MANATEE COUNTY
FLORIDA

April 28, 2009

TO: All Interested Bidders

SUBJECT: **Invitation for Bid # 09-1478-DS**
Trailer Estates Subdivision Phase VI Water System Improvement

ADDENDUM # 1

Bidders are hereby notified that this Addendum shall be acknowledged on pages 00300-1 of the Bid Form and made a part of the above named bidding and contract documents. Bids submitted without acknowledgement of the Addendum will be considered incomplete.

The following items are issued to add to, modify, and clarify the bid and contract documents. These items shall have the same force and effect as the original bidding and contract documents, and cost involved shall be included in the bid prices. Bids to be submitted on the specified bid date, shall conform to the additions and revisions listed herein.

Based upon instructions from the Project Manager, Mr. Chuck Froman, Manatee County Government, Public Works Department and from Mr. John M. Eash, Senior Project Manager of PBS&J, Sarasota Florida.

Q1. Bid Item 31 is for the service line from the new meter to the existing meter and is to be installed by directional bore. Page 01010-2 states this line is to be installed by a licensed plumber. The directional bore is a specialty that plumbers do not perform. Is the intent to have the plumber reconnect the private service? This would seem to make sense in lieu the service line itself, which should be by a directional bore specialty contractor.

A1. **Answer:** Licensed plumbers are required for the connections of service lines from the new meter boxes to the existing meter boxes in accordance with specification section 01010, 1.03, E. and note 22 on sheet 2 of the plans. The directional drilling of the service line may be completed by the main line directional drilling company but all connections at both ends of the service line shall be completed by a licensed plumber. Contractors shall obtain permits and pay the applicable permit fees for the service connections.

Finance Management Department
Mailing Address: Purchasing Division: 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205
PHONE: 941-749-3045 * FAX: 941-749-3034
www.mymanatee.org

Q2. Please address cooper tubing.

A2. **Answer**: The service lines to be supplied and installed for this project shall be CTS HDPE DR9.

Q3. What is existing lines--material presently in place?

A3. **Answer**: The existing 16" water main on American Way is asbestos cement and the existing 12" water main on 69th Ave. West is ductile iron pipe.

Q4. Connectors, what are they presently?

A4. **Answer** :(Connection methods for various pipe materials are detailed on sheet 29)

Q5. HDPE--adapters are they mandatory to existing line.

A5. **Answer:** (Connection methods for various pipe materials are detailed on sheet 29)

Q6. Must have licensed plumber for swap overs.

A6. **Answer**: Licensed plumbers are required for the connections of service lines from the new meter boxes to the existing meter boxes in accordance with specification section 01010, 1.03,.E. and note 22 on sheet 2 of the plans. The directional drilling of the service line may be completed by the main line directional drilling company but all connections at both ends of the service line shall be completed by a licensed plumber. Contractors shall obtain permits and pay the applicable permit fees for the service connections.

Q7. Easements on lot line dedicated. **Blanket Easement from each property owner.

A7. **Answer:** Manatee County has obtained blanket easements from the property owners for the service line installations

Q8. Dedicated storage area----contractor must work out for themselves. ---Should it be noted where not to have the storage area?

A8. **Answer:** Contractor must make arrangements for their own equipment/material storage area. There are no dedicated storage areas provided in the project.

Q9. All utilities are in the back easement area--contractor will have to hand dig only. Meter area--hand digging only.

A9. Answer: Note that there are many existing utilities in the easements along the back lot line. Contractors will need to coordinate with and protect existing utilities. All excavations in these areas shall be completed by hand digging.

Q10. Electrofusion saddles---transition--must have double strap.

A10. Answer: Service saddles with extra wide stainless steel strap as shown on the drawing details shall be used on this project. Electro-fusion saddles and couplings are not acceptable.

Q11 Contractors questioned do we work with plans or the March 2009 updates?

A11. Answer: Work to be completed for this project shall utilize the details and specifications provided in the contract documents. The details and specifications recently issued by Manatee County will not be required for this project.

Q12. Pre-construction video tapes required to document prior conditions.

A12. Answer: (In specs 01380)

Q13. No more than three streets under construction at one time?

A13. Answer: (On plan sheet 2 & specs 01010)

Q14. Where to purchase water? Must get a meter from county.--will you require a jumper?

A14. Answer: (In specs 01510)

Q15. Record drawings in intervals were a question--no submittals while doing work. When substantially complete record drawings are required. Data from Bore Logs must be transferred (red lined) to construction drawing.

A15. Answer: (In specs 01720)

Q16. In the pre-bid meeting the necessity of a 6' depth was to be clarified for the 6" main. A 4' depth would be less disruptive for splices pits, Ts and the multiple connections.

A16. Answer: (Note 29 on sheet 2 states 3' min to 6' max cover. Most of project is shown as 4' depth. Some locations have depth for clearance crossing existing utilities.)

Q17 Can the County property near the work site be used as a "lay down" yard for materials?

A17. Answer: Contractor must make arrangements for their own equipment/material storage area. There are no dedicated storage areas provided in the project.

Q18. Drawings do not show a service for the main office building @ 1903 69th Ave West should service be included for this building?

A18. Answer :(Service is shown with 2" meter on sheet 22)

Q19. 3 Properties do not show service connections are they to be included or omitted from the quote? The properties are: 6911, 6917, and 6919 Sunset Dr

A19. Answer: (Sheet 13 shows properties being served by connection to existing meter in front near proposed main.)

Q20. Will the County allow electro-fusion couplings to hook the HDPE to the MJ adapters?

A20. Answer Service saddles with extra wide stainless steel strap as shown on the drawing details shall be used on this project. Electro-fusion saddles and couplings are not acceptable.

Q21. Specifications section 02619, par. 2.03, DRILLING FLUID, sub. Par. A, is this an oversight from a previous project? Bentonite free drilling fluid is very expensive and I do not know why this type of fluid would be applicable to this project. Please clarify if this is what the County really wants.

A21. Answer Delete specification Section 02619 DIRECTIONAL BORES USING POLYETHYLENE (PE) PRESSURE PIPE FOR TRANSMISSION LINES 4" DIAMETER AND LARGER and replace with the new specification Section 02619 HORIZONTAL DIRECTIONAL DRILLING attached. The new section allows for the use of bentonite drilling fluid.

Q22. Bid items applicable to surface restoration, are these items limited only to the areas shown on the drawings that are earmarked for either driveway repair or pavement repair? What about surface restoration at areas where fire hydrants, gate valves, service corporation stops, etc., have to be excavated and the new pipe exposed in order for these items to be installed? How are we going to be compensated for restoration efforts at these areas?

A22. Answer: Pavement and driveway restoration shall be paid at the unit price bid for all areas excavated to install pipe, valves, service connections, hydrants, etc. as described in the specifications and detailed in the drawings.

Q23. Rock excavation or drilling through rock, since there are no soil borings available and we do not know what we are going to encounter it does not seem unreasonable that bid items be made available to compensate the contractor for excavation, removal and disposal of rock, an arbitrary quantity should be established and let the contractor's bid accordingly.

A23. Answer: (Rock excavation is part of bid items per Measurement & Payment section 01150)

Q24. I understand from the prebid meeting (April 7th 2009) that the contractor will have to retain a plumber to make the "swap over" as it was called. Where in the specifications does it tell us that?

A24. Answer: Licensed plumbers are required for the connections of service lines from the new meter boxes to the existing meter boxes in accordance with specification section 01010, 1.03, E. and note 22 on sheet 2 of the plans. The directional drilling of the service line may be completed by the main line directional drilling company but all connections at both ends of the service line shall be completed by a licensed plumber. Contractors shall obtain permits and pay the applicable permit fees for the service connections.

Q25. If we have to hire a plumber to perform the "swap over" will a permit for each "swap over" from the building department be required for each one?

A25. Answer: Licensed plumbers are required for the connections of service lines from the new meter boxes to the existing meter boxes in accordance with specification section 01010, 1.03, E. and note 22 on sheet 2 of the plans. The directional drilling of the service line may be completed by the main line directional drilling company but all connections at both ends of the service line shall be completed by a licensed plumber. Contractors shall obtain permits and pay the applicable permit fees for the service connections.

Q26. Will permit fees be waived if permit is required?

A26. Answer: Licensed plumbers are required for the connections of service lines from the new meter boxes to the existing meter boxes in accordance with specification section 01010, 1.03, E. and note 22 on sheet 2 of the plans. The directional drilling of the service line may be completed by the main line directional drilling company but all connections at both ends of the service line shall be completed by a licensed plumber. Contractors shall obtained permits and pay the applicable permit fees for the service connections.

If you have submitted a bid prior to receiving this addendum, you may request in writing that your original, sealed bid be returned to your firm. All sealed bids received will be opened on the date stated.

THIS ADDENDUM MUST BE ACKNOWLEDGED ON THE BID FORM FOR YOUR BID TO BE CONSIDERED RESPONSIVE.

END OF ADDENDUM # 1

Bids will be received at the Manatee County Purchasing Division, 1112 Manatee Avenue West, Suite 803, Bradenton, Florida 34205 until 2:00 P.M. on May 7th 2009.

Sincerely,

R. C. "Rob" Cuthbert, CPM, CPPO
Purchasing Division Manager

Enclosure
/ds

SECTION 02619 HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.01 SCOPE

The Contractor shall furnish all labor, materials, equipment and incidentals required to install all pipe, fittings and appurtenances as shown on the Drawings and specified in the Contract Documents by Horizontal Directional Drilling (HDD).

1.02 GENERAL

A. All existing structures, water and sewer lines, storm drains, utilities, driveways, sidewalks, signs, mail boxes, fences, trees, landscaping, and any other improvement or facility in the construction area that the Contractor disturbs for his own construction purposes shall be replaced to original condition at no additional cost to the County.

B. For "Navigable Waters of the U.S." reference 33 of the Code of Federal Regulations, Part 329.

C. For "Waters of the U.S." reference 33 of the Code of Federal Regulations, Part 323.

D. For "Waters of the State" reference Section 62-301 of the Florida Administrative Code.

1.03 TESTING

A. In place soil compaction tests shall be performed by a qualified testing laboratory.

B. Compaction tests shall be taken at every excavation, except in the road crossings or road shoulders; tests are to be taken according to current FDOT Standards.

C. All pipe shall be tested in accordance with the appropriate material specifications.

D. Reference Standards: American Society for Testing and Materials (ASTM), D1557, Moisture-Density Relations of Soils Using 10-lb. Rammer and 18-in. Drop.

E. The density of soil in place shall be a minimum of 95 percent in accordance with ASTM test 1557-70T, Method A or C.

1.04 QUALIFICATIONS

A. Pipe Manufacture: All pipe and fittings shall be furnished by a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the items to be furnished.

B. Drilling Supervisor: The Contractor shall provide a competent boring specialist who shall remain on the project site during the entirety of the directional boring operation. This includes, but is not limited to, drilling fluid preparation, seaming, boring and pulling. The boring specialist shall have a minimum of five years experience in supervising directional bores of similar nature, diameter, materials and lengths.

C. Pipe Fusion: All boring and fusing equipment shall be certified for operation. The Contractor responsible for thermal butt fusing pipe and fittings shall have manufacturer certification for performing such work or a minimum of five years experience performing this type of work. If no certification is available, written documentation of the required work experience shall be submitted for approval.

D. Drilling Fluid Specialist: The personnel responsible for supervising the supply, mixing, monitoring fluid quality, pumping and re-circulation system proposed for the drilling fluid shall have a written certification issued by the Drilling Fluid manufacturer for performing such work or a minimum of five years experience performing this type of work. If no certification is available, written documentation of the required work experience for the proposed personnel shall be submitted for review and approval.

1.05 SUBMITTALS

A. Detailed description including specifications and catalog cuts for:

1. Shop drawings and catalog data for all HDD equipment.
2. The pipe manufacturer's maximum degree of radial bending allowed for the pipe when full and when empty and pullback force recommended setting.
3. Steering and tracking devices including specific tracer wire.
4. Drilling fluids; the drilling fluid submittal shall include the ratio of mixture to water, including any additives, based on the Contractor's field observations prior to construction, knowledge and experience with drilling in similar conditions, and any soil data provided in the Contract Documents, which shall be verified by the fluid specialist.
5. Shop drawings for the breakaway swivel, including the method of setting the swivels' break point and set point to be used.
6. Pipe assembly procedure, details of support devices, and staging area layout including methods to avoid interference with local streets, driveways, and sidewalks.
7. Details of pipe fusion procedures and copies of the fusion technician qualification certification or documentation.
8. Drilling fluid technician qualification certification or documentation

B. If the Contractor proposes any changes to the pull-back distance or profile shown on the drawings, he may be required to submit a complete design for the proposed pipe including an analysis for pull-back forces, external loads including full hydrostatic pressure if empty, external forces due to borehole collapse, ovalization during pull-back, thermal stress while exposed to Sun-light, shortening after release of pull-back force, and tensile stress during pull-back.

C. Bore Plan: For all contiguous piping installations over 300 feet in length or any installations for piping larger than 4" in diameter, the Contractor shall submit a Bore Plan that includes the following:

1. Contact information and experience for the drilling fluid specialist.
2. The number of passes the bore will include to get the product pipe installed.
3. The pilot bore and all reaming bore sizes including the final pullback with the product pipe.
4. Drilling rod length in feet.
5. The pilot bore, pre-ream bores (if any) and pullback production rate in minutes per (drilling) rod to maintain adequate mud flow.
6. Details of the entry and exit pit locations along with entry and exit angles for the bore, drawn to scale, depicting the position of all required equipment, access points, existing facilities to remain in place, existing traffic lanes to be maintained in operation, office trailers and storage sites.
8. The method of fusing or joining pipe of adjacent bores to ensure that the joint is on grade with the installed pipe.

D. Furnish a Bore Path Report to the Engineer within seven days of the completion of each bore path. Data collected by the County Representative does not relieve the Contractor from the responsibility of recording his own data. Include the following in the report:

1. Location of project, project name and number
2. Name of person collecting data, including title, position and company name
3. Investigation site location (Contract plans station number or reference to a permanent structure within the project right-of-way)
4. Driller's Log & identification of the detection method used
5. Elevations and offset dimensions of installed pipe as referenced to the drawings
6. Data log of pullback force during product pipe installation
7. All failed bores. Include length of pipe left in place and explanation of failed installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Incidental materials that may or may not be used to install the product depending on field requirements are not paid for separately and will be included in the cost of the installed product.

B. Drilling Fluids shall use a mixture of bentonite clay or other approved stabilizing agent mixed with potable water with a pH of 8.5 to 10.0 to create the drilling fluid for lubrication and soil stabilization. Vary the fluid viscosity to best fit the soil conditions encountered. Contractor shall have appropriate additives for drilling fluid available for different soil conditions that may be encountered. Do not use any other chemicals or polymer surfactants in the drilling fluid without written consent from the Engineer. Certify to the Engineer in writing that any chemicals

to be added are environmentally safe and not harmful or corrosive to the product pipe.

C. For drilling operations that will be below waters of the State of Florida, only bentonite free drilling fluids shall be used. Acceptable products are BioMax, manufactured by M-I Swaco, Inc., P.O. Box 2216, Laurel, Mississippi 39440, Phone: (800) 731-7331 or Bio-Bore, manufactured by Baroid Drilling Fluids, Inc., P.O. Box 1675, Houston, Texas 77251, Phone: (731) 987-5900 or approved equal.

D. Identify the source of water for mixing the drilling fluid. Approvals and permits are required for obtaining water from such sources as streams, rivers, ponds or fire hydrants. Any water source used other than potable water may require a pH test.

E. The tracer wire to be used for all directional drills shall be a solid, 10 gauge, high strength, copper clad steel wire with a polyethylene jacket of appropriate color manufactured by Copperhead Industries or Manatee County approved equal.

F. Breakaway connectors shall be supplied by DCD Design & Manufacturing, Condux International, Inc. or approved equal.

PART 3 EXECUTION

3.01 SITE CONDITIONS

A. Carry out excavation for entry, exit, recovery pits, slurry sump pits, or any other excavation as specified in the Contract documents. Sump pits are required to contain drilling fluids if vacuum devices are not operated throughout the drilling operation, unless approved by the Engineer.

B. Within 48 hours of completing installation of the boring product, clean the work site of all excess slurry or spoils. Take responsibility for the removal and final disposition of excess slurry or spoils. Ensure that the work site is restored to pre-construction conditions or as identified on the plans.

C. Exposure of product pipe to sunlight shall be limited to 14 consecutive days unless approved by the Engineer.

A. The pipe shall be supported at intervals along its length with rollers or Teflon pads to minimize frictional forces when being pulled, and to hold the pipe above the ground. Surface cuts or scratches greater than or equal to the maximum defect depth in 3.08 E are not acceptable.

3.02 DAMAGE RESTORATION & REMEDIATION

A. The Contractor shall take responsibility for restoration for any damage caused by heaving, settlement, separation of pavement, escaping drilling fluid (frac-out), or the directional drilling operation, at no cost to the County.

B. When required by the Engineer, provide detailed plans which show how damage to any roadway facility will be remedied. These details will become part of the Record Drawings Package. Remediation Plans must follow the same guidelines

for development and presentation of the Record Drawings. When remediation plans are required, they must be approved by the Engineer before any work proceeds.

C. For HDD operations that will be below waters of the State of Florida, the contractor shall be responsible for any damage caused by the drilling operation, including, but not limited to, fracturing of the channel bottom. Any State or Federal required environmental cleanup due to the release of drilling fluids into State waters shall be at the Contractor's expense. The Contractor may at his own expense increase the depth of his drilling operations upon the approval from the Engineer.

3.03 QUALIFICATIONS FOR REJECTION OF DIRECTIONAL BORE

A. The Engineer may reject any portion of the work that is deemed to be non-responsive to the Contract requirements or not in conformance with approved plans and submittals, and for other factors including the following:

1. Failed Bore: When there is any indication that the installed product has sustained damage, stop all work, notify the County and investigate damage. The County may require a pressure and / or mandrel test at no additional cost to the County and shall have a County representative present during the test. Perform all testing within 24 hours unless otherwise approved by the Engineer. Furnish a copy of the test results and all bore logs to the Engineer for review and approval. The Engineer is allowed up to 5 working days to approve or determine if the product installation is not in compliance with the specifications.
2. Obstructions: If an obstruction is encountered during boring which prevents completion of the installation in accordance with the design location and specification, the pipe may be taken out of service and left in place at the discretion of the Engineer.
3. Pull-back Failure: If the installed breakaway device should fail during pull back.
4. Loss of Drilling Fluids: If the drilling fluid is "lost" during the pull back of the product and can not be regained within the required timeframe of the manufacturer or if more than a reasonable amount of fluid is used to fill an unknown void and flow can not be regained. No pipe shall be pulled without visible flow of drilling fluid.
5. Test Failure: If the pipe shall fail a hydraulic pressure test as specified by the County.
6. Damaged Pipe: If at any time when the product is pulled back and any exposed areas have a greater than allowable "gouging" or visible marring of the pipe per the table in 3.08 E.
7. Alignment Tolerance Exceeded: If the vertical and horizontal limits are not within tolerances.
8. Defective Material: Any other defect in material or workmanship which would affect the quality, performance, or installation life of the installed pipeline.

B. Remediation: All rejected bores shall be at the Contractors expense to correct and provide a satisfactory installed product. The Contractor shall submit to the Engineer a revised installation plan and procedure for approval before resuming

work. The Engineer may require non-compliant installations to be filled with excavatable flowable fill or to be completely removed at no additional cost to the County.

3.04 PRODUCT LOCATING AND TRACKING

A. The County recognizes walkover, wire line, and wire line with surface grid verification, or any other system as approved by the Engineer, as the accepted methods of tracking directional bores. Use a locating and tracking system capable of ensuring that the proposed installation is installed as intended. The locating and tracking system must provide information on:

1. Clock and pitch information
2. Depth
3. Transmitter temperature
4. Battery status
5. Position (x,y)
6. Azimuth, where direct overhead readings (walkover) are not possible (i.e. sub aqueous)

B. Ensure proper calibration of all equipment before commencing directional drilling operation.

C. Prepare the Driller's Log. Take and record alignment readings or plot points such that elevations on top of and offset dimensions from the center of the product to a permanent fixed feature are provided. Such permanent fixed feature must have prior approval of the Engineer. Provide elevations and dimensions at all bore alignment corrections (vertical and horizontal) with a minimum distance between points of 10 feet. Provide a sufficient number of elevations and offset distances to accurately plot the vertical and horizontal alignment of the installed product.

D. Installation Location Tolerances: The location of the initial bored hole shall be deemed acceptable by the Engineer if the deviations of the bore from the design alignment or approved adjustments do not exceed the following tolerances:

1. Profile:
   a. 2.0 feet within a length of 100 feet
   b. No reverse curvature within 200 feet
   c. Total deviation not to exceed 5 feet
2. Alignment:
   a. 3.0 feet within a length of 200 feet
   b. No reverse curvature
   c. Total deviation not to exceed 7.0 feet

3.05 PRODUCT BORE HOLE DIAMETER

Minimize potential damage from soil displacement/settlement by limiting the ratio of the bore hole to the product size. The size of the back reamer bit or pilot bit, if no back reaming is required, will be limited relative to the product diameter to be installed as follows:

Maximum Pilot or Back-Reamer Bit Diameter When Rotated 360 Degrees	
Nominal Inside Pipe Diameter Inches	Bit Diameter Inches
2	4
3	6
4	8
6	10
8	12
10	16
12 and greater	Maximum Product OD plus 6

3.06 EQUIPMENT REQUIREMENTS

A. The HDD equipment selected by the Contractor shall be capable of drilling, steering, tracking, reaming and installing the pipeline through all the subsurface conditions that may be present at the site.

B. Match equipment to the size of pipe being installed. Obtain the Engineer's approval for installations differing from the above chart. Ensure that the drill rod can meet the bend radius required for the proposed installation.

C. All HDD equipment shall have a data logger to record pull back force during all pipe installations.

D. All HDD equipment that has the capability to exceed the maximum recommended pulling force shall have a breakaway swivel properly attached to the product pipe that will release if the pullback force exceeds the pipe manufacturers recommended pulling force.

3.07 THRUST / PULLBACK REQUIREMENTS

The Contractor shall provide as part of the required working drawings submittal complete data regarding the operational and maximum thrust or pulling forces to be used for the initial drill head and back-reamer installations, and the final pull-back of the pipe. Gages or other measurement tools shall be used to monitor the forces being used.

3.08 INSTALLATION PROCESS

A. Ensure adequate removal of soil cuttings and stability of the bore hole by monitoring the drilling fluids such as the pumping rate, pressures, viscosity and density during the pilot bore, back reaming and pipe installation. Relief holes can be used as necessary to relieve excess pressure down hole. Obtain the Engineer's approval of the location and all conditions necessary to construct relief holes to ensure the proper disposition of drilling fluids is maintained and unnecessary inconvenience is minimized to other facility users.

B. The Contractor shall determine the pull-back rate in order to allow the removal of soil cuttings without building excess down-hole pressure and to avoid local heaving, or spills. Contain excess drilling fluids at entry and exit points until they are recycled and separated from excavated materials, or removed from the site

or vacuumed during drilling operations. Ensure that entry and exit pits and storage tanks are of sufficient size to contain the expected return of drilling fluids and soil cuttings. The bored hole shall always be maintained full of drilling fluids for support of surfaces, and the fluid re-circulation equipment shall operate continuously until the pipe installation is completed and accepted by the Engineer.

C. Ensure that all drilling fluids are disposed of or recycled in a manner acceptable to the appropriate local, state, or federal regulatory agencies. When drilling in suspected contaminated ground, test the drilling fluid for contamination and appropriately dispose of it. Remove any excess material upon completion of the bore. If in the drilling process it becomes evident that the soil is contaminated, contact the Engineer immediately. Do not continue drilling without the Engineer's approval.

D. The timing of all boring processes is critical. Install a product into a bore hole within the same day that the pre-bore is completed to ensure necessary support exists. Once pullback operations have commenced, the operation shall continue without interruption until the pipe is completely pulled into the borehole.

B. E. All prepared pipe that is being used for installation shall be adequately supported off the ground along the entire length to avoid damaging of the material during pullback due to ground surface conditions. Surface cuts or scratches greater than or equal to the maximum defect depth are not acceptable.

Pipe Size In.	Max. Defect Depth In.
4	1/16
6	1/11
8	5/32
10	3/16
12	1/4
> 12	Per Pipe Manufacturer's Recommendations

F. The drilling fluid specialist shall remain on the project site during the entirety of the directional boring operation to ensure proper mixture and production of drilling fluids needed for the bore.

G. Upon successful completion of the pilot hole, the borehole shall be reamed to a minimum of 25 percent greater than the outside diameter of the pipe being installed.

H. For bores with more than two radii of curvature (entrance and exit), the borehole should be reamed up to 50 percent larger than the outside diameter of the carrier pipe. Prereaming may be necessary dependent on size of material to be pulled.

I. Additional passes for prereaming may be required for larger pipe. Incremental increases shall be used as needed until appropriate bore hole size has been achieved.

J. Prereaming must be accomplished with no product attached to the reamer head on all bore pipe 6" and larger. The bore product maybe pulled back on final pass

of prereaming upon prior approval from the Engineer.

K. After reaming the borehole to the required diameter, the pipe shall be pulled through the hole. In front of the pipe shall be a breakaway swivel and barrel reamer to compact the borehole walls.

L. The Contractor shall not attempt to ream at a rate greater than the drilling equipment and drilling fluid system are designed to safely handle.

M. Install all piping such that their location can be readily determined by electronic designation after installation. For non-conductive installations, externally attach two (2) tracer wires; see Section 2.01 - Materials, Part I. above, to the product pipe. Connect any break in the conductor line before construction with an electrical clamp, or solder, and coat the connection with a rubber or plastic insulator to maintain the integrity of the connection from corrosion. Clamp connections must be made of brass or copper and of the butt end type with wires secured by compression. Soldered connections must be made by tight spiral winding of each wire around the other with a finished length minimum of 3 inches overlap. Tracking conductors must extend 2 feet beyond bore termini. Test conductors for continuity. Each conductor that passes must be identified as such by removing the last 6 inches of the sheath. No deductions are allowed for failed tracking conductors. Upon completion of the directional bore, the Contractor shall demonstrate to the County that the wire is continuous and unbroken through the entire run of the pipe by providing full signal conductivity (including splices) when energizing for the entire run in the presence of the County Representative. If the wire is broken, the Contractor shall repair or replace it at no additional cost to the County.

END OF SECTION