Procurement of Plant Design, Supply, Delivery, Installation, Testing and Commissioning of
Lot 1: 400 kV Ratmate Substation and works at Lapsiphedi and New Hetauda Substations
Lot 2: 400 kV New Butwal Substation
Lot 3: 400 kV New Damauli Substation

MCA-N/ETP/CB/004

ADDENDUM #6
Issued on: 18 July 2023

This Addendum No. 6 modifies respective portions of the Bidding Document issued on 24 March 2023 and amended through Addendum No. 1 on 04 April 2023, Addendum No. 2 on 30 May 2023, Addendum No. 3 on 6 June 2023, Addendum No. 4 on 10 July 2023 and Addendum No. 5 on 12 July 2023. The changes, as indicated below, are effective on the date of issue of this Addendum.

Except as expressly amended by this Addendum, all other terms and conditions of the Bidding Document - issued on 24 March 2023 and amended through Addendum No. 1 issued on 04 April 2023, Addendum No. 2 on 30 May 2023, Addendum No. 3 on 6 June 2023, Addendum No. 4 on 10 July 2023 and Addendum No. 5 on 12 July 2023 remains unchanged and shall remain in full force and effect in accordance with their terms.

<table>
<tr><th>SN</th><th>Pages/Paragraph</th><th>Amendments</th></tr>
<tr><td>1.</td><td>Part 1, Section IV, Form Tech-11: Technical Data Schedule, Lot 1- Technical Data Schedule, 8. 336kV Surge Arrestor Specifications, page 30 (PDF Page 176 of 1019), S.No. 10.</td><td>
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<tr><td>2.</td><td>Part 1, Section IV, Form Tech-11: Technical Data Schedule, Lot 1- Technical Data Schedule, 16. Ratmate 420kV and 245kV GIS Technical Specifications,
16.1 420kV GIS Technical Specifications, page 49 (PDF Page 195 of 1019), S.No. 3.6
&
16.2 245kV GIS Technical Specifications, page 62 (PDF Page 208 of 1019), S.No. 3.6</td><td>
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<tr><td>3.</td><td>Part 1, Section IV, Form Tech-11: Technical Data Schedule, Lot 1- Technical Data Schedule, 16. Ratmate 420kV and
245kV GIS Technical Specifications,
16.1 420kV GIS Technical Specifications, page 51 (PDF Page 197 of 1019), S.No. 8.5
&
16.2 245kV GIS Technical Specifications, page 64 (PDF Page 210 of 1019), S.No. 8.5</td><td>
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<tr><td>4.</td><td>Part 1, Section IV, Form Tech-11: Technical Data Schedule, Lot 2- Technical Data Schedule, 6. 336kV & 216kV & 30kV Surge Arrestor Specifications, page 44 (Page 357 of 1019), S.No. 8.</td><td>
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<tr><td>5.</td><td>Part 1, Section IV, Form Tech-11: Technical Data Schedule, Lot 2- Technical Data Schedule, 9. New Butwal 420kV GIS Technical Specifications, page 61 (PDF Page 374 of 1019), S.No. 3.6</td><td>
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<tr><td>6.</td><td>Part 1, Section IV, Form Tech-11: Technical Data Schedule, Lot 2- Technical Data Schedule, 9. New Butwal 420kV GIS Technical Specifications, page 63 (PDF Page 376 of 1019), S.No. 8.5</td><td>
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<tr><td>7.</td><td>Part 1, Section IV, Form Tech-11: Technical Data Schedule, Lot 3- Technical Data Schedule, 8. 336kV Surge Arrestor Specifications, page 30 (Page 511 of 1019), S.No. 10.</td><td>
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<tr><td>8.</td><td>Part 1, Section IV, Form Tech-11: Technical Data Schedule, Lot 3-Technical Data Schedule, 16. New Damauli 420kV GIS Technical Specifications, 16.1 420kV GIS Technical Specifications, page 48 (PDF Page 529 of 1019), S.No. 3.6</td><td>
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<tr><td>9.</td><td>Part 1, Section IV, Form Tech-11: Technical Data Schedule, Lot 3-Technical Data Schedule, 16. New Damauli 420kV GIS Technical Specifications, 16.1 420kV GIS Technical Specifications, page 50 (PDF Page 531 of 1019), S.No. 8.5</td><td>
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<tr><td>10.</td><td>Part 2, Section V, B01_GPD, Annex_B01</td><td>Add a new Annex, Annex B01-12-Oil Filtration Plant (attached with this addendum):
Please consider Annex B01-12-Oil Filtration Plant (attached with this addendum) for preparing technical and financial offer.</td></tr>
<tr><td>11.</td><td>Part 2, Section V, B01_GPD, Annex_B01</td><td>Add a new Annex, Annex B01-13-kmz files of Substation (attached with this addendum):
Please consider Annex B01-13-kmz files of Substation (attached with this addendum) for additional information.</td></tr>
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SN	Pages/Paragraph	Amendments
12.	Part 2, Section V, B11_PSR, 221123_Lot1_RAT_PSR, B1.1, Project Specific Requirements, (PSR), 3.1 400kV Ratmate GIS Substation, Page-16 (Word Page 21 of 69), e. Line Feeder Circuit Breaker Bay Element & Page-17 (Word Page 22 of 69), g. Autotransformer Circuit Breaker Bay Elements.	e. Line Feeder Circuit Breaker Bay Elements viii. (1) one three-phase set of gas-to-air bushings. g. Autotransformer Circuit Breaker Bay Elements viii. (1) one three-phase set of gas-to-air bushings. **has been replaced by:** e. Line Feeder Circuit Breaker Bay Elements viii. Three (3) nos. single-phase set of gas-to-air bushings. g. Autotransformer Circuit Breaker Bay Elements viii. Three (3) nos. single-phase set of gas-to-air bushings.
13.	Part 2, Section V, B11_PSR, 221123_Lot1_RAT_PSR, B1.1, Project Specific Requirements, (PSR), Page-23 (Word Page 28 of 69), 3.3 Auto Transformers,	**3.3 AUTO TRANSFORMERS** a. Design, engineering, manufacture, testing at manufacturer's facility, delivery to the site including all materials, accessories, spares, unloading, handling, proper storage at the site, erection, testing and commissioning of the 167 MVA, 400/√3/220/√3/33kV Single Phase Auto Transformers as specified below; i. 7 (6 + 1 Spare) of 167 MVA, 400/√3/220/√3/33 kV single phase, constant ohmic impedance type Auto Transformer with series winding for HV & IV and separate winding for LV, 50Hz, YNa0d11, oil immersed, ONAN/ ONAF/ OFAF cooled, equipped with on-load tap changer (OLTC), outdoor type, complete with all fittings and accessories including local OLTC control cabinet, cooler control cabinet and Remote Tap Changer Control panel, neutral CTs and On line Dissolved Gas , necessary arrangement for Delta formation of LV winding & Neutral Formation and Earthing Arrangement, surge protection device, Neutral Current transformer (NCT) and all fittings & accessories as specified/ required for completion of the scope of works as per technical specification. ii. Insulating oil for first filling plus 10 % extra to account for spillage, sampling etc. for all the Transformers. iii. Oil storage tank of suitable size. iv. Steel rails with all accessories to fix it on the transformer foundation. **has been replaced by:** **3.3 AUTO TRANSFORMERS** a. Design, engineering, manufacture, testing at manufacturer's facility, delivery to the site including all materials, accessories, spares, unloading, handling, proper storage at the site, erection, testing and commissioning of the 167 MVA, 400/√3/220/√3/33kV Single Phase Auto Transformers as specified below;

SN	Pages/Paragraph	Amendments
		i. 7 (6 + 1 Spare) of 167 MVA, 400/√3/220/√3/33 kV single phase, constant ohmic impedance type Auto Transformer with series winding for HV & IV and separate winding for LV, 50Hz, YNa0d11, oil immersed, ONAN/ ONAF/ OFAF cooled, equipped with on-load tap changer (OLTC), outdoor type, complete with all fittings and accessories including local OLTC control cabinet, cooler control cabinet and Remote Tap Changer Control panel, neutral CTs and On line Dissolved Gas , necessary arrangement for Delta formation of LV winding & Neutral Formation and Earthing Arrangement, surge protection device, Neutral Current transformer (NCT) and all fittings & accessories as specified/ required for completion of the scope of works as per technical specification. ii. Insulating oil for first filling plus 10 % extra to account for spillage, sampling etc. for all the Transformers. iii. Oil storage tank of suitable size. iv. Steel rails with all accessories to fix it on the transformer foundation. v. One (1) set of Oil filtration plant as per Annex B01-12-Oil Filtration Plant.
14.	Part 2, Section V, B11_PSR, 221123_Lot2_NBW_PSR, B1.1, Project Specific Requirements, (PSR), 3.1 400kV New Butwal GIS Substation, Page-13 (Word Page 18 of 64), f. Line Feeder Circuit Breaker Bay Element & Page-14 (Word Page 19 of 64), h. Autotransformer Circuit Breaker Bay Elements.	f. Line Feeder Circuit Breaker Bay Elements viii. (1) one three-phase set of gas-to-air bushings. h. Autotransformer Circuit Breaker Bay Elements viii. (1) one three-phase set of gas-to-air bushings. **has been replaced by:** f. Line Feeder Circuit Breaker Bay Elements viii. Three (3) nos. single-phase set of gas-to-air bushings. h. Autotransformer Circuit Breaker Bay Elements viii. Three (3) nos. single-phase set of gas-to-air bushings.

SN	Pages/Paragraph	Amendments
15.	Part 2, Section V, B11_PSR, 221123_Lot2_NBW_PSR, B1.1, Project Specific Requirements, (PSR), Page-16 (Word Page 21 of 64), 3.2 Auto Transformers,	**3.2 AUTO TRANSFORMERS** a. Design, engineering, manufacture, testing at manufacturer's facility, delivery to the site including all materials, accessories, spares, unloading, handling, proper storage at the site, erection, testing and commissioning of the 315 MVA, 400/√3/220/√3/33 3-Phase Auto Transformers as specified below; i. 2 Nos of 315MVA, 400/√3/220/√3/33 kV 3-phase, constant ohmic impedance type Auto Transformer with series winding for HV & IV and separate winding for LV, 50Hz, YNa0d11, oil immersed, ONAN/ ONAF/ OFAF cooled, equipped with on-load tap changer (OLTC), outdoor type, complete with all fittings and accessories including local OLTC control cabinet, cooler control cabinet and Remote Tap Changer Control panel, neutral CTs and On line Dissolved Gas , necessary arrangement for Delta formation of LV winding & Neutral Formation and Earthing Arrangement, surge protection device, Neutral Current transformer (NCT) and all fittings & accessories as specified/ required for completion of the scope of works as per technical specification. ii. Insulating oil for first filling plus 10 % extra to account for spillage, sampling etc. for all the Transformers. iii. Oil storage tank of suitable size. iv. Steel rails with all accessories to fix it on the transformer foundation. **has been replaced by:** **3.2 AUTO TRANSFORMERS** a. Design, engineering, manufacture, testing at manufacturer's facility, delivery to the site including all materials, accessories, spares, unloading, handling, proper storage at the site, erection, testing and commissioning of the 315 MVA, 400/√3/220/√3/33 3-Phase Auto Transformers as specified below; i. 2 Nos of 315MVA, 400/√3/220/√3/33 kV 3-phase, constant ohmic impedance type Auto Transformer with series winding for HV & IV and separate winding for LV, 50Hz, YNa0d11, oil immersed, ONAN/ ONAF/ OFAF cooled, equipped with on-load tap changer (OLTC), outdoor type, complete with all fittings and accessories including local OLTC control cabinet, cooler control cabinet and Remote Tap Changer Control panel, neutral CTs and On line Dissolved Gas , necessary arrangement for Delta formation of LV winding & Neutral Formation and Earthing Arrangement, surge protection device, Neutral Current transformer (NCT) and all fittings & accessories as specified/ required for completion of the scope of works as per technical specification. ii. Insulating oil for first filling plus 10 % extra to account for spillage, sampling etc. for all the Transformers. iii. Oil storage tank of suitable size. iv. Steel rails with all accessories to fix it on the transformer foundation. v. One (1) set of Oil filtration plant as per Annex B01-12-Oil Filtration Plant.

SN	Pages/Paragraph	Amendments
16.	Part 2, Section V, B11_PSR, 221123_Lot2_NBW_PSR, B1.1, Project Specific Requirements (PSR), Page-22 (Word Page 27 of 64) 3.10 Fire Protection System.	3.10 **Fire protection system.** Fire detection and protection system for 3 nos. of 400/220/33 kV, 315 MVA, 3-Ph Autotransformers, 400 kV GIS building, and control building, including Fire Fighting Pump House & water Tank, are envisaged in the present scope of Contract. **has been replaced by:** 3.10 **Fire protection system.** Fire detection and protection system for 2 nos. of 400/220/33 kV, 315 MVA, 3-Ph Autotransformers, 400 kV GIS building, and control building, including Fire Fighting Pump House & water Tank, are envisaged in the present scope of Contract.
17.	Part 2, Section V, B11_PSR, 221123_Lot3_NDM_PSR, B1.1, Project Specific Requirements, (PSR), 3.1.1 400kV New Damauli GIS Substation, Page-11 (Word Page 15 of 62), e. Line Feeder Circuit Breaker Bay Element & Page-12 (Word Page 16 of 62), g. Autotransformer Circuit Breaker Bay Elements.	e. Line Feeder Circuit Breaker Bay Elements viii. (1) one three-phase set of gas-to-air bushings. g. Autotransformer Circuit Breaker Bay Elements viii. (1) one three-phase set of gas-to-air bushings. **has been replaced by:** e. Line Feeder Circuit Breaker Bay Elements viii. Three (3) nos. single-phase set of gas-to-air bushings. g. Autotransformer Circuit Breaker Bay Elements viii. Three (3) nos. single-phase set of gas-to-air bushings.
18.	Part 2, Section V, B11_PSR, 221123_Lot3_NDM_PSR, B1.1, Project Specific Requirements, (PSR), Page-14 (Word Page 18 of 62), 3.1.2 220 kV New Damauli Substation	**3.1.2 220 kV New Damauli substation** a. The 220 kV GIS substation is generally NOT included in the scope of this project. Supply, installation, testing, and commissioning of all equipment including control and protection panels and automation systems shall be others' responsibility. However, overall Earthing and Land Development work for the entire substation area covering 400 kV and 220 kV side shall be included in the present scope of work. **has been replaced by:** **3.1.2 220 kV New Damauli substation** a. The 220 kV GIS substation is generally NOT included in the scope of this project. Supply, installation, testing, and commissioning of all equipment including control and protection panels and automation systems shall be others' responsibility. However, integration of 400kV Earthmat with 220kV side and associated land development works till the adjoining 220kV & 132kV Substation will be in the current scope of work.

SN	Pages/Paragraph	Amendments
19.	Part 2, Section V, B11_PSR, 221123_Lot3_NDW_PSR, B1.1, Project Specific Requirements, (PSR), Page-15 (Word Page 19 of 62), 3.2 Auto Transformers,	**3.2 AUTO TRANSFORMERS** a. Design, engineering, manufacture, testing at manufacturer's facility, delivery to the site including all materials, accessories, spares, unloading, handling, proper storage at the site, erection, testing and commissioning of the 167 MVA, 400/√3/220/√3/33kV Single Phase Auto Transformers as specified below; i. 7 (6 + 1 Spare) of 167 MVA, 400/√3/220/√3/33 kV single phase, constant ohmic impedance type Auto Transformer with series winding for HV & IV and separate winding for LV, 50Hz, YNa0d11, oil immersed, ONAN/ ONAF/ OFAF cooled, equipped with on-load tap changer (OLTC), outdoor type, complete with all fittings and accessories including local OLTC control cabinet, cooler control cabinet and Remote Tap Changer Control panel, neutral CTs and On line Dissolved Gas , necessary arrangement for Delta formation of LV winding & Neutral Formation and Earthing Arrangement, surge protection device, Neutral Current transformer (NCT) and all fittings & accessories as specified/ required for completion of the scope of works as per technical specification. ii. Insulating oil for first filling plus 10 % extra to account for spillage, sampling etc. for all the Transformers. iii. Oil storage tank of suitable size. iv. Steel rails with all accessories to fix it on the transformer foundation. **has been replaced by:** **3.2 AUTO TRANSFORMERS** a. Design, engineering, manufacture, testing at manufacturer's facility, delivery to the site including all materials, accessories, spares, unloading, handling, proper storage at the site, erection, testing and commissioning of the 167 MVA, 400/√3/220/√3/33kV Single Phase Auto Transformers as specified below; i. 7 (6 + 1 Spare) of 167 MVA, 400/√3/220/√3/33 kV single phase, constant ohmic impedance type Auto Transformer with series winding for HV & IV and separate winding for LV, 50Hz, YNa0d11, oil immersed, ONAN/ ONAF/ OFAF cooled, equipped with on-load tap changer (OLTC), outdoor type, complete with all fittings and accessories including local OLTC control cabinet, cooler control cabinet and Remote Tap Changer Control panel, neutral CTs and On line Dissolved Gas , necessary arrangement for Delta formation of LV winding & Neutral Formation and Earthing Arrangement, surge protection device, Neutral Current transformer (NCT) and all fittings & accessories as specified/ required for completion of the scope of works as per technical specification. ii. Insulating oil for first filling plus 10 % extra to account for spillage, sampling etc. for all the Transformers. iii. Oil storage tank of suitable size. iv. Steel rails with all accessories to fix it on the transformer foundation.

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<tr><td></td><td></td><td>v. One (1) set of Oil filtration plant as per Annex B01-12-Oil Filtration Plant.</td></tr>
<tr><td>20.</td><td>Part 2, Section V, B12_TS, 220913_Lot1_RAT_TS, B1.2 Technical Specifications, Chapter 1: GIS Technical Specification, Section 1: 420kV GIS Technical Specification, 11. Gas Insulated Switchgear and Building General Requirements, Page 25 (Word Page 33 of 841).
&
Section 2: 220kV GIS Technical Specification, 11. Gas Insulated Switchgear and Building General Requirements, Page 24 (Word Page 142 of 841).</td><td>
11. Gas Insulated Switchgear and Building General Requirements
Gas Insulated Switchgear General Requirements Materials and Construction Features
<table>
<tr><th>Rating Parameter</th><th>400kV System</th><th>220kV System</th></tr>
<tr><td>Rated Maximum Voltage</td><td>420kV</td><td>245k V</td></tr>
<tr><td>Rated Frequency</td><td>50 Hz</td><td>50 Hz</td></tr>
<tr><td>System Earthing</td><td>Effectively Grounded</td><td>Effectively Grounded</td></tr>
<tr><td>Rated Impulse Withstand Voltage (BIL), peak</td><td>1425kV</td><td>1050kV</td></tr>
<tr><td>Rated Switching Impulse Withstand Voltage, peak</td><td>1050kV</td><td>Not applicable</td></tr>
<tr><td>Rated Peak Withstand Current</td><td>125kA</td><td>125kA or 164kA</td></tr>
<tr><td>Rated Symmetric Short-time Withstar Current (up to 1 s)</td><td>50kA</td><td>50kA or 63kA</td></tr>
<tr><td>Rated Continuo Current</td><td>4000A</td><td>3000A or 4000A</td></tr>
</table>
has been replaced by:

11. Gas Insulated Switchgear and Building General Requirements
Gas Insulated Switchgear General Requirements Materials and Construction Features
<table>
<tr><th>Rating Parameter</th><th>400kV System</th><th>220kV System</th></tr>
<tr><td>Rated Maximum Voltage</td><td>420kV</td><td>245k V</td></tr>
<tr><td>Rated Frequency</td><td>50 Hz</td><td>50 Hz</td></tr>
<tr><td>System Earthing</td><td>Effectively Grounded</td><td>Effectively Grounded</td></tr>
<tr><td>Rated Impulse Withstand Voltage (BIL), peak</td><td>1425kV</td><td>1050kV</td></tr>
<tr><td>Rated Switching Impulse Withstand Voltage, peak</td><td>1050kV</td><td>Not applicable</td></tr>
<tr><td>Rated Peak Withstand Current</td><td>125kA</td><td>125kA</td></tr>
<tr><td>Rated Symmetrical Short-time Withstand Current (up to 1 s)</td><td>50kA</td><td>50kA</td></tr>
<tr><td>Rated Continuous Current</td><td>4000A</td><td>4000A</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>SN</th><th>Pages/Paragraph</th><th>Amendments</th></tr>
<tr><td>21.</td><td>Part 2, Section V, B12_TS, 220913_Lot1_RAT_TS, B1.2 Technical Specifications, Chapter 1: GIS Technical Specification, Section 1: 420kV GIS Technical Specification, 12.9 SF6 Gas-To Air Bushing, page 50, Clause 12.9.7
&
Section 2: 220kV GIS Technical Specification, 12.9 SF6 GAS-TO AIR BUSHING, page 49, Clause 12.9.7</td><td>12.9.7 The bushing insulation levels and creepage distances shall be such that they have an impulse and power frequency withstand level that is greater than or equal to the levels specified for GIS. The creepage distance over the external surface of outdoor bushings shall not be less than 25 mm/kV and in highly polluted areas it shall not be less than 31mm/kV.

has been replaced by:

12.9.7 The bushing insulation levels and creepage distances shall be such that they have an impulse and power frequency withstand level that is greater than or equal to the levels specified for GIS. The creepage distance over the external surface of outdoor bushings shall not be less than 25 mm/kV.</td></tr>
<tr><td>22.</td><td>Part 2, Section V, B12_TS, 220913_Lot1_RAT_TS, B1.2 TECHNICAL SPECIFICATIONS, CHAPTER 1: GIS TECHNICAL SPECIFICATION, Section 1: 420kV GIS Technical Specification, APPENDIX A - Gas Insulated Switchgear (GIS), Summary of Major Components and Detailed Specifications, Gas Insulated Switchgear Detailed Specification Gas Insulated Switchgear Detailed Specification for Ratmate Substation, Description of Components, 2. High Voltage Design Parameters, j. Gas Insulated Switchgear Gas-to-Air Bushing Terminals, Word Page 111 and 112 of 841</td><td>General Description
The interface transition from the GIS to the lines and auto transformers shall be via single-pole SF_6-to-Air termination modules. The length, shed form, and creepage distance of the outdoor SF_6 bushings shall be determined by the insulation coordination, minimum clearance, and degree of pollution for the area.

<table><tr><th>DESCRIPTION</th><th></th></tr><tr><td>Rated maximum system voltage</td><td>420kV</td></tr><tr><td>Rated insulation level—BIL</td><td>1550kV</td></tr><tr><td>Rated continuous current</td><td>4000A</td></tr><tr><td>Minimum centerline phase-to-phase spacing</td><td>4200mm (minimum), unless otherwise noted on the drawings</td></tr><tr><td>Minimum creepage distance to ground</td><td>40mm/kV</td></tr></table>
has been replaced by:

The interface transition from the GIS to the lines and auto transformers shall be via single-pole SF_6-to-Air termination modules. The length, shed form, and creepage distance of the outdoor SF_6 bushings shall be determined by the insulation coordination, minimum clearance, and degree of pollution for the area.

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</table>

<table>
<tr><th>SN</th><th>Pages/Paragraph</th><th>Amendments</th></tr>
<tr><td>23.</td><td>Part 2, Section V, B12_TS, 220913_Lot1_RAT_TS, B1.2 TECHNICAL SPECIFICATIONS, CHAPTER 1: GIS TECHNICAL SPECIFICATION, Section 2: 220kV GIS Technical Specification, APPENDIX A - Gas Insulated Switchgear (GIS), Summary of Major Components and Detailed Specifications, Gas Insulated Switchgear Detailed Specification Gas Insulated Switchgear Detailed Specification for Ratmate Substation, Description of Components, 2. High Voltage Design Parameters, k. Gas Insulated Switchgear Gas-to-Air Bushing Terminals, Word Page 218 of 841</td><td>General Description
The interface transition from the GIS to the lines and auto transformers shall be via single-pole SF_6-to-Air termination modules. The length, shed form, and creepage distance of the outdoor SF_6 bushings shall be determined by the insulation coordination, minimum clearance, and degree of pollution for the area.
<table><tr><td>DESCRIPTION</td><td></td></tr><tr><td>Rated maximum system voltage</td><td>242kV</td></tr><tr><td>Rated insulation level—BIL</td><td>1050kV</td></tr><tr><td>Rated continuous current</td><td>4000A</td></tr><tr><td>Minimum centerline phase-to-phase spacing</td><td>2100mm (minimum), unless otherwise noted on the drawings</td></tr><tr><td>Minimum creepage distance to ground</td><td>40mm/kV</td></tr></table>
has been replaced by:
The interface transition from the GIS to the lines and auto transformers shall be via single-pole SF_6-to-Air termination modules. The length, shed form, and creepage distance of the outdoor SF_6 bushings shall be determined by the insulation coordination, minimum clearance, and degree of pollution for the area.
<table><tr><td>DESCRIPTION</td><td></td></tr><tr><td>Rated maximum system voltage</td><td>242kV</td></tr><tr><td>Rated insulation level—BIL</td><td>1050kV</td></tr><tr><td>Rated continuous current</td><td>4000A</td></tr><tr><td>Minimum centerline phase-to-phase spacing</td><td>2100mm (minimum), unless otherwise noted on the drawings</td></tr><tr><td>Minimum creepage distance to ground</td><td>25mm/kV</td></tr></table></td></tr>
<tr><td>24.</td><td>Part 2, Section V, B12_TS, 220913_Lot1_RAT_TS, B1.2 Technical Specifications, Chapter 4: LV Switchgear Specification, Page-1, 1.1 Constructional Details, Word Page 333 of 841</td><td>1.1 CONSTRUCTIONAL DETAILS
c. The main distribution panel shall be suitable for a 400/230 VAC 3-phase 4-wire system. The main incomer feeds and bus tie air circuit breakers shall be 4-pole type. Molded case circuit breakers for three phase feeders shall be 3-pole with neutral link.
has been replaced by:
1.1 CONSTRUCTIONAL DETAILS
c. The main distribution panel shall be suitable for a 400/230 VAC 3-phase 4-wire system. The main incomer feeds and bus tie air circuit breakers shall be 4-pole type. Molded case circuit breakers for three phase feeders shall be 4-pole type.</td></tr>
</table>

SN	Pages/Paragraph	Amendments
25.	Part 2, Section V, B12_TS, 220913_Lot1_RAT_TS, B1.2 Technical Specifications, Chapter 7: Battery and Charger Specification, 1. General, 1.1 General Technical Requirements, c. Page 1 (Word Page 440 of 841),	**1. GENERAL** **1.1. GENERAL TECHNICAL REQUIREMENTS** c. There will be different sets of 220V Battery and Battery Charger for 400kV and 220kV switchgears. **has been replaced by:** **1. GENERAL** **1.1. GENERAL TECHNICAL REQUIREMENTS** c. There will be two sets of batteries and three chargers for the 400 kV and 220 kV systems in the present scope of works. Batteries and chargers for 132 kV and 33 kV systems will be in the future scope of works. However, provision of space for the future batteries and chargers must be allowed.
26.	Part 2, Section V, B12_TS, 220913_Lot1_RAT_TS, B1.2 Technical Specifications, Chapter 18: Miscellaneous Specification, Page-7 (Word Page 826 of 841), 1.6 Parameters	**1.6 PARAMETERS** For tension application, double insulator strings for 400kV/ 220 kV and single insulator strings for 132 kV system shall be used. For suspension purpose single suspension insulator string shall be used for 220 kV & 132 kV system. **has been replaced by:** **1.6 PARAMETERS** For tension application, double insulator strings for 400kV/ 220 kV and single insulator strings for 132 kV system shall be used. For suspension purpose single suspension insulator string shall be used for 400 kV, 220 kV & 132 kV system.
27.	Part 2, Section V, B12_TS, 220913_Lot2_NBW_TS, B1.2 Technical Specifications, Chapter 1: 420kV GIS Technical Specification, 12.9 SF6 Gas-To Air Bushing, Page 48 (Word Page 55 of 732), Clause 12.9.7	12.9.7 The bushing insulation levels and creepage distances shall be such that they have an impulse and power frequency withstand level that is greater than or equal to the levels specified for GIS. The creepage distance over the external surface of outdoor bushings shall not be less than 25 mm/kV and in highly polluted areas it shall not be less than 31mm/kV. **has been replaced by:** 12.9.7 The bushing insulation levels and creepage distances shall be such that they have an impulse and power frequency withstand level that is greater than or equal to the levels specified for GIS. The creepage distance over the external surface of outdoor bushings shall not be less than 25 mm/kV.

<table>
<tr><th>SN</th><th>Pages/Paragraph</th><th>Amendments</th></tr>
<tr><td>28.</td><td>Part 2, Section V, B12_TS, 220913_Lot2_NBW_TS, B1.2 Technical Specifications, Chapter 1: 420kV GIS Technical Specification, APPENDIX A - Gas Insulated Switchgear (GIS), Summary of Major Components and Detailed Specifications, Gas Insulated Switchgear Detailed Specification Gas Insulated Switchgear Detailed Specification for New Butwal Substation, Description of Components, 2. High Voltage Design Parameters, j. Gas Insulated Switchgear Gas-to-Air Bushing Terminals, Word Page 106 of 732</td><td>General Description
The interface transition from the GIS to the lines and auto transformers shall be via single-pole SF6-to-Air termination modules. The length, shed form, and creepage distance of the outdoor SF6 bushings shall be determined by the insulation coordination, minimum clearance, and degree of pollution for the area.
<table><tr><td>DESCRIPTION</td><td></td></tr><tr><td>Rated maximum system voltage</td><td>420kV</td></tr><tr><td>Rated insulation level—BIL</td><td>1550kV</td></tr><tr><td>Rated continuous current</td><td>4000A</td></tr><tr><td>Minimum centerline phase-to-phase spacing</td><td>4200mm (minimum), unless otherwise noted on the drawings</td></tr><tr><td>Minimum creepage distance to ground</td><td>40mm/kV</td></tr></table>
has been replaced by:
The interface transition from the GIS to the lines and auto transformers shall be via single-pole SF6-to-Air termination modules. The length, shed form, and creepage distance of the outdoor SF6 bushings shall be determined by the insulation coordination, minimum clearance, and degree of pollution for the area.
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<tr><td>29.</td><td>Part 2, Section V, B12_TS, 220913_Lot2_NBW_TS, B1.2 Technical Specifications, Chapter 4: LV Switchgear Specification, Page-1, 1.1 Constructional Details, Word Page 221 of 732</td><td>1.1 CONSTRUCTIONAL DETAILS
c. The main distribution panel shall be suitable for a 400/230 VAC 3-phase 4-wire system. The main incomer feeds and bus tie air circuit breakers shall be 4-pole type. Molded case circuit breakers for three phase feeders shall be 3-pole with neutral link.
has been replaced by:
1.1 CONSTRUCTIONAL DETAILS
The main distribution panel shall be suitable for a 400/230 VAC 3-phase 4-wire system. The main incomer feeds and bus tie air circuit breakers shall be 4-pole type. Molded case circuit breakers for three phase feeders shall be 4-pole type.</td></tr>
<tr><td>30.</td><td>Part 2, Section V, B12_TS, 220913_Lot2_NBW_TS, B1.2 Technical Specifications, Chapter 18: Miscellaneous Specification, Page-6 (Word Page 699 of 732), 1.6 Parameters</td><td>1.6 PARAMETERS
For tension application, double insulator strings for 400kV/ 220 kV and single insulator strings for 132 kV system shall be used. For suspension purpose single suspension insulator string shall be used for 220 kV & 132 kV system.
has been replaced by:
1.6 PARAMETERS
For tension application, double insulator strings for 400kV/ 220 kV and single insulator strings for 132 kV system shall be used. For suspension purpose single suspension insulator string shall be used for 400 kV, 220 kV & 132 kV system.</td></tr>
</table>

SN	Pages/Paragraph	Amendments
31.	Part 2, Section V, B12_TS, 220913_Lot3_NDM_TS, B1.2 Technical Specifications, Chapter 10: Civil Works Specification, Section 1: General Civil Works Specification, Page-26 (Word Page 407 of 741), 15. River Protection Works	**15. RIVER PROTECTION WORKS** **15.1. SCOPE OF WORK** The Contractor shall conduct a hydrological study of the natural drainage systems within 500 metres upstream and at least 2 km downstream of the New Damauli substation boundaries and carry out a flood risk assessment for 200-year return period. This study finding will need to be compared against available evaluations and documentation conducted and prepared by other NEA affiliated stakeholders for the respective substation **(Refer: Annex_NDM_Chabdi_Hydrology)**. The study shall include rivers and streams that may undercut the site, as well as those that may flood the site from upslope. Seasonal and perennial watercourses must all be addressed. The Contractor shall consider the risk of change in hydrology of the natural drainage systems due to the construction of river and stream protection works, and also the mitigation measures necessary to ensure that they can be built without disturbing the riparian and aquatic environments. The designs must therefore include a detailed sequential construction plan, complete with its own detailed environmental management plan. Based on the findings of the study, the Contractor shall design suitable river protection works by taking into consideration that the substation electrical and mechanical equipment is not damaged by the possible flooding for the parts of the substation allocated to ETP infrastructure. The designs of these works must be integrated with similar parallel activities by other parties, and the works must be implemented in tandem so as to ensure full flood protection in the event of 1 in 200 years flood for the entire site before the commissioning of the ETP components. The Contractor's designs must be included in the environmental review of substation drainage protection as required in clause 15.2. The Engineer will review the study, the designs and the environmental review and may request revisions before approving the construction of the protection works. The Contractor must not commence site works until approval has been granted. This is considered a specialised study which the Contractor may consider outsourcing from an environmental consultancy, although the Contractor will be responsible for the implementation and quality of the work. **15.2. ENVIRONMENTAL REVIEW OF RIVER PROTECTION AND DRAINAGE** The Contractor shall undertake an Environmental Review of the needs and likely effects of protection measures for rivers and other watercourses, and for drainage works for the substation and its surroundings. The review must be undertaken to international standards as required by MCC's Environmental Guidelines and may need to be developed as an addendum to the project's Environmental Impact Assessment or Environmental and Social Impact Assessment. This work will be implemented by competent professional staff approved by the Engineer following submission of curricula vitae. As a minimum, they must consist of: a. A geomorphologist or physical geographer; b. A hydrologist;

SN	Pages/Paragraph	Amendments
		c. A meteorologist; and d. A biologist. All consultants must have relevant bachelor's and master's degrees and at least ten years of relevant postgraduate professional work experience. The review team will undertake the following tasks: a. Undertake an initial site visit to the substation to gather facts and scope the work. The minimum area to be covered in the review will be the substation area plus a zone extending 500 metres all round, and at least 2 km downstream. The assessment will need to evaluate catchment conditions which may necessitate extending the area beyond these limits. b. Review the Contractor's proposed designs for river and watercourse protection works, and drainage systems, both on and off the substation site. c. Present a detailed methodology for the study, explaining how it will be undertaken. If there is evidence that the proposed works will have impacts on the socio-economic environment, then a professional of the relevant discipline and of equal standing to the rest of the team must be co-opted to join the team. The methodology will be subject to the approval of the Engineer in consultation with the Environmental and Social Protection team of the Client. d. Undertake the fieldwork, making careful mapping of the land and its features, watercourses and natural drainage lines, and the proposed drainage discharge points. e. Model or review the models developed by the Contractor's civil engineering design team, to assess the likely flows in the watercourses and drainage systems. f. Undertake a detailed assessment of likely environmental impacts of the proposed river protection and drainage systems, focusing on the effects on both the physical environment and the biological environment, particularly riverine and aquatic habitat. g. Devise a schedule of mitigation measures required to safeguard the environment in the event that the potential environmental impacts occur. Propose ways in which these can be integrated into the project's overall Environmental, Social, Health and Safety Management Plan (ESHSMP), providing detailed protocols and guidelines as necessary. h. Present a report that records all of the above, for the consideration of the Engineer. If necessary, the report must be modelled to provide an addendum to the project's Environmental Impact Assessment or Environmental and Social Impact Assessment.

<table>
<tr><th>SN</th><th>Pages/Paragraph</th><th>Amendments</th></tr>
<tr><td></td><td></td><td>i. Modify and finalise the report following the review by the Engineer in consultation with the Environmental and Social Protection team of the Client.

has been replaced by:

The content stated under Attachment 1 of this Addendum.</td></tr>
<tr><td>32.</td><td>Part 2, Section V, B12_TS, 220913_Lot3_NDM_TS, B1.2 Technical Specifications, Chapter 1: 420kV GIS Technical Specification, 12.9 SF6 Gas-To Air Bushing, Page 48 (Word Page 55 of 741), Clause 12.9.7</td><td>12.9.7 The bushing insulation levels and creepage distances shall be such that they have an impulse and power frequency withstand level that is greater than or equal to the levels specified for GIS. The creepage distance over the external surface of outdoor bushings shall not be less than 25 mm/kV and in highly polluted areas it shall not be less than 31mm/kV.

has been replaced by:

12.9.7 The bushing insulation levels and creepage distances shall be such that they have an impulse and power frequency withstand level that is greater than or equal to the levels specified for GIS. The creepage distance over the external surface of outdoor bushings shall not be less than 25 mm/kV.</td></tr>
<tr><td>33.</td><td>Part 2, Section V, B12_TS, 220913_Lot3_NDM_TS, B1.2 Technical Specifications, Chapter 1: 420kV GIS Technical Specification, APPENDIX A - Gas Insulated Switchgear (GIS), Summary of Major Components and Detailed Specifications, Gas Insulated Switchgear Detailed Specification Gas Insulated Switchgear Detailed Specification for 400 kV New Damauli Substation, Description of Components, 2. High Voltage Design Parameters, j. Gas Insulated Switchgear Gas-to-Air Bushing Terminals, Word Page 108 of 741</td><td><u>General Description</u>
The interface transition from the GIS to the lines and auto transformers shall be via single-pole SF_6-to-Air termination modules. The length, shed form, and creepage distance of the outdoor SF_6 bushings shall be determined by the insulation coordination, minimum clearance, and degree of pollution for the area.

<table>
<tr><td>DESCRIPTION</td><td></td></tr>
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<tr><td>Rated continuous current</td><td>4000A</td></tr>
<tr><td>Minimum centerline phase-to-phase spacing</td><td>4200mm (minimum), unless otherwise noted on the drawings</td></tr>
<tr><td>Minimum creepage distance to ground</td><td>40mm/kV</td></tr>
</table>

has been replaced by:

The interface transition from the GIS to the lines and auto transformers shall be via single-pole SF_6-to-Air termination modules. The length, shed form, and creepage distance of the outdoor SF_6 bushings shall be determined by the insulation coordination, minimum clearance, and degree of pollution for the area.

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<tr><td>DESCRIPTION</td><td></td></tr>
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<tr><td>Minimum centerline phase-to-phase spacing</td><td>4200mm (minimum), unless otherwise noted on the drawings</td></tr>
<tr><td>Minimum creepage distance to ground</td><td>25mm/kV</td></tr>
</table>
</td></tr>
<tr><td>34.</td><td>Part 2, Section V, B12_TS, 220913_Lot3_NDM_TS, B1.2 Technical Specifications, Chapter 4: LV Switchgear</td><td>1.1 CONSTRUCTIONAL DETAILS
c. The main distribution panel shall be suitable for a 400/230 VAC 3-phase 4-wire system. The main incomer feeds and bus tie air circuit breakers shall be 4-pole type. Molded case circuit breakers for three phase feeders shall be 3-pole with neutral link.</td></tr>
</table>

SN	Pages/Paragraph	Amendments
	Specification, Page-1, 1.1 Constructional Details, Word Page 222 of 741	**has been replaced by:** **1.1 CONSTRUCTIONAL DETAILS** c. The main distribution panel shall be suitable for a 400/230 VAC 3-phase 4-wire system. The main incomer feeds and bus tie air circuit breakers shall be 4-pole type. Molded case circuit breakers for three phase feeders shall be 4-pole type.
35.	Part 2, Section V, B12_TS, 220913_Lot3_NDM_TS, B1.2 Technical Specifications, Chapter-7, 220kV XLPE CABLE SPECIFICATION, 2. Materials and Construction Features, 2.1 Cable Construction, e. Cable, vi. Cable Sheath, Page 4 (Word Page 333 of 741), c.	**2. MATERIALS AND CONSTRUCTION FEATURES** **2.1.CABLE CONSTRUCTION** **e) Cable** **vi) Cable Sheath** c. The sheath shall have a fault capacity of at least 63 kA amperes for 15 cycles (on a 50 hertz basis) with a starting conductor temperature of 90C and an ending conductor temperature not to exceed 250C. **has been replaced by:** **2. MATERIALS AND CONSTRUCTION FEATURES** **2.1.CABLE CONSTRUCTION** **e) Cable** **vi) Cable Sheath** c. The sheath shall have a fault capacity of at least 50kA amperes for 15 cycles (on a 50 hertz basis) with a starting conductor temperature of 90^0C and an ending conductor temperature not to exceed 250^0C.
36.	Part 2, Section V, B12_TS, 220913_Lot3_NDM_TS, B1.2 Technical Specifications, Chapter 19: Miscellaneous Specification, Page-6 (Word Page 728 of 741), 1.6 Parameters	**1.6 PARAMETERS** For tension application, double insulator strings for 400kV/ 220 kV and single insulator strings for 132 kV system shall be used. For suspension purpose single suspension insulator string shall be used for 220 KV & 132 kV system. **has been replaced by:** **1.6 PARAMETERS** For tension application, double insulator strings for 400kV/ 220 kV and single insulator strings for 132 kV system shall be used. For suspension purpose single suspension insulator string shall be used for 400 kV, 220 KV & 132 kV system.

Attachment 1:

15 RIVER PROTECTION WORKS

15.1 Scope of Works for Hydrological, Environmental and Social Assessment of New Damauli Substation Area

The New Damauli Substation and the working area lie in Vyas Municipality of Tanahu district. The location of the substation is shown in the topographical map and Google Imagery that follow (Figure 15-1 and Figure 15-2).

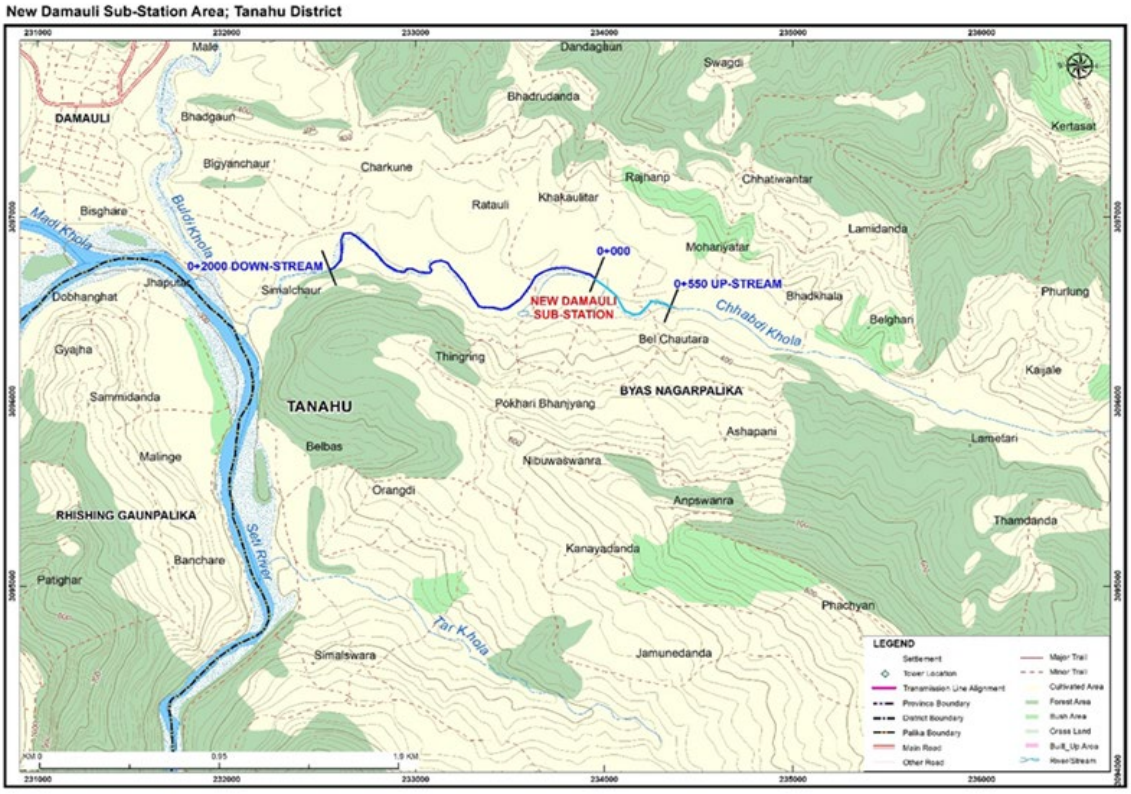

Figure 15-1: Topographical Map showing Substation location

NEA has already conducted hydrological studies of Chhabdi River **(Refer: Annex_NDM_Chabdi_Hydrology).** The contractor shall conduct a hydrological study of the natural drainage systems extending a minimum of 550 meters upstream (or further until post-construction flood impacts are negligible) and at least 2 km downstream (i.e. to the confluence with the Seti River) of the boundaries of the New Damauli substation, and carry out a flood risk assessment for a projected 200-year return period of the Chhabdi River near New Damauli Substation. This shall include rivers and streams that may undercut the site, as well as those that may flood the site from upslope. Seasonal and perennial watercourses must be addressed. The contractor shall consider the risk of change in the hydrology of the natural drainage systems due to the construction of river and stream protection works, and also the mitigation measures necessary to ensure that they can be built without disturbing the riparian and aquatic environments.

The designs must therefore include a detailed sequential construction plan, complete with its own detailed environmental management plan.

Figure 15-2: Google Image of Substation location

Based on the findings of the study, the contractor needs to design appropriate river and stream protection works that will be required to protect (a) the ETP infrastructures and substation from flooding during the monsoon or any other time, and (b) other areas where works are needed to protect nearby land against changes caused by the substation protection works. The designs of these works must be integrated with similar parallel activities by other parties, and the works must be implemented in tandem so as to ensure full flood protection for the entire site before the commissioning of the ETP components and its substation. The design of protection works should follow the environmental guidelines and environmental review that will be further reviewed by MCA-Nepal and MCC. The contractor shall be responsible to incorporate all the comments made by MCA-Nepal and MCC before the final design of the protection works.

The scope of works for Hydrological, Environmental and Social Assessment of New Damauli Substation Area are:

- Hydrological Study of the Chhabdi River near New Damauli Substation
- Environmental/ Social Assessment of Chhabdi River near New Damauli Substation Area

The contractor shall conduct following tasks :

15.1.1 Activity 1: Hydrological Study of the Chhabdi River near New Damauli Substation

15.1.1.1 Task 1: Topographical Survey and Mapping

Topographical survey and mapping of the river corridor including its tributaries from a minimum of 550 m upstream of the upper boundary of the New Damauli Substation to 2 km downstream of the lower boundary of the substation at a 1:1000 scale with 1 m counter interval, along with river cross-sections at 25 m distance or wherever the river sections changes. Survey and cross-sections need to cover the ground level 5 m higher than the flood level at the time of 1:200 years flood. (about 45 hectares of land and 130 river cross sections).

15.1.1.2 Task 2: Hydrological Studies

❖ **Sub Task 2.1**

Conduct a geomorphological study of the entire Chhabdi catchment upstream of the substation site. This must identify areas prone to land sliding and erosion, and with the potential to supply debris and sediment that can become entrained in the river. Mapping of the catchment should be undertaken that shows active, meta-stable and stable areas of land. Broad estimates should be made of potential sediment volumes that might be fed into the river on an annual basis. These should be used to estimate the extent to which the river channel might braid (i.e. shift up, down and sideways), (a) during "normal" monsoon conditions and (b) during exceptional floods of intervals such as 1:10, 1:50, 1:100 and 1:200 years.

❖ **Sub Task 2.2**

Review the locations of official and verified weather recording stations in the area around the Chhabdi catchment and obtain the longest sequence possible of rainfall data that is most appropriate to the catchment, taking account of the topographic variations in the area. Compare data from nearby rain gauges to determine whether it is appropriate to add a multiplication factor to the extreme events recorded in the selected data set, in order to improve the representation of rainfall in the Chhabdi headwaters.

❖ **Sub Task 2.3**

River discharge measurement of Chhabdi River in the vicinity of the Substation area using the current meter for three different days. If at all possible, these must include measurements taken during the monsoon. Data on rainfall in recent days and weeks at the nearest available rain gauge station must also be obtained. If it is not possible to take monsoon season flow measurements during the study period, then the maximum flow in the previous monsoon should be calculated from a series of at least ten surveyed cross-sections of the highest flood levels in that season, as determined from evidence along the river banks.

❖ **Sub Task 2.4**

Conduct stream flow analysis of the Chhabdi River in the vicinity of the Substation area using a Regional Analysis approach and/or a better methodology suitable for the Chhabdi River.

❖ **Sub Task 2.5**

Carry out Flood frequency analysis up to 1:500 years return period flood of Chhabdi River and its sub-basins using Regional Flood Frequency Analysis or Empirical Method and Catchment Correlation Method (Hydrologically similar catchment and Seti Gandaki catchment), Compare the different results and select the suitable method for New Damauli substation.

15.1.1.3 Task 3: River Flow Analysis

Prepare detailed data for HEC-RAS_2D model (Including but not limited to, Flood data, Manning's Roughness data, Bank Station data, etc.). Prepare a detailed model in HEC-RAS_2D. Perform simulations under three conditions for the projected 1:200 return period flood.

a. Without river training structure but with permanent structure that are already built on the river course and flood plain.
b. With a river training structure on the left bank of the river along the side of the substation and with a permanent structure that is already built on the river course and flood plain.
c. With the structures in (b), plus with further structures necessary along either bank to mitigate increased erosion and flooding due to the substation river protection works.

Perform simulations and prepare the reports of the results.

15.1.1.4 Task 4: Erosion Study

❖ **Sub Task 4.1: Field Data Collection**

Field data collection and laboratory tests for the 2D Sediment transport model in HEC-RAS-2D. A geotechnical team needs to carry out the in-situ sampling of bed load material during the topographical survey period. The number of samples collected from the river bed along the entire stretch of the river (about 3.2 km) should be good enough to run the HEC-RAS-2D model for the sediment transport study and should be at least one sample from each 20 m river stretch. All samples collected need to have georeferencing with coordinates and to be shown in the topographical map prepared. Collected samples from the site need to be analyzed at the laboratory to determine the sediment characteristics required for the sediment transport model test.

Field survey and mapping of bank conditions along the entire stretch of the river (about 3.2 km). This is to verify the erosivity of the river banks in relation to the findings of the erosion modelling in Sub Task 4.2 and the river protection in Task 5. The mapping must distinguish the different soil and material types within the normal monsoon river channel banks and up to the height of the projected 1:200 year flood, and their liability to erosion.

With the environmental specialist, identify the potential sources of filling materials to be used for levelling substation lands.

❖ **Sub Task 4.2: Erosion Study**

Undertake a study of actual and potential erosion along both banks of the above-mentioned river stretch by using 2D Sediment transport model in HEC-RAS-2D for the 1:200 flood, with and without river training structures along the left bank of the river at the substation boundary.

15.1.1.5 Task 5: Design of River Protection works

Design of river protection work for erosion control in the affected area. The contractor shall design suitable river protection works for the parts of the substation allocated to ETP infrastructure, and for other parts of the river that might be adversely affected by the construction of its substation and associated works. The designs will take into account the results of the geomorphological, sediment and hydrological studies. The designs of these works must be integrated with similar parallel activities by other parties, and the works must be implemented in tandem so as to ensure full flood protection for the entire site before the commissioning of the ETP components. In addition, the contractor will propose and design river and watercourse protection works, and drainage systems, both on and off the substation site including the right bank. Off the substation site, the river protection works must be designed not necessarily to stop existing flooding and erosion, but to mitigate additional flooding and erosion that results from the construction of the substation and its associated protection works.

The contractor's designs must be included in the environmental review of substation drainage protection as required which is mentioned in the scope of the environmental review of river protection and drainage (Activity 2).

15.1.2 Activity 2: Environmental and Social Assessment

The environmental team of the contractor shall undertake assessments of environmental and social impacts of potential flooding, river protection works, and other construction activities within sub-station and surrounding areas. This assessment shall include the following tasks:

Review earlier environmental and social impact assessment reports including MCA-Nepal ETP EIA report, and IEE and RAP reports prepared by the NEA;

- Undertake an initial site visit to the substation to gather facts and scope the work. The minimum area to be covered in the review will be the substation area plus a zone extending at least 500 meters all round, and 2 km downstream (i.e. to the confluence with the Seti River). The 6assessment will need to evaluate catchment conditions, which may necessitate extending the area beyond these limits.
- Present a detailed methodology for the study, explaining how it will be undertaken; the methodology will be subject to the approval of the Engineer in consultation with the Environmental and Social Performance team of the Client;
- Review the models developed by the geomorphologist, geotechnical engineer and hydrologist, to assess the likely flows in the watercourses and drainage systems;
- Review the proposed designs for river and watercourse protection works, and drainage systems, both on and off the substation site and on both sides of the river;
- Undertake the fieldwork, making careful mapping of the land and its features, watercourses and natural drainage lines, and the proposed drainage discharge points and structures
- Undertake a detailed assessment of the likely environmental impacts of the proposed substation platform and river protection and drainage systems, focusing on the effects on the physical, biological and social environments; Work closely with the geomorphologist and hydrologist to assess the potential of flooding on the substation structures, using the findings generated under Activity 1;
- Using the work of Activity 1, assess the materials, slopes, erosion and landslide tendency of the lands in the right bank of the Chabdi river, and in the left bank upstream and downstream of the substation site, in relation to the geomorphological, flood and erosion studies.;
- Assess the environmental and social impacts of potential flooding and erosion arising from natural events along both banks of the Chabdi river, and from natural events altered by the construction of the substation and its associated protection works;
- Assess the impacts of substation construction and operation activities on the pollution of Chabdi river water;
- Study the riverine and aquatic biology of the Chabdi river near the substation and assess the likely impacts of water pollution on these;
- Undertake repeated field visits to the site to undertake the investigations and verify the findings.
- Conduct key informant interviews with appropriate members of the local communities about the extent of "normal" and severe flooding on the area around the substation site and the impacts on land and livelihoods, including any social distinctions;
- With the geotechnical engineer, identify the potential sources of filling materials to be used for levelling substation lands and assess the environmental and social impacts of each source, including haulage and rehabilitation;
- Devise a schedule of mitigation measures required to safeguard the environment in the event that potential environmental impacts occur, in line with the provisions in the project's EIA and its overall Environmental, Social, Health and Safety Management Plan (ESHSMP), providing detailed protocols and guidelines as necessary.
- Present a report that records all of the above, for the consideration of the Engineer and the Client; if necessary, the report must be modelled to provide an addendum to the project's Environmental and Social Impact Assessment;
- Prepare a substation-specific Environmental and Social Management Plan (ESMP) to mitigate all identified environmental and social risks and impacts, in line with the ETP's overall Environmental, Social, Health and Safety Management Plan.

- Modify and finalise the report and the ESMP following the review by the Engineer in consultation with the Environmental and Social Protection team of the Client

15.1.3 Study Team and Level of Effort

The study team shall comprise the following (note that some roles may be combined by suitably qualified individuals) experts with tentative level of efforts of each individual. These experts need to have abundant experiences to conduct the job as mentioned in the Scope of Works.

i.	Sr. Hydrologist	4.0 PM
ii.	Sr. Geomorphologist	1.5 PM
iii.	Sr. Geotechnical Engineer	1.0 PM
iv.	Sr. Civil Design Engineer	1.0 PM
v.	Sr. Structural Engineer	0.5 PM
vi.	Sr. Environmental Expert	3.0 PM
vii.	Biologist	1.0 PM
viii.	Sr. Social Expert	3.0 PM

15.1.4 Deliverables and Duration of Assignment

The contractor needs to prepare the following reports:

a. Hydrological Report. This report consist of all activitie that comes under Activity 1.
b. Environmental and Social Assessment Report. This report consist of all activities that comes under Activity 2 including site-specific Environmental and Social Management Plan.

The total duration of this assignment is six months. The contractor is request to complete all the activities within six months from commencement date. The contractor shall be responsible to incorporate all the comments made by MCA-Nepal, ENGINEER and MCC before the final design of the protection works.

Annex B01-12-Oil Filtration Plant

Annex B01-12-Oil Filtration Plant_Clea

Technical specifications for "*Transformer Oil Filtration Plant*"

1.1 Performance Requirement

1.1.1 The Ultra High Vacuum type oil treatment plant of capacity of 6000 liters per hour shall be mobile and shall be suitable for treatment of new oil and reconditioning of used oil in EHV class transformer, shunt reactor and other oil-filled equipment in order to achieve properties of treated oil within specified limits at the rated capacity.

1.1.2 The plant shall be capable of treatment of new oil (as per IEC 296/IS:335) and reconditioning of used oil (as per IS:1865/IEC:422 for oil in-service) at rated capacity on single pass basis as follows:

(i) Removal of moisture from 100 ppm to 3 ppm (max.)

(ii) Removal of dissolved gas content from 10% by Vol. to 0.1% by vol.

(iii) Improvement of dielectric strength break down voltage from 20 kV to 70 kV (min).

(iv) Vacuum level of degassing chamber at rated flow and at final stage: - not more than 0.15 torr (0.2 m bar) max.

(v) (Degassing chambers of different degree of vacuum should have sufficient surface areas to achieve the final parameters. A detailed justification as to how end parameters shall be met with detailed calculations and test reports in support of the same shall be submitted along with the offer.

(vi) Filtering capacity: Maximum particle size less than 0.5 micron in the filtered oil.

(vii) Processing temperature: - 40º C to 60ºC

(viii) Maximum allowed temperature in oil to prevent oxidation (when oil is at atmospheric pressure): - 60ºC

1.1.3 Bidder is to furnish along with the bid detailed calculation to establish the sizing and capability of the vacuum pumping system with respect to moisture and gas removal as above.

1.1.4 Bidder is to submit along with the bid test reports, test methodology to prove the capability of the plant offered.

1.1.5 The plant shall also have two independent vacuum pumping systems one for evacuating the transformer for vacuum filling of oil in transformer and the other for degassing chamber. The blank off vacuum of each pumping system shall be 10^{-3} torr or less.

1.1.6 The plant shall be provided with control and indication panel with full automation.

1.1.7 The plant shall be fitted with hoses for connection of oil lines and vacuum lines to transformers and reactors. Hoses shall have leakage rate of 10^{-2} torr-ltr/sec. (max.)

1.1.8 The Ultra High Vacuum Type oil purification plant shall be complete with oil pumps for drawing oil from transformers and reactors, oil heater (max. heating rate = 2.0W/cm²) of adequate rating, suitable filter or centrifuge as required to ensure oil quality, degasifier complete with vacuum pumps, oil extraction pump etc. of adequate capacity such that throughput from the purification plant is of guaranteed purity.

1.1.9 The plant shall also be suitable for cleaning and degassing of the oil stored in the storage tanks.

1.1.10 All equipments required as above shall be mounted on a tow-able road worthy trailer unit with 4 nos. pneumatic tyres. The equipment shall be suitable for outdoor use.

1.2 Design & Construction

The features and construction details of each 6000 liters per hour capacity mobile outdoor type oil filtration & purification plant shall be in accordance with the requirements stated hereunder.

1.2.1 Oil Pump (Inlet Side)

Two (2) nos. electrically driven oil pumps with one (1) working and one (1) standby shall be provided. Selection switch is to be provided for selection of either of pumps. The pumps shall be single stage positive displacement gear type. Suitable mechanical seals shall be provided to ensure vacuum tightness. A built-in pressure relief valve to re-circulate the oil to suction side in case of accidental pressure rise shall be provided. Suction lift of the pump shall be at least 5 meters of transformer oil at atmospheric pressure & temperature. A separate by pass valve is provided across the gear pump so that the flow rate through the filter can be adjusted as required. The pump should be controlled by **variable frequency drive**. This should help to set the flow rate of filter plant from 4000 – 6000 LPH.

1.2.1.1 The pumps shall be provided with an interlock with delay such that if there is no oil flow for a period of 30 sec. through the heater, the pump shall trip automatically. Further, heater shall not be energized unless pump is already operating.

1.2.2 Magnetic Strainer

The plant shall be provided with suitable magnetic strainer with wire mesh to filter all particles of sizes above 0.5 mm and all magnetic particles. The strainer shall be installed at the suction of the oil pump described above.

1.2.3 Heater

a. An oil heater for heating up inlet oil shall be provided at the discharge side of the oil pump.

b. The oil heater vessel shall be of mild steel welded construction & insulated with glass/mineral wool.

c. The vessel shall be constructed for ultra high vacuum & pressure application.

d. Electric heater shall be provided inside the heater vessel to heat up oil from lowest ambient temperature to temperature required for filtration/degasification operation in single pass. The heater shall also be rated for heating the inlet oil from lowest ambient temperature at 70°C in single pass during filling up of transformers. Two separate temperature settings with thermostatic controllers shall be provided for this purpose.

e. The heating shall be indirect type and specific heat load shall not exceed 2.0 watt/cm² in order to avoid local overheating.

f. The total heating capacity shall be divided into three independent thermostatically controlled heating stages evenly balancing the three phases of power supply. The control switches and knobs shall be housed on a control panel.

g. An additional preset temper proof safety thermostat set at the highest temperature shall be provided on the heater to put off the heater and give audio and visual alarm to take care of accidental overheating.

h. The heater body shall be so designed as to allow replacement of heating elements without draining of oil. Suitable pressure relief valve, vent and drain valves & two (2) dial type temperature gauges at inlet & outlet of heater shall be provided.

1.2.4 Filter

a. Cartridge filter as may be required to ensure maximum particle size to less than 0.5 micron in the filtered oil shall be provided.

b. The filter body shall be fabricated of mild steel & designed for tightness against leakages at full vacuum & high pressures. The oil will flow from dirty oil chamber to clean oil chamber through filter elements.

c. Cartridge type element used shall be suitable for transformer oil in service and submicronic filtration, the media shall be non-hygroscopic and of high dirt holding capacity.

d. The filter elements shall be easily removable for replacement when required. Compound gauge to indicate pressure across the filter, vent and drain with valves & other necessary accessories shall be mounted on the filter for each operation.

1.2.5 External Solenoid Operated valves

Two valves should be provided at the inlet and outlet of the plant. The moment inlet and outlet pumps are switched on these valves open thus making way for oil to pass. In case of power failure, oil from the transformer will not enter the plant and vacuum system.

1.2.6 Degassing Chamber

a. The degassing chamber shall be of welded construction and shall be suitable for operation under full vacuum. The fill of raschig rings & trays for distribution shall be designed for efficient distribution of oil over large areas. Incoming transformer oil

should be spread over these rings in the form of film and over a longer surface area, thus achieving better degassing and dehumidification.

b. The degassing chamber shall be multistage (minimum 02 stages) type suitable for ensuring the desired oil properties. Arrangement for condensing back lighter fraction (aromatics) of the insulating oil into the system shall be provided.

c. The degassing channels shall have adequate height to allow long enough free fall for complete degassing. Design shall be such as to minimize foam formation.

d. The degassing chambers shall be provided with suitable level monitor for oil or foam level in the chamber and shall trip the inlet gear pump when the level rises above the designed maximum level in order to prevent foam/oil to enter the vacuum pumping system. The oil inlet pump starts again automatically once the oil level in the degassing chamber falls below the preset oil level.

e. Necessary illuminated sight glass shall be provided through which oil flow through the degasser can be viewed clearly.

f. The degasser shall be provided with vacuum gauges, vacuum breaking valves, main and auxiliary vacuum connections and other necessary accessories.

1.2.7 Vacuum Pumping System

a. The pump shall be provided with a suitable vacuum pumping system for creating adequate high vacuum in the degassing chambers. The pumping system shall consist of suitable combination of Roots Blowers and Rotary vane vacuum pumps with inter-stage condensing units.

b. The roots blowers shall be of reputed make. Suitable built in labyrinth packing system, slinger rings, oil return chambers shall be provided between bearings and working chambers to prevent penetration of lubricating oil to the working chamber. The pumps motor shall be dynamically balanced. The pumps shall be suitable for starting evacuation from atmospheric pressure and shall be applied with necessary overflow valve.

c. The rotary vane vacuum pumps shall be installed after the roots blower. An automatic by pass valve across the roots blower shall permit operation of rotary vane pump alone to operate when so required. The rotary vane pumps are provided with gas ballast valve to prevent contamination of vacuum pump oil with moisture. The vacuum pump shall also be provided with suitable non-return valve device such that in the event of power failure the vacuum in the degassing chamber shall be maintained and the vacuum pump oil is not sucked back into the degassing chamber. A high vacuum safety valve (piston type) to prevent back streaming of oil and air intrusion shall be provided. The pump motors shall be having return stop device.

d. Necessary water-cooled condensing units to condense the light faction (aromatics) and return the same to the transformer oil shall be provided to reduce the loss of

aromatics. Condensing units shall also be suitable for operation with broken ice for remote location operation where cooling water connection is not available.

1.2.8 Vacuum Pumping system for Transformer Evacuation

An independent vacuum pumping system shall be provided for evacuating the transformer for oil filling. The vacuum level required for transformer evacuation for oil transfer is about 0.76 torr (1 m bar) for transformer oil heated to 70-80°C. The pumping system shall be identical to that of the degassing vacuum system. **The capacity shall be adequate for evacuation of:**

a. 60kL Tank in one hour from 1 atm to 1mbar.

The vacuum systems for degasser and transformer evacuation shall be interconnected in such a way that it shall be possible to use either or both the systems for any of the purpose. A reinforced hose of 10 meter length should be provided. The hoses must be suitable for vacuum leakage rate of 10^2 torr-litre/sec.

1.2.9 Oil Extraction Pump

Suitable pumping system shall be provided for extracting oil from degasser under vacuum and supplying to transformer/reactor etc., at discharge pressure of 1.5 kg/cm² at the outlet hose nozzle of the plant, the pump shall be either glandless centrifugal type with canned motors or a combination of gear pump and centrifugal pump with mechanical seals suitable for extracting oil from high vacuum degassing chamber. The oil extraction pump shall be located at a suitable level below the degasser chamber to ensure adequate suction head for the pump. The pump shall be supplied with double check valve assembly and solenoid operated non-return valve. In order to stop reverse flow of oil in case of power failure, the pumping system shall preferably be self-priming type alternatively priming device with safety interlock to protect pump against dry running shall be provided. Sampling valves shall be provided at the discharge of extraction pump for testing of oil properties. A recirculation line with valves shall be provided to re-circulate a part of the purified oil to the inlet point if necessary during operation. The pump should be controlled by **variable frequency drive**. This should help to set the flow rate of filter pant from 4000 – 6000 LPH.

1.2.10 Hoses for Transformer Oil, Vacuum, Air and Water

a. Separate reinforced rubber hoses shall be provided for each operation for oil suction, oil discharge, transformer vacuum connection and cooling water supply and return. The hoses shall be at least 15 meter long each and shall be complete with hose quick connect couplers for connection to installations under operation.

b. Hose pipes for oil service shall be suitable for transformer oil application upto temperature of 100° C, full vacuum and pressure upto 2.5 kg/cm². All oil hoses shall be built up around an earthed core or have built in earthed conductor to avoid static

electricity accumulation. Inlet and outlet nozzles of purification plant and corresponding hoses shall be of 50 NB/40 NB size respectively in order to avoid error in connecting.

c. Vacuum hoses shall be of braided nitrile rubber suitable for full vacuum without collapsing and kinking. Suitable provision/ mechanism should be provided to monitor oil flow in the vacuuming system. Further, in case of accidental oil flow in the vacuum hose, the vacuum process should be stopped automatically.

1.2.11 Oil sampling valve: Suitable valve shall be provided for taking sample during filtration.

1.2.12 Material of construction and painting

a. Oil heater, filter vessel, degasser shall be of mild steel construction. The internal and external surfaces including oil heater, filter vessel, degassifier and structural steel work to be painted shall be shot or sand blasted to remove all rust and scale of foreign adhering matter or grease. All steel surface in contact with insulating oil shall be painted with two coats of heat resistant oil insoluble, insulating varnish.

b. All internal paints steel surfaces shall be given a primary coat of zinc chromate, second coat of oil and weather resistant varnish of a color distinct from primary and final two coats of glossy oil and weather resisting paint.

c. All paints shall be carefully selected to withstand heat and extremes of weather. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling.

d. Bolts & Nuts: All bolts and nuts exposed to weather shall be hot dip galvanized/cadmium plated and passivated /zinc plated and passivated.

e. Material of construction for vacuum pumps air compressor, air-drying plant, air receiver shall be steel of suitable grade.

f. All piping and equipment carrying transformer oil shall be insulated with glass wool/mineral wool insulation.

1.3 Instrumentation and Control

1.3.1 Following minimum instruments shall be provided on the oil purification plant:

a. Compound gauge at oil pump discharge

b. Compound gauge at filter inlet.

c. Compound Gauge at filter outlet

d. Pressure Gauge at discharge pump outlet

e. Pressure Gauge at degasifier

f. Vacuum Gauge at transformer evacuation line

g. Vacuum Gauge in between roots, vacuum pump and rotary vane vacuum pump.

h. Panel mounted vacuum indicators at degasser

i. Panel mounted vacuum indicators at transformer evacuating line.

j. Separate fine vacuum gauge for measurement of vacuum for transformer evacuation system and oil line degassing chamber evacuation system should be provided. This vacuum gauge should be electronic type having range from 0.01 torr to 20 torr and should be of any of these reputed manufacturers' (Wika/ Hasting/ Edwards) make.

k. Oil Filtration Machine should be fitted with on-line moisture in oil-PPM indicator.

l. Sight glass at degassifier

m. Temperature indicator cum controller at heater inlet

n. Temperature indicator cum controller at heater outlet

o. Oil flow meter (Positive displacement type)

p. Voltmeter

q. Ammeter

1.3.2 Control Panel:

A centralized electrical panel with auxiliary step-down transformer, contractors, back up protection fuses, indicating lamps etc. to be provided with following minimum audio and visual alarms:

a. High temperature at heater outlet

b. High differential pressure across filters

c. Oil pump trip

d. Vacuum pump trip

e. Loss of vacuum in degassing chamber

f. Loss of vacuum in transformer evacuation line

g. No oil flow through heater

h. High oil level in degasser.

All controls and annunciation equipment should be suitable for 240 V AC.

1.3.3 There shall be independent vacuum pump for creating and holding the transformer/ reactor winding under vacuum for vacuum drying and filling of winding when required. The

vacuum pump shall have capacity to develop and maintain adequate vacuum in the oil space of the 60kL tank within 1 hour time.

1.4 Electrical System:

1.4.1 The plant shall receive 400V, 50 Hz, 3-phase 4-wire power supply through flexible cable in the distribution panel located on the plant. The incomer of the distribution panel shall be switch fuse unit.

1.4.2 One length of 50 meters of core 1100V grade flexible cable with crimped lugs at one end shall be provided for connection of the unit to the mains. The length of the cable will be covered in a suitable cable drum.

1.4.3 Provision for earthing the plant at the operating locations with earthing terminals for safety shall be provided.

1.4.4 The plant shall be suitably illuminated and ventilated for comfort of operator.

1.5 Guarantee: Min 01 year from the date of successful & complete commissioning at MCA-Nepal sub-station. All the materials, including accessories, cables, components etc. are to be covered under warranty/guaranty period. If any component of the plant needs to be shifted to supplier's works for repairs within warranty/guaranty period, suppliers will have to bear the cost of spares, transportation of component/plant for repair at works.

1.6 Commissioning, handing over the Instrument: Successful bidder will have to commission the plant to the satisfaction of MCA-Nepal. The equipment failed during the demo shall be rejected and no repairs are allowed.

1.7 Training: Supplier shall have to ensure that the plant is made user friendly. Apart from the detailed demonstration at site, the supplier shall also have to arrange necessary training to MCA-Nepal engineers.

1.8 After Sales Services: Bidder will have to submit the documentary evidence of having established mechanism for **"after sales services'.**

Annex B01-13-kmz files of Substation (attached with email)

Substations.kmz