PROJECT REFERENCE NO.	SHEET NO.
U-5105	UC-3B
DESIGNED BY: RBW	
DRAWN BY: JNA	
CHECKED BY: CLS	
APPROVED BY: RBW	
REVISED:	
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION	6/7/2018 9:23:31 AM EDT
UTILITIES ENGINEERING SEC. PHONE:(919)707-6690 FAX:(919)250-4151	UTILITY CONSTRUCTION PLANS ONLY

NORTH CAROLINA PROFESSIONAL SEAL 10719 ENGINEER RONALD B. WILKINS
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UTILITY CONSTRUCTION

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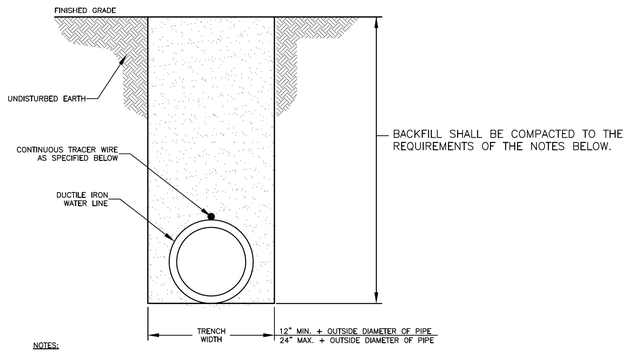


NOTES:

1. TRENCHES EXCAVATED OUTSIDE EXISTING ROAD AND RAILWAY RIGHTS-OF-WAY SHALL BE BE BACKFILLED WITH COMMON BACKFILL MATERIAL CONSISTING OF EXCAVATED MATERIALS EXCEPT HIGHLY ORGANIC SILTS AND CLAYS AND TAMPED THOROUGHLY. FILL SHALL BE DEPOSITED IN SUCCESSIVE, UNIFORM, APPROXIMATELY HORIZONTAL LAYERS. MATERIAL SHALL BE FREE OF ROOTS, STONES, AND DEBRIS. ALL MATERIAL SHALL HAVE AN IN-PLACE DENSITY OF AT LEAST 85% OF MAXIMUM DRY DENSITY (STANDARD PROCTOR) OR AS APPROVED BY THE ENGINEER. COMMON BACKFILL SHALL NOT CONTAIN STONE BLOCKS, BROKEN CONCRETE, MASONRY RUBBLE, OR OTHER SIMILAR MATERIALS. IT SHALL HAVE PHYSICAL PROPERTIES SUCH THAT IT CAN BE READILY SPREAD AND COMPACTED DURING FILLING. SNOW, ICE, AND FROZEN SOIL WILL NOT BE PERMITTED.

   WHERE EXCAVATED MATERIAL, AFTER REMOVAL OF ROCKS, STUMPS, PLANT MATERIAL, AND OTHER EXTRANEOUS MATERIAL AND PROPER DEWATERING, DRYING, PROTECTION, AND STORAGE OF THE EXCAVATION BY THE CONTRACTOR, CANNOT BE PREPARED TO MEET THE REQUIREMENTS FOR COMMON BACKFILL, DUE TO THE NATURE OF THE MATERIAL (E.G., EXCESSIVE ROCK, MUCK, ORGANICS, CLAY, SILT, OR OTHER MATERIAL), AND AS DETERMINED BY THE ENGINEER, THE UNACCEPTABLE EXCAVATION SHALL BE REMOVED FROM THE SITE AND DISPOSED OF BY THE CONTRACTOR AND REPLACED BY IMPORTED BACKFILL MEETING THE REQUIREMENTS OF STRUCTURAL BACKFILL. IMPORTED STRUCTURAL BACKFILL SHALL BE FREE OF ORGANICS, ROOTS OR OTHER DELETERIOUS MATERIALS AND SHALL NOT CONTAIN MORE THAN FIVE PERCENT (BY WEIGHT) ORGANIC MATERIAL, HAVE A PLASTICITY INDEX (PI) GREATER THAN 25, OR HAVE A MAXIMUM DRY DENSITY LESS THAN 90 POUNDS PER CUBIC FOOT. IMPORTED STRUCTURAL FILL SHOULD CONSIST OF MATERIAL CLASSIFIED AS ML, CL, SC, OR SM, OR BETTER PER ASTM D-2487 AND BE CAPABLE OF BEING COMPACTED TO 85% STANDARD PROCTOR.

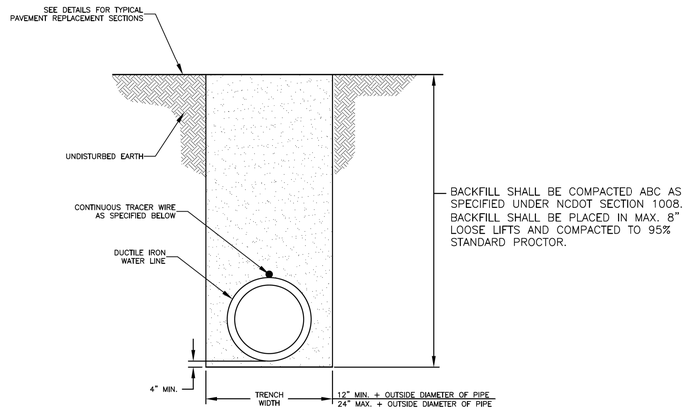
2. THE WATER LINE SHALL HAVE A MINIMUM OF 3' OF COVER AT FINISHED GRADE.

3. TRACER WIRE WILL BE A 19 GAUGE, TIN COATED, COPPER CONDUCTOR WITH POLYETHYLENE INSULATION. CORE MATERIAL COMPRISED OF HIGH-TENACITY, WOVEN POLYESTER WITH WATER BLOCKING YARNS ENCAPSULATED IN 30 MIL. BLUE HDPE JACKET PROVIDING CORROSION RESISTANCE, FLEXIBILITY, IMPACT STRENGTH AND 1800 LBS. TENSILE STRENGTH. TRACER WIRE WILL NOT CONDUCT AN ELECTRICAL CURRENT WHEN STRUCK BY LIGHTNING AND IS DESIGNED FOR DIRECT BURY AND DIRECTIONAL BORING APPLICATIONS. WHEN SPLICES AND LATERAL CONNECTIONS ARE MADE, ONLY GEL FILLED CONNECTORS DESIGNED FOR WIRE WITH WOVEN POLYESTER FIBER CORE ARE TO BE USED. TRACER WIRE AND CONNECTORS SHALL BE TRACE-SAFE® WATER BLOCKING TRACER WIRE AND RELATED CONNECTORS, MANUFACTURED BY NEPTCO, INC. AND PRODUCED IN THE UNITED STATES OF AMERICA.

   TRACER WIRE SHALL BE EXTENDED ALONG ALL WATER LINES, FITTINGS, VALVES, SERVICES, AND HYDRANTS. LOCATING CLIPS SHALL BE PROVIDED AT ALL VALVES, HYDRANT VALVES AND METER BOXES. THE CONTRACTOR SHALL DUCT TAPE TRACER WIRE ON CROWN OF WATER LINE EVERY FIVE FEET.

WATER TRENCH CONSTRUCTION OUTSIDE PAVEMENT

NOT TO SCALE



NOTES:

1. THIS TRENCH BACKFILL DETAIL APPLIES TO AREAS UNDER PAVEMENT AND AREAS WHERE THE TRENCH IS WITHIN FIVE (5) FEET OF THE EDGE OF PAVEMENT.

2. COMPACTION OF THE BACKFILL SHALL BE ACHIEVED THROUGH THE USE OF AN APPROVED VIBRATORY PLATE TAMPER OR ROLLER.

3. COMPACTION TESTING OF THE BACKFILL SHALL BE PROVIDED, DIRECTED AND COORDINATED BY THE OWNER. INTERVALS OF TESTING SHALL BE AT THE TOTAL DISCRETION OF THE OWNER AND MAY BE CHANGED AT ANY TIME.

   IF A TEST DOES NOT PASS, THE CONTRACTOR SHALL REMOVE THE DEFECTIVE BACKFILL, REDO THE WORK AND THE AREA WILL BE RETESTED. THE CONTRACTOR SHALL BE AWARE OF THE LEVEL OF COMPACTION REQUIRED.

   IF THE WORK IS SUSPECT TO BE DEFECTIVE BY THE OWNER, THE WORK SHALL BE RETESTED.

   THE WATER CONTENT OF THE BACKFILL MATERIAL SHALL ALSO BE TESTED AND RECORDED FOR EACH TEST COMPLETED. THE CONTRACTOR WILL BE ALLOWED TO ADD WATER TO THE BACKFILL MATERIAL IN ORDER TO OBTAIN THE OPTIMUM WATER CONTENT. HOWEVER, THE CONTRACTOR WILL NOT BE ALLOWED TO UTILIZE THE ADDITION OF WATER AS A MEANS OF COMPACTION. FURTHERMORE, SHOULD THE BACKFILL MATERIAL BE FOUND TO HAVE WATER CONTENT RATIOS WHICH IN THE OPINION OF THE ENGINEER OR THE OWNER PREVENTS THE APPROPRIATE COMPACTION OF THE TRENCH, THE CONTRACTOR SHALL REMOVE ALL DEFECTIVE MATERIAL AND UNDERTAKE THE NECESSARY CORRECTIVE WORK.

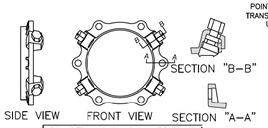
4. THE WATER LINE SHALL HAVE A MINIMUM OF 3' OF COVER AT FINISHED GRADE.

5. TRACER WIRE WILL BE A 19 GAUGE, TIN COATED, COPPER CONDUCTOR WITH POLYETHYLENE INSULATION. CORE MATERIAL COMPRISED OF HIGH-TENACITY, WOVEN POLYESTER WITH WATER BLOCKING YARNS ENCAPSULATED IN 30 MIL. BLUE HDPE JACKET PROVIDING CORROSION RESISTANCE, FLEXIBILITY, IMPACT STRENGTH AND 1800 LBS. TENSILE STRENGTH. TRACER WIRE WILL NOT CONDUCT AN ELECTRICAL CURRENT WHEN STRUCK BY LIGHTNING AND IS DESIGNED FOR DIRECT BURY AND DIRECTIONAL BORING APPLICATIONS. WHEN SPLICES AND LATERAL CONNECTIONS ARE MADE, ONLY GEL FILLED CONNECTORS DESIGNED FOR WIRE WITH WOVEN POLYESTER FIBER CORE ARE TO BE USED. TRACER WIRE AND CONNECTORS SHALL BE TRACE-SAFE® WATER BLOCKING TRACER WIRE AND RELATED CONNECTORS, MANUFACTURED BY NEPTCO, INC. AND PRODUCED IN THE UNITED STATES OF AMERICA.

   TRACER WIRE SHALL BE EXTENDED ALONG ALL WATER LINES, FITTINGS, VALVES, SERVICES, AND HYDRANTS. LOCATING CLIPS SHALL BE PROVIDED AT ALL VALVES, HYDRANT VALVES AND METER BOXES. THE CONTRACTOR SHALL DUCT TAPE TRACER WIRE ON CROWN OF WATER LINE EVERY FIVE FEET.

WATER TRENCH CONSTRUCTION UNDER PAVEMENT

NOT TO SCALE

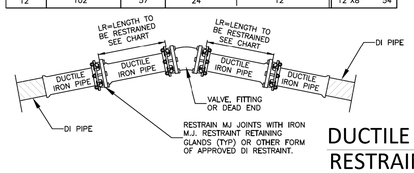


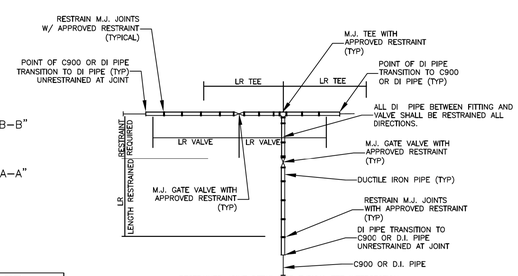
IRON RETAINING GLAND M.J. RESTRAINT			
NOMINAL PIPE SIZE	WEDGES QUANTITY	BOLTS QUANTITY	PRESS RATING
6"	3	6	350
8"	4	6	350
12"	8	8	350

8" SIZE SHOWN 6" & 12" SIMILAR
IRON RETAINING GLAND M.J. RESTRAINT

LR (MIN. LENGTH OF RESTRAINT EACH DIRECTION OF THRUST IN LINEAR FEET)
Based on 200 psig pressure, Safety Factor of 2.0:1, BARE DI PIPE AND ML Soil, 3.5' cover
Chart does not apply to pipes wrapped in polyethylene wrap

PIPE SIZE	VALVES DEAD ENDS TEES	90° ELBOWS	45° ELBOW & CROSSES	22-1/2° ELBOWS	REDUCER
6"	55'	31'	13'	7'	8"X2" 67'
8"	72'	40'	17'	8'	8"X6" 30'
12"	102'	57'	24'	12'	12"X8" 54'





RESTRAINED JOINT DETAIL FOR TYPICAL TEE INTERSECTION
4 WAY INTERSECTION SIMILARLY RESTRAINED

NOTES:

1. THRUST RESTRAINT SHALL BE INSTALLED ON DUCTILE IRON WATER DISTRIBUTION LINES 6" THRU 12" DIAMETER IN THE MANNER SHOWN.

2. IRON RETAINING GLAND M.J. RESTRAINT OR OTHER FORMS OF IRON RESTRAINT SHALL NOT BE USED ON PVC PIPE.

3. PIPE GREATER THAN 12 INCH DIAMETER SHALL REQUIRE RESTRAINED JOINT PIPE FOR THE PROPER LENGTH.

4. COMPACT FITTINGS ARE ACCEPTABLE FOR USE WITH IRON RETAINING GLAND M.J. RESTRAINT AND OTHER FORMS OF DI RESTRAINT.

5. THE MINIMUM LENGTH OF RESTRAINT INDICATED SHALL REQUIRE ALL JOINTS WITHIN THE LR DISTANCE TO BE RESTRAINED.

6. RESTRAINT SYSTEM SHALL BE INSPECTED AND APPROVED PRIOR TO BACKFILLING.

7. RESTRAINT SYSTEMS MAY VARY BASED UPON THE ENGINEERS' DESIGN AS SHOWN ON THE PLAN AND PROFILE SHEETS.

8. GRIPPER RING AND FIELD LOK GASKETS ARE AN ACCEPTABLE METHOD OF RESTRAINT ON DUCTILE IRON PIPE ONLY.

9. TRACKER WIRE NOT SHOWN FOR CLARITY. WIRE SHALL BE INSTALLED PER OTHER DETAILS.

DUCTILE IRON PIPE RESTRAINT DETAIL

NOT TO SCALE

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