

TOHOPEKALIGA WATER AUTHORITY
STANDARDS, SPECIFICATIONS, AND DETAILS

2025 EDITION



TOHOPEKALIGA WATER AUTHORITY

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INTRODUCTION

DOCUMENT TITLE

The title of this document is "TOHOPEKALIGA WATER AUTHORITY STANDARDS, SPECIFICATIONS, AND DETAILS".

JURISDICTION

This MANUAL shall apply to all proposed WATER, REUSE, and SEWER mains and appurtenances to be owned and operated by TOHO and all privately maintained systems connected to TOHO facilities. Projects within the City of St. Cloud service area shall be subject to City encumbrances.

Other permitting and regulatory agencies may have jurisdiction and/or regulations which supplement or supersede the requirements outlined in this MANUAL.

Where a Federal, State, or Local ordinance or regulation conflicts with the content of this MANUAL, the more stringent of the specifications shall prevail.

PURPOSE

This MANUAL is adopted to establish minimum acceptable standards for the design and construction of WATER and REUSE distribution and transmission facilities and SEWER collection and transmission facilities within the TOHO service area. Such facilities include WATER mains, REUSE mains, gravity SEWER, SEWER force mains, SEWER lift stations, and miscellaneous related appurtenances associated with such systems.

The standards, specifications and details outlined in this manual are subject to exception at the discretion of TOHO's CEO/Executive Director.

SCOPE

This Document is divided into three parts:

Part 1 - Standards: Division I contains general requirements governing review and approval of PLANS, and construction inspection and acceptance. Division II presents design standards for WATER, REUSE and SEWER facilities.

Part 2 - Specifications: Divisions III, IV, and V contain detailed technical specifications governing construction of WATER, REUSE, and SEWER facilities within the TOHO service area.

Part 3 - Standard Construction Details: Contains drawings showing Standard Construction Details associated with the installation of WATER, REUSE, and SEWER facilities.

PART 1 STANDARDS

DIVISION I – GENERAL REQUIREMENTS

SECTION 10 - DEFINITIONS

10.1 DEFINITIONS

Except where specific definitions are used within a specific section, the following terms, phrases, words, and their derivation shall have the meaning given herein when consistent with the context. Words used in the present tense include the future tense, words in the plural number include the singular number and words in the singular number include the plural number. The word shall is mandatory and the word may is permissive.

AASHTO - means American Association of State Highway and Transportation Officials. Any reference to AASHTO standards shall be taken to mean the most recently published revision unless otherwise specified.

ANSI - means American National Standards Institute. Any reference to ANSI standards shall be taken to mean the most recently published revision unless otherwise specified.

ASTM - means American Society for Testing Materials. Any reference to ASTM standards shall be taken to mean the most recently published revision unless otherwise specified.

AWWA - means American Water Works Association. Any reference to AWWA Standards shall be taken to mean the most recently published revision unless otherwise specified.

CITY - means the City of Kissimmee or St. Cloud City Commission(s), City of Kissimmee, or St. Cloud, Florida, and/or its designated representative(s).

CONTRACTOR - means the person, firm, or corporation with whom the contract for work has been made by the OWNER, the DEVELOPER, or TOHO, holding an underground Contractor's license issued in the State of Florida.

COUNTY - means the County Commission(s) of Osceola, Polk, Orange, and/or Lake Counties, Florida, and/or their designated representative(s).

DEVELOPER - means the person, firm, or corporation engaged in developing or improving real estate for use or occupancy.

DEVELOPER'S ENGINEER - means an engineer or engineering firm registered with the State of Florida Department of Professional Regulation, retained by the DEVELOPER to provide professional engineering services for a project.

DIRECTOR - means the Executive Director of TOHO, acting directly or through an authorized representative.

ELECTRICAL ENGINEER – means an electrical engineer or engineering firm registered with the State of Florida Department of Professional Regulation.

ENGINEER - means an engineer or engineering firm registered with the State of Florida Department of Professional Regulation.

FDOT - means the State of Florida Department of Transportation.

GEOTECHNICAL/SOILS ENGINEER - means a Registered Florida Engineer who provides services related to terrain evaluation and site selection, subsurface exploration and sampling, determination of soil and rock properties, foundation engineering, settlement and seepage analysis, design of earth and earth retaining structures, the design of subsurface drainage systems and the improvement of soil properties and foundation conditions and testing and evaluation of construction materials.

INSPECTOR – means an authorized representative of the DIRECTOR responsible for ensuring field compliance with this MANUAL and the PLANS.

MANUAL – means this Tohopekaliga Water Authority Standards, Specifications and Details.

NEMA - means National Electrical Manufacturers Association. Any reference to NEMA Standards shall be taken to mean the most recently published revision unless otherwise specified.

NSF - means National Sanitation Test Laboratory Foundation. Any reference to NSF Standards shall be taken to mean the most recently published revision unless otherwise specified.

OSHA - means the Federal Occupational Safety and Health Administration.

OWNER - means the person, firm, corporation, or governmental unit holding right of possession of the real estate upon which construction is to take place.

PLANS - means engineering drawings prepared by an ENGINEER to show the proposed construction.

RECORD DRAWINGS - means a revised set of signed and sealed PLANS submitted by the ENGINEER upon completion of WORK that reflects all changes made in the PLANS during the construction process, and showing the exact dimensions, geometry, and location of all elements of the WORK completed.

REUSE – means treated effluent/reuse water transmission mains, distribution mains, pipes, fittings, valves, services, meters, and miscellaneous related appurtenances.

SEWER – means a wastewater sewer collection system comprised of gravity sewer, pressure sewer, manholes, service laterals, lift stations, and other related appurtenances required for the transmission of raw wastewater sewer to a wastewater treatment facility.

SPECIFICATIONS – means the General Construction Requirements contained in Part 2 of this MANUAL

STANDARD CONSTRUCTION DETAIL(S) - means the detailed drawings in Part 3 of this MANUAL related to WATER, REUSE, and SEWER main materials and installation.

TOHO - means Tohopekaliga Water Authority, an independent special district, established and created pursuant to Chapter 189, Florida Statutes, by the Florida Legislature as a special purpose government body, corporate and politic, authorized to do business in the State of Florida.

WATER – means treated potable water transmission mains, distribution mains, pipes, fittings, valves, hydrants, services, meters, and miscellaneous related appurtenances.

WORK - means the labor, materials, equipment, supplies, services and other items necessary for the execution, completion and acceptance of the project.

SECTION 11 - PLAN REVIEW, ACCEPTANCE, CONSTRUCTION, AND ACCEPTANCE OF WATER AND SEWER IMPROVEMENTS

11.1 PLANS AND SPECIFICATIONS

11.1.1 GENERAL

An electronic submittal of plans and soil boring reports shall be submitted for review, and when complete for acceptance. Electronic plans and soil boring reports shall be submitted through Toho's Development Portal (<https://tohowaterauthfl-energovweb.tylerhost.net/apps/selfservice#/home>).

All submitted plans shall be standard size sheet 24" x 36" with title block. Graphic scale(s) shall be provided on each sheet. All PLAN sheets shall be signed, sealed, and dated by the DEVELOPER'S ENGINEER. Electrical PLANS for SEWER lift stations shall be signed, sealed, and dated by an ELECTRICAL ENGINEER. FDEP Water and Wastewater permit applications shall not be processed by TOHO until PLANS substantially meet FDEP requirements.

11.1.2 MASTER UTILITY PLAN

A Master Utility Plan (MUP) and report shall be submitted for all Development of Regional Impact (DRI) projects, multi-phased projects, and large commercial projects containing one or more lot or tenant. The MUP must be accepted by TOHO prior to construction plan acceptance for any portion of the MUP. MUP shall include the following:

- Existing utility size(s) and type(s)
- Meter location(s) and size(s)
- Overall layout including line size(s) of all proposed mains
- All points of connection to existing utilities
- Method of connection to existing utilities
- Location where Toho responsibility ends (If private)
- Phase line(s)
- Manhole ID numbers
- Sanitary Structure Table that includes:
 - o Manhole numbers
 - o Invert elevation(s) including core drills and drop connection(s)
 - o Rim elevation
 - o Manhole diameter
 - o Manhole depth
 - o Pipe size(s)
 - o Precast material
 - o Existing MH information

11.1.3 PLAN AND PROFILE

All WATER, REUSE, and SEWER force mains 4" and larger and all SEWER Gravity mains 8" and larger shall be drawn in plan and profile view.

Privately owned WATER, REUSE and SEWER force mains are not required to be shown in profile view. Those portions of any privately-owned system within the public right-of-way or as otherwise indicated on the drawings as being owned by TOHO shall be provided per the above.

On-site WATER, REUSE, and SEWER systems shall be shown on the same PLAN sheet. As a minimum, both the plan and profile drawings shall include the following information:

- General information such as north arrow, names of designer and DEVELOPER'S ENGINEER, revision block with dates, graphic scale(s) and sheet number
- DEVELOPER'S ENGINEER must provide a project map showing how the project is phased and number of units in each section (or phase).
- Profiles with elevations at 100-foot intervals, including finished grade, or more frequently if required by good design practice. Finished grade elevations shall be provided over the top of pipe.
- Development layout with horizontal and vertical controls
- All conflicts with other utility and drainage systems
- All manhole locations, rim and invert elevations, and lateral elevations at manholes
- Pipe data including size(s), length(s), material(s), and slope(s)
- Size(s), type(s), and location(s) of fittings, valves, hydrants, air release valves, and other related appurtenances
- Limits of pipe deflection
- Limits of special exterior coatings
- Special bedding requirements
- Pipe restraint requirements
- Details of connection to existing systems
- Location(s) and layout of SEWER lift station(s)
- Elevations of wet well lid and all fence corners
- TOHO's current General Construction Notes as outlined in Appendix 'B' of this MANUAL.
- All walls, retaining walls, gates, signs, and miscellaneous structures shall be shown on the plan view.
- Other details and specific notes required to construct utilities

11.1.4 DETAILS

The PLANS shall include all applicable STANDARD CONSTRUCTION DETAILS as shown in Part 3 of this MANUAL. Special details shall be prepared by the DEVELOPER'S ENGINEER for aerial and underwater crossings of rivers, streams, canals, and ditches. Other special details shall be prepared by the DEVELOPER'S ENGINEER as required.

11.1.5 SCALE

The MUP shall be prepared at a scale not to exceed 1" to 200'. Plan and profile sheets shall not exceed a scale of 1" to 50'. Special details shall be of sufficiently large scale to show pertinent construction information.

11.2 WATER, REUSE, AND SEWER IMPROVEMENTS ASSOCIATED WITH DEVELOPMENT WITHIN THE TOHO SERVICE AREA

11.2.1 GENERAL

All WATER, REUSE, and SEWER improvements that are to be dedicated or connected to TOHO shall be designed, reviewed, constructed, and approved in accordance with the criteria established in this MANUAL.

11.2.2 DESIGN AND PLAN REVIEW

Design of WATER, REUSE, and SEWER improvements shall be in compliance with this MANUAL. PLANS shall be reviewed by and accepted by the TOHO Assets & Infrastructure Division.

11.2.3 PRECONSTRUCTION MEETING

A preconstruction meeting with TOHO, the OWNER, the Underground Utility CONTRACTOR, the surveyor, and the GEOTECHNICAL/SOILS ENGINEER is required prior to initiating construction. All correspondence shall be forwarded to the owner's representative as identified in the preconstruction meeting. If the project is requesting a phasing plan, the preconstruction meeting is the last opportunity to request to phase utilities for a project.

11.2.4 CONSTRUCTION INSPECTION

The INSPECTOR shall periodically inspect all construction subject to this MANUAL. Field as-built drawings shall be made available to the INSPECTOR upon request.

After all required improvements have been installed and tested, the DEVELOPER'S ENGINEER shall submit certification to TOHO that the improvements have been constructed substantially according to the accepted plans and this MANUAL along with a certification of actual WATER, SEWER and REUSE construction costs. Non-compliance with the accepted plans or specifications and jurisdictional requirements or evidence of faulty materials or workmanship shall be called to the attention of the DEVELOPER or DEVELOPER'S ENGINEER. If noted noncompliance is not corrected in a timely manner, all WORK on the project shall be suspended and/or WATER services withheld.

Additional field and/or laboratory tests shall be required when appropriate.

Private systems shall conform to the following tests and inspections.

- Grease interceptor(s)
- Backflow preventer
- SEWER manhole inspections
- SEWER low air pressure testing
- SEWER video inspection
- SEWER mandrel testing
- Pressure main pigging
- Potable main disinfection
- Bacteriological testing of WATER main(s)
- WATER, REUSE, AND SEWER pressure main tests, certified by the DEVELOPER'S ENGINEER and witnessed by TOHO
- SEWER lift station hydraulic start up report
- SEWER lift station conformance with TOHO's private lift station policy
- RECORD DRAWINGS that conform to TOHO requirements

All pipe to be installed may be inspected at the site of manufacture for compliance with this MANUAL by an independent laboratory selected and paid for by TOHO. The manufacturer's cooperation shall be required in these inspections.

11.2.5 GRAVITY SEWER SLOPE SURVEY AND PRESSURE TEST

A gravity SEWER slope survey provided by a surveyor licensed in the state of Florida is required to be submitted and approved by TOHO prior to low air testing, line lamping and installation of pavement, sidewalks, landscaping, and other features over the utilities. Low air pressure tests and video inspection of lines shall not be performed until sub-base or 10' of cover is over the main and laterals are in to grade at the ROW line.

Hydrostatic testing of WATER, REUSE, and SEWER pressure mains and low air testing of gravity SEWER mains shall be completed prior to construction of pavement, sidewalks, landscaping, and other features over the utilities.

11.2.6 MAINTENANCE, MATERIALS, AND WORKMANSHIP SURETY BOND

A surety bond payable to TOHO shall be posted by the DEVELOPER and executed by a company authorized to do business in the State of Florida. The bond shall be in the amount of ten (10) percent of the certified construction cost of all required WATER, REUSE, and SEWER improvements to be owned and maintained by TOHO. Such bond shall guarantee maintenance of all improvements intended to be owned and maintained by TOHO for a two (2) year period, and the materials, workmanship and structural integrity of WATER, REUSE, and SEWER systems, and miscellaneous related facilities for a two (2) year period, commencing after the project has been fully accepted by TOHO.

As an alternative to the provision of a surety bond, the DEVELOPER may provide for the deposit of cash in an escrow account, or an irrevocable letter of credit issued by a financial institution approved by TOHO.

At the expiration of the two (2) year surety bond and verification by TOHO of satisfactory performance of all WATER and SEWER improvements, TOHO shall there by release the DEVELOPER from further responsibilities.

TOHO will begin operation of the system begins at receipt of FDEP Water and Wastewater clearances. TOHO project ownership and maintenance responsibility will begin at the time of full acceptance.

11.2.7 PROJECT ACCEPTANCE CERTIFICATE

After successful completion of all WATER, REUSE, and SEWER improvements, and after receipt of the required documents outlined in Appendix 'D', Project Acceptance Certificate, TOHO shall accept satisfactory construction of all improvements intended to be owned and maintained by TOHO.

At the expiration of the two (2) year surety bond and verification by TOHO of satisfactory performance of all WATER, REUSE, and SEWER improvements, TOHO shall there by release the DEVELOPER from further responsibilities.

11.3 MISCELLANEOUS WATER, REUSE, AND SEWER IMPROVEMENTS

All WATER, REUSE, and SEWER improvements constructed which are intended to be owned, operated and maintained by TOHO, shall be designed, reviewed, inspected and approved in strict compliance with the criteria established in all sections of this MANUAL.

11.4 COMPLIANCE WITH OTHER REGULATORY REQUIREMENTS

It shall be the responsibility of the DEVELOPER to obtain and comply with all applicable Federal, State and Local regulatory requirements.

11.5 RECORD DRAWINGS

11.5.1 GENERAL

All RECORD DRAWINGS submitted to TOHO, as part of the project acceptance shall comply with the following requirements:

- Each sheet of the RECORD DRAWINGS shall be signed and sealed by the DEVELOPER'S ENGINEER. The cover sheet shall be signed and sealed and shall include the following certification statement:

"I CERTIFY THAT THESE RECORD DRAWINGS HAVE BEEN REVIEWED BY ME OR BY INDIVIDUAL/S UNDER MY DIRECT SUPERVISION AND THAT THESE RECORD DRAWINGS INCORPORATE THE INFORMATION CONTAINED IN THE CERTIFIED AS-BUILT SURVEY PREPARED BY [SURVEY COMPANY NAME] DATED [DATE SIGNED AND SEALED], JOB NUMBER [SURVEY COMPANY JOB NUMBER]. TO THE BEST OF MY KNOWLEDGE AND BELIEF THESE RECORD DRAWINGS SUBSTANTIALLY REFLECT ALL WATER, SEWER AND REUSE UTILITIES THAT APPLIES, AS CONSTRUCTED. THE ACCURACY OF THESE RECORD DRAWINGS IS RELIANT ON THE ACCURACY APPLIED BY THE SURVEYOR THAT PREPARED THE CERTIFIED AS-BUILT SURVEY."
- The entire WATER, REUSE, and SEWER systems shall be shown on a single Master Plan sheet.
- The CONTRACTOR shall be responsible for recording information onto the TOHO accepted PLANS concurrently with the construction progress in the field.
- The ¼ Section, Township, and Range of the beginning point of construction shall be displayed on the lower right-hand corner of the cover sheet as __1/4, S__, T__, R__.
- The RECORD DRAWINGS submittal number shall be displayed on the lower right-hand corner of the cover, as "SUBMITTAL SET __".
- All privately maintained utilities shall be clearly outlined in a separate private utilities statement on each sheet of the RECORD DRAWINGS. Private utilities shall also be marked on the RECORD DRAWINGS as "Private".
- RECORD DRAWINGS shall be legibly marked to record actual construction.
- RECORD DRAWINGS shall show actual location and elevations of WATER, REUSE, SEWER piping, fittings, and related appurtenances. All changes to piping location including horizontal and vertical locations of utilities and appurtenances shall be clearly shown and referenced to permanent surface improvements or any structure within 20 feet of the installation.
- Record Drawings shall show actual installed pipe material, class, nominal size, etc. Pressure pipe locations and elevations shall be shown at a maximum of 100-foot intervals with finished grade also shown at each location. Sleeves and casing pipes shall be shown including locations, elevations, length, size and type of pipe material.
- RECORD DRAWINGS shall clearly show all details not on the original PLANS but constructed in the field. All equipment and piping relocation shall be clearly shown. All SEWER lift station data and pump curves shall be provided.
- Location of all manholes, hydrants, fittings, valves, and valve boxes shall be shown at its correct location on RECORD DRAWINGS.

- Location of all abandoned taps utilized for WORK to include temporary jumper taps, bacteriological sample points, and bleed-offs shall be shown on the RECORD DRAWINGS
- Dimensions between all manholes shall be field verified and shown. The inverts and grade elevation of all manholes shall be shown on the RECORD DRAWINGS.
- Plan and profile are required for all mains. RECORD DRAWINGS of plan and profile drawings shall show elevations of all piping at all crossings and borings.
- RECORD DRAWINGS shall be submitted with changes conforming to all items in this section noted on the accepted plans.
- PLANS simply stamped RECORD DRAWINGS and lacking information requested in this section, shall be returned to the DEVELOPER. The Project Acceptance Certificate shall not be issued until correct RECORD DRAWINGS and all supporting information have been submitted and approved.
- RECORD DRAWINGS shall provide the CONTRACTOR's business address and contact information that is current at the time of submittal.

11.5.2 RECORD DRAWING DELIVERABLES

Deliver one (1) set of certified, full size, hard copy of RECORD DRAWINGS, based on as-built information provided by a Florida Registered Surveyor and Mapper (PSM). All drawings shall be tied to the following horizontal and vertical control datum:

- Horizontal - State Plane, Florida East Zone (901), Transverse Mercator projection, NAD 1983 (90) Adjusted.
- Vertical – NAVD 1988

Deliver digital RECORD DRAWINGS in all the following formats:

- AutoCAD (DWG) format including all associated files and XRefs.
- Adobe Protected Document File (PDF) format scans of the original signed and sealed hard copy.
- Tagged Information File (TIF) format scans of the original signed and sealed hard copy.
- Coordinate Asset Table in CSV format

11.5.3 COORDINATE ASSET TABLE

Horizontal locations and vertical elevations shall be per the minimum RECORD DRAWING accuracies as outlined in Appendix 'I', Record Drawing Accuracy Table.

One (1) certified hard copy of the coordinate asset table signed and sealed, on each page, by a Florida Registered Surveyor and Mapper (PSM).

A coordinate asset table shown on each RECORD DRAWING sheet may be substituted for a separate coordinate asset table document.

11.5.4 PROJECT INFORMATION SHEETS

The project information sheet(s) shall be full size (24x36) blank sheets in AutoCAD (DWG). The project information sheet(s) shall contain legible scanned copies of:

- All approved permit pages showing signatures
- Special Purpose Surveys and Boundary Surveys, and Recorded
- Easements
- Certified Engineer's Cost Estimate
- SEWER lift station pump curve data with system curve(s)
- Contractor Demolition Sheets

Each sheet(s) shall be signed and sealed on the lower right-hand corner by the DEVELOPER'S ENGINEER. The project information sheet(s) shall be attached to the front sheet of the RECORD DRAWINGS.

11.5.5 CONTRACTOR'S DEMOLITION SHEETS

Demolition sheets, showing abandoned or demolished piping and/or structures shall be added to the project information sheet(s) along with the RECORD DRAWINGS. Lengths of existing piping and/or structures abandoned or demolished, and the method used shall be clearly indicated on the demolition sheets.

11.5.6 ADDITIONAL REQUIREMENTS

Appendices 'H', 'I', and 'J' of this MANUAL may contain additional requirements not outlined in this Section and is subject to change at any time at the sole discretion of TOHO.

11.6 EASEMENTS

11.6.1 SPECIFIC PURPOSE SURVEY

If WATER, REUSE, or SEWER piping and appurtenances are not constructed within a dedicated right of way, platted tract or existing easement, a specific purpose survey shall be required and included in the conveyance document.

The specific purpose survey shall be a survey, map and report certified by a Florida Registered Professional Surveyor and Mapper (PSM) of an easement with WATER, SEWER and/or REUSE pipes maintained by TOHO. The report shall be required when the pipe centerline is not constructed within 2 feet of the centerline of the easement. The provided sketch shall include record drawing information showing location of utilities within the proposed easement.

Deliver two (2) sets of the certified survey in hard copy and a scanned version of the hard copy in Adobe Protected Document File (PDF) format.

11.6.2 BOUNDARY SURVEY

If new SEWER lift station(s) are not constructed within a dedicated platted tract, a BOUNDARY SURVEY shall be required and included in the conveyance document.

Deliver two (2) hard copies of the certified survey of the SEWER lift station property and a scanned version of the hard copy in Adobe © Protected Document File (pdf) format.

11.6.3 PLATS

Plat shall include language stating, "Grantor shall not place any permanent structures or improvements such as buildings or foundations on, over, or across the easement. Grantee shall have the right and authority to clear the easement area of trees, limbs, vegetation, or other physical objects which endanger or interfere with the safe or efficient installation, operation, or maintenance of facilities existing within the easement.

Plats may be used to show legal description of easements. However, easements shall be conveyed by separate legal document. Plats inside City of St. Cloud service are acceptable for assignment of easements to the City of St. Cloud.

11.6.4 DEED REQUIREMENTS FOR SEWER LIFT STATIONS

TOHO owned SEWER lift stations require the tract to be deeded to TOHO by warranty deed. Quit claim deeds are not sufficient. This requires no other utilities be placed within that SEWER lift station tract. Required documentation:

- Warranty Deed
- Title Insurance
- FIRPTA Certificate of Non-Foreign Entity Status
- Seller's Affidavit
- Affidavit of Authority/LLC Affidavit
- Closing Statement (Acknowledgement that all costs related to
- closing and conveyance of the SEWER lift station is the responsibility of the Seller).

The above documents must be provided to TOHO and accepted by TOHO Legal Counsel prior to TOHO signing the FDEP Wastewater clearance application.

11.6.5 EASEMENTS AND SPECIAL REQUIREMENTS FOR UTILITY MAINS

All mains 20" or larger and/or any mains placed in a municipality's ROW that has roadway widening within its five (5) year CIP or designated as a "Collector" Road shall be placed within a dedicated utility easement with a minimum of 10' from the edge of pipe to the outside edge of the easement.

Project offsite utility improvements placed in a municipality's ROW that has roadway widening within its five (5) years CIP or designated as a "Collector" Road shall be placed in a 10' utility easement adjacent to the ROW unless specifically approved in the ROW by TOHO. Mains shall be placed with a minimum 6' from edge of pipe to the outside edge of the utility easement.

All TOHO owned mains shall be placed with 12' minimum separation from buildings and exfiltration system or at least 6' outside the bearing area, whichever is greater. High pressure mains (mains with average operating pressure above 75 psi) and/or mains 16" and larger shall provide a minimum 20' from any building.

All TOHO owned pressure mains shall be in dedicated ROW or utility easements. When installed in ROW, mains shall maintain a consistent alignment with respect to the centerline of the road. All mains located adjacent to a road ROW shall require a minimum 10-foot easement abutting the ROW. All mains located outside or not immediately adjacent to the dedicated ROW shall require a minimum 20-foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. Using OSHA Standard 29 CFR PART 1926 Subpart P App. B, the width of the easement can be calculated. Additional easement widths shall be provided if the pipe size or depth-of-cover so dictates. Easement widths are subject to review and approval at the discretion of the Executive Director of TOHO.

END OF SECTION 11

PART 1 STANDARDS

DIVISION II – DESIGN STANDARDS

SECTION 20 - GRAVITY SEWERS

20.1 GENERAL CONSIDERATIONS

20.1.1 TYPE OF SEWERS

TOHO shall approve PLANS for new gravity SEWER and extensions only when designed as separate systems in which precipitation, runoff, and groundwater are excluded.

20.1.2 DESIGN PERIOD

SEWER systems should be designed for the estimated ultimate tributary population, as determined by TOHO, except in considering parts of the systems that can be readily increased in capacity.

20.1.3 LOCATION

Gravity SEWERS shall be in utility easements or under roadways unless otherwise specifically authorized. Whenever possible, gravity SEWERS shall be located under pavement in dedicated rights-of-way. Gravity SEWERS shall not be located within 12 feet of buildings or building foundations and other structures. All gravity SEWERS located outside of dedicated rights-of-way shall require an easement conforming to the following table for an 8" pipe with a minimum trench width of 36" at the pipe bedding, using a 1½:1 slope based upon the OSHA definition of type "C" soils and a 1:1 slope based upon the OSHA definition of type "B" soils, clear area at the top of the excavation and spoils room, the minimum width shall be:

<u>Depth</u>	<u>Minimum easement width (Type "C" soil)</u>	<u>Minimum easement width (Type "B" soil)</u>
5'	20'	20'
6'	20'	20'
7'	21'	20'
8'	23'	20'
9'	24'	21'

For depths greater than 9 feet, easement widths shall be determined by site specific conditions.

Type "B" soils shall only be considered if corroborating evidence of such soil is provided by a certified soil boring and a signed and sealed ENGINEER's analysis.

Additional easement widths shall be provided when the pipe size or depth of cover so dictate. Using OSHA Standard 29 CFR PART 1926 Subpart P App. B, a minimum of 3 feet for the trench width per the STANDARD CONSTRUCTION DETAIL Toho-14, Typical Pipe Trench Section, and additional area for spoils, the width of the easement can be calculated.

If a gravity SEWER is located immediately adjacent to a road right-of-way, the easement shall be a minimum of ½ of the table value.

No gravity SEWERS shall be placed under wet or dry retention ponds, tennis courts, dumpster pads, or other structures.

Gravity SEWERS shall not be located along walls or side or rear lot lines. Placement of a gravity SEWER along a side or rear lot line may be allowed on a case-by-case basis if such a gravity SEWER configuration results in efficient placement and utilization of the gravity SEWER system. These criteria shall also apply to gravity SEWER placement in retention pond berms. No manholes shall be placed along a side or rear lot line. Manholes shall be designed to be accessible.

No plantings shall be installed with root ball placed within 5 horizontal feet of any TOHO owned gravity SEWER main or appurtenance. Measurement shall be taken from the outside edge of the pipe or appurtenance to the edge of the plantings root at maturity. This minimum separation may be adjusted at the sole discretion of TOHO depending on the depth of the main or appurtenance.

20.2 DESIGN BASIS

20.2.1 DESIGN LAYOUT

Gravity SEWERS shall be designed to minimize the number of SEWER lift stations and maximize the gravity SEWER slope. Multi-phased projects shall submit a MUP per Section 11.1.2. Layouts shall also consider servicing off site properties as directed by TOHO staff.

20.2.2 AVERAGE DAILY FLOW

Gravity SEWER systems shall be designed for the estimated ultimate tributary population, as delineated by TOHO. Average daily SEWER flow shall be calculated by the current TOHO Flow Rate Ordinance as outlined in Appendix 'A', Flow Rates and Fees.

20.2.3 PEAK DESIGN FLOW

Gravity SEWERS shall be designed based on ultimate development maximum rates of flow, which shall be the product of selected peak factors times the cumulative average daily flow as calculated above. The following minimum peak factors shall be applicable for the range of average daily flow rates.

<u>Flow Range</u>	<u>Minimum Peak Factor</u>
Flows to 100,000 GPD	4.0
100,000 GPD to 250,000 GPD	3.5
250,000 GPD to 1,000,000 GPD	3.0
Flows greater than 1,000,000 GPD	2.5

For design average daily flows above 2,000,000 GPD, peaking factors less than 2.5 may be considered if substantiated by extensive data. Under no circumstances shall peaking factors less than 2.0 be allowed.

20.2.4 DESIGN CALCULATIONS

DEVELOPER'S ENGINEER shall submit signed, sealed, and dated design calculations with the PLANS for all projects. Calculations shall show that SEWERS shall have sufficient hydraulic capacity to transport all design flows.

20.3 DETAILS OF DESIGN AND CONSTRUCTION

20.3.1 MINIMUM SIZE

No gravity SEWER main conveying SEWER shall be less than 8" in diameter.

20.3.2 MINIMUM COVER

The minimum cover over gravity SEWER shall be dictated by right-of-way requirements of applicable agency(s) but no less than 36". Minimum cover requirements shall be measured from the top of pipe to the bottom of the roadway base or finished grade in unpaved areas. Exceptions to this requirement may be made for a short length of pipe where structural considerations are incorporated into the design.

20.3.3 DEPTH

No gravity SEWER main shall be designed at a depth greater than 12' without the CEO/Executive Director's approval. No mains shall be designed at depths greater than 15'. PVC pipe with more than 12 feet of cover shall be SDR26.

Criteria for depths greater than 12' include but are not limited to:

- Length of pipe and number of manholes at depth greater than 12'
- Structure, building, and retaining wall locations in relation to mains
- Accessibility and traffic relief if these mains are under repair. Specific MOT for residential and commercial properties impacted by road closures
- Average water table and proximity to water bodies
- Rationale for need to exceed 12' depth including chosen location for lift station versus alternative locations

20.3.4 SLOPE

Gravity SEWERs shall be laid with uniform slope between manholes.

SEWER drop connections shall only be approved on a case-by-case basis

All gravity SEWERs shall be designed and constructed to provide a minimum velocity of not less than 2.0 feet per second with a Manning's N factor of 0.012 at peak flow.

The requirement may be waived for 8" gravity SEWER if each of the following conditions applies:

- Site constraints do not allow slope construction to maintain a velocity of 2 feet per second
- Less than 100 single family homes connect to the gravity SEWER or for non-single family home development, less than 110,400 GPD peak flow is discharged to the gravity SEWER

Minimum Slope in Feet; pipe diameter equal or greater than 8 inches:

<u>SEWER Size</u>	<u>Minimum Slope Per 100 Feet</u>
8 inch	0.40
10 inch	0.24
12 inch	0.19
15 inch	0.15
18 inch	0.11
21 inch	0.09
24 inch	0.08
27 inch	0.07
30 inch	0.06
36 inch	0.05

20.3.5 ADDITIONAL REQUIREMENTS

Main pool drains, elevator sumps, and storm drain systems shall not connect to the gravity SEWER system.

Leachate drains and pool filter backwash drains may be connected to the SEWER system.

All gravity SEWER extensions for future connection(s) shall terminate at a manhole with an SDR35 gasketed cap on the outgoing invert. Plugs inserted into the SEWER main are not permitted.

20.4 MANHOLES

20.4.1 LOCATION

Manholes shall be installed at the terminal end of each gravity SEWER run, at all changes in pipe grade, size, or alignment, at all gravity SEWER intersections, and at distances not greater than 400 feet. Private gravity SEWER systems shall be separated from the TOHO gravity SEWER system by a manhole located at the right-of-way line or a dedicated easement line.

No plantings shall be installed within 5 horizontal feet of any TOHO owned SEWER manhole. Measurement shall be taken from the outside edge of the structure to the edge of the plantings root at maturity. This minimum separation may be adjusted at the sole discretion of TOHO depending on the depth of the manhole.

Gravity SEWERs crossing under walls, storm structures or pipes shall be installed within steel casings per TOHO Standards Section 33.2.1. Casing spacers and plugged ends shall be required per the STANDARD CONSTRUCTION DETAIL Toho-21, Jack & Bore.

20.4.2 DIAMETER

For gravity SEWER 15" in diameter and smaller, the minimum inside diameter of manholes shall be 48". For gravity SEWER greater than 15" and up to 36", the minimum inside diameter shall be 60". For gravity SEWER larger than 36" in diameter, manholes shall be 72".

Minimum manhole inside diameter shall be 48" for depths to 11.99 feet, and 60" for depths to 15.00 feet. Manholes with drop connections shall have a minimum inside diameter of 60".

A minimum overall access opening diameter of 36" shall be provided. Access lid shall be double cover style with a 20" minimum diameter center access lid.

20.4.3 FLOW CHANNEL

The flow channel through manholes shall be made to conform in shape and slope to that of the gravity SEWER. Flow direction changes exceeding 90 degrees shall not be included in gravity SEWER alignments. A flow line elevation drop of 0.1 to 0.2 feet across all manholes shall be provided. Benching shall be provided per the STANDARD CONSTRUCTION DETAIL, Toho-07.0.0, Standard Manhole and Toho-08.0, Miscellaneous Manhole. At all changes in pipe sizes, the crown elevations of the pipes shall match.

Where an unavoidable conflict requires the difference in elevation between the incoming SEWER invert and the outgoing invert to be less than 24", the manhole invert shall be filleted to prevent solids deposition.

Where the difference in elevation between the incoming SEWER invert and the outgoing invert to be more than 24", an internal drop connection per the STANDARD CONSTRUCTION DETAIL Toho-09, Manhole Drop or Force Main Connection shall be provided.

20.4.4 MATERIALS

Manholes shall be constructed of precast units as specified in Section 42. Brick manholes shall not be permitted.

20.4.5 POLYMER MANHOLES AND COATINGS

New manholes that receive SEWER force mains, SEWER lift station junction manholes, manholes deeper than 12', and any manhole with a drop connection per the STANDARD CONSTRUCTION DETAIL Toho-09, Manhole Drop or Force Main Connection and all manholes within 400 feet upstream and downstream of these manholes shall require a polymer manhole per the STANDARD CONSTRUCTION DETAIL Toho-07.1, Polymer Manhole.

Existing manholes that receive SEWER force mains and any manhole with a drop connection per the STANDARD CONSTRUCTION DETAIL Toho-09, Manhole Drop or Force Main Connection, all existing manholes within 400 feet upstream and downstream of these manholes, or existing manholes within 400 feet upstream and downstream of a new SEWER lift station junction manhole or manhole deeper than 12', shall require a TOHO approved lining system.

The lining manufacturer shall warrant the product being supplied to TOHO against defects in workmanship and material for a minimum period of ten (10) years. The warranty shall begin at the time of a successful final inspection of the gravity SEWER collection system. The DEVELOPER and/or CONTRACTOR shall be responsible for securing an additional warranty period to meet the minimum ten (10) years or from the time of a successful final inspection if required. The CEO/Executive Director, at his sole discretion, may approve precast concrete with TOHO approved liner systems where a project can demonstrate that a delivery time issue exists and will substantively affect project delivery.

20.4.6 CASTINGS

Cast iron frames and covers shall be as specified in Section 42.3. Inflow dishes shall be provided where manholes are allowed by TOHO to be in areas subject to ponding or flooding.

20.4.7 ACCESS

A minimum 12-foot-wide access road shall be provided for all manholes which are located outside of paved roadways. The top 8" of the access road shall be stabilized to a Florida Bearing Value of 75 psi, and compacted to 98% of AASHTO T-180. The road must not be prone to flooding and shall be designed and constructed to remain permanently accessible for TOHO maintenance vehicles.

20.5 SERVICE CONNECTIONS

20.5.1 GENERAL

Service connection shall be through a lateral and miscellaneous appurtenance as shown on the STANDARD CONSTRUCTION DETAIL Toho-05, Sanitary Sewer Lateral, to connect the gravity SEWER to the house or establishment served.

Locator balls are required at the wye, 45-degree bend(s), and each cleanout for all SEWER laterals. The maximum depth of locator balls is 4'.

20.5.2 SIZE AND LENGTH

Service laterals and fittings shall be a minimum of 6" in diameter. TOHO owned service laterals shall be no more than 100 feet in length.

20.5.3 SLOPE

Service laterals shall have a minimum slope of 1%.

20.5.4 CONNECTION

Service laterals shall be allowed to discharge into manholes matching the crown elevation of the discharge pipe.

Connections to existing gravity SEWER mains shall be made with a cut-in wye for similar material to the existing main. Rigid sleeves are required for cut-in wye connections, flexible Fernco style connectors are not permitted.

20.6 PRETREATMENT STRUCTURES

20.6.1 GREASE AND OIL INTERCEPTORS

All grease and oil interceptors shall conform to the latest edition of the Florida Building Code, the Florida Department of Transportation's Design Standards, and the Florida Department of Health.

Grease and oil interceptors shall be provided when they are necessary for the proper handling of wastes containing ingredients harmful to the public SEWER or sewage treatment plant or processes.

Oil interceptors shall be required for all automobile service/repair establishments, car wash and car wash structures, gasoline service stations, businesses or industries that use petroleum based, metal or sand products in their day-to-day activities, where a hazard exists, or where oils or other flammables can be introduced or admitted into the SEWER system by accident or otherwise.

All food preparation/service establishments shall generally have grease interceptors sized as discussed herein. All SEWER flow from the kitchen areas of these establishments shall flow through approved grease interceptors prior to entering the TOHO system.

The minimum grease and oil interceptor size shall be 750 gallons, two (2) compartment type, as shown in the STANDARD CONSTRUCTION DETAILS Toho-12.0, Standard Grease Interceptor or Toho-12.1, Hydromechanical Grease Interceptor. Oil interceptors shall be vented per the STANDARD CONSTRUCTION DETAIL Toho-11, Oil Interceptor.

All grease and oil interceptors shall be provided with an approved sampling station located downstream of the interceptor as shown in the STANDARD CONSTRUCTION DETAILS Toho-13.0, Sampling Station or Toho-13.1 Alternative Sample Station and prior to connection with human waste lines.

Grease and oil interceptors shall have clean outs with two (2)-way tees in the inlet and discharge lines.

The owner shall be responsible for proper and regular maintenance. The owner shall provide ingress and egress to TOHO for periodic inspection of the industrial waste system.

All grease interceptors shall be designed to conform to the capacity requirements of the following:

- Restaurants:
 - o $(\text{Number of Seats}) \times (\text{GPD} / \text{Seat}) \times (\text{Daily Operating Hours}/12) \times 1.5 = \text{Minimum Capacity}$
 - GPD / Seat: 25 w/ Reusable Plates, 10 w/ Disposable Plates
- Other Establishments with Commercial Kitchens:
 - o $(\text{Number of meals prepared}/\text{day}) \times 5 \times \text{LF} = \text{Minimum Capacity}$
 - LF: 10 w/ Dishwasher, 5 w/o Dishwasher

20.6.2 LOCATION

Each interceptor shall be so located as to provide ready accessibility to the cover and means for servicing and maintaining the structure in working and operating condition.

20.6.3 GRIT INTERCEPTORS

Sand and mud traps shall be a minimum of 4 feet in diameter and constructed as shown in the STANDARD CONSTRUCTION DETAIL Toho-10, Sand and Mud Trap.

20.6.4 LAUNDRIES

Commercial laundry facilities shall be equipped with lint traps or interceptors with a removal basket, or similar device that shall prevent detrimental items such as strings, rags, buttons, or other materials and toxic fumes that could pass to the SEWER system.

20.6.5 HAZARDOUS MATERIALS

Any establishment that uses hazardous material for all or any portion of its day-to-day operation is required to submit two (2) copies of the Materials Safety Data Sheet(s) for each hazardous product in use on site and two (2) copies of the proposed method of pre-treatment for review and approval.

In no case shall corrosive liquids, spent acids, or other harmful or hazardous waste which may destroy or injure the SEWER system, or which might create noxious or toxic fumes, discharge into the TOHO SEWER system without being thoroughly diluted or neutralized by passing through a properly constructed and acceptable dilution or neutralizing device.

Nothing may be discharged into the SEWER system prior to acceptance by TOHO.

20.7 TRASH COMPACTOR AND DUMPSTER PAD DRAIN CONNECTIONS

20.7.1 CONNECTION REQUIREMENT

Trash Compactor and Dumpster Pad Drains are to be connected to the gravity SEWER collection system where required by applicable Code(s).

20.7.2 GREASE INTERCEPTOR REQUIRED

All Trash Compactor Pad Drains shall be provided with a grease interceptor in accordance with Section 20.6.

20.7.3 PAD ELEVATION AND AREA GRADING

To prevent storm water runoff from entering the pad drain, all pads shall be elevated a minimum of 6" above the surrounding grade and the surrounding area shall be graded to carry flow away from the pad.

Clean-outs shall be provided with a locking cap. A sign shall be provided instructing operators to keep the cap locked at all times, except during wash-down of the pad.

END OF SECTION 20

SECTION 21 - SEWER FORCE MAINS

21.1 GENERAL CONSIDERATIONS

21.1.1 DESIGN PERIOD

SEWER force main systems shall be designed for the estimated ultimate tributary population, as delineated by TOHO.

21.1.2 LOCATION

SEWER force mains shall be in dedicated rights-of-way or utility easements. When installed in rights-of-way, SEWER force mains shall maintain a consistent alignment with respect to the centerline of the road. All SEWER force mains located adjacent to a road right-of-way shall require a minimum 10-foot easement abutting the right-of-way. All SEWER force mains located outside or not immediately adjacent to dedicated rights-of-way shall require a minimum 20-foot easement. Additional easement widths shall be provided where the pipe size or depth of cover so dictate. Using OSHA Standard 29 CFR PART 1926 Subpart P App. B, the width of the easement can be calculated.

SEWER force mains shall not be located within 12 feet of walls, buildings or building pads and shall not be placed under wet or dry retention ponds, tennis courts, dumpster pads or other permanent structures. SEWER force mains shall not be located along side or rear lot lines or within 12 feet of the top of bank of ponds, pond berms, water impoundments, or other water bodies unless specifically approved by TOHO.

21.1.3 DEPTH

The minimum cover over SEWER force mains shall be dictated by right-of-way requirements of applicable agency(s) but no less than 36". Minimum cover requirements shall be measured from the top of pipe to the bottom of the roadway base or finished grade in unpaved areas.

Adequate cover shall be provided so that the top of valve nuts are 18" – 24" below finished grade.

21. 2 DESIGN BASIS

21.2.1 AVERAGE DAILY FLOW

SEWER force main systems shall be designed for the estimated ultimate tributary population as known or projected. Average daily SEWER flow shall be calculated by the current TOHO Flow Rate Ordinance as outlined in Appendix 'A', Flow Rates and Fees.

21.2.2 PEAK DESIGN FLOW

Provisions of Section 22.2 shall generally apply. Consideration shall be given to a 2.5 feet per second minimum velocity and generally 5 feet per second maximum and a compatible head pressure for manifold systems. Velocities above the maximum velocity shall be evaluated on a case-by case basis.

21.2.3 DESIGN CALCULATIONS

The DEVELOPER'S ENGINEER shall submit signed, sealed, and dated design calculations with the PLANS for all projects. Calculations shall show that SEWER force mains shall have sufficient hydraulic capacity to transport all design flows.

21.3 DETAILS OF DESIGN AND CONSTRUCTION

21.3.1 VELOCITY AND DIAMETER

At design pumping rates, a minimum velocity of 2.5 feet per second should be maintained. The minimum SEWER force main diameter shall be 2" PE or 4" PVC. Only 2" PE or 4", 6", 8", 10", 12", 16", 20", 24", and 30" diameter SEWER force mains shall be approved.

The minimum pipe diameter for a privately maintained force main system connecting to the TOHO system shall be 2" PE.

21.3.2 DESIGN FRICTION LOSSES

Friction losses through SEWER force mains shall be based on the Hazen-William's formula with a C factor of 100.

When initially installed, SEWER force mains may have a significantly higher C factor. The higher C factor should be considered only in calculating maximum power requirements and duty cycle time of the motor.

21.3.3 DESIGN PRESSURE, DEFLECTION AND RESTRAINT

Design pipe deflection to a maximum of 25% of the manufacturer's specifications. All new pipe under roadway shall be restrained. The SEWER force main and fittings, including all restrained joint fittings shall be designed to withstand system operating pressures and pressure surges of no less than 100 psi.

Only restrained joint devices shall be allowed. The number of restrained joints shall be calculated by an ENGINEER or shall be in accordance with the STANDARD CONSTRUCTION DETAIL Toho-20, Restrained Joint Table.

21.3.4 TERMINATION

SEWER force mains shall not terminate directly into a gravity SEWER line. SEWER force mains shall enter the gravity SEWER system at a connection to a manhole as shown on the STANDARD CONSTRUCTION DETAIL Toho-09, Manhole Drop or Force Main Connection

21.3.5 AIR RELEASE VALVES

Air release valves shall be provided at all high points as determined by TOHO. All such valves shall be clearly delineated on the SEWER force main plan and profile in the PLANS. The DEVELOPER'S ENGINEER shall submit calculations to TOHO justifying the valve sizing, if requested. Additional ARV's may be required if additional high points are discovered after construction. Requirements in Section 52.7 shall also apply.

21.3.6 VACUUM RELIEF VALVES

Vacuum relief valves may be required on a case-by-case basis, as determined by TOHO.

21.3.7 AERIAL CROSSINGS

Support shall be provided for all joints in pipes utilized for aerial crossings. The supports shall be designed to prevent overturning and settlement. Expansion joints shall be provided as required by TOHO.

The impact of floodwaters and debris shall be considered. The bottom of the pipe shall be placed no lower than 1 foot above the 100-year flood plain.

Flanged joints shall be used. Pipe and flange material shall be ductile iron, minimum class 53. All above ground pipe shall be painted as specified in Section 50.4 for above ground SEWER force mains.

Underground valves shall be provided at both ends of the crossing so the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding.

An air release valve shall be installed at the high point of the crossing.

Appropriate fan-type pedestrian barriers shall be installed at both ends of the crossing to prevent pipe access to the public.

It shall be the responsibility of the DEVELOPER to obtain all applicable regulatory permits. When the Aerial Crossing is accomplished by attachment to a bridge or drainage structure, the DEVELOPER shall meet all requirements of the Agencies who own or have jurisdiction over such structures.

21.3.8 UNDERWATER CROSSINGS

Use polyethylene pipe as described in Section 50.5 of this MANUAL for installation of SEWER, REUSE, and WATER mains.

Valves shall be provided a minimum of 24" from both ends of a bore casing or directional bore crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible, and not subject to flooding.

An air release valve shall be installed at the upstream high point of the crossing.

It shall be the responsibility of the DEVELOPER to obtain all applicable regulatory permits.

Leak detection as required by FDEP shall be installed at all crossings under bodies of water.

21.3.9 VALVES

Sufficient valves shall be provided on SEWER force main systems to facilitate effective isolation of the pipe system for repairs and maintenance. On continuous runs of SEWER force mains, valve spacing shall not exceed 2000 feet. Additional valves shall be provided at inlets of fittings where SEWER force mains intersect to facilitate isolation of pipe segments.

Underground valves shall be provided at both ends of a bore casing or directional bore under roadway crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding.

Adequate cover shall be provided so that the top of valve nuts are 18" – 24" below finished grade.

Where valves are in unpaved roads or rights-of-way, above ground markers shall be provided at the edge of the road or right-of-way indicating the location of the valve(s). Valve pads shall be installed at a grade with a 36"x12" round reinforced concrete pad.

21.3.10 PIGGING PORTS

SEWER force Mains 4" and larger shall require pigging ports. Ports shall be located on the upstream and downstream ends and installed at each end of underwater crossings. Pig ports shall be installed per STANDARD CONSTRUCTION DETAIL Toho-33, Pig Port.

21.4 MATERIAL, INSTALLATION AND TESTING

Applicable provisions of Divisions III, IV and V of this MANUAL shall apply.

21.5 LOCATION AND IDENTIFICATION

Means for locating and identifying all SEWER force mains and valves shall be provided in accordance with the provisions in Section 51.10 and the STANDARD CONSTRUCTION DETAILS Toho-14, Typical Pipe Trench and Toho-17.0, Valve and Box.

No plantings shall be installed within 5 horizontal feet of any TOHO owned SEWER force main or appurtenance. Measurement shall be taken from the outside edge of the pipe or appurtenance to the edge of the plantings root at maturity.

21.6 ADDITIONAL REQUIREMENTS

While designing SEWER force main systems, consideration shall be given to possible future connecting SEWER lift stations. If applicable, this requirement shall be reviewed with TOHO prior to finalizing the design.

Private SEWER force mains may connect to an existing TOHO SEWER force main with a minimum 2" tapping saddle and 2" resilient wedge gate valve. Green polyethylene tubing shall be installed from the tapping valve to the property line. The private SEWER force main shall also have a 2" resilient wedge gate valve at the property line to denote the end of TOHO maintenance responsibility. Delineation of TOHO maintenance responsibility shall be called out on approved PLANS and RECORD DRAWINGS.

END OF SECTION 21

SECTION 22 - SEWER LIFT STATIONS

22.1 GENERAL CONSIDERATIONS

The design standards outlined in this section apply to SEWER lift stations discharging a peak flow of 3,000 gallons per minute or less. All such SEWER lift stations shall be submersible type stations. For designing SEWER lift stations discharging more than 3,000 gallons per minute, the type of SEWER lift station and the Design Basis shall be reviewed with TOHO before proceeding with the design.

22.2 DESIGN BASIS

22.2.1 DESIGN FLOWS

SEWER lift stations shall be designed for the estimated ultimate tributary population to the SEWER lift station, as delineated by TOHO. Average daily SEWER flow shall be calculated by the current TOHO Flow Rate Ordinance as outlined in Appendix 'A', Flow Rates and Fees. The design pumping capability of the station shall be based upon the peak design flow which shall be calculated by multiplying the design average flow with the applicable minimum peaking factors as outlined below:

<u>Minimum Peaking Factor</u>	<u>Design Average Daily Flow for Peak Design Flow</u>
Flows to 100,000 GPD	4.0
100,000 GPD to 250,000 GPD	3.5
250,000 GPD to 1,000,000 GPD	3.0
Flows greater than 1,000,000 GPD	2.5

For design average daily flows above 2,000,000 GPD, peaking factors less than 2.5 may be considered if substantiated by extensive data. Under no circumstances shall peaking factors less than 2.0 be allowed.

22.2.2 NUMBER OF PUMPS

For SEWER lift stations with a peak design flow of 1,500 GPM or less, a minimum of two (2) pump units shall be provided. Where the peak design flow exceeds 1,500 GPM, three (3) or more units shall be provided.

22.2.3 PUMP AND MOTOR SELECTION

SEWER lift stations shall be capable of pumping the peak design flow with the largest pumping unit out of service. Pumps shall be capable of meeting all system hydraulic conditions without overloading the motors. The minimum power requirement for motors shall be 5 HP.

Total dynamic head and flow capacity curves shall be prepared and submitted to TOHO along with the SEWER lift station plans. Such curves shall be based upon the static head and friction losses outlined in Section 21.3 of this MANUAL. Head capacity curves shall verify that the pumps are operating at peak efficiency and are suitable for the design flow application. Pump and motor selection and total dynamic head and flow capacity curves shall reflect hydraulic conditions in cases where receiving SEWER force main systems are interconnected to additional SEWER lift stations.

22.2.4 DESIGN CALCULATIONS

The DEVELOPER'S ENGINEER shall submit signed, sealed, and dated calculations for all SEWER lift stations. For those impacted by a manifold system, show condition when one (1) pump is operating in each SEWER lift station and condition where new SEWER lift station only is operating. Calculations shall include total dynamic head and pump system curves with copies of manufacturers pump curves, hydraulic analysis of SEWER force main system, operating cycle with wet well sizing, buoyancy, and wire-to-water efficiency.

The DEVELOPER'S ENGINEER shall submit pump and system curve calculations for each TOHO approved pump manufacturer listed in Appendix 'E', Approved Materials and Manufacturers and include a wire-to water efficiency calculation for each. Wire-to water efficiency shall be calculated as $E_M \times E_P \times 100\%$ where E_M is the motor efficiency as a fraction and E_P is the pump efficiency as a fraction.

22.3 DETAILS OF DESIGN AND CONSTRUCTION

22.3.1 FLOODING

SEWER lift station structures and electrical and mechanical equipment shall be protected from physical damage by the 100-year flood event. SEWER lift stations should remain fully operational and accessible during a 100-year flood event. Regulations of local, state, and federal agencies regarding flood plain obstructions shall be considered. Wet wells shall have a rim elevation a minimum of 1' higher than then 100-year flood elevation and minimum 6" higher than any fence post elevations. Finished grade inside the fenced area shall be a minimum of 6" above the 100-year flood event and the surrounding area shall be graded to carry flow away from the SEWER lift station.

22.3.2 ACCESSIBILITY

The SEWER lift station shall be readily accessible by maintenance vehicles during all weather conditions. The access road to the SEWER lift station shall be paved with concrete. The facility shall not be in road rights-of-way. SEWER lift stations adjacent to parking areas shall have a 32-foot clear area reserved for maintenance vehicles. Driveways shall have turnouts. The minimum driveway size shall be 14' with a minimum 16' gate per the STANDARD CONSTRUCTION DETAIL Toho-31.1, Miscellaneous Lift Station Detail I.

In a phased development, a stabilized access road meeting the requirements outlined in Section 20.4.7 may be approved during the initial phase with paving to be accomplished in the later phase at TOHO's discretion.

22.3.3 BUOYANCY

Buoyancy of the SEWER lift station structures shall be considered, and adequate provisions shall be made for protection against flotation. ENGINEER signed and sealed calculations shall be provided and shall assume saturated ground conditions to grade, empty SEWER lift station structures, and provide a minimum safety factor of 1.25.

22.3.4 PUMP REQUIREMENTS

Submersible SEWER lift station pumps shall comply with the requirements specified in Section 47. Only approved pumps listed in Appendix 'E', Approved Materials and Manufacturers shall be allowed.

Pump motors shall be housed in an air filled, watertight casing and shall have Class H insulated windings which shall be moisture resistant. Motors shall be NEMA Design B, rated 155 degrees C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially, or non-submerged condition.

Submersible pumps and motors shall be designed specifically for raw sewage use, including totally submerged operation during a portion of each pumping cycle.

Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well.

Pumps shall be capable of handling raw sewage and passing solids of at least 3 inches in diameter unless approved variance from FDEP and TOHO. Pump suction and discharge openings shall be at least 4 inches in diameter.

22.3.5 WET WELL REQUIREMENTS

Pumping levels shall be set to provide a minimum capacity between operational water levels sufficient to allow a minimum of 5 minutes between successive starts of the pumps, with a minimum pump run time of 2.5 minutes.

Pump-off water levels shall provide complete submergence to prevent pump inlet vortexing, or air binding. High level alarm shall not exceed the invert elevation of the influent pipe. Minimum level between control lead to off, lag to lead, and lag to alarm is 6". Minimum of 2' storage from top of pump to lead pump on and an additional 1' storage to lag pump on.

The wet well floor shall have a minimum slope of 1:1 to the hopper bottom. The horizontal area of the hopper bottom shall be no greater than necessary for proper installation and function of the pump inlet.

No interior ladders shall be permitted in the wet well.

Only one (1) inlet connection shall be permitted to a wet well. Provide a cross on the inlet, to direct the influent downward.

Wet well shall be minimum 8-foot diameter and shall have a minimum 4.5 foot depth below the inlet invert. Additional depth shall be required if the available storage volume at build out conditions does not meet minimum pumping cycle requirements. The structure shall be designed by an ENGINEER. Wet well shall be a TOHO approved polymer concrete structure.

22.3.6 SEWER LIFT STATION WATER SYSTEM

All SEWER lift stations shall be provided with a WATER system with adequate capacity and pressure for station wash down and other requirements. The station WATER system shall be completely separated from the WATER supply by means of a reduced pressure type backflow preventer or other TOHO approved system.

22.3.7 ELECTRICAL EQUIPMENT, POWER SUPPLY AND POWER CORDS

Requirements in Sections 46 and 47 shall apply.

22.3.8 CONTROLS

Requirements in Section 47 shall apply.

22.3.9 SITE SIZING AND EASEMENT REQUIREMENTS

Per Section 11.6.4, TOHO owned SEWER lift stations shall be deeded by Warranty Deed to TOHO. Deed shall be provided with:

- Warranty Deed
- Title Insurance
- FIRPTA Certificate of non-foreign entity status
- Seller's Affidavit
- Affidavit of Authority/LLC Affidavit
- Closing statement (Acknowledgement that all costs related to closing and conveyance of the SEWER lift station is the responsibility of the Seller)

The site for the paved access road shall also be dedicated to TOHO by warranty deed. An exception to this requirement may be allowed on a case-by-case basis in the form of an ingress/egress easement for the paved access road.

22.3.10 SITE FENCING

Fencing or walls at the SEWER lift station site perimeter shall comply with the technical criteria established in Sections 45.7 and 45.8. All SEWER lift station sites shall be provided with fences or walls per the STANDARD CONSTRUCTION DETAIL Toho-31.1, Miscellaneous Lift Station Detail I. Fencing shall be required around the perimeter of the deeded lot/parcel, plat dedicated lot/parcel, or easement area. Fences shall be vinyl coated with slats provided for screening.

22.4 FLOW MONITORING SYSTEM

All SEWER lift stations shall have a flowmeter as specified in Section 45.6. If flow is over 1,000 GPM, by-pass piping shall be provided around the flowmeter to facilitate meter maintenance.

22.5 EMERGENCY OPERATION

All SEWER lift stations shall be provided with emergency power 3P4W receptacles as specified in Section 47.8. All repump SEWER lift stations with less than 8 hours of gravity storage shall require a stand-by emergency generator. In addition, stand-by emergency generators or diesel-powered auxiliary pumps meeting the TOHO approved pump curve shall be provided at all SEWER lift stations which are at critical points in the SEWER system as determined by TOHO, or which have a peak design capacity of 1,000 GPM or more. Such stand-by generator facilities shall comply with the requirements specified in Section 45.5. All such generators shall be rated and designed to operate the SEWER lift station under TOHO approved design conditions.

22.6 ODOR CONTROL

An odor control system shall be provided for all SEWER lift stations as specified in Section 45.9 where the closest edge of the wet well is within 50 feet of the nearest habitable structure or where the peak design inflow to the SEWER lift station is 1,000 GPM or more. Two Stage odor control units shall be provided at the discretion of TOHO during shop drawing review and approval.

22.7 TELEMETRY

All SEWER lift stations shall include a remote telemetry unit (RTU) for monitoring and/or controlling functions as specified in Section 47.9.13. The RTU shall be paid for by the DEVELOPER and furnished and installed by TOHO. Final commissioning of the RTU shall be scheduled with TOHO a minimum of thirty (30) days prior to start-up of the SEWER lift station. The cost for the telemetry unit shall be provided by TOHO at the time of request by the CONTRACTOR.

END OF SECTION 22

SECTION 23 - WATER AND REUSE MAINS

23.1 GENERAL CONSIDERATIONS

23.1.1 TYPE OF WATER AND REUSE MAINS

TOHO shall approve PLANS for WATER and REUSE extensions only when such mains are designed and constructed in accordance with the criteria set forth in this MANUAL.

REUSE shall be used, when applicable, for irrigation and other uses that do not require WATER as determined and approved by TOHO.

23.1.2 DESIGN PERIOD

WATER mains should be designed for the estimated ultimate tributary population, as delineated in the approved MASTER UTILITY PLAN except in considering parts of the system that can be readily increased in capacity. WATER systems shall be designed to satisfy the domestic WATER demand, and fire protection requirements for the area or the peak hour demand whichever is greater. Design calculations shall be based on a Hazen-William's C factor of 120 and include local losses. Design should not exceed a maximum velocity of 7 fps.

Systems with WATER mains greater than 8" and all large commercial and residential projects shall be looped with a minimum of two (2) connection points. System must be looped to different WATER mains whenever possible. Connection to a single main separated by a minimum of one isolation gate valve may be approved at Toho's discretion. Looping the system shall be required prior to release of the 101st Certificate of Occupancy (CO) or 20,000 GPD of use, whichever is less.

REUSE mains should be designed for the estimated ultimate tributary population, as delineated by TOHO. REUSE systems shall be designed to satisfy the REUSE requirements for the area, with full-sized main extensions across the entire projected width of the development's frontage. Residential REUSE peak demand shall be based on a minimum 3.4 peak factor over average design calculations and shall be based on a Hazen-Williams C factor of 120 and include minor daily losses. A normal level of service is 40 psi at the point-of-connection to the existing system.

23.1.3 LOCATION

WATER and REUSE mains shall be in dedicated rights-of-way or utility easements. When installed in rights-of-way, WATER and REUSE mains shall maintain a consistent alignment with respect to the centerline of the road. All WATER and REUSE mains located adjacent to a road right-of-way shall require a minimum 10-foot easement abutting the right-of-way. A project's offsite utility improvements placed adjacent but not in the ROW shall be placed in a 10' utility easement adjacent to the right-of-way unless specifically approved to be in the right-of-way by TOHO. WATER and REUSE mains shall be placed with a minimum 6' from edge of pipe to the outside edge of the utility easement. All WATER and REUSE mains located outside or not immediately adjacent to dedicated rights-of way shall require a minimum 20-foot easement. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. Using OSHA Standard 29 CFR PART 1926 Subpart P App. B, the width of the easement can be calculated.

All TOHO owned WATER and REUSE mains shall be placed with 12' minimum separation from buildings or private raw wastewater exfiltration systems or within 6' of a building's bearing area whichever is greater. High pressure mains and mains 20" and larger shall provide a minimum 20' from any buildings. WATER and REUSE mains shall not be located under retention ponds, tennis courts, dumpster pads or other permanent structures. WATER and REUSE mains shall not be located along side or rear lot lines or within 10 feet of the top of bank of ponds and pond berms unless specifically approved by TOHO.

All mains 20" or larger and/or any mains placed in a municipality's right-of way that has roadway widening within its 5-year CIP shall be placed within a dedicated utility easement with a minimum of 10' from the edge of pipe to the outside edge of the easement.

23.1.4 DEPTH

The minimum cover over WATER and REUSE mains shall be dictated by right-of-way requirements of applicable agency(s) but no less than 36". Minimum cover requirements shall be measured from the top of pipe to the bottom of the roadway base or finished grade in unpaved areas. Adequate cover shall be provided so that the top of valve nuts are 18" – 24" below finished grade.

23.1.5 SPECIAL CONSIDERATION

See Section 24.2 for Toho Efficiency Program requirements.

23.2 DESIGN BASIS

23.2.1 DESIGN PRESSURE, DEFLECTION AND RESTRAINT

Design pipe deflection to a maximum of 25% of the manufacturer's specifications. All new pipe under the roadway shall be restrained. Average daily water flow shall be calculated by referencing the flow rates as outlined in Appendix 'A', Flow Rates and Fees, which is subject to revision by TOHO at any time.

The maximum day to average day ratio is 1.7.

The peak hour to average day ratio is 3.4.

23.2.2 FIRE FLOW REQUIREMENTS

Fire flow requirements shall be determined in accordance with applicable CITY or COUNTY fire department codes. Where fire flow requirements exceed the anticipated available fire flow from the central WATER system, on-site fire protection system or other CITY or COUNTY approved mitigation measures shall be utilized.

The DEVELOPER'S ENGINEER shall submit ISO fire flow calculations for review by TOHO. It is the DEVELOPER'S ENGINEER's responsibility to contact the appropriate CITY or COUNTY for specific requirements.

23.2.3 HYDRAULIC MODEL

A hydraulic model, signed and sealed by an ENGINEER, shall be submitted identifying the adequacy of the design to meet peak system demands. Systems shall be designed for a minimum 20 psi during a maximum day + fire flow event and a normal level of service of 40 psi during peak hours.

23.2.4 FIRE FLOW TESTING

Fire flow tests shall be provided to TOHO showing the location of the hydrant(s) tested, the static and residual pressures measured, and the flow(s) measured at each hydrant. Fire flow tests shall be performed by a licensed CONTRACTOR or ENGINEER after notifying TOHO a minimum of ninety-six (96) business hours in advance.

23.3 DETAILS OF DESIGN AND CONSTRUCTION

23.3.1 DESIGN PRESSURE AND RESTRAINT

The WATER and REUSE main and fittings, including all restrained joint fittings shall be designed to withstand system operating pressures and pressure surges of no less than 150 psi.

Only restrained joint devices shall be allowed. The number of restrained joints shall be calculated by an ENGINEER or shall be in accordance with the STANDARD CONSTRUCTION DETAIL Toho-20, Restrained Joint Table.

23.3.2 DIAMETER

Only 4", 6", 8", 10", 12", 16", 20", 24", 30", 36", 42", 48" and 54" diameter WATER and REUSE mains shall be approved. At the end of cul-de-sac areas, a 2" looped connection as shown on the STANDARD CONSTRUCTION DETAIL Toho-04, Cul-de-sac shall be allowed with an automatic flushing device to prevent dead ends shall be placed on the WATER loop.

As a minimum, 6" looped systems shall be required in single family residential projects. Where looping of mains is not practical, 8" mains shall be required unless detailed calculations are submitted to substantiate the sufficiency of a smaller diameter main.

In commercial, industrial, and high-density residential areas, minimum 8" looped mains shall be required.

23.3.3 FIRE HYDRANT LOCATION AND SPACING

As a minimum, specifications outlined in the latest version of CITY or COUNTY codes and applicable CITY or COUNTY fire department codes shall apply.

Hydrants shall be placed at a maximum interval of 500 feet and/or at high points as needed to remove air and to provide for proper flushing for all off-site mains.

23.3.4 DEAD ENDS

To provide increased reliability of service, water quality, and reduce head loss, dead ends shall be minimized by making appropriate tie-ins to loop the system whenever possible, including providing easements to accomplish tie-ins as determined by TOHO. WATER and REUSE mains 6" and greater shall be looped unless physically impossible.

Where WATER mains cannot be looped, they shall be provided with an approved automatic flushing device per the STANDARD CONSTRUCTION DETAIL Toho-24, Automatic Flushing Device. No flushing device shall be directly connected to any SEWER or storm sewer.

Where REUSE mains cannot be looped, they shall be provided with blow-off per the STANDARD CONSTRUCTION DETAIL Toho-25, Blow-Off.

All developments shall connect with the TOHO system at two (2) or more locations unless a single connection is specifically authorized by TOHO.

23.3.5 VALVES

Valves shall be located at not more than 500-foot intervals in commercial, industrial and residential areas and at not more than 1000-foot intervals in all other areas. Appropriate valving shall be provided on all tees and crosses to ensure effective isolation of WATER and REUSE lines for repair, maintenance, or future extension. This shall include all sides of tees and crosses within looped systems where flow is potentially multidirectional and the downstream side(s) of tees and crosses where the system is not looped. Valves shall be placed at all phase lines and at the end of all WATER and REUSE mains.

Valves shall be provided on all stub-outs for future connection. If the stubout is not located within 20 feet downstream of a tee or cross, an additional gate valve will be required at the point of termination.

Underground valves shall be provided at both ends of a bore casing or directional bore under roadway crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding.

Adequate cover shall be provided so that the top of valve nuts are 18" – 24" below finished grade.

Where valves are in unpaved roads, rights-of-way, or easements, above ground markers shall be provided at the edge of the road or right-of-way indicating the location of the valve(s). Valve pads shall be installed at a grade with a 36"x12" round reinforced concrete pad.

23.3.6 SEPARATION OF WATER MAINS AND SEWERS

Horizontal and vertical separation between WATER, SEWER, REUSE mains and storm piping shall be as described in Florida Administrative Code 62-555.314 and STANDARD CONSTRUCTION DETAIL Toho-16, Pipe Clearances and Crossings.

Extreme caution should be exercised when locating WATER and REUSE mains at or near certain sites such as SEWER treatment plants or industrial complexes. Individual private septic tanks and associated drain fields, SEWER or storm sewer manholes shall be located and avoided.

No WATER or REUSE pipe shall pass through or come in contact with any part of a SEWER main or manhole.

23.3.7 SURFACE WATER CROSSINGS

Requirements outlined in Sections 21.3.6 and 21.3.7 shall apply. All above ground pipe shall be painted as specified in Section 50.4 for WATER and REUSE mains.

23.3.8 AIR RELEASE VALVES

Air release valves are required at aerial crossings and other high points at the discretion of TOHO.

23.3.9 DISINFECTION FOLLOWING REPAIR OR REPLACEMENT

Any part of the TOHO WATER system, which has direct contact with finished WATER and has been out of service for repair, alteration, or replacement shall be disinfected as outlined in Section 51.7 of these SPECIFICATIONS and the procedures outlined in Appendix 'F', Water Line Leaks - Break Repair Policy.

23.4 WATER AND REUSE SERVICES

WATER and REUSE services and connections shall conform to the applicable provisions of Section 50, 51, and 52 and the STANDARD CONSTRUCTION DETAILS Toho-01.0, Typical Residential Water Service, Toho-01.1, Typical Potable & Irrigation Service, and Toho-02.0, Typical Commercial Water Service. Only 1", 1-1/2", 2", 4", 6", 8", 10", and 12" services shall be permitted.

23.5 WATER METERING

23.5.1 GENERAL

All WATER and REUSE service connections shall be metered. The method of metering shall follow the guidelines listed below. However, the DEVELOPER'S ENGINEER shall obtain approval from TOHO before finalizing the design of the metering system.

Meters 2" and less shall be placed a minimum of 6' from any building.

Meters larger than 2" shall be placed a minimum of 10' from any building.

23.5.2 WATER AND REUSE FOR SINGLE FAMILY RESIDENTIAL

Each unit shall be individually metered. Single and double meter services shall be installed at property lines as indicated by the STANDARD CONSTRUCTION DETAILS Toho-01.0, Typical Residential Water Service, Toho-01.1, Typical Potable & Irrigation Service and Toho-29, Typical Service Locations.

23.5.3 WATER FOR MULTI-FAMILY RESIDENTIAL WATER

Each unit shall be individually metered. Single, double, and meter vault services shall be installed at property lines as indicated by the STANDARD CONSTRUCTION DETAILS Toho-01.0 thru Toho-03.2 (as applicable), and Toho-29, Typical Service Locations.

Sub-metering of multi-family residential projects may be allowed on a case-by-case basis. At a minimum, a master meter shall be required at each building or at the point(s)-of-connection and the WATER, REUSE, and SEWER systems shall be privately maintained. All sub-metered multifamily residential projects will be required to enter into a Sub-metering Agreement with TOHO which outlines the specific requirements and responsibilities of the DEVELOPER and TOHO. This agreement is attached as Appendix 'N', Submetering Agreement and may be revised by TOHO from time to time.

23.5.5 WATER FOR TIME SHARE AND SHORT-TERM MULTI-FAMILY RENTAL DEVELOPMENTS

Time share and short-term multi-family rental developments may be master metered.

23.5.6 WATER FOR COMMERCIAL, INDUSTRIAL, AND INSTITUTIONAL PROJECTS

Each tenant space within the building shall be individually metered. Meter(s) shall be located in an easement adjacent to the public rights-of-way at the property line.

The developer shall provide CDR Meter Vaults or approved equal to accommodate the maximum number of actual or future tenant spaces whichever is greater.

Shopping centers shall require installation of a fire line master meter.

23.5.7 REUSE FOR COMMERCIAL, INDUSTRIAL, INSTITUTIONAL, MULTI-FAMILY, RESIDENTIAL PROJECTS

All commercial, industrial, institutional, and multi-family residential projects shall require the installation of a master meter.

23.5.8 METER INSTALLATION

All meters 2" and smaller shall be installed by TOHO after payment of applicable fees and charges. All meters 2" and smaller shall be installed underground in an approved meter box.

Meters larger than 2" shall be installed above ground and as shown in the STANDARD CONSTRUCTION DETAILS Toho-22, Large Reuse Meter, and Toho-23, Large Potable Meter.

Meters shall be in a meter easement located adjacent to the public rights-of-way and outside of paved areas.

23.5.9 METER SIZING

Size of all meters shall be determined based upon project flow range provided by the Developer. The DEVELOPER'S ENGINEER shall provide sufficient information on estimated peak flows and low flows so that meter sizing calculations can be verified. The DEVELOPER'S ENGINEER shall include head losses through metering device when designing the WATER and REUSE systems. Meter sizes and corresponding flow ranges are provided below:

<u>Meter Size</u>	<u>Flow Range</u>
3/4"	1/4 GPM to 20 GPM
1"	3/8 GPM to 50 GPM
1.5"	3/4 GPM to 100 GPM
2"	2-1/2 GPM to 200 GPM
4"	3/4 GPM to 1,200 GPM
6"	1-1/2 GPM to 2,500 GPM
8"	2 GPM to 4,000 GPM
10"	2 GPM to 6,500 GPM

23.6 MATERIAL, INSTALLATION AND TESTING

Applicable provisions of Divisions III, IV, and V shall apply.

23.7 LOCATION AND IDENTIFICATION

Means for locating and identifying all WATER and REUSE mains and valves shall be provided in accordance with Sections 50, 51, 52 and the STANDARD CONSTRUCTION DETAILS Toho-14, Typical Pipe Trench and Toho-17.0, Valve and Box.

No plantings shall be installed within 5 horizontal feet of any TOHO owned WATER or REUSE main or appurtenance. Measurement shall be taken from the outside edge of the pipe or appurtenance to the edge of the plantings root at maturity.

23.8 CROSS CONNECTION CONTROL

23.8.1 GENERAL

To protect the public WATER supply system from contamination due to cross-connections, the DEVELOPER and/or PROPERTY OWNER shall install approved backflow prevention assemblies where there is the potential of a non-potable substance coming into contact with the public WATER system, in accordance with the Florida Plumbing Code and TOHO's Cross Connection Control Manual.

Common instances requiring installation of the cross-connection control assemblies are listed in this section, however, the DEVELOPER and/or PROPERTY OWNER'S ENGINEER shall obtain TOHO approval before finalizing the design of a cross connection control assembly. TOHO provides dual-check backflow preventers for 3/4" and 1" domestic services only. All potable irrigation backflow preventers shall be provided by the DEVELOPER and/or PROPERTY OWNER.

All backflow assemblies shall be installed above ground, a minimum of 12" to a maximum of 24" above the 100-year flood plain. Pressure vacuum breakers shall be installed a minimum of 12" above the highest shared outlet.

All dedicated fire services shall require a detector check assembly which shall be designed and installed per applicable fire and life safety code(s).

Where a privately maintained potable water system is connected to the TOHO WATER system, an above ground master meter and RPZ backflow assembly shall be required. A minimum 5' air gap shall be designed and constructed where a WATER to REUSE cross connection is provided.

23.8.2 COMMERCIAL, INDUSTRIAL AND MULTI-FAMILY RESIDENTIAL

All commercial, industrial, and multi-family residential projects shall, as a minimum, require installation of approved double check valve assemblies. Projects with a higher degree of hazard shall be required to install an approved reduced pressure zone assembly on the metered WATER service.

All commercial and multi-family residential projects with fire sprinkler and standpipe systems or with extensive on-site WATER systems shall be required, as a minimum, to install an approved reduced pressure zone assembly on a WATER meter.

All systems shall be designed in accordance with the latest edition of TOHO's 'Cross-Connection Control Manual'.

23.8.3 IRRIGATION SYSTEMS

Pressure-type vacuum breakers, reduced pressure zone, or double check valve assemblies shall be utilized on all potable irrigation systems.

All backflow prevention devices used on potable irrigation systems shall be placed within 18" of the meter.

23.8.4 LOCATION AND INSTALLATION

All backflow prevention devices are to be located within 18" downstream of the WATER meter on DEVELOPER'S property and installed to facilitate maintenance and testing. It shall be the DEVELOPER'S responsibility to pay for, install, test and maintain backflow prevention assemblies.

END OF SECTION 23

SECTION 24 - SPECIAL DESIGN CONSIDERATIONS

24.1 UPPER FLORIDAN AQUIFER RECHARGE

All projects located west of CR 545 (Old Lake Wilson Road) shall be evaluated by TOHO to evaluate the impact on the Upper Floridan Aquifer. The development of the property shall not result in an adverse impact to the Upper Floridan Aquifer recharge characteristics. The ENGINEER shall provide TOHO with all necessary storm water calculations, plans, and permit applications required to perform the evaluation. The project's irrigation and storm water collection, detention, and retention design may require modification to eliminate any potential impact to the recharge characteristics of the Upper Floridan Aquifer.

Toho Efficiency Program (TEP) is a water conservation program for new and existing residential and commercial developments. This certification program is a requirement for new developments within the TOHO service area. Questions for the TEP should be directed to TOHO's Water Conservation Coordinator at 407.944.5121.

24.2 TOHO EFFICIENCY PROGRAM

24.2.1 REQUIRED PARTICIPANTS

All new projects are required to comply with the Toho Efficiency Program (TEP)

Participation and application for the TEP can be made through TOHO. The requirements outlined by the TEP can be met by a DEVELOPER without submitting all required documentation to SJRWMD for the purposes of certification by participants in the TOHO service area only.

24.2.2 DEVELOPER SERVICE AGREEMENT REQUIREMENT

The OWNER shall execute and deliver to TOHO a Developer Service Agreement (DSA) in recordable form, agreeing that the property shall comply with the terms and conditions of the TEP.

Projects within St. Cloud service area outside of City limits shall be required to sign Encumbrances with the City of St. Cloud as part of the DSA.

24.2.3 USE OF CURRENT TOHO EFFICIENCY PROGRAM

The current version of the Toho Efficiency Program at the time of plan approval shall be used for all inspections for the project and its common areas. All certification inspections shall use the version of the point list in effect at the time of execution of the DSA. The most recent TEP requirements are shown in Appendix 'K', Toho Efficiency Program and Affidavit . TEP requirements may be amended from time to time and the current version shall be available on the TOHO website and from TOHO Conservation Coordinator at 407.944.5121.

24.2.4 COMPLIANCE SCHEDULE

The property shall be certified under the TEP prior to the later of either the date of receipt of WATER service from the Authority or the date the certificate of occupancy for that property is issued.

24.2.5 NON-COMPLIANCE PENALTY

If the WATER and/or REUSE/potable irrigation meters have been installed on the property prior to compliance with TEP, TOHO has the right to discontinue WATER and/or REUSE service with prior notice to the property owner. Service shall not be restored until the property in question fully complies with TEP.

24.2.6 INSPECTION

TOHO shall provide the certification inspection at no charge to the property owner. Obtaining the certification inspection from another source is permissible except when the other source has a vested interest in the project.

TOHO shall provide the TEP inspection at the time of building final. Inspection by a 3rd party will not be accepted.

24.2.7 COORDINATION

The efficiency of the inspection shall be enhanced by coordination with TOHO early in the planning process. Coordination should include review of the typical irrigation and landscaping plans, plumbing appliance and fixture specifications.

END OF SECTION 24

PART 2 – SPECIFICATIONS

DIVISION III - GENERAL CONSTRUCTION REQUIREMENTS

SECTION 30 - GENERAL

30.1 CERTIFICATION AND LICENSING

All underground construction shall be performed by a CONTRACTOR holding a current Certified Underground Utility Contractor's license for the State of Florida or a self-performing Certified General Contractor licensed in the State of Florida.

30.2 SURVEYS

All WORK performed shall be under the supervision of a Professional Land Surveyor registered in the state of Florida. All WORK shall meet or exceed the Minimum Technical Standards for Land Surveying in the State of Florida, in accordance with Chapter 61G17-6, Florida Administrative Code.

30.3 UTILITY COORDINATION

30.3.1 LOCATION OF UTILITIES

Prior to proceeding with trench excavation, it shall be the CONTRACTOR's responsibility to contact Sunshine State One Call of Florida for locates. The CONTRACTOR shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities may be determined.

The CONTRACTOR shall take precautions against damage to existing utilities. However, in the event of a break in existing WATER, REUSE, or SEWER mains, gas mains, or underground telecommunication or power lines, the CONTRACTOR shall immediately notify the responsible official of the organization operating the interrupted utility. The CONTRACTOR shall lend all possible assistance in restoring services and shall assume all costs, charges, or claims connected with the interruption and repair of such services.

The CONTRACTOR shall be responsible for scheduling a pre-construction inspection with TOHO to document the condition of all existing utilities within the area of the WORK. The CONTRACTOR will be responsible for repairing or replacing all utilities impacted by the WORK.

30.3.2 DEVIATIONS OCCASIONED BY STRUCTURES OR UTILITIES

Wherever obstructions are encountered during the progress of the WORK and interfere to such an extent that an alteration in the PLANS is required, the DEVELOPER'S ENGINEER and CONTRACTOR shall have the authority to order a deviation from the line and grade or arrange with the owners of the structures for the removal, relocation, or reconstruction of the obstructions.

Where existing WATER, REUSE, SEWER, gas, telephone, electrical or other utilities are an impediment to the vertical or horizontal alignment of the proposed WATER, SEWER, or REUSE main, the DEVELOPER'S ENGINEER shall order a change in grade or alignment or shall direct the CONTRACTOR to arrange with the owners of the utilities for their relocation. If a change in line or grade of a gravity SEWER is necessary, TOHO shall require the addition of any manholes needed to maintain the integrity of the gravity SEWER system.

All deviations from the accepted PLANS or shop drawings shall be reviewed and approved by TOHO prior to commencing any additional WORK.

30.3.3 TEST PITS

CONTRACTOR shall field verify all existing utilities prior to starting construction activities. Test pits for the purpose of locating underground pipeline, utilities, or structures in advance of the construction shall be excavated and backfilled by the CONTRACTOR. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the authority having jurisdiction. The costs for such test pits shall be the responsibility of the CONTRACTOR.

30.3.4 CONDITION OF EXISTING UTILITIES

All impacted utilities not noted during a pre-construction inspection shall be brought to current TOHO standards as noted in this MANUAL at the sole expense of the CONTRACTOR.

30.4 MAINTENANCE OF TRAFFIC AND CLOSING OF STREETS

All maintenance of traffic (MOT) and street closures shall be subject to the rules and regulations of the authority having jurisdiction.

30.5 PROTECTION OF PUBLIC AND PROPERTY

The CONTRACTOR shall be solely responsible for adhering to the rules and regulations of OSHA and other appropriate authorities regarding safety provisions. The CONTRACTOR shall be solely responsible for acquiring and remaining in compliance with all necessary permits required to complete the WORK.

30.5.1 BARRICADES, GUARDS AND SAFETY PROVISIONS

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, lights, and guards as required shall be placed and maintained at the CONTRACTOR's expense during the progress of the WORK and until it is safe for traffic to use the roads and streets.

All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor.

All signage and barricades shall be in accordance with the U.S. Department of Transportation, Federal Highway Administration Manual on Uniform Traffic Control Devices, Latest Edition

30.5.2 PROTECTION OF UTILITY STRUCTURES

Temporary support, adequate protection, and maintenance of all underground and surface utility structures, including storm drains, SEWER manholes, hydrants, valves, valve cans, power poles and miscellaneous other utility structures encountered in the progress of the WORK shall be furnished by the CONTRACTOR at their expense. Any such structures which may have been disturbed shall be restored upon completion of the WORK.

30.5.3 OPEN EXCAVATION

All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights, and other means to prevent accidents to persons and damage to property. The CONTRACTOR shall not leave excavations open overnight. The CONTRACTOR shall, at their own expense, provide suitable and safe bridges with hand railings and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required.

The length of open trench shall be controlled by the surrounding conditions but shall be limited to 300 feet unless otherwise approved by TOHO. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, TOHO may require special construction procedures, such as limiting the length of open trench, fencing, prohibiting excavated material in the street and requiring that the trench shall not remain open overnight. The CONTRACTOR shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles, which could be dangerous to the public, shall be well lighted at night.

30.5.4 PROTECTION OF TREES AND SHRUBS

All trees and shrubs not shown to be removed on the PLANS shall be protected by the CONTRACTOR at their expense. Tree trimming and removal shall be performed as directed by the authority having jurisdiction.

30.5.5 PROTECTION OF LAWN AREAS

Lawn areas shall be left in as good or better condition as before starting of the WORK. Where sod is to be removed, it shall be carefully restored with new sod of the same type at the expense of the contractor.

30.5.6 RESTORATION OF FENCES AND WALLS

Any fence or wall, or part thereof, that is damaged or removed during the WORK shall be replaced or repaired by the CONTRACTOR and shall be left in as good a condition as before the starting of the WORK. The way the fence or wall is repaired or replaced, and the materials used shall be subject to the approval of TOHO. A temporary fence shall be erected each evening for security.

30.5.7 PROTECTION AGAINST SILTATION AND BANK EROSION

The CONTRACTOR shall arrange their operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches per the local, state, or federal authority having jurisdiction. The CONTRACTOR, at their own expense, shall remove any siltation deposits and restore to original grade.

30.5.8 RESTORATION OF GRADE

CONTRACTOR shall be responsible for restoring all finished grades within the limits of the WORK to their original condition. This shall include all areas outside the limits of construction disturbed by the WORK. All valve cans and SEWER manholes shall be brought to finished grade per the STANDARD CONSTRUCTION DETAILS Toho-17.0, Valve and Box, Toho-07.0, Standard Manhole, and Toho-0.8.0, Miscellaneous Manhole.

30.6 ACCESS TO THE PUBLIC SERVICES

Neither the materials excavated, nor the materials or equipment used in the construction of the WORK shall be so placed as to prevent free access to public services. All excavated material shall be stored in a manner that shall not endanger the WORK and that shall avoid obstructing streets, sidewalks, and driveways. Excavated material suitable for backfilling shall be stockpiled separately on the site. No material shall be placed closer than 2 feet from the edge of an excavation. Active fire hydrants, valve pit covers, valve boxes, meter boxes, or other active utility controls shall be left unobstructed and accessible.

Gutters shall be kept clear or other satisfactory provisions made for street drainage. Natural water courses shall not be obstructed or polluted.

Surplus material and excavated material unsuitable for backfilling shall be transported and disposed of off the site in disposal areas obtained by the CONTRACTOR.

30.7 PUBLIC NUISANCE

The CONTRACTOR shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, or excessive noise or dust. The CONTRACTOR shall eliminate noise to as great an extent as practicable at all times.

30.8 CONSTRUCTION HOURS

No WORK shall be done between the hours of 5:00 p.m. and 7:00 a.m., or on Saturdays, Sundays, and legal holidays of TOHO unless the proper and efficient prosecution of the WORK requires operations during the night, weekend, or holidays. Written notification for doing WORK outside the approved dates and times outlined in this section shall be provided to TOHO a minimum ninety-six (96) business hours before starting such items of the WORK. TOHO recognizes the following legal holidays: New Year's Day, Martin Luther King Day, Memorial Day, Juneteenth, Independence Day, Labor Day, Veterans Day, Thanksgiving Day & the Friday following Thanksgiving, and Christmas Eve & Christmas Day.

30.9 CONSTRUCTION IN EASEMENTS AND RIGHTS-OF-WAY

30.9.1 CONSTRUCTION IN EASEMENTS

In easements across private property, the CONTRACTOR shall confine all operations within the easement area and shall be responsible and liable for all damage outside of the easement area. Trees, fences, shrubbery, or other type of surface improvements located in easements shall require protection during construction. Precautions shall be taken by adequate sheeting or other approved method to prevent any cave-in or subsidence beyond the easement limits or damage to improvements within the easement. The easement area is intended to provide reasonable access and working area for efficient operation by the CONTRACTOR. Where easement space for efficient operation is not provided, the CONTRACTOR shall be responsible for organizing their operations to perform within the restrictions shown on the PLANS.

30.9.2 CONSTRUCTION IN RIGHTS-OF-WAY

The CONTRACTOR shall strictly adhere to the requirements of the Florida Department of Transportation, CITY, and/or COUNTY where construction WORK is in a right-of-way under the jurisdiction of the State of Florida, CITY, and/or COUNTY and shall take care to avoid any unreasonable traffic conflicts due to the WORK in road right-of-way.

30.10 SUSPENSION OF WORK DUE TO WEATHER

During inclement weather, all WORK which might be damaged or rendered inferior by such weather conditions shall be suspended. During suspension of the WORK from any cause, the WORK shall be suitably covered and protected to preserve it from injury by the weather or otherwise.

30.11 USE OF CHEMICALS

All chemicals used during project construction or furnished for project operation including but not limited to herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, shall show approval of either the United States Environmental Protection Agency and/or the United States Department of Agriculture as well as any other applicable regulatory agency. Use of all such chemicals and disposal of residues shall be in strict conformance with label instructions and local, state, and federal guidelines.

30.12 COOPERATION WITH OTHER CONTRACTORS AND FORCES

During construction progress, it may be necessary for other CONTRACTORS and persons employed by TOHO to work in or about the site. TOHO reserves the right to put such other CONTRACTORS to work and to afford such access to the construction site and at such times as TOHO deems proper. The CONTRACTOR shall not impede or interfere with the work of such other CONTRACTORS and shall cooperate with the other CONTRACTORS for proper execution of the WORK.

30.13 SUBSURFACE EXPLORATION

The CONTRACTOR shall make such subsurface explorations believed necessary to perform the WORK. Requirements outlined in Section 30.3 shall apply as well as requirements set forth by other agencies having jurisdiction.

30.14 CLEANING

30.14.1 DURING CONSTRUCTION

During construction, the CONTRACTOR shall always keep the construction site and adjacent premises as free from material, debris, and rubbish as is practical and shall remove the same from any portion of the site if, in the opinion of TOHO, such material, debris, or rubbish constitutes a nuisance or is objectionable.

30.14.2 FINAL CLEANING

At the conclusion of the WORK, all tools, temporary structures, and materials belonging to the CONTRACTOR shall be promptly taken away. The CONTRACTOR shall remove and promptly dispose of all water, dirt, rubbish, or any other foreign substances.

30.15 SALVAGE

Any existing TOHO owned equipment or material including but not limited to valves, pipes, fittings, couplings, etc., which are removed or replaced because of construction, may be designated as salvage by TOHO and, if so, shall be carefully excavated if necessary and delivered to TOHO.

30.16 UTILITY SERVICE INTERRUPTION

No foreseeable WORK shall interrupt customer utility service without prior approval by and direct coordination with TOHO. A written proposal shall be provided to TOHO for approval a minimum of five (5) business days before the proposed WORK. The CONTRACTOR shall notify in writing all affected customers a minimum of ninety-six (96) business hours before the proposed WORK. TOHO shall maintain the ultimate authority to cease the WORK and reinstate customer service at any time during the shutdown if the approved scope of the WORK is not strictly adhered to.

30.17 SHOP DRAWINGS AND SAMPLES

Prior to construction the CONTRACTOR shall electronically submit shop drawings, reviewed, and signed by the DEVELOPER'S ENGINEER, to TOHO through the online Toho Development Portal. The data shown on the shop drawings shall be complete with respect to dimensions, design criteria, materials of construction and the like to enable review of the information as required.

The CONTRACTOR shall, if requested by TOHO, furnish certificates, affidavits of compliance, invoices, test reports, or samples for check analysis for any of the materials specified in this MANUAL.

To make electronic submissions:

- Log in the Development Portal using verified credentials.
- Select the Project Number that coincide with the Project where submittal is required:
- Select the attachments tab. Click the add symbol and upload the recorded document. For multiple documents repeat Step C until all documents have been submitted.
- Notification to the TOHO Development Project Managers to inform your submittal has been uploaded is automated.
- Submittals for shop drawings must be properly named per item B above and must include the type of material being submitted for review. i.e. WATER, REUSE, SEWER, Structure(s), etc.

Materials installed without written TOHO approval are installed at CONTRACTOR's risk and are subject to rejection.

END OF SECTION 30

SECTION 31 - SITE PREPARATION, SURFACE REMOVAL AND RESTORATION

31.1 GENERAL

This section covers clearing, grubbing, stripping, and restoration within the WORK area. The CONTRACTOR shall clear and grub all of the areas within the limits shown on the PLANS and approved by TOHO prior to the beginning of any WORK. All site WORK shall conform to the applicable local codes and ordinances.

31.2 CLEARING AND GRUBBING

31.2.1 CLEARING

The surface of the ground for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish, and all other objectionable obstructions resting on or protruding through the surface of the ground. However, trees and shrubs shall be preserved as specified in Section 30.5. Clearing operations shall be conducted to prevent damage to existing structures and installations and to those under construction, and so as to provide for the safety of employees and others.

31.2.2 GRUBBING

Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2" in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18" below the sub-grade. All depressions excavated below the original ground surface for or by the removal of such objects shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

31.2.3 STRIPPING

In areas so designated, topsoil shall be stripped and stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all WORK is in place shall be disposed of by the CONTRACTOR.

31.2.4 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

The CONTRACTOR shall dispose of all material and debris from the clearing and grubbing operation in accordance with all applicable ordinances.

31.3 DUST CONTROL

CONTRACTOR shall control dust until project completion to prevent nuisance to adjacent property owners and the public. CONTRACTOR shall use dust control methods and materials approved by TOHO.

31.4 SURFACE REMOVAL

Along the proposed pipelines as indicated on the PLANS, the CONTRACTOR shall remove the surface materials only to such widths as shall permit a trench to be excavated which shall afford sufficient room for proper efficiency and proper construction. All applicable regulations shall be followed. Where sidewalks, driveways, pavements and curb and gutter are encountered, care shall be taken to protect against fracture or disturbance beyond reasonable working limits. All fractured, broken, or disturbed surfaces shall be restored to their original condition prior to completion of the WORK.

31.5 RESTORATION

Restoration of all surfaces including road sub-base, soil cement, lime rock base, asphaltic concrete surface, Portland cement concrete pavement and driveways, sidewalks and concrete curbs shall be in accordance with the requirements of the authority having jurisdiction. All grassing and mulching shall be done as specified. Solid sodding shall be placed on all slopes steeper than 4:1, within 10 feet of all proposed structures and where existing sod is removed or disturbed by the WORK. In addition, CONTRACTOR shall restore all storm drains, culverts, inlets, and storm manholes to equal or better condition.

END OF SECTION 31

SECTION 32 - EXCAVATION, BACKFILL, COMPACTION AND GRADING

32.1 GENERAL

This section covers excavation, backfill, fill and grading associated with utility trench and structural construction. All such WORK shall be performed by the CONTRACTOR concurrently with the WORK specified in this MANUAL. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, fill, compaction, grading and slope protection required to complete the WORK shown on the PLANS and specified herein. The WORK shall include, but not necessarily be limited to SEWER lift stations, SEWER manholes, WATER, REUSE, and SEWER vaults, conduit, WATER, REUSE, and SEWER pipe and fittings, roadways and paving; all backfilling, fill and required borrow; grading; disposal of surplus and unsuitable materials; and all related WORK such as sheeting, bracing and water handling.

All excavating shall be performed in conformance with the Chapter 17 of the Occupational Safety and Health Administration Field Safety and Health Management System Manual, latest issue.

32.2 SOIL BORINGS AND SUBSURFACE INVESTIGATIONS

The CONTRACTOR shall examine the site and undertake subsurface investigations, including soil borings, before commencing the WORK. TOHO shall not be responsible for presumed or existing soil conditions in the WORK area.

32.3 EXISTING UTILITIES

CONTRACTOR shall locate and confirm all existing utilities per Section 30.3 of this MANUAL.

32.4 MATERIALS

Materials for use as bedding and backfill, whether in situ or borrow, shall be as described under this section. The CONTRACTOR shall, upon request by TOHO, make an appropriate sample of this material available for testing by TOHO or its designated representative.

32.4.1 STRUCTURAL FILL

Materials for structural fill shall be bedding rock or select common fill as specified herein or other suitable material as approved by TOHO.

32.4.2 COMMON FILL

Fill shall be local materials as defined in the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, Section 902, Article 902-6.

Material falling within the above specifications encountered during the excavation may be stored in segregated stockpiles for reuse. All material which, in the opinion of TOHO is not suitable for reuse shall be spoiled as specified herein.

32.4.3 SELECT COMMON FILL

Select common fill shall be as specified above from common fill, except that the material shall contain no stones larger than ½" in largest dimension and shall be no more than 5 percent by weight finer than the No. 200 mesh sieve.

32.4.4 BEDDING ROCK

Bedding rock shall be FDOT, size No. 57 as defined in the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, Section 901, Article 901-1.4, Table I.

Crushed concrete that has been cleared of debris shall be allowed when it adheres to the standards of size No. 57 rock as defined in the Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, Section 901, Article 901-1.4, Table I; with prior TOHO approval.

32.5 SHEETING AND BRACING IN EXCAVATIONS

32.5.1 GENERAL

If required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that is necessary for proper construction and to protect adjacent structures, existing piping and/or foundation material from disturbance, undermining or other damage, the CONTRACTOR shall construct and maintain sheeting and bracing. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and compacted.

32.5.2 MISCELLANEOUS REQUIREMENTS

During construction for trench sheeting for pipes, no sheeting is to be withdrawn if driven below mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by TOHO. If, during the progress of the WORK, TOHO decides that additional wood sheeting should be left in place, TOHO may direct the CONTRACTOR to do so. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by TOHO for an alternate method of removal. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction of other structures, utilities, existing piping or property.

Unless otherwise approved or indicated on the PLANS or in this MANUAL, all sheeting and bracing shall be removed after completion of the substructure. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by compacting with tools specially adapted to that purpose, by watering or as otherwise directed.

The right of TOHO to order sheeting and bracing left in place shall not be construed as creating any obligation on its part to issue such orders, and its failure to exercise its right to do so shall not relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the WORK occasioned by negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

The CONTRACTOR shall construct the cofferdams and sheeting outside the neat lines of the foundation unless indicated otherwise to the extent deemed desirable for their method of operation.

Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the structure shall be subjected. Pumping, bracing and other WORK within the cofferdam shall be done in a manner to avoid disturbing any construction already performed. Any movement or bulging, which may occur, shall be corrected by the CONTRACTOR at their own expense to provide the necessary clearances and dimensions.

32.6 DEWATERING, DRAINAGE AND FLOTATION

32.6.1 GENERAL

The CONTRACTOR shall excavate, construct, and place all pipelines, concrete work, fill, and bedding rock, in-the-dry. Pipe trenches and other construction excavations shall be kept dry by well pointing, rim ditch and sump, bedding rock and sump or other methods as allowed by the permitting authorities and approved by TOHO. For purposes of these SPECIFICATIONS "in-the-dry" shall be considered as no standing water and no loose or yielding saturated soils.

Discharge water shall be clear, with no visible soil particles. Stilling ponds or other methods of filtering silt may be necessary for dewatering operations. Discharge from dewatering shall be disposed of in such a manner that it shall not interfere with the normal drainage of the area in which the WORK is being performed, create a public nuisance, or form ponding. Groundwater levels shall be 24" below proposed bottom prior to bottom excavation.

The operations shall not cause injury to any portion of the WORK completed, or in progress, or to the surface of streets, or to private property. The dewatering operation shall comply with the requirements of any appropriate regulatory agency. Permits or exemptions shall be obtained from FDEP for water quality and the Water Management District having authority around WORK for quantity and duration. Additionally, where private property shall be involved, advance permission shall be obtained by the CONTRACTOR, in writing. Permission shall be obtained prior to discharging into storm drains.

32.6.2 ADDITIONAL REQUIREMENTS

The CONTRACTOR shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed sub-grade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they shall not be floated or otherwise damaged by allowing water levels to return to natural elevations.

Dewatering shall always be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the sub-grade soils at proposed bottom of excavation.

It is expected that well-points shall be required for pre-drainage of the soils prior to final excavation for some of the deeper in-ground structures, or piping and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline, or fill shall not be floated or otherwise damaged. Well-points shall be surrounded by suitable filter sand and negligible fines shall be removed by pumping. Upon removal of well-points, the voids shall be backfilled and compacted.

The CONTRACTOR shall furnish all materials and equipment and perform all WORK required to install and maintain the drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines, and compacted fills.

During structure construction and backfilling, water levels shall be measured in observation wells located as directed by an ENGINEER.

Continuous pumping shall be required if water levels are required to be below natural levels.

Electric pumps shall be utilized where practical, to minimize noise.

Residential type mufflers shall be used on all piston driven pumps or generators.

32.7 EXCAVATION

32.7.1 GENERAL

Excavation consists of removal and storage, or disposal of material encountered when attaining required grade elevations and in accordance with the notes shown in the PLANS.

Authorized earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, and other materials encountered that are not classified as rock excavation or unauthorized excavation. Unauthorized excavation consists of removal of material beyond the limits needed to establish required grade and sub-grade elevations without specific direction of TOHO.

If requested by TOHO, when excavation has reached required sub-grade elevations, a GEOTECHNICAL/SOILS ENGINEER shall make an inspection of conditions. If the sub-grade is unsuitable, CONTRACTOR shall carry excavation deeper and replace excavated material with select common fill or bedding rock, as directed by TOHO.

If the CONTRACTOR excavates below grade through error or for their own convenience, through failure to properly dewater the excavation, or disturbs the sub-grade before dewatering is sufficiently complete, TOHO may direct the CONTRACTOR to excavate below grade, refill the excavation using select common fill or bedding rock, and compact the fill.

Sloped sides of excavations shall comply with all regulatory requirements. CONTRACTOR shall shore and brace where sloping is not possible due to space restrictions or instability of the material being excavated. Shoring and slopes shall be maintained in a safe condition until completion of the WORK.

CONTRACTOR shall stockpile suitable excavated materials at a location approved by TOHO until required for backfill and fill. When needed in the WORK, material shall be located and graded at the direction of a GEOTECHNICAL/SOILS ENGINEER.

Stockpiles shall be placed and graded for proper drainage. All soil materials shall be located a minimum of 2-feet away from the edge of excavations. All surplus and/or unsuitable excavated material shall be legally disposed of by the CONTRACTOR. Any permits required for the hauling and disposing of this material shall be obtained by the CONTRACTOR prior to commencing hauling operations.

32.7.2 EXCAVATION FOR STRUCTURES

All such excavations shall conform to the elevations and dimensions shown on drawing within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removing form WORK, installation of services and other construction, inspection or as shown on the PLANS. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. Bottoms shall be trimmed to required lines and grades to leave a solid base to receive concrete.

32.7.3 TRENCH EXCAVATION

Excavation for all trenches required for the installation of utility pipes shall be made to the depths indicated on the PLANS and in such manner and to such widths as shall give suitable room for laying the pipe within the trenches, for bracing and supporting and for pumping and drainage facilities. The bottom of the excavations shall be firm and essentially dry as noted in Section 32.6.1 and as approved by TOHO.

Where pipes are to be laid in bedding rock, select common fill, or encased in concrete, the trench may be excavated to or just below the designated subgrade. The material remaining in the bottom of the trench shall be no more than slightly disturbed.

Where the pipes are to be laid directly on the trench bottom, bell holes shall be made as required.

32.8 BEDDING AND BACKFILL

32.8.1 GENERAL

Material placed in fill areas under and around structures and pipelines shall be deposited within the lines and to the grades shown on the PLANS or as directed by TOHO, making due allowance for compaction and settlement of the material. Fill shall be placed only on properly prepared surfaces, which have been inspected and approved by TOHO. If sufficient select common or common fill material is not available from excavation on site, the CONTRACTOR shall provide fill as may be required.

Fill shall be brought up in substantially level lifts starting in the deepest portion of the fill. The entire surface of the WORK shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section.

Fill shall be placed and spread in 8" to 12" layers unless otherwise specified. Prior to the process of placing and spreading, all materials not meeting those specified under Section 32.4 shall be removed from the fill areas.

If the compacted surface of any layer of material is determined to be too smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.

All fill materials shall be placed and compacted in-the-dry. The CONTRACTOR shall dewater excavated areas as required to perform the WORK and in such a manner as to preserve the undisturbed state of the natural inorganic soils.

Prior to filling, the ground surface shall be prepared by removing vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials. The CONTRACTOR shall remove and replace all unsuitable materials, if encountered, and replace selected common fill. The CONTRACTOR shall plow, strip, or break up sloped surfaces steeper than one 1:4 so that fill material shall bond with the existing surface. When existing ground surface has a density less than that specified under Section 32.9 for the area classification, the CONTRACTOR shall break up the ground surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing, if necessary, until the moisture content is reduced to allowable limits. If added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which shall insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued. The CONTRACTOR shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place water in the fill in the manner specified. CONTRACTOR shall compact each layer to required percentage of maximum dry density or relative dry density in accordance with Section 32.9. Backfill or fill material shall not be placed on surfaces that are muddy, frozen or contain frost or ice.

When unavoidable wet conditions exist, bedding rock may be used for backfilling at the sole discretion of TOHO.

32.8.2 BEDDING AND BACKFILL FOR STRUCTURES

Bedding rock shall be used for bedding under all precast structures as indicated on the STANDARD CONSTRUCTION DETAIL Toho-07.0, Standard Manhole. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed. Appropriate fill shall be used as backfill against the exterior walls of the structures. Fill shall be compacted sufficiently in accordance with Section 32.9 of these SPECIFICATIONS.

Backfilling shall be carried up evenly on all walls of an individual structure. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength.

In locations where pipes pass through structure walls, the CONTRACTOR shall take precautions to consolidate the fill up to an elevation of at least 1 foot above the bottom of the pipes. Structural fill in such areas shall be placed for not less than 3 feet either side of the centerline of the pipe in level layers not exceeding 8" in depth.

The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the PLANS. No soft spots or uncompacted areas shall be allowed in the WORK.

Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure, and earth pressure. The bracing shall be capable of resisting all loads applied to the walls because of backfilling.

32.8.3 BEDDING AND BACKFILL FOR PIPES

Bedding for pipe shall be as shown on the PLANS and detailed on the STANDARD CONSTRUCTION DETAIL Toho-14, Typical Pipe Trench. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.

Backfilling over and around pipes shall begin as soon as practicable after the pipe has been laid, jointed, and inspected. All backfilling shall be prosecuted expeditiously and as detailed on the applicable STANDARD CONSTRUCTION DETAIL Toho-14, Typical Pipe Trench.

Any space remaining between the pipe and sides of the trench shall be carefully backfilled and spread by hand or approved mechanical device and thoroughly compacted with a tamper as fast as placed, up to a level of one (1) foot above the top of the pipe. The filling shall be carried up evenly on both sides. Compaction shall be in accordance with the STANDARD CONSTRUCTION DETAIL Toho-14, Typical Pipe Trench and Section 32.9.

The remainder of the trench above this compacted backfill shall be filled and thoroughly compacted in uniform layers. Compaction shall be in accordance with the STANDARD CONSTRUCTION DETAIL Toho-14, Typical Pipe Trench and Section 32.9.

32.8.4 MISCELLANEOUS BACKFILL REQUIREMENTS

All disturbed areas not outlined above, including but not limited to wellpoints and sheeting voids, shall be backfilled, and compacted in accordance with the STANDARD CONSTRUCTION DETAIL Toho-14, Typical Pipe Trench and Section 32.9.

32.9 COMPACTION

32.9.1 GENERAL

The CONTRACTOR shall control soil compaction during construction to provide the percentage of maximum density specified. The CONTRACTOR and TOHO shall be provided copies of all soils testing reports, signed, and sealed by a GEOTECHNICAL/SOILS ENGINEER, demonstrating compliance with this MANUAL.

The minimum soil compaction requirements set forth in Section 32.9 are applicable to all WORK unless a greater degree of compaction is required by the permitting authority or special requirement of the ENGINEER.

32.9.2 PERCENTAGE OF MAXIMUM DENSITY REQUIREMENTS

When existing trench bottom has a density less than 95% of the maximum dry density as determined by AASHTO T-180, the CONTRACTOR shall compact to required percentage of maximum density.

Fill or undisturbed soil from the bottom of the pipe trench to grade shall be compacted to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.

Fill under and around structures and to the extent of the excavation, and fill or undisturbed soil from the bottom of pipe trenches to grade under all paving, shall be compacted to a minimum density of 98% of the maximum dry density as determined by AASHTO T-180.

32.9.3 COMPACTION TESTS

One (1) compaction test shall be taken for each 12" layer of fill for each 300 feet of pipe or between manholes, whichever is less. Compaction tests around structures shall be taken every 100 square feet for each 12" layer of fill. Compaction tests shall be taken at staggered locations and elevations throughout the length of the pipe section or around the perimeter of the structure. TOHO may determine that more compaction tests are required to certify the installation depending on field conditions.

Water shall not be allowed into the filled and compacted area until density tests have determined that the compacted area meets the specification minimum requirements.

32.10 GRADING

All areas within the limits of construction, including transition areas, shall be uniformly graded to produce a smooth uniform surface. Areas adjacent to structures or paved surfaces shall be graded to drain away from structures and pavement. Ponding shall be prevented. The area shall be compacted to the specified depth and percentage of maximum density.

No grading shall be done in areas where there are existing utilities that may be uncovered or damaged until such lines have been relocated or otherwise protected.

32.11 MAINTENANCE

CONTRACTOR shall protect graded areas from traffic and erosion and keep them free of trash and debris. CONTRACTOR shall repair and reestablish grades in settled, eroded and rutted areas.

32.12 INSPECTION AND QUALITY ASSURANCE

32.12.1 INSPECTION

CONTRACTOR shall examine the areas and conditions under which excavating, filling, and grading are to be performed, and shall not proceed until disputed conditions have been resolved.

CONTRACTOR shall examine existing grade prior to commencement of WORK and report to the TOHO if elevations of existing grade vary from elevations shown on PLANS.

32.12.2 QUALITY ASSURANCE

All WORK shall be performed in compliance with the PLANS, this MANUAL, and applicable requirement of all governing authorities having jurisdiction.

Quality assurance testing shall be performed during construction to ensure compliance with the Contract. CONTRACTOR shall provide all assistance necessary to allow the testing service to inspect and approve fill materials and fill layers before further construction is performed.

END OF SECTION 32

SECTION 33 - JACK AND BORING

33.1 GENERAL

The installation of a casing pipe by the method of jack and boring shall be covered by these SPECIFICATIONS. The overall WORK scope shall include, but not limited to, jack and bore pits and equipment, sheeting, steel casing pipe, casing spacers, steel straps, coatings, location signs as required, miscellaneous appurtenances to complete the entire WORK as shown on the STANDARD CONSTRUCTION DETAIL Toho-21, Jack and Bore, and restoration. Applicable provisions of this MANUAL shall apply concurrently with these SPECIFICATIONS. Jack and bore operations shall be performed within the right-of-way and/or easements shown on the PLANS. For pipe crossing under roadways or railroads, the design shall also comply with regulations of the specific owner.

33.2 PIPE MATERIAL

33.2.1 STEEL CASING

Steel casings shall conform to the requirements of ASTM Designation A139 (straight seam pipe only) Grade "B" with a minimum yield strength of 35,000 psi. Minimum casing pipe size shall be not less than 12" larger than the carrier pipe and the size and wall thickness shall be as indicated in the following table:

<u>Casing Pipe Size</u>	<u>Coated</u>	<u>Non-Coated</u>
14"	0.188"	0.250"
16"	0.219"	0.281"
24"	0.312"	0.375"
30"	0.406"	0.469"
36"	0.469"	0.532"
42"	0.562"	0.625"

Field and shop welds of the casing pipes shall conform to the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than $\frac{3}{4}$ ".

The sections of steel casing shall be field welded in accordance with the applicable portions of AWWA C206 and AWS D7.0 for field welded pipe joints. CONTRACTOR shall wire brush the welded joints and paint with Inertol Quick-Drying Primer 626 by Koppers Company or approved equal. After completion of jacking, CONTRACTOR shall clean the interior of the casing of all excess material. Steel casings shall be accurately included on record drawings.

33.2.2 CARRIER PIPE

The carrier pipe for WATER and REUSE shall be HDPE or a minimum pressure class 150 ductile iron pipe, or greater if otherwise indicated. HDPE and ductile iron pipe shall comply with all areas of this MANUAL. Ductile iron carrier pipe joints shall be individually restrained.

The carrier pipe for SEWER force mains shall be HDPE.

33.2.3 INSPECTION

All casing pipe shall be subject to an inspection by TOHO prior to being installed and after installation prior to backfill being placed.

33.2.4 CERTIFICATION

All casing sections shall be accompanied by manufacturer's certification that casing meets all specified standards, with an enumeration of each parameter specified herein and such other parameters as required by the permitting authority.

33.3 PIPE HANDLING

Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe shall not be dropped. All pipe shall be examined before lying, and no piece shall be installed which is found to be defective. Any damage to the pipe or coatings shall require replacement of the pipe.

33.4 CONSTRUCTION REQUIREMENTS

33.4.1 WORK COORDINATION

It shall be the CONTRACTOR'S responsibility to perform the jack and bore WORK in strict conformance with this MANUAL and the agency in whose right of way or easement the WORK is being performed. Any special requirements of the agency such as insurance, flagmen, etc., shall be strictly adhered to during the performance of WORK. The special requirements shall be the sole responsibility of the CONTRACTOR.

33.4.2 DEWATERING

Dewatering through the casing during construction shall not be permitted. All dewatering methods shall be as specified in Section 32.6.

33.4.3 CARRIER PIPE SUPPORT

The carrier pipe shall be supported within the casing pipe. Casing spacers shall be installed within three (3) feet on either side of a joint and spaced along the pipe to maintain a maximum spacing of 10' between casing spacers. Pipe bells shall not rest directly on the casing. Casing spacers and all hardware required inside the casing shall be 316 stainless steel.

33.4.4 JACKING PITS

Excavation adjacent to the roads shall be performed in a manner to adequately support the roads. Bracing, shoring, sheeting, or other supports shall be installed as needed. CONTRACTOR shall install suitable reaction blocks for the jacks as required. Jacking operations shall be continuous, and shall not cause interruptions, which might cause the casing to freeze in place. Voids outside casing are not allowed. Upon completion of jacking operations, the reaction blocks, braces, and all other associated construction materials shall be completely removed from the site.

33.4.5 MISCELLANEOUS REQUIREMENTS

Correct line and grade shall be carefully maintained. Earth within the casing shall not be removed too close to the cutting edge to prevent the formation of voids outside the casing.

Casing pipes located within CSX rights-of-way shall have a minimum cover dictated by current CSX or FDOT requirements.

Where required by FDOT or other permitting authorities, approved vents shall be installed at each end of the casing.

The sections of steel casing shall be field-welded in accordance of applicable portions of AWWA C206 and AWS D7.0 for field-welded pipe joints. Welded joints shall be wire brushed and painted with approved materials. Only certified welders shall perform welding operations. After completion of jacking operations, the casing shall be cleared of all excess materials prior to carrier pipe installation.

END OF SECTION 33

SECTION 34 - DIRECTIONAL BORING

34.1 GENERAL

This section covers installation of HDPE and PVC pressure pipe using directional boring techniques.

Directional bores shall be completed per the requirements of this MANUAL and any authority having jurisdiction over the area of the WORK.

34.2 PIPE MATERIAL

34.2.1 PIPE

For WATER, REUSE, and SEWER force mains, the pipe shall be high-density polyethylene (HDPE) tubing conforming to AWWA C901, AWWA C906, PE3408 and ASTM D3350 latest editions, in the sizes shown on the PLANS.

HDPE tubing classification shall be DR11 or DR9, ductile iron pipe inside diameter for WATER or REUSE.

HDPE tubing classification shall be DR17, ductile iron pipe inside diameter for SEWER..

HDPE pipe shall be black in color with permanent stripes extruded into the pipe length, blue for WATER, purple for REUSE, or green for SEWER.

34.2.2 ADAPTERS

Provide adapters on lines over 2" suitable for connection to DIP or PVC pipe. These shall be butt-fused mechanical joint end only.

34.2.4 CERTIFICATION

All pipe shall be accompanied by manufacturer's certification that the pipe meets all specified standards, with an enumeration of each parameter specified herein and such other parameters as required by the permitting authority.

34.2.5 TRACER WIRE

TOHO shall require a minimum of one (1) each of 8-gauge steel core and 8-gauge solid copper wire be pulled with the directional bore and adequately secured to the pipe during and after boring.

34.3 PIPE HANDLING

Care shall be taken in loading, transporting and unloading to prevent injury to the pipe or coatings. All pipe for directional drilling installation shall be supported by rollers or other devices to prevent pipe from being dragged across ground or other surfaces. Pipe shall not be dropped. All pipe shall be examined before lying, and no piece shall be installed which is found to be defective. Any damage to the pipe shall require replacement of the pipe.

34.4 CONSTRUCTION REQUIREMENTS

The pipe shall be installed to the exact lines and grades required.

The type and size of the pilot string cutting head shall be at the CONTRACTOR's discretion. The type and outside diameter of the drill pipe to be used in the pilot string shall also be at the CONTRACTOR's discretion.

The method of guidance utilized in locating and steering the pilot string from entry to exit shall be controlled in both vertical and horizontal directions.

Readings shall be recorded after the advancement of each successive drill pipe and the readings plotted at a minimum of 5-foot intervals. Recorded readings and plan profile information shall be submitted to the ENGINEER and TOHO and included on the final RECORD DRAWINGS.

The minimum depth required below existing ditch bottoms, utilities, or roadways shall be 6 feet. All directional bore design depths shall be reviewed and approved by TOHO prior to commencing WORK. Lateral position at exit shall be no further than 3 feet left or right of planned centerline and horizontal positioning shall be no further than 5 feet short or long of proposed exit location. Entry and exit locations, as well as intermediate centerline stationing shall be staked by the CONTRACTOR. This information shall be shown on the RECORD DRAWINGS.

Upon completion, a complete set of as-built records shall be submitted to the ENGINEER and TOHO. These records shall include copies of the plan and profile drawing, as well as directional readings recorded during the drilling operation.

Upon approval of the pilot hole location by the ENGINEER and TOHO, the hole enlarging, or back reaming phase of the installation, shall begin. The borehole diameter shall be increased to accommodate the pullback operation of the pipe. The type of back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation. The reamer type shall be at the CONTRACTOR's discretion with the final hole diameter being a minimum of forty percent larger than the outside diameter of the product pipe being installed in the borehole.

The open borehole may be stabilized by means of Bentonite drilling slurry being pumped through the inside diameter of the drill pipe and through openings in the reamer. The slurry shall also serve as an agent to carry the loose cuttings to the surface through the annulus of the borehole. These cuttings and Bentonite slurry are to be contained at the exit hole or entry side of the directional bore in pits or holding tanks. The slurry may be recycled at this time for the reuse in the hole opening operation or it shall be hauled by the CONTRACTOR to an approved dumpsite and properly disposed of.

A complete list of all drilling fluid additives and mixtures to be used in the directional operation shall be submitted to the ENGINEER and TOHO along with their respective Material Safety Data Sheets. All drilling fluids and loose cuttings shall be contained; no fluids shall be allowed to enter any unapproved area or natural waterways. Upon completion of the directional drill project, all excess drilling fluid and cuttings shall be removed by the CONTRACTOR.

The pipe shall be fused together according to manufacturer's specifications by a certified technician. No fittings shall be installed in the directional bore. Adapters for connection to DIP or PVC shall be butt-fused to HDPE pipe per ASTM D3261.

After installation, the line shall be pigged.

A pressure test shall be performed after installation in the borehole. The pre-installation test pressure is at the CONTRACTOR's discretion. After installation, the pipe shall be pressure tested in accordance with Section 51.6. Heat fusion joints shall be completely cooled before pressure testing.

The manufacturer's recommendations on pipe stretch, pull strength, and allowances shall be observed.

END OF SECTION 34

SECTION 35 – PRESSURE PIPE RESTRAINT

35.1 GENERAL

All pressure pipe and fittings shall be restrained as specified in the STANDARD CONSTRUCTION DETAILS Toho-19, Thrust Restraint and Toho-20, Restrained Joint Table. Use of thrust blocks for pressure pipe shall not be allowed for any pipe, fitting, or appurtenance within the TOHO WATER, REUSE, or SEWER systems.

Restraining of existing utilities shall be verified prior to beginning construction. Where no restraints exist, it shall be the responsibility of the DEVELOPER'S ENGINEER and CONTRACTOR to develop a method of excavation and restraint to protect the existing utilities.

35.2 RESTRAINED JOINT CONSTRUCTION

Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained locked-type joints manufactured by the pipe and fitting manufacturer and other means of mechanical restraint retainer including retainer glands, push joint restraining gaskets, etc., and the joints shall be capable of holding against withdrawal for line pressures equivalent to the test pressure.

Any restrained joints that allow for elongation upon pressurization shall not be allowed on aerial crossings.

The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil.

The required number of restrained joints shall be determined by the ENGINEER or as shown in a tabular form depicted on the STANDARD CONSTRUCTION DETAIL Toho-20, Restrained Joint Table, whichever is greater.

Wherever 2 – 45° bends are used in place of a 90° bend and the minimum restrained joints required from 1 – 45° bend extend beyond the other 45° bend, the 2 – 45° bends shall be considered as though a 90° bend were located midway between the 2 – 45° bends.

All ductile iron pipe bells utilizing push joint restraining gaskets shall be painted with an 8" wide red full circumference strip around the bell.

END OF SECTION 35

SECTION 36 – PRESSURE CONNECTION

36.1 GENERAL

Installations of pressure connections 4" and larger shall be made in accordance with this section.

These connections shall include wet taps and line stops.

36.2 TAPPING SLEEVES

36.2.1 GENERAL

Tapping sleeves shall be mechanical joint sleeves or fabricated steel sleeves as specified below. All pressure connections to asbestos cement pipe and all size-on-size taps on WATER and REUSE mains shall utilize full body ductile iron mechanical joint sleeves. All taps on SEWER force mains shall utilize full body stainless steel tapping sleeves.

36.2.2 MECHANICAL JOINT SLEEVES

Sleeves shall be ductile iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B16.1 properly recessed for tapping valve. Glands shall be ductile iron. Gaskets shall be synthetic rubber. Bolts and nuts shall comply with ANSI A21.11/AWWA C111. Sleeves shall be capable of withstanding a 200-psi working pressure.

36.2.3 FABRICATED STEEL TAPPING SLEEVES

Sleeves shall be fabricated of minimum 3/8" carbon steel meeting ASTM A285 Grade C. Outlet flange shall meet AWWA C-207, Class "D" ANSI 150 lb. drilling and be properly recessed for the tapping valve. Bolts and nuts shall be stainless steel, meeting AWWA C111 (ANSI A21.11). Gasket shall be synthetic rubber. Sleeve shall have manufacturer applied fusion bonded epoxy coating, minimum 12 mil thickness.

36.2.4 STAINLESS STEEL TAPPING SLEEVES

Tapping sleeve shall meet ANSI/AWWA Standard C223 and be fabricated from 304 Stainless Steel or its equivalent with a pass-through bolt design and provide 360 degree seal around the pipe. Flange outlet shall be 304 Stainless Steel or equivalent. Flange outlets shall be recessed per MSS-SP60 to accept tapping valve. Nuts, bolts, and washers shall be 304 stainless steel.

Full circumferential gasket shall be molded of synthetic rubber compounded for use with water salt solutions, mild acids, bases, and sewage. The gasket shall have a gridded surface, be a full 1/4" thick with 304 stainless steel bridge plates molded flush into the gasket and have a raised hydromechanical outlet seal to seal against line surges and water hammer.

36.2.5 TAPPING VALVES

Tapping valves shall meet the requirements of Section 52.2 except that units shall be flange by mechanical joint ends. Valves shall be compatible with tapping sleeves as specified above.

36.3 NOTIFICATION AND CONNECTION TO EXISTING MAINS

All connections to existing mains shall be made by the CONTRACTOR only after the connection procedure and the work scheduling has been reviewed and approved by TOHO. The CONTRACTOR shall submit a written request to TOHO a minimum of five (5) working days prior to scheduling said connections. All requests shall outline the following:

- Points of connection, fittings to be used, and method of flushing and disinfection if applicable.
- Estimated construction time for all connections.
- A bypass method and schedule if the WORK necessitates

TOHO shall review the submittal within three (3) working days after receiving it and inform the CONTRACTOR regarding approval or denial of the request. If the request is rejected by TOHO, the CONTRACTOR shall resubmit the request modifying it in a manner acceptable to TOHO.

All connections shall only be made on the agreed upon date and time. All materials required to make the connection shall be onsite prior to beginning the WORK. If the CONTRACTOR does not initiate and complete the connection WORK in the agreed upon manner, the CONTRACTOR shall be required to reschedule the said connection by following the procedure outlined above.

The CONTRACTOR shall not operate any valves in the TOHO system unless directed by and witnessed by TOHO personnel.

36.4 INSTALLATION

36.4.1 EXCAVATION, BACKFILL, COMPACTION AND GRADING

The applicable provisions of Section 32 shall apply.

36.4.2 CONSTRUCTION DETAILS

Sufficient length of main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be adequately supported to properly carry its own weight, plus the weight of the tapping sleeve valve and machinery. Any damage to the main due to improper or insufficient supports shall be repaired at the CONTRACTOR'S expense.

The inside of the tapping sleeve and valve or the line stop equipment to be inserted into an approved WATER or REUSE main, the outside of the main, and the tapping machine shall be cleaned and swabbed or sprayed with 10% liquid chlorine prior to beginning installation for WATER or REUSE system pressure connections. The TOHO representative for the project shall be given sufficient opportunity to inspect the equipment for apparent cleanliness prior to installation.

After the tapping sleeve has been mounted on the main, the tapping valve shall be bolted to the outlet flange, making a pressure tight connection. Prior to beginning the tapping operation, the sleeve and valve shall be leak tested at the specified test pressure to ensure that no leakage shall occur. A test shall be required for a minimum of 15 minutes.

For pressure connections through 12" diameter or less the minimum diameter cut shall be $\frac{1}{2}$ " less than the nominal diameter of the pipe to be attached. For 14" through 20" installations the minimum diameter shall be 1-1/2" less; for larger taps the allowable minimum diameter shall be 2" to 3" less than the nominal diameter of the pipe being attached. After the tapping procedure is complete the CONTRACTOR shall submit the coupon to TOHO.

Restrained joint fittings shall be provided on the branch to prevent movement of the installation when test pressure is applied. Provisions of Section 35 shall apply. Restrained joints shall conform to the STANDARD CONSTRUCTION DETAIL Toho-19, Thrust Restraint.

END OF SECTION 36

PART 2 – SPECIFICATIONS

DIVISION IV – GRAVITY SEWERS AND LIFT STATIONS

SECTION 40 – PIPE MATERIAL FOR GRAVITY SEWERS

40.1 GENERAL

Pipe used in gravity SEWER construction shall be polyvinyl chloride (PVC) or high-density polyethylene (HDPE). Where reference is made to an ASTM, ANSI, or AASHTO designation, it shall be the latest revision.

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until approved by TOHO. All materials found to be defective or damaged in handling or storage shall be replaced at the expense of the contractor. The CONTRACTOR shall, if requested by TOHO furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

Maximum allowable depth for gravity SEWER main at any point shall be 12'. With the Executive Director's approval, depths up to 15' may be permitted. Criteria for depths greater than 12' include but are not limited to:

- Length of pipe and number of manholes at depth greater than 12' Structure and building locations in relation to mains
- Accessibility and traffic relief if these mains are under repair
- Average water table and proximity to water bodies
- Rationale for need to exceed 12' depth

40.2 PIPE MATERIALS

40.2.1 PVC GRAVITY SEWER PIPE

PVC Gravity SEWER Pipe 4" – 12", ASTM D3034, SDR 35: Uniform minimum pipe stiffness at 5 percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-4.

PVC Gravity SEWER Pipe 15" – 27", ASTM F679, SDR 35: Uniform minimum pipe stiffness at 5 percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-7.

All PVC pipe shall bear the NSF-DW seal. The minimum standard length of pipe shall be 13 feet.

PVC piping with 3 feet – 15 feet of cover shall be a minimum SDR35.

40.2.2 PIPE MARKINGS

All pipes shall have a homing mark on the spigot provided by the manufacturer. On field cut pipe, CONTRACTOR shall provide homing mark on the spigot in accordance with manufacturer's recommendations.

All gravity SEWER mains shall be light green in color or marked with a continuous longitudinal stripe of acrylic enamel paint. The stripe shall be a minimum 2" in width and shall be light green in color painted on top of pipes under 24". For lines 24" or larger, there shall be painted 3 – 2" wide stripes painted within the top 90 degrees of the pipe. Paint should be touch-dry before backfilling. Provide 3M marker tape 12" to 18" above all gravity SEWER mains and no deeper than 4'.

All field cuts shall be coated in accordance with the original manufacturer's recommendations and shall require inspection by TOHO.

40.3 JOINT MATERIALS

40.3.1 PVC PIPE

PVC gravity SEWER pipe joints shall be flexible elastomeric seals per ASTM D 3212.

40.3.2 JOINTS FOR DISSIMILAR PIPE

Joints between pipes of different materials shall be made with a rigid, PVC, adaptor coupling. Transition between SDR 35 PVC pipe and DIP shall be accomplished with MJ sleeve and transition gasket. Transitions between existing clay pipe and pipe of other materials shall be accomplished with Fernco adaptors or an approved equal.

40.4 FITTINGS

Unless otherwise specified, wye branches shall be provided in the gravity SEWER main for service lateral connections. Branches shall be minimum 6" inside diameter, unless otherwise approved by TOHO. All fittings, including adaptors, shall be of the same material as the pipe being installed. Locator ball is required at the cleanout wye. Depth of locator balls shall not exceed 4'.

40.5 INSPECTION AND TESTING

40.5.1 GENERAL

Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. The markings shall be clearly visible on the pipe barrel. Pipe which is not marked clearly is subject to rejection. All rejected pipe shall be promptly removed from the project site by the CONTRACTOR. Warped PVC pipe shall be rejected.

40.5.2 MISCELLANEOUS INSPECTION AND TESTING REQUIREMENTS

All pipe and accessories to be installed shall be inspected and tested at the place of manufacture by the manufacturer as required by the specifications to which the material is manufactured. Each length of pipe shall be subject to inspection and approval at the factory, point of delivery, and site of WORK. If requested by TOHO a sample of pipe to be tested shall be selected at random by the TOHO or a testing laboratory hired by TOHO.

When the specimens tested conform to applicable standards, all pipe represented by such specimens shall be considered acceptable based on the test parameters measured. Copies of test reports shall be available before the pipe is installed in the project.

If any of the test specimens fail to meet the applicable standards, all pipe represented by such tests shall be subject to rejection. The CONTRACTOR shall furnish two (2) additional test specimens from the same shipment or delivery, for each specimen that failed, and the pipe shall be considered acceptable if all these additional specimens meet the requirements of the applicable standards. All such retesting shall be at the CONTRACTOR'S expense.

Pipe, which has been rejected by TOHO shall be removed from the site of the WORK by the CONTRACTOR and replaced with pipe, which meets these SPECIFICATIONS.

END OF SECTION 40

SECTION 41 – PIPE INSTALLATION FOR GRAVITY SEWER

41.1 SURVEY LINE AND GRADE

The CONTRACTOR shall set Temporary Benchmarks (TBM'S) at a maximum 500-foot interval. The CONTRACTOR shall constantly check line and grade of the pipe by laser beam method. In the event line and grade do not meet specified limits described hereinafter, the WORK shall be immediately stopped. TOHO shall be notified, and the cause remedied before proceeding with the WORK. A slope survey shall be provided to the TOHO representative prior to the witnessing of any test procedures and placement of road sub-base.

41.2 PIPE PREPARATION AND HANDLING

All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are being used. The CONTRACTOR shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after lying.

Proper implements, tools, and facilities shall be used for the safe and proper protection of the WORK. Pipe shall be lowered into the trench in such a manner as to avoid any physical damage to the pipe. Pipe shall not be dropped or dumped into trenches under any circumstances.

41.3 SEWER PIPE LAYING

Lying of gravity SEWER pipe shall be accomplished to line and grade in the trench only after it has been dewatered and the trench has been prepared in accordance with this MANUAL. Refer to Section 41.4 for additional bedding requirements. Mud, silt, gravel and other foreign material shall be kept out of the pipe and off the jointing surface. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient backfill has been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the line and grade shown on the PLANS.

Variance from established grade, at any point along the length of the pipe, shall not be greater than 10% and at no location shall the slope be less than 0.4%. The maximum allowable slope of gravity mains shall not be greater than 10% for any size main and at no location shall the slope be less than 0.40% for 8" gravity mains.

The gravity SEWER pipe, unless otherwise approved by TOHO shall be laid up grade from point of connection on the existing gravity SEWER or from a designated starting point. The gravity SEWER pipe shall be installed with the bell end forward or upgrade. When pipe lying is not in progress the open end of the pipe shall be kept tightly closed with an approved temporary plug. Pipe laying shall not begin until approved temporary plug is on site.

All PVC pipe shall be installed in accordance with the pipe manufacturer's written recommendations as approved by TOHO Laying of Ductile Iron Pipe shall conform to the SPECIFICATIONS outlined in Section 51.4.

41.4 TRENCH PREPARATION AND PIPE BEDDING

41.4.1 TRENCH EXCAVATION, DEWATERING, BEDDING MATERIAL, BACKFILL, COMPACTION, FILL AND GRADING

Applicable provisions of Section 32 shall apply as well as any applicable STANDARD CONSTRUCTION DETAILS.

41.4.2 PLACEMENT OF PIPE BEDDING MATERIAL

CONTRACTOR shall hand-grade bedding to proper grade ahead of pipe laying operation. Bedding shall provide a firm, unyielding support along the entire pipe length.

If the trench has been excavated below the required depth for pipe bedding material placement, CONTRACTOR shall fill the excess depth with pipe bedding material to the proper grade.

CONTRACTOR shall excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.

41.4.3 DEPTH OF BEDDING MATERIAL

CONTRACTOR shall provide pipe bedding material in accordance with the STANDARD CONSTRUCTION DETAIL Toho-14, Typical Pipe Trench.

41.5 GRAVITY PIPE AND WATER MAIN SEPARATION

Gravity SEWER that is laid in the vicinity of pipelines designated to carry WATER or REUSE shall meet the conditions set forth in Section 51.3.

41.6 PIPE JOINTING

All pipes shall be installed by hand and homed so that the home mark placed by the manufacturer of the pipe is completely covered by the bell end of the downstream pipe. The INSPECTOR shall be given an opportunity to check all joints prior to backfilling. Joints found to be under-homed shall be replaced from the affected joint to the nearest manhole in either direction at the expense of the CONTRACTOR and/or DEVELOPER. Type of joint to be used shall conform to the requirements of Section 40.3. All pipe and jointing for gravity SEWERS shall be subject to the tests specified in Section 44.

END OF SECTION 41

SECTION 42 – MANHOLES

42.1 GENERAL

Manholes shall be leak-tight and constructed of pre-cast concrete units.

42.2 PRE-CAST CONCRETE SECTIONS

42.2.1 GENERAL

Pre-cast manholes shall conform to specifications for ASTM C 478 “Precast Reinforced Concrete Manhole Sections”, except as otherwise specified below. Pre-cast manholes shall be constructed with a pre-cast monolithic base structure as shown on the STANDARD DETAILS.

Concrete for manholes shall be Type II, 4000 psi at 28 days. Barrel, top and base sections shall have tongue and groove joints. All jointing material shall be a cold adhesive preformed plastic gasket, conforming to ASTM C 443 “Manhole Section Connections”. Manholes shall be leak free. Sections shall be cured by an approved method as per ASTM C 478 for at least 28 days prior and shall not be shipped until at least two days after having been coated.

New concrete structures shall contain a crystalline waterproofing concrete admix for ALL new concrete structures including but not limited to manholes. Crystalline Waterproofing Concrete Admix shall be added to the concrete during the batching operation. Admix concentration shall be added based upon manufacturer design percent concentration of admixture to the required weight of cement. The amount of cement shall remain the same and not be reduced. A colorant shall be added to verify the admix was added to the concrete for all precast structures. Colorant shall be added and provided at the admix manufacturing facility, not at the concrete batch plant. It is recommended that the admix be added first to the rock and sand and blended thoroughly before adding cement and water or per the manufacturer’s recommendations. Concrete structures without crystalline waterproofing admix or admix without colorant for field verification shall be rejected. CONTRACTOR shall provide certification from the pre-caster that the admix was installed in accordance with the manufacturer’s recommendations.

The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on each pre-cast section after coating on exterior surface. Pre-cast concrete top slabs shall be used where cover over the top of the pipe is less than four feet. Lift rings or nonpenetrating lift holes shall be provided for handling pre-cast manhole sections. Manholes shall be coated or lined to resist corrosion from a sanitary SEWER environment.

New manholes that receive SEWER force mains, SEWER lift station junction manholes, manholes deeper than 12’, and any manhole with a drop connection per the STANDARD CONSTRUCTION DETAIL Toho-09, Manhole Drop or Force Main Connection and all manholes within 400 feet upstream and downstream of these manholes shall require a polymer manhole per the STANDARD CONSTRUCTION DETAIL Toho-07.1, Polymer Manhole.

Existing manholes that receive SEWER force mains and any manhole with a drop connection per the STANDARD CONSTRUCTION DETAIL Toho-09, Manhole Drop or Force Main Connection , all existing manholes within 400 feet upstream and downstream of these manholes, or existing manholes within 400 feet upstream and downstream of a new SEWER lift station junction manhole or manhole deeper than 12', shall require a TOHO approved lining system.

Polymer concrete manholes do not require Crystalline Waterproofing Concrete Admix.

42.2.2 MISCELLANEOUS REQUIREMENTS

The minimum wall and base thickness shall be as shown on the STANDARD CONSTRUCTION DETAILS Toho-07.0, Standard Manhole, Toho-07.1, Polymer Manhole, and Toho-08.1, Miscellaneous Manhole,

Concrete for manholes shall attain 4000 psi in twenty-eight (28) days using Type II cement only. Barrel, top and base sections shall have tongue and groove joints. All jointing material shall be cold adhesive preformed plastic, butyl rubber gaskets, or asphaltic enriched polymer.

Pre-cast concrete top slabs may be used where cover over the top of the pipe is less than 4 feet. Lift rings or non-penetrating lift holes shall be provided for handling pre-cast manhole sections. After installation, lift rings shall be removed and openings patched. Non-penetrating lift holes shall be filled with non-shrink grout after installation of the manhole sections.

The top of buried manholes, cone, riser rings, iron frame, cover and all joints shall be encapsulated with a heat shrink-wrap with a minimum thickness of 98 mils (2.5mm). The wrap shall have a cross-linked polyolefin backing coated with a protective heat activated adhesive. The wrap should effectively bond to the substrate via primer provided by the manufacturer, providing corrosion and moisture protection. The wrap shall be applied with a high intensity propane torch. Heat Shrink wrap for all barrel section joints of manholes shall be a minimum 9-inch width wrap and a minimum of 12-inch width wrap on the corbel section, riser rings and ring & cover. Adhesive tape materials shall not be allowed.

All wet wells, wet well top slabs, junction manholes, manholes accepting a force main connection and/or a drop connection, and any manhole within 400' of these manholes shall be polymer concrete manholes approved by TOHO. All manholes approved to be deeper than 12' shall also be TOHO approved polymer concrete manholes. Polymer concrete manholes do not require Crystalline Waterproofing Concrete Admix. Manholes that receive SEWER force mains, SEWER lift station junction manholes, and any manhole with a drop connection per the STANDARD CONSTRUCTION DETAIL Toho-09, Manhole Drop or Force Main Connection and all manholes within 400 feet upstream and downstream of these manholes shall require a TOHO approved lining system.

The lining manufacturer shall warrant the product being supplied to TOHO against defects in workmanship and material for a period of ten (10) years. The warranty shall begin at the time of a successful final inspection of the gravity SEWER collection system. The DEVELOPER and/or CONTRACTOR shall be responsible for securing an additional warranty period to meet the minimum ten (10) years or from the time of a successful final inspection if required.

The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on each pre-cast section.

42.2.3 INSPECTION

The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by TOHO. Such inspection may be made at the place of manufacture or at the site after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though sample sections may have been approved as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All sections, which have been damaged after delivery shall be rejected and, if already installed, removed, and replaced, entirely at the CONTRACTOR's expense.

At the time of inspection, the sections shall be carefully examined for compliance with the specified ASTM designation, and with the approved manufacturer's PLANS. All sections shall be inspected for general appearance, dimension, scratch-strength blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.

42.3 CASTINGS

Gray iron castings for manhole frames, covers, adjustment rings and other items shall conform to the ASTM Designation A48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects which would impair their strength, or otherwise make them unfit for the service intended.

The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling shall be allowed. Lifting or pick holes shall be provided but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the STANDARD CONSTRUCTION DETAILS Toho-07.0, Standard Manhole, Toho-07.1, Polymer Manhole, and Toho-08, Miscellaneous Manhole. All manhole frames and covers shall be traffic bearing to meet AASHTO H-20 loadings. Frames shall be suitable for the future addition of a cast iron ring for upward adjustment of top elevation.

42.4 CONSTRUCTION DETAILS

42.4.1 BEDDING

Base sections shall be placed on bedding rock conforming to the requirements in Section 32. The bedding rock shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast element. Refer to the STANDARD CONSTRUCTION DETAILS Toho-07.0, Standard Manhole, Toho-07.1, Polymer Manhole, and Toho-08, Miscellaneous Manhole for additional bedding details.

42.4.2 CAST-IN-PLACE BASES

Cast-in-place bases shall be utilized only when specifically approved by TOHO unless otherwise specified; cast-in-place bases shall be at least 8" in thickness and shall extend at least 6" radially outside of the outside dimension of the manholes section. Reinforcement and connection to the riser sections shall be designed by the DEVELOPER's ENGINEER and submitted for approval.

42.4.3 PRE-CAST MANHOLES

A pre-cast base section shall be carefully placed on the prepared bedding to be fully and uniformly supported in true alignment and making sure that all entering pipes can be inserted on proper grade.

Pre-cast manhole sections shall be handled by lift rings or non-penetrating lift holes. Such holes shall be filled with non-shrink grout after installation of the manhole. HDPE adjustment rings and polymer concrete adjustment rings shall be required on all polymer concrete manholes. If precast riser rings are used, then a polymer concrete seal shall be placed over the rings.

The first pre-cast section shall be placed and carefully adjusted to true grade and alignment. All inlet pipes shall be properly installed to form an integral watertight unit. The sections shall be uniformly supported by the base structure and shall not bear directly on any of the pipes.

Pre-cast sections shall be placed and aligned to provide vertical alignment with a 1/4-inch maximum tolerance per 5 feet of depth. Wall penetrations shall be placed with a minimum 12" from any joint and 18" from any other wall penetrations. The completed manhole shall be rigid, true to dimensions, and watertight. Manhole ring and joints shall have an exterior sealer and sealer between manhole sections.

42.4.4 EXCAVATION AND BACKFILLING

Requirements of Section 32 shall apply.

42.4.5 PLACING CASTINGS

Casting shall be fully bedded in mortar with adjustment brick courses placed between the frame and manhole. Mortar joints shall not exceed 1/2". Bricks shall be a minimum two (2) and maximum five (5) courses. Mortar shall conform to ASTM C-270, type M, with crystalline admixture and the bricks shall be clay or concrete and conform to ASTM C-216, grade SW, size 3 1/2" (w) x 8" (L) x 2 1/4" (h).

Pre-cast riser rings will be required where an integrally cast liner is specified, brick adjustment shall not be allowed.

Top of manhole castings located inside pavement and sidewalks shall be set flush with grade. Top of manhole castings located outside pavement and sidewalks shall be provided with a concrete collar as noted on the STANDARD CONSTRUCTION DETAIL Toho-27, Manhole Collar.

42.4.6 INFLOW BARRIER

Manholes located within drainage flow channels, including gutters and swales, shall be equipped with an inflow prevention barrier.

42.4.7 CHANNELS

Manhole flow channels shall be as shown in the STANDARD CONSTRUCTION DETAIL Toho-08.0, Miscellaneous Manhole, with smooth and carefully shaped bottoms, built up sides and benching constructed using concrete only, with no voids. Channels shall conform to the dimension of the adjacent pipe and provide changes in size, grade and alignment evenly. Cement shall be 2,500 psi Portland Cement Type II with crystalline admixture only.

42.4.8 PIPE CONNECTIONS

Special care shall be taken to see that the openings through which pipes enter the structure are provided with watertight connections. Cores to existing manholes shall be a minimum 12" from new or existing joints. If 12" requirement cannot be maintained, a new larger diameter manhole shall be required to be installed at no cost to TOHO. Connections shall conform to ASTM C 923, Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.

42.4.9 DROP MANHOLE CONNECTIONS

Drop manholes shall be approved on a case-by-case basis. Drop manhole connections shall conform in all respects to details shown on the STANDARD CONSTRUCTION DETAIL Toho-09, Manhole Drop or Force Main Connection and all other applicable provisions of this MANUAL.

Manholes with drop connections shall have a minimum inside diameter of 5 feet.

New manholes that receive SEWER force mains, SEWER lift station junction manholes, manholes deeper than 12', and any manhole with a drop connection per the STANDARD CONSTRUCTION DETAIL Toho-09, Manhole Drop or Force Main Connection and all manholes within 400 feet upstream and downstream of these manholes shall require a polymer manhole per the STANDARD CONSTRUCTION DETAIL Toho-07.1, Polymer Manhole.

Existing manholes that receive SEWER force mains and any manhole with a drop connection per the STANDARD CONSTRUCTION DETAIL Toho-09, Manhole Drop or Force Main Connection, all existing manholes within 400 feet upstream and downstream of these manholes, or existing manholes within 400 feet upstream and downstream of a new SEWER lift station junction manhole or manhole deeper than 12', shall require a TOHO approved lining system.

For existing manholes, the lining manufacturer shall warrant the product being supplied to TOHO against defects in workmanship and material for a period of ten (10) years. The warranty shall begin at the time of a successful final inspection of the gravity SEWER collection system. The DEVELOPER and/or CONTRACTOR shall be responsible for securing an additional warranty period to meet the minimum ten (10) years or from the time of a successful final inspection if required.

42.5 CLEANING

All newly constructed manholes shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of final inspection.

42.6 INSPECTION FOR ACCEPTANCE

No leakage in the manhole or at pipe connections shall be permitted. No exposed concrete shall be approved. All manholes shall be inspected by the TOHO prior to acceptance. All manholes failing to meet the specification set forth in Section 42 above shall be repaired or replaced by the CONTRACTOR to comply with these SPECIFICATIONS. Pressure grouting of manholes for repair shall not be approved.

END OF SECTION 42

SECTION 43 - SERVICE LATERALS

43.1 GENERAL

A service lateral is a branch gravity SEWER constructed from the main gravity SEWER to the right-of-way line or to a point established by TOHO.

The general requirements for construction of gravity SEWERs in Sections 40 and 41 of this MANUAL shall apply for service laterals unless they are inconsistent with the provisions of this section.

Service laterals and fittings shall be a minimum of 6" in diameter.

Maximum length of TOHO owned service lateral shall be 100 LF.

43.2 MATERIALS

Service lateral pipe, fittings, and joints shall be SDR 26 up to the point of connection to the main, where the fitting shall be adapted to the same SDR as that of the main.

Service laterals shall be connected to the wye, provided in the gravity SEWER where such is available, utilizing approved fittings or adapters.

On existing mains where no wye is provided or cut-in suitable, connection shall be made by either a tap and saddle, or a cast-in-place or doghouse manhole as referenced in Section 20.4.

43.3 CONSTRUCTION DETAILS

43.3.1 GENERAL

Service lateral connections shall conform to these SPECIFICATIONS and the STANDARD CONSTRUCTION DETAIL Toho-05, Sanitary Sewer Lateral. All necessary approvals for gravity SEWER service construction shall be obtained prior to beginning the WORK.

43.3.2 EXCAVATION AND BACKFILL

Excavation and backfilling for gravity SEWER services shall conform to the requirements of Section 32 and 41, excepting that no backfill more than that required to hold the pipe in true alignment shall be placed prior to inspection.

43.3.3 PIPE LAYING AND JOINTING

Pipe lying and jointing, except as hereinafter provided, shall conform to the requirements of Section 41. During the pipe laying and jointing, the service lateral shall be kept free of any water, dirt, or objectionable matter.

43.3.4 LINE AND GRADE

Service lateral pipe shall be laid with a minimum slope of 1%. The CONTRACTOR shall establish such alignment and grade control as is necessary to properly install the gravity SEWER service. Service lateral pipe shall be laid in a straight line at a uniform grade between fittings.

43.4 TERMINATION OF SERVICE LATERALS

Service laterals shall terminate at the right-of-way line and the clean out riser shall be capped and left 3 feet to 4 feet above finished grade until preparations for final inspection for Certificate of Occupancy are made. Watertight factory-made plugs shall be installed at the end of each service lateral.

Plugs for stub outs shall be of the same material as the pipe, and gasketed with the same gasket material as the pipe joint or be of material approved by TOHO. The plug shall be secured to withstand test pressures specified in Section 44 of these SPECIFICATIONS.

43.5 INSPECTION

SEWER services shall meet the inspection requirements specified in Sections 40.5 and 44.

43.6 RESTORATION, FINISHING AND CLEANUP

The CONTRACTOR shall restore all paved surfaces, curbing, sidewalks or other surfaces to their original condition in such manner as to meet the requirements established in Division III of this MANUAL. All surplus material and temporary structures, as well as all excess excavation shall be removed, and the entire site shall be left in a neat and clean condition.

43.7 IDENTIFICATION

The exact location of the termination point of each installed service lateral shall be marked by etching a 3" high letter "S" on the concrete curb. Where no curb exists, locations shall be adequately marked by a 4" X 4" X 18" concrete marker with "S" indented into the top of the marker, or other method approved by TOHO.

END OF SECTION 43

SECTION 44 - TESTING AND INSPECTION FOR ACCEPTANCE OF GRAVITY SEWERS

44.1 GENERAL

All gravity SEWERS shall be tested for alignment, deflection, and integrity prior to acceptance. In addition, a leakage test shall be required for gravity SEWERS with no allowable loss on any leakage tests. The leakage testing shall be performed by the CONTRACTOR who shall be responsible for furnishing all necessary labor and equipment to conduct such testing.

44.2 TESTING FOR LEAKAGE

44.2.1 TYPE OF TEST

Gravity SEWERS shall be required to pass a leakage test before acceptance. Leakage tests shall be by the low-pressure air test as described below.

44.2.2 SELECTION OF TEST SECTIONS

Each section shall be tested between consecutive manholes.

44.2.3 PREPARATION AND COORDINATION FOR TESTING

The CONTRACTOR shall flush all gravity SEWER with water sufficient in volume to obtain free flow through each line. Flushing water and debris shall not enter any SEWER lift station wet well or existing SEWER. Water shall be pumped from the gravity SEWER system during flushing to an acceptable discharge location. A visual inspection shall be made, and all obstructions removed. Spark testing shall be done on dry manholes in the presence of a TOHO INSPECTOR.

The CONTRACTOR shall pre-test all SEWERS prior to scheduling the leakage test with TOHO. The CONTRACTOR shall schedule with the INSPECTOR a minimum of ninety-six (96) business hours prior to performing any testing.

44.2.4 LEAKAGE TEST

Leakage tests shall be for minimum of seven (7) minutes with no allowable loss.

TOHO personnel shall witness low air testing of gravity SEWERS for privately maintained systems.

44.3 INSPECTION FOR ALIGNMENT, DEFLECTION AND INTEGRITY

Low air pressure tests and video inspection of lines shall not be performed until sub-base or 10' of cover is over the main and laterals are in to grade at the ROW line.

A recorded video inspection shall be required to check for cracked, broken or otherwise defective pipe, sags, and overall pipe integrity.

CCTV shall be done from downstream manhole to an upstream manhole with water flowing through the pipe. A gauge, clearly marked at 1" intervals shall be visible on the front of the camera. Gauge must be measured against a tape measure at the start of every run. Camera must stop at every joint and pan every connection. All cracks, bumps, dips, and other abnormalities must be clearly documented on report. Camera must stop and pan to investigate as necessary. TOHO personnel shall witness all testing.

If any video inspection reveals cracked, broken, or defective pipe or fittings, pipe misalignment, or sags in excess of 1" and in the case of PVC pipe a ring deflection in excess of 5%, the CONTRACTOR shall be required to replace the pipeline from the affected area to the nearest manhole in either direction.

At TOHO's discretion, an additional video inspection of the gravity SEWER may be required before the end of the two (2) year warranty period. CONTRACTOR is required to submit a new copy of CCTV 90 to 120 days prior to maintenance bond expiration date.

END OF SECTION 44

SECTION 45 - SEWER LIFT STATIONS

45.1 GENERAL

This section includes the specifications for equipment, materials, site WORK, fences, and appurtenances for the installation of SEWER lift stations.

All exposed metal mounting hardware, accessories, and panels within the SEWER lift station yard including those on the control panel structure and inside the wet-well shall be stainless steel S.S 316.

Emergency replacement of any facility with new facilities of the same capacity at the same location as the facilities being replaced shall follow the Florida Administrative Code 62-604.600(2)(a).

45.2 WET WELL AND VALVE SLAB

Wet well and valve slab shall be constructed to the dimensions shown on the STANDARD CONSTRUCTION DETAILS Toho-31.0, Standard Lift Station and Toho-31.1 Miscellaneous Lift Station I, and per manufacturer's recommendations. Wet wells and slabs shall be made of TOHO approved polymer concrete. The slab shall be a minimum of 5" thick, 3,000 psi, Type II concrete, reinforced with minimum #4 reinforcing bars at 12" centers, in each direction.

All pipe penetrations shall have a minimum 12" vertical separation from wet well joints.

45.3 ACCESS FRAMES AND COVERS

The wet well shall be furnished with aluminum access frames and covers with safety grates. Fall protection grating should be aluminum. Equipment furnished shall include stainless steel upper guide holder, and level sensor cable holder. Doors shall be of aluminum checkered plate. The access cover and frame shall be sized as shown on the STANDARD CONSTRUCTION DETAILS Toho-31.0, Standard Lift Station and Toho-31.1 Miscellaneous Lift Station I and shall open towards the exterior discharge piping. "CONFINED SPACE" shall be embossed on the cover.

45.4 PIPING, VALVES AND ACCESSORIES

45.4.1 PIPING

Influent piping to the wet well shall be HDPE meeting the requirements of Sections 40.3 and 50.5. Flexible boot connection shall be provided at all underground wall penetrations. All pipe inside the wet well shall be as shown on the STANDARD CONSTRUCTION DETAILS Toho-31.0, Standard Lift Station and Toho-31.2 Miscellaneous Lift Station II and coatings shall be as per the requirements of Section 50.4.

45.4.2 VALVES

Above ground shut-off/isolation valves shall be plug type gear reduction with side mounted hand wheels.

In-ground valves shall meet the requirements of Section 52.2.

45.4.3 CHECK VALVES

Check valves for ductile iron pipelines shall be swing type and shall meet the material requirements of AWWA C508. The valves shall be iron body; rubber seated, 8-mil epoxy lined 150 psi working water pressure, non-shock, and hydrostatically tested at 300 psi. Ends shall be 125 pound ANSI B16.1 flanges.

Valves shall be so constructed that rubber seat may easily be removed and replaced without removing the valve from the line.

45.4.4 AIR RELEASE VALVES

Air release valves shall be as specified in Sections 21.3, 52.7 and Appendix 'E', Approved Materials and Manufacturers.

45.4.5 PRESSURE TRANSMITTER

Pressure transmitters shall be installed prior to the SEWER lift station start-up inspection unless otherwise requested by TOHO.

45.5 STANDBY POWER GENERATOR SYSTEM

45.5.1 GENERAL

A standby power generator system shall be installed at SEWER lift stations as required by Section 22.5 for electrical power during the loss of normal power.

45.5.2 GENERATOR SET

The generator set shall consist of a diesel engine directly coupled to an electric generator, together with the necessary controls and accessories to provide continuous electric power to the SEWER lift station for a minimum of ninety-six (96) hours under normal operating conditions.

A complete engine generator system shall be furnished and installed with fuel transfer pump, fuel tank, battery, battery charger, muffler, radiator, control panel, remotely mounted automatic transfer switch (part of the control panel and monitored by TOHO's SCADA system), and all other accessories required for an operational system to include a full tank of fuel. All materials and parts of the generator set shall be new and unused. Each component shall be of current manufacture from a firm regularly engaged in the production of such equipment. The set shall be of a standard model in regular production at the manufacturer's place of business. Units and components offered under the Specifications shall be covered by the manufacturer's standard warranty on new machines.

45.5.3 REQUIREMENTS

The emergency generator set and accessories shall be of a type that complies with the latest edition of the National Electrical Code and all applicable state and local building codes.

The material and workmanship used in the manufacture of this equipment shall be of the highest quality consistent with the current standards for like equipment, and the equipment shall be manufactured in such a manner to conform to the latest applicable IEEE, ANSI, ISA, NEMA, and EEIA Standards.

The equipment supplier shall be liable for any latent defects due to faulty materials or workmanship in the equipment which may appear within one (1) year from the date of equipment start-up.

45.5.4 TESTING

Equipment shall be completely assembled and tested at the factory prior to shipment. Certified copies of the data obtained during these tests shall be submitted to TOHO.

Final tests shall be conducted at the site, after installation has been completed, in the presence of the TOHO's representative. The emergency generator manufacturer shall furnish a service representative to operate the engine during the tests, to check all details of the installation and to instruct the TOHO's representatives in proper equipment operation.

Field tests shall include operating the diesel generating set for eight (8) hours, carrying normal SEWER lift station loads. The CONTRACTOR shall refill the main fuel tank at the completion of the tests. The test shall be certified by a state of Florida licensed ELECTRICAL ENGINEER.

45.5.5 RATINGS

The rating of the generator shall be sized for the maximum load at buildout condition. These ratings shall be substantiated by the manufacturer's standard published curves. Special ratings shall not be acceptable. The set shall be capable of supplying the specified usable KW for the specified duration, including the power required for the pump start-up, without exceeding its safe operating temperature.

45.5.6 ENGINE

The engine shall be water-cooled, four-stroke cycle, compression ignition diesel. It shall meet specifications when operating on No. 2 domestic burner oil. The engine shall be equipped with fuel, lube oil and intake air filters, lube oil coolers, fuel transfer pump, fuel priming pump, and gear driven water pump.

The engine and generator shall be torsional compatible to prevent damage to either engine or generator.

An engine instrument panel shall be installed on the generator set in an approved location. The panel shall include oil and fuel pressure and water temperature gauges. A mechanically driven engine hour meter shall also be provided.

The engine governor shall be of the isochronous electronic type. Frequency regulation shall not exceed plus/minus 0.25% under steady state conditions. The engine shall start and assume its rated load within 10 seconds, including transfer time.

45.5.7 GENERATOR

The generator shall be a three-phase, 60 hertz single bearing synchronous type built to NEMA Standards. Epoxy impregnated Class F insulation shall be used on the stator and the rotor.

The excitation system shall employ a generator mounted volts per hertz type regulator. Voltage regulation shall be plus/minus 2% from no load to full load. Readily accessible voltage drop, voltage level, and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of plus/minus 5%.

45.5.8 ENGINE GENERATOR CONTROL PANEL

A generator mounted NEMA 3R, vibration isolated, 14-gauge, Type 316 stainless steel control panel shall be provided. Panel shall contain, but not be limited to, the following equipment:

Control equipment shall consist of all necessary exciter control equipment, generator voltage regulators, voltage adjusting rheostat, speed control equipment and automatic starting controls, as required to satisfactorily control the engine/generator set. In addition, an automatic safety shut down shall be provided for low oil pressure and/or high temperature conditions in the engine. An emergency shutdown lever switch shall be provided on the air intake.

Metering equipment shall include 3-1/2" meters (dial or digital type frequency meter, 2 percent accuracy voltmeter, and ammeter and ammeter-voltmeter phase selector switch). The control panel shall also include the engine water temperature, lube oil pressure and hour meter.

Individual press-to-test fault indicator lights for low oil pressure, high water temperature, low water level, overspeed, over crank, and for tank high and low fuel level shall be provided.

A four (4) position function switch marked Auto, Manual, Off/Reset, and Stop shall be provided.

45.5.9 BATTERY CHARGER

The battery charger shall be so designed that it shall not be damaged and shall not trip its circuit protective device during engine cranking or it shall be automatically disconnected from battery during cranking period. The charger shall be mounted in the emergency generator control panel. The charger shall have a 7 day/24-hour timer control.

45.5.10 BATTERY

The battery shall be lead-acid type with sufficient capacity to provide 90 seconds total cranking time without recharging. The battery shall be adequately rated for the specific generator set. The battery shall be encased in hard rubber or plastic and shall be furnished with proper cables and connectors, together with rack and standard maintenance accessories. The battery shall be provided with a 48-month warranty for the replacement of the battery if found to be defective.

45.5.11 BASE AND MOUNTING

A suitable number of spring-type vibration isolators with a noise isolation pad shall be provided to support the set and its liquids.

45.5.12 UTILITY CONNECTIONS

All connections to the generator set shall be flexible.

45.5.13 COOLING SYSTEM

The generator set shall be equipped with an engine-mounted radiator sized to maintain safe operation at 110-degree F maximum ambient at the SEWER lift station altitude. A blower type fan shall be used directing the airflow from the engine through the radiator. The entire cooling system shall be filled with 50/50 glycol-water solution.

45.5.14 FUEL SYSTEM

A main fuel oil storage tank with float switch and fuel level indication shall be furnished and installed by the CONTRACTOR. The emergency system shall include low fuel level contacts for remote alarm. If necessary to guard against loss of prime to pump, a check valve shall be mounted on pump intake. The emergency system shall include a float switch, fuel level gauge and standard control panel. Fuel tanks are required to alarm at 90% (high) and 10-15% (low) fuel levels. If necessary to guard against loss of prime to pump, a check valve and fuel shut off valve shall be mounted on pump intake. The emergency system shall include a float switch, fuel level gauge and standard control panel. Provide fuel level gauge with 4-20 ma output to indicate tank fuel level.

Fuel oil piping and any required tanks shall be furnished and installed by the CONTRACTOR. Fuel system shall meet all governing codes.

Fuel piping, including mounting of any required fuel tanks shall be 316 SS and welded at all joints. Unions shall be supplied between the fuel tank and the generator on both the supply and return lines to allow for easy removal of piping.

The fuel storage capacity shall be capable of running the SEWER lift station for 72 hours continuous operation.

45.5.15 EXHAUST SYSTEM

The generator set supplier shall provide a critical-type silencer, with flexible exhaust fittings, properly sized and installed, according to the manufacturer's recommendation. The silencer shall be mounted so that its weight is not supported by the engine.

The exhaust system shall be 316 SS and include a flexible, seamless, SS connection between the engine exhaust outlet and the muffler. The exhaust system shall be a part of generator enclosure. A 316 SS weatherproof rain cap shall be installed over the exhaust pipe.

45.5.16 WEATHERPROOF ENCLOSURE

Enclosure and all other items shall be designed and built by engine manufacturer as an integral part of the entire generator set and shall be designed to perform without overheating in the ambient temperature specified.

Enclosure shall be mounted on a curb, at least 6" above the slab.

Enclosure shall be constructed of an approved manufactured of formed aluminum components or aluminum suitably reinforced to be vibration free in the operating mode.

Four (4) hinged doors shall be provided to allow complete access without their removal.

Each door shall have at least two (2) latch-bearing points.

Side and rear panels shall be completely and simply removable for major service access.

Roof shall be peaked to allow drainage of rainwater.

Baked enamel finish with primer and finish coat shall be painted before assembly. All fasteners shall be rust resistant.

Unit shall have sufficient guards to prevent entrance by small animals. Padlocks shall be provided.

Batteries shall be designed to fit inside enclosure and alongside the engine. Batteries under the generator are not acceptable.

Unit shall have coolant and oil drains outside the unit to facilitate maintenance. Each drain line shall have a high-quality valve located near the fluid source.

Fuel filter shall be inside the base perimeter and located so spilled fuel cannot fall on hot parts of engine or generator. A cleanable primary fuel strainer shall be used to collect water and sediment between tank and main engine fuel filter.

Crankcase fumes disposal shall terminate in front of the radiator to prevent oil from collecting on the radiator core and reducing cooling capacity.

45.5.17 AUTOMATIC TRANSFER SWITCH

The automatic transfer switch shall be part of the control panel described in Section 48. The transfer switch shall be provided with the following features:

- Complete protection, close differential voltage sensing relays monitoring all three (3) phases (pick-up set for 95% of nominal voltage, drop-out set for 85% nominal voltage).
- Voltage sensing relay on emergency source (pick-up set for 95% of nominal frequency).
- Time delay on engine starting--adjustable from 1 second to 300 seconds (factory set at 3 seconds).
- Time delay normal to emergency transfer--adjustable from zero second to 300 seconds (factory set at 1 second). The CONTRACTOR shall request time delay settings in accordance with the priority rating or their respective loads.
- Time delay emergency to normal transfer--adjustable 30 seconds to 30 minutes (factory set at 5 minutes), and time delay bypass switch shall be provided on door of the switch cabinet.
- Unload running time delay for emergency engine generator cooling down adjustable from 0 to 5 minutes (factory set at 5 minutes) unless the engine generator control panel includes the cool down timer.

45.5.18 WARRANTY

Products shall be guaranteed to be free from defects in material and workmanship under normal use and service for a period of two (2) years after start-up and project acceptance by TOHO.

45.6 FLOW MONITORING SYSTEM

45.6.1 GENERAL

As required by Section 22.4, a flow monitoring system capable of indicating, recording, and totalizing SEWER flows shall be provided. The system shall include doppler or magnetic flow meter/transmitter, electronic recording receiver, and miscellaneous related accessories as specified herein. It shall be the CONTRACTOR's responsibility to provide and install such equipment resulting in a completely operational flow monitoring system that connects to Toho's SCADA system.

CONTRACTOR shall be responsible for coordinating start-up and calibration services with the manufacturer.

45.6.2 MAGNETIC FLOWMETER/TRANSMITTERS

The magnetic flow meter shall be of the low frequency electromagnetic induction type and shall produce a DC pulse signal directly proportional and linear to the liquid flow rate. The meter shall be designed for operation on 120 VAC \pm 10%, 60 Hz \pm 5% with a power consumption of less than 20 watts for sizes through 12".

The metering tubes shall be constructed of stainless steel. All magnetic flow meter shall be designed to mount directly in the pipe between ANSI Class 150 flanges and shall consist of a flanged pipe spool piece with laying length of at least 1-1/2 times the meter diameter. Meters shall be mounted according to manufacturer's specifications, but generally, precautions shall be taken to assure that the metering tube is always filled during measurement (i.e. do not mount meter at system high point). Meters shall have polyurethane liners with stainless steel electrodes.

The electronics portion of the magnetic flow meter shall include both a magnet driver to power the magnet coils and a signal converter. The signal converter shall be integrally mounted. The converter shall include a separate customer connection section to isolate the electronics compartment and protect the electronics from the environment. A separate terminal strip for power connection shall be supplied. The electronics shall be of the solid state, feedback type and utilize integrated circuitry.

The input span of the signal converter shall be continuously adjustable between 0-1 and 0-31 fps for both analog and frequency outputs. The converter shall not be affected by quadrature noise, nor shall it require zero adjustment or special tools for start-up.

Input and output signals shall be fully isolated. The converter output shall be 4 to 20mA and ethernet.

Meter shall be suitable for outdoors installation and shall be furnished complete with grounding rings and installation hardware including studs, nuts, gaskets, and flange adapter hardware.

The converter shall include an integral zero return to provide a constant zero output signal in response to an external dry contact closure.

Converter shall also include digital type switches for direct adjustment of scaling factor in engineering units along with integral calibration self-test feature to verify proper operation of the electronics.

The converter enclosure shall be provided with a sun shield across the panel top. This shield shall be of Type 304 14-gauge 316 stainless steel and be elevated above the panel top by 1" with 316 stainless steel rods and hardware.

The meter shall be hydraulically calibrated at a facility located in the United States and the calibration shall be traceable to the National Bureau of Standards. A computer printout of the actual calibration data giving indicated versus actual flows at 0%, 25%, 50%, 75% and 100% shall be provided with the meter. A certification letter shall accompany the computer printout of the calibration data for each meter referencing the meter's serial number. The accuracy of the metering system shall be 1% of rate from 10% to 100% of flow for maximum flow velocities of 3 to 31 feet per second. This information shall be provided to TOHO prior to the SEWER lift station start-up inspection.

Complete zero stability shall be an inherent characteristic of the meter system to eliminate the need to zero adjust the system with a full pipe at zero flow.

The meter housing shall be splash-proof and weather resistant design. The meter shall be capable of accidental submergence in up to 30 feet of water for up to forty-eight (48) hours without damage to the electronics or interruption of the flow measurement.

45.6.3 WARRANTY AND SERVICE

All items associated with the flow meter shall be guaranteed to be free from defects in material and workmanship under normal use and service for a period of two (2) years after a successful start-up inspection.

Service shall be available for in situ repair of the products. Manufacturer's repair personnel shall provide a reasonable response time of not more than two (2) days.

45.7 CHAIN LINK FENCE

45.7.1 GENERAL

The CONTRACTOR shall furnish and erect the chain link fence and gate in accordance with this MANUAL and in conformity with the lines, grades, notes, and typical sections shown on the PLANS and the STANDARD CONSTRUCTION DETAILS Toho-31.0, Standard Lift Station and Toho-31.1 Miscellaneous Lift Station I. Fencing shall conform to FDOT Roadway and Traffic Design Standards, January 2004, Fence type "B". Gates shall be swing type per ASTM F900 unless otherwise authorized. Cantilever slide Gate type "B" shall be considered on a case-by-case basis.

45.7.2 MATERIALS

The fabric, posts, fastenings, fittings, and other accessories for chain link fence shall be vinyl coated in black and meet the requirements of AASHTO M 181 with the following changes:

- The weight of coating of wire fabric shall be 1.8 ounces of zinc per square foot (Class B)
- The galvanizing of steel materials shall be hot-dipped galvanized
- The weight of coating on posts and braces shall be 1.8 ounces of zinc per square foot, both inside and outside to meet the requirements of AASHTO M 111
- The base metal of the fabric shall be a good commercial quality 9-gauge steel wire. The fabric shall be of uniform quality and shall be 6' high with a 2" mesh size

All posts and rails shall be in accordance with the following schedule:

- End, corner, and pull posts - 2 3/8" O.D., Schedule 40
- Line posts and gate frames - 2" O.D., Schedule 40
- Gate posts - 3" O.D., Schedule 40
- Post braces and top rail - 1 5/8" O.D., Schedule 20

Tension wire shall be 0.1443" steel or 0.1875" alloy coiled spring wire tensioned along the bottom of the fabric and shall be coated similarly to the wire fabric.

Miscellaneous fittings and hardware, including three (3) strands of barbed wire, shall be zinc coated commercial quality or better steel or zinc coated cast or malleable iron as appropriate for the article. Post caps, designed to provide a drive fit over the top of the tubular post to exclude moisture, shall be provided.

45.7.3 INSTALLATION

All posts shall be set 3 feet deep in concrete footings, 12" diameter for line posts. Gate and corner post footings shall be 24" diameter.

After the post has been set, aligned, and plumbed, the hole shall be filled with 2500 psi concrete. The concrete shall be thoroughly worked into the hole to leave no voids. The exposed surface of the concrete shall be crowned 1/2" above finished grade to shed water.

End, corner, pull and gate posts shall be braced to the nearest post with horizontal brace used as a compression member and a galvanized 3/8" steel truss rod and truss tightener used as a tension member. Corner posts and corner bracing shall be constructed at all changes of fence alignment of 30 degrees or more. All chain link fences shall be constructed with a top rail and bottom tension wire.

Swing gates shall be two (2) 8-foot wide double hung gates as indicated on the STANDARD CONSTRUCTION DETAILS Toho-31.0, Standard Lift Station and Toho-31.1 Miscellaneous Lift Station I and hinged to swing through 180 degrees from closed to open and shall be complete with latches, locking device, stops (slotted mushroom type), keeper, hinges, fabric, and braces. Gates shall be the same height as the fence and the gate materials shall be the same as the fence materials.

The fabric shall not be placed until the posts have been permanently positioned and concrete foundations have attained adequate strength. The fabric shall be placed by securing one end and applying sufficient tension to remove all slack before making permanent attachments at intermediate points. There shall be a gap between the bottom of the fabric and finished grade of no less than 1" and no more than 2".

The fabric shall be fastened to all corner, end and pull posts by substantial and approved means. Tension for stretching the fabric shall be applied by mechanical fence stretchers.

45.8 PRE-CAST CONCRETE WALLS

Where required by other regulatory agencies, TOHO may allow the DEVELOPER to construct a pre-cast concrete wall around the perimeter of the SEWER lift station in accordance with this MANUAL and in conformity with the lines, grades, notes, and typical sections shown on the PLANS and the STANDARD CONSTRUCTION DETAILS Toho-31.0, Standard Lift Station and Toho-31.1 Miscellaneous Lift Station I. Pre-cast concrete walls shall contain at a minimum:

- 8-foot pre-cast removable wall panels
- Anti-climb measures permanently affixed to the top of all panels, gates and posts
- Sufficient signage on all sides of the SEWER lift station indicating the presence of anti-climb measures on the top of all panels. These signs shall be provided with both English and Spanish warnings.
- Solid aluminum or steel gates, no wood boards, slats, or paneling shall be permitted
- Casings for all WATER and SEWER utilities that cross under a wall section.
- 8"x8" ventilation holes in each wall section centered within the bottom 12" of each section.

45.9 ODOR CONTROL SYSTEM

The system shall be designed according to the volume of the SEWER lift station wet well. Odor control unit not to be over 12 feet tall, and in no case smaller than 500 CFM. The odor control system shall be mounted on a single skid anchored to a concrete slab designed to fit the skid and weight of the unit. Two-phase odor control units shall be required at TOHO's discretion based upon flow, SEWER age, storage times, and proximity to other buildings.

Provide a main breaker for the Odor Control System in the main SEWER lift station control panel. Odor control system shall be connected to TOHO's SCADA system for monitoring.

Only biological odor control systems shall be allowed. Chemical scrubber type systems are not permitted.

45.10 REQUIRED SUBMITTALS

Submittals shall be provided to TOHO in quadruplicate (minimum) and include the following:

- Shop and structural drawings showing all details of construction, dimensions, and anchor bolt locations.
- Descriptive literature, bulletins, and/or catalogs of the equipment.
- Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, submergence and horsepower. Curves shall be submitted on 8 ½" by 11" sheets, at as large a scale as is practical. Curves shall be plotted from no flow at shut off head to maximum manufacturer recommended pump capacity. Catalog sheets showing a family of curves shall not be acceptable.
- Complete layouts, wiring diagrams, elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the pump control system. Suitable outline drawings shall be furnished for approval before proceeding with manufacture of any equipment. Standard preprinted sheets or drawings simply marked to indicate applicability shall not be acceptable.
- A drawing showing the layout of the pump control panel shall be furnished. The layout shall indicate all devices mounted on the door and in the panel shall be completely identified.
- The weight of each pump.

Complete motor data shall be submitted including:

- Nameplate identification
- No-load current
- Full load current
- Full load efficiency
- Locked rotor current
- High potential test data
- Bearing Inspection report

45.11 ELECTRICAL GROUNDING SYSTEM

45.11.1 GENERAL

Cadweld connections shall be provided on the grounding rods and the counterpoise loop. Mechanical connections shall be provided on all other ground connections.

A grounding system shall be installed as per National Electrical Code, Local Codes and Ordinances. The PLANS shall clearly show the Electrical Grounding System. An underground perimeter cable grounding system shall be installed with connections to at least the following equipment:

- 4 corner posts
- Gate posts, gate, and fence
- Water service
- Control panel
- Wet well hatch and handrail
- Discharge piping.
- All metal conduit entries into the control panel by way of grounding bushings
- Generator
- Odor control system
- Main disconnect switch
- Utility company transformer
- Service disconnect switch
- Telemetry panel

45.11.2 MATERIAL AND INSTALLATION

The PLANS shall show details of material and installation to construct a completely functional and operational electrical grounding system.

The wet well frame and cover shall be grounded from the exterior.

45.12 INSPECTION AND TESTING

A factory representative knowledgeable in pump operation and maintenance shall inspect and supervise a test run at the SEWER lift station covered by this MANUAL. A minimum notification to TOHO of ninety-six (96) business hours shall be provided for the inspections. Additional time made necessary by faulty or incomplete WORK or equipment malfunctions shall be provided as necessary to meet the requirements in the MANUAL at no additional cost to TOHO Upon satisfactory completion of the test run; the factory representative shall issue the required manufacturer's certificate.

The test run shall demonstrate that all items of the MANUAL have been met by the equipment as installed and shall include, but not be limited to, the following tests:

- That all units have been properly installed
- That the units operate without overheating or overloading any parts and without objectionable vibration
- That there are no mechanical defects in any of the parts
- That the pumps can deliver the specified pressure and quantity at all design points
- That the pumps are capable of pumping the specified material
- That the pump controls perform satisfactorily

The Odor Control system shall be 3rd party tested prior to start up by an accredited testing laboratory such as UL or FM.

45.13 DRIVEWAY

A minimum 14 foot wide with 3' flair on each side, concrete paved access road shall be provided from the nearest public roadway. Curb, if present, shall have a 20-foot cut for the access road.

Roadway shall include deeded easement or dedicated right-of-way.

Roadway shall minimally consist of:

- 12" minimum stabilized sub-grade.
- Concrete surface (3000 PSI, Type 2 cement) a minimum of 8" thick, reinforced with 6" x 6" wire mesh, H-20 traffic loading.

END OF SECTION 45

SECTION 46 - SUBMERSIBLE SEWER PUMPS

46.1 GENERAL

The equipment covered by this MANUAL is intended to be standard pumping equipment of proven ability as manufactured by a reputable firm having at least five (5) years of experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods, and shall operate satisfactorily when installed as shown on the PLANS and STANDARD CONSTRUCTION DETAIL Toho-31.0, Standard Lift Station.

All parts shall be so designed and proportioned as to have liberal strength and stiffness and to be especially adapted for the WORK to be done. Ample space shall be provided for inspection, repairs, and adjustment. All necessary foundation bolts, plates, nuts, and washers shall be furnished by the equipment manufacturer, and shall be of Type Stainless steel 316 nameplates giving the name of the manufacturer, voltage, phase, rated horsepower, speed, and any other pertinent data shall be attached to each pump. Duplicate information shall be provided on an adhesive-backed, waterproof nameplate to be affixed to the interior of the control panel. The nameplate rating of the motors shall not be exceeded.

The pumps shall be capable of handling raw unscreened domestic SEWER and minimum 3" diameter solid spheres. Pump operation shall be controlled automatically by means of a level transducer or liquid level float sensors as in the wet well as specified on the DRAWINGS. Pumps shall be mounted in the wet well as shown on the PLANS and STANDARD CONSTRUCTION DETAILS Toho-31.0, Standard Lift Station and Toho-31.2 Miscellaneous Lift Station II.

Pumps shall be field tested and certified by manufacturer's representative. Certifications and guarantees shall be supplied to TOHO before acceptance.

46.2 PUMP CONSTRUCTION DETAILS

46.2.1 SHAFT

The pump shaft shall be of Series 300 or 400 stainless steel or carbon steel. When a carbon steel shaft is provided, the manufacturer shall demonstrate that any part of the shaft which shall normally encounter the SEWER has proven to be corrosion resistant in this application. The shaft and bearings shall be adequately designed to meet the maximum torque required for any start-up or operating condition and to minimize vibration and shaft deflection. As a minimum, the pump shaft shall rotate on two (2) permanently lubricated bearings. The upper bearing shall be a single row ball bearing. The lower bearing shall be a two (2) row angular contact ball bearing, if required to minimize vibration and provide maximum bearing life.

46.2.2 IMPELLER

The impeller shall be constructed of gray cast iron, ASTM A-48, class 30 with shop applied marine grade enamel. All external bolts and nuts shall be of series 304 or 316 stainless steel. Each pump shall be provided with a replaceable metallic wear ring system to maintain pump efficiency. As a minimum one (1) stationary wear ring provided in the pump volute or one (1) rotating wear ring provided on the pump impeller shall be required. A two (2)-part system is acceptable. The impeller shall be a non-clog design to achieve self-cleaning ability.

46.2.3 MECHANICAL SEAL

Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir, composed of two (2) separate lapped face seals, each consisting of one (1) stationary and one (1) rotating tungsten carbide or silicon carbide ring with each pair held in contact by a separate spring, so that the outside pressure assists spring compression in preventing the seal faces from opening. The compression spring shall be protected against exposure to the pumped liquid. The pumped liquid shall be sealed from the oil reservoir by one (1) face seal and the oil reservoir from the air-filled motor chamber by the other. The seals shall require neither maintenance nor adjustment and shall be easily replaced. Conventional double mechanical seals with a single spring between the rotating faces, requiring constant differential pressure to effect sealing and subject to opening and penetration by pumping forces, shall not be considered equal to tandem seal specified and required.

46.2.4 BEARINGS

Motor shaft bearings shall have a minimum life of 40,000 hours, ANSI B10.

46.2.5 GUIDES

A sliding guide bracket shall be an integral part of the pump casing and shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the wet well with 300 series stainless steel anchor bolts and so designed as to receive the pump discharge flange without the need of any bolts or nuts. Sealing of the pumps to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided by no less than two (2) 300 series seamless 2" minimum tubular 316 stainless steel guides which shall press it tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection by means of a diaphragm or similar method of sealing shall not be approved as an equal to a metal-to-metal contact of the pump discharge and mating discharge connection specified and required. Approved pump manufacturers, if necessary to meet the above specification, shall provide a sliding guide bracket adapter. The design shall be such that the pumps shall be automatically connected to the discharge piping when lowered into place on the discharge connection.

The pumps shall be easily removable for inspection or service, requiring no bolts, nuts, or fastenings to be removed for this purpose, and no need for personnel to enter the wet well.

46.2.6 PUMP BASE PLATE

Pump base should be made from a single cast and must not require any bolts to hold or attach any parts.

46.3 MOTORS

46.3.1 GENERAL REQUIREMENTS

All motors shall be built in accordance with latest NEMA, IEEE, ANSI and AFBMA Standards where applicable. Pump motors shall be housed in an air-filled, watertight casing and shall have at a minimum Class F insulated winding, which shall be moisture resistant. Motors shall be NEMA Design B, rated 155° C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation, in a totally, partially or non-submerged condition. The pump shall be capable of running continuously in a non-submerged condition at any point along the pump curve under full load without damage, for extended periods. The motor shall be capable of a minimum of 10 starts per hour. If required by TOHO before final acceptance, a field running test demonstrating this ability, with twenty-four (24) hours of continuous operation under the above conditions, shall be performed for all pumps being supplied.

Motors shall be rated 480 volt, 3 phase and speed shall be a nominal 1750 RPM.

All motors shall be supplied with integral lifting hooks to facilitate removal and replacement.

46.3.2 HEAT AND MOISTURE SENSORS

Each motor shall incorporate a minimum of one (1) ambient temperature compensated overheat sensing device and one (1) moisture sensing device. These protective devices shall be wired into the pump controls in such a way that if excessive temperature or moisture is detected the pump shall shut down. These devices shall be manually reset.

In lieu of moisture and temperature sensors, each pump motor shall have its motor winding insulation resistance monitored automatically by an automatic megger solid-state electronics module. Each automatic megger shall have an individual disconnect terminal plug, manual shut off switch, three (3) lights to indicate 10 Mohm, 5 Mohm, and 1 Mohm, resistance values, two (2) output circuits for external alarms, and two (2) switches for manual testing. The power source shall be 110 VAC fused at 0.24 AMP. The test voltage shall be 500-700 VDC. The automatic megger shall monitor the motor resistance only when the motor is off and shall activate an alarm system when the motor resistance drops to 1 Mohm.

46.3.3 CABLES

Cables shall be designed specifically for submersible pump applications and shall be properly sealed. A type CGB watertight connector with a neoprene gland shall be furnished with each pump to seal the cable entry at the control panel. All cables shall be continuous without spikes from the motor to the control panel.

46.4 SHOP PAINTING

Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt, and other foreign matter. All pumps and motors shall be shop coated with a corrosion resistant paint proven to withstand an environment of raw SEWER. All nameplates shall be properly protected during painting.

Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to TOHO up to the time of the final acceptance test.

46.5 HANDLING

All parts and equipment shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation. Finished surfaces of all exposed pump openings shall be protected by wooden planks, strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

46.6 WARRANTY

The pump manufacturer shall warrant the units being supplied to TOHO against defects in workmanship and material for a period of five (5) years or 10,000 hours, whichever comes first. The warranty shall not be prorated and shall begin at the time of a successful SEWER lift station start-up inspection. The DEVELOPER and/or CONTRACTOR shall be responsible for securing an additional warranty period to meet the minimum five (5) years or 10,000 hours from the time of a successful SEWER lift station start-up inspection if required.

46.7 REPLACEMENT PUMPS

The developer/contractor shall provide a spare pump of the same size, model and make to TOHO before final acceptance of the station.

END OF SECTION 46

SECTION 47 – SEWER LIFT STATION ELECTRICAL POWER AND CONTROL SYSTEM

47.1 GENERAL

This section specifies the electrical power and control system requirements for SEWER lift stations. These requirements apply to duplex pump panels. Similar requirements shall apply when more than two (2) pumps are involved except for the quantity of control equipment and panel size shall be increased accordingly. The manufacturer of the control panel shall provide data to indicate that the manufacturer has a minimum of 3 years of experience in the building of pump control panels.

A SEWER lift station control panel shall be provided for each SEWER lift station. The control panel shall respond to a level transducer or liquid level float regulators to automatically start and stop pumps as well as sound an alarm upon high wet well levels. The control panel shall operate submersible pumps at the power characteristics stipulated. The control function shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the lag pump(s) shall automatically start to handle the increased flows. As the flow decreases, pumps shall be cut off at elevation as shown on the PLANS. Pumps shall alternate positions as lead pump at the end of each cycle.

The control panel shall consist of main circuit breaker and reduced voltage soft starters or variable frequency drives (VFDs) for each pump motor, 15-amp 120 volt circuit breakers, and other equipment as outlined in the STANDARD CONSTRUCTION DETAILS Toho-31.0, Standard Lift Station and Toho-31.3 Lift Station Panel Rack. All pump control operations shall be accomplished by a level transducer or liquid level float sensors. Control switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select or automatically alternate the position of the lead and lag pumps after each pumping cycle.

A level transducer or liquid level float sensors shall continuously monitor wet well liquid level and control operation of the low-level cutoff for the pumps and shall operate off a 24 volt circuit.

47.2 PANEL CONSTRUCTION

The duplex pump panel shall be housed in a NEMA 4X Type 316 14gauge stainless steel enclosure with 30% extra mounting space for additional equipment. The enclosure shall be provided with a sun shield across the panel top. This shield shall also be NEMA4X Type 316 14gauge stainless steel and be elevated above the panel top by 1" with stainless steel rods and hardware. Enclosure shall have provisions for padlocking the door and a dead-front clear Lexan inner door unit for mounting controls. All exterior hardware and hinges shall be stainless steel.

There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10" x 12" pocket for log sheet storage. The nameplate shall contain the following information:

- Voltage
- Phase
- Rated horsepower
- Speed
- Date manufactured
- Pump and control panel manufacturer's name, address and telephone number
- Pump data, including impeller data, operating point and head, KW input, and amps at the operating point and at least two (2) other points on the pump curve

The control panel enclosure shall be Underwriters Laboratories (UL) 50 Type 3 listed.

The control panel shall be mounted such that it can withstand a 120 MPH wind load.

An interior LED panel light shall be provided and shall utilize a selector switch on the interior door of the panel.

47.3 POWER SUPPLY AND MAIN DISCONNECT

Power supply to the control panel shall be 480 volt, 3 phase, 4 wire. Minimum service shall be 100 AMP. Single-phase power shall not be approved, and phase converters shall not be used.

Non-fusible safety service main disconnects shall be installed at all stations. Disconnect shall be installed ahead of the meter. A non-fusible disconnect shall be installed after the meter. LED power available indicators shall be supplied on all legs.

47.4 CIRCUIT BREAKERS

47.4.1 MAIN BREAKERS

The panel shall have an inter-lock system between the normal power main breaker and the emergency breaker to ensure only one (1) breaker is in the on position at a time. Both breakers shall be equal in size.

47.4.2 CIRCUIT BREAKERS

All circuit breakers shall be heavy-duty molded case breakers. The handle on the circuit breakers shall be operational through the inner door.

47.5 MOTOR CIRCUIT PROTECTORS

Each pump motor shall be protected by a 3-pole motor circuit protector. The motor circuit protector shall be operated by a toggle type handle and shall have a quick-make quick-break over center switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against a short circuit and abnormal currents which cause the motor circuit protection to trip. Tripping shall be clearly indicated by the handle automatically assuming a position midway between the normal ON and OFF positions. All latch surfaces shall be ground and polished. All poles shall be so constructed that they open, close, and trip simultaneously. Motor circuit protector shall be completely enclosed in a high strength glass polyester molded case. Ampere ratings shall be clearly visible. Contacts shall be of non-welding silver alloy. Arc extinction shall be accomplished by means of arc chutes. Each pole of these motor circuit protectors shall provide instantaneous short circuit protection by means of an adjustable magnetic-only element.

47.6 MOTOR STARTER AND SELECTOR SWITCHES

The control panel shall contain the reduced voltage soft start motor starters. Power provider regulations shall govern.

Selector switches shall be installed on the face of the inner door unit. Selector switch shall be a heavy-duty oil tight Hand-Off-Auto three (3) position switch to control the operation mode of each pump motor starter.

All motors 10 hp and above shall be equipped with an approved soft start mechanism.

47.7 LIGHTS AND ALARMS

47.7.1 INDICATOR LIGHTS

There shall be installed on the face of the inner door unit, heavy duty oil tight indicator lights.

47.7.2 HIGH LEVEL ALARM

A vapor proof red light and horn shall be mounted on the side of the panel for high-level alarm. Also, there shall be an alarm silence push-button on the inner door and a silence relay, which shall silence the horn and automatically reset when these signals are restored to normal. The pushbutton shall be heavy-duty oil tight. The red globe shall be the screw on type.

47.7.3 MOTOR HIGH TEMPERATURE AND LEAK INDICATION

Motor high temperature and leak detection shall be provided. Upon high temperature or leak detection, contacts shall close, energizing panel mounted lights on the inner door and sending 120 VAC signals to the RTU to signal pump failure. Manual resets shall be provided on the inner door.

47.8 EMERGENCY POWER RECEPTACLE

The panel shall have external mounted 3P4W generator receptacle of the required size with a sealing lid that can be secured. Receptacle lid shall be hinged with a permanent effective way to close and seal when not in use.

All stations will get the 3P4W generator receptacle, this will facilitate if a portable unit is needed if the stationary unit goes down.

47.9 ADDITIONAL REQUIREMENTS

47.9.1 WIRING

All power wires shall be thermoplastic high heat nylon (THHN), machine tool wire (MTW) or equivalent 75-degree C insulated stranded copper conductors and shall be appropriately sized for the given load application. All control circuit wire shall be type THHN; Size 14, stranded type. All wiring within the enclosure shall be neatly routed using slotted type wiring duct with snap on type covers.

Wiring on the rear of the inner door shall be neatly bundled with nylon ties and include sufficient loop across the hinges to prevent wire damage, with each end of conductor marked (I.D.), 24 volt wire shall be red, 120 volt wire shall be white/black/neutral.

47.9.2 TERMINAL POINTS

Terminal points of all terminal strips shall be permanently identified. All terminal numbers and identifying nomenclature shall correspond to and be shown on electrical diagrams. All wiring shall be permanently shown on electrical schematic diagrams.

47.9.3 ENGRAVED NAMEPLATES

All circuit breakers, control switches, indicator pilot lights and other control devices shall be identified with legend plates and rigid phenolic engraved plates which are to be permanently affixed with mechanical fasteners.

47.9.4 SURGE PROTECTORS

Surge protectors shall be included and wired to protect motors and control equipment from lightning induced line surges. Surge protectors shall have a response time of picoseconds and be capable of dissipating high levels of line side surge energy, without damage to SEWER lift station equipment and controls. All surge protectors shall be U.L. approved and installed per respective power company requirements and manufacturer's specifications, primary surge protectors shall be attached to the main disconnects. LED power available indicators shall be supplied on all legs.

All surge protectors shall be NEMA 4x rated and shall be installed immediately after the second disconnect with the shortest leads possible provided.

47.9.5 ELAPSED TIME METERS

Elapsed time meters shall be 115V non-reset type and shall totalize pump running time in hours and tenths of hours to 99999.9 hours.

47.9.6 CONVENIENCE RECEPTACLE

On the face of the inner door unit, there shall be installed a 15 AMP 120V, duplex convenience 3P4W receptacle. It shall be provided with its own single pole ground fault interrupt 15-amp circuit breaker for protection.

47.9.7 CONTROL TERMINAL BLOCKS

Control terminal blocks shall be of the clamp screw type rated for 600V. Amperage rating shall accommodate the control circuit amperage. The minimum number of terminals provided shall be 30 single stacked or 20 double stacked.

Terminal blocks located in sacrificial boxes shall utilize stainless steel hardware.

47.9.8 CONTROL POWER TRANSFORMERS

Control power transformers are required for all control panels. The minimum size shall be 3kVA to provide 120V AC power to all items in the control panel as required by the electrical drawings or as determined by TOHO.

The signal required by the high-level float and relays shall be 24VAC. This shall be provided by a 24VAC control power transformer properly sized with a fused secondary.

47.9.9 CONTROL RELAY

The high-level control float relay shall be enclosed, plug-in 8 pin type with octal-style screw terminal sockets.

47.9.10 ELECTRICAL SCHEMATIC

There shall be permanently affixed to the interior side of the exterior enclosure door a laminated electrical schematic diagram with a copy supplied to TOHO personnel at start-up for all components per the STANDARD CONSTRUCTION DETAIL Toho-31.6, Lift Station Control Panel Schematic. The schematic diagram shall include the rated amperage and voltage for all components.

47.9.11 PHASE MONITOR

All lift stations shall require a plug-in type phase monitor for protection of electrical components due to phase loss.

47.9.12 AREA LIGHT

Area light shall be light emitting diode (LED) with a minimum 5,000 lumen rating. The fixture shall be mounted to the control panel support per the STANDARD CONSTRUCTION DETAILS Toho-31.0, Standard Lift Station and Toho-31.3 Lift Station Panel Rack. Light fixture shall be capable of withstanding a 120 MPH wind load.

47.9.13 TELEMETRY (RTU / ETHERNET)

DEVELOPER shall be responsible for purchasing the RTU directly from TOHO. TOHO will furnish and install the RTU prior to or at the SEWER lift station Pre-Start inspection.

47.10 TESTING, SERVICE AND WARRANTY

47.10.1 TESTING

After fabrication in the control panel manufacturer's plant, an operational test shall be performed to check out the entire panel before delivery. Three (3) phase source voltage to which the panel is intended for shall be used for the testing.

47.10.2 SERVICE

The control panel manufacturer shall maintain a service organization in the area that is available for service.

47.10.3 WARRANTY

The control panel manufacturer and/or CONTRACTOR shall warrant the equipment being supplied to TOHO against defects in workmanship and material for a period of five (5) years. The warranty shall not be pro-rated and shall begin at the time of a successful SEWER lift station start-up inspection. The DEVELOPER and/or CONTRACTOR shall be responsible for securing an additional warranty period to meet the minimum five (5) years from the time of a successful SEWER lift station start-up inspection if required.

END OF SECTION 47

PART 2 - SPECIFICATIONS

**DIVISION V – WATER, REUSE, AND SEWER PRESSURE
PIPE**

SECTION 50 - PIPE MATERIAL FOR WATER, REUSE, AND SEWER PRESSURE MAINS AND WATER AND REUSE SERVICE CONNECTIONS

50.1 GENERAL

These SPECIFICATIONS cover the pipe, fittings, and accessory items used for pressure mains including WATER, REUSE, and SEWER force mains.

Where SEWER is referenced in this section, it shall apply solely to pressurized pipe conveying raw sewage from a SEWER lift station.

Pipe used in WATER and REUSE distribution systems and SEWER force main collection systems shall be either polyvinyl chloride pipe (PVC), ductile iron pipe (DIP) or high-density polyethylene (HDPE). Pipe used in directional bore and service connections applications shall be high-density polyethylene pipe (HDPE).

Above ground WATER and REUSE pipe and buried pipe with less than 36" of cover or less than 6" of vertical clearance with other piping or structures or where traffic load is a concern shall be ductile iron pipe.

Above ground SEWER force main pipe shall be ductile iron pipe. SEWER pipe buried with less than 36" of cover or less than 6" of clearance from a WATER or REUSE main shall be DR11 HDPE.

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of Project Acceptance. The CONTRACTOR shall replace all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by TOHO, furnish certificates, affidavits of compliance, test reports, or samples for analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.

50.2 PIPE INSPECTION

Requirements specified in Section 40.5 shall apply.

50.3 PVC PIPE

50.3.1 PVC PIPE

All PVC pipe shall be manufactured in accordance with AWWA standard C900/905, latest edition.

PVC pipe for WATER and REUSE shall have a minimum working pressure rating of 150 psi and shall have a dimension ratio (DR) of 18.

PVC pipe for SEWER shall have a minimum working pressure rating of 100 psi or 1.5 times the operating pressure, whichever is greater, and shall have a maximum dimension ratio (DR) of 25. Where pipe restraint is required, SEWER pipe shall be DR18.

Pipe shall be the same O.D. as ductile iron pipe. Pipe shall be blue in color for WATER, purple for REUSE, and green for SEWER.

50.3.2 JOINTS

PVC pipe shall be integral bell, push-on type joints.

50.3.3 FITTINGS

Fittings used with PVC pipe shall conform to Section 50.4

50.4 DUCTILE IRON PIPE AND FITTINGS

50.4.1 DUCTILE IRON PIPE

All ductile iron pipe of nominal diameter 4" through 54" shall conform to ANSI/AWWA A21.51/C151. A minimum of Pressure Class 150 pipe shall be supplied for all sizes of pipe unless specifically called out in the PLANS or required by TOHO.

All testing of ductile iron pipe required by AWWA A21.51 shall be conducted in testing and laboratory facilities located in the US and shall follow all applicable governing laws and regulations. Such test results shall be certified by an ENGINEER.

Ductile iron pipe shall be handled during manufacture and shipped afterwards without nesting, which is without insertion of one (1) pipe inside another.

50.4.2 FITTINGS

Underground fittings required shall be mechanical joint ductile iron conforming to ANSI/AWWA A21.10/C110 or C153, 250 psi minimum pressure rating. All WATER and REUSE fittings shall have NSF-certification.

Above ground fittings on DIP shall be flanged with 316 stainless steel bolts, nuts, and washers. Flanged fittings shall conform to ANSI Standard B16.1-125LB.

50.4.3 JOINTS

Joints for ductile iron pipe shall be push on or mechanical joints conforming to ANSI/AWWA A21.11/C111. Where called for in the PLANS, restrained or flanged joints shall be provided.

Above ground flanged joints shall conform to ANSI Standard B 16.1-125 LB with 316 stainless steel bolts, nuts, and washers.

Restrained joints shall conform to Section 35 of this MANUAL.

50.4.4 COATINGS AND LININGS

Where ductile iron pipe and fittings are to be installed above ground, pipe, fittings, and valves shall be thoroughly cleaned and given one (1) field coat of rust inhibitor primer. Intermediate and finished field coats of Alkyd Enamel shall also be applied by the CONTRACTOR to ductile iron pipe and fittings installed above ground. Each field applied coat of primer and enamel shall be minimum 1.5 mill dry thickness for a total thickness of 4.5 mil. Primer and field coats shall be compatible and shall be applied in accordance with the manufacturer's recommendations. Final field coat color shall be blue for WATER, Pantone purple for REUSE, green for SEWER, or other as directed by TOHO.

All ductile iron pipe and fittings for WATER and REUSE shall have an interior protective lining of cement mortar with a seal coat of asphaltic material in accordance with ANSI/AWWA A21.4/C104.

All ductile iron pipe and fittings for SEWER shall have an interior protective lining of Protecto 401 epoxy, Permax Pipe Glaze, PC3-9043 Type II Glass-Flake Filled Epoxy Pipe Coating, or American Poly-bond with a minimum dry film thickness of 40 mils applied by the pipe manufacturer.

50.4.5 POLYETHYLENE ENCASEMENT

The pipe shall be polyethylene encased with a minimum 8 mil thickness where shown on the PLANS or required by TOHO in accordance with ANSI/AWWA A21.51/C105.

All ductile iron pipe shall be polyethylene encased when crossing or within 20' of power or gas easements, gas mains or if aggressive soils exist.

Polyethylene wrap shall be blue for WATER, purple for REUSE, and green for SEWER.

50.5 HDPE PIPE

50.5.1 POLYETHYLENE PIPE

All polyethylene pipe of nominal diameter 4" through 12" shall be manufactured in accordance with AWWA Standard C906, PE3408 latest edition. Polyethylene pipe for WATER and REUSE shall have a minimum working pressure rating of 160 psi and shall have a dimension ratio (DR) of 11. Polyethylene pipe for SEWER shall have a minimum working pressure of 100 psi and shall have a maximum dimension ratio (DR) of 17.

Pipe shall be DI pipe size with an inner diameter hydraulically equivalent to the upstream and downstream pipe material and size.

Pipe shall have embedded color stripes, blue for WATER, purple for REUSE, or green for SEWER.

HDPE pipe larger than 12" shall be reviewed and approved by TOHO on a case-by-case basis.

50.5.2 JOINTS

HDPE shall have butt fused fusion-bonded joints.

50.5.3 FITTINGS

Adapters connecting HDPE to DIP or PVC shall be butt-fused per ASTM D 3261, mechanical joint end only.

50.6 WATER AND REUSE SERVICES

50.6.1 SERVICE PIPE

All service lines shall be 1", 1-1/2", or 2" PC200, SDR9, polyethylene tubing conforming to specifications in AWWA C901, AWWA 800, PE3608 and NSF-61. Larger service pipe shall be as specified in Sections 50.3, 50.4, and 50.5. Provide 3M marker tape up to the curb stop on all services at a depth not to exceed 4'. Pipe shall be blue for WATER and purple for REUSE

50.6.2 STOPS

Corporation stops for WATER or REUSE services installed with new mains shall be 1" with CC thread or 1-1/2" or 2" with male iron pipe (MIP) thread inlet and pack joint outlets for connecting polyethylene tubing and in accordance with AWWA C800. Insert stiffeners are not allowed.

Corporation stops for new WATER or REUSE services installed on existing mains shall be 1" with CC thread or 1-1/2" or 2" with male iron pipe (MIP) thread inlet and female iron pipe (FIP) outlet with pack joint adapter for connecting polyethylene tubing and in accordance with AWWA C800.

2" and larger services shall have resilient wedge gate valves as specified in Section 52.2.

Curb stops shall be pack joint inlet, lockable equipped with connections compatible with the polyethylene tubing. 3/4" and 1" curb stops shall have swivel meter nut outlets. 1-1/2" and 2" curb stops shall be provided with 2-bolt flanged outlets. Insert stiffeners are not allowed.

50.6.3 FITTINGS

Fittings shall be no-lead brass, cast and machined in accordance with specifications in AWWA C800 with compatible polyethylene tubing connections.

50.6.4 SERVICE SADDLES

Direct taps are not permitted. Taps shall be accomplished using stainless steel double strap saddles. For taps larger than 2", refer to Section 36.

50.6.5 METER VAULTS

Meter vaults shall be manufactured from polymer concrete and fiber reinforced resin with a minimum traffic rating of 10,400-pound load designation from ASTM C857 A-8. Meter Vaults shall include a monolithic vault and bottom and removable cover with drop in reader doors. Vault shall be assembled with a manifold piping system that includes a 2" inlet and outlet pipe, a U-branch for each double set of meters, a curb stop for each individual meter setting, and a 2" corporation stop downstream of the last meter branch.

Wall penetrations shall be made with watertight gaskets. #57 stone shall be placed below meter vault a minimum of 6" deep and extending 6" beyond the vault in each direction. Bottom of vault shall have a minimum of four (4) 1" weep holes in the bottom. Vault shall be wrapped in filter fabric.

Meter assembly shall include a PVC pipe spacer in the place of the meter which shall be removed after all required testing is completed and before meters are requested. All pipe materials and fittings shall be brass.

END OF SECTION 50

SECTION 51 - PIPE INSTALLATION FOR PRESSURE MAINS

51.1 GENERAL

Pipe shall be installed in accordance with the manufacturer's specifications and instructions for the type of pipe used and applicable AWWA standards, such as C600, unless otherwise stated in this MANUAL.

All new connections to an existing system, excluding individual services, shall require a temporary jumper per the STANDARD CONSTRUCTION DETAIL Toho-30, Temporary Jumper Connection.

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of Project Acceptance by TOHO. The CONTRACTOR shall replace, at their expense, all materials found to be defective or damaged in handling or storage.

The CONTRACTOR shall, if requested by TOHO, furnish certificates, affidavits of compliance, test reports, samples or check analysis for any of the materials specified herein.

The CONTRACTOR shall exercise extreme caution when excavating in proximity of all existing utilities. Utility line locations shown on PLANS are not exact or guaranteed. The CONTRACTOR is responsible for field verifying existing utility locations.

Where SEWER is referenced in this section, it shall apply solely to pressurized pipe conveying raw sewage from a SEWER lift station.

51.2 PIPE HANDLING

All types of pipe shall be handled in such manner as shall prevent damage to the pipe or coating. Any pipe with accidental or intentional damage to pipe or coating shall be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on properly prepared ground graded to eliminate all rock points and to provide uniform support along the full length. PVC pipe shall be covered with a material suitable to TOHO for protecting the pipe from UV rays while stored on the project site. When being transported or stored, the pipe shall be always supported in a manner which shall not permit distortion or damage to the lining or coating.

Joint gaskets shall be stored in a clean, dark, and dry location until immediately before use.

Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned, and re-laid. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug.

51.3 SEPARATION OF WATER, REUSE, AND SEWER MAINS

Horizontal and vertical separation between WATER, REUSE, and SEWER mains and storm piping shall be as described in Florida Administrative Code (FAC) 62-555.314 and STANDARD CONSTRUCTION DETAIL Toho-16, Pipe Clearances and Crossings.

If current FAC standards differ from the STANDARD CONSTRUCTION DETAIL Toho-16, Pipe Clearances and Crossings, the more stringent of the two shall apply.

51.4 TRENCH PREPARATION AND PIPE BEDDING

51.4.1 TRENCH PREPARATION AND PIPE BEDDING

Applicable provisions of Section 32 and the applicable STANDARD CONSTRUCTION DETAILS shall apply.

51.4.2 PIPE PREPARATION AND HANDLING

All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are being used. CONTRACTOR shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after laying or installation.

CONTRACTOR shall use proper procedures, tools, and facilities for the safe and proper protection of the WORK. CONTRACTOR shall lower pipe into the trench in such a manner as to avoid any physical damage to the pipe and shall remove all damaged pipe from the jobsite. Care shall be taken to not drop or dump pipe into trenches under any circumstances.

51.4.3 TRENCH DEWATERING AND DRAINAGE CONTROL

Specifications from Section 32 shall apply. CONTRACTOR shall prevent water from entering the trench during excavation and pipe laying operations to the extent required to properly grade the bottom of the trench and allow for proper compaction of the backfill. Pipe shall not be laid in water.

51.4.4 SURVEY LINE AND GRADE

Pipe shall be laid to the lines and grades shown on the PLANS. The CONTRACTOR shall provide line and grade stakes at a 100-foot maximum spacing and at all line and/or grade change locations.

CONTRACTOR shall provide Temporary Benchmarks at maximum 1000-foot intervals.

The minimum cover over WATER, REUSE, and SEWER mains shall be dictated by right-of-way requirements of applicable agency(s) and no less than 36" if in an easement. Minimum cover requirements shall be measured from the top of pipe to the bottom of the roadway base or finished grade in unpaved areas.

51.4.5 PIPE LAYING IN TRENCH

CONTRACTOR shall prevent foreign material from entering the pipe while it is being placed in the trench. CONTRACTOR shall remove all foreign material from the pipe or joint ring before the next pipe is placed. During laying operations, CONTRACTOR shall keep debris, tools, clothing, or other materials out of the pipe. Pipe shall be laid in dry conditions. Dewatering when necessary is required.

51.4.6 LAYING PVC PIPE

All PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL Handbook of PVC Pipe: Design and Construction latest edition, unless such standards conflict with this MANUAL in which case this MANUAL shall apply.

CONTRACTOR shall provide special tools and devices, such as special jacks, chockers, and similar items required for proper installation.

Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, for WATER piping.

51.4.7 LAYING DUCTILE IRON PIPE

All ductile iron pipes shall be installed in accordance with AWWA C600 unless such standards conflict with this MANUAL in which case this MANUAL shall apply. CONTRACTOR shall cut pipe only as necessary to comply with alignment shown on the PLANS. Flame cutting of pipe shall not be allowed. At times when pipe laying is not in progress; the open ends of the pipe shall be closed by a watertight plug or by other means approved by TOHO to ensure absolute cleanliness inside the pipe.

CONTRACTOR shall provide special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, for potable water piping.

Polyethylene encasement of all pipe sections shall consist of a minimum of one (1) foot of polyethylene overlap onto the adjacent pipe at both ends. All overlap material shall be secured in place with at least two (2) wraps of 1-½" x 8 mil polyethylene adhesive tape. Any slack liner material along the pipe barrel shall be taken up by folds secured in-place with adhesive tape. All rips, punctures or other damage to polyethylene shall require replacement of the polyethylene encasement.

Polyethylene encasement of all valves, fittings and specialty items shall be jointed with proper overlaps and fastening as described above. Prepare openings for service taps, air reliefs, etc., by making a cut in the polyethylene and temporarily folding back the edges. After installation is completed, replace the polyethylene and repair the cut with polyethylene adhesive tape.

Care shall be taken during backfilling so that no damage shall occur to the polyethylene encasement.

51.4.8 LAYING OF PIPES ON CURVES

Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflections at the joints. Maximum deflections at pipe joints and laying radius for the various pipe lengths shall not exceed 50% of that recommended by the pipe manufacturer. Deflections shall not be made by bending or deforming the pipe in any way.

51.4.9 PIPE RESTRAINT

Requirements specified in Section 35 shall apply.

51.4.10 BEDDING AND BACKFILL FOR PIPES

Requirements specified in Section 32 shall apply.

51.4.11 HDPE PIPE INSTALLATION

HDPE pipe installation shall follow the methods described ASTM F1962 in the most current versions of the "Plastics Pipe Institute Handbook", PPI MAB-7, "Guidelines for Use of Mini-Horizontal Directional Drilling for Placement of HDPE (PE4710) Pipe in Municipal Applications" and AWWA "M55 PE Pipe – Design and Installations Manual".

51.5 PIGGING

51.5.1 PIPE PIGGING

Cleaning of all WATER, REUSE, and SEWER main piping systems shall be accomplished by the controlled and pressurized passage through the system of a series of polyurethane plugs of varying dimensions, coatings, and densities (poly pigs), prior to hydrostatic testing.

The dimensions, coatings and densities of these poly pigs shall be determined by the more stringent requirement of the following:

- The characteristics of the system to be cleaned.
- The recommendation of the DEVELOPER'S ENGINEER.
- The recommendation of the manufacturer of the poly pigs.
- The recommendation of the CONTRACTOR whose specialty is in the use and application of the poly pig for cleaning of piping systems.

The minimum size of the final pig shall be two nominal sizes larger than the pipe being pigged.

Pig(s) shall be inserted into the system at a point or points as close to the beginning of the newly constructed piping system as is mechanically feasible, and as shown on the PLANS.

The poly pigs shall be inserted into the system and allowances shall be made to:

- Provide the means to induce flow from either the existing water system, or from an external source on the back of the pig to develop sufficient pressure to force the pig through the system.
- A means to control and regulate this flow.
- A means to monitor the flows and pressures introduced into the system.
- A means to connect and disconnect from the system without any disruption of service.

As an alternative, these other means may be utilized to enter the pigs into the system:

- Hand insertion.
- Loading the pigs into the piping as it is being installed. The INSPECTOR shall be present when the pigs are installed.
- Dismantling or opening the system mechanically to provide access for the insertion of the pigs.

The poly pigs shall be discharged from the end of the system. This discharge point may be through an existing fitting, or a fitting installed specifically for this purpose. In either case, the discharge port shall be sized to accommodate the poly pigs.

If the poly pigs are inserted in an existing system, means for extraction shall not cause any disruption of service.

The CONTRACTOR is to maintain a constant surveillance of the pigging procedure and immediately report any deviations from the established procedure, any inline problems, or any malfunctions to the INSPECTOR.

Should the pig exit the line being cleaned showing evidence of damage or in less than whole condition, a new pig shall be inserted at the beginning and the pigging process started again until the line is clear.

The CONTRACTOR is to maintain a record of the pigs, their sizes, styles and any other information pertinent to the pigging procedure. A copy of this documentation is to be given to the INSPECTOR.

The system shall be thoroughly cleaned of all foreign material that would not be found in a properly cleaned system. The cleaning shall provide a smooth interior periphery of the pipe because of the cleaning procedure.

51.6 HYDROSTATIC TESTS

51.6.1 GENERAL

Hydrostatic tests shall consist of pressure tests conducted on all newly laid pressure pipes, joints, and valves, including all service lines to the curb stops, after the main has been cleared and flushed per Section.

Tests shall be made on sections not exceeding 1,000 feet, or between valves, whichever is less. No loss is allowed. CONTRACTOR shall furnish all necessary equipment and material, make all taps, and furnish all closure pieces in the pipe as required. Equipment to be furnished by the CONTRACTOR shall include graduated containers, pressure gauges, hydraulic force pumps, and suitable hoses and piping. TOHO shall monitor and approve a satisfactory test. Multiple sections may be tested simultaneously providing there are dead sections (50 psi or less) in between each pressure tested section.

The CONTRACTOR shall conduct hydrostatic tests after the trench has been partially backfilled with the joints left exposed for inspection for their informational purposes only. The hydrostatic tests for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified.

Air testing of pressure pipes shall not be permitted under any circumstance.

51.6.2 TESTING CRITERIA

All WATER and REUSE pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 150 psi and all SEWER force main pipe sections shall be subjected to a hydrostatic pressure of 100 psi. The duration of each pressure test shall be for a minimum period of two (2) hours. If during the test, the integrity of the tested line is in question, TOHO may require a longer pressure test. The basic provisions of AWWA C600 shall be applicable.

The pressure gauge used shall be oil filled with a minimum 2" diameter face and have a 0-300 PSI range in 5 PSI increments.

51.6.3 PROCEDURE FOR PRESSURE TEST

Each section of pipe to be tested, as determined by TOHO shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, and appropriate valves installed to ensure bleeding of all air from the main.

If defective pipes, fittings, valves, or hydrants are discovered because of this pressure test, all such items shall be removed and replaced by the CONTRACTOR with sound material and the test shall be repeated until satisfactory results are obtained. Provisions of AWWA C600, where applicable, shall apply.

51.7 DISINFECTION OF WATER MAINS

51.7.1 GENERAL

Before being placed in service, all new WATER mains shall be cleaned and chlorinated in accordance with the specifications below and the procedures outline in AWWA C651 Standard Procedure for Disinfecting Water Mains.

Prior to any flushing, pigging or disinfection procedure, the CONTRACTOR shall provide a minimum of ninety-six (96) business hours' notice to the INSPECTOR.

51.7.2 PIPE CLEANING

Sections of pipe to be disinfected shall first be pigged according to Section 51.6.3. Any discharge from the cleaning of piping systems shall be to upland bermed areas or retention areas with no discharge to surface waters or wetlands wherever possible.

All WATER mains 4" and greater in diameter shall be pigged. All piping larger than the existing main that it is connected to shall be pigged.

All taps required for chlorination or flushing, or for temporary or permanent release of air shall be provided for by the CONTRACTOR as a part of the construction of WATER mains. After the disinfection, all such taps shall be sealed to the satisfaction of TOHO and shall be noted on the RECORD DRAWINGS.

51.7.4 DISINFECTION CRITERIA

Before being placed into service, all new mains, valves, hydrants, appurtenances and repaired portions of, or extensions to existing mains shall be chlorinated so that the initial chlorine residual is not less than 50 mg/l and that a chlorine residual of not less than 25 mg/l remains in the water after standing twenty-four (24) hours in the pipe. Chlorine residual shall be monitored and documented for the initial application and following a 24-hour contact period.

51.7.5 FORM OF APPLIED CHLORINE

Gas Chlorine is not allowed unless specifically approved by the ENGINEER and TOHO. Chlorine may be applied as a mixture of water and high-test calcium hypochlorite. CONTRACTOR shall assume responsibility for safe handling of chlorine and shall meet requirements of OSHA and other regulatory agencies for safe handling of chlorine.

51.7.6 POINT OF APPLICATION

The preferred point of application of the chlorinating agent is at the beginning of the pipeline extension or any valve section of it, and through a corporation stop inserted in the pipe where the existing system has been protected by an approved backflow device.

The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipeline extension. Alternate points of applications may be used when approved or directed by TOHO.

51.7.7 OPERATION OF TOHO VALVES

Valves shall be operated by TOHO personnel so that the chlorine solution in the line being treated shall not flow back into the line supplying the water.

51.7.8 RETENTION PERIOD

Treated water shall be retained in the pipe at least 24 hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least 25 mg/l.

51.7.9 CHLORINATING VALVES AND HYDRANTS

In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent and under normal operating pressure.

51.7.10 FINAL FLUSHING AND TESTING

Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its lengths shows upon test, a free chlorine residual not more than that normally carried in the system. Chlorinated water shall not be discharged to surface water.

After flushing, water samples collected on two (2) successive days from the treated piping system, as directed by TOHO shall show acceptable bacteriological results.

All such bacteriological analysis shall be performed at the CONTRACTOR'S expense by a private laboratory certified by the State of Florida and shall be witnessed by TOHO.

Proper chain of custody procedures shall be followed, and samples shall only be collected by certified laboratory personnel in the presence of TOHO personnel.

Copies of testing results and all related correspondence with the Florida Department of Environmental Protection (FDEP) shall be copied to TOHO.

51.7.11 REPETITION OF FLUSHING AND TESTING

Should the initial treatment result in an unsatisfactory bacteriological test, the disinfection, flushing and testing shall be repeated in accordance with FDEP regulations, AWWA C651, and this MANUAL.

51.8 NOTIFICATION AND CONNECTION TO EXISTING MAINS

All connections to existing mains shall be made by the CONTRACTOR only after the connection procedure and the work scheduling has been reviewed and approved by TOHO. The CONTRACTOR shall submit a written request to TOHO a minimum of five (5) working days prior to scheduling said connections. All requests shall outline the following:

- Points of connection, fittings to be used, and method of flushing and disinfection if applicable.
- Estimated construction time for all connections.
- A bypass method and schedule if the WORK necessitates

TOHO shall review the submittal within three (3) working days after receiving it and inform the CONTRACTOR regarding approval or denial of the request. If the request is rejected by TOHO, the CONTRACTOR shall resubmit the request modifying it in a manner acceptable to TOHO.

Connections shall only be made on the agreed upon date and time. All materials required to make the connection shall be onsite prior to beginning the WORK. If the CONTRACTOR does not initiate and complete the connection WORK in the agreed upon manner, the CONTRACTOR shall be required to reschedule the said connection by following the procedure outlined above.

The CONTRACTOR shall not operate any valves in the TOHO system unless witnessed by TOHO personnel.

51.9 WATER AND REUSE SERVICE PIPING AND CONNECTION

WATER and REUSE service piping and connection shall be installed as indicated in the STANDARD CONSTRUCTION DETAILS Toho-01.0, Typical Residential Water Service, Toho 01.1, Typical Potable & Irrigation Service and Toho-02.0, Typical Commercial Water Service. The location of all service lines shall be as shown on the PLANS and shall be single, double, or multiple service. The service line shall terminate in and approved meter box or meter vault. On curbed streets the exact location for each installed service shall be identified by etching a 3" "W" in the concrete curb for WATER services or "R" for REUSE services. Where no curb exists, locations shall be adequately marked by a 4" x 4" x 18" concrete marker with "W" indented in top for WATER services and "R" for REUSE services. Services shall be set so that meters shall be installed 12" – 24" feet on the property side of the R.O.W. line.

51.10 LOCATION AND IDENTIFICATION

All WATER, REUSE, and SEWER mains, valves, hydrants, services, and appurtenances shall have 3M Marker Tape placed over the main to the valve, hydrant, curb stop or appurtenance at a depth not to exceed 4'. The CONTRACTOR shall conduct a preliminary locate check coordinated with the INSPECTOR, prior to the installation of the road base and shall be responsible for the marker tape location throughout the warranty period.

Marker tape for WATER shall be blue and designated for Potable Water. Marker tape for REUSE shall be purple and designated for Reuse Water. Marker tape for SEWER shall be green and designated for Wastewater.

TOHO shall require a minimum of one (1) each of 8-gauge steel core and 8-gauge solid copper wire be pulled with a directional bore and adequately secured to the pipe. Locator wires shall be blue for WATER, purple for REUSE, green for SEWER, and tested by the CONTRACTOR and witnessed by TOHO prior to acceptance.

All WATER mains shall be blue in color or marked with a continuous stripe of oil-based enamel paint. Said stripe shall be a minimum 2" in width and shall be blue in color painted longitudinally on top of the pipe for lines under 24". For lines 24" and larger, there shall be painted 3 - 2" stripes within the top 90 degrees of the pipe. Paint should be touch-dry before backfilling.

All REUSE mains shall be purple in color or marked with a continuous stripe of oil-based enamel paint. Said stripe shall be a minimum 2" in width and shall be purple in color painted longitudinally on top of the pipe for lines under 24". For lines 24" and larger, there shall be painted 3 - 2" stripes within the top 90 degrees of the pipe. Paint should be touch-dry before backfilling.

All SEWER mains shall be green in color or marked with a continuous stripe of oil-based enamel paint. Said stripe shall be a minimum 2" in width and shall be green in color painted longitudinally on top of the pipe for lines under 24". For lines 24" and larger, there shall be painted 3 - 2" stripes within the top 90 degrees of the pipe. Paint should be touch-dry before backfilling.

END OF SECTION 51

SECTION 52 - VALVES, HYDRANTS AND ACCESSORIES FOR PRESSURE MAINS

52.1 GENERAL

All valves and appurtenances shall be selected per Appendix 'E', Approved Materials and Manufacturers. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with this MANUAL as applicable.

52.2 RESILIENT WEDGE GATE VALVES

52.2.1 GENERAL

Valves shall hold test pressure, when applied in either direction per the hydrostatic testing methods described in Section 51.5 of this MANUAL.

52.2.2 VALVE CONSTRUCTION

Resilient Wedge Gate Valves shall be in accordance with AWWA C515. Valves shall have a fusion bonded epoxy coating with a corrosion resistant metal stem.

Valves shall have a synthetic rubber encapsulated gate with oil impregnated bronze mechanical components for permanent lubrication. Above ground service valves shall be flanged outside stem and yolk (OS&Y) with hand wheels for operation.

Buried service valves shall be mechanical joint non-rising stem (NRS) with a 2" operating nut. Operating nut shall be bolted on. Sheer pins and drift pins are not permitted.

Submerged, or otherwise inaccessible above ground service valves shall be flanged NRS with floor stand or suitable operator.

52.3 SEWER PLUG VALVES

52.3.1 GENERAL

Plug valves shall be used on above ground piping at SEWER lift stations only. Valves shall hold test pressure, when applied in either direction per the hydrostatic testing methods described in Section 51.5 of this MANUAL.

52.3.2 VALVE CONSTRUCTION

Plug valves shall be in accordance with AWWA C517. Valves shall have a fusion bonded epoxy coating. Thrust bearing shall be self-lubricating 316 stainless steel. All mounting hardware shall be stainless steel including nuts, bolts, and washers.

Plug valves shall have a factory supplied and installed gear reduction device and side mounted hand wheel for operation.

52.4 VALVE INSTALLATION

All valves shall be inspected upon delivery in the field to insure proper working order before installation. They shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connection ends furnished. All valves and appurtenances shall be installed true to alignment and rigidly supported. Any damage to the above items shall be repaired or replaced to the satisfaction of TOHO before they are installed. Prior to acceptance, valves shall be demonstrated for correct operation and direction.

After installation, all valves shall be subjected to the field test for piping as outlined in Section 51 of this MANUAL. Should any defects in materials or workmanship appear during these tests, the CONTRACTOR shall correct such defects to the satisfaction of TOHO.

Flanged joints shall be made with 316 stainless steel bolts, nuts, and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe.

52.5 VALVE BOXES

All buried valves shall have adjustable valve boxes. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as shown on the STANDARD CONSTRUCTION DETAIL Toho-17.0, Valve and Box.

WATER valve covers shall be round non-pop style and shall have "Water" cast into the top. REUSE valve covers shall be square non-pop style and shall have "Reuse" cast into the top. SEWER valve covers shall be round non-pop style and shall have 'SEWER' cast into the top..

Care shall be taken while installing valve boxes to ensure that valve stems are vertical, and the cast iron box has been placed and centered over the stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. CONTRACTOR shall remove any sand or undesirable fill from valve box prior to final inspection.

52.5.1 VALVE IDENTIFICATION

A 3" diameter cast bronze disc engraved with identification data as shown on the STANDARD CONSTRUCTION DETAIL Toho-17.0, Valve and Box shall be provided for each buried valve. Bronze disc shall be cast into the concrete valve box pad or set into the pavement if the valve is in a paved area.

52.6 FIRE HYDRANTS

52.6.1 MATERIAL

Fire hydrants shall have 5-1/4" valve opening and shall comply with AWWA Standard C502 for fire hydrants for water works service, unless in conflict with MANUAL in which case this MANUAL shall apply. Each hydrant shall have 6" mechanical joint ends and shall open by turning to the left (counterclockwise). Fire hydrant shall be of ample length for 3-1/2' depth of bury. It shall be provided with 2 - 2-1/2" hose nozzles and 1 - 4-1/2" pumper nozzle, all having National Standard hose threads.

Nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard. Fire hydrants shall be equipped with O-Ring packing. Fire hydrant shall be provided without weep hole or with weep hole suitably plugged. Fire hydrant shall be equipped with breakaway flanges. Shear bolts shall not be acceptable.

Fire hydrants will be tested and inspected for smooth operation and the absence of leakage from any ports, joints, or fittings in the hydrant assembly to the main.

52.6.2 PAINTING

All iron parts of the hydrant both inside and outside shall be painted, in accordance with AWWA C-501. All inside surfaces and the outside surfaces below the ground line shall be coated with bitumastic.

The outside of the hydrant above the finished grade shall be thoroughly cleaned and, thereafter, painted with one (1) coat of epoxy primer, and a minimum of two (2) coats of paint as per applicable codes. The first coat having dried thoroughly before the second is applied and the second thoroughly dried before the third is applied. Paint shall be applied to provide uniform appearance without voids. TOHO owned hydrants shall be gray in color unless otherwise directed by the fire authority having jurisdiction.

52.6.3 CONSTRUCTION DETAILS

Hydrants shall be plumb and shall be set so that the center line of the lowest hose connection is, at least, 18" and a maximum of 24" above the surrounding finished grade and the bottom of the mounting flange is a minimum of 6" above finished dirt grade. All hydrants shall be inspected in the field upon delivery to the job to insure proper operation before installation. The resetting of existing hydrants and moving and reconnecting of existing hydrants shall be handled in a manner like a new installation. Hydrant shall be constructed in accordance with the STANDARD CONSTRUCTION DETAIL Toho-26, Fire Hydrant.

52.6.4 LOCATION

Fire hydrants shall be in the general location shown on the PLANS and shall be per applicable fire codes and ordinances. Clear areas around hydrants shall be maintained per applicable fire codes and ordinances. Fire hydrants shall be placed a minimum of 5' from edge of pavement.

52.7 WATER AUTOMATIC FLUSHING DEVICES

Automatic flushing devices shall be installed on dead-end lines, construction phase lines and cul-de-sac loops. The flushing device assembly shall include the meter and meter box and shall conform to the STANDARD CONSTRUCTION DETAIL, Toho-24, Automatic Flushing Device.

Automatic flushing devices shall be located on the lot lines just inside a public right-of-way or dedicated utility easement. Devices should be placed close to storm inlets where possible.

52.8 SEWER AIR RELEASE VALVES

52.8.1 GENERAL

SEWER force mains shall be equipped with air release valves located at piping high points immediately upstream of dips, or other elevation declines 2' and greater. Valves shall be in an enclosure as shown on the STANDARD CONSTRUCTION DETAILS Toho-18.0, Typical Air Release valve and Toho-18.1, Large Air Release Valve.

52.8.2 AIR RELEASE VALVE

The valve body float, float guide and stem shall be stainless steel. The valve shall be suitable for 100 psi working pressure. Valve shall have standard NPT inlet and outlet ports unless otherwise shown on the PLANS. Size of valve shall be determined by the DEVELOPER'S ENGINEER and approved by TOHO based on the force main size and flow.

Back flushing accessories shall be provided and delivered to TOHO by the manufacturer and/or CONTRACTOR prior to project acceptance.

END OF SECTION 52