TUSCARORA TOWNSHIP

TECHNICAL SPECIFICATIONS

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SECTION 1 – GENERAL REQUIREMENTS

1.01 PROJECT DESCRIPTION

The Project generally consists of installing an additional Aero-Mod SEQQUOX PLUS activated sludge system, doubling the process tank capacity and equipment and adding a 150,000-gallon surge tank, the standards and specifications for which are provided herein.

1.02 DEFINITIONS

The intent of this section is to identify certain persons involved in the project.

DPW	The agency, group, or groups designated by the Authority performing the system operations and maintenance typically identified as a Department of Public Works.
Owner or Authority	Tuscarora Township
Authority or Owner's Engineer	Engineer whose services are procured by the Authority to review sanitary sewage system plans and installation methods. When the authority is the owner, the engineer will function as the owner's engineer.
Contractor	Contractor is prime Contractor who is so identified by the Owner and is responsible for the sanitary sewage system facilities installation.

1.03 PRECONSTRUCTION CONFERENCE

Prior to commencement of any construction activities involving the sanitary sewer system, a principal member representing the Owner, the Contractor, the Engineer, and the Authority DPW shall meet at a pre-determined location and time to discuss the project. It shall be the responsibility of the Owner or the Engineer to organize this meeting. At that time, the Contractor schedule, as well as the construction requirements, will be discussed to obtain a mutual understanding of the project and the Authority's inspection process.

1.04 LINES AND GRADES FOR CONSTRUCTION

The Owner (his Contractor and/or Engineer) shall provide adequate lines and grades for construction of the sanitary sewer prior to installing the utilities. The Engineer shall be given **48 hours notice** for review of these lines and grades prior to the start of construction.

1.05 PROGRESS SCHEDULE

The Contractor shall, as soon as practical, prepare and submit to the Engineer three (3) copies of the Progress Schedule regarding sanitary sewer construction. This schedule shall show in a clear, graphical manner the proposed date for commencement, progress and completion of the work.

1.06 INTERFERENCE WITH EXISTING SEWAGE TREATMENT WORKS

No bypassing of untreated sewage will be allowed during the construction of this project other than that which normally takes place due to stormwater overflows, etc. The Contractor shall provide a plan of work to the Engineer for approval before starting work on any phases of the project which might involve existing sewage facilities.

1.07 RELATIONS TO OTHER CONTRACTORS AND UTILITY FORCES

The Contractor shall so conduct his operations as not to interfere with or injure the work of other contractors or adjacent force account work, and he shall promptly make good any injury or damage which may be done to such work by him or his employees or agents. The Contractor shall grant to other contractors and forces necessary means of access to their work.

1.08 PERMITTING AGENCIES

The Contractor shall perform all work in accordance with any and all applicable permit requirements. The Authority, with the assistance of the Authority Engineer, will obtain the necessary permit for construction/installation prior to commencement of any work.

1.09 ACCESS TO WORK

The Engineer or Resident Project Representative shall have access maintained to all sanitary sewer work at all times. Proper notification **(48 hours)** shall be given to the Authority Engineer prior to the start of any construction or testing.

1.10 SHOP DRAWINGS

Shop drawings of all equipment shall be issued to the Engineer during the shop drawing review stage for his approval. The Authority Engineer shall review the shop drawings regarding compliance with the Authority requirements. The Contractor should supply a minimum of six (6) copies of all equipment shop drawings to the Engineer. Final record shop drawings shall be issued to the Authority Engineer as part of the close-out procedure in accordance with the close-out section of these specifications.

1.11 STREAM CROSSINGS

Stream crossings shall be performed in accordance with all permit requirements of the regulatory agencies (P.A. 451 requirements).

1.12 DUST AND NOISE REDUCTION

The Contractor shall keep dust and noise from construction operations to a minimum. A dust palliative shall be used on disturbed road sections prior to surfacing if so determined by the Authority Engineer.

1.13 MATERIAL CERTIFICATION

Manufacturer's certification slips shall be submitted to the Authority Engineer for all pipe, manholes, fittings, etc. used in the installation of sanitary sewer or watermains. This is to verify that the product meets applicable standard specifications required.

1.14 MAINTENANCE BOND REQUIREMENTS

The Contractor shall supply the Owner with a maintenance bond for the full cost of the installation of the sanitary sewer system that is to be turned over to the Authority. The maintenance bond shall be effective from the date of substantial completion for a period of one (1) year.

1.15 INSURANCE REQUIREMENTS

Where the contract involves construction in a public right-of-way, the Contractor shall provide proof of insurance in the type and amounts required by the Authority prior to start of the construction. In addition to the Authority, the Authority Engineer shall be named as additional insured.

SECTION 2 – STANDARDS AND REGULATIONS

2.01 REFERENCE STANDARDS

A. Throughout these specifications, reference is made to various standard specifications. Such reference gives the serial designation. The latest revised specification shall apply in all cases. These standard specifications, where applicable, shall be binding on all construction activities.

B. The following specifications and standards form part of this specification to the extent indicated by reference thereto or for quality of workmanship and materials required under the contract.

American Society of Testing Materials	(ASTM)
American Water Works Association	(AWWA)
American National Standards Institute, Inc.	(ANSI)
Michigan Department of Transportation	(MDOT)
American Concrete Institute	(ACI)
National Concrete Masonry Association	(NCMA)
Truss Plate Institute	(TPI)
National Electrical Code	(NEC)
National Fire Protection Association	(NFPA)
Michigan Department of Environment, Great Lakes, and Energy	(EGLE)

2.02 REGULATORY REQUIREMENTS

A. All construction work, alterations, repairs or mechanical installations and appliances connected herewith shall comply with all the State Rules and Regulations and local ordinances and such other statutory provisions pertaining to this class of work. Such Rules and Regulations and local ordinances are to be considered a part of these specifications by reference.

B. All electrical work shall be in accordance with the latest edition of the National Electrical Code, the National Electrical Safety Code and applicable state and local codes. This shall not be construed to permit a lower grade of construction where the plans and specifications require workmanship or materials in excess of code requirements. All electrical equipment, wiring, cable, pre-assembled electrical panels, and materials shall be listed by Underwriters Laboratories, Inc.

SECTION 3 – PROJECT CLOSE OUT

3.01 CLEANUP

Before final acceptance of the WWTP expansion work, the Contractor shall remove all false work, excavated or useless materials, and rubbish, and restore to presentable condition per the restoration specifications and satisfactory to the Authority Engineer, all property, both public and private, which may have been used or damaged during the prosecution of the sanitary sewer system work.

3.02 OPERATING AND MAINTENANCE DATA

The Contractor shall furnish written instructions for the operation and maintenance of all equipment provided at the time of shop drawing submittal. The instructions shall be short, easy to understand, with directions specifically written for this project, describing the various possible methods of operating the equipment. The instructions shall include procedures for tests required, adjustments to be made and safety precautions to be taken with the equipment. Maintenance instructions shall include test and calibration charts, exploded views of assembled components and spare parts lists. At least three (3) instruction booklets shall be furnished for each separate piece of equipment. These shall be transmitted to the Engineer as part of the close out of the project. Record drawings (1 hard copy and digital file) shall be submitted to the Authority along with drilling logs, manhole reports, and sanitary sewer lead reports as applicable to the project.

A. Pumps

Include the manufacturer's technical specification of the pump along with the application for the pump, the manufacturer's warranty certificate, installation instructions, serial numbers for all pumps, pump performance curve, pump trouble shooting guide and the pump efficiency rating.

B. Control Panel Operation and Maintenance Manual

Include the electrical panel legend, bill of material report, catalog cut sheets indicating make and model of all general accessories, installation instructions for the control panel, recommended spare parts, installation instructions for general accessories and a maintenance frequency chart.

C. Electrical Wiring

A color-coded drawing of the as-installed electrical schematic shall be submitted for all electrical work performed as part of the project.

3.03 GUARANTEE

The Contractor shall guarantee all materials and equipment furnished and work performed for a period of one (1) year from the date of substantial completion. The Contractor shall warrant and guarantee for a period of one (1) year from the date of substantial completion of the system that the completed system is free from all defects due to faulty materials or workmanship. The Contractor shall promptly make such corrections as may be necessary including the repairs of any damage to other parts of the system resulting from such defects. The Owner will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments or other work that may be made necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred.

3.04 FINAL COMPLETION/ACCEPTANCE OF PROJECT BY AUTHORITY

A. Authority Projects

Final payment will not be made to the Contractor until all closeout documents have been received and approved by the Authority Engineer. These items are listed below:

1. Punch list items satisfactorily completed.
2. Maintenance bond.
3. Letter of guarantee (prepared by Authority Engineer).
4. Affidavit of completion/consent of surety.
5. Sanitary Sewer Lead Reports (as applicable).
6. Record Drawings: Record drawings shall consist of plan and profile. Sanitary sewer leads and/or water service leads shall be re-drawn in the new location along with the mainline structures and piping when deviated from plan location. Manhole numbering sequences shall be obtained from the Authority Engineer. Each structure installed, manhole, sewer lead or other structures placed shall have 3 physical measurements from structures which are shown on the plans and apparently not to be changed. These measurements must be incorporated onto the record drawings except sewer leads. (Lead measurements are to be placed on the individual reports). Sanitary sewer profiles shall include rim and invert elevations, distances between structures, size and type of pipe. All profiles shall show conflict with existing utilities. Sanitary sewer lead information shall be placed in a table format on the record drawings. Each plan sheet shall have a table for the leads shown on that sheet. See Table 3.1 for an example.

Table 3.1

SEWER LEAD NUMBER	DISTANCE FROM DOWNSTREAM MANHOLE	DISTANCE FROM SEWER TO END OF LEAT AT PROPERTY LINE OR EASEMENT LINE	DEPTH BELOW GRADE

7. Operations and maintenance manuals.

SECTION 4 – EXCAVATING, TRENCHING AND BACKFILLING

4.01 SCOPE OF WORK

The work covered by this section shall consist of furnishing all materials, equipment and labor for the excavating, trenching, backfilling, and bore and jack required to install or repair sanitary sewers, and other structures as shown on the plans and referred to in these specifications.

4.02 MATERIALS

A. Backfill Material

All backfill material shall be free from cinders, ashes, refuse, sod, frozen lumps, vegetable or organic material, boulders, rocks or stones or other material which, in the opinion of the Engineer, is unsuitable. Pipe bedding material shall meet an MDOT Class II gradation, modified for not greater than ¾" stone. However, from one foot above the top of the pipe to the subgrade of the pavement, material containing stones up to three (3) inches in their greatest dimension may be used.

Where the type of backfill material is not specified, the Contractor may backfill with the excavated material provided that such material meets the requirements described above. Where excavated material is to be used for backfill and there is a deficiency due to a rejection of part thereof, the Contractor shall furnish the required amount of sand, gravel or other approved material at no additional cost.

B. Bore and Jack Materials

1. Steel Pipe

Jacked in place steel pipe shall meet the requirements of either ASTM A53, Type E or S, Grade B or ASTM A139, Grade B.

The ends of all steel pipe to be jacked shall be prepared for field welding at joints.

The nominal outside diameter and minimum wall thicknesses of steel pipe to be jacked in place shall be as shown below. Minimum wall thickness for railroad crossings may be reduced by 0.063 inch if cathodic protection is provided per railroad specifications.

Nominal Size	Outside Diameter (Inches)	Minimum Wall Thickness Required (Inches)	
		M.D.O.T.	Railroads
2"	2.375	0.154	0.251
2"	4.500	0.188	0.251
6"	6.625	0.188	0.251
8"	8.625	0.188	0.251
10"	10.750	0.188	0.251
12"	12.750	0.188	0.251
14"	14.000	0.250	0.282
16"	16.000	0.250	0.282
18"	18.000	0.250	0.313
20"	20.000	0.250	0.344
22"	22.000	0.250	0.375
24"	24.000	0.250	0.407
26"	26.000	0.312	0.438
28"	28.000	0.312	0.469
30"	30.000	0.312	0.469
34"	34.000	0.312	0.532

2. Grout

Grout shall consist of a mixture of Portland cement and sand in any proportion which does not have more than 50 percent sand by volume.

4.03 EXECUTION

A. Excavation

Excavation includes clearing the site of the proposed work and removal of all materials to a depth which is sufficient to permit the construction of the structure or utility in accordance with the plans. Excavated materials may be temporarily stored along the trench in a manner that will not cause damage to trees, shrubbery, or other properties and that will not endanger the banks of the trench by imposing too great a load thereon.

B. Length and Width of Trench

Not more than 200 feet of open trench will be permitted at a time without approval from the Authority Engineer, unless pedestrian bridges are maintained at 200 foot intervals and vehicular crossings of at least one lane are maintained at 300 foot intervals.

Streets shall not be completely blocked without written permission from the Engineer and roadway officials. All fire alarm boxes and fire hydrants must be kept clear and accessible at all times.

The width of the trench shall be ample to permit the pipe to be laid and joined properly and the backfill to be placed and compacted as specified.

In order to limit excessive loads on the pipe, the maximum width of trench shall not be more than two feet greater than the nominal inside diameter of the pipe. This limitation shall apply to the width of the trench at the top of the pipe. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting and bracing and handling of special conditions.

C. Bracing, Sheeting and Shoring

Open cut trenches shall be sheeted and braced as required by any governing federal or state laws and municipal ordinances and as may be necessary to protect life, property or the work. All bracing, sheeting, and shoring design, installation, and maintenance is the responsibility of the Contractor. The specifications contained herein provide general guidance and minimum criteria, the Engineer and Owner will not provide any excavation safety design for the project.

Sheeting and bracing left in place must be removed for a depth of three (3) feet below the established finish grade or the existing surface, whichever is lower.

Trench bracing, except that which must be left in place, may be removed when the backfilling has reached the respective levels of such bracing. Sheeting, except that which has been ordered left in place, shall be removed as the backfilling progresses.

D. Pumping, Bailing and Draining

The Contractor shall provide and maintain adequate pumping and draining facilities for removal and disposal of water from trenches or other excavations in accordance with the dewatering specifications. He shall provide pumping and draining facilities for bulkheaded sewer sections and shall operate same until bulkheads have been removed or construction is completed, if bulkheads are to be left in place. The drainage system must be maintained until the pipe has been covered with sufficient backfill material to prevent floating of the installed pipe sections. Where work occurs below the groundwater table, the Contractor shall provide, install and maintain a suitable dewatering system and shall so operate it to insure proper construction of the work. Proper disposal of the dewatering discharge (necessary easements, permits, erosion control, etc.) shall be the responsibility of the Contractor. Contractor shall not discharge or allow any groundwater to enter existing sanitary sewage system. Any water which does enter the· existing sewage system shall be the Contractor's responsibility and he will pay any and all transporting and treatment costs involved with this water according to the local municipal authority. Cost of pumping, bailing and draining shall be included in the dewatering pay item.

E. Excavation to Grade

The trench shall be excavated to the depth required to provide a uniform and continuous bearing and support for the pipe barrel on solid and undisturbed ground. The Contractor shall excavate the last four inches of depth to grade using hand tools.

Any part of the bottom of the trench excavated below the specified grade shall be refilled with approved materials and thoroughly compacted to a minimum of 95% of the maximum dry density as determined by ASTM D698 or the Michigan Cone Method. The finished subgrade shall be prepared accurately by means of hand tools. Blocking to bring the pipe to grade will not be permitted. Bell holes in the subgrade must be provided to allow for continuous support of the pipe barrel when bell type pipe is used.

If, in the opinion of the Engineer, subgrade pipe support conditions at some locations are found to be unsatisfactory, he shall have the authority to order subgrade preparation at these locations in accordance with the provisions for special foundations in clay, rock or poor soils.

F. Special Foundation in Clay or Rock

Subgrade consisting of clay or rock shall be excavated to at least four inches and not more than six (6) inches below the specified grade. Before the pipe is laid, the subgrade shall be prepared by backfilling with an approved granular material in three-inch compacted layers. The layers shall be thoroughly tamped as directed by the Engineer so as to provide a uniform and continuous bearing and support for the pipe barrel with a minimum compaction of 95% of the herein defined maximum dry density. The Contractor will not be allowed extra compensation for this work.

G. Special Foundations in Poor Soils

Where the bottom of the trench at subgrade is found to consist of unstable material which will, in the opinion of the Engineer, not provide adequate pipe support, the Engineer shall have authority to require the removal of the unstable material and replacement with approved backfill material. The use of stone bedding by the Contractor to reduce dewatering requirements will not be paid as an extra.

H. Backfilling around Pipes

From the bottom of the trench to a depth of one (1) foot above the top of the pipe, the trench shall be backfilled by hand with sand or approved excavated materials and tamped to a minimum of 95% of the herein defined maximum dry density.

The Contractor shall take care in placing this portion of the backfill so as to make sure sufficient material has been worked under the pipe and also avoid injuring or moving the pipe. Backfilling around PVC pipe shall be done in accordance with ASTM D2321 "Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe".

I. Backfilling to Natural Grade

From one (1) foot above the pipe to the grade shown on the drawing or specified herein, the trench shall be backfilled by mechanical methods approved by the Engineer. A minimum compaction of 85% of maximum unit weight is required, unless otherwise noted.

Provide 30 inches of cover above the top of the pipe before application of wheel loading and 48 inches before use of heavy compactors.

J. Backfill under Structures

Where the excavation is made through or under existing or proposed pavement, curb, shoulders, driveways or sidewalks or where such structures are undercut by the excavation or where noted on the plans, the entire backfill to the subgrade of the structure shall be made with granular material. The granular material backfill shall be placed in layers and compacted to 95% of the herein defined maximum dry density throughout. This requirement shall apply to- any trench that is within a one-on-three slope beneath the road from the shoulder point or back of curb line. Extra compensation will not be allowed for this work.

Granular material is defined as a material meeting granular material Class II as defined in M.D.O.T. Standard Specifications.

K. Special Backfilling Requirements

The Contractor will be required to comply with the regulations of the State Highway, Municipal or County Road Engineering Departments with regard to backfilling in their respective rights-of-way and beneath the roads, and shall be responsible for determining these regulations prior to bidding.

L. Compaction Testing

Compaction testing may be periodically performed by a source and method approved by the Authority Engineer to ensure that compaction requirements are being met. Compaction percentage is based on the maximum dry density as determined by ASTM 01557 or the Michigan Cone Method.

M. Boring and Jacking

The following provisions apply to the construction of sewers, forcemains, and house leads which cross pavements under the control of the Michigan Department of Transportation, County Road Commission, or under railroads.

1. General

Steel pipes shall be jacked in place under highways as specified in the current standards published by the Michigan Department of Transportation. Pipe jacked in place under railroads shall meet the current standards established by the

affected railroad. The Design Engineer shall incorporate bore and jack requirements into the contract documents. After the pipe has been installed in the steel casing pipe, the casing pipe shall be pressure grouted with an M.D.O.T. approved flowable fill or blown full of pea stone and the ends sealed with concrete.

2. Location of Jacking Pits:

   a. State Highways

      The minimum distance of the jacking pit to the edge of pavement will be specified by the M.D.O.T. and placed on the plans or contract documents by the Engineer.

   b. County Roads

      On all highways, a minimum distance of 15 feet shall be provided from edge of pavement to the face of boring pts. Any variances from these distances will require tight sheeting and if a traffic hazard, permanent guard rail will be required.

   c. Railroads

      The location of the jacking pit will be specified by the Railroad and/or the Design Engineer.

3. The boring machine shall be capable of assuring a crossing with no voids.

   a. In solid clay soils the cutting head or the auger, if no head is used, may be allowed to within one inch of the front of the casing.

   b. In sandy soils the cutting head or the auger, if no head is used, must be inside the casing at least 1/2 the diameter of the casing.

   c. If the soil is both clay and sand, the same procedure as for sand shall apply.

   d. In wet, sandy or gravelly type soils that have a tendency to move or run, the cutting head and/or auger shall be pulled back to at least three feet from the front of the casing.

   e. When boring is used to facilitate jacking pipe in place, the minimum diameter of the lead auger section shall be 1/2 inch smaller than the inside diameter of the pipe being jacked.

   f. Trenchless pipe placement - methods such as trenchless pneumatic piercing tools utilized to perform horizontal bores must be approved by the Authority Engineer prior to its use.

SECTION 5 – CONCRETE WORK

5.01 SCOPE OF WORK

The work under this section shall include all materials, labor and equipment necessary to achieve a finished product, including but not limited to the items in these specifications and those shown on the working drawings. Work includes, but is not limited to building footings, floor slabs, sidewalks, curb and gutter, driveways, etc.

All procedures and materials under this section, where not specifically stated, shall be in accordance with standards and recommendations of the American Concrete Institute's Building Code Requirements for reinforced concrete (ACI 318 - latest edition).

5.02 MATERIALS

A. Cement: Portland cement shall conform to "Standard Specifications for Portland Cement" (ASTM C150 latest edition) and shall be Type I, IA, III or IIIA.

B. Aggregates: Concrete aggregates shall conform to "Standard Specifications for Concrete Aggregates" (ASTM C33 - latest edition). Maximum coarse aggregate size for all members less than eight (8) inches in thickness shall be 3/4 inch. For members with thicknesses greater than or equal to eight (8) inches, the maximum coarse aggregate size shall be 1-1/2 inches.

C. Mixing Water: All water used in concrete shall be from a potable water supply.

D. Admixtures: Air-entraining admixtures shall conform to "Standard Specifications for Air-Entrained Admixtures for Concrete" (ASTM C260 latest edition).

E. Concrete Mix Proportions

Section 4.3.1. (ACI-318) shall be used for developing mixture portions. The Contractor shall furnish, for the Engineer's approval, all records to show that his concrete supplier is in compliance with all provisions of Section 4.3.1. If the concrete supplier is unable to furnish all records to comply with Section 4.3.1, Sections 4.3.1.2 and 4.3.2.2 can be used. If no records are available for any of the above ACI Sections, Section 4.3.3.2 shall be used to develop a concrete mix design.

5.03 EXECUTION

A. Concrete Quality

All concrete shown on the working drawings or referred to in the specifications shall be from an approved batch plant and shall have a minimum compressive strength of 2500 psi and a maximum water- cement ratio of 0. 64. Air entrainment shall be 5 %, more or less, 1 % for concrete with maximum aggregate size of 1-1/2 inches and shall be 6%, more or less, 1 % for concrete

with a maximum aggregatesize of 3/4 inch. The concrete shall be of a consistency to work easily into corners, angles of forms and around reinforcement. The slump shall not exceed 4 inches.

A. Mixing and Placing Concrete

1. Preparation of Equipment and Place of Deposit:
   a. Before placement, all equipment for mixing and transporting the concrete shall be cleaned and all debris and ice shall be removed from the places to be occupied by the concrete. Forms shall be thoroughly wetted (except in freezing weather) or oiled and masonry filler units that will be in contact with concrete shall be well drenched (except in freezing weather).
   b. Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the Engineer. All latents and other unsound material shall be removed from hardened concrete before additional concrete is added.
   c. Expansion joint material shall be placed at all locations where concrete is placed against a structure.

2. Mixing:
   a. Ready mixed concrete shall be mixed and delivered in accordance with "Standard Specification for Ready Mixed Concrete (ASTM C94 - latest edition). Mixing and transporting equipment shall be capable of providing concrete which meets the ASTM C94 requirements for uniformity.
   b. For job mixed concrete, the mixer shall be rotated at a speed recommended by the manufacturer. If mixer performance tests are not made, each batch of 1 cubic yard or less shall be mixed for at least 1 minute after all materials are in the mixer. The mixing time shall be increased 15 seconds for each additional cubic yard or fraction thereof. The entire batch shall be discharged before the mixer is recharged.

3. Conveying:
   a. Concrete shall be conveyed from the mixer to the place offinaldepositby methodsthatwillpreventseparationor loss of materials.
   b. Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery end without separation of materials.

4. Placing:

   a. Concrete shall be deposited, as nearly as practicable, in its final position to avoid segregation due to rehandling or flowing. Concrete shall be placed at such a rate that it is at all times plastic and flows readily. No concrete contaminated by foreign material shall be used nor shall retempered concrete be used unless approved by the Engineer.
   b. When placing is started, it shall be carried on as a continuous operation until placement is completed.
   c. All concrete shall be thoroughly consolidated during placement. It shall be thoroughly worked around embedded fixtures and into the corners of the forms.

5. Cold Weather Requirements:

   a. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather. No frozen materials or materials containing snow or ice shall be used.
   b. All reinforcement, forms, fillers and ground with which the concrete is to come in contact shall be free from snow and ice.
   B. Construction during cold weather shall be performed in accordance with ACI 306, "Recommended Practice for Cold Weather Concreting", or as directed by the Engineer.

SECTION 6 – SANITARY SEWER MAIN

6.01 SCOPE

The work covered by this section of the specifications consists of the furnishing of all plant, labor, materials, equipment and supervision and performing all operations involved in the construction of sanitary sewer mains in accordance with the provisions of the Plans and Specifications and subject to the terms and conditions of the Contract Documents.

Sanitary sewer leads and sewer appurtenances are covered under Section 7 of these specifications.

6.02 MATERIALS

A. Sewer Pipe

1. General

a. Sewer pipe, unless otherwise indicated on the plans or authorized in writing by the Authority, shall be new, unused material of the size and type shown on the plans and shall conform to the requirements of these specifications.

b. Pipe, materials and accessories offered by the Contractor shall be the standard products of reputable manufacturers normally engaged in the manufacturing of the particular item in question. The Authority Engineer shall have the final approval of a pipe manufacturer.

2. Sewer Pipe Selection

The sanitary sewer pipe used for gravity sewer main at the WWTP shall be DIP, unless otherwise specifically indicated. The sanitary sewer pipe used for pressure sewer may be PVC or HDPE, as indicated in the drawings.

3. PVC Gravity Sewer Pipe

PVC sanitary sewer pipe 15 inches in diameter and smaller shall meet the requirements of ASTM Designation D-3034 (latest edition), "Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings". The minimum wall thickness shall conform to SDR-35.

PVC sanitary sewer pipe 18 inches to 27 inches in diameter shall meet the requirements of ASTM Designation F-679 (latest edition), "Standard Specification for Polyvinyl Chloride (PVC) Large Diameter Plastic Gravity

Sewer Pipe and Fittings". The minimum wall thickness shall conform to ASTM Designation T-1.

The use of PVC sewer pipe requires special attention to proper subgrade and backfilling procedures. Failure of the Contractor to provide proper construction will result in probable excessive deflection of the PVC pipe and require replacement by the Contractor at no additional cost to the Owner.

4. Ductile Iron Pipe

Ductile iron pipe shall meet the requirements of ANSI A21-50, A21-5 1 and AWWA C15 1 and shall be of the design thickness classification as indicated on the plans.

5. Pressure Sewer Pipe (PVC)

Pressure sewer PVC pipe shall meet the requirements for Type 1, Grade 1 (PVC 1120) of ASTM Specification D-1784 and ASTM D-2241, Standard Specification for PVC pipe (SDR- PR). PVC pipe shall be a minimum rating of Class 200, SDR 21. PVC shall only be utilized for force mains installed in an open cut trench.

6. Pressure Sewer Pipe (HDPE)

Pipe shall be made from a material having a material designation code of PE 4710 or 3608. The material shall meet the requirements of ASTM D3350 and shall have a minimum cell classification of PE445474C for PE 4710 and PE345464C for PE 3608. Pipe wall thickness shall be in accordance with manufacturer specifications for SDR-11. Use adapters and transition fitting assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with system pressures, piping, and system liquid; made for joining different piping materials.

B. Pipe Joints

1. For PVC Sewer Pipe: PVC sewer pipe joints may be either solvent cement or elastomeric gasket type in accordance with ASTM D3212 (elastomeric gasket type) and/or in accordance with ASTM D2855 (for PVC pipe solvent cemented joints). Only chemical solvents approved by the pipe manufacturer shall be used.

2. For HDPE Sewer Pipe: HDPE sewer pipe shall be joined to itself by the heat fusion process which produces a homogeneous seal, leak tight. HDPE shall be joined by the butt fusion procedure outlined in ASTM F2620 whenever possible. Electrofusion welding, conforming to ASTM F1290 is

also permitted when necessary.

3. For Ductile Iron Pipe: Ductile iron pipe joints shall conform to the following:

   a. Flange joints shall meet ANSI B 16.1, Class 125.

   b. Mechanical joints shall meet ANSI A21.11 or Federal Specification WW-P-421.

   c. Rubber gasket joints shall meet AWWA C111.

C. Pipe Fittings

Pipe fittings in sewer lines shall correspond in type, size, class, joints and all other respects with the type of pipe used as specified above including the applicable ASTM requirements. Where linings and coatings are specified for pipe, the fittings to be used in conjunction therewith shall have the same lining and coating.

Fittings shall be used in ductile iron pipe lines as required, whether specifically called for or not, according to the best practice in installation of these lines. A manhole water stop shall be provided at each manhole connection as shown in the standard details.

As approved by the Authority Engineer, specifically designed adapters shall be used to connect pipes of different diameter or materials of construction. The adapters shall be constructed of flexible materials and clamped onto the pipe with stainless steel bands. Use mastic, solvent weld or rubber gasket seals and encase in concrete to prevent displacement.

D. Tracer Wire

Where required, force main and service laterals shall have a tracer wire, 12 AWG (minimum), Break Load 452 lbs, installed with the pipe to provide a continuous conductor between access points. Copperhead High Strength Tracer Wire (or approved equal).

E. Valves and Appurtenances

1. Gate valves shall meet the requirements of AWWA C500 and/or C509 of the American Water Works Association. Valves shall be designed for not less than 150 psi working pressure and shall be tested for leakage and distortion under a hydraulic pressure of not less than 150 psi. Under such pressure, the valves shall show no leakage or distortion.

   All gate valves shall be cast iron body, fully bronze mounted, bronze stem double disc gauge valves or resilient seated gate valves. Each valve shall

have a clear waterway equivalent in area, when open, to that of the connecting pipe. Valves shall be made to close when turned to the right or clockwise. All valves shall be operated by non-rising stems and shall have square wrench nuts, or hand-wheel operators with an opening arrow cast in the metal.

2. Plug valves shall be lubricated round port valves. Valves shall be 100% port area type with semi-steel body. Valve bodies shall be suitably marked to indicate whether the valve is open or closed.

   The seating surface of the rotating element shall be of material recommended by the manufacturer for sewage sludge service. Bearings at the top and bottom supporting the rotating element shall be permanently lubricated corrosion-resistant type, suitable for sewage plant service. Stem seals shall be 0-ring type of the same material as the seating surface and designed so replacement can be accomplished without disassembly of the valve.

   All plug valves shall be designed to operate with a pressure of 150 psi on either side of the valve without leakage.

3. Check valves shall be designed for a minimum working pressure of 150 pounds per square inch or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. Distinctly cast on the body of each valve shall be the manufacturer's name or initials or trademark by which he can be readily identified and the size of the valve, working pressure and the direction of flow.

   Check valves larger than 2 inches shall be iron body, bronze mounted, shall have flanged ends and shall be the non-slam type. Flanges shall be the 125-pound type conforming to ANSI Standard B16.1. All check valves shall be supplied with an external lever and weight. Springs shall be applied to lever, if necessary, to create a non-slam condition.

4. Valve operators shall be provided for all sewage and sludge valves of a type as indicated on the plans. Valve operators shall be of sufficient size and strength to overcome expected maximum operating torque. Valve operators found to be inadequate strength will be replaced by the Contractor at no expense to the Owner or the Authority.

   All valves 8 inches and larger to have crank, handwheel, chain wheel or square nut for buried service, totally enclosed, weatherproof worm gear or traveling screw-type operators with indicators.

For automatic (if required by the drawings) operation, cylinder, rotary or similar types of electric or pneumatic actuators may be used regardless of valve size. Various accessories shall be used, depending on the application, such as positioners, limit switches, solenoid valves, speed controls and failsafe assemblies.

5. Valve boxes shall be cast-iron, three piece, adjustable type with a 5-1/4 inch shaft. Covers shall be furnished with fingerholes and marked "SEWER". Valve boxes shall be similar to that as manufactured by the East Jordan Iron Works, Clow Corporation or equal.

6. Pipe supports, where required, shall be of the adjustable type made to support cast iron type pipe.

6.03 EXECUTION

A. Excavation

As specified in "Excavation, Trenching and Backfilling".

B. Gravity Sewer Main

Thermoplastic sewer pipe shall be installed per ASTM designation D 2321 (latest edition) unless otherwise indicated in these specifications. Rigid pipe types (DIP) shall conform to ASTM C12. Embedment material shall be ASTM D2321 standards unless otherwise indicated herein, or in the standard details.

Pipes located inside structures or above ground shall be rigidly supported as shown on the plans or as specified herein. The full length of each section of underground pipe shall rest solidly upon the prepared bed of undisturbed earth or compacted backfill with recesses only to accommodate pipe bells and joints. Any pipe which has its grade, alignment or joints disturbed after laying shall be taken up and re-laid. The interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operations.

The pipe shall not be laid in water or when trench or weather conditions are unsuitable for work. Water shall be kept out of the trench until the joints and backfilling are completed. When the work is not in progress, open ends of pipe and fittings shall be securely closed so that no water, earth, or other foreign substances can enter the line.

All sanitary sewer main shall be laid using a laser for alignment and grade. The Contractor shall be responsible for checking their work using the hubs, stakes, and/or benchmarks provided by the Owner and/or Engineer. Any sewer found

to have a grade or alignment that varies by more than 10% from the plan grade or elevation will be considered deficient. The Engineer will determine if the deficiency is serious enough to affect the objective of the project. The Contractor shall remove and re-lay any deficient sewer, if directed by the Authority Engineer, at no additional cost to the Owner.

Any section of pipe found to be defective, either before or after laying, shall be replaced with new pipe at the Contractor's expense. If repairs are necessary, Fernco adaptors will not be allowed for main line pipe. Similar material shall be utilized. Fernco adaptors may be allowed if constructed above the water table and approved by the Authority Engineer.

The Authority Engineer shall be notified at least 24 hours prior to the start of laying sewer main.

C. Force Main, Open Trench

PVC piping: PVC pressure sewer piping shall be installed in accordance with ASTM D-2774 for underground installation of PVC pipe, the manufacturer's written instructions, the drawings, and the following:

1. All force main piping shall be laid to the alignment and burial depth called for on the Drawings. Pipe shall be laid to minimize sags or high points as much as practical and shall be installed in a properly prepared, dry trench.
2. Piping shall be placed on trench bottom that is constructed to provide a firm, stable, and uniform support for the full length of the pipe.
3. Thrust blocking shall be installed at changes in direction greater than 45 degrees.
4. Pipe shall be lowered into the trench, bells and spigots cleaned, then promptly joined. Pipe shall be placed with the bell end pointed in the direction of the work.
5. After the pipe is laid, the bedding shall be carefully compacted under the haunches of the pipe, and the trench shall be backfilled to 12 inches above the pipe as specified within the trench backfill detail. Sufficient backfill shall be placed after each joint is made along the sides of the pipe to offset conditions that might tend to move the pipe off line and grade. Any pipe found off grade or out of line shall be re-laid properly by the Contractor.
6. Where a full pipe length must be field cut, the cut shall provide a smooth end at a right angle to the length of the pipe. Pipe spigot end shall be deburred and beveled to approximately match the factory bevel or left square when inserted into fittings.
7. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
8. Each pipe shall be inspected for defects prior to being lowered into the trench. Pipe having cuts or gouges in excess of 10% of wall thickness shall not be installed.
9. The PVC pressure piping shall be installed with a minimum allowable bending radius as indicated below:

1-1/2" nominal I.D.	= 52 feet
2" nominal I.D.	= 60 feet
2-1/2" nominal I.D.	= 72 feet

3” nominal I.D.	= 84 feet
4” nominal I.D.	= 100 feet
6” nominal I.D.	= 144 feet
8” nominal I.D.	= 189 feet

HDPE piping: HDPE piping shall be installed in accordance with ASTM D2657 for heat fused joints, piping manufacturers written instructions, the drawings, and the following:

1. All force main piping shall be laid to the alignment and burial depth called for on the Drawings. Pipe shall be laid to minimize sags or high points as much as practical and shall be installed in a properly prepared, dry trench.
2. Piping shall be laid in continuous sections, butt-fusing ends to join piping segments, or connection to mechanical joints.
3. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
4. Each pipe shall be inspected for defects prior to being lowered into the trench. HDPE pipe having cuts or gouges in excess of 10% of wall thickness shall be cut out and removed. The undamaged portions of the pipe shall then be butt fused to rejoin.
5. The HDPE SDR-11 pipe shall be installed with a minimum allowable bending radius as indicated below:

1-1/2” nominal I.D.	= 7 feet
2” nominal I.D.	= 9 feet
2-1/2” nominal I.D.	= 11 feet
3” nominal I.D.	= 13 feet
4” nominal I.D.	= 17 feet
6” nominal I.D.	= 25 feet
8” nominal I.D.	= 37 feet

6. After the pipe is laid, the bedding shall be carefully compacted under the haunches of the pipe, and the trench shall be backfilled to 12 inches above the pipe as specified under Division 2, "Earthwork." Sufficient backfill shall be placed after each joint is made along the sides of the pipe to offset conditions that might tend to move the pipe off line and grade. Any pipe found off grade or out of line shall be re-laid properly by the Contractor.

D. Connections to Existing Force Main

The Contractor shall furnish all labor and materials required for the connection of new sewers under this Contract to existing force main, as called for on the Drawings. Contractor shall coordinate temporary service disruption for tap with the Owner and provide notice to residents that will be affected. At time of service disruption, Contractor shall be prepared to immediately commence with tap; including having the excavation prepared and dewatered, having all necessary parts and equipment ready, and having personnel prepared to make connection, in order to minimize the duration of the service disruption.

E. Force Main, Directional Drilling

A. Staging Area & Bore Pits

1. Conduct all construction work, including pit excavations, equipment layout, material storage, and construction traffic within the designated areas established for the project.
2. Before beginning construction at any location, locate existing utilities, structures, and other facilities in the vicinity of the HDD alignment. Locate and size pit excavations to minimize conflicts with and damage to existing utilities.
3. Size upstream and downstream pits to completely contain drilling fluid and prevent fluid escape. Provide a secondary containment system around pits.
4. Fabricate the required length of pipe within the designated pipe laydown area.
5. Conduct all operations while maintaining access to the surrounding roads without creating dust or other construction nuisance to surrounding properties. Driveways shall not be closed for more than a 4 hour period.
6. All work shall be done to minimize disturbance or damage to roadways, adjacent structures, utilities or landscaped areas. Promptly repair any damage from operations to the satisfaction of the Owner, Engineer, property Owner or utility involved.

B. Control of Drilling Fluids, Cuttings, and Water

1. Control operational pressures, drilling mud weights, drilling speeds, and any other operational factors required to avoid hydrofracture fluid losses to formations, and control drilling fluid spillage. This includes any spillages or returns at upstream and downstream locations or at any intermediate point.
2. Provide a secondary spillage containment system down slope of the launch pit, capable of preventing spills from flowing beyond the immediate work zone.
3. Maintain on-site mobile spill removal equipment during all drilling, pre-reaming, reaming and pullback operations capable of quickly removing spills or inadvertent returns. Notify the Engineer of any spills or inadvertent returns and immediately contain and clean up the return or spill.
4. Drilling Fluids & Cuttings
   i. Recirculation of Drilling Fluids - Provide solids control and fluid cleaning equipment sufficient to handle the amount of recirculated drilling fluid and process it to produce drilling fluid suitable for reuse.
   ii. Dispose of all drilling fluid and cuttings off-site and in compliance with applicable state and local regulations.
   iii. Drilling fluid and cuttings shall not be discharged into any surface ditch, waterway, storm drain, sanitary sewer or any other such conveyance.
5. Water: Contractor shall be prepared to contend with any groundwater encountered and to dispose of any surfacing groundwater in accordance with applicable regulations.

C. Pilot Hole Drilling: Contractor shall drill the pilot hole along the profile indicated on the drawings or as otherwise approved by the Engineer. Contractor shall provide and maintain instrumentation to monitor drill fluid flow rate, fluid pressure and volume. Contractor shall maintain pilot hole location within the area delineated on the drawings and by Permits and right-of-way restrictions.

D. Reaming: Ream as required to enlarge the pilot hole so as to ensure a borehole diameter sufficient to accommodate the HDD pullback. The hole shall be reamed to a minimum diameter of 150% of the effective outside diameter of the pipe. Contractor may

incrementally upsize the ream as necessary to prevent damage to reaming tool.

E. Pipe Pullback

1. Pipe Assembly:
   i. Assemble the entire length of pipe to be installed by horizontal directional drilling methods in the pipe laydown area.
   ii. Assembled pipe shall be moved to the bore pit location in a manner that does not disrupt traffic or damage the pipe. Pipe shall not be dragged across surfaces which may damage the exterior surface of the pipe.

2. Pipe Pullback:
   i. Plan pullback operation to ensure that once started the operation can be completed without stopping.
   ii. Determine and apply safe pulling load required for proper installation.
   iii. Completely seal pipe to prevent drilling fluid from entering pipe during pullback.
   iv. Compensate for buoyancy effects as pullback installation proceeds, to help reduce pipe friction.
   v. Control torsional stress by use of a fully operational swivel to connect the pull section to the reaming assembly to minimize torsional stress. The torsional stress imposed on the pull section shall not exceed the maximum allowable torsional stress specified by the pipe manufacturer.
   vi. Provide accurate working gauges with register force being used to pull the pipeline back through the reamed borehole. If during the pipeline pulling process this force reaches 75% of the allowable load for the pipeline, notify the Engineer immediately.
   vii. Provide adequate support / rollers along pipe assembly and laydown area to support the required length of pipe for each location. Arrange supports to allow free movement during pullback. Monitor roller operation and use side-booms if required to assist movement of the pipe. Do not allow tail end of pipe or pipe sags to drag on the ground.
   viii. Take care as the pipeline is pulled to the borehole entrance and casing to avoid damage to pipe and/or tracer wire.
   ix. The tensile pulling load imposed on the pipe in the pull section shall not exceed the maximum allowable tensile load of the pipe as specified by the pipe manufacturer.
   x. Cut pipe to final length as shown on the Drawings. Install transition fittings as necessary to mate with fittings and valves as shown on the drawings.
   xi. Upon completion, Contractor shall provide paint markings along the route, indicating the as-installed pipe location and depth for the Engineer's documentation purposes.

F. Placement within Easements

Where sewer lines are shown crossing private property, the alignment of the sewers shall be as shown on the plans and as directed by the Engineer and extra care must be taken to ensure that the work is done within the construction easements.

G. Handling

The sewer pipe shall be handled at all times in such a manner as to ensure delivery to the site and installation in a sound, undamaged condition. Any damaged or defective pipe or other materials will not be accepted. PVC pipe shall not be stored or handled in a manner which will permit exposure to sunlight for extended periods of time.

H. Horizontal and Vertical Separation

Sewers shall be laid 10 feet horizontally from any existing or proposed watermains. This distance shall be measured edge to edge. Should local conditions exist which do not allow for this separation, the crown of the sewer pipe shall be laid at least 18 inches below the invert of the watermain - with the permission of the Authority Engineer and the Michigan Department of Environmental Quality, Drinking Water division.

Sewers crossing watermains shall be laid to provide a minimum vertical distance of 18 inches between the outside of the pipes. This shall be the case where the watermain is either above or below the sewer. The crossing shall be arranged so that one full length sewer pipe shall be centered with respect to the water pipe. Where a watermain crosses a sewer, adequate structural support shall be provided to prevent damage. If the 18-inch isolation distance cannot be maintained due to site constraints, then approval from the MDEQ Water Division will be required for the special construction method proposed (casing, sleeving, etc.)

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to water pipe and shall be pressure tested to assure watertightness prior to backfilling.

In all cases, state and local permit requirements shall be adhered to.

I. Placement of Sewer Pipe

The pipe shall be placed as soon as possible after the trench excavation has been made. The pipe shall be carefully laid to the required grade in a prepared trench, up-grade from structure to structure, with the bell or groove end of the pipe upgrade. Each section shall have a firm bearing throughout its length with recesses only to accommodate pipe bells and joints. Any pipe which has its alignment, grade or joints disturbed after laying shall be removed and re-laid. The joints and interior of all pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during the laying operations. Starting sewer construction in the middle of a project must be approved in writing by the Authority Engineer.

Water shall be kept out of the trench until the material of the joints has hardened

and the trench partially backfilled to prevent floating of the pipe. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth or other foreign substance can enter the line.

J. Joints

Joints shall be of the material specified and shall be placed in accordance with the manufacturer's specifications.

K. Backfilling

As specified in "Excavation, Trenching and Backfilling".

L. Cleaning Sewers

The sanitary sewer main must be clean at the time of acceptance. If, at any time, there is an accumulation of earth or silt in the pipe, the Contractor shall clean out and remove such deposits at their own expense.

M. Acceptance Tests

1. Gravity Sewer Air Testing

All new sewers shall be subjected to air, infiltration or exfiltration tests or a combination of same prior to acceptance by the Owner. All tests for acceptance of the sewer line shall be witnessed by the Authority Engineer. All sewers where the groundwater level above the crown of the sewer at the upstream manhole is over seven (7) feet shall be subjected to air tests or infiltration tests. If an exfiltration test is performed, the maximum exfiltration rate shall be the same as that permitted from infiltration. For the purposes of exfiltration testing, the internal water level shall be equal to the external water level plus seven (7) feet as measured from the crown of the pipe at the upstream manhole.

No sewer lines will be accepted until testing has been satisfactorily completed and approved. Testing shall be completed within 30 days of laying operations.

Where groundwater conditions require dewatering operations in order to construct sewers, the Contractor may, at his option, perform preliminary air tests after backfilling and while the dewatering equipment is still operating. After dewatering operations have ceased and the groundwater has stabilized at its normal level seven (7) feet or less above the sewer and if the preliminary air test was satisfactory, the preliminary air test may be accepted as final.

Maximum allowable infiltration shall not exceed 100 gallons per inch of diameter per mile of pipe per 24 hours for any individual run between

manholes.

The procedure for air testing of PVC (flexible / plastic pipe) sewers shall conform to ASTM F1 417 and be as follows:

The sewer line shall be tested in increments between manholes. All leads and wyes shown on the plans must be in place prior to testing. The lines shall be cleaned and plugged at each manhole. Such plugs shall be designed to hold against the test pressure, be braced in place, and shall provide an air tight seal. There shall be no standing water in the pipe during testing operations. One of the plugs shall have an orifice through which air can be introduced into the sewer. An air supply line shall be connected to the orifice. The air supply line shall be fitted with suitable control valves and a pressure gauge for continually measuring the air pressure in the sewer. The pressure gauge shall have a minimum diameter of 3-1/2 inches and a range of 0-10 PSIG. The gauge shall have minimum divisions of 0.10 PSIG and an accuracy of + 0.04 PSIG.

The sewer shall be pressurized to 4 PSIG greater than the greatest back pressure caused by groundwater over the top of the sewer pipe. Greatest back pressure is determined by averaging groundwater depth over the top of the pipe averaged at each manhole and multiplying by 0.433 to obtain psi. At least two (2) minutes shall be allowed for the air pressure to stabilize between 3.5 and 4 PSIG. If necessary, air shall be added to the sewer to maintain a minimum pressure of 3.5 PSIG during the stabilization period.

After the stabilization period, the air supply control valve shall be closed so that no more air will enter the sewer. The sewer air pressure shall be noted and timing for the test begun. The test shall not begin if the air pressure is less than 3.5 PSIG or such other pressure as is necessary to compensate for groundwater level.

The air test shall be performed for the duration shown in Table 6-2. The air pressure shall not drop over 1.0 psi during this test period.

TABLE 6-2 Required Test Time for Air Pressure Testing

Pipe Diameter In Inches	Duration of Air Test in Minutes per 100 ft. of Sewer Pipe Length
6	3.0
8	4.0
10	5.0
12	6.5
15	7.5
18	8.5
21	10.5
24	11.5

If a sewer segment fails to pass the air pressure test, the Contractor shall determine the location of the deficiency, repair them and retest the sewer. The sewer will not be accepted until satisfactory results are obtained.

The actual groundwater level for sanitary sewers subject to air tests shall be determined by the Authority Engineer or Resident Project Representative.

The air test pressure shall be adjusted to compensate for the maximum probable groundwater level above the top of the sewer pipe that is being tested.

The method of testing and measurement shall be approved by the Authority Engineer. The Contractor shall provide the necessary equipment and labor for making tests and the cost of same shall be included in the unit price bid for completed sewer.

Chemical grouting will be considered an acceptable method of repairing leaking pipe joints. Before this type of repair is undertaken, the Contractor shall obtain approval of the Authority Engineer to hire a pipe grouting firm for making such repairs. Additionally, if chemical grouting of pipe joints is necessary, this operation must be performed under the observation of the Authority Engineer and a complete report of all grouting operations shall be furnished to the Authority Engineer upon completion.

2. Deflection Testing of Thermoplastic Sewer Pipe

Thermoplastic sewer pipe shall be tested for vertical deflection. ***Deflection tests shall be performed on 100 percent of the total footage of PVC* sewer.**

This testing shall be carried out under the observation of the Authority Engineer using a Go-No-Go device approved by the Authority Engineer and furnished by the Contractor. The deflection testing shall be performed at least thirty (30) days after final backfill of the trench. The maximum allowable vertical deflection of the cross section of the pipe will be five percent (5%) of the actual internal pipe diameter. If the results show the deflection of any sewer to be in excess of allowable, then the Contractor shall make repairs by re-excavation and compaction or replacement prior to acceptance.

The deflection testing must be satisfactorily completed prior to final acceptance of the sewer. There will be no additional payment for deflection testing performed while the sanitary sewer is in service if the Authority executes their right to utilize the sewer upon Substantial Completion. The Authority Engineer shall be notified at least 24 hours prior to air testing of the sewer.

3. Television Inspection

New sewers connecting existing services may be inspected after installation by means of closed circuit television in lieu of air testing. Videotaping equipment shall have a running footage indication for aiding in locating all wyes, defects, etc. which is displayed and permanently recorded on the video tape of the section being filmed. The complete system shall be permanently recorded using video tape along with handwritten documentation indicating all information such as wye location, defects, infiltration and cleanliness. Immediately upon completion of the filming, the finished video tapes shall be turned over to the Authority Engineer in cassette style (VHS Format). Wyes and laterals shall be in place prior to the television inspection. This television inspection work will be done under the direction and observation of the Authority Engineer. The Contractor shall notify the Authority Engineer at least 24 hours prior to the television inspection.

The television inspection shall be completed prior to the final acceptance of the sewer section. The Authority may exercise their option to use the sewer upon substantial completion. No additional payment will be made for televising the sewer under liveconditions.

Any defect in the sewer construction observed during the television inspection such as poor grade, cracked or leaking pipe sections or excessive amounts of debris shall be corrected by the Contractor immediately. Sections with defects will have to be re-televised after the repairs are made.

4. Force Main Pressure Testing

A. General: All new sanitary force mains, service laterals, valves and fittings shall be pressure tested as described herein. Tests shall be made on all sections of pipe. All valves within the section of pipe being tested shall be pressure tested while closed. Caps or plugs shall be temporarily installed where necessary to perform the test. All parts of the piping must be braced and sufficiently backfilled to prevent movement of the pipe. PVC pressure pipe shall NOT be air tested due to the safety risks involved. The Contractor shall be responsible for providing all the labor, equipment, and materials necessary to satisfactorily complete the test.
B. The Contractor may, at his option, test any or all of the sewer lines prior to backfilling. However, such tests shall be in addition to the required test following the backfilling of the trench.
C. The Contractor shall make provisions for determining the ground water level prior to testing, and the level will be confirmed by the Engineer.
D. All tests shall be made under the supervision of the Engineer. Testing schedule and procedures will be submitted by the Contractor and approved by the Engineer prior to the start of the work. Schedule tests and

inspections with Engineer and authorities having jurisdiction with at least 48 hours' advance notice. No testing shall be accepted unless witnessed by Engineer

E. The Contractor shall clean and flush the pipe prior to conducting acceptance tests.

F. All visible leakage shall be repaired even though acceptance tests have been satisfactory.

G. Tightness Hydrostatic Testing for force main sewers shall be performed in accordance with AWWA procedures for hydrostatic testing of watermain, which includes the following:

1. Test equipment shall include water supply, pump for pressurizing system, water hose, plugs, hose connections, shutoff valve, throttling valve, pressure relief valve, monitoring pressure gauge, testing pressure gauge in not more than 1 psi gradations (visible for monitoring at a safe location outside of any excavations or manholes) and stopwatch.
2. Safety precautions shall be carefully observed by the Contractor during testing, recognizing the danger from plugs blowing out. No person shall be allowed in manholes during testing.
3. Isolate Pipe to be Tested: The section of pipe to be tested shall be plugged at each end. The ends of all branches, laterals and wyes which are to be included and in the test are to be plugged. All plugs shall be carefully braced to prevent slippage and blowout due to the internal pressure.
4. Add Water: Supply water to the system at low point in the piping, forcing air out through valve or air release at high point. Monitor the line pressure so that the pressure inside the pipe does not exceed the pressure rating of the pipe.
5. Stabilize: When air trapped in the line has been purged and the pressure is brought up to the greater of either 1.5 times the maximum operating pressure as determined by the Engineer, or 100 psi, throttle the pump so the internal pressure is maintained within 5 psi of test pressure specified by Engineer, plus adjustment for groundwater, for at least 2 minutes. If plugs are found to leak, bleed off the pressure, tighten the plugs and repeat.
6. Determine Rate of Water Loss: The control equipment consists of delicate gradation pressure gauge, valves and a pocket stopwatch. After the pressure has been allowed to stabilize, the pump is turned off and the pressure is monitored for 120 minutes. Water is added to the system throughout the testing period to maintain the test pressure within 5 psi. Water added by the pump to maintain test pressure shall be drawn from a reservoir with volumetric gradations sufficient to determine the total volume of water added during the 120 minute test period. If at the end of the 120 minute test period the amount of water added is less than the leakage rates below, then the pipe will be considered passing the tightness test :

1.25" Pipe : 0.08 gallons per hour per 1000 feet of pipe tested
2" Pipe : 0.12 gallons per hour per 1000 feet of pipe tested
2.5" Pipe : 0.13 gallons per hour per 1000 feet of pipe tested
3" Pipe : 0.15 gallons per hour per 1000 feet of pipe tested
4" Pipe : 0.33 gallons per hour per 1000 feet of pipe tested
6" Pipe : 0.50 gallons per hour per 1000 feet of pipe tested
8" Pipe : 0.66 gallons per hour per 1000 feet of pipe tested
10" Pipe : 0.83 gallons per hour per 1000 feet of pipe tested
12" Pipe : 0.99 gallons per hour per 1000 feet of pipe tested

7. Piping sections not passing the tightness test shall be repaired and retested at Contractor's expense, until a passing result is obtained.

5. Visual Observation

Any observed defects in the sewer or groundwater flowing in the sewer shall be repaired by the Contractor prior to final acceptance.

6. Tracer Wire

All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the Engineer, prior to acceptance. This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.

N. AIR RELEASE VALVES AND MANHOLES

Air release valves and manholes shall be constructed as detailed on the detail drawings.

O. FORCEMAIN CLEANOUTS

Forcemain cleanouts shall be constructed as shown on the detail drawings.

P. Certification

The manufacturer of pipe and fittings shall furnish a certification statement that all pipe and fittings furnished to the project have been inspected and tested in accordance with the applicable specifications. Pipe will be subject to inspection and approval upon delivery and no cracked, broken, damaged or defective pipe or fitting shall be laid in the work. Any piece that is found to be defective after it has been laid shall be removed by the Contractor and replaced by a sound and perfect piece. Material certifications must be received prior to final acceptance and/or final payment for the work.

Q. Well Isolation Encroachment

Unless otherwise indicated, it shall be assumed that sewer mains may encroach upon the standard 50-foot well isolation of adjacent private drinking water wells. Gravity sewers shall be constructed with watertight joints per Rule 122 per Part 127, 1978 PA 368 and must be at least 10 feet from wells.

Pressure sewers shall meet the following specifications:

a. All sewer piping and fittings shall meet water main standards for materials and construction as detailed in Part 127, R 325.1613 Rule 113 (2) (b) (iii) (B) "ASTM specification D1785-91 or D2241-89" or (C) "has a wall thickness that is equivalent to, or thicker than, schedule 40 or SDR 21" or they may be HDPE SDR11 pipe, or acceptable equivalent, conforming to the appropriate ASTM standard. If HDPE SDR 11, or an acceptable equivalent will be used, all joints outside structures shall be watertight and connected in accordance with the manufacturer's requirements, and all taps shall be completed using branch saddles fused to the mainline pipe, or acceptable equivalent. Alternative designs such as watertight carrier pipe may also be considered. Sewer shall be clearly marked as sanitary, per applicable standards.

b. All devices (intermediate flushing connections, terminal flushing connections, branch flushing connections, air/vacuum release valves, etc.) except for valves on leads, shall be placed in watertight vaults or structures, and shall be located no less than 50 feet from any existing private water well.

c. Where the horizontal distance between any portion of the public sewer or individual service leads (see d below) and any existing private water well is less than 50 feet, the separation distance shall be maximized; but in no case shall the distance be less than 10 feet. This is referred to as "suitable isolation distance" in the remainder of this procedure.

d. The sewer must pass a pressure test, equivalent to that required for water main, as described in Part 127, R 325.1613 [Rule 113(2)(B)(iii)(A)] "the sewer pipe and joints must be pressure tested, after installation, to not less than 100 pounds per square inch and determined to be watertight" or shall be tested using AWWA water main pressure testing procedures and standards.

e. For nonmetallic low-pressure pipe (e.g., HDPE or PVC), a continuous tracer wire shall be provided and attached directly to all piping owned, operated, or maintained by the public system.

SECTION 7 – SANITARY SEWER APPURTENANCES

7.01 General

The work covered in this section of the specifications consists in the furnishing of all plant, labor, materials, equipment and performing all operations involved in the construction of sewer appurtenances as shown on the Project Plans or Standard Details. This work includes, but is not limited to, the following items:

1. Sewer Manholes & Structures
2. Connection to Existing Sewers
3. Gravity Sewer Wyes and Leads
4. Pressure Sewer Leads

A. General

The following provisions apply to this section of the specifications:

1. All materials, unless otherwise indicated on the plans or authorized in writing by the Authority Engineer, shall be new and unused materials of the size and type shown on the plans and standard details and shall conform to the requirements of the specifications.

2. All materials offered by the Contractor shall be the standard products of reputable manufacturers normally engaged in the manufacturing of such materials. Certifications shall be provided on all materials prior to final acceptances.

3. The foundations of all structures shall be rigidly supported by undisturbed earth or compacted backfill. The interiors of all appurtenances shall be thoroughly cleaned of all foreign materials.

4. Where appurtenances are shown to be constructed on private property, the location of the structure shall be as shown on the plans. All work done within private property shall have an easement provided to the Authority by the Owner prior to turnover.

7.02 MATERIALS

A. Sanitary Sewer Manholes & Structures

Sanitary Sewer Manholes, valve vaults, cleanout and/or air release structures shall be

constructed of pre-cast manhole units in accordance with ASTM C478. Unless otherwise indicated, all manholes shall be four (4) feet in diameter. Manholes shall be delivered to the project in an un- damaged condition. Any manhole which shows visible signs of damage will not be accepted. Manholes shall be constructed to meet the dimensions shown on the Standard Details.

1. Waterstops: All structure connections will be fitted with a waterstop assembly. The waterstop shall be of a design acceptable to the Engineer and the pipe manufacturer. Waterstops shall be KOR-N-SEAL as manufactured by National Pollution Control Systems; PRESS WEDGE II as manufactured by the Press-Seal Gasket Corporation; RES-SEAL as manufactured by Scales Manufacturing Corporation or equal.

   The joint between the pipe and the structure wall shall be flexible. Mortar and grout shall not be used to fill the space between the structure wall and the pipe, except to form an adequate flow channel.

2. Waterproofing Material: All structures shall be waterproofed on the interior or the exterior.

   a. Interior Manhole Waterproofing Material: The materials to be used for interior manhole waterproofing shall be "Drycon" as manufactured by IPA Systems, Inc., "Thoroseal" as manufactured by Standard Dry Wall Products Company or equal.

   b. Exterior Manhole Waterproofing Material: The material to be used for exterior manhole waterproofing shall be a heavy fibered type waterproofing mastic conforming to Federal Specification SS-C-153 Type 1 or CS-206. The mastic shall be A.C. Horn (Grace), Flink Kote 710-23 or equal.

3. Manhole Steps: Manhole steps shall be cast iron or steel-reinforced plastic. Steps shall not be aligned over the pipe and shall be at a consistent 16” spacing.

   a. Cast Iron: Cast iron manhole steps shall fulfill the requirements of the ASTM Standard Specifications for "Gray Iron Castings", A-48, Class No. 30, minimum width 13 inches. They shall be East Jordan Iron Works No. 8509, Neenah Foundry Co. R-1980 or equal.

   b. Plastic: Polypropylene plastic, steel reinforced, manholes steps may also be furnished, minimum width 13". They shall be #PS2 manhole steps as manufactured by M.A. Industries, Inc., of Peachtree City, Georgia or equal.

4. Cast Iron Frames and Covers: Structure frames and covers shall be cast iron. Cast iron frames and covers for sanitary sewer manholes shall be a self-sealing lid with no holes extending all the way through the lid. The self- sealing lid shall fit into a precisely machined groove. A rubber gasket shall make contact with the frame to create a leak proof seal. The self-sealing lid shall include a concealed pickhole to facilitate the removal of the lid, but not allow water to enter.

   All structures shall have a 24" opening similar to an EJIW #1040 with Type A solid cover or equal. Manholes located within existing or proposed pavement areas shall also be installed with a 3" metal adjusting ring (EJIW #1000H) between the frame and cover. Metal adjustment rings shall be tack welded in at least 6 locations inside and out to secure the ring to the frame.

B. Gravity Sewer Wyes and Sewer Leads

All PVC sewer laterals shall be extra strength pipe, and unless otherwise specified, shall conform to the requirements of ASTM Designation D3034 with a standard dimension ratio of 23.5 (SDR 23.5), or conform to the requirements of ASTM Designation D-1785 Schedule 40. Any specified bends or curves shall be smooth, long-radius type curves. No mitered or segmental type bends will be approved.

The fitting between the SDR 35 wye and the SCH 40 PVC lead shall be a 35/40 adapter. SDR joint shall utilize a slip joint (no rigid glue joint will be allowed).

C. Clean-Outs

Clean-outs shall consist of pipe and fittings of the same type as the sewer main materials they connect to as required to provide a clean-out installation as shown in the standard details. The maximum distance between clean-outs is 75 lineal feet.

D. Pressure Sewer Services (HDPE)

Pipe shall be made from a material having a material designation code of PE 4710 or 3608. The material shall meet the requirements of ASTM D3350 and shall have a minimum cell classification of PE445474C for PE 4710 and PE345464C for PE 3608. Pipe wall thickness shall be in accordance with manufacturer specifications for SDR-11. Use adapters and transition fitting assemblies with combination of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with system pressures, piping, and system liquid; made for joining different piping materials.

Services shall be electrofusion tapping tee with butt fusion outlet of the size indicated, fused to the mainline pipe.

7.03 CONSTRUCTION METHODS

A. Excavation, Bedding and Backfilling

Excavation, bedding and backfilling for sewer manholes and clean-outs shall be in accordance with the Section 4, "Excavation, Trenching and Backfilling" of these specifications and applicable standard details.

B. Manholes and Pre-cast Structures

Manholes and precast structures shall be constructed only when the temperature is above 32° F. All work shall be protected against freezing.

Water shall be removed from the excavation during construction of the structure and during the time required for the concrete or mortar to develop sufficient strength to resist rupture by groundwater pressure.

Pre-cast O-ring sections shall be joined by first applying a lubricant as approved by the concrete manufacturer. The lubricant shall be placed on the O-ring and both faces of the sections to be joined. The pre-cast sections shall then be set evenly to provide a full seating of the O-ring within the grooves in the concrete sections. After the pre-cast sections have been placed, the interior joint surface shall be grouted smooth. Additional methods for joining two barrel sections must be approved by the Engineer.

C. Manhole Flow Channels

Manhole flow channels shall be formed as shown on the Standard Detail Plans by laying pipe through and cutting out the top portion before completion of the base of the manholes. Cut edges of pipe laid through the manhole shall be fully covered by concrete when the manhole invert is complete. The finished invert shall be smooth and true to grade. No mortar or broken pieces of pipe shall be allowed to enter the sewers.

D. Drop Structures

All sanitary manholes with an invert drop in excess of 24 inches shall have a drop structure. The drop structure shall be built as shown on the Standard Detail Plans.

E. Manhole Waterstops

The joint between the pipe and the manhole wall shall be flexible. Mortar and grout shall not be used to fill the space between the manhole wall and the pipe, except to form an adequate flow channel.

F. Placing Castings

Castings with adjustment rings, if applicable, shall be set to the required elevation in full mortar beds. No more than nine inches (9") of adjusting concrete rings or and mortar shall be used on any manhole between the pre-cast top section and the casting.

G. Connection to Existing Sanitary Sewer Systems

Connection to existing sanitary sewer systems shall be made in such a manner as to minimize the interruption of flow in those systems. The connection to an existing manhole shall be made by coring and the installation of a waterstop.

When a new manhole is to be installed over an existing line, it shall be initially placed without damaging the existing pipe. The existing pipe shall not be damaged until the new lines are ready to be placed in operation and the new flow channel is ready to be formed to connect with the existing flow lines.

H. Gravity Sewer Wyes and Leads

The wyes and sewer leads shall be constructed as shown on the Sanitary Sewer Standard Details in the plans.

The sewer lead is defined as the sewer pipe between the wye installation and 5 feet outside the building limits or to the property/easement line in the case of installation to an undeveloped parcel as indicated on the Standard Details for sewers. The sewer lead shall be brought to the property/easement line at a grade and location established before construction commences, based on a location document (provided by the Design Engineer) or as staked in the field by the Design Engineer or Resident Project Representative. If the proposed location of a sewer lead is not identified, it is the Contractor's responsibility to obtain the information from the Design Engineer/Resident Project Representative prior to the installation. If the lead location is not as per directed by the Resident Project Representative, or Engineer the relocation of the sewer lead shall be performed at the Contractor's expense.

After each sewer lead is installed, it shall be permanently marked at its termination (the property line or easement line) at the plug (see the Standard Detail) with a treated wood post 0.40 penetration for underground purposes. The post shall be installed vertically and cut and painted as directed by the Engineer, the post shall be installed from the

bottom of the stub to 18” above grade. For leads deeper than 12 feet, use wood post that provides an 18 inch (+) projection above ground. Should the post location fall in a driveway or other area where its above ground projection might cause problems, the Contractor shall pre-cut the 12-foot post to some convenient full foot dimension below grade level and attach 3-1/2" x 3-1/2" x 1/4" metal plate to the top of the post. The Contractor shall immediately report same to the Resident Project Representative. The Contractor shall allow the Resident Project Representative to obtain necessary record measurements on the lead installation prior to backfilling. If the sewer leads are backfilled without notification to a Resident Project Representative, the sewer lead shall be excavated, clearly showing the newly placed pipe, at the Contractor’s expense.

I. Pressure Sewer Services

Pressure sewer services shall be constructed as shown on the Sanitary Sewer Standard Details in the plans.

A pressure sewer service assembly is defined as the fused connection of the tapping tee to the main, the butt fused service pipe from the main to the property line, and a curb stop assembly at the property line. The curb stop assembly consists of an isolation valve and valve box extending to the surface, with a cast iron cover marked “sewer” and a check valve.

J. Cleaning

All manholes, sewer leads and cleanouts shall be kept thoroughly clean of silt, debris and foreign matter and shall be free from such accumulations at the time of final acceptance.

K. Sanitary Structure Waterproofing

The Contractor shall apply a waterproofing system to the inside or outside of all manhole and structure walls. The material to be used for this operation shall be as specified in these specifications.

The waterproofing system shall be applied and allowed to dry in accordance with the manufacturer’s directions. All steps, lids, frames and castings and sewer pipe entering or leaving the manhole shall be protected during application to prevent their being coated.

1. Interior Waterproofing

If any leaks in the manhole walls are detected twenty-four (24) hours after application of the first coat of the waterproofing system, they shall be sealed by application of a quick-set sealer. This sealer shall be a mixture of Portland

Cement - Type One and "Ipanex R", "Waterplug", ”Preco” or equal. The quick-set sealer shall be applied in accordance with the manufacturer’s directions. After the patched areas dry, they shall be covered with another coat of the waterproofing and allowed to dry. If any leaks are apparent after that time, the Contractor shall repatch them. The above steps shall be repeated until all leaks are sealed.

After all leaks are stopped and there are no leaks apparent after twenty-four (24) hours upon application of the first coat of the waterproofing system or twelve (12) hours after application of a patch, the Contractor shall apply over the dry surface a finish coat.

2. Exterior Waterproofing

The Contractor may elect to provide an exterior rather than interior manhole waterproofing to the manhole sections before installation.

The exterior surfaces of all manholes shall be thoroughly covered with mastic at a rate of one (1) gallon per twenty-five (25) square feet. The exterior surfaces shall be thoroughly cleaned before application of the mastic. The mastic shall be as specified in these specifications.

Should the exterior waterproofing fail to provide an adequate seal then the Contractor shall seal the interior of the manhole as specified above.

L. Defective Manholes

Any manhole that is defective, due to manufacturer or realignment of the pipe openings, should be returned to the manufacturer.

M. Acceptance Tests

1. Sanitary sewer manholes and structures shall be visually inspected for leaks prior to acceptance of the manhole. There shall be no visible leakage of groundwater into the manhole. Patching, if required, shall be accomplished via the methods indicated in 7.03K.

2. Sanitary sewer wyes and sewer leads shall be tested for leakage after completion of construction. The testing shall occur in conjunction with the overall main sewer testing. Should it be necessary to test sewer wyes and leads independently after the main sewer has been tested it shall be performed using air and following the procedure outlined in Section 6.03J of this specification.

SECTION 12 - WWTP

12.01 SCOPE OF WORK

A. The WWTP shall use the SEQUOX activated sludge process, along with the DO_2ptimizer™ D.O. control process. Design parameters are as follows:

	Plant Expansion	Entire Plant
Average Design Flow:	0.096 MGD	0.192 MGD
Maximum Daily Flow:	0.192 MGD	0.384 MGD
Peak Hour Flow:	0.384 MGD	0.768 MGD

Influent – Plant Expansion

	Design Average	Peak Day
BOD_5:	167.5 lbs/day	220 lbs/day
TSS:	193.5 lbs/day	
TKN:	28.8 lbs/day	37.7 lbs/day
P:	4.0 lbs/day	

Effluent Required

BOD_5:	___ mg/l
TSS:	___ mg/l
NH_3-N:	___ mg/l

B. The footprint of the plant expansion shall be as shown on the contract drawings. It shall include: one (1) fermenter tank, one (1) anaerobic selector tank, two (2) ClarAtor clarifier tanks, two (2) first stage aeration basins, two (2) second stage aeration basins, two (2) aerobic digesters, one (1) sludge holding tank, and one (1) side-line surge tank.

C. All equipment in this section shall be supplied by a single manufacturer as a total system. Equipment to be supplied shall be furnished by Aero-Mod, Inc. Items to be supplied are as follows:

1. Aeration drop pipes with diffusers in various tanks
2. Pneumatically-actuated valves
3. WAS and sludge transfer airlift pump equipment
4. Clarifier/RAS equipment
5. PLC-based and timer-based process control & D.O. control
6. Probe module and DO probes
7. Compressed air pneumatic system
8. Concrete tank mounted aluminum walkway & handrail
9. Aeration blowers
10. Blower VFD controls
11. Submersible mixer & controls.
12. Surge tank submersible pumps & controls.

12.02 SPLIT-CLARATOR CLARIFIER EQUIPMENT

The supplier of the Split-ClarAtor clarifier equipment shall have a minimum of 40 operating installations. The Split-ClarAtor clarifier equipment shall be supplied by Aero-Mod, Inc.

A. Split ClarAtor Clarifier Construction

The Split ClarAtor clarifier shall consist of (a) structural support frame with handrails and aluminum grating (b) coarse screening (c) a hydraulic suction hood for sludge removal (d) sludge return air lifts and MLSS return trough (e) floating skimmers (f) 3-weir level and rate control device and (g) the associated plumbing, equipment and accessories as noted herein or on the drawings.

The structural support frame shall be constructed of 3"x3" 304 SS rectangular tubing. The support frames will be placed into notches in the clarifier tank walls. The frame will have the MLSS return trough attached to its underside. The trough shall also be fabricated of 304 SS.

The hydraulic suction hood and structural support fins shall be of fiberglass. The hydraulic suction hoods will set over concrete suction hood bases on the floor of the clarifier tank.

For this project, two (2) Split ClarAtor clarifier modules, Model 12192 shall be provided, installed and arranged within the clarifier tankage as shown on the drawings.

B. Inlet Coarse Screens

Telene circular inlet screens shall be provided. For this project, a total of six (6) are required. Each inlet screen shall provide 4 linear feet of screen. The coarse screens shall consist of 1/2" wide slots on 2" centers. These screens have an 8" flange for connecting to the 8" PVC distribution piping. They are installed in the aeration tanks as per the drawings.

C. Walkways and Handrails

A walkway shall be provided across the entire support frame consisting of banded aluminum grating, 1" I-Bar, set into a frame made of SS.

A two-rail handrail system shall be supplied. Handrails shall be of 1-1/2" aluminum tubing with NU-RAIL aluminum handrail fittings (or equal). The handrail risers shall be securely mounted to the support frame and of proper length to place the top-rail 42" above the walkway.

D. Skimmers

Specially designed floating-skimmer assemblies shall be located in the clarifier chamber as per the detail drawing. Each skimmer shall consist of a formed floating head with a telescoping

pipe. This assembly will insert into union and discharge up into the MLSS return trough. Air is supplied from 2" SS air pipes located on the support frame. The telescoping section shall allow unrestricted level adjustment to accommodate the rising and falling clarifier levels caused by the surge control system. The skimmers consist of a SS union and ell for connection to the RAS trough and PVC fittings and sized to remove floatables that enter the clarifier chamber.

E. Clarifier Chamber

The clarifier chamber shall be designed such that PVC pipe distribution headers are located along both sides of the outer edge of each hydraulic suction hood. These inlet headers have ports provided. The inlet headers and ports are sized to provide even distribution across the entire settling area to prevent inlet turbulence during surge flows. There shall be two (2) rectangular clarifiers, and each clarifier shall provide 192 square feet of surface area.

F. Sludge Returns

Return sludge airlifts made of 4” Schedule 40 PVC pipe shall be located every four feet along the apex of the hydraulic suction hoods. Each airlift rate shall be controlled by a 3/4" ball valve. A pneumatic valve on the 1-1/2" SS air supply pipe will control the air supply to the airlifts. The flow rate for each air lift can be adjusted from zero to 100 gpm and can be operated continuously or intermittently by a timer device located in the plant process control panel.

G. Effluent Collector

Two (2) SS triangular effluent collection pipes with 5/8" holes spaced at 8" CC shall be furnished along the entire support frame length for effluent withdrawal. The apex of each triangular pipe shall be located approximately 1 inch below the minimum water level within the clarifier. This submerged orifice collection pipe shall provide uniform effluent withdrawal across the entire length without regards to leveling, will not pass surface scum or floatables, and will not be adversely affected by either algae accumulation or icing.

H. Level and Rate Control

Two (2) effluent boxes with adjustable low- and high-level weirs and a submerged orifice for surge control shall be furnished on the effluent withdrawal end of each triangular collection pipe. The low-level weir will set the minimum operating level, passing flow directly to an orifice plate for surge protection. The orifice shall be sized to limit the maximum effluent rate, keeping the clarifier surface settling rates below maximum design standards. The upper edge of the orifice plate shall serve as the high-level by-pass weir to limit the maximum water level within the plant. The distance between the low- and high-level weirs shall provide 5" surge storage within the freeboard across the entire mixed liquor aeration tank. A manual swing gate valve with the orifice located on the paddle portion will allow the operator to shut off effluent from each effluent box. This allows for effluent shut off during periods of cleaning and maintenance.

12.03 SUBMERSIBLE MIXER & CONTROLS

A. Wall Mounted Submersible Mixer System

The equipment manufacturer shall supply a submersible mixer, mast, and controls for the anaerobic selector tank.

1. Submersible Mixer
   One (1) Wilo, model TR 30-1.114-6/8 2.7 HP, 460V, 3ph mixer shall be located in the Anaerobic Selector Tank, as shown on the plans. The mixer shall include:
   - Thermal sensors in the windings
   - Explosion protection
   - Cast 316SS propeller
   - Liquid ceramic coating
   - Foot support
   - 33' power cable
   - Stainless steel guide pipe/mast assembly, which includes the following:
     - Sliding console/frame
     - Recessed guide pipe part
     - Bottom bearing console
     - Stop console
     - Fixing bracket
     - Upper guide holder

2. Davit Crane Assembly
   The equipment manufacturer shall supply one (1) portable davit crane assembly for the removal of the submersible mixer from the anaerobic selector tank. The crane shall be portable. The crane shall include the following:

   - Rotatable horizontal crane arm
   - Winch
   - Hook
   - Intermediate piece
   - Relief chain
   - One (1) wall-mount base

3. Electrical Control Panel
   A NEMA 4X panel shall supply power and control to the mixer. The control panel face shall have the following: 1) run light, and 2) H-O-A switch. In remote, the panel shall be controlled and monitored by the Plant Process Control Panel.

12.04 SIDE-LINE SURGE TANK TRANSFER PUMP & CONTROLS

A. Surge Overflow Weir

The second stage aeration tank shall be constructed with a notch (existing tank wall shall be cut) over which a surge overflow weir will be placed to allow surge flow to enter the side-line surge tank. For this project, two (2) supernatant weir & baffle assemblies are required.

B. Submersible Pump System

The equipment manufacturer shall supply (2) explosion proof submersible pumps, masts, and a single duplex control panel for the side-line surge tank.

1. Submersible Pump
The side-line surge tank transfer pump shall be manufactured by Liberty, or pre-approved equal. The explosion proof pump shall be model XLE152M-2 with a 1.5 HP motor and shall be capable of 150 gpm at 18' TDH. Two (2) pumps shall be supplied for the side-line surge tank, one discharging into the existing process tank (second stage aeration tank) and one into the new process tank (second stage aeration tank). Each pump shall include:
- Foot support
- Non-spark, stainless steel guide pipe/mast assembly, which includes the following:
  - Sliding console/frame
  - Recessed guide pipe part
  - Bottom bearing console
  - Stop console
  - Fixing bracket
  - Upper guide holder
- Three (3) float switches (to be wired into pump control panel)

2. Davit Crane Assembly
The equipment manufacturer shall supply one (1) portable davit crane assembly for the removal of the submersible pumps from the side-line surge tank. The crane shall be portable. The crane shall include the following:

- Rotatable horizontal crane arm
- Winch
- Hook
- Intermediate piece
- Relief chain
- Two (2) wall-mount bases (one for each pump)

2. Electrical Control Panel
A NEMA 4X panel shall supply power and control to the explosion proof submersible pumps. The control panel shall have the following through mounted: 1) run light, and 2) H-O-A switch. The panel shall be controlled by float switches and monitored by the Plant Process Control Panel.

12.05 WALL MOUNTED AERATORS

A. Aerators

The basins requiring aeration shall have wall-mounted aerators as shown on the plans. These aerators shall provide the necessary air required to maintain proper operation. The diffusers shall be set at a submergence depth in the aeration tank as shown on the plans. As shown on the plans, the air manifolds (drop pipes) shall be wall mounted with a SS support system. Easy diffuser removal from above the water line shall be by lightweight PVC drop pipes. Removal and replacement shall be assisted by a 1-1/2" Schedule 5 SS guide rail system. The guide rail shall be bolted to the SS wall mounting support system in the field. No field welding shall be required.

1. Aeration Tank – First Stage

The drop pipes used in the first stage aeration basins shall be 2" Schedule 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2” connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. Six (6) Model WA-PS4-2 aerators with four (4) 24" SS diffusers per drop pipe are required for this tank.

2. Aeration Tank – Second Stage

The drop pipes used in the second stage aeration basins shall be 2" Schedule 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2” connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. Ten (10) Model WA-HS2-2 aerators with two (2) 12" SS diffusers per drop pipe are required for this tank.

3. Aerobic Digester Tank

The drop pipes used in the aerobic digester tanks shall be 2" Schedule 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. Six (6) Model WAD-HS2-2 aerators with two (2) 24" SS diffusers per drop pipe are required for these tanks.

4. Fermenter Tank

The drop pipes used in the aerobic digester tanks shall be 2" Schedule 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air

transfer, which shall thread into the diffuser header for each aerator. One (1) Model WAD-HSS2A-2 aerator with two (2) 12" stainless steel diffusers and one (1) pneumatic diaphragm valve per drop pipe is required for this tank.

5. Anaerobic Selector Tank

The drop pipes used in the aerobic digester tanks shall be 2" Schedule 40 PVC pipe. A 2" SS throttling ball valve along with a SS union and ell shall be supplied in each aerator upper assembly. A single 2" connection from the air header to the flex connector on the aerator assembly is required for each aerator. SS coarse bubble diffusers shall be used for air transfer, which shall thread into the diffuser header for each aerator. One (1) Model WAD-HSS2A-2 aerator with two (2) 12" stainless steel diffusers and one (1) pneumatic diaphragm valve per drop pipe is required for this tank.

B. Air Header Condensate Blowoff: Each air header section for the first and second stage aeration tanks, the fermentation tank, the selector tank, and the digester tanks shall end with a pipe leading to a condensate blowoff valve. For this project, five (5) 2" SS blowoff valve assemblies shall be supplied. For all other air headers, the last connection off of the air header (aerator or airlift pump) shall include an ell or saddle that is mounted to point down before connection to the aerator or airlift pump, if applicable.

12.06 SLUDGE MANAGEMENT

A. Solids Wasting (WAS) Air Lift Pump – Aeration Tank to Digester Tank

The sludge wasting airlift pump shall be sized for a running time at design loading of approximately 60-120 minutes per day. All components below the water line shall be of SS. A pneumatically controlled automatic valve and a manual throttling and shut-off valve shall be supplied in the air feed line. The entire assembly shall be provided with anchor bolts. For this project, two (2) AL-400 airlift pumps are required to waste mixed liquor from the aeration tanks to the digester tanks.

B. Supernatant Weir & Baffle

The digester shall be constructed with a notch over which a supernatant weir & baffle will be placed to control the digester water level and return displaced supernatant back to the aeration basin. For this project, two (2) supernatant weir & baffle assemblies are required.

C. Solids Transfer Air Lift Pump – Digester Tank to Sludge Holding Tank

The sludge wasting airlift pump shall be sized for a running time at design loading of approximately 60-120 minutes per day. All components below the water line shall be of SS. A pneumatically controlled automatic valve and a manual throttling and shut-off valve shall be supplied in the air feed line. The entire assembly shall be provided with anchor bolts. For this project, two (2) AL-400L airlift pumps are required to transfer sludge from the digester tanks to the sludge holding tank.

12.07 PLANT CONTROLS

A. Plant Process Control Panel

The Manufacturer will provide a Remote Terminal Unit (RTU) enclosed in a NEMA type 12 enclosure. The Manufacturer will also provide an update to the existing plant's control panel PLC. The contractor shall provide conduit and wiring between the RTU and the existing control panel as well as conduit and wiring between the RTU and the new equipment being provided. This panel shall provide the control for the four (4) main process functions required for the AERO-MOD provided treatment equipment. This RTU panel shall be located as shown on the plans.

1. Function 1 - RAS Timer

The timer function shall control the operation of the RAS airlift pumps in the clarifier. The control logic shall be xx minutes of operation followed by xx minutes of standby (time to be determined at time of startup). The operation shall then index to the next set of RAS banks.

An electric signal shall be sent to activate the 1/8" solenoid valves that shall be used to activate the pneumatically actuated ball valves on the clarifier RAS air supply.

2. Function 2 – SEQUOX/Digester Alternating Air Timers

These timer functions shall control the operation of the SEQUOX alternating aeration in the first and second stage aeration basins and the alternating aeration in the digester tanks. The control logic shall be xx hours of aeration valve closure in one aeration basin, followed by xx hours of aeration valve closure in the corresponding aeration basin. An overlap timer function of xx minutes shall keep both aeration valves open during the transition. The same logic will be used for all of the aeration basin stages and the digesters.

An electric signal shall be sent to activate the 1/8" solenoid valve that shall be used to activate the pneumatically actuated butterfly valves in the air headers for the first and second stage aeration basins and the digester tanks.

3. Function 3 – WAS Timer, Aeration Tank to Digester Tank

These timer functions shall control the automatic solids wasting system that shall transfer solids from the aeration basins and digesters by a WAS pump system. The control logic shall include the ability to set on which days the solids wasting will occur, and the time of day the solids wasting will occur. The timer function shall control the aeration in each of the digester tanks and the operation of an airlift pump located in one of the aeration basins. For the days that the wasting function operates, at the user-defined time(s) of day, the timer function shall close the butterfly valve in the air header for each digester and shall operate the airlift pumps, which shall pump the WAS at a set rate to the

digesters. At the end of the timer function, the WAS airlift pump shall be turned off and the aeration butterfly valves shall be opened.

An electric signal shall be sent to activate the 1/8" solenoid valves that shall be used to activate the pneumatically actuated butterfly valves in the air headers for the digester tanks and the pneumatically actuated diaphragm valves on the WAS airlift pumps.

4. Function 4 – Speed Control of Aeration Blowers for D.O. Range Control

The DO_2ptimizer™ D.O. control process shall include a series of operator-established settings shall be incorporated to allow multiple adjustments in order to maintain a D.O. range within the aerated aeration basins. Timer functions shall be included that allow for blower shutdown, blower startup, and blower speed changes relative to the specified D.O. range that is set.

B. Pilot Air System

The pilot air system shall consist of an existing air compressor system followed by a new air-drying system to provide a constant, dry source of pneumatic pressure to the pneumatic control system. The contractor shall run 3/8” nylon tubing from the new regenerative desiccant dryer/dry storage tank to the Plant Process Control Panel. Air compressors are already installed onsite.

1. Regenerative Desiccant Dryer / Dry Storage Tank

A Tsunami Pure 10, or equal, dual tower regenerative desiccant dryer shall be furnished to keep the pilot air dry and prevent moisture buildup in the pneumatic control system. This unit shall operate using 115V, 15-amp service, and shall include a cord with plug. The dryer will be pre-mounted to a 60-gal dry air storage tank. For this project, one (1) unit shall be supplied, replacing the existing desiccant dryer.

3. Pneumatic System Air Tubing

Pneumatic 3/8” nylon tubing (black) shall be supplied to run between the Air Compressors and the Air Alternation Panel on the Regenerative Dryer/Dry Storage Tank, and between the Regenerative Dryer/Dry Storage Tank and the Plant Process Control Panel. Pneumatic 1/4” nylon tubing (color coded) for pneumatic control signals shall be supplied to run between the Plant Process Control Panel and actuators within the process tankage.

12.08 WALL MOUNTED WALKWAYS & HANDRAIL

Approximately 255 LF of aluminum walkway and handrail shall be provided for installation on top of the concrete walls of the plant tankage as per the drawings. The walkway frame shall consist of aluminum supports and channels to be either centered or cantilevered on top of the concrete walls. The walkway shall consist of banded aluminum grating, 1" I-Bar, set into the aluminum frame. Grating on the walkway frame shall have a width of 25 inches. Note: Non-walkway handrails shall be provided by the General Contractor as shown on the drawings.

A two-rail handrail system shall be supplied with the walkway. Handrails shall be of 1-1/2" aluminum tubing with NU-RAIL aluminum handrail fittings (or equal). The handrail risers shall be securely mounted to the support frame and of proper length to place the top-rail 42" above the walkway with a mid-rail 18" below the top-rail.

12.09 ACTUATED & MANUAL VALVES

A. SEQUOX Air Valves

1. First Stage Aeration Basin

The equipment supplier shall supply two (2) 4" Ultraflo series 399 butterfly air valves. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valves shall include an El-O-Matic double-acting actuator that is pneumatically controlled.

The equipment supplier shall supply two (2) 4" Ultraflo series 399 butterfly air valves. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valves shall include a gear-operator for manual valve control.

2. Second Stage Aeration Basin

The equipment supplier shall supply two (2) 4" Ultraflo series 399 butterfly air valves. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valves shall include an El-O-Matic double-acting actuator that is pneumatically controlled.

The equipment supplier shall supply two (2) 4" Ultraflo series 399 butterfly air valves. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valves shall include a gear-operator for manual valve control.

B. Aerobic Digester Tank

The equipment supplier shall supply two (2) 4" Ultraflo series 399 butterfly air valves. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valves shall include an El-O-Matic double-acting actuator that is pneumatically controlled.

The equipment supplier shall supply two (2) 4" Ultraflo series 399 butterfly air valves. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valves shall include a gear-operator for manual valve control.

C. Constant Air Valve (Clarifier/Fermenter Tank/Selector Tank/WAS Pump/Sludge Transfer Pump)

The equipment supplier shall supply two (2) 4" Ultraflo series 399 butterfly air valves. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be EPDM. The valves shall include a gear-operator for manual valve control.

D. Aeration Blower Isolation Valve

The equipment supplier shall supply one (1) 5" Ultraflo series 399 butterfly air valves for blower isolation. One valve shall be used for each blower and shall be mounted in the discharge header piping. The body shall be cast iron, the disc and stem shall be 316 SS, and the seat shall be FKM. Each valve shall include a lever-operator for manual valve control.

12.10 HAND LIFT STOP PLATES

Aluminum stop plates shall be used to direct and stop flow within the anaerobic selector tank and the two first stage aeration tanks. Stainless steel wall-mounted gate guides shall be used for the placement of the stop plates. A total of two (2) face-mounted guide frames and two (2) stop plates shall be supplied.

12.11 AERATION BLOWERS & CONTROLS

A. Aeration Blowers

The equipment supplier shall provide three (3) 30 HP positive displacement blower packages. Aerzen Generation 5 Delta blower package, or equal, with factory installed sound enclosures shall be provided. Design conditions are as follows:

Air Volume:	650 icfm
Discharge Pressure:	6.9 psig
Motor HP:	30 HP
Inlet Temperature:	104^0 F
Elevation:	620 FASL
Humidity:	80%

Each blower package shall fully fabricated and include the following:

Qty.	
1	Aerzen Rotary Lobe Blower GM 25 S DN 125
1	Narrow V-belt drive with guard
1	First fill of Delta Lube 06 oil
1	Intake filter-silencer, G4 per EN 779
1	Discharge silencer, reactive type, integrated with base frame
1	Spring loaded pressure relief valve, sized for full flow
1	Set of vibration isolating mounts
1	Discharge manifold with externally accessible integrated check valve
1	Hinged motor support as automatic belt tensioning device
1	Sound enclosure, powder-coated galvanized steel, fire retardant HDP foam construction with vent fan impeller driven by blower shaft
1	5” ANSI flanged discharge connection
1	5” ANSI flanged inlet connection
1	Factory set PRV to 10.9 psig

1 Set of instrumentation (4" gauges, P1 gauge, P2 gauge & switch, T2 gauge & switch)
1 Motor 30 HP, 2-pole, NEMA, TEFC, 460V / 60Hz, Premium Efficiency, 286TS
1 Motor thermostats, one per phase @ 155°C
1 Motor shaft grounding ring

B. Aeration Blower Controls

One (1) blower control panel shall be supplied (two existing VFD controls will remain in place and use). This blower control panel will be supplied by the manufacturer and contain an Allen-Bradley Powerflex 753 6-Pulse variable frequency drive module. The blower control panel will be in a NEMA 12 panel. The panel shall include:

1. Hand/Off/Automatic Controls (via HMI terminal)
2. Disconnect Switch
3. Fault Indication (via HMI terminal)
4. Power on Indication (via HMI terminal)
5. VFD Run Indication (via HMI terminal
6. Run Time Meter (non-resettable) (via HMI terminal)
7. Drive Enable Contact
8. Drive Fault Contact
9. Human-Machine Interface (HMI) Termianl
10. Run Permissive Feature
11. 3% Line Reactor
12. Relay for blower discharge temperature switch
13. Contact for motor thermostats

Note:
Harmonic distortion is a by-product of VFD controlled motors. Additional input filters ahead of the VFD's may be required and would need to be supplied by others to dampen the impact of the VFD controls and meet the appropriate electrical code.

12.12 PNEUMATIC SYSTEM

A. Pilot Air System

The pilot air system shall consist of an air compressor followed by an air-drying system to provide a constant, dry source of pneumatic pressure to the pneumatic control system. The contractor shall run 3/8" nylon tubing from both air compressors to the regenerative desiccant dryer/dry storage tank, and from the regenerative desiccant dryer/dry storage tank to the RTU.

Note: The existing plant air compressors will be used for this project. A new desiccant dryer will be provided as part of the Manufacturer's scope of supply.

1. Regenerative Desiccant Dryer / Dry Storage Tank

   A Tsunami Pure 10, or equal, dual tower regenerative desiccant dryer shall be furnished to keep the pilot air dry and prevent moisture buildup in the pneumatic control system. This unit shall operate using 115-V, 15-amp service, and shall include a cord with plug. The dryer will be pre-mounted to a 60-gal dry air storage tank. For this project, one (1) unit shall be supplied, replacing the existing desiccant dryer.

2. Pneumatic System Air Tubing
   Pneumatic 3/8" nylon tubing (black) shall be supplied to run between the Air Compressors and the Air Alternation Panel on the Regenerative Dryer/Dry Storage Tank, and between the Regenerative Dryer/Dry Storage Tank and the RTU. Pneumatic 1/4" nylon tubing (color coded) for pneumatic control signals shall be supplied to run between the RTU Panel and actuators within the process tankage.

12.13 PROBE MODULE & SENSOR PROBES

A. One (1) Insite model MPA-48 multi-channel sensor analyzer modules, 110V, with sunshield, or equal.
B. Two (2) Insite model 12 DO sensor probes with junction box, or equal.
C. Two (2) sensor handrail mounting kits.

12.14 INSTALLATION MATERIALS

A. Wall Inserts & Link-Seals

   All PVC wall inserts and link-seals for concrete wall penetrations (for PVC pipe) in the fermentation tank, selector tank, aeration basins, clarifiers, digester tanks, and the side-line surge tank shall be supplied by the equipment manufacturer. These wall inserts are for PVC wall penetrations on interior tank walls.

B. Mounting Hardware

   All required SS wall brackets, SS U-bolts, and SS anchor bolts for installation of the Aero-Mod supplied equipment and contractor supplied PVC piping (in the fermentation tank, selector tank, aeration basins, clarifiers, digester tanks, and the side-line surge tank) shall be supplied by the equipment manufacturer.

12.15 SPARE PARTS

The equipment manufacturer shall supply the following spare parts in a protective container for storage:

One (1) clarifier skimmer head
Two (2) clarifier skimmer head guide rod
One (1) blower maintenance kit:

- Blower oil sufficient for first change the blower,
- Blower inlet filter element for first change on the blower,
- Sets of blower belts for first change on the blower.

One (1) Aquamatic diaphragm actuator rebuild kit
Two (2) Prestolock union connectors
Two (2) four pole relay, 24VDC
Two (2) single pole relay, 24VDC
Two (2) solenoid valves
Three (3) mechanical inlet screen plug disks

12.16 WARRANTY

The equipment supplier shall warranty the Split-ClarAtor clarifier equipment for a period of five (5) years from the date of start-up. Blower warranty shall be as stated by blower manufacturer. All other equipment shall have a warranty of one (1) year from date of start-up, or eighteen (18) months after ship date, whichever occurs first.

12.17 O & M MANUALS

The equipment supplier shall provide four (4) copies of complete operation and maintenance manuals.

12.18 EQUIPMENT START-UP & OPERATOR TRAINING

The manufacturer shall provide two (2) days of on-site dry equipment inspection and equipment start-up/training upon complete installation of equipment. A check-off sheet shall be completed and signed by the contractor prior to dry equipment inspection.

The manufacturer shall provide two (2) additional days of on-site equipment and process training after successful start-up of the plant.

The manufacturer shall provide two (2) days of operator school at the manufacturer's home office for two (2) operators after the treatment plant is operational. The operator school shall provide 10 hours to the attending operator, as recognized by the State of Kansas.

SECTION 13 – MECHANICAL FINE SCREEN

13.01 SUMMARY

The contractor will furnish and install One (1) spiral screw screen/compactor(s) and associated piping, valves, controls, wiring, and appurtenances as specified and shown on the drawings. The spiral screw screen/compactor specified in this section will be provided by a single manufacturer to ensure coordination and compatibility of equipment. Compliance with the requirements and stipulations specified herein may necessitate modifications to the manufacturer's standard equipment. In addition, the contractor will be responsible for ensuring a complete and operable spiral screw screen/compactor and will establish the exact limits of work between the contractor and spiral screw screen/compactor supplier.

13.02 REFERENCES

The design, manufacture, and installation of this equipment will meet or exceed the applicable provisions and recommendations of the following codes and standards:

A. ASME, American Society of Mechanical Engineers

B. ASTM, American Society of Testing and Materials

C. ANSI, American National Standards Institute

D. AWS, American Welding Society

E. IEEE, Institute of Electrical and Electronics Engineers

F. NEC, National Electrical Code

G. OSHA, Occupational Safety and Health Act

H. AWS, American Welding Society

13.03 SUBMITTALS

The following will be submitted for the spiral screw screen/compactor furnished under this specification:

A. Certificate of Compliance or complete list of all deviations from the drawings and specifications.

B. Complete installation and assembly drawings, showing the manufacturer's dimensions, weights, and loadings.

C. Detailed specifications and data covering materials used, parts, instrumentation devices, and other accessories forming a part of the equipment furnished will be submitted for review.

D. Manufacturer's installation instruction and certification.

E. Operation and maintenance manual.

F. Manufacturer's warranty agreement.

G. Electrical requirements, schematic diagrams, and details of components included.

H. Manufacturer's recommended spare parts.

13.04 QUALITY ASSURANCE

A. In order to assure uniform quality, ease of maintenance and minimal parts storage, it is the intent of these Specifications that all equipment called for under this Section will be supplied by a single manufacturer.

B. Other than the named supplier, all manufacturers proposing equipment described herein, will provide a detailed submittal package, which will consist, at a minimum, of all information and details prescribed in Section 1.03 of this specification. All pre-qualification submittals will be submitted to the Engineer at least 30 days prior to the bid date.

C. If submitted equipment requires arrangement differing from that indicated on the drawings or specified, prepare and submit for review complete structural, mechanical, and electrical drawings and equipment lists showing all necessary changes and embodying all special features of equipment proposed. Any changes are at no additional compensation and the Contractor will be responsible for all engineering costs of redesign by the Engineer, if necessary.

13.05 DELIVERY, STORAGE & HANDLING

Items to be shipped as complete assemblies except where partial disassembly is required by transportation regulations or for protection of components.

13.06 DESIGN CRITERIA

The conditions of influent are based on the following design requirements as specified by the customer:

Flow Rates (MGD)	0.576
Channel Depth (Ft.)	1.25
Channel Width (Inch)	2.5
Discharge Height (Ft.)	5.00
Maximum Upstream Liquid Level (Inch)	1.35
Screen Basket Opening (MM)	6.00
Material of Construction	304 stainless steel unless noted
Screw material	304 stainless steel

13.07 WARRANTY

The manufacturer will warrant against any defects in material or workmanship to the spiral screw screen/compactor and framework. This warranty will commence upon delivery of the products and will expire on the earlier to occur of our (1) year from initial operation of the product or 18 months from delivery thereof (the "Warranty Period"). Initial operation will be deemed to take place when the products are first in production or, if applicable, when the product passes or is deemed to pass a performance test, whichever comes first.

13.08 MANUFACTURERS

The ICSS 2/6 spiral screw screen/compactor will be as manufactured by Kusters Water meeting these specifications.

13.09 MATERIALS

A. All components of the spiral screw screen/compactor will be stainless steel.

B. All structural steel components will conform to the requirements of "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" published by the American Institute of Steel Construction.

C. Fabricate all frame parts and assemblies from sheets and plates of 304 stainless steel with a 2B finish conforming to ASTM A240.

D. Field welding of stainless steel will not be permitted, except to connect customer piping to frame influent and effluent connections.

E. Bolts, nuts and washers will be ANSI stainless steel.

13.10 FINE SCREEN

Each spiral screw screen/compactor will consist of screen basket consisting of perf plate, shaftless screw, nylon spiral brush, stainless steel housings and covers, replaceable wear bars, slotted compaction zone, compaction zone spray bar assemblies and drain tube, and a shaft-mounted AC motor/gearbox.

13.11 CONSTRUCTION

The spiral screw screen/compactor will be designed and built to withstand maximum possible rotary and hydraulic forces exerted by the liquid. All structural and functional parts will be sized for the loads encountered during the screening/compacting operations.

A. Screening Section

1. The screen basket will be constructed of stainless-steel perf plate. Spacing will be 6.00mm Elastomeric flaps shall provide a seal between the screening basket and the channel wall
2. Diameter of the screen basket shall be 8.65 inches with a standard basket length.
3. Diameter of the screw inside the filtering basket shall be 8.25 inches.
4. A series of easily replaceable sectional nylon spiral brushes shall be attached to the following edge of the screw inside the filtering basket.
5. A spray bar of stainless steel will wash the screenings in the screening section to return fecal material to the channel. Maximum spray water consumption shall be 15 GPM at 35-40 psi during intermittent operation.

B. Conveying Section

1. The conveying section will be constructed of stainless steel with a minimum diameter of 8.5 inches.

2. The conveying section shall include four (4) replaceable wear bars running the length of the conveying section with a minimum thickness of 5/16 inches thick by 1 1/8" wide of stainless steel. The conveying screw shall be manufactured of one single flight from stainless steel bar stock with a pitch of 2/3. The spiral shall have a minimum thickness of 2.25 inch and 0.75 inch width.

C. Compaction/Dewatering Section

1. The compaction/dewatering section shall consist of a cylindrical plate mounted at the end of the conveyor with a pressate drain. A final maintenance wash water inlet shall be mounted near the inlet to the pressate drain to clear the drain passageway of any sediment or other deposits and shall include a manual ball valve. The housing shall include a hinged access and inspection cover with quick opening latches, sealing gasket, and a safety motor cutout switch to stop the unit whenever the hatch is opened. After compaction and dewatering, the screenings shall discharge through a cylindrical chute into the screenings receptacle.

2. Two (2) spray bars of stainless steel will wash and flush the compaction section. Maximum intermittent spray water consumption shall be 8 GPM at 35-40 psi pressure.

D. Drive Motor/Reducer

The fine screen screw drive system will consist of a single speed helical gear reducer The hollow shaft speed reducer shall be coupled to the motor and mounted directly to the upper end of the compaction/dewatering housing. The drive assembly shall rotate the conveyor at the specified speed of 15 RPM and shall be designed for 24 hour a day operation under normal moderate shock loadings.

The proof motor shall be a minimum 1 Hp.,1800 RPM, squirrel cage, induction type, TEFC-XP, ball bearing heavy duty unit of ample power for starting and operating the mechanism without overload, with a service factor of 1.15. Power supply to the equipment shall be 460 volt, 60 hertz, 3 phase

E. Installation Angle

The shaftless screw screen shall be mounted at an angle of 35 degrees to the horizontal.

F. Control System

The Fine Screen control system shall consist of a NEMA 4X enclosure with the following components:

1. System control power: Off-On selector switch and Emergency stop pushbutton.
2. ICSS mode: Manual-Off-Auto selector switch

3. Screening and Conveying section Spray bar: Open-Close-Auto selector switch
4. Compaction section spray bar: Open-Close-Auto selector switch
5. ICSS On-Off Auto selector switch with Forward-Reverse selector switch.
6. Alarm Control: Silence/Reset pushbuttons.
7. Level Monitor: LCD Display and Control.
8. Indicators provided on the control panel shall consist of
    a. System Control Power: On
    b. ICSS drive: On
    c. Screen and Washer Zone Shower: Open
9. Alarm Indicators provided on control panel door shall consist of:
    a. ICSS motor overload: Alarm
    b. Channel High-High level: Alarm
    c. Spiral Over –torque (optional): Alarm
    d. Alarm Horn
10. Drive and spray bar selector switches shall be green illuminated. Alarm indicators shall be amber illuminated. Emergency Stop Mushroom pushbutton shall be red illuminated. Man-Auto selector and alarm control pushbuttons shall be non-illuminated. All pushbutton and indicator controls shall be rated NEMA 4X.
11. Outputs for Customer use (Dry contacts)
    a. Common Alarm on
    b. Channel High-High level alarm
    c. Master Control Relay
    d. Spiral Screw Running

G. Options

1. Removable plastic bagging device mounting directly to compaction section discharge.
2. Weather protection consisting of stainless-steel cladding over insulated and heat traced conveying and compaction sections.

H. Outdoor Weather Protection

1. The screen transport tube and compaction zone shall be furnished with a heat tracing system for outdoor weather protection.
2. The weather protection package shall include self-regulating heat tracing, adjustable thermostat, CFC and HCFC free insulation and a stainless-steel protective cover.

3. The heat tracing system shall be suitable for operation down to a minimum temperature of -25^0 C (-13^0 F) and shall be powered by the main control panel.
4. The two piece stainless steel cover shall be split and flanged axially along the transport tube. The two halves shall be bolted together using stainless steel fasteners.

13.12 INSTALLATION

Spiral screw screen/compactor will be installed in complete accordance with the Manufacturer's recommendation.

13.13 MANUFACTURERS SERVICES

The manufacturer shall provide a service technician for the pre-start-up installation checks, start-up assistance, troubleshooting, testing, and training of Owner's operating personnel.

This service will consist of 1 trip with 2 consecutive eight-hour days on site for start-up assistance, troubleshooting, testing, training owner's operating personnel, and performance testing.

SECTION 14 - REPLACEMENT AND CLEANUP

14.01 SCOPE OF WORK

Under this item, the Contractor will restore all lawns, trees, gardens, landscape plantings, sidewalks, ramps, trails, fences, commercial signs, water courses and sand, gravel, dirt, asphalt and concrete roads, catch basins, storm sewers, building sewers, water services, water valve boxes, meter vaults, property markers (such as concrete monuments, irons, stakes, pipes, etc.), mailboxes and other items which may be damaged during the course of construction. All replacement and cleanup work will be incidental to the project except those items of work that are delineated in the bid proposal.

All restoration work shall attempt to return the existing facilities to their original condition. Substitutions, such as gravel instead of grass, will not be allowable.

The Contractor shall pay special attention to the requirements of Act 347, "Soil Erosion and Sedimentation Control". In all construction work the Contractor shall take all precautions necessary to prevent erosion and to conform to the requirements of Act 347. Should erosion occur within the guarantee period, the Contractor shall regrade and reseed the disturbed area at no additional cost to the Owner.

Replacement and cleanup operations shall follow immediately behind the construction work. The Contractor shall make every effort to keep the job site clean and free of trash and miscellaneous building materials. The Contractor shall pay special attention to restore commercial signs, fences, etc. and to patch and repair pavement, driveways and sidewalks immediately after the construction work. In the event that replacement and cleanup work does not proceed in a satisfactory manner, the Owner may withhold periodic payments or close the construction area until such time as the replacement and cleanup is satisfactory. An exception may be made if there are physical limitations which do not allow for immediate replacement and cleanup.

14.02 PAVEMENT RESTORATION

A. General

All permanent pavement restoration shall be done over compacted backfill and a minimum six (6) inches thick compacted MDOT 22A gravel base. The gravel base shall be placed and maintained in accordance with the MDOT Standard Specifications. All patches shall have square, neat, saw cut edges regardless of the final surfacing method planned for that section of the pavement restoration.

No patching work shall be started until the subgrade has been properly prepared. Prior to laying the bituminous patch, the adjacent road surfaces shall be swept clean of all foreign materials and the patch area and pavement primed with Michigan Department of Transportation's approved prime coat.

A bituminous bond coat shall be placed between successive lifts of the bituminous patch and bituminous surfacing. Each lift shall be thoroughly compacted before adding the next lift. This includes running the compaction roller longitudinally along the entire length of the joints between the patch and the existing pavement.

The bituminous mixture to be furnished under these specifications shall be delivered to the paver at a temperature no lower than 285 F. Any mixture that has a temperature below 285 F at the time of "laying" shall be rejected and hauled from the project.

Temporary road patches shall be gravel or bituminous cold patch. The patches shall be maintained in a smooth condition until final repairs are made.

The Authority Engineer and the County Road Commission shall be notified at least two (2) working days prior to the placement of any and all final pavement overlays.

B. Bituminous Patching

Existing asphalt roads and driveways shall be patched using the current Road Commission standards. All patches shall be placed in accordance with the surrounding pavement section thickness and for sections over 2-inches, it shall be placed in two lifts. A bituminous prime coat of 0.25 gallons per square yard and a tack coat of 0.10 gallons per square yard shall be used for all bituminous patches.

Shoulders shall be restored to their original width and depth in accordance with MDOT Standard Specifications using MDOT 23A gravel.

C. Gravel Roads, Driveways, and Shoulders

All gravel roads shall be restored in accordance with MDOT Standard Specifications using six (6) inches of MDOT 23A gravel. Shoulders shall be restored to their original width and depth in accordance with 2012 MDOT Standard Specification Section 307 using MDOT 23A gravel. Shoulders shall be raised on side opposite sewer construction to match new pavement surfaces.

D. Concrete Pavement, Sidewalk and Driveways

Concrete for restoring pavement, sidewalks, and driveways shall attain a 28-day strength of 3,500 pounds per square inch. Neat edges of patch areas shall be obtained by the use of a concrete saw. Concrete mixing aggregates and curing methods shall conform to Concrete section. Concrete patches shall match the original width and depth and in no case, a depth less than four (4) inches. Sidewalks shall have contraction joints a distance apart equal to the width of the slab.

14.03 GRASS AREA

Grass areas shall be considered as two types: A) Type 1, areas which had lawns before construction, and B) Type 2, open fields or ditches not adjacent to established lawns. The plans

may specifically call for Type 1 mixtures in which case the plans will govern. If there is a question as to which mixture to use, the Engineer shall make the final decision.

Terraces, lawns, ditches, open fields and other grassy areas shall be topsoiled, fertilized, seeded and mulched in such a manner that a grass approximately equal in type and density of the original is obtained. Slopes between 1:3 and 1:2 shall be sodded and staked or receive seed with mulch blankets.

A. Topsoil

Topsoil furnished shall consist of dark brown or black loam, clay loam, silt loam, or sandy loam surface of fertile, friable humus soil of mineral original, not including peat or muck. Soil shall be screened topsoil, free of stones, roots, sticks and any other extraneous materials. All topsoil furnished shall be approved by the Engineer. Type 1 areas shall be, topsoiled to a depth of four (4) inches and Type 2 areas to a depth of two (2) inches.

B. Seeding and Fertilizing

Areas to be seeded and fertilized shall be carefully raked to even surfaces and all stones, sticks and other debris removed. The area to be seeded shall be fertilized with agricultural fertilizer 12-12-12 analysis, Davco or Agrico or equal, applied on the prepared surface at the rate of 20 pounds per 1,000 square feet. Fertilizer shall be harrowed or raked into the soil to a depth of not less than one (1) inch.

Seeds shall be furnished in durable bags. On each bag of seed, the vendor shall attach a tag giving name, lot number, net weight of contents, and purity and germination. All seed shall be thoroughly mixed and sown in a method which will ensure uniform distribution. Seeding during high winds or inclement weather will not be permitted. All seed is to be raked in and compacted. The seed shall be sown at the rate of five (5) pounds per 1,000 feet. The seeding mixtures shall be composed of certified seed of the purity, germination and proportions by weight as specified in the following table:

	Seeds		Mixtures	
Kind of Grass	Minimum Purity	Minimum Germination	Type 1	Type 2
Perennial Rye	98%	90%	20%	50%
Kentucky Blue	90%	75%	60%	15%
Creeping Red Fescue	98%	80%	20%	35%

C. Mulching

Immediately after seeding all seeded areas, Type 1 and Type 2 shall be mulched with unweathered small grain straw or hay spread uniformly at a rate of 100 pounds per 100 square feet (two tons per acre). Hydroseeding method with similar application rate will be allowed.

D. Mulching Anchoring

All mulch shall be anchored using one of the following methods. The Contractor may use either method unless otherwise shown on the plans.

1. Method "A": The straw mulch shall be anchored by applying one of the following asphalt products at the rate shown. The asphalt may be blown on with the mulch or sprayed on immediately after the mulch is spread.

Asphalt Product	Application Rate
Liquid Asphalt	
R.C. 1, 2 or 3; M.C. 2 or 3	0.10 gal. per S.Y.
Emulsified Asphalt	
R.S. 1 or 2; M.S. 2; or S.S. 1	0.04 gal. per SY.

2. Method "B": A "Terra-Tak" mulch binder may be used in lieu of asphalt. Mixing and application shall be done in accordance with the manufacturer's recommendations.

3. Method "C": In areas with slopes greater than 10% or where shown on the plans, the Contractor shall place mulch netting or excelsior blanket mulch.

   a. Mulch Netting: Mulch shall be anchored by the use of mulch netting. The light weight fibrous netting shall be properly placed over the mulch and secured to the ground using wire staples, spaced per manufacturer's recommendations.

   b. Excelsior Blanket Mulch: An excelsior blanket shall be used in lieu of other mulch. The excelsior blanket shall be a consistent thickness of evenly distributed wood excelsior fibers, 80% of which are six (6) inches or more in length. The top side of the blanket shall be covered with a coarse net of twisted Kraft paper or biodegradable extruded plastic mesh. Ends and sides shall be securely butted and stapled with U-shaped wire staples of a size and length suited to the soil conditions.

14.04 DITCHES

Ditches which have been grassed and maintained by the abutting property owner shall be restored to the current Antrim County specifications.

Ditches in which culverts or drain tile have been installed shall have the same tile replaced, if in good condition, or a tile satisfactory to the Design Engineer installed in its place at the original line and grade.

Catch basins shall be reconstructed, if removed or damaged.

14.05 FENCE REPLACEMENT

A. Chain Link Fence shall be replaced according to MDOT specifications.

B. Other Fences shall be replaced equal to and of the same type as existing.

C. Salvaged material, if approved by the Engineer, may be used for replacement.

14.06 COMMERCIAL SIGNS

Commercial signs, which must be removed by the Contractor in order for work to proceed, shall be replaced and reconstructed to their original condition. It is very important that replacements follow immediately after the construction work.

14.07 BUILDING SEWERS

Building sewers shall include any and all parts of private residential, commercial or industrial sewage disposal system such as sewer pipe, septic tanks, drainfield, etc. Whenever the service of any such facility is interrupted because of the Contractor's operations, he shall provide such interim methods of sewage disposal as are required to maintain a safe, nuisance free, non-polluting construction operation.

14.08 OTHER DEBRIS

The Contractor shall remove, at his own expense from the site, any and all broken pipe, bricks, blocks, lumps of concrete, broken machinery, cans, containers, and other trash and debris.

14.09 TREES

The Contractor shall endeavor to save as many trees as possible. Cut trees, including stumps, shall be disposed of by the Contractor. Any elm tree which is removed must be burned. Tree branches which become broken shall be removed by cutting off flush with trunk and the cut on the trunk shall be painted with an approved tree paint. Where removal of a stump would result in damage to existing utilities, the stump may be removed by chipping to a depth of at least one foot below the finished ground surface.