



Appendix B:

Specification – Optical Fibre Communication Network for Nadi & Nausori Airport



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Applicable terms and definitions

AS	Standards Australia
AWOS	Automatic Weather Observation System
CWDM	Course Wavelength Division Multiplexing
DWDM	Dense Wavelength Division Multiplexing
FA	Fiji Airports
FIST	Fibre Infrastructure System Technology
FOPP	Fibre Optic Patch Panel
FRP	Fibre Reinforced Plastic
ILS	Instrument Landing System
ITP	Inspection and Test Procedure
LC	Lucent Connector
LSPM	Light Source and Power Meter
MBR	Minimum Bend Radius
MMOF	Multi Mode Optical Fibre
NATA	National Association of Testing Authorities
NZS	Standards New Zealand
OD	Outside Diameter
OTDR	Optical Time Domain Reflectometer
QoS	Quality of service
SMOF	Single Mode Optical Fibre
SNMP	Simple Network Management Protocol
UPC	Ultra Physical Contact

REFERENCES

Australian/New Zealand Standards

AS/NZS ISO/IEC 14763.3	Telecommunications Installations – Implementation and operation of customer premises cabling. Part 3: Testing of Optical Fibre Cabling (ISO/IEC 14763.3:2011 MOD)
AS/NZS ISO/IEC 14763.3	Telecommunications Installations – Implementation and operation of customer premises cabling. Part 3: Testing of Optical Fibre Cabling (ISO/IEC 14763.3:2011 MOD)
AS/ACIF S009:2013	Installation requirements for customer cabling (Wiring rules)
AS/NZS 2967:2010	Optical Fibre communication cabling systems safety.
AS/NZS IEC 60825.2	Safety of laser products – Safety of Optical Fibre Communication Systems (OFCS)
AS/NZS 3084:2003	Telecommunications installation generic cabling for commercial premises;
AS/NZS 3000 :2018	Electrical Installations - Wiring Rules
AS/NZS 4251.1	Electromagnetic Compatibility (EMC), Generic Emission Standards – Residential, Commercial and Light Industry
AS 4006-1992	Software Test Documentation
AS/NZS CISPR 22	Information Technology Equipment Radio Disturbance Characteristics - limits and Methods of Measurement
AS/NZS ISO 9002	Quality Systems - Model for Quality Assurance in Production, Installation and Servicing
AS/NZS 1768	Lightning Protection
AsA	HF RAMP Document
Other Standards	
ITU-T G652	Characteristics of a Single-mode Optical Fibre and Cable
IEC 60793-1	Optical Fibres – Measurement Methods and Test
IEC 60793-2-50	Optical Fibres – Product Specifications – Sectional Specifications for Class B Single-mode Fibre.
IEC 60794-3	Optical Fibres – Product Specifications – Outdoor Cable.



1 Scope Overview

Underground CAT 3 communication cable provides communication link to CNS/MET system for ATC operations at Nadi and Nausori Airports. CNS/MET systems are located on the airfield and dispersed geographically. CAT 3 communication cable has exceeded its recommended 50 year of life cycle and Fiji Airports is intending to replace it with Optical Fibre cable which is more reliable and less susceptible to lightening.

For Nadi Airport a hybrid communication network is planned to be installation, which will comprise optical fibre and radio link, while for Nausori Airport full optical fibre communication solution will be used to support current and future CNS/MET system for ATC operations.

Civil works component of the project will be handled by Fiji Airports and will be completed before optical fibre installation works.

All tenderers are to allow for co-ordination between different trades and to ensure that all of the following has also been included for:

- a) Permits and approvals as required under applicable legislation and referenced in this document including submissions of a method of works plan.
- b) Contractor Submissions as required by this document to the satisfaction of Fiji Airports including any necessary rework and resubmissions required to receive approval.
- c) Removal of waste materials from the site and disposal in an agreed location within 1km of the site.
- d) Liaison and meetings as required with Fiji Airports, CAAF and associated contractors.
- e) Personal Protective Equipment for your staff onsite.
- f) The contractor to also allow for the arrangement of airside passes for contractor personnel and vehicles accessing the site.
- g) Access to site to be maintained as clean and clear and adjacent roadways are not to be impacted without prior written approval in the form of traffic plan which will generally limit impacts to after hours road closures.
- h) Protection to all roadways and adjacent pavements, including cleaning of the pavements daily should dirt or dust be trafficked onto the pavements.

A schedule of day work rates for plant and labour is also to be provided should any unforeseen works arise.

1.2 Communication Network

1.2.1 General

Indicative performance requirements include:



System Component	Availability	MTBF	Useful Life
Radio Link	> 0.9999	> 10000HRS	-
Network Gears	> 0.9999	> 500,000HRS	-
Optical Fibre Cable	-	-	≥50 Years

1.3 Scope of works

1.3.1 General Obligations

Completion of the works and compliance with the requirements as detailed herein and as detailed in the documents listed under the contract documents.

1. Supply, Installation and Commissioning of Optical Fiber Communication Network System
2. Compliance to the technical specification
3. Provision of the Design and Submissions as required.
4. Complete Equipment Schedule (CES), technical data, and appropriate training to allow for the introduction into service of the vehicles. FA seeks a non-developmental solution which has a demonstrated and proven track record in deployment on other airport sites.
5. Supply of spare parts for the period of 10 years.

The delivery methodology is as a Supply delivery and training solution incorporating the following hold points:

1. Tender submission
2. Tender approval
3. Technical compliance review
4. Contract Award
5. Design Review – On Site
7. Site delivery
8. Site acceptance testing (SAT)
9. Training 15 days - Onsite
11. Commissioning/Handover.



1.3.2 Design and Submissions

Further to the submissions as required by the RFT response of this document, the scope in general terms is to within four (4) weeks of contract award to action the following:

- 1) Pending the Respondent's advice and input, liaison with the project stakeholders/ design consultants to select and recommend any additional requirements and facilities as required/ available for approval
- 2) Prepare a fully itemized equipment schedule including quantities, costs and any ongoing software licensing fees and charges if applicable.
- 3) Work with stakeholders to ensure to ensure the Optical Fibre Communication Network listing and quantities are correct and meet user requirements
- 4) Prepare a detailed Optical Fibre Communication Network installation program and then provide fortnightly monitoring during the periods where close control is required.
- 5) Detail any enabling or interface works required to enable the effective installation and operation of Communication Network scheduled or specified for the works.

1.3.3. Service Maintenance and Reliability

The Supplier shall provide written undertakings associated with the following that:

1. The Supplier will maintain current spare parts for the Communication Network and associated hardware under procurement for a period of 10 years post-delivery of Communication Network.
2. The Supplier will be able to provide remote support for the supply of spare parts during normal business hours in their place of business for 10 years post-delivery Communication Network and associated hardware.
3. The Supplier will provide a full 3 year warranty on all Parts for Communication Network devices, except for optic fibre cable warranty shall be 25years.



1.3.4 General Items for Pricing

RATES TO INCLUDE:

Item	Responsibility
Transport to site	Contractor
Cranage onsite	Contractor
Installation Labour	Contractor
Installation Supervision	Contractor
Airport Identification Passes per person – requires police report issued within prior 3 months, passport photo and verified copy of suitable proof of identification (passport/drivers licence etc).	Contractor:- \$12.50 for 3 month pass each
Vehicle/ equipment passes – vehicle registration details and roadworthy	Contractor:- \$100 per annum

- High Visibility workwear required.
- The Contractor must comply with Fiji Airports Rules and Regulations
- Allow 1.5 hours for Site Inductions. The Client will not pay additional funds for any additional meetings & tool box meetings

Contractors are to suitably resource the project in terms of both supervision and labour for the design, manufacture and installation of the works.

The Contractor is required to employ suitable systems to manage the project correctly.

Contractors are to submit a proposed management structure and associated C.V.'s with tender returns.

2 Technical Specifications

2.1 General

This document describes the general minimum specification for the Optic Fibre communication cable, radio link and network equipment for Nadi International and Nausori Airport. Before submitting a proposal, the contractor is urged to make every effort to be thoroughly acquainted with the location and accuracy of all aspects of the works. The contractor shall not be entitled to additional payments on the grounds that any information acquired from FA is incorrect or misleading or inadequate. The contractor shall submit five (5) site references for single mode optical fibre for outdoor installation for distances greater than 5km within last five (5) years. The reference shall **ONLY** include outdoor single mode optical fibre installation. The site references will also be required for the radio link solution.

2.2 Scope of Works

The scope of work shall include but not limited to the following:

- 2.2.1 Supply, Install & Commission optic fibre cable, associated accessories and network equipment for Nadi and Nausori Airport.
- 2.2.2 Supply, Install and Commission Radio Link and associated accessories for Nadi Airport **ONLY**.
- 2.2.3 Optical fibre and radio link training including supplying recommended test equipment and tools.
- 2.2.4 The contractor is required to do a site survey/visit to Nadi & Nausori airport to have a better understanding on the project requirement and site layout.

2.3 Implementation

- 2.3.1 The project duration shall be six (6) months from contract award. Proposed project schedule is provided in Annexure 8.0

2.4 Site Visit

- 2.4.1 The Contractor will be required to conduct a site visit at own cost to survey the site and understand the scope of work.
- 2.4.2 The layout of the site in Nadi & Nausori Airport is provided in Annexure 4.0 and 7.0 respectively.

2.5 Site Information

- 2.5.1 Before submitting a Tender, the Contractor is urged to make every effort to be thoroughly acquainted with the location and accuracy of all aspects of the Works.
- 2.5.2 The Contractor shall not be entitled to additional payments on the grounds that any information acquired from FA is incorrect or misleading or inadequate.



2.6 Weather Condition

- 2.6.1 The Contractor shall be deemed to have taken into account all possible weather conditions when preparing the tender and it shall not be entitled to extra payment by reason of the occurrence or effect of temperature or humidity or any other meteorological phenomena.
- 2.6.2 Without limiting its liabilities under the Contract, the Contractor shall make suitable arrangements to protect the Works and all equipment against the effects of weather.

3 Fibre Pulling, Termination & Network Equipment

Fiji Airports in conjunction with Fiji Meteorology have installed new Automatic Weather Observation System (AWOS) system at Nadi Airport and Fiji Airports has commissioned a new Instrument Landing System (ILS) at Nausori Airport. The system requires optic fibre infrastructure for communication amongst different components of the system dispersed geographically around both the airports. The contractor shall design, supply, install, test and commission 6 core single mode optical fibre cable to various sites for Nadi Airport and 24 core single mode for Nausori Airport with all fibre accessories that will be required to connect the end equipment.

The contractor shall also supply the required installation materials at both the airport as deemed appropriate for installation purposes. Network equipment such as switches, SFP switches, fibre transceivers with patch leads shall be supplied and installed by the contractor.

Detailed scope for both airports is outlined below.

The contractor shall adhere to the cable installation requirement mentioned in **Section 4** of this tender document and supply necessary documentation as required.

Nadi Airport will be a hybrid solution i.e a mixture of optical fibre and microwave technology for back haul network. Point to Multipoint and Point to Point wireless communication will be used to complete the back haul network. To achieve this, RAD microwave shall be supplied and installed or equivalent.

Nausori Airport installation will purely be optical fibre. The contractor shall provide separate costing for Nadi and Nausori Airport and shall be submitted in the pricing format provided in Annexure 1.

3.1 Nadi Airport Optical Fibre

- 3.1.1 Supply 6 core single mode (G652.D) of external type underground loose tube gel filled optical fibre cable. The cable shall be Low Smoke Zero Halogen (LSZH) rated.
- 3.1.2 There are four (4) Automatic Weather Observation System (AWOS) sites located at the Nadi Airport aerodrome and the cable route is attached to annexure 4 of this tender. Following name convention is used for the four sites:

- I. AWOS 02

- II. AWOS 20
- III. AWOS 27
- IV. AWOS 09

3.1.3 Optical fibre cable shall be hauled from the AWOS sites to the following locations on aerodrome:

- I. AWOS 02 – Glide Path Building
- II. AWOS 20 – Localizer Building
- III. AWOS 27 – Core Room 1 Terminal Building
- IV. AWOS 09 – Receiver Station

3.1.4 The contractor shall note that all civil work will be done by Fiji Airports and will be ready before the installation of optical fibre.

3.1.5 Enough fibre slack shall be provided while running cable to the mentioned positions above should there be any jointing works in future.

3.1.6 The contractor shall provide all necessary fibre management accessories such as swing out fibre optic patch panels, adaptor, pig tails, splice protector and connectors required for the successful termination of 6 core optical fibre.

3.1.7 The contractor shall supply and install UPC LC type connector with no or negligible loss. The contractor shall also supply the required number of bend insensitive LC – LC fibre patch lead for FA use.

3.1.8 Fiji Airports, preference is fusion splicing, thus the contractor is required to use this method of splicing. All splicing shall be of industry standard with no or negligible loss.

3.1.9 The swing out fibre optic patch panel shall be installed in 19" rack. Following rack size shall be installed in following locations:

- I. Glide Path Shelter - 12 RU wall mount
- II. Localizer Shelter - 12 RU wall mount
- III. Transmitter station – 12 RU wall mount

3.1.10 The wall mount cabinet/rack shall be securely mounted on the wall with appropriate fasteners and shall be earthed.

3.1.11 The contractor shall provide optical fibre link power budget for each run of the fibre end to end further explained in the cable installation requirement section 4.

3.1.12 The contractor shall provide all test results such power loss, insertion loss and OTDR test to FA during commissioning and is further explained in the section 4 below.

3.1.13 The contractor shall provide 25 years warranty on fibre optic cable from a reputable supplier. The contractor shall also provide authorized installer certificate from such reputable supplier.

3.1.14 The warranty certificate and policy shall be submitted as part of tender clearly stating expiry and other relevant details/clause of such policy.

3.1.15 The contractor shall make every commitment to replace part or whole of the fibre at no cost to FA, shall it arise from poor workmanship, factory defects, and/or other factors such as environmental condition before or after commissioning of optical fibre.



- 3.1.16 Most of the works will be carried out in the night due to the nature of operation at the airport. The contractor shall be thoroughly acquainted with procedures and policies governing any works that shall be carried out on the airside and as such it is mandatory for all contractor personnel to go through the induction program by FA before commencement of any work. Safety officer appointed by FA will oversee works performed.
- 3.1.17 All contractor personnel shall be fully vaccinated for COVID-19.
- 3.1.18 All contractor personnel shall have appropriate PPE worn at all times. It is highly recommended to wear high reflective vest and all contractor vehicle used on aerodrome shall have rotating beacon installed and switched on at all times.
- 3.1.19 Contractor shall be aware that aerodrome is a critical operational area, all debris, and left over material shall be disposed properly and not left at the site.
- 3.1.20 Contractor shall note that as per airside policy, smoking and eating is prohibited on the aerodrome. Anyone found violating this policy will be immediately removed from the site and entry will be denied on the aerodrome.
- 3.1.21 The contractor shall vacate the working area should there be any aircraft emergencies. Everything including the tools shall be removed from area of work. Open trench shall be filled and compacted, and in situations where this cannot be done steel plate of sufficient thickness shall be used to cover the trench.
- 3.1.22 Table 2.0 shows distance between the AWOS sites to respective stations. The distance mentioned below is from Google earth, which is approximate calculation, however the contractor must ensure accuracy in their calculation.

Table 2.0

AWOS Sites	Connecting Stations	Estimate Distance (m)
AWOS 02	GP	65
AWOS 20	LLZ	700
AWOS 09	Receiver	625
AWOS 27	Core Room 1	1300
Total Estimate Cable distance		2715

3.2 Nausori Airport

- 3.2.1 Supply 24 core single mode (G652.D) of external type underground, loose tube gel filled optical fibre cable. The cable shall be Low Smoke Zero Halogen (LSZH) rated.
- 3.2.2 There are three (3) current and two (2) future sites at Nausori Airport runway. Optical fibre final termination will be in the Nausori equipment room at the terminal building. Refer annexure 6 & 7 for route and site layout.
- 3.2.3 Nausori Airport runway extension project has been completed. Civil work for the optical fibre has been also completed and two cable routes will make entry into the Nausori equipment room. Refer to annexure 6 for the cable route layout. Cable route is shown in



- blue dash-dash line indicated by C (Communication Cable).
- 3.2.4 The total length for the route forming ring up to the Nausori Equipment is approximately 6500m and does not include entry into the building and the slack. The contractor shall make every effort to get the accurate distance during the site survey.
- 3.2.5 The contractor shall note that the design of cable route is such that it forms a ring around the runway and then making entry into the Nausori Equipment Room. Hence the contractor shall install fibre using ring method. This will ensure reliability and resilience of the overall network.
- 3.2.6 The contractor shall provide all necessary fibre management accessories such as swing out fibre optic patch panels, adaptor, pig tails, splice protector and connectors required for the successful termination of 24 core optical fibre at each sites.
- 3.2.7 The contractor shall supply and install UPC LC type connector with no or negligible loss. The contractor shall also supply the required number of bend insensitive LC – LC fibre patch lead for FA use and shall be Low Smoke Zero Halogen (LSZH) rated.
- 3.2.8 Fiji Airports, preference is fusion splicing thus the contractor is required to use this method of splicing. All splicing shall be of industry standard with no or negligible loss.
- 3.2.9 The swing out fibre patch panel shall be installed in 19" rack. Following rack size is to be installed in following locations:
- I. Glide Path Shelter - 12 RU wall mount
 - II. Localizer Shelter - 12 RU wall mount
 - III. DVOR/DME Station – 12 RU wall Mount
 - IV. Nausori Equipment Room – 42RU
- 3.2.10 The wall mount cabinet/rack shall be securely mounted on the wall with appropriate fasteners and shall be earthed.
- 3.2.11 The contractor shall provide optical fibre link power budget for each run of the fibre end to end further explained in the cable installation requirement section.
- 3.2.12 The contractor shall provide all test results such power loss, insertion loss and OTDR test to FA during commissioning and is further explained in the section 4 below.
- 3.2.13 The contractor shall provide 25 years warranty on fibre from a reputable supplier. The contractor shall also provide authorized installer certificate from such reputable supplier.
- 3.2.14 The warranty certificate and policy shall be submitted as part of tender clearly stating expiry and other relevant details/clause of such policy.
- 3.2.15 The contractor shall make every commitment to replace part or whole of the fibre at no cost to FA, shall it arise from poor workmanship, factory defects, and/or other factors such as environmental condition before or after commissioning of optical fibre.
- 3.2.16 Most of the works will be carried out in the night due to the nature of operation at the airport. The contractor shall be thoroughly acquainted with procedures and policies governing any works that shall be carried out on the airside and as such it is mandatory for all contractor personnel to go through the induction program by FA before commencement of any work. Safety officer appointed by FA will oversee works



performed.

3.2.17 All contractor personnel shall have appropriate PPE worn at all times. It is highly recommended to wear high reflective vest and all contractor vehicle used on aerodrome has to have rotating beacon installed and switched on at all times.

3.2.18 Contractor shall be aware that aerodrome is a critical operational area, all debris, waste and left over material shall be disposed properly and not left at the site.

3.1.23 Contractor shall note that as per airside, policy smoking and eating is prohibited on the aerodrome. Anyone found violating this policy will be immediately removed from the site and entry will be denied on the aerodrome.

3.2.19 The contractor shall vacate the working area should there be any aircraft emergencies. Everything including the tools shall be removed from area of work.

3.3 Network Equipment

3.3.1 The contractor shall supply only CISCO network equipment for the purpose of interconnecting various sites for Nadi and Nausori airport. The contractor shall only supply brand new original manufacturer cisco equipment, refurbished cisco equipment is strictly not allowed.

3.3.2 The contractor shall provide three (3) years supplier warranty (Smartnet) on all switches. The contractor shall state which support service criteria is being offered to FA.

3.3.3 All the Ethernet Switches that will be installed at Nadi and Nausori Airport shall be IP base and support two (2) fibre and gigabit Ethernet interfaces for uplink purposes.

3.3.4 Full port SFP Switches shall only be installed at the Equipment Room in Nadi and Nausori Airports. SFP switch will serve as distribution layer and shall support both single and multi-mode fibre interface including RJ 45 interface.

3.3.5 All the switches and routers if supplied shall support 10/100/1000mbs speed.

3.3.6 All the switches shall have access control by means of password control to prevent unauthorized access.

3.3.7 All the switches shall perform automatic data rate detection of installed fibre transceivers and the following:

- Shall support fibre redundancy with less than 50ms switching
- Shall support plug –and-play MDI/MDI-X RJ-45 ports
- Shall support auto-negotiation on all ports
- Shall support QoS, port access control and MIB statistics
- Shall support VLAN with 802.1q standard
- Shall support SNMP management

3.3.8 The switches shall have high reliability, MTBF and shall operate in extreme conditions



should there be no air-conditioning available.

3.3.9 All the fibre transceivers shall support a maximum distance of 10km point to point.

3.3.10 All fibre transceivers shall have better or improved noise immunity and quality of service.

3.3.11 All fibre transceivers shall support trunking i.e. IEEE 802.1Q standard.

3.3.12 Table below summarizes switch requirements for Nadi & Nausori Airports.

Table 3.0 Nadi Airport

#	ITEMS	QUANTITY
1	8 Port PoE Cisco Switch. 2 x 1G GigE & 2 x SFP, IP Base	5
2	24 Port Cisco Switch with Dual Power Supply – IP Base	2
3	Fibre Transceiver (SFP) – SM - LC	10
4	RJ45 Copper Transceiver (SFP) 10/100/1000mbps	10
5	LC to LC Patch Lead	10

Table 4.0 Nausori Airport

#	ITEMS	QUANTITY
1	8 Port PoE Cisco Switch. 2 x 1G GigE & SFP – IP Base	5
2	24 Port SFP Cisco Switch with Dual Power Supply – IP Base	2
3	Fibre Transceiver (SFP) – SM - LC	15
4	RJ45 Copper Transceiver (SFP) 10/100/1000mbps	15
5	LC to LC Patch Lead	15

3.4 Wireless Radio Link – Nadi Airport

3.4.1 The contractor shall supply RAD wireless radio link or equivalent for back haul network at Nadi Airport only. Contractor is required to price for both licensed and unlicensed frequency band and FA will decide which one to install. Unlicensed frequency band shall only be 5GHz.

3.4.2 Point to Multipoint and Point to Point wireless radio link is required to complete the backhaul network. In total there are six (6) sites of the six site one site is the core site. Refer to annexure 5

of this tender.

3.4.3 Wireless radio link is required at the following sites and Nadi Tower being the core site:

- I. Nadi Tower
- II. Contingency Tower
- III. Localizer
- IV. Receiver Station
- V. Glide Path
- VI. HF Transmitter Station

3.4.4 For Point to Multipoint communication, the base station will be located at Nadi Tower and will connect to the subscriber units installed at the following Location:

- I. Contingency Tower
- II. Localizer Shelter
- III. Receiver Station

3.4.5 For Point to Point communication, two base station will be located at Nadi Tower and will connect to the next points installed at the following Location:

- I. Glide Path Shelter
- II. HF Transmitter Station

3.4.6 The wireless radio link shall support 10/100/1000mb/s speed and easily integrated to other network switch gears such as Cisco. The speed shall not reduce at any point between the ODU and IDU unit.

3.4.7 The contractor is required to determine Line of Sight (LoS) to the location mentioned above to ensure maximum throughput is achieved by the wireless radio link network and as such the latency between the sites shall also kept as minimum as possible.

3.4.8 The contractor shall supply all the installation accessories such cables, lugs, connectors, cables, mounting brackets, mounting poles and lightening surge protectors etc to successfully install and commission the wireless system.

3.4.9 The contractor shall provide three (3) years warranty on wireless radio link.

3.4.10 The contractor shall propose sector base station radio unit for point to multipoint wireless communication that shall provide up to 500Mbps net aggregate throughput bandwidth (250 upload, 250 download) while delivering access connectivity to the subscriber units. The base station shall have following characteristics:

- Smart beamforming interference immunity
- High antenna gain
- Guaranteed service level agreement per subscriber unit
- Exceptionally low latency and no jitter
- Support multiple band
- Support diversity technologies
- Robust and reliable operations in harsh conditions, extreme temperatures and non-line of sight scenarios
- Ease of maintenance and operations



- VSWR 2.0:1
- Dual linear polarization
- Wind loading 80m/s

3.4.11 The contractor shall propose a subscriber unit that provides high access connectivity and shall have following characteristics:

- Guaranteed service level agreement per subscriber unit
- High antenna gain
- Exceptionally low latency and no jitter
- Support diversity technologies
- Robust and reliable operations in harsh conditions, extreme temperatures and non-line of sight scenarios
- Ease of maintenance and operations
- VSWR 1.5:1 or better
- Dual linear polarization
- Wind loading 80m/s

3.4.12 The contractor shall propose point to point wireless system that provides high access connectivity and shall have following characteristics:

- High antenna gain
- Exceptionally low latency and no jitter
- Robust and reliable operations in harsh conditions, extreme temperatures and non-line of sight scenarios
- VSWR of 2.0:1 or better
- Dual linear polarization
- Wind loading 80m/s

3.4.13 Data transmitted over the air interface for both types of radio shall be encrypted using Advance Encryption system such AES and shall support multiple frequency bands.

3.4.14 The contractor shall supply Radio network planning tool and any other tool for FA use during installation and post installation phase such as troubleshooting wireless radio link network.

3.4.15 Wireless radio link shall support Telnet, SNMP and Web based management for local and remote access.

3.4.16 The ODU (Outdoor Unit) for the wireless radio link shall meet IP67 rating for all severe weather conditions.

3.4.17 The contractor shall submit a test plan for the wireless radio link which shall describe how system components, its functions and the interfaces will be tested during commissioning.

3.4.18 The contractor shall perform end to end test using device such as Ethernet Throughput Tester by generating traffic through such device and recording over 24 hour period to measure the performance of wireless radio communication network. Traffic generated shall be same size as the maximum throughput of the wireless radio link.

3.4.19 The contractor shall furnish the report generated by the tester to the customer. Contractor shall ensure that the performance of the wireless network is met all times. Following network performance shall be achieved during the test:



Jitter - <10ms
 Latency - <20ms
 Packet Loss - 0%
 Bandwidth – Equal to values mentioned in table 5.0

3.4.20 The contractor shall replace part of or entire radio link with new if it does not meet performance requirement at no cost to FA.

3.4.21 The table below shows the bandwidth requirements for the mentioned sites.

Table 5.0

1.0	PTMP	Total Bandwidth(mbps)	Upload (Mbps)	Download (Mbps)
1.1	Tower	200	100	100
1.2	Contingency Tower	100	80	20
1.3	ILS Shelter	25	15	10
1.4	Receiver Station	25	15	10
2.0	PTP			
2.1	Tower	25	15	10
2.2	Glide Path Shelter	25	15	10
2.3	HF Transmitter Station	25	15	10

3.5 Network Configuration

3.5.1 The contractor shall be responsible for configuration of all network switches and the wireless radio link to successfully establish communication between each site.

3.5.2 The contractor shall configure specific routes and VLANS for Nadi and Nausori sites for connectivity purposes. Full IP plan with VLANS will be provided and discussed during design review.

3.5.3 The contractor shall also be responsible for configuring fail-over routes should one route fails, and this shall be accomplished within less than a second for seamless operations.

3.5.4 The contractor shall provide back-up configuration for all switches and radio link on USB stick for ease of restoring the failed device to minimise service downtime.

3.5.5 The contract shall also provide a Network Communication Monitoring System (NCMS) for the following functions:

- a. Common NCSM at Nadi – network monitoring for both Optical Fibre Communication Network for Nadi & Nausori Airpor
- b. Nausori NCMS – network monitor monitoring for Optical Fibre Communication Network for Nausori Airport

3.6 Training



- 3.5.1 Training is an important component of this scope delivery. The contractor shall ensure that adequate theoretical and practical training is provided to the trainees so that they are competent with any fibre and wireless radio link installation, maintenance and troubleshooting works. It very important that the training shall also focus on the use of test equipment so that trainees are able to troubleshoot and install future networks by themselves.
- 3.5.2 The contractor shall conduct training for 10 staff for two weeks or a period recommended by the supplier and will be conducted at designated FA venue. The objective of the training is to train staff to a level so that they are competent with optic fibre and wireless radio communication installation, maintenance and troubleshooting of faults.
- 3.5.3 The contractor shall submit FA the training objective with the syllabus that will be covered during the training 30 days prior to the training date. FA may request the contractor to change the contents of the training should it deem unsatisfactory.
- 3.5.4 The contractor shall carry out assessment of each trainees at the end of the training through theoretical and practical assessment.
- 3.5.5 The contractor's trainer shall be certified to conduct fibre & wireless training and shall submit their trainer's CV and certification.

3.7 Test Equipment & Tools – Fibre Optics

3.2.20 The contractor shall supply following test equipment and tools for FA's use.

	Fibre Test Equipment, Tools & Accessories	Quantity	Brand
1	Fusion Splicer (SM, MM)	1	SUMITOMO
2	OTDR (SM, MM) – LC, SC ,ST)	1	VeEX
3	Digital Fibre Scope (SM,MM)	1	VeEX
4	Light Source (SM, MM) – LC, SC, ST	1	VeEX
5	Power Meter (SM, MM) – LC, SC, ST	1	VeEX
6	Visual Fault Locator (SM, MM) – LS, SC, ST	1	VeEX
7	Tri-Hole Fibre Optic Stripper	2	
8	Kevlar Shears	2	
9	Round Cable Jacket Slitter	2	
10	Loose Tube Cutter & Stripper	2	
11	Sticklers Fibre Optic Cleaning Kit	2	
12	One Click Cleaner (SC,ST FC)	2	
13	One Click Cleaner (LC, MU)	2	
14	Celtop-S Type B Cleaner (SC, FC, ST)	2	
15	Celtop-S Type A Cleaner (LC, MU)	2	



16	Optical Clean Wipes	2	
17	Alcohol	1	

4 Fibre Optics Cable Installation Requirements

4.1 General

4.1.1 All external Optical Fibre Loose Tube cables shall:

- a) be of dielectric construction (i.e. Non- metallic),
- b) Include a Fibre Reinforced Plastic (FRP) central strength member,
- c) be water blocked without the use of petroleum based jelly filling compound to prevent the ingress of water and other impurities,
- d) Have a outer nylon jacket, and
- e) Be sheath marked containing the cable information every 1.0m

4.1.2 Have both the metre mark readings at each end and the Serial / Item code on the cable sheath recorded at time of installation and submitted with As Built drawings.

4.1.3 All cables shall be labelled as stated in Clause Cable Identification and labelling Requirements

4.2 Conduit / Duct Cleaning

4.2.1 Before cable installation, conduits / ducts shall be clean and free from obstructions.

4.3 Cable Hauling Equipment

4.3.1 Only certified cable hauling equipment is to be used. The contractor shall clearly state which certification they will be using.

4.3.2A winch calibrated to 2kN shall be used for all cables. For cables with a hauling tension of 2kN or greater, a winch must be used. It shall be equipped with a tension monitor and an automatic shutdown device calibrated and locked to operate when a pre-set maximum tension of 2kN is reached, thereby stopping the haul and not exceeding the maximum hauling tension.

4.3.3 For cables with a maximum hauling tension less than 2kN, an approved fusible link with a breaking force less than the stated requirement, as measured by a NATA certified laboratory, shall be used. (A copy of the certification for the fuse type shall be provided with the commissioning and hand over documents).

4.4 Hauling Eyes

4.4.1 The minimum tensile rating of all hauling eyes shall be equal to 1.5 times the cable tensile rating

4.4.2 If hauling eyes are not fitted and wire grips are used, extreme care must be taken to avoid cable damage and stripping of the sheath by attaching the correct sized grip in a proper manner.

- 4.4.3 On completion of the haul at least 2 m of cable should be removed from the cable end fitted with the wire grip.

4.5 Ropes for Hauling Optical Fibre Cables

- 4.5.1 Only Kevlar/Spectra braided rope shall be used for mechanical hauling of Optical Fibre cable. This rope must be manufactured with a braided core of Kevlar/Spectra fibre cordage, and braided polyester cover, and have an outside diameter of not less than 8 mm.
- 4.5.2 The Kevlar/Spectra braided hauling rope shall be at least of sufficient length to always extend between the cable end and the winch with the immediate cable load.
- 4.5.3 Where more than one winch is being used on a haul, the rope between winches and without the immediate cable load, shall be of an approved type other than the Kevlar/Spectra type hauling rope connected to the cable, e.g. Double braid hauling rope. The connection between the hauling ropes must be able to withstand a load in excess of 2kN, and must provide a smooth profile to avoid any damage to existing cable(s) or ducts.
- 4.5.4 For mechanically drawing in hauling ropes, approved hauling rope shall be used, e.g. double braided hauling rope.
- 4.5.5 Polypropylene rope shall not be used for mechanically hauling optical fibre cable or hauling ropes. It may be used for manual hauling, e.g. over short sections, for Feeder Cables, and cabling within buildings.

4.6 Cable Crush and Bend Radii

- 4.6.1 Suitable installation equipment such as cable guides, slippers and wheels (capstan) shall be used so that the dynamic and static bending and crush performance requirements are complied with.
- 4.6.2 Cable rollers systems shall be of such design not to exceed the minimum bending radii (MBR) and crush performance of cables.
- 4.6.3 When housing cables the MBR and Minimum outside Loop dimensions, must not be exceeded.
Minimum Outside Loop (L) = MBRx2 +2 x OD.

4.7 Installation of New Cables in Occupied Conduit / Ducts

- 4.7.1 The conduit must be proven with a suitable mandrel prior to attempting any hauling. As a guide where the conduit capacity is questionable (e.g. the aggregated existing plus new cable/subduct diameters exceeds 80% of the internal diameter of the conduit) the conduit must be proven with a suitable mandrel 1.5 times the size of the cable.
- 4.7.2 If this is successful and it can be reasonably assumed there will be no damage to any cables, subducts or infrastructure, the haul can proceed.
- 4.7.3 Once all sections of the proposed haul have been proven the hauling tensions and lay off points, if required, shall be determined.
- 4.7.4 Pressure roping shall be used in preference to hand rodding, to minimise the possibility of

intertwining of cables during hauling.

4.7.5 A water based cable lubricant that is Non-Toxic, Non-Flammable and compatible with all types of cable sheath shall be used, on the cables, rope and mandrel when hauling over existing cables.

4.7.6 Existing cables shall be restrained from moving in the same direction as the haul.

4.7.7 During the haul supervision shall be provided at entry, exit and change of direction locations.

5 Fibre Optic Tray Installation Requirements

5.1 General

5.1.1 Only a recognized Industry / Network Carrier accredited & ACMA licensed technician shall install any Splicing Joint Closures and FOPPs. The accredited / licensed technician shall have a minimum of 4 year experience in the Jointing, Splicing, Testing and installation of Optical Fibre cables and associated equipment.

5.1.2 All cable installation work shall be in accordance with the design documentation and to a standard that will not unduly shorten the life expectancy of any of the components.

5.1.3 All cables shall be installed in accordance with the design to facilitate unencumbered maintenance of the modules contained within it.

5.1.4 All installation works shall be coordinated with adjacent works of any description to ensure cables are installed without damage or are not affected in any way by the adjacent works activity.

5.1.5 All Splicing Joint cassette and fibre optic patch panel shall be installed in accordance with the manufacturer's recommendations.

5.1.6 All Splicing Joint cassette and fibre optic patch panel manufacturers specified minimum bend radius shall not be exceeded.

5.2 Cable Identification and Labelling Requirements

5.2.1 Cable labelling shall consist of rectangular white PVC tag (66mm x 25mm x 2mm). The tag shall contain information such the cable size, place it originates and it terminates.

5.2.2 The details of the cable shall be clearly printed in block letters and numbers between the ridges of the tag with a permanent black marking pen.

5.2.3 The tags shall be secured to the cable using PVC cable ties, with the excess cable tie trimmed off.

5.2.4 Splice Enclosure, Fopp and Cabinet Cable Labelling

5.2.4.1 All cables shall be clearly marked and identified 300mm below all Splice Closures, 100mm from FOPP entry and 100mm above the base of Cabinets.

5.2.5 Optical Fibre Hauling and Intermediate Pits Cable Labelling

5.2.5.1 All cables shall be clearly marked and identified in all Haul and intermediate

pits, the tag shall be located on the centre of the cable between each pit entry. It shall contain the same information as stated in the clause above.

5.3 Fibre Optic Patch Panel (FOPP)

- 5.3.1 All Optical Fibre cables to be terminated within fibre optic tray(s) shall have a front accessible patch panel.
- 5.3.2 Fibre Optic Tray shall be 19" rack mountable, with provision of up to minimum of 24 Ports and have a front sliding tray i.e swing out tray access unless otherwise specified.
- 5.3.3 All fibre optic tray(s) shall have front patching facilities.
- 5.3.4 All fibre optic tray(s) in the same cabinet shall be of the same make.
- 5.3.5 All fibre optic tray(s) shall be capable of accommodating and terminating the strength members of all cables entered into the FOPPs.
- 5.3.6 Each individual Fibre Cable entered into the fibre optic tray(s) shall be secured to the strength member fixation point/s.
- 5.3.7 Rubber cable boot / Cable Gland shall be used where cable enters the fibre optic tray(s).
- 5.3.8 Sufficient internal capacity shall be provided for the orderly storage of a minimum one metre length of each fibre end prior to splicing.
- 5.3.9 Each bundle of unsheathed fibres shall be sleeved in PVC tubing.
- 5.3.10 All fibre coils shall be wound through internal cable management rings.
- 5.3.11 All pigtailed shall be PVC sheathed with factory terminated LC connectors arranged to mate with the LC through adapters / connectors, unless otherwise specified.
- 5.3.12 Connector loss max 0.50db per mated through adapters /connector.
- 5.3.13 All pigtailed shall be wound through the internal cable management rings
- 5.3.14 All fibre optic tray(s) shall have LC through adapters / connectors fitted, unless otherwise specified.
- 5.3.15 Any unused through adapter / connector mounting positions shall be covered with manufacturers blanking plates.
- 5.3.16 24 way splicing tray / cassette shall be used for storing spliced fibre.
- 5.3.17 Storage of spliced fibres shall only be allowed with no degradation of either the transmission quality or the fibre itself.
- 5.3.18 No fibres shall exceed the manufacturer's specified minimum bending radius.
- 5.3.19 Easy access and removal of individual splice protectors shall be provided for future rearrangement or maintenance purposes, without disturbing adjacent fibres.
- 5.3.20 Heat shrinkable Splice Protectors with a length of 40mm shall be used unless otherwise specified
- 5.3.21 The fibre optic tray(s) patching ports shall be labelled in order to identify each fibre that is

terminated on the front of the FOPP.

5.3.22 Fibre optic tray(s) product specification datasheet shall be provided to FA.

5.4 Patch Cords & Leads

5.4.1 Patch Cord and Lead Management

5.4.1.1 19" rack mountable cable management rails shall be provided above and below each fibre optic tray(s) installed.

5.4.2 Patch Cord and Lead Storage

5.4.2.1 patch cords / leads to or from fibre optic tray(s) shall enter the left hand side of the storage management trays

5.4.2.2 patch cords / leads to or from communications equipment shall enter the right hand side of the storage management trays

6 Testing & Acceptance Criteria

6.1 Cable Acceptance

6.1.1 Cable Acceptance shall follow the completion of installation of the end-to-end Optical Fibre link as specified in AS/NZS ISO/IEC 14763.3:2012 Telecommunications installations – Implementation and operation of customer premises cabling. Part 3: Testing of Optical Fibre Cabling (ISO/IEC14763.3:2011 MOD).

6.2 OTDR Link Loss

6.2.1 All OTDR Fibre test results shall be recorded and saved with the correctly assigned cable description numbers used to describe End A / End B with cursors correctly aligned.

6.2.2 All fibres are to be tested utilising two-way OTDR Link Loss (LL) measurements. The measurements shall also be carried out on spare fibres within the cable that either terminate at one end only or are provided between joint/splice locations.

6.2.3 An OTDR Link Loss (LL) measurement shall be performed on all fibres to confirm the integrity of the cable link excluding the performance of the pre-terminated connector.

6.2.4 On terminated fibres the link loss tests shall be performed after termination of connector, which would then include the connector loss being factored in the LL data recording. The link loss shall be tested and recorded in both directions at wavelengths of 1550nm utilising the OTDR (Two-pair method i.e. position the first cursor just beyond the front end attenuation saturation dead zone where the trace is linear and position the second cursor at the end of the trace just before the trace begins to rise).

6.2.5 The two-way (average) link loss (LL) for a fibre shall be calculated as the average of the measurements. The two-way (average) OTDR LL shall not exceed the following:

Maximum Loss at 1550 nm (LL) = $0.3L + 0.1N + 0.5$, where:

- a) LL = Maximum allowable Link Loss in dB
- b) L = the optical link length in km
- c) N = number of splices

6.2.6 If a fibre fails the OTDR Link Loss after a number of re-measurements, then a more comprehensive evaluation of the fibre link should be undertaken to determine the high loss i.e. re-check of any irregularities, splice losses and fibre attenuation co-efficient (dB/km).

6.3 Irregularity Check

6.3.1 All fibres in each section length shall be checked for any irregularities in both directions at wavelengths of 1310nm and 1550nm. The magnitude of irregularities (point losses) in length shall be calculated as the average of the irregularity loss measured in both directions at wavelengths of 1310nm and 1550nm. Irregularities shall not exceed 0.10dB (two way average) for any wavelength.

6.3.2 The magnitude and distance from each fibre end to an irregularity shall be recorded on a fibre anomaly sheet to be included in the final report.

6.3.3 Any point loss that exceeds the above criteria shall be rectified with the fibre subsequently retested.

6.4 Splice Loss / Location

6.4.1 These measurements shall be undertaken for the purpose of ensuring the integrity and quality of splice performance and identifying and documenting optical fibre cable distances to all splice locations to assist in the future location of faults.

6.4.2 The optical distance and magnitude of all splices shall be measured from both directions at wavelengths of 1310nm and 1550nm. The loss of any splice shall not exceed 0.10dB (two way average) at 1310nm and 1550nm.

6.4.3 Any splice loss that exceeds the above criteria shall be re-spliced. If the splice does not improve after two attempts at re-splicing and OTDR testing confirms that the splice loss is not consistent with a high point loss within the splice enclosure then the splice shall be accepted but reported as a high splice loss. All splice loss/joint measurements shall be recorded and any reported high splice loss value shall be appropriately marked and reported.

6.5 LSPM Insertion Loss

6.5.1 This measurement shall be undertaken on terminated fibres to verify the overall end-to-end power budget level of the entire fibre link. The Insertion Loss (IL) for each fibre shall be measured in both directions using a stabilised LSPM.

6.5.2 These results shall be compared with predictions based on the manufacturer's SMOF geometrical properties and minimum splice loss criteria.

6.5.3 The maximum two-way (average) Insertion Loss shall not exceed the following criteria:

- a) Maximum Loss at 1310nm (IL) = $0.4L + 0.1N + 0.50C + 0.5$
- b) Maximum Loss at 1550nm (IL) = $0.3L + 0.1N + 0.50C + 0.5$

Where;

- a) IL = Maximum allowable Insertion Loss in dB,
- b) L = optical section link Length in km,
- c) N = Number of splices including pre-terminated connector, and
- d) C = total number of through Connectors

6.5.4 If a fibre exceeds the acceptance criteria then the insertion loss value shall be appropriately marked (e.g. circled, highlighted, etc.)

6.6 Pre-Terminated Connector Loss

6.6.1 This calculation is performed to verify the overall performance of the individual connector/pigtail combination situated at either end of the optical fibre link.

6.6.2 For each fibre the delta between the maximum Insertion Loss (average IL).

6.6.3 LSPM Insertion Loss (Clause 7.5) less the OTDR average Link Loss (LL) (Clause 7.2) shall not exceed 1.0dB. Results for all fibre shall be calculated and recorded.

6.6.4 If the 1.0dB limit is exceeded for any fibre then a more comprehensive evaluation of the individual pre-terminated connector at both ends will need to be undertaken to determine the high loss (i.e. investigate the launch conditions of each pre-terminated connector using OTDR in high resolution mode).

7 Commissioning Acceptance Test Results

7.1.1 All OTDR Fibre test results shall be recorded and submitted in both original Trace Format and pdf. Original Trace Format in soft copy (electronically) with original Trace Format reader and all tested Fibres Trace results, pdf's in both hard and soft copies (electronically).

7.1.2 All LL & IL measurements and calculations shall be recorded and submitted on completion in both hard and soft copies (electronically). Test result shall be compiled on an EXCEL spread sheet with the correct values entered in the required cells.

i. Insertion loss results - Insertion loss measurement Two-way and average Insertion Loss results shall be recorded.

ii. Connector/Pigtail performance results – Calculated and shall be recorded and incorporated along with the tabulated Insertion Loss results above.

7.1.3 Any issues and steps taken to correct shall be recorded.

7.1.4 All faulty links found during testing shall be replaced in their entirety. No lengths of damaged or suspect cable or components shall be left in the system. Cable damaged during installation shall not be reused. All retest and cable replacement costs where necessary shall be borne by the Contactor.

7.1 Equipment Acceptance and Commissioning

7.1.1 Factory Certification shall be provided for all Optical Fibre equipment to be supplied and installed and shall be tested in the Supplier's factory. The Contractor shall provide a factory quality control testing certificate for all supplied Optical Fibre equipment, to FA.

7.1.2 Site Acceptance Testing shall demonstrate the compliance of the Fibre installation after all works have been completed.

7.1.3 The Contractor shall be required to fully test and commission the installation. Commissioning/Acceptance Testing shall be carried out in the presence of FA.

7.1.4 Installation and/or equipment will be accepted only after satisfactory completion of commissioning tests. If a test is unsuccessful the equipment shall be repaired and re- installed as appropriate and subject to retest until successful.

7.1.5 The cost of any retesting if necessary shall be borne by the Contractor

7.2 Inspection & Test Plan (ITP)

7.2.1 General

7.2.1.1 In addition to the Contractor's own Quality Assurance requirements the Contractor shall provide a complete ITP. The ITP shall include test schedules designed to incorporate the following information:

- a. Name of Test and its status - original test or repeat (due to a previous test failure), date, time and location of the test;
- b. Record of all values measured during installation/commissioning;
- c. List of test equipment used and statement of software and software version number used;
- d. A description of how the test is to be conducted (connection to test equipment, configuration of test equipment, test process);

7.2.1.2 The ITP shall reference back to this specification to confirm compliance with each individual requirement clause.

7.2.2 Draft Submission

7.2.2.1 Thirty (30) days prior to the proposed date for commencement of **Draft ITP** Inspection and Testing, the Contractor shall submit a draft ITP for assessment by FA. Update the ITP based on the requirements of FA and conduct Inspection and Testing in accordance with the Plan.

7.2.3 Undertaking the ITP

7.2.3.1 Inspect, test and tick/cross off each item on the ITP. Each page of the ITP shall be signed and dated by the person conducting the site inspection and testing

7.2.3.2 Where a specific item on the ITP cannot be checked off by the inspection personnel, place a cross against the incomplete item, note the reason for the omission and identify the required rectification action.

- a. All crossed items shall be completed before Acceptance Testing with FA.
- b. On completion, the overall ITP shall be signed and dated by the Contractor.
- c. Forward a scanned electronic copy of the completed signed ITP to FA.
- d. On receipt of the ITP and supporting details, FA will confirm dates for Acceptance Testing.

7.2.4 Testing sequence

7.2.4.1 The Contractor shall undertake Testing and Commissioning in the following sequence:

- i. Submit draft Inspection and Test Plan (ITP);
- ii. Undertake Inspection and Testing;
- iii. Submit completed ITP for review; complete any additional items as required

7.2.4.2 Receipt of:

- i. The completed signed ITP;
- ii. Supporting details; and
- iii. Draft manuals and 'as-installed' documentation, by FA shall constitute advice by the Contractor that the installation is complete and ready for Acceptance Testing. FA will review the completed ITP and supporting details and will advise the Contractor if any further work or submissions are required prior to Acceptance Testing.

7.2.4.3 Prior to Acceptance Testing, the Contractor shall provide onsite copies of all relevant Equipment Manuals, Optical Fibre test results and "As Built / Red line marked up" drawings relating to each specific site. All relevant Equipment Manuals, Optical Fibre test results and "As Built / Red line marked up" drawings relating to each specific site shall be placed in a "B4 Clear Case" document folder.

7.2.4.4 Acceptance testing may include repeat of any or all elements of the ITP plus a detailed verification of the correct operation of each device and function.

7.2.4.5 Once the Acceptance Testing commences, FA reserves the right to delay or abort Acceptance Testing if:

- a. The status of the work does not match the status verified by the Contractor on the ITP;
- b. The status of the work does not allow full and complete operation of the system;
- c. A component failure renders any part of the system inoperable;
- d. d) The Acceptance Testing work cannot proceed with reasonable certainty that the installation is in its final state due to outstanding/ongoing work by the Contractor.

7.2.4.6 If the cause of the delay or cancellation is the within the responsibility of the Contractor as assigned under the Contract, any associated costs will be borne by the Contractor

8 As Built & Handover Requirements

8.1 As-Built Information

8.1.1 The Contractor shall supply "As Built" drawings.

8.1.2 The Contractor shall make an accurate record of all changes where the actual installation differs from that shown in the contract drawings and specification.

8.1.3 Drawings shall be supplied in hard copy and electronic format (AUTOCAD).

8.1.4 The Contractor shall supply copies of all test results as described in this specification.

Annexure 1 - PRICING FORMAT – NADI & NAUSORI AIRPORT

Cable, Accessories, Network & Test Equipment

	Item Description	Qty	Unit Price	Sub-Total price
1.1	Optic Fibre Cable			
1.1.1				
1.2	Optic Fibre Accessories			
1.2.1				
1.3	Network Equipment & accessories i.e brackets, cables etc			
1.3.1				
1.4	Radio Link & accessories			
1.4.1				
1.5	Training			
1.5.1				
1.6	Optic Fibre Test Equipment & Tools			
1.6.1				
1.7	Miscellaneous			
1.4.1				
	Grand Total (FJD VIP)			

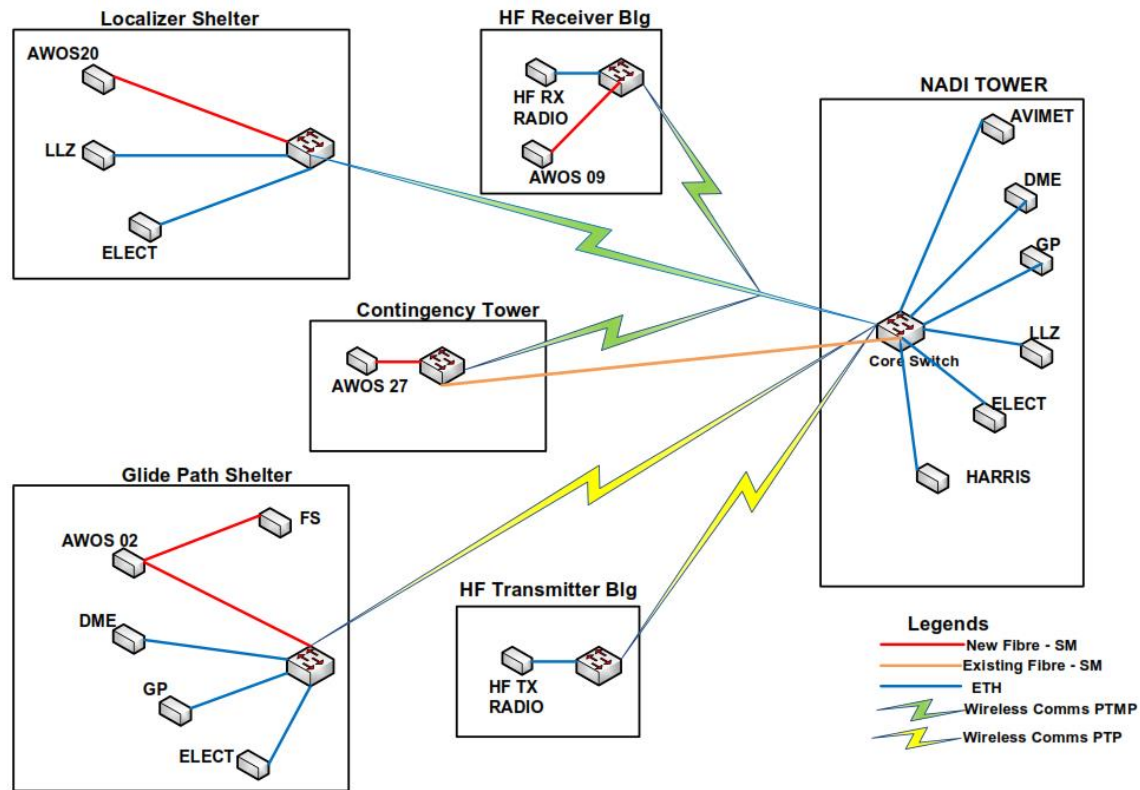
Project Services

#	Item Description	Qty	Unit Price	Sub-Total price
1.1	Installation			
1.1.1	Fibre Hauling			
1.1.2	Fiber Splicing & Termination			
1.1.3	Transportation			
1.1.4	Labor / Supervision			
1.2	Site Acceptance & Commissioning			
1.2.1	Integration & Testing			
1.2.2	Documentation			
1.2.3	Commissioning			
	Grand Total (FJD VIP)			



Annexure 2 – PROPOSED NETWORK DIAGRAM

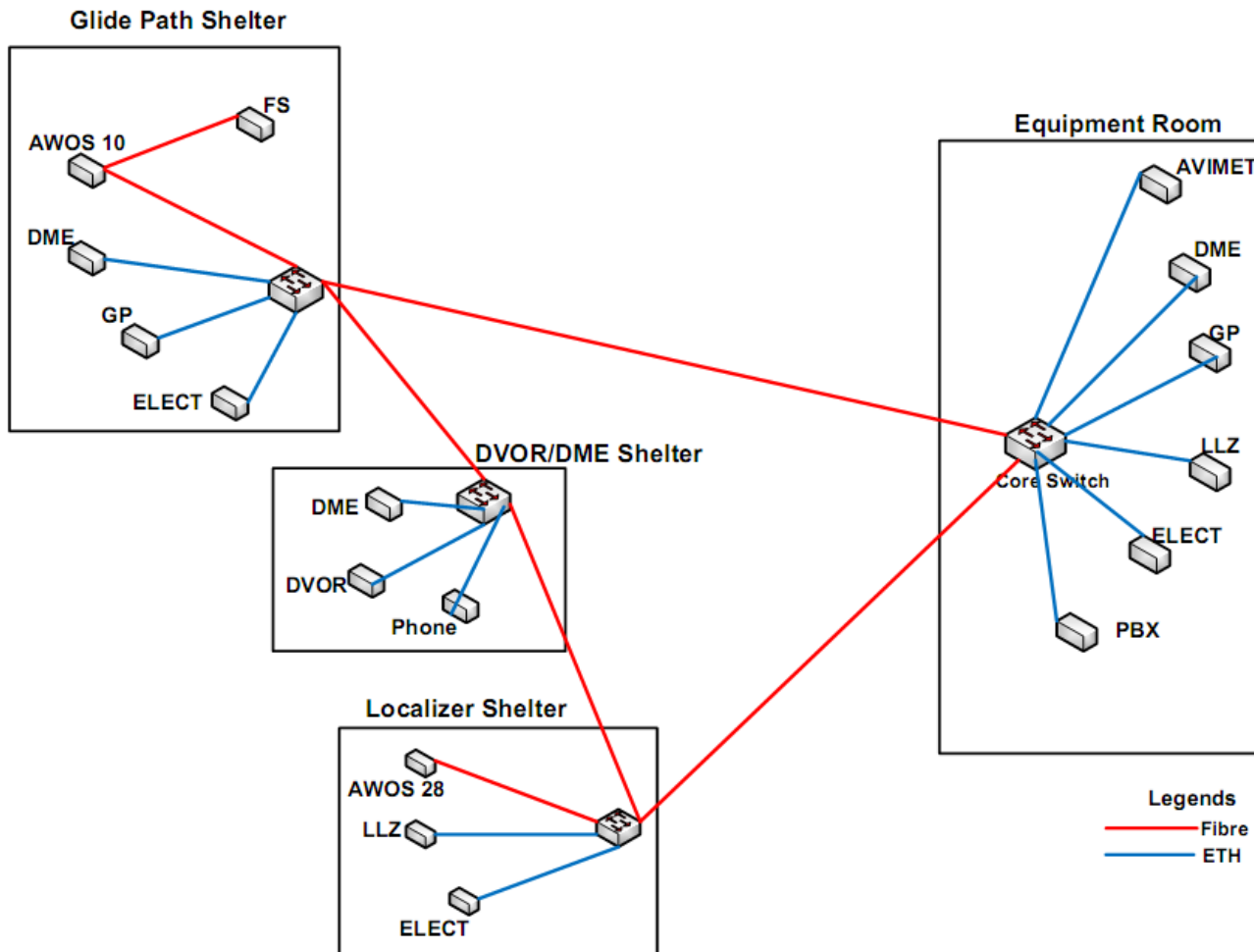
Proposed Network Diagram Nadi Airport





Annexure 3 – PROPOSED NETWORK DIAGRAM

Proposed Network Diagram Nausori Airport





Annexure 4 – CABLE ROUTE NADI





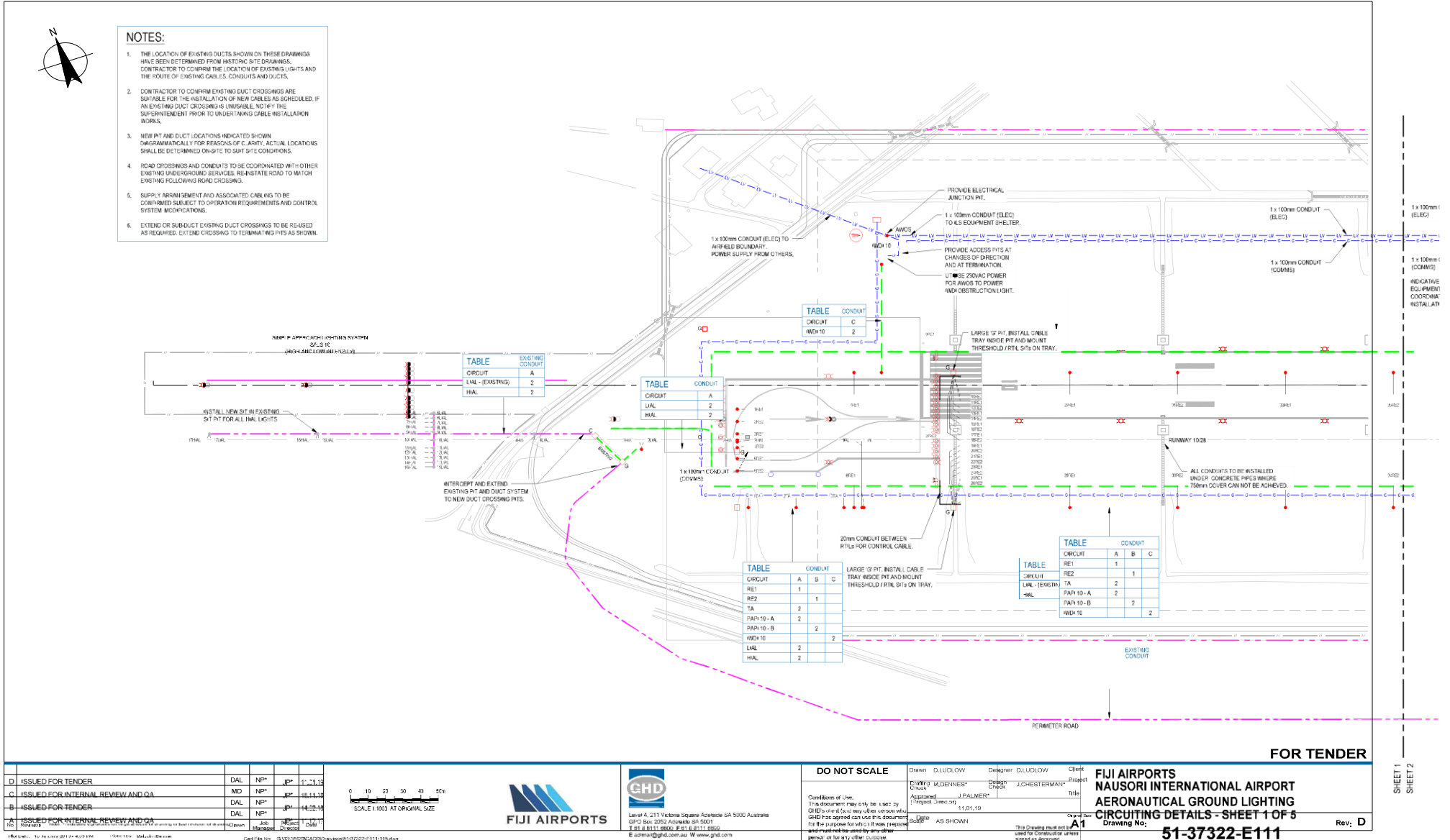
Annexure 5 – Radio Link Sites



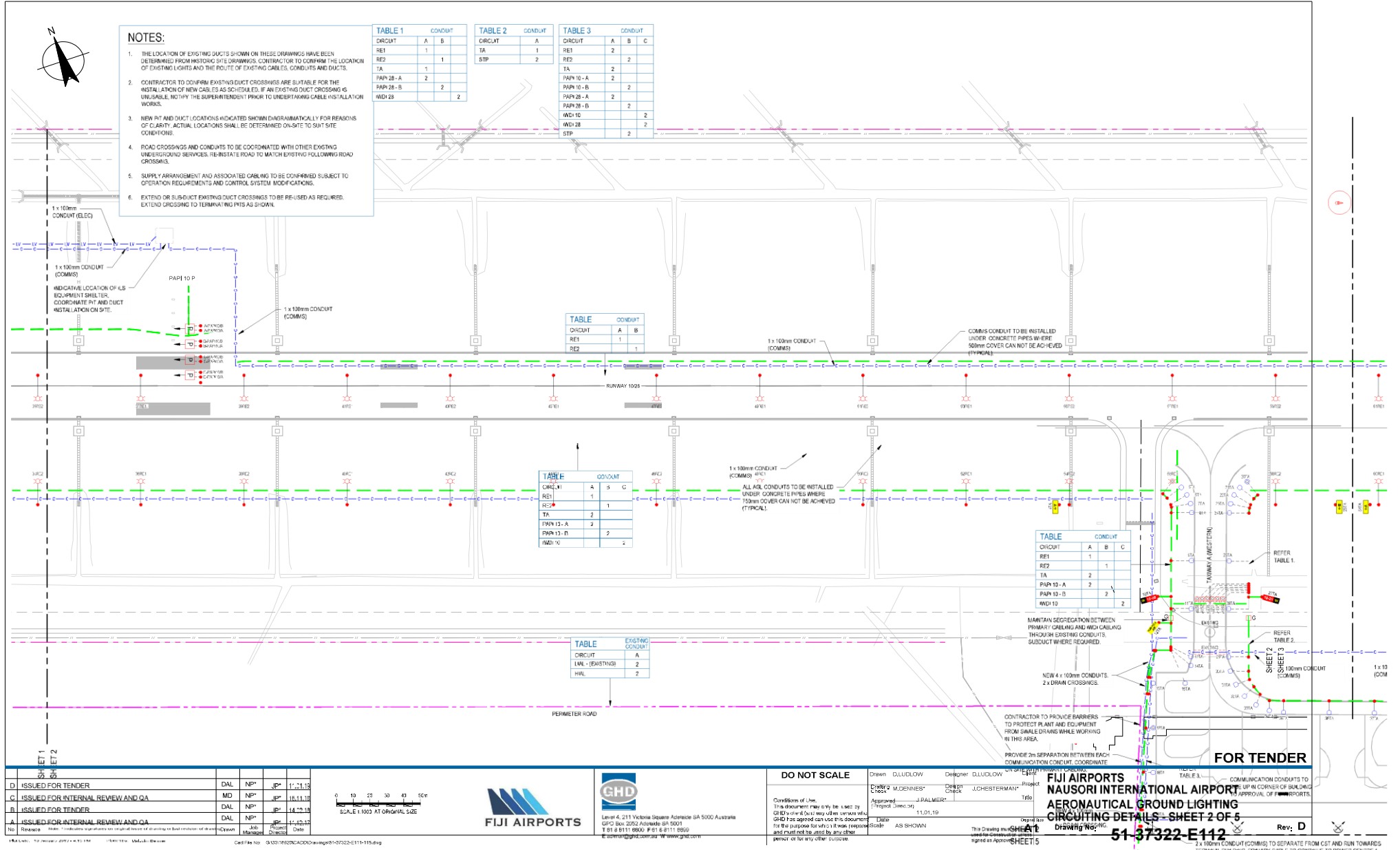
APPENDIX B - SPECIFICATION



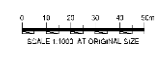
Annexure 6 – NAUSORI AIRPORT FIBRE ROUTE



APPENDIX B - SPECIFICATION



D	ISSUED FOR TENDER	DAL	NP	JP	11.21.13
C	ISSUED FOR INTERNAL REVIEW AND QA	MD	NP	JP	16.11.13
B	ISSUED FOR TENDER	DAL	NP	JP	14.09.13
A	ISSUED FOR INTERNAL REVIEW AND QA	DAL	NP	JP	11.05.13



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Drawn	D.LUDLOW	Designer	D.LUDLOW	Project	FIJI AIRPORTS NAUSORI INTERNATIONAL AIRPORT
Checked	M.DENNESS	Project Manager	J.PALMER	Scale	AS SHOWN
Approved	(Signature)	Date	11.01.10	Sheet	SHEET 2 OF 5

FOR TENDER

FIJI AIRPORTS NAUSORI INTERNATIONAL AIRPORT AERONAUTICAL GROUND LIGHTING CIRCUITING DETAILS - SHEET 2 OF 5

CONTRACTOR TO PROVIDE BARRIERS TO PROTECT PLANT AND EQUIPMENT FROM SMALL DRAINS WHILE WORKING IN THIS AREA.

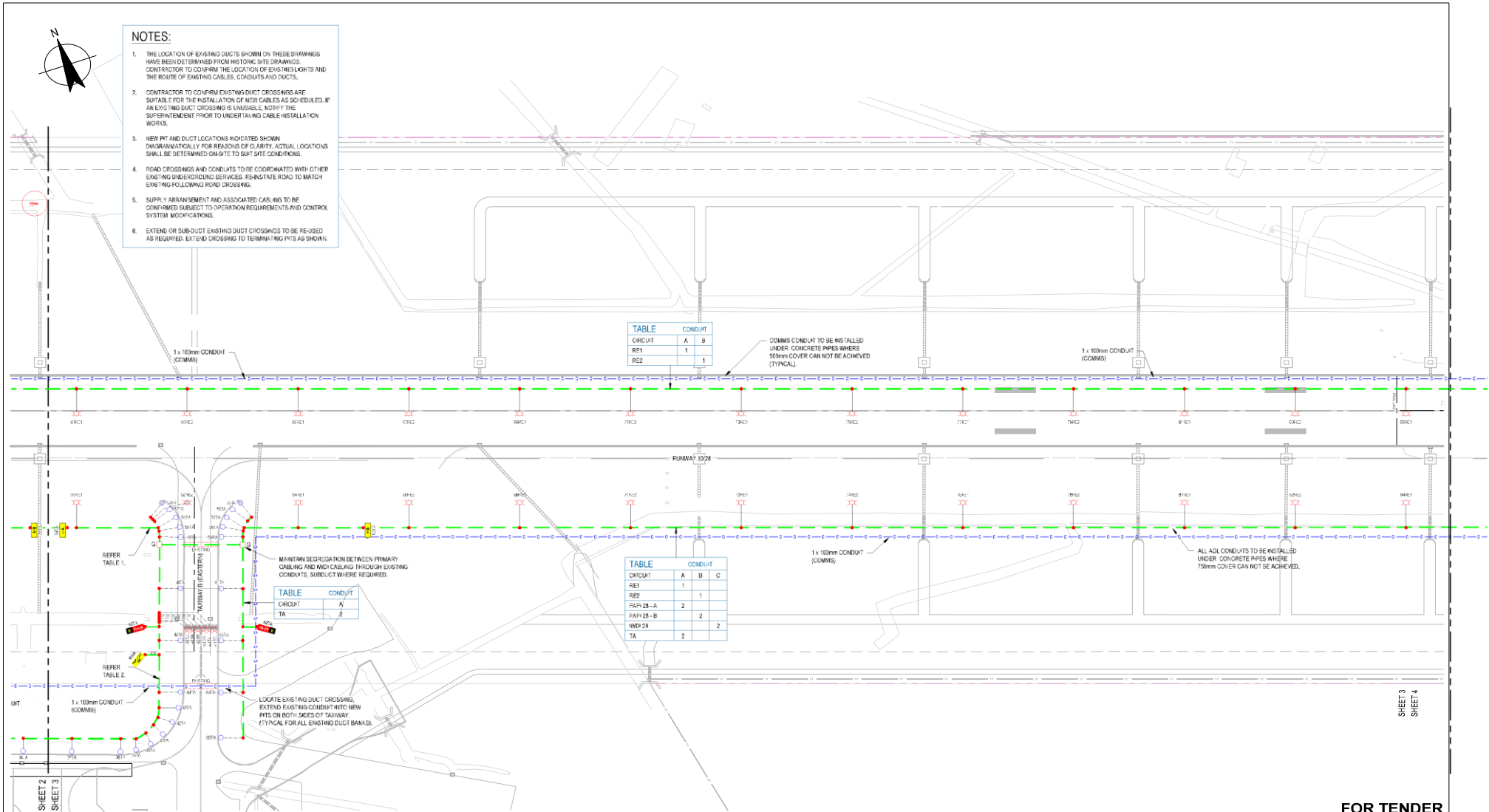
PROVIDE 2m SEPARATION BETWEEN EACH COMMUNICATION CONDUIT. COORDINATE.

COMMUNICATION CONDUITS TO BE SEPARATE FROM CST AND RUN TOWARDS TERMINAL BUILDING. PRIMARY CABLE TO CONTINUE TO POWER CENTRE 1.

Rev: D

51-37322-E412

APPENDIX B - SPECIFICATION



- NOTES:**
1. THE LOCATION OF EXISTING DUCTS SHOWN ON THESE DRAWINGS HAVE BEEN DETERMINED FROM HISTORIC SITE DRAWINGS. CONTRACTOR TO CONFIRM THE LOCATION OF EXISTING LIGHTS AND THE ROUTE OF EXISTING CABLES, CONDUITS AND DUCTS.
 2. CONTRACTOR TO CONFIRM EXISTING DUCT CROSSINGS ARE SUITABLE FOR THE INSTALLATION OF NEW CABLES AS SCHEDULED. IF AN EXISTING DUCT CROSSING IS UNSUITABLE, NOTIFY THE SUPERINTENDENT PRIOR TO UNDERTAKING CABLE INSTALLATION WORKS.
 3. NEW PIT AND DUCT LOCATIONS INDICATED SHOWN DIAGRAMMATICALLY FOR REASONS OF CLARITY. ACTUAL LOCATIONS SHALL BE DETERMINED ON-SITE TO SUIT SITE CONDITIONS.
 4. ROAD CROSSINGS AND CONDUITS TO BE COORDINATED WITH OTHER EXISTING UNDERGROUND SERVICES. RE-INSTATE ROAD TO MATCH EXISTING FOLLOWING ROAD CROSSING.
 5. SUPPLY ARRANGEMENT AND ASSOCIATED CABLING TO BE CONFIRMED SUBJECT TO OPERATION REQUIREMENTS AND CONTROL SYSTEM MODIFICATIONS.
 6. EXTEND OR SUB-DUCT EXISTING DUCT CROSSINGS TO BE REUSED AS REQUIRED. EXTEND CROSSING TO TERMINATING PITS AS SHOWN.

TABLE		CONDUIT	
CIRCUIT	A	B	
RE1	1		
RE2		1	

COMMS CONDUIT TO BE INSTALLED UNDER CONCRETE PAVES WHERE 50mm COVER CAN NOT BE ACHIEVED (TYPICAL).

TABLE		CONDUIT		
CIRCUIT	A	B	C	
RE1	1			
RE2		1		
PAP12B-A	2		2	
PAP12B-B		2		2
WD12B			2	
TA	2			2

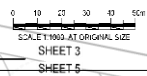
1 x 100mm CONDUIT (COMMS)

ALL AGL CONDUITS TO BE INSTALLED UNDER CONCRETE PAVES WHERE 75mm COVER CAN NOT BE ACHIEVED.

SHEET 3
SHEET 4

FOR TENDER

D	ISSUED FOR TENDER	DAL	NP*	JP*	1'-11.13
C	ISSUED FOR INTERNAL REVIEW AND QA	MD	NP*	JP*	1'-11.13
B	ISSUED FOR TENDER	DAL	NP*	JP*	1'-11.13
A	ISSUED FOR INTERNAL REVIEW AND QA	DAL	NP*	JP*	1'-11.13



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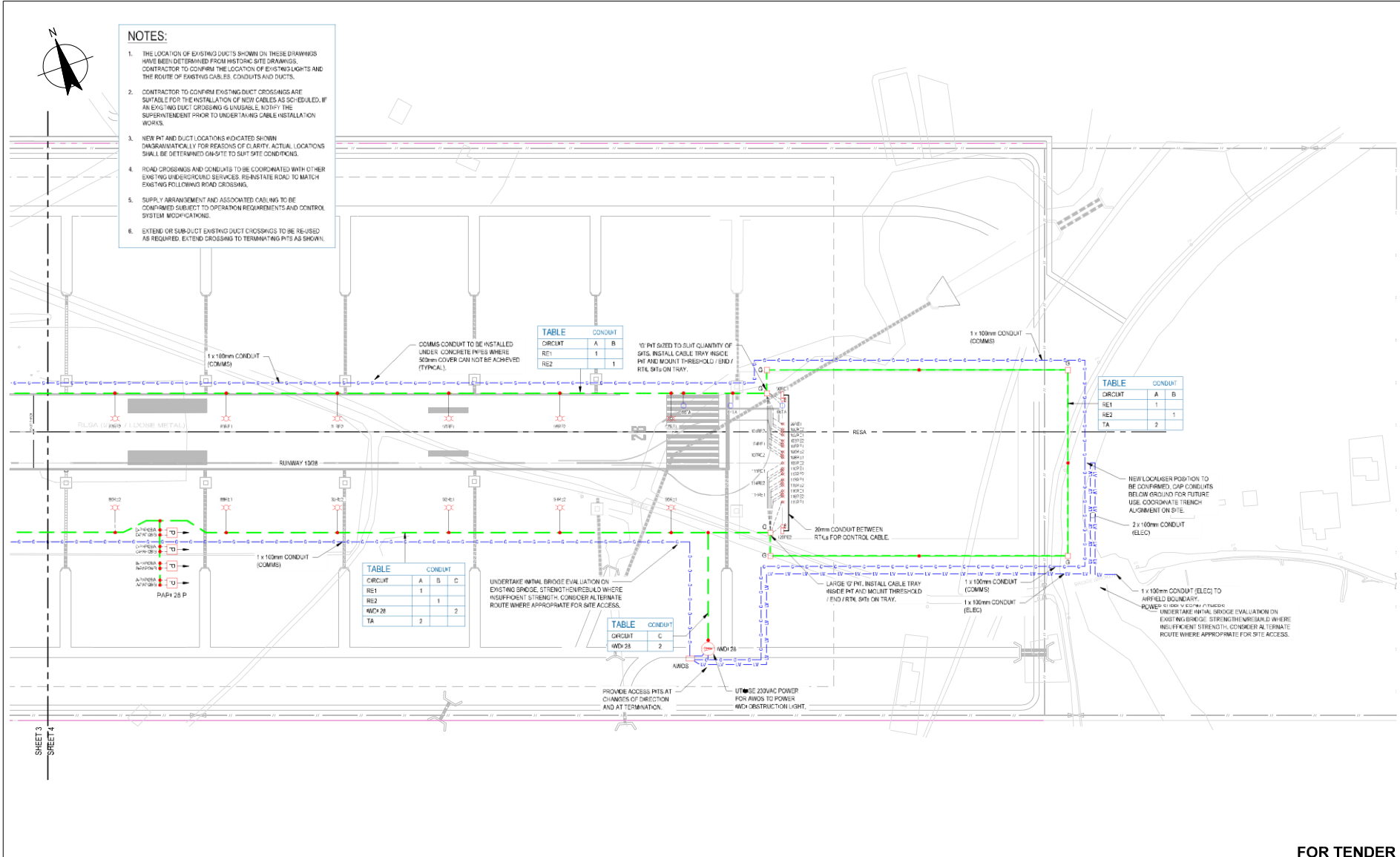
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Drawn	D.LUDLOW	Designer	D.LUDLOW	Client	FIJI AIRPORTS
Checked	M.DENNESS	Design Check	J.CHESTERMAN	Project	NAUSORI INTERNATIONAL AIRPORT AERONAUTICAL GROUND LIGHTING
Approved	J.PALMER	(Project Director)		Title	CIRCUITING DETAILS - SHEET 3 OF 5
Date	11.01.19	Scale	AS SHOWN	Sheet No	A1

FIJI AIRPORTS
NAUSORI INTERNATIONAL AIRPORT
AERONAUTICAL GROUND LIGHTING
CIRCUITING DETAILS - SHEET 3 OF 5
Drawing No: **51-37322-E113**

Rev: D

APPENDIX B - SPECIFICATION



- NOTES:**
1. THE LOCATION OF EXISTING DUCTS SHOWN ON THESE DRAWINGS HAVE BEEN DETERMINED FROM HISTORIC SITE DRAWINGS. CONTRACTOR TO CONFIRM THE LOCATION OF EXISTING LIGHTS AND THE ROUTE OF EXISTING CABLES, CONDUITS AND DUCTS.
 2. CONTRACTOR TO CONFIRM EXISTING DUCT CROSSINGS ARE SUITABLE FOR THE INSTALLATION OF NEW CABLES AS SCHEDULED. IF AN EXISTING DUCT CROSSING IS UNUSABLE, NOTIFY THE SUPERINTENDENT PRIOR TO UNDERTAKING CABLE INSTALLATION WORKS.
 3. NEW PIT AND DUCT LOCATIONS INDICATED SHOWN DIAGRAMMATICALLY FOR REASONS OF CLARITY. ACTUAL LOCATIONS SHALL BE DETERMINED ON-SITE TO SUIT SITE CONDITIONS.
 4. ROAD CROSSINGS AND CONDUITS TO BE COORDINATED WITH OTHER EXISTING UNDERGROUND SERVICES. RE-INSTATE ROAD TO MATCH EXISTING FOLLOWING ROAD CROSSINGS.
 5. SUPPLY ARRANGEMENT AND ASSOCIATED CABLING TO BE CONFIRMED SUBJECT TO OPERATION REQUIREMENTS AND CONTROL SYSTEM MODIFICATIONS.
 6. EXTEND OR SUB-DUCT EXISTING DUCT CROSSINGS TO BE RE-USED AS REQUIRED. EXTEND CROSSING TO TERMINATING PITS AS SHOWN.

COMMS CONDUIT TO BE INSTALLED UNDER CONCRETE PAVES WHERE 50mm COVER CAN NOT BE ACHIEVED (TYPICAL).

TABLE	CONDUIT	
CIRCUIT	A	B
RE1	1	1
RE2		

1/2" PIT SIZED TO SUIT QUANTITY OF SITS. INSTALL CABLE TRAY INSIDE PIT ABOVE MOUNT THRESHOLD / END / RTLS SITS ON TRAY.

TABLE	CONDUIT	
CIRCUIT	A	B
RE1	1	1
RE2		
TA	2	

NEW LOCALISER POSITION TO BE CONFIRMED. CAP CONDUITS BELOW GROUND FOR FUTURE USE. COORDINATE TRUNK ALIGNMENT ON SITE.

TABLE	CONDUIT		
CIRCUIT	A	B	C
RE1	1		
RE2		1	
WCH 28			2
TA	2		

UNDERTAKE INITIAL BRIDGE EVALUATION ON EXISTING BRIDGE. STRENGTHEN/REBUILD WHERE INSUFFICIENT STRENGTH. CONSIDER ALTERNATE ROUTE WHERE APPROPRIATE FOR SITE ACCESS.

TABLE	CONDUIT	
CIRCUIT	A	B
WCH 28	1	1
TA	2	2

PROVIDE ACCESS PITS AT CHANGES OF DIRECTION AND AT TERMINATION.

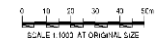
UTILISE 230VAC POWER FOR AWOS TO POWER WCH OBSTRUCTION LIGHT.

LARGE 1/2" PIT. INSTALL CABLE TRAY INSIDE PIT AND MOUNT THRESHOLD / END / RTLS SITS ON TRAY.

1 x 100mm CONDUIT (ELEC) TO AIRFIELD BOUNDARY. UNDERTAKE INITIAL BRIDGE EVALUATION ON EXISTING BRIDGE. STRENGTHEN/REBUILD WHERE INSUFFICIENT STRENGTH. CONSIDER ALTERNATE ROUTE WHERE APPROPRIATE FOR SITE ACCESS.

FOR TENDER

No	Revision	Issue	Author	Checked	Date
D		ISSUED FOR TENDER	DAL	NP*	11.21.19
C		ISSUED FOR INTERNAL REVIEW AND QA	MD	NP*	18.11.19
B		ISSUED FOR TENDER	DAL	NP*	14.12.19
A		ISSUED FOR INTERNAL REVIEW AND QA	DAL	NP*	11.12.19



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Drawn: D.LUDLOW Designer: D.LUDLOW Client: FIJI AIRPORTS
 Checked: M.DENNIS* Designer: J.CHESTERMAN* Project: NAUSORI INTERNATIONAL AIRPORT
 Approved: J.PALMER* Date: 11.01.19
 Scale: AS SHOWN
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FIJI AIRPORTS
NAUSORI INTERNATIONAL AIRPORT
AERONAUTICAL GROUND LIGHTING
CIRCUITING DETAILS - SHEET 4 OF 5

Drawing No: **51-37322-E114** Rev: **D**



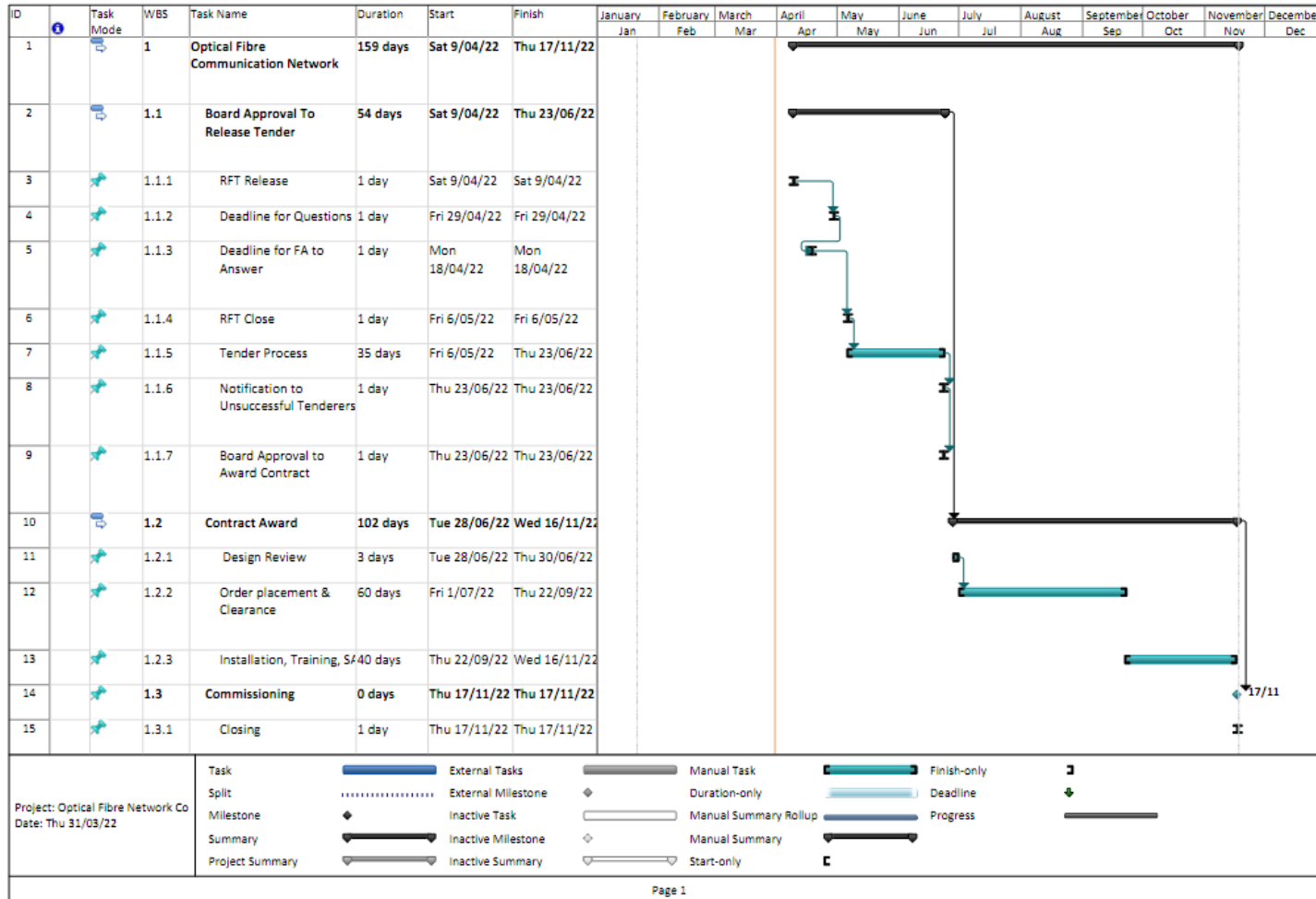
Annexure 7 - Nausori Site Layout





Annexure 8 – Proposed Project Schedule

APPENDIX B - SPECIFICATION



APPENDIX B - SPECIFICATION

