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Closeout Report

Kandahar Helmand Power Project (KHPP)

COMPONENT 1 SUBCOMPONENT 1

Replace Kandahar Breshna Kot Substation

Submitted by: Black & Veatch Special Projects Corporation (BVSPC)
Federal Services Division
Kandahar Helmand Power Project (KHPP)
USAID Contract Number 306-C-00-11-00506-00

Submitted to: Office of Economic Growth and Infrastructure (OEGI)
U.S. Agency for International Development (USAID)
Great Massoud Road
Kabul, Afghanistan

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Table of Contents

List of Tables

List of Figures

Attachments

Document # (if applicable)	Description (Note: The Section references below are the BVSPC-USAID Contract sections wherein specific deliverable requirements are located.)	Status	In Closeout Package?
a-01	Contract Closeout Procedures Manual (CCPM)	Complete	Yes
a-02	Security Plan (Section F.4.B(A)) - Site Specific	Complete	Yes
a-03	Implementation Plan - Work Plan (Section F.4.B-B)	Complete	Yes
a-04	Health and Safety Plan and Procedures (Section C.4.6; Section F.4.B-C)	Complete	Yes
a-05	Quality Control Plan (Section C.4.5; Section F.4.B-C)	Complete	Yes
a-06	Warranty Administration Plan (Section C.4.11; FAR 52.246.21)	Complete	Yes
a-07	Construction Manual (Section C.4.10)	Complete	Yes
a-08	Construction / Final Schedule (Section C.4.10; Section F.4.B-C) - Component Specific	Complete	Yes
a-09	Photo Album	Complete	Yes
a-10	Small Business Utilization Subcontracting Plan (Section H.23; Section J - Attachment 19; FAR 52.219-8)	Complete	Yes
a-11	Operations and Maintenance Manuals (Section C.4.11; Section F.4.B-C)	Complete	Yes; see d-03
a-12	Performance Monitoring and Evaluation Plan - each Component / Subcomponent, as stipulated by Contracting Officer's Representative COR (Section C.4.13)	Complete	Yes
a-13	Branding Implementation Plan (Section F.4 B,C; Section D.2)	Complete	Yes
a-14	Environmental Plan (Section H.16)	Complete	Yes
a-15	Environmental Compliance Documentation Schedule (Section H.16)	Complete	Yes
a-16	Environmental Closeout Report (Section H.16) - Site Specific	Complete	Yes
a-17	Environmental Reports (Section F.4.B-C) - Annual Reports until Mod 10 (16 Feb 2013), and then Quarterly Reports	Complete	Yes
a-18	Weekly Highlight Report (Section F.4.B-B)	Complete	Yes

Document # (if applicable)	Description (Note: The Section references below are the BVSPC-USAID Contract sections wherein specific deliverable requirements are located.)	Status	In Closeout Package?
a-19	Short Term Report - STTA Trip reports (Section F.4.B-B) - Site Specific	Complete	Yes
a-20	Design Submittals (Section F.4.B-C) - Site Specific	Complete	Yes
a-21	Inspection and Equipment Test Reports (Section F.4.B-C) - Site Specific	Complete	Yes
a-22	Concrete Strength tests: Steel reinforcements test reports (Section F.4.B-C) - Site Specific	Complete	Yes
a-23	Testing and Commissioning Report (Section F.4.B-C) - Site Specific	Complete	Yes
a-24	As-Built Construction Drawings (Section C.4.11; Section F.4.B-C) - Site Specific	Complete	Yes
a-25	Training Reports - Component-Specific	Complete	Yes
a-27	Final Closeout Report (Section C.4.11; Section F.4.B-C)	Complete	Yes
Tasks for Subcomponent 1.1: Replace Kandahar Breshna Kot Substation			
b-01	Task i: Replace the Kandahar Breshna Kot Substation while maintaining existing service for customers served by the existing deteriorated substation. Coordinate with DABS for removal of obsolete equipment and existing facilities as needed for construction of the new substation. Do not remove obsolete equipment or existing facilities which are not required to be removed for construction of the new substation unless requested by Da Afghanistan Breshna Sherkat (National Electrical Utility) and directed by the COR. (Mobilization Documents)	Complete	Yes
b-02	Task ii: Increase capacity and reliability of the substation to provide 60 MVA of capacity. The new substation will utilize four (4) new 20 MVA transformers: three (3) in service plus one (1) spare. (Generator Arrangement)	Complete	Yes
b-03	Task iii: The new substation will utilize a breaker and a half configuration. (Final Single Line Diagram)	Complete	Yes
b-04	Task iv: The Contractor must replace the substation providing: (a) two 110 kV transmission lines, one from Kajaki HPP and one future line to a future Substation planned on the east side of Kandahar; (b) three - 110/20 kV 20 MVA transformers; and, (c) four 20 kV switchgear lineups to supply twelve (12) 20 kV feeders. (Site Arrangement Documents)	Complete	Yes
b-05	Task v: The Contractor must replace the switchyard including, at a minimum, new surge arrestors, capacitance voltage transformers, SF6 circuit breakers, lightning arrestors, disconnect switches, voltage transformers, current transformers, auxiliary transformer, site fencing, and site lighting. (Section Views)	Complete	Yes
b-06	Task vi: The Contractor must replace medium voltage switchgear on 20 kV feeders including, at a minimum, the following new items: circuit breakers, current transformers, ampere meters, voltage meters, power factor meters, energy meters, lightning arrestors, voltage transformers, and relays. (Switchgear Drawings)	Complete	Yes

Document # (if applicable)	Description (Note: The Section references below are the BVSPC-USAID Contract sections wherein specific deliverable requirements are located.)	Status	In Closeout Package?
b-07	Task vii: The Contractor must replace the control room to include the 110 kV control, protection, metering, and communication equipment, as well as AC and DC battery systems necessary to support the substation operation. In addition, the Contractor must provide monitoring for voltage, current, power (watts and vars), and energy for all 20 kV feeders, both load and generation. (Control Room Component Drawings)	Complete	Yes
b-08	Task viii: The Contractor must install new 20 kV feeder cable from all functioning diesel generators to include existing QSK-60s, relocated KT A-50s, and new MTUs, to new 20 kV switchgear. Replace control, power, metering, and communications cable from generators to new 20 kV switchgear. (Cable Trench Layout)	Complete	Yes
b-09	Task ix: The Contractor must demolish the existing multipurpose building containing the worker dormitory and transformer repair shop, and the generator repair shop, due to the interference of these facilities with new substation construction. If requested by DABS and directed by the Contracting Officer, the Contractor will provide tools, equipment, or furnishings for existing replacement facilities onsite not to exceed a total cost of [redacted]. (Demolition Acknowledgment and Furnishing Turnover Documents)	Complete	Yes
b-10	Task x: The Contractor must remove and dispose of the following existing site structures currently interfering with planned substation construction: (a) concrete wall dividing the future substation site (for cost savings, if deemed adequate for anticipated substation structure loads, the Contractor will leave existing wall footings in place; (b) foundations from old Fairbanks Morse generators; and (c) oil storage and containment pit on east side of site. (Demolition Acknowledgement and Site Condition Statement)	Complete	Yes
b-11	Task xi: The Contractor must improve site security by providing a vehicle emergency egress route from site and an emergency exit gate. (Road Design Documents)	Complete	Yes
b-12	Task xii: The Contractor must provide technical reviews of US Army Corps of Engineers (USACE) SEPS Helmand and SEPS Kandahar designs to ensure adequate technical interface coordination between USACE scope and KHPP. (BVSPC / USAID RFI Log)	Complete	Yes
b-13	Task xiii: The contractor must provide a general Operation and Maintenance (O&M) plan for the substation. Items to be addressed must include, but not be limited to: listing of applicable equipment O&M manuals; preventive maintenance requirements not covered by O&M manuals; operator position descriptions and associated minimum training requirements, including recommendations for recurring training. (USAID Acceptance of O&M Plan)	Complete	Yes
b-14	Task xiv: The contractor must procure spare parts for Substation components. Notify the COR of planned parts' purchases and associated costs prior to procurement.	Complete	Yes
Deliverables for Subcomponent 1.1: Replace Kandahar Breshna Kot Substation			
d-01	Replacement and commissioning of the Substation completed. (Testing and Commissioning Document and USAID Acceptance)	Complete	Yes
d-02	Technical review reports of USACE's designs as directed by the COR. (RFI Requests and Responses)	Complete	Yes
d-03	O&M plan for the substation. (O&M Plan and Manuals)	Complete	Yes

Document # (if applicable)	**Description (Note: The Section references below are the BVSPC-USAID Contract sections wherein specific deliverable requirements are located.)**	**Status**	**In Closeout Package?**
d-04	Spare parts for the substation components.	Complete	Yes
c-05	Subcontract / Purchase Order Matrix which Indicates Closeout Status.	Complete	Yes
g-06	USAID Final Disposition Instructions.	Complete	Yes
g-07	Complete and Submit Handover/Disposal documents to USAID.	Complete	Yes, see g-06
m-01a	SUBSTANTIAL COMPLETION: (1) Certificate of Substantial Completion with Schedule of Defects (if applicable).	Complete	Yes
m-01b	FINAL INSPECTION AND ACCEPTANCE (1) Final Punch List (if applicable). (2) Final Completion and Acceptance Certificate (FCA). (3) Draft Bilateral Agreement with Supporting Documentation.	Complete	Yes
m-01c	WARRANTY PERIOD & FINAL WARRANTY INSPECTION: 1) Warranty Certificate	Complete	Yes
m-02	Prime Contract original signed copy in files KC.	Complete	Yes
m-03	Copy of all Fully Executed Prime Contract Modifications and Change Orders in electronic folder.	Complete	Yes
m-04	USAID Closing Statement Letter + BV Response Letter.	Not received from USAID	NA
m-05	Copy of Closeout Documentation – List Closeout Documents handed over / uploaded to USAID.	Complete	Yes

1 KANDAHAR HELMAND POWER PROJECT (KHPP) OVERVIEW

1.1 KHPP Background

The purpose of the Kandahar Helmand Power Project (KHPP) contract, issued by the United States Agency for International Development (USAID) on 9 December 2010, was to increase the supply and reliability of electrical power in the areas in southern Afghanistan served by the South East Power System (SEPS), particularly the City of Kandahar. The contract was to support the SEPS reconstruction and thereby increase the quality of life of the people in Kandahar and Helmand Provinces. The KHPP was conceived as a critical component of the United States' government's Counterinsurgency (COIN) strategy in southern Afghanistan. KHPP is a part of a larger United States (US) government sponsored program involving multiple USAID Implementers, the US Army Corps of Engineers (USACE), and other Donors to improve the SEPS and connect it with other electrical grids in Afghanistan.

A reliable, sustainable electric power generation, transmission, and distribution system in Kandahar and Helmand Provinces is an important objective of the Government of the Islamic Republic of Afghanistan (GIRoA). The system is expected to fuel economic growth not currently possible, especially in Kandahar City, the second largest city in Afghanistan and a center for education, health care, manufacturing, and transportation. Kandahar City has an electrical supply shortfall of at least 40 megawatt (MW) for its approximately 850,000 residents.

SEPS as a system is composed of multiple generation islands, an aged transmission system, and multiple distribution systems in southern Afghanistan serving 380,000 of the 1.7 million people residing in the region. Diesel generator sets and the Kajaki Hydroelectric Power Plant (HPP) provide the majority of the electrical power generation in the system. The 222 kilometers (km) SEPS transmission system operates at 110 kilovolts (kV), medium voltage distribution at 20 kV, and low voltage distribution at 400 volts (V). Kandahar City represents the largest power demand node within SEPS.

The Kajaki HPP was the first significant generation source installed in SEPS. Kajaki HPP, supported by the US government, went online in the mid-1970s. Prior to execution of the KHPP contract, its power was delivered to Kandahar City through one aged 25 megavolt amperage (MVA) transformer located at the Kandahar Breshna Kot (BK) Substation. In 2003, USAID began rehabilitation of the Kajaki HPP. At peak production, the Kajaki HPP currently provides 32 MW (during high water periods), with 12 MW of power serving Kandahar City and 20 MW of power transmitted to the remaining distribution nodes served by the SEPS transmission backbone.

To supplement generation for Kandahar City during the Kajaki HPP rehabilitation, USAID facilitated the installation of fourteen (14) KTA-50 diesel generators at the BK Substation in late 2003. Five (5) additional diesel generators owned by Da Afghanistan Breshna Moasessa (now known as Da Afghanistan Breshna Sherkat, or DABS) were installed at BK in 2008. This upgrade was done to increase the short term generation capacity, as the rehabilitation efforts at Kajaki HPP had been prolonged due to continued insurgent

activities and, the Kandahar City power supply was taking on increasing importance in the International Security Assistance Force's (ISAF's) COIN strategy in the area.

As of this report date, the BK Substation diesel generators have a combined generating capacity of 20.5 MW at peak production due to new units either provided by or installed by USAID. These units consist of the 10.5 MW MTU units, 5 MW of aged derated KTA-50 units, and 5 MW provided by aged derated QSK-60 units. The new 10.5 MW MTU units were installed and commissioned by the KHPP.

1.2 KHPP Summary of Scope of Work

The KHPP scope of work initially contained six (6) Components with ten (10) Subcomponents, outlined below, which, integrated with other work on SEPS, were designed with the purpose of increasing and improving the sustainability and reliability of electric supply provided by the SEPS:

Component 1. Improve Kandahar Power Distribution System

- Subcomponent 1: Replace the Kandahar Breshna Kot Substation.
- Subcomponent 2: Refurbish Kandahar City Medium Voltage (MV) Distribution System.
- Subcomponent 3: Construct a new Kandahar East Substation to (1) enhance the reliability of the system serving Kandahar, and (2) serve as a receiving point for an expected link between the SEPS and the North East Power System (NEPS), which is Afghanistan's major source of lower cost, imported power from the Central Asian Republics.
- Subcomponent 4: Construct a transmission line between the Kandahar Breshna Kot Substation and the new Kandahar East Substation.
- Subcomponent 5: Replacement of Aged Diesel Generators at the Breshna Kot Substation.

Component 2. Build Durai Junction Substation

- Subcomponent 1: Build a new Substation at Durai Junction.
- Subcomponent 2: Procure equipment for additional Substations.

Component 3. Program Support and Program Management

Component 4. Transportation, Installation, Operation and Maintenance of Kandahar (also known as Shorandam) Industrial Park Diesel Power Plant (also known as SIPD).

Component 5. Rebuild the Kajaki Dam Substation and Local Distribution System

Component 6. Installation and Commission Kajaki Unit 2

- Subcomponent 1: Perform inventory assessment of Government Furnished Equipment (GFE).

Subcomponent 2: Repair GFE, and provide missing and additional new equipment for completing Kajaki Unit 2 installation.
Subcomponent 3: Install and commission Kajaki Unit 2.

USAID issued the KHPP contract to Black & Veatch Special Projects Corporation (BVSPC) to provide engineering, procurement, construction, and all material, equipment and/or services necessary to successfully complete each of the Components and Subcomponents in accordance with the requirements of the contract.

BVSPC was tasked with developing appropriate engineering design and construction methodologies, being responsible for procurement, design, construction, quality control, testing, and commissioning. Additionally, BVSPC provided the support services needed to implement those activities (security, life support, ground and air movements, etc.). BVSPC was also responsible for issuing relevant warranties for the equipment and work provided under each Component and Subcomponent. Sustainability of the infrastructure being developed was one of the key deliverables of the KHPP. Drawing from previous Operation and Maintenance (O&M) training programs that BVSPC implemented on behalf of USAID through the Afghanistan Infrastructure Rehabilitation Program (AIRP), BVSPC was required to recommend and, in most instances, implement the training and skills development needed to sustain the efforts undertaken in this contract.

In addition, BVSPC was to provide spare parts' inventory necessary for DABS to perform the required operation and maintenance of installed equipment for each Component and its Subcomponent. These recommendations were, in select instances, to be submitted to USAID prior to initiation of the respective subcomponent, and were to be based on the BVSPC assessment of the capability and intent of the recipient to execute required O&M functions.

As KHPP was implemented, the security situation in the southern region of Afghanistan changed. While Regional Command Southwest and the US Marines achieved substantial success in clearing the Upper Sangin Valley in late 2011, enabling BVSPC to execute the first contractor convoy to Kajaki in several years, the region was impacted by significant increases in anti-government activity in 2011 to 2012 as the GIRoA, with ISAF support, increasingly imposed GIRoA control over the region. As a result, companies and organizations willing to work in the region significantly increased their pricing to accommodate the higher risk and security costs by escalating their "risk premium" with their standard pricing. In addition, commodity costs and construction costs within Afghanistan increased more rapidly than expected during 2011. The unexpected cost increases impacted all implementing agencies from BVSPC to USACE, and diminished the collective capability of all agencies involved to meet initial objectives.

Recognizing these budgets would not allow delivery of all Components and Subcomponents, USAID, in concert with Regional Command South, reviewed the KHPP program in mid-2011 to determine what adjustments could be made to retain core program objectives aligned with the COIN strategy while cutting projected costs. This review produced the realignment and de-scoping of select project activities. The net result was the de-scoping of Subcomponent 1.3, construction of a new Kandahar East Substation and 1.4,

construction of a transmission line between the Kandahar BK Substation, and the new Kandahar East Substation, with the intent to transfer these activities to USAID's Power Transmission Expansion and Connectivity (PTEC) program, which was then under development. In addition, the scope of Subcomponent 1.2 was adjusted to eliminate planned additional connections to the Kandahar distribution system, thereby avoiding potential "negative COIN impact" until such time additional sustainable, non-diesel based generation to supply additional customers could be supplied (Kajaki Unit 2 and the NEPS to SEPS connection to provide lower cost imported hydropower).

The elimination of the Substation at Kandahar East and the transmission line was accompanied by a realignment of Subcomponent 1.5, and the placement of 14 MTU generators, representing 21 MW of installed capacity at the Kandahar East location. With the implementation of the diesel power "bridging solution" in Kandahar City by US Forces Afghanistan which added two (2) 10 MW diesel plants in early 2011 operating in separate island modes and, increasing concern regarding the sustainability of additional diesel generation within Kandahar City, the installation of the 14 MTU units was suspended until USAID could further assess the situation. Following the adjustment of the KHPP scope, all six (6) original Components remained in the contract, but with the original ten (10) Subcomponents reduced to eight (8).

1.3 KHPP Contract Evolution

Table 1 provides a history of the changes that have occurred in the Prime Contract between BVSPC and USAID as the needs and demands were adjusted due to changing ground conditions. These changes were implemented in order to maximize benefits to the evolving people of Afghanistan.

Table 1: History of Changes in USAID Contract No. 306-C-00-11-00506-00

Contract	Date	Description
Initial Contract Award	09 Dec 2010	This contract will support US Agency for International Development (USAID), Afghanistan Mission's Kandahar Power Initiative (KPI).
Contract Modification 01	1 Feb 2011	The purposes of this modification are to add the following in Section H, Special Provisions/Special Contract Requirements to the listed contract as follows: • Use of Synchronized Pre-deployment and Operational Tracker (SPOT) for Contractors Supporting a Diplomatic or Consular Mission Outside the United States (Supplement to FAR 52.225-19). • Serious Incident Reporting in Afghanistan. • Gender Integration Requirements.
Contract Modification 02	17 Mar 2011	The purposes of this Modification are to: • Revise Section B.5 "Indirect Cost" based on BVSPC latest approved NICRA for FY2010. • Revise Section H.22 "Consent to Subcontracts" to incorporate the approved Subcontracting Plan dated 28 February, 2011. • Change the project name from "Kandahar Power Initiative (KPI)" to "Kandahar Helmand Power Project (KHPP)."
Contract Modification 03	27 Jun 2011	The purposes of this Modification are to: • Incorporate the following clause: *The Contractor shall comply with and adhere to all USAID Afghanistan Implementing Partner Notices. Copies of the notices are provided to implementing partners at the time of issuance. Copies are also available upon request from your Cognizant Contracting Officer.* • Remind the Contractor of the recently issued Implementing Partner Notice No. OAA-IP- 20ll – 004, which incorporates Mission Order No. 201.04 entitled, "National Security Screening (Non-US Party vetting)."

Contract	Date	Description
Contract Modification 04	17 Jul 2011	The purposes of this Modification are to: • Incorporate no cost changes in Sections C and F. • Incorporate the FAR Clause 52.209-9 under PART II – CONTRACT CLAUSES. SECTION I – CONTRACT CLAUSES.
Contract Modification 05	19 Jul 2011	The purposes of this Modification were to provide funding in the amount of [redacted], thereby bringing the total obligated amount to [redacted].
Partial Suspension of Work	09 Aug 2011	Partial Suspension of Work affecting: • Subcomponent 1.3 • Subcomponent 1.4 • Subcomponent 1.5 • Component 4
Change Order – Scope of Work	08 Sep 2011	SOW Changes affecting: • Subcomponent 1.3 • Subcomponent 1.4 • Subcomponent 1.5 • Component 4
Change Order – Amendment 01	20 Sep 2011	Changes affecting: • Subcomponent 1.3
Change Order – Amendment 02	22 Sep 2011	Changes affecting: • Subcomponent 1.5 - Diesel Generators
Change Order – Amendment 03	01 Oct 2011	Changes affecting: • Subcomponent 1.5 – Diesel Generators • Extension of the Submission Deadline
Change Order – Amendment 04	13 Oct 2011	Changes affecting: • Subcomponent 1.5 – Diesel Generators
Change Order – Amendment 05	16 Oct 2011	Changes affecting: • Subcomponent 1.5 – Diesel Generators
Change Order – Amendment 06	22 Oct 2011	Changes affecting: • Subcomponent 1.5 – Diesel Generators
Contract Modification 06	12 Nov 2011	The purposes of this Modification are to: • Provide incremental funding in the amount of [redacted], thereby increasing the total obligated amount from [redacted] to [redacted]. • Revise Section B.5 “Indirect Cost” based on BVSPC’s approved provisional rates for FY2011. • Revise Sections C, F, and J.
Change Order – Scope of Work	06 Feb 2012	SOW Changes affecting: • Subcomponent 1.1 • Subcomponent 1.5
Contract Modification 07	26 Sep 2012	The purposes of this Modification are to: • Provide incremental funding in the amount of [redacted], thereby increasing the total obligated amount from [redacted] to [redacted]. • Modify PART I-THE SCHEDULE. I. SECTION B-SUPPLIES OR SERVICES AND PRICE/COSTS, paragraph (c).
Contract Modification 08	29 Sep 2012	The purposes of this Modification are to: • Provide incremental funding in the amount of [redacted], thereby increasing the total obligated amount from [redacted] to [redacted]. • Modify PART I-THE SCHEDULE I. SECTION B-SUPPLIES OR SERVICES AND PRICE/COSTS, paragraph (c).

Contract	Date	Description
Contract Modification 09	30 Sep 2012	The purposes of this Modification are to: • Correct Modification 8 to provide incremental funding in the amount of ([redacted]), thereby decreasing the total obligated amount from [redacted] to [redacted]. • Provide incremental funding in the amount of [redacted], thereby increasing the total obligated amount from [redacted] to [redacted].
Partial Suspension of Work	28 Jan 2013	Partial Suspension of Work affecting: • Subcomponent 6.3
Contract Modification 10	14 Feb 2013	The purpose of this Modification is to revise Sections B, C, F, H, I, J and contract attachments.
Contract Modification 11	29 Sep 2013	The purpose of this modification was to extend the period of performance from 30 September 2013 to 31 December 2013, revise budgets, and to clarify deliverables in multiple sections.
Contract Modification 12	24 Dec 2013	The purpose of this Modification was to add Subcomponent 6.4, Technical Assistance to USAID on Kajaki Unit 2 on budget implementation until 30 November 2015 and to extend all remaining SUBCOMPONENT to 28 February 2014.
Contract Modification 13	06 Aug 2014	The purpose of this modification was to finalize agreements on fee, Durai Junction cure cost absorbed by BVSPC, applicable NICRA, and clarify Tasks and Deliverables as needed.
Contract Modification 14	22 Sep 2014	Environmental considerations for generators changed from USEPA Tier 4 standards to Tier 2 standards.

*See **Attachment m-03** for the documentation listed in the above table.*

The key to optimal effectiveness throughout the implementation of the KHPP has been to exercise flexibility to meet new opportunities in order to enhance program impact as the succession of operations in Southern Afghanistan changed. BVSPC, in partnership with USAID, maintained significant flexibility and made adjusted as needed and directed in order to deliver significant benefit to the people served by the SEPS.

1.4 KHPP Contract Coordination and Communication

At the inception of the KHPP, USAID coordinated the relationship with DABS-Kabul to maintain communication and reporting of KHPP activity and progress. BVSPC maintained communication and reporting of the KHPP field activity with the DABS-Kandahar Director and his direct reports. BVSPC continued to coordinate and maintain liaison with Kandahar DABS, as well as Regional Command South (RC-S) and Regional Command Southwest (RC-SW) as requested by the COR and the USAID Onsite Managers (OSM). BVSPC worked directly with DABS in Kandahar and Helmand Provinces, throughout the implementation of the KHPP. The COP and the Transmission and Distribution Lead and Generation Lead ("Leads") coordinated the communications with all stakeholders in Kandahar and Helmand addressing with each issues of concern as needed. The COP and COR communicated and coordinated all issues of implementation between themselves usually on a daily basis.

In order to establish USAID field presence for the project, and facilitate two-way reporting and communication, USAID designated one OSM for each of the two Regional Commands. The OSMs played a strong role in enhancing communications between all stakeholders in Kandahar and Helmand Provinces. The OSM reported to the COR, while maintaining coordination lines of communication with BVSPC Leads and Managers. The BVSPC Construction Managers and the O&M Managers, meanwhile, worked directly with

their counterparts in Kandahar DABS, and also communicated mutual needs and concerns in coordination with Leads. The working relationships between BVSPC staff and the Kandahar DABS Director, senior managers, and DABS staff, in coordination with the COR and OSM, were consistently positive and productive.

2 SUBCOMPONENT 1.1: REPLACE KANDAHAR BRESHNA KOT SUBSTATION

2.1 Objectives

The objective of Subcomponent 1.1 was to replace an aged and deteriorated Substation at Kandahar BK and thereby upgrade the level of electrical service to existing customers by enhancing reliability in the Kandahar City area.

2.2 History

The need for rebuilding the Kandahar City Breshna Kot (BK) Substation was identified as a strategic infrastructure reliability addition for the development of the Southeast Power System (SEPS). The existing Substation was built to receive power from Kajaki Hydro Power Plant (HPP) and the new 110 kV transmission line from Kajaki HPP in the 1970s. Much of the equipment within the Substation had exceeded its normal life expectancy, which is typically 30 to 40 years for equipment. Some upgrades of the 20 kV switchgear were completed in the mid-2000s. This Substation receives energy through one 110 kV transmission line from Kajaki Hydro Power Plant, passing through the Durai Junction Substation. The Durai Junction Substation was rebuilt in 2012 and 2013 by KHPP under Subcomponent 2.1. The BK Substation facilities are located within the Breshna Kot operations yard. This yard includes three diesel generating compounds consisting of: (1) the KTA-50 compound, (2) the QSK-60 compound, and (3) the new seven (7) unit MTU compound built by BVSPC under Subcomponent 1.5, which includes storage facilities for generation, Substation, distribution line materials, obsolete equipment storage, worker dormitory, transformer repair facility, staff housing, and offices. The transmission line enters the Substation from a concrete structure located northwest of the BK site, across the Kandahar “Grand” Canal. Figure 1 is an aerial photograph of the site, with the existing 110 kV equipment located east and west of Item 12. This site is located in the center of Kandahar City, approximately 1 kilometer north of the Provincial Governor’s compound.

Figure 1: Kandahar Breshna Kot Complex

With the award of the KHPP project, a conceptual design of a new Substation was developed. This design, consistent with Ministry of Energy and Water (MEW) and DABS design standards, included the use of the specifications for the 110/20 kV transformers and 110 kV circuit breakers included in the Prime Contract, Subcomponent 2.2, Attachments 5 and 6, respectively. With feeder work also at the Kandahar East site, a 20 kV switchgear specification was developed (Subcomponent 1.3). This equipment (transformers, circuit breakers, and switchgear) has a long manufacturing lead time, and was a priority to bid and award. In addition, the issued-for-manufacturing drawings were needed for the Substation tender process to ensure the bidders had the necessary thorough information.

The KHPP Design Manual was completed during the development of the conceptual design. This Design Manual, consistent with MEW and DABS design standards, was used as the design basis for technical specifications and quality control requirements for the transmission and distribution work. The BK conceptual design was documented in the form of the technical specifications and drawings for an engineering, procurement, and construction services subcontract specification. The KHPP Design Manual and this technical specification were submitted as the 10% design package to USAID (**Attachment a-20**).

As discussed in the Closeout Report for Component 3, with the issuance of Presidential Decree 6 in March 2010, BVSPC was unable to subcontract with a private security company upon award of the KHPP. BVSPC began implementing its security program in March 2011 with the signing of a bridging strategy and the outline for transitioning to the APPF. BVSPC issued an excusable delay notice to USAID on 24 April 2011 due to the loss of its ability to travel in the country as a result of the unavailability of security.

With the technical requirements complete, a request for proposal (RFP) for the engineering, procurement, and construction (EPC) of the new BK Substation was issued in February 2011. Every effort was undertaken during the RFP process to adhere to the Afghan First Policy of USAID. Three RFP addenda were issued and, in March 2011, the bid period closed. Proposals were received from two qualified bidders. The RFP for the Kandahar East Substation was issued simultaneously. Two qualified bids were also received for the East Substation RFP.

Negotiations with the two bidders were conducted, with the ultimate outcome of BVSPC's recommendation that each bidder be awarded one Substation project. The Request for Consent to enter into a Subcontract for the EPC of the new BK Substation was issued in June 2011. USAID issued clarifying questions and completed a site visit later that month due to the outcomes of the bid process of the Subcomponents 1.1, 1.3, 1.5, and Component 4 works. On 29 June 2011, USAID rejected the consent request due to the unexpected high cost as bid. BVSPC requested the bidders to reconsider their pricing. BVSPC again requested consent based on a reduced cost in July 2011. Consent to proceed with subcontract work was received in late September 2011. During this same timeframe, Subcomponents 1.3 and 1.4 were descoped from the project, and the Subcomponent 1.5 scope was significantly changed. The Subcomponent 1.5 scope change impacted this Subcomponent by adding generation work at the same site during the same time period.

The Substation subcontract was executed and commercial submittals and preliminary engineering work proceeded in October 2011. With the execution of the subcontract, an updated schedule was issued that required all demolition and restoration work to be completed by June 2012.

Prime Contract Modifications 4, 6, and 7 changed the scope of work at this Substation, reducing the work required. Rather than four transformers to be installed, three were installed with one left as a spare. Two transmission line connections were reduced to one connection with a space for the second connection. With the transmission line changes, the Substation contract required modification to add the transmission interconnection work, as this work was previously included in Subcomponent 1.4. In total, nine scope additions and three scope reductions were required, with the reductions of greater value than the additions.

BVSPC issued Request for Proposal Modification 3 (RFMP 3) to the Subcontractor, requesting pricing for each line item. The RFMP was issued both as a draft and formally to allow the Subcontractor to begin pricing the scope changes and to allow the scope to be finalized with USAID. The scope of work was finalized in March 2012. The Subcontractor

submitted pricing proposals; however, additional costing details were requested due to the size of the scope changes, particularly the scope reduction. By August 2012, sufficient detail was received, analyzed, and compared with independent cost estimates and considered reasonable. A second Request for Consent was issued with consent received on 20 August 2012. The summary of the subcontract changes for Amendment 2 is included in Section 3.3, Subcontracts and Major Procurements, Table 7: Work Scope Changes and Final Negotiated Subcontract Cost Impact.

The Subcontractor mobilized to the site in February 2012 to begin pre-construction activities simultaneously to the negotiations RFMP 3. This work included establishing a security perimeter and constructing onsite temporary housing and temporary construction offices.

In April 2011, BVSPC met the DABS Kandahar Director at the site and reviewed the proposed scope of work. DABS and BVSPC agreed upon the approximate location of the Substation during this site visit. In order to prepare for this Substation, DABS agreed to clear the area of obsolete materials and debris and to relocate generators and fuel tanks (Figure 1, Items 3 and 7 respectively). The agreement of what materials and facilities to be removed by the respective organization were formalized in a letter to the DABS Chief Operating Officer (COO) (**Attachment b-10**) requesting the materials within the extent of the Substation to be removed by 11 June 2011. DABS gradually removed the obsolete materials in 2011 and 2012; however, DABS ultimately requested USAID support for the complex demolition work and site restoration. USAID then modified BVSPC's scope of work to include the demolition of the concrete structures at the site (Prime Contract Modifications 4 and 6, Subcomponent 1.1, Tasks viii and ix). These scope changes were issued in July 2011 and November 2011.

During the discussions with DABS and at the request of USAID, BVSPC reviewed other options for the use of buildings at the site. Options reviewed included constructing a new workshop and dormitory, and reuse of the existing QSK building. For the new builds, a scope of work and specifications to support a tendering process were developed and issued to DABS and USAID.

In July 2012, BVSPC notified USAID that due to the DABS delay with its work, the BK Substation work was delayed. DABS evacuated the last building on 28 July 2012. DABS and BVSPC ultimately completed the removal of obsolete equipment, demolition work, and restoration work in August 2012.

In August 2012, BVSPC issued the 30% design submittal consisting of the civil and foundation design work (below grade work) and also turned over the new Substation site to the Subcontractor for construction to proceed. In November 2012, BVSPC issued the 60% design consisting of structural and physical design (above grade work) and, in June 2013, issued the 90% design consisting of the control, protection, and metering design work. BVSPC issued the 100%, including the as-left relay settings, in October 2013. An update of the as-left relay settings was issued in February 2014.

The Subcontractor used a major equipment supplier for both the detailed Substation design work and to provide materials and equipment. A design review was conducted at the Sub-subcontractor's office in Mannheim, Germany in December 2012. The design review was conducted over 3 days. Another design review meeting was conducted in the Czech Republic in April 2013. At this same time, the design team reviewed the manufacturing progress of the 110 kV protection, control, and metering panels, as well as the AC and DC system components. An additional trip to the Czech Republic was required in May 2013 to witness the factory testing of this equipment. Meeting minutes and trip reports are included in **Attachment a-19**. The equipment was then shipped to Germany for consolidation with other materials, including power and control cables, for shipment to Kabul. Due to the amount of time required to ground ship this material and, as a result of the vandalism that occurred during the ground shipment of the power transformers procured in Subcomponent 2.2, BVSPC removed the ground shipment from the Subcontractor's scope of work and transported these materials by air. Two shipments were required, one for the panels and one for the cables and balance of materials.

Structures, equipment, and materials provided by the Subcontractor arrived onsite between January and July 2013. Circuit breakers procured under Subcomponent 2.2 were transported to the site in April 2013. Power transformers procured under Subcomponent 2.2 were originally to be transported by the Subcontractor but, were transported by BVSPC to eliminate the risk of an extra lift. This equipment also arrived at site in April 2013. 20 kV switchgear procured under this component by BVSPC arrived at the site in June 2013.

Cut-over and energization planning coordination work with DABS was conducted beginning in June 2013. This coordination included familiarization of senior DABS staff with the overall configuration of the Substation. Most of the DABS senior operating staff participated in the Subcomponent 2.2 circuit breaker, transformer, and switchgear training. DABS' training for this Substation is discussed in Section 5: Sustainability. With both of these sets of training complete, the focus changed to system operation rather than equipment and component functionality.

Substation testing began in July 2013, with the 20 kV system ready to be energized on 15 August 2013. The 20 kV switchgear was tested and energized using a temporary supply from the existing power transformer. The station service transformers were energized, providing permanent power to the Control Building and switchgear. Generation feeders were connected to the new switchgear, and all 20 kV feeders were then energized from the new 20 kV switchgear. This transition to the new switchgear was accomplished over 2 days. As the end of the project approached, critical work included completion of the surface grading and graveling (for electrical insulation purposes), completing the road work, and completing testing.

In early September 2013, insurgent forces damaged the 110 kV transmission line between the Kajaki and Durai Junction Substations, resulting in the transmission line work required at the BK Substation to begin ahead of schedule. Road work construction was also temporarily suspended due to the quality of the concrete work in early September 2013. During this timeframe, USAID also reviewed in detail the road system design; no design changes were required. The quality of the concrete was impacted by the closure of the

local concrete batch plant for the Eid holiday and its owner's decision to not reopen the plant. The quality issues were resolved in a timely manner by adding controls and supervision to the process. Road work resumed by mid-September.

All gravel and road work, as well as all other miscellaneous related work, was complete by 25 September 2013. On 26 September 2013, the Substation itself was energized from the 110 kV system. On 27 September 2013, all Kandahar City loads previously fed from the old Substation were provided power from the new Substation. On 28 September 2013, the Substation operations were turned over to DABS.

The demolition of the temporary construction facilities commenced once the substation work was complete. DABS then issued the following requests to USAID:

- Allow temporary construction facilities to remain onsite.
- Add minor scope additions, including extra fencing on the south side of the Substation.

USAID agreed with the requests from DABS and included the changes in Prime Contract Modifications 10 and 11. USAID also requested additional spare parts to be provided to DABS in Modification 11. The scope change was a two-step process, first to provide a recommended list to the COR and then, with approval, obtain pricing for the items on the parts list. Procurement was then allowed to proceed. As some of these spare parts had long lead times, the delivery of all approved items was completed in November 2014.

Demolition and punch list work progressed in October 2013. Demobilization from the site was completed by 31 October 2013. USAID completed its walk-through of the Substation for final acceptance on 21 November 2014. Punch list work completion certificates, final drawings, test reports, and quality documents were submitted to USAID through March 2014. All final design and construction drawings were issued to USAID on 20 March 2014. The final punch list of work for the Substation and transmission line work was accepted as complete by USAID on 30 March 2014.

An aerial photograph of the completed substation and transmission line work is included on the cover of this Report.

2.3 Subcomponent 1.1 Modifications and Change Order History

Table 2 lists USAID Task (Contract Section C) and Deliverables (Contract Section F) modifications to Subcomponent 1.1 to date. The final Tasks and resulting Deliverables agreed upon between USAID and BVSPC described in the following modifications and change orders are shown in **bold** within Table 2.

Table 2: Subcomponent 1.1 – USAID Contract Modifications

Source & Date	Task	Change & Date
Original Contract 09 Dec 2010	Task i: Complete renovation of the Kandahar Breshna Kot Substation while maintaining existing service for customers served by the Substation.	Delete and Replace 14 Feb 2013

Source & Date	Task	Change & Date
Contract Modification 10 14 Feb 2013	Task i: Replace the Kandahar Breshna Kot Substation while maintaining existing service for customers served by the existing, deteriorated Substation.	Revised 29 Sep 2013
Contract Modification 11 29 Sept 2013	**Task i: Replace the Kandahar Breshna Kot Substation while maintaining existing service for customers served by the existing, deteriorated Substation. Coordinate with DABS for removal of obsolete equipment and existing facilities as needed for construction of the new Substation. Do not remove obsolete equipment or existing facilities not required to be removed for construction of the new Substation unless requested by DABS and directed by the COR.**	
Original Contract 09 Dec 2010	Task ii: Increase capacity and reliability of the Substation to provide 80 MVA of capacity. Renovated substation will utilize four (4) new 20 MVA transformers.	SOW of Work Change 29 Feb 2012
RFP – Contract Modification 7	Task ii: Increase capacity and reliability of the Substation to provide 60 MVA of capacity. Renovated substation will utilize four (4) new 20 MVA transformers: three (3) in service plus one (1) spare.	Delete and Replace 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Task ii: Increase capacity and reliability of the Substation to provide 60 MVA of capacity. Renovated substation will utilize four (4) new 20 MVA transformers: three (3) in service plus one (1) spare.**	
Original Contract 09 Dec 2010	Task iii: Renovate the Substation by utilizing breaker-and-a-half configuration.	Delete and Replace 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Task iii: The new Substation will utilize a breaker-and-a-half configuration.**	
Original Contract 09 Dec 2010	Task iv: Optimize the existing feeder configuration of three (3) incoming feeders (110 kV line from Kajaki HPP and two 20 KV feeders from the existing diesel generation) and twelve (12) outgoing 20 KV feeders (seven active and five spare). A total of fourteen (14) 20 KV feeders will be required; thus, four (4) switchgear lineups shall be utilized. One additional outgoing feeder shall be installed at 110 KV to provide the connection for the 110 KV transmission line included in Subcomponent 4. The optimization shall occur as the concurrent review of the distribution system design proceeds. In order to minimize outage times which may be necessary if existing switchgear is replaced, the Contractor shall consider installing new switchgear at a different location onsite, thus providing redundant controls and metering.	Delete and Replace 17 Jul 2011
Contract Modification 4 17 Jul 2011	Task iv: “Rebuild the substation for a) two 110 kV transmission lines. One from Kajakai HPP and one new one to the new East Substation as described in Subcomponent 4. b) four - 110/20 kV 20 MVA transformers, and c) four 20 kV Switchgear lineups to provide sixteen (16) 20 kV feeders. These sixteen feeders will consist of seven corresponding to the existing seven feeders (511, 512, 513, 514, 517, 518, 519), two from the existing QSK-60 generators, and seven spare. In order to minimize outage times that may be necessary if existing switchgear is replaced. the Contractor shall consider installing new switchgear at a different location onsite providing duplicative controls and lighting.”	Deleted and Replaced 12 Nov 2011

Source & Date	Task	Change & Date
Contract Modification 06 12 Nov 2011	Task iv: The Contractor shall rebuild the Substation for (a) two 110 kV transmission lines, one from Kajaki HPP and one future line to a future Substation planned on the east side of Kandahar; (b) three 110/20 kV 20 MVA transformers; and (c) three 20 kV switchgear lineups to provide twelve (12) 20 kV feeders. These twelve 20 kV feeders will consist of seven corresponding to the existing seven feeders (511, 512, 513, 514, 517, 18 and 519), two from the existing QSK-60 generators, two for the existing KTA-50 generators (or their replacement), and one spare. In order to minimize outage times which may be necessary if existing switchgear is replaced, the Contractor must consider installing new switchgear at a different location onsite, providing redundant controls and lighting. One lineup of switchgear, configured to interconnect with the new switchgear, shall remain onsite secured for future use. The Contractor shall maintain one of the new 20 MVA transformers onsite as a new system spare located such that relocation is not required should additional generation be available. The Contractor shall design and construct the configuration of the Substation such that the existing 110 kV transmission line does not need to be relocated when the second one is installed.	Delete and Replace 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Task iv: The Contractor must replace the Substation providing: (a) two 110 kV transmission lines, one from Kajaki HPP and one future line to a future substation planned on the east side of Kandahar; (b) three 110/20 kV 20 MVA transformers; and (c) four 20 kV switchgear lineups to supply twelve (12) 20 kV feeders.** **These twelve 20 kV feeders will consist of seven corresponding to the existing seven feeders (511, 512, 513, 514, 517, 18 and 519), two from the existing QSK-60 generators, two for the existing KTA-50 generators (or their replacement), and one spare. In order to minimize outage times which may be necessary if existing switchgear is replaced, the Contractor must install new switchgear at a different location onsite and provide redundant controls and lighting as needed. One lineup of switchgear, configured to interconnect with the new switchgear, must remain onsite secured for future use.** **The Contractor must maintain one of the new 20 MVA transformers on site as a new system spare located such that relocation is not required should additional generation be available.** **The Contractor shall design and construct the configuration of the Substation such that the existing 110 kV transmission line does not need to be relocated when the second line is installed.**	
Original Contract 09 Dec 2010	Task v: Renovate the switchyard, including, at a minimum: new surge arrestors, capacitance voltage transformers, SF6 circuit breakers, lightning arrestors, disconnect switches, voltage transformers, current transformers, auxiliary transformer, site fencing, and site lighting.	Delete and Replace 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Task v: The Contractor must replace the switchyard, including, at a minimum; new surge arrestors, capacitance voltage transformers, SF6 circuit breakers, lightning arrestors, disconnect switches, voltage transformers, current transformers, auxiliary transformer, site fencing, and site lighting.**	
Original Contract 09 Dec 2010	Task vi: Renovate the medium voltage switchgear (20 KV) on incoming feeders and outgoing feeders, including, at a minimum, the following new items: circuit breakers, current transformers, ampere meters, voltage meters, power factor meters, energy meters, lightning arrestors, voltage transformers, and relays.	Deleted and replaced 17 Jul 2011
Contract Modification 4 17 Jul 2011	Task vi: Replace medium voltage switchgear (20kV) on 20 kV feeders, including, at a minimum, the following new items: circuit breakers, current transformers, ampere meters, voltage meters, power factor meters, energy meters, lightning arrestors, voltage transformers, and relays.	Delete and Replace 14 Feb 2013

Source & Date	Task	Change & Date
Contract Modification 10 14 Feb 2013	**Task vi: The Contractor must replace medium voltage switchgear on 20 kV feeders, including, at a minimum, the following new items: circuit breakers, current transformers, ampere meters, voltage meters, power factor meters, energy meters, lightning arrestors, voltage transformers, and relays.**	
Original Contract 09 Dec 2010	Task vii: Renovate the Control Room to include, at a minimum, updated control and measuring panels. Panels shall include, at a minimum, high voltage control, protection, metering, and communication equipment, as well as AC and DC battery system necessary to support the Substation operation. Monitoring of voltage meters, power factor meters, energy meters, and ampere meters for all feeders shall be made available in the Control Room.	SOW of Work Change 29 Feb 2012
Request for a Proposal – Contract Modification no.7 29 Feb 2012	Task vii: Renovate the Control Room to include at a minimum, updated control and measuring panels. Panels shall include at a minimum high voltage control, protection, metering, and communication equipment, as well as AC and DC battery system necessary to support the Substation operation. The Contractor will make monitoring of voltage meters, power factor meters, energy meters, and ampere meters for all feeders available in the Control Room.	Delete and Replace 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Task vii: The Contractor must replace the Control Room to include the 110 kV control, protection, metering, and communication equipment, as well as AC and DC battery systems necessary to support the Substation operation. In addition, the Contractor must provide monitoring for voltage, current, power (watts and vars), and energy for all 20 kV feeders, both load and generation.**	
Contract Modification 4 17 Jul 2011	Task viii: Added as follows: "Relocate all or a portion of the existing fourteen (14) KTA·50 diesel powered generators as required for substation renovation, and as approved by DABS. When relocating units, do so one at a time in order to minimized reduction in generation capacity."	Deleted and Replaced 12 Nov 2011
Contract Modification 06 12 Nov 2011	Task viii: The Contractor shall install new 20 kV feeder cable from all functioning diesel generators to include existing aSK-60s, relocated KTA-50s, and new MTUs, to new 20kV switchgear. Replace control, power, metering, and communications cable from generators to new 20 kV switchgear. Ensure adequate protection and controls are added in existing switchgear.	Delete and Replace 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Task viii: The Contractor must install new 20kV feeder cable from all the functioning diesel generators to include existing QSK-60s, relocated KTA-50s, and new MTUs, to new 20 kV switchgear. Replace control, power, metering, and communication cable from generators to new 20 kV switchgear.**	
Contract Modification 06 12 Nov 2011	Task ix: The Contractor shall demolish the existing multipurpose building containing the worker dormitory and transformer repair shop and the generator repair shop due to interference of these facilities with new Substation construction. Provide materials for DABS to construct new replacement facilities. Replacement facilities shall be located and designed by DABS with assistance from B&V as required, and will be of comparable size and function to the facilities they replace. The Contractor shall submit a conceptual plan and cost estimate for proposed new facilities prior to procuring construction materials.	SOW change 29 Feb 2012
Request for a Proposal – Contract Modification no.7 29 Feb 2012	Task ix: The Contractor shall demolish the existing multipurpose building containing the worker dormitory and transformer repair shop and the generator repair shop due to interference of these facilities with new Substation construction. If directed by the Contracting Officer, the Contractor will provide tools, equipment, or furnishings for existing replacement facilities onsite, not to exceed a total cost of [redacted].	Delete and Replace 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Task ix: The Contractor shall demolish the existing multipurpose building containing the worker dormitory and transformer repair shop and the generator repair shop due to interference of these facilities with new Substation construction. If requested by DABS and directed by the Contracting Officer, the Contractor will provide tools, equipment, or furnishings for existing replacement facilities onsite, not to exceed a total cost of [redacted].**	

Source & Date	Task	Change & Date
Contract Modification 06 12 Nov 2011	Task x: The Contractor shall remove and dispose of the following existing site structures currently interfering with planned Substation construction: a) Concrete wall dividing the future Substation site. (For cost savings, Contractor shall consider leaving existing wall footings in place if deemed adequate for anticipated substation structure loads.) b) Foundation from old Fairbanks Morse generators. c) Oil storage and containment pit on east side of site.	Delete and Replace 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Task x: The Contractor shall remove and dispose of the following existing site structures currently interfering with planned substation construction:** **a) Concrete wall dividing the future Substation site. (For cost savings, Contractor shall consider leaving existing wall footings in place if deemed adequate for anticipated Substation structure loads.)** **b) Foundation from old Fairbanks Morse generators.** **c) Oil storage and containment pit on east side of site.**	
Contract Modification 06 12 Nov 2011	Task xi: Improve site security as follows: a) Contractor shall provide a vehicle emergency egress route from site and emergency exit gate. b) Contractor shall submit a conceptual plan, proposed gate specifications, and cost estimate prior to procurement or installation.	Delete and Replace 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Task xi: The Contractor must improve site security by providing a vehicle emergency egress route from site and an emergency exit gate.**	
Contract Modification 06 12 Nov 2011	Task xii: The Contractor shall identify and develop an action plan for addressing environmental issues identified at the site. Submit updated Initial Environmental Examination (IEE) and Baseline Environmental Site Inspection not later than 31 December 2011.	SOW change 29 Feb 2012
Request for a Proposal – Contract Modification no.7 29 Feb 2012	Task xii: The Contractor shall identify and develop an action plan for addressing environmental issues identified at the site. Submit Baseline Environmental Site Inspection not later than 31 December 2011.	Delete and Replace 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Task xii: The Contractor must provide technical reviews of USACE SEPS Helmand and SEPS Kandahar designs to ensure adequate technical interface coordination between USACE scope and KHPP.**	
Contract Modification 11 29 Sep 2013	**Task xiii: The Contractor must provide a general O&M plan for the Substation. Items to be addressed must include, but not be limited to: listing of applicable equipment O&M manuals; preventive maintenance requirements not covered by O&M manuals; operator position descriptions and associated minimum training requirements including recommendations for recurring training.**	
Contract Modification 11 29 Sep 2013	**Task xiv: The Contractor must procure spare parts for Substation components. Notify the COR of planned parts' purchases and associated costs prior to procurement.**	

Source & Date	Deliverable	Change & Date
Original Contract 09 Dec 2010	Deliverable 1: Renovation and commission of the Substation completed. 24 months following NTP.	Delivery Schedule change 12 Nov 2011
Contract Modification 06 12 Nov 2011	Deliverable 1: Renovation and commission of the Substation completed. 1 May 2013.	Deleted and Replaced 14 Feb 2013
Contract Modification 10 14 Feb 2013	**Deliverable 1: Replacement and commissioning of the Substation completed. 10 August 2013 commissioning completion. Final acceptance 31 Oct 2013.**	
Contract Modification 10 14 Feb 2013	**Deliverable 2: Technical review reports of USACE's designs as directed by the COR. As required. No less than 7 calendar days and no more than 21 calendar days from the time USAID provides the information to B&V.**	

Source & Date	Deliverable	Change & Date
Contract Modification 11 29 Sep 2013	**Deliverable 3: O&M plan for the substation. 30 November 2013.**	
Contract Modification 11 29 Sep 2013	**Deliverable 4: Spare parts for the substation components. 31 December 2013.**	

2.4 Deliverables

A listing of major deliverables and the dates scheduled and achieved for the work required by Subcomponent 1.1 is provided in Table 3 below:

Table 3: Subcomponent 1.1 – Contract Deliverable Scheduled and Achieved Dates

Deliverable	Original Schedule	Achieved Date
Deliverable 1: Replacement and commissioning of the Substation complete.	10 August 2013 Commissioning completion Final acceptance 31 October 2013	27 September 2014
Deliverable 2: Technical review reports of USACE's designs as directed by COR.	As required. No less than 7 calendar days and no more than 21 days from the time USAID provides the information to B&V	28 February 2014
Deliverable 3: O&M plan for the Substation.	30 November 2013	19 December 2013
Deliverable 4: Spare parts for the Substation components.	31 December 2013	8 December 2013*

** This date is when the notification to proceed with detailed pricing was received. Detailed pricing was provided and accepted by USAID on 17 January 2014.*
*Milestones taken from Schedule of Deliverables of Contract Modification 11(**Attachment m-03**).*

The statuses of the contract deliverables is listed in Table 4 below:

Table 4: Subcomponent 1.1 – Contract Deliverables Status

#	DELIVERABLE	METHOD OF VERIFICATION	STATUS	ATTACH.
1	Replacement and commissioning of the Substation complete.	Witness of commissioning according to government approved commissioning plan.	Complete	d-01
2	Technical review reports of USACE's designs as directed by COR.	Government review of technical review reports.	Complete	d-02
3	O&M Plan for the Substation.	Site inspection and document review.	Complete	d-03
4	Spare parts for the Substation components.	Site inspection and document review.	In Progress	d-04

Deliverables as of Contract No. 306-C-00-11-00506-00 Modification 11

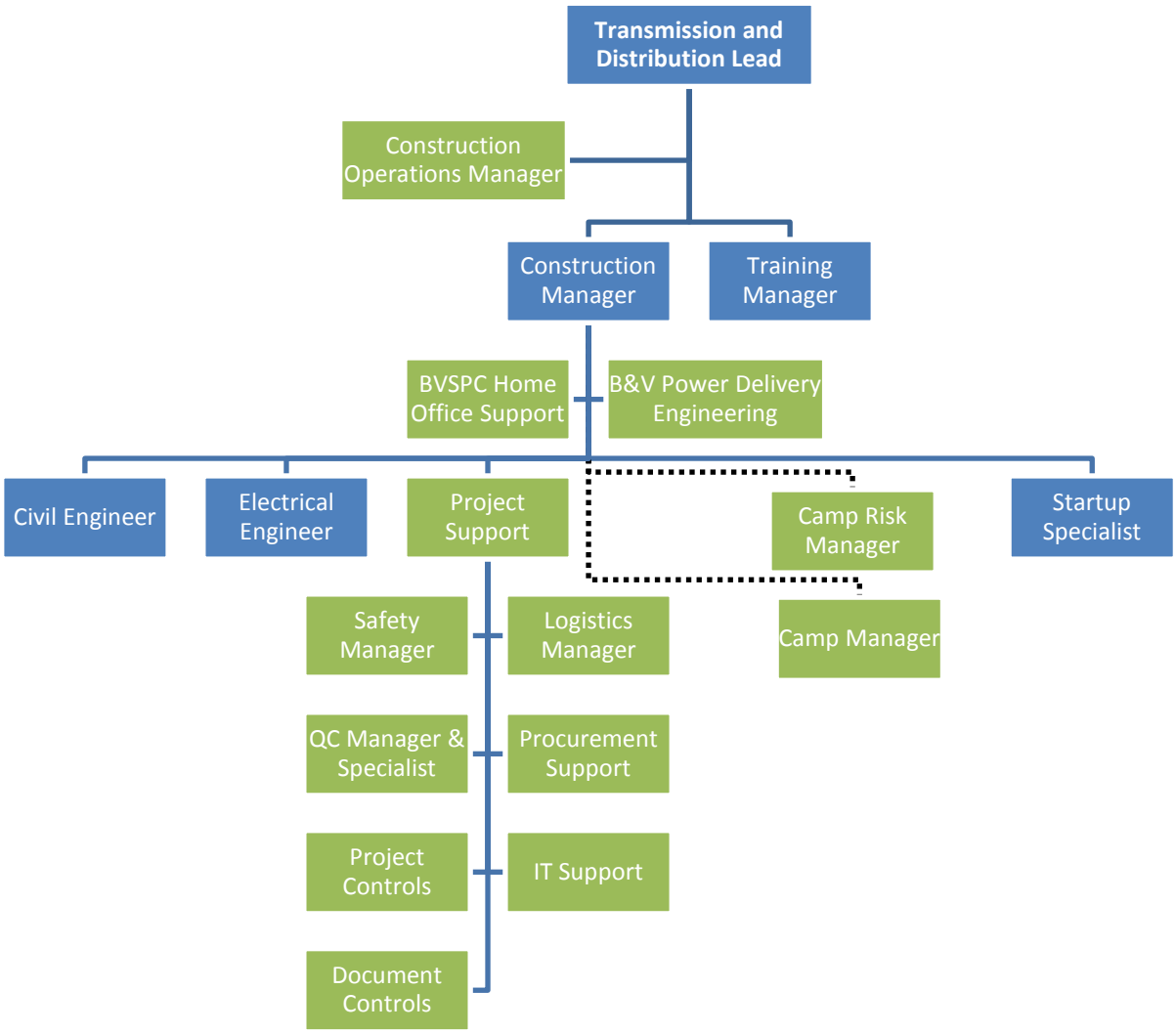
3 PROJECT EXECUTION

3.1 Organizational Structure and Management Details

(Reference Component 3 to review the entire Organization Chart for KHPP)

3.1.1 Sector Lead – Transmission & Distribution

Figure 2: Organization Structure of Subcomponent 1.1 as of May 2013



The Transmission and Distribution (T&D) Sector Lead was based at the KHPP Regional Camp located at Amtex Village, Kandahar. The Sector Lead assumed the overall responsibility for Subcomponent 2.1 implementation scope, schedule and budget, and was responsible for all related subcontract management, client coordination and reporting, correspondence, invoice approval, mobilization of personnel, approval of home office personnel applied to Subcomponent 1.1 and other project management activities in coordination with KHPP Program Management. The primary individual responsible for this position included Lynn Liikala-Seymore.

3.1.2 Construction Operations Manager

The Construction Operations Manager was responsible for coordination of the Substation safety, construction, testing, and commissioning on the project. This coordination included compliance with the schedule, safety, cost, and quality decisions in conjunction with the Construction Manager and Sector Lead. The primary individuals responsible for this position included Howard Wakefield and Michael Tennyson.

3.1.3 Construction Manager

The Construction Manager reported directly to the T&D Sector Lead and was based first at the KHPP Regional Camp and then at the Breshna Kot Camp. The Construction Manager was responsible for the execution of the Substation design and construction and the distribution line construction project scope of work within schedule. Additional responsibilities included implementation of DABS training for and oversight and assistance in the operation and maintenance of the facility during construction, budget and cost control, and ensuring daily activities were documented and reported in accordance with the Project Execution Plan. The Construction Manager was also responsible for the coordination of the work effort with KHPP Program Management resources, Sector Lead, COR and DABS officials located in Kandahar. The primary individuals responsible for this position included Phillip Baker and Max Turnbull.

3.1.4 Field Engineer Civil

The Field Engineer Civil reported directly to the Construction Manager and was based at the KHPP Regional Camp. The Field Engineer was responsible for the execution of the civil works of the Substation design and construction project. Additional responsibilities included implementation of DABS training for and oversight and assistance in the operation and maintenance of the substation, civil design review to completion, and ensuring daily activities were reported and in accordance with the schedule and the Project Execution Plan. The Field Engineer Civil was also responsible for the coordination of work effort with KHPP Program Management resources. The primary individuals responsible for this position included Jason Hussey and Michael Henderson.

3.1.5 CCN Field Engineer Civil

One Field Engineer Civil was local national staff. The job description is equivalent to 3.1.4.

3.1.6 Field Engineer Electrical

The Field Engineer Electrical reported directly to the Construction Manager and was based at the KHPP Regional Camp. The Field Engineer was responsible for the execution of the electrical works of the Substation design and construction project. Additional responsibilities included implementation of DABS training for and oversight and assistance in the operation and maintenance of the facility, electrical design review to completion, ensuring daily activities are reported and in accordance with the schedule and the Project Execution Plan, and the coordination of work effort with KHPP Program Management resources. The primary individuals responsible for this position included Vasile Berbece and Laurie Reese.

3.1.7 CCN Field Engineer Electrical

One Field Engineer Electrical was local national staff. The job description is equivalent to 3.1.6.

3.1.8 Safety Manager

The Safety Manager reported directly to the Constructions Operations Manager and was based at the KHPP Regional Camp. The Safety Manager was responsible for the safe execution of the Substation design and construction project scope of work. Additional responsibilities included assistance with Job Hazard Analysis (JHA) as required. The Safety Manager was responsible for training of DABS staff in Safety and Health as part of oversight and assistance in the operation and maintenance of the facility, and Safety and Health Inspections of the Work Site. The Safety Manager was also responsible for ensuring daily activities in accordance with the KHPP Safety Plan and the coordination of work effort with KHPP Program Management resources. Onsite Safety Management was by design to be undertaken daily by local Afghan Staff trained and overseen by the Safety Manager. The primary individuals responsible for this position included Phillip Brundage, Tom Franzoni, and Benny Garza.

3.1.9 CCN Safety Manager

One Safety Engineer was local national staff. The job description is equivalent to 3.1.8.

3.1.10 Quality Control (QC) Manager

The Quality Control (QC) Manager reported directly to the Constructions Operations Manager and was based at the KHPP Regional Camp. The QC Manager was responsible for the execution of the Substation design and construction project scope of work in accordance with the Three Phase QA program of the US Army Corps of Engineers, per Prime Contract requirements. Additional responsibilities included oversight of materials and equipment testing and phased acceptance of completed work as meeting QA Plan requirements. The QC Manager maintained daily Inspections of the Work Site and ensured daily work activities were in accordance with the KHPP QC Plan while coordinating the work effort with the KHPP Program Management as well as USAID onsite inspection resources. The primary individuals responsible for this position included Robert Lester, Ross Reyes, Roland Hanooman, Sao Kanjana, and Somkiet Nantasan.

3.1.11 CCN Quality Control Manager

One Quality Control Engineer was local national staff. The job description is equivalent to 3.1.10.

3.1.12 Document Control Specialist

The Document Control Specialist reported directly to the KHPP Deputy Chief of Party and was based at the KHPP Regional Camp. The Document Control Specialist was responsible for the control and proper archiving of all documents and reports applicable to Substation design and construction. The Document Control Specialist worked on multiple projects simultaneously and ensured all staff were following proper filing protocols. The primary individuals responsible for this position included Iba Wagner, Ilir Marevci, Leah Boice, Vicki Feazell, and Marina Bouwer.

3.1.13 Startup Specialist

The Startup Specialist reported directly to the Constructions Operations Manager and was based at the Durai Junction Camp. The Startup Specialist was responsible for oversight of the startup of the Substation. Additional responsibilities included implementation of DABS training for and oversight and assistance in the operation and maintenance of the facility, ensuring daily activities are reported and in accordance with the schedule and the Project Implementation Plan. The Startup Specialist was also responsible for the coordination of the work effort with the KHPP Program Management resources. The primary individual responsible for this position was Ratchasit Jitkarun.

3.1.14 Camp Manager

The Camp Manager reported to the KHPP Life Support and Air Operations Manager and was based at the Durai Junction Camp. The Camp Manager was responsible for ensuring quality control of all life support functions at the Substation design and construction project site.

3.1.15 Deputy Camp Manager

One Deputy Camp Manager was local national staff. The job description is equivalent to 3.1.14. One additional Administrative Assistant was a local national staff and served as the Acting Deputy Camp Manager as requested.

3.1.16 In-Country Program Management Resources

In-Country Program Management Organization (PMO) resources include: Program Management, Finance, Contracts - Procurement - Compliance, Logistics, Security, Health & Safety, Environmental, Reporting, Quality Control, Project Controls, Document Controls and Human Resources. The PMO team was located in Kandahar, Afghanistan and made periodic visits to the KHPP sites on an as-needed basis. The primary responsibilities of the PMO were to provide functional support to all Components in accordance with approved Implementation Plans, KHPP Program, and BVSPC Corporate and USAID established policies and procedures.

3.1.17 Home Office Program Management Resources

The Home Office management resources were available to perform project support throughout the duration of the KHPP program. Home Office project management

resources provided back-reach support to field office support personnel in all the KHPP program support areas. The field and home office jointly performed accounting, finance, human resources, procurement, and compliance functions. Monthly intensive reviews of the Project were performed at the Black & Veatch Special Projects Corporation, Federal Services Division Headquarters in Overland Park, Kansas, USA.

3.1.18 Home Office Engineering Resources

Home Office Engineering resources include civil, structural, electrical, and control and protection engineers, as well as drafters and technicians. The primary responsibilities of the Home Office Engineering Resources were to provide design and engineering for the electric distribution system analysis, the new Substation, and the new transmission line for connecting to the existing line. Home Office Engineering resources were to also specify the distribution materials needed for DABS to perform the system expansion and improvement work. This work also included writing the technical requirements to procure materials and construction services necessary to build the Substation and to procure materials for the distribution system expansion and improvements. This work was provided in accordance with approved plans, policies, and procedures. The primary individuals responsible for this position included Chris Martens, Samir Awad, and Jason Hussey.

3.1.19 Technical Training Manager

The Technical Training Manager reported to the T&D Sector Lead. The Technical Training manager was responsible for developing lessons and course content for Substation Operations and Maintenance. The Technical Training Manager was also responsible for job management, safety, and MEW standards. The primary individual responsible for this position included Rod Patullo.

3.1.20 CCN Technical Training Manager

One Technical Training Manager was local national staff. The job description is equivalent to 3.1.19.

3.1.21 Project Controls Engineer

The Project Controls Engineer reported to the Construction Manager. The Project Controls Engineer was responsible for developing and maintaining cost and schedule reports, including tracking work progress at the construction site. The primary individuals responsible for this position included Bill Rockey, Arlan Resoco, Daryl Robert, and Karen Marshall.

3.2 Implementation of Work

In December 2010, USAID awarded BVSPC Contract No. 306-C-00-11-00506-00 to perform the Kandahar Power Initiative (later re-named Kandahar Helmand Power Project or KHPP), and began immediately executing activities under Component 1 Subcomponent 1. At the inception of the KHPP, USAID coordinated the relationship with DABS Kabul to maintain communication and reporting of KHPP activity and progress. BVSPC maintained communication and reporting of KHPP field activity with the Kandahar DABS Director. BVSPC continued to coordinate and maintain liaison with Kandahar DABS, as well as

Regional Command - South (RC-S) and Regional Command - Southwest (RC-SW) and the USAID Onsite Mangers (OSM) working directly with DABS in Kandahar and Helmand Province. This communication and reporting continued throughout the implementation of the KHPP. The OSM reported to the COR. The construction Manager worked directly with their counterparts in Kandahar DABS, and communicated mutual needs and concerns. The working relationships between the KHPP staff and the Kandahar DABS Director, senior managers, and staff were consistently positive and productive.

After receiving USAID consent, a Firm Fixed Price EPC Subcontract was issued to Afghanistan Electrical and Power Systems (AEPC) to replace the existing Breshna Kot Substation and provide factory based training and onsite training for DABS staff. USAID reduced the scope of the project approximately 1 year into the project, resulting in a significant change to the subcontract. BVSPC utilized additional Subcontractors for demolition work and quality control testing work.

The Subcontractor utilized Sub-subcontractors for the following duties:

- Security
- Design and supply of equipment and materials
- Concrete work
- Testing and Commissioning
- Training

Task i: *Replace the Kandahar Breshna Kot Substation while maintaining existing service for customers served by the existing deteriorated Substation. Coordinate with DABS for removal of obsolete equipment and existing facilities as needed for construction of the new Substation. Do not remove obsolete equipment or existing facilities which are not required to be removed for construction of the new Substation unless requested by DABS and directed by the COR.*

Status: COMPLETE

In consultation with DABS and USAID, BVSPC replaced the Kandahar BK Substation as specified in tasks ii through xii. BVSPC coordinated with DABS for dismantling specific equipment. DABS requested the existing Substation remain in place so that it could be relocated to the Arghandab Hydro Power Plant. DABS also requested the existing protection, control, and metering panels, as well as the 20 kV switchgear, be removed and located to an onsite warehouse and that floor openings be secured. This relocation work and security work were completed. The replacement of the deteriorated Substation was completed without any extended customer outages (**Attachment b-01**).

Task ii: *Increase capacity and reliability of the Substation to provide 60 MVA of capacity. The new Substation will utilize four (4) new 20 MVA transformers, three (3) in service plus one (1) spare.*

Status: COMPLETE

BVSPC installed three 12/16/20 MVA power transformers which were procured as a task of Subcomponent 2.2. A fourth transformer of the same size was placed onsite and dressed for use as a spare transformer. The transformer details are listed in Table 5 below:

Table 5: 110/20 kV 20 MVA Power Transformer Serial Numbers

Unit	Manufacturer	Serial Number	Substation Designation
1	Crompton Greaves Limited	ET/9950/1	T1
2	Crompton Greaves Limited	ET/9950/2	T2
3	Crompton Greaves Limited	ET/9950/3	T3: Spare
4	Crompton Greaves Limited	ET/9950/4	T4

The general arrangement of the Substation is shown on Drawing 042246-KDBK-E7500, General Arrangement (**Attachment b-02**).

Task iii: *The new Substation will utilize a breaker-and-a-half configuration.*

Status: COMPLETE

The new Substation utilizes a breaker-and-a-half configuration on the 110 kV system. Space has been allocated for a second bay to accommodate a second transmission line and connecting the spare transformer. The single line diagram illustrates the breaker-and-a-half scheme as installed: Drawing 042246-KDBK-E7100 **(Attachment b-03**).

Task iv: *The Contractor must replace the Substation, providing: (a) two 110 kV transmission lines, one from Kajaki HPP and one future line to a future Substation planned on the east side of Kandahar; (b) three - 110/20 kV 20 MVA transformers; and (c) four 20 kV switchgear lineups to supply twelve (12) 20 kV feeders.*

These twelve 20 kV feeders will consist of seven corresponding to the existing seven feeders (511, 512,513, 514, 516, 518, and 519), two for the existing QSK-60 generators, two for the existing KT A-50 generators (or their replacement), and one spare. In order to minimize outage times which may be necessary when the existing switchgear is replaced, the Contractor must install new switchgear at a different location onsite and provide redundant controls and lighting as needed. One lineup of switchgear, configured to interconnect with the new switchgear, must remain onsite and secured for future use.

The Contractor must maintain one of the new 20 MVA transformers onsite as a new system spare located such that relocation is not required should additional generation be available.

The Contractor must design and construct the configuration of the Substation such that the existing 110 kV transmission line does not need to be relocated when the second line is installed.

Status: COMPLETE

The Substation has been designed and constructed to include the following components:

a) One110 kV line termination for the line from Kajaki HPP (via Durai Junction) and to accommodate a second transmission line on the north side of the Substation. A sketch of the line route is included in **Attachment b-04**. As noted in the sketch, the new 110 kV line section from Kajaki does not need to be relocated when a second line is brought into the Substation.

b) Three 110/20 kV 20 MVA transformers, plus one spare located to enable the transformer to be connected (**Attachment b-01**) when additional generation becomes available.
c) Four switchgear lineups (A1, B1, A2, and B2) to supply twelve feeders (feeders to 511, 519, QSK-60, 512, 514, MTU-2, 518, MTU-1, 516, 513, KTA-50, and one spare). Four 20 kV sources are also available as spares. Three of the four feeder positions are being utilized for the multiple auxiliary 20 kV/400 V transformers onsite (Aux-TR1,Aux-TR2, and Aux-MTU). These 20 kV breaker positions may be utilized in the event additional feeders are required, as shown on Drawing 042246-KDBK-E7100 Sheet 2 **(Attachment b-03**). Redundant controls and metering are installed in the 110 kV Control Building. The location of these controls is shown on Drawing 042246-KDBK-E7504 (**Attachment b-04**). The detailed panel elevation drawings are included in task vii (**Attachment b-07**).

Task v: *The Contractor must replace the switchyard including, at a minimum; new surge arrestors, capacitance voltage transformers, SF6 circuit breakers, lightning arrestors, disconnect switches, voltage transformers, current transformers, auxiliary transformer, site fencing, and site lighting.*

Status: COMPLETE

None of the 110 kV equipment within the old Substation was reutilized for the new Substation. New surge arresters, capacitance voltage transformers, 110 kV SF6 circuit breakers, disconnect switches, current transformers, auxiliary transformers, site fencing, and site lighting were installed. The 110 kV circuit breakers used were procured as a task of Subcomponent 2.2. Refer to the general arrangement drawing in **Attachment b-02**, the section drawings in **Attachment b-04,** and **Attachment b-05**.

Table 6: 110 kV Circuit Breakers Serial Numbers

Unit	Manufacturer	Serial Number	Substation Designation
1	Crompton Greaves Limited	X304389	CB1
2	Crompton Greaves Limited	X304390	CB2
3	Crompton Greaves Limited	X304391	CB3
4	Crompton Greaves Limited	X304392	CB4
5	Crompton Greaves Limited	X304393	CB5
6	Crompton Greaves Limited	X304394	CB6

Task vi: *The Contractor must replace medium voltage switchgear on the 20 kV feeders, including, at a minimum, the following new items: circuit breakers, current transformers, ampere meters, voltage meters, power factor meters, energy meters, lightning arrestors, voltage transformers, and relays.*

Status: COMPLETE

All 20 kV switchgear was replaced for the new Substation. The new switchgear utilizes circuit breakers, current transformers, multi-function meters (current, voltage, energy, and power factor), lightning arresters, voltage transformers, and protective relays (**Attachment b-06**).

Task vii: *The Contractor must replace the Control Room to include the 110 kV control, protection, metering, and communication equipment, as well as AC and DC battery systems necessary to support the Substation operation. In addition, the Contractor must provide monitoring for voltage, current, power (watts and vars), and energy for all 20 kV feeders, both load and generation.*

Status: COMPLETE

All 110 kV protection, control, and metering equipment was replaced for the new Substation. New AC and DC systems were installed. The new metering equipment monitors and records voltage, current, power (both watts and vars), and energy. Each feeder (both load and generation) and transformer are measured (**Attachment b-07**).

Task viii: *The Contractor must install new 20 kV feeder cable from all functioning diesel generators to include existing QSK-60s, relocated KT A-50s, and new MTUs to new 20 kV switchgear. Replace control, power, metering, and communications cable from generators to new 20 kV switchgear.*

Status: COMPLETE

All 20 kV cable was replaced as part of KHPP for the new Substation. New 20 kV cable was installed from the new switchgear to the existing feeders from the KTA-50 to the switchgear and from the QSK-60 to the switchgear. Subcomponent 1.5 installed two new 20 kV feeder cables from the MTU to the existing switchgear. These two new sets of cables were relocated to the new 20 kV switchgear (**Attachment b-08**).

Task ix: *The Contractor must demolish the existing multipurpose building containing the worker dormitory and transformer repair shop and the generator repair shop due to the interference of these facilities with new Substation construction. If requested by DABS and directed by the Contracting Officer, the Contractor will provide tools, equipment, or furnishings for existing replacement facilities onsite not to exceed a total cost of* [redacted].

Status: COMPLETE

In consultation with DABS and USAID, the multipurpose buildings (Figure 1, Items 16 and 17) were demolished by BVSPC using a local Subcontractor, as these building interfered with the location of the new Substation. DABS utilized onsite buildings located on the west side of the site for these functions. BVSPC provided tools and equipment for DABS. The list of tools provided to DABS is included in **Attachment b-09**.

Task x: *The Contractor must remove and dispose of the following existing site structures currently interfering with planned substation construction: (a) Concrete wall dividing the future Substation site. (For cost savings, if deemed adequate for anticipated substation structure loads, the Contractor will leave existing wall footings in place.) (b) Foundations from old Fairbanks Morse generators. (c) Oil storage and containment pit on east side of site.*

Status: COMPLETE

In consultation with DABS and USAID, all obsolete structures within the bounds of the substation were demolished, including the concrete wall, abandon foundations, and the oil

storage and containment pits (**Attachment b-10**). Refer to Figure 1, Items 14 (foundation) and 18 (concrete wall), and the area east of Item 7 (oil and containment pit). A new containment pit was installed as part of Subcomponent 1.5. The oil and containment pit utilized an impermeable membrane. All hydrocarbon contaminated refuse was transferred to this pit, which was then sealed with a concrete cap. Refer to Subcomponent 1.5 closeout report for additional details. Photographs of the clean site are included in **Attachment a-09**.

Task xi: *The Contractor must improve site security by providing a vehicle emergency egress route from site and an emergency exit gate.*

Status: COMPLETE
With consultation with USAID and DABS, a second exit route from the site was installed on the north side of the complex with an emergency exit gate installed on the east side of the complex as shown in the site plan, Drawing 042246-KDBK- C7611 (**Attachment b-11)**.

Task xii: *The Contractor must provide technical reviews of US ACE SEPS Helmand and SEPS Kandahar designs to ensure adequate technical interface coordination between USACE scope and KHPP scope.*

Status: COMPLETE
BVSPC provided technical reviews of USACE Helmand and Kandahar designs as requested. The list of these reviews is provided in **Attachment b-12.**

Task xiii: *The Contractor must provide a general O&M plan for the Substation. Items to be addressed must include, but not be limited to: listing of applicable equipment O&M manuals; preventive maintenance requirements not covered by O&M manuals; and operator position descriptions and associated minimum training requirements, including recommendations for recurring training.*

Status: COMPLETE
Following the DABS template, BVSPC developed an operations and maintenance plan for the Substation. The plan details what work is to be performed each week. The corresponding equipment manual and work tracking form was provided (**Attachment b-13)** for each task**.**

Task xiv: *The Contractor must procure spare parts for Substation components. Notify the COR of planned parts' purchases and associated costs prior to procurement.*

Status: COMPLETE
Two sets of spare parts have been identified for the Substation: (a) spare parts typical to a Substation were provided by the Subcontractor as part of the EPC scope of work, and (b) additional spare parts as required in Prime Contract Modification 11 (signed 29 September 2013) were to be provided by BVSPC. Per Modification 11, using the spare parts identified by manufacturers as well as spare parts recommended by Subcontractors, BVSPC submitted a recommended spare parts list to the COR on 2 December 2013. With the

agreement on the list of parts, BVSPC obtained estimated pricing and lead times. This information was submitted and accepted by the COR.

Procurement of this material progressed. Lead times of the parts varied from off-the-shelf to 8 months. The materials were delivered to Afghanistan in several shipments, the final of which was received and turned over to DABS on 30 September 2014 (**Attachment d-04**). Switchgear, circuit breaker, and transformer spare parts were procured under Subcomponent 2.2, and the documentation of that transfer is provided as part the Subcomponent 2.2 Closeout Package.

a) Spare parts provided by BVSPC's Subcontractor include the materials listed below. These items were inventoried with DABS and EQUALS:
    1. Disconnect switch pinion, auxiliary switch, hub magnet, insulators, and both earth and ground switch contacts.
    2. Surge arrestor.
    3. GPS clock (spare was on site, so no additional procurement was required.
    4. Control room ac panel circuit breakers.
    5. Control room dc panel circuit breakers.
    6. Control panel bulbs, lenses, position indicators, push buttons, diodes, and test pins.
    7. Battery room filter.
    8. Protective relays:
        i. SEL 451
        ii. SEL 787
        iii. SEL 387A
        iv. SEL 421
        v. SEL 587Z
        vi. GE D60

b) Spare parts provided by BVSPC include:
    1. 20 kV Switchgear:
        i. 1,250 A circuit breakers
        ii. 630 A circuit breakers
        iii. Trip coils
        iv. Close coils
        v. Current transformers (2 types)
        vi. Potential transformers
        vii. Test switches (4 types)
        viii. Lockout relays
        ix. Auxiliary relays (3 types)
    2. Four and five core 110 kV current transformers
    3. 110 kV switch contacts
    4. 110 kV capacitive voltage transformers
    5. Annunciator modules
    6. Data switch/router
    7. Protective relays:
        i. SEL 451
        ii. SEL 787

iii. SEL 387A
iv. SEL 421
v. SEL 587Z
vi. GE D60

8. Energy meter
9. 110 kV surge arrester

3.3 Subcontracts and Major Procurements

All filing and procurements used a four letter location code to designate the component/subcomponent as part of the project management process. The code is “KDBK” for this Subcomponent 1.1. A unique identifier was then added as a suffix for each subcontract for procurements. A KHPP location code was used if a subcontract was issued for either the camp or multiple components. All subcontracts utilized for this Subcomponent are listed in **Attachment c-05**.

3.3.1 KDBK.73.1010 - AFGHAN ELECTRIC POWER COMPANY/DRAKE & SKULL JOINT VENTURE (AEPC / DSI JV)

The major subcontracted elements of work for this Component were performed by AEPC/DSI JV. On 01 October 2011, after receiving USAID consent, a Firm Fixed Price EPC Subcontract was issued to AEPC/DSI by BVSPC for [redacted].

The scope of project services for this subcontract consisted of: (1) designing, engineering, procuring, manufacturing, testing and inspection of equipment at manufacturer’s works; (2) packing, supply, transportation, cargo insurance, delivery to site, unloading and handling at site, storage insurance and equipment erection, including associated civil and structural works; (3) constructing facilities; (4) installing and checking equipment; (5) checking out systems; (6) startup and commissioning; and (7) performance testing a complete Substation and transmission line. The scope further included the cabling, lighting, lightning protection, earthing, association of Sub-subcontractors in the erection, supervision, site testing, inspection, and commissioning of the work.

BVSPC responsibilities for monitoring the Subcontractor's work included, but were not limited to, the following:

- Review and monitor time schedules and milestone dates established by the Subcontractor and reported in Subcontractor’s monthly progress report.
- Monitor Subcontractor performance to ensure negotiated technical specifications are complied with and all obligations are met.
- Monitor quality assurance reviews by Subcontractor with equipment vendors as needed to ensure proper manufacture, assembly, and testing under the cooperation with the Purchaser’s independent inspection.
- Review critical shop drawings, documents, and reports as appropriate.
- Review main design criteria and parameters, concepts, techniques, procedures, and schedules provided by the Subcontractor.
- Witness shop test of major equipment.
- Monitor Customs Clearance process and procedures as needed to ensure Purchaser’s USAID Duty Exemption processes are met.

In addition, AEPC's scope of services included, but was not limited to, provision of all required project management, including administration, project coordination, scheduling, estimating, scheduling, etc.

Engineering services provided by AEPC/DSI JV included, but were not limited to:

- Taking all statutory clearances from regulating and controlling authorities for various equipment and services.
- Detailed layout and project detailed design.
- Equipment and material specification preparation.
- Procurement and expediting of all Substation, transmission line, and distribution line equipment, materials, and supplies.
- Delivery of equipment and materials used at the job site.
- Relay setting and coordination calculations.
- Site and soils investigations and surveys.
- Detailed design of the civil, structural, and electrical systems.
- Design documentation.
- Submittal of Subcontractor-generated documents for compliance review.
- Resident engineering.
- Quality Assurance/Quality Control (QA/QC).
- Spare parts control and inventory.
- O&M manuals and instructions.
- Reconciliation with custom authorities in case of foreign suppliers.
- Complete design engineering documentation.
- Engineering completion.
- "Conformed to construction records" (as-built) drawings.
- Participation in meetings as requested by the Purchaser.

Construction services included in AEPC/DSI JV subcontracted scope of work included, but was not limited to, the following:

- Construction management.
- Construction scheduling.
- Erection documentation/philosophy.
- Construction, equipment erection and installation, labor, labor supervision, and tools required to implement the engineering designs as also provided by AEPC/DSI JV.
- Construction equipment.
- Temporary (construction) power supply.
- Construction facilities, services and utilities.
- Safety and loss prevention.
- Quality assurance/ quality control.
- Expediting procurement.
- Manufacture's field services.
- Site security to be a coordinated effort with the Purchaser's site security team.
- Equipment/material receiving, handling, and storage.

- Pre-operational checkout, testing, and startup.
- Commissioning.
- Construction closeout.

In order for AEPC/DSI to furnish a complete Substation, their scope of work also included site preparation, surveying and topographic mapping. Once this work was completed, AEPC/DSI designed the site pad and location and performed required excavation, fill and soil improvements, and compaction. Required drainage, waste disposal, roads and walkways were also included in the site preparation and construction.

AEPC/DSI also provided consumables and spare parts for construction, startup, testing, commissioning until commercial operation was achieved, including, but not limited to, the following: grease, lubricating oils (flushing and operating), maintenance materials, spare parts warehousing, management, and turnover to the Purchaser.

Furthermore, AEPC/DSI provided training and instruction of the Owner's O&M staff in the operation, maintenance and repair of all Substation equipment, including any and all Supervisory Control and Data Acquisition (SCADA) systems used. Coordination of checkout, startup, and initial operation of Substation equipment and systems with Purchaser, DABS, and Owner was conducted.

This subcontract furnished, but was not limited to, the following: (1) Make earth resistivity measurements at site (based on four electrode method), and design and install the earthing grid in accordance with the applicable codes and standards. The earthing grid was then completed along with earthing of all Substation equipment, including transformers. (2) Complete direct stroke lightning protection using Lightning Mast and/or shield wire and its connection to earth grid, power and control cables, cabling (including interpole and interpanel), cable support angles, cable trays and accessories necessary for cable erection such as glands, lugs, clamps for cables, ferrules, cable ties, etc. were furnished and installed as required. (3) Power and control cable schedule and termination schedules were prepared by AEPC/DSI and reviewed by the Purchaser.

Substation ac and dc services, including automatic transfer switches, medium voltage power transformer, distribution transformers, generator set, batteries, battery chargers, and protective equipment for these services, were included. In addition, AEPC/DSI included lighting system for the complete Substation within the Substation perimeter wall, SCADA system, protection and metering system including distance recorder, fault locators, event logger and GPS time synchronization equipment. Finally, AEPC/DSI furnished bay identification plates, phase markers, and danger plates.

AEPC/DSI's scope of work also included all structures/facilities required for the effective functioning of the Substation, whether or not they are specifically mentioned. The scope of Subcontractor for Civil and Structural works included, but

was not limited to, detailed design criteria, including basis of design prepared by the Subcontractor based on various requirements specified elsewhere in the specifications. All the above documents were finalized after Purchaser's review and formed the basis of detailed engineering work.

In addition, AEPC/DSI's scope of work included civil and structural works associated with the Substation gantry structure and Lightning Mast as required, civil and structural works associated with the Substation equipment supporting structures and station service equipment as required and, the foundations for the equipment support structures, including foundations for the structures and equipment pads.

The Subcontractor determined the foundation type required based on site conditions. Support structures are galvanized steel, and structures are galvanized steel. All protection measures were included to prevent any damage to the adjoining structures/facilities.

Included in this Scope of Work was Purchaser furnished equipment specifications. The Subcontractor provided any and all items, as required, not specifically listed in these specifications necessary for the installation, testing, and operations of this substation. Any items, though not specifically mentioned but which are required to render the Substation complete in all respects for its safe, efficient, reliable, and trouble-free operation, were deemed to be included and were supplied and erected by the Subcontractor as required, unless specifically excluded.

Amendment 1:
On 04 October 2011, BVSPC amended the contract with AEPC/DSI JV for [redacted] cost to modify the milestone payment schedule.

Amendment 2:
On the 11 October 2011, BVSPC amended the contract with AEPC/DSI JV to decrease the contract value by [redacted]. This amendment accounted for additions/deletions to the scope of work and changes to the contract milestones and language as listed in Table 7 below.

Table 7: Work Scope Changes and Final Negotiated Subcontract Cost Impact

Item	Description	Driver	Subcontract Cost Impact
1	Transport, unload, refurbish, and installation of two 20' GFE containers from AMTEX Village to Breshna Kot. Provide number of days to complete the work and lump sum price to complete the work. Provide option price for additional pairs of containers to a maximum of ten (10) total containers.	Need for office space and emergency overnight accommodation.	$ 33,001.40
2	Demolition of existing buildings (dormitory, transformer repair shop, diesel generator repair shop). Provide number of days and a lump sum price to complete the work.	Condition identified after Security Movement allowed and confirmed in Mod 6.	Work to be completed by Others at lower cost.

Item	Description	Driver	Subcontract Cost Impact
3	Demolition of the Great Wall and Diesel Fuel pit. Provide estimated quantities of concrete to be removed, estimate of fill material required, number of days to complete the work, and lump sum price to complete the work.	Condition identified after Security Movement allowed and confirmed in Mod 6.	Work to be completed by Others at lower cost.
4	Install two structures and conductor and relocate existing conductor on the 110 kV transmission line for reconfiguring existing line into new Substation. Provide number of days to design these structures, number of days to install the structures, and lump sum price to complete the work.	C1S4 BK – East T-line work cancellation required this work to be transferred to C1S1 and confirmed in Mod 6.	[redacted]
5	Design, procure, and install grounding of all conductive structures below the reconfigured 110 kV transmission line. Design, procure, and install ground grid interconnection between the three onsite generation facilities and the new Substation. Provide size and estimated quantity of conductor required and lump sum price to complete the work.	Safety condition identified after Security Movement allowed.	[redacted]
6	Design, procure, and install one annunciator panel. Provide estimated number of days to design this system and lump sum price to complete the work.	Requested by MEW NLCC Project.	[redacted]
7	Remove existing KTA-50 generator 20 kV feeder and install one (1) new 20 kV feeder, including design, procurement, and construction.	Mod 6 requirement to relocate the on-site KTA-50 generators.	[redacted]
8	Remove existing MTU generator 20 kV feeders (yet to be installed to old switchgear) and install two (2) new 20 kV feeders, including design, procurement, and construction.	Mod 6 requirement to add MTU generators at Breshna Kot.	[redacted]
		Subtotal - Additions.	[redacted]
Delete the following scope of work items per the attached draft subcontract document:			
9	One 110 kV Bay/Diameter (structures, foundations, wire, switches, control, protection systems, etc.), excluding the bus disconnect switches. Provide a detailed list of materials not being procured and work not being performed and lump sum deduction price.	Mod 6 C1S4 BK – East T-line work cancellation required resulted in this work being not required at this time.	[redacted]

Item	Description	Driver	Subcontract Cost Impact
10	Transport of three 110 kV circuit breakers from AMTEX Village to Breshna Kot. Provide lump sum deduction price.	Mod 6 C1S4 BK – East T-line work cancellation required resulted in this work being not required at this time.	[redacted]
11	Installation and testing of one power transformer. Transformer transport, placement, and connection for heat are required. Provide lump sum deduction price.	Mod 6 C1S4 BK – East T-line work cancellation required resulted in this work being not required at this time.	[redacted]
12	Subtraction of one RTU/HMI system. Provide lump sum deduction price.	Requested by MEW NLCC.	[redacted]
		Subtotal - Deletions	[redacted]
		Total Change	[redacted]

Amendment 3:
On 01 October 2013, BVSPC amended the contract with AEPC/DSI JV to remove SCADA from the work scope (language missed in Amendment 2) and milestone changes. The amendment did not impact cost or schedule.

Amendment 4:
Effective 01 July 2013, BVSPC amended the contract with AEPC/DSI JV to decrease the contract value by [redacted], a net reduction in subcontract value. This amendment accounted for additions/deletions to the scope of work and changes to the contract milestones and language, as listed in Table 8 below.

Table 8: Work Scope Changes and Final Negotiated Subcontract Cost Impact - Closeout

Item	Description	Driver	Subcontract Cost Impact
1	Addition of costs due to the Subcontractor due to cancellation of training class due to DABS trainees not being available.	DABS Director requested change in travel due to management responsibilities in DABS Kabul.	[redacted]
2	Addition of costs due to the Subcontractor UK/Germany/CR training cancellation (ABB.	Passport and visas not available for DABS employees.	[redacted]
3	Addition of work Transformer repair work.	Repair 20 MVA transformers for damage that occurred during shipping.	[redacted]

Item	Description	Driver	Subcontract Cost Impact
4	Addition of additional fence work.	Work requested by USAID and DABS at final inspection.	[redacted]
5	Reduction in cost for Control Panels Surface Shipment and ac/dc Panels, Cable, and Other Items Surface Shipment that were shipped by BVSPC by air.	Risk mitigation decision based on damage during shipment to transformers.	[redacted]
6	Reduction in cost for transport of transformers from AMTEX to Breshna Kot by BVSPC.	Risk mitigation decision.	[redacted]
7	Reduction in cost for cable jacket deviation.	Subcontractor requested scope variation due to schedule.	[redacted]
8	Reduction in cost for technical assistance required by subcontract not performed.	Work not required.	[redacted]
		Total Change	[redacted]

3.3.2 KDBK.71.0202 Demolition

As part of Modification 11, BVSPC was requested to remove the worker's dormitory, and transformer repair shop, and abandon generator foundations, concrete wall, and diesel tank concrete saddles. Following removal, the site was filled, graded, and compacted, and made ready for Substation construction. A local Kandahar company, Aino Construction, performed this work.

3.3.3 Quality Control

KHPP.12.2003 - Testing Services, including moisture content, compaction, and material analysis, were provided by a local Kandahar company, Real Eiffel.

KHPP.12.2004 - Testing Services, including material analysis, were provided by a local Kandahar company, Shawal.

3.3.4 Camp, Life Support, and Construction Offices

BVSPC self-performed the life support function at the Substation site and maintained full time site construction offices; therefore, multiple subcontracts were utilized for food, IT equipment, printers, plotters, generators and generator parts, diesel fuel, and other life support activities and materials. These subcontracts are identified in detail in **Attachment c-05**.

3.3.5 KDBK.71.0221 Environmental Membrane (Pit Liner)

Due to the amount of materials containing hydrocarbons, a containment cell was installed by Subcomponent 1.5. The liner for this containment cell was procured under this Subcomponent.

3.3.6 Substation Tools

KDBK.63.6901 - Grainger, USA, tools per Task ix.

KDBK.63.6902 - Tasra, UAE, tools per Task ix.

3.3.7 Spare Parts - Testing and Commissioning

KDBK.63.2002 Schweitzer Engineering Laboratories (SEL), USA, relays for commissioning.

KDBK.63.5506 Crompton Greaves Limited transformer conservator bladder.

3.3.8 Spare Parts - per Modification 11

KDBK.63.3814 Hyundai Heavy Industries, Korea, 20 kV switchgear circuit breakers, auxiliary relays, and instrument transformers.

KDBK.63.3815 CEWE, Sweden, energy meters.

KDBK.63.3816 Hamby Young, USA, test switches.

KDBK.63.6012 Tri-Star Power Sales, USA, SEL relays.

KDBK.63.6013 Midwest Technical Sales, USA, General Electric relays.

KDBK.63.6014 KC Utilities, USA, instrument transformers, etc.

KDBK.63.6016 Vertek Industrial Supply, USA, miscellaneous Substation yard parts.

KDBK.63.6017 Electro Industries, USA, precision energy meters.

3.3.9 Request for Equitable Adjustment

Two issues are outstanding for the KDBK.73.1010 subcontract:

1. Implementation of APPF.
2. Extension of security and bonds and insurance due to inability to access site (DABS delays in clearing site).

At the time of this report, BVSPC is finalizing its review of the Subcontractor's request for equitable adjustment including its supporting data. A Request for Equitable Adjustment and a Request for Consent are anticipated to be issued to USAID by 01 January 2015.

3.4 Budget and Expenditures

Per the Contract, the estimated cost and fixed fee values are established at the Component 1 level. The final costs of this subcomponent may vary; however, the sum of the final costs of all Component 1 subcomponents is limited to the total value of Component 1. A summary of the Subcomponent 1.1 Estimated Cost (revised as of Contract Modification 13) and costs billed through 25 July 2014 (as reflected in Invoice 105), is provided in Table 9 below.

Table 9: Subcomponent 1.1 – Financial Summary

Cost Report	Budget (Modification 13)	Costs Billed thru 25 July 2014	Remaining Budget
TOTAL COST (Including Fee)	[redacted]	[redacted]	[redacted]

3.5 Government Property Summary

The Final Physical Inventory was conducted by the KHPP T&D Sector Lead, DABS, USAID/EQUALS, and the Subcontractor performed on 24 October 2013. Upon completion of this inventory, this document was signed by all four parties' authorized representatives (BVSPC, USAID/IRD, DABS, and Subcontractor) to signify the completion of this task, 27 October 2013. The Final Disposition Instructions (**Attachment g-06**) were issued on 13 October 2013. Handover/Disposal Documents (**Attachment g-07**) were signed by DABS throughout closeout and turnover of the BK site.

3.6 Final Schedule

The overall schedule is included in **Attachment a-08**. The overall schedule was impacted by numerous events, including:

a. Implementation of Presidential Decree # 63 slowed the ability of BVSPC to hire a Private Security Company (PSC) and private guard force until 7 months into the project. The site was not accessible until this subcontract was in place.
b. Transition from PSC to the use of a Risk Management Company and the APPF again impacted the site due to the change in the risk profile. All expatriate personnel were limited in travel to the substation site for 66 days.
c. Closure of the Port of Quetta from 28 November 2011 through 04 July 2012 impacted the delivery of all goods manufactured outside Afghanistan.
d. Periodic closures of the border between Afghanistan and Pakistan.
e. Security incidents at the site and in Kandahar, limiting work and movement.
f. Security on the route between the KHPP Camp and BK Substation was regularly delayed or cancelled.
g. DABS completing the removal of obsolete and spare equipment from the Substation site which was not complete until August 2012, which was 1 year later than requested and required.

On 21 June 2012, BVSCP notified USAID of a 45 day schedule slip due to security issues and the Pakistan border closure. BVSPC notified USAID of a delay due to the Substation site not being cleared of DABS materials and equipment in July 2012.

Throughout June, July, August, and September of 2013, BVSPC notified USAID multiple times weekly of the status of the work, including delays associated with APPF unrest, extreme heat impacting production, particularly concrete work, and Ramadan productivity rate decreases.

For energization, BVSPC remained flexible with its energization plan to maximize the benefits of the new Substation configuration. As the Subcontractor finished specific systems, the plans were updated to place that system in service. To this end, a temporary energy source from the existing system was utilized to energize the new switchgear buses and back-feed to each generation step-up transformer to check phasing and rotation. The same approach was used to check phasing and rotation for the existing feeder connections. On 13 September 2013, each bus was energized and the loads were transferred from the old switchgear to the new switchgear, thus completing energization of the 20 kV system. With the completion of the roadways, substation surfacing, and earthing, the 110 kV Substation was energized on 25 September 2013. On 26 September 2013, the

temporary 20 kV connection was removed and all feeder loads were provided from the new 110 kV system. The Substation was turned over to DABS for operation on 27 September 2013.

The substantial completion inspection was conducted on 10 September 2013. The final completion inspection was conducted on 21 November 2013.

All site work was completed by 30 November 2013. All project work was completed by 30 November 2013, with the exception of the following:

a. Organizing testing and commissioning documents extended to 28 February 2013.
b. Procuring spare parts per Modification 11. The recommended spare parts list was approved for pursing pricing by USAID on 24 October 2013, and was on order by 28 February 2014. All parts were delivered by 30 September. One current transformer was damaged in transit and USAID determined not to replace this item.
c. Developing the maintenance plan for the Substation. This work was completed on 20 December 2013.
d. Completing the updating of the as-built and final drawings. This work was completed on 25 October 2014.

4 PROJECT PHYSICAL COMPLETION

4.1 Documentation of Completion

This project was completed with provision of all materials, equipment, and services to DABS on 27 September 2013. USAID issued the Certificate of Substantial Completion on 16 October 2013 (**Attachment m-01a**), at which time a final punch list was developed that would need to be completed before Final Completion and Acceptance was issued. BVSPC (and its Subcontractor, AEPC) completed the final punch list and informed USAID on 04 March 2014.

Spare parts procurement and delivery was completed on 30 September 2014, and USAID received and accepted all Material Receiving Reports (MRRs) documenting the receipt of the materials by DABS. USAID issued the Final Completion and Acceptance Certificate on 10 December 2014. Therefore, all project activities under this Subcomponent are complete.

4.2 Photo Album

The photo album is presented as **Attachment a-09**.

5 SUSTAINABILITY

The addition of this Substation to the SEPS system is a significant infrastructure investment that required a significant training investment by USAID for DABS operators and managers. The goal of the training program was to enable DABS to effectively operate and maintain the Substation and modify, reprogram, reconfigure, upgrade, and commission the Substation with minimal technical assistance.

Substation training was completed using three approaches. First, equipment training (110/20 kV Power Transformers, 110 kV Circuit Breakers, and 20 kV Switchgear) was conducted at

the respective factory. This training was conducted using the equipment specifically manufactured for the KHPP. The details of this training are included in the closeout report for Subcomponent 2.2, **Attachment a-25**, Procure Equipment for Additional Substations. Five DABS Kandahar representatives attended these training sessions. Second, a training regimen entitled "Introduction to Substations" was conducted in Kandahar. And third, the BK Substation Subcontractor conducted offsite and onsite detailed training. The details of the offsite and onsite training are presented in the following section.

The complete training summary for Subcomponent 1.1 was submitted to USAID October 2013, **Attachment a-25**.

5.1 Introduction to Substations

The fundamental components and principles of substations, specifically Breshna Kot Substation, were conducted at the KHPP Regional Camp in Kandahar weekly from 13 February through 6 March 2013. Ten DABS personnel, both operators and managers, attended the course. The course was designed to prepare the trainees for the intensive offsite and onsite training to be conducted later in the year. Topics presented included:

1. Introduction to the basic power system.
2. Types of Substations, configuration schemes.
3. Single line diagram of the BK Substation.
4. Protection in power system.
5. Types of relays.
6. Relay protection schemes.
7. Over-current protection.
8. Distance protection.
9. Differential protection.
10. Under- and over-voltage protection.
11. Breaker failure protection.
12. Isolation of breakers.
13. Reclosing during fault conditions.
14. Transfer trip system.
15. Communication channels for relay protection.
16. Metering system.
17. Auxiliary AC and DC power systems.
18. Substation alarm and remote control system.
19. Maintenance program.
20. Preventive and corrective maintenance.
21. Troubleshooting.

The course was conducted in both English and Pashto. The presentation format was informal, and focused on basic principles and concepts.

5.2 Offsite Training

Three offsite training sessions were conducted for DABS. Five DABS employees, including operators and managers and one BVSPC Training Manager (translator), participated in these sessions.

1. Instrument Transformer and Disconnect Switch Operation and Maintenance Training was conducted at the ABB factory in India from 9 August 2013 through 24 August 2013. The trainees benefited from having factory provided components and trainers. The learning objectives focused on the equipment utilized at this Substation:
    a. Current transformers construction and operating principles.
    b. CT equivalent circuit.
    c. The various parts of the current transformers, e.g., primary and secondary terminals, cores, oil level indicators, and bushings.
    d. CT nameplates.
    e. CT design criteria, such as live tank and dead tank designs.
    f. Oil level checking in the bellows.
    g. Installation and commission checks.
    h. CVT theory and applications.
    i. Different parts of CVT and its construction.
    j. Burden and accuracy of the CVT.
    k. Parts of the CVTs, including capacitors, HV choke etc.
    l. Manufacturing process of the CVT.
    m. CVT factory testing.
    n. Routine tests of the CVT.
    o. CT and CVT test during maintenance.
    p. Construction and different parts of the disconnect switches.
    q. Selection criteria of the disconnect switches.
    r. Closing/opening operations of the disconnect switches.
    s. Disconnect switches testing.
    t. Maintenance and troubleshooting.
    u. Earth switches and interlocks system.
    v. Disconnect switches applications and purposes.

2. Control and Protective Relay Application was conducted at the Subcontractor's facility in Dubai from 26 August 2013 through 30 August 2013. The local manufacturer's factory representative conducted the training. The trainer worked closely with the project team to align the objectives with the needs of the students. The learning objectives focused on both the protective relay schemes as well as their integration with the equipment operating characteristics and function:
    a. SEL-787 transformer differential protection relay basics.
    b. Differential protection of transformer.
    c. SEL-787 front panel operations.
    d. Rear and front panel parts of the SEL-787 relay.
    e. Output and input to the SEL-787 relay.
    f. Rear panel connections to the relay.
    g. Establishing communication with the relays.
    h. Making basic settings/changes to the relay.
    i. Login procedure to the relays.
    j. Event analysis and downloading into the PC.
    k. SEL-787 transformer differential relay settings.
    l. Restricted earth fault settings in the relay.

m. Reviewing, interpreting, and clearing the event reports.
n. Navigation across the menu.
o. Operator control push buttons and LEDs.
p. Introduction to the SEL 421 relay and its basic principles.
q. Front panel operations of the relay.
r. Rear and the front panel parts of the SEL 421 relay.
s. Navigation across the menu of the 421 relay display.
t. Login to the relay, basic settings, and analyzing the event reports.
u. Distance protection concepts, examples, and protection zones.
v. An introduction to the SEL 587Z bus bar protection relay and its connection diagrams.
w. Login, basic settings, and analyzing and downloading the events.
x. High impedance differential protection of the BK bus bars.
y. Introduction to the SEL 451 protection, automation, and control relay.
z. Basic relay operations and settings.
aa. Bay and circuit breaker control settings.
bb. Open/close operations of the CBs and disconnect switches with the SEL 451 relay.
cc. CBs and disconnect switches open/close status at the BCU panel.
dd. Circuit breaker monitoring and circuit breaker failure protection through SEL 451 relay.
ee. Analyzing and downloading the events reports.
ff. Breaker failure protection of the BK Substation.

3. Power Line Carrier Communication (PLCC) System Application training was conducted at the Subcontractor's facility in Dubai from 1 September through 5 September 2013. The trainer was the manufacturer's representative from the United Kingdom (UK) office. The learning objectives were specific to the equipment and its configuration at the Substation, and included the following:
    a. Introduction to the PLCC system with block diagrams and schematics.
    b. Teleportation purposes and functions.
    c. Different communication channels.
    d. Advantages and disadvantages of the PLCC.
    e. Schematic views of the three distinct parts of the PLCC.
    f. Various PLCC terms definitions.
    g. Signal to Noise Ratio (SNR) of the channel and frequency selection.
    h. Various parts of the PLCC, e.g., transmitter/receiver (Tx/Rx) sections, line coupling equipment, line traps etc.
    i. Major goals/applications of PLCC.
    j. General overview of the different cards/modules of the RFL 9785.
    k. Installation and connections of the device.
    l. Front and rear views.
    m. Operating instructions.
    n. Power supply to the device.
    o. Transmitter, its functions, carrier frequency and transmit power.
    p. Maintenance of the RFL 9785 device.
    q. Replacement of the cards/modules.

r. Directional comparison blocking arrangement.
s. RF power amplifier.
t. Different sections of the RFL 9785.
u. Receiver downshifter card.
v. Receiver detector module.
w. Login into the device and obtaining the Sequence of Events (SOE) report.
x. Alarm I/O module and alarm list.
y. Check-back module and its functions.
z. Changing display modes.
aa. Display menu and its configuration.
bb. RS-232 cables for sequence of events.

The offsite training was rescheduled multiple times due to visa delay issues and DABS staff availability. The original plan was for the Control and Protective Relay session to be held in the Czech Republic at the factory and the PLCC training to be conducted at the factory in England. DABS personnel were unable to obtain visas in a timely manner, and the training was rescheduled to be conducted in Dubai. The dates were adjusted to meet the needs of DABS personnel for the Dubai training.

5.3 Onsite Training

Substation Operations and Maintenance training was conducted at the Subcontractor's facility in Dubai from 1 September 2013 through 21 September 2013 at the BK Substation. Twelve DABS operators and managers participated. The trainer was a Sub-subcontractor with in-depth experience working with students of varying skills and background. The training agenda was regularly adapted based on the capacity of the students to understand and demonstrate the lessons learned. Daily assessments were given on the material presented.

The students were each provided with hard and soft copies of their training material, including the O&M manuals for the Substation equipment. The students were frequently onsite reviewing information presented and, when available, operating equipment. The training was delivered both in English and in Pashto. The senior Substation personnel frequently shared their knowledge gained from the factory and offsite training sessions. The BVSPC Training Manager attended and participated in each training session:

The topics presented included the following:

a. Typical electrical power network.
b. Electrical substations.
c. Main HV equipment.
d. General substation site layout.
e. 110 kV single line diagrams.
f. 20 kV single line diagrams.
g. Diagram referencing designation.
h. Fundamentals AC and DC electrical theory and applied math.
i. Typical HV switchgear installations.
j. Typical DC voltage supply.
k. Control, measurement and regulation (Secondary Systems).

l. Interlocking.
m. Control center equipment and operations.
n. Power line communication carrier (PLCC) equipment and basic testing.
o. Insulating rating (Basic Insulation Levels) and clearances.
p. Earthing systems: purpose, operations, maintenance and control.
q. Earth potential rise and transfer.
r. Surge and transient protection.
s. Environmental impacts.
t. Hazards and safety practices.
u. Electrical, chemical, and personal safety.
v. Working at height using support devices.
w. Dangers and accidents.
x. Protective measures for persons and installations.
y. Safety risk management and review.
z. Viewing operating and maintenance manuals.
aa. Onsite substation equipment identification and specifications.
bb. Applicable onsite substation equipment identification and specifications.
cc. Viewing O&M manuals.
dd. Introduction to HV and LV circuit breakers, LV delta breakers, HV and LV switches, and auto-reclosers.
ee. HV vacuum and SF6 circuit breakers and solenoid and motor/spring.
ff. Operating mechanisms.
gg. General circuit breaker maintenance.
hh. New circuit breaker inspections and tests.
ii. HV and LV switches.
jj. SF6 gas properties and handling.
kk. Properties of SF6, handling, cleanup, and personal protection.
ll. Vacuum interrupter principles.
mm. Test principles, precautions, and preparations.
nn. Circuit breaker time-travel characteristics.
oo. Purpose and principles of time-travel testing.
pp. Circuit breaker operations.
qq. Contact resistance testing and purpose.
rr. Field inspection and field control checks.
ss. Transformer principles.
tt. Transformer protection.
uu. Power transformer cooling systems: self-cooled and forced air/oil cooled.
vv. Inspection of a transformer exterior condition, sealing system, and cooling system.
ww. Tap changers: purpose, operations and maintenance.
xx. De-energizing, isolating, and grounding a power transformer.
yy. Onsite inspections and tests.
zz. Power transformer oil testing.
aaa. Fire prevention systems.
bbb. Review Substations: annunciator panel, alarms, protective and communication equipment.
ccc. Procedures for operating and monitoring substation instrumentation and alarms.

ddd. Over-current time protection.
eee. Distance protection.
fff. Auto-reclosing.
ggg. Differential protection.
hhh. Directional ground fault protection.
iii. Overload protection.
jjj. Understanding the Substation interlocking.
kkk. Knowledge of auxiliary Substation equipment utilized at Breshna Kot Substation (auxiliary transformers, ac/dc station services, etc.).
lll. Ability to inspect auxiliary Substation equipment.

5.4 Sustainability Summary

With DABS Kandahar the primary technical resource for SEPS and, due to the lack of Substation improvements in its infrastructure in many years, BVSPC required factory based training by technical experts in each of its major subcontracts. The combination of Subcomponent 2.2 equipment training and this Subcomponent site specific training provided a solid and sustainable foundation for DABS staff to operate and maintain the state-of-the-art Substation facility built at BK.

6 SECURITY PLAN AND INCIDENT REPORTS

The work associated with this project was performed at the BK Substation in Kandahar City. BVSPC operated under a program-wide Security Plan (**Attachment a-2**) managed and coordinated by the BVSPC Security Managers in conjunction with Mondial Risk Management Company and the Afghanistan Public Protection Force. A site-specific Breshna Kot Security Plan (**Attachment a-2**) was developed due to the location of the Substation. This plan provided additional details and security measures for protection of the site. The static and mobile security needs of BVSPC staff assigned to this Subcomponent were met by use of the Kandahar Regional Camp Security forces consisting of BVSPC Security Management and two Subcontractors: Mondial Risk Management Company and the Afghanistan Public Protection Force.

Two security incidents impacted work at the BK Substation:

1. 28 February 2013: A KHPP mission to Breshna Kot was aborted onsite due to reports of a threat in the immediate area. Subsequent to withdrawal from the site, an IED was discovered in the immediate vicinity and destroyed in place by ANSF elements.
2. 14 August 2013: The controlled detonation of an IED adjacent to the site by the Afghanistan National Security Forces (ANSF) resulted in 2-1/2 hours of work lost.

Due to the Substation's location within the City and its proximity to the Kandahar Province Governor's compound, the risk profile was frequently significant enough to either limit the site visit duration or eliminate the opportunity to travel to/from site.

7 SAFETY PROGRAMS/PLANS

BVSPC operated under a program-wide Health and Safety Plan and Procedures (**Attachment a-04**) managed by the BVSPC Health and Safety Manager. No safety incidents were reported throughout the duration of this portion of the project.

8 QUALITY CONTROL PROGRAM/PLAN

BVSPC operated under a project-wide Quality Control Plan (**Attachment a-05**)**.** The implementation of a QC program at Subcomponent 1.1 – Replace Kandahar Breshna Kot Substation was the responsibility of the KHPP professionals and Subcontractors engaged in the work. Qualified KHPP Quality Management professionals supplied weekly QC reports to USAID and provided oversight and guidance.

9 ENVIRONMENTAL CONTROL

The activities executed under this contract component were governed by the KHPP's overall Environmental Plan (**Attachment a-14**). BVSPC also developed a site-specific environmental plan associated with the BK Substation site provided as part of **Attachment a-14**. Regular environmental reports were submitted to USAID as required by the contract.

10 STATEMENT OF PATENTS, ROYALTIES OR CLASSIFIED MATERIALS

No patents, royalties or classified materials were obtained or generated under the activities of this Subcomponent.

11 VALUE ENGINEERING CHANGES (IF APPLICABLE)

One value engineering change was utilized:

1. For long lead, high cost, and/or complex materials, the Prime Contractor procured the materials and provided them to Subcontractors. This approach allowed the materials to be procured early in the schedule, creating schedule float and enabling standardization of key equipment.

12 ENHANCING BEST PRACTICES (LESSONS LEARNED)

Table 10 identifies considerations to enhance best practices which result from the implementation of Subcomponent 1.1:

Table 10: Subcomponent 1.1 – Considerations from Implementation

Observation	Lesson	Recommendation
While common relays and schemes were utilized, Subcontractors chose different implementation methods.	Design and design review durations were extended due to different applications by each Substation Subcontractor.	For control and protection schemes, provide a template schematic diagram for each scheme to specify approach, port usage, and I/O points.

Observation	Lesson	Recommendation
Subcontractors may not share the technical requirements of the subcontract with their Sub-subcontractors.	Sub-subcontractors performed design which, while possibly effective, did not meet the requirements of the subcontract, thus requiring rework.	Request review acknowledgement of subcontract requirements for key Sub-subcontractors. Request the acknowledgement early in the design process.
Subcontractor may utilize proprietary software for design not compatible with end user requirements.	End user may choose to not keep the design and drawing records current if a proprietary tool is required.	Add subcontract language to specify the technology required for use on the project. When proprietary software is used, reach agreement on the format and content on the output.
Prime contract had conflicting code requirements and codes not applicable to the work being performed.	Code conflicts were not identified and were issued as flow-downs to Sub-subcontractors, occasionally resulting in incompatible materials or rework by others.	Thoroughly review technical code requirements and exclude conflicting and/or extraneous requirements.
Engineering registration requirements vary from country to country.	Not all subcontractors are willing to certify designs and specifications.	Define professional registration requirements in subcontracts.
Subcontractor drafting and drawing management skills vary significantly.	Subcontractor drafting and drawing management skills impact design and construction.	Add a subcontract requirement to provide a drawing management plan, including samples of previous work. Provide feedback to Subcontractor on how to leverage capabilities of their drafting tools. For example, the use of reference files can identify physical conflicts as designs develop, conflicts otherwise found in design reviews, or worst case during construction.

13 WARRANTY

BVSPC as required by the Prime Contract has a project-wide Warranty Plan (**Attachment a-06**). For Subcomponent 1.1, the warranty conditions reflect the Certificate of Warranty provided to USAID applicable to this Component.

14 OUTSTANDING ISSUES

There are no outstanding issues related to Subcomponent 1.1.

15 CONCLUSION: IMPACT ASSESSMENT

Subcomponent 1.1 designed, constructed, tested, and energized a new 110 kV Substation to replace deteriorated facilities at the existing BK Substation. This new Substation provided the second major upgrade to the SEPS system in over 35 years. With buswork and equipment rated for 1,600A (260 MW), this Substation provides a pivotal power transfer and power transformation location for a variety of future energy supply improvement projects.

DABS has gained knowledge and experience with current technology and with current Substation configuration application. DABS has a new generation of employees developing a career path in the utility industry.

The reliability of service to all customers served by the SEPS system has improved due to the additional fault identification, sectionalizing, and options for restoration of service. In addition, the Substation configuration allows equipment to be taken out of service for maintenance without the need for customer outages. Approximately 372,000 persons have been impacted by this improvement. The Performance Monitoring Plan for the KHPP provides the metrics indicating the impact of the implementation of this project (**Attachment a-12**). The impact of this Substation will continue to increase as additional generation, transmission, and distribution facilities are added without the need for outages or reconfiguration of the Substation.

16 DEVELOPMENT EXPERIENCE CLEARINGHOUSE (DEC)

Documents to be submitted to the Development Experience Clearinghouse (DEC) resulting from the implementation of Subcomponent 1.1 are listed below.

- Closeout Report of Subcomponent 1.1

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