STATE OF HAWAII

DEPARTMENT OF HAWAIIAN HOME LANDS
91-5420 Kapolei Parkway,
Kapolei, HI. 96707

# TECHNICAL SPECIFICATIONS

FOR

FURNISHING LABOR AND MATERIALS FOR

## LAIOPUA VILLAGE 4 SUBDIVISION, PHASE 2 - HEMA

Kailua-Kona, North Kona, Island of Hawaii, Hawaii

T.M.K. (3) 7-4-21:12 (portion)

IFB No.: IFB-21-HHL-007

November 2020

SECTION 01010 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS AND COVENANTS: The General Conditions, General Specifications, Special Provisions, and other applicable documents preceding these specifications shall govern all work specified hereinafter in all Divisions and Sections.

1.02 APPLICABLE REGULATIONS: The Contractor shall comply with all local laws, ordinances, rules and regulations pertaining to such work and must obtain all required permits, licenses, and certificates and publish and post all notices required thereby.

1.03 DESCRIPTION OF THE WORK: These specifications are divided for convenience into titled divisions and sections as set forth in the TABLE OF CONTENTS preceding these specifications and shall not be considered an accurate or complete segregation of the several units of labor and materials. No responsibility, either direct or implied is assumed by the Department of Hawaiian Home Lands (DHHL) for omissions or duplications of the subject matter. The Contractor will be held responsible for the complete work whenever or wherever the parts are described in one or more trade heads. Any mention in these sections or indication on the drawings of articles, materials, operations, or methods, require that the Contractor furnish each item so mentioned or indicated, of the kind, type, or design and quality of each item so mentioned on the drawings, and that the Contractor furnish all labor, materials, equipment, incidentals and supervision necessary to complete the work in accordance with the drawings and the true meaning and intent of these specifications, even though such mention of articles, materials, operations, methods, quality, qualifications or condition is not expressed in complete sentences.

Where devices or items, or parts thereof are referred to in the singular, it is intended that such references shall apply to as many such devices, items, or parts as are required to properly complete the work.

Schedule of work included in these specification sections are given for convenience and shall not be considered as a comprehensive list of items necessary to complete the work of any section.

The Contractor shall employ the usual standard practice of coordinating the work covered in each section with the work of other sections. The necessary information and the items, accessories, anchors, connections, patterns, templates, etc., shall be delivered when required in order to prevent any delay in the progress and completion of the work.

1.04 PLANS AND SPECIFICATIONS: These specifications are intended to cover all labor, materials and standards of workmanship employed in the work indicated on the plans and called for in the specifications or reasonably implied therein. The plans and specifications complement one another. Any part of the work mentioned in one and not represented in the other, shall be done the same as if it had been mentioned or represented in both.

The Contractor shall not alter from the drawings and specifications. In the event of errors or discrepancies, the Contractor shall immediately notify the Engineer.

All figured dimensions take precedence over scaled measurements. No important dimension shall be determined by scale.

Specifications and drawings are prepared in abbreviated form and may include incomplete sentences. Omissions of words or phrases such as "the Contractor shall", "as shown on the drawing", "a", "an", and "the", are intentional. Omitted words and phrases shall be provided by inference to form complete sentences.

1.05 REFERENCE STANDARDS: All work shall be done in accordance with the most current standards listed below as amended and/or amplified herein.

ASA American Standards Association

ASTM American Society for Testing and Materials

AISC American Institute of Steel Construction

ACI American Concrete Institute

UBC Uniform Building Code - current edition

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01340 - DRAWINGS TO BE FURNISHED BY CONTRACTOR

The following shall supplement the General Conditions.

1.01 Shop drawings and submittals shall be made in accordance with Section 5.5 - Shop Drawings and Other Submittals of the General Conditions.

1.02 All submittals, RFIs, change requests and other documentation shall be submitted electronically via Newforma.

1.03 The Contractor's stamp and verification of drawings shall consist of the following format:

LAIOPUA VILLAGE 4 SUBDIVISION, PHASE 2 - HEMA
DHHL CONTRACT NO. IFB-19-HHL-010

(Contractor's Name) _____

(Signature ) _____ (Date) _____

This submittal has been checked and verified in accordance with the requirements of the contract documents and any equipment submitted herewith can be installed in the allocated spaces.

Submittal No. _____

Specification Section No. _____

Paragraph No. _____

Contract Drawing Ref. _____

Subcontractor _____

Supplier _____

Manufacturer _____

Exceptions Taken: Yes _____ No _____

Details of Exception _____

_____

_____

1.04 The person signing the Contractor's submittal stamp shall be the one designated under the contract agreement with the DHHL. The signature shall be in original ink. Stamped signature will not be acceptable. Submittal forms shall be completely filled out, signed and dated.

1.05 All changes made to the submittal drawings by the Contractor in the form of written or typewritten markings shall be initialed and dated by the Contractor.

1.06 When the Contractor takes any exception to the submittal drawings, such exception shall be brought to the attention of the Engineer. The exception shall be submitted with the shop drawings together with sufficient details and justifications.

1.07 Within 30 days after receipt of notice to proceed, the Contractor shall submit to the Engineer in duplicate, a schedule, listing all items that will be submitted for review and approval action by the DHHL, the State Department of Transportation, or the County of Hawaii. The schedule shall include, among other things, a list of shop drawings and manufacturer's literature, certificates of compliance, material samples, and guarantees. The schedule shall indicate the type of item, contract requirement reference; the Contractor's scheduled date for submitting the above items and projected needs for approval answers and procurement dates. In preparing the schedule, adequate time (minimum of 15 days) shall be allowed for review and approval; additional time shall be allowed to provide for possible resubmittal. Also, the scheduling shall be coordinated with the approved progress schedule.

1.08 The Contractor shall maintain at the job site two sets of full size contract drawings, marking them in red to show all variations between the construction actually provided and that indicated or specified in the contract documents, including buried or concealed herein, or where variations in scope or character of work from that of the original contract are authorized, the drawings shall be marked to define the construction actually provided. Where equipment installation is involved, the size, manufacturer's name, model number and power input or output characteristics are applicable shall be shown on the as-built drawings. The representations of such changes shall conform to standard and detail as necessary to clearly portray the as-built construction. The drawings shall be maintained and updated on a daily basis.

Monthly and final payments of the Contactor shall be subject to prior approval of the drawings.

On completion of the work, both sets of marked-up drawings shall be delivered to the Engineer, and shall be subject to his approval before acceptance.

END OF SECTION

SECTION 01430 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.01 GENERAL: This section covers prevention of environmental pollution and damage during and as the result of construction operations under this contract and for those measures set forth in other sections of the TECHNICAL SPECIFICATIONS. For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land, and includes management of visual aesthetics, noise, solid waste, as well as other pollutants. It is the responsibility of the Contractor to investigate and comply with all applicable Federal, State and County laws and regulations concerning environmental protection and pollution control, and to secure all necessary permits.

1.02 SUBMITTALS: The Contractor shall submit an environmental protection plan in accordance with the provisions as herein specified. Environmental protection plan shall include but not be limited to the following:

A. Methods for protection of features to be preserved within authorized work areas. The Contractor shall prepare a listing of methods to protect resources needing protection; i.e., trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological, and cultural resources.

B. Procedures to be implemented to provide the required environmental protection and to comply with all applicable laws and regulations. The Contractor shall set out the procedures to be followed to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures set out in accordance with the environmental protection plan.

C. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles or spoil material.

D. Environmental monitoring plans for the job site, including land, water, air and noise monitoring.

E. Methods of protecting surface and groundwater during construction activities.

F. Training for his personnel during the construction period.

1.03 IMPLEMENTATION: After receipt of Notice to Proceed, the Contractor shall submit in writing the above environmental protection plan for approval of the Engineer within 15 days after Notice to Proceed. Approval of the Contractor's plan will not relieve the Contractor of his responsibility for adequate and continuing control of pollutants and their environmental protection measures.

1.04 SUBCONTRACTORS: Assurance of compliance with this section by subcontractors will be the responsibility of the Contractor.

1.05 NOTIFICATION: The Engineer will notify the Contractor in writing of any observed noncompliance with the aforementioned Federal, State or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Engineer of proposed corrective action and take such action as may be approved. If the Contractor fails to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspension.

## PART 2 - PRODUCTS (NOT USED)

## PART 3 - EXECUTION

3.01 PROTECTION OF ENVIRONMENTAL RESOURCES: The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. The Contractor shall confine his activities to areas defined by the drawings and specifications.

3.02 PROTECTION OF LAND RESOURCES: Prior to the beginning of any construction, the Contractor shall identify all land resources to be preserved within the Contractor's work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without special permission from the Engineer. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such special emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs.

A. Work Area Limits: Prior to any construction, the Contractor shall mark the areas that are not required to accomplish all work to be performed under this contract. Isolated areas within the general work area, which are to be saved and protected, shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor shall convey to his personnel the purpose of marking and/or protection of all necessary objects.

B. Protection of Landscape: Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques.

C. Reduction of Exposure of Unprotected Erodible Soils: Earthwork brought to final grade shall be finished as indicated and specified. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All

earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Runoff from the construction site shall be controlled by construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.

D. Disposal of Solid Waste by Removal From State Property: The Contractor shall transport all solid waste off State property and dispose of it in compliance with Federal, State and local requirements for solid waste disposal.

E. Disposal of Chemical Waste: Chemical waste shall be stored in corrosion resistant containers, removed from the work area and disposed of in accordance with Federal, State, and local regulations.

3.03 PROTECTION OF WATER RESOURCES: The Contractor shall keep construction activities under surveillance, management and control to avoid pollution of surface and groundwaters. Special management techniques as shall be implemented to control water pollution.

A. Protection of Waterways: Construction of drainage facilities as well as performance of other contract work which will contribute to the control of siltation shall be carried out in conjunction with the earthwork operations or as soon as thereafter as is practicable.

Prior to or during any suspension of construction operations for any appreciable length of time, the Contractor shall provide for any temporary erosion control measures deemed necessary. Such measures shall be continued until the permanent drainage facilities have been constructed and when called for, until the protective ground cover is sufficiently established to be an effective erosion deterrent. Should such measures fail and an appreciable quantity of material begins to erode into the natural waterway, the Contractor shall act immediately to bring the siltation under control.

B. Pollution: The Contractor shall exercise every reasonable precaution throughout the life of the project to prevent pollution of rivers, streams or impoundments. Pollutants such as chemicals, fuels, lubricants, bitumens, raw sewage and other harmful waste shall not be discharged into or alongside of the stream, or into natural or manmade channels leading thereto. The Contractor shall also comply with the applicable regulations of the State Department of Land and Natural Resources and other statutes relating to the prevention and abatement of pollution.

The Contractor shall conduct his operations near harbors, bays, swimming and water recreation areas, to avoid and minimize pollution. He shall comply with the applicable regulations of the United States Department of Interior, State Department of Health and other authority having jurisdiction.

Monitoring of water areas affected by construction activities shall be the responsibility of the Contractor. All water areas affected by construction activities shall be monitored by the Contractor.

3.04 PROTECTION OF FISH AND WILDLIFE RESOURCES: The Contractor shall keep construction activities under surveillance, management and control to minimize interference with, disturbance to and damage of fish and wildlife.

3.05 PROTECTION OF AIR RESOURCES: The Contractor shall keep construction activities under surveillance, management and control to minimize pollution of air resources. All activities, equipment, processed, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with the State of Hawaii Public Health Regulations, Chapter 43, "Air Pollution Control." Special management techniques as set out below shall be implemented to control air pollution by the construction activities, which are included in the contract.

A. Particulates: Dust particles, aerosols, and gaseous by-products from all construction activities and processing and preparation of materials shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards mentioned above to be exceeded or which would cause a hazard or a nuisance. Sprinkling or other methods approved by the Engineer will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated at such intervals as to keep the disturbed area damp at all times. The Contractor must have sufficient competent equipment available to accomplish this task. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

B. Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

C. Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

D. Monitoring of air quality shall be the responsibility of the Contractor. All air areas affected by the construction activities shall be monitored by the Contractor.

3.06 PROTECTION FROM SOUND INTRUSIONS: The Contractor shall adhere to the requirements of the Department of Health and shall implement acceptable noise abatement methods to minimize the construction noise level.

Noise shall be kept within acceptable levels at all times in conformance with Title II, Administration Rules, Chapter 43, Community Noise Control, State Department of Health, Public Health Regulations. The Contractor shall obtain the pay for community noise permit from the State Department of Health when the construction equipment or other devices emit noise at levels exceeding the allowable limits. .

All internal combustion engine-powered equipment shall have mufflers to minimize noise and shall be properly maintained to reduce noise to acceptable levels.

3.07 POST CONSTRUCTION CLEANUP: The Contractor shall clean up areas used for construction.

3.08 RESTORATION OF LANDSCAPE DAMAGE: The Contractor shall restore all landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Such restoration shall be in accordance with the plan submitted for approval by the Engineer. This work will be accomplished at the Contractor's expense.

3.09 MAINTENANCE OF POLLUTION CONTROL FACILITIES: The Contractor shall maintain all constructed facilities and portable pollution control devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.10 TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL: The Contractor shall train his personnel in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities (vegetative covers and instruments required for monitoring purposes) to ensure adequate and continuous environmental pollution control.

END OF SECTION

SECTION 01440 - ARCHAEOLOGICAL FINDINGS

PART 1 - GENERAL

1.01 PRESERVATION AND RECOVERY OF HISTORICAL, ARCHAEOLOGICAL. AND CULTURAL RESOURCES: Existing historical, archaeological, and cultural resources within the Contractor's work area will be so designated by the Engineer if any have been identified. The Contractor shall take precautions to preserve all such resources as they existed at the time they were pointed out to him. The Contractor shall provide and install all protection for these resources so designated and shall be responsible for their preservation during this contract. If during excavation or other construction activities in areas with existing or known resources, as well as in any other work area, any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Such temporary suspension of work shall not be attributable to the Contractor. These resources of cultural remains (prehistoric or historic surface or subsurface) include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, parings, wall, or other constructed features; and any indication or agricultural or other uses. Upon such discovery or find, the Contractor shall immediately notify the Engineer. When so notified, the Engineer will notify the State Historic Preservation Officer (SHPO) for further direction.

As directed by the Engineer, the Contractor may be allowed to continue any operation which would not further disturb the site(s); however, all work within the protected area shall be suspended until the Engineer is notified by the SHPO that all investigations or salvage operations have been completed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01750 - GUARANTEE

PART 1 - GENERAL

1.01 GENERAL

A. The Contractor guarantees all materials and equipment furnished to be in operable condition upon 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.

B. He further guarantees all such materials and equipment against defects and poor workmanship and, to the extent that he 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.

C. The period of this guarantee shall commence upon acceptance of the work by the appropriate agency, and shall extend through the project performance evaluation period not to exceed 1 year 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 for the corrected work.

D. The Contractor shall correct all defects or failures discovered within the guarantee period. The appropriate agency will give the Contractor prompt written notice of such defects or failures following their discovery. The Contractor shall commence corrective work within five (5) days following notification and shall diligently prosecute such work to completion. 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. Any period that a particular equipment is not operable due to its failure shall not be considered as a part of the guarantee period. The guarantee period shall be extended for a like period. If due to failure of other equipment the equipment is unable to perform its intended function, the guarantee period shall be extended for a like period. Time that equipment is operating shall be counted as applying to the warranty. Such time shall be determined by use of plant operator's log or other suitable documentation.

F. If the Contractor falls to perform corrective work in the manner and within the time stated, the Department of Hawaiian Home Lands (DHHL) may proceed to have such work performed at the

G. Contractor's expense and his sureties will be liable therefor. The DHHL shall be entitled to reasonable attorney's fees and court costs necessarily incurred by the Contractor's refusal to honor and pay such costs of corrective work.

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

I. The rights and remedies of the DHHL 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.

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

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 02100 – CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED

A. Furnish all labor, materials, equipment and tools necessary to accomplish all clearing and grubbing work as indicated on the plans and as specified herein.

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

C. 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 plans and/or described herein or may vary therefrom.

D. All debris of any kind accumulated from clearing or grubbing shall be disposed of off-site weekly and the whole area left clean. The Contractor shall be required to make all necessary arrangements related to the proposed place of disposal.

E. Burning onsite will not be permitted.

1.03 RELATED WORK IN OTHER SECTIONS

Trench Excavation and Backfill..... Section 02221

Temporary Soil Erosion Control..... Section 02270

SUBSURFACE SOIL DATA: Subsurface soil investigations have been made at the La'i'opua Village 4 Akau and Hema Subdivisions project site by Fewell Geotechnical Engineers, Ltd. entitled "Subsurface Investigation Report La'i'opua Village 4 Akau and Hema Subdivisions, Kealakehe, Hawaii, Hawaii" dated March 22, 2012. Test pit logs are shown in the soils report. A copy of the complete soils report is available on the DHHL website or the bid compact disc.

The Contractor is expected to examine the site and the record of soil investigation and decide for himself the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or condition at locations other than places shown and at the time investigations were made.

The soils report and its recommendations are made part of these specifications except where expressly modified herein.

PART 2 – PRODUCTS (NOT USED)

## PART 3 – EXECUTION

### 3.01 PROTECTION

A. Adequate precautions shall be taken before commencing and during the course of the work to insure the protection of life, limb and property.

B. The Contractor shall protect from damage all surrounding structures, tress, plants, grass, walks, pavements, utility boxes, etc. Any damages will be repaired or replaced by the Contractor to the satisfaction of the Engineer.

### 3.02 PERMITS

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

### 3.03 BARRICADE

Erect temporary barricade to prevent people and animals from entering the project area, to the extent as approved by the Engineer. Such barricades shall not be less than 5'-0" in height. The extent of barricades may be adjusted as necessary with the approval of the Engineer. This work shall be accomplished to the satisfaction of DHHL and at no extra cost to DHHL. Barricades shall be removed upon completion of work and job site premises left clean.

### 3.04 MAINTAINING TRAFFIC

A. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, etc.

B. When necessary, the Contractor shall provide, erect and maintain lights, barriers, etc., as required by traffic and safety regulations with special attention to protection of life.

### 3.05 CONSTRUCTION LINES, LEVELS AND GRADES

A. The Contractor shall verify all lines, levels and elevations indicated on the plans 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 with his instruction. The Contractor shall not be entitled to extra payment if he fails to report the discrepancies before proceeding with any work whether within the area affected or not.

B. All lines and grades shall be established by a Surveyor licensed in the State of Hawaii.

C. Starting of clearing and grubbing operations will be construed to mean that the Contractor agrees that the existing grades, inverts, and improvements are essentially correct as indicated.

3.06 DEMOLITION, REMOVAL AND RELOCATION

A. Execute all work in an orderly manner, with proper safety precautions observed at all times. Provide warning signs, lights, barricades, etc. as required or as directed by the Engineer.

B. Removed material having no salvage value, as determined by the Engineer, shall become the property of the Contractor and shall be removed from the premises at no cost to the County.

3.07 CLEARING AND GRUBBING

A. The Contractor shall clear off and remove from the area to be graded, all rubbish, grass and weeds, stumps, large roots, buried logs, garbage, boulders and other unsuitable material. Where soft wet soils are encountered, light equipment should be used.

B. No excavation or filling shall be undertaken until area has been cleared and grubbed.

C. Recycling green waste: Where a commercial composting or recycling facility is available on the island on which the project is situated and where economically practical, deliver the green waste material (e.g. yard debris and tree trimming, logs and stumps, untreated wood, etc.) to a composting or recycling facility for recycling. Confirm the types and condition of acceptable green waste material with the composting facility and pay all applicable charges. Submit a copy of the receipt for disposal (e.g. tipping fees) to the Engineer.

3.08 DISPOSAL

A. All removed materials with no salvage value shall be removed from the premises. All removed material with salvage value as determined by DHHL shall be neatly stored on the premise as direction by DHHL.

B. Excessive accumulation of debris, rubbish and dirt will not be permitted. All material or debris shall be removed regularly from the site. A fog spray or other dust settling method shall be employed to dampen areas where there is excessive dust and dirt.

C. All items to be later reused shall be carefully removed, inspected by DHHL and neatly stored away. Items damaged during the removal work shall be replaced with new of the matching type, size and shape at no cost to DHHL.

D. Comply with Federal, State and local hauling and disposal regulations.

3.09 CONTRACT ZONE LIMITS

The Contract Zone Limits shown on the plans indicate only in general the limits of the work involved. The Contractor, however, is required to perform any and all necessary and incidental work which may fall outside of these demarcation lines. The Contractor is

also expected to confine all of his construction activities within the Contract Zone Limits, except as provided hereinbefore, and not to spread his equipment indiscriminately about the area.

3.10 CLEAN-UP

Clean up and remove all debris accumulated from construction operations from time to time, when and as directed. Upon completion of the construction work and before final acceptance of work, remove all surplus materials, equipment, etc., and leave entire job site clean and neat to the satisfaction of the Engineer.

3.11 UNSUITABLE EXCAVATED MATERIAL

The Contractor shall remove from the site all unsuitable excavated material unless specified otherwise by the Engineer. The unsuitable material not containing organic material shall be hauled and placed in the excavation for coralline material where shown on the drawings. Unsuitable material containing organic material shall be disposed of off-site.

Removal, including hauling and disposal, of the unsuitable material will not be paid for directly, but shall be considered incidental to the project.

END OF SECTION

SECTION 02202 – STRUCTURAL EXCAVATION, BACKFILL AND COMPACTION

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary for excavating and backfilling trench for water lines, drain lines, sewer lines, electrical units, and appurtenances in conformity with the dimensions, profiles, section and details shown on the plans and the Water System Standards of the Department of Water Supply, County of Hawaii, Station of Hawaii, 2002 and as supplemented and/or modified herein. The Contractor shall be solely responsible for the means, techniques, procedures, and sequences for dewatering and bracing and shoring the excavation.

1.03 RELATED WORK IN OTHER SECTIONS

Site Earthwork ..... Section 02210
Trench Excavation and Backfill ..... Section 02221

SUBSURFACE SOIL DATA: Subsurface soil investigations have been made at the La'i'opua Village 4 Akau and Hema Subdivisions project site by Fewell Geotechnical Engineers, Ltd. entitled "Subsurface Investigation Report La'i'opua Village 4 Akau and Hema Subdivisions, Kealakehe, Hawaii, Hawaii" dated March 22, 2012. Test pit logs are shown in the soils report. A copy of the complete soils report is available on the DHHL website or the bid compact disc.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXCAVATION

A. Excavation for structures shall be carried down to elevations required by the drawings and shall be graded level on unfilled, undisturbed, firm bearing soil. Soft spots shall be compacted to unyielding firmness if soil conditions are suitable and approve footing cuts may be made exact dimensions of the footing.

B. If any conditions not described in the Contract Documents such as perched water, seepage, lava tubes or blisters of a potentially adverse nature, these conditions shall be immediately brought to the attention of the Geotechnical Engineer so supplemental recommendations can be made to address these conditions.

C. The Contractor is responsible for providing protection from erosion, ponding and storm water pollution. Construction Best Management Practice (BMP) shall be utilized for the duration of the project.

3.02 UNSUITABLE EXCAVATED MATERIAL

The Contractor shall remove from the site all unsuitable excavated material unless specified otherwise by the Engineer. The unsuitable material not containing organic material shall be hauled and placed in the excavation for coralline material where shown on the drawings. Unsuitable material containing organic material shall be disposed of off-site.

Removal, including hauling and disposal, of the unsuitable material will not be paid for directly, but shall be considered incidental to the project.

END OF SECTION

SECTION 02210 – SITE EARTHWORK

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, services, equipment and related items necessary to excavate, fill, remove, transport, stockpile and dispose of all materials within the limits of the project required to construct the site work improvements in accordance with these specifications, dimensions, sections and details shown on the plans, and the approval of the Department.

1.03 RELATED WORK IN OTHER SECTIONS

Trench Excavation and Backfill..... Section 02221
Temporary Soil Erosion Control..... Section 02270

SUBSURFACE SOIL DATA: Subsurface soil investigations have been made at the Laiopua Village 4 Subdivision project site by Fewell Geotechnical Engineers, Ltd. entitled "Subsurface Investigation Report Laiopua Village 4, Akau and Hema Subdivisions, Kealakehe, Hawaii, Hawaii" dated March 22, 2012. Test pit logs are shown in the soils report. A copy of the complete soils report is included as part of the bid documents.

The Contractor is expected to examine the site and the record of soil investigation and decide for himself the character of materials to be encountered. The Engineer will not assume responsibility for variations of subsoil quality or condition at locations other than places shown and at the time investigations were made.

The soils report and its recommendations are made part of these specifications except where expressly modified herein.

1.04 PROTECTION

A. Erosion Control: The Contractor shall incorporate into his work schedule the Temporary Erosion Control Measures and the Permanent Erosion Control procedures indicated on the plans and as specified in the contract.

B. Dust Control: Every effort shall be made by the Contractor to keep dust to a minimum. Spraying the ground with water or other means of control shall be used wherever possible. The Contractor shall have an adequate supply of water for moisture conditioning of fill material.

Without limiting the generality or applicability of other indemnity provisions of the contract, the Contractor agrees that he shall indemnify and hold harmless the Department from and against all suits, actions, claims, demands, damages, costs and expenses (including but not limited to attorney's fees) arising out of any damage to any property whatsoever or injury to any person whomsoever, in any way caused or contributed to by dust from the Contractor's operations.

C. Existing Utilities and Work Areas: The Contractor shall be responsible for the protection of existing surface and subsurface utilities and poles within and abutting the project site, trench excavations and other work areas. Any damages will be repaired or replaced by the Contractor to the satisfaction of the Engineer.

D. Finished Grades and Subgrades: All subgrades shall be kept moist until covered by subbase, base course, or concrete. All finished grades shall be kept moist until covered by landscaping or other permanent groundcover. Where shrinkage cracks are noted after compaction of the subgrade or finished grade, the subgrade or finished grade shall be rescarified, moisture-conditioned to above the optimum moisture content, and recompacted to the specified requirement at no additional cost to the Department. During construction, the Contractor shall properly grade and maintain all excavated surfaces to provide positive drainage and prevent ponding of water. In the event that ponding of water caused softening of the subgrades, the Contractor shall remove the soft soils and shall backfill the excavation with compacted fill at no additional cost to the Department.

## PART 2 – PRODUCTS

### 2.01 MATERIALS

For Laiopua Village 4, fills, backfills, select borrow, large over-sized rocks and boulders and rock fill shall conform to the soils report, entitled “Subsurface Investigation Report Laiopua Village 4, Akau and Hema Subdivisions, Kealakehe, Hawaii, Hawaii” dated March 22, 2012 and the plans entitled “Laiopua Village 4 Subdivision, Phase 2 - Hema”.

## PART 3 – EXECUTION

### 3.01 GRADING

A. General: All cuts, fills and trenching to be constructed shall be monitored by a licensed geotechnical consultant (soils engineer) retained by DHHL, who shall approve all foundation preparation, fill material, methods of placing and compaction and perform field density tests during the grading. Geotechnical engineer shall notify DHHL that the work appears to be in general conformance with the project documents based on observations and testing. No deviation from these specifications shall be made except upon the written approval of the Engineer and/or other public agencies having jurisdiction.

B. Excavations: All excavation shall be made to the lines and grades as shown on the project plans. All excavation shall be inspected and approved by the Geotechnical Engineer. Where conditions encountered require, he shall direct the necessary modifications to be made.

Suitable material from excavation shall be used in the fill, and unsuitable material free of organic material from excavation shall be disposed of in the designated borrow site to replace material borrowed.

C. Drainage: Care shall be exercised during grading so that areas involved will drain properly. Water shall be prevented from running over the slopes by the temporary berms, drainage swales, diversion by ditches, silting basins and the detention basin.

D. Field Testing: The Engineer shall be notified at least two days prior to the start of grading. A pre-grading conference shall be held between the parties involved so as to discuss methods of operations, site problems and scheduling. Field density tests shall be taken by the Geotechnical Engineer retained by DHHL.

E. Supervision: At all times, the Contractor shall have a responsible field superintendent on the project in full charge of the work with authority to make decisions. He shall cooperate with the Engineer in carrying out the work. Any instructions given to him by the Engineer shall be considered to have been given to the Contractor personally.

F. Rainy Weather: No fill shall be placed, spread or rolled during unfavorable weather. When the work is interrupted by rain, operations shall not be resumed until field tests by the Engineer indicate that conditions will permit satisfactory results.

G. Unforeseen Conditions: If unforeseen or undetected soil conditions such as soft spots, existing utility trenches, structure foundations, voids or cavities, boulders, seepage water or expansive soil pockets, etc. are encountered, unless otherwise indicated of provided for in the proposal, the Contractor at his sole expense shall make all necessary corrective measures in the field as such conditions are detected.

Large lava tubes, defined herein as lava tubes or cavities that extend greater than 25 feet in either direction, beyond the end points of any opening that may be created by work under this contract, and exceed 5 feet in its smallest diameter or width as measured throughout the 25-foot length, and/or show obvious evidence of transmitting water, are excluded from this requirement.

3.02 UNSUITABLE EXCAVATED MATERIAL: The Contractor shall remove from the site all unsuitable excavated material unless specified otherwise by the Engineer. The unsuitable material not containing organic material shall be hauled and placed in the excavation for coralline material where shown on the drawings. Unsuitable material containing organic material shall be disposed of off-site.

Removal, including hauling and disposal, of the unsuitable material will not be paid for directly, but shall be considered incidental to the project.

END OF SECTION

SECTION 02215 – BLASTING

PART 1 – GENERAL

1.1 DESCRIPTION:

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

B. The work specified in this section shall also consist of any blasting used in any excavation process.

1. Definition: The term “controlled blasting” is defined as excavation of rock in which the various elements of the blast, including hole size, depth, spacing, burden, charge, size, distribution, and delay sequence are carefully balanced and controlled to provide a distribution of charge that will excavate the rock to the required limits with smooth surfaces. Controlled blasting minimizes overbreak, stressing, and fracturing of the rock beyond the design lines. Smooth wall blasting, presplitting, cushion blasting, and line drilling are examples of operations included in the term controlled blasting.

1.2 QUALITY ASSURANCE:

A. Workforce Experience-Blasting

1. The Contractor shall retain the services of a recognized blasting consultant experienced on similar projects to develop all controlled blasting designs and details.

2. Blasting supervisors shall have a minimum of five years experience in supervising the loading and firing of charges for excavation of tunnels and shall have all necessary licenses and permits required by Federal, State and local agencies or others having jurisdiction. The Contractor shall certify that blasting supervisors meet this experience and license requirement.

B. Requirements of Regulatory Agencies

1. Permits: The Contractor shall obtain the required permits for all blasting and other operations.

2. Reference Codes: Applicable ordinances, codes, statutes, rules and regulations of the City & County of Honolulu, the State of Hawaii, and the Federal government shall be complied with during performance of the work.

1.3 RELATED WORK IN OTHER SECTIONS

A. The Contractor must submit a letter of indemnification to the DHHL for damages and injuries caused by blasting as determined by the Engineer. This letter must meet the written acceptance of DHHL prior to award of the contract.

B. Blast Design: Specifics of proposed blast design shall be submitted prior to the start of blasting operations and prior to each change in blast design, and shall include the following:

1. Drilling pattern, hole diameters, spacing, depth, and inclination.

2. Type, strength, amount in terms of weight and number of cartridges of explosives proposed for use in each hole, on each delay and the total for the blast.

3. Distribution of the charge in the holes, priming of each hole, and stemming of holes.

4. Type, sequence and number of delays, delay pattern, wiring diagram for blast, size and type of hookup lines and lead lines, type and capacity of firing source and type of condenser discharge blasting machine.

5. Written evidence of the qualifications of the person or persons who will be directly responsible for supervising, loading, and firing of the shot.

6. Proposed schedule of dates/times of each shot. The Contractor shall notify the surrounding subdivisions and commercial properties of blasting schedule a minimum of two (2) weeks prior to commencing blasting activities.

7. Blast design shall be subject to review and acceptance by the Engineer. Inappropriate design will be rejected. Review by the Engineer of the blast design and techniques shall not relieve the Contractor of responsibility for the accuracy, adequacy, and safety of the blasting operations, or for exercising proper fired supervision and judgment, and producing the end results required by these specifications.

C. Daily Records: Daily records of all blasting operations shall be maintained, and the Engineer shall be provided with one copy of the record of each day's work on the following work day. The following data shall be included in the daily record:

1. Unusual occurrences, including rock falls, unstable ground, groundwater problems, work delays, and equipment malfunction, and time of each occurrence.

2. Complete description of each blast round used, including:

a. Date, time and limits of blast.

b. On a diagram of the appropriate blast pattern, indicate holes not drilled, drilled but not loaded, changes in spacing or in pattern of delays or in loading of holes and burden of round.

c. Amount of explosives used by weight and number of cartridges.

d. Total number of delays used and number of holes for each delay period.

e. An evaluation of the blast indicating areas of significant overbreak and planned adjustments for the next blast.

f. Location and elevation of significant rock strata boundaries, and brief description of the rock.

PART 2 – MATERIALS

2.1 BLAST MONITORING EQUIPMENT: The Contractor shall provide a minimum of two, 10 to 200 Hertz three-component recording blast seismographs with three-component seismic wave paper trace, self-calibration capability, variable trigger level setting, and digital peak particle velocity memory operation (in inches per second). One seismograph shall have an air wave detector for monitoring air blast overpressures. These devices shall be maintained by Contractor for use in monitoring blasting vibrations.

PART 3 – EXECUTION

3.1 PROTECTIVE MEASURES

A. All excavation shall be protected and guarded against danger to life, limb and adjacent properties.

B. Shoring, as required to safely preserve the excavations and earth banks free from damages resulting from the work, shall be provided and installed by the Contractor.

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

D. The Contractor shall conduct operations with minimum interference to streets, driveways, sidewalks, passageways, traffic, and adjacent properties, etc.

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.

3.2 LAYING OUT:

A. The laying out of baselines, establishment of grades and staking out the entire work shall be done by a Licensed Professional land Surveyor, licensed in the State of Hawaii, at the expense of the Contractor, and he shall be solely responsible for their accuracy. The Contractor shall erect and maintain substantial batter boards showing construction lines and levels.

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

3.3 JOB CONDITIONS FOR BLASTING

A. General Safety Requirements:

1. Work shall be performed in a manner to minimize hazards and exposure of the public, construction personnel and equipment to hazardous and potentially hazardous conditions.

2. The Contractor shall coordinate all blasting operations with other contractors. The Contractor shall make all reasonable effort to perform his work with minimal disruptions to work by other contractors.

3. Contractor shall physically sweep and survey the area to be shot immediately before a blast and document who did it and that it was done since kids are known to loiter in the Village 4 area.

4. Contractor shall place personnel at commonly known approaches to the blasting zones along Keanalehu Drive, Manawalea Street, or known footpaths during blasting operations to divert pedestrians from the site during blasting operations.

5. Contractor shall place warning sign at obvious approaches to blasting areas along Keanalehu Drive, Manawalea Street, and known footpaths.

6. Contractor shall notify in writing, the Kaniohale Community Association, Kealakehe High School, and Kealakehe (Elementary/Middle) School of the planned dates of blasting 72 hours in advance.

B. Blasting

1. Blasting patterns shall be maintained so as not to exceed 2 inches per second peak radial particle velocity at the ground line of the nearest structure for distances greater than 35 feet.

2. For utilities and improvements closer than 35 feet, special procedures shall be implemented and 2 inches/second velocities will be permitted if no damage is sustained. The Contractor shall adopt trial blast

procedures with monitoring or vibrations and inspection for damage. Charge weights per delay shall be adjusted as experience indicates.

3. Blasting operations shall be controlled so that air blast overpressures shall not exceed 0.02 pounds per square inch at any structure.

4. The Contractor shall take measurements to determine if the Contractor's operations are exceeding the specified particle velocity and overpressure limitations. The data will be available to the Engineer.

5. If the data indicates that the particle velocity or overpressure limitations are not being met, measures shall be taken to reduce particle velocity or overpressure to the specified levels, including such measures as reducing the size of charge, changing blasting delays used, and shortening length of blast round.

C. Damages:

Reference is made to DHHL Interim General Conditions 2.5, 7.17 and 7.19 which shall be applicable to any blasting conducted by the Contractor intended for the work under this contract.

## PART 4 – EXECUTION

4.1 MEASUREMENT: Blasting will not be measured for payment

4.2 PAYMENT: Blasting will be considered incidental to the various contract items and will not be paid for separately.

END OF SECTION

SECTION 02221 – TRENCH EXCAVATION AND BACKFILL

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary for excavating and backfilling trench for water lines, drain lines, sewer lines, electrical units, CATV, and appurtenances in conformity with the dimensions, profiles, section and details shown on the plans. Work shall be governed by Section 206 of the State of Hawaii Standard Specifications for Road, Bridge and Public Works Construction as amended herein. The Contractor shall be solely responsible for the means, techniques, procedures, and sequences for dewatering and bracing and shoring the excavation.

1.03 RELATED WORK IN OTHER SECTIONS

Site Earthwork ..... Section 02210

Storm Drainage System ..... Section 02721

1.04 SUPPLEMENTS: All excavated material shall be unclassified regardless of its composition, whether soil, solid rock, coral, asphalt pavement, concrete, rubbish or other material.

The installation and removal of sheeting shall be done in a manner that will not cause settlement or disturbance of the pipe cradle material.

All existing ground, roadways and other improvements damaged, destroyed or disturbed shall be, at the Contractor's expense, replaced, reconstructed and restored in kind to an equal or better condition satisfactory to the Engineer.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials for roads shall be in accordance with the following sections of the State of Hawaii Standard Specifications for Road, Bridge and Public Works Construction, as revised, except as amended on the plans and/or in the specifications herewith:

Trench Backfill Material ..... Section 703

B. Trench Backfill: Trench backfill shall meet the requirements of Structure Backfill A or Trench Backfill A of Section 703.20 and 703.21 respectively, of the Hawaii Standard Specifications for Road, Bridge and Public Works Construction.

C. Pipe Cushion: Pipe cushion shall consist of No. 3B fine gravel as described by ASTM C33 (No. 67 gradation).

PART 3 – EXECUTION

3.01 TRENCH BOTTOMS: Should the trench bottom be within 2 feet of the soft clayey material, the trench shall be overexcavated to provide 2 feet of suitable material under the bottom of the trench. Suitable material shall be coralline material or crushed rock required by the particular utility company and installed as specified herein.

Should voids be encountered when trenching for utilities, the contractor shall provide for the placing and compacting of additional fill material to fill any voids encountered to obtain a level trench bottom. The materials, equipment and labor required shall be considered incidental to excavation for utilities in the proposal schedule.

3.02 PLACEMENT AND COMPACTION: Trench backfill shall be moisture-conditioned to within 3 percent of the optimum moisture content, placed in level lifts not exceeding 8 inches in loose thickness and compacted to a minimum of 90 percent maximum dry density per ASTM Test Method D1557.

END OF SECTION

SECTION 02270 – TEMPORARY SOIL EROSION CONTROL

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Submit three (3) sets of the erosion control materials for approval by the Engineer. Furnish all labor, materials, services, equipment and related items necessary to implement the temporary erosion control measures, submitted separately, as required by these specifications and as ordered by the Engineer during the life of the contract to control water pollution through the use of berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

A. Temporary erosion and siltation control measures as described herein shall be applied to any erodible material within this project, including local material sources and work areas.

B. The Contractor shall be responsible for providing the necessary erosion control measures which are shown on the plans or which may be ordered by the Engineer. All grading operations shall be performed in conformance with the applicable provisions of the "Water Pollution Control and Water Quality Standards" contained in the "Public Health Regulations," State Department of Health.

C. The Contractor shall be responsible for promptly (next day after storms) removing all silt and debris resulting from his work and deposited in drainage facilities, roadways, neighboring lands, and other areas.

1.03 RELATED WORK IN OTHER SECTIONS

Site Earthwork ..... Section 02210

PART 2 – PRODUCTS

2.01 MATERIALS

A. Mulches: To be bagasse, hay, straw, fiber mats, netting, wood cellulose, bark, wood chips, or other suitable material acceptable to the Engineer and shall be reasonably clean and free of noxious weeds and deleterious materials.

B. Slope Drains: To be constructed of fiber mats, plastic sheets, or other materials acceptable to the Engineer.

## PART 3 – EXECUTION

### 3.01 TEMPORARY EROSION CONTROL

A. The Engineer has the authority to limit the surface area exposed by clearing and grubbing and to limit the surface area exposed by excavation, borrow and fill operations. The Engineer may also direct the Contractor to provide immediate, permanent, or temporary pollution control measures to prevent contamination of streams, lakes, ponds, drainage channels and pipes, roads, neighboring lands, and other areas.

Except for specified measures which may be shown on the plans, the Contractor shall determine the appropriate erosion control measures to use. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, and slope drains, and the use of temporary mulches, mats, and grassing, or the construction and use of other control devices or methods as necessary to control erosion.

B. The Contractor shall incorporate all erosion control measures shown in the plans. The erosion controls may be modified as necessary to adjust to conditions that develop during construction. All modifications are subject to approval by the Engineer.

C. The Contractor shall limit the surface area exposed by grubbing, stripping of topsoil, and grading to that which is necessary for him to perform the next operation and which is within his capability and progress in keeping the finish grading, mulching, grassing, and other such pollution control measures current.

The grubbing of the vegetative root mat and stumps and the stripping of topsoil shall be confined within the limits of grading which can be actively and continuously prosecuted within 15 calendar days. The area to be graded shall be limited to the minimum area necessary to accommodate the Contractor's equipment and work force and shall not at any time exceed 15 acres, unless otherwise stated on plans, without prior approval of the Engineer.

Any area remaining bared or cleared for more than 10 calendar days and which is not within the limits of active construction shall be immediately hydro-mulch seeded or remedied as directed by the Engineer at the Contractor's expense without cost to the Department. All areas where finish grading has been completed shall be grassed within three calendar days after the completion of grading for that area.

D. The Contractor shall, at the end of each work operation in any one day, shape the earthwork in such a manner as to control and direct the runoff to minimize the erosion of soils. He shall construct earth berms along the top edges of embankments or along the property line with adjacent properties, streams and water channels, to intercept any runoff. Temporary slope drains shall be provided to carry runoff from the top of cuts and fills. Temporary facilities for controlled discharges shall be provided for runoff impounded, directed, or controlled by project activities or by any erosion control measure employed.

E. Cut slopes shall be shaped, topsoil added if necessary, and planted as the work progresses. In no case shall the exposed surface be greater than 15 feet in height. Whenever major excavation is suspended or halted and the slope is bared for more than 15 consecutive days, the exposed surfaces shall be hydro-mulch seeded or protected as directed by the Engineer at the Contractor's expense without cost to the Department of Hawaiian Home Lands.

Fill slopes shall be finished as specified and in accordance with the requirements outlined for cut slopes above.

F. Construction of berms, cofferdams, or other such construction in or near the vicinity of streams, ponds, waterways, or other bodies of water shall be with approved materials.

G. The temporary erosion and siltation control measures outlined in these specifications are minimum requirements and shall not preclude the provision of any additional measures which the Contractor may deem necessary. Damages caused by the erosion of soils and the pollution of downstream areas shall be the responsibility of the Contractor and all costs for repairing, correcting, replacing and cleaning damaged or polluted facilities shall be borne by the Contractor.

END OF SECTION

SECTION 02500 – ROAD PAVEMENT

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, asphalt concrete pavement for roads in conformity with the dimensions, profiles, sections and details shown on the plans and specified herein.

1.03 SUBMITTALS: The Contractor shall submit for approval, the job mix formula for the Asphalt Concrete to be supplied for the project. The job mix formula shall indicate the source of aggregates and grades of bituminous material to be used in the mix. The total amount of bituminous binder in the mix shall be between 4.5 percent to 8.0 percent by weight depending on the specified Asphalt Concrete Mix. All test data used to develop the job mix formula shall also be submitted. The job mix formula for the mixture shall be in effect until modified in writing by the Engineer. Should a change in sources of materials be made, a new job mix formula shall be established and approved before the new material is used.

The bituminous mixtures shall be designed using procedures contained in Chapter III, Marshall Method of Mix Design, of the Asphalt Institute's Manual Series No. 2 (MS-2), current edition, and shall meet the requirements of Table I below:

TABLE I
REQUIREMENTS FOR MARSHALL METHOD OF MIX DESIGN

| Test Property | Mix #2 | Mix #3 | Mix #4 | Mix #5 |
|---|---|---|---|---|
| Number of Blows | 75 | 75 | 75 | 75 |
| Stability, lb (minimum number) | 2,000 | 2,000 | 2,000 | 2,000 |
| Flow, 0.01 in. | 8 - 16 | 8 - 16 | 8 - 16 | 8 – 16 |
| Percent air voids | 4 - 6 | 4 - 6 | 4 - 6 | 4 – 6 |
| Percent air voids in mineral aggregate (min.) | 13 | 14 | 16 | 18 |

The job-mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size and a single percentage of bituminous material to be added to the aggregate.

After the job-mix formula is established, all mixtures furnished for the project shall conform thereto within the following ranges of tolerances in Table II below:

TABLE II
RANGE OF TOLERANCES FOR JOB-MIX FORMULA

| | |
|---|---|
| Passing No. 4 and larger sieves | ± 7 percent |
| Passing No. 8 to No. 100 sieves (inclusive) | ± 4 percent |
| Passing No. 200 sieve | ± 2 percent |
| Bitumen | ± 0.4 percent |

Acceptance Sampling and Testing of the Bituminous Mixture.

A. The Contractor shall provide laboratory testing for control and acceptance functions during periods of mixture productions: One (1) field Marshall Test, asphalt content test, gradation analysis, and specific gravity test for each mixture.

B. The compacted mixtures of the in-place pavement shall not be less than 91 percent of the specific gravity (ASTM D2041, commonly called the Rice Method) of the combined mixture without voids.

C. Two (2) core or cut samples per street for the determination of the thickness and density of the completed pavements (or using nuclear gauge for determination of density) shall be obtained and/or tested by the Contractor at no extra cost (including that to restore the affected area). The size and locations of the samples will be directed by the Engineer.

D. All data for the control and the acceptance testing shall be submitted to the DHHL as specified in the general conditions.

## PART 2 – PRODUCTS

2.01 MATERIALS: Materials for roads shall be in accordance with the following sections of the State of Hawaii Standard Specifications for Road, Bridge and Public Works Construction, except as amended on the plans and/or in the specifications herewith:

Excavation and Embankment ..... Section 203
Aggregate Subbase Course ..... Section 305
Aggregate Base Course ..... Section 304
Hot Mix Asphalt Pavement ..... Section 401
Street Survey Monuments ..... Section 614

To include:

Recycled Glass Content .....HRS 103D-407

Asphalt cement grade shall be PG 64-16.

PART 3 – EXECUTION

3.01 INSTALLATION: Stake out the areas to be paved using wooden stakes on which the final finish elevations, base course and subgrade elevations are clearly marked. All stakes and elevations shall be approved by the Engineer before any work is done.

Contractor shall fine grade the subgrade under the pavement and sidewalk by bringing the subbase or coralline material to the proper grade from the mass grade elevations to the proper shape before installing the base course or concrete sidewalk.

Install roadways in accordance with the applicable sections noted hereinbefore.

3.02 COMPACTION TESTING: The Contractor shall notify the Engineer at least 5 days prior to the start of fine grading for the roadway subgrade. Field density tests will be taken on the roadway subgrade, and aggregate base course by the Geotechnical Engineer retained by the Contractor. The Contractor shall be responsible for any corrective measures required as a result of inadequate compaction.

3.03 CLEANING OF SURFACES: Immediately before applying the prime coat or tack coat, the surface to be treated shall be swept clean of all loose material, dirt, excess dust or other objectionable material. No application shall be permitted when the surface to be treated is appreciably damp or when weather conditions are unsuitable.

3.04 ADJUSTMENT OF EXISTING UTILITY STRUCTURES TO FINISHED GRADE: Adjust existing utility structures to finished grade in accordance with the Hawaii Standard Specifications for Road, Bridge and Public Works Construction.

3.05 REPAIRS OF EXISTING ASPHALT CONCRETE PAVEMENTS: Repair to the original conditions and to the satisfaction of the Engineer all existing asphaltic concrete pavements that have been damaged by construction activities, including damage done by heavy equipment.

3.06 PLACING ASPHALT CONCRETE PAVEMENT: Install asphalt concrete pavement as specified in Section 401 of the Hawaii Standard Specifications for Road, Bridge and Public Works Construction.

END OF SECTION

SECTION 02520 – CONCRETE CURBS, GUTTERS, SIDEWALKS, DRIVEWAY APRONS AND CURB RAMPS

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, concrete curbs, gutters, sidewalks, driveway aprons and wheelchair ramps in conformity with the dimensions, profiles, sections and details shown on the plans.

1.03 APPLICABLE SECTIONS: Work shall be in accordance with the following sections of the DPW Standard Specifications, except as amended on the plans and/or in the specifications herewith:

| | |
|---|---|
| Portland Cement Concrete | Section 39 |
| Curb and/or Gutter | Section 41 |
| Sidewalk | Section 42 |
| Reinforced Concrete Driveways | Section 46 |
| Reinforcing Steel | Section 48 |

PART 2 – PRODUCTS

2.01 MATERIALS: Materials shall conform to the sections of the DPW Standard Specifications noted hereinbefore.

PART 3 – EXECUTION

3.01 INSTALLATION: The Contractor shall be responsible for precisely laying out the curbs, gutters, sidewalks, driveway aprons and curb ramps shown on the contract plans in accordance with the sections of the DPW Standard Specifications noted hereinbefore. The Contractor shall note that the plan and profile curb grades are based on the standard 6-inch high curbs and shall make necessary adjustments for the difference in height of the rolled curb as shown in the DPW Standard Details.

3.02 QUALITY CONTROL FOR CURB RAMPS: The Contractor shall install curb ramps to the dimensions and grades shown in the plans. Installation of the curb ramps shall be within the tolerance range shown in the table below.

| CONSTRUCTION TOLERANCE | | |
|---|---|---|
| Surface Slope per Plans | Allowable Slope Tolerance | Allowable Flatness Tolerance |
| Less than 5% | +0.9% max. | 1/4” max. gap |
| 5% - 8.3% | +1.2% max. | 3/8” max. gap |
| Greater than 8.3% | +1.5% max. | 1/2” max. gap |

| For Horizontal Plan Measurements, Length of Intended Dimension | Horizontal Tolerance Allowed |
|---|---|
| Less than 12” | +1/4” or -1/4” |
| 12” - 36” | +3/8” or -3/8” |
| Greater than 36” | +1/2” or -1/2” in each 10’ |

The method of measuring the surface requires a 24” long digital level to be placed so, when set on the measured sloped surface, it reads the steepest slope of any part of the measured surface.

The method of measuring flatness requires a 24” long level to be placed so it is centered over any trough or balanced on a ridge with equal gap at both ends of the level. Measure the gap under the level at troughs and at the end of the level at ridges.

Horizontal measurements are to be made with a steel tape.

3.03 MEASUREMENT AND PAYMENT FOR CURB RAMPS: Concrete curb ramps shall be measured for payment by each in place complete. Payment of the accepted curb ramps shall be full compensation for excavating, backfilling, installing reinforcing steel, concrete expansion joints, special drop curbs, bed course material, detectable warning strips, standard curb, curb ramp integral curb and gutter, curb ramp sidewalk and furnishing all labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay for the accepted curb ramps separately.

END OF SECTION

## SECTION 02577 - PAVEMENT MARKERS, STRIPING AND MARKINGS

### PART 1 - GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials and equipment required to accomplish the installation of all pavement markers, reflectorized white and yellow traffic pavement striping and other markings in conformance to the DPW Standard Specifications, and these plans and specifications. This work shall also include the removing of existing pavement markers and removing or eradicating of existing pavement striping and markings when called for in the plans and/or directed by the Engineer.

1.03 SUBMITTALS: Submit material certifications, test results and brochures for all pavement markers and traffic paint materials.

### PART 2 - PRODUCTS

2.01 Materials shall conform to the requirements of Pavement Markers, Adhesives for Pavement Markers, and Thermoplastic Pavement Markings, as specified in the State of Hawaii Standard Specifications for Road and Bridge Construction, 2005 and these specifications.

### PART 3 - EXECUTION

3.01 GENERAL: Pavement markers and markings shall be applied to surfaces that have been thoroughly cleaned and are free of dirt, dust, curing compound, grease, oil, moisture, loose aggregates, unsound layers and any other material which would adversely affect the bond of the adhesive or paint.

In the installation of pavement markers, the cleaning of Portland cement concrete and asphalt concrete surfaces shall be by blast cleaning. Clean, newly placed asphalt concrete need not be blast cleaned unless the surface contains an abnormal amount of asphalt or the surface is contaminated with dirt, grease, oil or any other material which would adversely affect bonding.

Unless otherwise specified, the Contractor shall establish control points, spaced at intervals that will insure accurate location of pavement markers and striping. Markers and tape shall not be applied when moisture or foreign matter is present on the pavement surface or when wind conditions are such as to cause dust to be deposited on the prepared areas or to prevent satisfactory application of the marker adhesive or paint.

The Contractor shall paint temporary guidelines and outline of arrows, legends and crosswalks with a 2-inch wide brushed line on the day the roadway is opened to traffic which shall be approved by the County of Hawaii before permanent lines are placed.

The Contractor shall furnish and place all warning and directional signs necessary to direct and control the traffic during marker installation or the striping operations. Warning signs

shall be set up before the beginning of each operation and extra signs shall be kept well ahead of the marking equipment.

The Contractor shall install all markers and apply all pavement striping before opening roadways to public traffic except that when connections to existing pavements are made or when temporary detours carry public traffic, the Contractor shall mark or stripe the connecting pavements on the day that the roadway is open to traffic.

If it is necessary to run public traffic over roadways soon after paving, the Contractor shall paint, on the day of each day's paving, temporary guide dashes at the traffic stripe or marker location on the pavement, as guidance for drivers, until the permanent markings can be placed. The Contractor shall maintain and repaint, if necessary, all temporary markings until the permanent striping and/or markers are installed. This work shall be considered incidental to the items of paving, pavement markers and/or pavement striping, and no separate payment will be made therefor.

Permanent pavement markers, striping and markings shall be applied no sooner than 7 calendar days nor later than 14 calendar days after completion of the pavement.

3.02 PAVEMENT MARKERS: Unless otherwise ordered in writing by the Engineer, markers shall be cemented to the pavement with Standard Set Type adhesive. If ordered by the Engineer, the Contractor shall use Rapid Set Type adhesive for the Standard Set Type adhesive at no extra cost to DHHL.

If the Contractor uses Rapid Set Type adhesive, he shall submit samples of the markers and Rapid Set Type adhesive proposed for use to the Engineer, for testing and approval, at least 10 days before the date of its intended use.

The Standard Set Type adhesive shall not be used when either the pavement or the air temperature is less than 50°F. The Rapid Set Type adhesive shall not be used when either the pavement or the air temperature is less than 30°F. No markers shall be installed if the relative humidity of the air is greater than 80 percent or if the pavement is not surface dry. DHHL shall be the judge as to when the adhesive has set sufficiently to bear traffic. The following table may be used as a guide; however, the times shown may vary, depending upon field conditions:

| TIME TO BEAR TRAFFIC | | |
|---|---|---|
| Temperature* (°F) | Standard Set Type (Hours) | Rapid Set Type (Minutes) |
| 100 | 1-1/2 | 15 |
| 90 | 2 | 20 |
| 80 | 3 | 25 |
| 70 | 4 | 30 |
| 60 | 5 | 35 |
| 50 | 7 | 45 |
| 40 | No Application Below 50°F | 65 |
| 30 | | 85 |
| | | No Application Below °F |

*The temperature indicated is either pavement surface or air temperature, whichever is lower. The hardness of the rim of epoxy around the marker shall not be used as an indication of the degree of cure of the epoxy under the marker.

No pavement markers shall be installed over longitudinal or transverse joints of the pavement surface.

3.03 PAVEMENT STRIPING AND MARKINGS: Pavement striping and markings shall be of the length, width and placement specified and shall conform to the County of Hawaii Traffic Division Standards.

Pavement arrows, legends, and crosswalks shall be applied with appropriate templates (refer to "Manual on Uniform Traffic Control Devices for Streets and Highways," dated 2009).
No stripe shall be less than the specified width. No stripe shall exceed the specified width by more than 1/2 inch. The length of the 10-foot painted segment for skip stripe may vary ±1 foot and the 30-foot gap between segments may vary ±1 foot. The alignment of the stripe shall not deviate from the intended alignment by more than 1 inch on tangents and on curves up to and including one degree. On curves exceeding one degree, the alignment of the stripe shall not deviate from the intended alignment by more than 2 inches.

When necessary to correct a deviation which exceeds the permissible tolerance in alignment, that portion of the stripe so affected shall be removed plus an additional 30 feet in each direction, and a new stripe then provided in accordance with these specifications.

All stripes, segments of stripes and markings shall present a clean cut, uniform appearance. All striping and markings which fail to meet the requirements specified herein, or are marred

or damaged by traffic or from other causes, shall be corrected prior to acceptance by the County at the Contractor's expense.

The Contractor shall submit to DHHL test specimens as requested. Test films shall be applied to a suitable plane rigid surface. The area shall be of sufficient size to permit film thickness measurement to be made at least 1 inch from any edge.

3.04 REMOVING EXISTING PAVEMENT MARKERS, STRIPING AND MARKINGS: Existing pavement markers shall be removed by methods that cause the least possible damage to the pavement or surfacing.

Where specified on the plans and/or directed by the Engineer, existing pavement striping and markings shall be removed to the fullest extent possible by methods that will not materially damage the surface or texture of the pavement, or leave impressions on the roadway that could be confused with permanent striping during inclement weather or night driving conditions. Any damage to the pavement or surfacing caused by the removal operations shall be repaired by the Contractor at his expense by methods acceptable to the County of Hawaii.
Painting over the existing striping and markings will not be permitted. Burning off existing striping and markings will be permitted using an approved method using excess oxygen.

Sand or other material deposited on the pavement as a result of removing pavement markers, traffic striping and markings shall be removed as the work progresses. Accumulation of sand or other material which may constitute a hazard to traffic will not be permitted.

Extraneous traffic striping and markings shall be removed before any change is made in the traffic pattern.

3.05 PREFORMED PAVEMENT MARKING TAPE: Preformed pavement marking tape may be applied manually or with the tape applicators approved by the tape manufacturer. All markings shall be applied in accordance with the tape manufacturer's recommendations and as specified herein.

The Contractor shall install permanent preformed pavement marking tape only at the locations shown on the plans and as specified herein.

Preformed pavement marking tape shall not be applied over other markings or old paint. The Contractor shall remove all old markings and otherwise prepare the surface for tape application as specified.

The minimum temperatures for the application of preformed pavement marking tape shall be 60° (15°C) for air and 70°F (21°C) for roadway surfaces, with both temperatures rising. The maximum temperature shall be 150° (66°C) for roadway surfaces.

The Contractor shall prime existing roadway surfaces with an approved primer immediately prior to the application of permanent preformed pavement marking tape. The Contractor shall apply the primer as recommended by the tape manufacturer and as directed by the Engineer.

The Contractor may use tapes of different widths to form a specified stripe width (i. e., two 4-inch wide tapes may be used to form an 8-inch wide stripe); however, 12-inch wide stripe shall be of a single width and payment shall be made for the specified stripe width as shown on the plans and called for in the proposal.

The Contractor shall use butt splices only and shall not overlap the tape material.

All markings shall be thoroughly tamped with approved mechanical tampers. Additionally, the Contractor shall slowly drive on the newly applied markings several times with a truck.

All areas marked with preformed pavement marking tape shall be ready for traffic immediately after application.

3.06 REMOVAL OF TEMPORARY TAPE TRAFFIC MARKINGS: The Contractor shall remove all temporary tape striping placed to delineate traffic lanes, crosswalks, stop bars, etc., prior to the laydown of the finish asphalt concrete mix #4 layer.

END OF SECTION

SECTION 02610 – PIPE AND FITTINGS

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 GENERAL REQUIREMENTS

A. Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, and ready for use, pipes and fittings in conformity with the dimensions, profiles, sections, and details shown on the plans.

B. Whenever the Contractor is required by State or local laws or regulations to make a deposit and/or to pay for a permit before proceeding with any work called for under this part of the specification, the Contractor shall make the necessary deposit and/or pay for obtaining the required permit for the work.

1.03 REFERENCES

A. Conform to the requirements of the "Water System Standards, Department of Water Supply, County of Hawaii, State of Hawaii, 2002", including any amendments.

RELATED WORK IN OTHER SECTIONS

Valves and Cocks ..... Section 02610
Potable Water System ..... Section 02713

1.04 SUBMITTALS

A. Submit manufacturers' information bulletins, catalog cuts, drawings and other data to show that the proposed items conform to the specifications requirements. The manufacturer and details of the flanged pipe and fittings must be approved by the Engineer before the piping layout drawings are submitted.

B. Submit six sets of piping layout drawings. Drawings shall show all dimensions valves, piping, fittings, and appurtenances. Manifold piping layout drawings must be approved by the Engineer prior to ordering of the piping, valves, fittings and appurtenances.

PART 2 - PRODUCTS

2.01 PIPE

A. Pipe: Pipe materials shall meet County Standards.

B. Flanges: Flange materials shall meet County Standards. Bolt holes shall straddle the vertical center line.

2.02 FITTINGS: Fittings shall meet County Standards.

2.03 CEMENT MORTAR LINING: All flanged pipe and fittings shall be cement mortar lined in accordance with ANSI A21.4. Interior linings shall have ends tapered and sealed with a bituminous coat.

2.04 GASKET

A. Gaskets shall be 1/16 inch thick duck inserted rubber packing, Garlock No.19 or approved equal.

B. A 1/8 inch thick gasket may be substituted for the 1/16 inch gasket specified above. If the thicker gasket is to be used, it must be noted on the piping layout drawings with the appropriate changes made in piping lengths. The design and materials of the substitute gasket must be approved by the Engineer prior to construction.

2.05 STEEL BOLTS AND NUTS

A. All bolts shall be hot dip galvanized steel machine bolts with cut threads and American Standard heavy hexagon heads.

B. All nuts shall be hot dip galvanized American Standard cold punched heavy hexagon nuts.

C. One coat of Inertol #49 as manufactured by Koppers Co., Inc., or approved equal, shall be applied to all buried bolts and nuts.

## PART 3 - EXECUTION

3.01 INSTALLATION: Install pipe, fittings and appurtenances in strict accordance with the manufacturer's installation instructions.

END OF SECTION

SECTION 02640 – VALVES AND COCKS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 REFERENCED DOCUMENTS: Work shall be governed by The Water System Standards, 2002, The Approved Material List and Standard Details for Water System Construction, 2002 and Water System Exterior Corrosion Control Standard, 1991, for the Department of Water Supply (DWS), County of Hawaii and all subsequent amendments, hereinafter referred to as the DWS Standards, and the Uniform Plumbing Code.

RELATED WORK IN OTHER SECTIONS:

Pipe and Fittings……Section 02610

Potable Water System……..Section 02713

1.03 DESCRIPTION OF WORK: This Section includes the furnishing and installation of a pressure reducing valve station which consists of a combination pressure reducing and pressure sustaining valve, pressure reducing valve, pressure relief valve, gate valves, ball valves, necessary piping, fittings and appurtenances as shown on the plans.

The equipment package shall include, but not limited to the following:

A. Combination Pressure Reducing and Pressure Sustaining Valve:

| | | |
|---|---|---|
| 1. | Number and size required: | 1 – 6 inches |
| 2. | Main valve trim: | Bronze |
| 3. | End detail: | F.E., 150 lb. |
| 4. | Pressure rating: | 250 psi |
| 5. | Temperature range: | 180° F |
| 6. | Rubber material: | Buna-N |
| 7. | Coating: | Fusion bonded epoxy |
| 8. | Desired Options: | B: Pilot System Isolation cocks |
| | | P: X141 Pressure Gauge |
| | | S: Opening Speed Control |
| | | Y: “Y” Pattern Strainer |

B. Pilot Control System for Combination Pressure Reducing and Pressure

Sustaining Valve:

| | | |
|---|---|---|
| 1. | Pressure rating: | 300 psi |
| 2. | Trim: | Monel, Stainless Steel |
| 3. | Rubber material: | Buna-N |
| 4. | Tubing and Fittings: | Brass, Bronze, Copper |

5. Operating Fluids: Water
6. Pressure reducing adjustment range: CRD: 15-75 psi
7. Pressure sustaining adjustment range: CRL: 20-200 psi

C. Pressure Reducing Valve:

1. Number and size required: 1 – 2 inches
2. Main valve trim: Bronze
3. End detail: S.E.
4. Pressure rating: 400 psi
5. Temperature range: 180° F
6. Rubber material: Buna-N
7. Coating: Fusion bonded epoxy
8. Desired Options: A: Flow Clean Strainer
   B: Pilot System Isolation cocks
   S: Opening Speed Control

D. Pilot Control System for Pressure Reducing Valve:

1. Pressure rating: 300 psi
2. Trim: Monel, Stainless Steel
3. Rubber material: Buna-N
4. Tubing and Fittings: Brass, Bronze, Copper
5. Operating Fluids: Water
6. Pressure reducing adjustment range: CRD: 15-75 psi

E. Pressure Relief Valve:

1. Number and size required: 1 – 2 inches
2. Main valve trim: Bronze
3. End detail: S.E.
4. Pressure rating: 400 psi
5. Temperature range: 180° F
6. Rubber material: Buna-N
7. Coating: Fusion bonded epoxy
8. Desired Options: B: Pilot System Isolation cocks
   P: X141 Pressure Gauge

F. Pilot Control System for Pressure Relief Valve:

1. Pressure rating: 300 psi
2. Trim: Monel, Stainless Steel
3. Rubber material: Buna-N
4. Tubing and Fittings: Brass, Bronze, Copper
5. Operating Fluids: Water
6. Pressure reducing adjustment range: CRD: 15-75 psi

1.04 SUBMITTALS

A. Shop Drawings and Catalog Cuts: 6 copies of dimensioned shop drawings of the valves and piping layout of the pressure reducing station.

B. Manufacturer's Installation, Operation and Maintenance Manual including spare parts list and ordering instructions.

PART 2 - PRODUCTS

2.01 COMBINATION PRESSURE REDUCING AND PRESSURE SUSTAINING VALVE

A. This valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure. When the upstream pressure becomes equal to the spring setting of the pressure sustaining control, the valve throttles to maintain a constant inlet pressure.

B. The valve shall be hydraulically operated, single diaphragm-actuated and globe pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

C. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. No fabrication or welding shall be used in the manufacturing process.

D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer, forming a tight seal against a single removable seat insert. No O-ring type disc (circular, square or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

E. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part

and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.

F. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

G. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat shall be threaded into the cover and body. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No “pinned” covers to the valve body shall be permitted. Cover bearing, disc retainer and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.

H. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4” through 24” sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity and if there will be cavitation damage.

I. The valve shall be a Cla-Val Model No. 92-01 BYSP KCX X101 Combination Pressure Reducing and Pressure Sustaining Valve as manufactured by Cla-Val Co. or approved equal.

2.02 PILOT CONTROL SYSTEM

A. The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm and it closes when the delivery pressure acting on the underside of the diaphragm

exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted.

B. The pilot control shall have a second downstream sensing port which can be utilized to install a pressure gauge.

C. The pressure sensing pilot control shall be a direct-acting adjustable spring loaded control which opens when upstream pressure exceeds the spring setting on the pilot. The pilot control system shall include an X44A strainer and orifice assembly. A full range of spring settings shall be available in ranges of 0 to 450 psi.

D. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

2.03 PRESSURE REDUCING VALVE

A. This valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure.

B. The valve shall be hydraulically operated, single diaphragm-actuated and globe pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

C. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. No fabrication or welding shall be used in the manufacturing process.

D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer, forming a tight seal against a single removable seat insert. No O-ring type disc (circular, square or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

E. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.

F. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the

center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

G. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat shall be threaded into the cover and body. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No “pinned” covers to the valve body shall be permitted. Cover bearing, disc retainer and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.

H. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4” through 24” sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity and if there will be cavitation damage.

I. The valve shall be a Cla-Val Model No. 90-01 ABS KCX X101 Pressure Reducing Valve as manufactured by Cla-Val Co. or approved equal.

2.04 PILOT CONTROL SYSTEM

A. The pressure reducing pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted. The pilot system shall include an opening speed control.

B. The pilot control shall have a second downstream sensing port which can be utilized to install a pressure gauge.

C. A full range of spring settings shall be available in ranges of 0 to 450 psi.

D. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

2.05 PRESSURE RELIEF VALVE

A. This valve shall maintain a constant downstream pressure by bypassing or relieving excess pressure and shall maintain close pressure limits without causing surges. If upstream pressure decreases below the spring setting, the valve shall close.

B. The valve shall be hydraulically operated, single diaphragm-actuated and globe pattern. The valve shall consist of three major components: the body with seat installed, the cover with bearings installed and the diaphragm assembly. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

C. No separate chambers shall be allowed between the main valve cover and body. Valve body and cover shall be of cast material. No fabrication or welding shall be used in the manufacturing process.

D. The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer, forming a tight seal against a single removable seat insert. No O-ring type disc (circular, square or quad type) shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edge sides and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across this surface. No hourglass-shaped disc retainers shall be permitted and no V-type or slotted type disc guides shall be used.

E. The diaphragm assembly containing a non-magnetic 303 stainless steel stem of sufficient diameter to withstand high hydraulic pressures, shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. The seat shall be a solid, one-piece design and shall have a minimum of a five-degree taper on the seating surface for a positive, drip-tight shut off. No center guides shall be permitted. The stem shall be drilled and tapped in the cover end to receive and affix such accessories as may be deemed necessary. The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.

F. The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The center hole for the main valve stem must be sealed by the vulcanized process or a rubber grommet sealing the center stem hole from the operating pressure. The diaphragm must withstand a Mullins Burst Test of a minimum of 600 psi per layer of nylon fabric and shall be cycle tested 100,000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully open or fully closed position.

G. The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat shall be threaded into the cover and body. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits. To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No “pinned” covers to the valve body shall be permitted. Cover bearing, disc retainer and seat shall be made of the same material. All necessary repairs and/or modifications other than replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted and components including cast material shall be of North American manufacture.

H. The valve manufacturer shall be able to supply a complete line of equipment from 1 1/4” through 24” sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a computerized cavitation chart which shows flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity and if there will be cavitation damage.

I. The valve shall be a Cla-Val Model No. 50-01 BP KCX X101 Pressure Reducing Valve as manufactured by Cla-Val Co. or approved equal.

2.06 PILOT CONTROL SYSTEM

A. The pressure relief pilot control shall be a direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlling pressure exceeds the adjustable spring setting. The pilot control is held closed by the force of the compression on the spring above the diaphragm and it opens when the pressure acting on the underside of the diaphragm exceeds the spring setting. Pilot control sensing shall be upstream of the pilot system strainer so accurate control may be maintained if the strainer is partially blocked.

B. A full range of spring settings shall be available in ranges of 0 to 450 psi.

C. A direct factory representative shall be made available for start-up service, inspection and necessary adjustments.

## PART 3 - EXECUTION

3.01 Construction and installations shall conform to the applicable sections of the Water System Standards, Department of Water Supply, County of Hawaii, State of Hawaii, 2002.

END OF SECTION

SECTION 02713 – POTABLE WATER SYSTEM

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, and ready for use, the potable water system in conformity with the dimensions, profiles, sections, and details shown on the plans.

1.03 REFERENCES: Work shall be governed by The Water System Standards, 2002, The Approved Material List and Standard Details for Water System Construction, 2002 and Water System Exterior Corrosion Control Standard, 1991, for the Department of Water Supply (DWS), County of Hawaii and all subsequent amendments, hereinafter referred to as the DWS Standards, and the Uniform Plumbing Code.

PART 2 – PRODUCTS

2.01 MATERIALS:

A. All materials shall conform to the approved Material List and Standard Details for Water System Construction, Department of Water Supply, County of Hawaii, 2002, except asbestos cement pipes and fittings shall not be used. Gate valves shall be cast iron, Class 200, with mechanical joints. Fire hydrants shall be wet-barrel type.

B. 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.

PART 3 – EXECUTION

3.01 INSTALLATION: The installation, testing, disinfection and acceptance of water lines shall be governed by the DWS Standards and the Uniform Plumbing Code.

The Contractor shall be responsible for precisely laying out the various utility lines shown on the contract plans as provided elsewhere in these specifications. The location shown on the contract plans of the various existing utility lines which the new lines are to cross over or under or connect to were determined on the basis of the best information available; however, no assurance can be provided that the actual locations will be precisely as shown on the contract plans.

In performing all work, the Contractor shall exercise due care and caution necessary to avoid any damage to and impairment in the use of any existing utility lines. Any damage inflicted on existing lines resulting from the Contractor's operations shall be immediately repaired and restored as directed by the Engineer at the Contractor's expense.

Connections to or the lowering or relocation of existing mains shall be done by the Contractor in accordance with the DWS Standards. The Contractor shall furnish all necessary pipe, fittings, appurtenances and other incidental materials.

Trenching, pipe cushion and backfilling for the water main shall be in accordance with the DWS Standards.

The Contractor shall coordinate the connection of the new water line with the Engineer. The Contractor shall inform the Engineer a minimum of one week prior to the date of the actual connection. The inverts shown on the plans are approximate only, and the Contractor shall adjust the slope of the new water line as necessary to construct a fully functional and acceptable system. The Contractor shall ensure that all piping, fittings, materials, tools, equipment and incidentals are at the site and ready for connection.

The installation, testing, disinfection and acceptance of water lines shall be governed by the DWS Standards. The Contractor shall coordinate with the DWS Inspector to coordinate timely inspections to allow work to proceed unimpeded.

END OF SECTION

SECTION 02721 – STORM DRAINAGE SYSTEM

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, the storm drainage system piping, catch basins, storm drain manholes, drain inlets, drainage ditches and drywells in conformity with the dimensions, sections, and details shown on the plans. Work relating to drainpipes and drainage structures shall be governed by the following sections of the DPW Standard Specifications:

Trench Excavation and Backfill ..... Section 11

Drainpipes ..... Section 24

Drain Manholes ..... Section 25

Catch Basins and Storm Water Inlets ..... Section 26

Concrete Structures ..... Section 40

1.03 CONTRACTOR SUBMITTALS: Shop drawings shall be submitted for drain inlet grating.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials for the storm drainage system shall be in accordance with the sections of the DPW Standard Specifications noted hereinbefore.

PART 3 – EXECUTION

3.01 INSTALLATION: Install the storm drainage system in accordance with the sections of the DPW Standard Specifications noted hereinbefore.

3.02 The Contractor shall be responsible for precisely laying out the catch basins and drywells locations shown on the contract plans. The location shown on the contract plans of the various existing utility lines which the new lines are to cross over or under or connect to were determined on the basis of the best information available; however, no assurance can be provided that the actual locations will be precisely as shown on the contract plans.

3.03 In performing all work, the Contractor shall exercise due care and caution necessary to avoid any damage to and impairment in the use of any existing utility lines. Any damage inflicted on existing lines resulting from the Contractor's operations shall be immediately repaired and restored as directed by the Engineer at the Contractor's expense.

3.04 The installation of drain pipes and testing and acceptance shall be governed by the DPW Standard Specifications.

END OF SECTION

SECTION 02731 – SANITARY SEWER SYSTEM

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary to complete, in place, the sewer system in conformity with the notes, dimensions, profiles, sections, and details shown on the plans. Work relating to the sewer system shall be governed by current County of Hawaii Department of Environmental Management Wastewater Division Standard Notes (9/2017) and Details (WW-1 through WW-9) and the following sections of the DPW Standard Specifications:

PVC Sewer Pipe and Appurtenances ..... Section 21

Sewer Manholes ..... Section 23

1.03 In case of conflicts or discrepancies between the Wastewater Division Standards Notes and Details and DPW Standard Details and Specifications for the sanitary sewer system, Wastewater Division Standard Notes shall govern over Wastewater Standard Details, and Wastewater Division Standard Notes and Details shall govern over DPW Standard Specifications and Details.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Sewer Pipe and Appurtenances shall meet County of Hawaii Department of Environmental Management Wastewater Division Standards.

B. Substitution requests for sewer pipe, equipment and materials must be approved by the Wastewater Division Chief.

PART 3 – EXECUTION

3.01 Install the sewer system in accordance with the approved plans and sections of the DPW Standard Specifications noted hereinbefore.

3.02 The Contractor shall be responsible for precisely laying out the sewer line shown on the contract plans. The location shown on the contract plans of the various existing utility lines which the new lines are to cross over or under or connect to were determined on the basis of the best information available; however, no assurance can be provided that the actual locations will be precisely as shown on the contract plans.

3.03 In performing all work, the Contractor shall exercise due care and caution necessary to avoid any damage to and impairment in the use of any existing utility lines. Any damage inflicted on existing lines resulting from the Contractor's operations shall be immediately repaired and restored as directed by the Engineer at the Contractor's expense.

3.04 The installation of sewer pipes and testing and acceptance shall be governed by the Hawaii County Code Chapter 21, approved plans, current County of Hawaii Department

of Environmental Management Wastewater Division Standard Notes and Details and DPW Standard Specifications and Details.

END OF SECTION

SECTION 02840 – TRAFFIC SIGNS

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary to accomplish the installation of all traffic signs as indicated on the plans and specified herein.

1.03 SUBMITTALS: A list of component parts indicating the description of each part, the materials from which it has been fabricated (including ASTM numbers where applicable and a statement certifying compliance to the material specification.

PART 2 – PRODUCTS

2.01 MATERIALS

A. 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.

B. Materials shall be in accordance with Section 621 – Traffic Control Signs of the State of Hawaii Standard Specifications for Road and Bridge Construction, except as shown on the plans or amended in the specifications herewith.

PART 3 – EXECUTION

3.01 INSTALLATION: Installation of signs shall be in accordance with Section 631 – Traffic Control Regulatory, Warning, and Miscellaneous Signs of the State of Hawaii Standard Specifications for Road and Bridge Construction except as shown on the plans or amended in the specifications herewith.

END OF SECTION

SECTION 03300 – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Cast-in-place concrete and reinforcing steel for concrete slabs and footings. Work shall be in conformance to Section 39 - Portland Cement Concrete and Section 48 - Reinforcing Steel of the DPW Standard Specifications.

1.03 QUALITY ASSURANCE:

A. Codes: Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified.

1. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”

2. ACI 318 “Building Code Requirements for Structural Concrete”

3. ACI 304, “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete”

4. ACI 311, “Recommended Practice for Concrete Inspection”

B. Concrete Testing Service

1. The Contractor will employ, at his own expense, a testing laboratory experienced in the testing of concrete materials and mixes to perform material evaluation tests. This laboratory shall be the official testing agency for this project.

2. Materials and installed work may require testing and retesting, as directed by the Engineer, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. Test, if not the retesting of rejected materials and installed work, shall be done at the Contractor’s expense.

3. Tests shall comply with ASTM Standards whenever applicable.

1.04 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Indicate amounts of mixing water to be withheld for later addition at project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar

schedules, stirrup spacing, bend bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing and supports concrete reinforcement.

D. Field quality-control test and inspection reports.

PART 2 – PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I

B. Aggregates: ASTM C33

1. Fine Aggregates: Clean, Sharp, Natural sand or rocksand as manufactured locally free from loan, clay, lumps or other deleterious substances.

2. Course Aggregates: Clean, uncoated, processed aggregate containing no clay, mud loam or foreign matter.

C. Reinforcing:

1. ASTM A615-51, Grade 60

2. ASTM A185, galvanized welded wire fabric

2.02 CONCRETE ADMIXTURES

A. Air-Entraining Admixtures: ASTM C260

B. Water-Reducing Admixtures: ASTM C494,l Type D

C. Set Control Admixtures: ASTM C494, as follows

1. Type B, retarding

2. Type D, water-reducing and retarding

D. Set Control Admixtures: ASTM C494, as follows

2.03 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type of concrete; 28-day compressive strengths shall be 3,000 psi (Class A); 2,500 psi (Class B); 2,000 psi (Class C) and in the DPW Standard Specifications.

B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required.

C. Unless otherwise noted, Class A concrete shall be used for all electrical ducts, reaction blocks, slabs and walls; Class B concrete for curb and gutter, and sidewalk applications.

2.04 JOINT MATERIALS

A. Premolded Joint Fillers: Premolded material of specified thickness composed of fiberboard impregnated with asphalt.

B. Joint Sealing Compound: Tremco Butyl Sealant or approved equal.

C. Epoxy-Resin Bonding Agent: Two component, mineral filled epoxy polysulfide polymer complying with FS MMM-G-650, Type I or Type II, Grade A.

2.05 MOISTURE BARRIER: Provide moisture barrier over prepared base material where shown on plans. Use only materials which are resistant to decay when tested in accordance with ASTM E154, as follows: Polyethylene sheet not less than 6 mils thick.

2.06 CURING MATERIALS

A. Curing compounds for membrane curing shall conform to ASTM C309.

B. Liquid Curing - Hardening Compound: Aqueous solution of sodium silicate with non-acid penetrating agent, reacting chemically with free lime in concrete to form a hard, non-dusting surface which will not inhibit bonding with future finishes. Products offered by manufacturers to comply with the requirements for liquid curing hardening compounds include the following:

1. Demicon: Castle Chemical Corp.

2. Eucosil: Euclid Chemical Co.

3. Chem Hard: L&M Construction Chemicals

2.07 EPOXY GROUT: Manufactured grout with built-in bonding material subject to approval of the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION: Pre-Placement Inspection -- Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work, as required.

3.02 CONCRETE PLACEMENT

A. General: Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to

cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.

2. Screen concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the project site and dispose of it in an acceptable location.

B. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris water, and other deleterious materials.

C. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Bring slab surfaces to the correct level with a straightedge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

4. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

D. Dowel installation where shown. Prepare for bonding of dowels and anchors to existing concrete by using drilled holes and a two-component epoxy which is

manufactured for this specific purpose. Install in accordance with manufacturer's requirements to develop strength of dowels.

## 3.03 CONCRETE SLAB FINISHES

Slabs: Finish by tamping the concrete to force aggregate away from the surface and screen at the proper level. Float the surface and lightly trowel. When concrete has set sufficiently to ring under the trowel, give a second troweling to produce a smooth, dense surface free from trowel marks and sweeps, air bubbles or other imperfections of troweling.

## 3.04 CONCRETE CURING AND PROTECTION

### A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

### B. Curing Methods

1. Perform curing of concrete by moist curing, or by moisture retaining cover curing, by membrane curing, or by combinations thereof, as herein specified for a continuous period of 14 days.

2. Liquid Curing-Hardening Compound: Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray, or hair broom in accordance with manufacturer's directions.

### C. Curing Unformed Surfaces

1. Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing, whenever possible.

2. Moist cure surfaces to receive fluid applied waterproof membranes and composition flooring. Do not cure by membrane curing or curing compounds.

3. All slabs not receiving a finish floor material shall receive a liquid curing-hardening compound in accordance with the manufacturer's recommendations.

4. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

D. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

## 3.05 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures from the passage of work by other trades, unless otherwise shown or directed, after the work or other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

B. Epoxy Adhesive: For application on corrective work where the ordinary methods of remedy are deemed inadequate by the Engineer. Type of adhesive shall be subject to the approval of the Engineer.

## 3.06 CONCRETE SURFACE REPAIRS

A. Repair of Unformed Surfaces

1. Test unformed surfaces such as monolithic slabs, for smoothness and to verify surface plane to the tolerance specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finish unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include cracks in excess of 0.03 inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

B. Finishing of Formed Surfaces

1. Joint marks and fins shall be removed and surfaces left smooth and dense. Tieholes and honeycombing shall be repaired with cement and sand mortar.

2. Exposed concrete surfaces shall be vigorously and thoroughly rubbed with a sand cement mortar the consistency of a thick paint to fill all voids and provide a smooth surface. There shall be no discernible thickness of mortar on the surface.

3.07 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor shall engage, at his own expense, an independent qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections

1. Steel reinforcement placement

2. Steel reinforcement welding

3. Headed bolts and studs

4. Verification of use of required design mixture

5. Concrete placement, including conveying and depositing

6. Curing procedures and maintenance of curing temperature

C. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mix placed each day.

a. When frequency of testing will provide fewer than five compressive strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F4.4 deg C and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

    a. Cast and field cure one set of four standard cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.

    a. Test two field-cured specimens at 7 days and two at 28 days.

    b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

8. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi3.4 MPa.

9. Test results shall be reported in writing to the Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Engineer but will not be used as sole basis for acceptance or rejection of concrete.

11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as

directed by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.

END OF SECTION

SECTION 04220 – UNIT MASONRY

PART 1 - GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary for completing this item of work as specified in DIVISION 300 – CONSTRUCTION, Section 303.13 UNIT MASONRY and Section 303.04 REINFORCING STEEL of the Water System Standards, 2002, and as amended hereinafter as applicable to this project, in conformity with the dimensions, profiles, sections, and details shown on the plans.

1.03 REFERENCES: Work shall be governed by The Water System Standards, 2002, The Approved Material List and Standard Details for Water System Construction, 2002 and Water System Exterior Corrosion Control Standard, 1991, for the Department of Water Supply (DWS), County of Hawaii and all subsequent amendments, hereinafter referred to as the DWS Standards, and the Uniform Plumbing Code.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Unit masonry for the pressure reducing valve vault shall be Type II, normal weight, nominal 8 inch wide x 16 inch long x 8 inch high concrete block units, two-cell type with closed or open ends. Unit masonry for the perimeter wall along the easement shall be normal weight, nominal 6 inch wide x 16 inch long x 8 inch high concrete block units, two-cell type with closed or open ends. The units shall have a compressive strength of 1,900 psi.

B. Reinforcing shall be as shown on the plans and as described in Section 303.04 of the Water System Standards and as amended by the following:

1. Reinforcing steel shall conform to ASTM A615, Grade 60 typical.

2. Minimum overlap for lapped splices shall be 40 bar diameters, but not less than 2’-0”. Splices shall be staggered at least 24 inches.

3. Bends not shown shall be Standard Hooks. Fabricate steel reinforcement according to CRSI’s “Manual of Standard Practice”.

4. Horizontal joint reinforcement shall not be used.

C. Mortar and grout shall utilize portland cement. Masonry cement shall not be used unless approved in writing by the Manager.

PART 3 - EXECUTION

3.01 Lay all blocks in running bond, with vertical joints staggered 8 inches. Use full blocks wherever possible, use half blocks at wall ends, joints or corners only. Place units to provide a uniform blend of color variations with blocks.

3.02 PLACING REINFORCEMENT

Comply with requirements in ACI 530.1 and Section 2104.5 in the Uniform Building Code.

3.03 JOINTS SHALL BE COMPRESSED BY TOOLING AND FINISHED AS SHOWN

A. Exterior joints shall be tooled concave.

B. Interior joints shall be made flush. Tooled concave joints may be acceptable, provided that they are completely hidden by the interior finish.

C. Minimum overlap for reinforcement lapped splices shall be as specified on the Drawings. Bends not specified shall be Standard Hooks.

3.04 GROUTING OF MASONRY

A. All the cells shall be grouted solid.

B. Comply with requirements in Section 2104.6 in the Uniform Building Code for cleanouts and for grout placement, including minimum grout space and maximum pour height.

C. Consolidate grout to eliminate voids, reconsolidate after 5 minutes of grout placement to fill voids created by water absorption from grout by masonry units.

END OF SECTION

SECTION 05500 - FABRICATED METAL WORK AND CASTINGS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS: The General Conditions and Special Provisions preceding these specifications shall govern this section of the work.

1.02 WORK INCLUDED: Furnish all labor, materials, tools, equipment and related items necessary to complete installation of the vault access hatch on to a pressure reducing valve vault.

1.03 REFERENCED DOCUMENTS: The following specifications and standards of the issues listed below including the amendments, addenda and errata, form a part of this specifications, to the extent required by the reference thereto.

A. DIVISION 300 – CONSTRUCTION, Section 303.22 MISCELLANEOUS IRON AND METAL WORK of the Water System Standards, Department of Water Supply, County of Hawaii, State of Hawaii, 2002, and as amended hereinafter as applicable to this project.

PART 2 – PRODUCTS

2.01 VAULT ACCESS HATCH:

A. The vault hatch shown shall be “CHS2” Heavy Duty H-20 Rated Aluminum Hatch by EJ or approved equal.

B. Material shall be 6061-T6 aluminum for bars, angles and extrusions, 1/4" diamond plate shall be 5086 aluminum.

C. Hatch assembly shall be designed Heavy Duty, for 16,000 lbs. plus 30% impact over a 10’ x 20’ contact area. Frame and bearing plate must be cast into and supported by concrete designed for H-20 wheel loads.

D. Unit not suitable for wheel line placement.

E. Each door shall be supplied with a heavy duty, pneu-springs, for ease of operation when opening cover. Cover shall be counterbalanced, so one person can easily open the hatch door. Spring design shall accommodate ease of maintenance. Mechanical springs are not acceptable.

F. Frame shall be of extruded aluminum, with a continuous 1-1/4” anchor flange. A dovetail groove shall be extruded into the seat of the frame for a 1/8” silicone gasket (UV tolerant). Channel frame shall be a minimum of 1/4” thick, with a minimum cross section of 7.5 square inches.

G. Each door shall be equipped with a stainless steel automatic hold open arm. Door shall lock open in the 90-degree position. Hold open arm shall be fastened to the frame with a 1/2” grade 316 stainless steel bolt.

H. Hinges shall be of heavy-duty design. Material shall be grade 316 stainless steel. Each hinge shall have a grade 316 stainless steel, 3/8" diameter hinge pin. Hinge shall be fastened to the channel frame and diamond plate with grade 316 stainless steel bolts and ny-lock nuts.

I. Aluminum shall be supplied with mill finish, exterior of frame which comes in contact with concrete shall have one coat black primer.

J. Each hatch shall be supplied with a grade 316 stainless steel slam lock, with keyway protected by a threaded aluminum plug. The plug shall be flush with the top of the 1/4" diamond plate. The slam lock shall be fastened with four grade 316 stainless steel bolts and washers.

K. Each hatch shall be equipped with a cast stainless steel lift handle. The lift handle shall be flush with the top of the 1/4" diamond plate.

L. Each "CHS2" style hatch is supplied with a 1-1/2" threaded drain coupler on the underside of channel frame for a pipe connection.

M. The hatch cover shall be insulated with foam insulation. Insulation board must be marked "mold resistant" and "insect resistant". Insulation shall be enclosed by a 1/8" aluminum liner panel.

N. Double leaf hatch covers shall be supplied with stainless steel safety chains that shall be connected to each opposing leaf on both the front side and the back side of the access hatch.

## PART 3 – EXECUTION

### 3.01 INSTALLATION:

A. Install access hatch as indicated and in accordance with the manufacturer's written instructions. The hatch frame shall be set flush with the adjacent concrete surface.

B. Bolts: Where stainless steel bolts are in contact with dissimilar metals, provide insulating sleeves and phenolic washers to electrically isolate the bolts.

END OF SECTION

SECTION 16301 - EXTERIOR ELECTRICAL WORK

PART 1 - GENERAL

1.01 GENERAL CONDITIONS:

A. The General Conditions and Special Provisions preceding this Specification shall govern this section.

B. Specification and Plans complement each other and what is specified, scheduled or mentioned by one shall be binding as if called for by both. Specification and Plans are intended to specify nature, quantity and quality of electrical work.

C. Before bidding, visit project site, carefully review each section of the Specification and all Drawings of this Contract, and obtain from utility companies their standards, drawings and specifications for the work to be provided. Verify details, report any error, conflicts or omissions to the Owner's representative (hereafter referred to as Engineer) at least 10 calendar days before submission of bids for interpretation or clarification. If errors or omissions are not reported, Contractor shall provide necessary work at no cost to the Department to properly complete intent of Specification and Drawings.

By submitting a proposal of the work included in this contract, the Contractor shall be deemed to have made such examination and to be familiar with and accept all conditions of the job site.

1.02 WORK INCLUDED:

A. In general, provide complete underground electric, communications, and power systems within project boundaries. Furnish all labor, materials (except as hereinafter noted), tools, equipment and appliances required to provide and install all Electrical Work, complete, as indicated on the Drawings and/or as herein specified, and as required for its correct and proper operation. The Drawings note various sizes of equipment as determined for basis of design; the Electrical Work, however, shall be installed to comply with the equipment furnished by the successful supplier. The work shall include but not necessarily be limited to:

1. Complete underground raceway system including trenches, ducts, manholes, and boxes, to be used by the Hawaii Electric Light Company (HELCO) for their cables and equipment.

2. Complete underground raceway system including trenches, ducts, manholes, and boxes, to be used by Sandwich Isles Communications, Inc. for their cables and equipment.

3. Complete street light system including energization of the system by HELCO.

4. Coordinate work and arrange for periodic inspections by Hawaii Electric Light Company, Sandwich Isles Communications, Inc., State Inspectors, County Inspectors, and Engineer.

5. Pass test mandrel through all ducts and conduits, and make corrections as directed by inspectors or Engineer.

6. Provide pulling wire, No. 12 AWG galvanized steel or polypropelene cord, in all empty ducts and conduits, unless indicated otherwise. Provide duct measuring/cable pulling tape in all Hawaii Electric Light Company and Sandwich Isles Communications, Inc. ducts and conduits.

7. Immediately report and pay for damages to existing equipment.

B. Obtain and pay for electrical permits, arrange for periodic inspection by local authorities and deliver certificate of final inspection to Engineer.

C. Contractor shall check and test the installation for completeness and functional operation as described by the Drawings and specified herein. Final test shall be in the presence of Engineer and representatives of the utility companies, Sandwich Isles Communications, Inc., and the County. Contractor shall arrange and pay for all testing costs. Should intermediate or final inspections of the duct system reveal crushed, damaged or impassable ducts, the Contractor shall repair those sections of duct system, including repairs to paved surfaces and concrete structures, at no additional cost to the owner.

1.03 SPECIAL CONDITIONS:

A. Contractor shall install duct systems and schedule the electric and communications work within the timetable set by the General Contractor.

B. Contractor shall verify duct entry configurations and their locations, for each utility company and Sandwich Isles Communications manhole and handhole, with the respective utility company and Sandwich Isles Communications.

C. Contractor shall make detailed arrangements for work by utility companies and Sandwich Isles Communications, Inc. pertaining to this Contract. Payment to utility companies for their work shall be by the State.

D. Contractor shall closely coordinate all work with Sandwich Isles Communications, Inc. (SIC). All trenches must be inspected prior to backfilling material. The Contractor shall notify the SIC Inspector (Customer Service Toll Free No. 1-888-995-7274) at least 72 hours prior to pouring of concrete or backfilling trenches.

E. Arrange for the General Contractor to identify the locations of all civil site utilities (i.e. drain, water and sewer lines, etc.) and driveways prior to layout of electric and communications systems.

F. Contractor and General Contractor shall closely supervise and coordinate all electrical work with the utility companies and Sandwich Isles Communications, Inc. to ensure that proper roadway drainage is maintained during construction. Should damage and erosion occur during construction, the Contractor or General Contractor shall repair all damage and restore existing grade at no additional cost to the State.

1.04 RELATED WORK BY OTHERS:

A. Service cables and transformer(s), final connection thereto, and metering equipment by Hawaii Electric Light Company. Obtain service raceway, grounding, transformer, and metering requirements before bidding, fabricating, constructing and installing. Make detailed arrangements for all work by utility company pertaining to Contract.

B. Street light installations and connection of street light circuits to utility company power source shall be by the contractor.

C. Telecommunications utility cables and equipment shall be by Sandwich Isles Communications, Inc.

D. Equipment utilizing electricity shall be provided by respective sections of Specification. Furnishing of equipment controllers (motor starters), unless otherwise specified, and providing complete control and interlock is provided by respective section supplying equipment. Installation of complete feeder or branch circuit system, and power wiring to equipment and controllers shall be part of electrical work.

1.05 SUBMITTALS:

A. Shop Drawings: Within four weeks of award of Contract and prior to installation, submit complete shop drawings and manufacturer's literature for Engineer's review before any work is fabricated. Submit six sets of manufacturer's literature and/or fabrication drawings for the following:

1. Complete street light standards and accessories.

2. Complete electric and utility system pullboxes, handholes, manholes, conduit and accessories. For utility system pullboxes, handholes, and manholes, obtain approvals from respective utility company prior to submission for Engineer’s review.

3. Utility companies' drawings.

B. Prequalification: Brand names, manufacturer's names and catalog numbers indicate standard of design and quality required. Where materials or products specified herein are designated by manufacturer's name, any request to substitute materials or products other than those specified shall be approved by the Engineer. Burden of proof of equality of proposed substitutions will be the responsibility of the Contractor. List of substitute material together with qualifying data shall be submitted for approval at least ten days before bid opening.

Submission shall be as follows:

EXAMPLE:

| Item | Manufacturer and Catalog Number Specified | Substitute Manufacturer And Catalog Number |
|---|---|---|
| Cable | John Doe - No. 3200 | King - No. 2200 |

C. Shop drawings and catalogue cuts for substitute materials shall clearly specify compliance with and/or deviation from specified material. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; and "achieve the same end use and results as materials formulated in accordance with the referenced publications". Certifications shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and shall be signed by the manufacturer's official authorized to sign certificates of compliance. Review of shop drawings and catalogue cuts shall not release Contractor from complying with intent of Drawings and Specifications.

D. Intent of Shop Drawing and Catalog Cut Review:

1. Shop drawing and catalog cut submittals processed by the Engineer are not Change Orders. The purpose of the submittals by the Contractor is to demonstrate to the Engineer that he understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use;

2. If deviations, discrepancies or conflicts between shop drawings and Specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed;

3. The fact that a manufacturer does not offer a specific option or meet a minimum guaranteed performance specification, called for herein or in a formal bid specification, is not deemed proprietary when such is available from one or more manufacturers.

E. Approvals rendered on shop drawings shall be considered as a guarantee of measurements or site conditions. Where drawings are approved, said approval does not relieve the Contractor from his responsibility for furnishing material or performing work as required by the Contract Drawings and Specifications.

1.06 GUARANTEE AND CERTIFICATE:

Defective materials and workmanship shall be removed and replaced at no cost to the owner. For period of one year after acceptance of work by the owner, materials and workmanship developing defects and malfunctions shall be repaired and/or replaced, to conform to intent of the Specification and Drawings at no additional cost to the owner.

## PART 2 - PRODUCTS

2.01 GENERAL:

A. All materials shall be new, except as specifically noted, and shall bear the label of Underwriters' Laboratories whenever standards have been established and label service is normally and regularly furnished by the agency.

B. All materials used for Sandwich Isles Communications, Inc. work shall be on the Rural Utilities Service (RUS), United States Department of Agriculture list of approved materials.

2.02 MATERIALS:

A. Direct Buried Conduits (for below grade use):

1. Under Sidewalk or Protective Concrete Topping: Conduits for electric systems shall be round bore, PVC (polyvinyl chloride) Schedule 40 plastic or approved equal. Conduits for communication systems shall be round bore, PVC (polyvinyl chloride) Schedule 40 plastic, or approved equal. Conduits for secondary power systems shall be PVC (polyvinyl chloride) Schedule 40.

2. Under Road Pavement or Grassed Areas: Conduits for electric systems shall be round bore, PVC (polyvinyl chloride) Schedule 80 plastic or approved equal. Conduits for communication systems shall be round bore, PVC (polyvinyl chloride) Schedule 40 plastic, or approved equal. Conduits for secondary power systems shall be PVC (polyvinyl chloride) Schedule 80.

B. Concrete Encased Conduits (for below grade use): Conduits for electric systems shall be round bore, PVC Schedule 40 plastic or approved equal. Conduits for communications systems shall be round bore, PVC Schedule 40 plastic or approved equal. Conduits for street lighting system shall be PVC Schedule 80.

C. Conduit and Duct Accessories: Couplings, spacers, plugs, and accessories shall be as recommended by the manufacturer of conduits and ducts and shall be of the same schedule as the ducts which are connected to it.

D. Ground Rods: Diameter shall be adequate to permit driving to full length of the rod, but not less than 5/8" in diameter unless otherwise indicated. Ground rods for street light standards shall be 5/8" x 10'-0" copper-cladded steel core. All others shall be 5/8" x 8'-0" copper-cladded steel core, unless indicated otherwise.

E. Wire Mesh: Welded steel wire fabric for reinforcing concrete, galvanized, conforming to ASTM Specification A185.

F. Concrete: Ready mixed type with compressive strengths as shown on Drawings. Concrete material and aggregates shall conform to latest ASTM Specifications. Concrete aggregates for ductlines shall be 3/4" maximum in size.

G. Backfill Material Type A: Black or beach sand, earth or earth and gravel mixture. Material used shall be non-expansive. If earth and gravel mixture, rock size shall be 1-inch or smaller and shall not contain more than 50% rock particles by volume. This fill shall be used over concrete encased ducts and over direct buried ducts after backfill Type B has been placed.

H. Backfill Material Type B: Black or beach sand, earth or earth and gravel mixture. Material used shall be non-expansive. If earth and gravel, mixture must pass a 2-inch screen and contain not more than 20% rock particles by volume. This fill

shall be used all around direct buried conduits.

I. Manholes, Handholes and Pullboxes: Shall be the type noted on the drawings and shall be constructed in accordance with the applicable details as indicated. Manholes, handholes and pullboxes may be precast or cast-in-place.

1. Precast Manholes, Handholes and Pullboxes: Provide precast manholes, handholes and pullboxes complete with all accessories (i.e. cable racks, steps, pegs, etc.) and strengths as required for cast-in-place manholes, handholes and pullboxes. Identify each casting by having the manufacturers name and address cast into an interior face or permanently attached thereto.

a. Precast manholes, handholes and pullboxes shall have a smooth trowel finish for horizontal surfaces.

b. Precast units shall be the product of a manufacturer regularly engaged in the manufacturer or precast concrete manholes, handholes and pullboxes.

c. Precast manholes assembly, including frame and cover shall be rated for AASHTO Class H20 wheel loading, unless otherwise indicated.

d. Sandwich Isles Communications UM-35 and UM 4x6 manhole assembly units shall be by Hawaii Precast, per master purchase agreement. Covers shall have the “SIC” logo.

e. Sandwich Isles Communications Handholes: Shall include 20K traffic load rated cover(s).

(1) UHC 30x48x36 Handhole (Pullbox) Assembly Unit: Consist of one Armorcast polymer concrete box and cover assembly, with ground rod, penta-head bolted covers and “SIC” logo. Part Number (A6001430TA-SIC2) or equal.

2. Cast-in-Place Manholes and Handholes: Concrete used shall provide 4000 pounds compressive breaking strength at 28 days maturity. Floor surface shall have a steel trowel finish. Walls shall be of monolithic concrete construction. The complete manhole assembly, including cover, shall be rated for AASHTO Class H20 wheel loading. Submit manufacturer’s certificate of compliance with requirements.

3. Pulling-in Irons: Shall be steel bars bent in the form indicated and cast in the manholes or handhole walls. In the wall they shall be not less than 6 inches above or below, and opposite the conduits entering the manholes or handhole. Pulling-in irons shall be projected into the handhole and manhole approximately 6 inches. Irons shall be zinc coated after fabrication.

4. Cable Racks: Including hooks and insulators, shall be sufficient to accommodate the cables and shall be spaced not more than 18 inches horizontally. The wall bracket shall be channel or T-section steel. The hooks shall be of steel or malleable iron and shall be of the removable type.

Insulators shall be dry-process glazed porcelain. The metal portion of racks shall be zinc-coated after fabrication. Cable racks for use in existing manholes shall be compatible with existing rack supports.

5. Cast end bells shall be provided; “knock outs” shall not be allowed.

6. Concrete bricks shall be concrete masonry units conforming to ASTM C 139.

J. Wires and Cables: Conductors shall be copper, No. 12 AWG minimum; No. 10 AWG and smaller, solid and round; No. 8 AWG and larger, 7 or 19 strands concentric.

1. For street light circuits, exterior and below-grade locations, conductors shall be type RHW-USE, ground wire may be type THW.

2. Grounding conductors shall be 1/c - #4 bare copper unless indicated otherwise.

3. Wires and cables for locations and uses not specified above shall be suitable for the purpose and in accordance with the NEC.

K. Sandwich Isles Communications BM 2(5/8)(8) Housing Ground Assembly Unit: Consists of providing a copper clad ground rod, ground rod clamp and the required length of bare #6 AWG tinned copper ground wire connected to an auxiliary grounding connector (included in the housing assembly unit) within the housing. The first set of parentheses indicates the required diameter of the ground rod, and the second set of parentheses indicates the length of the ground rod.

L. Connectors and Terminals: Connectors and terminals shall be designed and approved for use with the associated conductor material, and shall provide a uniform compression over the entire contact surface. Solderless terminal lugs shall be used on all stranded conductors. Crimp type connectors will be acceptable; however, the type which makes only one indentation will not be acceptable. The crimping tool shall make a minimum of four indentations around the circumference of the cable. In addition, crimp type connectors to be used on 250 MCM and larger conductors shall have adequate length for two sets of indentations on each half of the connector.

1. Gaskets shall be of neoprene or Buna N rubber, and shall be a resilient, heat-resistant and oil-resistant grade having low compression set and high tear strength.

2. Cap screws shall be of a cadmium or zinc-coated steel or of copper-silicon alloy, and shall be of extra-large size and closely spaced so as to maintain a tight joint.

M. Waterproof Connection Kits: Shall be quick disconnect in-line fuse holder (6 ampere fuse link unless indicated otherwise) fused for hot leg. The fuse holder body shall be molded plastic made in two sections where lead side section shall have a captive nut and waterproofing ring. Fuse holder shall be TRON and manufactured by BUSSMANN, or approved equal.

N. Luminaires (LED Street Light):

1. Photometric

a. General

i. Total system Efficacy (lumens/W): >55 (luminaire including power supply)

ii. Color Rendering Index (CRI): ≥36

iii. Maintained Lumens: >5000 for 5 years

b. Blue Light Content: Blue Light Content is defined in this proposal request to mean the ratio of the amount of energy emitted by the outdoor light fixture between 400 and 500 nm divided by the amount of energy between 400 and 700 nm. Blue Light Content will be less then 2%. The spectral output shall be measured in milliwatts at one nm increments between 400nm and 700nm.

c. Color Coordinates: X=0.46±0.03: Y=0.53±0.03 (Blue Light Contect will be less than 2%)
Color co-ordinates shall be outside the ITE coordinates for the amber and red traffic signal and outside the SAE white headlight color distinction.

d. Color Stability: Blue light contect and color coordinates must be maintained for >5 years.

2. Electrical

a. Photoelectrical controller: 45,000 hour lifetime

b. Input Voltage/Frequency: 90-305 VAC, 50/60Hz, single phase

c. Power Consumption: <92W

d. Surge Protection: Rated at 10kV level

e. Efficiency: ≥90% in the system

f. Input Voltage: 120/240VAC, nominal

g. Ingress Protection: IP67

h. Power Supply Rating: The power supply will provide a 30% level of excess power rating for the luminaire

i. Safety: UL regonized

3. Mechanical

a. Road Mounting Height: 30’ nominal (27’ pole w/3’ mast arm rise)

b. Fixture Mounting: Mast arm fitter for 2-3/8" OD arm, ring gasket, and 3/8" stainless steel hex head set bolts that are externally accessible.

c. The luminaire must have a provision to allow leveling of the fixture

d. Fully shielded configuration

4. Housing: Die cast aluminum luminaire housing. Powder-coated, ASA-70 light grey paint (interior & exterior). Heavy-duty, stainless steel latches to provide safe, secure installation with tool-less access to the housing interior. The luminaire mounting shall be able to swing in the vertical axis, at a minimum of ±10º to align the fixture horizontally on existing poles that are not perpendicular to the ground. All exposed internal connections shall be made inside a water tight compartment. An approved equal shall be considered.

5. LED Unit: Shall be modular; lens shall have high-impact acrylic lens.

6. Thermal considerations: The assembly shall be built to allow sufficient cooling to prevent any electronic components from overheating.

7. Luminaire Weight: <30lbs

8. Environment

   a. Operating Temperature Range (minimum): 4ºC - 60ºC (39ºF - 140ºF);

   b. Operating Humidity: up to 100%

9. Certifications

   a. NEC: Article 410

   b. UL: Suitable for wet locations

   c. Safety: CE, UR, RoHS

   d. Ingress Protection for all electrical components: IP65 or higher

   e. LED Lumen Maintenance (LM80): Verified by the LED manufacturer to provide 70% of initial lumens for at least 50,000 hours (L70) in accordance with LM80 (IES-80-08).

   f. Corrosion Protection: Rated to meet or exceed the ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus.

10. System Warranty

    a. Power Supply: >50,000 hours, base on average daily use.

b. LEDs: >50,0000 hours, based on 11-1/2 hours per day in use.

c. Enclosure Unit: >10 years, based on 24 hours per day in use.

O. Poles: Shall be vandal resistant, with access handhole, for anchor base mounting, complete with fixture luminaire aperture, hot-dipped galvanized anchor bolts, etc. as indicated on the Drawings. Pole strength design shall be for minimum of 105 MPH winds.

P. Hardware, Supports, Backing, Etc.: All hardware supports, backing and other accessories necessary to install electrical equipment shall be provided. Wood materials shall be "wolmanized" treated against termites, iron or steel materials shall be galvanized for corrosion protection, and non-ferrous materials shall be brass or bronze.

## PART 3 - EXECUTION

### 3.01 GENERAL:

A. Rules and Permit: The entire installation shall conform to ordinances of the County of Hawaii; General Order No. 10, Public Utilities Commission, State of Hawaii; and shall be made in strict accordance with the latest rules and regulations of the National Board of Fire Underwriters, the currently adopted edition of the National Electrical Code (NEC) and the local Electrical Bureau. The Contractor shall obtain and pay for the electrical permit as required by local laws and rules. All work shall be inspected by the proper local authorities as it progresses. The Contractor shall pay all inspection fees and shall deliver certificates of completion and inspection to the Engineer before final payment will be made. Costs of permits and inspection fees shall be included in the Contractor's bid price.

B. Materials and Workmanship: All labor and materials of every kind shall be subject to the approval of the Engineer who shall be afforded every facility for ascertaining the competence of such labor and examining such materials as he may deem necessary. Concealed work shall be reopened at random as directed during formal inspection by Engineer or Electrical or Utility Inspector.

C. Qualification of Installers: For actual fabrication, installation and testing of the Work of this section, use only thoroughly trained and experienced workmen completely familiar with items required and with manufacturers' recommended methods of installation. In acceptance or rejection of installed work, no allowance will be made for lack of skill on part of workmen.

D. Construction Methods: Construction shall conform to construction practices as recommended by the American Electricians Handbook by Croft (latest edition), American National Standards Institute (ANSI), Edison Electric Institute, National Board of Fire Underwriters (NBFU), National Electrical Code (NEC), National Electrical Manufacturer's Association (NEMA), National Electrical Safety Code (NESC), National Fire Protection Association (NFPA), Underwriters' Laboratories, Inc. (UL) and applicable instructions of manufacturers of equipment and material supplied for this project.

E. Inspection: Skill and competency of workmanship shall be subject to the approval of the Engineer, inspectors of the utility companies, Sandwich Isles Communications, Inc., the State of Hawaii and the County of Hawaii. Notification for inspection shall be given to the respective companies or agencies three working days in advance of work.

F. Record Drawings: The Contractor shall maintain an accurate and adequate record of each change as it occurs, regardless of how ordered. As-built drawings shall be prepared in accordance with project requirements.

G. Plans and Specification: This specification is intended to cover all labor, materials and standards of workmanship to be employed in the work indicated on the plans and called for in the specification or reasonably implied therein. The plans and specification supplement one another. Any part of the work mentioned in one and not represented in the other, shall be done the same as if it has been mentioned in both. The Contractor shall not make alterations in the drawings and specification.

H. Discrepancies and Interpretations:

1. Should the Contractor find any discrepancies in or omissions from any of the documents or be in doubt as to their meaning, he shall advise the Engineer who will issue any necessary clarification within a time period which does not disrupt the progress of the work.

2. All interpretation and supplemental instructions will be in the form of a written addenda to the Contract Documents.

3. Should any discrepancy arise from the failure of the Contractor to notify the Engineer, the higher quality or larger quantity of item shall prevail. Engineer shall make the final interpretation and judgement.

4. In the event of a discrepancy between small scale drawings and large scale details, or between drawings and specification, on which is in violation of any regulations, ordinances, laws or codes, the discrepancy, if known by the Contractor, shall be immediately brought to the attention of the Engineer for a decision before proceeding with the particular work involved. Work carried out disregarding these instructions will be subject to removal and replacement at the Contractor's expense.

I. Symbols: The standard electrical symbols together with the special symbols, notes and instructions shown on the drawings indicate the work and outlets required and are all to be included as a part of this specification.

J. Coordination: This specification is accompanied by plans, sections and elevations, and site plans indicating locations of all outlets, controls, service runs, and other electrical apparatus. These locations are approximate and, before installing, the Contractor shall study the adjacent civil utility and landscaping details and actually make the installation in the most logical manner. Any outlet may be relocated within ten feet before installation at the direction of the Engineer. The circuit routing is typical only and may be varied in any logical manner.

K. Before installation, verify all dimensions, conditions and sizes of equipment at job

site. Installation shall be complete in every detail as specified and ready for use.

L. Work shall conform to ordinances of County of Hawaii; latest edition of National Electrical Code (NEC); General Order No. 10, Public Utilities Commission, State of Hawaii; and Regulations and Standard Practices of Hawaii Electric Light Company, and Sandwich Isles Communications, Inc.

M. Applicable rules, standards and specifications of following associations shall apply to materials and workmanship:

American National Standards Institute (ANSI)
Illumination Engineer Society (IES)
National Board of Fire Underwriters (NBFU)
National Electrical Manufacturer's Association (NEMA)
National Fire Protection Association (NFPA)
Underwriters' Laboratories, Inc. (UL)

Applicable instructions of manufacturers of equipment and material supplied for this project.

N. All metallic materials shall be protected against corrosion. Exposed metallic parts of outdoor apparatus shall be given a rust-inhibiting treatment and standard finish by the manufacturer. All such parts as boxes, bodies, fittings, guards and miscellaneous parts made of ferrous metals but not of corrosion-resistant steel, shall be zinc-coated in accordance with ASTM A153. The Contractor shall not join dissimilar metals that will result in deterioration due to galvanic corrosion.

3.02 CONSTRUCTION REQUIREMENTS:

A. Trench Excavation:

1. Dimensions and locations of trenches for boxes, transformer and equipment pads, direct buried conduits and ductlines shall be as indicated on Drawings. Trench width and depths shall be sufficient to accommodate proper installation of conduit banks and cables.

2. Should material at bottom of trench for direct buried conduits not be equal to backfill material Type B, the trench shall be excavated an additional 3” to permit backfilling with Type B backfill.

3. Where a trench is excavated on slope, sides are to be vertical, and depth measured at lowest side. All measurements are to be based on final grades.

4. Bottom of trenches to be flat and smooth.

5. Trenches shall be widened at equipment pads, manhole, handhole and pullbox sites to permit proper entry of conduits.

6. Trenches shall be approved by respective utility inspectors prior to any ducts being installed.

7. All excavations for manholes, pullboxes and handholes in excess of the

required depths shall be filled with concrete or crushed lava rock.

8. Excavate 30'-0" on both sides of manhole and handhole locations prior to installation of manhole and handhole. If water, drainage or sewer lines are encountered, provide smooth transitions below the respective utility line.

9. Sheathing and bracing as required shall be provided to support sides of excavations from cave-ins.

10. Provide drainage and pumps to keep trenches dry.

11. Saw cut all edges of existing sidewalks and pavement before trenching.

12. Excavated material may be placed alongside trench; however, it shall not interfere with utility company work.

13. Utility companies and Sandwich Isles Communications, Inc. shall be notified a minimum of seventy-two hours before commencing excavations.

B. Backfill:

1. Ducts, boxes, and conduit installations shall be approved by the respective inspector from utility company and Sandwich Isles Communications prior to backfilling. All excavations for boxes in excess of the required depths shall be filled with concrete or crushed lava rock.

2. Should material below utility company and Sandwich Isle Communications= direct buried conduits not be equal to 3" (thickness) of backfill material Type B, trench shall be deepened by 3", and backfilled with Type B backfill.

3. Backfilling shall be to finished grades indicated on accompanying Drawings, and matching existing conditions.

4. Backfill material shall be completely free of wood or other debris. Excavated material may be reused as backfill, providing that it conforms to the requirements of Type A and Type B backfill. For excavated material used to backfill Sandwich Isles Communications ducts, a written soils report of conformance by a licensed third party Geotechnical Engineer is required prior to backfilling using the excavated material.

5. Type B backfill over conduits shall be installed under the supervision of the respective utility companies' and Sandwich Isles Communications= inspector.

6. Backfill material shall be placed in maximum of 8" layers in loose thickness before compacting. Backfill shall be thoroughly compacted with hand or mechanical tampers to 95% of ASTM D1557 maximum dry density. In no case shall tamping be accomplished by using the wheels or tracks of a vehicle.

7. Backfill over conduit bends at transformer pads shall be Type A or better.

C. Installation of Conduit and Duct Bank:

1. Bottom of trench shall be clean, smooth, and well-graded and approved by utility company inspectors.

2. Saw cut, ream and taper ducts and conduits with manufacturers' approved tool.

3. Couplings and bells shall be tight to prevent entry of dirt or concrete into ducts and conduits. Stagger the joints of the ducts by rows and layers so as to provide a ductline having the maximum strength.

4. Provide spacers to maintain proper separation between ducts.

5. Changes of direction shall not exceed 4 degrees per length of conduit or duct. Radii and turns shall be made with appropriate duct bends and sweeps.

   Horizontal bends for Sandwich Isles Communications, and communications conduits/ducts shall be constructed with 25-foot minimum radius curves unless indicated otherwise or approved by the Sandwich Isles Communications, Inc. inspector or Engineer, respectively. Angled couplings are not permitted. If factory made bends are to be provided, the contractor shall demonstrate their suitability to the Engineer and inspectors by pulling the respective mandrel completely through the bend prior to installation. Vertical bends for Sandwich Isles Communications, and communications conduits/ducts shall be constructed with 20-foot minimum radius curves unless indicated otherwise or approved by the respective inspector or Engineer.

6. Ducts shall be clean and free from debris and rubbish.

7. After each day's work, provide temporary watertight conduit plugs or seals at the end of conduit banks to prevent entry of dirt, rubbish, debris, or concrete. Ducts for Sandwich Isles Communications use shall be provided with Jackmoon Plug or equivalent. Duct tape is not acceptable.

8. Pass a test mandrel conforming to the respective utility company, County of Hawaii or the Engineer's requirements, through the entire length of each duct or conduit to test for burrs and obstructions. Unless indicated otherwise, mandrel shall be 14" long and shall have diameter of 2" less than inside diameter of duct. Mandrel for Sandwich Isles Communications ducts shall be 12" long and shall have diameter of 3" less than inside diameter of duct. Mandrel shall be pulled through each Sandwich Isle Communications duct, after which a brush with stiff bristles shall be pulled through to make certain that no particles of earth, sand, or gravel have been left in the duct. The Sandwich Isles Communications Inspector shall be present during the mandrel testing. If burrs or obstructions are encountered, that section shall be replaced at no additional cost to the Department.

9. Unless indicated otherwise, install #12 AWG galvanized iron pulling wire or polypropylene cord, having a breaking strength of at least 200 pounds, in

each conduit after testing.

a. For electric utility company ducts, provide cable pulling tape (NEPTCO WP1800P Muletape or approved equal) in each new duct.

b. For Sandwich Isles Communications ducts, provide duct measuring/cable pulling tape (NEPTCO WP1800P Muletape or approved equal) in each new duct.

Using the duct measuring/cable pulling tape, the Contractor shall measure at least one duct of a common duct run. The distance shall be marked on a copy of the record prints and submitted to the respective Sandwich Isles Communications inspector for record keeping.

10. Terminate ducts in end-bells where ductlines enter manholes and handholes. Ducts shall enter handholes at 90 degree angle. Ducts entering handholes at angles other than 90 degrees may be permitted, but only when specified by the Engineer.

11. Apply thin coat of sealing compound on ducts and conduits at couplings and bells.

12. Conduits stubbed for future connections shall be plugged and marked.

13. Securely anchor duct banks prior to pouring concrete encasement to prevent ducts from floating. Utility Company and Sandwich Isles Communications duct banks shall be inspected and approved by the respective inspector prior to placing concrete and backfilling.

14. When pouring concrete, prevent heavy masses of concrete from falling directly on ducts. If unavoidable, protect ducts with plank.

15. Direct flow of concrete down sides of duct bank to bottom, allowing concrete to rise between ducts, filling all open spaces uniformly.

16. To ensure against voids in concrete, work a long, flat splicing bar or spatula liberally and carefully up and down the vertical rows of ducts. Mechanical vibrators shall be used for stacked duct banks of three ducts or higher.

17. Cure concrete for a minimum of 72 hours before permitting traffic and/or backfilling.

18. Warning Tapes:

a. 6" wide warning tape, red in color with a black imprinted message ACAUTION ELECTRIC LINE BURIED BELOW@, shall be placed 12" below finish grade over electric ducts or the concrete jacket for electric ducts for the entire length of ductline installations.

b. A 3" wide warning tape, orange in color with black imprinted message "CAUTION BURIED TELEPHONE CABLE BELOW" shall

be placed 12" above Sandwich Isles Communications ducts or the concrete jacket for said ducts for the entire length of ductline installations.

D. Concrete and Brick Work:

1. Concrete, ready mixed according to ASTM C94-98.

2. Convey concrete from mixer to forms rapidly to prevent segregation. Free drop shall be limited to five feet, unless authorized by inspector.

3. Placing:

a. Clean and remove all debris from inside forms and trenches before placing concrete.

b. Place concrete only on clean damp surfaces, free from water.

c. Place concrete in forms, in horizontal layers not exceeding 18" thickness.

d. Place concrete to avoid segregation of materials and displacement of ducts, inserts and reinforcing.

e. Vibrate structural concrete thoroughly during and immediately after placing to ensure dense watertight concrete.

f. Prior to placing concrete for utility company ductlines, the Contractor shall obtain the approval of the respective inspector.

4. Forming:

a. Forms shall be of good sound lumber with sufficient strength and conforming to shapes and dimensions indicated on Drawings.

b. Forms shall be treated with non-staining form oil immediately before each use.

5. Patching: Patch all voids, pour joints and holes before concrete is thoroughly dry. Use mortar of same proportions as original concrete.

6. Curing: Curing of concrete shall be accomplished by impervious membrane method with liquid membrane compound. Apply two or more coats to obtain a total of one gallon for each 150 square feet of concrete surface.

7. Reinforcing Steel:

a. Clean reinforcing of mill or rust scale and form to dimensions indicated.

b. Install reinforcing in proper locations and secure in place to prevent movement during concrete placing or vibrating.

8. Concrete Brick and Hollow Concrete Block Work:

   a. Concrete brick and hollow block shall be laid in full bed of mortar, both horizontally and vertically.

   b. Mortar shall be one part (by volume) cement and three parts (by volume) fine aggregate, thoroughly mixed and used when fresh. Retampering will not be allowed. Mortar shall have a minimum 28 days strength of 2,500 psi.

   c. Setting bed shall be of depth required to bring top of blocks flush with finish line.

E. Manholes, Handholes and Pullboxes:

1. Boxes shall be installed approximately where shown. The exact location of each manhole, handhole and pullbox shall be determined after careful consideration has been given to the location of other utilities, grades and pavement. Manholes, handholes and pullboxes shall be of the type noted on the Drawings and shall be constructed in accordance with the applicable details as indicated. Provide number of cable racks and pull-in irons as required by the respective utility company. A machine-finished seat shall be provided to insure a perfect joint between frame and cover. Covers shall be machined to prevent rocking within frames. In paved areas, the tops of pullbox, handhole and manhole covers shall be flush with the finished surface of the paving. In unpaved areas, the top of handhole covers shall be approximately ½ inch above the finished grade; Sandwich Isles Communications' handholes shall be set approximately 1" above the finished grade.

2. Precast Handhole and Pullbox Installation: Commercial precast assembly shall be set on 6 inches of level, 90 percent compacted crushed rock fill, ¾ inch to 1 inch size, extending 12 inches beyond the handhole/pullbox on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator. Provide number of cable racks and pull-in irons as required by the respective utility company, complete with all hardware including steps and pegs.

   Pits for Sandwich Isles Communications precast handholes and manholes are to be flat and smooth, free of rocks, rock chips, hardened lumps of dirt, debris and all deleterious material. A six-inch layer of compacted sand shall be placed as a base for the precast manholes and handholes. Set handhole or manhole on a level area, in the bottom of the excavation, on a 4" layer of crushed rock, for drainage purposes.

3. Sandwich Isles Communications Manholes, Handholes and Pullboxes:

   a. Provide a 5/8" diameter x 8-foot copper clad ground rod in all handholes and manholes, unless indicated otherwise.

   b. Damp-proofing shall be provided on all exterior precast manhole and

handhole walls. All dust, dirt and other deleterious substances shall be removed from the concrete surface. The concrete surface shall be thoroughly dry before the damp-proofing is applied. The concrete surface shall be primed in accordance with the manufacturer's instructions and two coats of damp-proofing compound shall be applied. Allow the compound to dry thoroughly after priming and in between coats. Do not backfill until the final coat has dried hard.

c. Before backfilling and compacting, make sure covers are in place and secured. Layer 6" to 8" of backfill material around the manhole or handhole. Tamp each individual layer of backfill material. Continue the layering and "tamping" until final grade is achieved.

d. Caulk manhole and handhole seams after the unit is assembled using a good quality silicone compound material.

e. Where manholes or handholes have adjustable frames that are raised to finish grade and secured in position, the base of the manhole or handhole shall be placed level, and form work is constructed between the underside of the frame and topside of the manhole or handhole using duct tape, wood strips, cardboard, etc. All voids created during the installation shall be filled with mortar mix, concrete or slurry and allowed to set. Strip forms after sufficient strength has developed. This is especially important where manholes or handholes may be subject to any vehicular traffic.

f. UM-35 manholes are equipped with jack moon duct plugs to accommodate the UD (1x3) configurations. All 4-inch duct plugs, however, are to be provided by the Contractor. This unit will accommodate six SDR-11 conduits; therefore, the Contractor is required to provide plugs for the vacant conduit holes in the jack moon.

g. UM4x6 manholes shall be installed with the deck set at a minimum of 14" below finished grade.

4. Ducts ending in manholes or handholes shall be terminating with junior end bells. End bells, terminators or ducts shall be flush to inside wall surfaces; duct extensions into boxes are not acceptable. All ducts entering manholes or handholes shall be grouted between conduits and sidewalls, inside and out. Verify complement and arrangement of ducts entering each manhole or handhole and location of duct entrance with the respective utility company and Sandwich Isles Communications, Inc. prior to the fabrication of the respective manhole or handhole.

   Sandwich Isles Communications duct shall enter the manholes and handholes on the property side at all times unless otherwise specified by the Engineer. Ducts shall enter handholes at 90 degree angle.

F. Electrical Equipment Pads:

1. Slope of lots/area for concrete equipment pads shall not exceed one-inch

rise in one foot run.

2. Grade sufficiently around equipment pad area to prevent future filling of lot/area.

3. Transformer pads may be precast or cast-in-place reinforced concrete as indicated on Drawings.

4. Concrete equipment pads shall be installed level. Pad elevation shall be 2" above the highest grade fronting the pad.

G. Street Lighting Systems:

1. Street lighting materials and installation shall be in accordance with the Standard Specifications of the County of Hawaii, and as specified herein and on the Drawings.

2. Street lighting system shall be provided illumination along length of project roadways. System shall be provided complete, and be completely tested and ready for use. Furnish computerized footcandle arrays to show illumination levels and distribution along all project roadways.

a. Street light fixtures shall be mounted with bracket arms oriented 90 degrees to center line of road. Shaft shall be field adjusted for vertical alignment.

b. Prior to trenching or excavating, structural outlines and center lines of ductlines and street light foundation shall be clearly staked, and approval received from Engineer, County inspectors and utility companies. Staking shall be with steel or wood pegs or paint.

c. Base foundation for street light standards shall consist of cast-in-place reinforced concrete complete with anchor bolts, sized and placed in accordance with pole manufacturer's requirements and installation template. Length of base shown on Drawings shall be considered as minimum and shall be lengthened to suit the soil conditions and to adequately support the pole and lighting fixture assembly.

d. After pole is set, grease (or bituminous coat) ends of all anchor bolts, bottom of the anchor plate and all screws and bolts.

3. Provide duct seal in duct entries into handholes and pullboxes to prevent moisture from entering light fixtures.

H. Structural Steel And Miscellaneous Metal Work: Structural steel work including bolts, nuts, anchors, pulling-in irons, etc. shall be galvanized by hot-dipped process after fabrication into largest practical sections.

I. Installation of Wiring System:

1. Street light electrical system materials and installation shall be in accordance

with Standard Specifications, and as specified herein and on the Drawings.

2. Unless otherwise indicated or specified herein, wiring shall consist of single conductor cables installed in conduit/duct in areas where permitted by the NEC and NESC.

3. Conductors:

   a. Mechanical means for pulling shall be torque-limiting type and not used for #2 AWG and smaller wires.

   b. Pulling tension shall not exceed wire manufacturer's recommendations.

   c. Where necessary, powdered soapstone may be used as a lubricant for drawing wires through conduit. No other means of lubricating will be allowed.

   d. Form neatly in enclosures and boxes for minimum of crossovers. Tag all feeders.

   e. Thoroughly swab out existing ducts to remove foreign material before the pulling of cable.

4. Splicing of Wire and Cable:

   a. Splices made according to NEC Article 110.

   b. Splices for 600 Volt Class Cables: The conductors shall be joined securely both mechanically and electrically by the use of solderless or crimp type connectors with properly sized tools.

      (1) Splices for cables No. 10 AWG and smaller in underground systems shall be made only in accessible locations using a compression connector on the conductor, taped watertight.

      (2) Splices for cables No. 8 AWG and larger in underground systems shall be made only in accessible locations using a compression connector on the conductor and by insulating and waterproofing suitable for continuous submersion in water.

5. Cable Terminations: Protect terminations of insulated power and lighting cables from accidental contact, deterioration of coverings and moisture by the use of terminating devices and materials.

   a. Install all terminations of insulated power and lighting cables in accordance with the manufacturer's requirements.

   b. Make terminations using materials and methods as indicated or specified herein or as designated by the written instruction of the cable manufacturer and termination kit manufacturer.

6. Protection of Wire and Cable Ends: The ends of wire and cables in handholes, pullboxes, and in other wet locations, as defined by the NEC, that are not to be spliced or connected to equipment shall be protected from moisture and other damage.

   a. The ends of wires and cables shall be protected by applying not less than six half-lapped wraps of electrical insulating tape beginning

      three inches from the end of the wire or cable and continuing over the exposed conductor to form a watertight seal.

   b. The ends of wires and cables that are to be left unspliced or unconnected temporarily during construction shall be protected to prevent moisture from getting into the cable.

7. Finishing:

   a. All cutting that may be required for complete installation of the electrical work shall be carefully performed, and all patching shall be finished in first-class condition by the Contractor.

   b. Wipe clean all exposed raceways with rag and solvent. Unfinished raceways shall be prime-painted and finished to blend into background.

8. Miscellaneous Details:

   a. Cut, drill and patch as required to install electrical system. Repair any surface damaged or marred by notching, drilling or any other process necessary for installation of electrical work. Cutting, repairs and refinishing subject to the approval of the Engineer. Need for remedial work determined by Engineer as attributable to poor coordination and workmanship shall be cause for reconstruction to the satisfaction of the Engineer.

   b. Attachment of electrical equipment to wood by non-ferrous wood screws. Attachment to concrete by expansion anchors. Powder-charge-driven studs and anchors permitted only with prior approval.

   c. Furnish necessary test equipment and make all test necessary to check for unspecified grounding, shorts and wrong connections. Correct faulty conditions, if any.

3.03 EXISTING UNDERGROUND UTILITIES:

Underground utilities indicated on plans are approximate in location. It is not the intention of plans to imply that all existing utilities are drawn and located. It shall be the responsibility of Contractor to coordinate locations of existing utilities prior to doing any excavation work. Any damage to existing utilities shall be repaired by Contractor at no cost to the owner.

3.04 CLEANING AND REPAIRING:

A. During the progress of work, all rubbish, waste lumber, displaced materials, etc. shall be removed as soon as possible and upon completion of the work, Contractor shall remove from Owner's property and from all public and private property, at his own expense, all temporary structures, rubbish and waste material resulting from his operations.

B. The Contractor shall restore all removed or damaged pavement, gutters, curbs, sidewalks, sign posts, trees and landscape damaged by his operations to as near their original condition or better.

3.05 TESTS:

A. Ground Resistance: Ground resistance measurements of each ground rod shall be taken and certified by the Contractor. Ground resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the ground under test isolated from other grounds. Upon completion of the project, the Contractor shall submit in writing to the Engineer, the measured ground resistance of each ground rod and grounding system, as well as the resistance and soil conditions at the time the measurements were made.

B. Test all 600 volt class conductors to verify that no short circuits or accidental grounds exist. Make tests using an instrument which applies a voltage of approximately 500 volts to provide a direct reading in resistance, and measure the insulation resistance from phase to phase and phase to neutral. All test results shall be recorded and submitted.

C. Wherever test or inspection reveals faulty materials or installation, Contractor shall take corrective action, at his own expense, repairing or replacing materials or installation as directed. The materials or installation shall then be retested.

END OF SECTION