., Inc. 2003 Lakeview Dr. London, KY 40741		McGowan Excavating, Inc. 285 Richardson Rd. Nancy, KY 42544	
			UNIT PRICE	TOTAL COST	UNIT PRICE	TOTAL COST	UNIT PRICE	TOTAL COST
	BASE BID CONTRACT							
1	6-Inch PVC SDR-21 Water Line	17,690 LF	$12.10	$214,049.00	$11.00	$194,590.00	$10.97	$194,059.30
2	4-Inch PVC SDR-21 Water Line	60 LF	6.30	378.00	14.00	840.00	9.50	570.00
3	3-Inch PVC SDR-21 Water Line	4,010 LF	10.07	40,380.70	8.50	34,085.00	8.49	34,044.90
4	Bore & Case for 6-Inch Water Line	120 LF	145.00	17,400.00	140.00	16,800.00	98.28	11,793.60
5	Bore & Case for 4-Inch Water Line	40 LF	125.00	5,000.00	110.00	4,400.00	82.33	3,293.20
6	Bore & Case for 3-Inch Water Line	110 LF	149.00	16,390.00	110.00	12,100.00	77.59	8,534.90
7	Free Bore for 6-Inch Water Line	660 LF	18.00	11,880.00	40.00	26,400.00	52.53	34,669.80
8	Free Bore for 3-Inch Water Line	340 LF	15.00	5,100.00	40.00	13,600.00	52.53	17,860.20
9	6-Inch Gate Valve	8 EA	690.00	5,520.00	1,100.00	8,800.00	1,347.15	10,777.20
10	4-Inch Gate Valve	1 EA	560.00	560.00	900.00	900.00	1,112.20	1,112.20
11	3-Inch Gate Valve	6 EA	509.00	3,054.00	850.00	5,100.00	1,025.34	6,152.04
12	2-Inch Gate Valve	1 EA	412.00	412.00	750.00	750.00	853.80	853.80
13	2-Way Flush Hydrant Assembly	6 EA	3,543.00	21,258.00	3,500.00	21,000.00	2,977.78	17,866.68
14	Connection	12 EA	1,347.00	16,164.00	2,400.00	28,800.00	1,908.75	22,905.00
15	Meter Reconnection	124 EA	299.00	37,076.00	500.00	62,000.00	573.13	71,068.12
16	Meter Setting	4 EA	765.00	3,060.00	1,000.00	4,000.00	857.31	3,429.24
17	3/4-Inch PE Service Tubing	6,110 LF	6.29	38,431.90	5.00	30,550.00	7.11	43,442.10
18	Check Meter Assembly	3 EA	3,686.00	11,058.00	6,500.00	19,500.00	2,344.89	7,034.67
19	3/4-Inch Service Line Reconnection	5 EA	303.00	1,515.00	500.00	2,500.00	231.49	1,157.45
20	Exploration	40 HR	150.00	6,000.00	60.00	2,400.00	131.32	5,252.80
21	Pavement Replacement	200 LF	76.00	15,200.00	25.00	5,000.00	46.35	9,270.00
	TOTAL BASE BID			**$469,886.60**		**$494,115.00**		**$505,147.20**

THE ABOVE IS A TRUE AND COMPLETE TABULATION OF BIDS RECEIVED AT 11:00A.M. LOCAL TIME, THURSDAY, FEBRUARY 2, 2017 AT THE BRONSTON WATER ASSOCIATION.

BY: _____ 2.2.2017
Deron S. Byrne — Date

COMMONWEALTH OF KENTUCKY
DERON S. BYRNE
23127
LICENSED PROFESSIONAL ENGINEER

Project No. 1615

MONARCH ENGINEERING, INC.
556 Carlton Drive
Lawrenceburg, KY 40342
Phone (502) 839-1310
Fax (502) 839-1373

BID TABULATIONS
BRONSTON WATER ASSOCIATION
2017 WATER SYSTEM IMPROVEMENTS:
CONTRACT 1
GREENHILL ESTATES & CEDAR HILL HEIGHTS
WATER LINE REPLACEMENTS
PULASKI AND WAYNE COUNTIES, KENTUCKY
BID DATE: FEBRUARY 2, 2017 @ 11:00 A.M. LOCAL TIME

ITEM NO.	DESCRIPTION	QUANTITY	Stotts Construction Co., Inc. P.O. Box 1689 Columbia, KY 42728 UNIT PRICE	Stotts Construction Co., Inc. TOTAL COST	Flo-Line Contracting 189 Sunstar Blvd. Monticello, KY 42633 UNIT PRICE	Flo-Line Contracting TOTAL COST	Weddle Enterprises, Inc. 25 Shanes Lane Somerset, KY 42501 UNIT PRICE	Weddle Enterprises, Inc. TOTAL COST
	BASE BID CONTRACT							
1	6-Inch PVC SDR-21 Water Line	17,690 LF	$15.20	$268,888.00	$15.00	$265,350.00	$13.72	$242,706.80
2	4-Inch PVC SDR-21 Water Line	60 LF	14.50	870.00	12.00	720.00	19.42	1,165.20
3	3-Inch PVC SDR-21 Water Line	4,010 LF	13.00	52,130.00	11.00	44,110.00	14.85	59,548.50
4	Bore & Case for 6-Inch Water Line	120 LF	110.00	13,200.00	100.00	12,000.00	102.55	12,306.00
5	Bore & Case for 4-Inch Water Line	40 LF	110.00	4,400.00	100.00	4,000.00	94.59	3,783.60
6	Bore & Case for 3-Inch Water Line	110 LF	100.00	11,000.00	100.00	11,000.00	77.47	8,521.70
7	Free Bore for 6-Inch Water Line	660 LF	40.00	26,400.00	30.00	19,800.00	52.50	34,650.00
8	Free Bore for 3-Inch Water Line	340 LF	40.00	13,600.00	25.00	8,500.00	52.50	17,850.00
9	6-Inch Gate Valve	8 EA	1,200.00	9,600.00	800.00	6,400.00	776.50	6,212.00
10	4-Inch Gate Valve	1 EA	1,000.00	1,000.00	700.00	700.00	645.15	645.15
11	3-Inch Gate Valve	6 EA	1,100.00	6,600.00	650.00	3,900.00	600.00	3,600.00
12	2-Inch Gate Valve	1 EA	1,000.00	1,000.00	500.00	500.00	445.50	445.50
13	2-Way Flush Hydrant Assembly	6 EA	3,000.00	18,000.00	3,800.00	22,800.00	3,337.00	20,022.00
14	Connection	12 EA	1,400.00	16,800.00	1,500.00	18,000.00	1,594.00	19,128.00
15	Meter Reconnection	124 EA	300.00	37,200.00	575.00	71,300.00	215.75	26,753.00
16	Meter Setting	4 EA	1,000.00	4,000.00	800.00	3,200.00	705.00	2,820.00
17	3/4-Inch PE Service Tubing	6,110 LF	10.25	62,627.50	10.00	61,100.00	12.45	76,069.50
18	Check Meter Assembly	3 EA	4,000.00	12,000.00	4,500.00	13,500.00	3,278.30	9,834.90
19	3/4-Inch Service Line Reconnection	5 EA	200.00	1,000.00	500.00	2,500.00	85.50	427.50
20	Exploration	40 HR	100.00	4,000.00	100.00	4,000.00	500.00	20,000.00
21	Pavement Replacement	200 LF	20.00	4,000.00	30.00	6,000.00	65.00	13,000.00
	TOTAL BASE BID			$568,315.50		$579,380.00		$579,489.35

MONARCH ENGINEERING, INC.
556 Carlton Drive
Lawrenceburg, KY 40342
Phone (502) 839-1310
Fax (502) 839-1373

BID TABULATIONS
BRONSTON WATER ASSOCIATION
2017 WATER SYSTEM IMPROVEMENTS:
CONTRACT 1
GREENHILL ESTATES & CEDAR HILL HEIGHTS
WATER LINE REPLACEMENTS
PULASKI AND WAYNE COUNTIES, KENTUCKY
BID DATE: FEBRUARY 2, 2017 @ 11:00 A.M. LOCAL TIME

ITEM NO.	DESCRIPTION	QUANTITY	Twin States Utilities, Inc. P.O. Box 14 Mt. Hermon, KY 42157 UNIT PRICE	Twin States Utilities, Inc. TOTAL COST	United Pipeline, Inc. 150 Hill Road Tompkinsville, KY 42167 UNIT PRICE	United Pipeline, Inc. TOTAL COST	Akins Excavating Co., Inc. 182 Busy Lane Corbin, KY 40701 UNIT PRICE	Akins Excavating Co., Inc. TOTAL COST
	BASE BID CONTRACT							
1	6-Inch PVC SDR-21 Water Line	17,690 LF	$16.00	$283,040.00	$12.00	$212,280.00	$19.50	$344,955.00
2	4-Inch PVC SDR-21 Water Line	60 LF	14.00	840.00	12.00	720.00	18.50	1,110.00
3	3-Inch PVC SDR-21 Water Line	4,010 LF	13.00	52,130.00	10.00	40,100.00	16.75	67,167.50
4	Bore & Case for 6-Inch Water Line	120 LF	100.00	12,000.00	90.00	10,800.00	90.00	10,800.00
5	Bore & Case for 4-Inch Water Line	40 LF	100.00	4,000.00	85.00	3,400.00	92.00	3,680.00
6	Bore & Case for 3-Inch Water Line	110 LF	95.00	10,450.00	85.00	9,350.00	85.00	9,350.00
7	Free Bore for 6-Inch Water Line	660 LF	30.00	19,800.00	40.00	26,400.00	38.00	25,080.00
8	Free Bore for 3-Inch Water Line	340 LF	30.00	10,200.00	40.00	13,600.00	36.00	12,240.00
9	6-Inch Gate Valve	8 EA	850.00	6,800.00	1,000.00	8,000.00	1,150.00	9,200.00
10	4-Inch Gate Valve	1 EA	800.00	800.00	900.00	900.00	925.00	925.00
11	3-Inch Gate Valve	6 EA	700.00	4,200.00	800.00	4,800.00	850.00	5,100.00
12	2-Inch Gate Valve	1 EA	520.00	520.00	600.00	600.00	730.00	730.00
13	2-Way Flush Hydrant Assembly	6 EA	3,000.00	18,000.00	4,000.00	24,000.00	3,500.00	21,000.00
14	Connection	12 EA	2,300.00	27,600.00	2,000.00	24,000.00	2,525.00	30,300.00
15	Meter Reconnection	124 EA	400.00	49,600.00	600.00	74,400.00	305.00	37,820.00
16	Meter Setting	4 EA	800.00	3,200.00	1,000.00	4,000.00	850.00	3,400.00
17	3/4-Inch PE Service Tubing	6,110 LF	11.00	67,210.00	20.00	122,200.00	12.00	73,320.00
18	Check Meter Assembly	3 EA	6,000.00	18,000.00	4,000.00	12,000.00	3,425.00	10,275.00
19	3/4-Inch Service Line Reconnection	5 EA	320.00	1,600.00	200.00	1,000.00	540.00	2,700.00
20	Exploration	40 HR	100.00	4,000.00	45.00	1,800.00	360.00	14,400.00
21	Pavement Replacement	200 LF	30.00	6,000.00	80.00	16,000.00	31.00	6,200.00
	TOTAL BASE BID			**$599,990.00**		**$610,350.00**		**$689,752.50**

MONARCH ENGINEERING, INC.
556 Carlton Drive
Lawrenceburg, KY 40342
Phone (502) 839-1310
Fax (502) 839-1373

BID TABULATIONS
BRONSTON WATER ASSOCIATION
2017 WATER SYSTEM IMPROVEMENTS:
CONTRACT 2
500,000 GALLON GROUND WATER STORAGE TANK REPLACEMENT
PULASKI AND WAYNE COUNTIES, KENTUCKY
BID DATE: FEBRUARY 2, 2017 @ 11:00 A.M. LOCAL TIME

ITEM NO.	DESCRIPTION	QUANTITY	Caldwell Tanks, Inc. P.O. Box 35770 Louisville, KY 40232 UNIT PRICE	Caldwell Tanks, Inc. TOTAL COST	Engineering America, Inc. 1629 Industrial Parkway NW Bolivar, OH 44612 UNIT PRICE	Engineering America, Inc. TOTAL COST
	BASE BID CONTRACT					
1	500,000 Gallon Ground Storage Water Tank					
	1A) Foundation Concrete	1 LS	$128,000.00	$128,000.00	$241,639.00	$241,639.00
	1B) Steel Tank Structure & Erection	1 LS	282,380.00	282,380.00	306,250.00	306,250.00
	1C) Tank Coating System	1 LS	77,620.00	77,620.00	0.00	0.00
	1D) Tank Disinfection	1 LS	5,000.00	5,000.00	5,066.00	5,066.00
	1E) Chain Link Fence	1 LS	14,000.00	14,000.00	19,333.00	19,333.00
	1F) Site Work	1 LS	9,000.00	9,000.00	169,680.00	169,680.00
	1G) Yard Piping & Appurtenances	1 LS	32,000.00	32,000.00	44,761.00	44,761.00
	TOTAL BASE BID			**$548,000.00**		**$786,729.00**

THE ABOVE IS A TRUE AND COMPLETE TABULATION OF BIDS RECEIVED AT 11:00A.M. LOCAL TIME, THURSDAY, FEBRUARY 2, 2017 AT THE BRONSTON WATER ASSOCIATION.

BY: 

Deron S. Byrne

2.2.2017
Date

Project No. 1615

TECHNICAL SPECIFICATIONS
BRONSTON WATER ASSOCIATION
PULASKI COUNTY, KENTUCKY

2017 WATER SYSTEM IMPROVEMENTS:
CONTRACT 2
500,000 GALLON GROUND STORAGE WATER TANK
REPLACEMENT

PROJECT NO. 1615

JANUARY 2017

Monarch Engineering, Inc.

TABLE OF CONTENTS

SECTION 1 - WATER GROUND STORAGE TANK STRUCTURE

1.0 Work Included. Under this item, the CONTRACTOR shall furnish all labor, tools, materials and equipment to excavate and erect the storage tank of the size shown on the drawings complete with foundation and appurtenances. The Owner will accept a 1) steel welded type tank, or 2) steel bolted type tank.

The storage tank required under this item include:

John Gover Road Tank -	Nominal Capacity =	500,000 Gallons
	Nominal Diameter =	57' – 3"
	Sidewall Height =	26' - 0"
	High Water Elevation =	1084.00 Feet
	Finished Floor Elevation=	1058.00 Feet
	Control Valve Required	

The CONTRACTOR shall be responsible for the influent/effluent piping, overflow pipe, the tank drain line with appurtenances as shown on the Drawings. The CONTRACTOR will be responsible for the connection to the distribution line. The location of the tank drain line and overflow line shall be field located with the approval of the ENGINEER.

The CONTRACTOR will be responsible for the access road to the tank and all cleanup and seeding on the tank site.

1.1 Tank Foundation. The Contractor shall submit as a part of the shop drawings, a detailed analysis of the foundation on which the tank structure will be supported. This determination shall be as a result of the geotechnical information contained elsewhere in these Contract Documents. In the event that the Contractor is not satisfied that the geotechnical information is sufficient to ensure that the tank will safely rest on the subsurface, the Contractor shall perform additional investigations at his own cost.

The entire work area shall be stripped of all vegetation, roots, and boulders, and the area within which foundations are to be constructed shall be stripped of all top soil to a minimum of six inches deep and excavated until level within three inches. The entire leveled area shall be in layers not exceeding six inches in depth loose and compacted to 90% Modified Proctor. No filling to obtain grade shall be done without the ENGINEER'S supervision.

Concrete foundations from the top of the foundation to a depth of six inches below grade shall be formed with removable forms. From six inches below grade and downward, the foundations may be formed using the sides of the excavation. Concrete shall be Class "A" in accord with these specifications. Reinforcing steel shall conform to these specifications as described elsewhere.

The tops of all foundations shall be level and plane within one-quarter inch.

On ground storage tanks, after all forms and loose materials have been removed from the interior of the retainer ring, a minimum six-inch layer of No. 9 crushed limestone or dense grade aggregate shall be placed and compacted within six inches of the retainer ring surface. The remaining six inches of the interior shall be filled and compacted flush with the retainer ring bearing surface with an oil-bearing sand as recommended and approved by the tank manufacturer.

The prepared foundation shall be protected and kept dry until the floor of the tank is in place.

All areas that have been disturbed by construction or noted to be cleared on the drawings shall be cleared of underbrush and graded in a uniform and neat manner leaving the lot in a shape as near possible to the contours as shown on the construction drawings. All graded areas shall be left smooth and shall be sown with grasses as specified in other portions of these specifications.

Upon the completion of all construction of tank and tank foundations, the CONTRACTOR shall remove all debris and surplus construction material resulting from the work.

1.2 WELDED STEEL WATER STORAGE TANK

1.2.1 Welded Steel Storage Tank. The tank shall be furnished and erected in strict conformity with the current requirements of AWWA "Standard Specifications for Steel Tanks, Stand Pipes, Reservoirs and Elevated Tanks for Water Storage" latest revision. The tank shall be of welded construction.

Each storage tank shall be fabricated, transported and erected on the prepared foundation, as shown on the plans or approved shop drawings and as specified herein. The steel tanks shall be of the volume and dimensions shown in the plans and shall have a conical roof with a three-quarter inch in twelve inch pitch. Bottom plates, shell plates and top plates shall be of the thickness required, but in no case shall plates adjacent to stored water be less than one fourth (1/4) inch in thickness.

A fixed ladder shall be provided on the inside of the tank extending from the manhole in the roof to the bottom of the tank.

The tank shall be furnished with manholes, a vent and finial. A 24-inch diameter manhole shall be provided in the shell near the ground level. A second manhole meeting the requirements of AWWA D100 (latest revision) shall also be installed. Two roof hatches 24-inches square, with locking cover, shall be located over the inside ladder in the roof and the second shall be located near the center of the roof in accordance with AWWA D100.

The roof vent shall be capable of reducing dangerous air pressures that could develop by the maximum flow of water either leaving or entering the tank. The vent and finial may be combined. The overflow pipe shall not be considered as a tank vent. The vent and finial shall be so designed to prevent the ingress of birds, insects, and animals. All screening shall be corrosion resistant.

The storage tank shall be provided with an overflow as shown on the plans. The overflow shall be provided with a weir or funnel at the elevation of high water line. The overflow shall extend down the inside of the tank and discharge as shown on the Drawings.

All hinges, hasps, and similar items shall be constructed using corrosion resistant materials such as brass, stainless steel, or copper.

All tank construction shall be sufficient to meet the OSHA Standards. After the award of the contract, the CONTRACTOR shall furnish detailed plans of the structures, including detailed drawings for the foundations and vaults if different from that shown on the plans. The shop drawings shall show the thickness of plate and other data in connection with the work, and shall be submitted to the ENGINEER for review, and said review must be completed before any work is commenced. Shop drawings shall be furnished as required under other sections of these specifications.

The tank shall be painted in accordance with AWWA Standard D102 - Standard for Painting and Repainting Steel Tanks, Standpipes, Reservoirs and Elevated Tanks for Water Storage - latest revision. On the interior, the CONTRACTOR shall use a paint that is ANSI/NSF 61 Certified for use inside potable water storage tanks. CONTRACTOR shall submit for approval prior to painting, the paints to be used.

After painting has been completed and allowed to stand for at least 48 hours in good drying weather, the tank shall be sterilized in accordance with the provisions specified herein.

1.2.2.1.1 Cleaning and Painting. All paint, materials, and methods of cleaning to be used in the shop and field shall conform to the latest edition of American Water Works Association D 102 and as specified herein.

All materials shall be brought to the job site in the original sealed and labeled containers of the paint manufacturer, and shall be subject to inspection by the Engineer on the job. Colors, where not specified, shall be as selected by the Engineer.

The painter shall apply each coating at the rate and in the manner specified by the manufacturer. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. Deficiencies in film thickness shall be corrected by the application of an additional coat of paint. Where thinning is necessary, only the products of the manufacturer furnishing

the paint, and for the particular purpose, shall be allowed. All thinning shall be done strictly in accordance with the manufacturer's instructions, as well as with the full knowledge and approval of the Engineer. Paint shall be applied when surface and air temperature are as specified by the manufacturer. Paint shall not be applied to wet or damp surfaces, and shall not be applied in rain, snow, fog or mist, or when the relative humidity exceeds 85%. No paint shall be applied when it is expected that the relative humidity will exceed 85% or that the air temperature will drop below 40^{o}F within 18 hours after the application of the paint. No paint shall be applied when the surface temperature is less than 5°F above the dew point. Dew or moisture condensation should be anticipated, and if such conditions are prevalent, painting shall be delayed until midmorning to be certain that the surfaces are dry. The Contractor shall furnish the necessary measuring equipment to monitor temperature and humidity. Further, the day's painting should be completed well in advance of the probable time of day when condensation will occur, in order to permit the film an appreciable drying time prior to the formation of moisture.

The Contractor shall submit to the Engineer, immediately upon completion of the job, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to properly coat all surfaces. Such certification shall make reference to the square footage figures provided to the manufacturer and the Engineer by the Contractor.

1.2.1.2 Paint Certification. The Contractor shall deliver to the Owner samples of all paint, primers, coatings, etc., to be used. The Owner may then select samples of each coating, which will be tested for verification of the coating material. Coatings not complying with this specification shall be removed and replaced at the Contractor's expense.

1.2.1.3 Exterior Tank Surfaces. All Exterior painting shall conform to the latest revision of AWWA D-102. The steel surface shall be blast cleaned in the shop in accordance with the SSPC: The Society for Protective Coatings Specification SSPC-SP6 commercial blast cleaning.

The profile of the steel prepared for painting shall be 1.5 – 2.5 mils. Within eight (8) hours after the surface preparation, apply on (1) shop coat of Tnemec Series 91H_2O primer to a minimum dry film thickness of 2.5 to 3.5 mils. This primer shall be as otherwise specified herein or an approved equal.

A two (2) inch margin around the edge of each plate shall not be primed.

Subsequent to the erection of the structure all welds shall be free of any rough projections and the unprimed margins shall be blast cleaned to an SSPC-SP6 commercial grade finish as specified above. The ripples of the weld need not be ground smooth so long as a uniform weld is provided. All surfaces shall be cleaned just before painting and all unpainted abraded areas cleaned as above to remove any oxides which may have formed. Feather all edges of existing primer to remove any loose or lifted primer. All dirt, slag,

blast products and other foreign debris shall be removed from the tank bottom and riser pipe prior to any painting work.

Prior to applying subsequent fieldcoats make sure all metal surfaces are clean and dry.

Apply Tnemec Series 91H_2O, or equal, on all blasted areas to a dry film thickness of 2.5-3.5 mils. Allow primer to dry before applying topcoat.

Apply one intermediate coat of TNEMEC Series 66 Epoxoline, or equal, to a dry film thickness of 2.0-3.0 mils.

Apply one finish coat of Tnemec Series 1074/1075, or equal, to a dry film thickness of 2.0-3.0 mils.

The total dry film thickness of the exterior coating system shall not be less than 6.5 mils.

1.2.1.4 Interior Tank Surfaces. All interior painting shall conform to the latest revision of AWWA D-102. The steel surface shall be blast cleaned in the shop in accordance with SSPC: The Society for Protective Coatings Specification SSPC-SP10 near white metal blast cleaning.

The profile of the steel prepared for painting shall be 1.5 – 2.5 mils.

Within eight (8) hours after the surface preparation, apply one (1) shop coat of Tnemec Series 91H_2O primer to a minimum dry film thickness of 2.5 – 3.5 mils. This primer shall be as otherwise specified herein or an approved equal.

A two (2) inch margin around the edge of each plate shall not be primed.

Subsequent to the erection of structure all welds shall be free of any rough projections and the unprimed shall be blast cleaned to an SSPC-SP-10 near white metal finish as specified above. The ripples of the weld need not be ground smooth so long as a uniform weld is provided. All surfaces shall be cleaned just before painting and all unpainted abraded areas cleaned as above, to remove any oxides which may have formed. Feather all edges of existing primer to remove any loose or lifted primer. All dirt, slag, blast products and other foreign debris shall be removed from the tank bottom and riser pipe prior to any painting work.

Prior to applying subsequent finish coat, make sure all metal surfaces are clean and dry.

Apply Tnemec Series 91H_2O Primer, or equal, on all blasted areas to a dry film thickness 2.5 - 3.5 mils.

Apply one intermediate coat of Tnemec Series 20-11WH Potapox white, or equal, to dry film thickness of 4.0 - 6.0 mils.

Apply one finish coat of Tnemec Series 21-15BL Potapox tank white, or equal, to dry film thickness of 4.0 – 6.0 mils.

The total dry film thickness of the interior coating system shall not be less than 10.5 mils.

1.2.1.5 Disinfection. The storage tank shall be thoroughly disinfected before being placed in service in accordance with the applicable AWWA specification.

1.3 STEEL BOLTED WATER STORAGE TANK

1.3.1 Steel Bolted Tanks. This specification covers the furnishing of all labor, material, equipment, tools, services and erection of a Fusion Bonded Epoxy Coated Bolted Steel sectional water storage tank, including foundation, tank cover, tank structure and appurtenances as shown on the contract drawings, and described herein.

Field erection of the Fusion Bonded Epoxy coated, bolted-steel tank shall be in accordance with the procedures outlined in the Manufacturer's Construction Guide and performed by an Authorized Distributor of the tank Manufacturer, regularly engaged in erection of these tanks or a suitably qualified specialist sub contract builder under the control and supervision of the Authorized Distributor.

All labor, materials, plant, equipment and tools, as required for the construction of the storage tank shall be included.

The bolted steel tank shall conform to the requirements of American Water Works Association (AWWA) D103-09 Standard for Factory-Coated Bolted Steel Tanks for Water Storage.

The tank specified herein shall be Fusion V1100 Epoxy Coated as manufactured by Permastore Tanks & Silos, or approved equal

1.3.1.1 Shop Drawings. Construction shall be governed by the Owner's plans and specifications showing general dimensions and construction details, after approval by the Engineer of submittal drawings prepared by the Manufacturer. There shall be no deviation from these drawings and specifications except upon written order or approval from the Owner/Engineer.

Submittals shall include the minimum:

1. Design calculations, signed by a civil or structural engineer registered in the State of Kentucky.

2. Dimensions, color, description of materials and other pertinent information.

3. Joint and foundation attachment details.

4. Tank assembly (general arrangement drawing) with positions of appurtenances.

5. Details of appurtenances.

6. Roof Details (Aluminum Dome Structure).

The Bidder is required to furnish, for the review and approval by the Engineer, three sets of construction drawings for all work not shown in complete detail on the bidding drawings

1.3.1.2 Work Included. The Manufacturer shall furnish, erect and test the tank, as required by AWWA.D103-09. The Manufacturer shall be completely responsible for the construction and satisfactory performance of the tank during the guarantee period. The tank shall conform to AWWA 0103-09, to the latest edition Building Code, and to the requirements of the plans and these Specifications. The supplier shall submit for approval complete and detailed plans for the tank and appurtenances.

A cone roof, sloped to drain toward the shell, shall be provided. Provide the reservoir complete with all pipe connections, access openings, nozzles, taps, drains, ladders, vent, and other accessories as shown on the plans or required herein.

When approved, one set of drawings will be returned to the Contractor marked "APPROVED FOR CONSTRUCTION" and these drawings will then govern the scope of work detailed thereon. The approval by the Engineer of the Manufacturer's drawings shall be on approval relating only to their general conformity with the bidding drawings and specifications and shall not guarantee detailed dimensions and quantities, which remains the Contractor's responsibility.

1.3.1.3 Design Criteria. The tank plate/sheet materials, structural design and fabrication of the sectional tank shall be in accordance with standard AWWA D103-09. Structures are to be engineered with a predicted minimum 10 year design life and incorporate the relevant design standards giving consideration to the design loads specified below:

1.3.1.3.1 Design Loads

Roof Snow Load:	25	lb/ft²
Roof Live Load:	15	lb/ft²
Imposed Mechanical Load:	-	lb/ft²

Wind Speed:	100	mph
Allowable Soil Bearing Capacity:	3,000	lb/ft²
Seismic Zone:	1	
Specific Gravity of Tank Contents:	1	
Foundation Frost Depth:	15	in.
Internal Pressure:	-	in WG
Internal Vacuum:	-	in WG

1.3.1.4 Aluminum Dome Tank Roof. The roof shall comprise of a fully triangulated structural frame consisting of aluminum structural members complete with non-corrugated light gauge aluminum panels. The roof shall be clear span and self-supporting. Roof appurtenances shall include (but not be limited to) one 600NB air vent and 24-inch square inspection hatch. Construction shall be in accordance with the Manufacturer's Construction Guide.

1.3.1.5 Materials.

A. Plates and sheets used in the construction of the tank shell, optional floor and roofs, shall comply with the minimum standards as set out in clause 1.3.3. Such sheets shall be produced by a hot rolling process and shall be sourced from reputable steel mills.

B. Raw materials delivered to the Manufacturer's plant shall be tested/inspected to ensure compliance with the Manufacturer's requirements for strength.

C. Test Certificates and Certificates of Conformity shall be available for the Engineer's inspection if required. Such Certificates shall be requested at the time of issue of the Purchase Order.

1.3.1.6 Horizontal Wind Stiffeners. The top stiffener shall provide a flat, horizontal, continuous surface at tank rim level. Wind stiffeners shall be steel, hot dipped galvanized, rolled steel angle. Web truss stiffeners shall be profiled steel strip incorporating a hot dipped galvanized finish.

1.3.1.7 Bolt Fasteners. Bolts used in tank lap joints shall conform to BS 3692/ISO898 and ASTM A325 or ASTM A490 and shall be ½" - 13 UNC-2A rolled thread with hot dipped galvanized coating. All bolts for tank shell and Fusion Bonded Epoxy coated steel roof (where applicable) shall be installed such that the head portion is located inside the tank and the washer and nut are on the exterior. All lap joint bolts shall be properly selected such that threaded portions will not be excessively exposed in the "shear plane" between tank sheets. Also, bolt lengths shall be selected to achieve a neat and uniform

appearance. The torque values (as set down in the Manufacturer's Construction Guide) shall not be exceeded during tank construction.
All lap joint bolts shall be designed to prevent rotation during tightening.

1.3.1.8 Bolt Head Encapsulation. All tank shell and roof structure bolts shall have UV resistant polypropylene encapsulation of the bolt head and be certified to meet the requirements of Regulation 31 of the Water Supply (Water Quality) (Amendment) Regulation 2001 for The Storage of Water for Public Supply or NSF/ANSI 61 or BS6920 for indirect additives.

1.3.1.9 Sealant. The sealant proposed by the Manufacturer shall be suitable for use in the Fusion Bonded Epoxy bolted sectional tank supplied. The Manufacturer shall submit to the Distributor details of the proposed sealant for approval. The approved sealant shall be used strictly in accordance with the sealant manufacturer's recommendations. The sealant shall be used to seal lap joints, bolt connections and sheet edges. The sealant shall cure to a rubber-like consistency and have excellent adhesion to the coating, have low shrinkage, and be suitable for interior and exterior exposure. Where required, the sealant shall be suitable for contact with potable water and meet the requirements of Regulation 31 of the Water Supply (Water Quality) (Amendment) Regulation 2001 for The Storage of Water for Public Supply or NSF/ANSI 61 or BS6920 where specified. EPDM or Neoprene gaskets and tape type sealer shall not be used other than for shell manway door/hatch.

1.3.1.10 Fusion Bonded Epoxy Coating. The sheet face in contact with the stored liquid shall be treated as the inside surface for the purpose of this specification. In the case where the outside surface of the sheet is not in contact with the stored liquid the thickness of the epoxy coating is reduced with an additional super durable polyester top coating applied in accordance with the Manufacturer's recommendations.

A. Surface Preparation

1. Sheets shall be steel grit-blasted to a silver grey finish on both sides to remove mill scale and surface oxidation.
2. Grit blasting shall be performed to the equivalent of SSPC-SP10.

B. Cleaning

1. After fabrication and grit blasting and prior to application of the coating materials, all sheets shall be thoroughly cleaned by an alkali wash.
2. Following the alkali wash all sheets shall be rinsed in ambient de-ionized water.
3. The sheets are then dried in an extractive system to ensure they are clean, dry and ready to be coated.

C. Pre-Heat

1. All sheets are to be pre-heated in accordance with the epoxy paint manufacturer's recommendation prior to entering the coating stage.

D. Coating

1. All sheets shall receive a coating of FBE on both sides of the panel. The FBE application thickness is controlled and measured and sheets that do not meet the required specification, in accordance with the Manufacturer's specified parameters, shall be rejected at this point.
2. All interior steel surfaces, support members and miscellaneous parts shall receive an average of 6-10 mils using an NSF 61 Approved, using RESICOAT R4 – ES. The specified coating shall be Permastore Fusion V1100, or approved equal.
3. All sheets receive a subsequent coating of UV-stable polyester powder on the external panel surface. Electrostatic wraparound is removed after coating. Application thickness is controlled and measured and sheets that do not meet the required specification, in accordance with the Manufacturer's specified parameters, shall be rejected at this point.

E. Final Cure

1. All sheets receive a final cure at the temperature and period of time in accordance with the epoxy paint manufacturer's recommendations.
2. The process shall deliver to the internal surface in contact with the liquid a surface having general acid/alkali resistance to solutions in the range pH 3 to pH 13, subject to temperature and chemical composition.
3. Tank inside sheet color shall be as specified by the Manufacturer. Tank external color shall normally fall within the suite of standard color options available from the Manufacturer.
4. Sample tests shall be carried out by the Manufacturer to ensure that coating materials meet the physical properties and chemical resistance characteristics as published in the Manufacturer's product Quality Standard. The Manufacturer shall maintain records to demonstrate compliance with the relevant Quality Standard. When required the Manufacturer shall provide published product Quality Standards including details of the International Standards which the Manufacturer has used in the testing carried out.

F. Inspection

1. Inspection procedures shall be carried out within the Manufacturer's plant under ISO 9001:2015 Quality Management System.

2. A color comparator shall be used to measure the color of the outside sheet surfaces. Electronic color control shall be used to ensure that allowable color uniformity is achieved within the Manufacturer's specified parameters. Any sheet of a color outside of these limits shall be rejected.

3. The color comparator instrument used shall have a valid calibration record and shall be regularly checked against the Manufacturer's approved calibration standard.

4. Color measurement frequency shall be every 15 minutes and following every color and sheet thickness change.

5. Finished sheets shall be inspected for coating thickness using an approved instrument suitable for a measurement range of 0-500µm.

6. The instrument used for the measurement range specified in 5. shall have a valid calibration record and shall be regularly checked against the Manufacturer's approved calibration standard.

7. The thickness of the epoxy on the inside surface of every sheet exposed to liquid shall be maintained in the range from 175-250µm (7-10 mils).

8. The combined thickness of the FBE and Polyester Powder coating on the outside surface of every sheet not exposed to liquid shall be maintained in the range from 160-230µm (6.4-9 mils).

9. Sheets having a coating thickness outside of these ranges shall be rejected.

10. The outside surface of all sheets shall be inspected visually under good daylight (or equivalent lighting) for defects in the coating.

11. Any sheet having visible defects larger than 1mm (0.039 in) shall be rejected. Any sheet having more than three visible defects per m^2 of the total sheet area shall be rejected.

12. Any visible defects on the outside surface of accepted sheets shall be repaired using a repair material approved by the Manufacturer for this purpose and applied according to the repair material Manufacturer's instructions.

13. The contact sheet surface shall be inspected using a high voltage tester approved by the Manufacturer for this purpose and used in accordance with Test Method B of ASTM D5162- 08.

14. Inspection shall be carried out on every sheet and any sheet having any discontinuities shall be rejected.

15. Panels rejected for discontinuity shall be repaired with an approved repair material and re- tested at the test voltage.

16. The tester shall have an accuracy of ± 1% such that the voltage at the test probe and a test voltage of 1100volts shall be used. The tester shall have a valid calibration record.

17. Only finished sheets with zero coating continuity defects on the contact

surfaces after testing shall be released for packing.

18. An owner's representative may be present at the Manufacturer's production facility during these inspection procedures at their own cost.

G. Packing

1. All finished sheets shall be moved within the manufacturing plant using suitable handling equipment.
2. All inspection-passed sheets shall be protected from damage prior to packing for shipment.
3. All epoxy coated sheets shall be packed with a suitable membrane between the sheets.
4. Individual stacks of sheets shall be wrapped in a specified heavy duty plastic and banded to special pallets built to the roll radius of the tank sheets where necessary. This procedure eliminates contact movement of finished sheets during shipment.
5. Transportation of finished products shall be by dedicated hauler.

1.3.1.11 Construction. Particular care shall be taken in handling and bolting of the tank sheets and members to avoid abrasion of the coating system. All surface areas may be visually inspected by the Purchaser during construction and prior to liquid tests. An electrical Holiday test shall be performed on all contact surfaces of the tank shell sheets during or following construction using a 9-volt leak detection device. Any electrical leak points found on the contact surface shall be repaired in accordance with the Manufacturer's published touch up procedure. No backfill or mechanical loads shall be placed on the tank sidewall without prior written approval and design review by the tank Manufacturer. Any backfill shall be placed according to the instructions of the Manufacturer.

1.3.1.12 Appurtenances. The ancillary items of equipment should be installed as shown on the plans and as detailed in these specifications. They may include, but are not restricted to the following items:

1.3.1.12.1 Outside Tank Ladder. An outside ladder with safety cage beginning a minimum of 7'-2⅝" above the level of the tank bottom and at the location designated. Outside ladder and cage shall be in accordance with BS 4211 Class A or OSHA 1910.27.

1.3.1.12.2 Inside Tank Ladder. An internal ladder shall be installed below the roof hatch and shall be fabricated in stainless steel and be in accordance with BS 4211 Class A or OSHA 1910.27.

1.3.1.12.3 Access/Inspection Platform. A minimum 3 ft^2 galvanized steel platform shall be installed to allow safe access to the roof hatch. Platform shall be in accordance with

BS 4592 or OSHA 1910.27.

1.3.1.12.4 Shell Access Manway. One galvanized or epoxy coated circular manway having an opening size of 24-inch diameter shall be provided in the middle of the tank sheet clear of any vertical and horizontal bolt seams in accordance with the Manufacturer's design. The manway shall include a reinforcing frame and cover plate with a hinged support for cover removal. The manway cover plate shall be sealed with an approved gasket system.

3.1.12.5 Inlet and Outlet Connections. All galvanized or epoxy coated inlet, outlet and overflow connections shall conform to the sizes specified on the submittal drawings and shall be located so as to avoid vertical and horizontal bolt seams. Positions shall be agreed between the Engineer and the Authorized Tank Distributor. Where connections are shown to pass through tank sheets, these shall be pre-cut by the tank Manufacturer during manufacture. Where it is necessary for openings to be field located, the size and location of the openings shall be approved in writing by the Manufacturer prior to any openings being formed, all openings shall be saw cut, (**acetylene torch cutting, grinding or welding is not permitted**) and shall utilize an interior and exterior flange assembly. Sealant shall be applied on any cut sheet edges or bolt connections. Inlet, outlet and overflow connections shall be galvanized or epoxy coated steel.

1.3.1.13 Field Testing/Leak Test. Following completion of erection, low voltage electrical testing and cleaning of the tank, (and making due allowance for the full curing of the sealants) the structure shall be tested for liquid tightness by filling to its overflow elevation for a 24 hour period. Any leaks disclosed by this testing shall be corrected by the erector in accordance with the Manufacturer's recommendations. Labor and equipment necessary for tank testing shall be included in the price of the tank. Water required for testing shall be furnished by the CONTRACTOR. The rates for water used shall be at a rate of $2.00/1000 gallons. It is anticipated that each tank will be filled twice at the CONTRACTOR'S expense.

1.3.1.14 Disinfection.

1.3.1.14.1 Polyurethane Sealants. Disinfection shall not take place until the polyurethane joint sealant is fully cured (10 to 12 days @ 21°C 50% Relative Humidity). The tank shall be disinfected for use by chlorination in accordance with Method 3 of ANSI/AWWA C-562-11 with sentences 2, 3, 4 and 5 of clause 4.3.3 replaced with: - "This solution must be held in the storage tank for a period not less than 6 hours and not greater than 8 hours. Immediately following this initial containment period, the storage facility shall then be filled to the overflow level by flowing potable water into the highly chlorinated water. Water should be introduced at a rate such that at least 25 percent of the total storage volume is filled within 12 hours. Subsequently the remaining capacity should ideally be filled within a maximum period of 48 hours. It shall be held for a period of not less than 24 hrs. All highly chlorinated shall then be purged form the drain piping."

1.3.1.14.2 Non-Polyurethane Sealants. Disinfection shall not take place until the sealant has adequately cured in accordance with the sealant manufacturer's recommendations. The tank shall be disinfected for use in accordance with Method 3 of ANSI/ AWWA C-562-11. Where required, and prior to undertaking the disinfection of the tank, the Distributor shall agree any amendments to chlorination Method 3 with the Owner.

1.4 Warranty. Manufacturer shall warrant the tank against any defects in workmanship and materials for a period of one (1) year from the date of shipment. In the event any such defect should appear, it should be reported in writing to the manufacture during the warranty period. If, within one (1) year from the date of delivery of the tank, or any part thereof, shall prove to be defective by reason of poor design, materials or manufacture upon examination by the Manufacturer or his Authorized Distributor, the Manufacturer will supply an identical or similar replacement part or at its own option will repair the part.

1.5 Field Testing/Leak Test. Following completion of erection, low voltage electrical testing and cleaning of the tank, (and making due allowance for the full curing of the sealants) the structure shall be tested for liquid tightness by filling to its overflow elevation for a 24 hour period. Any leaks disclosed by this testing shall be corrected by the erector in accordance with the Manufacturer's recommendations. Labor and equipment necessary for tank testing shall be included in the price of the tank. Water required for testing shall be furnished by the CONTRACTOR. The rates for water used shall be at a rate of $2.00/1000 gallons. It is anticipated that each tank will be filled twice at the CONTRACTOR'S expense.

1.6 Tank Lettering. The Contractor shall be prepared to display the Owners name on one side of the tank in letter heights that encompass the majority of the side of the tank barrel. The lettering schematic shall be submitted for the Owner's approval as a part of the shop drawings and no other noticeable lettering shall be allowed on the tank structure.

1.7 Liquid Level Indicator. The CONTRACTOR shall install a liquid level indicator at the location directed by the ENGINEER. This indicator shall operate over the full height of the tank and shall read in feet.

1.8 Tank Foundation. Tank foundation shall be concrete ringwall per AWWA D103-09 section 13.4.1 or granular berm with steel retainer ring per AWWA D103-09 section 13.4.5.

1.9 Payment. The lump sum price for the tank construction shall be full compensation for the above described work and shall include the foundation, steel storage tank, and all yard piping.

SECTION 2 - STRUCTURAL CONCRETE

2.0 Work Included. Under this section the Contractor shall provide all labor, tools, equipment and materials to place concrete at the locations as shown on the Drawings. This shall include formwork, concrete specifications, reinforcement, finishes and any work related to the placement of concrete.

2.1 References. The Contractor shall obtain and have available in the field office at all times the latest revisions of the following references:

1. Specifications for Structural Concrete for Buildings ACI 301
2. Specifications for Structural Concrete for Buildings ACI Sp-15
3. Manual of Standard Practice - CRSI
4. Placing Reinforcing Bars - CRSI
5. Building Code Requirements for Reinforced Concrete ACI 318
6. Environmental Engineering Concrete Structures ACI-350R
7. Recommended Practice for Concrete Formwork ACI-347
8. Construction and Industrial Plywood PS-1
9. Field Reference Manual, ACI Publication SP-15

The following standards shall also apply to this work:

1. ASTM C-143 Test Method for Slump of Hydraulic Cement Concrete
2. ASTM C-150 Specification for Portland Cement
3. ASTM C-33 Specification for Concrete Aggregates
4. ASTM C-260 Specification for Air Entraining Admixtures for Concrete
5. ASTM C-494 Specification for Chemical Admixtures for Concrete
6. ASTM A-615 Specification for Deformed and Plain Billet
7. ASTM C-94 Specification for Ready-Mixed Concrete
8. ASTM C-31 Practice for Making and Curing Concrete Test Specimens in the Field
9. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens
10. ASTM C42 Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

11. ASTM A-616 Rail Steel Deformed and Plain Bars for Concrete Reinforcement
12. ASTM A-617 Axle Steel Deformed and Plain Bars for Concrete Reinforcement
13. ACI 315 Details and Detailing of Concrete Reinforcement
14. ACI 315R Manual of Engineering and Placing Drawings for Reinforced Concrete Structures
15. ASTM A-185 Welded Steel Wire Fabric for Concrete Reinforcement
16. ACI 301 Specifications for Structural Concrete for Buildings.

2.2 Submittals. The Contractor shall submit the following data established per Section 3.9 of ACI 301.

1. Concrete mix designs, test results and curves plotted to establish water cement ratio if paragraph 3.9.3.3. of ACI 301 is used.

2. Proposed mix designs and all necessary substantiating data used to establish proposed mix designs if paragraph 3.9.1.1. or 3.9.1.2. of ACI 301 is used.

3. Mix designs for all mixes proposed or required to be used, including all mixes containing admixtures.

4. A certified copy of the control records of the proposed production facility establishing the standard deviation as defined in paragraph 3.9.1.1. of ACI 301.

5. Certification attesting that admixtures equal or exceeds the physical requirements of ASTM C-494 for Type A (water reducing) Type D (water reducing and retarding) and Type E (water reducing and accelerating) admixtures.

6. Drawings showing locations of all proposed construction joints.

7. Certification that the concrete aggregates comply with the provisions of ASTM C33.

8. Certification that the air-entraining admixture complies with ASTM C-260.

2.3 Quality Assurance.

2.3.1 Consistency. Concrete shall be of such consistency that it can be worked readily into all parts of the forms and around embedded work, without permitting the materials to segregate, or free water to collect on the surface.

2.3.2 Compression Tests. During the progress of work, at least one set of three compression test cylinders shall be made for each 50 cubic yards of structural concrete or major fraction thereof, and not less than one such set for each type of concrete for each days pouring. Cylinders made in the field shall be made and cured in accordance with the ASTM Standard Method of Making and Curing Concrete Test Specimens in the Field, designation C31, except that wherever possible molds shall be left on cylinders until they reach the laboratory.

One cylinder of each set shall be broken in accordance with ASTM C-39 at seven days and the other two at 28 days. Two copies of these test results shall be submitted to the Engineer on the same day of the tests.

Additional tests of the in-place concrete shall be made when test results indicate specified concrete strengths and other characteristics have not been attained in the structure. Cored cylinders used to test concrete adequacy shall comply with ASTM C42. All test procedures and results shall be subject to the review and approval of the Engineer. The Contractor shall pay for such tests when unacceptable concrete is verified. On evidence of these tests, any concrete that fails to meet the specified strength requirements shall be strengthened or replaced as directed by the Engineer at the Contractor's expense.

2.3.3 Inserts in Concrete. All castings, inserts, conduits, and other metalwork shall be accurately built into or encased in the concrete by the Contractor as directed and all necessary precautions shall be taken to prevent the metalwork from being displaced or deformed. The installation shall be inspected before concrete is placed. All anchor bolts shall be set by means of substantial templates.

2.3.4 Testings. Concrete testing shall be performed by a testing agency hired by the Contractor, at his expense.

The testing agency shall perform the following tests on the sampled concrete:

a. Slump
b. Air Content
c. Concrete Temperature
d. Compression Test of Cylinders

If, in the opinion of the Engineer, there is reasonable doubt that the concrete aggregates comply with ASTM C33, the testing agency shall test the fine aggregate and course aggregate for compliance with these specifications.

Upon completion of the tests, written reports shall be submitted to the Engineer clearly identifying the tests performed, the results, and the batch of concrete in which the tests were performed.

2.4 Concrete Mix. Structural concrete of the various classes required shall be proportioned by Section 3.9 of ACI 301 to produce the following 28-day compressive strengths:

Selection of Proportions for Class A Concrete:

1. 4,000 psi compressive for strength at 28 days.

2. Type II cement plus water reducing dispersing agent and air. Type I cement may be used if the C3A content of the cementitious material is less than 8 percent.

3. Maximum (water)/(cement and water reducing dispersing agent) ratio = 0.45.

4. Minimum cement content = 564 lbs. (6.0 bags)/cu. yd. concrete.

5. Nominal maximum size coarse aggregate = No. 67 (3/4" maximum).

6. Air content = 6% plus or minus 1% by volume.

7. Slump = 2" - 3" in accordance with ASTM C-143.

2.4.1 Optional Concrete Mix Using Fly Ash.

Selection of Proportions for Class A Concrete:

1. 4,000 psi compressive for strength at 28 days.

2. Type II cement plus water reducing dispersing agent and air. Type I cement may be used if the C3A content of the cementitious material is less than 8 percent.

3. Maximum (water)/(cement plus water reducing dispersing agent) ratio - 0.45.

4. Minimum cement content - 517 lbs. (5.5 bags)/cu. yd. concrete.

5. Maximum Fly Ash Content - 71 lbs./cu. yd.

6. Nominal maximum size coarse aggregate - No. 67 (3/4" maximum) or No. 57 (1" maximum).

7. Air content - 6% plus or minus 2% by volume.

8. Slump = 2" - 3" in accordance with ASTM C-143.

2.4.2 Grout. Provide the following grout mixture at locations noted on the plans to be grouted, such as fillets, tank and trough bottoms:

(1) Less than 2" in depth

Material	Volume
Cement	1 part
Sand	2 part
Water = 5 gals./100 lbs. cement	

(2) From 2" to 12" in depth

Material	Volume
Cement	1 part
Pea Gravel	2.5 parts
Sand	2 parts
Water = 5 gals./100 lbs. cement	

(3) Greater than 12" in depth

Material
Class A Concrete

The grout mixtures shown above are not to be used in areas that are to receive non-shrink grout.

Grout fill which is formed in place by using rotating equipment as a screed shall be mixed in proportions and consistencies as required by the manufacturer or supplier of the equipment.

2.4.3 Admixtures. An air entraining admixture shall be used on all concrete and shall be the Master Builders MB-VR, or MicroAir, Euclid Chemical Company AIR-MIX, W. R. Graces Darex, or equal. The admixture shall meet the requirements of ASTM C-260. Certification attesting to the percent of effective solids and compliance of the material with ASTM C-260 shall be furnished.

A water-reducing, admixture for concrete shall conform to ASTM C-494 for type A (water-reducing and normal setting admixtures) and shall be Master Builders Pozzolith

344N, Nox-Crete Plastiflow, Plastocrete 161 by Sika, or an approved equal. The water-reducing, set retarding mixture for concrete shall conform to ASTM C-494 for Type D (water-reducing and retarding admixtures) and shall be Master Builders, Pozzolith 100-XR, Daratard-17 by W. R. Grace, or an approved equal. Certification shall be furnished attesting that the admixture exceeds the physical requirements of ASTM C-494, Type A, water-reducing and normal setting admixture, and when required, for ASTM C-494, Type D, water reducing and retarding admixture when used with local materials with which the subject concrete is composed. The admixture manufacturer shall provide a qualified concrete technician employed by the manufacturer to assist in proportioning concrete for optimum use. He also will be available to advise on proper addition of the admixture to the concrete and on adjustment of the concrete mix proportions to meet changing job conditions.

Where the Contractor finds it impractical to employ fully the recommended procedures for hot weather concreting, the Engineer may at his discretion require the use of a set retardant admixture for mass concrete 2.5 feet or more thick and for all concrete whenever the temperature at the time concrete is cast exceeds 80 degrees F. The admixture shall be selected by the Contractor subject to the review of the Engineer. The admixture and concrete containing the admixture shall meet all the requirements of these specifications. Preliminary tests of this concrete shall be required at the Contractor's expense.

When more than one admixture is used, all admixtures shall be compatible. They should preferably be by the same manufacturer.

Calcium chloride will not be permitted as an admixture in any concrete.

Water-reducing, non chloride, accelerators shall conform to ASTM C-494 Type E and shall be Accelguard 80 by the Euclid Chemical Company or Pozzolith High Early by Master Builders or an approved equal.

2.4.4 Water. The water for concrete shall be clean, fresh, and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

2.4.5 Aggregates. Fine aggregates shall be natural and having clean, hard, uncoated grains, and shall be free from injurious amounts of clay, dust, organic matter or other deleterious substances, and shall conform to ASTM C-33. Sand shall be graded as follows:

	Percent
Passing 3/8 Inch Sieve	100
Passing No. 4 Sieve	90-100
Passing No. 16 Sieve	45-80
Passing No. 50 Sieve	5-25
Passing No. 100 Sieve	0-8

Coarse aggregates shall be crushed stone having clean, hard, uncoated particles, and shall be free from injurious amounts of soft, friable, thin, elongated or laminated pieces.

Coarse aggregates shall conform to ASTM C-33 and shall be graded in accordance with the following:

	Percent by Weight	
	No. 57	No. 67
Passing 1-1/2 Inch Square Sieve	100	---
Passing 1-Inch Square Sieve	95-100	---
Passing 3/4-Inch Square Sieve	---	90-100
Passing 1/2-Inch Square Sieve	25-60	---
Passing 3/8-Inch Square Sieve	---	20-55
Passing No. 4 Square Sieve	0-10	0-10
Passing No. 8 Square Sieve	0-5	0-5

Refer to the Specification of ACI 301 for maximum size of coarse aggregate.

2.4.6 Aggregates and Determining Proportions. No concrete shall be used in the work until the materials and mix designs have been tested by the testing laboratory and accepted by the Engineer. The Engineer shall have the right to order changes as may be necessary to meet the specified requirements. If concrete of the required characteristics is not being produced as the work progresses, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure concrete of the specified quality. The Contractor shall make such changes at his own expense and no extra compensation will be allowed because of such changes.

2.4.7 Mixing. All central plant and rolling stock equipment and methods shall conform to the Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers' Bureau of the National Ready Mixed Concrete Assn., as well as the ACI Standards for Measuring, Mixing, Transporting, and Placing Concrete ACI 304R-89, and with the ASTM specification for Ready Mixed Concrete, Designation C94-89b.

2.5 Placing and Compacting Concrete. At least 20 hours before the Contractor plans to make any placement of concrete, he shall notify the Engineer of his intention and procedure. Unless otherwise planned, the work shall be so executed that a section begun on any day shall be completed during daylight of the same day.

Ready mixed concrete shall be transported to the site in watertight agitator or mixer trucks. The quantity of concrete to be mixed or delivered in any one batch shall not exceed the rated capacity of the mixer or agitator for the respective conditions as stated on the nameplates.

Information necessary to calculate the total mixing water shall be recorded on the delivery slip for the Engineer's information. Total mixing water includes free water on the aggregates, water and ice batched at the plant, and water added by the truck operator. The Contractor may request permission to add water at the job site, and when the addition of water is permitted by the Engineer, the quantity added shall be the responsibility of the Contractor and in no case shall the total water per bag of cement exceed that determined by the designed mix. Mixing and discharge time shall be as recommended in ACI-304.

Concrete which has become compacted or segregated during transportation to or on the site of the work shall be satisfactorily remixed just prior to being placed in the forms.

Partially hardened concrete shall not be deposited in the forms. The retempering of concrete which has partially hardened (that is, the remixing of concrete with or without additional cement, aggregate, or water) will not be permitted.

The concrete shall be mixed only in the quantity required for immediate use. Concrete that has developed an initial set shall not be used. The Contractor shall have sufficient plant capacity and transporting apparatus to insure continuous delivery at the rate required.

The temperature of the concrete mixture immediately before placement shall be between 50 degrees F and 90 degrees F.

Concrete that is truck mixed or transported in truck mixers or truck agitators shall be delivered to the site of the work and discharge completed in the forms within 1 1/2 hours or before the drum has revolved 300 revolutions whichever comes first after the introduction of the mixing water to the cement and aggregates, or the introduction exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed in the forms within 15 minutes after discharge from the mixer at the job site.

If concrete is placed by pumping, no aluminum shall be used in any parts of the pumping system which contact or might contaminate the concrete. Aluminum chutes and conveyors shall not be used.

No concrete shall be placed on frozen subgrade or in water, or until the subgrade, forms, and preliminary work have been accepted. No concrete shall be placed until all materials to be built into the concrete have been set and have been accepted by the various trades and by the Engineer. All such materials shall be thoroughly clean and free from rust, scale, oil, or any other foreign matter.

Forms and excavations shall be free from water and all dirt, debris, and foreign matter when concrete is placed. Except as otherwise directed, wood forms and embedded wood called for or allowed shall be thoroughly wetted just prior to placement of concrete.

Chutes for conveying concrete shall be metal or metal lined and of such size, design and slope as to ensure a continuous flow of concrete without segregation. The slope of chutes shall have approximately the same slope. The discharge end of the chute shall be provided with a baffle, or if required, a spout and the end of the chute or spout shall be kept as close as practicable to, but in no event more than 5 feet above the surface of the fresh concrete. When the operation is intermittent, the chute shall discharge into a hopper.

In thin sections of considerable height (such as walls and columns), concrete shall be placed in such manner as will prevent segregation and accumulations of hardened concrete on the forms or reinforcement above the mass of concrete being placed. To achieve this end, suitable hopper spouts with restricted outlets, etc. shall be used as required or permitted unless the forms are provided with suitable openings.

Chutes, hoppers, spouts, etc. shall be thoroughly cleaned before and after each run and the water and debris shall not be discharged inside the form.

For any one placement, concrete shall be deposited continuously in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the section, and so as to maintain until the completion of the unit, an approximately horizontal plastic surface.

No wooden spreaders shall be left in the concrete.

During and immediately after being deposited, concrete shall be thoroughly compacted by means of suitable tools and methods, such as internal type mechanical vibrators operating at not less than 5,000 rpm or other tool spading to produce the required density and quality of finish. Vibration shall be done only by experienced operators under close supervision and shall be carried in such manner and only long to produce homogeneity and optimum consolidation without permitting segregation of the solid constituents, "pumping" of air, or other objectionable results. All vibrators shall be supplemented by proper spade puddling approximately 2 to 3 inches away from forms to remove included bubbles and honeycomb. Excessive spading against the forms, causing the deposition of weak mortar at the surface shall be avoided.

The concrete shall be thoroughly rodded and tamped about embedded materials so as to secure perfect adhesion and prevent leakage. Care shall be taken to prevent the displacement of such materials during concreting.

The distance between construction joints shall not exceed 25 feet for all concrete construction and not less than 48 hours shall elapse between casting of adjoining units unless these requirements are waived by the Engineer. Provision shall be made for jointing successive units as indicated or required. Where joints are not shown on the Drawings, they are required to be made at a spacing of approximately 25 feet. Additional construction joints required to satisfy the 25 foot spacing shall be located by the

Contractor subject to the review of the Engineer. The Contractor shall submit for review Drawings separate from the steel reinforcing Drawings, showing the location of all proposed construction joints. All construction joints shall be prepared for bonding as specified in ACI 301 for Bonding Concrete at Construction Joints. Joints in walls and columns shall be maintained level.

The subgrades for slab on grade for the plant works building only shall be covered with a vapor barrier consisting of a 6 mil minimum thickness polyethylene sheet with joints lapped a minimum of 12 inches unless otherwise required or permitted.

2.6 Bonding Concrete at Construction Joints. In order to secure full bond at construction joints, the surface of the concrete previously placed (including vertical, inclined, and substantially horizontal areas) shall be thoroughly cleaned of foreign materials and laitance, if any. The previously placed concrete at the joint shall be damp but free of standing water. The surface shall be prepared as per ACI 301. The referenced cement grout shall be between one and two inches thick on all wall pours. Waterstops shall be used on all construction joints.

2.7 Sealing Concrete at Construction Joints. All Construction joint surfaces shall receive Sikaflex-2C NS Polyurethane Elastomeric sealant or approved equal. Surface preparation and manufacturer's specified primer shall be applied in accordance to the manufacturer's recommendations. Minimum joint size shall be 1/4" deep by 1/2" wide unless shown otherwise on the Drawings.

2.8 Epoxy Bonding Agent. The epoxy bond agent shall be provided as indicated on the Drawings and shall be applied per manufacturer's instructions. Epoxy bonding agent shall be Sikadur Hi-Mod LPL by Sika Corporation or Eucopoxy LPL by Euclid Company or approved equal.

2.9 Curing and Protection. All concrete, particularly slabs and including finished surfaces, shall be treated immediately after concreting or cement finishing is completed, to provide continuous moist curing for at least seven days, regardless of the adjacent air temperature. Walls and vertical surfaces may be covered with continuously saturated burlap, or kept moist by other acceptable means. Horizontal surfaces, slabs, etc. shall be ponded to a depth of 1/2" wherever practicable, or kept continuously wet by the use of lawn sprinklers, a complete covering of continuously saturated burlap, or by other acceptable means.

For at least seven days after having been placed, all concrete shall be so protected that the temperature at the surface will not fall below 45 degrees F. No manure, salt, or other chemicals shall be used for protection. The above mentioned seven day periods may be reduced if compression tests, in accordance with ASTM C-39, on field cured cylinders indicate that expected seven day strength gain has been achieved, and approval is granted by the Engineer. Wherever practicable, finished slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

2.10 Trimming and Repair of Surface Defects. The Contractor shall use suitable forms, mixture of concrete, and workmanship so that concrete surfaces, when exposed, will require no patching. Concrete which, in the opinion of the Engineer has excessive honeycomb, aggregate pockets, or depressions will be rejected and the Contractor shall, at his own expense, remove the entire section containing such defects and replace it with acceptable concrete. As soon as the forms have been stripped and concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties shall be filled and surface defects which do not impair structural strength shall be repaired.

Defective concrete shall be cut perpendicular to the surface until sound concrete is reached, but not less than 1" deep. The remaining concrete shall be thoroughly roughed and cleaned. Concrete in an area at least 6" wide surrounding the area to be patched shall be dampened. A bonding grout shall be prepared using a mix of approximately one part cement to one part fine passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface. The patching mixture shall be made of the same materials and approximately the same proportions as used for the concrete except that the course aggregate shall be omitted and the mortar shall consist of not more than one part cement to 2 1/2 parts sand by damp loose volume. White portland cement shall be substituted for a portion of the gray portland cement on exposed concrete in order to produce a color matching the color of the surrounding concrete. The quantity of mixing water shall be no more than necessary for handling and placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least one hour before being finally finished. The patched area shall be kept damp for seven days. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed.

After being cleaned and thoroughly dampened, the tie holes shall be filed solid with patching mortar.

The use of mortar patching as above specified shall be confined to the repair of small defects in relatively green concrete. If substantial repairs are required, the defective portions shall be cut out to sound concrete and the defective concrete replaced by means of gunite, or the structure shall be taken down and rebuilt, all as the Engineer may decide or direct.

2.11 Concrete Finishes. All concrete exposed to view in the completed structures shall be produced using materials and workmanship to such quality that only nominal finishing will be required. The provisions of paragraphs 13.3, 13.4 and 13.6 of ACI 301 shall apply to all exterior exposed to view concrete surfaces, including the outside surfaces of tanks.

All formed, exterior, exposed to view, concrete shall be prepared, then rubbed. Exterior vertical surfaces shall be rubbed to one foot below grade. Interior vertical surfaces of dry pits shall not be rubbed. Interior vertical surfaces of open topped liquid containers shall be rubbed to one foot below the minimum liquid level that will occur during normal operations. Walls inside a building shall not be rubbed. Overhead slabs (exterior or interior) shall not be rubbed.

All vertical surfaces below minimum liquid level in liquid containing structures and all other surfaces that are not to be rubbed shall have a smooth form finish.

All smooth form concrete vertical surfaces shall be true plane within 1/4" in 10 feet as determined by a 10 foot straight edge place anywhere on the surface in any direction. Abrupt irregularities shall not exceed 1/8". Basin, flume, conduit and tank floors shall have a "troweled" finish unless shown otherwise on Drawings. Weirs and overflow surfaces shall be given a troweled finish.

Exterior platforms, steps and landings shall be given a broom finish. Broom finish shall be applied to surfaces which have been steel troweled to an even smooth finish. The troweled surface shall then be broomed with a fiber bristle brush in the direction transverse to that of the main traffic.

Walking surfaces of slabs shall have a troweled finish unless shown otherwise on Drawings.

Nox-Crete Harbeton, Chem Hard by L & M Construction Chemicals, Lapidolith by Sonneborn hardener treatment, or an approved equal shall be applied to all exposed concrete floors in occupied spaces. The floors shall be thoroughly cured, cleaned, and perfectly dry with all work above them completed. The hardener shall be applied evenly and freely and in conformance with manufacturer's instructions, using not less than three coats, allowing 24 hours between coats. One gallon of hardener shall cover not more than 100 square feet. After the final coat is completed and dry, surplus hardener shall be removed from the surface of the concrete by scrubbing and mopping with water.

2.12 Watertightness. The structures which are intended to contain liquids and/or will be subjected to exterior hydrostatic pressures shall be so constructed that when completed and tested, there shall be no loss of water and no wet spots shall show. Liquid retaining structures shall be tested for leakage in accordance with ACI-350R. As soon as practicable after the completion of the structures, the Contractor shall fill them with water and if leakages develop or wet spots develop, the Contractor shall empty such structures

and correct the leakage in an approved manner. Any cracks which appear in the concrete shall be dug out and suitably repaired. Temporary bulkheads over pipe openings in walls shall be provided as required for the testing. After repairs, if any are required, the structures shall be tested again and further repaired if necessary until satisfactory results are obtained. All work in connection with these tests and repairs shall be at the expense of the Contractor.

Pipes shall not be poured or solidly grouted in concrete walls or floors unless fixations are indicated on the Project Drawings, for example as anchorage to resist pipe thrusts, unless otherwise required or permitted. At wall and slab penetrations, openings shall be formed approximately one inch greater than the OD of the pipe. For openings 10 inches and less in diameter, openings may be cored if permitted by the Engineer before pouring wall or slab so that extra reinforcing steel can be accurately located and referenced to avoid the subsequent core hole, unless otherwise required or permitted. After pipe placement and alignment adjustment, the annular space between opening and outside of pipe shall be packed with dry braided hemp (or unbraided where pipe does not center in openings) to within two inches of the wall or slab surface. The two-inch deep annular space shall be packed with non-shrink grout or caulked in strict accordance with the material manufacturer's instructions.

Sleeves shall be cast in floors and walls for penetrations of small pipe, cut and fitted on the job, such as steel, wrought iron, copper, plastic and rubber pipe and hoses. Unless otherwise required or permitted, sleeves shall be steel, cast iron or plastic or about one inch greater ID than the OD of the pipe and shall be flush with wall and slab surfaces. The annular space between sleeve and outside of pipe shall be packed and grouted or caulked as previously described, except the joint depth shall be one inch. Penetrations may be made by coring according to previously described requirements if permitted by the Engineer. Where openings larger than 10 inches in diameter are required for pipe penetrations in existing walls and slabs, the opening shall be made approximately two inches to four inches larger in diameter than the pipe OD. The pipe shall be wrapped with 1/2-inch braided hemp and positioned in the opening. The space between the hemp and the opening shall be solidly packed with non-shrink grout previously described, after application of a bonding adhesive to the opening surfaces. The grout shall be finished flush with wall and floor surfaces. After the grout has hardened sufficiently, hemp shall be removed to two-inch depths on each side of walls and slabs and the resulting annular spaces shall be packed with non-shrink grout or caulked as required or permitted, as previously described. All joints around pipe shall be watertight unless otherwise required or permitted.

The top surface of all concrete decks (except slabs on grade) shall be coated with Sikagard-70 water-repellent penetrating sealer as manufactured by the Sika Corporation, Nox-Crete Stifel, or another approved equal. The manufacturer's recommendations shall be followed in all areas of application.

2.13 Equipment Pads. Unless otherwise shown or directed, all pumps, other equipment, and items such as lockers, motor control centers and the like, shall be installed on concrete bases. The bases shall be constructed to the dimensions shown on the plans or as required to meet plan elevations. Where no specific plan elevations are required, the bases shall be six inches thick and shall extend three inches outside the metal equipment base. In general, the concrete bases shall be placed up to one inch below the metal base. The equipment shall then be properly shimmed to grade and the one inch void filled with nonshrink grout. Prior to the final set of the grout, it shall be cut back and the edge plastered with 1:2 cement mortar.

2.14 Concrete Form Materials. Plywood shall be Douglas Fir species, medium density overlaid one side grade; sound, undamaged sheets with straight edges. Forms shall be sufficiently rigid to prevent displacement or sagging between supports, and so constructed that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for their adequacy. For surfaces to be given rubbed finish, the form in contact with the concrete shall be made of plywood, metal, metal framed plywood faced, or other acceptable panel-type materials, to provide continuous straight, smooth, exposed surfaces. Forms shall not be pieced out by use of material different from those in the adjacent form or in such manner as will detract from the uniformity of the finished surface. For surfaces other than those to be given rubbed finish, forms shall be made of wood, metal or other acceptable material. Wooden forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots. Plywood shall be in reasonably good condition. Metal forms shall be of an acceptable type for the work involved.

Form ties to be encased in concrete shall not be made of through bolts or common wire, but shall be of a well established type, so made and installed as to embody the following features:

1. After removal of the protruding part of the tie, there shall be no metal nearer than 1-1/2" to the face of the concrete.

2. That part of the tie which is to be removed shall be at least 1/2" in diameter, or if smaller, it shall be provided with a wood, metal, or plastic cone 1" long placed against the inside of the forms. Cones shall be carefully removed from the concrete after the forms have been stripped.

3. Ties which pass through walls of liquid retaining basins and all dry rooms below grade shall be provided with acceptable water stop, securely fastened to the ties.

The Form Release Agent shall be a colorless material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete. Acceptable products include Nox-Crete Form Coating Release Agent, Debond Form Coating by L & M Construction Chemical, Inc., or approved equal.

Fillets for chamfered corners shall be wood strip type to the size and shape as shown on the Drawings.

Nails, spikes, lag bolts, through bolts and anchorages shall be sized as required of strength and character to maintain formwork in place while placing concrete.

Earth or rock forms shall not be permitted. The vertical surface of all footings shall be formed.

Forms for walls, columns, or piers shall have removable panels at the bottom for cleaning, and inspection. Forms for thin sections (such as walls or columns) of considerable height shall be arranged with suitable openings so that the concrete can be placed in a manner that will prevent segregation and accumulations of hardened concrete on the forms or reinforcement above the fresh concrete, unless special spouts are used to place concrete and so that construction joints can be properly keyed and treated. Forms for exposed surfaces shall be built with 3/4" chamfer strips attached to produce smooth, straight chamfers at all sharp edges of concrete.

Before form material is reused, all surfaces that are in contact with the concrete shall be thoroughly cleaned, all damaged places repaired, and all projecting nails withdrawn.

2.14.1 Wetting and Oiling Forms. The inside surface of wood board forms shall be soaked with clean water and kept continuously wet for 12 hours before any concrete is placed. In case forms have been erected for some time and have become dry so that joints have opened, then the forms shall be thoroughly soaked at least twice each day for at least three days prior to placing concrete. If the forms cannot be tightened to the satisfaction of the Engineer, they shall be torn down and rebuilt. Plywood forms may be treated with a nonstaining form oil, mineral oil or lacquer. If oil is used, all excess oil shall be wiped off with rags to leave the surface of the forms just oily to the touch. In freezing weather oil shall be used.

Coatings of dust shall be removed from contact surfaces of forms before placing concrete. Concrete shall not be placed in any form until inspected by the Engineer and permission is given to start placing.

2.14.2 Removal. Forms shall not be removed without approval of the Engineer. All form removal shall be accomplished in such a manner as to prevent injury to the concrete.

Forms shall not be removed sooner than the following minimum times after the concrete is placed. These periods represent cumulative number of days and fractions of days, not necessarily consecutive, during which the temperature of the air adjacent to the concrete is above 50 degrees F.:

Element	Time
Beams, arches - supporting forms and shoring	14 days
Conduits, deck slabs - supporting (inside) forms and shoring	7 days
Conduits (outside forms), sides of beams, small structures	24 hours
Columns, walls, spillway risers - with side or vertical load	7 days
Columns, walls, spillway risers - with no side or vertical load	4 days
Concrete supporting more than 30 feet of wall in place above it	7 days
Concrete supporting 20 to 30 feet of wall in place above it*	4 days
Concrete supporting not more than 20 feet in place above it*	24 hours

*Age of stripped concrete shall be at least seven days before any load other than the weight of the column or wall itself is applied.

When conditions on the job are such as to justify the requirements, forms will be required to remain in place for longer periods. Forms for beams, girders, and flood slabs shall remain in place for at least seven days and shall only be removed when test cylinders used under the same conditions as the members break with a compressive strength as required in these specifications.

2.15 Construction Tolerance. The forms shall be constructed and rigidly braced in place within the following tolerances:

(1) Variation from true alignment as shown on the drawings in the lines and surfaces of walls:

In 10 feet	1/4 inch
In 20 feet maximum	3/8 inch
In 40 feet or more	3/4 inch

(2) Variation from the level or from the grades indicated on the drawings in floors or slabs:

In 10 feet	1/4 inch
In 20 feet maximum	3/8 inch
In 40 feet or more	3/4 inch

(3) Variation in sizes and/or locations of floor and/or wall openings:

1/4 inch

(4) Variation in thickness of slabs and walls and in cross-sectional dimensions of columns and beams:

Minus	1/4 inch
Plus	1/2 inch

(5) Variation in plan dimension of footings:

Minus	1/2 inch
Plus	2 inches

2.16 Expansion and Contraction/ Construction Joints. Unless otherwise shown, waterstops for construction and control joints shall be 4 inches wide, 3/16" minimum thickness, flat-ribbed, or dumbbell polyvinyl chloride (PVC), in accordance with Corps of Engineers Specifications CRD-C-572, latest revision, as manufactured by Vinylex Corp., W.R. Grace Company, Greenstreak, or equal. Split-ribbed waterstops may be used where appropriate.

Unless otherwise shown, waterstops for expansion joints shall be nine inches wide, 1/4" minimum thickness, ribbed with center bulb polyvinyl chloride (PVC) in accordance with Corps of Engineers Specifications CRD-C-572, latest revision as manufactured by Vinylex Corp., W.R. Grace Company, Greenstreak, or equal.

Only where indicated on the drawings, the Contractor shall install a self-expanding waterstop impregnated with sodium bentonite similar to Volclay Waterstop-RX. The manufacturer's recommended installation procedures shall be followed. Self expanding waterstops shall not be used at expansion joints and water containment structures.

Joint filler shall conform to ANSI/ASTM D994 and they shall be bituminous impregnated fiberboard, closed cell polyethylene or self-expanding cork; of the sizes detailed and in the locations indicated on the Drawings. Bituminous impregnated fiberboard shall not be used to fill joints in liquid retaining structures. Where the application requires cementing the joint filler into place, a pressure sensitive adhesive recommended by the filler manufacturer shall be used.

2.16.1 Waterstops. Waterstops shall be provided at all joints where indicated on the Drawings. Waterstops shall also be provided in all joints, vertical and horizontal up to 1'-0" minimum above finished grades and in water containment and subterranean structures. Install waterstops continuous without displacing reinforcement. All joints between adjacent continuing and intersecting sections of waterstops including butt joints, tee joints, and other angled joints shall be heat fused to form a watertight seal. Waterstops shall not be lapped. Waterstops shall be securely wired in place to maintain proper position during placement of concrete.

2.17 Reinforcing Steel. The Contractor shall place reinforcing steel at the location as shown on the Drawings.

2.17.1 Materials. The minimum yield strength of the reinforcement shall be 60,000 pounds per square inch. Bar reinforcement shall conform to the requirements of ASTM A-615, A-616, or A-617. All bar reinforcement shall be deformed. Smooth dowels shall be plain steel bars conforming to ASTM A-615, Grade 40. Welded wire fabric when specified shall conform to ASTM 185, welded steel wire fabric for concrete reinforcement. Reinforcements supports and other accessories in contact with the forms for members which will be exposed to view in the finished work shall have approved high density polyethylene tips so that the metal portion shall be at least one quarter of an inch from the form or surface. Supports for reinforcement, when in contact with the ground or stone fill, shall be precast stone concrete blocks.

2.17.2 Fabrication. Reinforcement shall be bent cold. It shall be accurately to the dimensions and shapes shown on the plans and to within tolerance specified in the ACI code and the CRSI Manual of Standard Practice. Reinforcement shall be shipped with bars of the same size and shape, fastened securely with wire and with metal identification tags using size and mark.

2.17.3 Placing and Fastening. Before being placed in position, reinforcement shall be cleaned of loose mill and rust scale, dirt and other coatings that will interfere with development of proper bond. Reinforcement shall be accurately placed in positions shown on the drawings and firmly held in place during placement and hardening of concrete by using annealed wire ties. Bars shall be tied as required to prevent displacement under foot traffic and during casting operations, and shall be placed within tolerances allowed in Section 5.6.2 of ACI 301. Distance from the forms shall be maintained by means of stays, blocks, ties, hangers or other approved supports. If fabric reinforcement is shipped in rolls, it shall be straightened into flat sheets before being placed.

Before any concrete is placed, the Engineer shall have inspected the placing of the steel reinforcement and given permission to deposit the concrete. Concrete placed in violation of this provision will be rejected and thereupon shall be removed.

Unless otherwise specified, reinforcement shall be furnished in the full lengths indicated on the plans. Splicing of bars, except where shown on the plans, will not be permitted without the approval of the Engineer. Where splices are made, they shall be staggered insofar as possible.

Wire mesh reinforcement shall be continuous between expansion joints. Lamps shall be at least one full mesh plus two inches, staggered to avoid continuous lap in either direction and securely wired or clipped with standard clips.

Dowels shall be installed at right angles to construction joints and expansion joints. Dowels shall be accurately aligned parallel to the finished surface, and shall be rigidly held in place and supported during placing of the concrete. One end of dowels shall be oiled or greased or dowels shall be coated with high density polyethylene with a minimum thickness of 14 mils.

2.17.4 Shop Drawings. The Contractor shall submit a complete set of shop drawings including schedules and bending drawings for all reinforcement used in the work in accordance with ACI 315, and ACI 315R. Review of drawings by the Contractor and the Engineer is required before shipment can be made.

2.18 Measurement and Payment. Payment will be based on one of the following criteria as specified and described in the Contract Bid Item Descriptions and on the Drawings:

A. Cost shall be included in the work to which it is subsidiary and no separate measurement and payment will be made.

B. Payment will be based on Plan Quantities or a percentage of concrete installed to complete the structure as computed by the Engineer or as shown on the Drawings.

Payment as specified above shall be considered as full compensation for all labor, materials, equipment and incidentals necessary to perform the work as required.

Payment for concrete placed outside the lines shown on the Drawings due to over excavation or Contractor error will not be made. Where extra concrete is authorized by the Engineer in writing, payment will be made at a price agreed upon by the Contractor and the Engineer.

SECTION 3 - PIPE WORK AND VALVES

3.0 Work Included. Under these items, the CONTRACTOR shall provide all labor, tools, equipment and materials to furnish and install the process piping as shown on PLANS and as directed by the Engineer.

3.1 Water Pipe Materials. All pipe materials listed below shall conform to manufacturer's standard lengths and diameters. Testing when required by the owner shall be done in accordance with the appropriate ASTM Specs for the material selected.

3.2 Pipe Specifications.

3.2.1 Polyvinyl Chloride (PVC) Pipe (SDR 17) or (SDR 21) PVC pipe shall comply with ASTM D-1784 for material and shall be Class 250 (SDR 17) or Class 200 (SDR 21) as shown on the PLANS or indicated in the proposal form. (SDR PR, Type 1, Grade 1). All PVC pipe shall conform to the latest revisions of the following specifications:

ASTM D2241 (PVC Plastic Pipe SDR-PR and Class T)
National Sanitation Foundation Testing Laboratories (NSF)

The name of the manufacturer of the plastic pipe to be used must be found on the current listing of Plastic Materials for Potable Water Application, published by the NSF (National Sanitation Foundation), Ann Arbor, Michigan, and must meet the requirements of the Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, D1784, 12454-B (PVC 1120) published by ASTM. Rubber gaskets shall conform to ASTM D3139.

Wall thickness shall be in accordance with ASTM D-2241. Pipe ends shall be beveled to accept the gasketed coupling. The bell section shall be designed to be at least as strong as the pipe wall.

Samples of pipe, physical and chemical data sheets shall be submitted to the Engineer for approval and his approval shall be obtained before pipe is purchased.

The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions, or other defects. The pipe shall be as uniform as commercially practical in color. Pipe shall have a ring painted around spigot ends in such a manner as to allow field checking of setting depth of pipe in the socket. Pipe must be delivered to the job site by means that will adequately support it, and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close to the final point of placement as is practical.

Pipe markings shall include the following, marked continuously down the length:

Manufacturer's Name
Nominal Size
Class Pressure Rating
PVC 1120
NSF Logo
Identification Code

Lubricant shall be water soluble, non-toxic, non-objectionable in taste and odor imparted to the fluid, non-supporting of bacteria growth, and have no deterioration effect on the PVC or rubber gaskets.

3.2.2 Polyvinyl Chloride (PVC) Pipes - C.I. - Pipe Size. This pipe shall meet the requirements of AWWA C900-75, latest revision, "Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4" through 12" for water" and shall be furnished in cast-iron pipe equivalent outside diameters with rubber- gasketed separate couplings.

The pipe shall be made from Class 12454-A or Class 12454-B virgin compounds as defined in ASTM D-1784. The standard code designation shall be PVC 1120. The PVC compounds shall be tested and certified as suitable for potable water products by the NSF Testing Laboratory and shall carry the NSF approval marking.

Solvent-cement couplings or joints shall not be used. PVC joints using elastomeric gaskets shall be tested as assembled joints and shall meet the laboratory performance requirements specified in ASTM D-3139.

Pipe shall be pressure Class 200, DR 14 or Class 150, DR 18 (Dimension Ratio), as shown on the plans or the bid form.

Pipe and couplings shall be marked as follows:

a. Nominal size and OD base.
b. Material code designation (PVC 1120).
c. Dimension ratio number.
d. AWWA pressure class.
e. AWWA designation number (AWWA C900).
f. Manufacturers name or trade-mark and production record code.
g. Seal of the NSF Laboratory.

Pipe and couplings shall meet or exceed the following test requirements:

Sustained Pressure - ASTM D-1598 (1000 Hrs.)	
DR	Sustained Pressure
14	650
18	500

Burst Pressure - ASTM D-1599 (60-70 seconds)	
DR	Minimum Burst Pressure
14	985
18	755

Each standard and random length of pipe shall be proof-tested at four times its rated class pressure for a minimum of 5 seconds. Bells or couplings shall be tested with pipe.

The pipe shall not split, crack, or break when tested by the parallel-plato method as specified by ASTM D-2241.

The pipe shall not flake or disintegrate when tested by the acetone-immersion method as specified in ASTM D-2241.

Pipe shall be furnished in standard laying lengths of 20 ft. $\pm$ 1 in. A maximum of 15 percent of each pipe size may be furnished in random lengths of not less than 10 ft. each.

3.2.3 Ductile Iron Pipe. Ductile iron pipe shall be designed in accordance with AWWA (ASA A21.50) and for pressures and conditions as stated in these specifications or called for on the plans. Ductile iron pipe shall conform to AWWA C-151 (ASA A21.51.). Pipe shall be cement lined in accordance with AWWA C104 (ASA A21.4) and all exposed pipe and fittings shall have a shop prime coat applied that is compatible with the subsequent field enamel paint coats.

The specified thickness will be determined for the given internal and external loading requirements in accordance with ASA A21.50. The class of pipe, wall thickness, and coatings required will be shown on the plans or the bid form for all ductile iron pipe installation.

Pipe may be furnished in 12, 16, 16 1/2, 18 or 20 feet nominal laying lengths.

Hydrostatic and acceptance tests shall be in accordance with AWWA Specification C-106 for "Cast Iron Pipe Centrifugally Cast In Metal Molds" or C-108 for sand molds. The ENGINEER shall be provided with five (5) copies of each of the following tests for each contract involved:

a. Talbot strip test.
b. Ring and full length bursting tests.

c. Chemical analysis of pipe.
d. Certification that pipe was hydrostatically tested.

Any pipe not meeting the AWWA Specifications quoted above shall be rejected in accordance with the procedure outlined in the particular specifications.

The net weight, class or nominal thickness and sampling period shall be marked on each pipe.

Pipe joints shall be mechanical joint, rubber ring slip joint, flanged, or locked mechanical joint equal to AWWA C- 111.

Exposed piping shall be field painted and the colors shall match that of the existing piping.

3.2.4 Fittings. Cast or ductile iron mechanical joint fittings with appropriate adapters shall be used with PVC pipe. All such fittings shall be approved by the pipe manufacturer, and complete data sent to the ENGINEER, including the manufacturer's approval, for review. Fittings shall comply with AWWA C-110 or C-111 and shall be manufactured for the size and pressure class of the line on which they are used.

Mechanical joint fittings shall be used with ductile iron pipe for below ground burial and flange fittings shall be used for all interior piping where ductile iron pipe is used.

3.2.5 Pipe Handling. Pipe delivered to site in general, will be stored, handled, distributed, placed, joined together, etc. in accordance with the Manufacturer's recommendation unless instructed otherwise by these specifications or by the ENGINEER.

3.3 Gate Valves. The gate valves shall be installed at the locations as shown on the Drawings and they shall be resilient seated type.

3.4 Hydrant. The hydrant shall conform to all of the applicable requirements of ANSI/AWWA C502 Standard. They shall have a sealed oil reservoir that will provide positive lubrication of the stem threads and bearing surfaces each time the hydrant is opened. The hydrant shoe shall be designed for maximum full flow and the hydrant working pressure shall be 200 PSI. The hydrant shall the three way type with one 4 1/2-inch opening and two 2 1/2-inch openings.

3.5 Process Line Location. The CONTRACTOR shall be responsible for construction stakeout, based upon horizontal and vertical control points furnished by the ENGINEER. Changes in either vertical or horizontal alignment, as may be required during construction due to unforeseen obstacles or to accommodate changes in right-of-way, shall be made by the CONTRACTOR at the direction of the ENGINEER.

Such modifications in alignment shall be accommodated by the CONTRACTOR and the completed work shall be paid for under the unit prices bid for the work.

3.6 Excavation. The CONTRACTOR shall make trench excavations to only such width to provide ample room for proper construction. Sheeting and shoring shall be provided as required for proper safety and compliance with OSHA regulations. Rock excavation shall be taken to a depth of 6-inches below bottom of pipe. If poor foundation conditions exist due to organic material or quicksand, the trench shall be under-excavated to the depth required and filled with stone to obtain proper bearing capacity.

Watchmen or barricades, lanterns and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavations and other obstructions, shall be provided by and properly maintained at the expense of the CONTRACTOR.

Only one-half of street crossings and road crossings shall be excavated before placing temporary bridges over the side excavated for the convenience of the traveling public.

3.7 Blasting and Rock Excavation. The CONTRACTOR shall make his own investigation as he deems necessary to ascertain the sub-surface conditions to be encountered in the work.

All blasting operations shall be conducted in accordance with municipal ordinances, state and federal laws and Section 9, Explosives, of the "Manual of Accident Prevention in Construction, published by the Associated General Contractors of America, Inc. Soil particle velocity shall not exceed limit set by Kentucky law. All explosives shall be stored in conformity with said ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, sewer lines, natural or manufactured gas lines, liquid petroleum product lines or other utilities. Any damage done by blasting is the responsibility of the CONTRACTOR and shall be promptly and satisfactorily repaired by him.

The CONTRACTOR shall use delay caps or other approved methods to reduce earth vibrations and noise. Mud capping, as defined in the above manual, will not be permitted as a method of breaking boulders. No blasting shall be permitted on Sundays or after dark.

Prior to commencing with the work, the CONTRACTOR shall, during a preconstruction conference with the OWNER and ENGINEER, state clearly his approach to performing the excavations on the project. He shall be familiar with the laws and ordinances covering blasting and shall also give consideration to the use of hydraulically operated rock breaking devices in lieu of blasting where considered necessary. If blasting is not handled in an expert manner at all times, the ENGINEER reserves the right to suspend blasting and require the work to proceed without it.

Prior to blasting, the CONTRACTOR shall make his own detailed preblast survey of adjacent walks, curbs, retaining walls, house foundations, etc. to determine conditions prior to the work. Such a file of information, including photographs, may be certified in such a manner as the CONTRACTOR believes necessary since this is information that may stand in his defense.

3.8 Storage of Excavated Material. All excavated material shall be stored in a manner that will not endanger the work and that will avoid obstructing roadways, sidewalks, and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes or other utility controls shall be left unobstructed and accessible. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural watercourses shall not be obstructed.

3.9 Shoring, Sheeting, and Bracing. The CONTRACTOR shall furnish, place and maintain such sheeting and bracing as may be required to support the sides of the excavation or to protect other structures from possible damage. All sheeting and bracing shall be removed upon completion of the work, unless permitted to be left in place by the ENGINEER. Any sheeting or bracing left in place shall be cut off at least two feet below the finished ground surface elevation. The cost of furnishing, placing, maintaining and removing sheeting and bracing shall be included in the unit price bid for water lines. All work shall conform to OSHA requirements.

3.10 Removal of Water. The CONTRACTOR shall provide adequate pumps, temporary drains and appurtenant equipment to dewater excavations in such a manner that will not interfere with the progress of work.

3.11 Bedding. All process lines shall be bedded with 6- inches of #9 or approved equal stone under and on both sides of the pipe where necessary when rock or poor foundation conditions exist.

3.12 Thrust Blocks and Anchorage. Thrust blocks shall be installed whenever the pipe line changes direction, as at tees, bends, crosses, stops, as at a dead end; or at valves. The locations of thrust blocks depend on the direction of thrust and type of fitting. Their size and type depends on pressure, pipe size, kind of soil, and the type of fitting. Where thrusts act upward (as at vertical curves) the weight of the pipe, the water in the pipe and the weight of the soil over the pipe should be determined to make certain that the total weight is sufficient to resist upward movement. If there is not enough soil or if it will not compact over the pipe or it is too soft and mushy to resist movement, then ballast or concrete may be placed around the pipe in sufficient weight and volume to counteract the thrust. Where a fitting is used to make a vertical bend, the fitting may be anchored to a concrete thrust block designed to key in to undisturbed soil and to have enough weight to resist upward and outward thrust, since the new placed backfill may not have sufficient holding power.

Thrust blocks shall be constructed of not less than Class B concrete conforming to KBH Specification 601 and placed between the fitting and the trench wall. It is important to place the concrete so it extends to undisturbed (freshly cut) trench wall.

The thrust blocks shall be sized as shown on the DRAWINGS contained elsewhere in these Specifications.

3.13 Backfill. Trenches shall be backfilled and "walked in" at once up to the height specified and shown in the PLANS. Backfill material shall be such that it may be compactly tamped around the pipe. No rock larger than two inches will be permitted within six inches of the pipe. No loose rock larger than six inches shall be less than 12 inches from the pipe. In open, unpaved, or unsurfaced areas the remainder of the fill may be thrown in loose and ridged up over the top of the trench. Mechanical backfilling shall be done with a rotobackfiller or angle dozer. When trenches are in the traveled areas or other places where property will be damaged by settlement of fill, sufficient compaction shall be made immediately. The remainder of the dirt shall be ridged up over the trench unless otherwise ordered by the ENGINEER. The CONTRACTOR at no time shall open up more than 500 feet of trench ahead of backfill and cleanup.

Any damage to underground structures, pipes, wires, drains, etc. shall not be backfilled until they have been satisfactorily repaired or replaced to the original serviceability at the CONTRACTOR'S expense and as approved by the ENGINEER. Settlement of backfill may be done with water furnished by the CONTRACTOR under the direction of the ENGINEER where such will not endanger traffic or damage property. When excavated rock is used for backfilling, it shall have sufficient dirt or fine material to fill all voids and shall not be used within twelve inches of the pipe. All excess rock shall be cleaned up and taken away. No rock larger than two inches shall be left. In areas to be mowed, area shall be raked and smoothed with no rock larger than one inch.

The CONTRACTOR shall maintain the job in a neat and cleaned up condition at all times so as to cause minimum nuisance to the people. Procrastination of clean up and repair will not be tolerated. Minimum trench dirt shall be left outside trench and no soil outside trench shall be removed. Wherever it is necessary to tamp the trench because of traffic, sodding, or other conditions, the ENGINEER will so instruct the CONTRACTOR who will include this cost in unit price bid. This tamping must have a compaction of at least 90 percent. The CONTRACTOR will be responsible for any settlement or damage due to settlement where tamping has been done. The tamping must be done the same day that trenching is done if there appears to be any danger of precipitation. If the weather appears to be safe, the ENGINEER may permit the CONTRACTOR to complete the tamping the following day. Where tamping is ordered, all excess dirt must be removed the day trenching is done or the following day.

3.14 Temporary Surfacing. All trenches in streets, roads or drives shall, following compacted backfill, receive a top layer of compacted #610 dense grade stone. Such

temporary surfacing shall be maintained, including nights and weekends, and such areas shall be paved within two weeks as soon as conditions permit. All public or private drives shall be promptly backfilled or bridged.

3.15 Testing. The water line and appurtenances, as rapidly as valves are installed, shall be tested to the pressure rating of the pipe, or as directed by the ENGINEER, at point of maximum pressure. Defective joints of pipe shall be cut out and replaced as directed by the ENGINEER. Cracked or defective pipe fittings, valves or hydrants disclosed in the pressure test shall be replaced by the CONTRACTOR with sound material, and the test shall be repeated until the test results are satisfactory to the ENGINEER.

The CONTRACTOR shall maintain required pressure for six hours and shall measure the amount of water necessary to maintain this pressure for this length of time. The amount of water used to maintain the pressure shall not exceed five gallons per 24 hours per mile of pipe per inch nominal diameter of the pipe except in special hardship cases.

All leaks shall be repaired whenever or wherever there is evidence of a leak and the location is known or can be reasonably found. Water used by the CONTRACTOR shall be paid for by the CONTRACTOR at the rate of $2.00 per 1,000 gallons.

3.16 Sterilization. Upon completion of a section, disinfection shall be done strictly in accordance with the procedure designated in Kentucky State Department of Health regulations which reads as follows: "All new water distribution systems including storage distribution tanks and repaired portions of or extensions to existing systems shall be thoroughly disinfected before being placed in service by the use of chlorine or chlorine compounds in such amounts as to produce a concentration of not less than 50 ppm and a residual of not less than 25 ppm at the end of 24 hours and followed by thorough flushing." Putting small amounts of powdered chlorine in each joint will not be acceptable. Where the new system is connected to the present system the CONTRACTOR will install a 3/4" water meter for the CONTRACTOR on a regular water meter customer basis except that the CONTRACTOR will be charged a flat rate of $2.00 per 1,000 gallons.

3.17 Service Connections. Any utility connections encountered in the work shall be preserved and protected. Where relocation or repair is required to accommodate the work, they shall be made in a manner acceptable to the utility having jurisdiction over the service connection. Accommodation of service connections shall not constitute any basis for extra payment.

3.18 As-built Drawings. As each line is installed, i.e. Line A, etc., the CONTRACTOR shall maintain a carefully marked-up set of plans to show exact "as-built" location of all valves, fire hydrants, tees, blind flanges, tie-ins to existing lines, altitude valves, etc. All drawings shall pinpoint locations by two measured distances

from prominent landmarks. As-built drawings shall also show the accurate location of other structures and utilities adjacent to or crossing the work. As-built drawings shall be periodically delivered to the ENGINEER.

3.19 Coordinations With Utilities. Prior to construction, the CONTRACTOR shall arrange to meet with representatives of all utilities, and provide them with his anticipated work schedule. The CONTRACTOR shall have the utilities make their best determination of utility locations in the areas in which he is working. Throughout the progress of the work, such field markings of utilities shall be kept current. Repairs to any utilities damaged by the CONTRACTOR shall normally be performed by the utility at the CONTRACTOR'S expense, unless the CONTRACTOR and the utility negotiate other understandings and/or procedures.

3.20 Payment for Water. All water used from the OWNER supply shall be metered by meters supplied by the CONTRACTOR. The CONTRACTOR shall pay for such water monthly at the rate of $2.00/1,000 gallons. Water lost during water line breakage shall be computed at the rate of $2.00/1,000 gallons. The quantity lost shall be computed on the basis of a discharge velocity of 7 feet/second, the diameter of the line, and the estimated duration of free uncontrolled discharge.

3.21 Cleanup. The CONTRACTOR shall provide effective cleanup of the work as it progresses. At the time of final inspection, no trenches shall show any undue evidence of the previous construction. All areas shall be left free of ruts due to construction equipment and shall have a clean and neat appearance without rubble or debris. The areas shall not be mounded up and shall be completely restored, and all yards and fields shall be reseeded so land may be cultivated, mowed, etc. Straw and fertilizing shall accompany the seeding and the seed mixture shall match existing ground cover. If necessary to hasten proper restoration of terraces, principally along ditch lines, the CONTRACTOR shall sod such areas at the ENGINEER'S direction.

3.22 Protection of Adjacent Landscape. Reasonable care shall be taken during construction of the process lines to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

3.23 Underground Marking Tape. At all locations where PVC pipe is utilized a detectable underground marking tape shall be place in the trench approximately six inches below the finished grade. The tape used shall be mylar encased aluminum foil with the printing “CAUTION - Buried Water Line Below.” Printing shall be readable through the clear mylar and surface printing is not acceptable. Tape size shall be two inch width as provided by Lifeguard, Inc. or approved equal. Color of the tape shall be blue.

3.24 Payment. Payment shall be included in the payment for the work to which it is subsidiary in the Bid Schedule.

SECTION 4 - SITE WORK

4.0 Work Included. Under this section the Contractor shall provide all labor, tools, equipment and materials to perform the sitework which consists of topsoil removal, excavation, the removal and proper utilization or disposal of all excavated materials, necessary borrow, fill requirements, the shaping and finishing of all excavation work to the required lines and grades, preparation of subgrade for tanks, basins, building slabs, walks and pavements, engineered fill for support of building or basin slabs, backfilling of tanks, basins, basements, and trenches within building lines, pavement replacements, and seeding and mulching.

4.1 Geotechnical Data. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that the Owner will not be responsible for interpretation or conclusions drawn therefrom by the Contractor. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.

4.2 Existing Utilities. Prior to commencement of work, the Contractor shall locate existing underground utilities in areas of the work. If utilities are to remain in place, the Contractor shall provide adequate means of protection during earthwork operations.

4.3 Use of Explosives. The Contractor (or any of his subcontractors) shall not bring explosives onto the site or use in the work without prior written permission from the Owner. The Contractor shall present a blasting plan to the Owner and Engineer and not commence blasting operations until such plan is approved by the Engineer and Owner. All activities involving explosives shall be in compliance with all the Federal, State and Local laws and regulations pertaining to blasting and use of explosives. The Contractor is solely responsible for handling, storage, and the use of explosive materials and the safety of others in the area when their use is permitted. The Contractor shall review all blasting procedures with the Owner and Engineer prior to commencement of all blasting work. The Contractor is responsible for all blasting procedures. The particle velocity of all affected, adjacent structures shall be monitored with a seismograph located at that structure. The peak particle velocity shall not exceed two inches per second at a distance of 50 feet, or any velocity that may cause damage to adjacent structures. The Contractor is responsible for repair of any damaged structure.

No blasting shall be performed in areas where structural concrete is less than seven days old without the express written consent of the Engineer.

Protective material covering shall be used at all times to prevent flying rocks from damaging property or injuring personnel.

A copy of the required blasting log shall be available to the Owner and Engineer.

4.4 Excavation. Excavation includes excavation to subgrade elevations including excavation of earth, rock, bricks, wood, cinders and other debris. All excavation of materials shall be included in the lump sum portion of the work and will be unclassified and no additional payment will be made regardless of type of material encountered.

Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at Contractor's expense.

4.4.1 Clearing & Grubbing. The Contractor shall cut and remove designated trees, stumps, brush, logs, fences, or other materials such as stumps, roots and other natural obstructions. No cleared or grubbed materials shall be used in backfills or embankment fills.

All stumps, roots and other objectionable material shall be grubbed up so that no roots larger than three inches in diameter remain less than 18 inches below the ground surface.

All holes and depressions left by grubbing operations shall be filled with suitable material and compacted to grade.

The Contractor shall remove from the site and satisfactorily dispose of all miscellaneous rubbish including, but not limited to, masonry, scrap metal, rock, pavement, etc. that is under the fill or to be removed as shown on the Drawings, specified herein, or directed by the Engineer.

Existing improvements, adjacent property, utility and other facilities, and trees, plants and brush that are not to be removed shall be protected from injury or damage.

Trees and shrubs designated to remain or that are beyond the clearing and grubbing limits which are injured or damaged during construction operations shall be treated at the Contractor's expense by experienced tree surgery personnel.

4.4.2 Excavation for Structure. Excavation for structures shall conform to the elevations and dimensions shown within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection. All loose material shall be removed from the excavation just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

Protruding rock formations that would interfere with uniform footing bearing shall be removed such that the structure will bear upon uniform engineered fill at least 24 inches thick.

No slab shall bear directly upon rock. All excavations shall extend to a depth that allows a minimum of six-inches crushed stone base under slab.

All necessary precautions shall be taken to preserve the material below and beyond the lines of all excavation in the soundest possible condition. Any damage to the work due to the Contractor's operations, including shattering of the material beyond the required excavation lines, shall be repaired at the expense of and by the Contractor. Any and all excess excavation for the convenience of the Contractor for any purpose or reason, except as may be ordered in writing by the Engineer and whether or not due to the fault of the Contractor, shall be at the expense of the Contractor. Where required to complete the work, all such excess excavation and over excavation shall be refilled with materials furnished and placed at the expense of and by the Contractor. Slopes shattered or loosened by blasting shall be taken down at the expense of and by the Contractor.

All excavation for embankment and structure foundations shall be performed in dry weather conditions. No excavation shall be made in wet weather or where frozen materials exist without written approval.

4.5 Disposal of Material. All surplus excavated material and/or waste materials shall be disposed of outside the floodplain in an area provided by the Contractor and approved by the Engineer. The material shall be compacted to a smooth condition and sloped to provide positive drainage.

Any material removed from an impoundment, river, stream or shore shall be removed from the area and disposed of outside of the floodplain as described above. Where shore areas are excavated and/or disturbed, the final contours shall be established by using rip-rap stone or other materials as shown on the Drawings.

4.6 Sheeting and Bracing. Sheeting and bracing as may be required to safely support the sides of excavations while maintaining the required side slopes shall comply with the safety precautions as outlined in current and accepted safety manuals, such as "Associated General Contractors Manual of Accident Prevention in Construction". Where sheeting and bracing are necessary to prevent caving of the walls of excavations and to safeguard the workmen, the excavations shall be dug to such widths that proper allowance is made for the space occupied by the sheeting and bracing. The Contractor shall perform the additional excavation required and furnish and put in place the necessary sheeting and bracing and shall remove the same as the excavation is filled, at his own expense.

4.7 Removal of Water. The Contractor shall construct and maintain all necessary channels, flumes, and/or other temporary diversion and protective works; shall furnish all materials required therefore; and shall furnish, install, maintain and operate all well points, casings, pumps and other equipment for dewatering the various parts of the work and for maintaining the foundations, trenches and other parts of the work free from water as required for constructing each part of the work. After having served their purpose, all temporary protective works shall be removed, or leveled, to give a sightly appearance and

so as not to interfere in any way with the operation, usefulness or stability of the permanent structures.

4.8 Backfill and Fill Material. All material to be used as backfill material shall be approved by the Engineer prior to backfilling excavations. With the exception of the organic debris, existing fill material, and topsoil, the on-site soil removed from the excavations will be used as fill or backfill material that is approved by the Engineer.

After clearing and stripping operations have been completed, all structure locations shall be proofrolled with a loaded pan or heavy pneumatic tired vehicle to densify upper soils and to locate possible areas which will require undercutting, removal and/or recompaction. This operation shall be conducted under the surveillance of the Engineer.

Before initiating filling operations, the Contractor shall receive approval of fill material by the Engineer. Proctor density tests shall be run on representative samples obtained from the proposed borrow material.

Where structures or other appurtenances are constructed on fill, the fill shall be placed in layers not over six inches deep, as measured before compaction and be thoroughly compacted. Compaction may be obtained by use of a sheeps foot roller or pneumatic-tired roller. Water shall be applied as directed to obtain close adhesion between layers and all parts of the material. Fill shall be compacted to a minimum of 95% of the Standard Proctor maximum dry density (ASTM Specifications D-698). A minimum of two compaction tests per each two feet of fill on a structure location shall be performed by a geotechnical engineer.

Only suitable material approved by the Engineer shall be used for backfilling around structures. Backfilling around structures shall have material placed in layers of six inch depth and compacted by pneumatic tools or other small equipment operated by hand. In no case shall the backfilling be allowed to obtain an elevation of one foot above any other area. It shall be uniformly compacted throughout the structure depth. Any deviation shall be cause for the Engineer to require the material deposited to be removed and recompacted at the Contractor's expense.

All backfilling shall be done in such a manner that the pipe or structure over or against which it is being placed will not be disturbed. Any pipe or structure damaged or moved from its proper line or grade during backfilling operations shall be removed or repaired to the satisfaction of the Engineer and then backfilled.

4.9 Borrow Material. Borrow material shall consist of and include the required excavation and proper utilization of approved materials obtained from designated areas when sufficient quantities of suitable materials are not available from other required excavation.

The control of excavation in any borrow area and the selection of materials therefrom shall at all times be as directed by the Engineer. On completion of excavation, all borrow pits shall be left in a neat and sightly condition. Unless otherwise approved by the Engineer, all borrow pits shall be so graded and dressed that water will readily drain therefrom, and away from all embankments, berms and structures. When shown on the drawings, terraces or diversions shall be constructed to protect the slopes of the borrow areas from erosion and shall be considered a subsidiary of this specification.

4.10 Erosion Control. Temporary measures shall be applied throughout the construction permit to control and to minimize siltation to adjacent properties and waterways. Such measures shall include, but not be limited to, the use of berms, baled straw silt barriers, gravel or crushed stone, mulch, slope drains and other methods. These temporary measures shall be applied to erodible material exposed by any activity associated with the construction of this project.

4.11 Finish Grading. Finish grading shall be to the finished elevations and grades shown, and shall be made to blend into conformation with remaining natural ground surfaces. All finish graded surfaces shall be left smooth and free to drain. Excess materials shall be spread and compacted as directed. Grading within the construction area and around the outside of building and structure lines shall be performed in a manner which will prevent accumulation of water within the area. Where necessary, or where shown, finish grading shall be extended to insure that water will be directed to drainage ditches, and the site area left smooth and free from depressions holding water.

4.12 Seeding and Mulching. All disturbed areas shall be seeded, fertilized and mulched as shown on the Drawings. The application of materials shall be as follows:

4.12.1 Lime. Two tons of agricultural limestone per acre shall be required.

4.12.2 Fertilizer. The following amounts of fertilizer are required per acre:

(1) Nitrogen (N)	60 lbs.
(2) Phosphorous (P205)	120 lbs.
(3) Potash	120 lbs.

This requirement can be met by applying fertilizer having an analysis of 10-20-20 at the rate of 600 pounds per acre.

4.12.3 Seed. The following amounts of pure live seed are required per acre:

(1) KY-31 Fescue	60 lbs.
(2) Perennial Ryegrass	25 lbs.
(3) Red Clover	10 lbs.

4.12.4 Mulch. Mulch shall consist of wood fiber applied at a rate of 1600 pounds per acre, bituminous treated straw applied at a rate of 2000 pounds per acre or other mulch subject to the advance approval of the Engineer.

4.12.5 Execution. The seeding shall be completed within two weeks after completion of the work or as soon thereafter as conditions are favorable. Immediately prior to seedbed preparation, the Contractor shall apply the agricultural lime and fertilizer uniformly over the area to be seeded. The seedbed shall be prepared by pulverizing and breaking up the soil to a minimum depth of two inches with a disk harrow, drag harrow, spike tooth harrow or similar tool. All rocks, clods, and undesirable material that would interfere with seeding operations shall be removed.

The seeding operations shall be performed immediately after, or as soon as practicable, after the seedbed has been prepared. The seed shall be drilled or broadcast uniformly over the seedbed with regular approved type of equipment or method acceptable to the Engineer. The seeded area shall be passed over with a harrow or cultipacker to help cover more seed and improve seedling establishment. Excessive tillage shall be avoided. After all construction work is complete, prior to final payment, all exposed areas shall be cleaned and left in a sightly manner. All unused material shall be removed from the site.

The Contractor may hydroseed and hydromulch if the following requirements are met.

1. The individual seed quantities shall be increased by 20%.

2. The mulch shall be a processed hay or straw applied at a rate of 3/4 ton per acre with 80 lbs. per acre of an organic tackifier.

3. The hydroseeder slurry shall not be allowed to drop below a pH of 5.0.

The Contractor shall be responsible for the maintenance of all work under this section until final acceptance. Adequate protection of exposed slopes shall be provided at all times to prevent excessive erosion. No work will be accepted unless there is evidence of healthy growth and sufficient cover to prevent erosion.

Work executed under this section shall be guaranteed for one year with the guarantee beginning on the date of final acceptance of all work under this Contract. Any seeded areas of the site which are found to not have an adequate growth of cover during the guarantee period, shall be re-seeded as soon as weather conditions permit, at no cost to the Owner.

4.13 Bituminous Pavement. At the completion of construction, all roads shall be regraded and areas to be paved with bituminous shall be prepared for a prime coat of emulsified asphalt RT-2 applied at the rate of 0.35 gallon per square yard. A two-inch thick Class "I" Bituminous Concrete Binder shall be placed above the prime coat in accordance with the Kentucky Bureau of Highways Specifications. The three feet wide

shoulders of dense graded aggregate shall be graded and rolled to the top of the binder course and shall slope out and away from pavement.

After roadway has been traveled for a period of at least 60 days and all plant construction and piping is complete, a 1 1/2-inch thick layer of Class "I" Bituminous Concrete shall be placed as a finished and complete roadway surface.

The roadways and parking areas shall be constructed in accordance with good paving practices. Problems due to unequal settlement shall be properly handled to prevent an uneven road surface. In any case, the Contractor is responsible for providing roads with neat lines and smooth surfaces throughout the plant site.

Damage to the existing paving caused by the Contractor will be patched to the full road width in the damaged area. All patching shall be to neat lines and even surfaces.

4.14 Payment. Payment for all excavation and fill work shown on the Drawings and herein specified, that is required to complete the clearing, grubbing, site grading, roads, structural excavation, borrow excavation, backfill, sheeting, shoring, topsoil, crushed stone or gravel, drainage, pumping, embankment fills, pavement, seeding and mulching, and any other excavation and fills required to complete the work as shown on the Drawings shall be included in the work to which it is subsidiary in the Bid Schedule and no measurement of the quantities will be made. The contours and elevations of the present ground are believed to be reasonably correct but are not guaranteed. The Contractor shall satisfy himself by actual examination of the site of work as to the existing elevations and contours and the amount of work required under this section.

SECTION 5 – CHAIN LINK FENCING

5.0 Worked Included. The Contractor shall furnish all labor, equipment and materials required to furnish and install chain link fence and gates complete including all erection accessories, fittings and fastenings, as specified herein, and any other incidental items of the types and sizes and at the locations shown on the Drawings.

5.1 Description. Chain link fence shall be installed after completion of clearing and grubbing. The fencing shall be of standard overall height of nine (9) feet and constructed of chain link fabric with three rows of barbed wire on top of steel brackets. Chain link fabric shall be one foot less than the complete overall height of the fence. Pedestrian gates shall have four foot openings. Vehicular gates shall be of the double swing type as shown and with the opening indicated on the Drawings.

5.2 Materials. The fence shall be constructed of one type material as indicated on the Drawings and as specified under this Section. Posts, braces and accessories shall conform to the standards of the Chain Link Fence Manufacturer's Institute (CLFMI) Specifications for industrial steel fences. Fence material, setting and accessories shall be as follows:

5.2.1 Fabric. Galvanized after woven, chain link copper bearing steel No. 9 gauge wire with 2-inch mesh with twisted and barbed finish at top and bottom and of a normal fabric width of eight feet.

5.2.2 Posts, Top Rail, and Braces. Shall be galvanized steel pipe, steel tube, H, I or U rolled sections, standard with the manufacturer.

5.2.3 Extended Arms. Shall be of the angle type and of pressed steel so as to receive three strands of barbed wire.

5.2.4 Barbed Wire. Shall be two-strand twisted No. 12-1/2 gauge double galvanized copper bearing steel wire with four point barbs of No. 14 gauge double galvanized copper bearing steel wire spaced approximately five inches apart.

5.2.5 Fence Installation and Post Setting. Shall conform to the CLFMI standards for chain link fence installation. The purpose of this fence is to keep people and animals out and therefore no crawl space beneath the fence will be allowed.

5.2.6 Gates. Frames shall be filled with fabric of the same specification as used in the chain link fence. Gates shall be equipped with offset hinges and latch for padlock arrangement, including 2-inch padlock, plus plunger rod and catch. Three keys shall be furnished with each padlock.

5.3 Payment. Payment shall be included in the payment for the work to which it is subsidiary in the Bid Schedule.

SECTION 6 – EROSION CONTROL

6.0 Scope of Work. It is intent of this specification to define the acceptable methods and materials for preparing storm water Best Management Plan and Notice of Intent, installing all applicable erosion control measures in accordance with Best Management Practice Plan and as specified and maintain erosion control measures as needed.

6.1 Installation Plan.

6.1.1 Minimize Disturbance and Buffer Strips Only areas necessary for construction shall be disturbed, cleared or graded. Vehicles and construction equipment shall be excluded from these areas so to preserve all natural vegetation. All areas that are disturbed during construction, including slopes, shall be protected during clearing and construction in accordance with the approved erosion and sediment control plan until they are permanently stabilized.

If top soil is needed for the re-establishment of vegetation, it shall be piled until the necessary amount needed to finish grading of all exposed areas. Areas that are to be filled shall be cleared, grubbed to remove trees, vegetation, roots and other objectionable material, and stripped of topsoil.

Areas to receive topsoil shall be scarified to a minimum depth of three inches prior to the placement of topsoil. All fills shall be compacted as required by building standards to reduce erosion, slippage, settlement, subsidence and other related problems. Fill intended to support buildings, structures, conduits, etc., shall be compacted in accordance with local requirements or codes.

6.1.2 Land Grading for Minimizing Erosion. Only areas necessary for construction shall be disturbed, cleared or graded. Vehicles and construction equipment shall be excluded from these areas so to preserve all natural vegetation. All areas that are disturbed during construction, including slopes, shall be protected during clearing and construction in accordance with the approved erosion and sediment control plan until they are permanently stabilized. All sediment control measures shall be constructed and maintained in accordance with the approved erosion and sediment control plan and according to the standards and specifications for the appropriate erosion control practices.

If top soil is needed for the re-establishment of vegetation, it shall be piled until the necessary amount needed to finish grading of all exposed areas. Areas to receive topsoil shall be scarified to a minimum depth of three inches prior to the placement of topsoil.

The outer face of the fill slope should always be allowed to stay loose, not rolled, compacted, or bladed smooth. A bulldozer may run up and down the fill slope so the dozer treads create groves perpendicular to the slope. Use slope breaks, such as diversions, benches, or contour furrows as appropriate, to reduce the length of cut-and-fill slopes to limit sheet and rill erosion and prevent gullying. The finish cut-and-fill slopes,

which are to be vegetated with grass and legumes, should not be steeper than two horizontal to one vertical.

Roughen the surface of all slopes during the construction operation to retain water, increase infiltration, and facilitate vegetation establishment.

Seeps or springs encountered during construction shall be handled in accordance with approved methods.

Stabilize all graded areas with vegetation, crushed stone, rip-rap, or other ground cover as soon as grading is completed or if work is interrupted for 21 working days or more.

Use mulch to stabilize areas temporarily where final grading must be delayed. Stockpiles, borrow areas and spoil areas shall be shown on the plans and shall be stabilized to prevent erosion and sedimentation.

6.1.3 Erosion Control Blankets and Matting.

A. Site Preparation. Proper Site Preparation is essential to ensure complete contact of the protection matting with the soil. Grade and shape area of installation. Remove all rocks, clods, vegetation or other obstructions so that the installed blankets, or mats will have direct contact with the soil. Prepare seedbed by loosening two to three inches of topsoil above final grade. Incorporate amendments, such as lime and fertilizer, into soil according to soil test and the seeding plan.

B. Seeding. Seed area before blanket installation for erosion control and re-vegetation or seed after mat installation for turf reinforcement. When seeding prior to blanket installation, all check slots and other areas disturbed during installation must be re-seeded. Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

C. Anchoring. U-shaped wire staples, metal geotextile stake pins or triangular wooden stakes can be used to anchor mats to the ground surface. Wire staples should be a minimum of 11 gauge. Metal stake pins should be 3/16 inch diameter steel with a 1 ½ inch steel washer at the head of the pin. Wire staples and metal stake should be driven flush to the soil surface. Two inches of wood staking should remain above the soil surface. All anchors should be six to eight inches long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils.

D. Installation on Slopes. Begin at the top of the slope and anchor its blanket in a six inches deep by six inches wide trench. Backfill trench and tamp earth firmly. Unroll blanket down slope in the direction of the water flow. Lay blankets loosely and maintain direct contact with the soil. Do not stretch. The edges of adjacent parallel rolls must be overlapped two to three inches and be stapled every three feet. When blankets must be spliced, place blankets end over end (shingle style) with six inches overlap. Staple through overlapped area, approximately twelve inches apart.

Blankets shall be stapled sufficiently to anchor blanket and maintain contact with the soil. Staples shall be placed down the center and staggered with the staples placed along the edges Steep slopes, 1:1 to 2:1, require 2 staples per square yard. Moderate slopes, 2:1 to 3:1, require 1 ½ staples per square yard (1 staple three feet on center). Gentle slopes require 1 staple per square yard.

E. Installation in Channels. Dig initial anchor trench twelve inches deep and six inches wide across the channel at the lower end of the project area. Excavate intermitten check slots, six inches deep and six inches wide across the channel at twenty five to thirty five foot intervals along the channel. Cut longitudinal channel anchor slots four inches deep and four inches wide along each side of the installation to bury edges of matting, whenever possible extend matting two to three inches above the crest of channel side slopes.

Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at one foot intervals. Note: matting will initially be upside down in anchor trench.

In same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of three inches. Secure these initial ends of the mats with anchors at one foot intervals, backfill and compact soil. Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining three inch overlap.

Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot the fold back against itself. Anchor through both layers of mat at one foot intervals the backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench. Alternate method for non-critical installations: place two rows of anchors on six inch centers at twenty five to thirty foot intervals in lieu of excavated check slots.

Shingle-lap spliced ends by a minimum of one foot with upstream mat on top to prevent uplifting by water or begin new rolls in a check slot. Anchor overlapped area by placing two rows of anchors, one foot apart on one foot intervals.

Place edges of outside mats in previously excavated longitudinal slots, anchor using prescribed staple pattern, backfill and compact soil.

Anchor, fill and compact upstream end of map in a twelve inch by six inch terminal trench. Secure mat to ground surface using U-shaped wire staples geotextile pins or wooden stakes. Seed and fill turf reinforcement matting with soil, if specified. After seeding, spread and lightly rake ½ inch to ¾ inch of fine topsoil into the mat apertures to completely fill mat thickness. Use backside of rake or other flat implement.

Spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid sharp turns with equipment. Do not drive tracked or heavy equipment over mat. Avoid any

traffic over matting if loose or wet soil conditions exist. Use shovels, rakes or brooms for fine grading and touch up. Smooth out soil filling just exposing top netting of matrix.

F. Inspection and Maintenance. All blanket and mats should be inspected periodically following installation. Inspect installation after significant rainstorms to check for erosion and undermining. Any failure should be repaired immediately. If washout or breakage occurs, reinstall the material after repairing the damage to the slope or drainage way.

6.1.4 Topsoiling. Determine whether the quality and quantity of available topsoil justifies selective handling. Soils of the textural class of loam, sandy loam, and silt loam are best; sandy clay loam, silty clay loam, clay loam, and loamy sand are fair. Do not use heavy clay and organic soils such as peat or muck as topsoil.

Strip topsoil only from those areas that will be disturbed by excavation, filling, road building, or compaction by equipment. Determine depth of stripping by taking soil cores at several locations within each area to be stripped. Put sediment basins, diversions, and other controls into place before stripping. Select stockpile location to avoid slopes, natural drainage ways, and traffic routes. Use sediment fences or other barriers where necessary to retain sediment.

Protect topsoil stockpiles by temporarily seeding and/or mulching as soon as possible to assure the stored material is not exposed and allowed to erode.

If stockpiles will not be used within twelve months they must be stabilized with permanent vegetation to control erosion and weed growth.

Before spreading topsoil, establish erosion and sedimentation control practices such as diversions, berms, dikes, waterways, and sediment basins.

Where the pH of the existing subsoils 6.0 or less, or the soil is composed of heavy clays, incorporate agricultural limestone in amounts recommended by soil tests or specified for the seeding mixture to be used. Incorporate lime to a depth of at least two inches by disking.

Immediately prior to spreading the topsoil, loosen the subgrade by disking or scarifying to a depth of at least three inches, to ensure bonding of the topsoil and subsoil. If no amendments have been incorporated, loosen the soil to a depth of at least six inches before spreading topsoil.

Uniformly distribute topsoil to a minimum compacted depth of two inches on 3:1 slopes and four inches on flatter slopes.

Do not spread topsoil while it is frozen or muddy or when the subgrade is wet or frozen.

Correct any irregularities in the surface that result from topsoiling or other operations to prevent the formation of depressions or water pockets.

Compact the topsoil enough to ensure good contact with the underlying soil, but avoid excessive compaction, as it increases runoff and inhibits seed germination. Light packing with a roller is recommended where high maintenance turf is to be established.

6.1.5 Temporary Gravel Construction Entrance. The aggregate size for construction of the pad shall be two to three inch stone. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.

The thickness of the pad shall not be less than six inches. Use geotextile fabrics, if necessary, to improve stability of the foundation in locations subject to seepage or high water table.

The width of the pad shall not be less than the full width of all points of ingress or egress and in any case shall not be less than twelve feet wide.

The length of the pad shall be as required, but not less than fifty feet.

Locate construction entrances and exits to limit sediment leaving the site and to provide for maximum utility by all construction vehicles. Avoid entrances which have steep grades and entrances at curves in public roads.

The entrance shall be maintained in a condition that will prevent tracking or flowing of sediment onto public rights of way. This may require periodic top dressing with additional stone as conditions demand, and repair and/or clean out of any measures used to trap sediment.

All sediment spilled, dropped, washed or tracked onto public rights-of-way shall be removed immediately. Provide drainage to carry water to a sediment trap or other suitable outlet.

When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with crushed stone that drains into an approved sediment trap or sediment basin.

All sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, straw bales, or other approved methods.

Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. Replace gravel material when surface voids are visible. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary. Immediately remove all objectionable material spilled, washed, or tracked onto public roadways. Remove all sediment deposited on paved roadways within 24 hours.

6.1.6 Rock, Log and Straw Bale Check Dams. The maximum spacing between the dams shall be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.

Rock dams shall be constructed of two to fifteen inch rock. Keep the center rock (spill way) section at least six inches lower than the outer wall edges. Extend the abutments eighteen inches into the channel bank.

Straw bales shall be placed in a single row, lengthwise, oriented perpendicular to the flow, with the ends of adjacent bales tightly abutting one another. Straw bales shall be extended such that the bottoms of the end bales are higher in elevation than the top of the middle bale spillway to ensure that sediment-laden runoff will flow over the barrier, and not around it.

Each straw bale shall be embedded in the soil a minimum of four inches. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales. If the straw bales are wire bound, they should be oriented so the bindings are around the sides rather than along the top and bottom. Wire bindings that are placed in contact with the soil soon disintegrate and may allow the bale to fall apart.

Construct an energy dissipater to reduce downstream erosion.

The check dams shall be inspected for damage periodically during the winter and after each significant storm (one inch in 24 hours). Prompt repairs shall be made to ensure that the dam is functioning properly. Any erosion caused by flows around edges of the dam or under the structure shall be corrected immediately.

Remove sediment from behind the dams when they become sixty percent full, or as needed. The removed sediment shall be deposited in an area that will not contribute sediment off site and can be permanently stabilized. Remove check dams and stakes when stabilization is complete.

6.1.7 Straw Bale Dike. The bales shall be placed on the slope contour at the base of the slope or around the perimeter of the construction site. If the dike is constructed at the toe of a slope, place it five to six feet away from the slope if possible.

Do not construct the dike more than one bale high. Bales shall be placed in a row with the ends tightly abutting. Each bale shall be embedded in the soil a minimum of four inches. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales.

If the bales are wire bound, they should be oriented so the bindings are around the sides rather than along the top and bottom. Wire bindings that are placed in contact with the soil soon disintegrate and may allow the bale to fall apart.

The bales shall be securely anchored in place by two wooden stakes or rebar driven through the bales. The first stake in each bale shall be driven toward the previously laid bale to force the bales tightly together. Drive the stakes at least eighteen inches into the ground.

The straw bale dikes shall be inspected weekly and after each significant storm (one inch in 24 hours). Repairs and/or replacement shall be made promptly. Remove the straw bales when the upslope areas have been permanently stabilized. Remove sediment behind barrier when it reaches a depth of 6 inches.

6.1.8 Silt Fence. The height of a silt fence shall not exceed thirty six inches. Storage height shall never exceed eighteen inches. The fence line shall follow the contour as closely as possible. If possible, the filter fabric shall be cut from a continuous roll to avoid the use of joints. When joints are necessary, filter cloth shall be spliced only at a support post, with a maximum six inch overlap and both ends securely fastened to the post.

Posts shall be spaced a maximum of ten feet apart and driven securely into the ground (minimum of twelve inches). When extra strength fabric is used without the wire support fence, post spacing shall not exceed six feet. Turn the ends of the fence uphill.

A trench shall be excavated approximately four inches wide and six inches deep along the line of posts and upslope from the barrier.

When standard-strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least one inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of two inches and shall not extend more than thirty six inches above the original ground surface.

The standard-strength filter fabric shall be stapled or wired to the fence, and six inches of the fabric shall extend into the trench. The fabric shall not extend more than thirty six inches above the original ground surface. Filter fabric shall not be stapled to existing trees.

When extra-strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts.

The trench shall be backfilled and the soil compacted over the toe of the filter fabric.

Silt fences placed at the toe of a slope shall be at least six feet from the toe in order to increase ponding volume.

Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized, and any sediment stored behind the silt fence has been removed.

Silt fences and filter barriers shall be inspected weekly and after each significant storm (one inch in 24 hours). Any required repairs shall be made immediately. Sediment shall be removed when it reaches 1/3 height of the fence or nine inches maximum.

13.1.9 Drop Inlet Sediment Barriers.

A. Straw Bale Barrier. Excavate a four inch deep trench around the inlet and make the trench as wide as a straw bale in order to embed the bales properly. Orient the straw bales with the bindings around the sides of the bales so the wire does not come in contact with the soil.

Place bales lengthwise around the inlet and press the ends of adjacent bales together. The bales may be loosely joined if more gravel is utilized.

Drive two two by two inch stakes through each bale to anchor the bale securely in place.

Utilize ¾ inch to two inch gravel to fill the void spaces between the bales if necessary to dewater the ponded area more rapidly.

B. Silt Fence Sediment Barrier. Support posts for a silt fence must be steel fence posts or two inch by four inch wood, length three feet minimum, spacing three feet maximum, with a top frame support recommended. Excavate a trench four inches wide and six inches deep and bury the bottom of the silt fence in the trench. Backfill the trench with gravel or soil. Compact backfill well. The height of the silt fence shall be a maximum of eighteen inches measured from the top of the inlet.

Inspect the barrier after each rain and promptly make repairs as needed. Sediment shall be removed after each significant storm (one inch in 24 hours) to provide adequate storage volume for the next rain. The removed sediment shall be deposited in an area that will not contribute sediment off-site and can be permanently stabilized. For gravel filters, if the gravel becomes clogged with sediment it must be carefully removed from the inlet and either cleaned or replaced.

6.1.10 Curb Inlet Sediment Barriers. Place the barriers on gently sloping streets where water can pond. The barriers must allow for overflow from a severe storm event. Slope runoff shall be allowed to flow over blocks and gravel and not be bypassed over the curb. A spillway shall be constructed with the sandbag structures to allow overflow.

The sandbags should be of woven-type geotextile fabric since burlap bags deteriorate rapidly. Sandbags shall be filled with ¾ inch drain rock or ¼ inch pea gravel.

The sandbag shall be placed in a curved row from the top of the curb at least three feet into the street. The row should be curved at the ends, pointing uphill.

Several layers of bags should be overlapped and packed tightly. Leave a one-sandbag gap in the top row to act as a spillway.

Inspect and clean the barrier after each significant storm (one inch in 24 hours) and remove sediment from behind the structure after every storm. Any sediment and gravel shall be immediately removed from the traveled ways of roads. The removed sediment shall be placed where it cannot enter a storm drain, stream, or be transported off site.

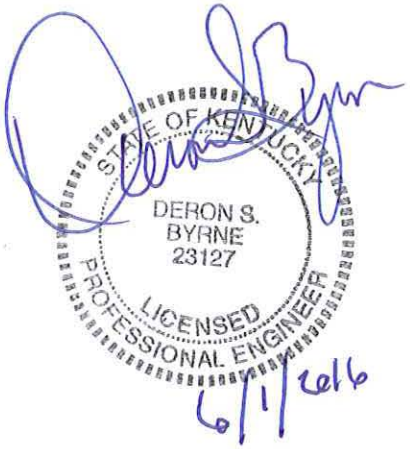
TECHNICAL SPECIFICATIONS
BRONSTON WATER ASSOCIATION
PULASKI COUNTY, KENTUCKY

2017 WATER SYSTEM IMPROVEMENTS:
CONTRACT 1
GREEN HILL ESTATES & CEDAR HILL HEIGHTS
WATER LINE REPLACEMENTS

PROJECT NO.
1615

JANUARY 2017

Monarch Engineering, Inc.



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SECTION 1 - WATER MAINS

1.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to furnish and install the water mains as shown on the drawings and as directed by the Engineer.

1.1 Water Pipe Materials. All pipe materials shall conform to the manufacturer's standard lengths and diameters. Testing when required by the Owner shall be done in accordance with the appropriate ASTM specifications for the material selected. The water main type shall be PVC or Ductile Iron as shown on plans.

1.1.1 Polyvinyl Chloride Pipe PVC SDR 17 or SDR 21. PVC pipe shall comply with ASTM D-1784 for material and shall be Class 250 (SDR 17) or Class 200 (SDR 21) as shown on the drawings or indicated on the bid form. All PVC pipe shall conform to the latest revisions of the following specifications:

ASTM D2241 (PVC Plastic Pipe SDR-PR and Class T)
National Sanitation Foundations Testing Laboratories (NSF)

The name of the manufacturer of the plastic pipe to be used must be found on the current listing of Plastic Materials for Potable Water Application, published by the NSF (National Sanitation Foundation), and must meet the requirements of the Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, D1784, 12454-B (PVC 1120) published by ASTM. Rubber gaskets shall conform to ASTM D3139.

Wall thickness shall be in accordance with ASTM D-2241. Pipe ends shall be beveled to accept the coupling with gasket. The bell section shall be designed to be as strong as the pipe wall.

Samples of pipe physical and chemical data sheets shall be submitted to the Engineer for approval prior to the pipe being purchased.

The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions, or other defects. The pipe shall be as uniform as commercially practical in color and shall have a ring painted around the spigot ends in such a manner as to allow field checking of setting depth of the pipe in the socket. Pipe must be delivered to the job site by means that will adequately support it and not subject it to undue stresses. In particular, the load shall be so supported such that the bottom rows of pipe are not damaged by crushing. The pipe shall be unloaded carefully and stored as close to the final point of placement as is practical.

Pipe markings shall include the following marked continuously down the length:

Manufacturer's Name

Nominal Size
Class Pressure Rating
PVC 1120
NSF Logo
Identification Code

The lubricant shall be that as recommended and supplied by the pipe manufacturer.

1.1.2 Polyvinyl Chloride Pipe (PVC) Cast Iron Pipe Size. This pipe shall meet the requirements of AWWA C900-75, latest revision, "Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch for Water" and shall be furnished in cast iron pipe equivalent outside diameters with separate couplings including gaskets.

The pipe shall be made from Class 12454-A or Class 12454-B virgin compounds as defined in ASTM D-1784. The standard code designation shall be PVC 1120. The PVC compounds shall be tested and certified as suitable for potable water products by the NSF approval marking.

Solvent cement couplings or joints shall not be used. PVC joints using elastomeric gaskets shall be tested as assembled joints and shall meet the laboratory performance requirements specified in ASTM D-3139.

Pipe shall be pressure Class 200, DR 14 or Class 150, DR 18 as shown on the drawings or the bid form.

Pipe and Couplings shall be marked as follows:

Nominal Size and OD Base
Material Code Designation (PVC 1120)
Dimension Ratio Number
AWWA Pressure Class
AWWA Designation Number (AWWA C900)
Manufacturers Name or Trade Mark and Production Record Code
Seal of the NSF Laboratory

Each standard and random length of pipe shall be proof tested at four times its rated class pressure for a minimum of 5 seconds. Bells or couplings shall be tested with the pipe.

The pipe shall not split, crack, or break when tested by the parallel plato method, and it shall not flake or disintegrate when tested by the acetone immersion method as specified by ASTM D-2241.

1.1.3 Ductile Iron Pipe. Ductile Iron Pipe shall be designed in accordance with AWWA (ASA A21.50) and for the conditions as stated in these specifications and the pressure rating for the pipe shall be 350 PSI. Ductile iron pipe shall conform to AWWA

C-151 (ASA A21.51). Pipe shall be cement lined in accordance with AWWA C104 (ASA A21.4) and all exposed pipe and fittings shall have a shop prime coat applied that is compatible with subsequent field enamel paint coats.

The specified thickness will be determined for the given internal and external loading requirements in accordance with ASA A21.50 and will be shown on the drawings or the bid form.

The net weight, class or nominal thickness and sampling period shall be marked on each pipe.

Pipe joints shall be mechanical joint, rubber ring slip joint, flanged, or locked mechanical joint equal to AWWA C-111.

1.1.4 Fittings. Ductile Iron mechanical joint fittings with appropriate adapters shall be used with PVC pipe and ductile iron pipe. Fittings shall comply with AWWA C-110 or C-111 and shall be manufactured for the size and pressure class of the line on which they are used. Compact fittings are acceptable and they shall conform to the latest AWWA specifications.

Mechanical joint fittings shall be used with ductile iron pipe for below ground burial and flange fittings shall be used for all interior piping where ductile iron pipe is used.

1.1.5 Mechanical Joint Restraints. Restraint devices for mechanical joint fittings shall be used with all ductile iron fittings and PVC pipe. Restraints shall conform to either ANSI/AWWA C111/A21.11 or ANSI/AWWA C153/A2153 and shall be manufactured for size and pressure class of the line on which they are used. Restraint devices for nominal pipe sizes 3-inch through 36-inch shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10. All Mechanical joint restraints shall be the MEGALUG® Restraint Series 2000 as manufactured by EBAA Iron, Inc., or approved equal.

1.2 Pipe Handling. Pipe delivered to the site shall be stored, handled, distributed, placed, joined together, etc. in accordance with the manufacturer's recommendation unless directed otherwise by the Engineer.

1.3 Water Main Location. The water main shall be installed in the locations as shown on the drawings and as directed by the Engineer. The Contractor and Engineer shall agree as to the exact location of the water line and there shall be no disputes unless it is clear that the proposed location significantly deviates from the drawings. At those locations where the drawings indicate that a fitting must be installed either by declaration on the drawings or by a defined bend as shown on the drawings, the Contractor shall do so and shall avoid over deflection of the pipe.

1.4 Excavation. Excavation of the pipe trench shall be via the use of bucket and hoe type equipment. The use of trencher type equipment shall not be allowed. The minimum width of the pipe trench shall not be less than 24 inches for the 12-inch pipe.

The Contractor shall make trench excavations to only such width to provide ample room for proper construction. Sheeting and shoring shall be provided as required for proper safety and compliance with OSHA regulations. Rock excavation shall be taken to a depth of 6 inches below the bottom of the pipe. If poor foundation conditions exist due to unstable subsurface conditions, the trench shall be under excavated to the depth required and filled with stone to obtain proper bearing capacity.

Watchmen or barricades, lanterns, and other such signs and signals as is necessary to warn the public of the dangers in connection with open trenches, excavations and other obstructions shall be provided by and properly maintained at the expense of the Contractor.

Only one half of street crossings and road crossings shall be excavated before placing temporary bridges over the excavation.

1.5 Blasting and Rock Excavation. The Contractor shall make his own investigation as he deems necessary to ascertain the sub surface conditions to be encountered in the work.

All blasting operations shall be conducted in accordance with municipal ordinances, state and federal laws and the applicable blasting codes. Soil particle velocity shall not exceed the limit set by Kentucky law. All explosives shall be stored in conformity with the applicable ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, sewer lines, natural or manufactured gas lines, liquid petroleum lines, or other utilities.

The Contractor shall use delay caps or other approved methods to reduce earth vibrations and noise. Mud capping shall not be permitted as a method to breaking boulders. No blasting shall be permitted on Sundays or after dark.

Prior to commencing with the work, the Contractor shall, during a preconstruction conference with the Owner and Engineer, state clearly his approach to performing the excavations on the project. He shall be familiar with the laws and ordinances covering blasting and shall also give consideration to the use of hydraulically operated rock breaking devices in lieu of blasting where considered necessary. If blasting is not handled in an expert manner at all times the Engineer reserves the right to suspend blasting and require the work to proceed without it. Prior to blasting, the Contractor shall make his own detailed preblast survey of adjacent walks, curbs, retaining walls, house foundations, etc. to determine conditions prior to the work. Such a file of information, including photographs, may be certified in such a manner as the Contractor believes necessary. This information if required or performed shall be supplied to the Engineer prior to performing the work.

1.6 Storage of Excavated Material. All excavated material shall be stored in a manner that will not endanger the work and that will avoid obstructing roadways, sidewalks, and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural watercourses shall not be obstructed.

1.7 Shoring Sheeting and Bracing. The Contractor shall furnish place and maintain such sheeting and bracing as may be required to support the sides of the excavation or to protect other structures from possible damage. All sheeting and bracing shall be removed upon completion of the work unless permitted to be left in place by the Engineer. Any sheeting or bracing left in place shall be cut off at least two feet below the finished ground surface elevation. The cost of furnishing, placing, maintaining, and removing sheeting and bracing shall be included in the unit price bid for water lines and all work shall conform the OSHA requirements.

1.8 Bedding and Backfill. All water mains shall be bedded with select earth backfill or six inches of #9 or approved equal stone under and on both sides of the pipe where it is installed along the unpaved areas. Where the water line is installed along the paved areas the water line shall be backfilled with #9 or approved equal stone. Trenches shall be backfilled immediately after the water main has been installed. No rock larger than two inches will be permitted within six inches of the pipe. In unpaved or unsurfaced areas the remainder of the fill may be mounded over the top of the trench. Where trenches are in paved or traveled areas, or yard areas, compaction shall be performed during backfill. The Contractor at no time shall open up more than 500 feet of trench.

Any damage to underground structures, pipes wires, drains, etc., shall not be backfilled until they have been satisfactorily repaired or replaced to the original serviceability at the Contractor's expense and as approved by the Engineer. Settlement of backfill may be done with water furnished by the Contractor under the direction of the Engineer where such will not endanger traffic of damage property. When excavated rock is used for backfilling, it shall have sufficient dirt or fine material to fill all voids and shall not be used within twelve inches of the pipe.

To be accepted as final cleanup all excess rock one inch and larger shall be removed from the disturbed site.

1.9 Thrust Blocks and Anchorage. Thrust blocks shall be installed at all tees, bends, crosses, dead ends, valves, hydrants, blowoff assemblies, and as directed by the Engineer. The size of the thrust block shall depend on the soil and type of fitting, and shall conform to the pipe manufacturer's recommendations. At any location where a vertical bend is required the Contractor shall install the anchorage as directed by the Engineer in conjunction with the pipe manufacturer.

Thrust blocks shall be constructed of Class B concrete conforming to KBH Specification 601 and placed between the fitting and the trench wall. At no time will sack-crete or pre bagged concrete mixtures be allowed. All thrust block and anchorage concrete shall be delivered to the job site by means of a ready mix concrete truck and placed immediately upon arrival.

The thrust blocks shall be sized as shown on the detail drawings or as directed by the Engineer.

1.10 Temporary Surfacing. All trenches in paved areas shall, following compacted backfill, receive a top layer of compacted dense grade stone as shown on the detailed drawings. Such temporary surfacing shall be maintained and shall be paved as soon as conditions permit.

1.11 Hydrostatic Testing. The water line and appurtenances, as rapidly as valves are installed, shall be hydrostatically tested in accordance with these specifications. Defective joints of pipe shall be replaced as directed by the Engineer. Cracked or defective pipe, fittings, valves, or hydrants shall be replaced by the Contractor and the test shall be repeated until the test results are satisfied. All meter settings and service tubing as shown on the drawings shall be included in the hydrostatic test.

The test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section and the hydrostatic test shall be of at least a two hour duration. The test pressure shall not vary by more that five psi. for the duration of the test.

1.11.1 Pressurization. After the pipe has been installed all or any valved section shall be subjected to the hydrostatic test. Each valved section of the pipe shall be slowly filled with water and the specified test pressure, corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. As part of the testing equipment a meter shall be installed to measure all water added to the tested section.

1.11.2 Air Removal. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the Owner.

1.11.3 Leakage Defined. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within five psi. of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

1.11.4 Allowable Leakage. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

Where:

L = allowable leakage in gallons per hour
S = length of pipe tested in feet
D = nominal diameter of the pipe in inches
P = average test pressure during the leakage test in pounds per square inch

This formula is based on an allowable leakage of 11.65 gpd./mi./in. of nominal diameter at a pressure of 150 psi.

All leaks shall be repaired whenever or wherever there is evidence of a leak. Water used by the Contractor shall be paid for by the Contractor at the rate of $2.00 per 1,000 gallons.

1.12 Sterilization. Upon completion and acceptance of the hydrostatic test of a section of the water main that section shall be thoroughly disinfected before being place in service by the use of chlorine or chlorine compounds in such amounts as to produce a concentration of not less than 50 ppm and a residual of not less than 25 ppm at the end of 24 hours and followed by thorough flushing. Putting small amounts of chlorine in each joint will not be acceptable.

1.13 Other Utilities. Other utilities encountered in the work shall be preserved and protected. Where relocation or repair is required to accommodate the work it shall be made in a manner acceptable to the utility having jurisdiction over the service connection. Accommodation of service connections shall not constitute any basis for extra payment.

Prior to construction, the Contractor shall arrange to meet with representatives of all utilities, and provide them with his anticipated work schedule. The Contractor shall have the utility companies make their best determination of utility locations in the areas in which he is working. Throughout the progress of the work such field markings of utilities shall be kept current.

1.14 Payment for Water. All water used from the Owner shall be metered by meters supplied by the Contractor. The Contractor shall pay for such water at the rate of $2.00 per 1,000 gallons. This shall include any unmetered water lost which shall be computed on the basis of a discharge velocity of seven feet per second, the diameter of the line, and the estimated duration of free uncontrolled discharge or the approved method.

1.15 Cleanup. The Contractor shall provide effective cleanup of the work as it progresses. At the time of final inspection no trenches shall show any undue evidence of the construction. All areas shall be left free of ruts due to construction and shall have a clean and neat appearance without rubble or debris. The areas shall not be mounded and shall be completely restored, and all yards and fields shall be reseeded. Straw and fertilizing shall accompany the seeding and the seed mixture shall match the existing ground cover. If necessary to hasten proper restoration of terraces, principally along ditch lines, the Contractor shall sod such areas at the Engineer's direction.

1.16 Protection of Adjacent Landscape. Reasonable care shall be taken during construction of the process lines to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

1.17 Underground Marking Tape. At all locations where PVC piping is utilized a detectable underground marking tape shall be placed in the trench approximately six inches below the finished grade. The tape used shall be mylar encased aluminum foil with the printing "CAUTION - Buried Water Line Below." Printing shall be readable through the clear mylar and surface printing is not acceptable. Tape size shall be two inches in width as provided by Lifeguard, Inc. or approved equal. Color of the tape shall be blue.

1.18 Underground Detection Wire. At all locations where yard piping is utilized, one strand of Number 12 copper wire shall be placed in the trench approximately six inches below the finished grade.

1.19 Payment. Payment shall be included in the payment for the work to which it is subsidiary in the Bid Schedule.

SECTION 2 - CASING PIPE

2.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to furnish and install casing pipes as shown on the drawings.

2.1 Materials. Bored and jacked casing pipe shall be plain end steel pipe conforming to AWWA Specification C200 with a minimum yield strength of 35,000 psi. The inside diameter of the casing pipe shall be a minimum of four inches greater than the largest outside diameter of the water pipe, joint or coupling.

The minimum wall thickness shall be in accordance with the following table:

Diameter of Casing-Inches	Minimum Wall Thickness-Inches Under Railroads	All Other Uses
12-3/4 and under	0.188	0.188
14	0.250	0.250
16	0.281	0.250
18	0.312	0.250
20 and 22	0.344	0.250

Casing pipe shall have continuously welded joints. Any field welding shall be performed by a certified welder and shall be in accordance with AWWA Specifications C206

2.2 Prior Approvals. Prior to boring and jacking under roadways the Contractor shall submit drawings and other necessary information regarding the proposed construction to the Engineer for approval by the proper authorities if requested.

2.3 Bore and Jack Construction. The Contractor shall investigate the subsurface conditions which will be encountered and shall base his bid on his findings. No distinction shall be made between boring through earth and boring through rock.

The Contractor shall provide a jacking pit, bore through the earth and or rock, and jack the casing pipe into place at the proper line and grade as the bore is being made. “Free boring” will not be allowed unless directed by the Engineer. The carrier pipe shall be pushed through the casing pipe with care being taken to insure that the pipe joints are tight and properly made. Shims attached to the carrier pipe to prevent floating shall be redwood or that as specifically made for the application.

The approach trench shall be large enough to accommodate one section of casing pipe and the jacks and blocking. Two rails or sills shall be laid in the bottom of the trench to keep the casing at the established line and grade.

The installation procedure must be such that the casing pipe is placed concurrently with the removal of the soil. The outside diameter of the lead auger section must not be less than one half inch smaller in diameter than the casing inside diameter.

The ends of the casing pipe shall be plugged and made watertight prior to backfilling. A neoprene gasket that will slip over the cover pipe and allow the carrier pipe to pass through will be considered water tight.

2.4 Traffic Control Devices and Maintenance of Traffic. The proper placement and maintenance of traffic control devices and the maintenance of traffic flows shall comply with the standards set forth under the General Specifications.

The Contractor shall notify the proper City, County, or State officials prior to the commencement of boring and jacking or tunnel operations.

2.5 Open Cut Construction. Where steel casing pipe is to be installed by open cutting rather than by boring or jacking the same casing pipe as described above will be utilized.

2.6 Measurement and Payment. The unit price bid per linear foot for boring and jacking, as measured from end to end of the casing pipe, shall constitute full compensation for the work as specified. Open cut steel casing pipe as measured from end to end of the casing pipe shall constitute full compensation for the work as specified. Carrier pipes shall be furnished under the item as described in other portions of these technical specifications.

SECTION 3 – VALVE AND VALVE BOX

3.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install gate valve and valve boxes at the locations as shown on the drawings and as directed by the Engineer.

3.1 Materials. Valves shall be resilient type and shall be designed for a minimum water working pressure of not less than 200 pounds per square inch. Valves shall have ends required for the piping in which they are installed. Gate valves shall have a clear water way equal to the nominal diameter, and shall be opened by turning to the left. The operating nut or wheel shall have an arrow cast in the middle indicating the direction of the opening. Each valve shall have the manufacturer's initials, pressure rating, and the year in which manufactured, cast onto the body.

Valves two inches and larger shall be iron body, bronze mounted, non rising stem, double disc, parallel seated gate valves and shall conform to the standard specifications of the AWWA.

Valve boxes shall be of cast iron extension type with screw or slide adjustments and flared base. The minimum thickness of metal shall be 3/16". The cover shall have the word "WATER" cast in the metal. Valve boxes shall be installed over each outside gate valve unless otherwise shown on the drawings. The boxes shall be of such length as to provide a depth of cover of not less than 30 inches over the pipe.

3.2 Installation. Valve boxes shall be set plumb and straight and with the operating nut directly in the center in thoroughly compacted earth with the top of the box level and projecting one fourth inch above paved streets and one inch above other areas. The valve boxes in unpaved areas shall have a four inch thick concrete slab three feet in diameter around and sloping away from the valve box.

3.3 Payment. The unit price bid shall constitute full compensation for furnishing and installing gate valves, valve boxes, and other related appurtenances.

SECTION 4 – FLUSH HYDRANT

4.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install the hydrants as shown on the drawings and as directed by the Engineer.

4.1 Materials. The hydrant shall conform to all of the applicable requirements of ANSI/AWWA C502 Standard. They shall have a sealed oil reservoir that will provide positive lubrication of the stem threads and bearing surfaces each time the hydrant is opened. The hydrant shoe shall be designed for maximum full flow and the hydrant working pressure shall be 200 PSI. The hydrant shall be two way type with two 2 1/2-inch openings or three way type with two 2 1/2-inch openings and one 4 1/2-inch opening as shown on the drawings and outlined in the Bid Schedule.

4.2 Installation. The hydrants shall be set in accordance with the detailed drawings complete with gate valve and connecting pipe. The hydrant shall be installed perpendicular to the surrounding ground surface and the hydrant riser shall be completely buried. The depth of bury shall be the same as the adjoining water line. The shoe of the hydrant shall be encased in Class B concrete and the concrete shall extend to undisturbed earth. Gravel shall be placed around the hydrant on top of the concrete thrust restraint and at the weep hole a minimum depth of twelve inches in depth. Select earth backfill shall be compacted to fill the remaining excavated void and the surface shall match the surrounding surface. The hydrant shall be secured to the companion gate valve by means of threaded rods secured to the valve and hydrant or by other approved means. The hydrant shall be coated with a prime coat and two finish coats of paint as suggested by the manufacturer and approved by the Engineer. The shop drawings shall indicate the coating and color proposal.

4.3 Payment. The unit price bid shall constitute full compensation for furnishing and installing the hydrant, gate valve, up to ten feet of water line, and any associated pipe fittings required to install the hydrant to the main water line.

SECTION 5 – BLOWOFF ASSEMBLY

5.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install the blowoff assemblies as shown on the drawings and as directed by the Engineer.

5.1 Materials. Blowoff assemblies consist of the valve, pipe, and fittings and shall be in accordance with these specifications. The gate valve and piping shall be the same size and pressure class as the line it is connected to.

5.2 Installation. The blowoff assembly shall be installed at the locations as shown on the drawings and as outlined on the detailed drawings.

5.3 Payment. The unit price bid shall constitute full compensation for the furnishing and installation of the blowoff assembly to include gate valve, piping, blocking, valve box, fittings and gravel.

SECTION 6 - CONNECTION

6.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to connect and disconnect water mains as shown on the drawings and as directed by the Engineer.

6.1 Materials. The connections and disconnects shall be performed by the use of ductile iron mechanical joint fittings, approved tapping valves and sleeves, and water main pipe as shown on the drawings described elsewhere in these technical specifications. Concrete for thrust restraint shall be Class B concrete and sack-crete shall not be allowed.

6.2 Installation. The connections shall be made with a tapping sleeve and valve and done so in accordance with the Owners schedule of operation. Once the main line has been tapped the new section of water main shall be valved off from the rest of the system by closing the tapping valve. The tapping valve shall remain closed until the Engineer has been satisfied that the new water main has been installed correctly, met the requirements of the hydrostatic test, been sanitized in accordance with the regulatory requirements, and any water main to be abandoned has been disconnected from the water system. The disconnection of a water main that is to be abandoned shall be accomplished by installing a blind flange at the point of abandonment and secured by means of a concrete thrust block. In the event where the thrust block shall be installed in the area of the abandoned water main a minimum three foot section of the abandoned water main shall be removed and the void replaced with concrete.

6.3 Payment. The unit price bid shall constitute full compensation for furnishing and installing the connections including any abandonment or disconnections of the water mains. This shall include all fittings but water mains and gate valves shall be paid as per the bid schedule for those respective items.

SECTION 7 - METER SETTING & METER RECONNECTION

7.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install the meter settings, meter reconnects, and service tubing as shown on the drawings and as directed by the Engineer.

7.1 Materials. The meter settings shall consist of a saddle, corporation stop, service tubing, coppersetter, meter, meter box, and appurtenances. The corporation stops/ball valves shall be B11-333 as manufactured by Ford with a pack joint for polyethylene pipe. Pack joint inlet couplings shall be C14-33-Q as manufactured by Ford for polyethylene pipe. Saddles shall be equal to the Ford S70 Series with a hinged pin for PVC and 202 Series for ductile iron. The coppersetter shall be equal to the Ford 70 Series Coppersetter VHH72-7W-11-33 with a seven inch rise for a 5/8 inch by 3/4 inch meter and complete with an inlet key valve and outlet dual check valve. A tandem coppersetter to accommodate a pressure reducer and meter shall be used where specified. The pressure reducing valve shall be Mueller, Model No. H-9300 No. 3, or approved equal with a bronze strainer. Each regulator is to have an adjustable pressure range of 60-125 psi and to be set at 70 psi.

The meters shall be a displacement type magnetic drive cold water meter complying with ANSI/AWWA Standard C700, latest revision. The meters shall be standard direct read, DIALOG® 3G AMR System registers as manufactured by Master Meter, Inc. The size of the meter shall be 5/8 inch by 3/4 inch or as shown otherwise on the Plans. The meter shall have a straight reading dial in U. S. gallons and must have a working pressure of 150 psi. Serial numbers shall be stamped on both the lid and meter body.

The meter boxes shall be green corrugated polyethylene round boxes (un-notched) and shall be 18-inches in diameter and 24-inches deep as manufactured by Hancor, Inc., or approved equal. Meter box settings shall be prefabricated with the copper-setters and fittings as specified ready for connection at the inlet and outlet ends. Meter box settings shall be that as manufactured by Water Works Supplies, Inc., Richmond, Kentucky, or approved equal. Meter boxes shall include a two piece flat cast iron lid and frame, RUSSCO LC-219 as manufactured by Sigma Corporation, or approved equal.

Service tubing shall be 3/4 inch polyethylene or type K copper tubing with a minimum pressure rating of 200 PSI. One-inch and two-inch service lines shall be PVC, PE, or K copper with a minimum pressure rating of 200 PSI.

Insert stiffeners shall be used when using polyethylene service tubing and shall be Series 50 or 70 as manufactured by Ford Meter Box Company, Inc., or approved equal.

7.2 Installation. Meters shall be set as shown on the detail drawings with backfill neatly compacted in place. The top of the meter box shall be set 1/2 inch above grade. The meter shall be at least 18 inches below the ground surface.

Meter reconnects shall consist of reestablishing service to the customer after the new meter has been installed. The new meter shall be installed adjacent to the existing meter as directed by the Owner or Engineer and new service line shall be installed to connect to the existing service line.

7.3 Payment. The unit price bid shall constitute full compensation for furnishing and installing the meter setting, or meter reconnect, with the above described appurtenances. Service tubing shall be paid by the linear foot. Installation of the service tubing through or beneath paved surfaces shall be considered as an incidental cost for the installation of the service tubing and there shall be no compensation for pavement replacement.

SECTION 8 -DIRECTIONAL DRILLING / BORING

8.0 Scope of Work. It is intent of this specification to define the acceptable methods and materials for installing water lines by the horizontal directional drilling method and the requirements for high density polyethylene (HDPE) pipe installed by directional drilling or in open cut trenches.

8.1 Installation Plan.

At least 7 days prior to mobilizing equipment, Contractor shall submit his detailed installation plan to the Engineer.

The plan shall also include a listing of major equipment and supervisory personnel and a description of the methods to be used.

8.2 Variations in Plan or Profile. The Contractor may request changes to the proposed vertical and horizontal alignment of the installation and the location of the entry and exit points. Proposed changes shall be submitted in writing to the Engineer and receive approval of the Engineer prior to construction.

8.3 Alignment. The proposed plan and profile installation locations are based on alignments to accommodate acquired right-of-way, to avoid obstructions, and to properly maintain operation flow velocities.

8.4 Qualifications. Directional drilling and pipe installation shall be done only by an experienced Contractor specializing in directional drilling and whose key personnel have at least five (5) years experience in this work. Furthermore, the Contractor shall have installed directional drilled pipe at least as large as 12 inches in diameter, have performed crossings at least 650 feet in length, and successfully installed at least 2000 feet in length.

8.5 Products. High density polyethylene pipe in accordance to these specifications shall be used in HDD installations. All piping system components shall be the products of one manufacturer and shall conform to the latest edition of ASTM D2447, ASTM D3350, and ASTM F714.

8.6 Piping. Piping shall be extruded from a polyethylene compound and shall conform to the following requirements:

The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 335434C, or better. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than 2 percent.

The maximum allowable hoop stress shall be 800 psi at 73.4 degrees F.

The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.

Joining shall be performed by thermal butt-fusion in accordance with the manufacturer's recommendations.

8.7 Execution. All polyethylene pipes shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe. The pipe supplier shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be on site to oversee the pipe joining. Expense for the representative shall be paid for by the Contractor.

8.8 Transportation. Care shall be taken during transportation of the pipe to ensure that it is not cut, kinked, or otherwise damaged.

8.9 Storage. Pipes shall be stored on level ground, preferable turf or sand, free of sharp objects which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature condition. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

8.10 Handling Pipes. The handling of the jointed pipeline shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubber protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Slings for handling the pipeline shall not be positioned at butt-fused joints. Sections of the pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends rejoined.

The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged at night to prevent animals or foreign material from entering the pipe line or pipe section.

Waterproof nightcaps of approved design may be used but they shall also be so constructed that they will prevent the entrance of any type of natural precipitation into the pipe and will e fastened to the pipe in such a manner that the wind cannot blow them loose.

The practice of stuffing cloth or paper in the open ends of the pipe will be considered unacceptable.

Where possible, the pipe shall be raised and supported at a suitable distance back from the open end such that the open end will be below the level of the pipe at the point of support.

8.11 Installation.

The Contractor shall install the pipelines by means of horizontal directional drilling. The Contractor shall assemble, support, and pretest the pipeline prior to installation in the directional drill tunnel.

Horizontal directional drilling shall consist of the drilling of a small diameter pilot hole from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion. The exact method and techniques for completing the directionally drilled installation will be determined by the Contractor, subject to the requirements of these Specifications.

The Contractor shall prepare and submit a plan to the Engineer for approval for insertion of the HDPE pipe into the opened bore hole. This plan shall include pullback procedures, ballasting, use of rollers, side booms and side rollers, coating protection, internal cleaning, internal gauging, hydrostatic tests, dewatering, and purging.

The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities. The Contractor shall erect temporary fencing around the entry and exit pipe staging areas.

8.12 Joining Pipe Sections.

Each length of pipe shall be inspected and cleaned as necessary to be fee of debris immediately prior to joining.

Pipes shall be jointed to one another by means of thermal butt-fusion Polyethylene pipe lengths to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied
from the same raw material supplier.

Mechanical connections of the polyethylene pipe to auxiliary equipment shall be through flanged connections which shall consist of the following:

a. A polyethylene “sub end” shall be thermally butt-fused to the ends of the pipe.

b. Provide ASTM A240, Type 304 stainless steel backing flange, 125-pound, ANSI B16.1 standard, and gaskets as required by the manufacturer.

c. Stainless Steel bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer's standard. Retorque the nuts after 40 hours.

d. Butt-Fusion Joining: Butt-fusion of pipes shall be performed in accordance with the manufacturer's recommendations as to equipment and technique. Butt-fusion joining shall be 100% efficient offering a joint weld strength equal to or greater than the tensile strength of the pipe.

8.13 Testing.

The pipe shall be hydrostatically tested after joining into continuous lengths prior to installation and again after installation. Pressure and temperature shall be monitored with certified instruments during the test. After this test, the water will be removed with pigs. Erosion prevention procedures will be used during removal and discharge of the water. Hydrostatic testing shall be performed in accordance with Section 1 of the Specifications. All costs associated with acquiring water for testing shall be included in the established contract unit bid prices.

8.14 Tolerances.

Pipe installed by the directional drilled method must be located in plan as shown on the Drawings, and must be no shallower than shown on the Drawings unless otherwise approved. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 30 feet. This "as built" plan and profile shall be updated as the pilot bore is advanced. The Contractor shall
at all times provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure. The Contractor shall grant the Engineer access to all data and readout pertaining to the position of the bore head and the fluid pressures and flows.

When requested, the Contractor shall provide explanations of this position monitoring and steering equipment. The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to the position or inclination of the pilot bores shall be withheld from the Engineer.

Sags in the pipeline shall not exceed 5 percent of the nominal pipe diameter. Sags will only be allowed where the entering and exiting grades are adequate to provide velocities through the sag area sufficient for moving solids. No more than (1) sag area shall occur between two (2) manholes. The alignment of each pilot bore must be approved by the Engineer before pipe can be pulled. If the pilot bore fails to conform to the above tolerances, the Engineer may, at his option, require new pilot boring to be made.

After the pipe is in place, cleaning pigs shall be use to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check

for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no shaper anomalies (e.g. dens, buckles, gouges, and internal obstruction) greater than 2 percent of the nominal pipe diameter, or excessive ovality greater than 5 percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of five feet or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of five feet.

8.15 Ream and Pullback.

Reaming: Reaming operations shall be conducted to enlarge the pilot after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor.

Pulling Loads: The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not over stressed.

Torsion and Stresses: A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.
The lead end of the pipe shall be closed during the pullback operation.

Pipeline Support: The pipelines shall be adequately supported by rollers and side booms and monitored during installation so as to prevent over stressing or buckling during the pullback operation. Such support/rollers shall be spaced at a maximum of 60 feet on centers, and the rollers to be comprised of a nonabrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback. Surface damage shall be repaired by the Contractor before pulling operations resume.

The contractor shall at all times handle the HDPE pipe in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the HDPE pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The Contractor shall take appropriate steps during pullback to ensure that the HDPE pipe will be installed without damage.

8.16 Handling Drilling Fluids and Cuttings.

During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. These fluids must not be discharged into the waterway. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. The Contractor shall conduct his directional drilling

operation in such a manner that drilling fluids are not forced through the subbottom into the waterway. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape to the waterway. The Contractor shall utilize drilling tools and procedures which will minimize the discharge of any drill fluids. The Contractor shall comply with all mitigation measures listed in the required permits and elsewhere in these Specifications.

To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.

The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the returned fluids to be used.

As part of the installation plan specified herein before, the Contractor shall submit a drilling fluid plan which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.

8.17 Drilling Operations.

The Contractor shall prepare a plan to be submitted for Engineer approval which describes the noise reduction program, solids control plant, pilot hole drilling procedure, the reaming operation, and the pullback procedure. All drilling operations shall be performed by supervisors and personnel experienced in horizontal directional drilling. All required support, including drilling tool suppliers, survey systems, mud cleaning, mud disposal, and other required support systems used during this operation shall be provided by the Contractor.

Drill pipe shall be API steel drill pipe, Range 2, Premium Class or higher, Grade S-135 in a diameter sufficient for the torque and longitudinal loads and fluid capacities required for the work. Only drill pipe inspected under API's Recommended Practice Specification API RP 7G within 30 days prior to start and certified as double white band or better shall be used.

A smoothly drilled pilot hole shall follow the design centerline of the pipe profile and alignment described on the construction drawings.

Between the entry or exit point the Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible. The exit point shall fall within a rectangle 5 feet wide and 10 feet long centered on the planned exit point.

During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory

agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.

Technical criteria for bentonite shall be as given in API Spec. 13A, Specification or Oil Well Drilling Fluids Material for fresh water drilling fluids. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included in Contractor's drilling plan presented to the Engineer. The Owner retains the right to sample and monitor the waste drilling mud, cuttings and water.

8.18 Environmental Provisions.

The Horizontal Directional Drilling operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to the adjacent creek or land areas involved during the construction process. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling operation shall be lined by Contractor with heavy duty plastic sheeting with sealed joints to prevent the immigration of drilling fluids and/or groundwater.

The Contractor shall visit the site and must be aware of all structures and site limitations at the directional drill crossing and provide the Engineer with a drilling plan outlining procedures to revent drilling fluid from adversely affecting the surrounding area.

The general work areas on the entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.

Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desalter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cutting and excess drilling fluids shall be dewatered and dried by the Contractor to the extent necessary for disposal in offsite landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of locally. The cuttings and water for disposal of locally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of Unplanned leaks or seeps.

Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps or spills.

Waste drilling mud and cuttings shall be dewatered, dried, and stock piled such that it can be loaded by a front end loader, transferred to a truck and hauled offsite to a suitable legal disposal site. The maximum allowed water content of these solids is 50% of weight. Due to a limited storage space at the worksite, dewatering and disposal work shall be

concurrent with drilling operations. Treatment of water shall satisfy regulatory agencies before it is discharged.

8.19 Payment. Payment shall be included in the payment for the work as shown on the plan sheets and to which it is subsidiary in the Bid Schedule.

SECTION 9 - PAVEMENT REPLACEMENT

9.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install the concrete and bituminous pavement replacement that is disturbed during construction.

9.1 Materials. The Contractor shall use Class A concrete for all concrete pavement that is to be replaced and it shall be reinforced with No. 4 reinforcing bars placed on twelve inch centers both ways unless directed otherwise.

Pavement replacement for bituminous surfaces shall consist of a prime coat of emulsified asphalt, Class 1 Bituminous Binder, and Class 1 Bituminous Concrete as specified by the Kentucky Bureau of Highways latest specifications.

Support gravel shall be No. 4 stone, No. 57 stone, and dense grade aggregate.

9.2 Installation. Immediately upon placement of the water lines and appurtenances the disturbed traveled way shall be backfilled with No. 57 stone or dense grade aggregate extending from the top of the pipe to the traveled way surface. The area of disturbance will be repaved once settlement has subsided or once installation of the water line has been completed as directed by the Engineer.

Where concrete pavement replacement is required the top twelve inches of stone backfill shall be tamped with a mechanical tamping machine and the lifts shall not exceed twelve inches. The use of rubber tire or track driven equipment such as backhoes or dozers shall not satisfy the requirement for final tamping. The reinforcing steel shall be placed within three inches of the surface of the concrete to be replaced and it shall be supported with concrete support pieces. The area to be repaved shall be formed to coincide with the adjoining concrete surfaces and the edges of the repaved area shall be smooth and uniform. The concrete shall be placed on top of the compacted gravel at a depth of six inches minimum and the surface shall be flush with the adjoining surface. The surface finish shall match the adjoining surface finish and the locations where the repaved surface connect to the existing surface shall be smooth and uniform such that ponding shall not occur.

Where bituminous pavement replacement is required the pipe trench shall be backfilled and the surface prepared as describe above for concrete pavement replacement. Upon placement of the bituminous the surface shall be prepared with a prime coat applied at the rate of 0.35 gallons per square yard. A 2-inch thick layer of bituminous binder shall then be placed above the prime coat. The final coat of bituminous concrete shall then be placed at a depth of 1 1/2 inches and rolled to a smooth finish connecting with the existing pavement.

9.3 Final Acceptance. All pavement that is replaced shall be inspected prior to the final warranty period expiration. Any pavement replacement found to be deteriorated or not uniform due to settlement of the disturbed subsurface shall be repaired before the work is recommended for final acceptance. It is anticipated that this inspection shall take place on or about the eleventh month of the one year warranty period. The warranty period for all pavement replacement shall not commence until the final warranty period for the project in its entirety is initiated.

9.4 Payment. Payment shall be included in the payment for the work to which it is subsidiary in the Bid Schedule.

SECTION 10 - EXPLORATION

10.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to explore for existing water lines and appurtenances that are not as shown on the Drawings.

10.1 Description of Work. In those locations where the existing water lines and appurtenances are not in the locations as shown on the Drawings the Contractor shall explore for the utility at the direction of the Engineer. The Contractor shall utilize all equipment necessary to search for the water line or appurtenance and any disturbance of other utilities shall be the responsibility of the Contractor. Any other work or disturbance created by the Contractor as a result of the exploration shall be incidental to this item.

In locations where new water lines are to be installed parallel to existing lines, the contractor shall locate existing water lines in 100 foot intervals. This particular requirement shall be considered incidental to the installation of the water lines and it **SHALL NOT** be included in the calculation of this pay item.

10.2 Payment. The unit price bid shall constitute full compensation for the exploration of the water lines and appurtenances. The Resident Engineer shall approve the Contractor to initiate and terminate the exploration and the Resident Engineer shall monitor the amount of time in 15 minute increments.

SECTION 11 – EROSION CONTROL

11.0 Scope of Work. It is intent of this specification to define the acceptable methods and materials for preparing storm water Best Management Plan and Notice of Intent, installing all applicable erosion control measures in accordance with Best Management Practice Plan and as specified and maintain erosion control measures as needed.

11.1 Installation Plan.

11.1.1 Minimize Disturbance and Buffer Strips Only areas necessary for construction shall be disturbed, cleared or graded. Vehicles and construction equipment shall be excluded from these areas so to preserve all natural vegetation. All areas that are disturbed during construction, including slopes, shall be protected during clearing and construction in accordance with the approved erosion and sediment control plan until they are permanently stabilized.

If top soil is needed for the re-establishment of vegetation, it shall be piled until the necessary amount needed to finish grading of all exposed areas. Areas that are to be filled shall be cleared, grubbed to remove trees, vegetation, roots and other objectionable material, and stripped of topsoil.

Areas to receive topsoil shall be scarified to a minimum depth of three inches prior to the placement of topsoil. All fills shall be compacted as required by building standards to reduce erosion, slippage, settlement, subsidence and other related problems. Fill intended to support buildings, structures, conduits, etc., shall be compacted in accordance with local requirements or codes.

11.1.2 Land Grading for Minimizing Erosion. Only areas necessary for construction shall be disturbed, cleared or graded. Vehicles and construction equipment shall be excluded from these areas so to preserve all natural vegetation. All areas that are disturbed during construction, including slopes, shall be protected during clearing and construction in accordance with the approved erosion and sediment control plan until they are permanently stabilized. All sediment control measures shall be constructed and maintained in accordance with the approved erosion and sediment control plan and according to the standards and specifications for the appropriate erosion control practices.

If top soil is needed for the re-establishment of vegetation, it shall be piled until the necessary amount needed to finish grading of all exposed areas. Areas to receive topsoil shall be scarified to a minimum depth of three inches prior to the placement of topsoil.

The outer face of the fill slope should always be allowed to stay loose, not rolled, compacted, or bladed smooth. A bulldozer may run up and down the fill slope so the dozer treads create groves perpendicular to the slope. Use slope breaks, such as diversions, benches, or contour furrows as appropriate, to reduce the length of cut-and-fill slopes to limit sheet and rill erosion and prevent gullying. The finish cut-and-fill slopes,

which are to be vegetated with grass and legumes, should not be steeper than two horizontal to one vertical.

Roughen the surface of all slopes during the construction operation to retain water, increase infiltration, and facilitate vegetation establishment.

Seeps or springs encountered during construction shall be handled in accordance with approved methods.

Stabilize all graded areas with vegetation, crushed stone, rip-rap, or other ground cover as soon as grading is completed or if work is interrupted for 21 working days or more.

Use mulch to stabilize areas temporarily where final grading must be delayed. Stockpiles, borrow areas and spoil areas shall be shown on the plans and shall be stabilized to prevent erosion and sedimentation.

11.1.3 Erosion Control Blankets and Matting.

A. Site Preparation. Proper Site Preparation is essential to ensure complete contact of the protection matting with the soil. Grade and shape area of installation. Remove all rocks, clods, vegetation or other obstructions so that the installed blankets, or mats will have direct contact with the soil. Prepare seedbed by loosening two to three inches of topsoil above final grade. Incorporate amendments, such as lime and fertilizer, into soil according to soil test and the seeding plan.

B. Seeding. Seed area before blanket installation for erosion control and re-vegetation or seed after mat installation for turf reinforcement. When seeding prior to blanket installation, all check slots and other areas disturbed during installation must be re-seeded. Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

C. Anchoring. U-shaped wire staples, metal geotextile stake pins or triangular wooden stakes can be used to anchor mats to the ground surface. Wire staples should be a minimum of 11 gauge. Metal stake pins should be 3/16 inch diameter steel with a 1 ½ inch steel washer at the head of the pin. Wire staples and metal stake should be driven flush to the soil surface. Two inches of wood staking should remain above the soil surface. All anchors should be six to eight inches long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils.

D. Installation on Slopes. Begin at the top of the slope and anchor its blanket in a six inches deep by six inches wide trench. Backfill trench and tamp earth firmly. Unroll blanket down slope in the direction of the water flow. Lay blankets loosely and maintain direct contact with the soil. Do not stretch. The edges of adjacent parallel rolls must be overlapped two to three inches and be stapled every three feet. When blankets must be spliced, place blankets end over end (shingle style) with six inches overlap. Staple through overlapped area, approximately twelve inches apart.

Blankets shall be stapled sufficiently to anchor blanket and maintain contact with the soil. Staples shall be placed down the center and staggered with the staples placed along the edges Steep slopes, 1:1 to 2:1, require 2 staples per square yard. Moderate slopes, 2:1 to 3:1, require 1 ½ staples per square yard (1 staple three feet on center). Gentle slopes require 1 staple per square yard.

E. Installation in Channels. Dig initial anchor trench twelve inches deep and six inches wide across the channel at the lower end of the project area. Excavate intermitten check slots, six inches deep and six inches wide across the channel at twenty five to thirty five foot intervals along the channel. Cut longitudinal channel anchor slots four inches deep and four inches wide along each side of the installation to bury edges of matting, whenever possible extend matting two to three inches above the crest of channel side slopes.

Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at one foot intervals. Note: matting will initially be upside down in anchor trench.

In same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of three inches. Secure these initial ends of the mats with anchors at one foot intervals, backfill and compact soil. Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining three inch overlap.

Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot the fold back against itself. Anchor through both layers of mat at one foot intervals the backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench. Alternate method for non-critical installations: place two rows of anchors on six inch centers at twenty five to thirty foot intervals in lieu of excavated check slots.

Shingle-lap spliced ends by a minimum of one foot with upstream mat on top to prevent uplifting by water or begin new rolls in a check slot. Anchor overlapped area by placing two rows of anchors, one foot apart on one foot intervals.

Place edges of outside mats in previously excavated longitudinal slots, anchor using prescribed staple pattern, backfill and compact soil.

Anchor, fill and compact upstream end of map in a twelve inch by six inch terminal trench. Secure mat to ground surface using U-shaped wire staples geotextile pins or wooden stakes. Seed and fill turf reinforcement matting with soil, if specified. After seeding, spread and lightly rake ½ inch to ¾ inch of fine topsoil into the mat apertures to completely fill mat thickness. Use backside of rake or other flat implement.

Spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid sharp turns with equipment. Do not drive tracked or heavy equipment over mat. Avoid any

traffic over matting if loose or wet soil conditions exist. Use shovels, rakes or brooms for fine grading and touch up. Smooth out soil filling just exposing top netting of matrix.

F. Inspection and Maintenance. All blanket and mats should be inspected periodically following installation. Inspect installation after significant rainstorms to check for erosion and undermining. Any failure should be repaired immediately. If washout or breakage occurs, reinstall the material after repairing the damage to the slope or drainage way.

11.1.4 Topsoiling. Determine whether the quality and quantity of available topsoil justifies selective handling. Soils of the textural class of loam, sandy loam, and silt loam are best; sandy clay loam, silty clay loam, clay loam, and loamy sand are fair. Do not use heavy clay and organic soils such as peat or muck as topsoil.

Strip topsoil only from those areas that will be disturbed by excavation, filling, road building, or compaction by equipment. Determine depth of stripping by taking soil cores at several locations within each area to be stripped. Put sediment basins, diversions, and other controls into place before stripping. Select stockpile location to avoid slopes, natural drainage ways, and traffic routes. Use sediment fences or other barriers where necessary to retain sediment.

Protect topsoil stockpiles by temporarily seeding and/or mulching as soon as possible to assure the stored material is not exposed and allowed to erode.

If stockpiles will not be used within twelve months they must be stabilized with permanent vegetation to control erosion and weed growth.

Before spreading topsoil, establish erosion and sedimentation control practices such as diversions, berms, dikes, waterways, and sediment basins.

Where the pH of the existing subsoils 6.0 or less, or the soil is composed of heavy clays, incorporate agricultural limestone in amounts recommended by soil tests or specified for the seeding mixture to be used. Incorporate lime to a depth of at least two inches by disking.

Immediately prior to spreading the topsoil, loosen the subgrade by disking or scarifying to a depth of at least three inches, to ensure bonding of the topsoil and subsoil. If no amendments have been incorporated, loosen the soil to a depth of at least six inches before spreading topsoil.

Uniformly distribute topsoil to a minimum compacted depth of two inches on 3:1 slopes and four inches on flatter slopes.

Do not spread topsoil while it is frozen or muddy or when the subgrade is wet or frozen.

Correct any irregularities in the surface that result from topsoiling or other operations to prevent the formation of depressions or water pockets.

Compact the topsoil enough to ensure good contact with the underlying soil, but avoid excessive compaction, as it increases runoff and inhibits seed germination. Light packing with a roller is recommended where high maintenance turf is to be established.

11.1.5 Temporary Gravel Construction Entrance. The aggregate size for construction of the pad shall be two to three inch stone. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.

The thickness of the pad shall not be less than six inches. Use geotextile fabrics, if necessary, to improve stability of the foundation in locations subject to seepage or high water table.

The width of the pad shall not be less than the full width of all points of ingress or egress and in any case shall not be less than twelve feet wide.

The length of the pad shall be as required, but not less than fifty feet.

Locate construction entrances and exits to limit sediment leaving the site and to provide for maximum utility by all construction vehicles. Avoid entrances which have steep grades and entrances at curves in public roads.

The entrance shall be maintained in a condition that will prevent tracking or flowing of sediment onto public rights of way. This may require periodic top dressing with additional stone as conditions demand, and repair and/or clean out of any measures used to trap sediment.

All sediment spilled, dropped, washed or tracked onto public rights-of-way shall be removed immediately. Provide drainage to carry water to a sediment trap or other suitable outlet.

When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with crushed stone that drains into an approved sediment trap or sediment basin.

All sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, straw bales, or other approved methods.

Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. Replace gravel material when surface voids are visible. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary. Immediately remove all objectionable material spilled, washed, or tracked onto public roadways. Remove all sediment deposited on paved roadways within 24 hours.

11.1.6 Rock, Log and Straw Bale Check Dams. The maximum spacing between the dams shall be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.

Rock dams shall be constructed of two to fifteen inch rock. Keep the center rock (spill way) section at least six inches lower than the outer wall edges. Extend the abutments eighteen inches into the channel bank.

Straw bales shall be placed in a single row, lengthwise, oriented perpendicular to the flow, with the ends of adjacent bales tightly abutting one another. Straw bales shall be extended such that the bottoms of the end bales are higher in elevation than the top of the middle bale spillway to ensure that sediment-laden runoff will flow over the barrier, and not around it.

Each straw bale shall be embedded in the soil a minimum of four inches. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales. If the straw bales are wire bound, they should be oriented so the bindings are around the sides rather than along the top and bottom. Wire bindings that are placed in contact with the soil soon disintegrate and may allow the bale to fall apart.

Construct an energy dissipater to reduce downstream erosion.

The check dams shall be inspected for damage periodically during the winter and after each significant storm (one inch in 24 hours). Prompt repairs shall be made to ensure that the dam is functioning properly. Any erosion caused by flows around edges of the dam or under the structure shall be corrected immediately.

Remove sediment from behind the dams when they become sixty percent full, or as needed. The removed sediment shall be deposited in an area that will not contribute sediment off site and can be permanently stabilized. Remove check dams and stakes when stabilization is complete.

11.1.7 Straw Bale Dike. The bales shall be placed on the slope contour at the base of the slope or around the perimeter of the construction site. If the dike is constructed at the toe of a slope, place it five to six feet away from the slope if possible.

Do not construct the dike more than one bale high. Bales shall be placed in a row with the ends tightly abutting. Each bale shall be embedded in the soil a minimum of four inches. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales.

If the bales are wire bound, they should be oriented so the bindings are around the sides rather than along the top and bottom. Wire bindings that are placed in contact with the soil soon disintegrate and may allow the bale to fall apart.

The bales shall be securely anchored in place by two wooden stakes or rebar driven through the bales. The first stake in each bale shall be driven toward the previously laid bale to force the bales tightly together. Drive the stakes at least eighteen inches into the ground.

The straw bale dikes shall be inspected weekly and after each significant storm (one inch in 24 hours). Repairs and/or replacement shall be made promptly. Remove the straw bales when the upslope areas have been permanently stabilized. Remove sediment behind barrier when it reaches a depth of 6 inches.

11.1.8 Silt Fence. The height of a silt fence shall not exceed thirty six inches. Storage height shall never exceed eighteen inches. The fence line shall follow the contour as closely as possible. If possible, the filter fabric shall be cut from a continuous roll to avoid the use of joints. When joints are necessary, filter cloth shall be spliced only at a support post, with a maximum six inch overlap and both ends securely fastened to the post.

Posts shall be spaced a maximum of ten feet apart and driven securely into the ground (minimum of twelve inches). When extra strength fabric is used without the wire support fence, post spacing shall not exceed six feet. Turn the ends of the fence uphill.

A trench shall be excavated approximately four inches wide and six inches deep along the line of posts and upslope from the barrier.

When standard-strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least one inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of two inches and shall not extend more than thirty six inches above the original ground surface.

The standard-strength filter fabric shall be stapled or wired to the fence, and six inches of the fabric shall extend into the trench. The fabric shall not extend more than thirty six inches above the original ground surface. Filter fabric shall not be stapled to existing trees.

When extra-strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts.

The trench shall be backfilled and the soil compacted over the toe of the filter fabric.

Silt fences placed at the toe of a slope shall be at least six feet from the toe in order to increase ponding volume.

Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized, and any sediment stored behind the silt fence has been removed.

Silt fences and filter barriers shall be inspected weekly and after each significant storm (one inch in 24 hours). Any required repairs shall be made immediately. Sediment shall be removed when it reaches 1/3 height of the fence or nine inches maximum.

13.1.9 Drop Inlet Sediment Barriers.

A. Straw Bale Barrier. Excavate a four inch deep trench around the inlet and make the trench as wide as a straw bale in order to embed the bales properly. Orient the straw bales with the bindings around the sides of the bales so the wire does not come in contact with the soil.

Place bales lengthwise around the inlet and press the ends of adjacent bales together. The bales may be loosely joined if more gravel is utilized.

Drive two two by two inch stakes through each bale to anchor the bale securely in place.

Utilize ¾ inch to two inch gravel to fill the void spaces between the bales if necessary to dewater the ponded area more rapidly.

B. Silt Fence Sediment Barrier. Support posts for a silt fence must be steel fence posts or two inch by four inch wood, length three feet minimum, spacing three feet maximum, with a top frame support recommended. Excavate a trench four inches wide and six inches deep and bury the bottom of the silt fence in the trench. Backfill the trench with gravel or soil. Compact backfill well. The height of the silt fence shall be a maximum of eighteen inches measured from the top of the inlet.

Inspect the barrier after each rain and promptly make repairs as needed. Sediment shall be removed after each significant storm (one inch in 24 hours) to provide adequate storage volume for the next rain. The removed sediment shall be deposited in an area that will not contribute sediment off-site and can be permanently stabilized. For gravel filters, if the gravel becomes clogged with sediment it must be carefully removed from the inlet and either cleaned or replaced.

11.1.10 Curb Inlet Sediment Barriers. Place the barriers on gently sloping streets where water can pond. The barriers must allow for overflow from a severe storm event. Slope runoff shall be allowed to flow over blocks and gravel and not be bypassed over the curb. A spillway shall be constructed with the sandbag structures to allow overflow.

The sandbags should be of woven-type geotextile fabric since burlap bags deteriorate rapidly. Sandbags shall be filled with ¾ inch drain rock or ¼ inch pea gravel.

The sandbag shall be placed in a curved row from the top of the curb at least three feet into the street. The row should be curved at the ends, pointing uphill.

Several layers of bags should be overlapped and packed tightly. Leave a one-sandbag gap in the top row to act as a spillway.

Inspect and clean the barrier after each significant storm (one inch in 24 hours) and remove sediment from behind the structure after every storm. Any sediment and gravel shall be immediately removed from the traveled ways of roads. The removed sediment shall be placed where it cannot enter a storm drain, stream, or be transported off site.