AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
	1 | 6

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0001	14-Jul-2011		ANA11-008a

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than item 6)	CODE
AFGHANISTAN DISTRICT SOUTH (AES) US ARMY CORPS OF ENGINEERS APO AE 09355	W5J9LE	**See Item 6**	

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		
	X	9A. AMENDMENT OF SOLICITATION NO. W5J9LE-11-B-0005
	X	9B. DATED (SEE ITEM 11) 30-Jun-2011
		10A. MOD. OF CONTRACT/ORDER NO.
		10B. DATED (SEE ITEM 13)
CODE / FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [ ] is extended, [X] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS.
IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

[ ] A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

[ ] B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).

[ ] C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

[ ] D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

Project: Kandaks (East) Camp Hero, Kandahar Province, Afghanistan; PN: ANA11-008a

Contracting POC: evan.b.carter@usace.army.mil

This Amendment Removes and Replaces Sections 00010, 00150, 01010, 01015, and 01321. All other terms and conditions of the subject IFB remain unchanged. The Bid Opening Date has not changed.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) TEL: EMAIL:	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED 14-Jul-2011

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

SECTION 00010 - SOLICITATION CONTRACT FORM

The following have been modified:
BID SCHEDULE

SECTION 00010
BIDDING SCHEDULE

The Contractor shall provide a price for all items.

ITEM	DESCRIPTION	QTY	UNIT	Unit Price	AMOUNT
0001	**GENERAL**				
0001AA	Mobilization/Demobilization	1	LS	XXX	$_____
0001AB	Security	1	LS	XXX	$_____
0001AC	Site Survey/Existing Conditions Map	1	LS	XXX	$_____
0001AD	Geotechnical Investigation	1	LS	XXX	$_____
0001AE	As-Built Drawings	1	LS	XXX	$_____
0002	**SITE DEVELOPMENT/ IMPROVEMENTS**				
0002AA	Site Grading and Stormwater Management	1	LS	XXX	$_____
0002AB	Water Well	1	LS	XXX	$_____
0002AC	Well House and Water Well System	1	LS	XXX	$_____
0002AD	Water Distribution System	1	LS	XXX	$_____
0002AE	Wastewater Treatment Plant	1	LS	XXX	$_____
0002AF	Wastewater Collection System	1	LS	XXX	$_____
0002AG	Underground Electrical Distribution System	1	LS	XXX	$_____

0002AH	Road Network	1	LS	XXX	$_____
0002AJ	Concrete Sidewalks	1	LS	XXX	$_____
0002AK	Motor Pool Areas	1	LS	$_____	$_____
0002AL	Site Communication System	1	LS	XXX	$_____
0002AM	Vehicle Wash Rack	3	EA	$_____	$_____
0002AN	Vehicle Refueling Point	2	EA	$_____	$_____
0002AP	Trash Collection Point	22	EA	$_____	$_____
0002AQ	Volley Ball Courts	4	EA	$_____	$_____
0003	**FORCE PROTECTION**				
0003AA	Perimeter Wall	1	LS	XXX	$_____
0003AB	Guard Towers	19	EA	$_____	$_____
0003AC	Entry Control Point	1	LS	XXX	$_____
0003AD	Personnel Bunkers	150	EA	$_____	$_____
0004	**FACILITIES**				
0004AA	Arms Storage Bldg.	5	EA	$_____	$_____
0004AB	POL Storage Bldg.	7	EA	$_____	$_____
0004AC	Fuel Operators Bldg.	2	EA	$_____	$_____
0004AD	Ammunition Supply Point	1	EA	$_____	$_____
0004AE	NCO Barracks	12	EA	$_____	$_____
0004AF	Enlisted Barracks	22	EA	$_____	$_____
0004AG	Large Latrine/Laundry Bldg.	10	EA	$_____	$_____
0004AH	Officers Barracks	6	EA	$_____	$_____
0004AJ	Battalion Storage Building	7	EA	$_____	$_____
0004AK	Small Latrine	3	EA	$_____	$_____
0004AL	Battalion Headquarters Building	5	EA	$_____	$_____
0004AM	Administration Building	1	EA	$_____	$_____
0004AN	Large Dining facility	1	EA	$_____	$_____

0004AP	Small Dining facility	1	EA	$_____	$_____
0004AQ	Vehicle Maintenance facility	7	EA	$_____	$_____
0004AR	Training Classroom Building	6	EA	$_____	$_____
0004AS	Post Exchange Building	1	EA	$_____	$_____
0004AT	MWR Building	1	EA	$_____	$_____
0004AU	Medical Clinic	1	EA	$_____	$_____
0005	**DBA INSURANCE (CLINSs 001- 004)**	1	LS	XXX	$_____

The amount listed by the offeror on this CLIN is the estimated DBA insurance premium (estimated payroll of the offeror and its subcontractors times the applicable rate(s)). The DBA insurance premium amount varies with payroll and the nature of services and will, therefore, be taken into account during price evaluation of offers. The actual amount paid by the government under this CLIN will be based on the amount of the Rutherfoord invoice, stamp "paid" and submitted by the offeror after contract award. In the event of recalculation of the premium by CNA based on actual payroll amounts, the contracting officer will adjust this CLIN by contract modification to reflect the actual premium amounts paid.

0006	**REIMBURSEMENT FOR ACTUAL PERFORMANCE AND PAYMENT BONDS PREMIUMS**	1	LS	XXX	$_____ Not to Exceed
	(see schedule note 7 of additional information)				
	TOTAL BASE BID ITEMS:				$_____
	OPTIONAL BID ITEMS				
0006AA	Site Power and Electrical Distribution System	**1**	**LS**	**$**_____	$_____
0006AB	**DBA Insurance for SUBCLIN 0006AA**	**1**	**LS**	**$**_____	$_____

The amount listed by the offeror on this CLIN is the estimated DBA insurance premium (estimated payroll of the offeror and its subcontractors, multiplied by the applicable rate(s)). The actual amount paid by the government under this CLIN will be based on the amount of the Rutherfoord invoice submitted by the offeror after contract award. In the event of recalculation of the premium by CNA based on actual payroll amounts, the Contracting Officer will adjust this CLIN by contract modification to reflect actual premium amounts paid.

	TOTAL OPTIONAL BID ITEMS				$_____
	SCHEDULE TOTAL:				$_____

SCHEDULE NOTES

1. Offeror shall submit prices on all items. Scope of work on each item is described in Section 01010.

2. Only one contract for the entire schedule will be awarded under this solicitation. This project will be awarded as a single contract.

3. Costs associated with this project shall include design and construction costs, site development, and utility installation.

4. EVALUATION OF OPTIONS: The award will be made to the lowest, responsive and responsible bidder. For pricing purposes the Government will evaluate both the Base Proposals and Option Proposals. The Government is not obligated to exercise the options.

5. EXERCISE OF OPTIONAL BID ITEMS: Optional bid items (if any) may, at the option of the Government, be added to the contract at any time within 180 calendar days after receipt of the notice to proceed.
6. A/E Design: Design costs shall consist of design analysis, drawings, and specifications for all facilities where a standard design has not been provided by the Government. The cost of all design shall be paid for under the bid item in which the design work is associated.

7. ORDER of WORK: See Section 00150.

8. PERIOD OF PERFORMANCE AND LIQUIDATED DAMAGES: See Section 00150 for performance schedule. Period of performance is defined as the number of calendar days from receipt of notice to proceed. Liquidated Damages are included in this contract. See FAR Clause 52.211-12.

9. Notwithstanding the Contract Clause entitled “Payments Under Fixed-Price Construction Contracts,” the Contractor shall not be reimbursed an amount which exceeds the dollar amount set forth in **bid item 0005**.

10. Abbreviations:

    LM = Linear meters
    SM = Square meters
    EA = Each
    LS = Lump Sum
    m^2 = square meters
    kPa = kilopascals
    m = meters
    cm = centimeters

l = liters
kVA = kilo volt amps

-END OF SECTION-

(End of Summary of Changes)

SECTION 00150
PROJECT PHASES

1.0 GENERAL

The Contractor shall construct the buildings included in this contract according to the Government issued building designs (included in the Appendices) and to design and construct all other structures, buildings and site features not included in the Government issued designs to provide a fully functioning facility as described in Section 01010 Scope of Work. Any building designs not included as part of this solicitation, but stated as part of this contract, are the responsibility of the Contractor to design as well as build. The facility shall be designed and built by a single Contractor. The Contractor may be a single firm or a team of firms that includes registered Architects and Engineers either employed by or subcontracted to the Contractor. The Contractor shall be responsible for all Contractor furnished designs, whether the Contractor utilizes services of licensed architects and engineers employed by its firm or subcontracts with independent architectural and/or engineering firm(s). The Contractor shall be solely liable for design errors and/or omissions and should be insured as the A-E firm against design errors and omissions. For this specification, the term "Government" is defined as the Contracting Officer for the US Army Corps of Engineers, Afghanistan District South.

Section 00555, DESIGN CONCEPT DOCUMENTS identifies project documents furnished herewith to be used as the basis for the project design and construction documents. The successful Offeror shall be required to complete the design and construction documentation, and construct the project in compliance with these completed requirements.

No work can begin on any phase of the process until an authorization Clearance for construction for that phase is issued.

1.1 PROPOSAL PHASE

The Proposal Phase includes the period from the time from the issuance of the solicitation through the selection process and the final award of the contract.

1.2 DESIGN PHASE

The successful contractor shall develop and submit for formal review Design Phase Submittals as indicated below and in the project schedule. The Contractor is encouraged to develop and submit multiple cost saving proposals for innovative design alternatives.

1.2.1 THE DESIGN PHASE SUBMITTALS

10% Design Submittal will be the basic services required to develop the preliminary submittal which represents items necessary for wells and subsurface investigation: Geotechnical report, well design and test results, and percolation test locations and results. After approval of the 10% design submittal, the Government may issue a Clearance for Construction (CFC) letter to commence with the construction phase of the well.

65% Design Submittal shall include 100% complete drawings and specifications for site preparation work and utility construction and shall include the incorporation of all review comments from the previous review. The 65% submittal shall also include approximately 65% complete drawings, design analysis and specifications of all other required construction documents.

99% Design Submittal shall include 100% complete drawings, design analysis, and specifications for all required construction. The 99% submittal shall also include the incorporation of all review comments from the previous review.

100% Submittal shall include all design services required to complete the design to 100% including the incorporation of all design review comments.

2.0 CONSTRUCTION PHASE

The Construction Phase shall be initiated by a CFC letter issued by the Contracting Officer.

A CFC will be provided separately by the Contracting Officer for each phase of the work. The Government may give the Contractor authorization for the Build Phase for portions of the work following review and approval of the particular Design Submittal.

Weekly coordination meetings will be held at which, as a minimum, the Contractor's Project Manager, a representative of the Designer, the site Superintendent, and the Contractor's Quality Control Manager shall be present.

3.0 PROJECT SCHEDULE:

The following is an internal design schedule and is subject to modification by the Offeror to suit their particular method of operation. Overall time constraints are required and cannot be changed except by contract modification. Prospective Offerors shall be required to submit a complete schedule for design and construction that meets or exceeds the overall time goals of the Government for this project.

Written Notice to Proceed (NTP)	following Contract Award
DESIGN PHASE	
10% Design Submittal Due	within 60 days following NTP
65% Design Submittal Due	within 120 days following NTP
99% Design Submittal Due	within 150 days following NTP
100% Design Submittal Due	within 180 days following NTP
CONSTRUCTION PHASE	
Clearance For construction	See Section 2.0
Total Design and Construction Period	**550** days (performance period includes design and construction phases)

The order of construction for all buildings and facilities shall be prioritized. The contractor shall construct in accordance with the Construction Priority Schedule in Section 01010.

All work under this contract shall be completed and buildings ready for beneficial occupancy in accordance with the Construction Priority Schedule. The Required Period of Performance is stated in Days following the NTP/Award Date, as described in Section 01010, Table 7-1.

--END OF SECTION--

SECTION 01010
SCOPE OF WORK

1. GENERAL

The project consists of the design and construction of an Afghan National Army Compound at Camp Hero, Kandahar Province, Afghanistan. The garrison project consists of new Transient Kandak, QRF Kandak, Engineering Kandak, Infantry Kandaks, and other common facilities for the brigade including all support facilities, utilities and infrastructure as applicable.

The project includes buildings and facilities that shall be constructed using full design Arch-Span type construction methods according to the standard design plans located in the Appendix of this IFB. The project is defined as the design, materials, labor, and equipment to construct buildings, roads, utilities, and other infrastructure to accommodate a garrison with a design-end population of approximately 4,600 personnel. The work within this contract shall be designed and constructed in accordance with the current International Building Code (IBC), Life Safety Codes (NFPA-101), force protection and security standards.

The Contractor may be required to coordinate the efforts required under this contract with at least one other contractor at the site. Such coordination is required as part of this contract. The coordination effort may be significant and may include such tasks as the exchange of information with other contractors such as design data, drawings, calculations, and technical information. Additionally, it may be necessary for the contractor to conduct meetings, hold teleconferences, and prepare the submittal of additional information to the Contracting Officer (KO) that demonstrates the coordination and integration of new work with existing and future work of other contractors. All coordination shall be in agreement with the KO and approved prior to the commencement of any work.

All buildings and facilities must be constructed and become operational following the Construction Priority List specified in the Section 01010. All buildings and facilities are categorized in four (4) priorities. Refer to Section 7, Completion of Work, for general requirements and for the priority listing of buildings and facilities as shown in Table 7.1, Construction Priorities Schedule.

1.1 ENGLISH LANGUAGE REQUIREMENT

All information shall be presented in English. The Contractor shall have a minimum of one English-speaking representative to communicate with the COR at all times when work is in progress.

1.2 CQM TRAINING REQUIREMENT

The Contractor's Quality Control (QC) Manager is required to have completed the U.S. Army Corps of Engineers (USACE) Construction Quality Management (CQM) course, or equivalent, before project design and construction begin or as soon as the class is available. The CQM course will be offered periodically by the USACE Afghanistan Engineer District (AES). Additional approved CQM courses include those offered by the Commercial Technical Training Center (in Jalalabad) and the Champion Technical Training Center (in Kabul). The Quality Assurance Branch of the AES can provide information related to AES offerings of the CQM course, as well as contact information for training centers. Alternative CQM courses, other than those mentioned above, must be approved by the Quality Assurance Branch.

The Contractor's quality control plan, as defined in USACE Guide Specification 01451, entitled "Contractor Quality Control", shall include "The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function." For the QC Manager, qualifications must include a certificate demonstrating completion of an approved CQM course.

1.3 SUBMITTALS REQUIREMENTS

Submittals and a Submittal Register are required as specified in Section 01335 of the Basic Contract.

1.4 COST ESTIMATE REQUIREMENTS

The Contractor shall prepare a parametric construction cost estimate for AES data collection purposes. The Contractor shall prepare a thorough, well-supported, estimate reflecting the final design features, construction

schedule, conditions, and any construction prioritizing requirements. The cost estimate shall be submitted as part of the 35%, 65%, 100% design submittals.

1.5 LOCATION

All work under this task order is for the Brigade Garrison Project 2 Camp Hero in Kandahar Province, Afghanistan. The approximate geographical location of the project is:

Longitude: 65°53'6" E

Latitude: 31°28'49" N

1.6 GENERAL REQUIRMENTS FOR FACILITIES

All requirements set forth in the Scope of Work (01010), but not included in the Technical Requirements (01015), shall be considered as set forth in both and vice versa.

In general, this project consists of designing and constructing facilities as described in this Section, the Concept Plan, standard design Arch-Span and CMU type building standard designs attached in the Appendix and the requirements stated in Section 01015 - Technical Requirements. In case of any discrepancy between Section 01010 and Section 01015, Section 01010 takes precedence. The USACE construction representative shall be notified immediately of any inconsistencies discovered in this document.

All standard construction amenities such as underground utilities, site grading, plumbing, heating, electrical, etc. shall be implied as a design and construction requirement.

All construction of the Standard Building designs identified in the Appendix of this document shall be done in strict accordance with the plans and specification furnished, with no changes made to any feature of work shown in these design drawings and specifications, unless otherwise specified.

The Contractor shall match existing on-site architectural materials and colors. All construction shall be done in the same style and paint schemes as existing buildings, respective of sustainable construction and design except as indicated. Construction shall provide for institutional (detention) grade vandal-resistant fixtures and valves in showers, toilets, and lavatories. All toilets shall be eastern style and shall face north or south.

The Contractor shall provide boot scrapers for boot cleaning at all building ingress/egress points.

Barracks shall be spaced as far apart from each other as possible given the final site design configuration, as to minimize sound propagation and to increase privacy.

The Contractor shall provide potable water, toilets, ablution areas, electrical, and communications service backbone in buildings as specified, connecting to and integrating with existing systems and shall be responsible for installing all upgrades. Specification of equipment and materials that match stocked items by the facility or central Department of Public Works is highly desirable. The Contractor shall reference the Appendix for building-specific construction details.

All materials and equipment shall be standard product of a manufacturer regularly engaged in the manufacture of the product and shall duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

All other design work not specifically identified in this document shall be the responsibility of the Contractor and it shall be submitted for review in accordance with Section 01335.

1.6.1 LIFE SAFETY

The facilities shall comply with all other safety requirements as required within references. A fire sprinkler system is not required. The Contractor shall equip buildings with wall-mounted CO_2 fire extinguishers at a 1:100 SM density (minimum). Exit signs shall be placed above doors opening to the exterior and labeled in English, Dari, and Pashto. The Contractor shall install hardwired smoke detectors to provide local alarm only. Install carbon monoxide (CO) monitors in large occupancy areas (15 SF per person or greater occupant density) and sleeping areas. . These CO monitors/alarms shall be hardwired for reliability and to prevent pilferage. For other requirements, refer to Section 01015.

1.6.2 LIGHTING

General lighting shall be provided for each building type and function within each building, in accordance with standard drawings in the Appendices. For any design build features that contractor shall adhere to the requirements in Section 01015.

1.6.3 HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

Environmental control of the facilities shall be achieved by natural ventilation, mechanical ventilation, and heating per the standard drawings in the Appendices. Cooling shall be provided in only specified rooms of specified buildings. In the case of design build facilities, for inside design conditions and air cooling and heating requirements for various spaces, see Section 01015.

1.7 UNEXPLODED ORDINANCE (UXO)/ MINES

The Contractor is not responsible for the clearance or removal of mines and unexploded ordnance (UXO) from the site prior to the commencement of construction. No construction activities are to be conducted without review of the written clearance certification for the site. If sub-surface construction activities will be performed on this site the clearance certification must state that the clearance depth was conducted to a minimum depth of 1 m.

NOTE 1: For previous UXO/mine information, and a copy of the clearance certification the following points of contact from the UN Mine Action Center (MAC) of Afghanistan are provided:

Mohammad Sediq, Chief of Operations,
Email: sediq@unmaca.org
Cell: +93 070 295207

Hansie Heymans, Chief Information Officer,
Email: hansie@unmaca.org
Cell: +93 070 294286

UXO Safety/ Demining COR, USACE
tas.uxo.safety@usace.army.mil
Comm: 540-667-6359
Roshan: 079-467-3891

NOTE 2: For construction in excess of 1.0 m (40") in depth on areas previously cleared. If the contract parameters for sub-surface construction exceed the minimum 1.0 m (40") clearance depth the Contractor WILL be responsible for clearance to these depths.

The Contractor may only provide clearance/removal services via UN Mine Action Center for Afghanistan (UNMACA) accredited entities and Clearance/removal may only be undertaken in accordance with International Mine Action Standards (IMAS), Afghanistan Mine Action Standards (AMAS), and applicable U.S. Army Corps of Engineer (USACE) Ordnance & Explosives (OE) safety standards.

The Contractor will provide a standard UXO/Demining safety work plan to the US Army Corps of Engineers UXO / Demining COR for review prior to commencement of all UXO clearance/demining activities on the project sites. Once the UXO/ Demining clearance has concluded, the Contractor shall provide the US Army Corps of Engineers UXO / Demining COR a clearance certificate for review and approval before any construction activities are to commence.

NOTE 3: The Contractor should be aware that many areas demined by NGOs and other groups may have only been cleared to a depth of 130 mm (5") for humanitarian purposes. If construction will take place, a minimum of 1.0 m (40") in depth is mandatory.

It is the responsibility of the Contractor to be aware of the risk of encountering UXO/mines and to take all actions necessary to assure a safe work area to perform the requirements of this contract. The Contractor assumes the risk of any and all personal injury, property damage or other liability arising out of or resulting from any Contractor

action taken hereunder. The Contractor and its subcontractors may not handle, work with, move, transport, render safe, or disarm any UXO/mine, unless they have appropriate accreditations from the MAC.

If a UXO/mine is encountered during project construction, the Contractor shall immediately stop work in the affected area, mark the area of the UXO/Mine and immediately notify the Contracting Officer, COR or the Government Construction Representative. UXO/Mine disposal will not be the responsibility of the Contractor unless the area exceeds the 1.0 m (40") clearance depth of the original clearance certificate.

2. SUMMARY OF WORK

All work including data collection, design, construction, equipment purchase, equipment installation, studies, and surveys as described in this Section 01010 of the IFB shall be accomplished by the Contractor unless otherwise stated.

2.1 GENERAL

2.2 MOBILIZATION / DEMOBILIZATION

Mobilization and Demobilization shall consist of all labor, equipment, supplies and facilities required to stage all equipment and facilities needed for construction of this project. See Contract Clauses for more information.

The Contractor shall install temporary access points and roads, temporary parking, construction lay-down areas, and foot paths with compacted base, appropriately graded for drainage, and cover with a well graded crushed stone aggregate surface capable of withstanding the anticipated construction traffic. At a minimum, the Contractor shall place 50 mm of crushed, well-graded, and compacted aggregate over areas to be used for drainage, pedestrian circulation (not including foot paths), and/or dust control.

Portable latrines: During construction, the Contractor shall furnish and install portable latrine units in locations as required. Portable latrines shall be a mix of western and eastern style units. Mix shall be determined by Contracting Officer.

Portable lavatories: During construction, the Contractor shall furnish and install handwash units in locations as required. Handwash units shall each include four (4) wash units. Each wash unit shall consist of a basin, foot controlled wash water dispenser, hand soap dispenser, and towel dispenser.

Mobilization/Demobilization shall have a unit measurement of lump sum and paid for under bid items 0001AA, Mobilization/Demobilization, of the Proposal Schedule (Section 00010).

2.3 SECURITY

Security is critical to construction in Afghanistan, especially on roads and remote areas away from Coalition Force bases. The Contractor must have an appropriate amount of security/protection to match the threat in the project area and along the supply routes. A detailed security plan in accordance with Section 01040 SECURITY shall be approved by the Government before construction notice to proceed.

The Contractor shall be responsible for physical security of all materials, supplies, and equipment of every description, including property which may be Government-furnished or owned, for all areas occupied jointly by the Contractor and the Government, as well as for all work performed.

Security shall have a unit of measure lump sum and paid for under bid items 0001AB, Security, of the Proposal Schedule (Section 00010).

2.4 SITE SURVEY / EXISTING CONDITIONS MAP

The site survey and existing conditions map shall consist of all labor, equipment and supplies necessary to produce the topographical data in accordance with the requirements specified in Sections 01015 and 01335.

Site Survey and Existing Conditions Map shall have a unit of measure lump sum and be paid for under bid items 0001AC, Site Survey/Existing Conditions Map, of the Proposal Schedule (Section 00010).

2.5 GEOTECHNICAL INVESTIGATION

Existing geotechnical information is not available at the project site. Any site-specific geotechnical data required to develop foundations, fill at elevated slabs, materials, earthwork, roads, and other geotechnical related design and construction activities for this project shall be the Contractor's responsibility.

The geotechnical report shall contain the results of a geotechnical investigation conducted in accordance with the requirements specified in Section 01015. All labor, equipment and supplies necessary to conduct a geotechnical investigation shall be considered a part of the geotechnical report.

Foundations, including sub-grade, are based on an assumed soil bearing value for standard building designs. The Contractor shall design and construct foundations for standard designs and design build facilities per the standard drawings, unless the actual soil bearing capacity is less than the assumed soil bearing capacity the foundations were based upon. In this case the foundations shall be design by the Contractor based on recommendations from the geotechnical investigation.

The Geotechnical Investigation shall have a unit of measure lump sum and be paid for under bid items 0001AD, Geotechnical Investigation, of the proposed schedule.

2.6 AS-BUILT DRAWINGS

The Contractor shall provide the Government with complete as-built drawings at the conclusion of the project. The bid item "As-Built Drawings" shall consist of all labor, equipment, and all supplies needed to produce design records, documents and drawings in accordance with the requirements specified in Section 01335 and 01780A.

The As-built Drawings shall have a unit of measure lump sum and paid for under bid items 0001AE, As-Built Drawings, of the Proposal Schedule (Section 00010).

3. SITE DEVELOPMENT/IMPROVEMENTS

3.1 DEMOLITION

The Contractor shall remove and dispose of all debris, trash, CONEXs, concrete, buildings, existing utilities above or below ground, fuel tanks, HESCO baskets, and foundations. The Contractor shall be responsible for locating and paying all fees associated with removal and relocation of all debris and shall verify the location of debris disposal with the Contracting Officer. Scrap metal on site shall be moved to an area away from the site perimeter as directed by the COR and left for the host government to salvage. Demolished fencing and concertina wire shall be neatly rolled up and used fence posts and outriggers shall be neatly stockpiled for reuse by the host government. There will be no separate measurement or payment for demolition and the costs associated with any demolition work shall be accounted for by the Contractor in the bid item for which the demolition is associated.

3.2 SITE GRADING AND STORMWATER MANAGEMENT

Site grading and stormwater management features shall conform to the requirements and references specified herein for development of the facility. The Contractor shall design and submit a Site Grading and Drainage Plan showing the location of all required drainage structures.

All barracks, headquarters buildings, well houses and small arms storage buildings shall be raised 450 mm above the existing grade to protect against potential flooding. All other building floor elevations shall be a minimum 150mm above grade and slope away from the building on all sides at a minimum of 5% for 3 m. All other grading on site shall be a minimum of 1% to ensure proper drainage.

The Grading and Drainage Plan shall indicate the existing and proposed contour lines, the location of drainage structures and the direction of flow. Spot elevations shall be indicated at the beginning and the end of all drainage structures and inflexion points and they shall be spaced every 25 m along the alignment. Proposed contour lines shall meet with existing contour lines on the Grading and Drainage Plan. The Grading and Drainage Plan shall be at a scale that all lines and structures can be easily seen and ascertained.

Culverts at perimeter wall penetrations shall have personnel access denial system(s).

The side slopes of all new earthen storm drainage (including canals, trenches, ditches, swales, etc) shall not have a slope greater than 1 Vertical to 3 Horizontal. The side slopes of storm drainage features with a greater slope are allowed, but the drainage features must be lined with a stone and mortar finish or concrete lining to prevent erosion.

At locations of the existing fence and perimeter wall where drainage ditches cross, new concrete culverts shall be installed to manage the wastewater and stormwater flows. The culverts shall include personnel access denial system(s).

The installation of culverts, sized for maximum stormwater flows, shall be required at all road and walkway locations which cross drainage ditches. All culverts outside of the perimeter fence or wall shall include personnel access denial system(s).

Native crushed stone 100 mm thick shall be placed around all buildings, from the building wall out 2.0 m and all areas of anticipated foot or vehicle traffic to reduce erosion and to provide dust control.

The Site grading and Stormwater Management shall have a unit of measure lump sum and paid for under bid items 0002AA, Site Grading and Stormwater Management, of the Proposal Schedule (Section 00010).

3.3 WATER WELL

The Contractor shall provide one (1) 350 m minimum to 400 m maximum depth water well to adequately supply the water flow to meet the needs of 4600 personnel. The Contractor shall locate the well per topographic and site design requirements.

The Contractor shall drill one (1) well to a depth of 350 m to 400 m in an attempt to find potable water meeting all World Health Organization (WHO) water quality requirements. If water cannot be found after drilling to 400 m, the Contractor shall immediately notify the Contracting Officer's Representative (COR). The Contractor will be considered to have fulfilled the terms of the contract and will be entitled to the full price of the contract CLIN for "Water Well".

The Water Well shall have a unit of measure lump sum and paid for under bid items 0002AB, Water Well, of the proposed schedule (Section 00010).

3.4 WELL HOUSE AND WATER WELL SYSTEM

The Contractor shall construct one (1) well house and design and construct the water well system. The well house shall be constructed per the standard drawings in the Appendix titled "Well House". The Contractor shall design and install a submersible pump to provide a minimum of 19 liters per second pumping capacity.

The Contractor shall design and construct a complete, functioning water well to include, but not inclusive of, all piping, flow meters, controls and hypochlorite disinfection system to meet the requirements of Section 01015 and in accordance with the AED Design Requirements-Water Wells, latest version.

The Contractor shall enclose the well facility (10 m x 10 m area) with 3 m high perimeter fence. All gates shall be swinging gates for these facilities. The technical requirements for fences and swinging gates are described in Section 01015.

The Well House and Water Well System shall have a unit of measure lump sum and paid for under bid items 0002AC, Well House and Water Well System, of the proposed schedule (Section 00010).

3.5 WATER DISTRIBUTION SYSTEM

The Contractor shall design and construct a potable water system and an enclosed booster pump station to provide sufficient water pressure with hydro-pneumatic surge tank(s), water storage tank(s) and underground pipe distribution system to all buildings and features requiring water supply. The Contractor shall install water meters between the storage tanks and the distribution system. The booster pump building shall be constructed per the standard drawings titled "Booster Pump Building" in the Appendix. The water system shall be designed and constructed in accordance with the AED Design Requirements, latest version. See Section 01015 for design and construction criteria. Water demand required for fire fighting and for irrigation and landscaping needs shall not be included in design demand calculations.

The Contractor shall connect the water distribution system with the adjacent Special Forces compound water distribution system and the water distribution system on the existing Camp Hero.

The Contractor shall design and construct a backup power generator system that is independent of the garrison power plant for the Booster Pumps and Well Pumps. The contractor shall ensure that the power generator system will accommodate the facilities power needs. The backup power generator system shall provide fuel storage for the generators with a capacity of 48 hours of continuous generator runtime along with an electrical distribution system to the facility. The generators, fuel storage, and distribution system shall be furnished by the Contractor.

The Water Distribution System shall have a unit of measure lump sum and paid for under bid items 0002AD, Water Distribution System, of the proposed schedule (Section 00010).

3.5.1 WATER STORAGE

Contractor shall provide circular steel ground storage tanks (GST). The storage tanks shall have a storage capacity of 3,000,000 liters. The storage facility shall be located above drainage areas and locations subject to flooding as approved by the Contracting Officer. The storage facility shall be located on the higher elevations of the site to promote gravity flow and reduce pumping requirements. Overflow and air vents shall be screened so that birds, insects, rodents and debris cannot enter the reservoir. The Contractor shall provide pipe of adequate strength, durability and be corrosion resistant with no adverse effect on water quality. The exterior surface of the pipe must be corrosion resistant.

There will be no separate measurement or payment for water storage and the costs associated with water storage work shall be accounted for by the Contractor in bid 0002AD, Water Distribution System.

3.6 WASTEWATER TREATMENT PLANT

The Contractor shall design and construct a Wastewater Treatment Plant (WWTP) per the requirements of Section 01015. The Wastewater Treatment Plant shall be a partial mix aerated lagoon type system and shall be located to minimize the use of lift stations and shall utilize gravity sewers as much as possible. The Waste Water Treatment Plant shall be designed and constructed such that the system shall not be flooded by a 25-year storm event and shall include considerations for potential flooding events originating upstream. The wastewater treatment plant shall be designed to treat 860,000 liters per day of waste water. The Contractor shall design and construct the Wastewater Treatment Plant to include sludge drying beds and shall include an adequate outfall to the nearest wadi per the Concept Plan in the Appendix. The design and construction of the outfall shall include concrete lining or rip rap measures to prevent erosion due to the flow from the Wastewater Treatment Plant.

The Contractor shall design and construct a 35 m^2 CMU type building for laboratory/office space and a 35 m^2 CMU type building for the hypochlorite disinfection system/chemical storage room. Both buildings shall have emergency eye wash stations and stainless steel sinks. See Section 01015 for technical requirements.

Approximate location of the proposed WWTP is indicated on the Concept Plan attached in the Appendix.

The WWTP shall have a unit of measure lump sum and paid for under bid items 0002AE, Waste Water Treatment Plant, of the Proposal Schedule (Section 00010).

3.6.1 WASTEWATER COLLECTION SYSTEM

The Contractor shall design and construct a sanitary sewer collection system for all facilities, to flow to the Waste Water Treatment Plant. The Contractor shall also connect the sewage holding tank at the adjacent Special Forces compound (located directly east of the 3/1/205 and 2/1/205 Infantry Kandaks) to the sewage collection system that flows to the wastewater treatment plant. The Contractor shall install lift stations as necessary to convey the waste water from the Special Forces compound to the wastewater treatment plant.

Sewer collection system shall consist of gravity sewer pipe and appurtenances such as manholes, cleanouts, building service connections and lift station(s). See Section 01015 for technical requirements.

The Wastewater Collection System shall have a unit of measure lump sum and be paid for under bid item 0002AF, Wastewater Collection System, of the Proposal Schedule (Section 00010).

3.7 ELECTRICAL DISTRIBUTION SYSTEM

The contractor shall design and construct an underground Electrical Distribution System to provide power to all facilities requiring electricity. The Contractor shall connect the electrical distribution system to the existing electrical distribution system on the existing Camp Hero and the existing electrical system at the adjacent Special Forces compound.

The Contractor shall design and construct an underground electrical distribution system to provide electricity to all facilities within this scope of work. The Contractor shall provide and install all appropriate transformers, cable and any other equipment necessary for a fully functioning electrical distribution system. All electrical design and installation shall meet British Standard BS 7671 requirements. All wiring shall be run and pulled through conduits. Electrical receptacles shall be provided as indicated.

Primary voltage shall be 15kV, 50Hz. Secondary voltage shall be 220/380V, 50Hz. Conductors and circuits shall be sized for the specific design loads utilization voltage shall be shall be 220/380V, 50Hz.

The Electrical Distribution System shall have a unit of measure lump sum and be paid for under bid items 0002AG, Electrical Distribution System, of the proposed schedule.

3.8 ROAD NETWORK

The Contractor shall design and construct the entire asphalt road network based on the analysis of the Contractor's geotechnical investigation.

The road layout shall provide ease of access to entrance points, buildings, loading ramps and docks, vehicle maintenance facilities, fuel points, trash collection points, grease traps, oil/water separators, convoy assembly area, etc. Roads shall be able to withstand 18,000 kg, 5-axle vehicles. The Contractor shall design and construct drainage ditches on both sides of all roads.

The main access and all main traffic shall be 8m wide (4m per lane) asphalt paving. This includes most of the inside roads except for the perimeter road. Perimeter access roads shall be 3.5 m wide per traffic lane with a stand-off distance of 3.0 m from the perimeter wall.

The Contractor shall design and construct one (1) 100 m long by 8 m wide asphalt paved Convoy Assembly Area as part of the Road Network bid item.

The Contractor shall provide design drawings showing detailed cross sections and road structure to comply with the Technical Requirements, Section 01015.

The Road Network shall have a unit of measure lump sum and paid for under bid items 0002AH, Road Network, of the Proposal Schedule (Section 00010).

3.9 CONCRETE SIDEWALKS/FIRE LANES

Concrete sidewalks shall be required as shown on the Concept Plan and shall be designed and constructed based upon recommendations from geotechnical analysis as required herein.

The Contractor shall design and provide a network of concrete sidewalks to connect the buildings. Sidewalks shall be 1.5 m wide.

The Contractor shall design and construct fire lanes that are a minimum of 3.0 m wide and shall be designed to accommodate the existing fire trucks on base. A sidewalk may be used as a fire lane if the sidewalk is a minimum of 3.0 m wide.

The Concrete Sidewalks/Fire Lanes shall have a unit of measure lump sum and be paid for under bid items 0002AJ, Concrete Sidewalks, of the Proposal Schedule (Section 00010).

3.10 MOTOR POOL AREAS

The Contractor shall design and construct Motor Pool Areas in coordination with the facilities required in this RFP. There shall be six (6) Motor Pool areas, varying in sizes and number of facilities contained within each area, as indicated in the Concept Plan attached in the Appendix.

Each Motor Pool Area shall be enclosed by a 3.0 m high chain link fence with Y-channel and triple strand concertina wire and two (2) lockable double swing arm vehicle gates and two (2) lockable personnel gates. The grade shall slope away from the fence for at least 5 meters and shall be kept a minimum of 3.0 m below the top of the fence for a distance of 10 m. The Contractor shall construct the fence and gates per the standard design drawings attached in the Appendix.

All motor pools shall be designed and constructed with 150 mm of aggregate surface compacted to 100% maximum density above 150 mm scarified fill compacted to 95% maximum density. Allow adequate vehicle maneuver space to access all parking and facilities.

Exterior pole-mounted lighting along the fence line shall be provided to provide illumination for night-time operations and safe movement of vehicles within the motor pool compound.

The Motor Pool Areas shall have a unit of measure of lump sum and be paid for under bid item 0002AK, Motor Pool Areas, of the Proposal Schedule (Section 00010).

3.11 SITE COMMUNICTATION SYSTEM

The Contractor shall design, provide, and install the exterior and interior communications infrastructure. The exterior communications infrastructure shall provide a looped communication system for perimeter security functions. The communications duct bank shall run to all guard towers, guard shacks, ECPs, and back to the central Communications Room located in the Battalion Headquarters Building.

The interior communications infrastructure shall provide a pathway to all communications outlets and head-end equipment located in the building. Communications head-end equipment, cabling, RJ45 jacks, and faceplates shall be provided by others. The design and construction of the systems shall be in accordance with the references and the requirements contained herein and in Section 01015.

The Site Communication System shall have a unit of measure lump sum and be paid for under bid items 0002AL, Site Communication System, of the Proposal Schedule (Section 00010).

3.11.1 LOUDSPEAKER AND ALARM SYSTEM

The Contractor shall install a Loud Speaker & Alarm System that can alert the entire compound via panic button from any tower or guard post station. The speaker and alarm system shall be exterior grade components to withstand severe weather conditions of cold, heat, rain, sleet, and dust storms and to be completely understandable during these conditions from any point within the compound. All wires shall be installed in conduits.

The Loudspeaker and Alarm System shall be paid for under the lump sum bid items 0002AL, Site Communication System, of the Proposal Schedule (Section 00010).

3.12 VEHICLE WASH RACK

The Contractor shall construct three (3) vehicle wash racks located adjacent to the vehicle fueling points. The vehicle wash racks shall include elevated concrete pads to accommodate 2 vehicles side by side, as indicated on the Concept Plan. The Vehicle Wash Racks shall be built according to the Standard Design attached in the Appendix and per the requirements of Section 01015.

The Contractor shall design and construct water service for the vehicle wash racks by a pressure pump connected to the nearest water source. Provide broom finish texture concrete pad and elevate with appropriate slope for drainage run-off to a trench drain. Extend drainpipes from trench drain away from the wash stations, with grit chambers, an oil/water separator, and clean outs, and tie into the storm drainage system.

All surface inside the compound up to the elevated concrete racks, shall be designed and constructed with 150 mm of aggregate surface. The Contractor shall allow for adequate vehicle maneuver space.

The Vehicle Wash Rack shall have a unit of measure per each and paid for under bid items 0002AM, Vehicle Wash Rack, of the Proposal Schedule (Section 00010).

3.13 VEHICLE REFUELING POINT

The Contractor shall design and construct two (2) Vehicle Refueling Points. Each vehicle refueling points shall include one (1) diesel dispenser, one (1) MOGAS dispenser, associated islands, fuel tanks and all other associated equipment for a fully functioning vehicle refuel point. Each vehicle refuel point shall have a fuel tank capacity as follows: 38,000 liters of Diesel and 10,000 liters of MOGAS. **The Contractor shall provide a full supply of fuel to the tanks at the time of turnover to the Government.** The Contractor shall use the drawings attached in the Appendix titled 'Fuel Storage and Vehicle Refueling Point' for reference and to the requirements of Section 01015 when designing the facility.

The Contractor shall provide asphalt paved maneuver areas for the dispensers and area for fuel truck deliveries. The Contractor shall grade and level the refueling area to match the adjacent existing with appropriate slope and drainage to tie into the storm drainage system.

For each vehicle refueling point, the Contractor shall provide 200 mm diameter by 1,000 mm high concrete-filled steel bollards around the new dispensers to prevent damage from vehicles. Around the fuel dispensers there shall be a concrete pad. The concrete hard surface pad shall extend for the full length of the dispensing area as shown in the standard drawings. The Contractor is required to provide explosion proof lighting, and fire extinguishers. The Contractor shall provide electrical service to the fuel pumps in accordance with the manufacturer's recommendations and provide area lighting for general illumination of vehicle fuel dispensing areas. Each refueling point shall have a metal roof canopy per the drawings attached in the Appendix.

All new fuel tanks shall be installed above ground to the requirements of Section 01015. The storage tanks shall have adequately protected distribution lines to the vehicle refueling points. The tanks shall be surrounded by concrete Alaska barriers and have a canopy structure to keep precipitation out of the tank pit.

All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Vehicle Refueling Point shall have a unit of measure per each and paid for under bid items 0002AN, Vehicle Refueling Point, of the Proposal Schedule (Section 00010).

3.14 TRASH COLLECTION POINTS

Construct twenty-two (22) Trash Collection Points per the Standard Design drawings in the Appendix. The Contractor shall locate each Trash Collection Point in locations convenient for easy removal. The Contractor shall locate trash points evenly spaced around the property and at each common facilities location.

The Trash Collection Points shall have a unit of measure per each and paid under bid items 0002AP, Trash Collection Points, of the Proposal Schedule (Section 00010).

3.15 VOLLEYBALL COURTS

The Contractor shall design and construct four (4) volleyball courts. All volleyball courts shall be outside. The Volleyball Courts shall be sand courts and include poles, nets and permanent delineated boundaries. The Volleyball Courts shall be regulation size.

Volleyball Courts shall have a unit of measure per each and shall be paid for under bid item 0002AQ, "Volleyball Courts".

4. FORCE PROTECTION

The Contractor shall design and construct force protection measures to include walls, Entry Control Points (ECP) and guard towers. The designer shall incorporate force protection setbacks for new facilities to maximum extent possible as permitted by size of the site.

4.1 PERIMETER STONE WALL

The Contractor shall construct the perimeter wall approximately 4,650 linear meters of reinforced concrete with masonry or native stone veneer per the Concept Plan for the general location. The Contractor shall follow the standard construction drawings attached in the Appendix.

The height of the walls shall measure the standard of 3.0 m from the inside and outside grades to the top of the concrete wall cap. The wall shall be topped with Y shaped outriggers and single-coil concertina style razor wire. The ground grade shall slope away from the wall for at least 5.0 m and shall be kept a minimum of 3.0 m below the top of wall for a minimum distance of 10 m.

The wall shall be designed to keep all pedestrian and truck traffic outside the compound from having a visual line of site into the compound. The perimeter road shall be at a standoff distance of no less than 3.0 m from the inside face of the perimeter wall.

The Perimeter Wall shall have a unit of measure lump sum and be paid under bid items 0003AA, Perimeter Wall, of the Proposal Schedule (Section 00010).

4.2 GUARD TOWERS

The Contractor shall design and construct nineteen (19) Guard Towers per the standard design drawings titled "Guard Tower" in the Appendix.

The Guard Towers shall be located at intervals of approximately 275 m apart from each other, as well as at all access penetration points in the perimeter wall. The floor height shall be elevated as to allow the window sill to be 500 mm above the top of the wall.

The Guard Towers shall be fitted with one 360-degree omni- directional searchlight. One weather-resistant duplex receptacle shall be provided as required for general use. The area in the immediate exterior vicinity of the guard tower shall be provided with an all weather non-slip surface and shall be graded to sufficiently drain away from structure. Lighting shall not consist of white lights inside guard towers. The Contractor shall use red, blue, or black lenses in interior guard tower lighting.

The Guard Towers shall have a unit of measure per each and paid under bid items 0003AB, Guard Towers, of the Proposal Schedule (Section 00010).

4.3 ENTRY CONTROL POINTS

The Contractor shall construct three (3) Primary Entry Control Points (ECP) and three (3) secondary ECPs per the conceptual ECP drawings in the Appendix. Each Primary ECP shall include a paved entrance, one (1) manually operated sliding steel vehicular gate, one (1) steel swing personnel gate, one (1) Guard Shack, one (1) steel canopy, three (3) vehicle drop arm barriers, one (1) bypass road and passive anti-vehicle barriers. Each secondary ECP shall include one (1) manually operated sliding steel vehicular gate, one (1) steel swing personnel gate, one (1) drop arm barrier and one (1) guard shack. See Section 01015 for technical requirements.

The ECPs shall all be included on one lump sum unit of measure and be paid under bid item 0003AC, Entry Control Points, of the Proposal Schedule (Section 00010).

4.3.1 GUARD SHACKS

The Guard Shack buildings shall be of a CMU type construction following the standard construction drawings titled "Guard Shack" attached in the Appendix.

There shall be a total of six (6) Guard Shack buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

Areas in the immediate outside vicinity of the guard shacks shall be lighted and provided with an all-weather, non-slip surface and shall be graded to sufficiently drain away from building and pedestrian areas. 2-way communications with all Guard Towers and Main ECP shall be provided. Category 5e dual RJ-45 outlets for voice and data and duplex receptacles shall be provided.

The Guard Shacks shall be paid under bid item 0003AC, Entry Control Points, of the Proposal Schedule (Section 00010).

4.4 PERSONNEL BUNKERS

The Contractor shall construct an approximate number of one hundred and fifty (150) Personnel Bunkers per the standard drawings in the Appendix titled "Personnel Bunker".

The contractor shall place bunkers at optimal locations on the Master Plan in relationship to personnel requirements.

The Personnel Bunkers shall have a unit of measure per each and paid under bid items 0003AD, Personnel Bunkers, of the Proposal Schedule (Section 00010).

5. FACILITIES

5.1 ARMS STORAGE BUILDING

The Arms Storage building shall follow the standard construction drawings titled “Arms Storage” attached in the Appendix.

There shall be a total of five (5) Arms Storage buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

Each Arms Storage building shall include the following:

a. Provide wooden racks for storing long-arm weapons vertically. Racks shall not be furnished with locking bars.
b. The Contractor shall provide power outlets in walls no more than 4.0 m apart.
c. Concrete stoops shall be provided at all exterior doors.
d. The facility will be enclosed with a 3.0 m high fence and a secure entranceway.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

Arms Storage Buildings shall have a unit of measure per each and be paid under bid item 0004AA, Arms Storage Bldg., of the Proposal Schedule (Section 00010).

5.2 POL STORAGE BUILDING

The POL Storage Building shall follow the standard construction drawings titled “POL Building” attached in the Appendix.

There shall be seven (7) POL Storage Buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The POL Storage Building shall have a unit of measure per each and paid under bid items 0004AB, POL Storage Building, of the Proposal Schedule (Section 00010).

5.3 FUEL OPERATORS BUILDING

The Fuel Operators Building shall follow the standard construction drawings attached in the Appendix.

There shall be two (2) Fuel Operators Buildings. The Contractor shall locate the fuel operators buildings adjacent to the Vehicle Fueling Points.

The Fuel Operators Building shall have a unit measure of each and be paid for under bid items 0004AC, Fuel Operators Building, of the Proposal Schedule (Section 00010).

5.4 AMMUNITION SUPPLY POINT

The Contractor shall construct one (1) Ammunition Supply Point. The Ammunition Supply Point shall consist of one (1) Weapons Storage Building and an associated Ammunition Supply Point Area. The Weapons Storage building shall be constructed per the standard drawings titled “Weapons Storage (ASP)” in the Appendix.

The Contractor shall construct a perimeter fence a distance of 30 m around the Weapons Storage Building. All areas within the perimeter fence shall be paved with 100 mm thick aggregate.

Provide exterior lighting at each corner of the ASP building sufficient to light an area of a 30 m radius.

The Ammunition Supply Point shall have a unit of measure per each and shall be paid for under bid item 0004AD, "Ammunition Supply Point".

5.5 NCO BARRACKS

The NCO Barracks building shall be constructed following the standard construction drawings attached in the Appendix – titled "NCO Barracks – Large".

There shall be a total of twelve (12) NCO Barracks buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The NCO Barracks shall have a unit of measure per each and shall be paid for under items 0004AE, NCO Barracks, of the Proposal Schedule (Section 00010).

5.6 ENLISTED BARRACKS

The Enlisted Barracks building shall be constructed following the standard construction drawings attached in the Appendix – titled "Enlisted Barracks".

There shall be a total of twenty-two (22) Enlisted Barracks buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Enlisted Barracks shall have a unit of measure per each and shall be paid for under items 0004AF, Enlisted Barracks, of the Proposal Schedule (Section 00010).

5.7 LARGE LATRINE/LAUNDRY BUILDING

The large Latrine/Laundry Building shall be constructed following the standard construction drawings attached in the Appendix – titled "Latrine - Large".

There shall be a total of ten (10) Large Latrine/Laundry Buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

All toilets shall be Eastern Style and shall face North–South.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Contractor shall provide three (3) 5.0 m long Clothesline units at each large Latrine/Laundry Building, following the standard construction drawings attached in the Appendix.

The Large Latrine/Laundry shall have a unit of measure per each and shall be paid for under bid item 0004AG, Large Latrine/Laundry Building, of the Proposal Schedule (Section 00010).

5.8 OFFICERS BARRACKS

The Officers Barracks building shall be constructed following the standard construction drawings attached in the Appendix -titled "Officers Barracks - Large".

There shall be a total of six (6) Officers Barracks buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Officers Barracks shall have a unit of measure per each and shall be paid for under bid item 0004AH, Officers Barracks, of the Proposal Schedule (Section 00010).

5.9 BATTALION STORAGE BUILDING

The Battalion Storage building shall be constructed following the standard construction drawings attached in the Appendix - titled ”Storage Building”.

There shall be a total of seven (7) Battalion Storage buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Battalion Storage Building shall have a unit of measure per each and shall be paid for under bid items 0004AJ, Battalion Storage Building, of the Proposal Schedule (Section 00010).

5.10 SMALL LATRINE BUILDING

The Small latrine Buildings shall be constructed following the standard construction drawings attached in the Appendix - titled “Latrine-Small”.

There shall be a total of three (3) Small Latrine buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

All toilets shall be Eastern Style and shall face North–South.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Contractor shall provide two (2) 5.0 m long Clothesline units at each large Small Latrine Building, following the standard construction drawings attached in the Appendix.

The Small Latrine Buildings shall have a unit of measure per each and shall be paid for under bid item 0004AK, Small Latrine Building, of the Proposal Schedule (Section 00010).

5.11 BATTALION HEADQUARTERS BUILDINGS

The Battalion Headquarter buildings shall be constructed following the standard construction drawings attached in the Appendix – titled “Headquarters Building”.

There shall be a total of five (5) Battalion Headquarters buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The contractor shall design and construct a backup power generator system that is independent of the garrison power plant for the battalion headquarters in emergencies. The contractor shall ensure that the power generator system will accommodate the facilities power needs. The backup power generator system shall provide fuel storage for the generators with a capacity of 48 hours of continuous generator runtime along with an electrical distribution system to the facility. The generators, fuel storage, and distribution system shall be furnished by the Contractor.

The contractor shall provide 3 flagpole structures for each Battalion Headquarters Building, per the standard construction drawings attached in the Appendix.

The Battalion Headquarter Buildings shall have a unit of measure per each and shall be paid for under bid item 0004AL, Battalion headquarters, of the Proposal Schedule (Section 00010).

5.12 ADMINISTRATION BUILDING

The Administration building shall be constructed following the standard construction drawings attached in the Appendix – titled “Admin Building”.

There shall be a total of one (1) Administration building. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Administration Buildings shall have a unit of measure per each and shall be paid for under bid items 0004AM, Administration Building, of the Proposal Schedule (Section 00010).

5.13 LARGE DINING FACILITY

The Large Dining Facility (DFAC) building shall be constructed following the standard construction drawings attached in the Appendix – titled "DFAC- Large".

There shall be one (1) Large Dining Facility building. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

All quantities of stoves, wood stoves, sinks, and other equipment are as illustrated in the standard construction drawings.

The DFAC shall include, as a minimum, the following:

a. A service area in support of the DFAC building. The service area shall be surrounded with a 3 m high chain link fence with Y-channel and triple strand concertina wire and one (1) lockable double swing arm vehicle gate and two (2) lockable personnel gates. Construct the fence and gates per the standard design drawings in the Appendix. The service area shall be able to accommodate propane storage, wood stoves, wood storage area, and storage areas, area for the future location of trailers, and maneuver area. In the event a K-Span is chosen to be designed and constructed, the service area configuration in the standard construction drawings in the Appendix shall be revised to meet the functional requirements of the DFAC.
b. The service areas shall be aggregate surfaced.
c. Grease separator shall be a hydro-mechanical model as defined in Standard PDI G101, revised 2007. Grease separator shall be outside and exterior to the building.
d. Storage area with covered and security fence shall be constructed for propane gas cylinders in close proximity to the kitchen.
e. Kitchen area shall be provided with propane stoves. For a 30-day supply of fuel, provide four (4) bottles per cook stove. **The Contractor shall provide a full supply of fuel to the tanks at the time of turnover to the Government.**
f. The contractor shall design and construct a backup power generator system that is independent of the garrison power plant for the DFAC in emergencies. The contractor shall ensure that the power generator system will accommodate the facilities power needs. The backup power generator system shall provide fuel storage for the generators with a capacity of 48 hours of continuous generator runtime along with an electrical distribution system to the facility. The generators, fuel storage, and distribution system shall be furnished by the Contractor.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Dining Facility shall have a unit of measure per each and shall be paid for under item 0004AN, Large Dining Facility, of the Proposal Schedule (Section 00010).

5.14 SMALL DINING FACILITY

The Small Dining Facility (DFAC) building shall be constructed following the standard construction drawings attached in the Appendix – titled "DFAC Small".

There shall be one (1) Small Dining Facility building. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

All quantities of stoves, wood stoves, sinks, and other equipment are as illustrated in the standard construction drawings.

The DFAC shall include, as a minimum, the following:

g. A service area in support of the DFAC building. The service area shall be surrounded with a 3 m high chain link fence with Y-channel and triple strand concertina wire and one (1) lockable double swing arm vehicle gate and two (2) lockable personnel gates. Construct the fence and gates per the standard design

drawings in the Appendix. The service area shall be able to accommodate propane storage, wood stoves, wood storage area, and storage areas, area for the future location of trailers, and maneuver area. The service areas shall be aggregate surfaced.

h. Grease separator shall be a hydro-mechanical model as defined in Standard PDI G101, revised 2007. Grease separator shall be outside and exterior to the building.
i. A covered wood storage area shall be constructed in close proximity to the wood stoves and be fenced.
j. Storage area with covered and security fence shall be constructed for propane gas cylinders in close proximity to the kitchen.
k. Kitchen area shall be provided with propane stoves. For a 30-day supply of fuel, provide four (4) bottles per cook stove. **The Contractor shall provide a full supply of fuel to the tanks at the time of turnover to the Government.**
l. The contractor shall design and construct a backup power generator system that is independent of the garrison power plant for the DFAC in emergencies. The contractor shall ensure that the power generator system will accommodate the facilities power needs. The backup power generator system shall provide fuel storage for the generators with a capacity of 48 hours of continuous generator runtime along with an electrical distribution system to the facility. The generators, fuel storage, and distribution system shall be furnished by the Contractor.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Dining Facility shall have a unit of measure of each and shall be paid for under item 0004AP, Small Dining Facility, of the Proposal Schedule (Section 00010).

5.15 VEHICLE MAINTENANCE FACILITY

The Vehicle Maintenance building shall be constructed following the standard construction drawings attached in the Appendix – titled “Vehicle Maintenance Building”.

There shall be a total of seven (7) Vehicle Maintenance buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site. To facilitate operations, where there is more than one (1) facility indicated at one motor pool in the Concept Plan, the individual Vehicle Maintenance buildings may be located closer to each other.

Additionally the design shall comply with the requirements of Section 01015 and follow the following programming standards:

a. There shall be four, 200 mm diameter by 1,000 mm high concrete filled steel bollards adjacent to each roll up door on the interior and exterior of the building.
b. There shall be a concrete hardstand apron outside all garage doors at a minimum 10 m width. Concrete hardstand apron shall support a minimum loading of a 3-axle, 30,000 kg vehicle without failing. There shall be at least 18 m clear distance around the vehicle maintenance building before any parking or between any other facilities.
c. The air compressor shall be located outside and to the rear of the building under a canopy and enclosed in a security with gate.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Vehicle Maintenance Facility shall have a unit of measure per each and shall be paid for under bid item 0004AQ, Vehicle Maintenance Facility, of the Proposal Schedule (Section 00010).

5.16 TRAINING CLASSROOM BUILDING

The Training Classroom buildings shall be constructed following the standard construction drawings attached in the Appendix – titled “Training Building”.

There shall be a total of six (6) Training Classroom buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Training Classroom Building shall have a unit of measure per each and shall be paid for under bid item 0004AR, “Training Classroom Building”, of the Proposal Schedule (Section 00010).

5.17 POST EXCHANGE BUILDING

The Post Exchange (PX) building shall be constructed following the standard construction drawings attached in the Appendix – titled “Post Exchange Building”.

There shall be a total of one (1) Post Exchange building. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Post Exchange Building shall have a unit of measure per each and shall be paid for under bid item 0004AS, “Post Exchange Building”, of the Proposal Schedule (Section 00010).

5.18 MWR BUILDING

The MWR building shall be constructed following the standard construction drawings attached in the Appendix – titled “MWR Building”.

There shall be a total of one (1) MWR building. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The MWR Building shall have a unit of measure per each and shall be paid for under bid item 0004AT, “MWR Building”, of the Proposal Schedule (Section 00010).

5.19 MEDICAL CLINIC

The Medical Clinic building shall be constructed following the standard construction drawings attached in the Appendix – titled “Medical Clinic-Small”.

There shall be a total of one (1) Medical Clinic building. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 7-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Medical Clinic Building shall have a unit of measure per each and shall be paid for under bid item 0004AU, “Medical Clinic”, of the Proposal Schedule (Section 00010).

5.1 OPTIONAL ITEMS

All work required to complete option items under this contract shall be completed within 180 calendar days including Government review time from Notice-to-Proceed (NTP) for option items.

5.1.1 SITE POWER AND ELECTRICAL DISTRIBUTION SYSTEM

Prime Power Plant: Design and construct one (1) central power plant for power supply to all facilities requiring power on the garrison. The power plant shall be a single, enclosed, stand alone building that will house the prime power generators, switchgear, and all appurtenances necessary to meet all power requirements. See drawings titled “Power Plant” in Appendix B for reference. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

Generators and Fuel Storage: Generation shall be supplied by six (6) individual 1.0 megawatt generators supplied by the Government (GFE). All other equipment necessary for installation and operation of the generators shall be supplied and constructed by the Contractor. The generator installation shall be provided with a synchronizer switch, so that when the total power demanded from any one or more of the generators reaches 90 percent of the generator's maximum, an additional generator shall automatically start and supplement the running generator(s). Generators

shall be programmed to run equally. The entire power plant, including synchronizer and switchgear, must be designed and constructed to accommodate two (2) additional generators for future expansion.

Design and construct a suitable generator pad with secondary containment for the generators. The generator pad shall have vibration isolators and the capability to dampen vibration to the surrounding ground through the use of foam plastic and sand. Install the generators with connections to the fuel supply tank(s), complete distribution system, transformers, panels, and all other required appurtenances for a basic, fully operational system. Switchgear and control panels must be designed to accept the future expansion for two (2) additional generators.

Provide fuel storage for a 30 day supply for all six (6) generators operating at 75% of rated capacity. Fuel storage shall have secondary containment with a sump and drain with valve(s) for draining rainwater. The fuel storage area must be designed to accommodate two (2) additional tanks for future expansion at the power generation facility. Fuel for commissioning and testing shall be provided by the Contractor. Also, the Contractor shall provide fuel tanks that are completely full at the time of turnover to the Government.

The power plant and fuel storage shall be enclosed within a compound with aggregate surfaced vehicle roadway and maneuver area. The compound shall be surrounded with a 3 m high chain link fence with Y-channel and triple strand concertina wire with two (2) lockable double swing arm vehicle gates and one (1) lockable personnel gate. Construct the fencing and gates per the Fencing Details provided in the Appendix.

Electrical Distribution System: The new electrical distribution system shall be underground. The electrical distribution system shall provide electricity to all facilities on the garrison. All electrical design and installation shall meet IEC requirements. All wiring shall be run and pulled through conduits. Electrical receptacles shall be provided as indicated. Conductors and circuits shall be sized for the specific design loads. Generation shall be 220/380V, 50Hz. Primary distribution voltage shall be 15kV, 50Hz. Secondary voltage shall be 220/380V, 50Hz. If this option item is exercised, this option item shall replace the Electrical Distribution System under paragraph 3.7.

The Site Power and Electrical Distribution System shall have a unit of measure lump sum and be paid for under bid items 0003AE, Site Power & Electrical Distribution System, of the proposed schedule.

6. COMPLETION OF WORK

The order of construction for all buildings and facilities shall be prioritized. The contractor shall construct in accordance with the Construction Priority Schedule and the requirements specified in Section 00150.

All work required under this contract shall be completed within 550 calendar days including Government review time from Notice-to-Proceed (NTP) for site work.

All work under this contract shall be completed and buildings ready for beneficial occupancy in accordance with the Construction Priority Schedule. The Required Period of Performance is stated in Days following the NTP/Award Date, as described in the Table 7-1 below:

Table 7-1 Construction Priorities Schedule

PRIORITY 1: 228 Days Completion from NTP
SITE WORK AND FACILITIES
Water Well
Well House and Water Well System
Water Distribution System
Wastewater Treatment Plant
Wastewater Collection System

Electrical Distribution System
Perimeter Stone Wall
Guard Towers
Entry Control Points
PRIORITY 2: 360 Days Completion from NTP
FACILITIES TO BE CONSTRUCTED
NCO Barracks
Enlisted Barracks
Large Laundry/Latrine Building
Officers Barracks
Small Latrine Building
Large Dining Facility
Small Dining Facility
PRIORITY 3: 450 Days Completion from NTP
FACILITIES TO BE CONSTRUCTED
Battalion Headquarters Building
Motor Pool Areas
Vehicle Maintenance Buildings
Vehicle Refueling Points
Arms Storage Buildings
PRIORITY 4: 550 Days Completion from NTP
FACILITIES TO BE CONSTRUCTED
All Remaining Work Items

END OF SECTION

SECTION 01015
TECHNICAL REQUIREMENTS

1.0 GENERAL

1.1 COMPLIANCE

The Contractor's design and construction must comply with technical requirements contained herein. The senior designers of all engineering disciplines shall have a minimum of 10 years experience with the design and construction of the same magnitude and complexity as required in this project. The Contractor shall provide design and construction using the best blend of cost, construction efficiency, system durability, ease of maintenance and environmental compatibility. This section 01015 represents technical requirements to support the scope of work section 01010. These requirements are generic in nature and to be used in conjunction with the referenced codes of this specification. In case of conflict between the sections 01010 and 01015, the 01010 will supersede.

1.2 MINIMUM & ALTERNATE REQUIREMENTS

The design and product requirements stated in these documents are minimum requirements. Exceeding the minimum requirements as improvements to the design stated herein is highly encouraged at no additional cost and as approved by the government. Any deviation from the technical requirements shall be approved by the Contracting Officer. Request for deviations shall be submitted for approval. The Contractor is encouraged to propose alternate design or products (equipment and material) that are more commonly used in the region; but these variations shall be equal in performance from a technical standpoint as well as more cost effective or allow for more timely completion. Variations shall furnish the same system safety, durability, ease of maintenance and environmental compatibility. The Contractor will be required to submit information as specified in Section 01335, paragraph Variations, for all proposed variations with which to make a comprehensive comparison of the proposed alternate. All variations of approved designs must be approved by the Contracting Officer.

1.3 ASBESTOS CONTAINING MATERIALS

Asbestos containing material (ACM) shall not be used in the design and construction of this project. If no other material is available which will perform the required function or where the use of other material would be cost prohibitive, a waiver for the use of asbestos containing materials must be obtained from the Contracting Officer.

1.4 SAFETY

1.4.1 UNEXPLODED ORDNANCE (UXO)

1.4.1.1 UXO/MINE DISCOVERY DURING PROJECT CONSTRUCTION

It is highly recommended that all construction ground guide/ground observation personnel maintain a minimum 16 m buffer zone from all heavy equipment during excavation activities. A daily check of the area for signs of recently emplaced UXO/IED’s is also highly recommended, to include unusual disturbed soil areas or mounds of soil from the previous day. If during construction, the contractor becomes aware of or encounters UXO/Mine or potential UXO/Mine, the contractor shall immediately stop work at the site of encounter, clearly mark the area of UXO/Mine, move to a safe location, notify the COR, and mitigate any delays to scheduled or unscheduled contract work. Once the contractor has informed the COR, the contractor will await further direction. UXO/Mine disposal will not be the responsibility of the Contractor.

1.5 LIMITATION OF WORKING SPACE

The Contractor shall, except where required for service connections or other special reason(s), confine his operations strictly within the boundaries of the site. Workmen will not be permitted to trespass on adjoining property. Any operations or use of space outside the boundaries of the site shall be by arrangement with all interested parties. It must be emphasized that the Contractor must take all practical steps to prevent his workmen from entering adjoining property and in the event of trespass occurring the Contractor will be held entirely responsible.

Contractors assume all risks when venturing in or out of the designated work area.

1.6 TEMPORARY STRUCTURES

The Contractor shall erect suitable temporary fences, lighting, and necessary structures to safeguard the site, materials and plant against damage or theft and for the protection of the general public and shall adequately maintain the same throughout the course of the contract.

1.7 SUBCONTRACTORS

Compliance with the provisions of this section by subcontractors will be the responsibility of the contractor.

1.8 LIST OF CODES AND TECHNICAL CRITERIA:

The following codes and technical criteria and those referenced therein shall be required for this project. References within each reference below shall be required and adhered to, as much as possible. Standards that cannot be met or require interpretation of their usage, the contracting officer shall make the determination. If there is conflict in the criteria the contracting officer shall make the determination. This list is not exhaustive and is not necessarily complete.

AABC - Associated Air Balance Council (National Standards for total System

Balance)

ACI 301M Specifications for Structural Concrete (latest edition), American Concrete Institute

ACI 318 Building Code Requirements for Structural Concrete (latest edition), American Concrete Institute

ACI 530/ASCE 5/TMS 402, Building Code Requirements for Masonry Structures (latest edition)

Air Force Manual 32-1071, Security Engineering, volumes 1-4, 1 May 1994

American Institute of Steel Construction (AISC), Specifications for Structural Steel Buildings (latest edition)

American Petroleum Institute (API) Codes

American Water Works Association, ANSI/AWWA C651-99 standard

ARI - Air Conditioning and Refrigeration Institute

ASCE 7, Minimum Design Loads for Buildings and Other Structures (latest edition)

ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning

Engineers Handbooks latest editions: Fundamentals; HVAC Systems and Equipment; HVAC Applications; Refrigeration.

ASHRAE Standard 55-latest edition, Thermal Environmental Conditions for Human Occupancy

ASHRAE Standard 62.1-latest edition, Ventilation for Acceptable Indoor Air Quality

ASHRAE Standard 62.2-latest edition, Ventilation and Acceptable Indoor Air Quality for Low-Rise Residential

ASHRAE Standard 90.1-latest edition, Energy Standard for Buildings Except Low-Rise Residential Buildings

ASHRAE Standard 90.2-latest edition with Supplement, Energy-Efficient Design of Low-Rise Residential Buildings

ASME - American Society for Mechanical Engineering

ASTM - American Society for Testing and Materials

ASTM-D-1586 Standard Test Method for Standard Penetration Test

ASTM-D-5299 Standard Guide for Decommissioning Ground Water Wells

AWS D1.1, Structural Welding Code – Steel (latest edition), American Welding Society

DCID 6/9 Physical Security Standards for Sensitive Compartmented Information Facilities

DCID 1/21, Manual for Physical Security Standards For Sensitive Compartmented Information Facilities (SCIF)

Design Standard per Memorandum for Record, Design Standards, DTD 16 August 2009 BT, Appendix B-1 and B-2

DoD Ammunition and Explosives Safety Standards

EIA ANSI/TIA/EIA-607: (1994) Commercial Building Grounding/Bonding Requirement Standard

Factory Mutual (FM) Approval Guide-Fire Protection (2002)

HESCO® Bastion Concertainer® Construct Guide for Engineers

IBC - International Building Codes, 2006 edition (and its referenced codes including those inset below)

IEEE C2, National Electrical Safety Code (NESC), latest edition

IFGC – International Fuel Gas Code, latest edition

IMC – International Mechanical Code, latest edition

IPC – International Plumbing Code, latest edition

Lighting Handbook, IESNA, latest edition

MIL-HDBK-1190, Facility Planning and Design Guide

National Association of Corrosions Engineers (NACE) Codes

Codes and Standards of the National Fire Protection Association (NFPA), as applicable and enacted in 2002 or later.

NFPA 1, General Fire Protection, latest edition

NFPA 10, Portable Fire Extinguishers, latest edition

NFPA 13, Fire Sprinkler Code, latest edition

NFPA 30, Flammable and Combustible Liquids Code, latest edition

NFPA 30A, Code for Motor Fuel Dispensing Facilities and Repair Garages, latest edition

NFPA 54, National Fuel Gas Code, latest edition

NFPA 55, Standard for the Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders and Tanks, latest edition

NFPA 58, Liquefied Petroleum Gas Code, latest edition

NFPA 70, National Electrical Code, latest edition

NFPA 72, National Fire Alarm Code, 2002 edition

NFPA 75, Standard for the Protection of Information Technology Equipment

NFPA 80, Fire Rated Doors and Windows, latest edition

NFPA 90A, Air Conditioning and Ventilating Systems, latest edition

NFPA 96, Fire Protection for Commercial Kitchens, latest edition

NFPA 99, Health Care Facilities, latest edition

NFPA 101, Life Safety Code, latest edition

NFPA 110, Standard for Emergency and Standby Power Systems, 2005 edition

NFPA 1141, Site Fire Protection, latest edition

Plumbing and Drainage Institute (PDI-WH-201) water hammer arrestors

SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Standards and Guides, latest editions

International Mine Action Standards, latest edition; (see http://www.mineactionstandards.org for copy of standards)

TM 5-785 Weather Data

TM 5-805-4 Noise and Vibration

TM 5-811-1 Electrical Power Supply and Distribution

UFC 1-200-01, Design: General Building Requirements

UFC 1-300-07A Design Build Technical Requirements

UFC 3-220-03fa Soils and Geology

UFC 3-230-03a, Water Supply, 16 Jan 2004

UFC 3-230-04a, Water Distribution, 16 Jan 2004

UFC 3-230-06a, Subsurface Drainage, 16 Jan 2004

UFC 3-230-07a, Water Supply: Sources and General Considerations, 16 Jan 2004

UFC 3-230-09a, Water Supply: Water Storage, 16 Jan 2004

UFC 3-230-10a, Water Supply: Water Distribution, 16 Jan 2004

UFC 3-230-17FA, Drainage in Areas Other than Airfields, 16 Jan 2004

UFC 3-240-04a, Wastewater Collection, 16 Jan 2004

UFC 3-240-07fa Gravity Sewers 16 Jan 2004

UFC 3-240-04A Wastewater Collection 16 Jan 2004

UFC 1-300-09N, Design Procedures

UFC 3-310-01, Structural Load Data

UFC 3-310-02A, Structural Design Criteria for Buildings

UFC 3-410-01FA Heating, Ventilating and Air Conditioning, latest edition

UFC 3-410-02A, HVAC Control Systems, latest edition

UFC 3-410-04N, Industrial Ventilation, latest edition

UFC 3-420-01, Plumbing Systems Design, latest edition

UFC 3-420-02FA, Compressed Air, latest edition

UFC 3-430-01FA, Heating and Cooling Distribution Systems, latest edition

UFC 3-460-01, Petroleum Fuel Facilities, latest edition

UFC 3-501-03N, Electrical Engineering Preliminary Considerations, 16 Jan 2004

UFC 3-520-01, Interior Electrical Systems, 10 June 2002

UFC 3-520-05, Stationary Battery Areas, latest edition

UFC 3-530-01AN, Design: Interior and Exterior Lighting and Controls, 19 Aug 2005

UFC 3-550-03FA Design: Electrical Power Supply and Distribution Systems, 1 Mar 2005

UFC 3-600-01, Design: Fire Protection Engineering for Facilities, 14 Jul 2009

UFC 4-010-01, Design: Minimum DoD Antiterrorism Standards for Buildings, 22 Jan 2007

UFC 4-020-03, Security Engineering: Fences, Gates, and Guard Facilities, 14 June 2007

UFC 4-020-03FA, Security Engineering: Final Design, 1 Mar 2005

UFC 4-020-04FA, Electronic Security Systems: Security Engineering, 1 Mar 2005

UFC 4-021-01, Design and O&M: Mass Notification Systems, draft 1 May 2006

UFC 4-022-01, Security Engineering: Entry Control Facilities/Access Control Points, 25 May 2005

UFC 4-229-01N, Design: General Maintenance Facilities, latest edition

UFC 4-722-01, Design: Dining Facilities, 27 January 2003

UL Standards (as applicable)

Underwriters' Laboratories (UL) Fire Protection Equipment Directory (2002)

UL 752, Bullet Resisting Equipment, 2000 or later

USCINCCENT OPORD 97-1

Overseas Environmental Baseline Guidance Document, Department of Defense, May 2007

The publications to be taken into consideration shall be those of the most recent editions.

Unified Facility Criteria (UFC) is available online at http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

In addition, technical criteria provided in USACE-AED Design Requirements (located in appendix C) shall be required for use in design and construction specifications as indicated in the following documents. The following design criteria shall be used:

AED Design Requirements - Site Layout Guidance, latest version

AED Design Requirements – Water Tank and Water Distribution Systems, latest version

AED Design Requirements – Hydrology, latest version

AED Design Requirements - Culvert and Causeway Design, latest version

AED Design Requirements - Sanitary Sewer and Septic Systems, latest version

AED Design Requirements - Vertical Curves, latest version

AED Design Requirements – Horizontal Curves & Super elevation , latest version

AED Design Requirements – Geotechnical Investigations for USACE Projects, latest version

Standards other than those mentioned above may be accepted if the standards chosen are internationally recognized and meet the minimum requirements of the specified standards. The Contractor shall be prepared to submit proof of this if requested by the Contracting Officer.

1.9 AED DESIGN REQUIREMENTS DOCUMENTS

AED Design Requirements documents (latest version) listed above shall be adhered to in this contract. These documents are available from the COR. These documents shall be used as the basis for design and construction, and for selecting options within the United Facilities Guide Specifications (UFGS). It is the contractor's option to use specifications contained in the AED Design Requirements Documents, when provided, or to adapt the UFGS specifications to match the requirements provided in the AED Design Documents and specifications. Site or project specific data and requirements in the AED Design Requirements documents shall supersede UFGS language where there are differing criteria which must be evaluated and selected.

2.0 SITE DEVELOPMENT

2.1 ENVIRONMENTAL PROTECTION

2.1.1 APPLICABLE REGULATIONS

The Contractor shall comply with all Host Nation laws, rules, regulations or standards concerning environmental pollution control and abatement with regard to discharge of liquid waste into natural streams or manmade channels. The Contractor shall review host nation and U.S. Government environmental regulations with the Contracting Officer prior to design and discharge of any liquid wastes into natural streams or manmade channels.

2.1.2 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed non-compliance with the foregoing provisions. The Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No extension of time or damages will be awarded to the Contractor unless it was later determined that the Contractor was in compliance.

2.1.3 SPILLAGES

Measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, waste washings, herbicides and insecticides, and construction materials from polluting the construction site and surrounding area.

2.1.4 DISPOSAL

Disposal of any materials, wastes, effluents, trash, garbage, oil, grease, chemicals, etc., shall be taken to a dumpsite off site and be subject to the approval of the Contracting Officer. Burning at the project site for the disposal of refuse and debris will not be permitted.

2.2 CIVIL SITE DEVELOPMENT

2.2.1 EXISTING CONDITIONS MAP AND SITE PLAN

The Contractor shall prepare an Existing Conditions Map of the property including a Boundary and Site Survey. The survey shall show the closure of the property boundary consisting of identifying all property corners, establishing horizontal and vertical control, listing all bearing and distances of property lines from all property corners, and tie-ins (showing bearing and distance) from at least two (2) major offsite man-made or natural features. This survey shall meet the requirements of World Geodetic System 1984 (WGS 84 UTM Zone 41North in decimal degrees). The Existing Conditions Map shall include topographic information with existing contour lines and spot elevations of relevant topographic features, and show the locations of all on-site and nearby offsite existing features including but not limited to buildings, structures, major trees, road pavements and right of ways, names of roads, widths of roads, easements, right of way, setbacks, parking, paved areas, storage containers, stoops, sidewalks, walkways, walls, fences and gates, barriers, and existing underground and aboveground utilities, dry creek beds, drainage channels, etc. and hydrological, geological, and vegetative or other physical conditions that could impact design. If there are areas where offsite surface water runoff has the potential to affect this project, topographic information of these areas will be required to be provided.

Based on the Boundary Survey a separate Site Plan shall be prepared showing the property boundary, and all proposed surface features including but not limited to buildings, roads, setbacks, parking and paving areas, storage containers, stoops, sidewalks and walkways, above ground utilities, bunker locations. The contractor shall identify and show perimeter walls, fences and gates. Also shown on the Site Plan shall be pertinent existing features (on-site and off-site) that will have an influence or impact on the development of the site. The Contractor shall locate the facilities in agreement with the associated drawings included and any requirements in Section 01010. All site features shall be clearly defined and dimensioned on the Site Plan. Buildings shall be located to provide access for emergency vehicles and fire fighting. Roads and parking areas shall be designed for turning radius of the largest vehicle entering the compound. The site plan shall show geometric design of the site, including applicable dimensions of all exterior facilities, mechanical equipment, utilities, etc. Required facilities are described in the following sections of this specification. All site plans and master plans shall be drawn in the following projection and datum for incorporation into the USACE GIS system:

WGS 1984 UTM Zone 41 North

The Contractor shall conduct a utility survey to determine the locations of any nearby security fences and buildings, water lines, wells, sanitary sewers, storm sewers and communication/electrical lines. The Contractor shall provide survey for all stormwater outfall piping locations where the contractor is tying into the existing stormwater drainage system.

Topographic survey and geotechnical investigation of the proposed sewage treatment site is required and the Contractor shall design the wastewater treatment system to be compatible with site and soil conditions.

Wastewater Lagoon Site Survey. The Contractor shall conduct a topographic survey to determine existing site characteristics. The Contractor shall conduct a utility survey to determine the locations of any nearby security fences and buildings, water lines, wells, sanitary sewers, storm sewers and communication/electrical lines. The Contractor shall provide survey for all outfall piping locations and the outfall area in the existing wadi to include topographic survey of a minimum of 20 m on both sides of the proposed outfall location.

Waste water Treatment Lagoon Layout. The Contractor shall design a layout for the system to include all lagoon geometry, waste water inlet and off loading station configurations, number of process compartments, yard piping, bypass valves, surface aerators and disinfection equipment and piping, effluent contact chambers and discharge facilities including the outfall system, and sludge drying, sludge drying water recirculation piping, grey water irrigation pond and pumps and related site preparation and earthwork.

2.2.2 DEMOLITION

Demolition shall include removal of all structures, foundations, pavements, and utilities, and clearing and grubbing. Holes and depressions shall be backfilled.

2.2.3 SITE GRADING & DRAINAGE

The Contractor shall provide all necessary site grading to insure adequate drainage so that no areas will be flooded due to a rainfall of a 20-year frequency.

Proper drainage calculations shall be conducted in order to size drainage structures and channels properly.

Rainfall data shall be based on data obtained from meteorological records collected in Afghanistan. National agencies may be consulted for data. In the absence of site specific data, intensity-duration-frequency curves contained in the AED Design Requirements – Hydrology-most recent version shall be used by extrapolating the rainfall intensity information from the stations in closest proximity to the project.

Under no circumstances will relationships developed by extrapolation of hydrological data from foreign countries be used for hydrologic studies.

2.2.4 ROADS

Location, type, and width of roads required are stated in Section 01010. Roads shall be geometrically designed, graded for proper drainage and provided with necessary drainage structures. Contractor shall notify the Contracting Officer immediately if initial site survey determines that area hydrology requires major drainage structures or bridges. Also, the Contracting Officer shall be immediately notified if the preexisting conditions are determined to be substantially or materially different than the above-described conditions/estimates.

The centerline of all roads shall be sloped a minimum of 1% and a maximum of 8%.

The roads shall be capable of withstanding traffic of 18,000-kg vehicles. All roads shall be designed geometrically with applicable sections of UFC 3-250-18FA and UFC 3-250-01FA to accommodate WB-50 five axle vehicles with a maximum speed of 20 kilometers per hour. Pavement surfaces shall be designed for a design life of 25 years, Road Class F, Category IV.

All intersecting roads, foot paths, driveways, and culvert crossings are required to end with a smooth transition to the new road alignment. The Contractor shall show spot elevations of the existing terrain at all road tie in locations on the site plans.

Aggregate Base Course (ABC) material must be well graded, durable, uniformly moistened, and mechanically stabilized by compaction. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure in ASTM D 1557.

At a minimum the asphalt pavement shall consist of the following:

1. 100 mm Hot Mix Asphalt compacted to optimum compaction placed in 50 mm lift thickness
2. 150 mm Aggregate Base Course at 100% compaction
3. 300 mm Aggregate Subbase at 100% compaction
4. 150 mm natural or select fill, scarified and compacted to 95%

2.2.5 SIDEWALKS/FIRE LANES AND AGGREGATE PAVED AREAS

The Contractor shall provide 1.5 m wide concrete sidewalks between buildings, parking areas, and other logically anticipated areas to serve as pedestrian foot paths. The Contractor shall assume these above stated standards throughout this document unless otherwise noted.

For emergency access, each building or facility shall have 3.0 m wide fire lanes on three (3) sides. Fire lanes shall consist of 100 mm thick aggregate. This is in compliance with NFPA 2008, Section 6.2.1. Sidewalks may be used as fire lanes if the footpaths are at a minimum of 3.0 m wide concrete and designed to accommodate vehicular traffic.

The Contractor shall pave all areas listed in Section 01010 as requiring aggregate paving with 100 mm thick crushed stone aggregate.

The pavement structures dictated above are minimum requirements. Design of sidewalks and aggregate paved areas shall be conducted based on geotechnical data. The geotechnical data shall be used to calculate the pavement structure using the minimum pavement structure as dictated above as a reference. Reference Section "Geotechnical" below.

Aggregate Base Course (ABC) material must be well graded, durable, uniformly moistened, and mechanically stabilized by compaction. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure in ASTM D 1557.

Parking areas, motor pools and areas requiring aggregate paving per Section 01010 shall consist of 100 mm thick compacted aggregate base course compacted to 100% maximum density placed above 150 mm thick of scarified sub-grade compacted to 95% maximum density, unless otherwise noted.

Provide 1.0 m wide shoulder around all parking areas and motor pools consisting of 100 mm thick aggregate base course material at 2.0% slope.

2.2.6 FORCE PROTECTION DESIGN

The Contractor shall design and construct force protection measures. The Force Protection design shall incorporate minimum setbacks for new facilities to maximum extent possible as permitted by size of the site and the requirements of the user. Force Protection design shall also meet the requirements of UFC 4-010-01, Design: Minimum DoD Antiterrorism Standards for Buildings, 8 Oct 2003 and UFC 4-010-02, DoD Minimum Antiterrorism Standoff Distances for Buildings, 8 Oct 2003. For all fire lane design see International Fire Code (IFC) latest edition.

2.2.6.1 CHAIN-LINK FENCE AND GATES

Provide chain-link fences and gates where required. Chain link fence and gate fabric shall be No. 9 gage wires woven into a 50 mm diamond mesh. Fabric shall be coated with 366 grams per square meter zinc galvanizing. Posts shall be ASTM F 1083 Pipe, Steel, Hot Dipped Zinc Coated (Galvanized) Welded or equal. Top of fence and gates shall be provided with outriggers and reinforced barbed tape as indicated above. Post sizes shall be as shown on drawings.

The gates shall be swing type. Hinged gates shall be a pair of 3.65 m wide x 2.4 m high leafs, constructed of a steel tube frame and steel tube intermediate posts and rails. The design of the gates shall insure that it is dimensionally stable, square, true and planar. Gate leafs shall not rack or deflect when installed on its hinges. Gates shall have a sufficient number of hinges, anchor mounted to the exterior masonry walls, to support each gate leaf. Provide a locking mechanism that holds the gates together when in the closed position as well as a drop bolt that engages a steel sleeve embedded in the pavement.

2.2.6.2 OUTRIGGERS

Outrigger supporting arms shall be "Y" shaped with post securely embedded into the top of the wall. Posts shall conform to ASTM F 1083, Pipe, Steel, Hot Dipped Zinc Coated (Galvanized) Welded.

2.2.6.3 REINFORCED BARBED TAPE

Reinforced barbed tape shall be 600 mm diameter concertina style coil consisting of 31 loops. Each loop shall consist of 19 barb clusters per loop. Adjacent coils loops shall be alternately clipped together at three points about the circumference to produce the concertina effect upon deployment. Spacing between attachments points when deployed shall be 400 mm. The reinforced barbed tape shall be fabricated from 430 series stainless steel with hardness range of Rockwell (30N) 37-45 conforming to the requirements of ASTM A 176. Each barb shall be a minimum of 30.5 mm in length, in groups of 4, spaced on 102 mm centers. The stainless steel core wire shall have a 2.5 mm (0.098 inch) diameter with a minimum tensile strength of 895 MPa. Sixteen gauge stainless steel twistable wire ties shall be used for attaching the barbed tape to the barbed wire. The reinforced barbed tape shall be equivalent to NSN: 5660-01-457-9852.

2.2.6.4 PERIMETER STONE WALL

Native stone masonry walls, 600 mm thick, shall be constructed around the perimeter of the site. The height of the walls shall measure at least 3 m from the inside grade. Inside grade shall in all cases be higher than outside grade. The wall shall be capped with a cast-in-place concrete capping. Outriggers shall be installed to support barbed wires and 2 strands of concertina style razor wire. The ground grade shall slope away from the wall for at least 5 m and shall be kept a minimum of 2.5 m below the top of wall for a minimum distance of 10 m. The wall shall be designed to prevent visual access to the inside of compound by all pedestrian and vehicular traffic outside the compound which may require the wall to be built at a higher level in some locations. Any penetrations through the Perimeter Security Wall shall only be for site drainage purposes and shall have force protection such as a welded bar grill, welded grating, or other pre-engineered barrier. Details of any penetrations shall be produced by the contractor and provided in the design drawings.

2.2.6.5 PERIMETER WALL ACCESS GATES

2.2.6.5.1 SLIDING STEEL GATES

Gates shall be K4 sliding type. Gate shall be 3 m high with 0.5 m of high tension razor wire mounted on top. Gate shall be constructed of 100 mm x 100 mm x 5 mm square steel tubing, faced with 5mm steel plate. The design and construction of the gates shall insure that it is dimensionally stable, square, true and planar. Sliding Gate shall not rack or deflect when open, closed, or in motion. Gate tracks shall be anchor mounted to galvanized steel stanchions. Provide a locking mechanism that holds the gate closed. Provide reinforced grade beam across gateway flush with pavement to lock gate with flush mounted vertical sliding bolts, bolts shall be 50 mm diameter solid steel. The sliding gate will also have a built- in personnel gate with its own locking mechanism.

2.2.6.6 ENTRY CONTROL POINT (ECP)

The new Secondary ECP shall be laid out and constructed by the Contractor to facilitate secure entrance of authorized vehicles into the compound. A Guard House shall be provided inside the compound as part of the ECP. Entrance to the ECPs shall be paved, and shall have a single-leaf manually operated sliding steel gate. The gate shall be considered the Active Vehicular Barrier (AVB). A drop arm and guard shack shall be provided and located at a distance of one and a half vehicles away from the entrance to serve as a checkpoint. Jersey Barriers or other approved alternatives shall be used to design and construct a Passive Vehicular Barrier (PVB) beyond and away from the checkpoint to significantly slow down approaching vehicles. The PVB shall be laid out to force approaching vehicles into a snake-like manoeuvre while approaching the checkpoint and to significantly slow them down.

Provide a rejection lane after vehicle inspection and before entrance to the compound to allow rejected vehicles to circle back to the entrance road without interruption of the queue.

2.2.6.6.1 VEHICLE BARRIERS

2.2.6.6.1.1 ACTIVE BARRIERS - DROP ARM GATES

The height of the beam shall be a minimum of 762 mm above finished grade. The crash beam must be capable of blocking a minimum road width of 4.0 m. The crash beam shall be manually raised and lowered with less than 133

Newtons of force. The end of the crash beam should include a locking pin with padlock acceptance for securing the beam when it is in the down position capable of stopping large (4500 kg) trucks, in addition to heavy duty steel gates into the compound.

The gate shall be designed to accommodate a vehicle that is 6 m high (including gunners nest). Show a sketch in the design drawings of how the arm will clear the vehicle and gunners nest.

2.2.6.6.1.2 PASSIVE BARRIERS - CONCRETE

Barriers shall be concrete blocks of one meter by one meter by one meter dimensions. Similar arrangements of large stones (one cubic meter size), jersey barriers or equal sized obstacles may be used.

2.3 CIVIL UTILITIES

2.3.1 WATER

2.3.1.1 GENERAL

The Contractor shall provide water distribution mains, branches, service connections to include all pipe, valves, bends, thrust blocking, fittings and appurtenances. Exterior water line construction shall include service to all buildings as described in the Scope of Work Section 01010. The required average daily flow (ADF) shall be the average daily demand (ADD) per person - derived from 155 liters per capita per day (lpcd) – times a capacity factor, times the effective population. A capacity factor of 1.5 shall be used. The capacity factor shall be utilized as described in the following paragraph.

In the event potable or non-potable use water is required prior to completion of the water facilities infrastructure the Contractor may be issued a Request for Proposal to provide non-potable (tank truck) and potable (bottled or other reliable source) consumption.

Provide a minimum of one (1) outside water hydrant (hose spigot) for all buildings with water service. Every hose spigot shall have a lockable valve on its water line located inside an adjacent building or in a valve box. All buildings with water supply shall have a water meter installed in a locked cabinet area inside the building.

Features of the water system shall be sized to provide flow or storage capacity as follows:

- Water Well Pump Capacity - Capacity and total dynamic head (TDH) shall be based on an adjusted ADF (ADD, times the population, times the capacity factor) over a 16 hour period).

- Water Tanks - Capacity shall be based on ADF (ADD x c x CF x 3).

- Booster Pumps – The capacity shall be based on the installation wide, total fixture unit flow or 2 times the average daily flow (16 hour basis), whichever is greater. Three identical pumps shall be provided which are all sized to deliver 50% of the calculated capacity. Pumps shall automatically alternate to distribute wear and shall automatically turn on and off based on demand and system pressures. The total dynamic head (TDH) of the booster pumps shall be calculated to maintain a minimum, residual system pressure of 40 psi at the calculated capacity unless stated otherwise in the contract documents. Either a bladder style expansion tank or a hydro-pneumatic tank shall be supplied when booster pumps are used in the water system.

- Hydro pneumatic tanks – Volume and pressure regulation to maintain a pressure range provided in the technical requirements based on a rate equal to the ADF (ADD x c x CF).

- Water Mains – Diameter based on the installation fixture unit flow or two times the ADF (ADD x c x CF) and velocity requirements per this guide unless a minimum diameter is specified which is adequate to provide flow and meet the specified maximum velocity. The flow through the system shall be distributed on the basis of fixture unit flow in each the buildings serviced or per contract

- Water Service Lines - Diameter based on fixture units of the building serviced or per contract

2.3.1.2 WATER WELLS

The Contractor shall construct water well(s) inside the compound, to provide sufficient supply for the facility. The water well pump capacity and Total Dynamic Head (TDH) shall be based on an adjusted ADF (ADD, times the population, times the capacity factor) over a 16 hour period. The new well capacity shall have an allowable safe yield determined by a well pump test as described in the USACE-AED Design Requirements - Well Pumps & Well Design/Specifications, latest version. The new well site shall be at a location approved by the Government. The new well site shall be no closer than 60 meters from any existing wells. Well construction shall be in accordance with the USACE-AED Well Design Guide and Water Well Guide Specification. If installation of one or more wells with sufficient yield is not possible within the compound, the Contractor shall immediately notify the COR for resolution. Off-site water wells may then be considered upon approval by the COR.

After de-mining, if applicable, but prior to the construction of any structures, the Contractor shall submit a well test plan, drill and test the water well, conduct well design activities, conduct a chemical analysis of the water, and submit all required information to AES for review prior to installing any permanent well features. A plan for decommissioning dry wells shall be included with the well drilling plan. It is acknowledged that water may not be available at the site despite Contractor good faith efforts to find it.

Well construction shall be in accordance with AED Design Requirements - Well Pumps & Well Design/Specifications, latest version - which includes, but is not limited to, requirements for well screen, casing, gravel pack, well pump, disinfection, water meters and testing requirements. All design requirements, material specifications, and testing contained in this document shall be used and submittals shall be made promptly in accordance with Section 01335. Failure to follow the construction and submittal procedures outlined may, at AED's discretion, result in rejection of the well and, the Contractor having to remove the well casing and screen, re-drill the well and reinstall the proper features per the approved design.

Well Depth. The Contractor shall drill a minimum of two wells to a minimum depth of between 350 meters and 400 meters in an attempt to find potable water meeting WHO water quality requirements. The depth of the permanent well shall take into consideration the drawdown depth, screen depth and pump submergence. If water cannot be found the Contractor shall immediately notify the Contracting Officer's Representative (COR). The Contractor will be considered to have fulfilled the terms of the contract and will be entitled to the full price of the contract CLIN for Water Well.

Casing. Selection of the casing diameter, material and depth shall be per the AED Design Requirements document. In unconsolidated material, casing shall extend to the top of the well screen. In rock formations (drilled wells) the hole may be left open (i.e., well screen not required) with casing extended 3 m into the rock formation. All wells will be cased 610 mm above grade (i.e., base of pit, ground surface, etc.) and be fitted with a lockable cap with air gap (vacuum relief during pumping). Each section of casing will be joined with standard couplings and full-threaded joints, or by proper welding, so that all joints are sound and watertight. Well casing alignment shall not interfere with the proper installation and operation of the pump. The bottom of the casing shall be fitted with a metal or PVC well screen that will permit maximum transmission of water without clogging. The minimum length of screen shall be at least 3 m.

Sealing: The drilling process shall create a hole (borehole) larger than the casing (minimum of 2 inches). The annular space between the casing and the borehole will be filled with gravel, overburden, or concrete as follows:

a. The annular space between the well screen and borehole shall be filled with material that will form a filter to minimize production of fines and not clog the slots in the screen (e.g., washed, well-graded silica sand).

b. The annular space above the filter pack up to the base of the grout seal may be backfilled with overburden or other clean earth material.

c. The upper 3 m of the well bore shall be sealed with neat cement grout. The grout shall be placed in one continuous mass and shall be impermeable.

d. Crushed stone for well sealing shall consist of crushed stone containing angular shapes and surfaces with no rounded surfaces with the following gradation:

Sieve Size	% Total Wt. Passing
12.5 mm	100
4.75 mm	75 ± 13
1.18 mm	25 ± 15
75 µm	8 ± 4

e. All aggregate shall contain less than 5 percent of shale, clay lumps, coal, lignite, soft or unfragmented stone, or other deleterious materials.

Well screen, casing, gravel pack, well pump, disinfection, and testing requirements for well construction shall meet the specifications and design requirements in *AED Design Requirements - Well Pumps & Well Design/Specifications*, June 2009, or most recent version.

Screen. The casing will be fitted with a well screen that will permit maximum transmission of water without clogging. The material of construction, opening requirements, minimum lengths and placement shall be per the AED Design Requirements document. **Screens shall not be installed throughout the depth of the well. Screening shall only be installed in the deepest targeted aquifer.**

Source Protection: Surface drainage within 30 m of the wellhead shall ensure no ponding, flooding, or collection of runoff adjacent to the well. This can be accomplished through surface grading or use of gravel drains to modify site drainage in the vicinity of the well. The Contractor shall identify all sources of contamination and ensure the proposed well site meets minimum standoff distances as indicated below:

Sewage storage areas (outhouses, tanks, individual sewage pits, lagoons, and WWTP) – 30 m

Septic fields (infiltration galleries) – 30 m

Fuel storage, engine maintenance/repair – 30 m

Expansion Tank – Provide bladder style expansion tank for the well pump to minimize pressure surges and water hammer effects.

2.3.1.3 WATER QUALITY CONTROL AND TESTING

The Contractor shall perform water quality sampling and testing at the source. The Contractor shall utilize well-qualified and equipped testing capability in the project site area, if available. If professional testing services are not available in the area, the Contractor will submit an alternative practical testing source for approval. Raw water quality criteria requirements for laboratory testing shall be addressed in accordance with USACE-AED Well Pumps & Well Design Guide with Attachment A – Guide Specifications for Drinking Water Wells, latest version for requirements for laboratory testing.

2.3.1.4 WELL WATER PUMPS

An electric submersible well pump will fill the above ground water tank. The well pump shall be installed inside the casing set no less than 3 m above the screen or in casing between screened intervals a minimum of 3 m above and below the screens. Pumps shall not be located in a screened interval. Control of the pump shall be by means of a Hand-Off-Auto (HOA) switch. In the "Auto" position, the pump shall be started and stopped automatically by water levels in the water storage tank. Pump shall start at low level and shall stop at high level. Level controls shall be adjustable. Manual start shall be the Hand position.

2.3.1.5 RAW WATER DISINFECTION

Contractor shall perform disinfection of the well water in accordance with AED Design Requirements - Well Pumps & Well Design/Specifications, latest version.

Bacteriological samples shall be collected and examined in accordance with Standard Methods for the Examination of Water and Wastewater by a qualified lab as approved by the Contracting Officer.

2.3.1.6 SERVICE BOOSTER PUMPS

Contractor shall provide a booster pump station to provide water to the water distribution system. The system shall be equipped with hydropneumatic surge tank(s). Service booster pumps shall be end suction or split case double suction horizontal split case (frame mounted) centrifugal pumps arranged in parallel for pumping water storage into the water distribution system. The pumps and controls shall be designed to supply and maintain acceptable system pressure to the water distribution system. The suction side of the service booster pumps shall have an eccentric reducer and gate valve installed. The discharge side shall have a gate valve, check valve between the pump and the gate valve and concentric reducer, pressure gage and air relief valve.

Three identical pumps shall be provided. Two pumps shall alternate to distribute wear (with one as a back-up) and shall automatically turn on and off based on demand. The booster pump system shall be enclosed in a CMU booster pump building per the drawings titled "Booster Pump Building" in Appendix B.

2.3.1.6.1 HYDRO-PNEUMATIC SURGE TANK(S)

The Contractor shall provide horizontally mounted and insulated above ground surge hydro-pneumatic tank(s) containing water and compressed air located adjacent to the water pumps to maintain pressure during surges. A compressor is required to charge the tank with air, or a pre-charged bladder type tank may be used. At low level the water remaining in the tank(s) shall be at least ten percent of the capacity of the tank. The tank(s) size shall be determined such that the pump cycles not less than 4 times per hour or more than 10 times per hour.

2.3.1.7 WATER STORAGE TANK

Contractor shall provide a steel ground storage tank(s) (GST) to be located on the ground surface and sized per Section 01010. The storage facility shall be located above drainage areas and locations subject to flooding as approved by the Contracting Officer. The storage facility shall be located on the higher elevations of the site to promote gravity flow and reduce pumping requirements. Overflow and air vents shall be screened so that birds, rodents and debris cannot enter the reservoir. The tank shall meet all applicable codes for potable water storage. The interior coatings for the tank shall meet NSF/ANSI 61 requirements.

2.3.1.8 DISINFECTION & CHLORINATION SYSTEM

The Contractor shall test water for World Health Organization (WHO) potable drinking water standards and if treatment is required, the Contractor shall immediately notify the Contracting Officer. Regardless of water quality the Contractor shall provide and install a water disinfection system. The chlorination system shall be enclosed in the booster pump building.

Use hypochlorite compounds for disinfection. A hypo-chlorinator shall be used to feed a sodium hypochlorite solution of 5-15% available chlorine into the system. Hypochlorite compound may be a liquid or solid form. The hypo chlorination system shall consist of a chemical solution tank for hypochlorite, diaphragm-type pump, power supply, water pump, pressure switch and storage tank (optional hydro-pneumatic/storage). The pump shall feed a hypochlorite solution in proportion to the water demand. The hypo-chlorinator shall have a pumping rate, liters per day (lpd) adequate to deliver 5 percent (%) available hypochlorite solution adjustable to the quantity of water being produced from the source. Dosage rate will vary somewhat depending on actual pump production rate and available residual chlorine in the system. Contractor shall determine the required dosage rate milligrams per liter (mg/l) to maintain the required chlorine residual (usually 0.2-0.4mg/l) in the distribution system. Chlorine solution tank shall be large enough to hold a three day supply of hypochlorite solution. A fresh solution shall be prepared every two or three days because the solution may lose its strength over time and this will affect the actual chlorine feed rate. The hypochlorite shall be stored in a cool dry place. Sodium hypochlorite can lose from two to four percent of its available chlorine content per month at room temperature. Contractor shall verify required minimum residual chlorine in accordance with local requirements verified and approved by the Contracting Officer. The chlorination system shall have the capability for manually adjusting the dosage rate and be installed in such a manner that the system can be easily disconnected and bypassed in the event of health safety or routine maintenance and repair. Disinfection of water mains shall be in accordance with AWWA standard C651-86 and disinfection of storage facilities in accordance with AWWA standard C652-86.

2.3.1.9 WATER DISTRIBUTION CHLORINE BUILDING

The Contractor shall design and construct a 35 m^2 CMU Chemical Building for housing the chlorination system and storage of chemicals. The Chemical Building shall have an emergency eye wash station, one (1) stainless steel sink and water source for mixing chemicals. The chemical building shall be adequately vented to maintain a safe working environment and per the chlorine manufacturer's requirements. The Contractor shall provide manufacturers catalog information and shop drawing to the Contracting Officer for approval.

2.3.2 WATER DISTRIBUTION SYSTEM

2.3.2.1 GENERAL

The Contractor shall provide a water distribution system. The distribution network shall be laid out in a combination grid and looped pattern with dead ends not exceeding 30 m. Use similar piping materials for all buildings and pipe runs in the distribution system for efficiency of future maintenance activities. Dead end sections shall not be less than 150 mm diameter and shall either have blow off valves or fire hydrants (flushing valves) installed for periodic flushing of the line. Any pipe with a fire hydrant on the line shall be at least 150 mm in diameter. Water supply distribution shall connect to a building service at a point approximately 1.5 m outside the building or structure to which the service is required. All piping and joints shall be capable of at least 1.03 MPa leakage testing and 1.38 MPa hydrostatic pressure test, unless otherwise specified. Pipe diameters shall be adequate to carry the maximum flow of water at velocities less than 1.5m/sec. Piping segments where velocities less than 0.15 m/sec are anticipated shall be noted and brought to the attention of AES. The operating pressure range shall be between 345 kPa to 414 kPa at all points of the distribution system. If pressures greater than 690 kPa cannot be avoided, pressure-reducing valves shall be used. A system pressure of 30 psi is acceptable at extreme peak flow conditions. A system pressure below 30 psi shall be considered a deviation in the technical requirements requiring Contracting Officer approval.

Contractor shall not use HDPE pipe and fittings, regardless if existing project water distribution system had this pipe material.

Adequate cover must be provided for frost protection. A minimum cover of 800 mm is required to protect the water distribution system against freezing. Water lines less than 1.25 m deep under road crossings shall have a reinforced concrete cover of at least 150 mm thickness around the pipe extending out to 1 m from each road edge.

2.3.2.2 PIPE

The Contractor shall provide Ductile Iron or PVC pipe of adequate strength, durability and be corrosion resistant with no adverse effect on water quality.

2.3.2.2.1 WATER MAINS AND BRANCHES

Water main diameter shall be based on the installation fixture unit flow or two times the ADF (ADD x c x CF) and velocity requirements per this guide unless a minimum diameter is specified which is adequate to provide flow and meet the specified maximum velocity. Pipe material for water mains and branches shall be PVC or Ductile Iron (DI). The exterior surface of the pipe must be corrosion resistant. Distribution lines shall not be less than 100mm in diameter. Pipe diameters shall be 100mm and larger. Pipe diameters shall be selected to meet the previously specified flow, velocity, and pressure conditions. If Ductile Iron (DI) pipe is installed underground the pipe shall be encased with polyethylene in accordance with AWWA C105. Ductile iron pipe shall conform to AWWA C104. DI fittings shall be suitable for 1.03 MPa pressure unless otherwise specified. Fittings for mechanical joint pipe shall conform to AWWA C110. Fittings for use with push-on joint pipe shall conform to AWWA C110 and C111. DI fittings shall be cement mortar lined (standard thickness) in accordance with C104. All pipes and joints shall be capable of at least 1.03 MPa leakage test and and 1.38 MPa hydrostatic pressure test unless otherwise specified herein. Polyvinyl Chloride (PVC) pipe shall conform to ASTM D 1785. Plastic pipe coupling and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B. PVC screw joint shall be in accordance with ASTM D 1785, Schedules 40, 80 and 120. PVCu pipe couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B. Pipe less than 80mm (3 inch), screw joint, shall conform to dimensional requirements of ASTM D schedule 80. Elastomeric gasket-joint, shall conform to dimensional

requirements of ASTM D 1785 Schedule 40, PVCu (or uPVC) pipe and fittings shall have SDR that provide equal or superior strength properties to ASTM 1785 SCH 40 or SCH 80 pipe and fittings.

2.3.2.2.2 WATER SERVICE

Water service line diameter based on fixture units of the building serviced or per contract. Building service lines will be sized according to the following guidance. Water service connections from the mains to the buildings shall vary from 19mm, 25mm, 38mm, 75mm, to 100mm as calculated, depending on the maximum flow velocity and minimum pressure requirements as determined by hydraulic analysis of fixture flows. Pipe service connections from the distribution main to the building shall be either Polyvinyl Chloride (PVC) plastic Schedule 80 ASTM D 1785 or copper tubing conforming to ASTM B 88M, Type K, annealed. PVC pipe couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B. Contractor shall not use HDPE for any of the water pipes.

2.3.2.3 HYDROSTATIC, LEAKAGE AND DISINFECTION TESTS

The Contracting Officer will be notified not less than 48 hours in advance of any water piping test and will be given full access for monitoring testing procedures and results. Where any section of water line is provided with concrete thrust blocking for fittings or hydrants, tests shall not be made until at least 5 days after installation of concrete thrust blocking, unless otherwise approved. Pressure and leakage testing shall be as specified in AED Design Requirements – Water Tank and Water Distribution Systems, latest version.

2.3.2.4 PRESSURE TEST

After the pipe is laid, the joints completed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants and valves shall be carefully examined during the partially opened trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves discovered following this pressure test shall be removed and replaced and retested until the test results are satisfactory.

2.3.2.5 LEAKAGE TEST

Leakage tests shall be conducted after all pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and, during the test, water lines shall be subjected to not less than 1.01 MPa. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure to within 34.5 kPa of the specified leakage test pressure after the pipe has been filled with water and all air expelled. Pipe installation will not be accepted if leakage exceeds the allowable leakage, as determined by the following formula:

L = 0.0001351ND (P raised to 0.5 power), where:

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipeline tested

D = Nominal diameter of the pipe in inches

P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the government.

2.3.2.6 BACTERIOLOGICAL DISINFECTION

2.3.2.6.1 DISINFECTION PROCEDURE

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by AWWA C651. After pressure tests have been completed, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. Flushing will be performed in a manner and sequence that will prevent recontamination of pipe that has previously been disinfected. The chlorinating material shall be liquid chlorine, calcium hypochlorite, or sodium hypochlorite. The chlorinating material shall provide a dosage of not less than 50 ppm and shall be introduced into the water lines in an approved manner. Polyvinyl Chloride (PVC) pipelines shall be chlorinated using only the above-specified chlorinating material in solution. The agent shall not be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. Valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period, each fire hydrant on the line shall be opened and closed several times.

2.3.2.6.2 SAMPLING

For each building connected to the water system, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with approved methods. The commercial laboratory shall be verified to be qualified by the appropriate authority for examination of potable water. Contractor shall submit a water sampling protocol for approval. This shall include at a minimum the name of the laboratory, parameters to be tested, the Company conducting the sampling, and the sample locations.

2.3.2.6.3 ACCEPTANCE REQUIREMENTS

The disinfection shall be repeated until tests indicate the absence of bacteria for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained. All retests shall be conducted at the Contractor’s expense.

2.3.2.6.4 TIME FOR MAKING TESTS

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipeline jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill.

2.3.2.6.5 CONCURRENT TESTS

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be recorded for submission and approval. Replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government. Pressure and leakage testing may be conducted concurrently. Hydrostatic tests and disinfection may be conducted concurrently using water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be re-accomplished.

2.3.2.6.6 VALVES

Valves (Gate valves w/box) shall be placed at all pipe network tees and cross intersections, and the number of valves shall be one less than the number of lines leading into and away from the intersection. For isolation purposes valves shall be spaced not to exceed 3600 mm (12 feet). Gate valves shall be in accordance with AWWA C 500 and/or C509. Butterfly valves (rubber seated) shall be in accordance with C504 etal. The valves and valve boxes shall be constructed to allow a normal valve key to be readily used to open or close the valve. Provide traffic-rated valve boxes. Provide concrete pad, 1 m square, for all valve boxes.

2.3.2.6.7 VACUUM AND AIR RELEASE VALVES

Air release valves are required to evacuate air from the main high points in the line when it is filled with water, and to allow the discharge of air accumulated under pressure. Vacuum relief valves are needed to permit air to enter a line when it is being emptied of water or subjected to vacuum. Contractor shall submit manufacturer's data for properly sized combination air and vacuum release valves and determine their locations on the distribution system subject to review and approval of the Contracting Officer.

2.3.2.6.7.1 BLOW-OFF VALVES

The Contractor shall provide 40-50 mm blow-off valves at ends of dead end mains. Valves should be installed at low points in the mains where the flushing water can be readily discharged to natural or manmade drainage ditches, swales or other.

2.3.2.7 THRUST BLOCKING

Contractor shall provide concrete thrust blocking at any point where the layout of the system changes the direction of the flow, increases the velocity, or decreases or stops the flow. At these points, the pipes and fittings must be anchored and kept from moving or pulling apart by the use of thrust blocks installed against undisturbed earth.

For piping that has **restrained joints** and **less than** 100 mm diameter, thrust blocking is not necessary.

2.3.3 SANITARY SEWER

2.3.3.1 GENERAL

Sanitary sewers less than 1.25 meters under road crossings shall have reinforced concrete cover at least 150 mm thick around the pipe. Concrete cover will extend out to at least 1 m from each road edge.

Exterior sanitary sewer line construction shall include service to all buildings as described in the Scope of Work Section 01010. Contractor shall design sanitary sewer collection system using approved field survey data and finished floor elevations. Depending upon the topography and building location, the most practical location of sanitary sewer lines is along one side of the street. In other cases they may be located behind buildings midway between streets. Main collection sewers will follow the most feasible route to the point of discharge. The sewer collection system shall be designed to accommodate the initial occupancy and a reasonable expansion capability. Sewer collection capacity shall be based on the two times the average daily wastewater flow unless minimum diameter specified is adequate to provide flow and required maximum velocity; wastewater flow through the system shall be distributed on the basis of fixture unit flow in each the buildings serviced by multiplying the proportion of the total fixture flow from each building or facility times the total wastewater flow for the project or installation as determined above.

All sewers shall be located outside of the roadways as much as practical, and minimize the number of roadway crossings. To the extent practical, a sewer from one building shall not be constructed under another building, or remain in service where a building is subsequently constructed over it.

The Contractor shall use the following criteria where possible to provide a layout which is practical, economical and meets hydraulic requirements:

1) Follow slopes of natural topography for gravity sewers.

2) Check subsurface investigations for groundwater levels and types of subsoil encountered. If possible, avoid areas of high groundwater and the placement of sewers below the groundwater table.

3) Avoid routing sewers through areas which require extensive restoration or underground demolition.

4) Depending upon the topography and building locates, the most practical location of sanitary sewer lines is along one side of the street. In other cases they may be located behind buildings midway between streets. The intent is to provide future access to the lines for maintenance without impacting vehicular traffic.

5) Avoid placing manholes in low-lying areas where they could be submerged by surface water or subject to surface water inflow. In addition, all manholes shall be constructed 50 mm higher than the finished grade, with the ground sloped away from each manhole for drainage.

6) Sewer lines shall have a minimum of 800 mm of cover for frost protection.

7) Locate manholes at change in direction, pipe size, or slope of gravity sewers.

8) Sewer sections between manholes shall be straight. The use of a curved alignment shall not be permitted.

9) If required by the design, locate manholes at intersections of streets where possible. This minimizes vehicular traffic disruptions if maintenance is required.

10) Sewer lines less than 1.25 m deep under road crossings shall have a reinforced concrete cover of at least 150 mm thickness around the pipe or shall utilize a steel or ductile iron carrier pipe. It is recommended to continue the reinforced concrete cover or carrier pipe a minimum of one (1) m beyond the designated roadway.

11) Verify that final routing selected is the most cost effective alternative that meets service requirements.

2.3.3.2 PROTECTION OF WATER SUPPLIES

The Contractor shall ensure that the sewer design meets the following criteria:

1) Sanitary sewers shall be located no closer than 30 m horizontally to water wells or reservoirs to be used for potable water supply.

2) Sanitary sewers shall be no closer than 3 m horizontally to potable water lines; where the bottom of the water pipe will be at least 300 mm above the top of the sanitary sewer, horizontal spacing shall be a minimum of 1.8 m.

3) Sanitary sewers crossing above potable water lines shall be constructed of suitable pressure pipe or fully encased in concrete for a distance of 3 m on each side of the crossing. Pressure pipe will be as required for force mains in accordance with local standards and shall have no joint closer than 1 m horizontally to the crossing, unless the joint is fully encased in concrete.

4) When sanitary sewers cross water lines the designer shall cross the water line above the sewer line whenever possible. In such cases the water line shall be located a minimum distance of 450 mm above the sewer line or shall be fully encased in concrete for a distance of 3 m on each side of the crossing.

2.3.3.3 GRAVITY SEWER

Sanitary sewers shall be designed in accordance with the AED Design Requirements for Sanitary Sewer and Septic Systems, latest version to flow at a maximum in the following way:

1) Sanitary sewer laterals, mains and trunk lines flow velocities shall be designed to provide a minimum velocity of 0.6 meters per second (mps).

2) A minimum velocity of 0.8 mps at the peak diurnal flow rate.

3) Flows shall be based on allocating the proportion of the average daily or peak daily flow to each building or facility on the basis of fixture unit flow developed for the plumbing design.

4) Minimum pipe slopes shall be provided regardless of the calculated flow velocities to prevent settlement of solids suspended in the wastewater. Minimum pipe slopes are provided in the AED Design Requirements for Sanitary Sewer and Septic Systems.

Unless otherwise indicated (see Building Connections and Service Lines), gravity sewer pipe shall be installed in straight and true runs in between manholes with constant slope and direction. Adequate cover must be provided for frost protection. A minimum cover of 800 mm will be required to protect the sewer against freezing.

2.3.3.4 SITE SELECTION FOR SUBMERSIBLE INFLUENT SEWAGE LIFT STATION

The Contractor shall locate sewage lift stations as needed based primarily on topographic considerations. The lift stations will be located, so that all points within the intended service areas of the facility can be served adequately by gravity sewers en route to the lift station.

2.3.3.4.1 SUBMERSIBLE INFLUENT LIFT STATION PUMP CAPACITY

The number and capacity of pumps provided will be sufficient to discharge minimum, average, peak daily and extreme peak flow rates as calculated in TM 5-814-1/AFM 88-11, Vol 1 or UFC 3-240-08FA. Pumping capacity

will be adequate to discharge the peak flow rates with the largest pump out of service.

Each pumping unit will be a constant speed type, and will be capable of discharging the extreme peak flow rate. Influent lift stations will be used to pump major wastewater flows to the treatment facility and operate on a continuous basis. The rate of pumpage must change in increments as the flow to the station varies. The Contractor will provide two or more wastewater pumps of the constant speed type, as required to match the incoming flow rate.

2.3.3.5 MANHOLES

The Contractor shall provide standard depth manholes (MH), (depth may vary) an inside dimension of 1.2 m. Manholes shall be made of cast-in-place reinforced concrete with reinforced concrete cover. Alternate pre-cast manhole option shall taper to a 750 mm cast iron frame that provides a minimum clear opening of 600 mm. In every case, the manholes, frames and covers shall be traffic rated, H-20 load rating. All manholes shall be provided with a concrete bench with a flow line trough, smoothly formed to guide waste flow to the outlet pipe from the inlet pipe(s). The top surface of the bench shall be above the crown of all pipes within the manhole. All surfaces of the bench shall be sloped smoothly toward the trough to guide flow, even under peak flow conditions. Sanitary sewer lines shall enter at the manhole flow line. Where the invert of the inlet pipe would be more than 0.5 meter above the manhole floor, a drop inlet shall be provided. No internal drop structures shall be permitted at lift stations. Inlet to lift station wet wells shall enter below the lowest water level of the pump operating range, and if necessary a drop inlet approach pipe external to the lift station may be used to avoid cascading influent flow. The angle between inflow and outflow pipes converging at a manhole shall not be less than 90°.

2.3.3.5.1 MANHOLE DESIGN REQUIREMENTS

Manholes are required at junctions of gravity sewers and at each change in pipe direction, size or slope, except as noted hereinafter for building connections. Manholes shall be installed at start of all main runs.

2.3.3.5.2 SPACING

The distance between manholes must not exceed 120 m in sewers of less than 460 mm in diameter. For sewers 460 mm and larger, and for outfalls from wastewater treatment facilities, a spacing of up to 180 m is allowed provided the velocity is sufficient to prevent sedimentation of solids.

2.3.3.5.3 PIPE CONNECTIONS

The crown of the outlet pipe from a manhole shall be on line with or below the crown of the inlet pipe.

2.3.3.5.4 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete, traffic rated in any case to an H-20 load rating. Cast iron frames and covers shall be traffic rated, circular with vent holes.

2.3.3.5.5 STEPS FOR MANHOLES

Steps shall be cast iron, polyethylene coated, at least 15 mm thick, not less than 400 mm in width and spaced 300 mm on center.

2.3.3.6 PIPE

Pipe shall conform to the respective specifications and other requirements as follows: Provide Polyvinyl Vinyl Chloride (PVC) conforming to ASTM D 3034, Type PSM with a maximum SDR of 35, size 380 mm or less in diameter. PVC shall be certified as meeting the requirements of ASTM D 1784, cell Class 12454 B. Minimum pipe sizes for the main lines and laterals shall be 200 mm diameter and service lines shall be a minimum of 150 mm diameter. Contractor may use uPVC pipe provided the SDR and strength properties of the pipe equal or exceed the properties of ASTM D 1784 for PVC.

2.3.3.6.1 FITTINGS

Fittings shall be compatible with pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and requirements as follows: provide PVC fittings conforming to ASTM D

3034 for type PSM pipe.

2.3.3.6.2 JOINTS

Joints installation requirements shall comply with the manufacturers installation instructions. Flexible plastic pipe (PVC or high density polyethylene pipe) gasket joints shall conform to ASTM D3212.

2.3.3.6.3 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent-cemented saddles as approved. Saddles for PVC pipe shall conform to Table 4 of ASTM D 3034. The minimum depth of the cover over the pipe crown shall be 0.8 m.

2.3.3.6.4 BUILDING CONNECTIONS AND SERVICE LINES

Building connections and service lines will be planned to eliminate as many bends as practical and provide convenience in rodding. Bends greater than 45 degrees made with one fitting should be avoided; combinations of elbows such as 45-45 or 30-60 degrees should be used with a cleanout provided. Connections to other sewers will be made directly to the pipe with standard fittings rather than through manholes. However, a manhole must be used if the connection is more than 30 m from the building cleanout. Tee connections to the main or branch are not allowed. Service connection lines will be a minimum of 150 mm diameter and laid at a minimum 1% grade. Laterals shall be 200 mm and sloped to maintain the minimum velocity as described in paragraph “Gravity Sewer.”

2.3.3.6.5 CLEANOUTS

Cleanouts must be installed on all bends of sewer-building connections to provide a means for inserting cleaning rods into the underground pipe. Install manufactured wye fittings. In lieu of a wye fitting, an inspection chamber may be installed. The inspection chamber shall be of the same construction as a manhole. The cleanout will be of the same diameter as the building sewer, and never be smaller than 150 mm. If there are no bends in the sewer building connection, a cleanouts shall be installed within 1 m from the building.

2.3.3.7 GREASE TRAP

Grease traps are used to remove grease from wastewater to prevent it from entering the sanitary sewer and septic systems. All Dining Facilities (DFACs) shall incorporate preliminary treatment with use of a grease trap prior to the sanitary sewer system. The only waste lines upstream of the grease trap shall be grease laden waste from the kitchen or other areas. Grease trap design shall be based on AED Design Requirements - Grease Trap, latest version. The grease trap shall be of reinforced cast-in-place concrete, reinforced precast concrete or equivalent capacity commercially available steel, with removable three-section, 9.5 mm checker-plate cover, and shall be installed outside the building. Steel grease trap shall in be installed in a concrete pit and shall be epoxy-coated to resist corrosion as recommended by the manufacturer. Concrete shall have a minimum compressive strength of 21 MPa at 28 days. The grease trap shall connect to the sanitary sewer system.

Contractor shall provide bollards around the tank and construct a minimum 4 m wide access road from the closest roadway to the grease trap for a pump truck. The access road shall be of the same material as the main roads in the compound. Under no circumstance shall the grease interceptor be installed inside the building. Provide outside water spigot for cleaning.

2.3.3.8 FIELD QUALITY CONTROL

2.3.3.8.1 FIELD TESTS AND INSPECTIONS

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment and incidentals required for testing.

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically a full circle of light through the pipeline when viewed from the adjoining end of the line. When pressure piping is used in a non-pressure line for non-pressure use, test this piping as specified for non-pressure pipe.

Test lines for leakage by either infiltration tests or exfiltration tests. Prior to testing for leakage, backfill trench up to at least lower half of the pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe to prevent movement during testing, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

Infiltration tests and ex-filtration tests: Perform these tests for sewer lines made of specified material, not only concrete, in accordance with ASTM C 969M, ASTM C 969. Make calculations in accordance with the Appendix to ASTM C 969M and ASTM 969.

Perform Low Pressure Air tests as follows:

1) Concrete pipe: Test in accordance with ASTM C 924M, ASTM C 924. Allowable pressure drop shall be given in ASTM C 924M ASTM C 924. Make calculations in accordance with the Appendix to ASTM C 924M, ASTM C 924.

2) Ductile-iron pipe: Test in accordance with the applicable requirements of ASTM C 924M, ASTM C 924. Allowable pressure drop shall be as given in ASTM C 924M, ASTM C 924. Make calculations in accordance with the Appendix to ASTM C 924M, ASTM C 924.

3) PVC Plastic pipe: Test in accordance with applicable requirements of UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

2.3.3.8.2 DEFLECTION TESTING

Deflection testing will not be required however; field quality control shall ensure that all piping is installed in accordance with deflection requirements established by the manufacturer.

2.3.4 WASTEWATER TREATMENT LAGOON SYSTEMS

The Contractor shall design and construct a partial mix aerated wastewater treatment lagoon system in accordance with AED Design Requirements - Package Wastewater Treatment Plants and Lagoons, latest version. The Waste water treatment plant shall include a laboratory/office and a chlorine storage building per Section 01010.

2.3.4.1 WASTE WATER TREATMENT LAGOON SYSTEM CAPABILITIES

The partial mix aerated wastewater treatment lagoon system shall be designed to accommodate the wastewater hydraulic load as specified in Section 01010. The wastewater treatment lagoon system shall be designed and constructed such that it operates with the ability to process inflow rates to the waste water lagoon system from the off loading station based on the calculated peak hourly flow. Feed rate to the plant components shall be determined by the Contractor from the analysis of the installation peak flow and average daily flow evaluation. All treatment train components shall be designed and constructed in pairs and with bypass capability in order to continue wastewater treatment while performing maintenance on a particular component in the treatment train.

2.3.4.2 REQUIREMENTS OF DESIGN

Influent Characteristics of Wastewater:

BOD_5 – 400 mg/L

TSS –400 mg/L

TKN – 80 mg/L

Fecal Coliform – 10^8 MPN /100 mL

Effluent Criteria Limitations for Direct Surface Water Discharge:
BOD_5

a. The 30-day average shall not exceed 30 mg/L

b. The 7-day average shall not exceed 45 mg/L

$CBOD_5$ may be substituted for BOD_5. In those cases the following limits will apply:

a. 30-day average will not exceed 25 mg/L

b. The 7-day average will not exceed 40 mg/L

Note: Parameter $CBOD_5$ limit, if substituted for the parameter BOD_5, should be at least 5 mg/L less than each numerical limit for the thirty (30) day and seven (7) day average for the BOD_5 limit. The $CBOD_5$ test procedure suppresses the nitrification component in the BOD_5 test procedure, thereby reducing the value or effects and lowering the oxygen demand.

TSS

The 30-day average shall not exceed 30 mg/L.

The 7-day average shall not exceed 45 mg/L.

pH

The effluent pH values shall be maintained between 6.0 and 9.0.

Temperature Ranges: see the mechanical section for the range of temperatures that apply.

Processes: To be determined by the Contractor as part of the scope of work subject to Government approval as required in AED Design Requirements - Package Wastewater Treatment Plants and Lagoons latest version.

2.3.4.3 LAGOONS

The Contractor shall design the partial mix aerated lagoons in accordance to the AED Design Requirements - Package Wastewater Treatment Plants and Lagoons latest version. The lagoons shall be lined with a geomembrane liner with a hydraulic conductivity no greater than 1×10^{-7}cm/sec, or shall be concrete lined. The Contractor shall construct a minimum of two (2) lagoons of equal volume.

2.3.4.4 FLOW SPLITTING

For multiple treatment trains, provide flow splitting capabilities to evenly distribute flow to each treatment train with broad adjustable rectangular weirs. Plant influent shall be conveyed directly into the flow lagoon basins.

2.3.4.5 INLET BAR SCREEN

A bar screen shall be provided prior to flow equalization to remove large solids from the incoming raw sewage. The bar screen will be fabricated from 13 mm diameter bars spaced 25 mm apart. The bars shall be sloped to permit easy cleaning of accumulating debris. A deck shall be furnished for drying the debris. Minimum area of bar screen shall be 0.9 m x 0.9 m.

2.3.4.6 FLOW EQUALIZATION

Provide flow equalization volume designed to attenuate maximum peak flows equal to 150% of the design flow for two hours. Flow control to the lagoons shall be accomplished by gravity flow of the influent from the off loading station. The off loading station shall contain broad adjustable rectangular discharge weirs. The broad weirs will be adjustable so that a measured amount of influent will flow to the lagoons.

2.3.4.7 CHLORINE CONTACT CHAMBER

A chlorine contact chamber shall be provided for proper disinfection of the treated waste water prior to discharging from the plant. The chlorine contact chamber shall have appropriate detention time based on the design flow to meet effluent standards. Sufficient flow baffles shall be supplied to ensure proper mixing of the chlorine solution with the plant effluent and detention time.

2.3.4.8 HYPOCHLORITE SYSTEM

The Contractor shall design and construct a liquid chlorine (hypochlorite) feed system sized to satisfy all disinfection requirements at the waste water treatment plant. It is anticipated that calcium hypochlorite will be delivered to the plant in the small containers and stored in a dedicated, dry, well ventilated building. No other chemicals, cleaning solvents, lubricants, etc. are to be stored in the dedicated space. The hypochlorite feed system will consist of batch mix/feed storage tanks, positive displacement metering pumps, piping, valves and other appurtenances, and pump controls. For redundancy, provide a dedicated metering pump for each treatment train.

Provide two minimum 400 liter fiberglass reinforced plastic or polyethylene mix/feed tanks. The Contractor shall base the preliminary tank size on commercial strength 12.5% hypochlorite batch solution, and assumption that 45 kilograms of calcium hypochlorite batched in each tank. Tanks shall be elevated on a pad for housekeeping and to provide flooded metering pump suction, and shall come with hinged cover, top mounted mixer, and 25 mm bottom outlet connection. The Contractor shall provide a concrete secondary containment for the mix/feed tank. The concrete secondary containment shall provide a minimum total of 900 liter capacity. The Contractor shall construct a concrete Mixers shall have local, manual on/off control. Hypochlorite metering pumps shall be positive displacement type with stroke and speed control. The pumps shall be capable of adjustable speed operation using DC SCR drive and shall be flow-paced off a flow signal from the lagoon system. Coordinate pump motor type with drive unit provided. Metering pumps shall have capacity to dose minimum 10 mg/L chlorine or as required to meet applicable discharge limits, whichever is greater. Provide a dedicated pump for each treatment train. At a minimum, each metering pump shall be provided with the following appurtenances: Pulsation dampener, adjustable diaphragm backpressure valve, adjustable pressure relief valve, calibration column, pressure indicator with diaphragm seal, Y-strainer. Provide a suitable diffuser or injection assembly for dispersing chemical at the point of application.

Provide non-potable dilution water for batching the dry calcium hypochlorite. Provide appropriate protective clothing and eye protection. Provide an emergency shower and eyewash station in the chlorine feed building.

Chlorine feed piping shall be 13 mm schedule 80 PVC. Provide double walled containment for chlorine lines between the feed building and the point of application. Provide isolation valves to allow equipment to the isolated for maintenance.

Provide power, control wiring and dilution water as required for a complete and operable system.

2.3.4.8.1 WASTEWATER TREATMENT CHLORINE BUILDING

The Contractor shall design and construct a 35 m^2 CMU Chemical Building for housing the chlorination system and storage of chemicals. The Chemical Building shall have an emergency eye wash station, one (1) stainless steel sink and water source for mixing chemicals. The chemical building shall be adequately vented to maintain a safe working environment and per the chlorine manufacturer's requirements. The Contractor shall provide manufacturers catalog information and shop drawing to the Contracting Officer for approval.

2.3.4.9 CENTRAL CONTROL PANEL

The electrical controls will consist of magnetic starters, program timers and switches necessary to automatically control all electrical devices and/or motors on the waste water treatment system.

Manual-off-auto selector switches and magnetic starters in conjunction with the program timer will control the blower/motor. The program timers will have the capability to operate the treatment system when required as determined by the variation in the daily flow rate. Properly sized circuit breakers and fuses will protect all electrical equipment and circuitry. The control system will be designed to operate all duplex or standby equipment.

Electronic flow meters shall be installed at appropriate locations on inflow and outfall locations to monitor influent and effluent flows. The controls and monitors shall be located at the central control panel.

2.3.4.10 ACCESS LADDER, WALKWAYS AND HANDRAILS

Provide an access ladder to each structure above grade. Provide service walkways with handrails to service the plant equipment. Walkways shall be a minimum 0.9 m. Provide service walkways between trains and other plant structures so each structure can be accessed without having to climb back down a ladder.

2.3.4.11 PIPING

All piping that is not buried in accordance with this section shall be Schedule 40 black steel pipe.

2.3.4.12 VALVES

The Contractor shall install bypass valves and piping so that each component in the process train can be bypassed for maintenance.

2.3.4.13 SLUDGE DRYING BEDS

Provide four (4) sludge drying beds sized to adequately provide the capacity to dry sludge produced by the lagoon system. Convey sludge from lagoons to beds by gravity. Provide isolation valves to each bed and splash plate in front of outlet to spread the sludge over the bed and prevent erosion of the sand.

Beds shall be capable of holding 0.3 m of liquid sludge. Profile the following bed layers:

a. 0.3 m top layer of uniform coarse sand (effective size between 0.3 to 0.75 mm)

b. 0.1 m intermediate layer of uniform fine gravel (effective size between 4 to 5 mm)

c. 0.1 m bottom layer of uniform coarse gravel (effective size between 20 to 25 mm)

Slope bed subgrade to drain to drainage laterals. Encase drainage laterals in 0.1 m of uniform coarse gravel. Drainage lateral shall be 0.1 m below bottom gravel layer. Slope drainage laterals and header a minimum of 1% to drain to lift station. Drainage laterals shall be perforated ASTM 3034 100 mm PVC pipe with two rows of holes 13 mm in diameter on 120 mm centers and 120° apart. Space laterals evenly at 3 m apart. Lateral are to run entire length or width of bed. Manifold laterals to common ASTM 3034 150 mm PVC header. Locate feed pipe at opposite end of access point for dried sludge removal equipment (e.g. bulldozer). Slope bed side walls at 2H: 1V slope.

The Contractor shall design and construct effluent recirculation system for the excess effluent that collects in the drying beds. The effluent recirculation system shall consist of, but not inclusive of, pumps and piping that will convey effluent to the lagoon system.

2.3.4.14 START UP TESTING

The Contractor shall include a proposed start-up testing and training program in the operation and maintenance manuals. When the wastewater system construction nears completion and all units are operative, the Contractor shall commence a commissioning and startup procedure for the treatment system. The treatment system includes all treatment plant units and associated equipment, sludge holding and digestion, sewage dump pad, and all buildings. The Contractor shall operate the treatment facility for a trial period of two months performing all daily and weekly operation and maintenance (O&M) tasks recommended by the equipment manufacturer. The Contractor shall utilize services of qualified operators; including the use of at least two Afghan Nationals that the Contractor shall train. During the routine O&M, the Contractor shall perform all sampling and testing necessary to ensure proper daily operations in achieving the required effluent standards. The Contractor shall maintain a log that includes records of daily O&M activities, e.g. repairs, inflow measurement, aeration cycles, effluent cycling, waste and return sludge pumping, and sludge drying. The Contractor shall also maintain and operate the sludge disposal operation during the trial period.

2.3.5 STORM SEWER SYSTEMS

2.3.5.1 DESIGN STORM RETURN PERIOD (BASELINE FREQUENCY)

Developed portions of the site installation such as administration, industrial and barracks areas, shall be based on a rainfall of 20-year frequency. Basic system design shall be in accordance with UFC 3-230-17A, Chapter 2. Potential damage or operational requirements may warrant a more severe criterion or in certain areas a lesser criterion may be appropriate. The design of roadway culverts and other on-site storm drainage features & structures will be based on 20-year rainfall event. Protection of installations against flood flows originating from areas exterior to the base installation shall be based on a minimum 25-year rainfall event.

2.3.5.2 STORM DRAINAGE SYSTEM DESIGN

The Contractor shall be responsible for the complete design of the storm drainage system. Drainage of runoff from unpaved areas onto pavements shall be minimized. If storm drain piping is required it shall comply with the requirements in this section. Where storm drain pipes are of different diameters, the pipe crown elevations should be matched at the drainage structure. Storm drain lines shall be located outside of paved areas to the extent possible. Under no circumstance shall storm drain lines be located beneath buildings. All open storm drainage channels shall be concrete lined. Erosion control shall be provided for all storm drain structures during construction. Water from roof down spouts shall be drained off building site. All storm drain pipe and structures shall comply with the requirements specified in Specification Section 33 40 00 Storm Drainage Utilities. Holding or evaporation of stormwater shall not be accepted as an acceptable design. All stormwater shall be conveyed either from camp shorab or into adequate existing ditches.

2.3.5.3 HYDRAULIC DESIGN

New storm drain pipes shall be designed for gravity flow during the design storm baseline unless otherwise approved by the Government. The hydraulic grade line shall be calculated for the storm drain system and all energy losses accounted for. Design computations shall adhere to procedures contained in UFC 3-230-17A. Storm drain systems shall be designed to provide a maximum velocity of 2m/s.

2.3.5.4 AREA INLETS

Area inlets shall be properly sized and designed to accommodate the design flows. All grates shall be of a “bicycle safe” design.

2.3.5.4.1 CONCRETE PIPE

Reinforced concrete pipe shall be a minimum Class III. Type I cement may be used only when sulfates in the soil are 0.1 percent or less and dissolved sulfates in the effluent are 150 ppm or less. Type II cement may be used only when sulfates in the soil are 0.2 percent or less and dissolved sulfates in the effluent are 1,500 ppm or less. Only Type V cement may be used if sulfates in the soil exceed 0.2 percent or dissolved sulfates in the effluent exceed 1,500 ppm. Concrete pipe shall be assumed to have a minimum design service life of 50 years unless the Contractor determines that conditions at the site will reduce the service life. Concrete culverts and storm drains shall be protected by a minimum of 1 m of cover during construction to prevent damage by heavy construction equipment.

2.3.5.4.2 PLASTIC PIPE

Stiffness of the plastic pipe and soil envelope shall be such that the predicted long-term deflection shall not exceed 7.5 percent. Plastic culverts and storm drains shall be protected by a minimum of 1 m of cover during construction to prevent damage by heavy construction equipment. Split couplers shall not be allowed for corrugated high-density polyethylene pipe. Plastic pipe shall be assumed to have a minimum design service life of 50 years unless the Contractor determines that conditions at the site will reduce the service life (then plastic pipe shall not be used).

2.3.6 OIL WATER SEPERATORS

Oil/water separators shall be utilized for all drains from industrial sites. Separators shall be installed as close as possible from the drain location. Storm sewer system shall not be mixed with sanitary sewer system and shall be in accordance with UFC 3-240-07FA, latest edition.

2.4 EARTHWORK AND FOUNDATION PREPARATION

2.4.1 CAPILLARY WATER BARRIER

ASTM C 33 fine aggregate grading with a maximum of 3 percent by weight passing ASTM D 1140, 75 micrometers, No. 200 sieve, or 37.5 mm and no more than 2 percent by weight passing the 4.75 mm No. 4 size sieve and conforming to the soil quality requirements specified in the paragraph entitled "Satisfactory Materials."

Capillary water barriers shall be placed under floor slabs (not under footings) and be a minimum of 150 mm thick.

2.4.2 SATISFACTORY MATERIALS

Any materials classified by ASTM D 2487 as GW, GM, GC, GP, SP, SW, SM, and SC and free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.4.3 UNSATISFACTORY MATERIALS

Any materials which do not comply with the requirements set forth in the Satisfactory Materials paragraph. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 75 mm. The Contracting Officer shall be notified of any unsatisfactory materials.

2.4.4 CLEARING AND GRUBBING

Unless indicated otherwise, remove tress, stumps, logs, shrubs, brush and vegetation, and other items that would interfere with construction operations within lines 1.5 m outside of the building and structure line. Remove stumps entirely. Grub out matted roots and roots over 50mm in diameter to at least 460 mm below existing surface.

2.4.5 EXCAVATION AND COMPACTION OF FILL

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill with satisfactory material and compact to at least 95% of the maximum dry density, as determined by the Modified Proctor laboratory procedure. ASTM D 1557 shall be used for producing the Modified Proctor moisture-density curve, unless the soil to be compacted includes more than 30% retained on the 19 mm sieve. In this case, the Contractor must replace the ASTM D 1557 laboratory compaction procedure with AASHTO T 180, Method D, corrected with AASHTO T 224.

During compaction, the moisture content of the soil shall be within 1.5% of the optimum moisture content, as determined by the Modified Proctor laboratory procedure. The thickness of compacted lifts shall not exceed 15 cm and the dry density of each compacted lift shall be tested by either sand cone (ASTM D 1556) or nuclear gage (ASTM D 2292). If the nuclear gage is used, it must first be compared to sand cone tests for each soil type to verify the accuracy of the nuclear gage measurements for moisture content, wet density, and dry density. Furthermore, every tenth nuclear gage test must be accompanied by a sand cone test and these verification data must be summarized and submitted to the Contracting Officer. Density tests shall be performed at a frequency of not less than one test for each 200 square meters and not less than two tests per compacted lift.

2.5 GEOTECHNICAL

2.5.1 SOIL INVESTIGATION

Existing geotechnical information is not available at the project site. Any site-specific geotechnical data required to develop foundations, fill at elevated slabs, materials, earthwork, and other geotechnical related design and construction activities for this project shall be the Contractor's responsibility. The Contractor shall develop all

pertinent geotechnical design and construction parameters by appropriate field and laboratory investigations and analyses. The Contractor shall produce a detailed geotechnical report that includes:

a. A clear description of the anticipated construction including planned grading and structural details to provide an estimation of foundation loads (compression, uplift, lateral, and moment) and settlement tolerance.

b. A detailed site and area reconnaissance that includes a description of local geology and origin of sediments, surface features (e.g., ditches or other excavations, existing structures, vegetation, rock outcrops, seeps or springs), surface soil type(s), and subsurface lithology).

c. Justification of number and depth of borings.

d. Site plan illustrating exploratory boring locations.

e. Boring logs that include groundwater levels (if encountered).

f. Field tests and analyses (e.g., Unified Soil Classification System, field density, SPT).

g. Analytical laboratory test results in accordance with ASTM or other recognized standards (e.g., sieve analysis, Atterberg Limits (plastic and liquid), moisture content, hydrometer, consolidation/collapse potential, specific gravity of solids, direct shear, density, chemical [sulfate, chloride, pH, lime], K values) and any other tests as needed to properly conduct necessary calculations to determine the engineering properties of the soil.

h. A summary of the results of the subsurface geotechnical conditions including allowable soil bearing capacity, foundation recommendations, pavement design criteria, and construction materials (e.g. concrete cement, asphalt, and aggregates).

i. Two copies of the geotechnical report shall be submitted to the COR. Foundations, including sub-grade, shall be designed and constructed based on calculations and recommendations from a licensed structural engineer provided by the Contractor.

For standard penetration test (SPT), the Contractor shall use ASTM D1586. All geotechnical laboratory and field work shall be based on standards set forth in the ASTM. Contractor shall not use any DIN standards for penetration tests in lieu of ASTM D 1586. Soil investigations shall be in accordance with AED Design Requirements: Geotechnical Investigations for USACE Projects, latest version, or most recent version.

For foundation design, allowable soil bearing pressures shall be determined by calculations made based on the physical and mechanical properties obtained from laboratory testing. The soil bearing pressures calculated shall be compared with the International Building Code (IBC) 2006 Table 1804.2. The lower of the two bearing pressures, calculated or Table 1804.2, shall be chosen for the allowable soil bearing pressure.

California Bearing Ration (CBR) tests shall be conducted on the existing soils throughout the proposed road alignment and vehicle parking and maneuver areas. Results from the tests shall be used to calculate the pavement structure using the minimum pavement structure as dictated in paragraph 2.3.4 as a reference. In the event that the calculations based on the CBR tests reveal that the pavement structure dictated in paragraph 2.3 is insufficient to carry the design load, the Contractor shall design and construct a subbase layer for the pavement structure.

The Contractor shall conduct soils classification per ASTM D 2487-06.

No design review submittal shall be considered complete without an approved geotechnical report. Geotechnical investigation plans and report of investigations shall be submitted promptly in accordance with Section 01335.

2.5.2 GEOTECHNICAL QUALIFICATIONS

A geotechnical engineer that is a member of a geotechnical firm responsible to the Contractor shall oversee all geotechnical engineering design parameters. The geotechnical engineer shall be qualified by:

a. Education in geotechnical engineering;

b. Professional registration;

c. Minimum of ten (10) years of experience in geotechnical engineering design.

The geotechnical firm conducting the field investigation and laboratory work shall be certified by the Chief, Quality Assurance Branch USACE-AES or Chief, Quality Assurance Branch USACE-AEN. Certification document shall be submitted as part of the Geotechnical Report.

3.0 STRUCTURAL

3.1 GENERAL

The structures shall consist of reinforced concrete footings supporting a variety of structure types.

3.2 DESIGN

Design shall be performed by or under the direct supervision of the Contractor's structural engineer. The structural engineer shall be a registered Professional Engineer. All structural design documents shall be stamped and signed by the structural engineer. Calculations shall be in SI (metric) units of measurements.

3.3 STANDARDS

The Contractor should use the following American standards to provide structural design if local standards are not available, relevant, or applicable. All codes are latest edition.

Concrete	ACI 318 and ASTM C 39
Steel Reinforcement	ASTM A 615
Anchor Bolts	ASTM F 1554; Grade 36 steel.
Bolts and Studs	ASTM A 307.
Concrete Masonry Units	ASTM C 90; Type I (normal weight, moisture control).
Mortar	ASTM C 270; Type S (ultimate compressive strength of 13 MPa).
Grout	ASTM C 476; 14 MPa (2,000psi) minimum compressive strength @ 28 days (Slump between 200 mm to 250mm).
Structural Steel	ASTM A 36; 250 MPa (F_y = 36,000psi).
Welding	AWS D1.1 (American Welding Society).
Cold-Formed Steel	AISI Specification for the Design of Cold-formed Steel Structural
Members	

3.4 LOADS (DEAD & LIVE)

Dead loads shall be in accordance with ASCE 7-05 Minimum Design Loads for Buildings and Other Structures. Dead loads consist of the weight of all materials of construction incorporated in the buildings. Live loads shall be per Chapter 4. All facilities shall be classified as a minimum of Category II in accordance with Table 1-1.

3.5 WIND LOADS

Wind loads shall be calculated in accordance with ASCE 7-2005 using a "3-second gust" wind speed of 135 km/hr. Exposure = C. Importance Factor = 1.0.

3.6 SEISMIC

Seismic design of all structures in southern Afghanistan shall be in accordance with ASCE 7-05. Seismic Acceleration Parameters shall be S_s = 1.28g and S_1 = 0.51g.

3.7 REINFORCED CONCRETE

All concrete members shall be designed and constructed in accordance with the provisions of the American Concrete Institute, Building Code Requirements for Structural Concrete, ACI 318. A minimum 28 day compressive strength of 28 MPa shall be used for design and construction of all concrete. Concrete shall have maximum water-cement ratio of 0.45. Reinforcing steel shall be deformed bars conforming to American Society for Testing and Materials publication ASTM A 615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement. The minimum yield strength Fy shall be 420 MPa.

No concrete shall be placed when the ambient air temperature exceeds 32 degrees C unless an appropriate chemical retardant is used. In all cases when concrete is placed at 32 degrees C or hotter it shall be covered and kept continuously wet for a minimum of 48 hours.

3.8 REINFORCED CONCRETE

Concrete structural elements shall be designed and constructed in accordance with the provisions of the American Concrete Institute, Building Code Requirements for Structural Concrete, ACI 318. A minimum cylinder 28 day compressive strength of 28 MPa shall be used for design and construction of all concrete, except that 24 MPa shall be used for Shotcrete applications. Reinforcing steel shall be deformed bars conforming to American Society for Testing and Materials publication ASTM A 615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement. Concrete members at or below grade shall have a minimum concrete cover over reinforcement of 75 mm. Concrete shall have maximum water-cement ratio of 0.45. No concrete shall be placed when the ambient air temperature exceeds 32 degrees C unless an appropriate chemical retardant is used. In all cases when concrete is placed at 32 degrees C or hotter it shall be covered and kept continuously wet for a minimum of 48 hours. Except with authorization, do not place concrete when ambient temperature is below 5 degrees C or when concrete is likely to be subjected to freezing temperatures within 24 hours. When authorized, when concrete is likely to be subjected to freezing within 24 hours after placing, heat concrete materials so that temperature of concrete when deposited is between 18 and 27 degrees C. Methods of heating materials are subject to approval of the Contracting Officer. Do not heat mixing water above 74 degrees C. Remove lumps of frozen material and ice from aggregates before placing aggregates in mixer. Follow practices found in ACI 306.1.

3.9 MASONRY

Masonry shall be designed and constructed in accordance with the provisions of Building Code Requirements for Masonry Structures, ACI 530/ASCE 5/TMS 402, latest editions. Mortar shall be Type S and conform to ASTM C 270. All masonry used below grade shall me fully grouted. All cells of exterior reinforced CMU walls shall be fully grouted. For interior CMU walls, only the reinforced cells need to be grouted. All CMU walls shall have reinforced horizontal bond beams at a maximum spacing of 1,200 mm on center.

3.10 STRUCTURAL STEEL

Structural steel shall be designed and constructed in accordance with the provisions of American Institute of Steel Construction (AISC), Specifications for Structural Steel Buildings.

3.11 COLD-FORMED LIGHT GUAGE STEEL

Design of cold-formed steel structural members shall be in accordance with the provisions of American Iron and Steel Institute (AISI), Specifications for Design of Cold-Formed Steel Structural Members.

3.12 ARCH-SPAN COLD-FORMED LIGHT GUAGE STEEL ARCHES

Cold-formed light gage steel Arch-span structures shall be constructed with arch-span building machines.

Fabrication shall be in accordance with the building machine manufacturer's recommendations. Finite element models and design calculations for cold-formed steel arch-span shapes shall use effective section properties to account for localized buckling. Structural analysis and design calculations for arch-span arch type structures shall use the building machine manufacturer's proprietary finite element software when available.

Thickness of arch-span sheet metal shall be as required by design in accordance with manufacturer's recommendation for span of arch-span, but in no case shall thickness be less than 1 mm.

Arch-span steel specification requirements (international standards):

1. DESIGN LOADS (DE GRADE 40 AND 50)
2. THICKNESS FROM 0.60mm TO 1.524mm
3. SAMPLE PPGI STEEL COIL SPECS :
4. Galvanized steel in coils conforming to ASTM A 653-05
5. Structural quality (SS) suitable for roll forming.
6. Minimum base material complies with AISI 1018.
7. Minimum elongation is 40%.
8. Hardness range is between 70-78 Rb.
9. Coil Maximum outside diameter: 101.60 cm, inside diameter: 48-53cm.
10. Maximum coil weight: 2,270 kilograms.
11. Galvanized coating class G-90 (Z-275), Regular spangle, chemically treated, lightly oiled with evaporative lubricant
12. Coil width: 91.44 cm
13. Steel Grade: Grade 40: Yield strength - 28 kg/mm2 (280MPa)

3.13 CORRUGATED METAL ROOFING

Design of cold-formed steel structural members shall be in accordance with the provisions of American Iron and Steel Institute (AISI), Specifications for Design of Cold-Formed Steel Structural Members.

3.14 FOUNDATIONS

All structures shall be provided with a reinforced concrete foundation properly placed on suitable native or compacted earth and shall be prepared in accordance with the recommendations from the geotechnical investigation. The foundation shall be designed so that the bottom is 800mm below the local frost line depth.

4.0 ARCHITECTURAL REQUIREMENTS

4.1 GENERAL

All material approved shall become standardized material to be used throughout the facilities under contract. Different sub-contractors shall not use different material or standards under the contract. Intent of the project is to use locally procured materials (unless specified otherwise) and labor to the maximum extent possible while satisfying seismic, international building code, and national fire protection agency life safety code. Conflicts between criteria shall be brought to the attention of the Contracting Officer for resolution. In such instances, the Contractor shall furnish all available information with justification to the Contracting Officer.

4.2 DESIGN CRITERIA

Schematic designs for the facility types requested in this proposal are provided in the Appendix. These designs shall be used to create a complete and usable facility meeting the minimum requirements stated in these documents. The Codes, Standards, and Regulations listed in these documents shall be used in the construction of this project. The publications shall be the most recent editions. Standards other than those mentioned may be accepted provided they meet the minimum requirements and the Contractor shall submit proof of equivalency to the Contracting Officer for approval.

IBC - International Building Code, latest edition

NFPA 101 - Life Safety Code, latest edition

4.2.1 PREMANUFACTURED ARCH-SPAN COMPONENTS

It is recommended that all Arch-Span exterior penetrations shall be designed and pre-manufactured off-site using modular design techniques that shall be applied for both structural and finish construction components.

Provide complete architectural and engineering services from project inception through completion of construction.

Prior experience in design and support of major industrial complexes, military bases, ministry projects, as well as public and private projects and provides a wide range of engineering services in Afghanistan or other similar building environments is highly desirable.

Recommend minimal field assembly to the highest extent possible. Pre-manufactured elements are recommended `to include Doors, Windows, Vent Louvers, stove through wall/roof sleeve and other exterior envelope penetrations.

Fabricate all pre-manufactured components to engineered design specifications under controlled conditions, to ensure consistent quality and maximum load bearing capabilities.

Specifications shall address the following criteria:

1. High strength-to-weight ratio.
2. Use of non-combustible material.
3. Wind and seismic resistance.
4. Compatibility with most decking and roofing systems.
5. Modular design.

The Arch-Span system shall meet or exceeds local and international building codes and seismic standards.

Structural and architectural components shall be designed as integral components, so that the site erection is quicker.

The building system shall be fully insulated using non-flammable and non-toxic spray on systems and allow for fully heated, cooled, or refrigerated facilities.

4.2.2 LIFE SAFETY/ FIRE PROTECTION/ HANDICAPPED ACCESSIBILITY

A life safety and fire protection analysis shall be completed prior to construction commencement for all buildings designed by the Contractor. This analysis shall be documented in plans and in the design analysis. All spaces shall be classified following NFPA 101 or IBC. Whichever code is used shall be stated and referenced in the life safety plan. The facility shall comply with all other safety requirements of the NFPA 101, as much as possible, the final determination of code application made by the contracting officer. To the extent possible, all facilities shall be designed in accordance with recognized industry standards for life safety and building egress. An adequate fire alarm system, fire extinguishers, and smoke alarms shall all be included as required. Due to the lack of adequate water volume and pressure, sprinkler systems are not feasible. In keeping with the intended function of these facilities, handicapped accessibility will not be incorporated in this project. Due to the war contingency requirement, it is assumed that only able-bodied military and civilian personnel will use the facilities listed herein.

4.2.3 ANTITERRORISM / FORCE PROTECTION

Construct force protection measures to include gates and personnel bunkers. Force protection requirements shall be in accordance with UFC 4-010-01, *Minimum DoD Anti-terrorism Standards for Buildings*; and UFC 4-010-02, *DoD Minimum Anti-terrorism Standoff Distances for Buildings**, as much as possible*.** Stand-off distances between buildings and other structures shown on the concept site plan are to be kept as indicated; the UFC requirements are not required in these instances. When there is doubt of the application of the UFC reference, the contracting officer shall make the determination.

4.3 CONCRETE

4.3.1 FINISH

Horizontally placed concrete shall be vibrated and floated prior to screening, followed by progressive troweling and edging with a radius profile edging tool as the concrete sets. Broom finished texture shall be applied to fully trowel finished surfaces and shall be re-edged after the broom finish is added.

Vertical work shall have a form finish. Exposed concrete shall be sealed with an approved sealer.

4.3.2 PRECAST

Storage of precast units shall be in a dry place or materials shall be covered with a plastic or protective layer. Units shall be detailed to provide size, shape and location of installation. Precast units shall meet the minimum concrete strength requirements.

4.4 MASONRY

Storage of masonry materials shall be in a dry place or materials shall be covered with a plastic protective layer. Cover open walls each day to keep them protected and dry. Masonry construction systems shall be reinforced.

4.4.1 CONCRETE MASONRY UNITS

Concrete masonry units (CMU) for exterior walls shall be either 290 mm wide x 390 mm x 190 mm high or otherwise as shown on the standard drawings. They shall be reinforced and installed in running bond level and plumb. Mortar joints shall be 10 mm on all sides between CMU. Joints shall be struck with a concave tool to provide a smooth recessed curved surface. Install only quality units. The surface shall be free of chips, cracks, or other imperfections that would detract from the overall appearance of the finished wall. Defective CMU or mortar shall be rejected.

4.5 STONE

Stone type shall be identified for approval in design. Provide and use Type "S" mortar for all stone work. Provide weep holes at veneer installations and all cavity wall systems.

4.6 THERMAL PERFORMANCE OF EXTERNAL BUILDING ASSEMBLIES

External building assemblies shall meet the requirements of TI-800, Design Criteria, UFC 3-400-01 Design: Energy Conservation, and ASHRAE Standard 90.1, latest editions, but shall meet the following minimum requirements:

Assembly	Minimum Thermal Value
Exterior walls (above grade)	RSI 2.280 (R 13)
Ceilings/roof	RSI 3.540 (R 20)
Floor (over unheated space)	RSI 3.346 (R 19)
Exterior doors	RSI 0.252 (R 1.43)
Exterior windows/(glazing within doors)	RSI 0.308(R 1.75)
Skylights	RSI 0.180 (R 1.02)

This table is a summary of ANSI/ ASHRAE 90.1 Table 5.5-5, Climate Zone 5 (A,B,C)

RSI measured in K-m2/W, R measured in SF-F-hr/BTU. 1 K-m2/W = 5.678 SF-F-hr/BTU.

The building design shall utilize solar heating by orientating the buildings and wind breaks, insulation and exterior window shading techniques to reduce building heat loss and heat gain. Contractors shall include energy efficient heating and cooling solutions to minimize energy consumption.

4.7 ROOFING AND WEATHERPROOFING

All buildings shall have a sloped metal roof. Buildings with pitched roofs shall be provided with metal eaves, and soffits. All exterior entry ways to be covered and protected by rain gutters and diverters as to not have water falling on the entry ways to all buildings.

4.7.1 SLOPED ROOFS

A sloping roof shall be as defined in the IBC. On sloping roofs provide and install 0.60 mm galvanized steel in either corrugated or standing seam design. Metal roofing shall be anchored to the steel "Z" purlins using exposed fasteners at 300 mm on center at all seams and at 600 mm on center in the panel field. Fasteners shall be placed at the top of the corrugation taking care not to dent panel. Roof sealant or adhesive shall be placed over each anchor head. Roofing system shall include all edge, ridge and penetration flashings necessary for a watertight installation

and as described in this section. All metal roof panel systems and associated trim/accessories shall be in the manufacturer's standard white color. Provide 600mm x 600mm white metal louvered vents with insect screen in all gable end walls. Panels shall be overlapped two corrugations side to side and be continuous sheets from ridge to eave. Provide continuous ridge vents on all gable roofs.

4.7.1.1 INSULATION

Provide sprayed on polyurethane insulation on underside of all K-span structures. For standard design drawings, provide a 50 mm thick extruded polystyrene rigid thermal insulation boards, conforming DIN, EN 13164 BS, EN 13164, k=0.2 @ 75 degrees F mean temperature, 2.82 kg/sq cm compressive strength, hydrophobic, Type VI. Provide thickness by multiple boards to meet the designed R-value. Comply with insulation manufacturer's instructions and recommendations for handling, installing, and bonding or anchoring insulation to substrate. Insulation boards shall be installed loose, without glue, in staggered manner. Attention should be paid not to leave separation along edges. Where overall insulation thickness is 50 mm or greater, install required thickness in two layers with joints of second layer offset from joints of first layer a minimum of 300 mm each direction.

4.8 CONNECTIONS AND JOINTING

4.8.1 SOLDERING

Soldering shall apply to copper and stainless steel items. Edges of sheet metal shall be pre-tinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pre-tinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

4.8.1.1 SEAMING

Flat-lock and soldered-lap seams shall finish not less than 25 mm wide. Unsoldered plain-lap seams shall lap not less than 75 mm unless otherwise specified. Flat seams shall be made in the direction of the flow.

4.8.1.2 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 3 mm apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 300 mm on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

4.9 METAL

4.9.1 MATERIALS

Any metal listed by ASTM, DIN, BS or EN standards. Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in ASTM, DIN, BS or EN standards. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

4.9.1.1 STEEL SHEET, ZINC-COATED (GALVANIZED)

Zinc coated steel conforming to ASTM A 525, DIN BS or EN Standards. Cold-formed light gage steel K-span arch structures shall be constructed per industry standards.

Fabrication shall be in accordance with the building machine manufacturer's recommendations. Finite element models and design calculations for cold-formed steel K-span shapes shall use effective section properties to account for localized buckling. Structural analysis and design calculations for K-span arch type structures is required and shall be submitted as part of a design analysis for design submittals.

Thickness of S-span sheet metal shall be as required by design in accordance with manufacturer's recommendation for span of K-span, but in no case shall thickness be less than 1 mm.

4.9.1.2 ALUMINUM WALL CAPPING

Aluminum wall capping shall conform to ASTM B 209 M, DIN 18339, BS or EN Standards.

4.9.2 FLASHING

Flashing shall be installed at locations indicated and as specified below. Sealing shall be according to the flashing manufacturer's recommendations. Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be installed on top of joint reinforcement. Lashing shall be formed to direct water to the outside of the system.

4.9.2.1 THROUGH-WALL FLASHING

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further in to the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

4.9.2.2 LINTEL FLASHING

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 50 mm, or shall be applied over top of masonry and pre-cast concrete lintels. Bed joints of lintels at joints shall be under laid with sheet metal bond breaker.

4.9.2.3 VALLEY FLASHING

Valley flashing shall be provided at intersections of roofs where a valley is formed. Flashing shall be a minimum of 500 mm centered on the valley (extending each direction a minimum of 250 mm). Valley flashing shall have a small ridge in the center to allow for expansion and contraction. Material shall be stainless steel, galvanized or match finished roofing metal.

4.9.2.4 SILL FLASHING

Sill flashing shall extend the full width of the sill and not less than 100 mm beyond ends of sill except at joint where the flashing shall be terminated at the end of the sill.

4.9.3 METAL FASCIA & SOFFIT

No wood fascias and/or soffits are allowed. Use metal fascias and soffits throughout. Extend roof decking out over fascia a minimum of 20 mm. Provide a 40 mm drip flashing over edge of roof decking so that it extends past bottom of decking on all sides of the building. Soffits shall be a minimum width of 600mm extending from the building wall.

4.9.4 CONTINUOUS SOFFIT VENT

Enclose soffits and return to vertical wall. Provide continuous soffit venting of all overhangs on the underside of the soffit. The opening shall be no larger than 100 mm and set in a minimum of 50 mm from the exterior fascia edge.

4.9.5 RIDGE VENT

For sloping roofs, provide continues metal ridge vent at the top of roof along the ridge. Ridge vent shall be sized to provide adequate ventilation of the roofing system. Provide all ridge vents in white to match the roof panel system.

4.9.6 SCREEN

Provide insect screen for all soffit, ridge, vents, louvers and all openings except for doors and windows unless otherwise specified.

4.9.7 EXPANSION JOINT PROFILES

Metal expansion joints shall have a profile to allow deflection and expansion in two directions. Metal shall be treated for exterior conditions. Expansion joints shall be water proof.

4.9.8 ROOF GUTTERS

Roof gutters shall be installed as indicated. Roof gutters shall be rigidly attached to the building. Supports for roof gutters shall be spaced according to manufacturer's recommendations. A 600 mm overlap, jointing with approved crimping or welding shall provide a continuous gutter along the building eaves. Provide all gutters in white to match the roof panel system.

4.9.9 DOWNSPOUTS

Downspouts shall be designed and fabricated for each specific application. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 13 mm hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing and shall not block the flow of water to the downspout for low sloped roofs. Downspouts shall be rigidly attached to the building with supports a minimum of 1.5 m apart. At the base of each downspout, concrete splash block shall be placed to eliminate damage to the building due to rain water runoff toward the building. In rural locations, a layer of rock 10 - 80 mm in size, 100 mm thick, may be substituted upon governmental approval. Provide all downspouts in white to match the roof panel system. All downspouts shall be a minimum of 100mm in diameter or greater based on the projected rain amounts to be handled by the system.

4.9.10 WALL CAPPING

Wall Capping shall be installed according to the manufacturer's recommendations.

4.10 SEALANTS

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and cannot be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. The Contractor shall tool smooth fresh sealant after application to ensure adhesion. Sealant shall be uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints; apply sealant, and tool smooth as specified. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

4.10.1 INTERIOR SEALANT

ASTM C 834 or ASTM C 920, Type S or M, Grade NS, Class 12.5. Use NT, DIN, BS, or EN equal standards.

4.10.2 EXTERIOR SEALANT

For joints in vertical and horizontal surfaces, provide ASTM C 920, Type S or M, Grade NS, DIN, BS, or EN equal standards.

4.10.3 FLOOR JOINT SEALANT

(ASTM C 920) Type S or M, Grade P, class 25, use T

4.10.4 PRIMERS

Provide a non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application. Immediately prior to application of the sealant, clean out loose particles from joints. Where

recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

4.10.5 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint. Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

4.10.6 BACKING

Backing shall be 25 to 33% oversize for closed cell and 40 to 50% oversize for open cell material, unless otherwise indicated.

4.10.7 SURFACE PREPARATION

Surfaces shall be clean, dry to the touch, and free from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. When resealing an existing joint, remove existing calk or sealant prior to applying new sealant. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

4.10.8 MASKING TAPE

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

4.10.9 BACKSTOPS

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified.

4.10.10 PROTECTION

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

4.10.10.1 FINAL CLEANING

Provide cleaning solvent type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant. Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

4.10.10.1.1 MASONRY AND OTHER POROUS SURFACES

Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.

4.10.10.1.2 METAL AND OTHER NON-POROUS SURFACES

Remove excess sealant with a solvent-moistened cloth.

4.11 LOUVERS

4.11.1 INTERIOR LOUVERS

SDI 111-C, Louvers shall be stationary sight-proof or lightproof type as required. Louvers for lightproof doors shall not transmit light. Detachable moldings on room or non security side of door; on security side of door, moldings to be integral part of louver. Form louver frames of 0.90 mm thick steel and louver blades of a minimum 0.60 mm. Louvers for lightproof doors shall have minimum of 20 percent net-free opening. Sight-proof louvers shall be inverted "V" blade design with minimum 55 or inverted "Y" blade design with minimum 40 percent net-free opening.

4.11.2 EXTERIOR LOUVERS

Louvers shall be inverted "Y", "V" or "Z" type. Weld or tenon louver blades to continuous channel frame and weld assembly to door to form watertight assembly. Form louvers of hot-dip galvanized steel of same gage as door facings. Louvers shall have steel-framed insect screens secured to room side and readily removable. Provide aluminum wire cloth, 7 by 7 per 10 mm or 7 by 6 per 10 mm mesh, for insect screens.

4.12 WINDOWS, DOORS & GLAZING

4.12.1 WINDOWS

Windows shall be operable. Operable windows shall be slider or awning type. A window with blackout film on the inside shall be provided only for the laundry space.

4.12.1.1 WINDOW SECURITY BARS

Provide 20 mm diameter steel bars, 100 mm on center spacing. Provide frame and secure with fasteners a minimum of 100 mm deep.

4.12.1.2 MATERIALS

4.12.1.2.1 ALUMINUM EXTRUSIONS

Provide alloy and temper recommended by the window manufacturer for the strength, corrosion resistance, and application of required finish, meeting the DIN 1725 raw material requirements, but not less than 215 N/mm2 ultimate tensile strength and not less than 1.5 mm thick at any location for main frame and sash members.

4.12.1.2.2 FASTENERS

Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by the manufacturer to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.

4.12.1.2.3 REINFORCEMENT

Where fasteners screw-anchor into aluminum less than 3 mm thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard non-corrosive pressed-in splined grommet nuts.

4.12.1.2.4 EXPOSED FASTENERS

Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match the finish of the member or hardware being fastened, as appropriate.

4.12.1.2.5 ANCHORS, CLIPS, AND WINDOW ACCESSORIES

Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with the requirements of DIN 1748; provide sufficient strength to withstand design pressure indicated. As a minimum provide 3 anchors on each side of the frame.

4.12.1.2.6 COMPRESSION-TYPE GLAZING STRIPS AND WEATHERSTRIPPING

Unless otherwise indicated, and at the manufacturer's option, provide compressible stripping for glazing and weather stripping such as molded EPDM or neoprene gaskets.

4.12.1.2.7 SEALANT

For sealants required within fabricated window units, provide type recommended by the manufacturer for joint size and movement. Sealant shall remain permanently elastic non-shrinking, and non-migrating. Comply with Sealants of these specifications for selection and installation of sealants.

4.12.1.2.8 WIRE FABRIC INSECT SCREEN

Wire Fabric Insect Screen shall be permanently fixed to the exterior of operable windows.

4.12.1.3 HARDWARE

Provide the manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended. Provide at a minimum one locking device on the interior of each window. Any operable window over 2 square meters shall have two locking devices as a minimum.

4.12.1.4 FABRICATION

Provide aluminum windows with factory finish in all buildings as indicated in the design drawings. Window openings shall be provided with insect screening permanently fixed to the exterior. Provide a minimum of 3 anchors on each side of the frame into the adjoining structure. Provide weather stripping system for all exterior windows and doors.

4.12.1.5 METAL WINDOW SILLS

Galvanized metal window sills, 0.90 mm, shall be installed on the exterior of all windows. The metal window sills shall have a turn down of 50 mm over the exterior masonry and stucco. Metal sills shall extend from side to side of the masonry opening in a single piece. Extend the metal window sill a minimum of 20 mm under the bottom of the aluminum windows. Install masonry mortar as required for a smooth surface under the window sills. Sills shall slope a minimum of 6 mm to the exterior and not allow water to puddle.

4.12.1.6 FINISHES

Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting. Color shall be white meeting the requirements of DIN 50018

4.12.1.7 INSPECTION

Inspect openings before beginning installation. Verify that rough or masonry opening is correct and the sill plate is level. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.

4.12.1.8 INSTALLATION

Comply with manufacturer's specifications and recommendations for installation of window units, hardware, operators, and other components of the work. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place. Set sill members and other members in a bed of compound or with joint fillers or gaskets, as shown, to provide weather tight construction. Refer to the Sealant

sections for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the work.

4.12.1.9 ADJUSTING

Adjust operating sash and hardware to provide a tight fit at contact points and at weather stripping for smooth operation and a weather tight closure.

4.12.1.10 CLEANING

Clean aluminum surfaces promptly after installation of windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

4.12.2 DOORS

Fire rated door assemblies including hollow metal frame and hardware shall be provided as indicated in the design drawings. Rated doors and frames shall be tested and approved as an assembly and shall be provided by a single manufacturer/distributor. Hardware for fire rated door assemblies shall be labeled as appropriate for fire rated applications and shall be coordinated with door manufacturer. All exterior doors shall be heavy duty metal doors with metal frames. Interior door shall be hollow metal doors with hollow metal frames. Commercial duty lock sets and hardware shall be used on all doors. Hinges shall be the 5 knuckle type or equivalent. Provide door handles and locksets that can be locked with a key on all doors. All door locks shall have a thumb latch on inside of door such that no key is necessary to exit the room or building. Coordinate the final keying schedule with Contracting Officer prior to ordering lock sets. Generally each building should have 8 master keys fitting all locks, 8 sub-master keys fitting all exterior doors and 3 keys each for each interior door. Include 25% spare key blanks for the amount of keys provided per building. Provide numbering system identifying key to associated room door. Provide weather stripping system for all exterior doors.

4.12.2.1 OVERHEAD DOORS

Overhead doors shall be sized as required. Doors shall be fabricated from interlocking cold-rolled slats, designed to withstand building wind loading and be installed with wind locks. Curtain door slats shall be continuous for the width of the door and steel interlocking flat-profile design. Standard steel slats shall be made of roll-formed steel 18 gauge steel, either primed & painted galvanized, stainless steel or anodized aluminum as provided by manufacture. Channel or curtain door guides shall be provided on each side of door. Overhead doors shall have a weather stripping bottom bar, head and jambs. Weather stripping and astragals shall be natural rubber or neoprene rubber. A manual pull chain shall be connected to the operation of the rolling door to provide open and close operation. A locking pin shall be provided on each jamb of the interior side of the door. Door shall have manufacturer's standard five pin tumbler locks, keyed. Coiling housing shall be mounted above all opening, on the interior side. For rated openings, a fusible link shall be provided on the most hazardous side. The coiling shutter shall also be rated and designed accordingly by the manufacture for the required fire rating. Hoods shall be fabricated from steel sheets with minimum yield strength of 227.5 MPa. Doors shall be counterbalanced by an adjustable, steel, helical torsion spring mounted around a steel shaft in a spring barrel and connected to the door curtain with the required barrel rings.

Counterbalance-barrel components shall be as follows:

1) Spring barrels shall be hot-formed structural-quality carbon steel, welded or seamless pipe. Pipe shall be of sufficient diameter and wall thickness to limit deflection to a maximum of 1/360 of the span.

2) Counterbalance springs shall be oil-tempered helical steel springs designed with a safety factor of 4.

Springs shall be sized to counterbalance the weight of the curtain at any point of its travel, and shall be capable of being adjusted to counterbalance not less than 125% of the normal curtain load. Spring adjustment shall be arranged in such a way that the curtain need not be raised or lowered to secure the adjustment.

3) Counterbalance shafts shall be case-hardened steel of the proper size to hold the fixed ends of the spring and carry the torsion load of the spring.

4) Barrel plugs shall be fabricated from cast steel machined to fit the ends of the barrel. Plugs shall secure the ends of the spring to the barrel and the shaft.

5) Barrel rings shall be fabricated from malleable iron of the proper in-volute shape to coil the curtain in a uniformly increasing diameter.

6) Shaft bearings shall be factory sealed ball bearings of the proper size for load and shaft diameters.

Door operators shall consist of an endless steel hand chain, chain-pocket wheel and guard, and a geared reduction unit of at least a 3:1 ratio. Required pull for operation shall not exceed 16 kg. Chain hoists shall have a self-locking mechanism allowing the curtain to be stopped at any point in its upward/downward travel and to remain in that position until moved to the fully open or closed position. Hand chains shall be cadmium-plated alloy steel with a yield point of at least three times the required hand-chain pull. Pretreated zinc-coated steel sheets shall be given the manufacturer's standard prime coat and an enamel finish coat applied to the exterior face after forming.

After installation, doors, track, and operating equipment shall be examined and tested for general operation and weather against the specified wind pressure, and weather resistance. Doors that fail the required tests shall be adjusted and retested. Doors that have been adjusted and fail subsequent tests shall be removed and replaced with new doors at no additional cost.

4.12.2.2 STEEL DOORS

SDI A250.8, except as specified otherwise. Prepare doors to receive specified hardware. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 44.5 mm thick, unless otherwise indicated. Doors shall be constructed using heavy gauge steel with minimum thickness of 1.2 mm.

4.12.2.3 FIRE AND SMOKE DOORS AND FRAMES

The requirements of NFPA 80 and NFPA 105 respectfully shall take precedence over details indicated or specified.

4.12.2.4 THRESHOLDS

All exterior doors (except Mech/Elect rooms) shall be provided with manufactured metal thresholds conforming to ANSI/BHMA A156.21. Doors at all wet areas with ceramic tile or terrazzo tile flooring shall be provided with solid marble thresholds with marble threshold set 13 mm above tile. Thresholds shall span continuously from jamb to jamb.

4.12.2.5 STANDARD STEEL FRAMES

SDI A250.8, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, transoms, sidelights, mullions, cased openings, and interior glazed panels, unless otherwise indicated.

4.12.2.6 WELDED FRAMES

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

4.12.2.7 STOPS AND BEADS

Form stops and beads from 0.9 mm thick steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space the fasteners approximately 300 to 400 mm on centers. Miter molded shapes at corners. Use butt or miter square or rectangular beads at corners.

4.12.2.8 WEATHER-STRIPPING, INTEGRAL GASKET

Provide weather-stripping that is a standard cataloged product of a manufacturer regularly engaged in the manufacture of this specialized item. Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals. Weather stripping shall be looped neoprene, synthetic rubber gasket, or

vinyl held in an extruded non-ferrous metal housing. Air leakage of weather stripped doors shall not exceed 0.003125 cubic meters per second of air per square meter of door area when tested in accordance with ASTM E 283.

4.12.2.9 ANCHORS

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, anchors not lighter than 1.2 mm thick.

4.12.2.9.1 WALL ANCHORS

Provide at least three anchors for each jamb. For frames which are more than 2285 mm in height, provide one additional anchor for each jamb for each additional 760 mm or fraction thereof.

4.12.2.9.2 FLOOR ANCHORS

Provide floor anchors drilled for 10 mm anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

4.12.2.10 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in ANSI A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI A250.8 and ANSI A250.6. For additional requirements refer to BHMA A115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI A250.8, as applicable. Punch door frames, with the exception of frames that will have weather-stripping or lightproof or soundproof gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

4.12.2.11 HINGES

Exterior hinges shall have non-removable pins and be satin-chrome steel or stainless steel; Grade 1 anti-friction or ball bearing; and 3 each of 115 mm x 115 mm per leaf up to 900 mm wide door 125 mm x 125 mm for doors 900 mm to 1,200 mm wide. Interior hinges shall be Grade 1; antifriction or ball bearing; and 3 each of 115 mm x 115 mm per leaf up to 900 mm wide door 125 mm x 125 mm for doors 900 mm to 1,200mm wide. Hinges for labeled fire doors must be either steel or stainless steel. Hinges shall conform to ANSI/BHMA A156.1 and A156.7.

4.12.2.12 LOCKSETS, LATCHETS, EXIT DEVICES, AND PUSH AND PULL PLATES

Exterior doors shall have mortise locks conforming to ANSI/BHMA A156.13 for metal doors. Emergency exit devices shall be Grade 1, flush mounted type. Interior doors shall have mortise locksets conforming to ANSI/BHMA A156.13, Series1000, Grade 1. All locks and latchsets shall be the product of the same manufacturer. Locksets, padlocks and latchsets shall be provided, as required, with lever handles on each side. Provide heavy duty hasp and locks at all fuel storage tanks.

4.12.2.13 CLOSERS

Closers shall be provided on all exterior doors and fire-rated doors. All exterior doors and interior doors that require security or privacy such as toilet room shall be provided with heavy-duty hydraulic closers. Closers shall conform to ANSI/BHMA A156.4, Grade 1. Closers shall be surface-mounted, modern type, with cover. Closer shall be adjustable type and have slow-down control to prevent door leaf from slamming to frame. Provide door silencers on all door frames provided with closers.

4.12.2.14 DOOR STOPS

Door Stops: Door stops shall be provided on all exterior and interior doors. Door stops shall comply with ANSI/BHMA A156.16 and shall be satin chrome on bronze, Grade 1.

4.12.2.15 KEYING SYSTEM & LOCK CYLINDERS

Provide locks for all doors. A Master key system shall be provided. Master key system shall include a separate & different key for each door with a master key provided to open any & all doors.

Cylinders: Lock cylinders shall comply with BHMA A156.5. Lock cylinder shall have six pins. Cylinders shall have key removable type cores. All locksets, exit devices, and padlocks shall accept same interchangeable cores.

4.12.2.16 FINISHES

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI A250.8, or paintable A25 galv-annealed steel without primer. Where coating is removed by welding, apply touchup of factory primer. Provide door finish colors as selected by the Contracting Officer from the color selection samples.

4.12.2.17 WATER-RESISTANT SEALER

Provide a water-resistant sealer compatible with the specified finish as approved and as recommended by the door manufacturer.

4.12.2.18 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. On wraparound frames for masonry partitions, provide a throat opening 3 mm larger than the actual masonry thickness. Design other frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive caulking compound.

4.12.2.19 INSTALLATION

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with a 2 mm minimum, 3 mm maximum clearance at sides and top, and a 5 mm minimum, 6 mm maximum clearance over thresholds. Provide 10 mm minimum, 11 mm maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of 3 mm in 50 mm. Door warp shall not exceed 6 mm when measured in accordance with WDMA I.S. 1-A. Hang doors in accordance with clearances specified in SDI A250.8. After erection and glazing, clean and adjust hardware.

4.12.2.19.1 FRAMES

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

4.12.2.19.2 GROUTED FRAMES

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

4.12.2.20 PROTECTION AND CLEANING

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is completely removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat. Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

4.12.2.21 WEATHER STRIPPING

Install doors in strict accordance with the manufacturer's printed instructions and details. Weather strip the exterior swing-type doors at sills, heads and jambs to provide weather tight installation. Apply weather stripping at sills to bottom rails of doors and hold in place with a brass or bronze plate. Apply weather stripping to door frames at jambs and head. Shape weather stripping at sills to suit the threshold. Insert gasket in groove after frame is finish painted.

4.12.2.22 PRE-FITTING

At the Contractor's option, doors may be provided factory pre-fit. Doors shall be sized and machined at the factory by the door manufacturer in accordance with the standards under which they are produced. The work shall include sizing, beveled edges, mortising, and drilling for hardware and providing necessary beaded openings for glass and louvers. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules as required to coordinate the work.

4.12.3 GLAZING

All glazing shall be tempered double laminated and insulating. Laminated glazing shall be constructed of two panes of minimum 3 mm tempered glass laminated to a minimum 0.75 mm polyvinyl-butyral (PVB) interlayer, in accordance with UFC 4-010-01. Two panes of laminated glazing shall be installed in each window with hermetically sealed 13 mm airspace between them. After installation of windows, the contractor shall install a minimum 3 mil tinted film (Scotch Shield Ultra Safety and Security Window Film or approved equal) to the inside face of the glazing in accordance with manufacturer’s instructions.

4.12.3.1 TEMPERED GLAZING

Tempered glass shall be kind FT fully tempered flat type. Class 1 clear, condition A uncoated surface, Quality q3-glazing select, conforming to ASTM, DIN, BS or EN standards. Color shall be clear.

4.12.3.2 SEALANT

Sealant shall be elastomeric conforming to ASTM, DIN, BS, or EN standards. Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulation glass. Color of sealant shall be as selected from manufacturer’s full range of standard colors by Contracting Officer.

4.12.3.3 GLAZING GASKETS

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners.

4.12.3.4 FIXED GLAZING GASKETS

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM, DIN, BS or EN standards.

4.12.3.5 WEDGE GLAZING GASKETS

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM, DIN, BS, or EN standards.

4.12.3.6 PUTTY AND GLAZING COMPOUND

Glazing compound shall conform to ASTM, DIN, BS, or EN standards for face-glazing metal sash. Putty shall be linseed oil type conforming to DIN, BS, or EN standards for face-glazing primed wood sash. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

4.12.3.7 SETTING AND EDGE BLOCKING

Neoprene setting blocks shall be dense extruded type conforming to ASTM, DIN, BS, or EN standards. Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

4.12.3.8 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined for compliance with glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaced and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

4.12.3.9 INSTALLATION

Glass and glazing work shall be performed in accordance with, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

4.12.3.10 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

4.12.3.11 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth, or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

4.13 FINISHES

All exterior metal surfaces, including container exterior shall be painted to match existing adjacent buildings. Provide color boards with all materials, paints and finishes for COR approval prior to ordering materials. Color boards shall remain on site in view or with the Contractor until completion of the facility.

4.13.1 PAINTS & COATINGS

Paints and coatings shall be provided as a Specification 09 90 00 Paints and Coatings.

4.13.2 CONCRETE HARDENER

Concrete sealers shall be a liquid chemical sealer-hardener compound. Apply a minimum of two coats. Sealer shall be compatible with climate temperatures and not reduce the adhesion of resilient flooring, tile, paint, roofing, waterproofing or other materials applied to the concrete.

4.13.3 PAINT

Paint shall be oil based or latex. A primer shall be placed prior to any coats of paint. A minimum of two (2) coats of paint shall be used for each surface. Existing painted material shall be cleaned, cracks patched, and prepared for new paint. Existing sealant shall be inspected, cleaned or removed and new sealant placed.

4.13.3.1 EXPOSED EXTERIOR STEEL

Exposed exterior steel shall include items such as trim, frames, door, pipe rails and other exposed steel surfaces. Provide manufacturers standard baked on finish where possible. For unfinished steel items, paint with one coat oil-based primer, with 2 coats of oil-based alkyd gloss enamel, color to be selected by the Contracting Officer from the color board provided by the Contractor.

4.13.3.2 EXPOSED WOOD

Exposed wood shall include items such as trim, frames, doors and other exposed wood surfaces. Paint with one coat oil-based primer, 2 coats of gloss enamel, color to be selected by the Contracting Officer from the color board provided by the Contractor

4.13.4 EXPANSION JOINTS IN PLASTER & STUCCO

Expansion joints shall be provided as specified in ASTM, DIN 18339, BS or EN Standards for all walls, floors and ceilings.

4.13.5 EXTERIOR WALLS

The exterior of all buildings not scheduled to be K-span shall be stucco and/or plaster conforming to ASTM C926 where indicated in standard building design. A temperature of between 4 and 27 degrees C shall exist for a period of not less than 48 hours prior to application of plaster and for a period of at least 48 hours after plaster has set. Control joints shall be designed for expansion and contraction of plaster work due to thermal exposure. Control joints shall comprise of back to back casing beads. Install new stucco in 2 coats. The first coat shall be a scratch coat approximately 10 mm thick. Allow 7 days to cure. The second coat shall be finish stucco, smooth finish, approximately 10 mm thick. Allow 7 days to cure before painting. Stucco showing over sanding, cracks, blisters, pits, checks, discoloration or other defects is not acceptable. Defective plaster work shall be removed and replaced with new plaster at the expense of the Contractor. Patching of defective work will be permitted only when approved by the Contracting Officer. Patching shall match existing adjacent work in texture and color. All exterior color finish shall be integral with the stucco finish. No painted stucco shall be permitted due to minimize future maintenance.

4.13.6 INTERIOR WALLS

4.13.6.1 INTERIOR WALLS FOR K-SPAN BUILDINGS (SANDWICH PANELS)

Interior walls shall be a standard manufacturer's noncombustible, Class "A" rated, panelized insulated wall system that has been in production a minimum of 5 years. The interior wall system may either be an interlocking composite panel system of foam core units, with color coated prefinished metal skins on both sides, and an integral metal frame system with prefinished face sheathing both sides. The interior wall panel system shall be a complete system including trims and shall be able to receive multiple options on door and frame assemblies. Assembly including doors should provide a composite Sound Transmission Class (STC) of at least 42. Panelized system shall provide fire separation rating where required by design. Rating shall be by Underwriters Laboratory (UL) or an approved international testing agency.

4.13.6.2 PLASTER WALLS

Interior walls (except Arch-Span) shall be plaster applied in a similar manner as exterior stucco. Paint with 2 coats of semi-gloss off-white with less than 0.06% lead by weight color to be selected by the Contracting Officer from the color board provided by the Contractor.

4.13.6.3 SOUND CONTROL

Walls between sleeping rooms shall have a Sound Transmission Class (STC) minimum 45-55 or better, An STC value is a single number rating used to characterize the sound insulating value of a partition (wall, floor, or ceiling). All walls shall be caulked at floor and ceiling prior to installing wall base. All openings between rooms shall be caulked or sealed. Doors shall have rubber seal around frames and threshold.

4.13.6.4 HARDENED (CMU) INTERIOR WALLS

Interior walls intended to be CMU (except Arch-Span) shall be a minimum thickness of 100 mm. Interior CMU walls shall be plaster applied in a similar manner as exterior stucco. Paint with 2 coats of flat off-white paint with less than 0.06% lead by weight color to be selected by the Contracting Officer from the color board provided by the Contractor.

4.13.7 INTERIOR CEILINGS

4.13.7.1 CONCRETE CEILINGS

Concrete ceilings shall be exposed concrete painted with 2 coats of flat white, with less than 0.06% lead by weight.

4.14 TILE WORK

Tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C and rising. Temperature shall be maintained above 10 degrees C while the work is being performed and for at least 7 days after completion of work. Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a non-corrosive soap or other approved method of protection.

Floors in wet areas shall be 300 mm x 300 mm terrazzo tile with thin set mortar. Joints shall be 2-3 mm. Waterproof gray grout shall be applied the full depth of the tile. Floors shall slope, minimum 1/50, to floor drains. Slope shall be obtained with sloping mortar bed of minimum 20 mm thickness. Provide continuous waterproofing membrane beneath sloping mortar bed, turn up wall 300 mm behind wall base. Membrane shall be fully sealed at joints and shall shed water into body of floor drain. Color of tile shall be selected by the Contracting Officer from samples provided by the Contractor.

Floors in administration areas, living quarters, corridors, and all rooms unless otherwise stated in the standard drawings shall be sealed concrete. Joints shall be 2-3 mm. Waterproof gray grout shall be applied the full depth of the tile. Color of tile shall be selected by the Contracting Officer from samples provided by the Contractor.

Walls in wet areas shall be tiled with 150 mm x 150 mm glazed ceramic tile up to 2000 mm above the floor to include interior of toilet stalls, showers and behind sinks. Joints shall be 2-3 mm. Waterproof gray grout shall be applied full depth of the tile. Grout shall cure for 72 hours and then be sealed with a commercial grout sealant in two coats. Color of tile shall be selected by the Contracting Officer from samples provided by the Contractor.

The ablution drain areas shall be recessed below the floor level 200 mm and lined with ceramic tile. Ceramic tile shall extend up the wall past the water spigots to a height of 2000 mm above finished floor. Seats shall be formed concrete with terrazzo tile finish to match the floor, 300 mm x 300 mm x 300 mm high finished dimensions. Color of ceramic tile shall be selected by the Contracting Officer from samples provided by the Contractor. Spacing between tiles shall be similar to terrazzo tile.

4.15 SPECIALTIES

4.15.1 MIRRORS

600 mm x 900 mm, 6 mm plate glass shall be mounted above all lavatories. Mount bottom of mirrors 1100 mm above finished floor.

4.15.2 TOILET PAPER HOLDERS

Toilet paper holders with removable pin shall be stainless steel, installed approximately 200 mm above floor by eastern toilets and 600 mm above floor by western toilets.

4.15.3 SHOWER CURTAIN RODS & SHOWER CURTAIN

Shower curtain rods, stainless steel, heavy duty, 1.20 mm shall be mounted between the walls of each shower stall. Mount rod 2000 mm above finished floor. Provide a shower curtain with support rings for each shower stall.

4.15.4 GRAB-BARS

Stainless steel grab-bars, heavy duty, 1.20 mm, two each 900 mm and 1050 mm long, 40 mm diameter shall be mounted behind and beside all eastern toilets, and bathtubs as they occur. Mount grab-bars between 610mm - 900 mm height on the walls. Each bar shall support no less than 91 Kg in any direction.

4.15.5 PAPER TOWEL DISPENSERS

Paper towel dispensers, 0.683 mm Type 304 stainless steel, surface mounted. Furnish tumbler key lock locking mechanism.

4.15.6 LIGHT DUTY METAL SHELF

Provide a 600 mm long x 150 mm wide, light duty stainless steel shelf with integral brackets over each lavatory and laundry sink.

4.15.7 ROBE HOOKS

Provide a minimum of two robe hooks on all toilet and shower stalls.

4.15.8 CLOTHESLINES

Fabricate clothes line assembly in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling imitations. Clearly mark units for reassembly and coordinated installation. Wire-rope assemblies (clothes line cable) shall minimize the amount of turnbuckle take-up used for dimensional adjustment so the maximum amount is available for tensioning wire ropes. Wire rope shall be nylon covered. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of ~1 mm, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces. Form work true to line and level with accurate angles and surfaces. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Cut, reinforce drill, and tap as indicated to receive finish hardware, screws, and similar items. Welded connections: cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

4.16 FACILITY TYPES

All facility types shall be constructed according to the standard designs unless otherwise noted.

5.0 MECHANICAL

5.1 GENERAL

The work covered by this section consists of design, supply, fabrication, and installation of building heating, ventilation and air-conditioning (HVAC), electrical generation, incineration, and all systems stated in this Section. It also includes the delivery to site, erection, setting to work, adjusting, testing, balancing and handing over in perfect operating and running condition all of the equipment including all necessary associated mechanical works.

5.2 SPECIALIST SUB-CONTRACTORS QUALIFICATIONS

All works shall be executed by specialist sub-contractors experienced in the design and construction of the equipment stated in this Section.

5.3 STANDARD PRODUCTS & SUBMITTALS

All materials and equipment shall be standard product of a manufacturer regularly engaged in the manufacture of the product and shall duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

The Contractor shall submit the following for equipment to be provided under this Section of the specification: Manufacturer's data including performance characteristics at design conditions; Catalog cuts showing dimensions, performance data, electrical requirements, compliance with the codes, standards and regulations; Drawings, as necessary, indicating location and installation details.

5.4 CODES, STANDARDS, & REGULATIONS

The design and installation of equipment, materials, and work covered under the Mechanical services shall conform to the standards, codes, and regulations provide in the paragraph, List Of Codes And Technical Criteria, where applicable except where otherwise indicated under particular clause(s). The publications to be taken into consideration shall be those of the most recent editions and, for HVAC, primarily in accordance with the American Society of Heating, Refrigeration, and Air-Conditioning (ASHRAE).. Standards other than those mentioned may be accepted provided that the standards chosen are internationally recognized and meet the minimum requirements of the specified standards. The Contractor shall submit proof of equivalency if requested by the Contracting Officer.

5.5 EQUIPMENT PROTECTION

All exterior pad-mounted mechanical equipment shall be provided with either protective fences and concrete-filled steel bollards or protective screen walls to prevent accumulation of debris and minimize vandalism.

5.6 DESIGN CONDITIONS

Outside Design Conditions are provided for reference only and the Contractor is not to provide any design analysis. If the design conditions vary greatly and increases the HVAC capacity, bring this to the attention of the COR. (Contractor shall verify the ambient conditions with available and reliable local weather data).

Kandahar Area:

Latitude – (approx.) 31.5 deg. North

Longitude – (approx.) 65.85 deg. East

Elevation – (approx.) 1,010 m (3,314 ft)

Summer – 41 C (106 F) Dry Bulb (DB) & 21.7 C (71 F)] Wet Bulb (WB)

Winter – -1.7 C (29 F)

Daily Range – 12 C (21 F)

5.6.1 INDOOR DESIGN CONDITIONS

Facility Type	Summer Temperature	Winter Temperature
Chemical Buildings	No Cooling	Heating 20 C (68 F)
Wastewater Laboratory/Office	No Cooling	Heating 20 C (68 F)

5.6.2 NOISE LEVEL

Noise levels inside occupied spaces generated by HVAC systems indoors shall not exceed NC 35. Noise levels for outdoor generators are provided in paragraph: Mechanical Requirements For Generators.

5.6.3 INTERNAL LOADS

Occupancy: ASHRAE standards shall be used to calculate sensible and latent heat from people. In general, light/moderate office work is 73 W (250 Btuh) sensible and 45 W (155 Btuh) latent.

Lighting: 21.5 W/sq.m (2 W/sq.ft) maximum (however lighting levels shall meet minimum requirements and shall be accounted for in the cooling loads based on the actual lighting design).

Outdoor Air: Outdoor ventilation air shall be provided per ASHRAE Standard 62.1. Minimum outside ventilation requirements for offices and bedroom sleeping quarters shall be 2.5 lps/person (5 cfm/person) plus 0.3 lps/sq.m of floor space (0.06 cfm/sq.ft). Outdoor air requirements can be satisfied by windows that open to the outside. **Enclosed occupied areas without windows shall have outside air ventilation rates based on occupancy using the formula above in combination with a means for allowing outside make-up air exterior air louvers and adjoining parts of the building.**

Communication (Comm) Rooms: Comm rooms containing computer servers and other heat-producing electronic equipment shall be provided with independently controlled cooling. See Electrical for comm room equipment requirements.

Toilet/Shower Exhaust: 85 cmh (50 cfm) per toilet, urinal, and shower head.

Ablution Exhaust: 35 cmh/sq.m (2 cfm/sq.ft).

Building Pressurization: Maintain negative pressure in latrine areas. Pressurization is only applicable for buildings provided with central ducted forced air systems.

5.6.4 AIR COOLING & HEATING EQUIPMENT

Contractor shall size and select equipment based on equipment manufacturer's performance data at the project site elevation and temperature conditions and ensure the equipment's performance meets the design heating and cooling sizing requirements. The following table represents, as a minimum, facility-specific system requirements and does not limit the applicability of general system requirements stated elsewhere in this specification. All buildings with government provided standard drawings shall be constructed per the drawings.

Facility Type	Type of HVAC System	Remarks
Chemical Buildings	Electric unit heaters	Provide exhaust fans & electric unit heaters
Wastewater Laboratory/Office	Electric unit heaters	Provide exhaust fans & electric unit heaters

* Indirect-tempering of outside make-up air shall be accomplished by locating heating and/or cooling equipment in close proximity to outside air louvers (fitted with filters, screens, and dampers as a minimum) for minor conditioning of raw outside air.

5.6.5 UNITARY DUCTLESS (SPLIT-PACK) HEAT PUMP UNITS

Unitary ductless split-pack heat pump units shall be provided as indicated. Ductless split units shall be unitary in design and factory manufactured ready for installation. Heat pump units shall provide cooling during summer and heating during winter. **Heat pump units shall be suitable for low ambient operation.** Interior evaporator fan coil units shall consist of a DX coil, blower, and washable filter all mounted in a housing finished for exposed installation. Cooling coil condensate piping shall route to the sanitary sewer system or the building exterior to within 20 cm (8") of grade and not cross nor discharge on sidewalks. The exterior condensing units shall contain compressor, condenser coil, and all controls/fittings enclosed in a weatherized housing. Outdoor condensing unit shall be wall-mounted on steel supports or on a concrete pad. Copper refrigerant suction and liquid piping shall be sized, insulated and installed in accordance to unit manufacture recommendations. Unit temperature control shall include wall-mounted adjustable thermostat, blower on-off-auto switch and heating-cooling change over control.

5.7 ELECTRIC HEATERS

Electric trace heating cables for freeze protection shall not be provided as a substitute for space heating systems.

5.7.1 UNIT HEATERS

Electric resistance unit heaters shall be installed in spaces where only heating is required. Generally, unit heaters shall be mounted as high as possible. Unit heaters shall be of the industrial grade, durable, and securely fastened to the ceiling, wall or structure. Electric heating unit shall be self-contained with heating elements and fan. Unit shall be provide control-circuit terminals and single source of power supply with disconnect. Limit controls shall be provided for overheat protection. Hard-wired integral thermostats shall be provided and generally located under the unit in the return air stream.

5.7.2 CABINET OR CONVECTOR HEATERS

Cabinet or convector type heaters shall be generally provided in areas where unit healers are not feasible. Heaters shall be self-contained and surface-mounted on wall or structure with heating elements and, where required for coverage, fan with at least two (2) speeds. Unit shall be provided with control-circuit terminals and single source of power supply with disconnect. Limit controls shall be provided for overheat protection of heaters.

5.8 DUCT SYSTEMS

Air shall be distributed by the equipment supply fans to achieve proper airflow throughout the facility, introduced from the exterior for outside make-up air fans and louvers, and/or removed by exhaust fans all by means of duct systems.

5.9 DUCTWORK

Ductwork shall be comprised of supply, return, transfer, exhaust, and outside make-up air ducting, fittings, turning vanes, volume control dampers, grilles, registers, diffusers and/or louvers. Ductwork shall be constructed of galvanized steel, stainless steel (i.e. Kitchen hoods, laboratory exhaust systems, etc.), or aluminum sheets (i.e. Shower exhaust systems, etc.) and installed as per SMACNA “HVAC Duct Construction Standards (Metal and Flexible)” (and NFPA 96 for kitchen grease hoods). Flexible non-metallic duct may be used for final unit/diffuser connection in ceiling plenums. These flexible duct run-outs shall be limited to 3 m (10') in length.

5.9.1 DUCT INSULATION

Duct insulation shall be provided for all supply ductwork that is not located in the conditioned space and for return ductwork not located within the conditioned space. Duct installed above suspended ceilings are NOT considered to be located within the conditioned space. All ductwork exterior to the building shall be insulated with a minimum RSI=0.88 (R-5).

Outside make-up air duct systems shall be provided with insulation and vapor barrier to prevent condensation. Insulation exposed to weather or physical damage shall be protected with aluminum jacketing.

5.9.2 DIFFUSERS, REGISTERS, & GRILLES

Diffusers, registers, and grilles shall be factory fabricated of steel or aluminum and distribute the specified air quantity evenly over the space intended. The devices shall be round, half round, square, rectangular, linear, or with perforated face as determined by the design. Units will be mounted in ceilings, high sidewalls, or directly to ductwork and shall be sized for the airflow to be delivered with a maximum NC rating of 35. Pressure loss through the diffuser shall be considered in sizing the duct system and the system static pressure calculations.

5.9.3 BRANCH TAKE-OFFS & BALANCING DAMPERS

Air extractors or 45-degree entry corners ("boots") shall be provided at all branch duct take-offs. Manual volume control dampers shall be included at the branch duct take-offs and where required to facilitate air balancing and shall be shown on the design drawings.

5.9.4 WALL PENETRATIONS

Building wall penetrations for fans, exhaust duct, vents, louvers, etc. shall be carefully made so as not to deteriorate the structural integrity of the wall system. **The Contractor is encouraged to locate exterior wall louvers above doors, whenever possible, to take advantage of the structural framing void located above doors.** The Contracting Officer shall be consulted and recommendations strictly adhered to.

5.9.5 WALL TRANSFER GRILLES

Wall penetrations for air transfer between two spaces shall be installed as high as possible within architectural constraints or a minimum of 1.5 m (5') above the floor and provided with a factory fabricated grille on both the inlet and outlet sides of the opening. For fire-rated walls in accordance with NFPA-90A, fire dampers shall be installed between the inlet and outlet grilles.

5.9.6 OUTSIDE AIR INTAKE, MAKE-UP, AND EXHAUST LOUVERS

Outside air louvers shall be factory fabricated of steel, stainless steel, or aluminum and allow the specified air quantity into the intended space. Louvers shall be square or rectangular with rain-proof exterior face blades and internal grille. **To reduce sand and dirt migration, outside air intakes shall be installed as high as possible within architectural constraints or a minimum of 1.5 m (5') above the ground.** Consideration shall be given to locating the louvers near the heating and cooling units (for indirect tempering of air) and encourage air flow across the room in conjunction with the exhaust fan. Outside air intake louvers shall be provided with air filter (See Air Filtration), insect screen, and, if indicated, motorized dampers interlocked to open when the exhaust fans operate. Minimum louver dimensions shall be submitted in the design analysis (DA) calculations.

All supply air shall be filtered using manufacturer's standard washable filters mounted inside the unit. In addition, all outside make-up air intakes shall be equipped with 50 mm (2") thick washable filters. Control wiring and protection of the air conditioning units shall be the manufacturer's standard, pre-wired factory installed or as recommended.

5.10 VENTILATION & EXHAUST FAN SYSTEMS

All fans used for building ventilation, exhaust, and pressurization shall be selected for minimum noise level generation. All fans used for supply or roof/wall exhaust, including toilets, showers, and ablutions, shall be **centrifugal** forward curved, backward inclined, or airfoil fans with non-overloading characteristics of high efficiency and quiet running design. The fans shall be of the heavy-duty type with durable construction and proved performance in a desert environment. Each wall exhaust fan shall be provided with motorized or gravity dampers which close automatically when the fan is not running. Each ventilation or intake air fan shall be provided with an interlocked motorized damper which closes automatically when the fan is not running and shall be sized for and provided with filter and insect screen. Each fan shall be provided complete with vibration isolator, external lubricators, individual wall on/off switches, and all accessories and sound attenuators as necessary.

Intake or outside make-up air openings for exhaust fans shall be provided with motorized dampers which are interlocked with the exhaust fans and provided with air filters and insect screens. The motorized dampers shall open or close when the ventilation or exhaust fan is on or off, respectively. Louvered openings for ventilation or exhaust fan systems shall be sized for a maximum static pressure (SP) drop (that includes filter resistance) of 25 Pa (0.10" wg) to prevent excessive negative pressurization of the building. **Exterior outside door louvers and undercuts are not permitted except when approved or directed by the U.S. Army Corps of Engineers.**

Maintenance shops and similar spaces that use solvents and oils shall be provided with mechanical exhaust air systems. Intake or outside make-up air openings for an exhaust fan system shall be provided as indicated above. The exhaust systems shall consist of a fan, ductwork, exhaust grills, and interlock controls. Design shall be in compliance with the latest addition of the Industrial Ventilation UFC 3-410-04N or ACGIH Industrial Ventilation manual.

All occupied windowless rooms, without connections to a ducted central HVAC system (or without an avenue for obtaining outside ventilation air) shall be provided with forced-air outside air ventilation systems or forced-air exhaust systems.

5.10.1 KITCHEN HOOD EXHAUST AND OUTSIDE MAKE-UP AIR

Kitchen hood exhaust and outside make-up air system shall be provided for dining facilities (DFAC) and comply with ASHRAE Handbook- HVAC Applications, NFPA 96, SMACNA, as per Kitchen design specialist and equipment supplier requirements, and as stated in this Section. Outside make-up air and exhaust systems for each hood shall be independent of the other duct systems in the DFAC. Residential kitchen ventilation hoods shall NOT be used. Kitchen exhaust hoods and exhaust ductwork shall be design for Type I (grease smoke and provided with baffle or mesh grease filters. Hood and exhaust ductwork shall be constructed from minimum 1.0 mm (20-gauge) stainless steel material. Exhaust flow rate shall be a minimum of 2,230 cmh per linear meter (400 cfm per linear foot) of open-sided hood.

The air velocity in the exhaust duct shall be not be less than 4 m/s (500 fpm) but limited to 7.6 m/s (1,500 fpm). All exhaust duct joints and seams shall be continuously welded or brazed. Bracing and supports shall be constructed of non-combustible material securely fastened to the structure. Bolts, screws, rivets, and other fasteners shall not penetrate the duct walls. Ducts shall be placed a minimum of 450 mm (18") from combustible material or 75 mm (3") from gypsum wallboard attached to non-combustible structures. Ductwork terminating through the roof shall extend a minimum of 1,000 mm (40") above the roof. Where roof terminations are not possible, ducts may be terminated through an exterior wall. All ductwork terminating through an exterior wall shall be located a minimum of 900 mm (3') from exterior openings and at least 2 m (80") above the interior floor. All exhaust ductwork shall be pitched to drain back to the hood.

Roof-mounted centrifugal exhaust fans shall be the upblast type. Exhaust fans shall be centrifugal and fan motors shall be located outside the airstream. Fan discharge shall not impinge on the roof, other equipment or appliances, or parts of the building. Discharge outlet of exhaust fans shall be a minimum of 1,000 mm (40") above the roof. Up-blast fans shall be hinged and supplied with a flexible weatherproof electrical cable to permit inspection and cleaning. Where roof installations are not possible, upblast type fans but in the horizontal configuration may be mounted on an exterior wall. Fans terminating through an exterior wall shall be located a minimum of 900 mm (3') from exterior openings and at least 2 m (80") above the interior floor. All fan exhaust ductwork shall be pitched to drain back to the hood. Connection between ductwork and exhaust fans shall be flanged, gasketed, and bolted. Each exhaust fan shall be electrically interlocked with its corresponding outside make-up air fan to prevent system operation without both fans in service.

Outside make-up air shall be either an integral part of the hood system or be located within 1.0 m (40") distance from the hood to prevent cold drafts. Non-integral outside make-up air greater than this distance shall be tempered to within 6 C (10 F) of room design temperature. The outside air capacity shall be 85% to 90% of the hood exhaust capacity to ensure the kitchen area is under negative pressure. Remaining air balance, 10-15%, shall be pulled from the dining area through the kitchen. In general, outside make-up air shall be enough to prevent kitchen negative pressures from exceeding 5.0 Pa (0.02" of water).

Outside make-up air inlet locations shall take into consideration the prevailing wind direction and shall be placed upstream of exhaust outlets. Wherever possible, outside make-up air inlets shall be located a minimum distance of 3 m (10') from exhaust outlets. Where outside make-up air inlets are located within this distance from the exhaust outlets, the outside make-up air inlet shall be located a minimum of 920 mm (3') below the exhaust outlet. Each outside make-up air fan shall be electrically interlocked with its corresponding exhaust air fan to prevent system operation without both fans in service.

A separate general kitchen exhaust system, independent of the hood system, for the food preparation and serving areas in accordance with ASHRAE Standard 62.1. The general kitchen exhaust system shall be electrically interlock and cease operation when the main kitchen hood exhaust system is in operation.

To reduce sand and dirt migration, outside air intakes shall be located as high as possible within architectural constraints. The intakes shall be sized so that free area velocities of the louvers are below 2.5 mps (500 fpm). For inhabited buildings, locate all air intakes (from center-line of intake) at least 1.5 m (5') above the ground. Each air intake shall be provided with a motorized damper which is interlocked with the exhaust fan(s).

5.10.2 BATTERY ROOM EXHAUST

Battery room exhaust shall comply with UFC 3-520-05 and NFPA 70E. The exhaust fan for the lead acid shop shall be sized to maintain concentrations of hydrogen gas in the battery room to below the 1.0 percent concentration and shall be a minimum of 20 cmh/sq.m (1.0 cfm/sq.ft). The exhaust fan shall be sized larger when required for

mechanical ventilation cooling. Fan(s) shall have a continuous operation rating and installed as high as possible within architectural constraints or a minimum of 1.5 m (5') above the floor with rodent-insect screen but be provided WITHOUT backdraft dampers (to facilitate natural ventilation). Any components such as fan and ductwork in contact with the exhaust air shall be constructed out of fiberglass reinforced plastic (FRP) or polyvinyl chloride (PVC). The ventilation system for the shop shall be designed to provide a negative static pressure by exhausting a minimum of 10% more air than is supplied. Supply air for the shop shall be 100% outside air. Outside air louver(s) shall be sized with calculations provided in the design analysis (DA) for review and installed as low as possible within architectural constraints or a maximum of 30 cm (1') above the floor with rodent screen but WITHOUT filters or backdraft dampers (to facilitate natural ventilation should the fan be nonoperational).

5.10.3 OVERHEAD VEHICLE TAILPIPE EXHAUST SYSTEMS

Exhaust system shall provided in shops for each vehicle maintenance bay to provide adequate air exhaust capacities and fume capture velocities.

Duct shall be constructed of stainless steel sheets of the minimum gauge thickness for ducts as required in SMACNA. Ducts shall be constructed and sealed in accordance with SMACNA and shall be round with longitudinal lock seam (Steel spiral wound duct is not acceptable) for a negative pressure.

Tailpipe adapters shall be of the tapered-cone type with spring clips or other suitable devices for exhaust pipe attachment. The adapter shall fit the nominal diameter exhaust pipe.

Flexible exhaust hose shall be 0.30 mm (0.012") minimum stainless steel. The exhaust hose suspension system shall suspend the flexible tubing overhead when not in use allowing it to be lowered to the operating level when required. The suspension system shall be furnished complete with cable and operating mechanism. The suspension system shall be the counter-weighted or manually operated balancer type.

Fan system shall consist of a direct drive heavy duty radial blade blower capable of high static pressure vented to the outdoors. For vehicle exhaust systems, fan size and capacity shall be as per manufacturer's recommendation. Fan shall be mounted high in space for roof discharge or high gable sidewall termination. Control fan with wall switch.

5.10.4 LABORATORY EXHAUST SYSTEMS

In general, laboratory exhaust systms shall be provided in medical facilities, drinking and waste water treatment plants, waste collection facilities, and areas with similar uses. Exhaust hoods shall be sized with a minimum face opening approximately equal in size to the below counter top. Hoods shall be installed above the counter top a maximum of 600 mm (24"). The system shall consist of a stainless steel capture hood and duct with a negative-pressure blower capable of high static pressure and vented to the outdoors. Fan shall be sized for a hood face (or opening) capture velocity of 0.63 mps (125 fpm) and the static pressure (SP) required to draw the laboratory air through the hood and ductwork. Fan may be integral with the hood, roof-mounted, or wall-mounted and be controlled with a separate wall switch. Hood shall be provided with a fluorescent light fixture with a switch located on the exterior of the hood frame.

5.10.5 CEILING FANS

Ceiling fans shall be 5-bladed, 1320 mm (52”), minimum, in diameter, and provided at one per 40 sq.m (430 sq.ft) of floor space unless indicated otherwise. Fans shall be centered or distributed evenly throughout the room. Fan placement shall be coordinated with the lighting plan to prevent conflict or the casting of moving shadows. Fan mount shall be flush, standard, or angle mount depending on ceiling height and configeration. Fan shall be mounted such that the fan blades are a minimum 2.5 m of (98") above the finished floor. The fan shall be provided without light kit. The finish shall be factory painted white. The controls shall be wall-mounted from either a single pole switch or from two (2) 3-way switches to provide on/off operation. The electrical supply shall be as indicated. Install per manufacturers’ instructions.

5.10.6 OSCILLATING WALL FANS

Oscillating fans shall be 460 mm (18”), minimum, in diameter and installed in occupied administrative areas where ceiling fans are not feasible. Fans shall be centered or distributed evenly throughout the room. Fan mount shall be a painted steel wall bracket and mounted such that the fan blade is approximately 2.1 m (7’) above the finished floor. The finish shall be factory painted white. The controls shall be from either a single pole switch or from two (2) 3-

way switches to provide on/off operation. The electrical supply shall be s indicated. Install per manufacturers' instructions.

5.11 CONTROL AND PROTECTION DEVICES

Control wiring and protection of the air conditioning units being offered must be the manufacturer's standard, pre-wired, installed in the unit at the factory or as recommended.

5.11.1 THERMOSTATS

Thermostats shall be wall-mounted and located near the unit air returns or next to the main entrance door. For units serving more than one (1) area, the thermostat shall be located in the space with the highest heat generation. Wall-mounted thermostats shall be mounted 1.5 m (5') above the finished floor and be easily accessible.

5.11.2 OVERHEAD DOOR CONTROL DEVICES

Control switch and wiring shall generally be provided in large shop areas to activate when the overhead doors are in the open position. The switch shall override the space thermostat and deactivate the space heating equipment. The minimum setpoint temperature to override the heating deactivation switch during door-open periods shall be 5 C (40 F) for freeze protection. After the doors are closed, the room thermostat should assume normal control.

5.12 TESTS FOR HVAC EQUIPMENT

Upon completion of all HVAC work, the Contractor shall demonstrate to the Contracting Officer that the installation is adjusted and regulated correctly to fulfill the function for which it has been designed. The Contractor shall test, adjust, balance and regulate the system(s) of concern as necessary until the required conditions are obtained. Operational tests shall be conducted once during the winter and once during the summer. Contractor shall coordinate with the Contracting Officer on when the test shall be scheduled. Tests shall include all interlocks, safety cutouts, and other protective devices to ensure correct functioning. All tests shall be carried out with full written records to be submitted in tabulated form with the design requirements and final settings to the Contracting Officer upon completion. The following tests and readings shall be made by the Contractor at the beginning of the testing and in the presence of the Contracting Officer:

Conditions:

1. The make, model, and capacity of each piece of equipment tested.
2. Outside ambient dry bulb (db) temperature and wet bulb (wb) temperature.
3. Room ambient dry bulb (db) temperature and wet bulb (wb) temperature before test.
4. Room ambient dry bulb (db) temperature and wet bulb (wb) temperature during test.

Packaged Heat Pumps, Air Handling Equipment:

Air quantities shall be obtained by anemometer readings and all necessary adjustments shall be made to obtain the specified quantities of air indicated at each inlet and outlet.

Following readings shall be made:

1. Supply, return, and outside air quantities by each system.
2. Supply, return and outside air temperature for each system.
3. Voltmeter and ammeter readings for each system component.
4. Motor speeds, fan speeds, and input ampere readings for each fan.
5. Split-Pack Heat Pumps, Unit Heaters: The following readings shall be made:
6. Voltmeter & ammeter readings for each system component.
7. Supply and return air temperatures for each system.

Exhaust, Outside Make-up, Air Fans (Including, but not limited to, battery room, laboratory, kitchen, vehicle, & welding exhaust systems):

Air quantities shall be obtained by anemometer readings and all necessary adjustments shall be made to obtain the specified quantities of air indicated at each inlet or outlet.

The follow readings shall be made:

1. Supply and exhaust air quantities by each system.
2. Motor speeds, fan speeds, and voltmeter and ammeter readings for each fan.

5.13 ELECTRICAL REQUIREMENTS FOR HVAC EQUIPMENT

All electrical work shall comply with the National Electric Code.

Operation of the control system shall be at the manufacturer's standard voltage for the unit.

The following are the minimum requirements for motors regarding enclosure, insulation: and protection:

1. Refrigerant compressors: Provide hermeticly sealed type with inherent (internal) overload protection.
2. Refrigerant condensers: Provide internal thermal overload protection.
3. Refrigerant evaporator fans: Provide Open Class "A" fan motor type with internal thermal overload protection.

5.14 WOOD COOKING STOVES FOR DINING FACILITIES

A separate wood burning cooking stove kitchen annex building shall be provided within the DFAC yard with commercial grade built-in-place wood-fired cooking stoves. The annex shall be located adjacent to the kitchen at minimum distance of 4.0 m (12') and maximum 10.0 m (30') away and be provided with a covered walkway. The annex shall be provided with a concrete slab, a sloped metal or concrete roof slab, and a minimum of three (3) reinforced CMU walls. Walls shall have a minimum height of 3.0 m (10') from floor to finished ceiling). The wood stove kitchen shall be well vented with louvers elevated a minimum of 1.5 m (5') on the end or side walls. Exhaust fans shall NOT be provided because of the effects on the chimney draft. A covered wood storage area, equal to a minimum of 0.3 cu.m (10 cu.ft) of volume per stove, shall be provided for rain shielding. Security fencing with gates and locks shall be provided around the entire annex kitchen complex.

The annex kitchen concrete floors shall be provided with trench drains that extends the length of the cooking area for cleaning purposes. Water service shall be provided for the cooking annex. Water piping shall be buried to prevent pipe freezing. Freeze-proof yard hydrants (where the actual valve is located below the frost line) shall be provided.

The kitchen annex shall be provided with power for light fixtures, receptacles, and other electrical devices required for a complete functional facility, see Electrical.

5.14.1 STOVES

Stoves shall be constructed from masonry fire bricks and cooking stove tops shall be wide enough for a person to walk and accessible by small movable stairs. The stove firebox shall be shaped to maximize the heat absorbed by the cooking pots above and lined with an 15 mm (1/4") cast-iron insert to protect the fire brick. A 40 mm (1.5") toe space shall be provided for the entire interior length of floor in front of the stove lineup.

The minimum height of the stove shall be 950 mm (37") with a minimum stove-to-finished-ceiling clearance of 2.0 m (80"). Stoves shall be topped with a minimum 50 mm (2") thick cast-iron plate. The cast-iron stove top shall be a minimum of 1,000 mm x 1,000 mm (40" x 40") square with a 750 mm (30") diameter hole in the center to accommodate a similar diameter stove plate insert. The 750 mm (30") metal insert shall also have a 450 mm (18") diameter hole in the center that accommodates a second smaller stove plate insert. The second insert shall have a 250 mm (10") diameter hole in the center that accommodates a final stove plate insert.

A minimum 25 mm (1") thick thick cast-iron fire grate (grid plate or fire basket) shall be provided in the wood firebox not less than 100 mm (4") nor more than 150 mm (6") above the firebox floor . The fire grate grill spacing shall not be less than 50 mm (2"). The wood feeding and ash removal doors shall be located on the exterior. The doors shall be constructed of not less than 7.0 mm (1/4") thick steel and provided with 40 mm (1.5") thick metal frames. One (1) exterior wood loading door shall have at least one (1) smaller peek door on the door itself that is approximately 100 mm x 100 mm (4" x 4").

5.14.2 STOVE CHIMNEYS

Each stove shall be provided with a dedicated chimney routed inside the building envelope (or kitchen space) for the maximum allowable distance; hotter exhaust gases produce better chimney drafts. The main chimney shall be

constructed using a stainless steel vent (or flue) enclosed with face brick. The face brick shall protected the user from accidental human contact and the metal flue from potential damage from large cooking pots; metal rails may be provide with approval. The minimum flue diameter shall not be less than 200 mm (8") diameter and thickness shall not be less than 3.0 mm (12-gauge). Chimneys penetrating and exiting through walls shall be provided with a 16 mm (5/8") thick steel lentil and exterior eschuteon type pipe sleeve for wall anchoring. All exterior protions of a chimney that exits through a wall shall be double-wall stainless steel with a minimum 25 mm (1") gap filled with fire-proof insulation.

All chimneys shall rise a minimum of 60 cm (24") above the roof ridge so a stable draft can be produced. In addition, the chimney shall be provided with rain cap to reduce the chances of adverse wind pressures. The chimney system shall be reasonably well-sealed to prevent leaks that introduce cool air and make the system more vulnerable to adverse pressures. **Contractor must submit shop drawings for approval.**

5.15 COLD STORAGE SYSTEMS

All cold storage units shall be designed to operate as both refrigerators or freezers should a freezer become non-operational (requiring the frozen stores to be transported to the other unit). The Contractor shall submit to the Contracting Officer for approval, prior to start of work, copies of both the assembly and installation instructions along with shop drawings for appropriately sized walk-in refrigerators and freezers. The submittal shall also include the proposed manufacturer, cooling load calculations, evacuation and charging procedures, operation and maintenance data, and start-up and initial operational tests.

5.15.1 MODULAR CONSTRUCTION

Dimensions shall be as indicated. All walk-in cold storage units shall be the prefabricated insulated panel (or modular) type. Doors shall be the swing type. Remote refrigeration equipment shall be located on the exterior of the building. Floors of cold storage units shall be the prefabricated insulated type provided by the manufacturer of the cold storage units. The concrete floors under the cold storage units shall NOT be depressed.

Walls, ceilings, doors, and flooring of the cold storage units shall not contain any wood or wooden material. Walls, ceilings, doors, and flooring shall be made of sandwiched panels filled with polystyrene or urethane insulation material. Interior panel surfaces shall be aluminum or stainless steel lined. Ramps shall be provided at the door of each cold storage unit.

5.15.2 REFRIGERATION EQUIPMENT

All refrigeration systems shall be designed for 16-18 hours of continuous operation and be able to maintain the interior product temperature between -23 to -18 C (-10 to 0 F) with an outside ambient temperature down to of –18 C (0 F). Remote condensing units shall be factory fabricated and rated in accordance with UL303 and ARI 365 and consist of, as a minimum, motors, air cooled condensers, receivers, and compressors all mounted on a common base. Compressors shall be hermetic type.

Evaporators shall be factory fabricated and rated in accordance with UL 412 and ARI 420. Evaporator shall be the forced convection unit cooler type made to suspend from the ceiling panels with forced air discharged parallel to the ceiling. Evaporators shall be provided with air circulating motors, multi-fin tube type coils assembled within a protective housing, and grilles. Air circulation motors shall be lifetime sealed and the entire unit-cooler assembly shall be accessible for cleaning. Refrigeration piping shall be annealed or hard drawn seamless copper tubing in conformance with ASTM B280.

Condensate drip pan and drain connections shall be provided for the evaporators. Condensate drains and drain lines in the space between the modular floors and concrete slab shall be provided with electric heating cable thermostatically controlled to maintain 10 C (50 F) at zero flow rate. The cable shall be sized in accordance with manufacturer’s recommendations.

Outdoor condensing units shall be provided with a protective canopy and security fence or wall to protect from direct sun, weather, and vandalism.

5.15.3 CONTROLS

A recording thermometer, temperature alarm system, and interior lighting with exterior switch shall be provided as a minimum. The temperature alarm shall be connected to a remote temperature alarm located in a frequented area. Automatic electric heat defrosting system shall be provided for ALL cooler units to allow for freezing operations, Timer type defrost controllers shall be provided. For power characteristics; See Electrical.

5.15.4 COLD STORAGE TESTING

Start up and initial operation shall be undertaken upon completion of the equipment and refrigerant piping installation. Safety and automatic controls shall be adjusted to place them in operating sequence. The manufacturer's recommended readings shall be record hourly for a period not less than 24 hours. Upon completion of operational tests, the systems shall be performance tested for a duration not less than eight (8) hours. The test shall include the following information to be in the report with conclusions regarding the adequacy of the systems:

5.15.5 TIME, DATES, AND DURATION OF TESTS

The Contractor shall provide the following information when testing refrigeration equipment:

1. Inside dry-bulb and wet-bulb temperatures maintained in each cold storage unit during the tests employing recording instruments calibrated before the tests.
2. Outside dry-bulb and wet-bulb temperatures obtained from recording instruments calibrated and checked hourly with a sling psychrometer.
3. Evaporator and condenser entering and leaving air temperatures taken hourly with the compressors in operation.
4. The make, model, and capacity of each evaporator and condensing unit.
5. Voltmeter and ammeter readings for condensing units and evaporators.

5.15.6 COLD STORAGE OPERATIONS & MAINTENANCE

A chart showing the complete layout of the refrigeration systems, including piping, valves, wiring, and control mechanisms shall be provided. Printed instructions covering the maintenance and operation of refrigeration equipment shall be submitted. Shutoff valves shall be tagged in accordance with the instructions. Special tools necessary for repair and maintenance of the systems shall be provided. Upon completion of the work and at a time designated by the Contracting Officer, instruction shall be given to designated personnel in the operation and maintenance of each refrigeration system. The period of instruction shall not be less than one 8-hour day.

5.16 MECHANICAL REQUIREMENTS FOR GENERATORS

Generator quantities and sizes shall be as stated in Section 01010. The following shall be provided in the Mechanical design and installation for **Prime** stationary generator sets and related mechanical systems. This includes, but not limited to: Foundations, mountings, exhaust systems, cooling systems, ventilation, noise attenuation, and equipment configuration. See Electrical for power and electrical equipment requirements, and Plumbing for fuel system requirements,

The generator set(s) shall be the manufacturer's design for outdoor weather-proof installation with skid-mounted high-ambient temperature radiator rated for 50 C (120 F).

Heating devices for the generator set engine coolant and starter batteries shall be provided as per manufacturer's recommendation for cold starting. Ambient temperature and elevation derating calculations shall be clearly shown in the design analysis (DA).

5.16.1 EXTERIOR INSTALLED GENERATORS

All exterior installed generator sets (i.e. With three or fewer walls) shall be provided with, as a minimum, the manufacturer's factory installed weather-proof enclosure cabinet, the manufacturer's integral muffler system, vibration isolators, and vibration isolating foundation to reduce noise and prevent damage to the overhead structure. Generator set(s) shall be oriented with the prevailing winds when possible (with the alternator upwind) to promote heat removing air flow across the alternator and engine by the radiator fan.

All exterior weather-proof generator sets shall be provided with a covered structure and enclosed with a chain link security fence. A structural cover shall also be provided over the generator accessories (i.e. Switch gear, etc.). The overhead structure shall have a minimum clearance of 2.0 m (6.5') above the equipment and extend out with a minimum overhang of 1.0 m (40") beyond the equipment and any spill containment dikes.

Exhaust systems shall have minimal backpressure, directed to disperse the noise away from people and occupied buildings, and be located near the radiator air discharge.

5.17 MEDICAL WASTE INCINERATORS

Medical waste incinerators shall be provided in quantities and capacities as required in Section 01010 and specifically designed by the manufacturer to dispose of all medical wastes. All units shall be designed for 8 hours per day of continuous operation and be rated in quantity per hour (i.e. kg/hr or lbs/hr).

Incinerator loading or charging of medical waste shall be batched-fed manually.

Primary combustion chamber shall be the stationary fixed-hearth (or kiln), multiple-chamber, retort type or larger capacity rotary-hearth (or kiln) type. Burner and combustion air controls shall be fully automatic comprising of, as a minimum, electronic ignition and all necessary interlocks and safety devices to provide safe operation. The chamber and burner shall be designed to maintain a minimum combustion temperature of at least 760 to 870 C (1400 to 1600 F). The ash-removal system shall consist of the automatic continuous removal of the ash into an ash-quench pit where cooled by water and removed by conveyor.

Secondary combustion chamber shall be a solid-walled and -floored, horizontal, refractory-lined cylinder type incinerator designed to oxidize (or burn) the organic vapors and gases. Burner and combustion air controls shall be fully automatic comprising of, as a minimum, electronic ignition and all necessary interlocks and safety devices to provide safe operation. The chamber and burner shall be designed to maintain a minimum combustion temperature of at least 930 to 1200 C (1700 to 2200 F) with a minimum gas residence (or dwell) time of 2.0 seconds. The ash-removal system shall consist of, as a minimum, the direct manual removal into a dry collection hopper.

Cyclone air filters shall be provided to remove the larger particulates. Cyclone air separators may be provided with powered fans to increase the velocity of the gases inside the cyclone to improve the collection efficiency for smaller particles.

5.17.1 INCINERATOR STACKS (OR CHIMNEYS)

Stack size shall be in accordance with the manufacturer's recommendations. Stacks shall be the forced-air type and completely self-supporting and unattached to nearby structures. As a minimum, stack heights shall minimize downwash of stack emissions due to aerodynamic influences from nearby structures and be calculated in accordance with DoD 4715.05-G, Overseas Environmental Baseline Guidance Document. Stacks shall be provided with corrosion-resistant steel weather caps.

5.18 OPERATIONS & MAINTENANCE (O&M) FOR MECHANICAL

Contractor is required to provide a 12-month supply of parts for operation and maintenance of equipment according to the manufacturer's recommendations. In addition to this, the Contractor shall provide an inventory of all items, location/address stored and secured, and commissioning plans.

The O&M manuals must be provided prior to any training activities. Manuals shall be "tri-lingual" in Dari, Pashto, and English.

All control panels shall have tri-lingual name plates in Dari, Pashto and English.

The contractor shall provide an outline of the training lesson plan (to be approved by the Government) prior to conducting training. CD recordings of training on video shall also be provided, after training is conducted.

6.0 PLUMBING

6.1 GENERAL

The Contractor shall design and build domestic cold and hot water systems, waste, drain and vent systems, compressed air, medical gas storage and distribution systems, fuel-oil storage and distribution systems, and as

required in the facilities identified in Section 01010 Scope of Work and as described herein. The Contractor shall also be responsible for complete design and construction of all domestic and special plumbing systems required for full and safe operations for all facilities or structures required in this contract.

The work covered in this scope also includes the delivery to site, erection, adjusting, testing and balancing, and handing over in full operating condition all equipment and associated works.

6.2 SUB-CONTRACTORS QUALIFICATIONS

The plumbing systems shall be executed by specialist subcontractors experienced in the design and construction of implied systems and the types of systems described in this Section.

6.3 STANDARD PRODUCTS & SUBMITTALS

All materials and equipment shall be standard product of a manufacturer regularly engaged in the manufacture of the product and shall duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

The Contractor shall submit the following for equipment to be provided under this section of the specification: Manufacturer's data including performance characteristics at design conditions; Catalog cuts showing dimensions, performance data, electrical requirements, compliance with the codes, standards and regulations; Drawings, as necessary, indicating location and installation details.

6.4 CODES, STANDARDS, & REGULATIONS

The design and installation of equipment, materials and work covered under the plumbing services shall conform to the standards, codes, and regulations provide in the paragraph, List of Codes and Technical Criteria, where applicable except where otherwise indicated under particular clause(s). The publications to be taken into consideration shall be those of the most recent editions and primarily in accordance with the ICC International Plumbing Code (IPC) and ASHRAE Handbook-HVAC Applications for Service Water Heating. Standards other than those mentioned may be accepted provided that the standards chosen are internationally recognized and meet the minimum requirements of the specified standards. The Contractor shall submit proof of equivalency if requested by the Contracting Officer.

6.5 EQUIPMENT PROTECTION

Exterior plumbing equipment shall be pad-mounted. In addition, security fences, traffic bollards, designed overhead structures for exterior installed generators, incinerators, and adjacent fuel tanks. LP gas-propane canister storage areas shall be provided. Overhead canopy height shall be a minimum of 2 m (80") above the highest point of the engine cabinets and fuel tanks.

6.6 PLUMBING SYSTEM REQUIREMENTS

6.6.1 WATER

Domestic cold and hot water shall be provided in the facilities to serve the water usage and plumbing fixtures provided for the facility. Water service to each facility shall enter the building in a mechanical, toilet, storage, or similar type space. The building service line shall be provided with a shut off valve installed either outside in a valve pit or inside the mechanical room or similar spaces. Water piping shall not be installed in or under the concrete foundation except for the service line. All water piping shall be routed parallel to the building lines and concealed in all finished areas. Insulation shall be provided where required to control sweating of pipes or to provide protection from freezing. Electric heat trace cable for freeze protection shall not be provided as a substitute for space heating systems.

6.6.2 PIPING MATERIALS

Domestic cold water shall be distributed by means of standard weight schedule 40 galvanized steel pipe, Polyvinyl Vinyl Chloride (PVC) or Polyethylene (PE) (ASTM D 2737) plastic piping. Domestic hot water shall be distributed by means of standard weight schedule 40 galvanized steel pipe, or Chlorinated Polyvinyl Vinyl Chloride (CPVC) piping. Domestic water joints shall be connected using either solvent cement or mechanical threads.

Waste and vent piping can be made of either galvanized steel pipe (schedule 40) or Polyvinyl Vinyl Chloride (PVC) conforming to ASTM D 2665. Flexible waste and vent lines from fixtures (i.e. Lavatories, Water Closets, etc.) and inserted into an adjacent pipe are not allowed accept for clothes washer installations.

Corrosion protection shall be provided if galvanized piping comes in contact with earth or masonry floors, walls or ceilings. The Contractor shall attempt to route all piping beyond the grasp of the occupants. **All exposed domestic water, waste, and vent piping shall be schedule 40 galvanized steel; wall mounting brackets for exposed domestic water, waste, and vent piping shall be spaced a maximum of 40 cm (16") apart to minimize vandalism.**

Polypropylene (PP) pipe is NOT allowed as a substitute (where plastic piping is allowed) because connections, many times, are made using the fusio-therm technique which requires special training and maintenance equipment for installation and repair.

6.6.3 PLUMBING WATER FIXTURES

The following typical plumbing fixtures shall be provided:

WC-1: Eastern Water Closets: Eastern water closets shall be provided with flush tank assembly. Provide acid resisting fired porcelain enameled cast iron water closet complete with rotating No-Hub 'P' trap and No-Hub coupling to meet piping requirements. Eastern Style water closet shall be furnished with integral non-skid foot pads and bowl wash down non-splashing flushing rim. The water closet shall be completely self supporting requiring no external mounting hardware and shall be flush with floor. The Eastern Style water closet shall incorporate waterproofing membrane flashing flange. Provide a cold water spigot/hose bib 300 mm (12") above finished floor on the right (from a perspective of standing inside of the cubicle and looking out) sidewall of the cubicle. Toilets shall be oriented north and south; toilets shall not face east or west.

WC-2: Western Water Closets: Western style water closets shall be provided with flush tanks and shall be provided as requested by the User. Western style toilets shall be white vitreous china, siphon jet, round bowl, pressure assisted, floor mounted with floor outlet. Top of toilet seat height shall be 356 to 381 mm. Water closet shall be flush tank type. Provide a cold water spigot 300mm above finished floor. Spigot shall have a flexible hose and spray nozzle.

FU-1: Flush Valve Urinals: Urinals shall be white, vitreous china, wall-mounted, wall outlet, siphon jet, integral trap and extended side shields and shall be provided as requested by the User. Provide urinal with the rim 600 mm (24") above the floor. Water flushing volume of the urinal and flush valve combination shall not exceed 0.5 liters (0.125 gallons) per flush. Mount flush valves not less than 280 mm (11") above the fixture.

L-1: Lavatories (For Afghan Facilities): Lavatories shall be trough-type constructed of block and concrete with ceramic tile exterior and lining capable of withstanding abuse. Provide maintenance access to waste piping and P-traps from under the sink. Trough-type sink faucets shall be similar to heavy duty service sink faucets with one-piece brass body construction, fixed short integral spout, hot and cold water manual mixing valves, and ability to withstand abuse. Lavatories inside prisoner cells shall be tamper-proof with integral spout, soap depression, and outlet connection to slip 40 mm (1.5") OD tubing.

JS-1: Service (Mop or Janitor's) Sink: All janitor's sinks shall be floor mounted, enameled cast iron, and be provided with copper alloy rim guard. Service sinks provided in maintenance areas shall be concrete. Service sinks in battery rooms shall be acid resistant. Include a stainless steel shelf and three (3) mop holders with janitor sinks. Provide hot and cold water heavy duty service sink valves with manual mixing. Faucet handles shall chrome plated brass or bronze alloy.

SH-1: Shower Base shall be sized to fit from wall to wall. Refer to Architectural drawings and specifications. Showerhead and faucet handles shall be chrome plated brass or bronze alloy. Provide hot and cold water valves for manual mixing. In addition to a shower head, provide each shower stall with a threaded faucet approximately 1.2 m (4') AFF with hot and cold-water controls, mixing valve, and diverter valve so water can be directed to either the shower or to the lower faucet. Shower shall be provided with low flow shower head not to exceed 7.0 lpm (2.0 gpm) (Note: Provide flow restrictor to achieve designated flow at available water pressure). The shower head shall be heavy duty type and securely fastened to the wall. Hand-held shower head with flexible hose shall be allowed.

Floor or Shower Drain: Cast iron construction with galvanized body, integral seepage pan, and adjustable perforated or slotted chromium plated bronze, nickel-bronze, or nickel brass strainer consisting of a grate and threaded collar. Toilet room floor drains are similar except are provided with built-in, solid, hinged grate.

ESE-1: Emergency Shower and Eye Wash. Provide emergency shower and eye wash assembly as indicated on architectural drawings. In non freezing locations, a floor drain shall be provided. Provide a floor drain in the area if appropriate (i.e. Non-freezing locations, etc.).

EEW-1: Emergency Eye Wash Assembly. Provide emergency eye wash assembly in facilities where shown on the architectural drawings. Provide a floor drain in the area if appropriate (i.e. Non-freezing locations, etc.).

EEF-1: Emergency Eye and Face Wash: Provide emergency eye and face wash assembly in facilities where shown on the architectural drawings. Provide a floor drain in the area if appropriate (i.e. Non-freezing locations, etc).

KS-1: Kitchen Sink. Single bowl sink shall be heavy gauge formed type 304 stainless steel.

KS-2: Kitchen Sink. Two (2) compartment sink shall be heavy gauge formed type 304 stainless steel.

KS-1 and KS-2 Faucet: Faucet bodies and spout shall be chrome plated brass or bronze alloy. Handles, drain assembly, and stopper shall be corrosion resisting steel or brass/bronze alloy.

Ablution Trench: See building floor plans for size and construction of trench and number of stations. Provide trench drain with brass grating and strainer.

Ablution Trench Faucet type: See L-1 Option 1 and Option 2 above. Provide faucets above with hose end, 1 meter of hose a spray nozzle and a hook to hang the nozzle. Install faucet 300 mm above the floor.

Grease Trap: Refer to Civil Drawings.

FS-1: Floor Sink. Provide square floor sink with 300mm overall width or diameter and 250mm nominal overall depth. They shall have acid resistant enamel interior with cast iron body, aluminum sediment bucket and perforated grate of cast iron. Outlet size as indicated on plans. Provide full, half or three quarter grates as needed

TD-1: Trench Drains: Floor trench shall be of concrete construction with a flush mounted cast iron grate. The cast iron grate shall be sectionalized for cleaning access. The grate shall fit into a frame so the grate is flush with the finished floor. Iron grates shall be fabricated in sections in length not greater than 1,500 mm (5'). The cast iron grate shall have 12 mm wide slots, maximum. This style of floor trench shall be installed in the kitchen area of the DFACs in response to kitchen cleaning practices of the local national staff. Trench drains shall not be piped into the grease waste system.

HB-1: Freeze proof hose bib for exterior use.

HB-2: Room hose bibs and floor drains shall be provided as required. Afghan dining facility kitchen area clean-up hose bib to be supplied with connecting hose on reel including approximately 12 m (40') of hose. Provide clean-up spray nozzle with hose assembly.

Traps: Provide P-Traps per IPC for all fixture drains, floor and trench drains, and shower drains. P-traps shall have minimum of 50 mm (2") water seal.

PS-1: Large Pot sink, provide clean-up spray nozzle with hose assembly.

PS-1 Faucet: Provide hot and cold water heavy duty service sink valves with manual mixing. Faucet shall have hose end on fixture spout. Provide 2 m of hose and spray nozzle. Mount faucet 300 mm above top of largest pot.

TS-1: Laundry Tub Sink: Sinks shall be the standard height polypropylene single-bowled floor-mounted on four (4) legs. Approximate tub dimensions shall be approximately 660 mm depth x 635 mm front (22" x 25") with a minimum 80 l (20 gal) capacity. Sinks shall be provided with hot and cold water valves for manual mixing. Faucet handles shall be copper alloy.

6.7 HOT WATER

Hot water shall be provided for the facility to supply 50 C (120 F) hot water to fixtures and outlets requiring heated water. Water of a higher temperature, 60 C (140 F) and above, shall be provided for special uses or processes as in kitchens (except hand wash lavatories) and for sterilization. All hot water piping shall be insulated. A hot water re-circulating pump shall be provided if hot water piping run exceeds 30 m (100) in accordance with the IPC.

6.7.1 WATER HEATERS

The hot water shall be generated by electric water heaters (WH). All WHs shall be factory insulated. Each water heater shall be equipped with a vacuum relief valve and temperature and pressure (T&P) relief valve that discharge into a nearby floor drain; discharge piping shall terminate 50 mm (2") above the floor drain. The larger floor-mounted units shall be located inside mechanical rooms, storage rooms, janitor rooms, or similar type spaces. Smaller wall-mounted units may be located in toilet-lavatory areas for single remote water closets. Multiply water heaters (two or more) shall be of equal size and connected by common inlet and outlet manifolds in a **"reverse return"** configuration to ensure equal flow and drawdown rates. All floor-mounted WHs shall be elevated on a 100 mm (4") raised concrete pads. In cases where the pressure of the water system violates the manufacturer's recommendations, a pressure reducer shall be installed in the line before the water heater.

Water heater storage capacity (liters) and recovery capacity elements (kW or liters per hour) shall be sized in accordance with ASHRAE Fundamentals Handbook-HVAC Applications, "Service Water Heating," Provide water heater sizing according to the following chart:

Building Type	ASHRAE Category
Barracks, Latrine	Hotel
HQ, Admin, TOC, DPW, PX,	Office
DFAC	Hotel
Medical Clinic, Hospital	Hospital

The unit(s) capacities shall be for commercially available tank and electric heating element sizes.

6.8 WASTE, DRAIN, & VENT SYSTEMS

Every trap and trapped fixture shall be vented in accordance with the IPC. In order to minimize vent piping, incorporate either "Circuit Venting," "Combination Drain & Vent," or "Wet Venting" options systems in accordance with the IPC.

6.8.1 DESIGN & INSTALLATION CONSIDERATIONS

The Designer and installer shall have in mind a vent option (i.e. Fixture Venting, Circuit Venting, Wet Venting, etc.) before designing the route of the waste line(s) in a building in order to comply and avoid inconsistencies with the IPC. **Under no circumstances shall VENT PIPING be routed horizontally under the floor due to blockages over time.** Every dry vent connection shall rise up vertically from the waste pipe no less than 45-degrees with the horizontal (Note: In most cases, the connection will be 90 degrees for the horizontal or straight up. See IPC). Every dry vent shall rise up vertically at least 15 cm (6") above the flood level rim, of the fixture being vented, before going horizontally.

6.8.2 FLOOR DRAINS

Floor drains shall be provided in each room that contains a water source. Floor drains shall be provided in the mechanical equipment and toilet/shower/ablution rooms. Floor drains shall be provided next to water heaters. In mechanical rooms, floor drains shall be provided to avoid running drain piping long distances above or over the floor. Drain outlet shall use a P-trap system to trap sewer gases and shall be a one-piece system without removable parts. Trench drains shall be provided for the DFAC kitchen areas. This style of floor trench shall be installed due to the kitchen washdown cleaning practices of the local national staff.

6.8.3 CLEANOUTS

Cleanouts shall be provided no more than 8 m (25') apart when measured from the upstream entrance of the cleanout.

6.9 SPECIAL PLUMBING SYSTEMS

Contractor shall design and construct compressor air storage and distribution, waste-oil collection and storage, fuel-oil storage and distribution and other plumbing systems that are required for full performance of equipment and operations and for maintenance in the Power Plant and Vehicle Maintenance facilities. These systems shall be designed and built in accordance with codes and publications referenced herein before and in compliance with equipment manufacturer recommendations.

6.9.1 KITCHEN GREASE INTERCEPTORS

A grease interceptor or automatic grease removal devices shall be required to receive the drainage from fixtures and equipment with fats, oils or grease-laden waste located in food preparation areas, Facilities include, but not limited to, kitchens of dining facilities (DFACs), hospitals, school, etc. Fixtures and equipment shall include prep sinks, pot sinks, pre-rinse sinks, automatic dishwashers, and similar devices. All such devices shall be connected to the grease waste. **Floor drains shall not be connected to grease waste unless the floor sink is used to empty pots.**

6.9.2 PLUMBING FOR BATTERY ROOMS

Plumbing features for battery room shall comply with requirements in Part 6 of UFC 4-229-01N. Plumbing shall be provided as follows:

Acid-resistant and alkali-resistant floor drains shall be provided in the lead acid and NICAD shops, respectively.

Emergency shower and eyewash facilities shall be provided and be located within 16 m (25') of the battery handling areas.

Acid-resistant and alkali-resistant dump sinks shall be provided in the lead acid shops. The sinks shall be elevated to allow emptying into portable containers for disposal.

Facilities shall be provided with hose bib, garden hose, and rack for flushing and neutralizing spilled electrolytes for shop.

6.9.3 COMPRESSED AIR SYSTEMS

Compressed air system shall be in accordance with UFC 3-420-02FA. Compressed air shall be provided using a packaged air-cooled electric motor driven compressor and ASME rated receiver with air cooler and moisture separator to remove moisture and oil. Compressed air system shall be capable of operation up to 10 kPa (200 psig) maximum for 6 kPa (125 psig) normal units. High-pressure system (above 10 kPa (200 psig)) shall be provided to supply compressed air to equipment where required. Provide an engine driven air compressor where generator electrical power is unreliable. Noise level of air compressor should not exceed acceptable db limits.

The air distribution system shall be provided with necessary regulator valves to maintain desired pressure. Compressed air drops shall be provided in each maintenance bay, tire shop, tool room, paint shop and other areas requiring compressed air service. Where required, line filters, lubricators, and/or hose reels shall be provided. Compressed air piping shall be black steel pipe and painted to match wall color.

6.9.4 MEDICAL GAS SYSTEMS

Medical gas system design and installation shall include all labor, equipment and services necessary for and incidental to the installation of piped medical gas and support, and vacuum systems. Oxygen systems shall be complete to the source valve, ready for connection to the bulk gas supply system. All systems shall be complete, started, tested and ready for use.

The following gas, support, and vacuum systems conforming to NFPA 99 Level 1 criteria shall be provided: oxygen (O), medical compressed air (MA), and medical-surgical vacuum (MV).

None of the above systems intended for patient care shall be supplied to or used for any purpose other than patient care applications.

The Contractor shall provide the initial supply of gases in cylinders or containers as appropriate for cylinder sources a minimum of four (4) containers of each gas completely filled at turnover to the Government. In addition, the Contractor shall submit, for approval, detailed drawings for the complete systems including piping layouts and

locations of connections; dimensions for roughing-in, compressor foundations, and support points; schematic diagrams; and wiring diagrams or connection and interconnection diagrams.

Upon completion of the installed systems, the Contractor shall test and provided test reports in booklet form showing all field tests performed to adjust each component and field tests performed. Each test report shall indicate the final position of controls.

6.9.5 WASTE-HAZARDOUS DRAINAGE

Waste or hazardous drainage from battery repair/charging areas shall be treated prior to entering the base general waste drainage system. Hazardous waste drainage piping shall be acid resistant. Smaller battery rooms shall have waste treatment available using an acid neutralizing tank.

6.9.6 DRAINAGE FROM MAINTENANCE AREAS

Drainage from maintenance areas, fueling areas, POL areas, etc., shall be treated prior to entering the base general waste drainage system. Treatment shall consist of sand and oil separators as required by facility function. Buried oil storage tanks shall be provided where required.

6.10 GENERATOR & INCINERATOR FUEL STORAGE & DISTRIBUTION

The work shall include the fabrication and installation of the entire fuel storage and distribution system.

6.10.1 FUEL OIL STORAGE AND CONTAINMENT

Fuel Oil Storage and Distribution system shall be provided to support the operation of diesel engine generator set(s) and incinerator(s). Tanks shall be designed to store those fuels specified in Mechanical.

Fuel (non-waste oil) storage tank capacity shall be as specified in Section 01010. For initial operation and testing, only non-waste oil fuels shall be provided. **The Contractor shall provide a full supply of fuel for ALL tanks at the time of turnover to the Government**.

Bulk storage of fuels shall be designed around above-ground horizontal steel tanks with single-walls and containment dike. **Under NO circumstances shall GALVANIZED tanks be provided for storage of fuel oil or diesel.** Tanks shall be installed in accordance with NFPA 37.

The containment dike(s) shall be sized to contain the entire contents of the tank plus 10 percent. The dike structure shall be constructed of reinforced concrete. If more than one (1) tank is sharing a containment dike, then the dike need only be sized for the capacity of the largest tank, plus 10 percent.

Bulk storage tanks shall be designed and manufactured for horizontal aboveground installation. Tanks shall be complete with fill tube and cap, suction tube, tank gauge, vent, and other fittings and appurtenances required for full and safe operation. Tanks shall be provided with support saddles, platform/stair and concrete pad. Molded neoprene isolation pads shall be provided at locations where steel contacts concrete to isolate the tank. Steel tank supports specifically are prone to encounter premature rusting due to constant exposure to moisture and their incompatibility with concrete.

Tanks of 3,880 to 45,400 liters (1,000 to 12,000 gallons) capacity shall be provided with 760 mm (30") diameter manways. Tanks larger than 45,400 liters (12,000 gallons) shall be provided with 900 mm (36") diameter manways. Tanks 3,800 liters (1,000 gallons) and larger shall be provided with a minimum of one (1) tank manway to allow for internal tank access. Piping shall not penetrate through access manways. Tank shall be provided with a combination cleanout and gauge connection.

Vent pipe sizing shall be not less than 32 mm (1-1/4") nominal inside diameter. Vent shall be the rupture disc type calibrated to burst at 14 kPa (2 psi) pressure, and operate at 80 percent of burst setting. Tank shall be provided with an overfill alarm system. Tank shall be provided with two (2) stick gauges graduated in m and mm. Stick gauge shall be of wood and treated after graduating to prevent swelling or damage from the fuel being stored. Cathodic protection shall be provided for metal components in accordance with the manufacturer's recommendations. Storage tanks shall be handled with extreme care to prevent damage during placement and shall be installed in accordance with the manufacturer's installation instructions.

At least one (1) external platform/ladder access to tank top (i.e. manway) shall be provided and installed on a concrete pad.

6.10.2 FUEL DISTRIBUTION SYSTEM

Fuel system shall be designed to supply clean fuel to the generator(s) and incinerator(s). Fuel shall be transferred from the bulk storage tank(s) by either the generator engine fuel pump(s), bulk tank submersible pump(s), or duplex-fuel pumps as determined by the designer and/or manufacturer, and be fitted with in-line fuel filters within 2 m (7') of the tank shell.

Fuel piping shall be black steel for ALL piping above grade and either steel or fiberglass for underground. Rubber hoses shall not be allowed. Under NO circumstances shall GALVANIZED piping, fittings, valves, or other equipment be used for fuel oil or diesel conveyance. Secondary containment for underground fuel piping shall be provided with either double-wall fiberglass, double-wall black steel inner and steel outer with cathodic protection, double-wall black steel inner and fiberglass outer, or either black steel or fiberglass piping located in a concrete secondary containment trench with applied POL-resistant coating and removable covers (traffic-rated as applicable). Piping shall be installed straight and true to bear evenly on supports. Piping shall be free of traps, not embedded in concrete or pavement, and drain toward the corresponding storage tank when elevation permits. Belowground nonmetallic pipe shall be installed in accordance with pipe manufacturer's instructions. Belowground piping shall be laid with a minimum pitch of 0.4 m per 100 m (0.4 percent slope).

Day tank(s) for generators shall be provided if so determined by the designer and/or manufacturer and **shall be provided one (1) for each generator set** and with secondary containment (i.e. Double-wall tank (Not commonly available at this time), containment dike, etc.) and store enough fuel to operate each generator set at full load for an 8-hour period. However, total capacity of all tanks located in an enclosed engine room shall not exceed 2,500 l (660 gal). Complete fuel piping hydraulic calculations shall be clearly shown in the 65% design analysis (DA) with the generator engine fuel pump manufacturers specifications (in the form of a catalog cut). and, if provided, the submersible or in-line fuel pump manufacturer's specifications.]

6.10.3 FUEL OFF-LOAD SYSTEM

A fuel filling system shall be provided for unloading fuel from fuel tanker trucks into individual bulk storage tanks and comprises of truck pad(s) and valves all in weather-proof cabinet. The system shall provide remote fuel level monitoring panels at the pad(s). Lockable containment box shall be provided to contain any spillage encountered during tank filling. Before construction begins, the Contractor shall coordinate with the Contracting Officer Representative and locate the fuel off-loading point outside of the perimeter wall to facilitate transfer of fuel from the commercial tanker trucks to the bulk storage tanks.

6.10.4 TANK/PIPE TESTING AND TURNOVER

A tightness test shall be performed on each storage tank and associated piping. The tank tests shall be performed prior to making piping connections. Tests shall be capable of detecting a 0.1 ml/s (0.0126 cu.ft/h) leak rate from any portion of the tank while accounting for effects of thermal expansion or contraction. Each storage tank shall be pressurized with air to 35 kPa (5 psi) and monitored for a drop in pressure over a two (2) hour period during which there shall be no drop in pressure in the tank greater than that allowed for pressure variations due to thermal effects. Following the tank tightness test(s), each storage tank shall be leak tested in accordance with the manufacturer's written test procedure if the manufacturer's test procedure is different from the tightness tests already performed. Also following the tank tightness test(s) all associated piping shall be tested using the same procedures stated for testing the tank(s), **The Contractor shall provide a full supply of fuel for EACH tank at the time of turnover to the Government**.

6.11 VEHICLE WASH FACILITIES-RACKS

The following shall be provided in the design and installation for wash facilities to clean vehicle exteriors only. This includes, but not limited to: Foundations, mountings, pumps (booster pumps if required), wash stations, equipment configurations. See Electrical Section for power, lighting, and electrical equipment requirements,

As a minimum, each wash station island shall consist of water supply piping with valve boxes, concrete pads with vehicle barriers and trench drains, tower(s), and cleanup hydrants (i.e. Hose bibs). **NO solvents or detergents are used to wash vehicles at the facility.**

Minimum pressure at the nozzles shall be 50 kPa (5.2 bars or 75 psi) with a minimum design flow rate of 95 lpm (25 gpm) for each tower arm hose and 95 lpm (25 gpm) for each hydrant, all operating simultaneously. Pressure and flow rate requirements shall be used to facilitate the (booster) pump selection. All pumps shall be installed on a concrete pad, protect in a weather-proof enclosed structure with bollards, and sized with hydraulic calculations that are included for review in the design analysis (DA), For facility site water supply, see Civil.

Each wash station shall be provided with heavy-duty traffic-rated trench drains, below-grade concrete valve box (with traffic-rated cover) to isolate from the water supply. For facility wash station site plan, see Civil.

In addition, each wash station shall be provided with at least one (1) 5 m (16') high tower of sufficient strength to support a minimum of one (1) hose pivot (i.e. Swing arm) without visible deflection. Hose pivot shall rotate a minimum of 180 degree and be a minimum or 3 m (10') in length (to pass over the vehicle), Hose pivots shall be provided with a flexible hose 10 m (32') minimum in length that is fitted with a durable triggered wand (i.e. Long nozzle type),and controlled by a tower-mounted manual valve. In addition, each wash station shall be provided with at least one (1) tower-mounted waist-high hydrant (i.e. Hose bibs) with a minimum length hose of 0 m (32') and hose reel to facilitate cleanup. All flexible hoses shall be the reinforced industrial type rated for a minimum working pressure or 2,000 kPa (20 bars or 300 psi). For freeze protection, all above-ground piping shall be sloped back to the base of the tower and provided with a 3 mm (1/8") weep holes (i.e. Drain openings) where the piping penetrates the concrete. For facility site water supply, see Civil.

The Contractor shall coordinate vehicle wash facilities projects with the environmental regulations, technical requirements, and concerns of multiple agencies within federal, state, and local governments. See Civil requirements for primary wastewater treatment.

6.12 LPG COOKING STOVE

Cooking areas shall be provided with canopy type exhaust and associated exhaust and outside make-up air fans. See paragraph Mechanical in this Section. New stoves shall be set into formed concrete openings such that they can easily be removed for replacement, maintenance, and cleaning.

6.12.1 COOKING STOVES/BURNERS

Each LPG-propane stove shall be provided with three (3) burners and metal frame with four (4) legs. The stoves shall be of commercial quality and be capable of producing the highest heat output with all three (3) burners on. The center burner is low heat, center and middle burner is medium heat and all three burners is high heat. A gas flow regulating-adjusting valves shall be provided for each burner at the face of the appliance.

Stove dimensions are approximately 720 mm (28”) long by 720 mm (28”) wide by 500 mm (20”) high.

6.12.2 GAS PIPING

Gas piping from the LPG/propane tanks to the respective gas stoves shall be wrought iron, ASTM B36.10M or steel (black or galvanized), ASTM A53. The steel piping shall terminate in front of the stoves with a shut off valve and quick disconnect nipple. A stainless steel flexible hose shall connect from the LPG/propane stove to the steel piping. Each end of the flexible hose shall be provided with quick disconnect fittings.

The LPG/propane piping shall not be embedded in the concrete floor. Installation of the LPG/propane piping in concrete trenches is highly recommended. The piping may be surface mounted provided that it is not susceptible to damage or causes any safety hazards.

Piping passing through the exterior wall shall be provided with pipe sleeves.

New stoves shall be set into formed concrete openings such that they can easily be removed for replacement, maintenance, and cleaning. Stove dimensions are 720 mm long by 720 mm wide by 500 mm high. The height includes the grill.

6.12.3 PROPANE FUEL STORAGE (45 KG BOTTLES)

LPG-propane storage tanks shall be located outside and exterior to the building in a storage yard.

The storage of fuels shall consist of individual 45 kg (100-pound) portable bottle tanks. For a 30-day supply of fuel, provide two (4) bottles per cook stove. **The Contractor shall provide all tanks filled with LPG/propane fuel at time of completion.**

Remote Storage Area: Stored filled and empty LPG/propane storage tanks shall be installed on a concrete pad and placed within a covered, secure, enclosure located a minimum of 8.0 m (26') from any occupied building. Portable bottle tanks shall be secured with chains to prevent tipping, and have caps on all bottles. Chain link enclosure with two (2) walkways and four (4) rows of tanks is recommended for ready access and easy securing of the bottles. Enclosed buildings are discouraged due to the potential for the buildup of propane in the event of a leak. Chain link fences with a visibility barrier are acceptable if the visibility barrier allows minimally impeded airflow.

Connected Storage: Connected Portable Tanks shall be located outdoors near or adjacent to the building behind a fire rated exterior wall. Tank area shall have a cover and be located in a chain link secured enclosure. One (1) tank per stove will be allowed in this location, with all tanks manifolded together (For facilities with three (3) or fewer stoves, the stoves may be individually piped.). The tanks shall be complete with fill fittings, tank gauge, vent, 2-stage and line regulators, and other fittings and appurtenances required for full and safe operation. Portable bottle tanks shall be secured with chains to prevent tipping.

6.13 MOTOR POOL REFUELING POINT (STORAGE-DISPENSING)

Fuel storage and distribution shall be provided to support the vehicles used at various locations. The fuels shall be stored in one or more above-ground or underground horizontal steel tank as per the capacity schedule given below.

Under NO circumstances shall GALVANIZED tanks be provided for storage of fuel oil or diesel.

The refueling point shall provide for both diesel and MOGAS of quantities as stated in Section 01010. The Contractor shall provide a full supply of fuel for ALL tanks at the time of turnover to the Government.

Tanks shall be complete with fill tube and cap, suction tube, tank gauge, vent, and other fittings and appurtenances required for full and safe operation. Tanks shall have overfill protection devices and remote overfill alarms. Aboveground tanks shall be provided with support saddles, platform/stair, concrete pad, and spill containment provisions. Underground tanks shall be with either, double-wall fiberglass, double-wall steel (Not commonly available at this time) with cathodic protection, or single-wall steel or fiberglass with a reinforced concrete secondary containment vault and applied POL-resistant coating.

Secondary containment dikes shall be provided for aboveground tank(s) and sized to contain the entire contents of the tank plus 10 percent. If more than one (1) tank is sharing a containment dike, then the dike need only be sized and have the capacity for the largest tank plus 10 percent.

Fuel piping shall be black steel only for piping located above grade and either steel or fiberglass for underground; rubber hoses shall not be allowed, except for fuel dispensers. Under NO circumstances shall GALVANIZED piping, fittings, valves, or other equipment be used for fuel oil or diesel conveyance. Secondary containment for underground piping shall be provided with either double-wall fiberglass pipe, double-wall steel with catholic protection, or steel or fiberglass pipe located in a concrete secondary containment trench with removal covers (traffic-rated as applicable) and applied POL-resistant coating.

Separate dispensing units shall be provided for diesel and MOGAS. Each dispensing unit shall be equipped with dual nozzles, two (2) mechanical dispensing meters, and key control. Fuel dispensing unit shall be installed on an island such that two (2) vehicles can simultaneously fuel on either sides of the dispensing unit.

6.13.1 TESTING & COMMISSIONING

The Contractor shall test all piping systems in accordance with IPC International Plumbing Code. The final test shall include a pressure test for all piping. After completing the work, the Contractor shall demonstrate that all piping systems operate to fully satisfy the function for which these systems have been designed. The Contractor shall test, adjust, balance and regulate the system and its controls as necessary until the required designed conditions are met. The Contractor shall include tests for interlocks, safety cutouts and other protective devices to demonstrate

safe operation. All such tests shall be carried out in the presence of the Government and full written records of the test data and final settings shall be submitted to the Contracting Officer. After all tests are complete, the entire domestic hot and cold water distribution system shall be disinfected. The system shall not be accepted until satisfactory bacteriological results have been obtained.

7.0 FIRE PROTECTION
7.1 PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers shall be provided inside all facilities and at exterior locations as required in accordance with NFPA 10. Generally, extinguishers will be of the multi-purpose dry chemical type except for occupancies requiring a special type extinguisher (e.g., carbon dioxide portable fire extinguishers for electrical rooms). Fire extinguishers shall be located in an accessible location, free from blocking by storage and equipment, near room exits that provide an escape route. The top of the extinguisher shall not be more than 1.5m above the floor and not less than 101mm above the floor. The extinguisher shall be easy to each and placed where it will not be damaged.

8.0 ELECTRICAL
8.1 GENERAL

Contractor shall design and construct all electrical systems for the facilities to be provided. This includes design, construction, all necessary labor, equipment, and material for a fully functional system.

8.2 ELECTRICAL WORKERS QUALIFICATIONS

Electrical work shall be performed by qualified persons with verifiable credentials who are thoroughly knowledgeable with applicable code requirements. Verifiable credentials consist of a certificate of graduations from an approved trade school and required amount of experience, depending on work being performed, and should be identified in the proposal that is submitted. A qualified person is one who has received training in and has demonstrated skills and knowledge in the construction and operation of electrical equipment and installations and the hazards involved. This includes the skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment, to determine the nominal voltage of exposed live parts, the clearance distances and corresponding voltages to which the qualified person will be exposed.

8.2.1 SUPERVISORY ELECTRICIAN

Supervisory electricians must be graduates of an approved trade school, and must have two years of relevant electrician experience. Approved programs include but are not limited to the Afghanistan Technical and Vocational Institute (in Kabul), the Kunar Trades Training Center, and the Commercial Technical Training Center (in Jalalabad). Work experience resumes and graduation certificates shall be submitted and approved prior to commencement of any design or construction involving electrical work. Approval is granted by the Contracting Officer's Representative with guidance by the Quality Assurance Branch and/or the Safety Office of the U.S. Army Corps of Engineers, Afghanistan Engineer District-South.

8.2.2 ELECTRICIANS

Electricians must be graduates of an approved trade school and must be able to provide upon request a certification of successful course work completion and graduation in addition to a resume of work experience.

8.3 DESIGN CRITERIA

8.3.1 APPLICABLE STANDARDS

Design shall be in the required units as stipulated herein. Conflicts between criteria and/or local standards shall be brought to the attention of the Contracting Officer for resolution. In such instances, all available information shall be furnished to the Contracting Officer for approval. All electrical systems and equipment shall be installed in accordance with the requirements set forth in the documents referenced herein.

8.3.2 ACCEPTANCE TESTING

Contractor shall develop and submit for approval complete acceptance test procedures on all systems provided. As a minimum the testing procedures shall comply with the requirements of the National Fire Protection Association (NFPA) and the International Electrical Testing Association Inc. (NETA).

8.4 MATERIAL

8.4.1 GENERAL

Unless noted otherwise, all material used shall be in compliance with the requirements of UL standards. In the event that UL compliant materials are not available, Contractor may then select applicable British Standards (BS), IEC, CE, CSA, GS, DIN listed material (or equivalent), but the Contractor must prove equivalence and must provide the government with a full copy of the relevant specification(s)/standard(s). Material and equipment installed under this contract shall be for the appropriate application and installed in accordance with manufacturers recommendations.

Equipment enclosure types shall be in compliance with the National Electrical Manufacturer's Association (NEMA) or the International Electro-Technical Committee (IEC) standards.

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a non-corrosive and non-heat sensitive plate, securely attached to the equipment. All equipment delivered and placed in storage, prior to installation, shall be protected from the weather, humidity and temperature variation, dirt and dust, and any other contaminants. All equipment shall be in new condition, undamaged and unused.

8.4.2 STANDARD PRODUCT

All material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

8.4.3 DESIGN CONDITIONS

All equipment shall be rated and designed for the maximum ambient temperature and altitude of the construction site. Equipment that is altitude and temperature sensitive, such as generators, shall be derated according to the manufacturer’s recommendations. Generic derating criteria for altitude and for ambient temperature may be used to approximate the required size of such equipment during the design phase, but a stipulation shall be placed on the construction plans to adjust the size according to the derating criteria specific to the manufacturer’s equipment chosen before the equipment is ordered.

8.4.4 RESTRICTIONS

Aluminum conductors shall not be specified or used except as bare steel reinforced (ACSR) overhead conductors in an aerial primary distribution system.

8.5 DESIGN REQUIREMENTS

8.5.1 ELECTRICAL DISTRIBUTION SYSTEM

The Contractor shall design and build a prime power distribution system to distribute power to the site’s facilities and other loads as required. The distribution system shall be underground.

The underground portion of the distribution system shall be in direct buried schedule 80 ductbanks, except for under roadways and heavy traffic areas, with the ducts not less than 1220mm below grade. Manholes and handholes shall be provided at changes of direction of more than 40 degrees and elsewhere as required to limit the pulling tension and sidewall pressure on the cables during installation to acceptable levels as defined by the cable manufacturer. Manholes shall be provided for ductbanks with more than 2 ducts. Handholes shall be provided wherever a manhole is not required by quantity of ducts or by cable manufacturer’s installation recommendations. Underground ducts shall be not less than 100mm diameter Schedule 80 PVC for non roadway and light traffic areas and concrete

encased schedule 40 for roadways and heavy traffic areas. The Contractor shall provide one additional duct per duct bank beyond the design for future growth.

The Contractor shall design and build a medium voltage primary distribution system with distribution feeders to supply power to distribution transformers. The transformers shall be loop feed, dead front type with load break elbows. Each transformer shall be sized to provide power for the total load of the facility served without being loaded to more than 110% of its rated capacity.

The Contractor shall provide all required conduit stub ups to connect all equipment (both present and planned) to the switchgear lineup. Contractor shall provide stepup transformers and the required conduits to connect the generators to their respective transformer and the transformers to the switchgear lineup.

Transformers shall be strategically located close to the loads. Primary side load-break disconnecting means shall be provided with all transformers. Transformers shall come complete from manufacturer. Transformer selection, design, and installation shall be governed by NEC, NESC, ETL 1110-3-412, TM 5-684, UFC 4-510-01, UFC 3-550-03FA, UFC 3-550-03N, IEEE C57.12.28, ANSI/IEEE C57.12.22, IEEE C57.12.34, and C57.12.80.

Size of transformers and power feeds shall be governed by UFC 4-510-01, NFPA 99, and the NEC. In case of conflict between transformer design criteria between the above named standards, UFC 4-510-01 shall govern; in cases where UFC 4-510-01 cannot resolve the conflict, it shall be brought to the attention of the Contracting Officer for resolution.

Design of the electrical system within facilities shall include, but is not limited to (a) interior secondary power distribution system, (b) lighting and power branch circuit and devices, and (c) fire detection and alarm system. All systems shall be designed for the demand loads, plus 25% spare capacity.

The Contractor shall provide feeders from the distribution system to each facility. Equipment shall include a distribution panel board shall be sized for the total load of each facility plus 25% spare capacity for future growth. Feeder lengths shall be kept as short as possible to minimize voltage drop.

All panelboards shall be circuit breaker ‘bolt-on’ type panels. Circuit breakers shall be connected to bus bar(s) within the panelboards. Daisy chain (breaker-to-breaker) connection(s) are not acceptable. Indoor distribution panels shall be surface mounted. All circuit breakers shall be labeled with an identification number corresponding to the panel schedule. A 3-pole circuit breaker shall be a single unit and not made up of 3 single pole circuit breakers connected with a wire or bridge to make a 3-pole breaker. All branch circuit wiring shall be copper. All building service entrance (service intake) panels shall be provided with kilowatt-hour (KWh) meters. A voltmeter and ammeter shall be provided also. All metering shall read true RMS values. Series rated equipment is not permitted. A digital power meter in lieu of a KWh meter, ammeter and voltmeter may be provided. Digital power meters shall meet or exceed ANSI/IEEE C37.90.1. Power receptacles (outlets) shall be 220 V, 50 hertz, 16 amp type CEE 7-7 three-wire grounded and shall be compatible with the required secondary power. All splicing and terminations of wires shall be performed in junction or device boxes. Proper wire nuts/connectors shall be used for splicing wire. No twist-wire connections with electrical tape wrapped around it shall be acceptable. All electrical installation shall be in accordance with NFPA 70 (National Electric Code), British Standard (BS) Wiring Regulations, International Electrotechnical Commission (IEC) standards, or Deutsches Institut fur Normung (DIN) standards. Receptacle locations are dictated by NEC, British, and other electrical standards.

Contractor shall design and provide circuits for all mechanical equipment and any other equipment that requires power and make the final connections.

Phase imbalance at each panel shall not exceed 5%.

Voltage Drop for branch circuits should be limited to no more than 3%; voltage drop for branch and feeder circuits combined should be limited to no more than 5%.

All circuit breakers shall use down-stream coordination to ensure the breaker nearest a fault or overload is the first to trip.

8.5.1.1 GENERATOR POWER SYSTEM

Generators: The generator power system shall consist of six (6) individual 1.0 megawatt Prime Power Rated (1.25 megawatt NOMINAL, or 1.0 megawatt at 50Hz as derated for temperature and altitude) capacity generators for supply and distribution to all buildings. The generators shall be provided with a synchronizer switch, so that when

the total power demanded from one generator reaches 90 percent of the generator's maximum, an additional generator shall automatically start and supplement the running generator(s). Generators shall be programmed to run equally. The facility must be designed and built to accommodate two (2) additional generators for future expansion therefore providing a total capacity of eight (8) 1.0-MW generators.

The generators will supply power at a higher distribution voltage. Stepup transformer(s) shall be provided to step up the voltage to 15kV.

Generators shall be derated as necessary for the ambient temperature and altitude of the site and equipped with double air filtration for dusty environment. Generators shall be designed for 50C ambient temperature and be equipped with 50C radiators.

The generator power system shall be equipped with synchronizing/paralleling equipment to allow the generators to share the load of the site. When generator power is required at least one (1) generator shall be online at all times. When the site's load reaches 90% of the online generator's capacity, another generator(s) shall start. The generator that synchronizes first shall come online and share the load equally. When the site's load drops below 80% of the online generators' combined capacity, the generator(s) shall drop off line, one at a time, keeping a minimum of one generator operating online.

Whenever a generator stops, it shall go through a cool down cycle prior to shutdown. All relaying shall be automatically reset for automatic restart and stopping of generators as the load increases or decreases. Load sharing by the standby generator(s) shall be adjustable between 50% and 95% of the load on the online generator(s). Sequence of operation shall be time clock controlled. A properly sized main switchboard shall be provided to distribute the power produced by the generator(s) to the facilities on the site.

Individual back-up generators shall be provided for the wells and water distribution, the waste water treatment plant, the DFAC, and the medical clinic.

Prime Power Plant: Design and construct one (1) central power plant for power supply to all facilities requiring power on the garrison. The power plant shall be a single, enclosed, stand alone building that will house the prime power generators, switchgear, and all appurtenances necessary to meet all power requirements.

For information only, the ANA Regional Brigade, Afghanistan, Power Plant, design drawings that area provided in the Appendix shall be used as a reference for the design of the power plant. This project does not require a black start generator.

Design and construct a suitable generator pad with secondary containment for the generators. The generator pad shall have vibration isolators and the capability to dampen vibration to the surrounding ground through the use of foam plastic and sand. Install the generators with connections to the fuel supply tank(s), complete transmission/distribution system, transformers, panels, black start generator, and all other required appurtenances for a basic, fully operational system. Switchgear and control panels must be designed to accept the future expansion for additional generators.

Provide fuel storage for a 30 day supply. Fuel storage shall have secondary containment with a sump and drain with valve(s) for draining rainwater. The fuel storage area must be designed to accommodate additional tanks for future expansion at the power generation facility. **Fuel for commissioning and testing shall be provided by the Contractor. Also, the Contractor shall provide fuel tanks that are completely full at the time of turnover to the Government.**

The power plant and fuel storage shall be enclosed within a compound with aggregate surfaced employee and government vehicle parking and vehicle roadway and maneuver area. The compound shall be surrounded with a 3 m high chain link fence with Y-channel and triple strand concertina wire with two (2) lockable double swing arm vehicle gates and one (1) lockable personnel gate. Construct the fencing and gates per the Fencing Details provided in the Appendix.

For fuel storage requirements, see Mechanical paragraph: Generator Fuel Storage/Distribution.

8.5.2 LIGHTING

Design levels shall be per IES standards as a minimum. For convenience, the following lighting level table is listed. Note: all spaces listed below may not be within the work required within this contract.

Living room/Quarters	35 FC (350 Lux)
Toilets, Showers, Latrines, washrooms	20 FC (200 Lux)
Mechanical/Electrical rooms	30 FC (300 Lux)
Corridors and Stairways	20 FC (200 Lux)
Offices (private)	50 h/5 v FC (500 h/50 v Lux)
Office areas (open)	30 h/5 v FC (300 h/50 v Lux)
Kitchens (commercial)	70 h/3 v FC (700 h/30 v Lux)
Dining Areas	20 h/3 v FC (200 h/30 h Lux)
Auditoriums (social)	5 h/3 v FC (50 h/30 v Lux)
Conference	30 h/5 v FC (300 h/50 v Lux)
Armories	30 h/3 v FC (100 h/30 v Lux)
Reading (at desk-serious)	50 h/10 v FC (500 h/100v Lux)
Patient Rooms (general)	Per UFC 4-510-01
Patient Rooms (critical)	Per UFC 4-510-01
Egress path (incl. exterior)	10 Lux
Areas adjacent to egress path	0.5 Lux
Areas Requiring Lighting Per Section 01010	0.5 Lux

FC = FootCandle

h = horizontal component

v = vertical component

Area lighting for the Motor Pool shall have photocell controlled switches.

8.5.3 INTERIOR AND EXTERIOR LIGHTING

Indoor lighting for all areas shall consist of fluorescent surface mounted light fixtures.

Exterior lighting such as light steel pole shall be HID (metal halide or high pressure sodium).

Moisture resistant/waterproof fluorescent light fixtures shall be provided in high humidity and wet areas such as latrines, showers and outside. Battery powered ‘emergency’ and ‘exit’ lights shall be provided within each building, as applicable, for safe egress during a power outage. All light fixtures shall be factory finished, complete and operational, to include but not be limited to, lens, globe, lamp, ballast etc. Every room shall be provided with a minimum of one light switch. Light fixtures shall be mounted approximately 2.5-meters above finished floor (AFF) minimum. Fixtures may be pendant or ceiling mounted, depending on the ceiling type and height.

8.5.4 LIGHT FIXTURES

Lighting fixtures shall be a standard manufacturer’s product. Fluorescent surface mounted light fixtures shall be power factor corrected and equipped with standard electronic ballast(s), except in medical facilities where magnetic ballast(s) are required. Ballasts shall be rapid start type. All light fixtures shall properly operate using standard

lamps available locally. Fixtures shall be fully factory wired and designed for appropriate application i.e. appropriate for that location where installed.

8.5.5 EMERGENCY "EXIT" LIGHT FIXTURES

Emergency "EXIT" light fixture shall be provided in accordance with NFPA requirements. Fixtures shall be single or double sided as required by the location and for wall/ceiling mounting. Unit shall illuminate continuously and be provided with self-contained nickel cadmium battery pack, to operate on floated-battery or trickle charge circuit. Fixture shall operate satisfactorily for 90 minutes during a power outage. Unit shall have test/re-set button and failure indication lamp. Primary operating voltage shall be 220 volts. Lettering "EXIT" shall be color red and not less than 150 mm in height and on matte white background. Illuminations shall be with LEDs.

8.5.6 EMERGENCY LIGHTING

Battery powered emergency lights shall be provided within each building per NFPA for safe egress during power outage. Fixtures shall be provided with self-contained nickel cadmium battery pack to operate on stand-by circuit for 90-minute minimum. Unit shall have test/re-set button and failure indication lamp. Normal operating voltage shall be 220 volts. Emergency lighting fixtures shall be connected to the normal lighting system.

8.5.7 LIGHT SWITCHES

Light switch shall be single pole. Minimum of one light switch shall be provided in every room. Lighting in rooms with multiple means of egress may be controlled from multiple switches.

8.5.8 RECEPTACLES

General-purpose receptacles shall be as required herein.

Areas with computer work-stations or similar equipment will have additional receptacles. Sinks may have a receptacle above. All receptacles shall be duplex, unless otherwise specified in this section, the NEC, or other referenced standard. Receptacles in wet/damp areas or within 1 meter of sinks, lavatories, or wash-down areas shall be ground fault circuit interrupter (GFCI) type or residual current disconnect (RCD) type. Total number of receptacles shall be limited to six (6) per 20-ampere circuit breaker.

8.5.9 CONDUCTORS

All cable and wire conductors shall be copper. Conductor jacket or insulation shall be color coded to satisfy requirements of the NEC. The use of 75 or 90 degree C (minimum) terminals and insulated conductors is required. Use of higher degree C rated conductors on circuits with protective device terminals rated at a lower degree C is allowed but must be derated to the rating of the device terminals.

8.5.10 GROUNDING AND BONDING

Grounding and bonding shall comply with the requirements of NFPA 70. All exposed non-current carrying metallic parts of electrical equipment in the electrical system shall be bonded. Insulated equipment grounding conductor (separate from the electrical system neutral conductor) shall be installed in all feeder and branch circuit raceways. Equipment grounding conductor shall be green-colored, unless the local authority requires a different color-coded conductor. If required, ground rods shall be 20 millimeters in diameter and 3 meters long made of copper-clad steel.

8.5.11 ENCLOSURES

Enclosures for exterior and interior applications shall be NEMA Type 3S (IEC Classification IP54) and NEMA Type 1 (IEC Classification IP10) respectively.

8.5.12 FIRE DETECTION & ALARM SYSTEM

A complete Fire Detection and Alarm System shall be provided throughout the buildings and installed in accordance with NFPA 72 requirements. System shall include, but not limited to, Fire Alarm Control Panel (FACP), manual pull stations, horns, strobes, and smoke and/or heat detectors (with alarm verification feature). Fire alarm system shall be complete and a standard product of one manufacturer.

8.5.13 CONDUIT RACEWAY SYSTEM

Metal conduit (EMT) system shall be complete, to include but not limited to, necessary junction and pull boxes for all surface mounted conduit systems. PVC conduit, junction and pull boxes are allowed for raceways not subject to severe damage. All empty conduits shall be furnished with pull wire or cord or rope (depending on the size of conduit and length of run). System design and installation shall be per NFPA 70 requirements.

8.5.14 CABLE TRAY RACEWAY SYSTEM

Cable trays shall be ladder type and provided with, but not limited to, splices, end plates, dropouts and miscellaneous hardware. System shall be complete with manufacturer's minimum standard radius and shall be free of burrs and sharp edges. Nominal width of cable tray shall be per NFPA 70 requirements. The cable tray shall be made of galvanized steel.

8.5.15 IDENTIFICATION NAMEPLATES

Major electrical equipment, such as transformers, panelboards, and load centers, etc. shall be provided with permanently installed engraved identification nameplates. The nameplates shall mention the source that feeds each major piece of electrical equipment.

8.5.16 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)

Transient Voltage Surge Suppression shall be provided utilizing surge arresters to protect sensitive and critical equipments. As a minimum TVSS protection shall be provided at each panel serving electronic loads and shall be shown on the panel schedule. It is recommended that Metal Oxide Varistor (MOV) technology be used for such applications.

8.5.17 SCHEDULES

All panel boards and load centers shall be provided with a directory. Directory shall be typed written in English, Dari, and Pashto. The directory shall also indicate the source where the panelboard/loadcenter is fed from.

8.5.18 SINGLE LINE DIAGRAM

Complete single line diagrams shall be provided for all systems installed. All major items in each system shall be identified and labeled for respective ratings. Single line diagrams for each system, installed in a clear plastic enclosure, shall be provided. Most current version of design, based on current design review, shall be kept on project site at all times for reference, and updated with redline edits to show any and all variations from the drawings.

8.6 OPERATIONS AND MAINTENANCE (O&M) FOR ELECTRICAL

The O&M manuals must be provided prior to any training activities. Manuals shall be "tri-lingual" in Dari, Pashto and English.

All control panels shall have tri-lingual name plates in Dari, Pashto and English.

The Contractor shall provide an outline of the training lesson plan (to be approved by the Government) prior to conducting training. CD recordings of training on video shall also be provided, after training is conducted.

9.0 COMMUNICATIONS SYSTEM

9.1 DESIGN CRITERIA

9.1.1 APPLICABLE STANDARDS

Design shall be in the required units as stipulated herein. Conflicts between criteria and/or local standards shall be brought to the attention of the Contracting Officer for resolution. In such instances, all available information shall be furnished to the Contracting Officer for approval. All communications systems and equipment shall be installed in accordance with the requirements set forth in the documents referenced herein.

The Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by designation only.

United States Department of Agriculture, Rural Utilities Service

RUS Bulletin 1751F-643 (2002) Underground Plant Design

RUS Bulletin 1751F-644 (2002) Underground Plant Construction

RUS Bulletin 1753F-151 (2001) Construction of Underground Plant, Parts II & III

ANSI TIA/EIA 606-A (2002) Administration Standard for The Telecommunications Infrastructure

ANSI TIA/EIA 607-A (2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

ANSI TIA/EIA 568-C.1 (2009) Commercial Building Telecommunications Cabling Standard

ANSI TIA/EIA 568-C.2 (2009) Balanced Twisted-Pair Telecommunications Cabling and Components Standards

ANSI TIA/EIA 568-C.3 (2008) Optical Fiber Components Standard

ANSI TIA/EIA 569-B (2004) Commercial Building Standard for Telecommunications Pathways and Spaces

ANSI TIA/EIA 758-A (2004) Customer-owned Outside Plant Telecommunications Infrastructure Standard

UFC 3-580-01 Telecommunications Bldg Cabling Systems Planning/Design

9.2 COMMUNICATION SYSTEM

The Contractor shall design, provide, and install the exterior and interior communications infrastructure. The exterior communications infrastructure shall provide a looped communication system for perimeter security functions. The communications duct bank shall run to all guard towers, guard houses, ECPs, and back to the central Communications Room located in Battalion HQ Building. The interior communications infrastructure shall provide a pathway to all communications outlets and head-end equipment located in the building. Communications head-end equipment, cabling, RJ45 jacks, and faceplates shall be provided by others. The design and construction of the systems shall be in accordance with the references and the requirements contained herein.

9.2.1 EXTERIOR COMMUNICATION SYSTEM

The Contractor shall design, provide and install the exterior communications infrastructure system. The system shall include but is not limited to communications manholes, hand-holes, inner duct, and underground ductbank. The Contractor shall coordinate the communication system with the power distribution system to distribute communications to the site's facilities as required. The distribution system shall be an underground system. Communications manholes and hand-holes-shall not be shared with other utilities. Manholes and hand-holes shall be cast in place or precast type. Manholes minimal interior dimensions shall be 3.66m L x 1.83m W x 2.13m H. Hand-holes minimal interior dimensions shall be 1.22m L x 1.22m W x 1.22m H. The minimum concrete thickness shall be 127mm for walls, 152mm for roof, and 127mm for the floor. The quality of the concrete pour and the construction of the manhole and hand-hole shall be such that the rebar or visible rock shall not be seen in the surface of a wall. In other words, the pour shall not have any voids. The maximum distance between manholes and/or hand-holes shall be 170 m. Place a manhole or hand-hole at all 90 degree turns. The ducts shall be direct buried with a minimum of 900 mm of properly tamped dirt/backfill on the top. Hand-holes shall be installed in laterals between manholes and buildings only where the distance between manhole and the building is 100 meters or more. The maximum number of ducts in a hand-hole wall shall be two, with one having four (4) inner ducts installed unless there are two buildings close by and can be fed from one hand-hole. In this case, four (two with inner ducts) conduits can be installed in the walls. Manholes and hand-holes shall be installed on a leveled, crushed, washed gravel base of sufficient depth, i.e.,a minimum thickness of 150 mm under the entire manhole or handhole, to allow for drainage and stability. Where manholes and hand-holes are installed in roadways or areas subject to vehicular traffic, the structure and lid (cover) shall support heavy vehicular traffic. Manholes and hand-holes shall be equipped with corrosion-resistant pulling irons and cable racks that are grounded and with a sump for drainage. Cable racking diagrams (manhole/hand-hole butterflies) shall be provided for the manholes and hand-holes. See accessories chart below for additional requirements.

Manhole and Hand-hole Accessories	HANDHOLE 1.22m X 1.22m X 1.22m	MANHOLE 3.66m X 1.83m X 2.13m
Bonding Ribbon 16mm	20	65
Bonding Ribbon Clamps	12	20
Cable Rack 762mm	4	
Cable Rack 47 Hole		14
Corner Cable Rack Support		8
Cable Rack Hook 191mm	8	14 minimum
Cable Rack Standoff Bracket	9	12
Concrete Collar 152mm	1	1
Cover (Lid) 762 Diameter	1	1
Frame Support Structure for Lid	1	1
Ground Rod 19mm X 3m	1	1
Ground Rod Clamp 19mm	1	1
Metal Hit Anchor	10	20
Pull-In Irons	4	4
Sump	1	1

9.2.1.1 EXTERIOR CONDUIT

The underground conduit for the manhole and duct system shall be direct buried (900 mm below surface), 100 mm DB type PVC or schedule 80, PVC. Inner ducts shall be four (4) 25 mm PVC or PE inner ducts field installed in the outer-duct. The inner ducts shall be installed in the duct face and secured with properly sized duct plugs which expand to seal the duct. The ducts shall be stubbed up, sealed, capped and tagged in the communications equipment room, and shall be sealed, capped, tagged and marked at the other end. Empty ducts shall be sealed with a mechanical, screw-type, reusable duct plug. The ducts shall be concrete encased when install under roadways or areas subject to vehicular traffic. The ducts (inner and outer) shall be listed on the RUS list of materials acceptable for use on RUS projects. The minimum duct configuration in the main duct system shall be a six way duct, being three conduits wide by two conduits deep (3 X 2) with two of the conduits having inner-ducts installed. Laterals off of the main duct system manhole to manhole shall be a minimum of a 4 way (1x4) with one duct having inner ducts. The duct system from the manhole/hand hole to a building with cable installed shall be a 1x2, 100 mm PVC duct bank with one duct having inner ducts. The duct system from a manhole/hand-hole to a building with allocations only shall be two (2), 100 mm DB type PVC conduits stubbed out 3 meters from the manhole/hand hole. All conduits shall be terminated in ABS plastic terminators cast into the walls of the concrete structures. In manholes, all conduit windows shall be recessed. Pull wire/rope must be provided in all conduits. Conduits shall enter the manholes and hand-holes in the lower portion of the knockout window to simplify future conduit additions..

9.2.2 MAIN DISTRIBUTION FRAME

The Contractor shall route all communications to the Main Distribution Frame located in central Communications Room.

9.2.3 BUILDING INTERIOR COMMUNICATIONS SYSTEM

The Contractor shall design, provide and install the building communications infrastructure system. The system shall include but is not limited to communications equipment racks, conduit, pull boxes, communications outlet boxes, and communications grounding/bonding infrastructure. Provide communications outlet boxes in locations shown on the standard drawings. Outlet boxes shall be a single gang box (51 mm x 102 mm x 57 mm) or double gang box (119 mm x 119 mm x 57 mm boxes). The contractor may use an equivalent sized outlet box. Conduit shall be installed from each outlet box location to the communications equipment rack location. Label the conduit on both ends with room number and outlet box number. Contractor shall coordinate the location of the communications rack

to be installed in central Communications Room. Equipment racks shall be standard wall mounted 19" steel telecommunications racks. Provide all empty conduits with a pull rope. Properly sized metallic conduit and cable tray shall be used as appropriate to distribute the telephone/data cabling throughout the building. Minimum conduit size shall be 20 mm inside diameter. Pull boxes shall be placed in conduit runs where a continuous conduit length exceeds 30 meters or where there are more than two 90-degree bends. Pull boxes shall be placed in straight runs of conduit and shall not be used in lieu of a bend. Equipment racks shall be wall mounted and 475 mm wide. Equipment racks shall have a minimum 900 mm of space both in front of and behind the rack and behind any installed equipment. A minimum side clearance of 600 mm shall be provided on end racks. The contractor shall provide a grounding and bonding system in accordance with ANSI TIA/EIA 607-A. The grounding system shall include but is not limited to a Telecommunications Main Grounding Busbar (TMGB), Telecommunications Grounding Busbars (TGB) where applicable, Telecommunications Bonding Backbone (TBB), Grounding Equalizer (GE), and Bonding Conductors.

9.3 TESTING

Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568-C.1 and TIA-568-C.2, Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

9.3.1 INSPECTION

Visually inspect UTP and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1, TIA-568-C.2, Visually confirm Category 6 marking of outlets, cover plates, outlet/connectors, and patch panels.

9.3.2 VERIFICATION TESTS

UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connected. For single-mode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with TIA-568-C.3 and TIA-526-7 using Method A, Optical Power Meter and Light Source for single-mode optical fiber. Perform verification acceptance tests.

9.3.3 PERFORMANCE TESTS

Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA-568-2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew. Perform verification tests for UTP and optical fiber systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

9.4 LOUDSPEAKER AND ALARM SYSTEM

Install Loud Speaker & Alarm System that can alert the entire compound via panic button from any tower or guard post station. Loud Speaker & Alarm System shall include, but is not limited to central control stations, high power speaker arrays (HPSA), communication links, and ancillary equipment. Central control stations shall operate and control the system. Loud Speaker & Alarm System shall be capable of providing intelligible live and pre-recorded voice signals. The system shall include tones for conventional attack warning, non-conventional attack warning, all clear, and a system test tone. Speaker & Alarm System shall be exterior grade components to withstand severe weather conditions of cold, heat, rain, sleet, and dust storms and to be completely understandable during these conditions from any point within the compound. All wires shall be installed in conduits.

9.4.1 CENTRAL CONTROL STATIONS

Loud Speaker & Alarm System shall be provided with at least one primary and one redundant central control station. The locations of the central control stations shall be coordinated with the Contracting Officer's Representative. The primary central control station should be located at the command post or similar location. The redundant central control center should be located at a physically separate location such as a security forces building, military police station, fire station, or emergency services office. The central control stations shall control the operation of outdoor speakers. Each central control station shall be equipped with batteries to supply power for a minimum of 4 hours of

full-load operation. Control stations shall be capable to provide automatic status reporting for each HPSA and for all activations and the status of the activations. The controls shall provide an alarm summary report that provides a historical report for all changes of status, including all troubles, equipment failure, power system trouble (including normal and emergency power), unsolicited messages, tamper/supervision of the enclosure for the HPSA electronics, amplifier status, last activation and synchronization error, operator log on and log off, and configurable reports for time-based events such as "report all troubles from 1/01/04 to 6/30/04." Control stations shall feature multiple levels of password protection, including levels for system operators, maintainers, supervisors, and military commanders. The control stations shall be capable to deliver at least two essentially concurrent voice messages: one for threatened areas or buildings and one for adjacent areas or buildings. This includes the capability for two pre-recorded voice messages, or one live and one pre-recorded voice message. The control station shall have the capability to target specific messages to any individual HPSA, zone of HPSAs, or to all areas on the installation

9.4.2 HIGH POWER SPEAKER ARRAYS (HPSA)

HPSAs shall be arranged into zones so that each zone can be individually controlled by the control station. HPSAs shall be designed with directional characteristics that will minimize the distortion of voice signals by interface from other zones. HPSAs shall be designed to maintain the intelligibility of voice signals within the zone at a level no less than 0.8 on the Common Intelligibility Scale (CIS) or 0.7 on the Speech Transmission Index (STI) during normal weather conditions in special outdoor areas such as those with a high concentration of multi-story buildings in close proximity. Parade grounds, training fields, and similar outdoor areas should also be provided with this higher intelligibility. Intelligibility may be less than 0.8 CIS in areas of the zone if personnel can determine that a voice signal is being broadcast and could walk less than 25 m to find a location in the zone with a CIS score of at least 0.8. It is necessary to control the occupational noise exposure to personnel from the HPSA. Sound levels at any location where personnel may be located, including directly underneath the HPSA, shall not exceed 120 decibels (adjusted) (dBA) when measured on the A-scale of a standard sound level meter at slow response. Do not exceed 85 dBA at the location of the individual HPSA equipment cabinet for those HPSAs designated to be furnished with a local microphone. Each HPSA site for each zone shall include a field-mounted local control unit, microprocessor, amplifier, standby batteries, charger, power supply, radio, mounting brackets and loudspeaker assembly for pole or building mounting. Designated HPSA sites shall be capable of microphone input and shall be provided with a microphone designed to prevent feedback at that particular microphone location. All external conductors (conductors passing outside of the HPSA equipment cabinet) shall be provided with surge suppression tested to Underwriters Laboratories, Inc. (UL) standards. The HPSA control units shall feature a digitally addressable controller. The HPSA control units shall receive and store messages via the primary (and redundant, if required) communication link with a confirmation signal sent back to the primary and redundant central control stations. Provide a charger/ power supply that will accept alternating current (AC) input, backup electrical power generator input, battery input, or solar power cell input. The HPSA control units shall have the capability of storing pre-recorded messages. The HPSA control units shall provide a minimum of 7 standard tones. In addition, the systems shall have the capability to provide custom tones. Provide a tamper switch that will signal the central control station that the HPSA enclosure door is open. All equipment for each HPSA speaker site shall be housed in modular, mountable cabinets suitable for the local environmental conditions, including space heaters and ventilation fans, as appropriate. Speakers shall be able to operate between temperatures of -40 degrees Celsius (C) (-40 degrees Fahrenheit (F)) to +60 degrees C (+140 degrees F). Enclosures shall protect the HPSA control unit from external temperatures ranging from -40 degrees C (-40 degrees F) to +60 degrees C (+140 degrees F). The height shall not be less than 9 m (30 ft) or greater than 18 m (60 ft) above ground level. HPSA equipment cabinets shall be mounted on the elevated supporting structure with the top of the enclosure no more than 3 m (10 ft) above ground level. The equipment cabinet and power boxes must be capable of being locked shut.

9.4.3 COMMUNICATIONS LINKS

Primary communications shall use radio frequency-type systems that comply with National Telecommunications and Information Administration (NTIA) requirements. The systems shall be designed to minimize the potential for interference, jamming, eavesdropping, and spoofing. Confirm that the devices conform to regulations and obtain the approval from the authority having jurisdiction prior to using radio frequency-type devices. Redundant communication means (when required) should be established using several alternate wireless radio frequency paths to the radios. The redundant communication means might be accomplished by using the communications backbone network (e.g., optical fiber cable). In this case, the central control units should accomplish this by being directly connected to the backbone network. Communications equipment furnished as part of the wide area MNS shall be commercial off-the-shelf (COTS). All programming codes or passwords required to access, update, modify, and

maintain the communications equipment shall be provided no later than the date of final system acceptance. Full system supervision shall be provided. Notification of system alarm, supervisory, and trouble signals shall be provided to the central control stations within a time period not to exceed 200 seconds. The communications systems shall provide self-test and diagnostics capabilities. Local diagnostics information shall be transmitted to the central control stations.

END OF SECTION

SECTION 01321
PROJECT SCHEDULE

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referenced in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE) ER 1-1-11 (1995) Progress, Schedules, and Network Analysis Systems

1.2 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The scheduling of Construction design and construction shall be the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Designers, Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. The Contractor is responsible for scheduling the construction contract work to include procurement of critical materials and equipment, Contractor quality control and construction, acceptance testing and training. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor's progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, the Contracting Officer may hold, retain up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made. Resource loading of cost is required and will be used as the cost breakdown for progress payments.

3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the Project Schedule shall be capable of providing all requirements of this specification. Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer. Project schedules must be prepared and maintained in a software compatible with current versions of government’s systems RMS and Primavera Project Manager. Contracts with price value over $500,000 will use Primavera SureTrak, Primavera Project Manager P6, or current version of government’s systems. The Licensed copy of scheduling software shall be submitted for acceptance to the Contracting Officer within two weeks after Contract Award.

3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in the Precedence Diagram Method (PDM).

3.3.2 Level of Detail Required

The Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule.

The Network Analysis System (NAS) shall identify all Government, Construction Quality Management (CQM) Construction activities planned for the project and all other activities that could impact project completion if delayed. Refer to 3.5.5.4 Banding for further detail in grouping activities.

With the exception of the Contract Award and Contract Completion Date (CCD) milestone activities, no activity shall be open-ended; each activity shall have predecessor and successor ties. Once an activity exists on the schedule it may not be deleted or renamed to change the scope of the activity and shall not be removed from the schedule logic without approval from the Contracting Officer. The ID number for a deleted activity shall not be re-used for another activity. No more than 20 percent of the activities shall be critical or near critical. Critical is defined as having zero days of Total Float. "Near Critical" is defined as having Total Float of 1 to 14 days. Contractor activities shall be driven by calendars that reflect Saturdays, Sundays and all Federal Holidays as non-work days.

The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule:

3.3.2.1 Activity Durations

Contractor submissions shall follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods (usually less than 2 percent of all non-procurement activities' Original Durations are greater than 20 days).

3.3.2.2 Design and Permit Activities

Design and permitting activities, including necessary conferences and follow up actions and design package submission dates, shall be integrated into the schedule.

3.3.2.3 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, and delivery. The Contractor shall show each delivery with relationship tie to the Construction Activity specifically for the delivery. For rejected material/equipment not in compliance with approved submittals a new procurement activity shall be inserted in the schedule.

3.3.2.4 Critical Activities

The following activities, as applicable, shall be listed as separate line activities on the Contractor's project schedule:

a. Submission and approval of mechanical/electrical layout drawings.
b. Submission and approval of O & M manuals.
c. Submission and approval of as-built drawings.

d. Submission and approval of 1354 data and installed equipment lists.
e. Submission and approval of testing and air balance (TAB).
f. Submission of TAB specialist design review report.
g. Submission and approval of fire protection specialist.
h. Submission and approval of testing and balancing of HVAC plus commissioning plans and data.
i. Air and water balance dates.
j. HVAC commissioning dates.
k. Controls testing plan.
l. Controls testing.
m. Performance Verification testing.
n. Other systems testing, if required.
o. Pre-final inspection.
p. Correction of punch list from pre-final inspection.
q. Final inspection.

3.3.2.5 Government Activities

Government and other agency activities germane to the contract shall be shown. These activities include, but are not limited to: design reviews, environmental permit approvals by State regulators, inspections, proposals and pay estimates reviews, and utility tie in.

3.3.2.6 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, contractor work force, or government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

3.3.2.7 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

3.3.2.8 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible, changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications. A new current approved baseline shall be created to reflect the changes to the previous approved baseline (see item 3.5.5.6 Baseline Network Analysis Schedule.)

3.3.2.9 Work Item

All activities shall be identified in the project schedule by the Work Item to which the activity belongs. An activity shall not contain work in more than one work item. The work item for each appropriate activity shall be identified by the Work Item Code.

3.3.2.10 Phase of Work

All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

3.3.2.11 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as designs, design package submissions design reviews, review conferences, permits, submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

3.3.2.12 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to, a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

3.3.3 Scheduled Project Completion

The schedule interval shall extend from award of contract to the contract completion date.

3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which award of contract was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have an "ES" constraint date equal to the date that the award of task order was acknowledged, and a zero day duration.

3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted in the narrative report at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually complete prior to the contract period.

3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the award of task order was acknowledged, and a zero day duration.

3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Program features which calculate one of these parameters from the other shall be disabled.

3.3.6 Out-of-Sequence Progress

Activities that have posted progress without all preceding logic being satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contractor shall propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule.

3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

3.4.1 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 30 calendar days after award of contract. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail. The baseline schedule shall be reviewed and deemed acceptable prior to the contractor entering (manually or electronically via SDEF file) in QCS.

3.4.2 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

3.4.3 Standard Activity Coding Dictionary

The Contractor shall use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used. The contractor shall assure the schedule contains the holidays, fiscal year starting month, work day start and finish shift and preferences for units of time, observed by the government.

3.5 SUBMISSION REQUIREMENTS

The following items shall be submitted by the Contractor for the preliminary submission, initial submission, and every periodic project schedule update throughout the life of the project:

3.5.1 Data Disks

Two (2) Data Compact Disks containing the project schedule shall be provided. Data on the disks shall adhere to the SDEF format specified in ER 1-1-11, Appendix A.

3.5.1.1 File Medium

Required data shall be submitted on Compact Disk, formatted to hold 700 MB of data, under the MS-DOS Version 5 or 6.x, unless otherwise approved by the Contracting Officer.

3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Preliminary, Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number of person responsible for the schedule, and the MSDOS version used to format the disk.

1. Two (2) Data Compact Disks containing the project schedule shall be provided. Data on the disks shall adhere to the SDEF format specified in ER 1-1-11, Appendix A.

2. File Medium - Required data shall be submitted on Compact Disk, formatted to hold 700 MB of data, under the MS-DOS Version 5. or 6.x, unless otherwise approved by the Contracting Officer.

3. Disk Label - A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Preliminary, Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number of person responsible for the schedule, and the MSDOS version used to format the disk.

4. File Name - Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

3.5.1.3 File Name

Each file submitted shall have a name related to the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

3.5.2 Narrative Report

A Narrative Report shall be provided with the preliminary, initial, and each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to relay to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis.

3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, and Total Float. Actual Start and Actual Finish Dates shall be printed for those activities in progress or completed.

3.5.4.1 Activity Report

A list of all activities sorted according to activity number.

3.5.4.2 Logic Report

A Logic Report is a list of Preceding and Succeeding activities for every activity in ascending order by activity number. Preceding and succeeding activities shall include all information listed above in paragraph Schedule Reports. A blank line shall be left between each activity grouping.

3.5.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

3.5.4.4 Earnings Report

An Earnings Report is a compilation of the Contractor's Total Earnings on the project from award of contract until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by work item and sorted by activity numbers. This report shall: sum all activities in a work item and provide a work item percent; and complete and sum all work items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on monthly schedule update submissions. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity number, description, duration, and estimated earned value shall be shown on the diagram.

3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.5.3 Critical Path

The critical path shall be clearly shown.

3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility. Separate activities shall be created for each Phase, Area, Floor Level and Location in which the activity is occurring. Each set of activities identified as a separate group shall be included in a Work Breakdown Structure to avoid confusion with similar activities repeated in other phases, floors, or locations.

3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

3.5.5.6 Baseline Network Analysis Schedule

The original approved baseline shall not change through the duration of the contract. The original baseline naming convention is B/L – Contract Name – (Date created). A second revised baseline shall be maintained to reflect approved time extensions, and/or changes to the contract; this could be named as Current Approved Baseline and follow the naming convention: C/A - Contract Name – (Date changed). A third monthly baseline shall be maintained to reflect the monthly updates submitted by the contractor for payment. Naming convention is Mmm- Contract Name-(Date created). Submittal of the Baseline Network Analysis Schedule, and subsequent schedule updates, shall be understood to be the Contractor's certification that the submitted schedule meets all of the requirements of the Contract Documents, represents the Contractor's plan on how the work shall be accomplished, and accurately reflects the work that has been accomplished and how it was sequenced (as-built logic).

Samples of baselines naming conventions:

Field Description in Primavera	Baseline Type	Naming Convention
Project Baseline	Current Approved Baseline	CA – Cerrillos Dam – (12-Jan-1992)
Primary	Monthly Baseline	M02 – Cerillos Dam – (1-Feb-1992)

Secondary	Original Baseline	BL – Cerrillos Dam – (12-Jan-1992)

3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly onsite meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost-to-Date shall be subject to the approval of the Contracting Officer. As a minimum, the Contractor shall address the following items on an activity by activity basis during each progress meeting.

3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish date for each activity currently in progress or completed.

3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations shall be based on Remaining Duration for each activity.

3.6.3.3 Cost Completion

The earnings for each activity started. Payment will be based on earnings for each in-progress or completed activity. Payment for individual activities will not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

3.6.3.4 Logic Changes

All logic changes pertaining to change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include:

a. Delays beyond the Contractor's control, such as strikes and unusual weather.

b. Delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary.
c. Changes required in order to correct a schedule which does not represent the actual or planned prosecution and progress of the work.

3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, or any interim milestone date, the Contractor shall furnish the following for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of less than 2 weeks based upon the most recent schedule update at the time of the constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

a. A list of affected activities, with their associated project schedule activity number.
b. A brief explanation of the causes of the change.
c. An analysis of the overall impact of the changes proposed.
d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

3.7.3 Additional Submission Requirements

For any requested time extension greater than 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

3.8 DIRECTED CHANGES

If changes are issued prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of this task order being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions

within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

-- End of Section --

ADDENDUM

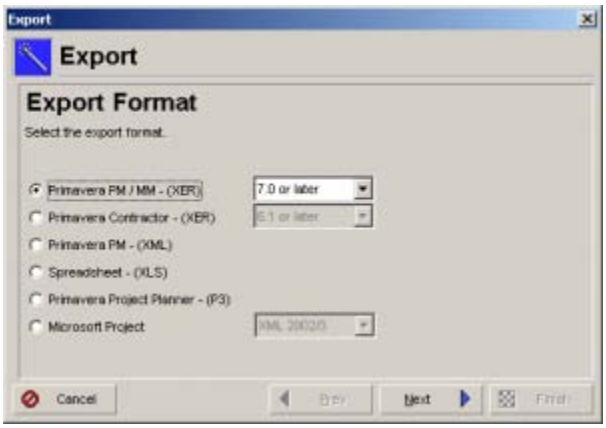
Exporting and Importing Project Information
October 25th, 2009 Activities, EPS primaverarena

As you know Primavera P6 is not a File based system, you need to export Project files if you wish to share your project with someone not in your network via email or other electronic delivery system. Export a Project file is simple and the exported file is a compressed file of all you project

As you know Primavera P6 is not a *File based system*, you need to export Project files if you wish to share your project with someone not in your network via email or other electronic delivery system. Export a Project file is simple and the exported file is a compressed file of all you project information which the other party needs to import in order to see it.

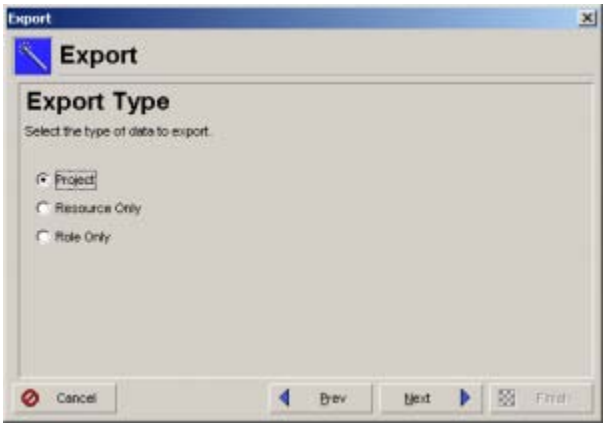
Export

To export a project file, you can go to File menu and click on Export.

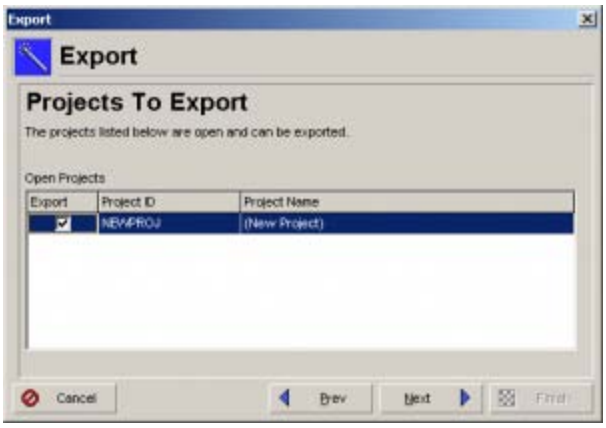


Select Primavera PM/MM format.

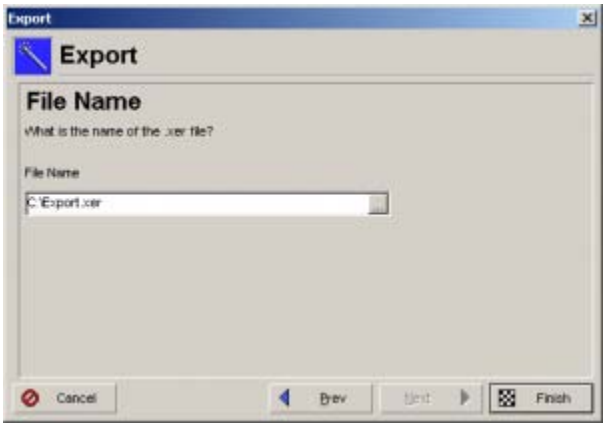
Choose which type of data you wish to export.



Select the Project.



Select the location of the exported file to be placed in.



Click Finish and Ta'daa

And you will find the*.XER file on your desktop (or the location you chose).

Import

To Import the file just double clicking the *.xer file would take you through the same steps and help you successfully update or create a new Project in your EPS.

Key definitions

1. Earned value is a technique for measuring project performance according to both project cost and schedule. This technique compares the budgeted or planned cost of the work to the actual cost. While earned value analyses are typically performed for WBS elements, you can also perform an earned value analysis for activities and groups of activities.

    a. In order to perform an earned value analysis, you must specify two calculation techniques. These techniques apply to activities that are currently in progress. The first technique is used to calculate an activity's percent complete. The second technique is used to calculate an activity's Estimate To Complete (ETC). A set of options is provided for both of these techniques, and you can set these options for each WBS element.

    b. The fundamental earned value parameters used to calculate an activity's Estimate to Complete are: Earned Value Cost; Budget at Completion; Planned Value Cost; and, Actual Cost. You can derive an activity's Estimate to Complete and other earned value indexes from these parameters.

    c. If you are the administrator for your organization, you can specify default earned value techniques for WBS elements.

2. Critical path: The critical path is a series of activities that determines a project's completion time. The duration of the activities on the critical path controls the duration of the entire project; a delay to any of these activities will delay the finish date of the entire project. Critical activities are defined by either the total float or the longest path in the project network.

3. Critical Path Method (CPM) scheduling: The method by which activity durations and the relationships between activities are used to mathematically calculate a schedule for the entire project. CPM focuses your attention on the critical path of activities that affect the completion date for the project or an intermediate deadline.

    Early dates, the earliest possible dates each activity can start and finish, and late dates, the latest possible dates each activity can start and finish without delaying the project finish or an intermediate deadline (constraint) are also calculated.