

**Site Specific Environmental and Social Management Plan
(SSE & SMP)**

**Site No. 17
Durekkanda, Ratnapura District - Package 1**

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Prepared for:

**Sri Lanka Landslide Mitigation Project
Asia Infrastructure Investment Bank
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Abbreviations

AIIB	Asian Infrastructure Investment Bank
CEA	Central Environmental Authority
DFC	Department of Forest Conservation
DS	Divisional Secretary
DWLC	Department of Wild Life Conservation
EH & S	Environmental Health & Social
E & SU of PMU	Environmental & Social Unit of Project Management Unit
E & S & H & S unit of PMU	Environmental & Social & Health & Safety Unit of Project Management Unit
ESMF	Environmental and Social Management Framework
ESMP	Environmental Social Management Plan
SSE&SMP	Site Specific Environmental and Social Management Plan
GN	Grama Niladhari
GOSL	Government of Sri Lanka
GSMB	Geological & Mines Bureau
IUCN	International Union for Conservation Nature
LRC	Land Reforms Commission
NBRO	National Building Research Organization
RDA	Road Development Authority

1. Introduction

The Government of Sri Lanka intends obtaining a loan from the Asian Infrastructure Investment Bank (AIIB) for mitigating/rectifying unstable slopes in high risk areas especially in 11 districts of 06 provinces of the country. The project requires to be implemented in accordance with environmental and social safeguards and mandates of the AIIB and that of Sri Lanka. Considering the nature of project actions and its implementation, an environmental and social management framework has been (ESMF) prepared as required by the AIIB environmental and social safeguard policy.

The purpose of the environmental and social management framework (ESMF) is to provide a guide for application of AIIB safeguards and national environmental and social mandates during the implementation of project. The project implementing agency (NBRO) is expected to ensure implementation of environmental and social management plans prepared under the ESMF during all phases of project implementation so that the impacts on the environment and community are minimum.

During the scoping exercise it was revealed that the environmental, social, and health & safety conditions are more site specific which should be addressed specific to site conditions. Therefore, the ESMF has recommended a site specific environmental and social assessment followed by Site Specific Environmental and Social Management Plan (SSE&SMP) for each site. The SSE&SMP gives planning, design, construction and operation phase environmental, social, and health & safety management measures to be considered in the project Implementation.

This is the site specific environmental and social management plan for Durekkanda landslide mitigation site. The plan has been prepared by an in-depth environmental and social assessment to;

- i. Identify sensitive environmental and social elements in the project influence area
- ii. Identify significant environmental and social impacts due to project actions
- iii. Propose mitigation measures
- iv. Decide appropriate environmental and social monitoring requirements specific to this project
- v. Study relevant environmental regulation and procedures to be followed during project implementation specific to the site

2. Location details and site description

Site reference: Site No.17 Package 1 – Ratnapura District, Durekkanda.

Site Details

- i. The site falls administratively under Durekknada Grama Niladhari (GN) division of Ratnapura Divisional Secretariat Division, Ratnapura District of Sabaragamuwa Province. The affected slope section is located between culverts-11/3 and 11/5 of Ratnapura Wewalwatta B391 Road at Durekkanda.
- ii. The nearest town to site is Ratnapura, about 10 km from the site.
- iii. GPS locations: 6.707202°N / 80.46518°E: (Fig 1-Google image of the location)
- iv. The current land ownerships are the Road Development Authority (RDA) for the road reservation area and the section of forest lands which is under the jurisdiction of Land Reforms Commission (LRC)



Fig 1: Google image of the proposed landslide mitigation site, the surrounding environmental features and service infrastructure. Refer drone image for details Annexure I.

3. Landslide hazard incident details

On 26.05.2017, a precipitation of >300 mm has triggered the slope instability at this site. The cause of failure is largely due to non-engineered slope stabilization and poor land management practices. The road construction has not considered engineered slope mitigation in designing the cut-slope. This almost vertical cut-slope has been exposed to erosion under heavy precipitation creating a weak zone in the toe area. The upper half of the failed section was earlier an isolated plot of tea. The cultivation has not considered proper drainage management. The unstable slope geometry, slope erosion and poor drainage conditions have collectively initiated the slope instability in this location. This slide has reactivated in September 2017 again. After these failures there were no notable failures, but, dislodging of debris occur frequently during rain. At present an area of about 40,000 m² is affected due to the failure.

The damages occurred due to incident

At these events, the debris from the collapsed slope had moved across the road up to the nearby stream forming a debris flow path depositing soil and boulders on the road. The incidents have completely obstructed the movement of traffic. The road is the access route for place of cultural and religious importance, (A famous temple “Punchi Dambadiwa” is located about 8 km from the site). The road is also used by Sri Pada Pilgrims, one of the renowned pilgrimage of mainly Buddhists. Further, the tea planters in the area use the road to transport plucked tea and the products. Also, peak wilderness sanctuary can be accessed through this road. Due to exceptional scenic beauty the road is a popular ecotourism route.

During the first hazard incident the authorities had closed the road for about three weeks. This has caused obstruction to commuters who use the road for various activities mentioned above. The subsequent failure also had obstructed the traffic more or less in a similar manner.

One house located down slope was damaged by the incident. There were no reported casualties. Initially there were only cracks in this house. The incident in September has damaged the house beyond repair. The occupants have now evacuated the house. The collapse had completely damaged the plot of tea, but, leaving forest land with no damage. The debris had destroyed the power line at this section. As debris flow had

continued up to the stream, it had blocked completely the stream flow path causing temporary inundation in upstream area. The deposited debris had changed the stream flow path damaging fully the aquatic ecology and riverine vegetation in the affected stream section. Flooding had been temporary and had not submerged the upstream houses which are located much above the flood water level. Ref. Fig 2: Images of the project area

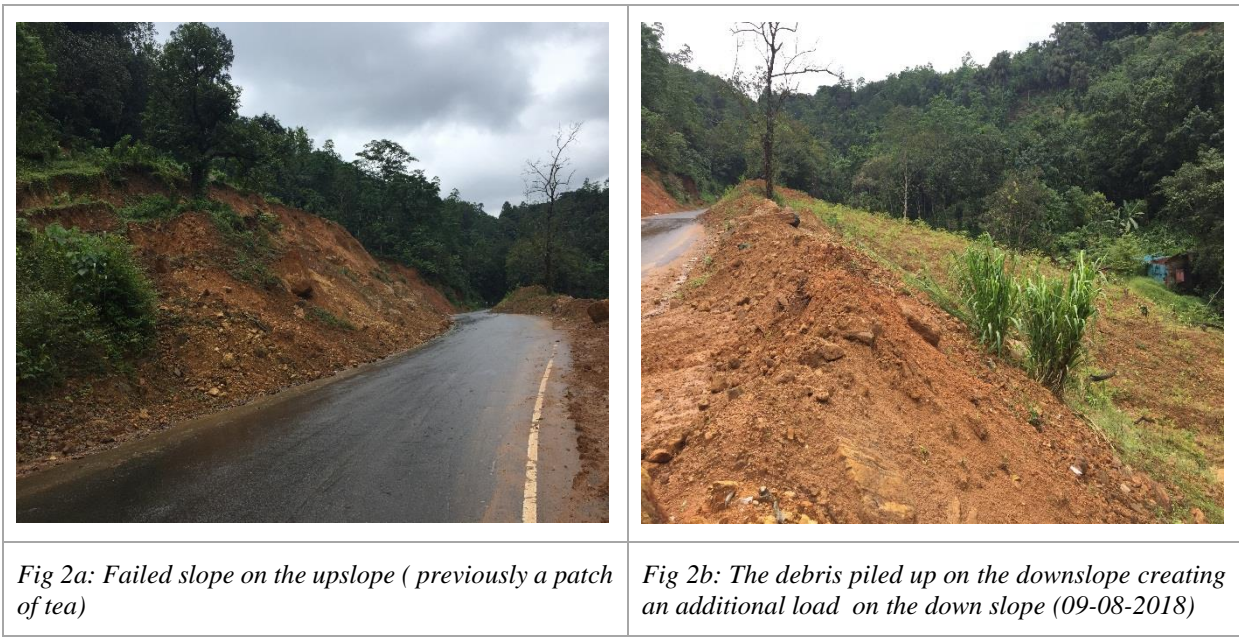


Fig 2: Images of the project area

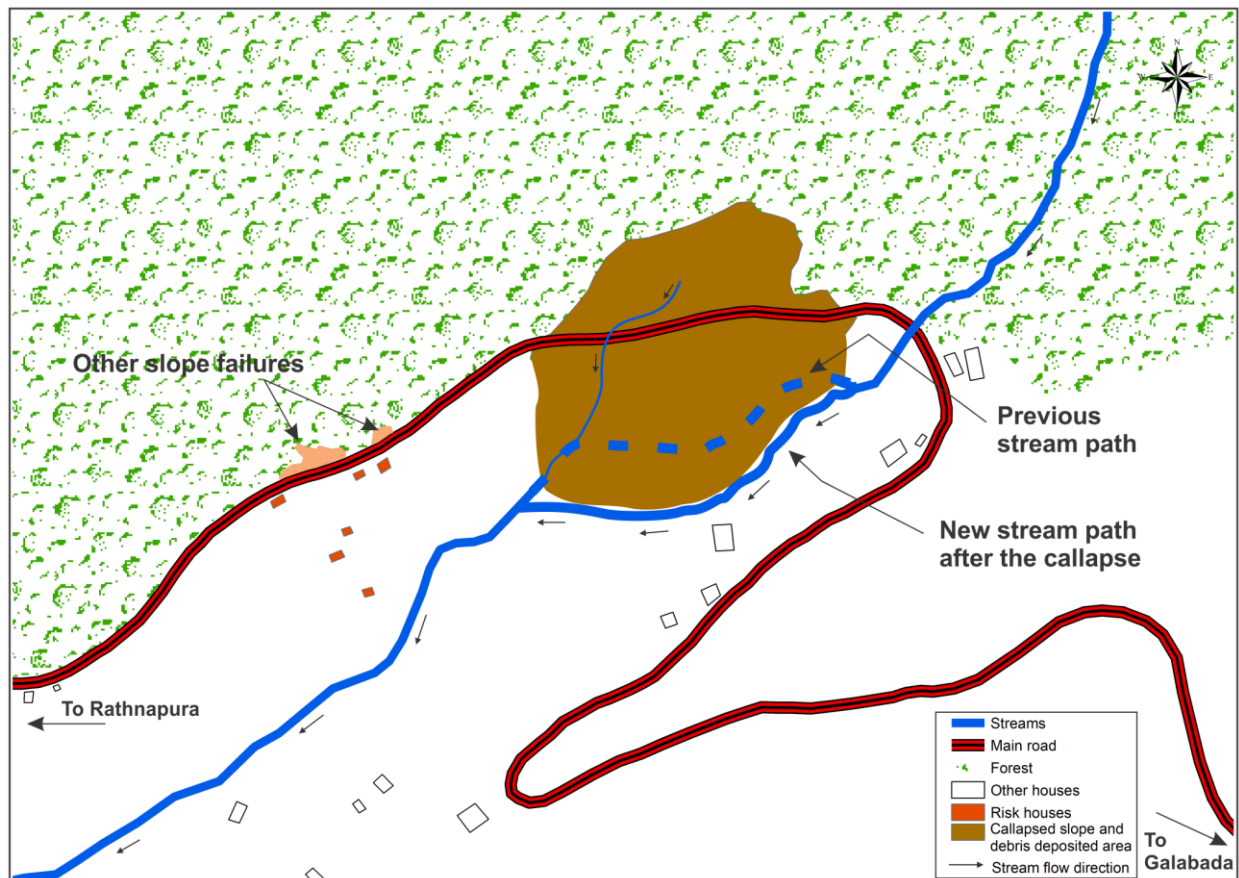


Fig 3: Diagrammatic interpretation of affected slope area and buildings due to ground movement

4. Description of any remedial measures already undertaken to reduce the potential risk

Road was cleared by the Road Development Authority within 3 weeks from the failure incident and it was made available to traffic. The interrupted power supply was established via an alternative route. Soon after the incident the NBRO team has alerted the occupants including the GN officer on the risk. The people at high risk are given preparedness and evacuation alerts by Grama Niladhari of the area communicating through the Divisional Secretariat.

Evacuations: After the incident, the NBRO has inspected the site and given an inspection report. On the NBRO advice the occupant of the house of Mrs G D Irangani Sriyalatha had evacuated the house. The report indicates that under mentioned households as low risk as the risk for them due to this hazard is low. Names of the occupants who are low risk; Mrs UWKA Sumanawathi, Mrs H L Ramani Chandrasena, Mr A L Thrarindu Buddhika, Mr.P Weerasinghe, Mrs H L Chandima Liyanage – (Ref. Report No. NBRO/LRRMD/RT/17/31/30977-ERR). It is noteworthy that these houses are located completely outside the potential hazard zone of unstable slope considered for this project. They have been noted as risk elements due to this slide mainly considering the risk of flooding. Nevertheless, these houses are now at higher risk due to another landslide which is on the same road (about 200m) adjacent to the site proposed for mitigation. The mitigation of this site is identified under 120 sites of AIIB financing.

Resettlement (progress): The government has offered a subsidiary type resettlement package to a value of LKR 1.6 million for all landslide hazard victims whose houses are damaged or at high risk. Mrs G D Irangani Sriyalatha has accepted this package and she has resettled elsewhere. Hence, there will be no further resettlement due to this slide or due to future mitigation works in this site. Nevertheless, the occupants of the other houses are still living in same houses with the risk from another slope instability risk.

5. Description of the area of the landslide and areas adjacent to the landslide and current level of risk

The upslope area is largely forest lands belonging to Land Reforms Commission. The slope either sides of road is RDA road reservations. There are no occupied houses directly downslope of the failed slope. Even now there are impinging loose weathered rock and fractured pieces of rocks posing high risk on the commuters. The removed soil debris and boulders are currently piled up between the road and upper edge of the down slope. This situation is risky on the down slope. The excess load and seepage of water through loose soil may create a further instability on the down slope.

6. Brief description on the surrounding environment with special reference to sensitive elements that may be affected by the project actions

The vegetation in the area is largely natural forests and isolated patches of home gardens. Most of the home gardens too resemble forest like vegetation with well grown tree species consisting of both natural and planted trees. The crest of the mountain in the upslope has a well grown forest cover. However, in the road reservation area the vegetation is highly disturbed due to road cuts which is still in succession. The other vegetation type is naturally established stream riparian vegetation in the slope's toe area which gives an ample protection against erosive flows in the natural stream called Anda Ella. At present there are no occupied houses in the immediate risk zone. The three houses located in the immediate proximity have no direct impact due to project actions

Following sensitive elements will be at risk due to project actions;

- i. The road and the commuters are the main sensitive elements that will be affected by the project, as the site is located adjoining the road. The commuters will be affected during construction
- ii. The forest cover (fauna and flora) and ecology in the crest area above the affected slope
- iii. The natural springs
- iv. Stream ecology of Anda Ella and its water quality
- v. Scenic beauty of the area

7. Description of the works envisaged under the project

The proposed mitigation works will be largely concentrated on already failed upslope area. The type of mitigation works will be i) slope reshaping and removal of impeding rock fragment to achieve more stable slope geometry, ii) removal of deposited debris from earlier failures, iii) improvement to the drainage, which includes improvement to both surface and subsurface drainage. The surface drain system will include crown drains in the crest area, berm drains and cascade drains. The Subsurface drains if considered will be on both upslope and down slope area which may include a system of horizontal drains and vertical wells, iv) Rock bolting, soil nailing and other slope reinforcement structures. v) Surface erosion control measures, and this will be applicable mostly on the upslope section.

The project may also consider site camps storage areas etc. these will be established in separate areas common to many sites under each package. Hence will be addressed in ESMF and therefore should be referred wherever necessary.

8. Identification of social and environmental impacts and risks related to the works

8.1 Positive impacts

This site and another site on the same road at Galaboda are currently posing a severe risk on the commuters from falling rocks and debris during rainy season. RDA has established a continuous watch on this road section to ensure that commuters are safe from risk of falling debris. Both these sites will be mitigated under AIIB financing.

This road is one of the connectivity road between Ratnapura and Nuwara Eliya Districts, a route for famous Sri Pada Pilgrimage and other religious place called Punchi Dambadiwa, also a route with exceptional scenic beauty for current and future ecotourism, a transportation path for tea industry and several of indirect development and economic activities. The mitigation work will ensure uninterrupted traffic flow and road connectivity throughout and will increase the safety of commuters during rainy season. Further, above mentioned industry, economic activities and other cultural and religious activities are benefitted largely by this mitigation.

8.2 Negative impacts

The mitigation works are generally confined to an area which is already disturbed by a slope failure. Therefore, negative impacts are much localized and also limited mostly to construction period.

8.2.1 Loosing access to land and future development opportunities

The mitigation works will be carried out in the road reservations and lands of LRC. The land is currently not occupied or used for any purposes. Hence there will be no issue on loss of access to land.

8.2.2 Ecological, biological impacts, and fauna and flora

There are no annual crops within the study area and there will not be impact on them. The vegetation in the already disturbed area due to the landslide is dominated by tree species most of them are exotic species. The impacts on terrestrial ecosystems are localized as many project actions will be taking place on already failed or disturbed slopes.

However, The Peak Wilderness Heritage Area (PWHA), which contains large block of sub montane and montane forest with high endemism in species of flora is located about 10 km from the site. According to the Range Office- Samanala Wildness Nature Reserve of Department of Wildlife Conservation (DWLC) the project site falls within the buffer zone of the PWHA or closes to the buffer zone.

The forest ecology (fauna and flora) on the crest of the slope can be disturbed during construction works as follows;

- i. Clearance of vegetation for construction of crown drains and disturbance to niches and habitat connectivity for some species,
- ii. Removal of valuable timber species and species listed in the red list of IUCN,
- iii. Illegal extraction of specimens (flora and fauna) protected under regulations.

- iv. Poaching and hunting
- v. Forest fires

All these impacts are significant, but localised, confined only to a limited area where mitigation works are envisaged. The magnitude and severity of these impacts can be largely minimized by proper environmental management and planning.

8.2.3 Impacts on the drainage pattern of the area

Currently, there are several springs in the area. According to the villages these springs give water even in the dry period and is used as a source of drinking water. The wild animals also may be using these spring water for their living. The proposed mitigation will change these springs, will drawdown the groundwater storage and it will result low dry weather flow. These impacts are locally significant, but confined only to this location.

8.2.4 Erosional impacts and stream bed alterations

The proposed mitigation works will be largely focused on the upslope area which is currently an exposed earth mass with impinging rock fragments and weak soils. The slope reshaping may pose slope more vulnerable to erosion especially in the rainy season. This will result sediment laden runoff leading to nearby stream "Anda Ella". After the mitigation the runoff will be increased during rainy period. The erosion in culvert area and nearby stream banks and beds may also result as the flow in the rainy season increases. All these impacts are significant, but will be confined only to this location. And the impacts can be mitigated by proper design constructions.

8.2.5 Water pollution impacts from construction activities

Washout of fines, sedimentation in existing watercourses and siltation in the downstream channels can be expected during the removal of debris and boulders and during the process of landscaping/reshaping of slopes. Improper disposal of oils and other harmful substances/contaminants from machineries, leakages from temporary storage tanks, solid waste and wastewater disposal/dumping could occur causing adverse impacts on quality of the stream running in the toe area.

Intentional or careless disposal of construction waste including cements/ grout materials etc. used for soil strengthening can mix with surface runoff to cause temporary water quality degradation and accumulation of unwanted substances in the downstream.

The discharges may increase the pollution load in the streams with high Biochemical Oxygen Demand, Chemical Oxygen Demand, Suspended Solids, Oils and Greases etc. The emission will exceed the ambient water quality standards prescribed for designated uses such as drinking, bathing, and aquaculture and may violate even the minimum standards for water quality during the construction phase. The water quality impacts from discharge of wastewater and pollutants to environment during construction phase is therefore highly significant.

8.2.6 Open defecation and waterborne infections spread during construction phase

Faecal contamination of down slope water stream can be expected during construction due to open defecation by contractor's labour force.

8.2.7 Impacts on the downstream water uses

Impacts on water quality and aquatic ecology in the natural stream will be high as the emissions will exceed the ambient water quality standards prescribed for designated uses such as drinking, bathing, and aquaculture and may violate even the minimum standards. The water pollution impacts on downstream area discharge of wastewater and pollutants to environment during construction phase is therefore highly significant.

8.2.8 Solid waste disposal issues

Haphazard disposal of solid waste can pollute water and soil, and leave various environmental impacts if proper disposal mechanism is not in place during the construction period. Since the site is located close to the road, improper solid waste management can cause impacts on pedestrians, commuters and unpleasant, awful visual pollution. The effect is significant if proper solid waste disposal mechanism is not used during the construction period.

8.2.9 Air pollution impacts

Construction activities that contribute to air pollution include land clearing activities, operation of diesel engines, demolition activities, burning, and transportation of construction materials, construction waste and working with toxic materials. During the construction, it generates high levels of dust (typically from concrete, cement, wood, stone, and silica) and can become airborne. Since there are no households or buildings located nearby the effect are less significant. However, the air pollution may have an impact for the pedestrian/ commuters on the road.

8.2.10 Noise pollution, vibration, blasting, impacts during construction, potential damage to buildings, infrastructure

Since there are no buildings or houses close to the site, the impact of noise and vibration is less significant on human. However, as the site is located in a forested area with very high ecological richness impacts on wildlife is significant, especially if noise generating activities are carried out in the night.

8.2.11 Relations between workers and the people living in the vicinity of the site and possibility of disputes

There may be disputes with the workers of construction site and the villagers.

8.2.12 Work camps and lay-down sites requirement

The solid waste and sewage removal in the camp if not properly designed will be a nuisance to the surrounding community.

8.2.13 Risks of public accessing the site during construction

The site may have machinery with high hazard risk such as drilling, boring and excavation etc. Only skilled workforce will be safe working in this environment. If unauthorized persons access the site there may be a risk of being subjected to accidents by the heavy machinery.

8.2.14 Explosive hazards and hazardous materials

Explosives may be used if the rock blasting is envisaged. This may pose a risk due to unsafe use. As these operations are to be done on unstable slopes the risk of improper use of explosive and accidents from rock fragment are highly significant at this site.

8.2.15 Road traffic and Safety to the public from construction activities: risk to commuters

During construction phase the road will be obstructed by frequently moving machinery, loaders, trucks etc. As most of the mitigation works are to be carried out in a limited space on a failed slope the heavy machinery, the trucks and loaders etc. can obstruct the commuter passage and may pose risk on their life. However, it was observed that number of pedestrians using this road is low as most of the people travel either by three wheelers, motor cycles, busses, cars, and or other motor vehicles. The moving heavy machinery and construction vehicles may pose a risk on these commuters.

8.2.16 Workers safety during construction

During the construction, heavy machinery and construction vehicles will be operating in a very limited space. Workers need frequently to climb on vertical unstable slope for various activities. Rock blasting,

drilling and intrusion of nails, steel bars etc., which are high risk, will be involved in the construction phase. The hazard risk from these on workers' safety is considered highly significant. Contractor may engage under age workers (children) for construction work, which is risky, can result serious accidents and injuries.

9. Public and stakeholder consultations that have been and/or will be held

The following house owners lived in the houses ranked as risk with respect to the slide by NBRO were involved in the consultation: Mrs UWKA Sumanawathi, Mrs H L Ramani Chandrasena, Mr. P Weerasinghe. The occupants in these houses were made aware of the project and the social concerns pertinent to the project. As mentioned earlier these people have not been considered in a resettlement plan up to now. But, they have been made aware by the Grama Niladhari of the division to be vigilant on the extreme rainfall, the warnings and to act according to the alerts. Further, they indicated that water in the spring in the area is used as an alternative drinking water source during dry season. The water in the Anda Ella is used by these communities for bathing, washing and for other sanitary purposes.

9.1 Stakeholders involved in the consultations, recommendations or agreements reached in the consultations (Ref: annexure III)

10. Significant Environmental and Social Impacts: Social or Environmental impacts or risks that will require special measures on the part of NBRO and the contractor; Indicative significant impacts

10.1 Impacts on water or wetlands (issues relating to changes or contamination of streams, rivers and other bodies of water, typically downstream from the site). This includes long-term impacts and potential impacts and risks during construction/remediation of the landslide site:

Improper disposal of oils and other harmful substances/contaminants from machineries, leakages from temporary storage tanks, solid waste and wastewater disposal/dumping from workers' sites could occur causing adverse impacts on surface quality of the Anda ella.

10.2 Erosional impacts and stream bed alterations

Erosional impacts in the project area will be high during the construction phase. Due to increased discharge after mitigation, the impacts on environmental flow, stream banks/ bed and aquatic ecosystems will be locally significant.

10.3 Impacts on transport infrastructure (especially temporary loss of road or rail access, risks of traffic congestion)

The traffic due to full/partial road closure may obstruct the smooth flow of vehicles during the week days, poya days, during office hours, school times, (in morning, day time and evening). This will cause nuisance mainly to commuters especially during Sri Pada pilgrimage season and on Poya days who visit Place of Punchi Dambadiwa.

10.4 Impacts on downstream service provision (water supply, sewerage, electricity, etc.)

The proposed mitigation will drawdown the groundwater storage and it will result low dry weather flow in the springs. These impacts are locally significant, and confined only to this location.

10.5 Households living in high-risk or medium-risk areas adjacent or near to the site (up-slope, down-slope, downstream, etc.)

There are no occupied houses or other immediately adjacent to the site hence has no impact.

10.6 Areas used for businesses, agriculture or other within the area to be remediated

There are no areas used for business, specific agriculture practices or other immediately adjacent to the site hence has no significant impact.

10.7 Areas used for businesses, agriculture or other immediately to the site

As there are no areas used for business, agriculture or other immediately adjacent to the site, impact will be insignificant.

10.8 Need for people to enter or cross the site

There is no special need for people to enter the site for other purposes. However, unauthorised entry of the people may occur due to intentional or unintentional purposes and they may be at risk due to operating machinery, and vehicles, electricity, and may even by blasting materials.

10.9 Priority Health and Safety Issues; Specific H&S concerns that require measures that go beyond the standard contractual requirements for contractors

The worker and public health and safety concern pertinent to this site is highly significant as the project actions are expected to take place on both upslope and down slope using heavy machinery and construction vehicles. Also in the upslope mitigation workers are exposed to high risk as they have work on unstable vertical slopes dealing with heavy machinery. The health and safety issues pertinent to this site is highly significant.

The health and safety issues pertinent to this site is largely common to any landslide mitigation site. Such common E & HS issues have been discussed in the **ESMF**. Worker safety requirement in the construction site is more detailed under 2003 5: Safety equipment and clothing in the section 2003: Working conditions and community health and safety in the Bidding document.

10.10 Child labour & forced labour

Child labor & Forced labor is detailed under 2003.3 under section 2003: Working conditions and community health and safety in the Bidding document.

11. Clearances, no objection, consent and approvals required for the implementation of the project

11.1 Project implementation

i. Approval from the District Secretariat

The approvals will require to be obtained from the District secretary for the implementation of project where the proposals need to be presented at the district coordinating committee, to which chief minister and stakeholder agencies in the district will also participate. The Officer of PMU will present the project, disclose the project details and various concerns including environmental and social. The issues will be discussed, the recommendation at this meeting will be considered in the implementation of the ESMP

ii. Approval from the planning committee

The PMU will obtain the approval to project from the planning committee of the Ratnapura Urban council

11.2 Approval from sate land owners to implement the project in state lands of the site

The relevant agencies are Road Development Authority and Lands Reforms Commission of Sri Lanka as part of the project actions are taking place on the road reservation and LRC lands. Necessary agreements will be made between NBRO, RDA and LRC to access the land, carry out construction work, remove materials (trees, soils, rocks and boulders), erect structures, and continue with operation and maintenance works.

Approvals from regional office of Ceylon Electricity Board will be required for power supply for site operation.

11.3 Approval from Central Environmental Authority, Department of Forest, Department of Wildlife Conservation

- i. As project site is located in environmentally sensitive areas approval from the district Central Environmental Authority is required. (refer Annexure IV for the procedure)

- ii. Also, the project actions may involve removal of protected species. Approvals from the Forest Department through Divisional Secretary will be obtained for the removal of protected trees (refer Annexure III for the procedure).
- iii. The Department of Wild Life Conservation requested a project report as the site is located in a sensitive area; the site specific ESMP for Durekkanda and a brief report on the proposed design work will be submitted to this department. Further, DWC and DF will be informed of forest area that would be cleared (if necessary) under this project, and tree species to be removed etc. when obtaining approvals for project by the PMU. According to DWC and DF the site will be inspected by them when granting approvals.

11.4 Other approvals

- i. Approval from regional Geological Surveys and Mines Bureau will be obtained for transportation and disposal of earth, rocks and mineral debris
- ii. Approval for extraction of materials - Approval from Geological & Mines Bureau (GSMB) is needed (if necessary only).
- iii. Approvals from Ratnapura Urban Council will be obtained for the disposal of waste and plant litter
- iv. Approval through the Divisional Secretary from the district office of Ministry of Defense will be obtained for the sites if requiring rock blasting.

11.5 Consent/ no objection/ legally bound agreement from the private land ownerships

May not be applicable to this site

The tentative timeline for getting approval is given in the table 1.

Table 1: Tentative timeline for getting approvals

Approvals	Month 1				Month 2			
	W1	W2	W3	W4	W1	W2	W3	W4
Project implementation								
<i>Approval from the District Secretariat</i>								
Submission of application	—							
Project briefing		—						
Respond to comments		—	—	—				
Approvals					—			
<i>Approval from planning committee</i>								
Submission of application	—							
Project briefing		—						
Respond to comments			—	—				
Approvals					—			
<i>Approval from state land owners RDA & CEB</i>								
Submission of application		—						
Respond to comments			—					
Approvals				—				
<i>Approval from DFC, DWLC</i>								
Submission of application		—		—				
Respond to comments			—					
Approval								
Other approvals								
GSMB		—						
Ministry of Defense (Depends on the requirement)			—	—				
Consent/ no objection from the private land ownership		—	—					

12. Environmental Social Management Plan (ESMP)

This section will describe the mitigation measures highly specific to this site, considering specially the impacts and risks identified in Sections 8 & 9.

12.1 Resettlement action plan

Will not be applicable to this site as there is no project based resettlement.

12.2 Evacuation of people

This will not be applicable to this site

12.3 Procedure for removal of damaged structures, facilities infrastructure

Not triggered in this site.

12.4 Requirement for compensation for loss of property /uses due to project actions

Not triggered in this site.

12.5 Public awareness and education- needed for following areas

Programs to inform and educate people in the vicinity about the risks posed by landslides,

12.6 Design based environmental/ social management considerations

Following environmentally and socially significant design considerations are recommended to consider in designing the mitigation works.

Table 2: Design stage Environmental & Social considerations

Design feature	Recommended level of consideration for this site
i. Natural resource management and resource optimized designs Project specific designs should be considered to eliminate mass clearing of vegetation and minimum number of removal of tree species. Sufficient emphasis should be made to consider conservation of trees if important tree species are found	Very High
ii. Habitat connectivity and animal trails If large fraction of vegetation is required to be cleared in ecologically fragile habitats for permanent structures or for access, or if deep drains etc. are to be made the designs should include habitat connectivity features, animal trails and vegetation strips and etc. even if the impact are localized.	High
iii. Conservation of water resources The mitigation works involve extraction of water both surface and sub-surface. The water extracted is in relatively good quality. In a well thought design this extracted water can be conveyed in such a manner that the water can be accessed by wild fauna as well as the neighboring communities for bathing and other domestic purposes even as drinking water. The community consultation indicated water scarcity during dry season in this area.	Very high
iv. Interruption to water supplies If the water in the mitigated slope is used as a source for individual or community water supply, the chance the water source can be affected by the mitigation work is high due to water table draw down. In such instances the design should include alternative source of water for the community (temporary/or permanent).	Medium
v. Aesthetically compatible design considerations The designs in aesthetically sensitive environments should consider structures that blend with natural environment to keep the visual pollution to minimum.	Very High

Service of landscape architect may be important for the design of suitable mitigation structures.	
<p>vi. Consideration of green environmental features</p> <p>As many of the mitigations works are carried out in ecologically sensitive habitats, It is recommended to consider green environmental designs as much as possible in the designs e.g.: use of local vegetation species for erosion control, combination of plants to sustain species diversity in the environment, avoiding inclusion of potentially invasive species, use of excavation materials for construction and etc.</p>	Very High
<p>vii. Workers/ commuters and community safety</p> <p>Activation of slide may occur during construction phase and may pose threat to workers and commuters. Therefore design based safety consideration such as berms, safety nets etc. should be considered</p>	Very High
<p>viii. Erosion control structures</p> <p>In drainage management, water is extracted and conveyed to nearby streams often through culverts. During rainy season the flow in these drainage structures can be significantly high and this may cause stream bed and bank erosion. Hence the design should adequately consider flow speed breakers to reduce erosive flows entering natural streams. This should be an inclusive part of the design if there are streams and culverts in the proximity of the mitigation site. A natural stream with potentially high aquatic diversity flows at the toe area of the failed slope.</p>	Medium-high
<p>ix. Low post maintenance and operation designs</p> <p>The mitigation should consider passive techniques such as gravity drains for drainage management. Correct pipe diameters, pore diameters and laying angles should be considered to avoid clogging of drains. Low maintenance structures and designs such as designs to withstand erosive forces, sediment trapping systems etc. should be considered if drain water is expected to be directed to natural streams.</p> <p>The materials used for structures and should be chosen carefully so as to withstand local weather conditions with high durability. Designs should specially consider corrosion prevention techniques if steel structures are used and geotextiles if fine sediments are prone to enter sub drains.</p>	Very high

12.7 Mitigation of impacts during the construction phase

12.7.1 Construction contractors' requirement to comply with environmental and social management during the construction phase

Measures to manage and to mitigate the environmental and social impacts are generally common to all landslide mitigation sites. Such impacts are largely attributed to activities in the construction phase. The mitigation of impacts therefore becomes an obligation of construction contractor. NBRO has prepared a comprehensive document on “*contractors’ requirement to comply with Environmental and Social and Health and Safety (ES & HS) management during the construction phase*” to be included in construction contractors’ bid document. The main sections are summarised below Table 3) indicating the degree of relevancy for this site. For details ESMP for construction contractors should be referred.

The contractor is expected to indicate in the bid the ESMP procedure to be implemented along with relevant proofs of his competency. The cost for ESMP will require to be indicated as a separate pay item. The environmental and social management method statement is expected to be submitted by the selected construction contractor and to be approved by the PMU unit.

Table 3: Contractor requirement to comply with ES & HS

Reference No. as per construction contractors obligation to ESMP	Item	Relevance to the project
2002. Environmental and Social Monitoring		
2002.2 1)	Storage on site	Highly Relevant
2002.2 2)	Noise and Vibration	Relevant (Night time noise for wildlife)
2002.2 3)	Cracks and damages to the buildings	No relevance
2002.2 4)	Disposal of waste	Relevant (Stream nearby)
2002.2 5)	Disposal of refuse	Highly relevant (stream/ road reservation)
2002.2 6)	Dust control	Highly Relevant (Commuters)
2002.2 7)	Transport of Construction materials and waste	Relevant
2002.2 8)	Water	Highly relevant (stream nearby)
2002.2 9)	Flora and Fauna	Highly relevant (forest on the upslope)
2002.2 10)	Physical and cultural resources	Not relevant
2002.2 11)	Soil Erosion	Highly relevant (vertical slope/stream nearby)
2002.2 12)	Soil Contamination	Relevant
2002.2 13)	Borrowing Earth	Relevant
2002.2 14)	Quarry Operations	Not relevant
2002.2 15)	Maintenance vehicles and Machinery	Relevant
2002.2 16)	Disruption to public	Low relevance
2002.2 17)	Utilities and roadside amenities	Relevant (road)
2002.2 18)	Visual environment enhancement	Highly relevant (aesthetically sensitive road sections)
2002-5. Environmental Monitoring	Baseline surveys (air, water, noise , vibration, crack surveys)	Refer site specific monitoring plan
	Surveys during construction (air, water, noise , vibration, crack surveys)	Refer site specific monitoring plan
	Surveys during operation phase	Optional
	Reporting and maintenance of records	Relevant
2003. Working Conditions and Community Health and Safety		
2003.2	Safety organization and communication	Highly relevant (unsafe slopes/commuters/ machinery)
2003.3	Child Labor and Forced Labor	Relevant
2003.4	Safety reports and notification of accidents	Highly relevant
2003.5	Safety Equipment and Clothing	Highly relevant
2003.6	Safety inspections	Highly relevant
2003.7	First Aid Facilities	Highly relevant
2003.8	Health and safety information and training	Highly relevant
2003.9	Plant equipment and qualified personnel	Relevant
<p>Relevant: The section is relevant to the site as a common ESMP applicable to any site</p> <p>Highly relevant: The contractor should pay special emphasis in the preparation of environmental method statements to ensure that the relevant ESMP is implemented specific to the site</p> <p>Possibly relevant: This ESMP will be triggered if the site come across with relevant aspect during project implementation</p> <p>Not relevant: The section may not be relevant to this site under disclosed conditions</p> <p>Optional: require to be implement if needed only</p> <p>Refer site specific monitoring plan: Contractor is obliged to carry out monitoring as specified in the site specific monitoring plan</p> <p>Reference: Contractors Obligation for implementation of ESMP</p>		

12.7.2 Site specific mitigation

Given below is the site specific mitigation measures that the project is expected to implement during the construction period.

Table 4: Site specific ES & HS mitigatory measures

Mitigation item	Project implementation phase	Responsibility
<p>i. Minimize erosional impacts during construction It is recommended that mitigation works involved with site clearance, slope reshaping, removal of debris etc. are avoided during rainy season. Therefore it is imperative that site works in upslope mitigation are carried out in the dry season before rainy season begins and avoid such activities on upslope area in the wet season as much as possible. This should be considered in project planning stage.</p>	Site preparation and construction	Construction Contractor
<p>ii. Invasive species should be avoided in using vegetative erosion control structures. Native plants in the local environment should be chosen for vegetative control. The species used for vegetative control measures need approval from the Department of Wildlife Conservation. Tree plants for vegetative control can be obtained from the Forest Department nurseries, by informing them in advance on the requirement.</p>	Construction	Construction Contractor
<p>iii. Use forest trees for construction support structures Under no circumstance the contractor shall use forest trees for construction support structures: scaffoldings etc. Use of non-timber materials for scaffoldings and support structures should be made compulsory to contractor unless in essential cases. Contractor's terms and conditions should include strict restrictions on the use of local timber material during construction</p>	Site preparation and construction	Construction Contractor
<p>iv. Disposal of construction waste The contractor should pay special attention with respect to disposal of construction waste. Such waste if generated should store properly without getting washed off and dispose according to approved procedures by the PMU. Under no circumstances that construction waste should be disposed to nearby stream or its riparian zone.</p>	Site preparation and construction	Construction Contractor
<p>Contractors should implement sound traffic control plan as construction activities are to be taken place in road reservations</p>	Construction	Construction Contractor
<p>v. Dust and aerosol control screens Special screens etc. should be used if heavy dust or aerosol generating activities are envisaged</p>	Site preparation and construction	Construction Contractor
<p>vi. Water for construction Water for construction works should be obtained only from the approved sites</p>	Site preparation and construction	Construction Contractor
<p>vii. Community water supply The water line currently running adjacent the failed upslope need to be installed properly without being affected during the construction works.</p>	Site preparation and construction	Construction Contractor
<p>viii. Impacts on transport infrastructure (especially temporary loss of road or rail access, risks of traffic congestion) A good traffic control should be in place following the contractors ESMP specific to this site. As there is bend on the road adjacent to the site proper road safety measures should be included with warning signs and permanent trained watchmen</p>	Site preparation and construction	Construction Contractor

<p>ix. Workers health and safety As the workers in the site have to work in high risk conditions, it is imperative to implement recommendations given in section B of contractors' obligation on ESMP under "working conditions and community health and safety". These recommendations should be followed carefully in a proper organization and safety monitoring system. Additionally, work should be discontinued for sufficient time period during rainy period as working on unstable slopes will be highly risky in the rainy season. A good warning system and fulltime watchmen is strongly recommended for this site for both worker and commuter safety. Safety barriers and safety nets should be installed at places of risk to protect workers and commuters from boulder falling risk</p>	Site preparation and construction	Construction Contractor
<p>x. Working hours The construction activities should be restricted to day time only. Working after 6.p.m. is not recommended for any reason due to safety issues and impacts due noise and vibration on wildlife.</p>	Construction	Construction Contractor
<p>xi. Need for people to enter or cross the site Possible unauthorized access to the site should be avoided by awareness, warning signs and vigilance by the contractor's full time watchmen.</p>	Site preparation and construction	Construction Contractor
<p>xii. During construction good housekeeping should be maintained to minimize visual pollution.</p>	Site preparation and construction	Construction Contractor
<p>xiii. Open defecation and littering The potential water/soil pollution issues will be mitigated by</p> <ol style="list-style-type: none"> i. Awareness on water pollution and water borne infections, damage to downstream uses due to open deification ii. Arrange toilet facilities for workers in the proximity of the site iii. Vigilance and monitoring of worker mal sanitation practices iv. Punishment to worker violating the conditions v. Onsite sanitary facilities should be made available for the workers, and sanitary waste should be properly disposed. 	Site preparation and construction	Construction Contractor
<p>xiv. Awareness to workforce on the regulations pertinent to poaching and hunting, obligations on nature conservation, punishments to those who violate the law</p>	Site preparation and construction	Construction Contractor
<p>xv. Awareness to contractor's workforce on possible acts leading to fires, environmental obligations to protect the nature, regulations regarding intentional fires. Prohibition of setting fires at the site</p>	Site preparation and construction	Construction Contractor

12.8 Monitoring requirements specific to the site

Following monitoring plan is strongly emphasized during the construction phase specific to this site. In addition to this, monitoring procedure indicated in the contractors' obligation to ESMP should also be implemented by construction contractor.

Table 5: Environmental and Social monitoring plan; construction phase

Monitoring requirement	Parameters	Frequency
i. Baseline monitoring	Stream water quality	Once*
	Pre crack survey of the high risk houses	-
	Ground vibration	-
	Background noise measurement	Once*
	Air quality: particulate matter	Once*
ii. During construction	Stream water quality	During slope excavations, ground soil boring works (every month) *
	Crack survey of the high risk houses	-
	Ground vibration	-
	Construction noise	During heavy noise generation times *
	Air quality particulate matter	Once a month *
iii. Vehicular Emission	All machinery/vehicles operational should have the emission control test certificate as applicable - should be checked by the site ES officer of the consultant	
iv. Monitoring agency	* A competent independent monitoring agency with registration of Central Environmental Authority for all parameters except crack surveys **Crack surveys should be conducted by competent agency acceptable to PMU	
v. Reporting requirements	Stream water quality – Comparison with ambient water quality standards published by the CEA, 2017 Pre crack survey of the high risk houses -Professional report Ground vibration -as per The interim standards on vibration for the Machinery, Construction activities and Vehicular movements, CEA Background noise measurement –Extraordinary Gazette No.924.1, May 23,1996, CEA Air quality particulate matter - The National Ambient Air Quality standards stipulated under the Extraordinary Gazette, No. 1562/22 August 15, 2008 -Central Environmental Authority of Sri Lanka.	

13. Grievance redress mechanism for this site

Should be followed as per the recommendations of ESMF

14. Information disclosure

It is the responsibility of the PMU to disclose the ES information to following agencies and organizations by indicated modes as a minimum

Table 6: Proposed scheme of information disclosure

Information	Proposed agencies	Mode of information disclosure
i. Project plan (site details, design , implementation arrangements)	District CEA, DFC, DWLC, District Secretariat, Divisional secretary, RDA, State land owners Other district levels Agencies, NBRO district office, AIIB	Meetings, District coordination committee, submission of relevant report to sign agreements, approvals and consents.
ii. Environmental and Social Management plan	District CEA, DFC, DWLC, AIIB,	Meetings, District Coordination Committee, submission of relevant report to sign agreements, approvals and consents
iii. Monitoring reports (baseline and during construction)	District CEA, DFC, DWLC, AIIB and relevant parties as appropriate	Progress meetings, special meetings, submission of relevant reports
iv. Site inspections for environmental conformance workers health and safety	District CEA, DFC, DWLC, RDA, Divisional secretary, Police, State Land Owners, Grama Niladhari, District Office NBRO, AIIB and relevant parties as appropriate	Written and verbal communications, submission of relevant reports
v. Decisions taken at the progress review meetings pertinent to ES matters	District CEA, DFC, DWLC, RDA, Divisional secretary, Police, State Land Owners, Grama Niladhari, District Office NBRO, AIIB and relevant parties as appropriate	Meetings, submission of relevant reports
vi. Grievance redress mechanism	Relevant parties , AIIB	Meetings, written and verbal communications

Table 7: Level of information gathered through consulting institutions

Date	Institution	Person contacted for information
08/08/ 2018 @ 10.30 hrs	Road Development Authority	Mr. WPGI Werajeewa –Executive Engineer
08/08/2018 @ 13.00 hrs	Forest Department	Mr Nimal S Dewage – Range Forest Officer
09/08/2018 @ 10.00 hrs	Central Environmental Authority	Mr.K G.D.N Kiriella Director –CEA Ratnapura District
09/08/2018 @ 13.00 hrs	Department of Wildlife & Conservation (DWLC)	Mr Manjula Vidyarathna / Wild Life Range Officer Ratnapura
09/08/2018 @ 14.00 hrs	Land Reforms Commission	MS. Dulmini Patabadiarachchi Staff Assistant

Annexure I: Drone image of the project area (soon after the failure)



Annexure II: Images of the site condition and the consultation



Fig a: Upslope and down slope of the failed slope



Fig b: Forest cover above the failed upslope



Fig c: NBRO team communicating with the residents about the project



Fig d: The natural stream blocked by the debris flow, note well grown stream riparian vegetation cover

Annexure III: Report on the Stakeholder Consultation: Ratnapura District

Date: 08/08/2018 and 09/08/2018		
Institution	Name and designation of the contact officer	Concerns raised
Road Development Authority	Mr. WPGL Werajeewa – Executive Engineer	<ul style="list-style-type: none"> ✓ This area is under the jurisdiction of Ratnapura-Awissawella RDA regional office ✓ The RDA has no objection and states the mitigation is very much needed. ✓ Other concerns raised <ul style="list-style-type: none"> • A proper handing over of the project is required after the mitigation • RDA will do the maintenance after mitigation • It is emphasised that during the construction the contractor should use Personal Protective Equipment • At all times, the contractor shall provide safe and convenient passage for vehicles, pedestrians, and traffic safety measures, barricades, flagmen and for the night work, lights and illumination should be provided. ✓ It is also stated that Construction waste/ excavated materials should not be a nuisance to public/commuters
Forest Department	Mr Nimal S Dewage – Range Forest Officer	<ul style="list-style-type: none"> ✓ The Forest Department has no objection on the project <p>Following matters were emphasized.</p> <ul style="list-style-type: none"> ✓ There are Forest reservation in the Ratnapura district. However, some large portions of land still remain without clear boundaries and many of them are under jurisdiction of LRC. Currently the surveying of forested area is in progress. ✓ However, all lands under forest, private or under LRC and any other if cleared require approval from Forest Department ✓ Private/LRC/Forest land require approval from forest Department for complete clearance of land as in the case of boundaries are still not clear. ✓ Role of Forest Department is that they examine the plot to be cleared, measure the breadth of trees to be removed and specific habitat significance of the area to be cleared. The plot will be surveyed by the FD and report will be submitted to Timber Cooperation. The tree can be cut by the contractor, however, removal will be done by the Timber cooperation. All trees dbh of > 18 cm will be taken by the Timber Cooperation. ✓ Regarding the project implementation, he said that mitigation proposal with draft layout should be submitted to Conservator Forest and approval to be obtained. ✓ This does not apply only forested areas but isolated any location in the proximity of forest ✓ As Ratnapura is having lot of forest areas, therefore project is required to obtain consent for project implementation with the services of conditions such as; <ul style="list-style-type: none"> • No entry of forest reserves, extraction of forest species, timber for project work, any other • Chemical blasting should be done in a manner not harmful to fauna • Structural mitigation measures should essentially have followed environmentally friendly aesthetically comparable designs.

		<ul style="list-style-type: none"> • If plants are used for remediation prior approval should be obtained • Early informing the project, the Forest Department can support the project by providing good quality trees for planting. • Prior approval for suitable species for reforestation should be obtained from Forest Department. <ul style="list-style-type: none"> ✓ The Central Environmental Authority (CEA) will directly intervene for removal of forested area of > 1ha in the lands of LRC or private lands ✓ The Central Environmental Authority (CEA) and forest Department will intervene removal of forested area of < 1ha in the lands of LRC or private lands ✓ The clearance process may demand baseline studies for certain sites in which aquatic and terrestrial habitat surveys may be recommended. Similar reports may be demand by CEA during the project implementation.
Central Environmental Authority	Mr.K G.D.N Kiriella Director –CEA Ratnapura District	<ul style="list-style-type: none"> ✓ Under the Soil Conservation Act 772/22 of 1996. of National Resource Management Centre, Ratnapura District has been gazetted a sensitive area except the Embitipitiya area ✓ Under this gazette any development is not allowed irrespective of the magnitude of the project. ✓ In a disaster this is not needed. ✓ The Basic Information Questionnaire (BIQ) is needed to fill for the project and submit the application ✓ Since the waterway is located downslope in the area it is needed to keep the Environmental flow ✓ There may be endemic species, special habitats (niches) , fauna flora study are needed ✓ This Environmental assessment may be required to see their difference after mitigation ✓ The CEA will grant approval with recommendations.
09/08/2018		
Institution	Name and designation of the contact officer	Concerns raised
Department of Wildlife & Conservation (DWLC)	Mr Manjula Vidyarthna / Wild Life Range Officer Ratnapura	<ul style="list-style-type: none"> ✓ No objection on the project ✓ A report to be submitted to DWLC for approval ✓ Removal of Fauna & Flora is needed under Wild Life Ordinance ✓ Removal of flora & fauna; endemic, threatened, identified under Red List needed approval from DWLC.
Land Reforms Commission	MS. Dulmini Patabadiarachchi Staff Assistant	<ul style="list-style-type: none"> ✓ If the land tenure is Land Reforms Commission an approval should be requesting from Commissioner –Land Reforms Commission through a letter

Annexure IV: Proposed procedure for obtaining approvals from state land owners and environmental agencies

1. Proposed procedure by RDA for approval for implementation of landslide mitigation projects in RDA reservation areas

- i. The design to be approved by the RDA: The project implementing agency should submit detailed design report to RDA with a formal request on nature of approvals required. PMU should prepare above documents and should submit the documents to RDA regional office.
- ii. RDA regional office will evaluate the proposal and may call for project briefing. The PMU should provide necessary briefing as appropriate
- iii. On the approval by RDA an agreement will be signed between RDA and Project implementing agency to access the site, erect structures, and implement mitigation works.
- iv. A conditions that would include is
 - A proper handing over of the project is required after the mitigation
 - RDA will do the maintenance after mitigation
 - It is emphasised that during the construction the contractor should use Personal Protective Equipment
 - At all times, the contractor shall provide safe and convenient passage for vehicles, pedestrians, and traffic safety measures, barricades, flagmen and for the night work, lights and illumination should be provided.
 - Construction waste/ excavated materials should not be a nuisance to public/commuters

2. Proposed approval procedure for Environmental Clearance form District Central Environmental Authority

- i. In the project preparation phase, the ES & H&S unit of PMU study the Site specific ESMPs and should submit the project proposal to district office of CEA with details of the Arial extent that would be influenced by the project actions with spatial references to sections of site specific ESMP relevant to the project.
- ii. A basic information questioner (BIQ) should be completed and submitted along with the above details
- iii. CEA may call for project briefing and further information on ESMP that should be provided by the PMU
- iv. Approval will be granted subjected to site specific conditions that should be adhered by the project

Annexure V: Study team

Name	Designation	Position in the study
TDSV Dias	Director/ ESSD/NBRO	Team leader
SAMS Dissanayake	Senior Scientist/ESSD/NBRO	Senior Environmental Scientist
Prabath Liyanaarachchi	Scientist/ ESSD/NBRO	Environmental scientists
Abheetha Wanasundara	Officer in charge / Ratnapura District	Geotechnical Engineer
Indu Upamali	Scientist/ LRRMD/NBRO	Geologist
H Kusalasiri	Technical Officer/ESSD/NBRO	GIS/Demographic data /survey support

Annexure VI: List of references

1. NBRO site investigation report on landslide disaster at Durekkanda – (Ref. Report No. NBRO/LRRMD/RT/17/31/30977-ERR)
2. Contractor’s obligations for Environmental and Social Management Plan- Sri Lanka Landslide Mitigation Project-AIIB
3. Environmental and Social Management Framework-Sri Lanka Landslide Mitigation Project _AIIB
4. Resettlement Planning Framework- Sri Lanka Landslide Mitigation Project -AIIB