**TWC STANDARD CONSTRUCTION NOTES FOR PLANS**
**Effective July 27th, 2023**

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**GENERAL**

1. SECTION 1 – INTRODUCTION
    a. SECTIONS OF THE TWC ENGINEERING DESIGN CRITERIA AND THE TWC STANDARD CONSTRUCTION NOTES FOR PLANS HAVE BEEN WRITTEN CONCURRENTLY. INFORMATION THAT APPLIES TO THE CONTRACTOR AND WORK PERFORMED ON-SITE IS LISTED IN THE TWC STANDARD CONSTRUCTION NOTES FOR PLANS. DURING DESIGN, BOTH DOCUMENTS SHOULD BE CHECKED FOR CLARITY.
    b. CONSTRUCTION OF DOMESTIC WATER PIPELINES AND APPURTENANCES ARE SUBJECT TO INSPECTION AND APPROVAL BY THE TEXAS WATER COMPANY (TWC) AND SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THIS DOCUMENT AND TWC'S STANDARD DRAWINGS AND TWC ENGINEERING DESIGN CRITERIA.
    c. ALL WATER DISTRIBUTION SYSTEMS, WATER MAIN EXTENSIONS, AND ALL APPURTENANT ITEMS SHALL BE DESIGNED IN ACCORDANCE WITH THESE STANDARDS, TWC STANDARD DETAILS AND TCEQ TITLE 30 CHAPTER 290 STANDARDS, WHICHEVER IS MOST STRINGENT. CONSULT TWC FOR CLARIFICATION OF SPECIFIC ITEMS.
    d. THE MOST RECENT TWC ENGINEERING DESIGN CRITERIA AND DETAILS SHALL APPLY TO ALL CONSTRUCTION REGARDLESS OF INFORMATION PROVIDED ON PLANS. CONTRACTORS ARE ENCOURAGED TO VERIFY CURRENT INFORMATION WITH TWC STAFF PRIOR TO THE BEGINNING OF CONSTRUCTION.
    e. CONTRACTORS ARE RESPONSIBLE FOR ALL SAFETY REQUIREMENTS (OSHA AND ANY OTHER AGENCIES THAT APPLY) ASSOCIATED WITH TRENCH CONSTRUCTION AND SHALL BE REQUIRED TO HAVE A TRENCH SAFETY PLAN PREPARED BY AN APPROVED PROFESSIONAL. UNLESS OTHERWISE NOTED IN THE CONSTRUCTION DOCUMENTS, THERE IS NO SEPARATE PAY ITEM FOR THIS REQUIREMENT FOR PROJECTS COMPLETED ON BEHALF OF TWC.
    f. IT IS THE INTENT OF THESE PLANS TO SHOW THE LOCATION OF EXISTING UNDERGROUND FACILITIES IN ACCORDANCE WITH EXISTING RECORDS. HOWEVER, IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE AND VERIFY THE EXACT LOCATION OF ALL EXISTING UNDERGROUND FACILITIES PRIOR TO EXCAVATION. THE CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR ANY AND ALL DAMAGES TO EXISTING FACILITIES.

2. SECTION 2 – PLAN PREPARATION
    a. PLAN REVIEW
        i. ONE SET OF THE "APPROVED FOR CONSTRUCTION" PLANS MUST BE ON SITE AT ALL TIMES DURING CONSTRUCTION.
        ii. ANY CHANGES TO THE PLANS DURING CONSTRUCTION MUST BE DOCUMENTED ON THE "APPROVED FOR CONSTRUCTION" PLANS AND DENOTED ON THE AS-BUILT PLANS.

iii. MINOR CHANGES MAY BE REVIEWED AND APPROVED ON SITE BY A REPRESENTATIVE OF TWC AND THE CHANGES ANNOTATED ON THE AS-BUILT PLANS.
iv. ALL MAJOR CHANGES DURING CONSTRUCTION SHALL BE SUBMITTED IN WRITING TO THE TWC ENGINEERING DEPARTMENT FOR FORMAL REVIEW AND APPROVAL. DETERMINATION AS TO WHETHER OR NOT AN RFI/SUBMITTAL IS REQUIRED SHALL BE DETERMINED ON A CASE BY CASE BASIS BY TWC PERSONNEL.

3. SECTION 3 – MANDATORY PRE-CONSTRUCTION MEETING
    a. NO LATER THAN ONE WEEK PRIOR TO COMMENCING WORK, THE CONTRACTOR SHALL CONDUCT A PRE-CONSTRUCTION MEETING WITH TWC, AT A LOCATION MUTUALLY DETERMINED.
    b. CONTRACTOR SHALL NOTIFY THE TWC CONSTRUCTION INSPECTION DEPARTMENT (830-312-4600) AT LEAST 72 HOURS PRIOR TO COMMENCING CONSTRUCTION.
    c. THE PURPOSE OF THE PRE-CONSTRUCTION MEETING IS TO REVIEW PROJECT STATUS AND COORDINATE SCHEDULED ACTIVITIES.
    d. NO CONSTRUCTION ACTIVITIES SHALL BEGIN UNTIL A PRECONSTRUCTION MEETING HAS BEEN HELD BETWEEN THE CONTRACTOR, ENGINEER OF RECORD, AND A REPRESENTATIVE OF TWC.

4. SECTION 4 – PROJECT CLEANLINESS
    a. CONSTRUCTION METHODS, MATERIAL AND DISPOSAL OF PRODUCTS SHALL ALSO BE SUBJECT TO CURRENT STANDARDS ESTABLISHED BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) AND ANY OTHER LOCAL, STATE OR FEDERAL AGENCIES HAVING AUTHORITY IN THEIR RESPECTIVE JURISDICTIONS.
    b. BOUNDARY FENCES OR OTHER IMPROVEMENTS REMOVED TO PERMIT CONSTRUCTION SHALL BE REPLACED IN THE SAME LOCATION AND IN SAME CONDITION AS GOOD OR BETTER THAN IN WHICH THEY WERE FOUND. UNLESS OTHERWISE STATED ON THE PLANS, NO COMPENSATION SHALL BE GIVEN TO THE CONTRACTOR FOR REMOVAL AND REPLACEMENT OF FENCES.
    c. THE CONTRACTOR IS RESPONSIBLE FOR KEEPING STREETS AND SIDEWALKS ADJACENT TO PROJECT FREE OF MUD AND DEBRIS FROM THE CONSTRUCTION.
    d. CONTRACTOR SHALL NOT PLACE FILL OR WASTE MATERIAL ON ANY PRIVATE PROPERTY WITHOUT PRIOR WRITTEN AGREEMENT WITH THE PROPERTY OWNER. A COPY OF ANY WRITTEN AGREEMENT BETWEEN PROPERTY OWNER AND CONTRACTOR SHALL BE FURNISHED TO TWC.
    e. NO EXCESS EXCAVATION MATERIAL SHALL BE DEPOSITED IN LOW AREAS OR ALONG NATURAL DRAINAGE WAY WITHOUT WRITTEN PERMISSION FROM THE ENGINEER.
    f. REMOVE AND DISPOSE OF TREES, STUMPS, BRUSH, ROOTS, VEGETATION, LOGS, RUBBISH AND OTHER OBJECTIONABLE MATTER WITHIN THE LIMITS OF AREA AFFECTED BY THE WORK, INCLUDING ALL AREAS TO BE RE-GRADED. PROTECT TREES, SHRUBS, AND OTHER LANDSCAPE FEATURES SPECIFICALLY DESIGNATED FROM DAMAGE DURING CONSTRUCTION OPERATIONS.

5. SECTION 5 – PROJECT LAYOUT CONTROL AND SURFACE REPAIR
    a. CONTACTOR TO CONFIRM ACTUAL HORIZONTAL AND VERTICAL LOCATION OF EXISTING STRUCTURES, PIPING, PAVING, FENCING, UNDERGROUND UTILITIES AND ALL OTHER EXISTING FACILITIES PRIOR TO CONSTRUCTION.
    b. CONTRACTOR SHALL COORDINATE FOR ALL NECESSARY UTILITY LOCATES AT LEAST 48 HOURS PRIOR TO CONSTRUCTION.
    c. CONTRACTOR SHALL NOTIFY TEXAS DEPARTMENT OF TRANSPORTATION AT LEAST 48 HOURS PRIOR TO ANY CONSTRUCTION ACTIVITY WITHIN THE STATE RIGHT-OF-WAY.
    d. NO UTILITY TRENCHES OR PITS ARE TO BE LEFT OPEN OVERNIGHT. CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING ADEQUATE SAFETY MEASURES ARE IN PLACE FOR BOTH HUMANS AND LIVESTOCK FOR ANY TRENCH LEFT OPEN OVERNIGHT. BACKFILLING WILL OCCUR DAILY AND AS SOON AS PRACTICAL FOLLOWING CONSTRUCTION OPERATIONS.
    e. CONTRACTOR SHALL NOT OPEN CUT ANY IMPROVED DRIVEWAY IN COUNTY OR STATE RIGHT-OF-WAY WITHOUT PRIOR WRITTEN APPROVAL OF THE AGENCY.
    f. FINE GRADE AREAS TO ACHIEVE FINAL CONTOURS INDICATED OR RESTORE EXISTING GRADES. REMOVE RUBBISH VEGETATION AND ROCKS OVER 1 ½" IN DIAMETER. ADJUST CONTOURS TO ACHIEVE POSITIVE DRAINAGE AWAY FROM STRUCTURES. PROVIDE UNIFORM ROUNDING AT TOP AND BOTTOM OF SLOPES AND OTHER BREAKS IN GRADE. CORRECT IRREGULARITIES AND AREAS WHERE WATER WILL STAND.
    g. ALL VEGETATED AREAS DISTURBED BY CONSTRUCTION ACTIVITIES SHALL BE RESTORED TO ORIGINAL OR BETTER CONDITIONS THAN FOUND PRIOR TO THE BEGINNING OF CONSTRUCTION.
    h. BEFORE FINAL COMPLETION OF THE PROPOSED WORK, ALL ROADWAY, SLOPES, DITCHES AND BERMS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.

6. SECTION 6 – CONTRACT CLOSE-OUT
    a. FINAL INSPECTION
        i. TWC WILL REQUIRE A FIELD FINAL INSPECTION ON ALL MAIN LINE CONSTRUCTION PROJECTS. TWC WILL VERIFY OPERATION OF VALVES, HYDRANTS AND SERVICES. METER BOXES, VALVE BOXES AND VAULTS, MUST BE SET TO GRADE AND WORK SITE MUST BE FREE OF DEBRIS, EXCESS MATERIAL, ETC.
        ii. FIELD SET OF AS-BUILT DRAWINGS MUST BE PROVIDED AT THE FIELD FINAL INSPECTION.
        iii. BACTERIOLOGICAL TEST SAMPLES MUST HAVE RETURNED FROM THE DESIGNATED LAB FREE FROM COLIFORM BACTERIA AND MEET THE SAME STANDARDS AS THE SOURCE WATER. THIS MUST BE NOTED ON THE TWC ACCEPTANCE FORM BY A WATER QUALITY TECHNICIAN. INSPECTOR WILL THEN PROVIDE THREE DIGITAL ACCEPTANCE FORMS TO BE SIGNED BY THE ENGINEER, CONTRACTOR AND TWC INSPECTOR. EACH PARTY SHALL RECEIVE A DATED COPY OF THE FORM.
        iv. SEE SECTION 7B FOR FURTHER GUIDANCE ON DISINFECTION REQUIREMENTS.
    b. RECORD DRAWINGS

i. CONTRACTOR SHALL PROVIDE A NEAT AS-BUILT DRAWING WITHIN 30 DAYS OF JOB COMPLETION IN BOTH PAPER AND ELECTRONIC (.PDF) FORMAT TO TWC AND THE ENGINEER OF RECORD.
ii. ACCEPTANCE OF FACILITIES BY TWC WILL NOT BE AUTHORIZED UNTIL RECEIPT OF AN APPROVED SET OF RECORD DRAWINGS COMPLETED BY THE ENGINEER OF RECORD.
iii. SEE GENERAL SECTION 2A OF TWC ENGINEERING DESIGN CRITERIA.

c. WARRANTY PERIOD
i. THE WARRANTY PERIOD FOR ALL WORK COMPLETED SHALL BEGIN UPON WRITTEN ACCEPTANCE OF FACILITIES BY TWC. THE WARRANTY PERIOD AND REQUIREMENTS FOR BONDING SHALL BE OUTLINED IN THE CONTRACT.

7. SECTION 7 – LINE SEPARATION
a. HORIZONTAL SEPARATION
i. HORIZONTAL SEPARATION SHOULD BE IN ACCORDANCE WITH TCEQ REQUIREMENTS.
ii. JOINT TRENCHES OF WATER WITH OTHER UTILITIES SUCH AS ELECTRICAL, TELECOM, NATURAL GAS, FIBER OPTIC OR CABLE LINES ARE NOT PERMITTED.

b. VERTICAL SEPARATION
i. VERTICAL SEPARATION SHOULD BE IN ACCORDANCE WITH TCEQ REQUIREMENTS.
ii. AT ALL WATER MAIN CROSSINGS, ONE FULL LENGTH OF WATER PIPE SHALL BE CENTERED AT THE CROSSING SO BOTH JOINTS OF THE WATER PIPE WILL BE AS FAR FROM THE OTHER PIPELINES AS POSSIBLE.
iii. NATURAL OR PROPANE GAS LINE CROSSINGS SHALL BE ENCASED IN CONCRETE. THE CONCRETE ENCASEMENT SHALL EXTEND 12” ABOVE AND BELOW THE GAS LINE AND SHALL HAVE A MINIMUM SEPARATION OF 18” FROM OUTSIDE OF PIPE TO OUTSIDE OF PIPE.
iv. ALL OTHER UTILITIES SHALL BE LOCATED BELOW WATER MAINS UNLESS OTHERWISE APPROVED BY TWC. THIS INCLUDES SERVICE LINES FOR ALL OTHER UTILITIES.

c. TYPICAL SECTION SHOWING ALL UTILITIES
i. SEE GENERAL SECTION 7 OF TWC ENGINEERING DESIGN CRITERIA.

8. SECTION 8 – PIPE LAYING REQUIREMENTS
a. IF APPLICABLE, DEWATERING SHALL BE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
b. PIPE SHALL BE CONSTRUCTED OF MATERIALS SPECIFIED AND AS SHOWN ON THE DRAWINGS.
c. EXCAVATION, TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH TWC ENGINEERING DESIGN CRITERIA AND DETAILS.
i. ALL DICL PIPE SHALL BE INSTALLED IN ACCORDANCE WITH STANDARDS SET FORTH IN THE DIPRA “INSTALLATION GUIDE FOR DUCTILE IRON PIPE” UNLESS SUCH STANDARDS CONFLICT WITH TWC STANDARDS IN WHICH CASE TWC STANDARDS SHALL APPLY.

ii. ALL PVC AND PVCO PIPE SHALL BE INSTALLED IN ACCORDANCE WITH STANDARDS SET FORTH IN THE UNI-BELL "HANDBOOK OF PVC PIPE DESIGN AND CONSTRUCTION" UNLESS SUCH STANDARDS CONFLICT WITH TWC STANDARDS IN WHICH CASE TWC STANDARDS SHALL APPLY.

d. NO PIPE SHALL BE LAID WHEN THE TRENCH CONDITIONS OR THE WEATHER IS UNSUITABLE FOR SUCH WORK, EXCEPT BY PERMISSION OF TWC.
e. EACH SECTION OF PIPE SHALL REST UPON THE PIPE BED FOR THE FULL-LENGTH BARREL, WITH RECESSES EXCAVATED TO ACCOMMODATE BELLS AND JOINTS. ANY PIPE WHICH HAS A GRADE OR JOINT DISTURBED AFTER LYING SHALL BE TAKEN UP AND RE-LAID.
f. ANY SECTION OF PIPE ALREADY LAID WHICH IS FOUND TO BE DEFECTIVE OR DAMAGED SHALL BE REPLACED WITH NEW PIPE WITHOUT ADDITIONAL COST TO TWC.
g. USE DUCTILE IRON FITTING WITH MECHANICAL JOINT AND RESTRAIN PER TWC ENGINEERING DESIGN CRITERIA ON ALL PIPE REGARDLESS OF PIPE MATERIAL UNLESS OTHERWISE INDICATED ON PLANS.
h. CONTRACTOR SHALL CUT DUCTILE IRON PIPE ONLY AS NECESSARY TO COMPLY WITH ALIGNMENT SHOWN ON THE DRAWINGS.

9. SECTION 9 – TRENCH EXCAVATION
    a. ALL EXCAVATIONS SHALL BE OPEN CUT, WITH BANKS OF TRENCHES KEPT AS NEARLY VERTICAL AS POSSIBLE IN ACCORDANCE WITH OSHA REQUIREMENTS.
    b. WATER MAINS MAY BE OFFSET TO ONE SIDE OF A TRENCH BUT A MINIMUM OF 6" CLEARANCE MUST BE MAINTAINED BETWEEN THE TRENCH WALL AND THE WATER MAIN.
    c. SEE TRENCHING REQUIREMENTS BELOW:

| **TRENCHING REQUIREMENTS** | | |
|---|---|---|
| **PIPE DIAMETER (INCHES)** | **MINIMUM TRENCH WIDTH** | **MINIMUM TRENCH DEPTH** |
| 4" | 16" | 36" |
| 6" | 18' | 42" |
| 8" | 20" | 44" |
| 12" | 30" | 52" |
| 16" | 36" | 56" |
| >16" | DIAMETER + 24" | DIAMETER + 40" |

    d. THE TRENCH FLOOR SHALL PROVIDE A UNIFORM BEARING FOR EACH FULL LENGTH OF PIPE SECTION. EXCAVATE BELL HOLES AFTER THE BEDDING HAS BEEN GRADED. PERFORM ALL EXCAVATIONS OF WHATEVER SUBSTANCE ENCOUNTERED TO THE DEPTHS SHOWN OR INDICATED ON THE DRAWINGS.
    e. WHEN APPROPRIATE, TWC WILL ALLOW CUT OR FILL TECHNIQUES TO BE USED TO LEVEL AN AREA FOR EXCAVATION.

10. SECTION 10 – BEDDING, BACKFILL, COMPACTION, AND FINAL GRADING

a. FOR ALL WATER LINES CROSSING COUNTY OR STATE ROADWAYS, THE PROVISIONS FOR TRENCH COMPACTION AND BACKFILL AS ESTABLISHED BY THESE AGENCIES SHALL BE MET. WHERE THESE PROVISIONS AND THE TWC ENGINEERING DESIGN CRITERIA ARE IN CONFLICT, THE MORE STRINGENT STANDARD SHALL APPLY.
b. BEDDING
    i. PIPE SHALL BE BEDDED WITH A MINIMUM OF 6" OF THE SAWS MODIFIED GRADE 5 BEDDING. SCREENING OF EXCAVATED TRENCH MATERIAL FOR BEDDING MAY BE ALLOWED USING A 1" OR 1-1/4" SCREEN UNDER NO CIRCUMSTANCE WILL ROCKS LARGER THAN 2" BE ALLOWED IN BEDDING.
    ii. BEDDING OF ALL WATER MAINS SHALL ADHERE TO THE STANDARD BEDDING DETAILS BASED ON BOTH CURRENT AND PROPOSED USAGE OF THE AREA ABOVE THE PIPE, WHICHEVER IS MORE STRINGENT.
c. BACKFILL
    i. WHEN, IN THE OPINION OF TWC, MATERIAL EXCAVATED FROM THE TRENCH IS UNSUITABLE BACKFILL OR WHEN IT IS REQUIRED BY THE JURISDICTIONAL AGENCY, SUITABLE BACKFILL SHALL BE FURNISHED AND PLACED BY THE CONTRACTOR.
    ii. ALL UNSUITABLE MATERIAL AND EXCESS BACKFILL SHALL BE REMOVED AND DISPOSED OF BY THE CONTRACTOR CONCURRENTLY WITH THE INSTALLATION OF THE MAIN.
    iii. BACKFILL SHALL NOT BE PLACED UNTIL THE PIPELINE HAS BEEN INSPECTED BY TWC. BACKFILL MATERIAL SHALL NOT BE DROPPED DIRECTLY UPON THE PIPELINE. THE BACKFILL MATERIAL SHALL BE DEPOSITED FROM ONE END OF THE TRENCH UNIFORMLY ON BOTH SIDES OF THE PIPE.
    iv. BACKFILL FOR HAND TAMPING SHALL BE DEPOSITED IN LAYERS NOT TO EXCEED 4" THICKNESS AND FOR MECHANICAL TAMPING NOT TO EXCEED 6". CARE SHALL BE TAKEN NOT TO INJURE THE PIPE WHILE ENSURING THOROUGH CONSOLIDATION. WHERE APPROPRIATE, EXCESS MATERIAL SHALL BE HEAPED OVER THE TRENCH TO ALLOW FOR SETTLEMENT.
d. COMPACTION
    i. SEE TWC STANDARD DETAIL FOR COMPACTION REQUIREMENTS.
e. FINAL GRADING
    i. ALL STREETS ARE TO BE RESTORED TO THEIR ORIGINAL CONDITION WITH AT LEAST THE SAME AMOUNT OF PROPERLY COMPACTED SUB GRADE AND PAVEMENT.
    ii. FINAL GRADING OF THE AREA SURROUNDING THE TRENCH EXCAVATION SITE SHALL NOT INTERRUPT THE NATURAL DRAINAGE COURSE OF THE SITE. THE AREA SHALL BE RELATIVELY FREE OF LARGE ROCKS AND OTHER DEBRIS THAT IS GREATER THAN THAT OF ORIGINAL CONDITIONS.

**WATER NOTES**

1. SECTION 1 – SYSTEM DESIGN AND FLOW CRITERIA
    a. LINE SIZING CRITERIA

i. SEE WATER SECTION 1 OF TWC ENGINEERING DESIGN CRITERIA.

b. MINIMUM LINE SIZE
   i. THE MINIMUM PIPE SIZE FOR DISTRIBUTION MAINS SHALL BE 4 INCHES, UNLESS OTHERWISE AUTHORIZED BY TWC. THE MINIMUM SIZE FOR DISTRIBUTION MAINS SERVING FIRE HYDRANTS AND FIRE HYDRANT BRANCHES SHALL BE 6 INCHES IN DIAMETER.

c. WATER LINE ROUTING AND LOOPING
   i. CONTRACTOR SHALL ESTABLISH PIPE GRADES USING TOP OF FINISHED GRADE UNLESS OTHERWISE INDICATED ON PLANS.
   ii. CONTRACTOR SHALL GRADE MAIN TO AVOID USE OF AIR VALVES.
   iii. ALL ROAD CROSSING UNDER COMAL COUNTY ROADWAYS SHALL REQUIRE A SEPARATE PERMIT FROM THE COMAL COUNTY ENGINEER. CONTRACTOR IS RESPONSIBLE FOR AQUIRING ALL NECESSARY PERMITS AND SHALL CONSTRUCT ALL CROSSINGS IN ACCORDANCE WITH COMAL COUNTY STANDARDS.
   iv. CONTRACTOR SHALL CONSTRUCT ALL CROSSINGS WITH SANITARY SEWER FACILITIES IN ACCORDANCE WITH THE MOST RECENT VERSION OF APPLICABLE TCEQ STANDARDS.

d. WATER LINE EASEMENTS
   i. SEE WATER SECTION 1 OF TWC ENGINEERING DESIGN CRITERIA.

e. DEPTH OF COVER
   i. COVER AS MEASURED FROM FINISHED GRADE TO TOP OF THE PIPELINE SHALL BE A MINIMUM OF 30 INCHES FOR PIPE DIAMETERS UP TO AND INCLUDING 12 INCHES. DEPTH OF COVER FOR PIPES 14 INCHES AND GREATER IN DIAMETER SHALL BE A MINIMUM OF 36 INCHES. EXCEPTIONS MUST BE APPROVED BY TWC AND MAY REQUIRE 4 INCHES OF CONCRETE ABOVE THE PIPING IN AREAS WHERE MINIMUM COVER CANNOT BE OBTAINED.
   ii. DEPTH OF COVER AND TRENCH WIDTH REQUIREMENTS CAN BE FOUND IN THE STANDARD DETAIL FOR TRENCH CONSTRUCTION.

2. SECTION 2 – CONNECTION TO EXISTING WATER MAINS
   a. TAPPING SLEEVES AND VALVES
      i. TAPPING SLEEVES FOR SIZE-ON-SIZE CONNECTIONS ARE NOT ALLOWED.
      ii. TAPPING SLEEVES SHALL HAVE AN OUTLET FLANGE PER ANSI B16.1.
      iii. FOR TAPPING PVC AND PVCO PIPE, TAPPING SLEEVES SHOULD BE STAINLESS STEEL MANUFACTURED BY SMITH BLAIR OR POWERSEAL.
      iv. FOR TAPPING DUCTILE IRON PIPE, USE THE MUELLER DUCTILE IRON TAPPING SLEEVE WITH EPOXY COATING.
      v. TAPPING VALVES SHALL BE MECHANICAL JOINT OUTLET, NON-RISING STEM, RESILIENT SEAT GATE VALVES MEETING THE APPLICABLE REQUIREMENTS OF AWWA C509 AND C550. TAPPING VALVES SHALL BE SPECIFICALLY DESIGNED FOR PRESSURE TAPPING WITH SUFFICIENT SEAT OPENING TO ALLOW FULL DIAMETER TAPS TO BE MADE.

b. CONTRACTOR SHALL FOLLOW METHODS AND PROCEDURES OF SHUTDOWN AS DIRECTED BY THE TWC STAFF.
c. CONTRACTOR SHALL NOTIFY CONSUMERS OF, AND COORDINATE ALL SHUTDOWNS WITH TWC, PER TWC GUIDELINES.
d. ALL TAPS 2" AND LARGER MADE TO EXISTING WATER MAINS SHALL BE MADE BY A VENDOR APPROVED BY TWC ONLY.
e. WATER MAINS SHALL BE TAPPED IN SUCH A MANNER AS TO AVOID DISTURBANCE OR DISRUPTION TO THE OPERATION OF THE MAIN IN SERVICE AND TO PROTECT THE POTABLE WATER SUPPLY FROM CONTAMINATION.
f. IF APPLICABLE, THE CONTRACTOR SHALL DETERMINE THE OUTSIDE DIAMETER OF THE EXISTING MAIN BEFORE ORDERING THE SLEEVE.
g. VALVES ON EXISTING MAINS SHALL ONLY BE OPERATED BY TWC PERSONNEL.
h. WHEN SERVICE MUST BE INTERRUPTED TO EXISTING CUSTOMERS DURING CONSTRUCTION OF A TAP OR ADDITION OF APPURTENANCES:
    v. THE CONTRACTOR SHALL PROVIDE 3 DAYS' NOTICE TO TWC.
    vi. THE CONTRACTOR OR DEVELOPER SHALL BE REQUIRED TO NOTIFY EXISTING CUSTOMERS AS DIRECTED BY TWC.

3. SECTION 3 – CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION
    a. SEE WATER SECTION 3 OF TWC ENGINEERING DESIGN CRITERIA.

4. SECTION 4 – FIRE PROTECTION STANDARDS
    a. FIRE FLOW
        i. SEE WATER SECTION 4 OF TWC ENGINEERING DESIGN CRITERIA.
    b. FIRE HYDRANT SPACING
        i. IN AREAS WHERE LOCAL MUNICIPAL CODES ARE ENFORCED FOR DEVELOPMENT, AND CONFLICT WITH THIS INFORMATION, THE MORE STRINGENT REQUIREMENT SHALL APPLY.
        ii. RESIDENTIAL AREAS: FIRE HYDRANTS SHALL BE PLACED A MAXIMUM OF 1,000 FEET APART MEASURED ALONG THE RIGHTS-OF-WAY WITH A MAXIMUM SEPARATION OF 500 FEET TO THE LAST LOT.
        iii. COMMERCIAL AND APARTMENT AREAS: FIRE HYDRANTS SHALL BE PLACED EVERY 500 FEET ALONG THE RIGHTS-OF-WAY WITH A MAXIMUM SEPARATION OF 250 FEET TO THE LAST LOT. THE REQUIRED FIRE FLOW SHALL BE DETERMINED BY TWC, OR LOCAL AGENCY REQUIREMENT, WHICHEVER IS GREATER.
        iv. MANUFACTURING AND INDUSTRIAL AREAS: FIRE HYDRANTS SHALL BE PLACED EVERY 300 FEET ALONG THE RIGHTS-OF-WAY WITH A MAXIMUM SEPARATION OF 150 FEET TO THE LAST LOT. THE REQUIRED FIRE FLOW SHALL BE DETERMINED BY TWC, OR LOCAL AGENCY REQUIREMENT, WHICHEVER IS GREATER.
    c. FIRE HYDRANT LOCATION

i. HYDRANTS SHALL BE LOCATED WITHIN ONE FOOT OF THE SIDE LOT LINES, BETWEEN ADJACENT PROPERTIES IN RESIDENTIAL AREAS, OR IN FRONT OF COMMERCIAL AND INDUSTRIAL PROPERTIES AS REQUIRED.
ii. HYDRANTS SHALL BE A MINIMUM OF 2 FEET FROM EDGE OF RIGHTS-OF-WAY OR CURB IN AREAS WITHOUT SIDEWALKS AND SHALL NOT OBSTRUCT SIDEWALKS.
iii. THE LOCATION OF NEW FIRE HYDRANTS SHALL BE IDENTIFIED WITH A BLUE REFLECTIVE PAVEMENT MARKER INSTALLED ON THE ROADWAY. THE REFLECTIVE MARKER SHALL BE LOCATED PERPENDICULAR TO THE HYDRANT, IN THE CENTER OF THE LANE CLOSEST TO THE HYDRANT.
iv. CONTRACTOR SHALL MAINTAIN MINIMUM 10 FEET CLEARANCE BETWEEN HYDRANTS AND DRIVEWAYS.

d. FIRE HYDRANT REQUIREMENTS
i. THE INTERIOR OF THE HYDRANT SHALL BE THOROUGHLY INSPECTED AND CLEANED OF ALL FOREIGN MATTER BEFORE BEING SET IN PLACE.
ii. FIRE HYDRANTS SHALL BE OF THE DRY BARREL, COMPRESSION TYPE AND SHALL COMPLY WITH AWWA C502 “STANDARD FOR DRY-BARREL FIRE HYDRANTS” AND BE MUELLER CENTURION 200 TO 250 CLASS OR CLOW MEDALLION FIRE HYDRANTS. USE EPDM FOR O-RINGS AND SEATS (RUBBERS).
iii. HYDRANT OPERATING NUT SHOULD OPEN LEFT.
iv. GASKETS SHALL BE FURNISHED IN ALL OUTLET CAPS. THE BARREL LENGTH SHALL BE AS REQUIRED TO ACCOMMODATE THE DEPTH OF THE MAIN.
v. HYDRANTS SHALL BE INSTALLED AT LOCATIONS SHOWN ON THE DRAWINGS. IF ONE OR MORE HYDRANTS CANNOT BE INSTALLED AS SHOWN BECAUSE OF OBSTRUCTIONS, DRIVEWAYS, OR CHANGES, NEW LOCATIONS SHALL BE REQUESTED OF TWC OR THE FIRE DEPARTMENT HAVING JURISDICTION.
vi. EACH HYDRANT SHALL STAND PLUMB, WITH STEAMER CONNECTION FACING STREET AND THE 2.5” NOZZLES ON EACH SIDE AT A 90 DEGREE ANGLE TO THE STREET.

e. STANDBY SERVICE LINES (FIRE LINES)
i. STANDBY SERVICE LINES (FIRE LINES) SHALL BE DESIGNED WITH ADEQUATE CROSS-CONNECTION AND BACKFLOW PREVENTION MEASURES AS WELL AS A METHOD FOR DETERMINING WATER FLOW. SEE THE CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION PROGRAM FOR MORE INFORMATION.
ii. IT IS NOT NECESSARY TO INSTALL A METER ON A STANDBY SERVICE LINE. A DETECTOR CHECK IS REQUIRED. AN EFFICIENT WAY TO MEET BOTH CROSS CONNECTION AND BACKFLOW PREVENTION REQUIREMENTS WITH ONE DEVICE IS TO INSTALL A DOUBLE CHECK DETECTOR ASSEMBLY (DCDA) ON THE STANDBY SERVICE LINE. THE DCDA SHALL BE INSTALLED AS CLOSE AS POSSIBLE TO THE LOCATION OF CONNECTION TO THE PUBLIC MAIN AND SHALL BE ACCESSIBLE BY TWC PERSONNEL. DOUBLE CHECK VALVES, DOUBLE CHECK DETECTOR ASSEMBLIES, REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTERS, AND OTHER APPURTENANCES IF INSTALLED UNDERGROUND

MUST HAVE A VAULT THAT MEETS THE STANDARDS OUTLINED IN THIS DOCUMENT. ALL UNDERGROUND INSTALLATIONS MUST BE REVIEWED AND APPROVED BY TWC.

iii. THE BACKFLOW PREVENTION DEVICE WITH FLOW DETECTION SHALL BE INSTALLED ON THE LINE AS CLOSE AS POSSIBLE TO WHERE THE FIRE LINE CROSSES THE PROPERTY LINE.

5. SECTION 5 – VAULTS
    a. CONTRACTOR SHALL PROVIDE TWC ENGINEERING STAFF WITH SPECIFIC INFORMATION ON ANY VAULT FOR REVIEW AND APPROVAL PRIOR TO INSTALLATION.
    b. VAULTS SHALL BE CONSTRUCTED OF CONCRETE WITH DOUBLE SPRING LOADED, SKID RESISTANT, STEEL DOOR WITH AUTOMATIC HOLD OPEN FEATURE.
    c. VAULTS SHALL BE SIZED IN ORDER TO HOUSE THE APPURTENANCE WITH A MINIMUM 2' OF SPACING AROUND IT FOR ROUTINE MAINTENANCE AND INSPECTION.
    d. VAULTS SHALL BE SET 2" ABOVE FINISHED GRADE BUT SHOULD NOT EXCEED 6" ABOVE FINISHED GRADE WITHOUT TWC ENGINEERING STAFF APPROVAL.
    e. EACH END OF THE VAULT SHALL HAVE A CIRCULAR OPENING 2" LARGER IN DIAMETER THAN THE PIPE TO ALLOW FOR PIPE PENETRATION. THESE OPENINGS SHALL BE SEALED WITH LINK SEALS UPON INSERTION OF THE PIPING.
    f. FOR ELECTRONICALLY CONTROLLED VALVES, PROVIDE THE FOLLOWING VAULT DESIGN:
        i. THE VAULT FLOOR SHOULD BE CONCRETE.
        ii. PROVIDE AN APPROPRIATELY-SIZED SUMP AND SUMP PUMP DRAINING WATER TO ABOVE FINISHED GRADE ON VAULT EXTERIOR.
    g. FOR HYDRAULICALLY CONTROLLED VALVES, PROVIDE THE FOLLOWING VAULT DESIGN:
        i. THE VAULT FLOOR SHALL CONSIST OF 1"-11/2" WASHED ROCK 12" THICK. THIS SAME WASHED ROCK WILL SERVE AS THE FOUNDATION AND THE BOTTOM 18" OF BACKFILL FOR THE VAULT.
        ii. PROVIDE AN APPROPRIATELY-SIZED FRENCH DRAIN AROUND VAULT FOR PROPER DRAINAGE.
    h. ALL VAULTS AND VAULT DOORS PLACED IN AREAS WHERE TRAFFIC MAY CROSS OVER IT MUST MEET H-20 LOAD STANDARDS.

6. SECTION 6 – WATER MAIN MATERIALS
    a. DUCTILE IRON PIPE, FITTINGS, AND GASKETS
        i. MECHANICAL JOINTS CONSISTING OF BELL, SOCKET, GLAND, GASKET, BOLTS AND NUTS SHALL CONFORM TO ANSI A21.11.
        ii. ALL DUCTILE IRON PIPE AND FITTINGS SHOULD BE PRESSURE CLASS 350 UNLESS OTHERWISE APPROVED BY TWC AND SHALL CONFORM TO ANSI/AWWA A21.10/C110 OR A21.53/C153.
        iii. PIPE AND FITTINGS SHALL HAVE AN EXTERIOR BITUMINOUS COATING IN ACCORDANCE WITH ANSI A21.51. PIPE AND FITTING INTERIOR SHALL HAVE A CEMENT MORTAR LINING WITH AN ASPHALTIC SEAL COAT CONFORMING TO ANSI/AWWA A21.4/C104.

iv. PIPE AND FITTINGS SHOULD BE DOMESTIC PRODUCTS. FOREIGN MANUFACTURING WILL NOT BE ACCEPTED.
v. PIPE AND FITTING GASKETS, CONFORMING TO ANSI A21.11, SHALL BE MADE OF EPDM (ETHYLENE PROPYLENE DIENE MONOMER) OR SBR (STYRENE-BUTADIENE RUBBER).

b. PVC AND PVCO PIPE
i. PVC PIPE SHOULD BE SDR-21 ASTM D-2241 CLASS 200.
ii. PVCO PIPE SHOULD BE AWWA C909 PVCO PC235.
iii. ALL PVC AND PVCO PIPE FOR POTABLE WATER MAINS SHALL BE BLUE IN COLOR.
iv. ALL PVC AND PVCO PIPE AND FITTINGS SHALL BEAR THE APPROVAL SEAL OF THE NATIONAL SANITATION FOUNDATION (NSF) THAT WILL REMAIN LEGIBLE DURING NORMAL HANDLING, STORAGE, AND INSTALLATION.
v. FITTINGS FOR PVC AND PVCO PIPE (4 INCHES THROUGH 8 INCHES) SHALL BE DUCTILE IRON MECHANICAL JOINT WITH A MINIMUM PRESSURE RATING OF 250 PSI AND SHALL CONFORM TO THE REQUIREMENTS OF ANSI/AWWA A21.10/C110 OR A21.53/C153.

c. HDPE PIPE
i. HDPE PIPE SHOULD BE IPS DR11 RATED TO 200 PSI, OR GREATER AS NEEDED BASED ON SPECIFIC PROJECT REQUIREMENTS. SEE WATER SECTION 6 OF TWC ENGINEERING DESIGN CRITERIA.
ii. HDPE PIPE AND FITTINGS SHOULD BE FUSED UNLESS OTHERWISE NOTED BY TWC.

7. SECTION 7 – WATER MAIN PIPE RESTRAINTS
a. THRUST BLOCKING
i. ALL TEE'S, CROSS'S AND ELBOWS MUST HAVE A CONCRETE THRUST BLOCK SUPPORT. THRUST BLOCKING SHALL BE CONSTRUCTED IN ACCORDANCE WITH TWC STANDARD DETAILS.
ii. THE CONCRETE MUST BE POURED WITH ADEQUATE CONTAINMENT IN PLACE TO AVOID LOSS OF CONCRETE FROM UNDER AND AT THE POINT OF THRUST ON THE FITTING.
iii. THE USE OF ROCKS, BRICKS, AND DRY BAGGED CEMENT ARE NOT CONSIDERED AS ADEQUATE THRUST BLOCKING AND ARE NOT PERMITTED.

b. PVC AND PVCO PIPE JOINT AND FITTING RESTRAINTS
i. ALL PVC AND PVCO PIPE JOINTS SHALL BE RESTRAINED WITH EXTERNAL BELL RESTRAINTS.
ii. ALL DUCTILE IRON FITTINGS ON PVC PIPE SHOULD BE RESTRAINED WITH RETAINER GLANDS, MEGALUG MANUFACTURED BY EBAA OR APPROVED EQUAL.

8. SECTION 8 – WATER MAIN VALVES
a. GATE VALVES
i. BURIED AND ABOVE-GROUND GATE VALVES SHALL BE OF THE RESILIENT SEAT TYPE MEETING THE REQUIREMENTS OF AWWA C509, AND COATED PER AWWA C550 AS MANUFACTURED BY THE MUELLER OR CLOW COMPANY.

ii. GATE VALVES SHALL HAVE NON-RISING STEMS AND SHALL OPEN WHEN THE NUT IS TURNED COUNTERCLOCKWISE.
iii. BURIED GATE VALVES SHALL BE FURNISHED WITH 2 INCH SQUARE AWWA OPERATING NUTS.
iv. ABOVE-GROUND GATE VALVES SHALL BE FURNISHED WITH A HANDWHEEL.

b. VALVE BOXES
i. VALVE BOXES FOR ALL VALVES INSTALLED BELOW GROUND SHALL CONSIST OF A PVC RISER, AND A CAST IRON “LINCOLN HAT” BOX AND LID.
ii. VALVE BOX EXTENSIONS SHALL BE INSTALLED TO RESERVE A MINIMUM OF 50% OF THE ADJUSTMENT FOR A FUTURE EXTENSION.
iii. THE OPERATING NUT SHOULD NOT EXCEED 36 INCHES BELOW FINISHED GRADE. HOWEVER, IF CONDITIONS REQUIRE THAT THE OPERATING NUT EXCEEDS 36 INCHES, THEN AN EXTENSION, MECHANICALLY ATTACHED TO THE VALVE, SHALL BE ADDED, AND THE TOP OF THE EXTENSION SHALL NOT EXCEED 12 INCHES BELOW FINISHED GRADE.

c. AIR RELEASE VALVES
i. AIR RELEASE VALVES SHALL BE APCO #55 OR EQUIVALENT SUBJECT TO APPROVAL BY TWC.
ii. AIR RELEASE VALVES SHALL BE HOUSED IN AN 18”X24” OR LARGER CONCRETE METER BOX WITH A CAST IRON RING AND LID WITH THE WORD WATER CAST INTO THE LID.
iii. AIR RELEASE VALVE ASSEMBLIES SHALL BE CONSTRUCTED IN ACCORDANCE WITH TWC STANDARD DETAILS.

d. PRESSURE REDUCING VALVES (PRV)
i. STEEL BRAIDED LINES FROM PRV TO REGULATOR MUST BE INSTALLED ON THE PILOT SYSTEM. SEE WATER SECTION 8 OF TWC ENGINEERING DESIGN CRITERIA.

9. SECTION 9 – PIPE AND VALVE LOCATING
a. ELECTRONIC LOCATOR TAPE
i. ALL BURIED WATER MAINS SHALL HAVE A SUITABLE ELECTRONIC LOCATOR TAPE BURIED OVER THE WATER MAIN APPROXIMATELY ONE FOOT ABOVE THE CROWN OF THE PIPE AT THE TOP OF THE BEDDING MATERIAL.
ii. THE TAPE SHALL BE CONTINUOUS BETWEEN VALVES.
iii. THE TAPE SHALL BE AT LEAST 4.5 MILS THICK, 6 INCH MINIMUM WIDTH AND MADE WITH AN ALUMINUM MATERIAL SANDWICHED BETWEEN 2 LAYERS OF POLYETHYLENE.
iv. THE TAPE SHALL HAVE IMPRINTED IN PERMANENT BLACK INK WITH 1 INCH LETTERS "CAUTION WATER MAIN BURIED BELOW" ON BLUE BACKGROUND.

b. TRACER WIRE
i. ALL BURIED WATER MAINS SHALL HAVE TRACER WIRE TAPED ON TOP OF THE WATER MAIN. SEE STANDARD DETAILS FOR INSTALLATION REQUIREMENTS.
ii. THE WIRE SHALL BE CONTINUOUS BETWEEN VALVES AND SECURED TO EACH VALVE WITH A TEST STATION. TEST STATION SHOULD BE SNAKEPIT ACCESS POINT MANUFACTURED BY COPPERHEAD INDUSTRIES.

iii. THE WIRE SHALL BE BLUE 12 GAUGE COPPER-CLAD MANUFACTURED BY COPPERHEAD INDUSTRIES, SEE TWC STANDARD DETAIL.

c. VALVE AND LINE MARKERS
   i. ALL TWC CROSS-COUNTRY MAIN LINE VALVES WILL HAVE A 2” X 54” MARKER POST INSTALLED 12” BEHIND THE VALVE BOX, UNLESS OTHERWISE DIRECTED BY TWC. THE MARKER POST SHOULD BE BURIED AND CONCRETED INTO PLACE 18” DEEP AND PAINTED BLUE. 2” MARKER PIPE MUST BE FILLED WITH CONCRETE PER TWC STANDARD DETAIL.

10. SECTION 10 – SERVICE INSTALLATION REQUIREMENTS
    a. WATER SERVICES ARE ONLY ALLOWED ON WATER LINES 16" AND SMALLER.
    b. WATER METERS AND METER BOX INSTALLATION
       i. THE CONTRACTOR SHALL FURNISH ALL LABOR AND MATERIAL REQUIRED TO INSTALL THE SERVICES. THE METER WILL BE FURNISHED AND INSTALLED BY TWC. THE CONTRACTOR SHALL LEAVE THE PROPER SPACE BETWEEN THE ANGLE METER STOP OR VALVE IN THE METER BOX AND CONSUMER’S PIPING SO THE METER MAY BE EASILY INSTALLED IN THE SPACE PROVIDED.
       ii. METER BOXES SHALL, WHERE POSSIBLE, BE SET SQUARE AND LEVEL 2” ABOVE THE FINISHED GRADE OF THE SURROUNDING AREA IN ORDER TO AVOID RUN-OFF WATER. THEY SHALL BE LOCATED AT THE EDGE OF PROPERTY OR ROW LINE AND 6” OUTSIDE THE BACK OF THE CURB OR SIDEWALK.
       iii. WHERE NO CURB OR SIDEWALK EXISTS, THE METER BOXES SHALL BE SET AT THE LOCATION INDICATED ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER; METER BOXES WILL BE PLACED AT PROPERTY LINES IN MOST CASES.
       iv. WHEN POSSIBLE, METER BOXES FOR ADJACENT LOTS SHALL BE PLACED SIDE BY SIDE ON EITHER SIDE OF THE PROPERTY LINE DIVIDING THE TWO LOTS. THE BOXES, RECTANGULAR IN SHAPE, SHALL BE SET WITH THE LONG SIDE PERPENDICULAR TO THE CENTER LINE OF THE STREET OR RIGHTS-OF-WAY, WITH THE NOTCHED END TOWARD CONSUMER PIPING IN ACCORDANCE WITH TWC STANDARD DETAIL.
       v. TRAFFIC BEARING METER BOXES SHALL BE USED IN ANY PAVED AREA WHERE VEHICLE TRAFFIC IS ANTICIPATED.
    a. SERVICE SADDLES
       i. SERVICE SADDLES ARE REQUIRED FOR WATER SERVICES ON PVC PIPE AND DUCTILE IRON PIPE.
       ii. SERVICE SADDLES SHALL HAVE A BRASS BODY, HINGED, BE SUITABLE FOR WET OR DRY INSTALLATION, AND OF THE SIZE AND APPLICATION SPECIFIED.
       iii. SERVICE SADDLE MATERIAL SHALL BE IN ACCORDANCE WITH ASTM B62 AND B584 (85-5-5-5) REQUIREMENTS AND FABRICATED TO ANCI/AWWA C800, LATEST REVISION.
       iv. SADDLES FOR PVC PIPE SHALL BE PERFORMED TO AWWA C900 AND C905 OR C909 OUTSIDE DIAMETER DIMENSIONS AND SO STAMPED OR OTHERWISE IDENTIFIED BY A PERMANENT INKED MARKING THAT WILL NOT SMEAR OR WASH OFF ON THE BODY OF THE SADDLE.

v. SADDLES SHOULD BE IN ACCORDANCE WITH TWC STANDARD PRODUCTS.
vi. SADDLES FOR DUCTILE IRON PIPE SHALL BE STAMPED OR OTHERWISE IDENTIFIED IN A SIMILAR MANNER. THE SEALING GASKET SHALL BE THE O-RING TYPE SUITABLE FOR THE APPLICABLE SERVICE. OUTLET FLANGE SHALL BE ANSI B16.1.

11. SECTION 11 – HYDROSTATIC AND LEAKAGE TEST REQUIREMENTS
    a. CONTRACTOR SHALL COMPLETE HYDROSTATIC AND LEAKAGE TEST AND DISINFECT WATER LINES PRIOR TO PROJECT COMPLETION.
    b. WATER MAINS SHALL BE TESTED AS A WHOLE OR IN SECTIONS BETWEEN VALVES. THE TOTAL LENGTH OF PIPE FOR ANY SINGLE TEST SHALL NOT EXCEED 2,000 FEET.
    c. PRIOR TO TESTING, ALL VALVES SHALL BE TESTED FOR SECURE CLOSURE.
    d. THE MAINS SHALL BE TESTED IN ACCORDANCE WITH SECTION 4, HYDROSTATIC TESTING, AWWA C600 (LATEST REVISION).
        i. WHEN INSTALLING C909 CLASS 200, TESTING SHALL NOT BE LESS THAN 175 PSI FOR 30 MINUTES USING A 300 PSI GAUGE.
        ii. WHEN INSTALLING C909 CLASS 150, TESTING SHALL BE NOT LESS THAN 150PSI FOR 30 MINUTES USING A 300 PSI GAUGE.
    e. ALL PUMPS, GAUGES AND MEASURING DEVICES SHALL BE FURNISHED, INSTALLED, AND OPERATED BY THE CONTRACTOR AND ALL SUCH EQUIPMENT AND DEVICES AND THEIR INSTALLATION, SHALL BE APPROVED BY TWC.
    f. ALL WATER FOR TESTING AND FLUSHING SHALL BE POTABLE WATER PROVIDED BY TWC, AT THE CONTRACTOR'S EXPENSE.
    g. THE QUANTITY OF WATER USED FOR TESTING, WHICH SHALL BE COMPARED TO THE ALLOWABLE QUANTITY, SHALL BE MEASURED BY PUMPING FROM A CALIBRATED CONTAINER OR CERTIFIED WATER METER, THAT MEETS TWC APPROVAL.
    h. ALL RESTRAINED SECTIONS OF THE BURIED MAIN SHALL BE COMPLETELY BACKFILLED BEFORE SUCH SECTIONS ARE TESTED.
    i. THE ENTIRE PRESSURE AND LEAKAGE PROCESS SHALL BE DONE IN THE PRESENCE OF A TWC INSPECTOR. COORDINATE WITH TWC INSPECTION DEPARTMENT A MINIMUM OF 2 DAYS IN ADVANCE.
    j. WHEN LEAKAGE OCCURS IN EXCESS OF THE SPECIFIED AMOUNT, DEFECTIVE PIPE, PIPE JOINTS OR OTHER APPURTENANCES SHALL BE LOCATED AND REPAIRED AT THE EXPENSE OF THE CONTRACTOR. IF THE DEFECTIVE PORTIONS CANNOT BE LOCATED, THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL REMOVE AND RECONSTRUCT AS MUCH OF THE ORIGINAL WORK AS NECESSARY TO OBTAIN A WATER MAIN WITHIN THE ALLOWABLE LEAKAGE LIMITS UPON RETESTING.

12. SECTION 12 – DISINFECTION REQUIREMENTS
    a. WATER LINES
        a. THE CONTRACTOR SHALL DISINFECT ALL PIPE AND FITTINGS INSTALLED IN THE SYSTEM AND RECEIVE THE REQUIRED APPROVALS AND CLEARANCES PRIOR TO PLACING THE SYSTEM IN SERVICE.
        b. THE DISINFECTION SHALL BE ACCOMPLISHED IN ACCORDANCE WITH THE APPLICABLE PROVISIONS OF AWWA C 651, "DISINFECTING WATER MAINS," AND ALL APPROPRIATE APPROVAL AGENCIES. CARE SHALL BE TAKEN TO PROVIDE DISINFECTION OF THE ENTIRE SYSTEM.

c. AFTER DISINFECTION, THE CONTRACTOR WILL THOROUGHLY FLUSH THE LINE UNTIL WATER SAMPLES SHOW A CHLORINE CONTENT EQUAL TO OR GREATER THAN EXISTING SYSTEM AND BACTERIOLOGICAL TESTS ARE SATISFACTORY.

b. TANKS
    a. THE REQUIRED DISINFECTION METHOD FOR TANKS (GROUND STORAGE, ELEVATED, CLEAR WELLS, ETC.) IS METHOD #2 PER AWWA C652.