SECTION 33 11 00 – WATER UTILITY DISTRIBUTION PIPING

1.01 SUMMARY:

A. **Basic Function**: [A17]The work under this Section, without intending to limit or restrict the Contractor's responsibility, shall include the design, fabrication, installation and acceptance testing of the water distribution piping for the entire locks facilities in both lock complexes, in order to provide on a 24-hour-a-day basis, clean and sufficient water at an appropriate pressure, from the existing main lines up to a distance of 1.50 m from each facility.[A17] The piping following onwards into each facility is covered in Section 01 86 13 (*Plant – Mechanical Systems and Equipment*).

B. **Related Sections**:

1. Section 01 14 00 (*Work Restrictions*)

2. Section 01 86 13 (*Plant Mechanical Systems and Equipment*)

3. Section 09 96 00 (*Corrosion Control Coatings*)

1.02 REFERENCES:

A. [A17] (Reserved) [A17]

1. **American Water Works Association (AWWA) Standards**:

C 104 / A21.3-03	Cement - Mortar Lining for Ductile-iron Pipe and Fittings for Water
C 110 / A21.10-03	Ductile-Iron and Gray-Iron Fittings, 3 In.-48 In. (76 mm - 1,219 mm), for Water
C 111 / A21.11-03	Rubber-gasket Joints for Ductile-iron Pressure Pipe and Fittings.
C 151 / A21.51-02	Ductile Iron Pipe, Centrifugally Cast, for Water.
C 500-02	Metal-seated Gate Valves for Water Supply Service.
C 502-05	Dry-Barrel Fire Hydrants.
C 504-06	Rubber-seated Butterfly Valves.
C 508-01	Swing-Check Valves For Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
C 550-05	Protective Epoxic Interior Coatings for Valves and Hydrants

C 600-05	Installation of Ductile-iron Water Mains and their Appurtenances
C 561-04	Disinfecting Water Mains
M 17-06 (Fourth Edition)	Installation, Field Testing and Maintenance of Fire Hydrants

2. **National Fire Protection Association (NFPA)**:

14-03	Standard for the Installation of Standpipe, Private Hydrants and Hose Systems
291-07	Recommended Practice for Fire Flow Testing and Marking of Hydrants

3. **National Sanitation Foundation (NSF)**:

61-07	Drinking Water System Components – Health Effects.

4. **American Society for Testing and Materials (ASTM) Standards**:

A 126-04	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
A 276-06	Stainless Steel Bars and Shapes
A 395-04	Ferritic Ductile Iron Pressure-retaining Castings for Use at Elevated Temperatures
A 536-04	Ductile Iron Castings
A 564-04	Hot-Rolled and Cold-finished Age Hardening Stainless and Heat-resisting Steel Bars and Shapes

5. **American National Standards Institute (ANSI) Standard**:

B16.1-98	Cast Iron Pipe Flanges and Flanged Fittings

6. **Occupational Safety and Health Administration (OSHA) Standard**s:

29 CFR 1919	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction

7. **Instituto de Acueductos y Alcantarillados Nacionales (IDAAN) Publications**:

"Normas Técnicas para Aprobaciones de Planos de los Sistemas de Acueductos y Alcantarillados"

B. **Other Standards**: [A7]Refer to Section 01 42 19 (*Reference Standards*).[A7]

1.03 [A7]REQUIREMENTS:[A7]

A. **Protection of Existing Roads and Property**:

1. The Contractor shall take the necessary precautions against damage to any property of the Employer, including existing roads and structures, during the period that work is being performed under this [A7]Contract[A7]. The Contractor shall conduct its operations to provide and ensure at all times safe passage of traffic along all highways, driveways, roads, and detours within the limits of the Contract. The Contractor shall prevent interruption of or interference with the operation of the existing plant. Damage done by the Contractor shall be rectified at the expense of the Contractor and to the satisfaction of the Employer's Representative. [A17]The Contractor shall remove from roads, debris related to the Works.[A17]

2. [A17]Any conditions resulting from the Works, which hinder utilization of the land or endangers persons or property during and following the course of the work under this Contract, shall be corrected promptly.[A17]

3. The Contractor shall avoid impounding or impeding the flow of the water in drainage canals, water supply channels, brooks, streams, etc., that lie within the construction area.

1.04 DESIGN CRITERIA/SYSTEM DESCRIPTION:

A. **Materials**:

1. **Piping**: The water pipes shall be ductile iron pipes in accordance with AWWA C151 with a required minimum operating pressure of 1.03 MPa (150 psi), unless otherwise indicated herein. The pipes shall have a standard internal cement-mortar liner in accordance with AWWA C104. Ductile iron pipe joints shall be of the push-on type.

2. **Fittings**: Fittings shall be ductile iron fittings of the push-on type in accordance with AWWA C110 and AWWA C111, with a required minimum operating pressure of 1.03 MPa (150 psi), unless otherwise indicated herein. The fittings shall have a standard internal cement-mortar liner in accordance with AWWA C104.

3. **Supports**: Exposed pipe shall be securely supported, strapped, anchored or guided to prevent excessive vibration and to relieve equipment and pipe of excessive stress. Supports shall be provided at valves, fittings, outlets, changes in direction, equipment and accessories.

4. **Gate Valves**: The gate valves shall be designed and fabricated according to the requirements of AWWA C500. The valve body shall be of ductile iron conforming to ASTM A 395/A 395M or A 536. Gate valves of 30-inch diameter or larger shall be provided with a gear system for opening and closing purposes

with a relief line connected directly from the body. The epoxy coating shall conform to AWWA C550 and NSF 61.

5. **Check Valves**: Shall be of the swing type and designed for installing in horizontal position for water service in accordance with AWWA C508.

6. **Butterfly Valves**:

   a. The butterfly valves shall be Class 150 or 250 designed and fabricated in accordance with AWWA C504. The valves shall be designed for horizontal piping mounting with vertical shaft.

   b. The butterfly valve body shall be of ductile iron (ASTM A 536, Grade 65-45-12) with stainless steel seat (ASTM A 564/A 564M or A 276, 18-8 Type 304). The shafts shall be of stainless steel according to ASTM A 564/A 564M or A 276, 18-8 Type 304, with a torque classified as full, Class 150B. The disc shall be ductile iron, ASTM A 536, Grade 65-45-12.

   c. The epoxy coating shall conform to AWWA C550 and NSF 61.

   d. Butterfly valves shall be furnished with manual operators of the worm gear type, self-locking in any position, and sealed, gasketed, and lubricated. [A17]The operators shall be specifically designed for the operation of butterfly valves and sized to permit the operation of the valve with full hydraulic unbalance across the valve equal to the design pressure.[A17] The valve operator shall be provided with a hand-wheel that will permit opening and closing operation by one person. The valve shall have a position indicator and an adjustable mechanical stop limit devices. Hex nut type stops are not acceptable.

7. **Electric-operated Butterfly Valves**:

   a. Electric actuators shall be rated to produce not less than the required valve operating torque. Additionally, the motor of electric actuators shall be capable of producing an actuator output on not less than one and a half times the required valve operating torque.

   b. Electric-motor drives shall be equipped with limit switches and torque switches for both open and closed positions.

   c. Any gearing in direct association with the electric-motor drive shall be totally enclosed and shall operate in a lubricant.

   d. Each valve operator shall be provided with a hand-wheel and clutch for manual operation.

   e. Unless otherwise specified, electrically-actuated butterfly valves shall operate from fully open to fully closed positions, or the reverse, in approximately 60 seconds.

f. The manufacturer shall apply a warning label in the area of the hand-wheel listing the maximum number of turns from full open to full close and full close to full open (90°).

g. [A5](Reserved)[A5]

h. Each valve shall be capable of opening and closing using 120 VAC power at 60 HZ, and shall be operable by 24 VDC momentary contact circuits.

i. Butterfly valves shall be equipped with a local and a remote position indicator which will indicate the position of the valve opening with respect to the body opening. A mechanical dial position indicator shall show local valve position on a dial graduated in percent of valve opening.

8. **Valve Boxes**:

a. **Valve Box for Gate Valves**: [A17]The Contractor shall submit for review a proposed design for the valve box for review.[A17] The valve box shall be made of concrete with a steel cover. The word [A5] "AGUA" [A5] shall be cast in the cover. The boxes shall be of the depth required for the pipe at the valve location [A5]and shall include a dresser type joint or an adapter flange to facilitate changing the valve. There shall be a minimum clear distance of 0.90 m from the pipe to the box to allow adequate space for maintenance personnel. [A5]

b. **Valve Box for Butterfly Valves**: The Contractor shall submit a proposed design for the valve box. The valve box shall be made of concrete or masonry boxes, segmental blocks, and cast iron cover. The word [A5] "AGUA" [A5] shall be cast in the cover. The boxes shall be of the depth required for the pipe at the valve location [A5]and shall include a dresser type joint or an adapter flange to facilitate changing the valve. There shall be a minimum clear distance of 0.90 m from the pipe to the box to allow adequate space for maintenance personnel. [A5]

9. **Thrust/anchor Blocks**: [A17]The Contractor shall submit a proposed design for the thrust/anchor blocks for review.[A17] The blocks shall have a compressive strength of not less than 21 MPa (3,000 psi) after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of the thrust blocks not subject to thrust may be poured against forms. Blocking shall be placed so that fitting joints are accessible for repairs.

10. **Fire Hydrants**: Shall be dry-barrel traffic type conforming to AWWA C502., "Base Valve" design. Size and shape of operating nut, cap nuts, and threads on hose and fireman connections shall be as specified in AWWA C502. Hydrants shall be epoxy coated on its interior in accordance with AWWA C550. Epoxy

coatings shall comply with NSF Standard 61. Exterior coating shall comply with AWWA C502. The location of fire hydrants, including the spacing between hydrants and the distance from buildings shall be in accordance with the requirements of the applicable NFPA standards.

B. **Safety**: [A17]The Contractor shall take the necessary precautions against injury to the Employer's Personnel working at the Site, during the period that work is being performed under this Contract.[A17] [A7]See Section 01 35 29 (*Health and Safety Management and Emergency Response Procedures.*)[A7]

C. **Noise Limits**: [A17]Unless otherwise indicated in these specifications, the steady state noise levels shall be maintained as low as possible, and shall not exceed the limits specified in the Employer's standards on noise levels, see ACP 2600SEG-215 [A17]. The steady state noise level at the manned locations shall be maintained at less than 85 dBA in an 8-hr time weighted average without personal protection equipment.

D. **Use of Hazardous Materials**: Prior to incorporating any hazardous material in the design, such as chemicals, insulation, abrasives, coatings, grease, oil and lubricants, the Contractor shall submit to the Employer's Representative for review a list of all hazardous materials proposed. The use of asbestos, lead base coatings, PCB and CFC is prohibited. Additionally, products listed in the Employer's hazardous materials listing shall not be used. [A17]See http://www.pancanal.com/esp/legal/reglamentos/security/industrial/materiales-peligrosos.html, and the definition of "Prohibited Materials" which the Contractor may not use, Sub-Clause 1.1.5.15 and Sub-Clause 4.1.2 (d) of the Conditions of Contract. [A17]

E. **Installation**:

1. **Equipment**: Shall be installed according to the manufacturer's recommendations.

2. **Piping**: Shall be installed in accordance with AWWA C600.

F. **Connections**: The Employer will make the final connections of the new water pipes to existing water main with materials furnished by the Contractor. The Contractor shall coordinate the operation with the Employer's Representative.

G. **Corrosion Protection**: The entire installation shall be designed, fabricated, and constructed for the best corrosion protection for a coastal, tropical, industrial, marine environment. Materials shall be selected and protected to fulfill its mission but at the same time to minimize or avoid the requirement for maintenance. Coating in contact with water shall be National Sanitation Foundation (NSF) certified. Ductile iron piping shall be coated in accordance with Section 09 96 00 (*Corrosion Control Coatings*), and cathodically protected in accordance with Section 26 42 00 (*Cathodic Protection*).

1.05 SUBMITTALS: [A17]Whenever data as required below is for the Employer's Representative's review, the results of the Employer's Representative's review will be communicated to the Contractor within the next 28 days after the Employer's Representative's receipt of the required data.[A17]

A. **Preliminary Design Data**: [A17]Within 140 days of the Commencement Date and after completion of at least 30% of the design and prior to the procurement of materials or equipments, the Contractor shall submit to the Employer's Representative for review, five (5) sets preliminary design data. [A17] The preliminary design, data shall include but shall not be limited to:

1. **Design Analysis**: The design analysis shall include a written explanation of the system design and equipment selection. It shall contain a summary of the criteria including codes, references and safety requirements. The justification for each major selection and design decision shall be clearly stated, and include supporting calculations, when applicable.

B. **Final Design Data**: [A17]Within 686 days of the Commencement Date and after 100% completion of the design and prior to the procurement of materials or equipments, the Contractor shall submit to the Employer's Representative for his review, five (5) sets of final design data. [A17] The 100% design data, shall include but shall not be limited to:

1. **Final Design Analysis**: The design analysis shall include a written explanation of the system design and equipment selection. It shall contain a summary of the criteria including codes, references and safety requirements. The justification for each major selection and design decision shall be clearly stated, and include supporting calculations, when applicable.

2. **Preliminary Design Drawings**: Preliminary design drawings shall be of high quality and complete to permit the Employer a thorough evaluation of the technical design solutions provided for the proposed water distribution piping systems. At least the following drawings shall be submitted:

   a. Drawings showing the alignment and profile of the new water distribution lines for the locks facilities.

   b. [A5] (Reserved) [A5]

   c. [A5] (Reserved) [A5]

   d. Drawings showing alignment and profile of lines to be relocated temporarily.

3. **Final Systems Detail Drawings**: The Contractor shall submit to the Employer's Representative final drawings showing the general arrangement of piping and equipment, excavation limits; adapters, location of fittings; valve boxes; obstructions; notes, sections and all necessary details deemed necessary for the construction of the water distribution piping. At least all the drawings listed in Subparagraph 1.05 B.2 shall be submitted.

C. **Manufacturer's Catalog Data**: Manufacturer's standard drawings and catalog cuts shall be submitted for:

1. Water line piping, fittings, reducers, quick disconnects, joints, valves and couplings.

2. Hydrants.

3. Manholes.

4. Valve boxes.

D. **Manufacturer's Instructions**: Shall be submitted to the Employer's Representative, for each material or procedure to be utilized. The Contractor shall have a copy of the manufacturer's instructions at the Site at all times and shall follow these instructions unless otherwise directed by the Employer's Representative.

E. **Certificates of Compliance**: Shall be submitted for:

1. Water line piping, fittings, joints, supports, valves and couplings.

2. Fire Hydrants.

These certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or the frequency specified in the publication

F. **Shop Drawings**: Before starting the installation, drawings showing the proposed construction methods for temporary and permanent lines shall be submitted.

G. **As Built Drawings**: [A17]Prior to the Taking Over Certificate, prints of the Contract drawings shall be revised by the Contractor to show any deviations of the actual construction from the work indicated in the system detail drawings, and these revised prints shall be submitted to the Employer's Representative. [A17]

H. **Schedule**: [A5]The Contractor shall submit a schedule for the connection of the new locks facilities water lines to the existing main water lines. [A5]

I. **Disposition plan**: Before performing the hydrostatic tests and disinfection, the Contractor shall submit a plan for the disposition of the water used for these procedures.

J. **Disinfection plan**: The Contractor shall submit a plan for a complete piping disinfection.

K. **Test results**: Results of test by a commercial laboratory certifying by the "Ministerio de Salud" that the lines have been disinfected.

L. **Statements**: Written statements certifying that:

1. The installation is satisfactory.

2. The installation complies with all requirements.

3. The installation was done in compliance with the procedures and techniques recommended by the manufacturers.

1.06 [A7]QUALITY ASSURANCE:[A7]

A. **Regulations**:

1. All materials to be in contact with potable water shall be certified in accordance with NSF 61 and listed on the NSF site.

2. All components of the piping system shall comply with the requirements of NSF 14 and shall be legibly marked with the symbol.

3. **Hydrostatic Test**: The Contractor shall conduct pipe testing in accordance with the requirements and procedures indicated in AWWA C600 for hydrostatic testing. Where any section of the water lines is provided with concrete thrust blocking for fitting, the hydrostatic tests shall not be made until at least 5 days after the installation of the concrete thrust blocking.

4. **Disinfection**: Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed in AWWA C651. Required flow and openings shall be in accordance with AWWA C651, Table 3. The Contractor shall disinfect the water system after all the hydrostatic tests are completed and the water lines accepted. The Employer will perform, at no cost to the Contractor, the test to confirm the disinfection of the water piping. However, if the systems do not pass the test, the cost to repeat the test will be charged to the Contractor. After disinfection and later flushing, the Employer will make the tie-in, as specified.

END OF SECTION

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