PROPOSAL AND SPECIFICATIONS FOR KONA COMMUNITY HOSPITAL

79-1019 HAUKAPILI STREET, KEALAKEKUA, KONA, HAWAII

TMK: (3) 7-9-010-081

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PROPOSAL SCHEDULE

KONA COMMUNITY HOSPITAL WASTEWATER TREATMENT PLANT PROJECT

KEALAKEKUA, KONA, HAWAI'I

The undersigned Bidder hereby proposes to furnish and pay for all materials, tools, transportation, equipment, labor, and other incidental work necessary to construct and complete in place the "KONA COMMUNITY HOSPITAL WASTEWATER TREATMENT PLANT SYSTEM UPGRADE" , Kealakekua, Kona, Hawaii, together with equipment and all necessary appurtenances and work incidental thereto in accordance with the true intent and meaning of the plans, proposal, general specifications, and detailed specifications made a part of these specifications.

~~The Bidder agrees to complete the work within the time period specified below including the date of commencement.~~

~~Basic Bid 365 Consecutive Calendar Days from NTP~~

Work Days and Work Hours for this project shall be Monday through Friday, eight (8) hours per day. The Contractor shall be responsible for payment of overtime charges.

~~It is understood that the award of the contract shall be based on the Lowest Basic Bid.~~

Item No.	Quantity	Unit	Description	Unit Price	Total
1.	1	LS	Mobilization and Demobilization. (Not to Exceed 10% of the Total Sum Bid)		$_____
2.	5	EA	Concrete testing by 3rd party firm including sampling (set of 4 cylinders) and laboratory work.		$_____
3	5	EA	Compaction test for aggregates and asphalt pavement by 3rd party firm including aggregate sampling and gradation analysis of materials.		$_____
4.	1	LS	Demolition Work: to include demolition, hauling & disposal as required to construct new improvements.		$_____

Item No.	Quantity	Unit	Description	Unit Price	Total
5.	1	LS	Grading Work, as required to construct new improvements, complete in place.		$_____
6.	1	LS	New 50,000-gallon Packaged Wastewater Treatment, in place complete.		$_____
7.	1	LS	6" SDR-26 PVC sewer pipe and fittings, including trench, pipe cushion, and all items necessary, in place complete.		$_____
8.	1	LS	8" SDR-26 PVC sewer pipe and fittings, including trench, pipe cushion, and all items necessary, in place complete.		$_____
9.	1	LS	12" DI Sewer line including trench, pipe and fittings, in place complete.		$_____
10.	1	LS	Realignment of 1-1/4" HDPE force main piping from existing sewage pump station to new wastewater treatment plant, complete in place.		$_____
11.	1	LS	Installation of new in-line Muffin Monster grinder unit or approved equal, complete in place.		$_____
12.	1	LS	New CMU Retaining wall; as required to construct new improvements; complete and in place		$_____
12.	1	LS	Reconstruction existing wall rock to match existing, complete in place.		$_____
13.	1	LS	New sewer manhole over existing 8" sewer line complete in place.		$_____
14.	1	LS	New Chain Link Fence and double swing gate; including new fence posts, mesh material & appurtenances, as required, in place complete.		$_____
15.	1	LS	Electrical Work, in place complete.		$_____
16.	1	LS	Record Drawings		$_____
17.	1	LS	Site Restoration; asphalt; landscaping restoration including all incidentals and appurtenance complete in place.		$_____
18.	1	FA	Water Pollution and Erosion control, including maintenance and removal of BMPs, as required by weather conditions	$15,000.00	$ 15,000.00

Item No.	Quantity	Unit	Description	Unit Price	Total
19.	1	FA	Additional site restoration due to field realignment of unforeseen obstructions and unforeseen encroachment into asphalt concrete pavement, fences, and CMH/CRM walls; including all items necessary to restore the site to existing or better conditions, in place complete.	$25,000.00	$25,000.00

Total Sum Base Bid $_____

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Division 16 – Electrical

Division 46 – Water and Wastewater Equipment

SECTION 01000

GENERAL REQUIREMENTS

PART 1 – GENERAL

1.01 PROJECT DESCRIPTION

1. A brief description of the work is provided in the Summary of Work section. To determine the full scope of the project or any particular part thereof, it is necessary to refer to and coordinate the applicable information across several parts of these Contract Documents. This approach ensures that all relevant details are considered, providing a comprehensive understanding of the project's requirements and objectives.

2. The design of the wastewater treatment plant is a Purestream PT-50 Extended Aeration Treatment system and is described as a complete, prefabricated unit in a compact package that can be installed above or below grade.

3. The design of the wastewater treatment plant and associated appurtenances as present in these plans and specifications is for design purposes. The awarded contractor may, at their discretion, omit or modify certain or all elements as part of this bid proposal. It is expressly understood that any and all costs associated with such omissions or changes shall be borne entirely by the contractor. The contractor assumes full responsibility and will ensure the modifications or omissions do not compromise the functionality, safety, or regulatory requirements of this project. The owner and design team shall not be held liable for any additional expenses incurred as a result of the contractor's decision to deviate from the original design.

4. The General Requirements and Covenants of the Department of Public Works, County of Hawai‘i (July 1972) or as applied to the General Provisions for Construction Projects, State Department of Transportation; Air and Water Transportation Facilities Division dated 2016 shall be applicable and incorporated herein and made a part of these specifications.

5. The Standard Specifications (1986) and Standard Details (1984) for Public Works Construction, Department of Public Works, County of Hawai‘i, where applicable the 2005 Standard Specifications for Road and Bridge Construction shall be incorporated

herein and made a part of these specifications.

6. It is understood that the requirements and specifications for this project are comprehensively detailed within these bidding documents. In the event of any discrepancies or conflicts between various sections, codes, or regulations referenced herein, the more stringent regulation or requirements shall prevail.

1.02 WATER SYSTEMS STANDARDS

1. Water Systems Standards, dated 2002, as amended, Department of Water Supply, County of Hawaii. This document is not physically included in the Contract, but it is incorporated by reference as part of the Contract Documents.

1.03 SPECIFICATIONS

1. The following articles shall and do hereby apply to each and every section of the Specifications as though fully contained therein.

1.04 TRADE DISTINCTIONS

1. For convenience of reference and to facilitate letting of subcontracts, these Specifications are separated into Sections. Such separations shall not operate to make the Engineer an arbiter or to establish subcontract limits between the Contractor and Subcontractor. Sections in these specifications conform roughly to the customary trade practice. They are used for convenience only. The Engineer or Owner is not bound to define the limits of any subcontract.

2. Grouping items of work in divisions of technical specifications is not intended as assignment to a specific subcontractor or trade union.

1.05 WORK INCLUDED

1. Each specification section shall imply the furnishing of all labor and materials, required for the complete installation of the subject work unless specifically stated otherwise in the specific section of the Specifications.

1.06 RELATED WORK SPECIFIED IN OTHER SECTIONS

1. Considered to apply wherever it is properly implied in any section whether specifically stated or not.

1.07 CODES AND STANDARDS

1. Any reference in the specifications text to codes, standard specifications or manufacturer's instructions shall mean the latest printed edition of each in effect at the contract date.

1.08 BUILDING LAWS

1. Applicable to this project to the extent required by permits.

1.09 LAWS AND PERMITS

1. The Contractor shall comply with the local laws, ordinances, rules, and regulations bearing on the work, and he must obtain and pay for all permits, licenses, certificates, and give all notices which may be required.

2. In the event that Kona Community Hospital (KCH) secures project permits prior to award of the Contract, the Contractor shall be responsible for compliance with all permit conditions and submittal of additional documents which may be required under the conditions of the permit.

1.10 MATERIAL, EQUIPMENT AND WORKMANSHIP

1. Unless otherwise specifically stated in the contract documents, the Contractor shall provide and pay for materials, labor, tools, equipment, water, light, power, transportation, supervision, and temporary construction of any nature, and other services and facilities of any nature, whatsoever necessary, to execute, complete and deliver the work within the specified time.

2. Material and equipment shall be new and of a quality equal to that specified. The equipment offered shall be current models, which have been in successful regular operation under comparable conditions. This requirement does not apply to minor details, or to thoroughly demonstrate improvements in design or in materials of construction.

3. Construction work shall be executed in conformity with the standard practice of each trade.

1.11 QUALITY

1. Where the contract requires that materials or equipment be provided or that construction work be performed, and detailed specifications of such materials, equipment or construction work are not set forth, the Contractor shall perform the work using materials and equipment of the best grade in quality and workmanship obtainable in the market, from firms of established good reputations, and shall follow standard practices in the performance of construction work.

2. The work performed shall be in conformity and harmony with the intent to secure the standard of construction and equipment of work as a whole and in part.

1.12 MATERIAL AND EQUIPMENT SPECIFIED BY NAME

1. When material or equipment is specified by reference to one or more patents, brand names, or catalog numbers, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements, and that other materials or equipment, of equal capacities, quality and function shall be considered by Engineer of Record and KCH upon the Contractor's request for substitution.

1.13 SINGLE SOURCE PRODUCTS

1. If material or equipment is specified by only one patent or proprietary name, or by the name of only one manufacturer, it is for the purpose of standardization, or because the Engineer of Record or Owner knows of no equal. If standardization is the reason for using one name to specify any material or equipment, the specifications will so state, and substitutions will not be considered. In other cases, the Contractor may offer substitutions of products considered to be equal to that specified.

1.14 SPECIFIED ARTICLES OR EQUAL CLAUSE

1. In order to establish a basis of quality, certain materials or articles may be specified by designating a particular manufacturer's name, brand, or number. It is not the intent of the specifications to exclude other materials or articles that measure up to the standards of those specified. Whenever an article is specified by giving the manufacturer's name, it is understood that the words "or equal" follow thereafter.

2. Should the Contractor desire to make any substitutions, substitutions shall be requested in writing to Engineer of Record.

PART 2.00 - DEMONSTRATION OF COMPLIANCE WITH CONTRACT REQUIREMENTS

2.01 INSPECTION

1. To demonstrate their compliance with the contract requirements, the Contractor shall assist the Engineer in their performance of inspection work.

2. The Contractor shall grant the Engineer access to the work and to the site of the work, and to the places where work is being prepared, or where materials, equipment or machinery are being obtained for the work. The Contractor shall provide information requested by the Engineer in connection with inspection work.

3. If the contract documents, laws, ordinances, or any public regulatory authority require parts of the work to be specially inspected, tested or approved, the Contractor shall give the Engineer adequate prior written notice of the availability of the subject work for examination.

4. If parts of the work are covered in the absence of the Engineer and contrary to the Engineer's directive, the cost of exposing the work for inspection and closing shall be borne by the Contractor regardless of whether or not the work is found to be in compliance with the contract.

2.02 MATERIALS AND EQUIPMENT SPECIFIED BY NAME

1. When materials or equipment is specified by reference to one or more patents, brand names, or catalog numbers, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements, and that other materials or equipment, of equal capacities, quality and function shall be considered by KCH upon the Contractor’s request for substitution.

2.03 CERTIFICATION

1. In cases where compliance of materials or equipment to contract requirements is not readily determinable through inspection and tests, the Engineer shall request that the Contractor provide properly authenticated documents, certificates or other satisfactory proof of compliance. These documents, certifications and proofs shall include performance characteristics of materials.

2.04 INSPECTION AT POINT OF MANUFACTURING:

1. If inspection and testing of materials or equipment in the vicinity of the work by KCH is not practicable, the specifications may require that such inspection and testing or witnessing of tests take place at the point of manufacture.

2. In this case and in the event that remote inspection and testing is not specified and is requested by KCH, the required travel, subsistence, and labor expense shall be paid by KCH.

3. If the Contractor requests KCH to inspect and test material or equipment at the point of manufacture, then the additional cost to the KCH for travel, subsistence, and labor expenses shall be paid by the Contractor.

2.05 MANUFACTURER'S DIRECTIONS

1. Manufactured articles, material and equipment shall be applied, installed, connected, erected, adjusted, tested, operated and maintained as recommended by the manufacturer, unless otherwise specified.

2. Manufacturers' installation instructions and procedures shall be provided prior to installation of the manufactured articles, material, and equipment

2.06 SPECIAL TOOLS

1. For each type of equipment furnished by him, the Contractor shall provide a complete set of all special tools (including grease guns and other lubricating devices), which may be necessary for the adjustment, operation, maintenance and disassembly of such equipment. Tools shall be high-grade, smooth, forged, alloy, tool steel. Grease guns shall be lever type.

2. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.

3. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the work, at which time they shall be delivered to KCH.

2.07 PROTECTION AGAINST ELECTROLYSIS

1. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

2.08 CORRECTION OF DEFECTIVE WORK

1. When, and as often as the Engineer determines through the inspection procedures, material, equipment, or workmanship incorporated in the project do not meet the requirements of the contract, the Engineer shall give written notice of the noncompliance to the Contractor.

2. Within five (5) workdays from the receipt of such notice, the Contractor shall undertake the work necessary to correct the deficiencies, and to comply with the contract.

3. If the Contractor disagrees with the Engineer's determination and believes that the corrective work should be covered by a change order, the Contractor shall immediately notify the Engineer, in writing, setting forth their position.

4. Within ten (10) workdays after receipt of the Contractor's notification, the Engineer will review the matter and notify the Contractor, in writing, of the determination.

5. If the Engineer determines that the corrective work is required in order to comply with the contract, the Contractor shall proceed with such work.

6. As a condition precedent to the Contractor's request for either additional compensation or time extension, or both, resulting from the performance of such corrective work, the Contractor shall within 15 calendar days after receipt of the Engineer's determination notify the Engineer in writing of their intent to claim additional compensation, time or both.

7. The written notification to the Engineer shall be submitted prior to the performance of any and all corrective work.

8. The Contractor shall document the cost information associated with the corrective work with daily records and shall provide such information to the Engineer monthly. Receipt of the cost data by the Engineer shall not be construed to be an acceptance of the corrective work, or an authorization for a change order to cover the corrective work.

2.09 SITE INVESTIGATION AND REPRESENTATION

1. By submission of this Bid, the Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon availability of transportation, access to the site, disposal, handling and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, river stages, or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this Contract.
2. The Contractor further acknowledges that he has satisfied himself as to the character, quality, and quantity of surface and subsurface materials to be encountered from the inspection of the site and from reviewing any available records of exploratory work furnished by KCH. Failure by the Contractor to acquaint himself with the physical conditions of the site and all the available information will not relieve him of responsibility for properly estimating the difficulty or cost of successfully performing the work.
3. The Contractor warrants that as a result of examination and investigation of all the aforesaid data that he can perform the work in a good and workmanlike manner and to the satisfaction of KCH.
4. KCH assumes no responsibility for any representations made by any of its officers or agents during or prior to the execution of this contract, unless (1) such representations are expressly stated in the Contract, and (2) the Contract expressly provides that the responsibility therefore is assumed by KCH.
5. The Contractor shall be responsible for addressing, to the satisfaction of the Engineer, any unforeseen conditions encountered at no additional cost to the County.

2.10 INFORMATION ON-SITE CONDITIONS

1. Any information obtained by KCH and specifically referenced in the Contract Documents regarding site conditions, subsurface information, ground-water elevations, construction of existing site facilities as applicable, and similar data will be available for inspection at the office of the Engineer upon request.
2. Such information is offered as supplementary information only. Neither the Engineer nor the KCH assumes any responsibility for the completeness or interpretation of such

supplementary information.

PART 3 – EXECUTION

3.01 UNDERGROUND UTILITIES

1. Known utilities and structures adjacent to or expected to be encountered in the work are shown on the Drawings or provided record drawings. The locations shown are taken from existing records; however, it is expected that there may be some discrepancies and omissions in the locations and quantities of utilities and structures shown.

2. Those shown are for the convenience of the Contractor only, and no responsibility is assumed by either KCH or the Engineer for their accuracy or completeness.

3.02 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICES.

1. Where the Contractor's operations could cause damage or inconvenience to telephone, power, water, or sewer systems, the operations shall be suspended until all arrangements necessary for the protection of these utilities and services have been made by the Contractor.
2. Notify all utility offices which are affected by the construction operation at least 48 hours in advance. Under no circumstances expose any utility without first obtaining permission from the appropriate agency. Once permission has been granted, locate, expose, and provide temporary support for all existing underground utilities.
3. The Contractor shall be solely and directly responsible to KCH and operators of such properties for any damage, injury, expense, loss inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the construction operations under this Contract.
4. Neither the KCH nor its officers or agents shall be responsible to the Contractor for damages as a result of the Contractor's failure to protect utilities encountered in the work.

3.03 MAJOR UTILITIES SERVING THE AREA OF WORK

1. The following is a list of the major utilities serving the work area indicating the name of the authority responsible of the various utilities which should be notified as required if conflicts or emergencies arise during the progress of the work:

Utility	Agency	Phone

Water	Department of Water Supply	808-961-8060
Electricity	HECO	808-969-6999
Gas	GASCO, Inc (The Gas Co)	808-935-0021

3.04 INTERFERING STRUCTURES

1. Take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground. An attempt has been made to show major structures on the Drawings. The completeness and accuracy of information shown cannot be guaranteed, and it is presented simply as a guide to avoid known possible difficulties.
2. Protect underground and aboveground existing structures from damage, whether or not they lie within the limits of the work.
3. Without additional compensation and with the consent of the Engineer, the Contractor may remove and replace in a condition as good or better than original, such small miscellaneous structures as covers, backboards, and supports that interfere with the Contractor's operations.

3.05 FIELD RELOCATION

1. During the progress of construction, it is expected that minor relocation of the work will be necessary. Such relocation shall be made only by direction of the Engineer.

2. If existing structures and utilities are encountered which prevent the construction, and which are not shown on the Drawings, notify the Engineer before continuing with the construction in order that the Engineer may make such field revisions as necessary to avoid conflict with the existing structures and utilities.
3. If the Contractor shall fail to so notify the Engineer when an existing structure and utility is encountered, and shall proceed with the construction despite this interference, shall do so at their own risk.

3.06 DIMENSIONS OF EXISTING STRUCTURES

1. Where the dimensions and locations of existing structures are of importance in the installation or connection of any part of the work, the Contractor shall verify such dimensions and locations in the field before the fabrication of any material or equipment

which is dependent on the correctness of such information.

3.07 OBSTRUCTIONS

1. The Contractor shall remove all obstructions, the removal of which shall be necessary for the proper reception, performance, construction, installation, and completion of all work under this contract, as called for or implied in the plans and specification.

3.08 MEASUREMENTS

1. Figured dimensions and drawings take precedence over measurements by scale, and detail drawings over general drawings. The Contractor must verify all measurements at the site and be responsible for the accuracy of the same.

PART 4 – WORK HOURS AND CONSTRUCTION PROGRESS

4.01 HOURS OF LABOR

1. Work hours and workdays for this project have been established as Monday through Friday with eight (8) work hours per day. No work shall be done more than the established workdays and work hours, or legal holidays of the Federal, State or County government without a prior written consent of KCH. Should consent be given, Contractor shall be responsible for paying all overtime expenses for employees or representatives at no additional cost to KCH.

4.02 CONSTRUCTION PROGRESS

1. Avoidable Delays: Avoidable delays in the prosecution of the work shall include delays which could have been avoided by the exercise of care, prudence, foresight and diligence on the part of the Contractor or subcontractors. Avoidable delays include:
    a. Delays which may in themselves be unavoidable, but which affect only a portion of the work and do not necessarily prevent or delay the prosecution of other parts of the work nor the completion of the whole work within the contract time.

    b. Time associated with the reasonable interference of other contractors employed by KCH which do not necessarily prevent the completion of the whole work within the contract time.

2. Unavoidable Delays: Unavoidable delays in the prosecution or completion of the work shall include delays which result from causes beyond the control of the Contractor, and which could not have been avoided by the exercise of care, prudence, foresight and diligence on the part of the Contractor or subcontractors.

    a. Delays in the completion of the work of other contractors employed by the County under separate contracts will be considered unavoidable delays insofar as they interfere with the Contractor's completion of the work.

    b. Delays caused by acts of God, fire, unusual storms, floods, tidal waves, earthquakes, strikes, labor disputes, freight embargoes and shortages of materials shall be considered as unavoidable delays insofar as they prevent the Contractor from proceeding with at least seventy-five percent (75%) of the normal labor and equipment force for at least five hours per day toward completion of the current controlling item on the accepted critical path schedule.

3. Should abnormal conditions arise that either delay the standard start of the workday or prevent the Contractor from utilizing at least seventy-five percent of its standard labor or equipment for a minimum of five hours per day, and the crew is subsequently dismissed as a result, the Owner will not be charged for that working day. This provision applies regardless of whether conditions later improve to the point where a major portion of the day could have been considered suitable for work on the project's critical path item. In essence, a full day's credit is granted once the specified conditions of delay and dismissal are met, and this determination is not subject to reversal based on subsequent weather improvements.

4.03 SCHEDULE MODIFICATIONS:

1. The Contractor shall furnish such manpower, materials, facilities and equipment as may be necessary to ensure the prosecution and completion of the work in accordance with the accepted schedule.
2. It is further understood and agreed that none of the services performed by the Engineer in monitoring, reviewing and reporting project status and progress shall relieve the Contractor of responsibility for planning and managing construction work in conformance with the construction schedule.

3. If work falls 10 days or more behind the accepted construction schedule, the Contractor agrees that he will take some or all the following actions to return the project to the accepted schedule. These actions may include the following:

a. Increase manpower in quantities and crafts.

b. Reschedule activities: If requested by the Engineer, the Contractor shall prepare a proposed schedule revision demonstrating a plan to make up the lag in progress and ensure completion of the work within the contract time. The proposed revision shall be submitted to the Engineer.

4.04 CONTRACTOR'S RESPONSIBILITIES:

1. Avoidable Delays: All actions to return the project to the accepted schedule are at the Contractor's expense.

2. The Contractor shall pay all costs incurred by KCH which result from the Contractor's action to return the project to its accepted schedule. Contractor agrees that KCH shall deduct such charges from payments due the Contractor.

3. Unavoidable Delays: For delays which the Contractor considers to be unavoidable, the Contractor shall submit to the Engineer complete information demonstrating the effect of the delay on the controlling operation in the construction schedule.

4. The submission shall be made within the end of the following working day of the occurrence, which is claimed to be responsible for the unavoidable delay.

5. The Engineer shall review the Contractor's submission and determine the number of days unavoidable delay and the effect of such unavoidable delay on controlling operations of the work. KCH agrees to grant an extension of time to the extent that unavoidable delays affect controlling operations in the construction schedule. During such an extension of time, neither extra compensation or engineering inspection and administration nor damages for delay will be charged to the Contractor.

6. It is understood and agreed by the Contractor and KCH that time extensions due to unavoidable delays will be granted only if such unavoidable delay involves controlling operations which would prevent completion of the whole work within the specified contract time.

4.05 MEASUREMENT AND PAYMENT

1. Measurement and payment shall be as specified in the Proposal Schedule and shall include all work, complete in place, including labor, material, equipment, tools, testing, appurtenances and incidental items complete in place.

4.06 EXTRA WORK

1. No work of any kind in connection with the work covered by these specifications and plans shall be considered as extra work, or entitles the Contractor to extra compensation, except when the work has been ordered in writing by the Engineer and specifically referred to as EXTRA WORK and the amount of compensation stated in the order.

PART 5– SUPERVISION AND WORK COORDINATION

5.00 SUPERVISION AT THE JOB SITE

1. The Contractor shall be or have in person on the job site or be represented by a competent and responsible agent with full legal authority to act for the Contractor in connection with the contract during the performance of the contract.

2. The Contractor shall file with the Engineer a written statement signed by the Contractor giving the names of any and all foremen and employees who are authorized to act in place of the Contractor. Any communications signed on behalf of the Contractor by such agents shall bind the Contractor.

5.01 SUBCONTRACTORS

1. Under the terms of this contract, no subcontractor will be recognized by KCH. The subcontractor's dealings shall be with the Contractor; however, each and every subcontractor shall manage and take care of the materials and waste, as part of the work to be performed by him.

2. KCH will hold the Contractor responsible for all acts of a subcontractor, and it will deal only with the Contractor in any matter that may affect a subcontractor.

5.02 COORDINATION WITH OTHER CONTRACTORS

1. The Contractor shall coordinate the work with that of other contractors in the area and shall cooperate in the arrangements for storage of materials, scheduling of work, and scheduling of vehicular traffic patterns.

PART 6 – DISPOSAL OF MATERIALS

6.01 RESPONSIBILITY FOR SALVAGE AND PROTECTION OF EQUIPMENT AND MATERIALS REMOVED

1. The equipment and material to be salvaged as the work proceeds shall be removed with extreme care so as not to damage it for future use. Equipment shall be cleaned and protected from dirt and the elements and stored on site as directed.
2. Materials and equipment shall be stored and protected in accordance with the requirements of applicable technical specifications. Temporary storage facilities may be erected at the project site for protection of materials and equipment with written permission from the Engineer.
3. The Contractor shall be responsible for the security of the equipment and material until accepted by KCH.
4. Prior to dismantling equipment or piping, the Contractor shall confer with KCH and the Engineer. The Engineer will indicate the locations where equipment is to be disconnected. Damage caused by the Contractor to equipment or material specified or indicated on the Drawings to be salvaged shall be replaced or repaired by the Contractor, at the Contractor's own expense.

6.02 MATERIALS TO BE SALVAGED

1. Salvage work shall be considered incidental to the lump sum work or unit price work as applicable, and the Contractor's cost shall be included in the various work items in the Proposal Schedule. Material to be salvaged shall be delivered to the location specified by the Engineer.

6.03 DISPOSAL OF UNSUITABLE MATERIAL

1. All non-salvageable materials shall be disposed of at the cost of the Contractor. All surplus rock, boulder and soil that cannot be incorporated in the work shall be disposed of at the cost of the Contractor.

PART 7 – TEMPORARY CONSTRUCTION UTILITIES AND FACILITIES

7.01 - TEMPORARY WATER AND ELECTRICAL POWER

1. The Contractor shall make arrangements to provide a separate meter and piping for transporting water to the work, if so required, and shall pay all fees and costs resulting therefrom.
2. The Contractor shall notify the Engineer if there is any water shut-off prior to installing plumbing work. At the completion of the work, Contractor shall remove all temporary facilities at their expense.
3. The Contractor shall provide temporary Electrical power without additional fees charged to the Owner.

7.02 - SAFETY REQUIREMENTS FOR TEMPORARY ELECTRIC POWER

1. Temporary electric power installation shall meet the construction safety requirements of OSHA, State, the serving Utility, and any other applicable governing agencies.

7.03 - SANITARY FACILITIES

1. The Contractor shall provide and maintain sanitary facilities for the employees and the subcontractors' employees, and KCH project personnel that will comply with the regulations of the local and State Departments of Health and as directed by the Engineer.

PART 8 – MOBILIZATION AND DEMOBILIZATION

8.01 MOBILIZATION

1. Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the acquisition of false work materials; for the establishment of all offices; buildings and other facilities, excluding field office and project site laboratories; necessary for work on the project; and for all other work and operations which must be performed, or costs incurred, prior to beginning work on the various items on the project site.

8.02 BASIS OF PAYMENT

1. Mobilization and demobilization will be paid for on a lump sum basis per the Measurement and Payment Technical Specification. Absence of a Technical

Specification, payment shall be:

2. When 5 percent of the original contract amount is earned, 50 percent of the amount bid for mobilization and demobilization will be paid.

3. When 50 percent of the original contract amount is earned, 95 percent of the amount bid for mobilization and demobilization will be paid.

4. When 100 percent of the original contract amount is earned, 100 percent of the amount bid for mobilization and demobilization will be paid.

5. Nothing herein shall be construed to limit or preclude partial payment otherwise provided for by the Contractor.

PART 9 – PRESERVATION, RESTORATION AND CLEANUP

9.01 - SITE RESTORATION AND CLEANUP

1. At all times during the work, keep the premises clean and orderly, and upon completion of the work, repair all damage caused by equipment and leave the project free of rubbish or excess materials of any kind.

9.02 - STREET CLEANUP DURING CONSTRUCTION

1. Thoroughly clean all spilled dirt, gravel, or other foreign material caused by the construction operations from all public streets and roads at the conclusion of each day's operation.

9.03 - PROTECTION OF PROPERTY

1. The Contractor shall take all necessary precautions during the progress of the work to protect adjoining property from damage and injury, and shall promptly make good such damages to adjoining property.
2. The Contractor shall repair to the entire satisfaction of KCH all damages to existing streets, sidewalks, or other public property at the Contractor’s expense.

9.04 DUST & NOISE PREVENTION

1. The Contractor shall perform the work in such a manner as to avoid dust problems. Whenever visual observation of dust is detected by the Contractor or Engineer outside the property boundary, a dust problem is considered to exist. The Contractor shall take

immediate action to alleviate this problem.

2. Give all unpaved streets, roads, detours, or haul roads used in the construction area an approved dust-preventive treatment or periodically water to prevent dust. Applicable environmental regulations of the State Department of Health for dust prevention shall be strictly enforced.

3. Between 7:30 p.m. and 7:00 a.m., noise from Contractor's operations shall not exceed limits established by State Department of Health regulations and in no event shall exceed 86 dBA at a distance of 50 feet from the noise source.

9.05 STRUCTURES RESTORATION

1. The Contractor shall remove such existing structures, including curbs, gutters, pipelines and utility poles, as may be necessary for the performance of the work and shall rebuild the structures thus removed in as good a condition as found. The Contractor shall also repair existing structures which may be damaged as a result of the work under this contract at their own expense.

9.06 ROADS AND STREETS RESTORATION

1. Unless otherwise specified, roads and streets in which the surface is removed, broken, or damaged, or in which the ground has caved or settled during the work under this contract, shall be resurfaced and brought to the original grade and section.
2. Roadways used by the Contractor shall be cleaned and repaired. Before resurfacing material is placed, edges of pavements shall be trimmed back far enough to provide clean, solid, vertical faces, and shall be free of loose material. Repair work shall conform to the paving specifications.

9.07 CULTIVATED AREAS AND OTHER SURFACE IMPROVEMENTS

1. Cultivated or planted areas and other surface improvements which are damaged by the actions of the Contractor shall be restored as nearly as possible to their original condition at the Contractor’s expense.
2. Existing fences, barricades, and gravel areas shall be protected and replaced if damaged. Replacement costs shall be borne by the Contractor.

9.08 POLLUTION CONTROL

1. Throughout the entire contract period, the Contractor shall effectively maintain pollution control in accordance with Act 105, Section 1, Chapter 103 of the Hawai‘i Revised Statutes, as amended.

9.09 DAILY JOB SITE CLEAN UP

1. On completion of the work of each and every section of these specifications, or by each trade, on a daily basis, remove from the site all debris, tools and excess material resulting from the work and leave the area of the work and any affected surroundings broom clean.

9.11 FINAL CLEAN UP

1. As a condition precedent to final acceptance or release of a space or process unit for use by KCH, the Contractor shall thoroughly clean all work areas.

9.12 GUARANTEE

1. The Contractor guarantees all materials and equipment furnished to be in operable condition upon written final acceptance of the work and that all such materials and equipment conform to the requirements of this contract and be fit for the use intended.
2. The Contractor further guarantees all such materials and equipment against defects and poor workmanship and, to the extent that the Contractor is responsible for design, the Contractor guarantees the design to meet the criteria and operating requirements specified against failure to perform in accordance with such criteria and operating requirements.
3. The period of this guarantee shall commence upon written final acceptance of the work by KCH, and shall extend through the project performance evaluation period not to exceed two (2) years, unless otherwise specified herein, for all materials and equipment, provided that this period shall be extended from the time of correction of any defect or failures, corrected under the terms of this guarantee, for a like period of the corrected work.
    a. The Contractor shall correct all defects or failures discovered within the guarantee period.

    b. KCH will give the Contractor prompt written notice of such defects or failures

following their discovery.

c. The Contractor shall commence corrective work within 10 calendar days following notification and shall diligently prosecute such work to completion, or as required by the Technical Specifications.

d. The Contractor shall bear all costs of corrective work, which shall include necessary disassembly, transportation, reassembly, and retesting, as well as repair or replacement of the defective material or equipment, and any necessary disassembly and reassembly of adjacent work.

e. If the Contractor fails to perform corrective work in the manner and within the time stated, KCH may proceed to have such work performed at the Contractor's expense and sureties will be liable therefore.

f. KCH shall be entitled to reasonable attorney fees and court costs necessarily incurred by the Contractor's refusal to honor and pay such costs of corrective work.

4. The Contractor's performance bond shall continue in full force and effect during the period of this guarantee.

5. The rights and remedies of KCH under this provision do not preclude the exercise of any other rights or remedies provided by this contract or by law with respect to unsatisfactory work performed by the Contractor.

6. This guarantee shall be deemed supplemental to guarantee provisions provided in other sections of the specifications for the individual units and systems of units specified.

9.13 WORK ON PUBLIC ROADWAYS

1. Work that will be completed on State and County Public Roadways. Permissions and applicable permits shall be secured from the appropriate agencies.

PART 10 – TRAINING

10.01 - TRAINING OF OWNER'S PERSONNEL

1. Provide site-specific operations and maintenance training for items of mechanical,

electrical, and instrumentation equipment when specified in specifications for the equipment. Generally, all training will include a process overview of all components, operational process, maintenance, troubleshooting, and rebuilding. The Owner may provide a summary of training requirements.

2. Contractor shall organize and coordinate the training periods with the Owner's personnel and manufacturer's representatives and shall submit a training schedule at least 30 days prior to the time that the associated training is to be provided.
3. The Contractor shall use only qualified manufacturer's representatives to conduct training sessions.
4. For systems with multiple components, the manufacturer that has primary responsibility for the overall system shall coordinate and schedule the training.
5. Training sessions shall include hands-on activities, demonstrations, and discussion. Simply reviewing the equipment manual does not fulfill the training requirements.

END OF SECTION

SECTION 01010

SUMMARY OF WORK/PROJECT DESCRIPTION

1. This project encompasses the comprehensive installation of a Wastewater Package/Modular Wastewater Treatment Plant, requiring all necessary labor, materials, and services.
2. The contractor is responsible for furnishing and installing a complete PURESTREAM 50 factory-built extended aeration type sewage treatment plant, including all necessary equipment for its effective operation as manufactured. This plant shall consist of a welded steel rectangular tank structure, divided into two major sections: an aeration compartment and a settling basin. The principal equipment for each unit will include air diffusers, an effluent trough, return sludge air lift or air lifts, and rotary blower(s) complete with the required motors and controls.
3. Additionally, the plant will feature a blower and motor housing, along with all necessary internal piping and accessory equipment as specified herein. The treatment plant structure is designed and reinforced to withstand normal pressures from both the surrounding soil and the interior hydrostatic load, ensuring structural integrity and longevity.
4. Project plans applicable to the work are as follows:

    a. The plant will provide preliminary and secondary treatment. The treatment facility shall be able to handle 50,000 gallons per day of raw unprocessed sewage.
    b. Effluent disposal system exists therefore connection shall be to the sewer manhole immediately existing the wastewater treatment plant. Effluent is expected to meet HAR 11-62 disposal requirements.
5. There will be no off-site improvements. On-site improvements shall include but are not limited to:
    a. Installation of new chain-link fencing around new system with a double swing gate for manpower and equipment access.
    b. Construction of a new CMU retaining wall.
    c. Removal and replacement of concrete walkways around the facility.

d. Installation of a new diversion sewer manhole over the existing 8” sewer main; channelizing to split flow between the existing and newly constructed wastewater treatment facility.
e. Installation of new force main; sewer mains; cleanouts and all other appurtenances required and as noted on the project plans.

END OF SECTION

SECTION 01030

PERMITS AND ENDANGERED SPECIES

1.00 DESCRIPTION:

1. The Contractor will obtain the necessary permits for this project. The Contractor shall comply with the conditions of all permits issued by utility companies and regulatory agencies in connection with all work under the contract. Unless otherwise specified in the Contract, one (1) digital electronic copy of all permits required for the Project shall be submitted to KCH and the Engineer of Record.
2. The Contractor shall provide the necessary supporting documentation to secure the project-specific NPDES permit as required under KCH's Notice of General Permit Coverage.

1.01 COST OF PERMITS:

1. The Contractor shall pay all charges imposed by utility companies, public agencies, or regulatory agencies, resulting from all permits. The contractor shall be responsible for conducting all tests and furnishing materials, equipment, and labor necessary for compliance with all permits.

2. The required permits may include, but not be limited to, the following:

    a. DPW – Grading Permit

    b. Noise Variance Permit

    c. National Pollutant Discharge Elimination System Permit.

2.00 - UNITED STATES DEPARTMENT OF THE INTERIOR – FISH AND WILDLIFE SERVICE

1. The US Environmental Protection Agency has designated the State of Hawai'i, Department of Health as its non-federal representative to monitor rules and regulations under Section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq) (ESA) for the following listed species:

    a. 'Qpe'ape'a or Hawaiian hoary bat (Lasiurus cinereus semotus)

b. *Hawaiian seabirds, including Hawai'i Distinct Population Segment of the ake'ake or band-rumped storm petrel (Hydrobates castro), 'a'o or Newell;s shearwater (Puffinus newelli), 'ua'a or Hawaiian petrel (Pterodroma sandwichensis).*

2. This project shall incorporate the Service recommended Avoidance and Minimization Measures for federally listed Hawaiian seabird species and the ope'ape'a.

3. To avoid and minimize impacts to 'ope'ape'a, the Project will not use barbed wire fencing.

2.01 - Avoidance and Minimization Measures

1. Endangered ope'ape'a (Hawaiian Hoary Bat) roosts in woody vegetation across all islands and will leave their young unattended in trees and shrubs when they forage.

    a. If trees and shrubs 15 feet or taller are cleared during the pupping season, June 1 through September 15, there is a risk that young bats could inadvertently be harmed or killed, since they are too young to fly or move away from disturbance. Hawaiian hoary bat forage for insects from as low as 3 feet to higher than 500 feet above the ground and can become entangled in barbed wire used for fencing.

    b. To avoid and minimize impacts to the endangered Hawaiian hoary bat we recommend you incorporate the following applicable measures into your project description:

    c. Do not disturb, remove, or trim woody plants greater than 15 feet tall during the bat birthing and pup rearing season (June 1 through September 15).

    d. Do not use barbed wire for fencing.

2. Endangered 'ua'a (Hawaiian petrel, Pterodrama sandwichensis), 'A'o, (Newell's shearwater, Puffinus newelli), and the 'ake'ake (band-rumped storm-petrel, Hydrobates castro).

    a. Hawaiian seabirds may traverse the project area at night during the breeding, nesting and fledging seasons (March 1 to December 15). Outdoor lighting could result in seabird disorientation, fallout, and injury or mortality. Seabirds are attracted to lights and after circling the lights they may become exhausted and

collide with nearby wires, buildings and other structures or they may land on the ground. Downed seabirds are subject to increased mortality due to collision with automobiles, starvation, and predation by dogs, cats, and other predators. Young birds (fledglings) traversing the project area between September 15 and December 15, in their first flight from their mountain nests to the sea, are particularly vulnerable to light attractions.

b. To avoid and minimize potential project impacts to seabirds the contract shall incorporate the following measures into your project description.

c. Fully shield all outdoor lights so the bulb can only be seen from below.

d. Install automatic motion sensor switches and controls on all outdoor lights or turn off lights when human activity is not occurring in the lighted area.

e. Avoid nighttime construction during the seabird fledging period, through December 15.

f. Seabirds have been known to collide with fences, powerlines, and other structures near nesting colonies. To avoid and minimize the likelihood of collision we recommend you incorporate the following measures into your project description:

   i. Where fences extend above vegetation, integrate three strands of polytape into the fence to increase visibility.

   ii. For powerlines, guy-wires and other cables, minimize exposure to above vegetation height and vertical profile.

3. If additional information is needed, please contact:

   Fish and Wildlife Service
   Pacific Islands Fish and Wildlife Office 300 Ala Moana Boulevard, Room 3-122
   Honolulu, Hawai'i 96850

END OF SECTION

SECTION 01060

SAFETY AND HEALTH

PART 1 - GENERAL

1.01 SAFETY AND HEALTH

1. The Contractor shall be experienced and qualified to anticipate and meet the safety and health requirements of this project.

1.01 DRUG FREE POLICY

1. The Contractor and all subcontractors shall certify that a drug-free workplace shall be provided and maintained for the duration of the project. Certification signed by a corporate officer shall be submitted within ten (10) workdays of the Notice to Proceed.

1.02 SAFETY AND HEALTH REGULATIONS

1. The Contractor shall comply with the standards of the Occupational Safety and Health Administration (OSHA) and all applicable Federal, State, and County laws and regulations relating to safety in the performance of the work.

2. The Contractor shall comply with the State laws and standards regarding a safe place of employment and safe practices and shall do everything reasonable and necessary to protect the life, safety, and health of all personnel involved in the project, as well as the affected general public.

3. Strict compliance with all safety requirements will be enforced. Primary concern is safety of the Contractor's employees, KCH and its representatives and Consultants, as well as the affected general public. Safety related directions and/or orders by KCH or representatives shall not be construed as relieving the Contractor of it’s responsibility for safety.

4. All workers on the construction site as needed, must wear appropriate personal protective equipment (PPE), including

    a. Hard hats to protect against falling objects and head injuries.
    b. Safety glasses or googles for eye protection.
    c. Gloves to protect hands from cuts, abrasions, and chemical exposure.

d. Steel-toed boots for foot protection.

e. High-visibility vests or clothing to ensure workers are easily seen.

5. Falls are a leading cause of construction fatalities, so fall protection is critical:

6. Fall protection systems like guardrails, safety nets, or personal fall arrest systems are required for work at heights of 6 feet or more.

7. Proper scaffolding design, construction and use is mandated.

8. Ladders must be used safely and inspected regularly.

1.03 HAZARD COMMUNICATION

1. The contractor shall implement and maintain a comprehensive Hazard Communication Program in compliance with applicable regulations to ensure the safety of all personnel working on-site. The program must include the following mandatory elements:

    a. Safety Data Sheets (SDS): The contractor shall provide and maintain readily accessible Safety Data Sheets (SDS) for all hazardous materials brought to or used on the project site. These SDS must be available to all workers and project personnel at all times.

    b. Chemical Labeling: All chemicals used or stored on-site must be properly labeled in accordance with regulatory standards. Labels must clearly identify the chemical, its hazards, and any necessary precautions to ensure safe handling and use.

    c. Worker Training: The contractor is responsible for training all workers on chemical hazards associated with materials used on-site. The training must include information on recognizing hazards, understanding the SDS, safe handling procedures, emergency response protocols, and the use of appropriate personal protective equipment (PPE).

2. The contractor shall ensure full compliance with these requirements throughout the duration of the project. Failure to adhere to these provisions may result in corrective action, penalties, or termination of the contract.

1.04 EQUIPMENT AND TOOL SAFETY

1. The contractor shall implement and maintain comprehensive safety protocols for all tools, equipment, and machinery used on the project site.

2. Tools and Equipment Inspection and Maintenance:

    a. All tools and equipment must be inspected before each use to ensure they are in safe working conditions.

    b. A regular maintenance schedule shall be established and followed for all tools and equipment.

    c. Any damage or malfunctioning tools or equipment must be immediately removed from service and either repaired or replaced.

3. Proper Tools and Equipment Selection:

    a. The contractor shall ensure that the right tool or equipment is used for each specific task.

    b. Workers must be trained on proper tool and equipment selection of various job functions.

4. Machinery Safeguards and Engineering Controls:

    a. All hazardous machinery must have appropriate safeguards and engineering controls in place.

    b. These safeguards and controls must be regularly inspected and maintained to ensure their effectiveness.

    c. Workers must be trained on the proper use of machinery safeguards and the importance of not bypassing or disabling safety features.

5. The contractor shall ensure full compliance with these requirements throughout the duration of the project.

1.05 SITE ORGANIZATION AND HOUSEKEEPING

1. The Contractor shall maintain a clean and orderly jobsite throughout the duration of the wastewater treatment plant construction project. Regular debris removal and proper housekeeping practices shall be implemented to ensure a tidy work environment.

2. All tools and materials must be appropriately stored in designated areas when not in use, promoting both safety and efficiency on the site.

3. The Contractor shall also be responsible for maintaining clear and unobstructed pathways throughout the construction area to minimize the risk of trips and falls.

4. These measures are essential for creating a safe working environment, optimizing productivity, and presenting a professional appearance to visitors and inspectors. Compliance with these cleanliness and organization requirements will be monitored and enforced as part of the overall project management and safety protocols.

1.06 TRAINING AND PREPAREDNESS

1. As part of the wastewater treatment plant construction project, all workers must undergo safety training specifically tailored to their assigned tasks. To maintain a strong focus on safety throughout the project, regular safety meetings or toolbox talks shall be conducted. These sessions will serve to reinforce safety protocols and address any emerging concerns. Additionally, clear safety instructions and signage should be prominently displayed around the construction site. This comprehensive approach to safety education, ongoing communication, and visual reminders will help ensure a safe working environment for all personnel involved in the project.

1.07 EMERGENCY PREPAREDNESS

1. An emergency response plan must be in place and communicated to all workers.

2. Fire protection measures and firefighting equipment must be available.

3. First aid supplies and trained personnel should be accessible.

4. The Contractor shall put emphasis in the following:

5. Equipment must be provided with the necessary warning devices and signs.

6. Confined Space: The Contractor shall ensure that a Confined Space Program is provided for their employees and any and all Subcontractor employees who are required to enter Confined Spaces as defined by HIOSH and OSHA Regulations.

7. Entry into the existing wet wells; cesspools; manholes shall be considered as entries into Confined Spaces.
8. The Contractor shall be responsible for defining any other Confined Space areas during the construction work.
9. KCH will notify the Contractor of any non-compliance with environmental pollution control or with safety standards, of any safety violations, and the action to be taken.
10. If the Contractor fails or refuses to comply promptly, KCH may issue an order in writing to stop the work or any portion thereof, until satisfactory corrective actions have been taken.
11. The right to stop the work shall not be construed as creating a duty on the part of KCH to exercise this right for the benefit of the Contractor or any other person nor as an assumption of responsibility for the Contractor's administration, implementation, or enforcement of safety on the job site.
12. No extension of time or payment for excess costs or damages shall be made for the time lost due to such stop action.
13. All costs incurred to provide compliance shall be borne by the Contractor.

1.08 ACCIDENT REPORTS

1. If death or serious injuries or serious damages occur, the accident shall be reported immediately by telephone followed by email to the Engineer. In addition, the Contractor must promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance of the work whether on, or adjacent to, the site, giving full details and statements of witnesses.

2. If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

1.09 BARRICADES

1. The Contractor shall erect, install, and maintain all temporary walks, warning signs, barricades, or other protective means around the construction site as may be ordered by KCH, for the effectual protection of the public, employees, or of workmen employed on the project.

** END OF SECTION **

SECTION 01300

SUBMITTALS

PART 1 – GENERAL

1.01 GENERAL

1. The information to be submitted shall consists of drawings, specifications, descriptive data, certificates, samples, test results and such other information, all as specifically required in the specifications.

PART 2 – CONTRACTOR'S RESPONSIBILITIES

2.01 GENERAL

1. The contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the materials, equipment or method of work shall be as described in the submittal. Submittals shall contain all required information, including satisfactory identification of items, units, and assemblies in relation to the contract drawings and specifications. The Contractor shall verify that the materials and equipment described in each submittal conform to the requirements of the specifications and drawings.

2. Unless otherwise approved by the Engineer, submittals shall be made only by the Contractor, who shall indicate by a signed stamp on the submittals, that it (the Contractor) has checked the submittals, and that the work shown conforms to contract requirements and has been checked for dimensions and relationship with work of all other trades involved.

3. If the information shows deviations from the specifications and drawings, the Contractor, by statement in writing accompanying the information shall identify the deviations and state the reason(s) for the deviation(s).

4. The Contractor shall ensure that there is no conflict with other submittals and shall notify the Engineer in each case where its submittal may affect the work of another contractor or KCH. The Contractor shall ensure coordination of submittals among the related crafts and subcontractors.

5. The Contractor may authorize in writing a material or equipment supplier to deal directly with the Engineer or with KCH with regard to a submittal. The Contractor, however, shall be responsible for the accuracy and completeness of information contain in all submittals.

6. All equipment and manufacturer's instruction submittals, including follow-up submittals, shall be submitted no later than 30 days following the Notice to Proceed not later than necessary to procure the item or avoid schedule delays as established in the Contractor's construction schedule.

2.02 SUBMITTAL SCHEDULE

1. The Contractor shall provide a submittal schedule to allow coordination of review of the submittals in order that work may be accomplished within the specified contract time. Submittal schedule shall be provided within ten (10) calendar days after award of the Contract.

2.03 TRANSMITTAL PROCEDURES

1. A separate form shall be used for each specific item, class of materials, and items specified in separate, discrete sections, for which the submittal is required.

2. Submittals of various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.

3. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "xxx"; where "xxx" is the sequential number assigned by the Contractor.

4. Resubmittals shall have the following format:

    a. "xxx-y"; where xxx is the originally assign submittal number and "y" is a sequential letter assigned for re-submittal, i.e. A,B.C being the 1st, 2nd, and 3rd re- submittals respectively. Submittal 25B, for example, is the second re-submittal of submittal 25.

5. Submittals shall be sent to the Engineer of Record via electronic transmittal.
6. Deviation from Contract

    a. If the Contractor proposes to provide material which does not conform to the specifications and drawings, it shall indicate so under "deviations" on the submittal transmittal form accompanying the submittal copies. The Contractor shall prepare its reason for a change, including cost and time differential.

7. Submittal Completeness

    a. Submittals which do not have all the information required to be submitted, including deviations, shall be considered as not complying with the intent of the contract and are not acceptable and will be returned without review.

2.04 SUBMITTAL REQUIREMENTS

1. Submit shop drawings, manufacturers' data and certificates for equipment, materials, finish, and pertinent details for each system and have them approved before procurement, fabrication or delivery of the items to the job site.

2. Partial submittals will not be acceptable and will be returned without review.

3. Submittals shall include the manufacturer's name, trade name, catalog number or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable industry and technical society publication references and other information necessary to establish contract compliance of each item the Contractor proposes to furnish.

4. SHOP DRAWINGS

    a. Drawings shall be ANSI D (22 inches by 34 inches) in size, except as specified otherwise.

        i. Drawing shall include floor plans, sectional views, installation details of equipment; and equipment spaces identifying and indicating proposed locations, layout and arrangement of items of equipment, accessories, piping and other items that must be shown to ensure a coordinated

installation.

ii. Drawing shall indicate adequate clearance for operation, maintenance and replacement of operating equipment devices. If equipment is disapproved, drawings shall be revised to show acceptable equipment and be resubmitted.

5. MANUFACTURER'S DATA
    a. Submittals for each manufactured item shall be manufacturer's descriptive literature of cataloged.

2.05 CONTRACTOR'S RESPONSIBILITIES

1. All submittals required by these specifications are required to be submitted by the Contractor in full, complete form, no exceptions. The Contractor shall request in writing to the Owner those specific submittals not required or not applicable to the project. Unless so granted by the Owner, all submittals are required as a prerequisite to project acceptance.
2. Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. Submittals shall contain all required information, including satisfactory identification of items, units, and assemblies in relation to the contract drawings and specifications. The Contractor shall verify that the material and equipment described in each submittal conform to the requirements of the specifications and drawings. Unless otherwise reviewed by the Director, submittals shall be made only by the Contractor, who shall indicate by a signed stamp on the submittals, that it (the Contractor) has checked the submittals, and that the work shown conforms to contract requirements and has been checked for dimensions and relationship with work of all other trades involved. If the information shows deviations from the specifications or drawings, the Contractor, by statement in writing accompanying the information, shall identify the deviations and state the reason(s) therefore. The Contractor shall insure that there is no conflict with other submittals and shall notify the Director in each case where its submittal may affect

the work of another contractor or KCH. The Contractor shall ensure coordination of submittals among the related crafts and Subcontractors.

3. The Contractor may authorize in writing a material or equipment supplier to deal directly with KCH with regard to a submittal. The Contractor, however, shall be responsible for the accuracy and completeness of information contained in all submittals.
4. All equipment and manufacturer's instruction submittals, including follow-up submittals, shall be submitted no later than 180 days following the Notice to proceed nor later than necessary to procure the item or avoid schedule delays as established in the Contractor's construction schedule.

2.06 PERFORMANCE (CONSTRUCTION) SCHEDULE

1. The Contractor shall provide a construction schedule for scheduling and coordinating the work within the contract time. The construction schedule shall be in itemized and be in Gantt chart format, and shall be submitted to KCH for approval no later than 60 days after the Contract Award Date or prior to the issuance of Notice to Proceed, whichever is earlier. Contract time extensions shall be incorporated into updated schedules, reflecting their effect at the time of occurrence. Failure of the Contractor to comply with these requirements for submittal of the performance schedule and reports shall be cause for delay in review of progress payments by KCH. Project status review and update shall be provided each month and submitted with progress payment requests.

2.07 SAMPLES AND TESTING

1. Where required in the Specifications, and as determined necessary by KCH, samples of materials, appliances, and fittings to be used or offered for use in connection with the work shall be submitted to the KCH at the Contractor's expense, with information as to their sources, with all cartage charges prepaid, and in such quantities and sizes as may be required for proper examination to establish the quality or equality thereof, as applicable.
2. All samples shall be submitted in ample time to enable KCH to make any examinations necessary, without delay to the work. The Contractor will be held

responsible for any loss of time due to neglect or failure to deliver the required samples to KCH, as specified.

3. Samples also shall be taken during the course of the work, as required by KCH.

4. Laboratory tests and examinations that the KCH elects to make in its own laboratory will be made at no cost to the Contractor, except that, if a sample of any material or equipment proposed for use by the Contractor fails to meet the Specifications, the cost of testing subsequent samples shall be borne by the Contractor.
5. All tests required by the specifications to be performed by an independent laboratory shall be made at the sole expense of the Contractor.
6. Material used in the work shall conform to the submitted samples and test certificates as approved by KCH.

PART 3 – TRANSMITTAL PROCEDURE

3.01 GENERAL

1. Submittals regarding material shall be stamped as required, and accompanied by a transmittal document. A separate form shall be used for each specific item, class of material, and items specified in separate, discrete sections, for which the submittal is required. Submittals of various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.
2. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "XXX"; where "XXX" is the sequential number assigned by the Contractor.
3. Resubmittals shall have the following format:
   "XXX-Y"; where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of submittal 25.

3.02 DEVIATION FROM CONTRACT

1. If the Contractor proposes to provide a material which does not conform to the specifications and drawings, it shall indicate so under "deviations" on the submittal transmittal form accompanying the submittal copies. The Contractor shall prepare its reason for the proposed change, including cost and time differential. All deviations shall be reviewed and approved by KCH on an individual basis.

3.03 SUBMITTAL COMPLETENESS

1. Submittals shall contain all information specifically required and additional information as required to provide a complete description and reference for review by KCH.
2. Submittals shall be complete and not packaged by individual line items as may be presented in the specifications. Submittals shall include all information required of a specific Section and include pertinent or related information required under separate Sections.
3. Any and all deviations shall be so stated on the submittals.
4. Submittals that are not complete, in KCH's opinion, or fail to identify deviations, shall be considered not in compliance with the intent of the contract and are therefore unacceptable. Such unacceptable submittals will be returned to the Contractor without review and it will be the Contractor's responsibility to complete and resubmit the submittal.

PART 4 – REVIEW PROCEDURE

4.01 When the contract requires a submittal, the Contractor shall submit the specified information as follows to KCH for review.

1. Unless otherwise specified, upon receipt of the submittal by the Director, the submittal shall be reviewed and the Director shall return two (2) copies of the marked-up reproducible original. The reproduction original will be retained by the Director. The Contractor may submit additional sets of the submittal should he require additional sets for distribution to Subcontractors, suppliers, or for other purposes. Unless otherwise indicated, the Contractor shall allow for ten (10) working days for review and return of all submittals. Submittals requiring shorter

review times may be requested by the Contractor, however, no guarantee is made shorter review periods will be accommodated. The returned submittal shall indicate one of the following actions:

a. If the review indicates that the material, or work method is in general conformance with the design concept and complies with the drawings and specifications, submittal copies will be marked "NO EXCEPTIONS TAKEN". In this event the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
b. If the review indicates limited corrections are required, copies will be marked "NOTE MARKINGS". The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. A corrected copy of the submittal shall be provided.
c. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked accordingly and will be required to be resubmitted. The Contractor shall not undertake work covered by this submittal until the submittal has been revised resubmitted and returned and marked either "NO EXCEPTIONS TAKEN" or "NOTE MARKINGS".
d. If the review indicates that the material, equipment, or work method is not in general conformance with the design concept or incompliance with the drawings and specifications, copies of the submittal will be marked "REJECTED". Submittals with deviations that have not been identified clearly may be rejected. Except at its own risk, the Contractor shall not undertake work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "NOTE MARKINGS".

PART 5 – EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTAL

5.01 KCH's review of drawings, method of work, or information regarding materials or equipment the Contactor proposes to provide, shall not relieve the Contractor of its

responsibility for deficiencies, omissions and errors therein and shall not be regarded as an assumption of risks or liability by KCH, or by any officer, employee, consultant, or subcontractor thereof, and the Contractor shall have no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed. A mark of "NO EXCEPTION TAKEN" OR "NOTE MARKINGS" shall mean that KCH has no objection to the Contractor, upon its own responsibility, using the plan or method of work proposed, or providing the material or equipment proposed.

SECTION 01720

RECORD DRAWINGS

1.01 DESCRIPTION

1. Record drawings refer to those documents maintained and annotated by the Contractor during construction and are defined as:

    a. A neatly and legibly marked set of contract drawings showing the final location and elevation of piping and equipment, and

    b. The Contractor's layout and installation drawings.

1.02 PRODUCTS

1. Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition.

    a. Record documents shall not be used for construction purposes and shall be available for review by the Engineer during normal working hours at the Contractor's field office.

    b. The Contractor shall certify the record documents accurately reflect the as-built condition of the project and all modifications and changes made during construction are incorporated.

1.03 EXECUTIONS

1. Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. Annotations to the record documents shall be made with an erasable colored pencil conforming to the following color code:
    a. Additions - Red

    b. Deletions - Green

    c. Comments - Blue

2. At completion of the work and prior to Final Acceptance, two (2) sets of marked record drawings shall be submitted to the Engineer for review and acceptance.

3. Reproducible record drawings shall be submitted to Kona Community Hospital and the Engineer of Record.
4. The Record Drawings may be provided as a scanned document. Color coding is not required to be provided on electronic copy, however, all changes shall be clearly annotated.
5. The Contractor shall provide two (2) sets of final reproducible record drawings and shall be provided on bond, ANSI D (22" x 34"), paper.

END OF SECTION

SECTION 02000

WATER POLLUTION, EROSION, SEDIMENT AND DUST CONTROL

1.01 DESCRIPTION

1. This section is about submitting detailed plans, diagrams, and written site-specific best management practice (BMP); the construction, maintenance and repair of temporary and permanent water pollution, erosion, sediment, and dust control measures at the project site, including work areas, material stockpiling areas, and haul roads; removal and disposal of potentially hazardous wastes; and compliance with applicable State and Federal Permit conditions.
2. The requirements of this section also apply to borrow pit operations, haul roads and/or Contractor's storage sites located outside the contract limits.
3. The requirements of this section do not apply to dewatering or hydro-testing activities. If excavation/backfilling operations require dewatering or the installation of relocating water lines require hydro-testing, and the Contractor elects to discharge dewatering or hydro-testing effluents into State Waters or existing drainage systems, the Contractor shall obtain a National Pollution Discharge Elimination System (NPDES_ Dewatering or Hydro-Testing Waters Permit from the Department of Health, Clean Water Branch).
4. The Contractor shall conform to the requirements of the NPDES Notice of General Permit Coverage and shall follow the guidelines in the "Best Management Practices Manual for Construction Sites in Honolulu" dated November 2011 in developing, installing, and maintaining the BMP's for the project site and follow Honolulu's City and County "Rules for Soil Erosion Standards and Guidelines" and use respective soil erosion guidelines for County of Hawai'i.
5. The erosion and sediment control structures shall be maintained until temporary ground cover is established to stop all sediment, dust and erosion. All fines imposed for improper erosion, and sediment, and dust control shall be paid by the Contractor responsible for the work.
6. Install temporary erosion and sediment controls which will ensure that the storm water and other drainage from job site areas which will be stripped or modified of its naturally existing or artificially established stabilization or protection against erosion shall pass

through a filter system before being discharge and that these areas shall be kept sufficiently moist to control dust.

7. Requirements under this section shall apply to all work directly related to the performance of work under this Contract. If the Contractor elects to utilize excavated material as backfill material on private properties in areas outside of the project work limits or elects to perform additional grading and/or excavation work on properties outside of the work limits; such agreements shall be considered as private agreements between the Contractor and the private property owner. In such cases the Contractor shall be responsible for the costs of all required water pollution and erosion control measures for that work.

1.02 SILTATION FENCE, RE-VEGETATION, CRUSHED ROCK PAD, AND ROCK CHECK DAM

1. Establish, construct, and maintain erosion and sediment control measures. Temporary siltation control devices and a crushed rock pad shall be installed before construction begins. All disturbed and graded areas shall be hydro mulched at the end of the construction project. The installation of these erosion and sediment control measures shall be in accordance with the approximate locations shown on the Plans. All erosion and sediment control measures shall be kept in good repair and maintained throughout construction.

1.03 DUST CONTROL

1. The Contractor shall exercise precautionary measures to minimize dust emissions, which shall include, but not be limited to, periodic sprinkling or wetting of the site. The Contractor has the option of using a dust palliative. The Contractor must comply with all local requirements.

1.04 SUBMITTALS

1. Name(s) of the individuals designated to be responsible for the water pollution and erosion controls on the project site along with home, business, and cellular telephone numbers. Individuals shall be available during off-hours, weekends and holidays.

2. A copy of the site-specific BMP Plan will be provided by the Engineer of Record.

Modify and resubmit the above items to correct unforeseen conditions that develop during pre-construction and construction phases. These drawings shall be reviewed and approved by the Engineer of Record.

1.05 SILT FENCE

1. Silt fence shall be nylon reinforced polyester netting with fabric weight in excess of 4.0 ounces per yard and having a built-in cord running throughout the top edge of the fabric. Silt fence fabric shall be Mirafi 100X, or equal, inert to chemicals commonly found in soil and resistant to mildew, rot, insects, and rodent attack. Posts shall be either steel or two-inch square pressure treated fir, southern pine or hemlock and shall be spaced not more than six feet on center. The silt fence with a two-foot-height minimum shall be installed at the down slope boundaries of the project site.

1.06 GRAVEL DRIVEWAY

1. Crushed rock shall be #3 Coarse in accordance with ASTM C33.

1.07 CURB AND GUTTER INLET PROTECTION

1. BioSock sediment filter by BioSolutions Products or approved equal product. The purpose is to keep silt, sediment, and construction debris out of storm water systems.

1.08 GRATED INLET PROTECTION

1. Dandy Bag II by Dandy Products or an approved equal product. The purpose is to keep silt, sediment, and construction debris out of storm water systems.

1.09 CONSTRUCTION REQUIREMENTS

1. The Contractor shall conform to the requirements of the NPDES Notice of General Permit Coverage.
2. The Contractor shall not begin work on the project until all submittals detailed above is completed, reviewed and approved by the Engineer, and submitted in writing.
3. The Contractor shall install and maintain a rain gauge at the project location.
4. The Contractor shall install stabilized construction entrances and egresses (crushed rock pad) to minimize track of dirt, and mud onto the roadways.
5. BMP measures shall be installed and accepted by the Engineer of Record before

commencement of work activities that result in the disturbance of earth material. The Contractor shall coordinate and maintain BMP measures throughout the construction and post-construction period.

6. The Contractor shall address any water pollution, erosion and sediment control concerns brought to attention by KCH within 24 hours of notification.
7. The Contractor shall apply accepted erosion control measures to all exposed surfaces subject to erosion. If after 7 days, the erosion control measures have not been applied, the Contractor shall apply an accepted erosion control measure at no cost to KCH.
8. Silt fences shall be installed by securely fastening silt fence fabric using wire ties. The silt fence fabric panels shall be installed loosely with adjacent panels overlapping a minimum of 12 inches. Silt fence material shall be embedded at least 6 inches beneath the ground surface and shall extend upward at least two feet above the disturbed area ground surface. The top edge of the fabric shall be reinforced or shall have a one-inch tuck.
9. An eight-inch-thick gravel driveway shall be installed at the ingress/egress of the project site as shown on the Plans to aid in the removal of dirt/mud from the tires of trucks leaving the construction site areas.
10. Curb and gutter inlet production shall be installed at curb and inlets and shall be removed and cleaned of all accumulated sediment and debris after each storm event.
11. Grated inlet protection shall be installed at drainage inlets and shall be removed and cleaned of all accumulated sediments and debris after each storm event.

1.10 MONITORING AND REPORTING REQUIREMENTS

1. Accumulated silt and debris buildup behind the face of the silt fence and rock check dam shall be removed as needed whenever it reaches 1/3 of their heights to provide proper silt fence and rock dam operation. Clogged or damaged filter fabric for silt fence and rock check dam shall be immediately replaced and accumulated silt and debris shall be removed at no additional cost.
2. The Contractor shall implement erosion control measures around all areas to be disturbed prior to disturbing ground in the area, to the satisfaction of KCH. KCH will periodically inspect erosion and sediment control structures to confirm that the Contractor is maintaining these features.

3. The Contactor shall take sufficient precautions during construction to eliminate run-off polluting substances such as silt, clay, wastes, fuels, oils, and bitumen into the ocean, water supplies and surface waters. Special precautions shall be taken in the use of construction equipment to conduct operations in a manner that reduces erosion.
4. The temporary erosion and sediment control features shall be maintained at locations identified in Contractor's site-specific BMPs submitted for the NPDES permit. Care shall be taken to prevent the discharge of unsuitable drainage to the ocean, a water supply, or surface water body.
5. The contractor shall monitor and record daily (7 days/week) rainfall at the same or near same time of the day continuous for the duration of the project. The rainfall record shall be submitted to the Engineer of Record weekly.
6. The Contractor shall inspect, and shall make any necessary repairs to all erosion and sediment control measures continuously for the duration of the project at the following intervals:
    a. Weekly during dry periods,
    b. Within 24-hours of any rainfall event of 0.5 inch or greater occurring in a 24-hour period,
    c. Daily during periods of prolonged rainfall.
    d. When existing erosion control measures are damaged or not operating properly.
7. The contractor shall maintain a record of all inspections and repairs made. These records shall be continuously for the duration of the project and submitted weekly to the Engineer of Record.
8. Failure to conform to the above requirements shall be the cause for temporary or permanent suspension of operations. If operations are suspended due to the Contractor's failure to conform, the Contractor shall maintain the project during the period of suspension at no cost to KCH. KCH further reserves the right to employ outside assistance to address the necessary corrective action and hold the Contractor responsible for associated costs.
9. For all citations or fines received by KCH for non-compliance with the Notice of

General Permit Coverage, KCH will deduct the citations or fines amount from the progress payment due to the Contractor. If the progress payment due to the Contractor does not cover the cost of the citations or fines, the Contractor shall reimburse KCH within 30 calendar days for the full amount of the outstanding cost KCH incurred.

END OF SECTION

SECTION 02150

WASTEWATER TREATMENT PLANT SITE PREPARATION

1.00 GENERAL

1. This section provides requirements for site preparation at the existing site.

2. This section specifies site preparation which consists of the following:

    a. Clearing, grubbing, and stripping

    b. Demolition and removal of structures, and obstructions

3. Clearing, grubbing, and stripping shall be performed in accordance with Section 10 of the Standard Specifications for Public Works Construction, September 1986 and whenever specified herein along with the project plans. The most stringent requirement shall prevail.

1.01 PROTECTION

1. Site preparation shall not damage structures, landscaping or vegetation adjacent to the site. The Contractor shall repair or replace any damaged property to its existing condition or better.

1.02 CLEARING, GRUBBING AND STRIPPING

1. Unless otherwise specified, the Contractor shall remove obstructions such as brush, trees, logs, stumps, roots, heavy sod, vegetation, rock, stones, and broken or old concrete and pavement, and debris where the completion of the work required their removal. The area to be cleared, grubbed, and stripped shall be within clearing and grubbing limits as shown on the drawings, as staked by the Contractor, and as reviewed by the Engineer.

2. Included in this work shall be the preservation from injury or defacement, and the replacement, in kind, to the satisfaction of the Engineer, of any such injury or defaced vegetation or objects outside the limits of construction as staked by the Contractor, and as reviewed by the Engineer.

3. Material that is removed and is not to be incorporated in the work shall be disposed of at an authorized area. Clearing and grubbing shall be performed prior to performing as other work.

4. After the area has been cleared and grubbed, all surface soils containing organics, debris, and other deleterious materials shall be stripped and disposed of in accordance with the requirements of the State Department of Health and at an authorized disposal site. The stripped materials shall not be used for embankment or for backfilling of any type. Open burning is prohibited.

END OF SECTION

SECTION 02220

CONTROLLED LOW STRENGTH MATERIAL (CLSM)

1.01 DESCRIPTION

1. This work includes furnishing and placing CLSM as sewer line trench backfill material.

1.02 SUBMITTALS

1. The following information shall be provided.

    a. Mix design for the CLSM.

    b. Submit a manufacturer's certificate of the CLSM and include the unconfined 28-day compressive strengths. The material certification shall include the actual test data for each mixture used.

1.03 MATERIALS

1. CLSM shall include a mixture of Portland cement, aggregate, and water. The proportions of the CLSM shall:

    a. Produce a uniform, flowable mixture that is essentially self-leveling when placed.

    b. Provide flowable CLSM with aggregate in suspension.

    c. Have a 28-day compression strength of approximately 50-150 psi.

2. Aggregates shall be from a source acceptable to the Engineer and conform to ASTM C- 33 Aggregate for Concrete. Aggregate shall stay in suspension in the CLSM to the extent required for proper flow.

3. Acceptance: Proportion and place the CLSM as specified herein. In general, the strength desired is the maximum hardness that can be excavated later using conventional excavating equipment.

4. Provide CLSM conforming to Section 39, Standard Specifications for Public Works Construction, except as modified in this Section.

1.04 CONSTRUCTION REQUIREMENTS:

1. Check excavated sides and bottoms of trenches for cracks, voids, or other defects that may cause CLSM to escape. Plug or repair as necessary.

2. The mixture shall fill all voids during the backfill operation. When drainage layers such as permeable bases and permeable separators are present, restore the drainage layers as part of the pavement structure.

1.05 PIPES AND TRENCHES

1. Thoroughly mix the CLSM in the delivery truck before discharge.

2. Place CLSM using chute, conveyor, bucket or pump.

3. Install CLSM as indicated on the drawings and specified.

4. The trench or excavation should have vertical wall limits to confine the flowable CLSM mixture. Bulkheads, earth dams or stiffer concrete shall be used to contain the material at open end placement.

END OF SECTION

SECTION 02300

EARTHWORK

1.01 SCOPE

1. Furnish materials, labor and equipment required to accomplish all excavation, filling and grading as indicated on the drawings.

2. It shall be the responsibility of the Contractor to examine the site and determine for himself the existing conditions.

3. Obvious conditions of the site existing on the date of the bid opening shall be accepted as part of the work, even though they may not be clearly indicated on the drawings and/or described herein or may vary there from.

1.02 STANDARD SPECIFICATIONS

1. Work shall be in accordance with the following sections of the County's "Standard Specifications for Public Works Construction" (SSPWC), dated September 1986 as revised, except as amended in the plans and specifications herewith.

a. Clearing and Grubbing	Section 10
b. Trench Excavation and Backfill	Section 11
c. Roadway Excavation	Section 12
d. Structural Excavation and Backfill	Section 13
e. Rock for fill	Section 14
f. Crushed Rock	Section 15
g. Borrow	Section 16
h. Embankment	Section 17

1.03 PERMITS

1. The Contractor shall obtain and pay for necessary permits prior to the commencement of work.

1.04 CONSTRUCTION LINE, LEVELS AND GRADES

1. The Contractor shall verify all lines, levels, elevations and improvements indicated on the drawings before any clearing, excavation or construction begins. Any discrepancy shall be immediately brought to the attention of the Engineer, and any change shall be made in accordance as instructed. Starting of clearing and grubbing operations shall be construed to mean that the Contractor agrees that the existing grades and improvements are essentially correct as shown. The Contractor shall not be entitled to extra payment if existing grades and improvements are in error, or fails to report the discrepancies before proceeding with any work whether within the area affected or not.

2. All lines and grades shall be verified and established by a Surveyor or Civil Engineer licensed in the State of Hawaii.

3. The laying out of base lines, establishment of grades and staking out the entire work shall be done by a licensed Surveyor or licensed Civil Engineer.

1.05 MATERIALS

1. Asbestos Prohibition: No asbestos containing materials or equipment shall be used under this section. The Contractor shall ensure that all materials and equipment incorporated in the project are asbestos-free.

2. Structural Fill and Backfill Materials: Fill areas of the project site shall be capped with a minimum 2-foot thick layer of structural fill material. Structural fill shall be well graded granular material, with particles less than 3 inches in maximum size and contain less than 30 percent particles passing the No. 200 sieve by weight. When placed in confined areas, such as utility trenches and footing excavations the maximum particle size shall be limited to 2 inches.

3. General Fill Materials: Fill and backfill materials below the minimum 2-foot thick structural fill layer may consist of general fill material. General fill material shall be well-graded granular material, free from organic material and backfill, debris, other deleterious substances and majority of which are less than 12 inches in size with an

absolute maximum dimension of 18 inches. Materials between 12 and 18 inches in particle size should be limited to about 15 percent or less of the total volume.

4. Cushion fill: Under exterior and interior concrete slabs-on-grade shall be ASTM C33 Standard Size Aggregate No. 67 (No. 3B fine gravel).

5. Drain Rock: Shall meet the gradation requirements for ASTM C33 Standard Size No. 67 (No. 3B fine gravel).

6. Base Course and Subbase Course for roadways shall meet the requirements of the Standard Specifications for Public Works Construction, Section 30-Select borrow for Subbase Course and Section 31-Aggregate Base Course.

7. Insufficient Earth Material: The Contractor shall import all necessary material to complete the grading work at no additional cost to KCH. Such imported material shall meet the requirements as specified for each category of the materials.

8. Excavated onsite basalt materials may be used as fill and backfill, provided that the materials are well graded and maximum size of the individual fragments are limited to the applicable sizes for general fill and backfill and structural fill and backfill.

1.06 PROTECTIVE MEASURES

1. All excavation shall be protected and guarded against danger to life, limb and property in accordance with applicable regulations.

2. Shoring, as required to safely preserve the excavations, existing electrical hand-hole boxes, retaining walls, etc. free from damages resulting from the work, shall be provided and installed by the Contractor.

3. All excavations shall be kept free from standing water. The Contractor shall do all pumping and draining that may be necessary to remove water to the extent required in carrying on work. Grading shall be controlled so that the ground surface is properly sloped to prevent water run-off from entering open trenching excavations.

4. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, passageways, traffic, etc.

5. The Contractor shall confine all work, equipment, materials and personnel as much as possible to the work area as indicated. The Contractor shall schedule all work that involves excessive noise, dust, dirt, or any other detrimental aspect of this work in order that there will be minimum disruptions to neighbors.

6. When necessary and when directed, the Contractor shall provide and erect barriers, etc. with special attention to the protection of personnel.

1.07 LAYING OUT

1. The laying out of baselines, establishment of grades and staking out the entire work shall be done by a qualified surveyor, at the expense of the Contractor and shall be solely responsible for their accuracy. The Contractor shall erect and maintain substantial batter boards showing construction lines and levels.

2. Should any discrepancies be discovered in the dimensions given in the plans, the Contractor shall immediately notify the Engineer before proceeding any further with the work; otherwise, will be held responsible for any costs involved in corrections of construction placed due to such discrepancies.

1.08 SITE GRADING

1. All grading work shall be performed in conformance with County of Hawai'i Ordinance 168, the applicable provisions of Chapter 54, Water Quality Control Standards, and Chapter 55, Water Pollution Control, of Title 11, Administrative Rules of the State Department of Health. In addition, the work shall be in conformance with the Air Pollution Control Standards and Regulations of the State Department of Health.

2. The area to be graded shall be cleared of vegetation, debris, rubbish, old pavements, abandoned pipelines and other deleterious materials. Trees and large masses of roots shall be grubbed. All of these materials shall be removed and disposed of properly off-site at no cost to KCH.

3. No blasting will be permitted.

4. The areas not covered by concrete slab or pavement up to the Contract Zone Limits shall be graded to conform to finish contours with allowance for depth of topsoil. Rough grading shall prevent the drainage of water into construction areas.

1.09 SITE PREPARATION

1. Prior to commencement of earthwork operations, all vegetation debris and other deleterious materials shall be removed from the site.

2. Any underground structures such as cesspools, cisterns, septic tanks, wells, pipelines, fuel tanks, etc. discovered in the site preparation work shall be removed and backfilled in accordance with these specifications and any applicable regulations.

3. All subgrades of fill areas shall be ripped to a depth of about 3 feet below the existing ground surface to detect and collapse near-surface cavities and/or voids. As a minimum, ripping of the subgrades should extend at least three (3) feet laterally beyond the limits of the fill areas.

4. After the fill surface has been ripped to a depth of 3 feet below the ground surface, the ground should be proof-roll and compacted to provide a relatively level surface. Yeilding areas, loose area, or cavities disclosed during clearing and proof-rolling operations should be over-excavated and backfilled with compacted fill materials.

1.10 GENERAL FILL AND BACKFILL

1. General fill and backfill can be used in areas at least 3 feet outside of buildings and shall be placed in level lifts not exceeding 18 inches in loose thickness, moisture conditioned and compacted to a minimum of 90% relative compaction as determined by ASTM D1557-91.

2. General fill and backfill shall be compacted to a firm, unyielding surface. Conventional compaction testing is generally not practicable in fills which are composed of rocks, boulders and/or cobbles. A testing program to evaluate the number of passes of a compactor needed to achieve the desired level of compaction shall be conducted at the start of the grading phase of the project.

3. General fill, areas at least 3 feet outside of pavement shall be compacted not less than 90% compaction.

1.11 STRUCTURAL FILL AND BACKFILL

1. Structural fill, subgrade and backfill beneath the new asphalt concrete pavement, and underneath building footprint, and shall be compacted to 95% compaction as determined by ASTM D1557.

2. Structural fill and backfill shall be used under buildings and to backfill any voids detected during demolition and excavation.

3. All fill areas shall be capped with up to 12 inches of structural fill material.

4. Structural fill and backfill shall be laid in lifts not exceeding 8 inches in loose thickness moisture-conditioned and compacted to at least 95% relative compaction (ASTM 1557-91). For structural fill and backfill in confined areas, the material shall be placed in smooth, loose lifts less than 6 inches thick, moisture conditioned and compacted to at least 95% relative compaction (ASTM D1557¬91).

1.12 UTILITY TRENCH EXCAVATION AND BACKFILL FOR EXTERIOR UTILITIES

1. Trench excavation for exterior utility lines (water, sewer, drain, electrical), shall be dug to depths shown on the drawings.

2. If depths are not indicated, the trench shall be cut down to proper levels that will provide the minimum coverage required.

3. Trenching work shall be open cut excavation with banks as nearly vertical as practical, with sufficient width to provide proper working space and bottom of trench accurately graded to provide uniform slope and support.

4. Backfill for the utilities shall be as indicated on the plans and as specified within the project plan details. The upper portion of the trench backfill shall consist of granular material generally less than 6 inches in maximum size compacted to at least 90 percent relative compaction as determined by ASTM D1557-91.

5. For trenches located in paved areas, the upper 2 feet of the trench backfill below the road subgrade shall be compacted to not less than 95 percent relative compaction.

1.13 TESTING

1. The contractor shall provide compaction testing for driveways, building foundations, trenches, paved and unpaved areas as specified in the plans and/or specifications. In the absence of specific requirements, the Contractor shall meet the recommendations provided by a licensed geotechnical professional.

2. Driveways and Pavement Areas

3. Compact subgrades to 95% of maximum dry density per ASTM D698.

4. Compact base course to 98% of maximum dry density per ASTM D698

5. Building Foundations

6. Compact foundation subgrades to 95% of maximum dry density per ASTM D698.

1.14 TRENCHES

1. Compact pipe bedding, initial and final backfill to 95% of maximum dry density per plan detail.

2. Perform field density tests in accordance with ASTM D2922 (Nuclear Method) and/or as recommended by a licensed geotechnical professional or as specified in the project documents. The more stringent requirement will prevail.

3. All costs of testing shall be borne by the Contractor.

4. Testing shall be done throughout the project area for each compact lift.

5. All testing reports shall be certified and submitted to the Engineer of Record.

6. Should any test fail, additional testing will be required at no cost to KCH.

1.15 FINISH GRADING

1. Where finish grades and contours are not given, Contractor shall grade to provide drainage away from new and existing structures and shall provide good transitions into existing grades outside the grading limits.

END OF SECTION

SECTION 02362

SOIL TREATMENT FOR VEGETATION CONTROL

1.01 GENERAL

1. This work shall consist of spraying weed killer on the prepared parking area, driveway, roadway and shoulder subgrade prior to the installation of the base course and where called for on the plans and on existing growth prior to application of asphalt.

1.02 MATERIALS

1. Asbestos Prohibition: No asbestos containing materials or equipment shall be used under this section. The Contractor shall ensure that all materials and equipment incorporated in the project are asbestos-free.

    a. Weed Killer Trade Name Application

    b. Casoron 4G or Norsac 10G -Under new or rebuild asphalt pavement

    c. Hyvar X, Roundup -Existing weed for resurfacing work

2. Submit material product data and Material Safety Data Sheets

1.03 APPLICATION

1. Mix the under asphalt weed killer and uniformly spread using calibrated application equipment at the maximum rates permitted under asphalt use. Install base course material as soon as possible after applying the weed killer to preclude loss of germination inhibiting action.

2. In treatment of existing growth on resurfacing jobs, mix the weed killer and uniformly spray in strict accordance with the manufacturer's label.

3. Retreat nut grass and weeds two (2) days after initial application and again if growth still exists.

4. Notify KCH 24 hours before application of weed killer.

END OF SECTION

SECTION 02513

ASPHALTIC CONCRETE PAVING

1.01 DESCRIPTION

1. This section specifies the requirements for restoration of asphaltic concrete roadways and driveways over a backfilled trench, including the preparation of subgrade, and installation of aggregate base and subbase course materials, and installation asphaltic concrete pavement. This section also specifies the requirements for resurfacing roadways beyond the trench limits.

1.02 SUBMITTALS

1. The Contractor shall submit the test results (certified degree of compaction and moisture content and gradation tests) of aggregate base and subbase courses, and a job mix design for the asphalt concrete mixture to be applied to the project to the Engineer for review during submittal review process and all applicable requirements.

1.03 MATERIALS

1. Subbase Course – Refer to Section 30, Standard Specifications for Public Works Construction

2. Aggregate Base Course – Refer to Section 31, Standard Specifications for Public Works Construction

3. Tack Coat – Refer to Section 33, Standard Specifications for Public Works Construction

4. Asphalt Concrete Pavement – Refer to Section 34, Standard Specifications for Public Works Construction

5. Asphalt Concrete Resurfacing – Refer to Section 34, Standard Specifications for Public Works Construction

6. Asphaltic Concrete Mix shall be County Mix No. 4 for all work.

1.04 EXECUTION

1. Asphaltic Concrete pavement restoration shall include removal of existing pavement, preparation of the existing ground if within the cutback area, installation of subbase course, aggregate base course and asphaltic concrete pavement, and all testing and submittals.

2. Asphaltic Concrete pavement shall include installation of asphaltic concrete pavement by overlay on top of the existing roadway, and all testing and submittals.

3. Miscellaneous restoration: utility manhole frame/covers, survey monuments, pavement markers, markings, striping and signage.

1.05 REMOVAL OF EXISTING PAVEMENT

1. The contractor shall remove existing pavement as indicated on the Contract Drawings. Edges of the required excavation shall be cut with a power saw to ensure a neat cut along the pavement and facilitate removal.

2. Pavement removed beyond the limits indicated on the Contract Drawings shall be incidental and replaced at the Contractor's expense unless otherwise ordered by the Engineer.

3. The Contractor shall be responsible for the disposal of all removed pavement.

1.06 PREPARATION OF EXISTING GROUND

1. Prior to placement of any material, the existing ground shall be scarified to a depth of 6- inches, moistened to slightly above optimum moisture content, and compacted to 90% maximum density as determined by ASTM D1557.

2. Soft or loose soils that do not readily compact after six passes with a 15-ton, drum roller, shall be removed and disposed. All removed soil shall become the property of the Contractor.

1.07 SUBBASE COURSE

1. Place and compact the new subbase course to the thickness indicated on the Contract Drawings in conformance with Section 30 of the Standard Specifications for Public Works Construction, or as directed by the Engineer.

1.08 AGGREGATE BASE COURSE

1. Place and compact the new aggregate base course to the thickness indicated on the Contract Drawings in conformance with Section 31 of the Standard Specifications for Public Works Construction, or as directed by the Engineer.

1.09 ASPHALTIC CONCRETE PAVEMENT

1. Apply tack coat to existing asphaltic concrete pavement where it will contact the new asphaltic concrete pavement, in conformance with Section 33 of the Standard Specifications for Public Works Construction, or as directed by the Engineer.

2. Install Mix #4 (Fine) Asphalt Concrete Pavement to the thickness and widths indicated on the Contract Drawings in conformance with Section 34 of the Standard Specifications for Public Works Construction.

1.10 TESTING

1. Aggregate base course and asphaltic concrete pavement shall be tested by an independent testing agency selected by the Contractor and approved by the Engineer.

2. The contractor shall furnish the Engineer with test reports covering the shipment of each lot of asphalt cement used for the project.

3. The testing methodology, schedule and frequency shall be determined by Contractor and approved by the Engineer of Record. At a minimum, these shall include compaction tests conducted at frequent intervals on the finished base course and the finished asphaltic concrete surface.

4. The Engineer reserves the right to prohibit the Contractor from proceeding with any part of the work until tests have been completed and are deemed satisfactory. No additional payment will be made for resultant delays.

5. All costs associated with testing shall be borne by the Contractor.

END OF SECTION

SECTION 02710

SEWER CONSTRUCTION

1.01 DESCRIPTION

1. This work shall consist of furnishing all materials, labor, equipment and incidentals necessary for the construction of new sewer lines located as designated on the plans.

2. Lateral locations will be specified on the project plans. Changes to the lateral location must be approved by the Engineer. No cost changes will be allowed without prior authorization.

1.02 MATERIALS

1. Excavation for Sewer Construction shall be in accordance with Section 11, TRENCH EXCAVATION AND BACKFILL of the Standard Specifications for Public Works Construction, dated September 1986 as amended, except where noted in the plans and/or specifications herewith.

2. Materials for Sewer Construction shall be in accordance with Section 21, PVC Sewer Pipe and Appurtenances, of the Standard Specifications for Public Works Construction, dated September 1986 as amended, except where noted in the plans and/or specifications herewith.

3. Gravity sewer and lateral pipes and fitting shall be SDR26 PVC bell and spigot sanitary sewer pipe in compliance with ASTM D3034. PVC material used for pipes and fittings shall conform to Class 12454-B, as defined in ASTM D1784.

4. PVC pipe for gravity sewer shall be furnished complete with couplings of the same type and composition as the pipe, gaskets conforming to the ASTM F477, and required lubricants. All gaskets and lubricants shall be made from materials that are compatible with plastic materials and with each other when used together, are suitable for wastewater service and will support growth of bacteria.

5. Materials for pipe cushion (3/4” base course) shall conform to Section 15 CRUSHED ROCK, of the Standard Specifications for Public Works Construction, dated September 1986 as amended, except where noted in the plans and/or specifications herewith.

6. Materials for Select Borrow, Aggregate Subbase and Aggregate Base shall be in accordance with Section 29 SUBGRADE and Section 30 SELECT BORROW FOR SUBBASE COURSE and Section 31 AGGREGATE BASE COURSE, of the Standard Specifications for Public Works Construction, dated September 1986 as amended, except where noted in the plans and/or specifications herewith.

7. Materials for Concrete Jacket per Standard Detail S-5 shall be Class "B" be in accordance with Section 39, PORTLAND CEMENT CONCRETE of the Standard Specifications for Public Works Construction, dated September 1986 as amended, except as noted in the plans and/or specifications herewith.

8. Materials for Cleanout Concrete Collar shall be Class "B" Concrete be in accordance with Section 39, PORTLAND CEMENT CONCRETE of the Standard Specifications for Public Works Construction, dated September 1986 as amended, except as noted in the plans and/or specifications herewith.

9. Materials for cleanout enclosures where required for vehicular loading shall be traffic rated frames and covers (Model SBF 1246 W, manufactured by South Bay Foundry, or approved equal).

10. Plugging of the existing sewer lines to be abandoned in-place shall be by installation of a concrete plug using water stop repair mortar similar to or equal to Water plug repair mortar as provided by Chemrex, Inc.

1.03 NEW SEWER CONSTRUCTION

1. Sewer construction shall be in accordance with Section 21, PVC SEWER PIPE AND APPURTENANCES, of the Standard Specifications for Public Works Construction, dated September 1986.

2. Acceptance testing all new sewer line and sewer laterals shall be performed and approved by the Engineer prior to final intercept connection and/or channeling of existing live sewers.

3. New PVC sewer pipe connections shall be made with solid body repair coupling (GXG) or approved equal product.

1.04 PAVEMENT RESTORATION:

1. For County roadways, pavement restoration shall be to existing condition or in accordance with Section 33 ASPHALT SURFACE TREATMENT, Section 34 ASPHALT CONCRETE PAVEMENT, and Section 35 ASPHALT CONCRETE
   RESURFACING, of the Standard Specifications for Public Works Construction, dated September 1986 and specifications included herein whichever is structurally better. Pave or restore the pavement section no earlier than eight (8) hours after backfilling unless otherwise allowed by the Engineer. Protect the backfill material from traffic during the period before restoration of the pavement section.

2. For State roadways or highway, pavement restoration shall be to existing conditions or in accordance with Section 401 HOT MIX ASPHALT CONCRETE, Section 407 TACK COAT and any other applicable sections of the "Standard Specifications for Road and Bridge Construction", dated 2005. Pave or restore the pavement section no earlier than 8 hours after backfilling unless otherwise allowed by the Engineer. Protect the backfill material from traffic during the period before restoration of the pavement section.

3. Acceptance shall be in accordance with Section 21, PVC PIPE AND APPURTENANCES, of the "Standard Specifications for Public Works Construction", dated September 1986, and other specifications included herein.

4. CRM Restoration shall be in accordance with Section 44 CEMENT RUBBLE MASONRY, of the Standard Specifications for Public Works Construction, dated September 1986 as amended, except where noted in the plans and/or specifications herewith.

5. Driveway Restoration:

6. On County roadways, driveway restoration shall be in accordance with Section 55 RECONSTRUCTION DRIVEWAY RAMP WITHIN PRIVATE PROPERTIES, of the Standard Specifications for Public Works Construction, dated September 1986 as amended, except where noted in the plan and/or specifications herewith.

7. On State roadways or Highways, driveway restoration shall be in accordance with

Section 610 REINFORCED CONCRETE DRIVEWAYS and any other applicable sections of the "Standard Specifications for Road and Bridge Construction", dated 2005.

8. Soil preparation and landscaping shall be in accordance with State Department of Transportation's Specifications Section 209.09 (c) rye grass installation for temporary erosion control, as well as Section 50 SOIL PREPARATION and Section 52 TRANSPLANTING OR EXISTING TREES, of the Standard Specifications for Public Works Construction dated September 1986 as amended, except where noted in the plans and/or specifications herewith.

9. Sidewalk Restoration shall be to existing condition or in accordance with Section 42 CONCRETE SIDEWALK, of the Standard Specifications for Public Works Construction, dated September 1986 as amended, except where noted in the plans and/or specifications herewith. In addition, use edging tool with ¼-inch radius to finish outside edges of sidewalk. Finish sidewalk as plane surface with 2-percent (allowable construction tolerance of plus or minus 0.4 percent maximum) cross slope towards roadway. Test surface of concrete sidewalk with 10-foot straightedge. Correct any deviation in excess of ¼-inch.

10. Excavating or backfilling of abandoned in place utilities pipes (including water, sewer, telephone, oil and gas lines) and conduit (including roadway and sign lighting, traffic signal, and other communication systems) is required. Controlled Low Strength Material (CLSM) in accordance with Section 02220 - CLSM for may be used with written approval from the Engineer.

1.05 DEBRIS EXCLUSION FROM SEWER:

1. All debris resulting from the sewer construction work shall not be allowed to enter the sewer. The Contractor shall provide the necessary barriers and collection devices to prevent debris from entering the sewer. All debris shall be removed from the site by the end of each workday.

END OF SECTION

SECTION 02735

SEWER MANHOLES

1.01 DESCRIPTION

1. This work shall consist of furnishing all materials, labor, equipment and incidental's necessary for the construction of sewer manholes. Manholes shall conform to Section 23, SEWER MANHOLES, of the Standard Specifications for Public Works Construction, dated September 1986 and as supplemented or modified in the plans or specifications herein.

1.02 SUBMITTAL

1. The following shall be submitted.

    a. Show Drawings for Sewer Manholes

    b. Manufacturer's product certification and data for Concrete Mix Design, Frame and Cover, Rungs, Pipe Connect Gasket Sea, Butyl Rubber Mastic Strip/Caulking

1.03 PRECAST CONCRETE MANHOLE

1. Precast concrete manhole sections shall conform to the requirements of ASTM C478.

2. Cement shall be ASTM C150, Type II, low alkali, conforming to ASTM C150 with Xypex Admix C-1000 at a dosage rate of 3% by weight of the Portland cement fraction of the mix design.

3. Minimum wall thickness for reinforced sections shall be 5 inches. Manhole sections shall be lap jointed and sealed together by an approved butyl rubber mastic strip/caulking.

4. Plain and shallow drop manholes (depth <5.0'), shall have eccentric cone sections with Type SA frames and covers.

5. Plain and shallow drop manholes (depth <5.0'), and transition manhole, shall be provided with a flat top precast concrete cover with Type SB frames and covers.

6. The precast manhole riser section shall be cast with openings whenever sewer pipes

must pass through.

1.04 MANHOLE RUNGS

1. Manhole rungs shall conform to the requirements of ASTM A615 and C478.

2. Manhole Type SA rungs shall be of ¾ inch diameter Type 304 stainless steel.

3. Manhole Type SE rungs shall be corrosion resistant “Manhole Step No. 93810” (by BOWCO Industries), “Manhole Step PSI-PF” (by M.A. Industries Inc.), or approved equal.

1.05 MANHOLE FRAME AND COVER

1. All manhole frames and covers shall be standard SA & SB covers.

1.06 MANHOLE SEWER PIPE CONNECTIONS

1. Sewer pipe connections shall be made with a resilient watertight manhole gasket (i.e. A- Lok Gasket manufactured by A-Lok Products.

2. Manhole inverts shall be constructed with smooth transition to ensure an unobstructed flow through the manhole. Remove sharp edges or rough sections that tend to obstruct flow. Coat manhole inverts using Xypex Megamix II or an approved equal.

1.07 CLEAN UP

1. The contractor shall clean up all materials, equipment and debris upon completion of any portion of the work and upon completion of the entire backfilling and related work.

END OF SECTION

SECTION 02750

SEWERLINE ACCEPTANCE TEST

1.01 SCOPE

1. This section provides requirements for Leakage Testing and Mandrel Testing of newly installed sewer lines.

2. All sewer mains shall be subject to acceptance testing prior to final acceptance.

3. All sewer laterals shall be subject to leakage inspection prior to final acceptance.

1.02 SUBMITTALS

1. The following shall be submitted for approval.

2. Detailed drawings of the Mandrel to be used for inspection of the lines show compliance with Section 21.3.E of the Standard Specifications for Public Works Construction, September 1986.

1.03 LEAKAGE TEST EQUIPMENT

1. The Contractor shall be responsible for providing all Leakage Test equipment meeting the requirements of Section 21.3.D of the Standard Specifications for Public Works Construction, September 1986 and any and all appurtenances for performance of the leakage test.

1.04 MANDRELS

1. The Contractor shall be responsible for providing test mandrels meeting the requirements of Section 21.3.E of the Standard Specifications for Public Works Construction, September 1986 and any and all related appurtenances for performance of the mandrel test.

1.05 EXECUTION

1. Leakage testing shall be accomplished in accordance with Section 21.3.D of the Standard Specifications for Public Works construction, September 1986. All costs for

leakage testing shall be borne by the Contractor.

2. Mandrel testing shall be accomplished in accordance with Section 21.3.E of the Standard Specifications for Public Works construction, September 1986. All costs for mandrel testing shall be borne by the Contractor.

1.06 TESTING SCHEDULING

1. The Contractor shall coordinate all testing with the Engineer of Record and KCH to arrange a compatible time to conduct the tests.

2. The Contractor shall provide a minimum of ten (10) working days' notice prior to the proposed inspection date.

1.07 DISPUTES

1. Should the Contractor dispute the results of the inspection performed, the Contractor may obtain the services of a private Contractor to re-perform the inspection.

2. All costs related to use of the private Contractor shall be borne by the Contractor at no cost to KCH.

1.08 CORRECTIVE WORK

1. The Contractor shall promptly perform all Corrective Work in accordance with the General Requirements and Covenants of the Department of Public Works, County of Hawaii (July, 1972), as amended.

2. All corrective work shall be performed in accordance with the plans and specifications.

3. Sewer mains and laterals that have been corrected shall be leakage tested in accordance with the specifications and shall be re-inspected at the Contractor's expense.

4. In the event that defects are still observed after a maximum of two (2) repair attempts, the entire segment of piping shall be replaced from Structure-to-Structure.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1

1.01 DESCRIPTION

1. The section specifies reinforcing steel for use in reinforced concrete.

2. This section supplements Section 48 – REINFORCING STEEL of the Standard Specifications for Public Works Construction, September 1986, of the County of Hawaii. In cases of conflict between the requirements of this section and those of any referenced documents except the drawings, the requirements of this section shall prevail.

1.02 REFERENCES

1. American Society for Testing and Materials (ASTM)

   ASTM A82 Cold-Drawn Steel Wire for Concrete Reinforcement ASTM A185

   Welded Steel Wire Fabric for Concrete Reinforcement

   ASTM A615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

2. American Welding Society

   AWS D1.4-05 Structural Welding Code – Reinforcing Steel

1.03 SUBMITTALS

1. Certificates: Certified copies of mill reports attesting that the reinforcing steel furnished meets the requirements specified shall be submitted prior to the installation of reinforcing steel.

2. Shop Drawings: Provide reinforcing steel shop drawings indicating the size, number, arrangement and required shape of the reinforcing steel for review.

3. Qualifications of Welders: Welders shall be qualified in accordance with AWS D1.4. Furnish certificates of welders to Engineer prior to any welding.

1.04 DELIVERY

1. Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.

PART 2 - PRODUCTS

2.01 BAR REINFORCEMENT

1. Reinforcing bars shall be grade 60, unless noted otherwise on the drawing.

2.02 WIRE FABRIC

1. Wire fabric shall be welded steel mesh conforming to ASTM A185. The gauge of the wire and dimensions of the mesh shall be given in these specifications or as shown on the plans.

2.03 TIE WIRE

1. The wire shall be minimum 16 gage annealed steel conforming to FEDSPEC QQ-W- 461H.

2.04 SUPPORTS

1. Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI Manual of Standard Practice and shall be steel or precast concrete blocks. Precase concrete blocks shall be not less than 4 inches square when supporting reinforcement off ground. Precase concrete block shall have a compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within ½-inch of concrete surface shall be plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

PART 3 – EXECUTION

3.01 REINFORCEMENT

1. Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Tack welding of cross bars is prohibited.

Placement: Reinforcement shall be free from loose rust and scale, dirt, oil or other deleterious coating that could reduce bond with the concrete. Reinforcement shall be placed in accordance with ACI 318 at locations shown plus or minus one bar diameter. Concrete coverage shall be as indicated or as required by ACI 318. If bars are moved more than one bar diameter from their specified location to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved by the Engineer before concrete is placed.

Reinforcing steel shall be positioned accurately and secured against displacement by using annealed iron wire or clips at intersection and shall be supported by concrete or metal chairs, spacers or metal hangers. Steel rods and pegs may be used to support reinforcing steel on rock foundations. Reinforcing steel shall be placed in such a manner as to not damage waterproofing membrane or plastic lining which have been previously applied.

3.02 SPLICING

1. Splices of reinforcement shall conform to ACI 318 and shall be located only as indicated. If a splice is required other than where shown on the reviewed shop drawings, approval from the Engineer is required. Splicing shall be by lapping or by mechanical or welded butt connection, except that lap splice shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely ties or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete. Lapped bars shall not be spaced farther apart than one-fifth the requirement length of lap or 6-inches. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer or the mechanical splicing device. But splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flamed-dried before butt splicing. Adequate jigs and clamps or other devices shall be provided in support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

3.03 WELDED-WIRE FABRIC

1. Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between construction and contraction joints. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 2 inches. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 4 feet. Fabric shall be positioned by the use of supports.

3.04 DOWELS

1. Dowels shall be installed in slabs on grade at locations indicated and a right angle to joint being doweled. Dowels shall be accurately aligned parallel to the finished concrete surface and rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 DESCRIPTION

1. This section specifies cast-in-place concrete requirements, including furnishing and storage of materials, mixing, transporting, placing, curing and finishing.

2. This section supplements Section 39 – PORTLAND CEMENT CONCRETE of the Standard Specifications for Public Works Construction, September 1986, of the County of Hawaii. In cases of conflict between the requirements of this section and those of any referenced documents except the drawings, the requirements of this section shall prevail.

1.02 REFERENCES

1. American Society for Testing and Materials (ASTM)
    a. ASTM C 39 Compressive Strength of Cylindrical Concrete Specimens
    b. ASTM C 670 Preparing Precision Statements for Tet Methods for Construction Materials.
    c. ASTM C683 Compressive and Flexural Strength of Concrete Under Field Conditions.
    d. ASTM C 803 Penetration Resistance of Hardened Concrete
2. American Concrete Institute
    a. ACI 301 Specifications for Structural Concrete
    b. ACI 347 Guide to Formwork for Concrete

1.03 SUBMITTALS

1. Mix Design: Submit mix designs from ready mix provider indicating quantities for typical cubic yard of Portland cement concrete. In addition, provide gradations of both fine and course aggregate demonstrating compliance with requirements of Standard Specifications. The number and method of submittals shall be in accordance with Section 01300 “Submittal Procedure”.

2. Formwork Design: All falsework and forming requirements for elevated concrete

sections and walls must be designed by an engineer registered in Hawaii. The drawings, with supporting calculations, must each be signed and sealed by the engineer. No work shall be started until the form support and design has been submitted to the Manager. The false work design engineer must visit the site and approve the erection of all shoring prior to the placement of any concrete. The Contractor shall be solely responsible for the adequacy of the forming, shoring and bracing design.

3. Any formwork installed by the Contractor shall be solely at Contractor's risk. The Manager receipt of the required design documents will not lessen or diminish the Contractor's liability.

PART 2 – PRODUCTS

2.01 FORMWORK

1. Forms shall be true to line and plumb and design in accordance with ACI 347, with sufficient strength to support and hold the fluid concrete. Joints shall be tight enough not to allow concrete to seep through. Formwork shall be within the tolerances of ACI 301.
2. Forms and falsework supports for elevated slabs or beams shall be sufficiently rigid and strong to support the wet concrete, construction personnel, and equipment necessary for its placement without appreciable deflections. A minimum of 40 PSF for live-load shall be allowed in the design.
3. Form surfaces shall be smooth and joints aligned where concrete will be exposed to view.

PART 3 – EXECUTION

3.01 JOB-SITE MIXED CONCRETE

1. Concrete may be mixed at the job site only for minor concrete placements and only prior written approval of the Engineer.

3.02 READY MIX CONCRETE

1. Ready mix companies shall furnish delivery tickets, signed by a Certified Weighmaster, on which each ticket shall state the weight of aggregates, sand, cement, admixtures and water and the number of cubic yards of concrete furnished, which will be compared against the approved mix design and the time the truck left the batch plant. The ticket

shall be given to the inspector when the truck arrives to the site.

2. Limit the haul time of central-mixed concrete so that the specified slump is attained without the onsite addition of water which will cause the mix design water-cement ratio to be exceeded. In no event shall the time exceed 90 minutes from the batch plant to the completion of the pour, unless specifically approved by the Engineer of Record.

3.04 FORM WORK

1. Forms shall be used, whenever necessary, to confine the concrete, to shape the concrete to the required lines and grades, and to obtain a thoroughly compacted dense concrete through proper vibrating.

2. The forms shall have sufficient strength and rigidity to hold the concrete and to withstand the necessary pressure, tamping and vibration, without deflection from the prescribed lines. The surfaces of all forms in contact with the concrete shall be clean, rigid, tight and smooth.

3. Exposed sharp edges shall be eliminated from finished concrete work by means of ¾" triangular fillets or chamfer strips placed in the forms.

4. Before concrete is deposited within the forms, all inside surfaces of steel and plywood form surfaces shall be thoroughly, but not excessively, coated with an approved non staining bond releasing form oil.

5. Removal: Forms shall be so constructed that they can be removed without hammering on, or prying against, the concrete and shall be removed in such a manner as to prevent damage to the concrete and to ensure the complete safety of all parts of the structure. All forms shall be removed before backfilling is placed.

6. Forms may be removed as soon as the concrete has developed sufficient strength to prevent sagging, excess deflection, misalignment, spalling, cracking, breaking of edges and surfaces and any other damage to the concrete.

7. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being reused.

8. Tie holes shall be thoroughly sandblasted or roughened. The tie holes shall then be coated with a water insensitive epoxy or an acceptable bonding agent and properly filled

through damp-packing with a mortar of dry consistency and a mix of one part of cement to one part of sand. The amount of water to be added to the cement-sand mix shall be such that the mortar can be driven into the voids and will compact properly.

3.05 PROTECTION FROM ABRASION OR FIRE

1. Every reasonable precaution shall be taken to protect finished surfaces from abrasions or other damage. Concrete surfaces or edges likely to be injured during the construction period shall be protected by leaving the forms in place or by erecting satisfactory covers. No fire shall be permitted in direct contact with concrete at any time.

3.06 CONCRETE PLACEMENT

1. If avoidable, do not place concrete during rainstorms. Protect concrete placed immediately before rain to prevent rainwater from coming in contact with it. Keep sufficient protective covering on hand at all times for this purpose.

2. All dirt, chips, sawdust, mud, water and other foreign matter shall be removed from within the forms or within the excavated areas, before any concrete is deposited therein.

3. Concrete placed for encasement or arch of PVC shall not be backfilled until the concrete has reached at least 50% of its 28-day compressive strength confirmed by concrete cylinder tests. The Contractor may mold and cure additional concrete cylinder as specified here-in to verify that the 50% strength has been achieved, prior to the required 7-day test. The Contractor shall keep the trench dewatered until that time. The Contractor may use Type III cement (High Early Strength) in lieu of Type II cement in the samematch quantities as specified, but there will be no additional reimbursement to the Contractor for costs incurred using such concrete.

4. Concrete placed for encasement or arch of PVC shall not be backfilled until the concrete has reached at least 50% of its 28-day compressive strength confirmed by concrete cylinder tests. The Contractor may mold and cure additional concrete cylinder as specified here-in to verify that the 50% strength has been achieved, prior to the required 7-day test. The Contractor shall keep the trench dewatered until that time. The Contractor may use Type III cement (High Early Strength) in lieu of Type II cement in the same batch quantities as specified, but there will be no additional reimbursement to the Contractor for costs incurred using such concrete.

5. Determine pump size by the rate of concrete placement, length of delivery pipe or hose, aggregate size, mix proportions, vertical lifts, and slump of concrete. The minimum inside diameter of pipe or hose shall be based on the maximum aggregate size as follows: 1-inch maximum aggregate: 3 inches minimum I.D.

6. Do not use aluminum pipes to deliver concrete.

7. At cold joints in the concrete construction, the hardened concrete shall be roughened to provide a quarter-inch amplitude on the surface with exposed aggregate. A cement slurry or concrete bonding agent shall be scrubbed into the surface just prior to placing the fresh concrete.

3.07 CONSOLIDATION

1. Use mechanical vibration in placing concrete to eliminate rock pockets and voids, to consolidate each layer with that previously placed, to completely embed reinforcing bars and fixtures, and to bring just enough fine material to exposed surfaces to produce a smooth, dense, and even texture. Vibrators shall be of the high-frequency internal type, and the number in use shall be ample to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. In all cases, at least three (3) operable vibrators shall be available at the site.

3.08 CONCRETE REPAIR

1. Defective surfaces, such as honeycomb, shall be cut out entirely until homogeneous concrete is encountered, even if it means going through the entire concrete section.

2. The exposed surface shall be coated with an approved epoxy or adhesive bonding material, which shall be applied in accordance with the manufacturer's instructions, before damp-packing the area with a mix consisting of one part of Portland cement and two parts of sand and fine gravel, epoxy and sand mix, or any combination of materials and mixes as the situation dictates in the opinion of the Manager.

3. The water content of the damp-pack material shall be such that a ball of the mix may be squeezed in the hand without bringing free water to the surface.

4. Damp-pack material shall be tamped into place and finished to match adjacent concrete surfaces. Particular care shall be taken that no sagging of the material will occur.

5. The repair area shall be cured similar to the original concrete as specified in the

Standard Specifications.

3.09 CONCRETE TESTS

1. Compression tests shall conform to ASTM C-39, ASTM C-670, ASTM C-683 and ASTM C-803.

2. At least one slump test and four test cylinders shall be made, under the supervision of the Manager, by an approved testing lab for every 40 cubic yards of ready-mixed concrete delivered to the jobsite. Each cylinder shall be coded to identify the date of delivery, the truck number, the location where the concrete has been used and the slump measured upon discharge.

3. The Contractor may, take additional test samples to determine compressive strength prior to the day 7 test.

4. The specimens shall be standard test cylinders, six inches in diameter, twelve inches in length, and they shall be prepared in accordance with ASTM Standard C-31. Making and testing of cylinders shall be performed by an approved testing laboratory that normally engages in the preparation of concrete mix designs and testing of concrete materials

5. Molds for the standard test cylinders shall be furnished at the expense of the Contractor.

6. All costs for making and testing of concrete and materials, by an approved recognized reputable testing laboratory, will be borne by the Contractor.

7. A compression test may be made on one cylinder from each group test specimens after 7. A strength test shall be conducted using two cylinders from each group at 28 days for use in evaluating the concrete strength in accordance with the Standard Specifications.

8. In addition to the test cylinders specified above, an additional 3 test cylinders shall be made for each day's beam encasement pour. These cylinders will be used to determine the compressive strength on the beam concrete to determine when shoring can be removed from the form work of the beams.

9. They shall be cured in the same manner, and in the same location of the concrete area to be investigated. Before forms may be stripped, at least one cylinder, of each batch

of 3 cylinders, must be tested to verify whether the in-place concrete strength meets the minimum specified design strength.

10. Shall the compressive tests at 28-days not meet the specified criteria, any extra costs involved in such testing shall be borne by Contractor; and the concrete, at the Owner's option, and at Contractor's sole expense, may be cored for further evaluation or rejected and removed from the site or it may be strengthened with additional shotcrete or concrete as the situation warrants it. Should the core tests indicate that the strength requirement has been met or if the low strength concrete is deemed acceptable to the Manager, the extra costs involved in such testing shall still be borne by the Contractor.

END OF SECTION

SECTION 15130

COMMINUTING AND GRINDING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

Furnish and install one (1) complete in-channel, dual-shafted comminuting grinder unit, including motor, speed reducer, and all necessary components for a complete and operational assembly as specified herein and as indicated on the Drawings.

1.02 SUBMITTALS

1. Product Data: Submit manufacturer's technical data, catalog cuts, installation instructions, and dimensional drawings for the grinder unit, motor, and reducer.
2. Shop Drawings: Submit detailed drawings showing overall dimensions, connection locations and sizes, weight, and required clearances for service and maintenance.
3. Operation and Maintenance Data: Submit data for inclusion in the project O&M manuals.

1.03 QUALITY ASSURANCE

1. Manufacturer: Unit shall be manufactured by JWC Environmental (JWCE), or approved equal.
2. Standards: Equipment shall be designed and manufactured in accordance with applicable standards of NSF, ANSI, and ASTM.

1.04 DELIVERY, STORAGE, AND HANDLING

1. Store equipment in a clean, dry location. Protect from weather, dirt, and damage.

1.05 WARRANTY

1. Manufacturer's Warranty: Submit manufacturer's standard warranty agreement. Grinder shall be guaranteed against defects in materials and workmanship for a period of one (1) year from date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

1. Acceptable Manufacturer: JWC Environmental, Model “Muffin Monster” or approved

equal product.

2.02 COMMINUTING GRINDER

1. Model: JWCE ‘Muffin Monster”; Model 30001-1206 or approved equal.
    a. Design: In-channel, dual-shafted design.
    b. Cutters:
        i. Type: 11T "Cam Cutters."
        ii. Material: Hardened alloy steel, 1:1 stack configuration.
    c. Seals and Elastomers: Buna -N elastomers
    d. Gaskets: Cork and Rubber
    e. Flanges: New 6-inch diameter pipe flanges.
    f. Housing: Cast iron or fabricated steel with Epoxy Green paint
    g. Serial Number: Unit shall have a unique, factory-assigned serial number.

2.03 SOURCE QUALITY CONTROL

1. The unit shall be factory-tested prior to shipment to ensure proper operational function.

PART 3 – EXECUTION

3.01 EXAMINATION

A. The contractor shall verify existing site conditions, including piping alignment, mounting base and electrical supply, prior to installation. The new grinder is a direct replacement for the existing unit.

3.02 INSTALLATION

A. Install the grinder in the specified location in accordance with the with the manufacturer’s published instruction and approved shop drawings.
B. Connect to existing piping via the 6-inch flanges, using gaskets and bolts suitable for the service.
C. Connect electrical power to the motor in accordance with electrical specifications and local codes. All electrical connections shall be performed by a qualified electrician.

3.03 ADJUSTING AND CLEANING

A. After installation, ensure the grinder cutter assembly rotates freely by hand.
B. Conduct a operational test run to verify proper rotation, absence of unusual noise or vibration, and correct function.
C. Clean the exterior of the unit and leave the work area clean and ready for use.

3.04 DEMONSTRATION

A. The Contractor shall coordinate with the Manufacturer's Representative to provide a startup service and operational demonstration for the Owner's maintenance personnel.

END OF SECTION

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY

1. This section specifies the basic requirements for the electrical installations and includes requirements common to more than one section of Division 16. It expands and supplements the requirements specified in sections of Division 1.
2. Standards of the organizations listed below but referred to in the various sections by basic designation only, form a part of this specification to the extent indicated by the reference thereto:
    a. American Society for Testing and Materials (ASTM).
    b. National Fire Protection Association (NFPA).
    c. American National Standards Institute (ANSI).
    d. Illuminating Engineering Society (IES).
    e. Institute of Electrical and Electronics Engineers (IEEE).
    f. Insulated Cable Engineers Association ICEA).
    g. National Electrical Manufacturer's Association (NEMA).
    h. National Electrical Contractors' Association (NECA).
    i. Underwriters' Laboratories, Inc. (UL).
    j. Factory Mutual (FM).
    k. Federal Specifications (FS).
    l. National Electrical Code (NEC) with County of Hawaii Amendments.
    m. ANSI TIA/EIA Telecommunication Building Wiring Standards.
3. References shall mean to the latest edition of the standard.
4. Conform to local ordinances and codes.

1.03 QUALITY ASSURANCE

1. Verify final locations for rough-ins with field measurements and with the requirements

of the actual equipment to be connected. Contractor shall coordinate with the appropriate supplier, vendor, or subcontractor regarding the exact and specific rough-in requirements for equipment actually supplied.

2. Conduits, junction boxes, wireway, etc. required for low voltage/telecommunications, cabling shall be coordinated with telecommunications cabling divisions prior to rough-in.

1.04 ELECTRICAL INSTALLATIONS

1. Coordinate electrical equipment and materials installation with other building components.
2. Verify all dimensions by field measurement. Do not scale drawings.
3. Arrange for chases, slots, and openings in other building components to allow for electrical installations.
4. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work.
5. Coordinate the access panel requirements with General Contractor to accommodate the installation of electrical equipment and materials.
6. Where mounting heights are not detailed or dimensioned, install electrical services and overhead equipment to provide the maximum headroom possible.
7. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
8. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.
9. Contractor shall review Civil drawings prior to bid.
    a. Final connections to equipment shall be per manufacturer's approved wiring diagrams, details and instructions. It shall be the Contractor's responsibility to provide materials and equipment compatible with equipment actually supplied.
    b. It is the intent of these drawings and specifications to establish a standard of quality.
    c. Work shall be performed in a workmanlike manner to the satisfaction of the Hospital.
    d. Contractor shall verify and coordinate exact location of equipment to be

furnished by others prior to rough-in.

e. Contractor shall be responsible for replacing equipment which is damage due to incorrect field wiring provided under this section or factory wiring in equipment provided under this division.

f. Contractors shall visit site prior to bid and verify that conditions are as indicated. Contractor shall include in the bid, costs required to make the work that meet existing conditions.

10. Proposed substitutions of electrical equipment or request for "or equal" or approved equal" listing shall be submitted to the Hospital as specified under Division 1.
11. Wire termination provisions for panelboards, circuit breakers, safety switches and all other electrical apparatus shall be listed as suitable for 75 degree C.
12. Systems shall be complete, operable and ready for continuous operations. Lights, switches, receptacles, motors, etc., shall be connected and operable.
13. Electrical equipment shall be located to maintain clear and level clearances outlined in NEC 110-26. Panelboards, disconnects, switches, breakers, etc. shall be located to comply with NEC 110-26(a). Where the clearances outlined in NEC 110-26 cannot be obtained, the Contractor shall notify the engineer prior to performing any rough-in.
14. Maintain separation between telecommunication conduits and electrical feeders, electronic ballasts, transformers, etc. to minimize electromagnetic compatibility issues.

1.05 ELECTRICAL SUBMITTALS

1. Refer to Division 1 Specifications for submittal requirements.
2. Data shall be submitted at one time in three ring binders and indexed as scheduled below. Partial submittals will not be accepted.
    a. 16060 – Grounding and Bonding
    b. 16073 – Hangers and Supports for Electrical Systems
    c. 16075 – Electrical Identification
    d. 16120 – Conductors and Cables
    e. 16130 – Raceways and Boxes
    f. 16140 – Wiring Devices
3. Submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal.
4. Identify products requiring color selections.

5. Identify products for use on project.

1.06 PRODUCT OPTIONS AND SUBSTITUTIONS

Substitutions shall be made in accordance with Division 1 Specifications.

1.07 PRODUCT LISTING

1. Prepare listing of major electrical equipment and materials for the project.
2. Submit this listing as a part of the submittal requirement specified in the Division 1 Specifications.

1.08 NAMEPLATE DATA

Provide permanent operational data nameplate on each item of power operated equipment, indicating, manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.09 DELIVERY, STORAGE AND HANDLING

1. Deliver products to project properly identified with names, model numbers, types, compliance labels and similar information needed for distinct identification; adequately packaged and protected to prevent damage during shipment, storage and handling.
2. Store equipment and materials at the site, unless off-site storage is authorized in writing. Contractor shall protect stored equipment and materials from damage and theft.
3. Coordinate deliveries of electrical materials and equipment to minimize construction congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.10 RECORD DOCUMENTS

1. Refer to the Division 1 Specifications for requirements. The following paragraphs supplement the requirements of Division 1.
2. Mark drawings to indicate revisions to conduit size and location both exterior and interior, actual equipment locations, dimensioned to column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry;

fuse and circuit breaker size and arrangement support and hanger details; Change Orders; Addendums; concealed control system devices.

3. Mark specifications to indicate approved substitutions; Change Orders; Addendums and equipment and materials used.

1.11 OPERATION AND MAINTENANCE DATA

1. Refer to DIVISION 1 Specifications for procedures and requirements for preparation and submittal of maintenance manuals.
2. In addition to the information required by DIVISION 1 for Maintenance Data, include the following information.
3. Description of function, normal operating characteristics and limitations, performance curves, engineering data tests, and complete nomenclature and commercial numbers of all replaceable parts.
4. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down and emergency instructions and summer and winter operating instructions.
5. Maintenance procedures for routine preventative maintenance and troubleshooting, disassembly, repair and reassembly; aligning and adjusting instructions.
6. Servicing instructions and lubrication charts and schedules.

1.12 WARRANTIES

1. Refer to the Division 1 Specifications for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
2. Compile and assemble the warranties specified in Division 16, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
3. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.13 CLEANING

Refer to the Division 1 Specifications for general requirements for final cleaning.

END OF SECTION

SECTION 16060

GROUNDING AND BONDING

1.01 SUMMARY

This Section includes methods and materials for grounding systems and equipment grounding requirements specified in this section may be supplemented by special requirements of section described in other sections.

1.02 SUBMITTALS

1. Product Data: For each type of product indicated.
2. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features Including the following:
    a. Ground rods.
    b. Ground rings.
    c. Grounding arrangements and connections for separately derived systems.
3. Field quality-control test reports.
4. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:
    a. Instructions for periodic testing and inspection of grounding features based on NFPA 70B.
        i. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
        ii. Include recommended testing intervals.

1.03 QUALITY ASSURANCE

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with UL 467 for grounding and bonding materials and equipment.

1.04 CONDUCTORS

1. Insulated Conductors: Copper wire or cable insulated for 600V unless otherwise

required by applicable Code or authorities having jurisdiction.

2. Equipment Grounding Conductors: Insulated with green-colored insulation.
3. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
4. Grounding Electrode Conductors: Stranded cable.
5. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
6. Bare Copper Conductors:
    a. Solid Conductors: ASTM B 3.
    b. Stranded Conductors: ASTM B 8.
    c. Tinned Conductors: ASTM B 33.
    d. Bonding Cable: 28 mil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
    e. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
    f. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
    g. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches (6 by 50 mm) in cross section, unless otherwise indicated; with insulators.

1.05 CONNECTORS

1. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
2. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
3. Pipe Connectors: Clamp type, sized for pipe.
4. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

1.06 GROUNDING ELECTRODES

Ground Rods: Copper-clad/steel 5/8 inches in diameter by 120 inches (16 by 3000 mm) in length.

1.07 APPLICATIONS

1. Conductors: Install solid conductors for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
2. Underground Grounding Conductors: Install bare copper conductor, size per drawings.
3. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
4. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
    a. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 18 inches (450 mm) above finished floor, unless otherwise indicated.
    b. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
5. Conductor Terminations and Connections:
    a. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
    b. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
    c. Connections to Ground Rods at Test Wells: Bolted connectors.
    d. Connections to Structural Steel: Welded connectors.

1.08 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

1. Comply with IEEE C2 grounding requirements.
2. Duct Banks: Install a grounding conductor with at least 50 percent ampacity of the largest phase conductor in the duct bank.
3. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor

opening with waterproof, non-shrink grout.

4. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

1.09 EQUIPMENT GROUNDING

1. Install insulated equipment grounding conductors with all feeders and branch circuits.
2. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
    a. Feeders and branch circuits.
    b. Receptacle circuits.
    c. Single-phase motor and appliance branch circuits.
    d. Three-phase motor and appliance branch circuits.
    e. Flexible raceway runs.
    f. Armored and metal-clad cable runs.
    g. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
3. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
4. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

5. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

1.10 INSTALLATION

1. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
2. Ground Rods: Drive rods until tops are a minimum of 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
    a. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
    b. For the grounding electrode system, install at least three rods spaced at least one- rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
3. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
    a. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
    b. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
    c. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
4. Grounding and Bonding for Piping:
    a. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
    b. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

c. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

5. Ground Ring: Install a grounding conductor, electrically connected to each building structure steel column and other indicated items, extending around the perimeter of area or item indicated.
    a. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
    b. Bury ground ring not less than 30 inches (750 mm) below grade and 24 inches (600 mm) from building foundation.
6. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of bare copper conductor, size per drawings.
    a. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
    b. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

1.11 FIELD QUALITY CONTROL

1. Test completed grounding system at service disconnect enclosure grounding terminal, and at all grounding electrodes. Make tests at electrodes before any conductors are connected.
2. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
3. Report measured ground resistance. If resistance exceeds 25 ohms, provide supplemental ground if required to comply with NEC 250.53(A)(2). All costs to achieve required ground resistance shall be included in the contractor's bid.

1.12 GRADING AND PLANTING

1. Restore surface features, including vegetation, in areas disturbed by the Work of this Section. Re-establish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after the backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original

condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig and mulch.

2. Restore disturbed paving as indicated.

END OF SECTION

SECTION 16073

HANGERS & SUPPORTS FOR ELECTRICAL SYSTEMS

1.01 SUMMARY

1. This Section includes the following:
    a. Hangers and supports for electrical equipment and systems.
    b. Construction requirements for concrete bases.

1.02 DEFINITIONS

1. EMT: Electrical metallic tubing.
2. IMC: Intermediate metal conduit.
3. RMC: Rigid metal conduit.

1.03 PERFORMANCE REQUIREMENTS

1. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
3. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
4. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.04 SUBMITTALS

1. Product Data: For the following:
    a. Steel slotted support systems.

1.05 QUALITY ASSURANCE

Comply with NFPA 70.

1.06 COORDINATION

1. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

Concrete, reinforcement, and formwork requirements are specified in Division 3.

2. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7.

PART 2 – PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

1. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        i. Allied Tube & Conduit.
        ii. Cooper B-Line, Inc.; a division of Cooper Industries.
        iii. ERICO International Corporation.
        iv. GS Metals Corp.
        v. Thomas & Betts Corporation.
        vi. Unistrut; Tyco International, Ltd.
        vii. Wesanco, Inc.
    b. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
    c. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
    d. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
    e. Channel Dimensions: Selected for applicable load criteria.
2. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
3. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
4. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of

threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

5. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
6. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
    a. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
        i. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        ii. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
            a. Hilti Inc.
            b. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
            c. MKT Fastening, LLC.
            d. Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
7. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        i. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
            a. Cooper B-Line, Inc.; a division of Cooper Industries.
            b. Empire Tool and Manufacturing Co., Inc.

c. Hilti Inc.

d. ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

e. MKT Fastening, LLC.

8. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
9. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
10. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
11. Toggle Bolts: All-steel springhead type.
12. Hanger Rods: Threaded steel.

PART 3 – EXECUTION

3.01 - APPLICATION

1. Comply with NECA 1, NECA 101 and manufacturer's instructions for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
2. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
3. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
    a. Secure raceways and cables to these supports with two-bolt conduit clamps, single-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.
4. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.
5. Do not support raceway with wire or perforated pipe straps. Remove wire used

for temporary supports. Do not attach raceway to ceiling support wires or other piping systems.

3.02 SUPPORT INSTALLATION

1. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
2. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in NFPA 70.
3. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb. (90 kg).
4. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
    a. To Wood: Fasten with lag screws or through bolts.
    b. To New Concrete: Bolt to pre-set concrete inserts or expansion anchors.
    c. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners or pre-set concrete inserts on solid masonry units.
    d. To Existing Concrete: Expansion anchor fasteners.
    e. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, Beam clamps (MSS Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
    f. To Light Steel: Sheet metal screws.
    g. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
5. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
6. Install surface-mounted cabinets and panelboards with minimum of four anchors.
7. In wet and damp locations, use steel channel supports to stand cabinets and

panelboards one inch off wall.

8. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
9. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
10. Do not use power-actuated anchors.
11. Obtain permission from Owner before drilling or cutting structural members.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

1. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.
2. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
3. Field Welding: Comply with AWS D1.1/D1.1M.
4. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

3.04 CONCRETE BASES

1. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
2. Use 4500-psi (31.0-MPa) 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in "Cast-in- Place Concrete".
3. Anchor equipment to concrete base.
    a. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Install anchor bolts to elevations required for proper attachment to supported equipment.
    c. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

1. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
    a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
2. Touchup: Comply with requirements for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
3. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 FIRESTOPPING

Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are required to be met.

3.07 DEMOLITION

1. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
2. All abandoned wiring shall be removed in its entirety in accordance with the locally amended National Electrical Code, NFPA 70.
3. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
4. Abandoned Work: Cut and remove buried raceway, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
5. Remove demolished material from Project site.
6. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

1. This Section includes the following:

    a. Identification for raceway
    b. Identification for conductors and communication and control cable.
    c. Underground-line warning tape.
    d. Warning labels and signs.
    e. Instruction signs.
    f. Equipment identification labels.
    g. Miscellaneous identification products.

1.02 SUBMITTALS

1. Product Data: For each electrical identification product indicated.
2. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.03 QUALITY ASSURANCE

1. Comply with ANSI A13.1 and ANSI C2.
2. Comply with NFPA 70.
3. Comply with 29 CFR 1910.145.

1.04 COORDINATION

1. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
2. Coordinate installation of identifying devices with location of access panels and doors.
3. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.02 RACEWAY IDENTIFICATION MATERIALS

1. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
2. Color for Printed Legend:
    a. Power Circuits: Black letters on an orange field.
    b. Legend: Indicate system or service and voltage, if applicable.
3. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
4. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
5. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
6. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.02 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

1. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
2. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
3. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
4. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.

2.03 UNDERGROUND-LINE WARNING TAPE

1. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
    a. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
    b. Compounded for permanent direct-burial service.
    c. Embedded continuous metallic strip or core.
    d. Printed legend shall indicate type of underground line.

2. WARNING LABELS AND SIGNS
    a. Safety Signs: Comply with NFPA 70 and 29 CFR 1910.145.
    b. Baked-Enamel Warning Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4- mm) grommets in corners for mounting.
    c. Metal-Backed, Butyrate Warning Signs for Exterior Use: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting.
    d. Warning label and sign shall include, but are not limited to, the following legends:
    e. Multiple Power Source Warning: "DANGER – ELECTRICAL SHOCK HAZARD EQUIPMENT HAS MULTIPLE POWER SOURCES."
    f. Workspace Clearance Warning: "WARNING – OSHA REGULATION – AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.04 INSTRUCTION SIGNS

1. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
2. Engraved legend with white letters on black face for normal power. White letters on red face for emergency power.
3. Punched or drilled for mechanical fasteners.

2.05 EQUIPMENT IDENTIFICATION LABELS

1. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on black face for normal power. White letters on red face for emergency power. Minimum letter height shall be 3/8 inch (10 mm).

2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

1. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
    a. Minimum Width: 3/16 inch (5 mm).
    b. Tensile Strength: 50 lb. (22.6 kg), minimum.
    c. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
    d. Color: According to color-coding.
2. Paint: Paint materials and application requirements are specified in Division 9 painting Sections. Select primer and finish coats applicable to the materials to be painted.
3. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 – EXECUTION

3.01 APPLICATION

1. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than: Identify with orange self-adhesive vinyl label, paint, or self-adhesive vinyl tape applied in bands.
2. Accessible Raceways of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands or paint:
    a. Color coding for raceways shall be as follows:

Color Service	Band	Minimum Band Width
Telephone	Black	2”
Power	Yellow	2”
Emergency Power	Red	2”
Fiber Optic	Orange	2”

3. Power-Circuit Conductor Identification: For primary and secondary conductors in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and write-on tags. Identify source and circuit numbers of each set of conductors. For single conductor cables, identify phase in addition to the above.
4. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape.

Identify each ungrounded conductor according to source and circuit number.

5. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
6. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
    a. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
    b. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
    c. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
7. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
8. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
    a. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
9. Instruction Signs:
    a. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system

       or equipment operation.
    b. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch (10-mm) high letters for emergency instructions at equipment used for power transfer load shedding.
10. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of

each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

11. Labeling Instructions:
    a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch (13-mm) high letters on 1-1/2-inch (38-mm) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.

    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

12. Equipment to Be Labeled:
    a. Panelboards, electrical cabinets, and enclosures.
    b. Access doors and panels for concealed electrical items.
    c. Motor-control centers.
    d. Disconnect switches.
    e. Enclosed circuit breakers.
    f. Motor starters.
    g. Contactors.
    h. Remote-controlled switches, dimmer modules, and control devices.

3.02 INSTALLATION

1. Verify the identity of each item before installing identification products. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
2. Apply identification devices to surfaces that require finish after completing finish work.
3. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
4. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
5. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-

m) maximum intervals in congested areas.

6. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
7. Color shall be factory applied or, for sizes larger than No. 10 AWG, field applied.
   a. Colors for 208/120-V Circuits:
      1. Phase A: Black.
      2. Phase B: Red.
      3. Phase C: Blue.
      4. Neutral: White
      5. Ground: Green

   b. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
8. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
9. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.

END OF SECTION

SECTION 16120

CONDUCTORS & CABLES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

1. This Section include the following.
   a. Building wires and cables rated 600 V or less
   b. Connectors, splices, and terminations rated 600 V or less.
   c. Sleeves and sleeve seals for cables.
2. This Section include the following.
   a. Building wires and cables rated 600 V or less
   b. Connectors, splices, and terminations rated 600 V or less.

1.03 DEFINITIONS

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

1. Product Data: For each type of product indicated.
2. Field quality-control test reports.

1.05 QUALITY ASSURANCE

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

1.06 COORDINATION

1. Set sleeves in cast-in-place concrete, masonry walls, and other structural components

as they are constructed.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

1. Conductors shall be annealed copper with conductivity of no less than 98% pure copper.
2. Aluminum conductors are not permitted.
3. Copper Conductors: Comply with NEMA WC 70.
4. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN XHHW and SO.

2.02 CONNECTORS AND SPLICES

Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type and class for application and service indicated.

2.03 SLEEVE SEALS

1. Description: Modular sealing devices, designed for field assembly, to fill annular space between sleeve and conduit.
   a. Sealing Elements: EPDM interlocking links shaped to fit surface of conduit. Include type and number required for materials and size of raceway.
   b. Pressure Plates: Plastic Carbon steel. Include two for each sealing element.
   c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 – EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

1. Feeders: Solid for No. 10 AWG and smaller; stranded for No 8 AWG and larger, except as indicated below.
   a. Use standard conductors for control circuits.
   b. Use conductor not smaller than 14 AWG for control circuits.

c. Use 10AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (25 m).
d. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet (160 m).

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

1. Service Entrance: Type THHN_THWN, single conductor in raceway Type XHHW, single conductor in raceway.
2. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
3. Feeders Concealed in Ceilings, Walls, Partitions, below raised floors and Crawlspaces: Type THHN-THWN, single conductors in raceway.
4. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
5. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductor in raceway or MC Cable in sizes #6 AWG and smaller.
6. Branch Circuits Concealed in Ceilings, Walls and Partitions: Type THHN-THWN single conductors in raceway or type MC Cable in sizes #6 AWG and smaller.
7. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway or PVC coated type MC Cable in sizes #6 and smaller (in concrete slabs only).
8. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway or type MC Cable in sizes #6 AWG and smaller.
9. Class 1 Control Circuits: Type THHN-THWN, in raceway.
10. Class 2 Control Circuits: Type THHN-THWN , in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

1. Conceal cables in finished walls, ceiling, and floors, unless otherwise indicated.
2. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

4. Support cables according to Division 16 Section "Hangers and Supports for Electrical Systems."
5. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."
6. Feeders and Branch Circuits Larger than 6 AWG: Copper, stranded conductor, 600 volt insulation, THHN/THWN, or XHHW. With the exception of motor feeders, 600 volt aluminum wire in sizes 1/0 and larger may be substituted for copper feeders if ampacity is equal or greater than copper and voltage drop is equal to or less than copper.
7. Use no wire smaller than 12 AWG for power and lighting circuits, and no wire smaller than 16 AWG for control wiring.
8. Utilize 10 AWG conductor for 20 ampere, 120 volt branch circuit homeruns longer than 75 feet (23m), and for 20 ampere, 277 volt branch circuit homeruns longer than 200 feet (61m).

3.04 CONNECTIONS

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
2. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
3. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

1. Coordinate sleeve selection and application with selection and application of firestopping.
2. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
3. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
4. Rectangular Sleeve Minimum Metal Thickness:
    a. For sleeve rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

b. For sleeve rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

5. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
6. Cut sleeves to length for mounting flush with both wall surfaces.
7. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
8. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and conduit unless sleeve seal is to be installed.
9. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
10. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 7.
11. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 7.
12. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
13. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
14. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.06 SLEEVE-SEAL INSTALLATION

1. Install to seal underground exterior-wall penetrations.
2. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.07 FIRESTOPPING

1. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistant rating of assembly.

3.08 FIELD QUALITY CONTROL

1. Tests and Inspections:
    a. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, for compliance with requirements.
    b. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 16130

RACEWAYS AND BOXES
GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.03 DEFINITIONS

1. EMT: Electrical metallic tubing.
2. FMC: Flexible metal conduit.
3. IMC: Intermediate metal conduit.
4. LFMC: Liquidtight flexible metal conduit.
5. RGSC: Rigid galvanized steel conduit.
6. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.05 QUALITY ASSURANCE

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

1. Rigid Steel Conduit: ANSI C80.1.
2. IMC: ANSI C80.6.
3. EMT: ANSI C80.3
4. FMC: Zinc-coated steel.
5. LFMC: Flexible steel conduit with PVC jacket.
6. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
    a. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
    b. Fittings for EMT: Steel compression type. Use of die cast fittings is not permitted.

7. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 METAL WIREWAYS

1. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
2. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
3. Wireway Covers: Screw-cover type or Flanged-and-gasketed type as required.
4. Finish: Manufacturer's standard enamel finish.

2.03 BOXES, ENCLOSURES, AND CABINETS

1. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
2. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
3. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

4. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
5. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
    a. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
6. Cabinets:
    a. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
    b. Hinged door in front cover with flush latch and concealed hinge.
    c. Key latch to match panelboards.
    d. Metal barriers to separate wiring of different systems and voltage.
    e. Accessory feet where required for freestanding equipment.

2.04 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

1. Description: Comply with SCTE 77.
    a. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
    b. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
    c. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
    d. Cover Legend: Molded lettering, for each service.
    e. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
    f. Handholes 24 inches wide by 36 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
2. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work

include, but are not limited to, the following:

b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

c. Basis-of-Design Product: Subject to compliance with requirements, provide Jensen Precast or a comparable product by one of the following:

1. Armorcast Products Company.
2. Carson Industries LLC.
3. CDR Systems Corporation.
4. NewBasis.

2.05 SLEEVES FOR RACEWAYS

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
2. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
3. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

2.06 SLEEVE SEALS

1. Basis-of-Design Product: Subject to compliance with requirements, provide Advance Products & Systems, Inc. or a comparable product by one of the following:
   a. Calpico, Inc.
   b. Metraflex Co.
   c. Pipeline Seal and Insulator, Inc.

2. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
   a. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   b. Pressure Plates: Carbon steel. Include two for each sealing element.
   c. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of

length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 – EXECUTION

3.01 RACEWAY APPLICATION

1. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
    a. Exposed Conduit: Rigid galvanized steel conduit or IMC.
    b. Concealed Conduit, Aboveground: Rigid galvanized steel conduit, IMC, or EMT.
    c. Underground Conduit: RNC, Type EPC-80 PVC, direct buried.
    d. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
    e. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X.
    f. Application of Handholes and Boxes for Underground Wiring:
        1. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
        2. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units SCTE 77, Tier 8 structural load rating.
        3. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
2. Comply with the following indoor applications, unless otherwise indicated:
    a. Exposed, Not Subject to Physical Damage: EMT.
    b. Exposed, Not Subject to Severe Physical Damage: EMT.
    c. Exposed and Subject to Physical Damage: Rigid galvanized steel conduit. Includes raceways in the following locations:
        1. Loading dock.
        2. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    d. Concealed in Ceilings and Interior Walls and Partitions: EMT.

e. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

f. Damp or Wet Locations: Rigid galvanized steel conduit, IMC, or Sch 80 PVC where allowed by code or local jurisdiction.

g. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X, stainless steel in damp or wet locations.

3. Minimum Raceway Size: 3/4-inch (24-mm) trade size for homeruns and conduits below grade or slab on grade.
4. Raceway Fittings: Compatible with raceways and suitable for use and location.
    a. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
5. All conduits larger than 1" shall be furnished with grounding type busing with equipment grounding conductor solidly connected at both ends.

3.02 INSTALLATION

1. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter. Raceway and boxes located as shown on Drawings, and at other locations where required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway as required to complete wiring system. Sizes shall meet or exceed NEC requirements. Raceway routing is shown for reference only. Route as required for a complete raceway system.
2. Where wiring devices are shown to be installed at existing wall locations, provide flush mount wiring devices with raceways concealed inside existing walls unless otherwise noted. Provide all work required to repair and patch existing wall as required for installation of new raceways and wiring devices.
3. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
4. Complete raceway installation before starting conductor installation.
5. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

6. Install no more than the equivalent of three 90-degree bends in any conduit run between boxes except for communications conduits. Provide no more than the equivalent of two (2) 90 degree bends between boxes.
7. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated except as follows:
    a. Mechanical, Electrical, Telecommunications and elevator machine rooms.
    b. Any variance shall be obtained from the Architect.
8. Raceways Embedded in Slabs above grade:
    a. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
    b. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
    c. Change from Type EPC-40-PVC to PVC coated rigid steel conduit, before the elbow and rising above the floor.
9. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
10. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
11. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
12. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    b. Where otherwise required by NFPA 70.
13. Route raceways, concealed or exposed parallel and perpendicular to walls and building structural components.
14. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible

conduit for recessed and semi-recessed lighting fixtures, maximum 36 inches (915 mm) for connection to equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

a. Use LFMC in damp or wet locations.

15. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
16. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.
17. Cut conduit square using saw or pipecutter; de-burr cut ends.
18. Bring conduit to shoulder of fittings; fasten securely.
19. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
20. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate bends in metal conduit larger than 2-inch (50mm) trade size.

3.03 BOX APPLICATIONS

1. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
2. Set wall mounted boxes at elevations to accommodate mounting heights indicated. Comply with ADA where required.
3. Adjust box location up to 10 feet (3m) prior to rough-in if required to accommodate intended purpose.
4. Orient boxes to accommodate wiring devices oriented as specified in Section 16140.
5. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
6. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150mm) from ceiling access panel or from removable recessed luminaire.
7. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
8. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic

and fire rated walls.

9. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
10. Use stamped steel bridges to fasten flush mounting outlet box between studs.
11. Use adjustable steel channel fasteners for hung ceiling outlet box.
12. Do not fasten boxes to ceiling support wires or other piping systems.
13. Support boxes independently of conduit.
14. Use gang box where more than one device is mounted together. Do not use sectional box.
15. Use gang box with plaster right for single device outlets.
16. Do not use boxes smaller than 4-inches square.

3.04 INSTALLATION OF UNDERGROUND CONDUIT

1. Direct-Buried Conduit:
    a. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 2 Section "Earthwork" for pipe less than 6 inches (150 mm) in nominal diameter.
    b. Install backfill as specified in Division 2 Section "Earthwork."
    c. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 2 Section "Earthwork."
    d. Install manufactured Schedule 80 conduit elbows and risers for transitions from below grade or slab on grade to above grade.
        1. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches (75 mm) of concrete.

    e. Conduits located in areas subject to vehicular traffic, such as driveways, parking lots, fire access lanes, etc. shall be concrete encased.
        1. Concrete jacket shall be 2500 PSI compressive strength in 28 days.

2. Provide a minimum of 3” of concrete on all sides of conduit.

3. Provide 1-1/2” separation between ducts of same system and 3” between ducts of different systems.

f. All underground service entrance conduits shall be installed, inspected, and approved by the local utility. Coordinate all requirements with the latest edition of the utility service installation manual.

3.05 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
3. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
4. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
5. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.06 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

1. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7.
2. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
3. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

4. Rectangular Sleeve Minimum Metal Thickness:
    a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
    b. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

5. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
6. Cut sleeves to length for mounting flush with both surfaces of walls.
7. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
8. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.
9. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
10. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7.
11. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7.
12. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
13. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.07 SLEEVE-SEAL INSTALLATION

1. Install to seal underground, exterior wall penetrations.
2. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.08 FIRESTOPPING

1. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7.

3.09 PROTECTION

1. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
    a. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
    b. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

b. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

1. This Section includes the following:
   a. Receptacles, receptacles with integral GFCI, and associated device plates.
   b. Twist-locking receptacles.
   c. Receptacles with integral surge suppression units.
   d. Wall-box motion sensors.
   e. Isolated-ground receptacles.
   f. Snap switches.
   g. Wall-switch.
   h. Cord and plug sets.

1.02 DEFINITIONS

1. EMI: Electromagnetic interference.
2. GFCI: Ground-fault circuit interrupter.
3. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
4. RFI: Radio-frequency interference.
5. TVSS: Transient voltage surge suppressor.

1.03 SUBMITTALS

1. Product Data: For each type of product indicated.

1.04 QUALITY ASSURANCE

1. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Comply with NFPA 70.

PART 2 - PRODUCTS

2.03 STRAIGHT BLADE RECEPTACLES

1. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
    a. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
        i. Cooper; 6350 (single), 6352 (duplex).
        ii. Hubbell; HBL2162 (duplex).
        iii. Leviton; 16341 (single), 16362 (duplex).
        iv. Pass & Seymour; 26361 (single), 26362 (duplex).
2. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
3. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
    a. Hubbell; CR 1G2162.
    b. Leviton; 163621G.
    c. Pass & Seymour; 1G6362-HG.
    d. Cooper; 1G8362
4. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.04 GFCI RECEPTACLES

1. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
2. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
    a. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
        a. Cooper; GF20.
        b. Pass & Seymour; 2084.
        c. Leviton; 8898-HG

2.05 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

1. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
    a. Cooper Crouse-Hinds.
    b. EGS/Appleton Electric.
    c. Killark; a division of Hubbell 1nc.

2.06 TWIST-LOCKING RECEPTACLES

1. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
2. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
    a. Cooper; L520R.
    b. Hubbell; HBL2310.
    c. Leviton; 2310.
    d. Pass & Seymour; L520-R.
3. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
    a. Hubbell; 1G2310.
    b. Leviton; 2310-1G.
4. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.07 CORD AND PLUG SETS

1. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
    a. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
    b. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle

type for connection.

2.08 SNAP SWITCHES

1. Comply with NEMA WD 1 and UL 20.
2. Switches, 120/277 V, 20 A:
    a. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
        i. Cooper; DECB120 (single pole), DECB220 (two pole), DECB320 (three way).
        ii. Hubbell; 2121 (single pole), 2122 (two pole), 2123 (three way).
        iii. Leviton; 5621 (single pole), 5622 (two pole), 5623 (three way).
        iv. Pass & Seymour; 2621 (single pole), 2622 (two pole), 2623 (three way).
3. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
    a. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
        i. Cooper; 1995.
        ii. Hubbell; HBL1557.
        iii. Leviton; 1257.
        iv. Pass & Seymour; 1251.

2.09 WALL PLATES

1. Single and combination types to match corresponding wiring devices.

a. Plate-Securing Screws: Metal with head color to match plate finish.
b. Material for Finished Spaces: Satin-finished stainless steel, 0.04-inch- (1-mm-) thick,
c. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.10 POKE-THROUGH ASSEMBLIES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
   a. Hubbell Incorporated; Wiring Device-Kellems.
   b. Pass & Seymour/Legrand; Wiring Devices & Accessories.
   c. Square D/ Schneider Electric.
   d. Thomas & Betts Corporation.
   e. Wiremold Company (The).
2. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichannel, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
   a. Service Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.
   b. Size: Selected to fit cored holes in floor and matched to floor thickness.
   c. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
   d. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.
   e. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, 4-pair, Category 5e voice and data communication cables.

2.11 FINISHES

1. Color: Wiring device catalog numbers in Section Text do not designate device color.
   a. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

b. TVSS Devices: Blue.

c. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.00 INSTALLATION

1. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
2. Coordination with Other Trades:
    a. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
    b. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
    c. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
    d. Install wiring devices after all wall preparation, including painting, is complete.
3. Conductors:
    a. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
    b. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
    c. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
    d. Existing Conductors:
        i. Cut back and pigtail, or replace all damaged conductors.
        ii. Straighten conductors that remain and remove corrosion and foreign matter.
        iii. Pig tailing existing conductors is permitted provided the outlet box is large enough.
4. Device Installation:
    a. Replace all devices that have been in temporary use during construction or that's

how signs that they were installed before building finishing operations were complete.

b. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

c. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

d. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

e. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.

f. Use a torque screwdriver when a torque is recommended or required by the manufacturer.

g. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

h. Tighten unused terminal screws on the device.

i. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

j. Mounting heights shall be as follows unless noted:

k. Receptacles: 18" A.F.F. measured to bottom.

l. Switches: 44" A.F.F. measured to bottom.

5. Receptacle Orientation:

   a. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

   b. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

6. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

7. Dimmers:

   a. Install dimmers within terms of their listing.

   b. Verify that dimmers used for fan speed control are listed for that application.

   c. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

8. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
9. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.01 IDENTIFICATION

1. Comply with Division 16 Section "Electrical Identification."
    a. Receptacles: Identify panelboard and circuit number from which served on back of device plate.

3.02 FIELD QUALITY CONTROL

1. Perform tests and inspections and prepare test reports.
    a. Test Instruments: Use instruments that comply with UL 1436.
    b. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
2. Tests for Convenience Receptacles:
    a. Line Voltage: Acceptable range is 105 to 132 V.
    b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
    c. Ground Impedance: Values of up to 2 ohms are acceptable.
    d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
    e. Using the test plug, verify that the device and its outlet box are securely mounted.
    f. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

SECTION 46 07 53

PRE-PACKAGED WASTEWATER TREATMENT PLANT

1.01 PRE-PACKAGED WWTP

1. Although the PURESTREAM prefabricated steel sewage treatment plant is a complete factory fabricated place shipped to your ready to be set on the foundation pad; there are certain important details that must be taken care of by the contractor before and after the plant arrives at the job site. The tankage may be shipped in several pieces and require field erection.

1.02 SECTION EXCAVATION:

1. After your plant delivery date has been determined make sure you have the proper drawings to prepare the excavation and tank foundation pad, if required. The size of the excavation should be at least three feet wider and longer than the tank overall dimensions to allow for anchoring and touchup painting prior to back filling.
2. Pile dirt far enough away from the excavation site to allow trucks and cranes to operate safely from either side.
3. Care should be taken to see that the bottom elevation of the excavation is accurate and level and that the concrete pad is smooth and level. This is important in order to provide a uniform bearing over the entire tank bottom and to ensure the proper flow of liquids through the plant. Errors in grade or pad surface cannot be easily corrected after the plant has been set.
4. The foundation pad must be level within ½ inch across the width and along the length to maintain the proper water level in the plant.
5. The tie down arrangement shown on the pad drawing is for alignment only and will not prevent flotation when the plant is empty. If groundwater problems exist, consult the project engineer. The tank must be filled with water immediately after installation.

1.03 PRE PLANT DELIVERY CHECK OUT

1. In most cases the PURESTREAM plant will come directly to the jobsite by lowboy trailer. It is the responsibility of the contractor to remove the steek tank from the trailer and set it on the pad unless otherwise specified. The following are a few final details to check out before the plant arrives:

2. Ensure that road access to the plant site is adequate for the tank size and adequate clearance is provided for a lowboy trailer. Check the excavation and the pad to see that it is clear of all mud, water or debris and that the excavation is clear of all dirt piles around the adjacent area to allow for truck and crane operation.
3. Sizing of the crane should be based on both the weight of the heaviest piece of tankage and site conditions. Be sure you have a crane with sufficient capacity to lift and boom the tank over and onto the base pad. The steel tanks have lifting gussets located along each side of the tanks for use with a four-leg cable sling with a minimum ten-foot legs or spreader bar to prevent undue stress on lifting gussets. Cables and clevis should be supplied by the contractor.
4. PURESTREAM will not be responsible for damage to the tank due to improper cable or clevis configuration.

1.04 UNPACKING ELECTROMECHANICAL EQUIPMENT:

1. If the blower motor units and/or the electrical control panel are not going to be mounted IMMEDIATELY, they MUST be stored in a dry location and protected from possible construction hazards. The electrical control panel is WEATHERPROOF, not WATERPROOF, therefore, if stored unprotect, damage to the controls may occur. PURESTREAM will not be responsible for damage to electromechanical equipment from improper storage.

1.05 SETTING PLANT:

1. When the truck arrives, direct the driver to position the trailer if possible so that the hopper end of the tank will be placed at the discharge end of the foundation pad.
2. Carefully rig the tank with lifting slings and position it properly onto the pad in alignment with the anchors.
3. Check to see that the tank is level and the inlet and outlet are in the proper position and elevation before releasing slings. After tank is anchored to pad it should be rechecked to see that it is not more than one inch out of level in any plane.
4. Inspect tankage for equipment/pipe assembly tie downs. For shipping purposes, pipe assemblies and/or equipment mounted in the tankage may be tied down to prevent damage. Remove any such wire after tank installation and prior to filling tank with liquid.

5. BEFORE BACK FILLING: Check to see that the following things are done:
6. See that the tank has been securely anchored to the pad on both sides.
7. IMPORTANT NOTE: The tie down arrangement shown on the drawing is for alignment only and will not prevent flotation when the plant is empty. If ground water problems exist, consult the project engineer. The tank must be filled with water immediately after installation. PURESTREAM will not be responsible for tank flotation or damage due to ground water.
8. If tankage is anchored to the pad by welding re-bar to the tank side walls, these walls must be carefully checked for burnt through and repaired if required. After inspection the welds must be cleaned, primed and painted.
9. Check and tighten all drain plugs on the plant. Drain plugs are located on the end walls of the tank near the bottom and in most cases near the bottom of dividing walls.
10. Touch up all scratches or other damage to tank protective coating. Refer to field touchup instructions located in the back of this section.
11. Locate the magnesium anodes that were shipped with the tank. Uncoil the ten-foot wire leads. The anodes are wired to be solderless lugs mounted at the top rim of the tank around the tank perimeter. The purpose of the anodes is to protect the tank from electrolytic actin of the earth against metal. When only two anodes are shipped, one should be mounted on each side of the tank at opposite corners. They may be installed before the back filling or after back is within four or five feet from finish grade. They should be buried about five feet from the tank and about five feet from finish grade. Protective care is necessary during back filling to prevent damage to the anode. Before the back filling each anode should be doused with five gallons of water.

1.06 ELECTRICAL CHARACTERISTICS:

1. The plant has been built per the electrical characteristics shown below. Make sure that there has been no change in the power supply since the plant was ordered
    a. 230 Volt, THREE phase, 60 cycle, 4 Wire, power supply. See Neema O&M for power supply and a total of H.P. motor requirements.
2. A disconnect switch mounted within site, adjacent to the plant site, and wiring from this switch to the electrical control panel or an adjacent to the plant must be furnished and installed in accordance with the local electrical codes. If the plant electrical control

panel and blower motor units are mounted directly on the top of the plant wiring and conduit will be factory installed to make the electrical connections between the electrical control panel, the blower units and accessory equipment. The electrical contractor must make electrical connections to the proper terminals in the electrical control panel and at the accessory equipment.

3. If the plant electrical control panel and blower motor units are not mounted director on top of the plant the electrical contractor must make electrical connections between the electrical control panel and the blower motor conduit box in accordance with local electrical codes. Tank mounted pumps, float switches, and electrical accessories will be wired to junction boxes adjected to the equipment. The electrical contractor must also make the electrical connections between these junction boxes and the electrical control panel.
4. All electrical installations and connections must be made and ready for inspection before the factory representative arrives for startup.
5. If three phase service is used, it is important that proper blower motor rotation as indicated by the arrows on the motor, is maintained. Improper rotation will cause damage to the blower as water is pumped back from the plant. Failure to check for proper rotation will result in voiding of blower warranty.

1.07 BACK FILLING:

1. Back fill material should be as free as possible from rocks, trash, and caustic material. Extreme caution must be used to avoid deflecting or pre-stressing tank walls by excessive loads or backfill, or by using heavy equipment too close to the tank walls.

1.08 SEWER LINE CONNECTION:

1. Connect inlet and outlet sewer lines. Grout rings are normally provided on the outside of tank end walls. Fill these rings all around the sewer lines with cement group mixed with Embeco Grout or an approved equal product, making sure the pipe is sealed completely to keep out all mud and surface water.

1.09 GRADING:

1. Great care should be taken in grading around your PURESTREAM plant. The finish grade should be at least six inches below the top of the plant and the ground should slope away from all four sides of the plant. It is absolutely necessary to keep all surface waters

and mud from entering the plant in any way. If ground slope is not crushed stone walkway around the plant will help the appearance and maintenance of the plant. All other soil should be sodded or seeded to prevent erosion. Anything done to prevent or control the surface water or mud from entering the plant is a great step toward preventative maintenance and a properly operating sewage treatment plant.

1.10 FINAL ASSEMBLY:

1. The PURESTREAM prefabricated steel sewage treatment plant is shipped from the factory complete with all internal piping including diffusers complete and ready for operation. Road and shipping clearance restrict the shipment of tank mounted equipment.

1.11 TANK MOUNTED ELECTRICAL CONTROL PANEL AND BLOWER MOTOR UNIT:

1. Open the blower housing. The housing contains the necessary items of hardware and parts to complete the assembly of the plant. Install the rubber hose connector between the pipe coming from the bottom of the housing and the pipe coming out of the plant from the air header, leaving the clamps loose and adjusting the connector to give equal coverage of both pipes. Install the bolts and nuts with flat and lock washers provided through housing mounting holes into the blower base plate on the tank and tighten securely after aligning the rubber connector to a straight position. Check to see that there are no kinks or sharp twist in the connector before tightening the house clamps. Find the location of the pressure relief valve (Located in the blower discharge piping after the discharge silencer) and install using a pipe wrench to tighten securely.)

2. When dual blowers are used, locate one housing over the right-hand position looking at the plant from the inlet end toward the outlet. (Same side as valves for diffuser drops.) Place second housing on the opposite side of the tank.
3. Other loose items or accessories cartons should be removed from the truck and placed in a safe dry location until ready for installation at the plant. The truck driver has a copy of the packing list showing the equipment that was shipped with the plant. This should be checked to see if all equipment was received before signing manifest.

1.12 REMOTE MOUNTED ELECTRICAL CONTROL PANEL, BLOWER MOTOR UNITS:

1. When the electrical control panel and the lower motor units are mounted remotely from

the plant a suitable concrete foundation pad should be provided for mounting the equipment.

2. The pad should be large enough to allow for opening the blower housings (if housing is provided) and control panel door.
3. This equipment should be positioned on the pad and mounting holes for each piece of equipment marked. Remove the equipment and drill holes in the concrete pad for properly sized expansion type concrete anchors.
4. Relocate the equipment and bolt it in place.
5. The blower housing (or separate crate when blower housing is not provided) contains the blower accessories including the rubber sleeves with hose clamps, (one required per blower motor unit) and the pressure relief valve.
6. Referring to the remote blower motor unit drawing install, the blower discharge piping as shown on the drawings.
7. In dual blower applications the pressure relief valve must be installed in a common line between the two blower motor units.
8. Piping between the blowers and the air connection on the tank should, as a minimum, be the same size as this air connection. Avoid restrictions within this piping.

1.13 ELECTRICAL CONTROL PANEL:

1. All controls are pre-wired inside a lockable weatherproof control panel. On plants where the electrical control panel is tank mounted this unit must be set and bolted in place on the plant. It is normally located adjacent to the blower housing. Be sure to check the blower rotation before starting the plant. Single phase motors are pre-wired and checked for rotation at the factory but three phase motors must be checked in the field after power service has been connected.
2. Rotation may be reversed by changing any two of the three leads to the blower motor circuit breaker in the control panel. Rotation arrows are provided on the blowers.
3. SURGE (EQUALIZATION) TANK:

    a. A surge tank is designed to equalize the flow to the sewage treatment plant. It will normally consist of an integral tank with duplex submersible pumps., a flow control device, float switches and a blower motor unit. The influent raw sewage will be pumped into the flow control device. This device will allow the

average daily flow to enter the aeration tank of the treatment plant and the excess flow to be re-circulated back to the surge tank.

4. The electrical controls for the surge tank are included in the electrical control panel. Electrical connections between the electrical control panel, the float switches and blower motor unit should be as described in the previous section of these instructions. The blower motor unit should be installed as previously described. Check the rotation of three phase pumps as outlined in the previous section.
5. In order to prevent damage during shipping the surge pumps and float switches are shipped un-mounted. The surge pumps are equipped with compression ("Dresser") couplings to facilitate field installation. Unbolt the compression coupling from the inlet pipes to the flow control device and screw the pump discharge pipe into the threaded surge pump-discharge connection. Position the surge pumps in the surge tank as shown on the drawings and reinstall the compression coupling.
6. A float switch bracket located near the top of the surge tank is provided for mounting the float switches. Position the lowest float switch (Pumps "off" float switch.) so that the weight is approximately one foot off the tank bottom. Using the cord grips supplied, attach each float switch cable to the float switch bracket. Connect the remaining float switches (two each - if a high-water alarm if not supplied, three if a high-water alarm is supplied.) in the same manner at the elevations required for correct pump operation. In no case should the first float switch be installed at an elevation below the surge pump suction. Doing so would allow the pumps to run dry and damage the pumps.
7. It is important that the surge tank have its own blower motor unit to supply air to its diffusers. Due to the differences in operating water level between the plant's aeration compartment and the surge tank the majority of a common air supply would go to the surge tank and interfere with the operation of the aeration tank.

1.14 FIELD TOUCHUP, PAINTED SURFACES

1. Surface Preparation:
    a. The surface should be clean, dry and free of contaminants. Clean any chipped, rusted or flaking areas as required. Hand or pole sand surfaces to be re-coated, feathering the edges of repair.
2. Application:
    a. Apply the proper coating at the specified dry film thickness (D.F.T.), normally

8 to 10 mils inside and outside, by brush or roller. It may be necessary to apply more than one coat to achieve the specified D.F.T.. If this is the case allow for proper drying times prior for re-coating.

b. Please note that all epoxy coating will chalk and fade with exposure to UV light. The touchup areas may not match the color and the gloss depending on the length of exposure but will eventually blend in over time.

END OF SECTION

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