Schedule - B

(See Clause 2.1)

Construction for Mitigation Measures of Slope Protection work & Sinking Zones

1. Construction for Mitigation *Measures*

Survey, Identification of extent of instability, investigations, detailed designing and execution/ construction of mitigation measures as per approved design and standards (duly certified/vetted by the design director, Proof Consultant and vetted by any THDC (Tehri Hydro Development Corporation Limited) or one of the IITs as stipulated under Article-10 and schedule-I) to be followed during constrution and its stage and its maintenance for 10 years from the date of successful completion of the project / works with complete adherence of safety standards. Preference should be given to the hydroseeding and bioengineering in the design, wherever required, as per the ground requirement and relevant IRC codal provisions must be followed.

2. Specifications and Standards

The Execution / Construction of Mitigation Measures shall be surveyed, investigated /explored, designed and constructed in conformity with the Specifications and Standards specified in Annex-I of Schedule-D.

Annex – I

(Schedule-B)

Description

(i) Construction for mitigation measures of 04 no. Land Slide Zones, 04 no. Sinking Zones, and 1 no. Landslide cum Sinking Zone along NH-07 in the State of Uttarakhand.

1. Construction for Mitigation Measures

(i) The Project Highway refers to Construction for mitigation measures of 04 Land Slide Zones, 04 Sinking Zones, and 1 Landslide cum Sinking Zone along NH-07 in the State of Uttarakhand.

(ii) Design and development of mitigation measures shall be done in accordance with the relevant codes/manual/specification of Indian Standards Institution (ISI), IRC & its special publication, MoRTH circulars and guidelines. Wherever the Indian standards are not clear and sufficient for sound and safe design, other relevant codes of US / UK / European countries shall be used for design & development of mitigation measures and works shall be carried out as per the designs and drawing approved by the Authority. General Arrangement of mitigation measures has been shown in the drawings folder.

2. General Scope and Features

The area is very prone to landslides and sinking. The Contractor has to carryout Survey, Identify the extent of instability, investigations, detailed designing (duly certified by the design director, Proof Consultant and vetted by THDC (Tehri Hydro Development Corporation Limited) or one of the IITs as stipulated under Article-10 and Schedule-I) and execution/ construction of mitigation measures as per approved design and standards to be followed during construction stage and its maintenance for 10 years from the date of successful completion of the project / works with complete adherence of safety standards. The investigations comprise of geological, geo-physical and geotechnical exploration works required for stability analysis and design of mitigation measures. The locations of the landslide zones and the sinking zones are as under. All the works are to be carryout as per approved design and drawings of mitigation measures and as per technical specifications.

Details of protection work is as under

S.No.	Chainage Start	Chainage End	Length (m)	Height of Hill Side Protection	Height of Valley Side Protection	Reference of Drawing
A	**Land Slide Zone**					
1	Km. 434+320	Km. 434+400	80	130	22	VKSIMPL/P-134/NHIDCL/PL/LSZ-11&12/02
2	Km. 434+400	Km. 434+500	100			
3	Km. 437+790	Km. 437+870	80	39	NA	VKSIMPL/P-134/NHIDCL/PL/LSZ-13/02
4	Km. 447+360	Km. 447+500	140	75	NA	VKSIMPL/P-134/NHIDCL/PL/LSZ-15/02
B	**Sinking Zone**					
1	Km. 439+200	Km. 439+560	360	62	32	VKSIMPL/P-134/NHIDCL/PL/SZ-02
2	Km. 439+920	Km. 440+180	260	19	39	VKSIMPL/P-134/NHIDCL/PL/SZ-03

3	Km. 440+280	Km. 440+360	80	32	27	VKSIMPL/P-134/NHIDCL/PL/SZ-04
4	Km. 445+060	Km. 445+130	70	28	35	VKSIMPL/P-134/NHIDCL/PL/SZ-05
C	**Land Slide cum Sinking Zone**					
1	Km. 445+680	Km. 446+090	410	125	79	VKSIMPL/P-134/NHIDCL/PL/LSZ-14/03-05

The details provided in table are indicative in nature

2.1 Improvement of the existing road geometrics

Sl. No.	Stretch (from km to km)	Type of deficiency	Remarks
NA			

2.2 Right of Way

Details of the Right of Way are given in Annex II of Schedule-A.

2.3 Type of shoulders

Sl. No.	Stretch (from km to km)	Fully paved shoulders/ footpaths	Reference to cross section
NA			

2.4 Applicable cross section for slope protection work

S.No.	Chainage Start	Chainage End	Length(m)	Height of Hill Side Protection	Height of Valley Side Protection	TCS
A	**Land Slide Zone**					
1	Km. 434+320	Km. 434+400	80	130	22	TCS LS-1&2A
2	Km. 434+400	Km. 434+500	100			
3	Km. 437+790	Km. 437+870	80	39	NA	TCS LS-3C
4	Km. 447+360	Km. 447+500	140	75	NA	TCS LS-5E
B	**Sinking Zone**					
1	Km. 439+200	Km. 439+560	360	62	32	TCS SZ-1
2	Km. 439+920	Km. 440+180	260	19	39	TCS SZ-2
3	Km. 440+280	Km. 440+360	80	32	27	TCS SZ-3
4	Km. 445+060	Km. 445+130	70	28	35	TCS SZ-4
C	**Land Slide cum Sinking Zone**					
1	Km. 445+680	Km. 446+090	410	125	79	TCS LS & SZ-1

The details provided in table are indicative in nature.

Note:

*- start and end location of slope protection work in above table shall be as per site requirements during execution of work.
** Location and height required protection shall be vary as per site condition at the time of execution.
TCS wise description of Slope Protection Measures are described hereunder:
The Contractor shall provide the items as shown in the cross-section attached in Drawings. Various treatment proposed for slope protection work is as below:

Applicable TCS LS-1&2A

a) High tensile Rope Net System
b) Hexagonal Shaped Wire Mesh
c) Hydroseeding/ hydromulching
d) Double Twisted Hexagonal Shaped Wire mesh Gabion Boxes
e) PVC pipe
f) Non-Woven Geotextile
g) Geo-jute/Coir-Mat mat
h) Self Drilling Anchors
i) PCC

Applicable TCS LS-3C

a) High tensile steel wire mesh of Rhomboidal shape
b) Geocomposite mat
c) Hydroseeding/ hydromulching
d) Perforated PVC Pipe (Lined With Non -Woven Geotextile
e) Non-Woven Geotextile
f) Self Drilling Anchors
g) PCC

Applicable TCS LS-& SZ-1

a) High Tensile Rope Net System
b) Rhomboidal shape High Tensile Steel Wire Mesh
c) Geocomposite mat
d) Double Twisted Hexagonal Shaped Wire Mesh
e) Rapid slope Consolidator
f) Double corrosion-protected multi strand prestressed cable anchors
g) Geo-jute/Coir-Mat mat
h) Drainage pipe
i) Non-Woven Geotextile
j) Self Drilling Anchors
k) RCC
l) PCC

Applicable TCS LS 5E

a) High Tensile Rope Net System
b) Double Twisted Hexagonal Shaped Wire Mesh
c) Double Twisted Hexagonal Shaped Wire mesh Gabion Boxes
d) Geocomposite mat
e) Hydroseeding/ hydromulching
f) Drainage pipes

g) Non-Woven Geotextile
h) Self Drilling Anchors
i) PCC

Applicable TCS SZ-1

a) High tensile steel wire mesh of Rhomboidal shape
b) Geocomposite mat
c) Hydroseeding/ hydromulching
d) Double Twisted Hexagonal Shaped Wire Mesh
e) Gabion mattress
f) Uniaxial Geogrid
g) CRS rod
h) Nonwoven geotextile
i) Drainage pipes
j) Geocell
k) Multi strand prestressed cable anchors
l) Self Drilling Anchors
m) PCC

Applicable TCS SZ-2

a) High tensile steel wire mesh of Rhomboidal shape
b) Double Twisted Hexagonal Shaped Wire Mesh
c) Geocomposite mat
d) Hydroseeding/ hydromulching
e) Double Twisted Hexagonal Shaped Wire Mesh
f) Gabion mattress
g) Uniaxial Geogrid
h) CRS rod
i) Drainage composite
j) Drainage pipes
k) Geo-jute/Coir-Mat mat
l) Non-Woven Geotextile
m) Multi strand prestressed cable anchors
n) Self Drilling Anchors
n) RCC
o) HYSD bar
p) PCC

Applicable TCS SZ-3

a) High tensile steel wire mesh of Rhomboidal shape
b) Geocomposite mat
c) Hydroseeding/ hydromulching
d) Double Twisted Hexagonal Shaped Wire mesh Gabion Boxes
e) Gabion mattress
f) Uniaxial Geogrid
g) CRS rod
h) Drainage composite
i) Drainage pipes
j) Non-Woven Geotextile
k) Self Drilling Anchors

l) ISA angle
m) ISMC channel
n) PCC

Applicable TCS SZ-4

a) High tensile steel wire mesh of Rhomboidal shape
b) Double Twisted Hexagonal Shaped Wire Mesh
c) Geocomposite mat
d) Hydroseeding/ hydromulching
e) Double Twisted Hexagonal Shaped Wire mesh Gabion Boxes
f) Geogrid
g) CRS rod

2.5 Lateral and vertical clearances at underpasses

Sl. No.	Existing Chainage (Km)	Design Chainage (Km)	NH No.	Type of Underpass	Span/ opening (m)	Remarks
NA						

2.6 Lateral and vertical clearances at overpasses

Sl. No.	Location (Chainage) (from km to km)	Span/ opening (m)	Remarks
NA			

2.7 Service/Slip roads : Not Applicable

2.8 Grade separated structures : Not Applicable

Vehicular Underpass : Not applicable

Flyovers : Not applicable

2.9 Cattle and pedestrian underpass /overpass : Not applicable

2.10 Road Over Bridge (ROB): Not applicable

2.11 Limited Height Subway : Not Applicable

2.12 Typical cross-sections of the Project Highway : Not Applicable

Project Section	From (km)	To (km)	Length (m)	TCS	Description
NA					

3. Intersections and Grade Separators: - Not applicable

4. Road Embankment and Cut Section: - Not applicable

5. Pavement :

5.1 Pavement design shall be carried out in accordance with IRC : 37- 2018

5.2 Provision for rehabilitation of sunk road stretches

Type of Pavement

The project highway is proposed to provide flexible pavement. The composition of proposed pavement and their corresponding minimum thickness is given in the table below conforming to IRC: 37-2018 of the manual.

S. No.	Pavement Composition	Min. Thickness (mm)
1	Bituminous concrete	40
2	Treated RAP/BSM	100
3	CT Sub Base	200
	Total	**340**

6. Roadside Drainage: Drainage as shown in drawing are to be designed and got approved by the Authority and constructed.

7. Mitigation Measures

Site specific slope protection and drainage measures are proposed based on current understanding of site condition and engineering surveys.

Land Slide Zones:

Land Slide Zones				
Sl No	Change Start	Chainage End	Length (m)	Mitigation Measure
1	Km. 434+320	Km. 434+400	80	As per the Design & Drawing approved by the Authority. The minimum mitigation measure to be carried out is shown in the
2	Km. 434+400	Km. 434+500	100	
3	Km. 437+790	Km. 437+870	80	

4	Km. 447+360	Km. 447+500	140	drawing.
	Total Length		**400**	

Note: - The length of landslide is minimum and indicative in nature. The contractor shall be responsible for accurate assessment as per the site condition and prepare the design for slope protection and stabilization as per specification and standard stipulated in schedule-D and submit the same to Authority's Engineer /Authority for review through the proof consultant and implement it accordingly, thereafter.

Sinking Zones:

Sinking Zones				
Sl No	**Change Start**	**Chainage End**	**Length (m)**	**Mitigation Measure**
1	Km. 439+200	Km. 439+560	360	As per the Design & Drawing approved by the Authority. The minimum mitigation measure to be carried out is shown in the drawing.
2	Km. 439+920	Km. 440+180	260	
3	Km. 440+280	Km. 440+360	80	
4	Km. 445+060	Km. 445+130	70	
	Total Length		**770**	

Note: - The length of Sinking zone is minimum and indicative in nature. The contractor shall be responsible for accurate assessment as per the site condition and prepare the design for sinking zone and stabilization as per specification and standard stipulated in schedule-D and submit the same to Authority's Engineer /Authority for review through the proof consultant and implement it accordingly, thereafter.

Landslide cum Sinking Zone

1	Km. 445+680	Km. 446+090	410	As per the Desgn & Drawing approved by the Authority. The minimum mitigation measure to be carried out is shown in the drawing.
	Total Length		**410**	

Note: - The length of Landslide cum Sinking zone is is minimum and indicative in nature. The contractor shall be responsible for accurate assessment as per the site condition and prepare the design for sinking zone and stabilization as per specification and standard stipulated in schedule-D and submit the same to Authority's Engineer /Authority for review through the proof consultant and implement it accordingly, thereafter.

8. Traffic Control Devices and Road Safety Works

(i) Traffic control devices and road safety works shall be provided in accordance with the provision of relevant Manual as and when need arises or damaged by negligent working.

a). Traffic Signs: Traffic signs include roadside signs, overhead signs and curb mounted signs conforming to IRC:67 and section 800 of MoRTH specification.

b). Pavement Marking: Pavement markings shall cover road marking shall be provided conforming to IRC 35-2015.

9. Roadside Furniture

To be made good the damaged road side furniture during the execution.

10. Compulsory Afforestation

The number of trees which are to be planted by the Contractor as compulsory afforestation shall be as per Forest conservation Act.

11. Hazardous Locations

The safety barriers shall also be provided in accordance with the provision of relevant Manual.

12. Special Requirement for Hill Roads: Contractor shall follow Shall be followed in accordance with hill road manual.

13. Change of Scope

a) Applicable for Hill Side Slope Protection Work

The length, slope angle and height of slope protection work, drainage system, concrete shotcrete, concrete cladding, breast wall and other items specified herein above shall be treated as tentative requirements. The actual quantities as required on the basis of detailed investigations shall be determined by the Contractor in consultation with Authority and its Engineer and in accordance with the Specifications and Standards. Any variations in quantity in terms of Sqm upto 5 % (increase or decrease) for each location mentioned in this Schedule - B shall not constitute a Change of Scope, save and except any variations in the quantities arising out of a Change of Scope expressly undertaken in accordance with the provisions of Article 13 of the EPC Contract Agreement.

b) Applicable for Retaining Structures

Length and height specified in Schedule B is minimum requirement and increase in length and height as per detailed design / investigation and site requirement shall not be treated as COS.

Based on peer review outcome if Authority decided to change type of structures to viaduct the proposed retaining structures shall be descoped from the contract based on Schedule H and as per Article 13 of EPC Agreement.

In case of changes in types of structures to viaduct as per peer review report, Authority may or may not at his discretion decide to get the work done under this contract as COS under Article 13 of EPC Agreement or may carry out work through competitive bidding or any other method of procurement.

14. Shifting of Utilities

The shifting of utilities and felling of trees shall be carried out by the Contractor. The cost of the same shall be borne by the Contractor. The details of utilities are as follows:

The shifting of utilities, to an appropriate location in accordance with the standards and specifications of concerned Utility Owning Department, and felling of tress is part of the scope of work of the Concessionaire. The cost of the same shall be borne by the Contractor. The bidders may visit the site and assess the quantum of shifting of utilities for the project before submission of their bid. Copy of utility relocation plan is enclosed. The specifications of concerned Utility Owning Department shall be applicable and followed. The details of utilities are as follows:

Sr. No	Type of Utility	UNIT	Quantity	Location/stretch (LHS/RHS)
A	Electrical Utilities		As per Annex -I Schedule-A	
A1	Electrical Poles	Nos.		
A2	Electrical cables	meters		
A3	Transformers	Nos.		
B	Water/Sewage pipeline			
B1	Sewage	meters		
B2	Water supply	meters		
C	Felling of Tress	Nos.		

Note I:-

A. The type/spacing/size/specifications of poles/towers/ lines/cables to be used in shifting work shall be as per the guidelines of Utility Owning Department and it is to be agreed solely between the Concessionaire and the Utility Owning Department. No change of scope shall be admissible and no cost shall be paid for using different type/spacing/ size/specifications in shifted work in comparison to those in the existing work or for making any overhead crossings to underground as per requirement of Utility Owning Department and/or construction of project highway. The Concessionaire shall carry out joint inspection with Utility Owning Department and get the estimates from Utility Owning Department. The assistance of the Authority is limited to giving forwarding letter on the proposal of Concessionaire to Utility Owning Department whenever asked by the Concessionaire. The decision/ approval of Utility owning Department shall be binding on the Concessionaire.

B. The supervision Charges at the rates/ charges applicable of the Utility Owning Department shall be paid directly by the Authority to the Utility owning Department as and when Concessionaire furnishes demand of Utility Owning Department along with a copy of estimated cost given by the latter.

C. The dismantled material /scrap of existing Utility to be shifted/ dismantled shall belong to the Concessionaire who would be free to dispose-off the dismantled material as deemed fit by them unless the Concessionaire is required to deposit the dismantled material to Utility Owning Department as per the norms and practice and, in that case the amount of credit for dismantled material may be availed by the Concessionaire as per the estimated agreed between them.

D. The utilities shall be handed over after shifting work is completed to Utility Owning Department to their entire satisfaction. The maintenance ability shall rest with the Utility Owning Department after handing over process is complete as far as utility shifting works are concerned.

SCHEDULE – B-1

Sr. No.	Details of Utilities	Chainage	Quantity
A. Electrical Utilities			
	Extra High Tension (EHT) lines	439+300	1 no. of crossing
	11KV Electrical pole & Light poles along the existing road	434+400	4 nos. of poles
	11KV Electrical pole & Light poles along the existing road	439+920	2 nos. of poles
	11KV Electrical pole & Light poles along the existing road	445+680	2 nos. of poles
B. Water Pipe Lines			
Sr. No.	Details of Utilities	Chainage	Quantity
NIL			