Initial Environmental Examination

August 2021

Sri Lanka: Health System Enhancement Project—Additional Financing

Prepared by Project Management Unit (PMU) of Health System Enhancement Project (HSEP), Ministry of Health for the Asian Development Bank. This is an updated version of the draft originally posted in July 2021 available on https://www.adb.org/projects/documents/sri-51107-003-iee.

CURRENCY EQUIVALENTS

(As of 17 August 2021)

Currency unit	–	Sri Lanka rupees (SLRe/SLRs)
SLRe1.00	=	$0.00501
$1.00	=	SLRs199.50

ABBREVIATIONS

ADB	–	Asian Development Bank
CEA	–	Central Environmental Authority
DSD	–	divisional secretary division
EHS	–	environment, health & safety
EMP	–	environmental management plan
EMOP	–	environmental monitoring plan
EPL	–	environmental protection license
GRM	–	grievance redress mechanism
H&SP	–	health and safety plan
HCF	–	healthcare facility
HCW	–	health care waste
HCWM	–	health care waste management
HSEP	–	Health System Enhancement Project
IEE	–	initial environmental examination
MOH	–	Ministry of Health
NEA	–	National Environmental Act
O&M	–	operation and maintenance
PDHS	–	provincial director of health services
PIU	–	project implementation unit
PMCU	–	primary medical care units
PMU	–	project management unit
PPE	–	personal protective equipment
SKS	–	*saukya karya sahayaka*
SPS	–	Safeguard Policy Statement
SWL	–	scheduled waste license

NOTE

In this report, "$" refers to United States dollars

GLOSSARY

grama niladhari - is a Sri Lankan public official appointed by the central government to carry out administrative duties at village level.

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ANNEXES

EXECUTIVE SUMMARY

Strengthening primary health care (PHC)—both primary medical care and preventive health services—in Sri Lanka needs priority attention to tackle the rising costs of health care as well as to improve primary health services to lagging populations to meet the emerging public health challenges. The current health system under-invests in primary care and limited government funds mostly cater to higher-level hospitals. Given this background, the government has begun reforms to rationalize health care utilization with increased focus and orientation towards PHC to meet the emerging challenges in the health sector.

The Government of Sri Lanka implemented the Health System Enhancement Project (HSEP) to address these issues. Financed by the Asian Development Bank (ADB) through a concessional loan of $37.5 million from ADB's ordinary capital resources and a $12.5 million grant from ADB's special funds resources, the project was approved on 23 October 2018. The project is being implemented in nine districts covering the provinces of Central, North Central, Sabaragamuwa, and Uva which are lagging in health care services.

Ministry of Health (MOH) is the project's executing agency, while the project management unit (PMU) established in the MOH is implementing the project. Project implementing units (PIUs) established in each project-supported province is responsible for project implementation at provincial level which include project supervision, coordination, and undertaking procurement of civil works.

The spread of the coronavirus disease (COVID-19) pandemic in the country from March 2020 caused the project to channel some project funds to assist the immediate health care needs as requested by the government.

A mission from ADB in November 2020 identified that (i) $15 million financing gap which arose following the reallocation of $10 million and $5 million from the original loan and grant allocations respectively to emergency COVID-19 response; (ii) $25 million for project scaling up; and (iii) $5 million for the 18-month project extension due to COVID-19. The mission also emphasized that the original ratio of government counterpart funding at 20% of the ADB allocation (excluding the COVID-19 reallocation) should be maintained.

An additional financing has been considered for the ongoing HSEP considering the achievements of the ongoing project; the government's request for scaling up the project and extension of the project implementation period, as well as further addressing the ongoing third wave of COVID-19 pandemic; and the need to reallocate the funds utilized for immediate response to COVID-19 requirements in 2020. The additional financing shall be sourced through ADB funds supported by a grant from the Japan Fund for Poverty Reduction and government counterpart funding. The total allocation for the proposed additional financing of HSEP shall be $123 million and shall continue to support in strengthening PHCs, both in primary medical care and preventive health services in Sri Lanka. MOH shall continue as the executing agency for the additional financing of the project, while the PMU and PIUs shall continue to implement the project.

In compliance with the ADB Safeguard Policy Framework, the sub-projects involving civil works included in the HSEP have been classified as environmental assessment category B, which requires conducting an initial environmental examination (IEE). The Rapid environmental assessment carried out at the outset of the IEE study confirmed that the overall categorization of

the project, which is category B, based on the ADB Safeguard Policy Statement, is still valid. This IEE report covers that the physical interventions proposed by the HSEP is carried out as a requirement of the Safeguard Policy Framework of the ADB as outlined in the environmental assessment and review framework prepared for the HSEP.

Proposed activities under additional financing to support output 1 include shared care cluster support—base hospital development in nine districts (one per district). Civil works at the nine base hospitals in the nine districts are proposed. In addition, sewerage systems renovation or upgrading at eight of the cluster apex hospitals are also proposed. In addition, supply of medical equipment and furniture to nine base hospitals (cluster apex) in each of the nine district clusters is also envisaged. The following operational support to make clusters functional is also proposed: (i) payment of internet connectivity charges across all provincial director of health services, regional director of health services, and all district health facilities; (ii) payment of internet data charges for PHC staff and cluster-linked staff; (iii) managing vehicle hires for establishing health care waste management (HCWM) arrangements, transporting laboratory specimens within the clusters, establishing travel arrangements for staff working within and across clusters, carrying out supervision and monitoring, and providing outreach services by cluster hospital staff; and (iv) establishing cluster-based radiology and mobile laboratory services.

Proposed activities under additional financing to support output 2 include health information technology for better continuity of care and disease surveillance: COVID-19 response (reallocated funds) and COVID-19 management support (equipment and minor civil works). These include installation of 14 oxygen concentrator plants, and 14 large liquid oxygen storage facilities. Supply of medical oxygen and piping systems are also proposed at selected healthcare facilities, and purchasing of new ambulances and renovation of selected ambulance stations.

Proposed activities under additional financing to support output 3 include Distance Learning Centre and National Institute of Health Services development, costs to accommodate project extension (including PMU additional costs), and contingency allocations.

The Japan Fund for Poverty Reduction grant shall assist the project output 2 by introducing new ambulances to the existing health care vehicle fleet and by renovation of selected ambulance stations.

The nine apex hospitals selected in nine districts are located within the four provinces (Central, North Central, Sabaragamuwa, and Uva) which were selected under the ongoing HSEP. Civil works proposed for each of the subproject will include construction of new buildings and repair or renovation of existing buildings (or parts of buildings). The new buildings shall addition another 25,600 square meters of area into the existing building footprint of these hospitals. New sewage systems shall also be introduced to selected hospitals.

It was observed that the proposed sites for the establishment of the new facilities are located within existing health care facility (HCF) premises. None of the sites are located within or adjacent to areas that are ecologically or environmentally sensitive. New constructions are proposed for so of the hospitals (additions, extension, or construction of part of the existing building). Renovations are proposed for selected buildings at all nine locations. It is evident that most of the environmental issues during the construction phase is related to localized and temporary impacts such as (i) elevated levels of dust, noise, vibration; (ii) pollution due to solid waste disposal, including potentially hazardous components such as discarded construction material, construction wastewater, and operation of labor camps; (iii) onsite drainage impairment;

(iv) soil erosion and potential for alteration of surface drainage patterns; and (v) risk of occupational health and safety for construction workers. All these impacts can be minimized and mitigated with the adequate implementation of the provisions given in the environmental management plan. Moreover, the period of construction is also not long due to the simple nature of the construction.

None of the hospitals, other than Teldeniya district base hospital, has proper wastewater collection, treatment, and discharge systems. It is essential that all these hospitals appropriately treat wastewater prior to its disposal. Most importantly, the treated effluent must comply with regulatory limits and environmental protection licenses have to be obtained for each facility.

Oxygen concentrators, concentration or generation plants, gas cylinders, and gas conveyance systems should be installed and used based on a strict standard operating procedure, maintenance schedules, regular risk assessments and safety audits, and adopted and well-established proper monitoring systems and contingency plan. Tasks related to gas handling and maintenance should be carried out only by trained personnel and maintenance work should be attended only by competent personnel who are authorized to attend to such maintenance work. Such procedures should be well-established and documented prior to implementation.

As documented in this IEE Report, the current practices of hazardous HCWM in hospitals are inadequate and unhygienic. While a reasonable attempt is made at segregating waste according to the category at the point of generation, the segregation is not maintained throughout. Finally, the waste is openly burnt at all the sites that were visited. With the increased collection of clinical and infectious waste once the new facilities are established, such inappropriate waste management at HCFs are bound to increase, raising the risks for public health and the environment.

Findings of the IEE confirm that the positive impacts of the project far outweigh any negative impacts arising out of establishing new facilities at the five HCFs. None of the environmental impacts identified is irreversible and widespread; instead, they are localized, temporary in nature and short-term. With proper site management and safety practices, these impacts can be effectively managed. Stakeholder consultations have revealed that the demand for better and increased quality of healthcare services are urgently needed in the country. As such, the project will be a positive step towards providing better health services to the country, as well as prepare the country to face emerging health sector challenges successfully in the coming decades.

Among the recommendations, completion of the construction work at the shortest possible time which would minimize most of the impacts that will affect the hospital users will be stressed. HCWM, including proper strategies to be developed and implemented to manage the issue, and building capacity and awareness within hospital staff for HCWM, would be given priority. Also, a proper sewer disposal system by installing suitable on-site wastewater treatment systems (e.g., septic tank and suitable soakage arrangement) is needed. In addition, the improved facilities should be supplied with a dedicated electricity connection, water supplies, and telecommunication facilities by the HCFs. Additional water storage will also be needed. In conclusion, implementation of the environmental management plan and the environmental monitoring plan is essential to make sure that any environmental impacts are effectively mitigated.

I. INTRODUCTION

A. Project Background

1. The ongoing Health System Enhancement Project (HSEP) aims at strengthening the primary health care (PHC), both primary medical care and preventive health services in Sri Lanka. The project is financed by the Asian Development Bank (ADB) through a concessional loan of $37.5 million from ADB's ordinary capital resources and a $12.5 million grant from ADB's special funds resources, was approved on 23 October 2018. The counterpart funding of $10 million (i.e., equivalent to 20% of the ADB allocation) has been allocated by the Government of Sri Lanka for the project.

2. This project aligns with priorities identified by the government in the Public Investment Program (2017–2020), as well as with the Health Master Plan's National Strategic Framework for Development of Health Services (2016–2025). The project is also in line with the ADB Sri Lanka country partnership strategy (2018–2022). The project is being implemented in nine districts covering the provinces of Central, North Central, Sabaragamuwa, and Uva which are lagging in health care services.

3. The project is executed by the Ministry of Health (MOH), while the project management unit (PMU) setup at the ministry is implementing the project. Project implementing units (PIUs) established at provincial level (in the above provinces) assist the PMU in implementing the project at provincial level.

4. In March 2020, Sri Lanka reported its first coronavirus disease (COVID-19) case which is declared as a global pandemic. As response to an immediate request by the government some of the allocations of the ongoing project was channeled to the health care services to assist the immediate health care needs that arose due to this pandemic. A mission from ADB in November 2020 identified the following: (i) $15 million financing gap which arose following the reallocation of $10 million and $5 million from the original loan and grant allocations respectively to emergency COVID-19 response; (ii) $25 million for project scaling-up; and (iii) $5 million for the 18-month project extension due to COVID-19.

5. Considering the achievements of the ongoing project, the government's request for scaling-up the project and extension of the project implementation period as well as further addressing the ongoing third wave of COVID-19 pandemic, and the need to reallocate the funds utilized for immediate response to COVID-19 requirements in 2020; an Additional Financing (AF) has been proposed for the ongoing HSEP.

6. This additional financing shall continue to support in strengthening PHC, both in primary medical care and preventive health services in Sri Lanka. MOH shall continue as the executing agency for the additional financing of the project, while the PMU and PIUs shall continue to implement the project.

7. This document presents the initial environmental examination (IEE) prepared by the environmental specialist, HSEP, in consultation with the PMU, its project director, deputy project directors (DPDs) at PIUs and other consultants, and MOH; and covers the interventions proposed under additional financing of the HSEP.

B. Objectives of the Projects and Additional Financing

8. The broad objective of the HSEP is to improve services offered by the primary medical care facilities that include primary health care units (PMCUs), divisional hospitals (DHs) and field health centers.

9. The proposed additional financing shall support above objective as well as to assist the government in addressing the ongoing third wave of COVID-19 pandemic.

C. Objectives of the Initial Environmental Examination

10. Projects and programs financed by ADB need to comply with ADB's safeguard policies as detailed in the Safeguards Policy Statement (SPS) of 2009. The environmental assessment and review framework (EARF) prepared for the ongoing project has been updated for the proposed additional financing. Therefore, subprojects and components eligible for funding under the additional financing will be required to satisfy the ADB's safeguard policies, in addition to conformity with environmental legislation of the Government of Sri Lanka.

11. The objective of the IEE is to:

(i) gather and provide information about specific project interventions;
(ii) gather and provide information about the general baseline environmental setting of the larger project area with special reference to the land-use and existing environmental sensitivities of the specific locations of nine apex hospitals to be improved in nine districts;
(iii) identify potential beneficial and adverse effects on the existing physical, biological, and socio-economic environment during pre-construction, construction, and operational phases of the project;
(iv) propose mitigation measures to avoid or minimize project-induced negative impacts and enhance positive impacts, with attention on providing guidelines for handling hazardous waste;
(v) formulate an effective environmental management plan (EMP) which can be used as a template for all facilities, to be improved with guidance on site-specific issues to be included in the individual bidding documents, including costs of mitigation and institutional responsibilities; and
(vi) provide information on the public consultation process undertaken, and the project level grievance redress mechanism (GRM) established.

D. Approach, Methodology and Personnel Involved

12. This IEE was carried out based on:

(i) review of literature pertaining to the baseline environmental conditions of the project area;
(ii) environmental screening of each site; and
(iii) discussions with key government agencies such as MOH, provincial and regional directorates of health services, and the Ministry of Environment to obtain their strategic views of the project.

13. Environmental screening for each site included (i) a field visit to each of the nine apex hospitals to make direct observations of the areas, and (ii) filling of an environmental checklist

on-site based on direct observations and consultations with medical staff, health workers, and patients to record site-specific data supported by photo documentation. A composite environmental checklist is appended as Annexure 1 to this IEE report.

14. The IEE was prepared based on preliminary studies and feasibility studies and will be updated based on detailed design. The IEE covers civil works in base hospitals in nine districts, supply of medical Oxygen, and improvements to the Suwa Seriya Ambulance service. Proposed repair and renovation works for the National Institute of Health Sciences (NIHS) and Distance Learning Centers (DLCs) are minor and are not covered in this IEE report. The IEE also includes a preliminary assessment of environmental compliance with respect to existing facilities that are considered for expansion and upgrading under additional financing. However, a more comprehensive compliance audit shall be completed along with screening of each subproject under detail studies.

II. DESCRIPTION OF THE PROJECT

E. Project Impacts and Outcomes

15. Proposed investment in the project will continue to improve the primary and secondary health care management in selected lagging regions of the country, helping Sri Lanka's health system to adapt to emerging challenges and deal with shifting disease burdens.

F. Scope of Civil Work

16. Civil works under the ongoing program is focused mainly on expanding facilities within the outpatient's department (OPD) in primary medical care units (PMCUs) and divisional hospitals and nine apex base hospitals, typically adding between 1,000 to 2,000 square feet to the existing building footprint within the same premises depending on the institution's requirements.

17. The additional financing component of HSEP shall include construction of new building facilities within the nine apex cluster hospitals to accommodate emergency treatment units (ETU), OPDs, surgical theaters, dental services, eye theaters, and drug stores. These new buildings shall add about 22,600 square meters area of footprint to the existing building facilities in these nine hospitals. New sewage treatment plants shall also be constructed in selected hospitals. Renovation and refurbishment of existing buildings of these hospitals shall also be carried out. Such works shall be limited to repair or wards or clinics, improvements to existing corridor systems and access, and color washing. These activities shall not extend beyond the existing footprint of the buildings.

18. Further description of the scope of work proposed for HSEP additional financing is discussed below.

G. Project Components Proposed Under Additional Financing

1. Output 1: PHC enhanced in Central, North Central, Sabaragamuwa, and Uva Provinces

19. The proposed activities under the additional financing to support output 1 include the following:

(i) shared care cluster support**:** base hospital development in nine districts (one per district);
(ii) civil works such as: (a) civil works at the nine base hospitals in the nine districts; and (b) sewerage systems renovation or upgrading at eight of the cluster apex hospitals;
(ii) medical equipment and furniture to nine base hospitals (cluster apex) in each of the nine district clusters which are: package 1 - theatre equipment; and package 2 - physiotherapy equipment; and
(iii) operational support to make clusters functional including: (a) payment of internet connectivity charges across all provincial directors of health services (PDHS), regional directors of health services (RDHS), and all district health facilities; (b) payment of internet data charges for PHC staff and cluster-linked staff; (c) management of vehicle hires for establishing a health care waste management (HCWM) arrangements, transporting laboratory specimens within the clusters, establishing travel arrangements for staff working within and across clusters, carrying out supervision and monitoring, and providing outreach services by cluster hospital staff; and (d) establishment of cluster-based radiology and mobile laboratory services.

20. The nine base hospitals selected under the shared cluster support (apex hospitals) and proposed assistance under the additional financing is summarized in Table 1, while Figure 1 presents the locations of each apex hospital.

Table 1: Hospitals Selected to Implement Proposed Activities Under Additional Financing for Shared Care Cluster Support—Base Hospital Development

Province	District	Cluster	Civil works	Sewerage works	Medical equipment and furniture
North-Central	Anuradhapura	Thambuthegama	√	√ [a]	√
	Polonnaruwa	Medirigiriya	√	√ [a]	√
Central	Nuwara Eliya	Riklagaskada	√	√ [a]	√
	Matale	Dambulla	√	√ [b]	√
	Kandy	Theldeniya	√	X [c]	√
Uva	Badulla	Welimada	√	√ [a]	√
	Monaragala	Bibile	√	√ [a]	√
Sabaragamuwa	Ratnapura	Kahawatte	√	√ [d]	√
	Kegalle	Karawanella	√	√ [d]	√

√ = included, GOSL = Government of Sri Lanka, X = not included.
[a] New sewage system.
[b] Under Responsive COVID-19 Vaccines for Recovery Project (RECOVER)
[c] The Theldeniya base hospital has a good sewerage system that is functional.
[d] The sewage system shall be funded by the Government of Sri Lanka.
Source: Project Management Unit, Health System Enhancement Project, MOH

2. Output 2: Health information, disease surveillance capacity, and COVID-19 response strengthened

21. Proposed activities under the additional financing to support output 2 include the following:

(i) health information technology for better continuity of care and disease surveillance: COVID-19 response (reallocated funds);

(ii) COVID-19 management support (procurement of laboratory and medical equipment and consumables, furniture, and minor civil works); and
(iii) prehospital care system enhancement to ensure timelier and higher quality of care of COVID-19 patients (procurement of ambulances and minor civil works to renovate ambulance stations).

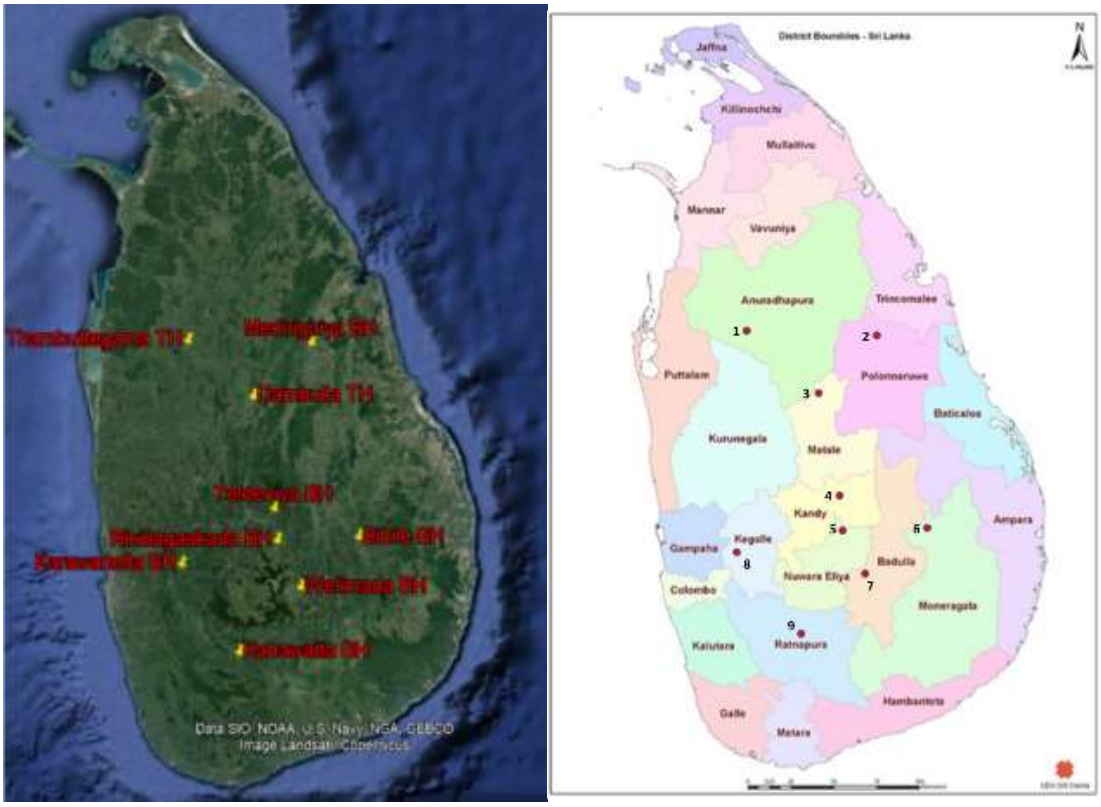
3. Output 3: Policy development, capacity building and project management supported

22. The proposed activities under the additional financing to support output 3 include the following:

(i) DLC and NIHS development (minor civil works and equipment for information technology facilities);
(ii) costs to accommodate project extension (includes PMU additional costs); and
(iii) contingency allocations.

23. **COVID-19 reallocation support of $15 million.** Through memos dated 25 March 2020 and 10 April 2020, ADB approved the reallocation of $10 million loan proceeds and $5 million grant proceeds from the project to support the government in meeting the urgent requirements detailed above. The procurement under this financing is being utilized to procure essential medical equipment, consumables, and necessary civil works, which are in line with output 2 of the project.

Figure 1: Location of the Nine Base Hospitals in the Four Provinces (Nine Districts)



BH = base hospital.
Source: Asian Development Bank, UDA GIS Centre

24. The funds are being used to meet the urgent requirements of the central and provincial hospitals, COVID-19 treatments centers, etc. Among the various procurements under this $15 million, the establishment of a polymerase chain reaction (PCR) lab at Mulleriyawa base hospital as a total solution; commitment of operational support for the functioning of this lab for one year, i.e., procurement of reagents and consumable; procurement of personal protective equipment (PPE), various COVID-19-related urgent medical equipment; and the refurbishment of cold room at Medical Research Institute can be treated as a short-term solution. In addition, under the medium-term investment, the construction of the molecular biology lab at Infectious Disease Hospital, the renovation of isolation rooms at the National Institute Infectious Diseases, quarantine unit at the Medical Research Institute, and refurbishment of isolation centers at four harbors (Colombo, Galle, Hambantota, and Trincomalee) are currently at the bid evaluation stage.

25. **Japan Fund for Poverty Reduction grant of $5 million**. This shall support the additional financing in (i) reduced response time of Suwa Seriya Ambulance service (by expanding the present vehicle fleet by purchasing new ambulances and renovation of ambulance stations); (ii) reduced turnaround time of the Suwa Seriya service; and (iii) improved capacity of the emergency medical technicians, call center staff, pilots, and ETU staff.

26. The location information, present condition, and proposed works of each base hospital

are presented in Annexure 2. It also presents the proposed ambulance locations and stations to be renovated.

H. Financing Plan for Additional Financing

27. Table 2 shows the summary of financing plan for the proposed additional financing with a total of $123 million. This includes a grant component from the Japan Fund for Poverty Reduction and counterpart funding from the government.

Table 2: Summary Financing Plan

	Current[a]		Additional Financing		Total	
Source	**Amount** ($ million)	**Share of Total** (%)	**Amount** ($ million)	**Share of Total** (%)	**Amount** ($ million)	**Share of Total** (%)
Asian Development Bank						
OCR (regular loan)	0.0	0.00	110.0	89.43	110.0	60.11
OCR (concessional loan)	37.5	62.50	0.0	0.00	37.5	20.49
Special Funds resources (Asian Development Fund grant)	12.5	20.83	0.0	0.00	12.5	6.83
Japan Fund for Poverty Reduction (grant)[b]	0.0	0.00	3.0	2.44	3.0	1.64
Government	10.0	16.67	10.0	8.13	20.0	10.93
Total	**60.0**	**100.00**	**123.0**	**100.00**	**183.0**	**100.00**

ADF = Asian Development Fund, OCR = ordinary capital resources.
[a] Refers to the original amount (and past additional financing).
[b] Administered by Asian Development Bank.
Source: Asian Development Bank.

III. ALTERNATIVE ANALYSIS

28. Present health care system in the country has successfully dealt with deaths due to communicable diseases and those relating to maternal, childbirth, and perinatal causes. However, deaths due to non-communicable diseases and accidents are sharply on the rise. Further, the rapidly changing demographic and epidemiological patterns has created new challenges for the health sector of Sri Lanka. It is also known that most of the secondary and tertiary health care facilities are overcrowded with patients and have exceptionally high bed occupancy rates, while the PHC facilities continue to be underutilized with bed occupancy rates as low as 25%–40%. The implications of this situation on health expenditure are overwhelming. The present wave of COVID-19 has posed additional pressure on both infrastructure and human resources in the health sector.

A. No Project Alternative

29. A no project alternative would mean that the PHC sector will continue to be underutilized and underdeveloped, causing the burdens of changing disease patterns and rising health costs to adversely affect the sector, and in the long-term, undermine the commendable achievements that Sri Lanka has gained in its health indicators.

B. With Project Alternative

30. With the implementation of HSEP and its additional financing, an efficient network of PHC facilities linked with a selected cluster of base hospitals as apex hospitals shall be established.

Such network shall provide more effective preventive and curative care to the local community who would benefit vastly from savings in out-of-pocket health expenses and long-distance travel to higher level hospitals seeking better treatment. Savings on travel time for patients and families would provide them the opportunity to spend more time on their livelihood activities as well. Furthermore, it shall assist in overcoming the health challenges posed by the current wave of the COVID-19 pandemic or any such rick in the future. Therefore, the project is an essential investment that will help make good use of existing hardware and software in the PHC sector.

IV. ASSESSMENT OF THE LEGAL FRAMEWORK AND INSTITUTIONAL CAPACITY

A. Existing Health Care Waste Management Framework in the Country

1. Draft national policy on health care waste management

31. In 2001, the Government of Sri Lanka drafted a comprehensive national policy on health care waste management. It has three main sections covering the following:

(i) general considerations on HCWM and the institutional mechanism for policy implementation should be set up at the national level;
(ii) provisions for the safe management of health care waste (HCW) in medical institutions, including regulations and HCWM plans; and
(iii) provisions for the implementation of and the monitoring of HCWM plans at national and provincial levels, including legislation, provision of human and financial resources, training and awareness, and participation of the private sector.[1]

32. Some salient features of the draft policy are highlighted below:

(i) HCW generated by the medical institutions of the public and private sector must be safely handled and disposed of. HCWM is an integral part of hospital hygiene and infection control. Hence, each health care facility (HCF) is legally responsible for the proper management of waste that it generates until its final disposal.
(ii) Major hospitals must prepare specific HCWM plans outlining needs, objectives, strategies, and procedures for approved management and disposal of HCW and timeframe for implementation. The PDHS must set up annual provincial and district HCWM plans to present the strategy for HCWM that should be developed at the regional level. The provincial and regional plan shall be a compilation of individual HCWM plans of each HCF the province is responsible for. All plans need to be validated and supported by the central or provincial health services before implementation.
(iii) Specific budget lines need to be developed relating to hospital hygiene and HCWM in the National Accountancy of the Health System to ensure sufficient human and financial resources are allocated to implement the HCWM plans in medical institutions.
(iv) Policy implementation needs to be monitored based on specific objectives defined in the National Action Plan (the plan developed to implement the policy country-wide - see below paragraph 33) and that institutionally, the National Committee on Clinical Waste Management is responsible for the overall monitoring and

[1] Government of Sri Lanka, Ministry of Health. 2001. *Draft National Policy on Health Care Waste Management.* Colombo.

evaluation and the PDHS for the implementation of monitoring procedures in HCFs within their area of jurisdiction.

(v) Other key aspects highlighted relate to approved HCWM practices, equipment for treatment and disposal, training and awareness, involvement of civil society, and private sector participation.

33. The institutional mechanism for implementing the national policy is envisaged under three levels of management:

(i) At the central level, coordination and development of strategies and mechanisms to implement policy commitments in accordance with national requirements have been vested with the National Committee on Clinical Waste Management (NCCWM). In addition, the development of training and capacity building packages, training implementation supervision, setting up of HCW monitoring protocols, overall monitoring and evaluation has been assigned to the NCCWM. The central health services are responsible for technically backstopping HCFs under its management purview.

(ii) At the provincial level, implementation of the policy has been vested with the provincial councils. The PDHS is responsible for setting up provincial HCWM plans, synthesized from individual hospital HCWM plans coming under its area of jurisdiction, developing financial resources, and implementing HCW monitoring and auditing procedures.

(iii) At the local level, the setting up of HCWM plans that outline needs, objectives, strategies, procedures, and timeframes for medical institutions has been vested with the hospital management.

34. The national policy on HCWM to this date remains a draft as all attempts for its formal adoption in the past has not been successful.

2. National guidelines on health care waste management

35. In 2001, the government drafted national guidelines for health care waste management with the aim of (i) providing a better understanding of the fundamentals of HCWM planning, and (ii) directing HCFs in setting necessary procedures and standards to comply with policy and legislative requirements. These have been drafted in a form that provides all fundamental elements that should be integrated into future legislation specific to HCW. Although guidelines were reviewed by the NCCWM as well as the MOH, they did not receive formal endorsement by the government.

36. The draft national guidelines contain both practical and conceptual information on HCWM, covering four main sections:

(i) definition and categorization of HCW, including potential harmful effects that can result from its improper management;

(ii) procedures for segregation, packaging, labelling, collection, storage, transportation, and disposal (including the selection of appropriate treatment and disposal technologies for HCW) should be applied and followed by all HCFs in the country;

(iii) instructions for the implementation of HCWM plans, including a detailed description of duties and responsibilities of health care provider at various levels; and

(iv) instruction for personnel of central and provincial health services who oversee HCWM to ensure smooth implementation of the guidelines and to set up regular monitoring mechanisms.

37. In 2007, concise guidelines for HCWM were prepared under the Hospital Efficiency and Quality component of the Sri Lanka Health Sector Development Project based on the detailed draft guidelines prepared in 2001. The concise guidelines, which mainly contain sections in waste categorization and HCWM procedures, have been formally adopted and incorporated into the Handbook of Infection Control.

38. **Code of Hygiene**. Management of HCW is an integral part of hospital hygiene and infection control that must be reinforced with internal rules. In 2008, the government developed a comprehensive Code of Hygiene that completed the existing Infection Control Handbook. The national Code of Hygiene contains recommended HCWM procedures and is seen as part of an overall set of actions to control the hygiene conditions within the hospital. It sets out duties and responsibilities of medical and non-medical staff regarding hygiene procedures to be applied, recommended practices to maintain a high level of hygiene, and ongoing management and managerial activities to be carried out in the hospital. The code of hygiene must be implemented along with the HCWM guidelines.

39. **National color code.** In 2006, the MOH developed a national color code for implementing a uniform system for separating HCW streams based on the type of waste, treatment, and disposal methods. The code recommends technical specifications for bags and bins to be used for different waste types. The national color code identifies seven specific categories as presented in Table 3.

Table 3: National Color Code for Segregation of Health Care Waste

Color	Category	Contents
Yellow	Infectious	Cultures or stocks from microbiology, tissues from surgeries and autopsies, materials, or equipment in contact with blood or body fluids, soiled linen, and dialysis equipment such as tubing and filters
Yellow with red stripes	Sharp waste	Sharps, needles, and IV sets contaminated with body fluids
Black	General waste	General or municipal waste that is uncontaminated
Green	Biodegradable waste	Garden, kitchen, and food waste
Red	Glass waste	Uncontaminated drink bottles, and water bottles
Blue	Paper waste	Paper, cardboard, and office stationery
Orange	Plastic waste	Uncontaminated plastic medicine bottles, saline bottles without IV sets, and plastic bags

IV = intravenous.

Source: Government of Sri Lanka, Ministry of Health. 2021. *Environmental management framework for health care waste and infrastructure development (Draft)*. Colombo.

40. The national policy on HCWM to this date remains a draft as all attempts for its formal adoption in the past have not been successful. As a result, there have been no legal enactments made to operationalize the policy. As such, to this date, the national policy and guidelines on HCWM serves as a broad guideline only with no mandatory binding legal requirement. The only

legal requirement for HCW in Sri Lanka stems from the National Environmental Act, as explained below.

3. Guideline for management of COVID-19 infectious waste

41. The Directorate of Environmental and Occupational Health (DE&OH) of MOH in March 2020 issued a guideline to manage COVID-19-related infectious waste and is available in Annexure 3. As per this guideline, the infectious waste generated from any HCF treating COVID-19 cases shall only be treated using the methods: (i) incineration; and (ii) using a metaMizer.[2]

B. Environmental Legislation

42. The requirement for environmental assessment and environmental pollution control in Sri Lanka is established by the National Environmental Act (NEA), No. 47 of 1980 and its amendments (No. 56 1988 and No. 53 of 2000). The three main regulatory tools implemented under the NEA are environmental impact assessment (EIA) or IEE, environment protection license (EPL) and schedule waste management license supported by standards for discharge and waste disposal guidelines.

43. The procedures for EIA/IEE are defined in the EIA Regulations Gazette No. 772/22 (1993). The regulations prescribe the activities for which EIA/IEE is mandatorily required in three separate schedules. The need for an environmental assessment and the level of analysis required (EIA or IEE) for each development activity is screened by the Central Environmental Authority (CEA) based on the submission of a basic information questionnaire by the developer. There are two possible screening outcomes.

(i) **Exclusion from EIA/IEE**. The activity under additional financing does not fall under the prescribed category or located in a sensitive area as defined in the regulations.

(ii) **EIA/IEE required**. The activity falls under the prescribed category, has potentially serious environmental impacts and/or is in a sensitive area. With a positive screening decision, the CEA appoints a scoping committee to decide on the level of analysis and prepare the terms of reference, or if the project falls within the jurisdiction of government authority which is an appointed project approving authority to administer the EIA process, the CEA will hand over the process to the said authority.

44. The second regulatory tool under the National Environmental Act is the EPL. The EPL procedure has been introduced to prevent or minimize the release of discharges and emissions into the environment from industrial activities in compliance with national discharge and emission standards to provide guidance on pollution control for polluting processes and to encourage the use of pollution abatement technology. The EPL regulations define the prescribed activities for which a license is required and procedures for obtaining one. Since 2008, the NEA requires all medical institutions to obtain a valid EPL.

[2] This is a unit developed by Medivac Company, Australia which simultaneously uses steam-based sterilization and shredding to treat clinical waste. A volume reduction of 90% and weight reduction of 30% of waste could be achieved through the process and the processed material which is granular in nature can be recycled or buried in landfills safely.

(i) Part II of the National Environmental (Protection & Quality) Regulations, No. 01 of 2008 includes “Health care service centers generating infectious wastes, including medical laboratories and research centers” as a prescribed activity that requires a license.

(ii) Schedule VIII lists HCW as a scheduled waste from specific sources that no person shall generate, collect, transport, store, recover, recycle, or dispose of, except under the license issued by the Authority and in accordance with standards and other criteria as may be specified by the Authority.

45. Accordingly, every HCF is legally responsible for the proper management of HCW from the point of generation until its final disposal to ensure minimum environmental and public health impacts. However, the NEA does not contain any definition of HCW, or characterization of the type and degree of hazards associated with different medical wastes, nor does it carry any guidance on treatment and disposal technologies that might be considered acceptable in Sri Lankans.

46. The third regulatory tool under the NEA deals with the disposal of scheduled waste as defined through the Gazette Notification No. 1534/18 of 2008. It deals with waste from specific and nonspecific sources. The notification has three parts and eight schedules of which part I deals with the issue of EPL for emission/disposal of waste; part II deals with the issue of license for the management of scheduled waste (hazardous waste); and part III on general matters including definitions and the effectiveness and validity of the license issued under National Environment (Protection and Quality) Regulations, No. 1 of 1990 published in Extraordinary Gazette No. 595/16 of February 1990. The eight schedules include the tolerance limits, applications, formats for reporting, categorization of nonspecific and specific waste, etc.

47. There are other key national legislations for environmental management and protection. The Flora and Fauna Protection Ordinance and the Forest Ordinance does not permit any construction activities in protected areas managed by the Department of Wildlife Conservation and Forest Department, respectively. If any development is bound to have an impact on protected areas, clearance from the two departments, as the case is, must be obtained.

48. The Antiquities Ordinance, No. 9 of 1940 prohibits any activity within declared archaeological reserves. If a certain development activity has the potential to cause structural or non-structural damage to an archaeological resource, clearance from the Department of Archaeology (DOA) must be obtained, and if required, the director of the department could request for an archaeological impact assessment before clearance is granted.

49. The Agrarian Development Act. No. 46 of 2000 prohibits any filling of paddy land for development without the written permission of the Commissioner-General of Agrarian Services. Under the Disaster Management Act, construction in identified land slide hazard areas will require approval from the National Building Research Organization.

50. The Urban Development Authority Act, No. 41 of 1978 and the Sri Lanka Land Reclamation and Development Corporation Act, No. 15 of 1968 require clearance to be sought when carrying out development work in areas that are declared under these acts.

51. In addition to the above, approval from the local authority is required for all new constructions.

Table 4: National Level Clearance that are Applicable to the Project

Activity	Relevant legislation	Statutory requirement	Authorizing body
Disposal of Health Care Waste	NEA	EPL/SWL	CEA
Discharge of wastewater effluents	NEA (Protection and Quality) Regulation No. 1 of 1990 published in Gazette Extraordinary No. 595/16 of February 1990	EPL	CEA
Air emissions	National Environmental (Ambient Air Quality) Regulations, 1994, published in Gazette Extraordinary, No. 850/4 of December 1994 and amendment gazette No. 1562/22 of 2008	EPL	CEA
Disposal of solid waste	National Environmental (Municipal Solid Waste) Regulations, No. 1 of 2009	Approval for disposal site	CEA
Emission of noise and vibration	National Environmental (Noise Control) Regulations No.1 of 1996 and its amendments	Compliance	CEA
Construction on steep slopes in the central province	DMA	Compliance	NBRO

DMA= Disaster Management Act, CEA= Central Environment Agency, EPL=environmental protection license, NBRO = National Building Research Organization, NEA= National Environment Act, SWL=schedule waste license.
Source: Asian Development Bank.

52. Apart from the above, none of the other clearances is likely to be required as the infrastructure development proposed under the project will be limited to a modest expansion or upgrade of the existing building footprint or facilities on land owned by the HCF. In a rare scenario, a completely new building could be supported to relocate the OPD functions to a different part of the hospital to be near wards and ETU. In the worst case, the land will be acquired for the proposed expansion, but this will be unlikely.

C. Safeguard Requirements of ADB

53. All projects funded by ADB must comply with the SPS (2009). The SPS includes operational policies that seek to avoid, minimize, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process. It sets out the policy objectives, scope and triggers, and principles for three key safeguard areas: (i) environmental, (ii) involuntary resettlement, and (iii) indigenous peoples. All three safeguard policies involve a structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. The safeguard policies require that impacts are identified and assessed early in the project cycle; plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts are developed and implemented; and affected people are informed and consulted during project preparation and implementation. A basic principle of the three existing safeguard policies is that implementation of the provisions of the policies is the responsibility of the borrower. Borrowers are required to undertake social and environmental assessments, carry out consultations with affected people and communities, prepare and implement safeguard plans, monitor the implementation of these plans, and prepare and submit monitoring reports.

54. All projects funded by the ADB are first screened and categorized for environment, involuntary resettlement and indigenous peoples safeguards in the early stages of project preparation. Screening and categorization are undertaken to (i) reflect the significance of potential impacts or risks that a project might present; (ii) identify the level of assessment and institutional resources required for the safeguard measures, and (iii) determine disclosure requirements.

55. For projects involving facilities that already exist or are under construction, the borrower will undertake an environment and/or social compliance audit, including on-site assessment, to identify past or present concerns related to impacts on the environment, involuntary resettlement, and indigenous peoples. The objective of the compliance audit is to determine whether actions were in accordance with ADB's safeguard principles and requirements for borrowers and to identify and plan appropriate measures to address outstanding compliance issues. Where noncompliance is identified, a corrective action plan agreed on by ADB and the borrower will be prepared. The plan will define necessary remedial actions, the budget for such actions, and the time frame for resolution of noncompliance. If a project involves an upgrade or expansion of existing facilities that has potential impacts on the environment, involuntary resettlement, and/or indigenous peoples, the requirements for environmental and social impact assessments and planning specified in safeguard requirements 1–3 will apply in addition to compliance audit.

56. The proposed additional financing shall continue the environmental review process adopted in the ongoing HSEP and commensurate with the level of anticipated impacts and policy requirements of a category B to ensure that it is environmentally sound and are designed to operate in compliance with applicable regulatory requirements. The rapid environmental assessment checklist adopted under the ongoing project shall be used for screening and categorization of subprojects under the additional financing.

57. **Hazardous waste handling**. The ADB SPS (2009) stipulates that the borrower will avoid the manufacture, trade, and use of hazardous substances and materials subject to international bans or phaseouts because of their high toxicity to living organisms, environmental persistence, the potential for bioaccumulation, or potential for depletion of the ozone layer; and will consider the use of less hazardous substitutes for such chemicals and materials. The only hazardous material generated under HSEP is the demolished asbestos cement sheet wastes and requires careful handling and safe disposal.

58. **Standards.** When national regulations differ from the performance levels and measures presented in the International Finance Corporation (IFC)'s Environmental Health and Safety Guidelines, the project is expected to achieve whichever is more stringent.

D. Project Relevant International Agreements and Conventions

59. Sri Lanka has acceded to or ratified around 40 multilateral environmental agreements, and those that are relevant to this project are shown in Table 5**.**

Table 5: Project-Related International Agreements to which Sri Lanka is a Party

Agreement	Ratification Date	Objectives
Atmosphere		
Vienna Convention for Protection of the Ozone Layer (1985)	15 December 1989	Protection of the ozone layer through international cooperation in the areas of scientific research, monitoring and information exchange
Montreal Protocol on Substances That Deplete Ozone Layer (1987)	12 Dec. 1989	Reduction and eventual elimination of the consumption and production of Un-anthropogenic ozone depleting substances
United Nations Framework Convention on Climate Change (UNFCCC-1992)	23 November 1993	Stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climatic systems
Kyoto Protocol (1997)	3 October 2002	The parties (developed countries) to reduce their collective emissions of GHGs by at least 5% of the 1990 level by the period 2008–2012

Agreement	Ratification Date	Objectives
Biodiversity		
International Plant Protection Convention (1951)	12 February 1952	To maintain and increase international cooperation in controlling pests and diseases of plants and plant products and in preventing their introduction and spread across national boundaries
Plant Protection Agreement for Asia and Pacific Region (1956)	27 February 1956	To prevent the introduction into and spread within the region of destructive plants
CITES—Convention on International Trade in Endangered Species of Wild Fauna & Flora (1973)	4 May 1979	To protect specific endangered species from being over-exploited by adopting a system of import andexport permits, for regarding the procedure
Convention on the Conservation of Migratory Species (1979)	6 June 1990	To protect those species of wild animals which migrate across or outside national boundaries
The Convention on Wetlands (Ramsar Convention) (1971)	15 October 1990	This is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources.
Convention on Biological Diversity (CBD-1992)	23 March 1994	Conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including appropriate access to genetic resources and by appropriate transfer of relevant technologies and proper funding
Environmental Modification Convention (1976)	5 October 1978	This is an international treaty prohibiting the military or other hostile use of environmental modification techniques having widespread, long-lasting, or severe effects
Biosafety, Health and Sanitation		
Agreement on the Application of Sanitary and Phytosanitary Measures (1995)	1995	Broadly, the sanitary and phytosanitary measures covered by the agreement are those aimed at the protection of human, animal or plant life or health from certain risks
Biological Weapons Convention (1972)	26 March 1975	The Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and their Destruction
Cartagena Protocol on Biosafety (2000)	11 Sept 2003	The Cartagena Protocol on Biosafety to the Convention on Biological Diversity is an international agreement on biosafety as a supplement to the Convention on Biological Diversity
Cultural Heritage		
Convention concerning the protection of the World Cultural and Natural Heritage (1972)	6 June 1980	To establish a system of collective protection of the cultural and natural heritage of outstanding universal value organized permanently and by modern scientific methods
The United Nations Educational, Scientific and Cultural Organization World Heritage Convention (1972)	06 June 1980	Convention concerning the protection of the World Cultural and Natural Heritage
Chemicals		
Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal (1989)	28 August 1992	To reduce transboundary movements of hazardous waste; to dispose of hazardous and other waste as close as possible to the source; to minimize the generation of hazardous waste; to prohibit shipments of hazardous waste to countries lacking the legal, administrative, and technical capacity to manage and dispose of them in an environmentally sound manner
Rotterdam Convention (1998)	19 January 2006	To promote shared responsibility and cooperative efforts in the international trade of certain hazardous chemicals, to protect human health and the environment, to contribute to the environmentally sound use of those hazardous chemicals by facilitating information exchange, and providing for a national decision-making process on their import/export

Agreement	Ratification Date	Objectives
Stockholm Convention on Persistent Organic Pollutants (POPs) (2001)	22 December 2005	To protect human health and the environment from POPs

Source: Asan Development Bank.

E. Review of Institutional Capacity of Executing Agency

60. The MOH, through the PMU and PIUs, will deliver the project. Management of environmental safeguards of the project is linked to all three components. Component 1 involves shared care cluster support under which base hospital development in nine districts and upgrade and expansion to physical infrastructure in secondary care health facilities. Component 2 involves health information technology for better continuity of care and disease surveillance: COVID-19 response (reallocated funds) and COVID-19 Management Support. Component 3 involves DLC and NIHS development, costs to accommodate project extension (includes PMU additional costs), and contingency allocations.

61. The MOH, through its PMU and the provinces through the PIUs, will be responsible for conducting environmental screening and follow up assessments, preparing relevant documents and monitoring compliance. The MOH has a DE&OH headed by a deputy director-general and has a separate budget line under the MOH. The DE&OH has sufficient staff strength with capacity for occupational health and safety, food, and drug safety, HCWM, etc. Regarding HCWM, the DE&OH has facilitated EPLs/scheduled waste licenses for major hospitals in all nine provinces so far through the provision of training, evaluation, and follow up support. The MOH will be directly involved in the project as the chair of the Ministerial Project Steering Committee. The MOH also has prior experience implementing projects funded by other multi-lateral banks such as the World Bank with similar safeguards requirements as well as by several bi-lateral donors.

62. The PMU will closely collaborate with the provincial and regional directorates of health services through their representation in the province-level PIUs. Since HCWM planning will be a crucial component of safeguards assessments and monitoring, it is important to note the province-level capacity for the same. None of the PDHSs has a formal program or dedicated staff for HCWM that sets direction and follows up with HCFs. The existing capacities between the provinces also vary, as seen by the difference in status quo regarding HCWM.

63. The implementing agencies, the PIUs in each of the four provinces, and relevant other staff from the PDHSs and the RDHSs will require training and capacity building in better understanding of project-related environmental issues, application of safeguard procedures under the project, and for the planning and monitoring of HCWM. The PMU under the MOH will have a dedicated environmental specialist to overcome capacity constraints within the implementing agencies and to provide the necessary implementation support. The PMU will continue to design and deliver training and capacity building program as necessary for safeguards management. A structured and phased out training and evaluation program will also need to be implemented to improve the current level of awareness and understanding for HCWM, which would be done in close collaboration with the DE&OH.

V. DESCRIPTION OF THE ENVIRONMENT

64. The nine apex hospitals in which civil works are proposed are located within the same four provinces which were selected under the ongoing HSEP. This chapter provides a general environmental profile at district level of the selected provinces along with a brief description of the selected sites considered under this IEE, paying attention to any environmental or social

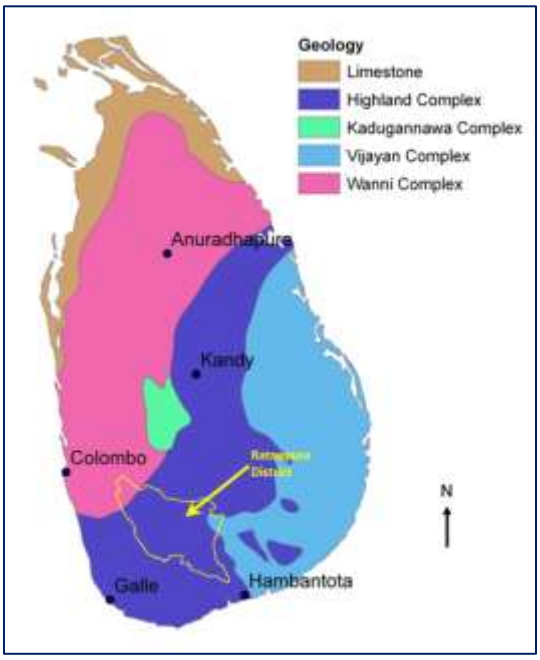
sensitivity observed, supported by photographs.

A. Ratnapura District

65. **Location.** The subproject involving civil works in Ratnapura District is shown in Figure 1**.**

66. **Geology and geomorphology and soil.** More than 90% of Sri Lankan rocks are metamorphic rocks that are metamorphic in high grades such as granulate and amphibolite facies. Most of the Sri Lankan crystalline rocks are belonging to Precambrian ages (older than 570 million years) while others are of more recent origin. This Precambrian age metamorphic rocks are subdivided into three major lithological groups as Highland, Wanni complex. According to this categorization, at least 90% of the Ratnapura District is within the Highland complex, and small part towards northwest belongs to the Wanni complex where Precambrian metamorphic rocks are prominent. Meta sediments, Charnokitic Gneisses, underlying rocks, Migmatites and granitic gneisses, granites, and pegmatite are mainly present in this region.

Figure 2: Location of Ratnapura District with respect to Country's Geology



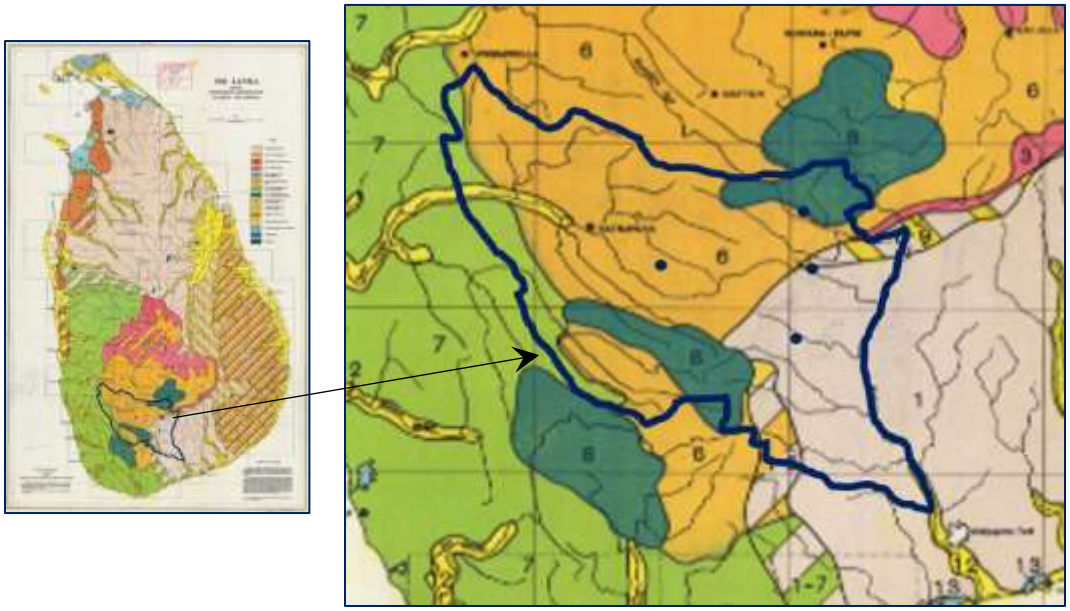
Source: Asian Development Bank.

67. Ratnapura District falls within Highland Complex which is the largest unit and forms the backbone of the Precambrian bedrock of Sri Lanka. Included in this unit are the supracrustal rocks and a variety of igneous intrusions, predominantly of granitoid composition, that are represented by banded gneisses). The rocks comprising the Highland Complex were mostly metamorphosed under granulite facies conditions. There has been the widespread formation of incipient (arrested) charnockite within this unit elsewhere, other granulite types, such as quartz-feldspar-garnet-sillimanite graphite schists, quartzites, marbles, and calc-silicate gneisses are prominent.

68. The centrally-located granulite grade Highland Complex presumably contains the host rocks for the gems. The source rocks of the gem minerals are skarns, marbles, pegmatites,

garnetiferous gneisses, and the contact rocks of charnockites.

Figure 3: Geomorphology Map of Ratnapura District



Note: Soil Types indicated by numbers:6: Red – Yellow Podzolic Soils (Modal); 7: Red – Yellow Podzolic Soils (Sub-group with Plinthite); 8: Red – Yellow Podzolic Soils (Sub-group with Prominent Al Horizon; 10: Immature Brown Loams (Wet Zone Sub-group)
Source: Survey Department of Sri Lanka

69. The agro-ecology zones in Ratnapura District contain low country red, yellow podzolic and red-yellow podzolic soils. The flood plains of Kalu Ganga are predominant with alluvial soils of variable drainage and texture. Ratnapura area also has red-yellow podzolic soils with strongly mottled subsoils and humic gley soils (rolling and undulating terrain). The landmass is made up of metasedimentary and concordant meta-igneous rocks of Precambrian age. The eastern section of the district exhibits continuation of the north and northwest trending fold structures of the hill country. Most of the soils have either developed in residual materials derived by weathering of the bedrock or in the weathering materials that have been transformed for a short distance. Red-yellow podzolic is the dominant soil group of the district.

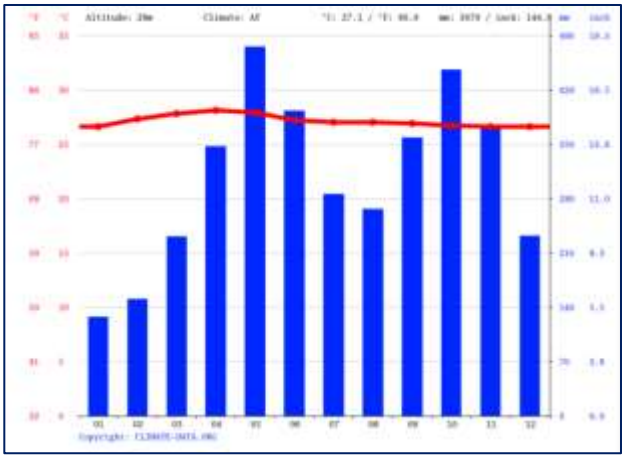
70. **Location and topography.** Mainly, Ratnapura District features wet zone, low country climate in areas such as Eheliyagoda, Kahawatta, Kuruwita, Kalawana, and Pelmadulla; in the western part, wet zone, mid-country in areas such as Gilimale, Rakwana, and Weddagala; intermediate, mid-country in areas such as Balangoda, Imbulpe, Kolonna and Mahawalatenna; intermediate, low country in areas such as Godakaweala and Pallebedda; low country, dry zone in areas such as Embilipitiya and Thimbolketiya; and in the southeastern part. Topographically, its elevation ranges from 18 meters (m) (Embilipitya area) to 2,250 m (at Adams Peak) above the mean sea level. Typically, the highest rainfall received during the period of northeast monsoon is from May to September.

71. Sabaragamuwa province is covered mostly with hilly areas and receives heavy rains around the year. It is a general fact that a large extent of roads gets inundated and damaged annually due to floods and landslides. There are many landslide-prone areas in the district, as

there are heavy slopes and unsteady areas. In the circumstances, huge landslides have occurred in the district, affecting many damages and losses to the country.

72. **Climate.** The Ratnapura District lies in the north of the equator in between the north longitudes of 6° 13' and 6° 54' and between the east latitudes of 80° 11' and 80° 56'. The height of Ratnapura from the sea level varies from 18 m to 2,250 m. The Ratnapura District is mostly located in the wet and intermediate zones of the country, which is north of the equator and having tropical climatic conditions (Figure 4). The area receives heavy rains during rainy periods (May to September, southwest monsoon; and October to November, inter-monsoon) and bright sunshine during the dry season (January to March), aligned with tropical climatic conditions. The mean annual rainfall in the district is from 2,500 millimeters (mm) to 3,000 mm, and the average annual temperature varies from 25°C to 28°C.

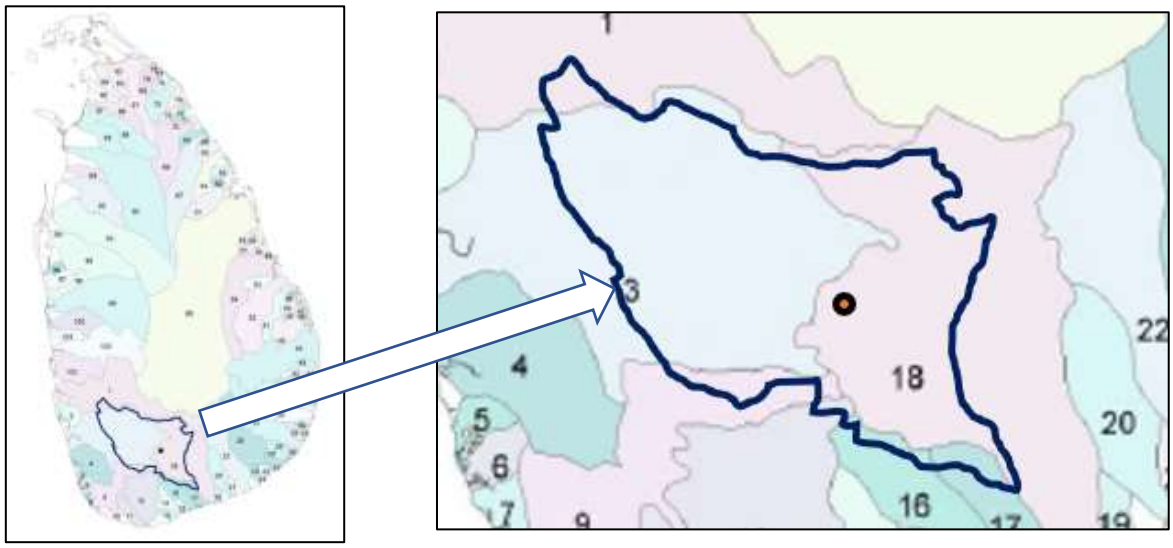
Figure 4: Variations of Mean Annual Rainfall in two locations in Ratnapura District (Average for 20 years: 1999 and 2019)



Source: CLIMATE-DATA.ORG. Climate Ratnapura (Sri Lanka). Available at: https://en.climate-data.org/asia/sri-lanka/sabaragamuwa-province/ratnapura-5054/ (accessed on 2 July 2021).

73. **Hydrology, drainage and river basins.** The Ratnapura District is located within the Kalu Ganga and Walawe Ganga Basins. A small part in the southern boundary falls within the Gin Ganga, Kachigal Ara, and Urubokka Oya Basins (Figure 5).

Figure 5: River basins in the Ratnapura District



Note: 3: Kalu Ganga; 18: Walawe Ganga; 9: Gin Ganga; 16: Urubokka Oya; 17: Kachigal Aru)
Source: Asian Development Bank.

74. **Floods in Sabaragamuwa province.** Annual torrential rains in the Kegalle and Ratnapura Districts have resulted in severe flooding and landslides in many parts of the province. The situation on the ground is extremely fluid with daily changes in figures of affected populations as well as of damaged and destroyed houses, assets, and belongings. A participatory rural appraisal exercise conducted by the Provincial Council with the relevant officers in July 2018, it was found that flooding and landslides have been the main disasters experienced by the communities in these two districts. The Aranayake Divisional Secretary Division (DSD) was one of the worst affected divisions in the country with the highest number of deaths and affected people. In addition, Aranayake, Bulathkohupitiya, Dehiovita, and Yatiyantota DSDs in the Kegalle District are affected by landslides. Flood-affected people are largely found in Ayagama, Eheliyagoda, Kiriella, and Kuruwita DSDs in the Ratnapura District. Ratnapura District has been recorded as one of the worst affected districts in the country experiencing both landslides and floods.

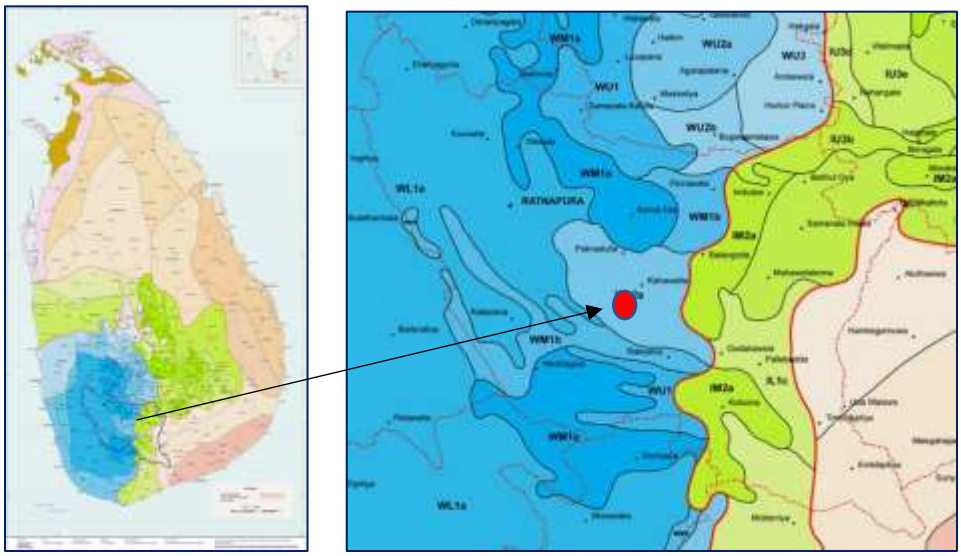
75. **Air quality.** Existing ambient noise and vibration levels in project areas in Kahawatta are consistent with suburban and light industrial areas, businesses, hotels, and restaurants. There are also moderate levels of traffic noise from adjoining roads. Industrial activities and commercial activities of much of the project area are not very significant to have high levels of noise. There is also traffic noise from the A4 highway, which carries heavy traffic during peak hours, as well as at night. Intermittent high noise and vibration levels are observed due to road traffic. All these urban activities contribute to noise levels in the project areas.

76. **Existing noise levels.** The subproject site is mostly located in urban settings with a sparse vegetation cover. Therefore, the noise levels are moderately high.

77. **Agro-ecological zones.** Figure 6 shows that 14 agro-ecological zones are represented in the Ratnapura District. The Ratnapura District is located in the wet-mid, wet-low, and wet-up country agro-ecological zones, making the area suitable for tea cultivation, rubber, mixed home gardens, paddy, and other agricultural crops. Parts of the district also fall within intermediate-mid,

intermediate-low, and dry-low country agro-ecological zones. Overall, about 70% of the district is within the wet zone, while about 20% and 10% are within intermediate and dry zones, respectively. The subproject at Kahawatta is within wet-low 2a.

Figure 6: Agro-ecological Regions of Ratnapura District (District Boundary Demarcated in Red-Dotted Line)



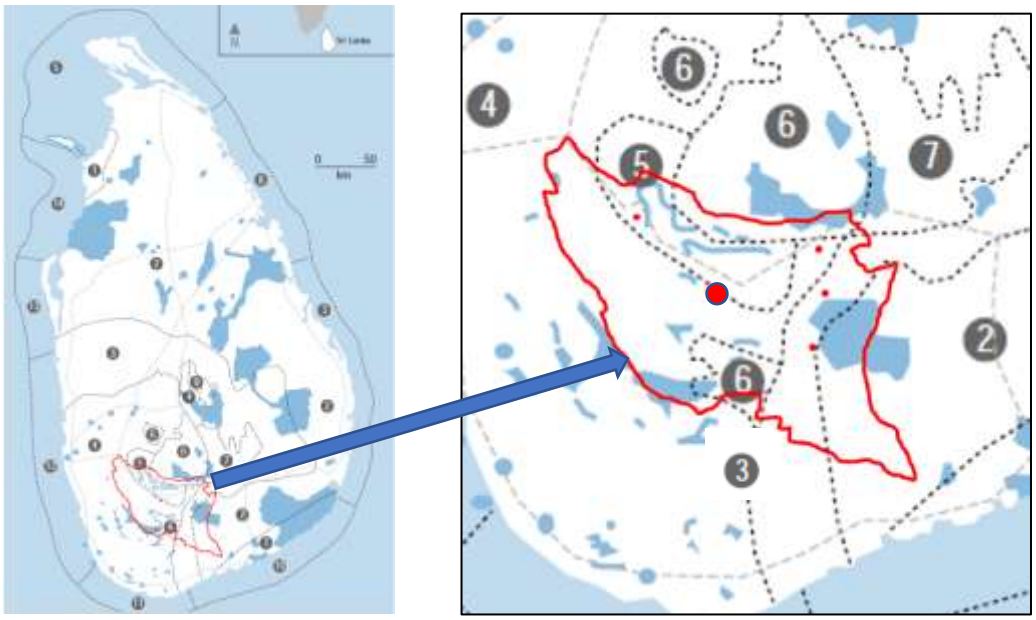
Source: Asian Development Bank.

78. It is evident that a significant portion of the Ratnapura District lies in the wet-lowlands and wet midlands, and intermediate lowlands and intermediate midlands; only a relatively small land area belongs to the wet highlands. As the district accommodates a broad wet and intermediate agro-ecological region, the cultivation appropriate crops, such as tea, spices, a variety of vegetable, papaya, and other fruits, etc. has been thriving.

79. **Bioregions.** In the Ratnapura District, there are five bioregions:

(i) Bioregion 2 (dry zone): dry mixed evergreen forest, altitude 0–500 m, annual rainfall 1,250–1,900 mm (mainly October to January), and 4–5 dry months;
(ii) Bioregion 3 (intermediate zone): moist evergreen forest, altitude 0–1,000 m, annual rainfall 1,900 mm–2,500 mm, and less than 3 dry months;
(iii) Bioregion 4 (lowland wet zone): lowland wet zone, tropical (lowland) wet evergreen forest, altitude up to 1,000 m, annual rainfall 2,500 mm–5,000 mm, and no dry months;
(iv) Bioregion 5 (sub-montane wetlands): sub-montane wetlands, sub-montane evergreen forest, altitude 1,000 m–1,500 m, annual rainfall 2,500 mm–5,000 mm, and no dry months; and
(v) Bioregion 6 (wet highlands): wet highlands, montane evergreen forests, altitude 1,500 m–2,500 m, annual rainfall 2,500 m–5,000 mm, and no dry months.

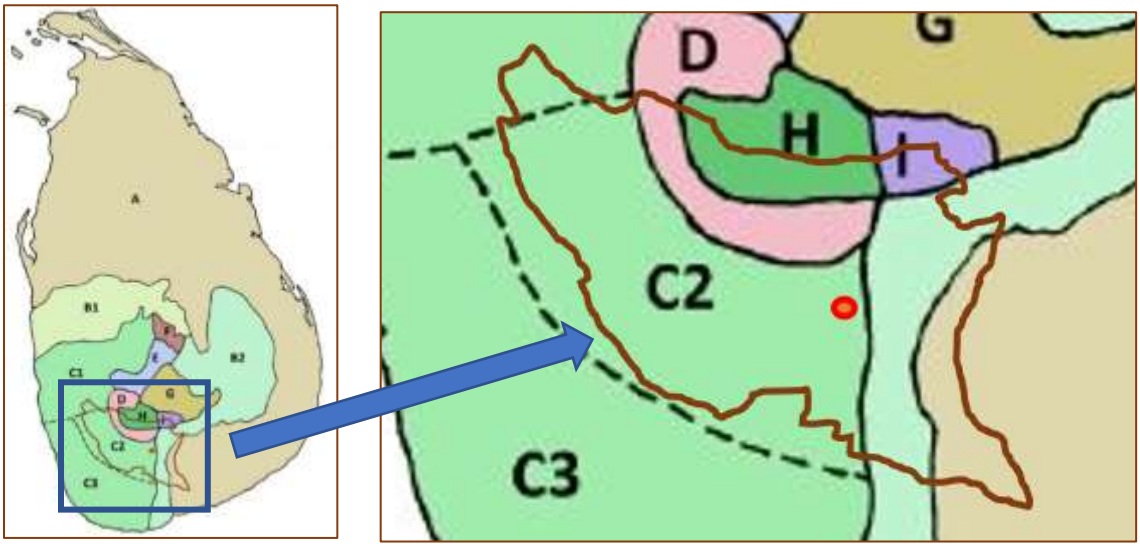
Figure 7: Bioregions of Ratnapura District



Source: Asian Development Bank.

80. **Floristic Regions.** Out of the 15 floristic regions proposed by Ashton and Gunatilleke (1987),[3] there are seven floristic regions represented in the Ratnapura District.

Figure 8: Floristic Regions in the Ratnapura District



(Floristic region A: Dry Zone; **Floristic region B2:** Eastern Intermediate lowlands; **Floristic region C1:** Northern wet lowlands; **Floristic region C2:** South of Ratnapura - Northern Sinharaja; **Floristic region D:** Foothills of Adam's Peak North of Ratnapura-Ambagamuwa; **Floristic region H:** Adam's Peak; Bordering **Floristic region I:** Horton Plains.)
Source: Asian Development Bank

[3] Ashton P.S. and Gunatilleke C.V.S. (1987). New light on the plant geography of Ceylon. I. Historical plant geography. Journal of Biogeography 14: 249-285.

81. Ratnapura District, also known as Sathara Koralaya which has a great history, extends 3,236 square kilometers (km^2) of a very fertile area of land. Its location is bounded on the north by Kegalla and Nuwara Eliya Districts; on the south by Galle, Hambantota, and Matara Districts; on the East by Badulla and Monaragala Districts; and on the west by Colombo and Kalutara Districts. At present, Ratnapura District has an administrative structure consisting of 575 Grama Niladhari divisions under 15 divisional secretariats.

82. **Demography.** The total population in Ratnapura District was 1.14 million as per the population estimates of 2016. The population density is about 352/km^2.

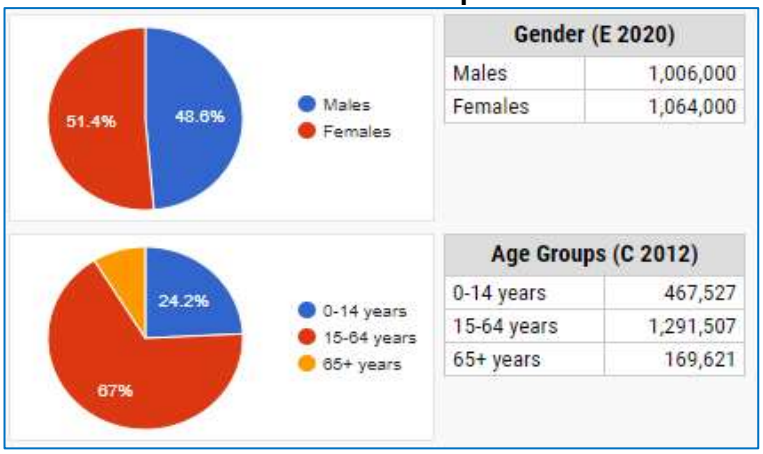
Table 6: Population, Land Area and Density by Province and District

Administrative Areas (Province/District)	Land Areas (sq. km) as at 1988[a]	Percentage Land Area	2016 Population ('000)[b]	2016 Percentage Distribution of Population	2016 Population Density (Persons per sq. km)	Average Annual Growth Rate (%) 1981-2012[c]
Sabaragamuwa Province	4,921	7.85	2,009	9.5	408	--
Ratnapura	3,236	5.16	1,140	5.4	352	1.3
Kegalle	1,685	2.69	869	4.1	516	0.7
Sri Lanka	62,705	100	21,203	100	338	1

[a] Survey General's Department
[b] Registrar General's Department
[c] Census of Population and Housing, 2012.

83. The percentage of the male population is slightly higher than the females (Figure 9), and more than 67% of the population is within the age category of 15–64 years. Nearly a quarter of the population is below 15 years.

Figure 9: Population distribution in the Ratnapura District based on Gender and Age Group

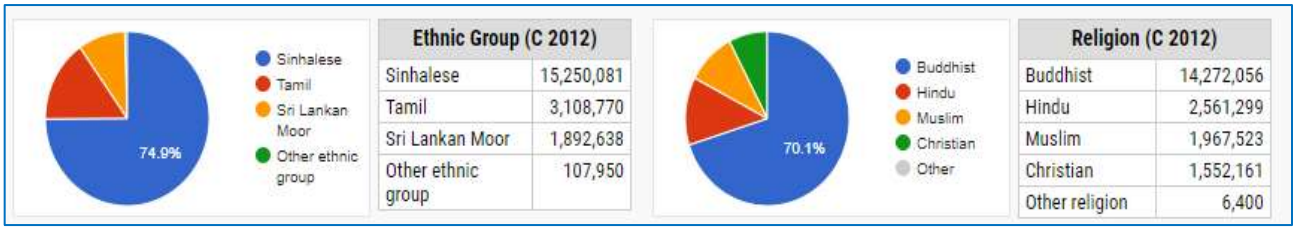


Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

84. Majority of the population are Sinhalese (approximately 75%), about 15% are Tamils, and 9% are Muslims (Figure 10).

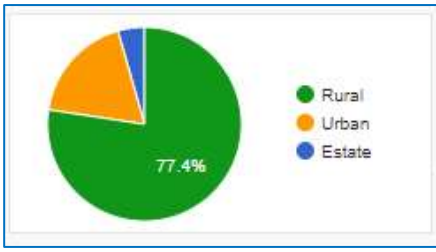
85. Data related to the population distribution in the Ratnapura District shows that at least 77% of the population live in rural areas and a small percentage in estate settlements.

Figure 10: Population distribution in Ratnapura District based on Ethnicity, Religion and Urbanization (estimate as on 2019-07-01)



Ethnic Group (C 2012)	
Sinhalese	15,250,081
Tamil	3,108,770
Sri Lankan Moor	1,892,638
Other ethnic group	107,950

Religion (C 2012)	
Buddhist	14,272,056
Hindu	2,561,299
Muslim	1,967,523
Christian	1,552,161
Other religion	6,400



Urbanization (C 2012)	
Rural	15,753,322
Urban	3,704,470
Estate	901,647

Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

86. **Economy**. The Sabaragamuwa Province provided the fifth highest contribution to the GDP and managing its GDP contribution at 7.9% in 2017, however dropping to 7.60% in 2018 (Central Bank, 2019). By taking advantage of its unique geography, the Sabaragamuwa Province contributed 8.9% of the total in the agricultural sector in 2018 in Sri Lanka. Gross domestic product (GDP) (at market prices in 2019) of Sabaragamuwa Province was SLRe 1096.63 billion, and it comfortably lies somewhere in the middle of the income continuum, manifesting fair income disparity. Household poverty was at a moderate level of 6.5% in the district (2016).

87. **Land use.** Ratnapura District is a lower-middle-income region with a population of 835,934 (2019). Land extent is about 1,693 km^2 (2.6% of the total area of the country).

88. There are about 220,749 families in 1,677 villages in 573 Grama Niladari Divisions (GND). Provincial contribution to the national agriculture GDP was 8.5% (2018), and provincial GDP of agriculture was SLRe 97.09 billion, while national GDP of agriculture was SLRe 1,137.10 billion (Central Bank Annual Report, 2018).[4] Employment in the agriculture sector is 23.7% (based on the Census and Statistics Department data for 2016).[5] Paddy and other agriculture cultivations including plantation crops occupy 84.4% of the total land area of the district. The total extent of forests (including scrubland) accounts for nearly 15% of the total land area. The potential growth sectors of the district constitute crop agriculture along with agriculture-related industries and trades. Paddy, tea, and rubber are the predominant crops in the province followed by other field crops (OFC) and vegetables and floriculture.

[4] https://www.cbsl.gov.lk/en/publications/economic-and-financial-reports/annual-reports/annual-report-2018.
[5] http://www.statistics.gov.lk/.

89. **Education.** There are 14 national schools (1AB), 41 provincial schools (1AB), 91 provincial schools (1C), 249 Grade 2 provincial schools, and 205 Grade 3 provincial schools functioning in the Ratnapura District 2019 data (footnote 5).

90. **Health and sanitation.** Healthcare services in the district are being provided to the community through a network of primary, secondary, and tertiary care institutions. These include 1 teaching hospital at Ratnapura, 1 district general hospital, 3 type-B base hospitals, 8 type-A divisional hospitals, 7 type-B divisional hospitals, 18 type-C divisional hospitals, and 26 primary medical care institutions. Some of the statistics of the number of hospitals and medical personnel are listed in Tables 7 and 8.

91. It has been reported by the Regional Director's Office of Health Services that there are 3,888 beds available at these health care facilities available at the district. The total number of outpatients that have obtained treatment from these governmental health care facilities (in 2018) was 3.49 million and number of inpatients was 387,776 (in 2019).

Table 7: Number of Hospitals in Sabaragamuwa Province (Ratnapura and Kegalle Districts) in 2017

RDHS Division		Ratnapura	Kegalle	Sri Lanka
Teaching Hospital	Ins	--	--	16
	Beds	--	--	20,109
Provincial General Hospital	Ins	1	--	3
	Beds	1,318	--	4,790
District General Hospital	Ins	1	1	19
	Beds	465	821	11,911
Base Hospital Type A	Ins	--	--	24
	Beds	--	--	8,862
Base Hospital Type B	Ins	3	3	47
	Beds	694	806	7,798
Divisional Hospital Type A	Ins	8	6	50
	Beds	714	553	5,406
Divisional Hospital Type B	Ins	7	3	135
	Beds	344	104	9,170
Divisional Hospital Type C	Ins	18	9	298
	Beds	345	62	7,937
Other Hospitals	Ins	1	2	25
	Beds	8	33	5,444
Total Hospitals	Ins	39	24	629
	Beds	3,888	2,379	81,580
Beds per 1,000 population		3.4	2.7	3.8
Primary Medical Care Units		26	21	480
MOH Area		18	11	342

Table 8: Number of Medical Personnel in Sabaragamuwa Province (2017)

RDHS Division	Ratnapura	Kegalle	Sri Lanka
Administrative Grade (Senior and Deputy) Medical Officer	6	5	207
Specialist (Curative Care)	80	50	2102
Hospital Medical Officers (D.M.O, S.H.O, H.O, M.O IN OPD, etc.)	457	354	12,544
Medical Officers in RDSH/MOH/AMOH	29	20	634
Medical Officers (Venereal Disease)	2	1	72
Medical Officers (Tuberculosis)	8	1	101
Judicial Medical Officers	2	5	80
Medical Officers (Blood Bank)	17	8	301
Intern Medical Officer	45	52	1231
P.G.I.M. Trainees	14		845
Other Medical Officer	7	11	598
Medical Officers	586	465	16,659
Total Medical Officers	672	510	18,968
Regional Dental Surgeon	1	1	31
Consultant Dental Surgeons	3	3	85
Hospital Dental Surgeons	58	37	1145
School Dental Surgeons	6	3	95
Dental Surgeons	68	44	1433

Source: Medical Statistics Unit 2017.

92. **Water Supply.** Water supply in the Ratnapura District is operated under the Central Regional Support Centre (RSC) under the supervision of Deputy General Manager, RSC. The Central RSC is functioning with 16 water supply schemes.

93. **Roads and transport.** According to the data published in 2019 by the Department of Census and Statistics, the total road length in Ratnapura District was 7,041.2 km that is under the purview of the Road Development Authority (RDA), Provincial Road Development Authority (PRDA), and local authorities.

94. **Electricity.** Presently 100% access for electricity is ensured in the western and southern provinces. However, in Sabaragamuwa province, 3%–4% of the total households in the province are still unable to get the electricity supply from the national grid.

1. Environmental Sensitive Areas and Natural Disasters

95. **Cyclones.** Many cyclones have passed over the country. Storm surges are more frequent on the east coast of Sri Lanka compared to the other parts of the island. The cyclones which occurred in the past have caused extensive damage, especially in the eastern part of Sri Lanka. However, the southeastern part of Sri Lanka, including the Sabaragamuwa Province has not been affected much, and the incidences of disaster situations due to cyclones are low.

96. **Floods.** Occurrences of floods in the Ratnapura District is very high. Exposure of infrastructure in the district has been categorized as high vulnerability. Extreme flood event records show that Ratnapura District has experienced 80 flood events during the period of 1990–2011. This can be considered as a very high incidence scenario. Out of all the districts in Sri Lanka, Ratnapura District has experienced the greatest number of floods during the period of 1990–2011, which is 80 times, as compared to the second highest in Kalutara which has been 48 times. The vulnerability of infrastructure to the expected increase in frequency and intensity of floods due to climate change is widespread and prevalent in many parts of the country. However, parts of Ratnapura District have been categorized under high vulnerability.

97. **Landslide exposure.** With climate change, the vulnerability of infrastructure to landslides is expected an increase in frequency and intensity and is focused mainly on the central hills. These figures highlight that there are areas in Ratnapura District which are exposed to high and moderate vulnerability. Landslides have been frequently experienced in some parts of the Ratnapura District.

98. It is apparent that the areas where the subprojects are proposed on the parts of the district are categorized as “safe slopes” or “landslides not likely to occur,” except for the Kalawana area. However, the Kahawatta site is located on flat land and there are no landslide-prone areas in the near vicinity or along the access roads.

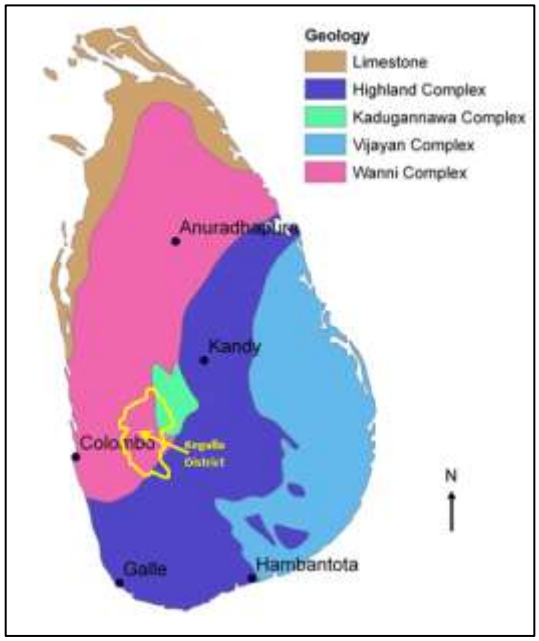
99. **Droughts.** Much of the Ratnapura District are relatively wet and located within intermediate and/or wet climatic zones of Sri Lanka. Much of the areas of eastern parts of Ratnapura District had nearly 100–200 days, where daily rainfall is less than 1 mm.

100. One advantage of the geographical location of western parts of Sabaragamuwa Province is that it is in the windward side of southwest monsoon winds which brings high rainfall during the May to September period to the western side of the hill country of Sri Lanka. The southwest monsoon winds pass the central mountain ridge and enter eastern parts of the Central Province as a dry and gusty wind. Most of these areas of the Sabaragamuwa Province experience a prolonged wet period during May to September. A major part of the western and southeastern areas of the Ratnapura District has become a very wet zone due to this effect**.**

B. Kegalle District

101. **Location.** The subproject involving civil works in Kegalle is presented in Figure 11.

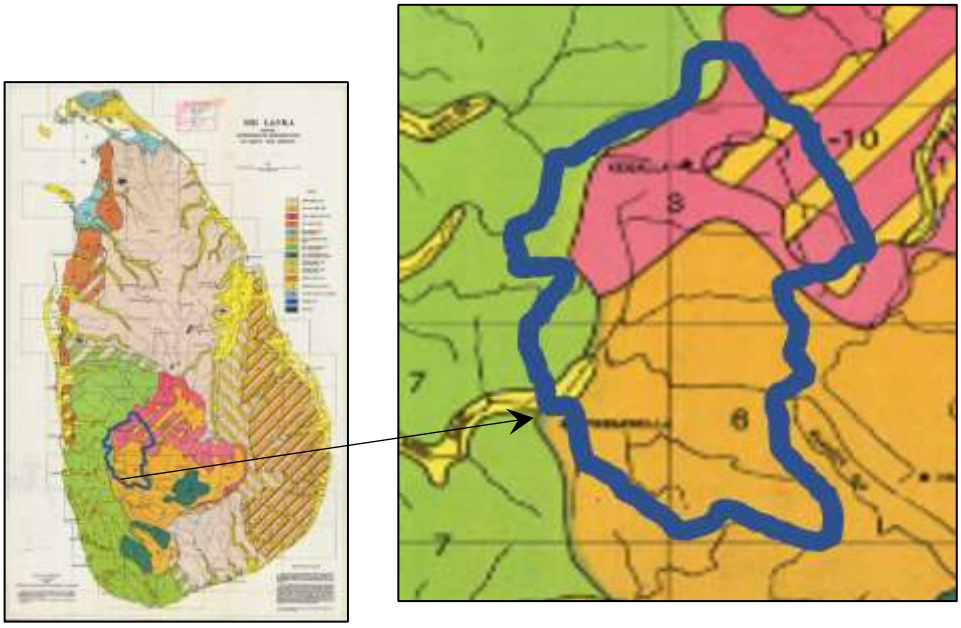
Figure 11: Kegalle District is located mostly within the Wanni Complex



Source: Asian Development Bank

102. **Geology and geomorphology and soil.** The Kegalle District falls within Wanni Complex and small parts in Highland and Kadugannawa Complex, and mainly consists of high-grade metamorphic rocks (crystalline) of Precambrian age. These rocks include quartzite, charnockites, granites, granitic gneisses, khondalites, quartzofeldspathic rocks (granulites and granulitic gneisses), gneisses migmatites, calcgranulites, calc gneisses, and marbles (crystalline limestones) which are of diverse origin. The folded structures in the area are open, tight, upright, and overturned anticlines and synclines, which had been plastically deformed under the granulite facies conditions.[6] Furthermore, the linear features in the area are tectonic lineaments (joint zones, fracture zones), strike valleys and strike ridges. The strike valleys and strike ridges, which are parallel to the general strike of the rocks, represent rocks that are either susceptible to weathering or resistant to weathering.

Figure 12: Geomorphology Map of Kegalle District



Note: Soil Types indicated by numbers:6: Red – Yellow Podzolic Soils (Modal); 7: Red – Yellow Podzolic Soils (Sub-group with Plinthite); 8: Red – Yellow Podzolic Soils (Sub-group with Prominent Al Horizon; 10: Immature Brown Loams (Wet Zone Sub-group)
Source: Survey Department of Sri Lanka.

103. Reddish Yellow Podzolic earth is the prominent soil type in the entire wet zone of the country. Sri Lanka has been subdivided into different agro-ecological zones considering soil type, rainfall, land use, etc. In the project area, Red Yellow Podzolic, Red Yellow Podzolic with semi-permanent A1 horizon, and Low Humic Gley and Lithosol soils are present. The district is geologically situated in the western plains of Sabaragamuwa. The landmass is made up of metasedimentary and concordant meta-igneous rocks of Precambrian age. The eastern section of the district exhibits continuation of the north, and northwest trending fold structures of the hill country. Most of the soils have either developed in residual materials derived by weathering of the bedrock or in the weathering materials that have been transformed for a short distance. Red-yellow podzolic is the dominant soil group of the district.

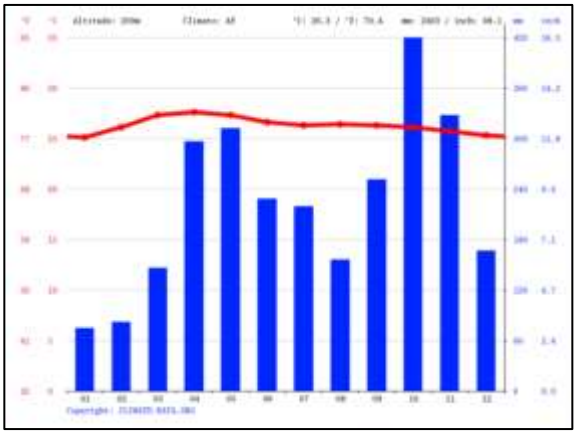
[6] BERGER, A.R. and JAYASINGHE N.R., 1976: Precambrian structure and chronology in the Highland Series of Sri Lanka. *Precamb. Res*., 3, 559-576.

104. **Location and topography.** Mainly, the Kegalle District features low country, wet zone climate and the eastern part situated in a higher area from the sea level, features upcountry, wet zone climate. Topographically, its elevation ranges from 18 m to 2,240 m above the mean sea level. Typically, the highest rainfall received during the period of northeast monsoon is from May to September. It nourishes many rivers and streams flowing from the western slope of the central hills of Sri Lanka. Gurugoda Oya and Seethawaka Oya are nourishing Kelani River, and the Ma Oya and Aththanagalu Oya start from the Kegalle District.

105. **Climate.** The Kegalle District lies in the north of the equator in between the north longitudes of 6.50' and 7.20' and between the east latitudes of 80.10' and 80.35'. The height of Kegalle from the sea level varies from 18 m to 2,240 m.

106. The Kegalle District is in the wet and intermediate zones of the country, which is north of the equator and having tropical climatic conditions (Figure 13). The area receives heavy rains during rainy periods (May to September, south-west monsoon; and October to November, inter-monsoon) and bright sunshine during the dry season (January to March), aligned with tropical climatic conditions. The mean annual rainfall in the district is from 2,500 to 3,000 mm, and the average annual temperature varies from 25°C to 28°C.

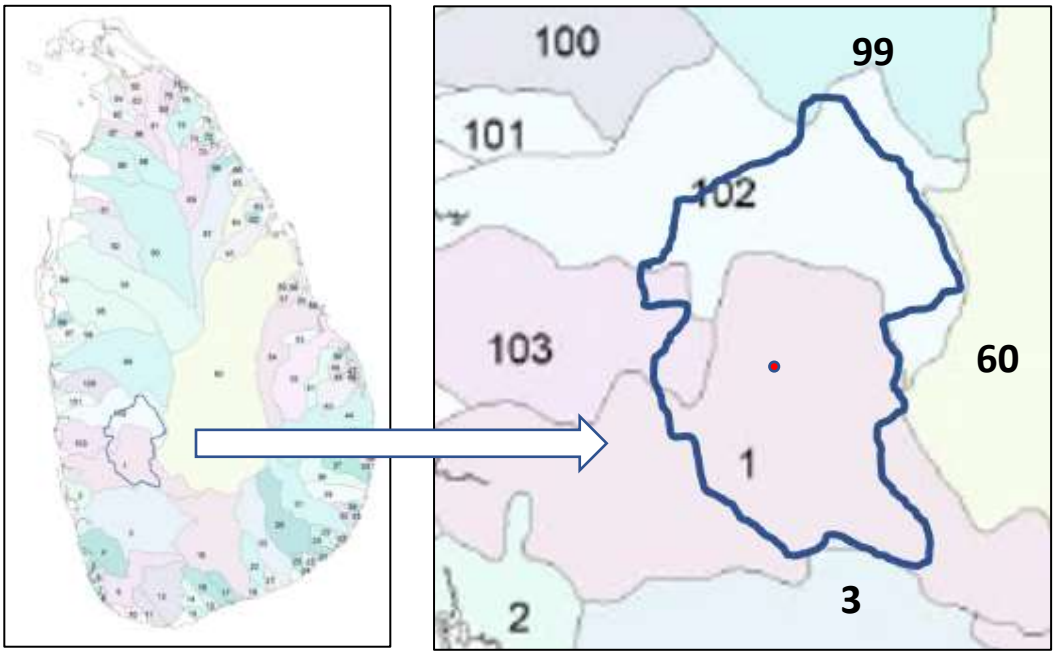
Figure 13: Variations of Mean Annual Rainfall in Kegalle District (Average for 1999–2019)



Source: CLIMATE-DATA.ORG. Climate Kegalle (Sri Lanka). Available at: https://en.climate-data.org/asia/sri-lanka/sabaragamuwa-province/kegalle-11319/ (accessed on 2 July 2021).

107. **Hydrology, drainage, and river basins.** The Kegalle District is located within the Kelani Ganga and Maha Oya Basins. A small part in the western boundary falls within the Attanagalu Oya (Figure 14). Small areas in the eastern boundaries of the district borders the Mahaweli River Basin. The southern part borders the Kalu Ganga Basin, and the northern part borders Kelani Oya, Deduru Oya (zone 99), and Maha Oya Basins

Figure 14: River basins in the Kegalle District



1: Kelani Ganga; 3: Kalu Ganga; 60: Mahaweli Ganga; 99: Deduru Oya; 102: Maha Oya; 103: Attanagalu Oya.
Source: Asian Development Bank

108. **Air quality.** Since the subproject location is located within urban areas, sources of air pollutants are found. The air quality in such subproject areas appears to be good. However, there is a chance of deteriorating the air quality temporarily due to vehicular emissions and drifting of dust from gravel roads and other deteriorated roads.

109. **Existing noise levels.** The subproject site is mostly located in urban settings with not much vegetation cover. Therefore, the noise levels are relatively high.

110. **Agro-ecological zones.** There are 14 agro-ecological zones represented in the Kegalle District.

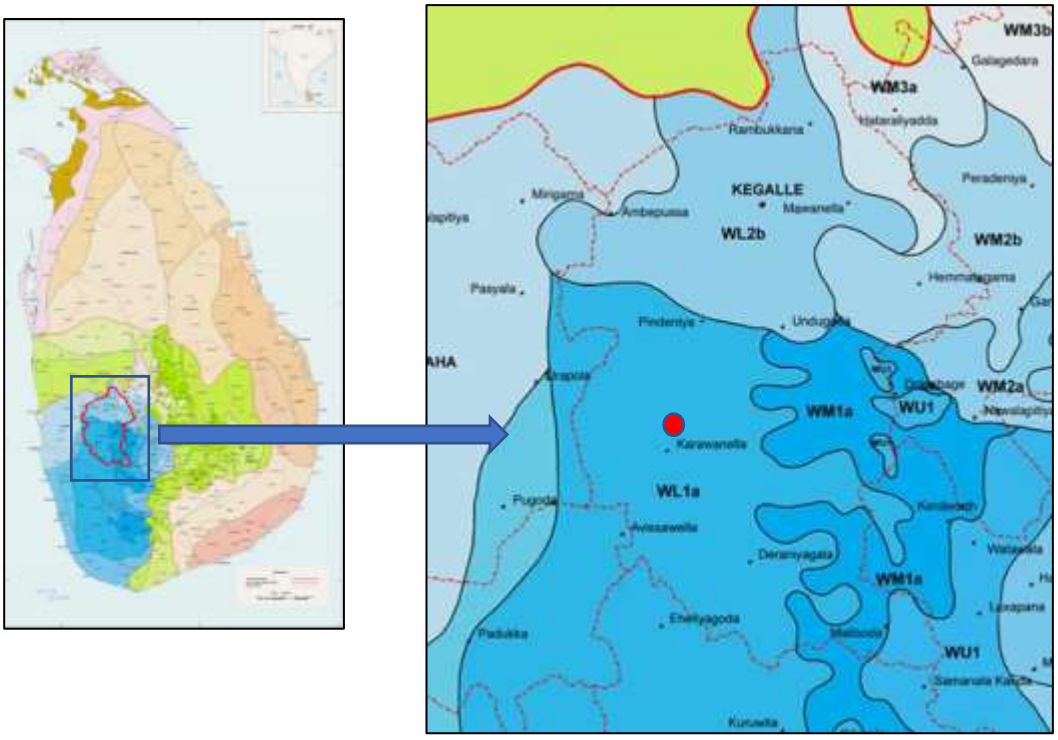
111. It is evident that a significant portion of the Kegalle District lies in the wet midlands and wet lowlands; only a relatively small land area belongs to the wet highlands. As the district accommodates a broad wet agro-ecological region (mostly low and mid climatic zones), the cultivation of appropriate crops, such as tea, spices, a variety of vegetable, papaya, and other fruits, etc. has been thriving. Subproject location in Kegalle District is located in the wet lowland (WL1a).

112. **Bioregions.** In the Kegalle District, there are three bioregions:

(i) Bioregion 4: lowland Wet Zone; tropical (lowland) wet evergreen forest, altitude up to 1,000 m, annual rainfall 2,500 mm–5,000 mm, and no dry months;
(ii) Bioregion 5: sub-montane Wetlands, sub-montane evergreen forest, altitude 1,000–1,500 m, annual rainfall 2500 mm–5000 mm, and no dry months; and

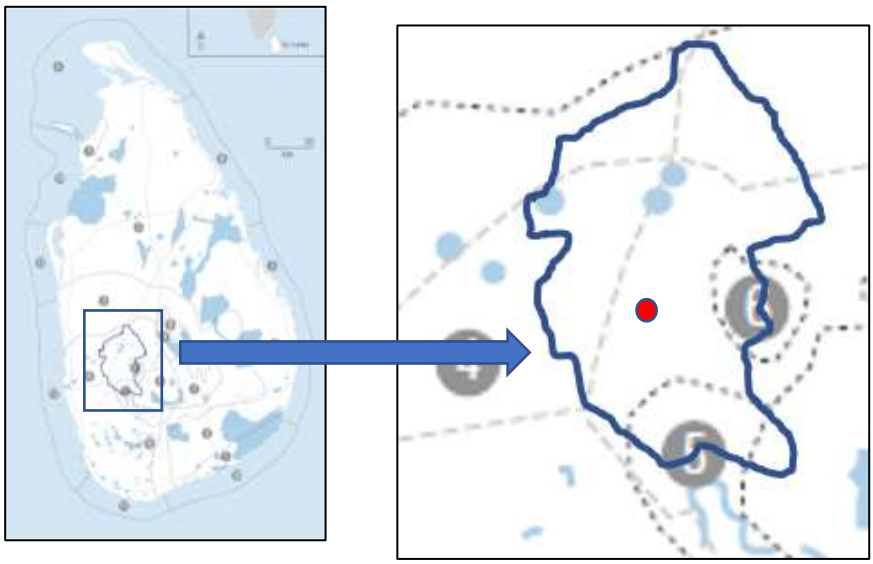
(iii) Bioregion 6: wet highlands, montane evergreen forests, altitude 1,500 m–2,500 m, annual rainfall 2,500 mm–5,000 mm, and no dry months.

Figure 15: Agro-ecological regions of Kegalle District



Source: Asian Development Bank.

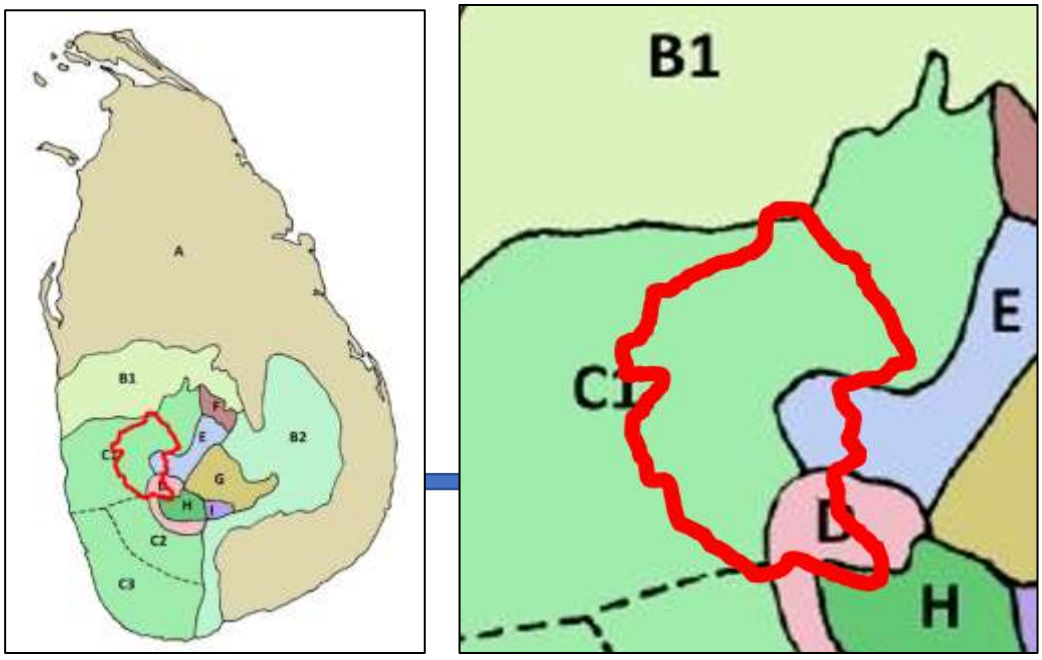
Figure 16: Bio-regions of Kegalle District



Source: Asian Development Bank.

113. **Floristic Regions.** Out of the 15 floristic regions proposed by Ashton and Gunatilleke (1987) (footnote 3), there are five floristic regions represented in the Kegalle District.

Figure 17: Floristic Regions in the Kegalle District



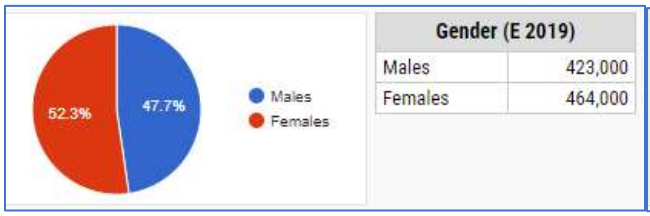
Floristic region C1: Northern wet lowlands; **Floristic region D:** Foothills of Adam's Peak North of Ratnapura-Ambagamuwa; **Floristic region E:** Kandy-upper Mahaweli; Bordering **Floristic region B1:** Northern intermediate lowlands & **Floristic region H:** Adam's Peak
Source: Asian Development Bank

114. Kegalle district, also known as Sathara Koralaya which has a great history, extends 1693 km^2 of a very fertile area of land. Its location is bounded on the north by Kurunegala District, on the south by Rathnapura District, on the east by Kandy and Nuwara-Eliya Districts, and on the West by Colombo and Gampaha Districts. At present, Kegalle District has an administrative structure consisting of 573 Grama Niladhari divisions under 11 divisional secretariats.

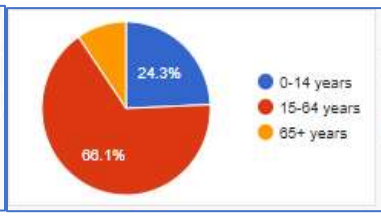
115. **Demography.** The total population in Kegalle District was 835,934 as per the population estimates of 2019. The population density is about 480.21/km^2.

116. Percentage of the male population is slightly higher than the females, and more than 68% of the populations are within the age category of 15–64 years. Nearly a quarter of the population is below 15 years.

Figure 18: Population distribution in the Kegalle District based on Gender and Age Group



Gender (E 2019)	
Males	423,000
Females	464,000



Age Groups (C 2012)	
0-14 years	204,309
15-64 years	555,880
65+ years	80,459

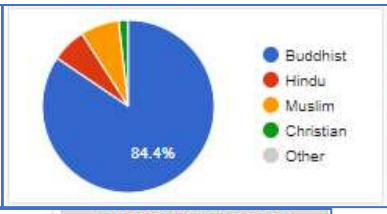
Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

117. Majority of the population are Sinhalese (approximately 86%), and about 12% are Tamils, and 11.5% are Muslims.

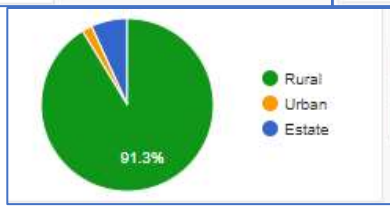
118. Data related to the population distribution in the Kegalle district shows that at least 91.3% of the population live in rural areas and a small percentage in estate settlements.

Figure 19: Population distribution in the Kegalle District with respect to Ethnicity, Religion and Urbanization

Ethnic Group (C 2012)	
Sinhalese	718,369
Tamil	61,609
Sri Lankan Moor	59,997
Other ethnic group	673



Religion (C 2012)	
Buddhist	709,917
Hindu	54,350
Muslim	61,164
Christian	15,163
Other religion	54



Urbanization (C 2012)	
Rural	767,469
Urban	15,993
Estate	57,186

Source: Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

119. **Economy**. The province has been a central economic location from the time when the British ruled. The Sabaragamuwa Province provided the fifth highest contribution to the GDP and managing its GDP contribution at 7.9% in 2017, however dropping to 7.6% in 2018 Central Bank, 2019 (footnote 4). By taking advantage of its unique geography, the Sabaragamuwa Province contributed 8.9% of the total in the agricultural sector in 2018 in Sri Lanka. GDP (at market prices in 2019) of Sabaragamuwa Province was SLR. 1096.63 billion, and it comfortably lies somewhere in the middle of the income continuum, manifesting fair income disparity. Household poverty is at a moderate level of 7.1% in the district (2016).

120. **Land use.** Kegalle District is a lower-middle-income region with a population of approximately 835,934 (2019). Land extent is about 1,693 km^2 (2.6% of the total area of the country).

121. There are about 220,749 families in 1,677 villages in 573 GN Divisions. Provincial contribution to the national agriculture GDP was 8.53% (2018), and provincial GDP of agriculture was SLR. 97.09 billion while national gross domestic production of agriculture was SLR. 1,137.10 billion (Central Bank Annual Report, 2018). Employment in the agriculture sector is 23.7% (based on the Census and Statistics Department data for 2016). Paddy and other agriculture cultivations including plantation crops occupy 84.4% of the total land area of the district. The total extent of forests (including scrubland) accounts for nearly 15% of the total land area. The potential growth sectors of the Kegalle District constitute crop agriculture along with agriculture-related industries and trades. Paddy, tea, and rubber are the predominant crops in the province followed by OFC and vegetables and floriculture.

122. **Education.** There are 14 national schools (1AB), 34 provincial schools (1AB), 93 provincial schools (1AC), 185 Grade 2 provincial schools, and 204 Grade 3 provincial schools functioning in the Kegalle District (2018 data).

123. **Health and Sanitation.** Healthcare services in the district are being provided to the community through a network of primary, secondary, and tertiary care institutions. These include 1 district general hospital, 3 type-B base hospitals, 6 type-A divisional hospitals, 3 type-B divisional hospitals, 9 type-C divisional hospitals, and 21 primary medical care institutions. Some of the statistics of the number of hospitals and medical personnel are listed in Tables 9 and 10**.**

124. It has been reported by the Regional Director's Office of Health Services that there are 2,379 beds available at these health care facilities available at the district.

125. The total number of outpatients that have obtained treatment from these governmental health care facilities (in 2019) was 4.09 million and number of inpatients was 756,160 (in 2019).

Table 9: Number of hospitals in Sabaragamuwa Province (Ratnapura and Kegalle Districts) in 2017

RDHS Division		Ratnapura	Kegalle	Sri Lanka
Teaching Hospital	Ins	--	--	16
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District General Hospital	Ins	1	1	19
	Beds	465	821	11,911
Base Hospital Type A	Ins	--	--	24
	Beds	--	--	8,862
Base Hospital Type B	Ins	3	3	47
	Beds	694	806	7,798
Divisional Hospital Type A	Ins	8	6	50
	Beds	714	553	5,406
Divisional Hospital Type B	Ins	7	3	135
	Beds	344	104	9,170
Divisional Hospital Type C	Ins	18	9	298
	Beds	345	62	7,937
Other Hospitals	Ins	1	2	25
	Beds	8	33	5,444

RDHS Division		Ratnapura	Kegalle	Sri Lanka
Total Hospitals	Ins	39	24	629
	Beds	3,888	2,379	81,580
Beds per 1,000 population		3.4	2.7	3.8
Primary Medical Care Units		26	21	480
MOH Area		18	11	342

Table 10: Number of medical personnel in Kegalle District (2017)

RDHS Division	Ratnapura	Kegalle	Sri Lanka
Administrative Grade (Senior and Deputy) Medical Officer	6	5	207
Specialist (Curative Care)	80	50	2102
Hospital Medical Officers (D.M.O, S.H.O, H.O, M.O IN OPD, etc..)	457	354	12,544
Medical Officers in RDSH/MOH/AMOH	29	20	634
Medical Officers (Venereal Disease)	2	1	72
Medical Officers (Tuberculosis)	8	1	101
Judicial Medical Officers	2	5	80
Medical Officers (Blood Bank)	17	8	301
Intern Medical Officer	45	52	1231
P.G.I.M. Trainees	14		845
Other Medical Officer	7	11	598
Medical Officers	586	465	16,659
Total Medical Officers	672	510	18,968
Regional Dental Surgeon	1	1	31
Consultant Dental Surgeons	3	3	85
Hospital Dental Surgeons	58	37	1145
School Dental Surgeons	6	3	95
Dental Surgeons	68	44	1433

Source: Medical Statistics Unit 2017.

126. **Water supply.** Water supply in the Kegalle District is operated under the Central RSC under the supervision of Deputy General Manager Regional Support Centre. The Central RSC is functioning with 16 water supply schemes.

127. **Roads and transport.** According to the data published in 2018 by the Department of Census and Statistics, the total road length in Kegalle District was 10,229 km that is under the purview of RDA, PRDA, and the local government authorities.

128. **Electricity.** Presently 100% access for electricity is ensured in western and southern provinces. However, in central province, 3%–4% of the total households in the province are still unable to get the electricity supply from the national grid.

1. Environmental Sensitive Areas and Natural Disasters

129. **Cyclones.** Many cyclones have passed over the country. Storm surges are more frequent on the east coast of Sri Lanka compared to the other parts of the island. The cyclones which occurred in the past have caused extensive damage, especially in the eastern part of Sri Lanka. However, the southeastern part of Sri Lanka, including the Sabaragamuwa Province has not been affected much, and the incidences of disaster situations due to cyclones are low.

130. **Floods.** Occurrences of floods in the Kegalle District is low. Exposure of infrastructure in the district has been categorized as no vulnerability. Extreme flood event records show that

Kegalle District has experienced 16–27 flood events during the period of 1990–2011. This can be considered as low incidence scenario. The vulnerability of infrastructure to the expected increase in frequency and intensity of floods due to climate change is widespread and prevalent in many parts of the country, however, Kegalle District in the Sabaragamuwa Province has been categorized under no vulnerability.

131. **Landslide exposure.** With climate change, the vulnerability of infrastructure to landslides is expected an increase in frequency and intensity and is focused mainly on the central hills. These figures highlight that there are areas in Kegalle District which are exposed to moderate and low vulnerability. Landslides have been frequently experienced in some parts of the Kegalle District.

132. **Droughts.** Much of the Kegalle District and Ratnapura District are relatively wet and located within intermediate and/or dry climatic zones of Sri Lanka. Much of the areas of eastern parts of Kegalle District had nearly 200 days, where daily rainfall is less than 1 mm.

133. One advantage of the geographical location of western parts of Sabaragamuwa Province is that it is in the windward side of southwest monsoon winds which brings high rainfall during May to September period to the western side of the hill country of Sri Lanka. The southwest monsoon winds pass the central mountain ridge and enter eastern parts of the central province as a dry and gusty wind. Most of these areas of the Sabaragamuwa Province experience a prolonged wet period during May to September. A major part of the western and southeastern areas of the Kegalle District has become a very wet zone due to this effect**.**

134. **Environmentally sensitive areas.** There are no environmentally sensitive areas within the proximity of the proposed site.

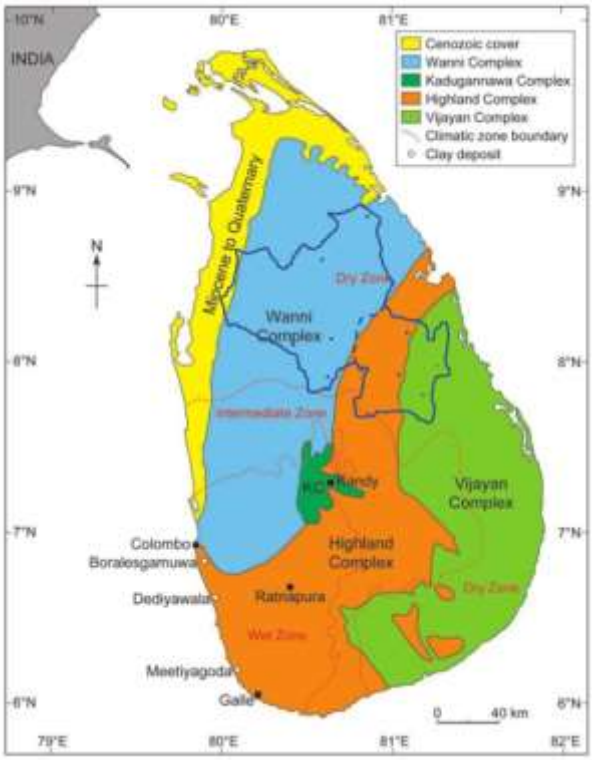
C. Anuradhapura District

135. **Location.** The subproject involving civil works is located at Thambuttegama in Anuradhapura District. Location of this subproject is presented in Figure 1.

136. **Geology and geomorphology and soil.** A part of the Anuradhapura District belongs to the Wanni Complex where Precambrian metamorphic rocks are prominent. Meta sediments, Charnokitic Gneisses, underlying rocks, Migmatites and granitic gneisses, granites and pegmatite are mainly present in this region.

137. The Anuradhapura District falls entirely within the Wanni Complex and borders Miocene to Quaternary (Cenozoic cover) in the western boundary and Highland Complex in the southeastern boundary of the district. The district mainly consists of high-grade metamorphic rocks (crystalline) of Precambrian age. These rocks include quartzite, charnockites, granites, granitic gneisses, khondalites, quartzofeldspathic rocks (granulites and granulitic gneisses), gneisses migmatites, calcgranulites, calc gneisses, and marbles (crystalline limestones) which are of diverse origin. The folded structures in the area are open, tight, upright, and overturned anticlines and synclines, which had been plastically deformed under the granulite facies conditions Berger and Jayasinghe, 1976 (footnote 6). The strike valleys and strike ridges which are parallel to the general strike of the rocks represent rocks which are either susceptible to weathering or resistant to weathering

Figure 20: North Central Province located within Wanni, Highland and Vijayan Complex



Source: Asian Development Bank.

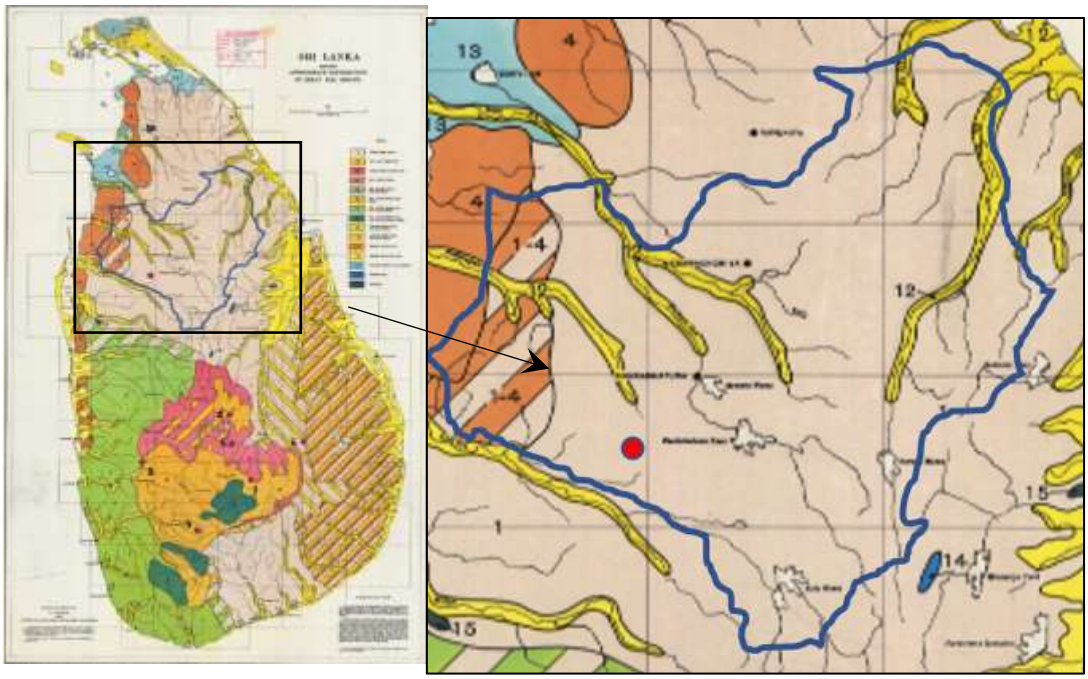
138. Reddish-brown earth is the prominent soil type in the entire dry zone, and reddish-brown lateritic soils and red-yellow podzolic soils in the wet zone. Sri Lanka has been subdivided into different agro-ecological zones considering soil type, rainfall, land use, etc. In the project area, reddish brown earth, low humic gley soils, and grumusol soils are present.

139. The North Central Province (NCP) on the average is considered below 300 m altitudes while the hills rise up to higher altitudes. The soils of the NCP belong to the DL1 Agro-ecological Region, or the reddish-brown earth, low humic gley soils, and their drainage associates. Alluvial soil is not uncommon in the river basins and in the catchment. Soil profiles do not show high variations although occasional variations cannot be ruled out. One of the most important assets with regard to minerals of the earth of NCP, is found in Eppawala within the district of Anuradhapura under Thalawa Divisional Secretary Division in the form of a phosphate ore. Pink quartz ores are also found in the Palagala Divisional Secretary Division. Mica is found in the Kebithigollewa Divisional Secretary Division. The Phosphate Ore is considered a very large ore while others are smaller in size.

140. **Location and topography.** NCP which is similar to other dry zone areas have a few mountains such as Cock Abbey, Dimbulagala, Isinbessagala, Mihinthale, Labunoruwa, Ritigala, Sudukanda, and Thanthirimale ridge of mountains. There are many other small hills scattered in the two districts. NCP has been an agricultural area largely due to its flat nature of the land with slight slopes and mild undulations. A large number of tanks have been constructed, while some

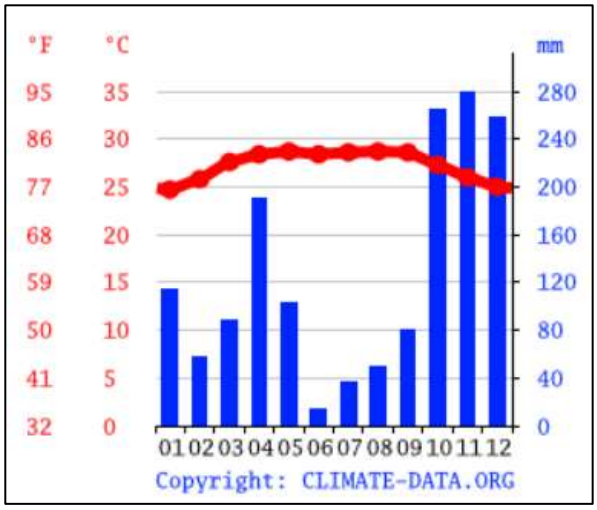
are naturally created. Small to medium free-standing rocky outcrops are a common feature in the province. Some rocks such as Mihinthalaya have come to be known due to its attachment to the introduction of Buddhism to Sri Lanka. Establishment of water tanks and the irrigation of paddy fields below the command areas of the water tanks have been established considering the gradual slopes throughout the province. Examination of water tanks in different areas reveals that the land slopes and the layout have been multidirectional.

Figure 21: Geomorphology Map of North Central Province



Note: Soil Types indicated by numbers: 1: Reddish Brown Earths; 4: Reddish Brown Lateritic Soils; 12: Regosols and Alluvial Soils
Source: Survey Department of Sri Lanka.

Figure 22: Monthly average rainfall pattern and the monthly average temperature in Anuradhapura (Average for 20 years: 1999–2019)

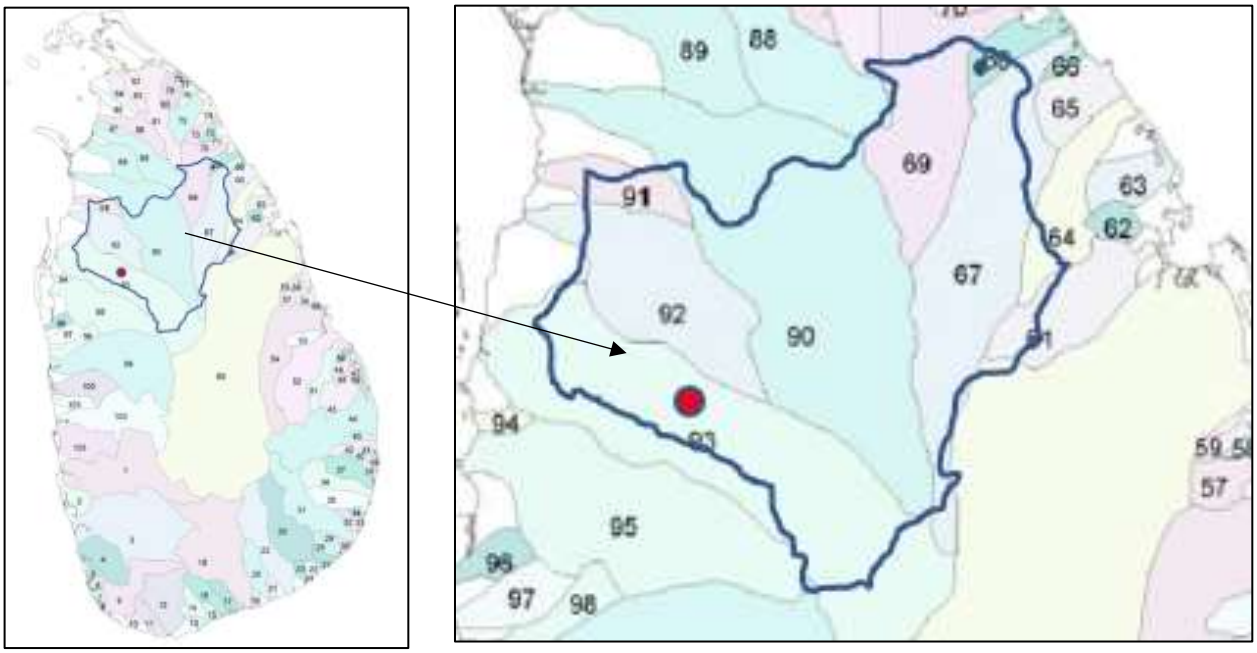


Source: CLIMATE-DATA.ORG. Climate Anuradhapura (Sri Lanka). Available at: https://en.climate-data.org/asia/sri-lanka/north-central/anuradhapura-4862/ (accessed on 2 July 2021).

141. **Climate.** Climatologically, Anuradhapura District is situated within the dry zone. The climate of Anuradhapura District is tropical. The most parts of the NCP receives its major rainfall during the northeastern monsoon which is received during November and February. Furthermore, the two inter-monsoonal periods which extend from October to November and March to April also enrich the district with considerably high rainfall. This location is classified as Aw by Köppen and Geiger classification. In Anuradhapura, the average annual temperature is 27.3°C (81.2°F). In a year, the rainfall is 1,368.0 mm (53.9 inches). The driest month is June, with 12.0 mm (0.5 inches) of rain. The greatest amount of precipitation occurs in November, with an average of 249.0 mm (9.8 inches). May is the warmest month of the year. The temperature in May averages 28.7°C (83.7°F). The lowest average temperatures in the year occur in January when it is around 24.7°C (76.5°F).

142. **Hydrology, drainage and river basins**. The few rivers and canals found in the NCP are well known, such as the manmade canals known as Yoda Ela; Kala Oya starting its tributaries at the base of the hills in Matale, Malwathu Oya feeding its water to Nachchaduwa, and flows down through Anuradhapura District. Weli Oya that starts from Hurulu Wewa, that feed Padaviya Wewa and flowing down feeding many paddy fields, are some of the main rivers of Anuradhapura. A well-developed network of canals has been established in the province to support the settlement colonies and the wide-spreading agricultural farmlands. There is a number of small rivers that appear during the northeast monsoon periods and dry up at other times.

Figure 23: River Basins in the Anuradhapura District



(61: Kantale Basin; 64: Pankulam Aru; 67: Yan Oya; 68: Mee Oya; 69: Ma Oya; 90: Aruvi Aru; 91: Kal Aru; 92: Moderagam Oya; 93: Kala Oya)
Source: Asian Development Bank.

143. **Air quality.** Since the selected subproject location is located within rural areas, sources of air pollutants are hardly found. Therefore, air quality in such subproject areas appears to be good. However, there is a chance of deteriorating the air quality temporarily due to vehicular emissions and drifting of dust from gravel roads and other deteriorated roads.

144. **Existing noise levels.** The subproject sites are mostly located in rural settings with sparse vegetation cover. Therefore, the noise levels are observed to be relatively low.

145. **Sensitive areas**. The site at Thambuththegama is not located within any environmentally sensitive areas.

146. **Bioregions.** Anuradhapura District is located entirely within the bioregion 2: dry zone, dry mixed evergreen forests, dry riverine evergreen forests, and dry deciduous thorn scrubland; altitude 0–500 m; annual rainfall 1,250 mm–1,900 mm; and 4–5 dry months.

147. **Agro-ecological zones.** Anuradhapura District is located almost entirely within the agro-ecological zone of DL1. Only a small area in the western boundary of the district falls within DL3.

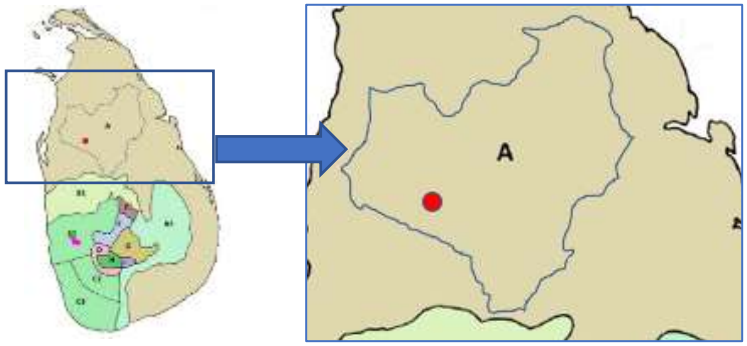
Figure 24: Agro-ecological Regions of Anuradhapura District

Source: Asian Development Bank

148. The key agricultural activity in the district is paddy cultivation and is targeted towards the Maha rains, i.e., northeast monsoons, while second cultivation is carried out during the Yala rains during southwest monsoon periods. Highland cultivations are often started during the inter-monsoonal rains from October to November. Water tanks generally fill up during the Maha rains and the water thus collected is generally used up for Yala cultivations. During the dry spells, dry desiccating winds, however, sweep through the slightly undulating lands at regular intervals. These dry and desiccating winds have a major effect on the soil moisture and hence on the growth of natural vegetation, agriculture and planted forest plantations, and survival of sensitive fauna. Vegetation in and around mountains and the lakes exhibit interesting habitats in terms of species diversity. The traditional monsoon forests, on the other hand, also exhibit an interesting type of forest that is able to withstand the dry desiccating winds. The site at Thambuththegama base hospital proposed for civil works under the HSEP is located within the agro-ecological region of DL1b.

149. **Floristic regions.** Out of the 15 floristic regions in Sri Lanka as proposed by Ashton and Gunatilleke (1987), the entire Anuradhapura District is located within Floristics Region A.

Figure 25: Floristic Regions in the Anuradhapura District

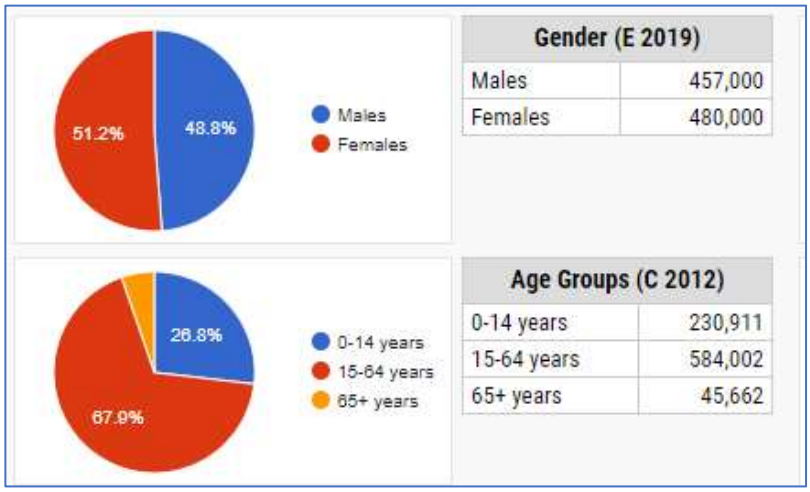


Floristic region A: Dry zone and Arid Lowlands.
Source: Asian Development Bank.

150. **Demography.** The total population in NCP was 1.38 million as per the population estimates of 2019, where the population in Anuradhapura District was 937,000 (population density: 130.5/km^2), and that of Polonnaruwa was 440,000 (population density: 133.6/km^2). The population density of the province in 2019 was 131.5/km^2.

151. Percentage of the female population is slightly higher than the males (Figure 26), and nearly 68% of the population is within the age category of 15–64 years. More than a quarter of the population is below 15 years.

Figure 26: Population distribution in the Anuradhapura District based on Gender and Age Groups



Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

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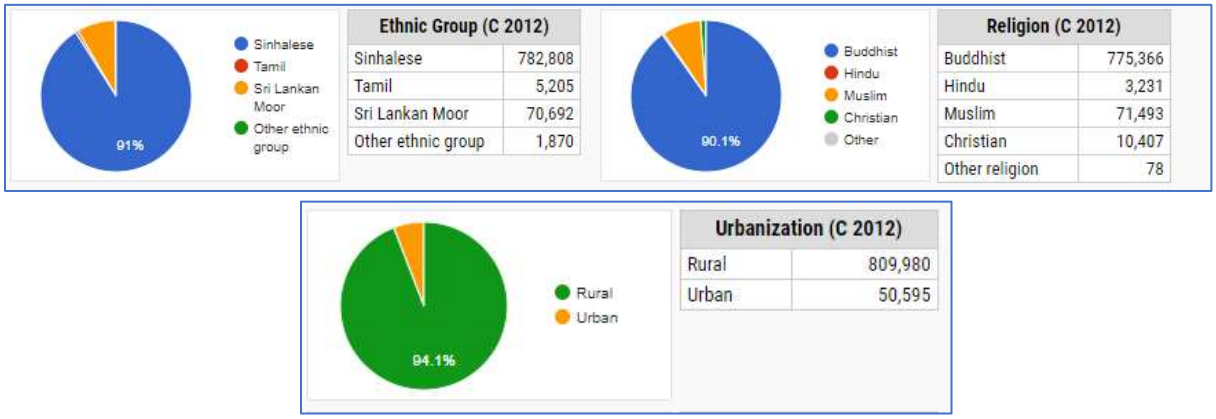
152. Majority of the population are Sinhalese (approximately 91%), about 7% are Tamils, and 2% are Muslims (Figure 27). Data related to the population distribution in the Anuradhapura District shows that at least 81% of the population live in rural areas and a small percentage in estate settlements. About 94% of the population live in rural areas in the district.

Figure 27: Population distribution in Anuradhapura District based on Ethnicity, Religion and Urbanization



Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/. (accessed on 3 July 2021).

153. **Economy**. The province has been a central economic location from the time when ancient kings ruled. However, the share of the GDP contributed to the national economy by the NCP in 2017 was 5.6%, which is lesser than other provinces except Northern province.

154. By taking advantage of its unique geography and irrigation services, the NCP contributed 24.1% of the total paddy production in 2018 in Sri Lanka, which was the largest except for the eastern province which produced 26.3%. In 2016, mean household per capita income of NCP was SLR 16,567 (average monthly mean household per capita income in Sri Lanka is SLR. 16,377 per month), which is very close to the national average and is the third highest after western (SLR. 21,665) and very close with North-western Province (SLR 16,671). The provincial average comfortably lies somewhere in the top half of the income continuum, manifesting fair income disparity.

155. **Land use.** Anuradhapura District is a lower-middle-income region with a population of 937,000 (2019). Land extent is about 7,179 km^2 (10.99% of the total area of the country), which is the largest district in Sri Lanka based on the area. The population density is around 130 persons per km^2, which is one of the least (only Kilinochchi, Mannar, Monaragala, Mullaitivu, and Vavuniya have lesser densities).

156. About 50.0 % of the land area is covered either by forests and/or scrubland. Another 9.3% is covered by inland water bodies, and 22.5% of the area is occupied by paddy fields.

157. There are about 175,780 persons (2019) engaged in agriculture (which was about 46.7% of the employable population with compared to 15.7% and 37.6% engaged in industrial and services sectors, respectively. Provincial contribution to the national agriculture GDP was 8.3%, and provincial GDP of agriculture was 11.5% while national GDP of agriculture is 7.78% (Central Bank Annual Report, 2017).[7] Employment in the agriculture sector was 46.7% (based on the Census and Statistics Department data for 2017 [footnote 5]). Paddy and other agriculture cultivations except plantation crops occupy about 25.0% of the total land area of the district. Other than paddy, the potential growth sectors of the Anuradhapura District constitute crop agriculture along with agriculture-related industries and trades. Out of the total land area of the province, 12.3% is used for home garden crop cultivation. Paddy is the predominant crop in the province followed by OFC and vegetables and fruit production.

158. **Education.** There are 6 national schools (Grade 1AB schools), 557 provincial schools (Grade 1AB: 31; Grade 1C: 99; Grade 2: 164; Grade 3: 263), 49 pirivenas, and 5 private schools functioning in the Anuradhapura District (2019 data).

159. **Health and sanitation.** Healthcare services in the district are being provided to the community through a network of primary, secondary, and tertiary care institutions. In the Anuradhapura Regional Director of Health Services Division, there are 1 teaching hospital, 3 type-B base hospitals, 4 type-A divisional hospitals, 10 type-B divisional hospitals, 21 type-C divisional hospitals, and other primary care institutions.

160. It has been reported by the Regional Director's Office of Health Services that there are 4,196 beds available at the 61 health care facilities available at the district. The total number of outpatients that have obtained treatment from these governmental health care facilities (in 2019) was 3,288,330 and number of inpatients was 345,435 (in 2019).

[7] https://www.cbsl.gov.lk/en/publications/economic-and-financial-reports/annual-reports/annual-report-2017.

161. **Water supply.** Water supply in the Anuradhapura District is operated under the North Central RSC under the Deputy General Manager, RSC. The North Central RSC is functioning with 20 water supply schemes.

162. Out of the total of 231,356 households, about 50.0% obtained drinking water from protected wells, and a further 3.0% used unprotected wells. Neary 60,000 households (24.5%) has National Water Supply Drainage Board (NWSDB) pipe-borne water supply connections. There are many community-based water supply schemes operated in Anuradhapura, and about 35,000 households (15.0%) are connected to such schemes. These schemes have been mostly funded by governmental agencies, private sector organizations as part of their social responsibility projects, or by nongovernment organizations (NGOs), as a response to the providing properly treated water supply to villages affected by the chronic kidney disease of unknown etiology (CKDu). Most of these schemes are groundwater treated with reverse osmosis technology.

163. In addition to the above, about 6,000 households obtain drinking water from tube wells, while about 4,600 households used river or tank water as their drinking water source.

164. **Roads and transport.** According to the data published in 2018 by the Department of Census and Statistics, the total road length in Anuradhapura District was 10,075 km that is under the purview of North Central Provincial Road Development Department.

165. **Electricity.** Presently 100% access for electricity is ensured in western and southern provinces. However, in NCP, 3%–4% of the total households in the province are still unable to get the electricity supply from the national grid.

1. Environmental Sensitive Areas and Natural Disasters

166. **Cyclones**. Many cyclones have passed over the country. Storm surges are more frequent on the east coast of Sri Lanka compared to the other parts of the island. The cyclones which occurred in the past have caused extensive damage, especially in the eastern part of Sri Lanka. However, the central parts of Sri Lanka, including the NCP, have not been affected much, and the incidences of disaster situations due to cyclones are low.

167. **Floods.** Occurrences of floods in the Anuradhapura District is low. Exposure of infrastructure in the district has been categorized as no vulnerability. Extreme flood event records show that both Anuradhapura and Polonnaruwa Districts have experienced 16–27 flood events during the period of 1990–2011. Polonnaruwa District experiences floods at a higher frequency than Anuradhapura. This can be considered as low to moderate incidence scenario. The vulnerability of infrastructure to the expected increase in frequency and intensity of floods due to climate change is widespread and prevalent in many parts of the country, however, out of the two Districts in the NCP (Anuradhapura and Polonnaruwa Districts), Anuradhapura has been categorized under no vulnerability.

168. **Landslide exposure.** With climate change, the vulnerability of infrastructure to landslides is expected an increase in frequency and intensity and is focused mainly on the central hills. These figures highlight that there are areas in the central parts of the country, which are hilly. However, Anuradhapura, as well as Polonnaruwa Districts, which are mostly flat in terrain, are exposed to low to minimal vulnerability. Landslides have not been recorded in the Anuradhapura District.

169. **Droughts.** Much of the Anuradhapura District and Polonnaruwa Districts are relatively dry and located within dry climatic zone of Sri Lanka. Much of the areas of eastern parts of Anuradhapura District had 271–300 days, where daily rainfall is less than 1.0 mm.

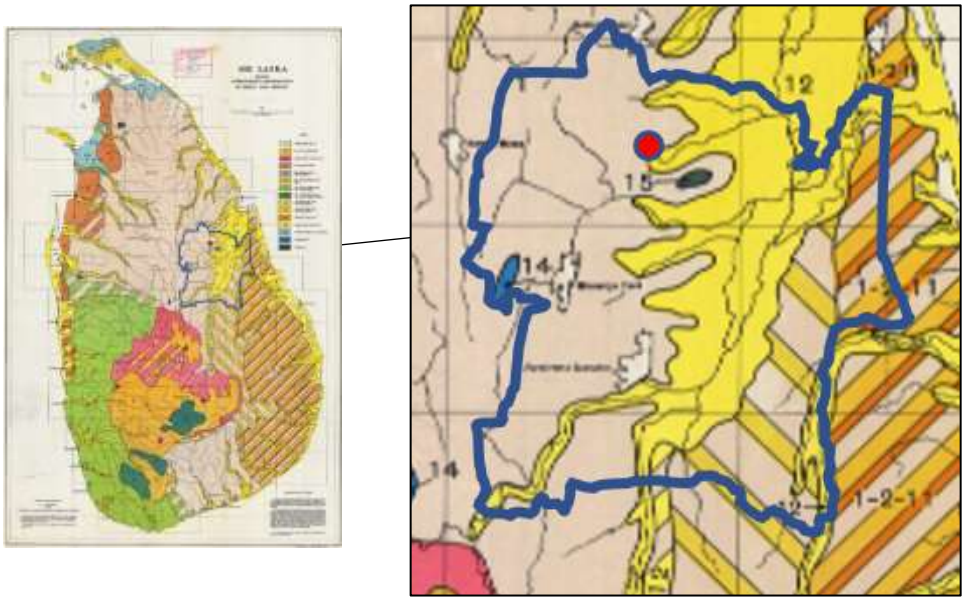
170. **Environmental Sensitive areas.** There are no environmentally sensitive areas within the proximity of the proposed site.

D. Polonnaruwa District

171. **Location.** The subproject involving civil works in Polonnaruwa District is presented in **Figure 1**.

172. **Geology and geomorphology and soil.** The Polonnaruwa District falls entirely within the Highland Complex in the western half and Vijayan Complex in the eastern half of the district (Figure 28). The district mainly consists of high-grade metamorphic rocks (crystalline) of Precambrian age. These rocks include quartzite, charnockites, granites, granitic gneisses, khondalites, quartzofeldspathic rocks (granulites and granulitic gneisses), gneisses migmatites, calcgranulites, calc gneisses, and marbles (crystalline limestones) which are of diverse origin. The folded structures in the area are open, tight, upright, and overturned anticlines and synclines, which had been plastically deformed under the granulite facies conditions Berger and Jayasinghe, 1976 (footnote 6). Furthermore, the linear features in the area are tectonic lineaments (joint zones, fracture zones), strike valleys and strike ridges. The strike valleys and strike ridges which are parallel to the general strike of the rocks represent rocks which are either susceptible to weathering or resistant to weathering.

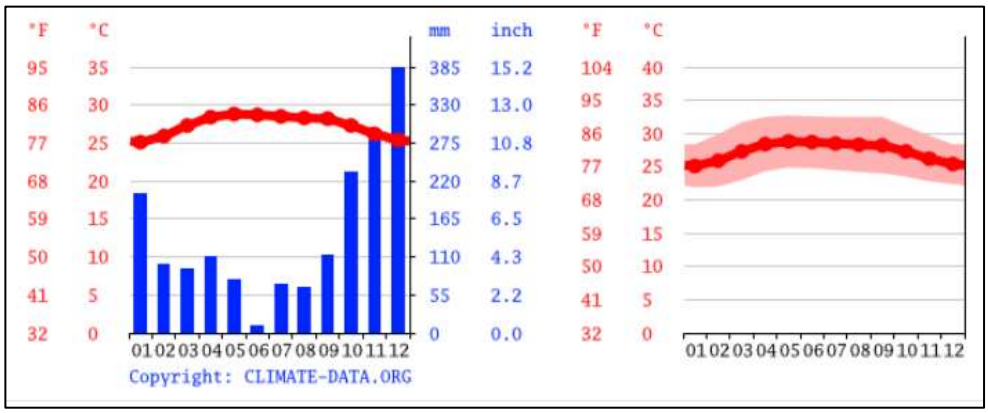
Figure 28: Geomorphology Map of Polonnaruwa District



Note: Soil Types indicated by numbers: 1: Reddish Brown Earths; 2: Non-Calcic Brown Soils; 11: Regosolic Alluvial Soils; 12: Regosols and Alluvial Soils; 14: Rendzina Soils15: Grumusols.
Source: Survey Department of Sri Lanka

173. **Location and Topography**. The NCP, like other dry zone areas, have a few mountains such as Cock Abbey, Dimbulagala, Isinbessagala, Labunoruwa, Mihinthale, Ritigala, Sudukanda, and Thanthirimale ridge of mountains. There are many other small hills scattered in the two districts. NCP has been an agricultural area primarily due to its flat nature of the land with slight slopes and mild undulations. Many water tanks have been constructed while some are naturally created. Small to medium free-standing rocky outcrops are a common feature in the province. Establishment of water tanks and the irrigation of paddy fields below the command areas of the water tanks have been established considering the gradual slopes throughout the province. Examination of water tanks in different areas reveals that the land slopes and the layout have been multidirectional.

Figure 29: Monthly average rainfall pattern and the monthly average temperature in Polonnaruwa (Average for 20 years: 1999–2019)



Source: CLIMATE-DATA.ORG. Climate Polonnaruwa (Sri Lanka). Available at: https://en.climate-data.org/asia/sri-lanka/north-central/polonnaruwa-26466/. Accessed on 2 July 2021.

174. Most parts of the district receive its major rainfall during northeastern monsoon received during November and February. Furthermore, the two inter-monsoonal periods which extend from October to November and March to April also enrich the district with considerably high rainfall. This location is classified as by Köppen and Geiger classification. In Polonnaruwa, the average annual temperature is 27.3°C (81.2°F). In a year, the rainfall is 1,678.0 mm (66.1 inches). The driest month is June, with 10.0 mm (0.4 inches) of rain. The greatest amount of precipitation occurs in December, with an average of 370.0 mm (16.5 inches). May is the warmest month of the year. The temperature in May averages 28.8°C (83.8°F). The lowest average temperatures in the year occur in January when it is around 25.1°C (77.2°F).

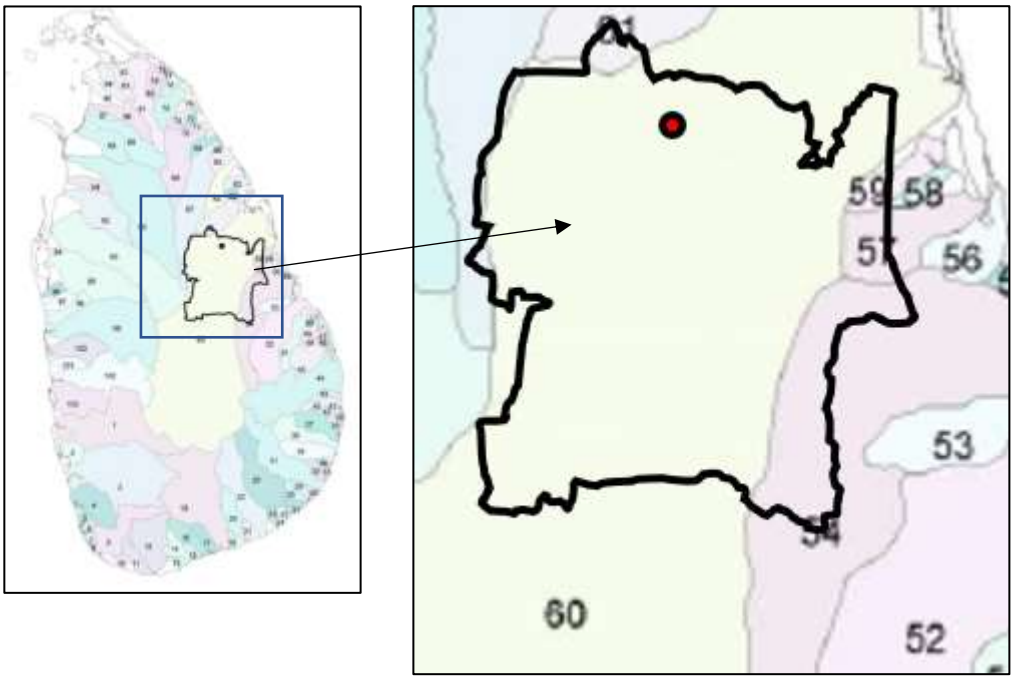
175. **Hydrology, drainage, and river basins.** The few rivers and canals found in the NCP are well known, such as the manmade canals known as Yoda Ela; Kala Oya starting its tributaries at the base of the hills in Matale, Malwathu Oya feeding its water to Nachchaduwa, and flows down through Polonnaruwa District. Weli Oya that starts from Hurulu Wewa, that feed Padaviya Wewa and flowing down providing many paddy fields, are some of the main rivers of Polonnaruwa. A well-developed network of canals has been established in the province to support the settlement colonies and the wide-spreading agricultural farmlands. There are a number of small rivers that appear during the northeast monsoon periods and dry up at other times. The Jaya Ganga of Polonnaruwa District that has augmented through the Accelerated Mahaweli Project are some of the new irrigation canals complexes that feed the agricultural community.

176. **Air quality.** Since the selected subproject locations are mostly located within rural areas,

sources of air pollutants are hardly found. Therefore, air quality in such subproject areas appears to be good. However, there is a chance of deteriorating the air quality temporarily due to vehicular emissions and drifting of dust from gravel roads and other deteriorated roads.

177. **Existing noise levels.** The subproject sites are mostly located in rural settings with a good vegetation cover. Therefore, the noise levels are observed to be relatively low.

Figure 30: River basins in the Polonnaruwa District



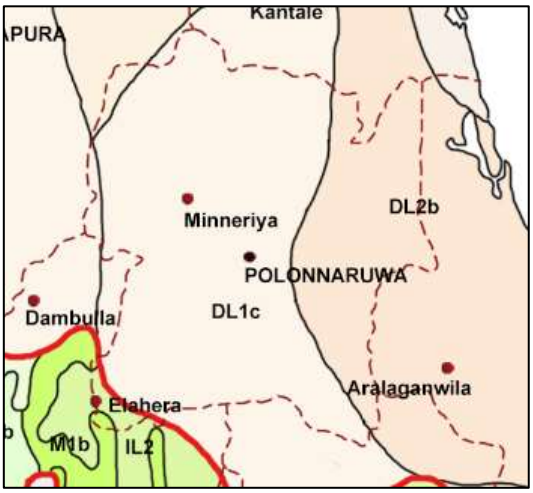
(54: Maduru Oya; 57: Bodigoda Aru; 58: Mandan Aru; 59: Makarachchi Aru; 60: Mahaweli Oa; 61: Kantale Basin; 61: Kantale Basin; 67: Yan Oya)

Source: Asian Development Bank

178. The forest cover of Polonnaruwa district is 1642.2 km^2 of forest cover. The forest cover of Polonnaruwa District is 40% of the total land area of Polonnaruwa, while the National Forest cover of the island as a whole is only 22%. Protected forests of Polonnaruwa is 15,872 hectares (ha) while another 10,438 ha have been proposed to be declared as other protected forests. Out of the 20 National Parks, seven are found within Polonnaruwa District. Minneriya-Girithale Sanctuary is 6,698.5 ha, and the Elahera-Girithale sanctuary is 14,035.2 ha in extent. Among other national parks, important in biodiversity are Maduru Oya, Minneriya Kawudulla, Somawathiya, and Wasgomuwa.

179. **Agro-ecological zones.** Polonnaruwa District is located almost entirely within the agro-ecological zone of DL1. Only a small area in the western boundary of the district falls within DL3. Medirigiriya base hospital is located within DL1c.

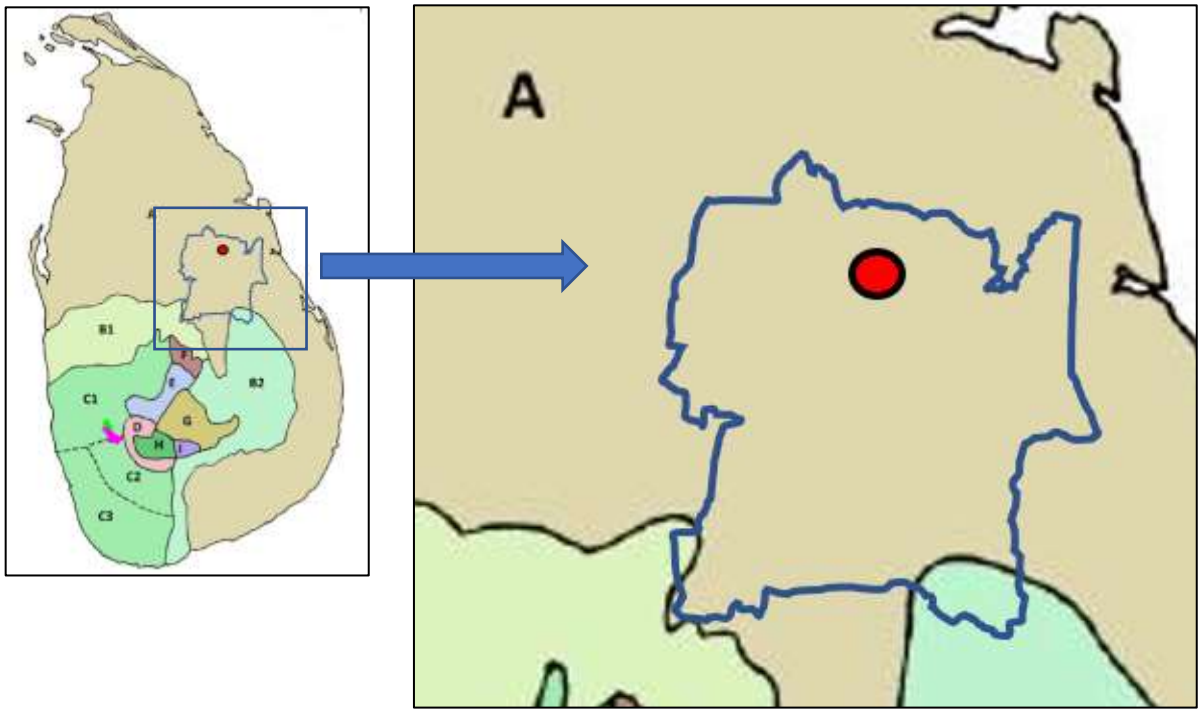
Figure 31: Agro-ecological regions in Polonnaruwa District



Source: Asian Development Bank

180. **Floristic regions.** Out of the 15 floristic regions in Sri Lanka as proposed by Ashton and Gunatilleke (1987),[3] the entire Polonnaruwa District is located within Floristics Region A.

Figure 32: Floristic Regions in the Polonnaruwa District and Sub-project locations and floristic regions where they are located



Floristic region A: Dry zone and Arid Lowlands.
Source: Asian Development Bank

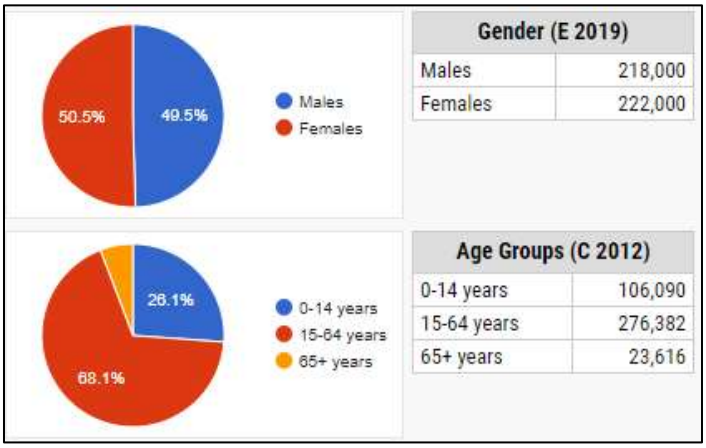
181. **Sensitive areas**. The site proposed for civil works at Medirigiriya base hospital is not located within any environmentally sensitive areas.

182. **Bioregions.** Polonnaruwa District is located entirely within the Bioregion 2: dry zone, dry mixed evergreen forests, dry riverine evergreen forests, and dry deciduous thorn scrubland; altitude 0–500 m; annual rainfall 1,250 mm–1,900 mm; and 4–5 dry months.

183. **Demography.** The total population in NCP was 1.38 million as per the population estimates of 2019, where the population in Anuradhapura District was 937,000 (population density: 130.5/km), and that of Polonnaruwa was 440,000 (population density: 133.6/km). The population density of the province in 2019 was 131.5/km.

184. Percentage of the female population is slightly higher than the males, and nearly 68% of the population is within the age category of 15–64 years. More than a quarter of the population is below 15 years.

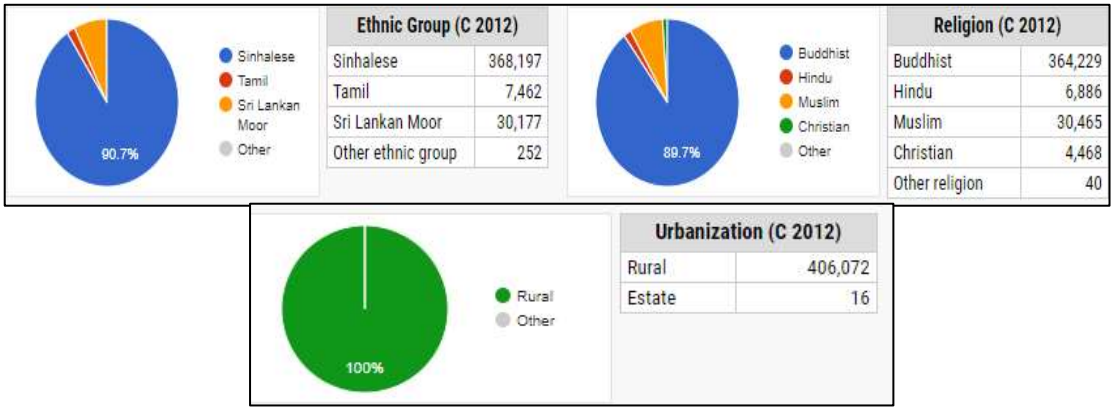
Figure 33: Population distribution in the Polonnaruwa District based on Gender and Age Groups



Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

185. Majority of the population are Sinhalese (approximately 91%), about 7% are Tamils, and 2% are Muslims. Data related to the population distribution in the Polonnaruwa District shows that almost all the households in rural areas and a small percentage in estate settlements.

Figure 34: Population distribution in Polonnaruwa District based on Ethnicity, Religion and Urbanization



Ethnic Group (C 2012)	
Sinhalese	368,197
Tamil	7,462
Sri Lankan Moor	30,177
Other ethnic group	252

Religion (C 2012)	
Buddhist	364,229
Hindu	6,886
Muslim	30,465
Christian	4,468
Other religion	40

Urbanization (C 2012)	
Rural	406,072
Estate	16

Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

186. **Economy.** The province has been a central economic location from the time when ancient kings ruled. However, the share of the GDP contributed to national economy by the NCP in 2017 was 5.6%, which is lesser than other provinces except northern province.

187. By taking advantage of its unique geography and irrigation services, the NCP contributed 24.1% of the total paddy production in 2018 in Sri Lanka, which was the largest except for eastern province which produced 26.3%. In 2016, mean household per capita income of NCP was SLR 16,567 (average monthly mean household per capita income in Sri Lanka is SLR. 16,377 per month), which is very close to the national average and is the third highest after western (SLR. 21,665) and very close with North-western Province (SLR 16,671). The provincial average comfortably lies somewhere in the top half of the income continuum, manifesting fair income disparity.

188. **Land use.** Polonnaruwa District is a lower-middle-income region with a population of 440,000 (2019). Land extent is about 3,293 km^2 (5.0% of the total area of the country). The population density is around 133.6 persons per km^2, which is one of the least (only Kilinochchi, Mannar, Monaragala, Mullaitivu, and Vavuniya have lesser densities). About 53% of the land area is covered either by forests and/or scrubland. Another 4.8% is covered by inland water bodies, and 24.2% of the area is occupied by paddy fields.

189. In Polonnaruwa District, there were about 59,700 persons (2019) engaged in agriculture (which was approximately 39.10% of the employable population as compared to 14.60% and 46.3% involved in industrial and services sectors, respectively). Provincial contribution to the national agriculture GDP was 8.30%, and provincial GDP of agriculture was 11.49% while national GDP of agriculture is 7.78% (Central Bank Annual Report, 2017). Employment in the agriculture sector was 46.70% (based on the Census and Statistics Department data for 2017). Paddy and other agriculture cultivations except plantation crops occupy about 24% of the total land area of the district. Other than paddy, the potential growth sectors of the Polonnaruwa District constitute crop agriculture along with agriculture-related industries and trades. Out of the total land area of the province, 14.10% per cent is used for home garden crop cultivation. Paddy is the predominant crop in the province followed by OFC and vegetables and fruit production.

190. **Education.** There are 4 national schools (Grade 1AB schools), 246 provincial schools (Grade 1AB: 21, Grade 1C: 32, Grade 2: 58, and Grade 3: 135), 21 pirivenas, and 2 private schools functioning in the Polonnaruwa District (2019 data).

191. **Health and sanitation.** Healthcare services in the district are being provided to the community through a network of primary, secondary, and tertiary care institutions. In the Polonnaruwa Regional Director of Health Services Division, there are no teaching hospitals, 1 district general hospital, 2 type-B base hospitals, 1 type-A divisional hospitals, 4 type-B divisional hospitals, 4 type-C divisional hospitals, and other primary care institutions.

192. It has been reported by the Regional Director's Office of Health Services that there are 1,652 beds available at the 12 HCFs available in the district. The total number of outpatients that have obtained treatment from these governmental HCFs (in 2019) was 1.16 million and number of inpatients was 192,496 (in 2018).

193. **Water supply.** Water supply in the Polonnaruwa District is operated under the North Central RSC under the Deputy General Manager, RSC.

194. Out of the total of 111,010 households, about 50.0% obtained drinking water from protected wells, and a further 6.8% used unprotected wells. Neary 60,000 households (24.3%) has NWSDB pipe-borne water supply connections. There are many community-based water supply schemes operated in Polonnaruwa, and about 18,400 households (16.6%) are connected to such schemes. These schemes have been mostly funded by governmental agencies, private sector organizations as part of their social responsibility projects or by NGOs, as a response to the providing appropriately treated water supply to villages affected by the CKDu. Most of these schemes are groundwater treated with reverse osmosis technology.

195. In addition to the above, about 3,270 households obtain drinking water from tube wells, while about 1,820 households used river or tank water as their drinking water source.

196. **Roads and transport.** According to the data published in 2018 by the Department of Census and Statistics, the total road length in Polonnaruwa District was 2,376 km that is under the purview of North Central Provincial Road Development Department.

197. **Electricity.** Presently 100% access for electricity is ensured in western and southern provinces. However, in NCP, 3%–4% of the total households in the province are still unable to get the electricity supply from the national grid.

a. Environmental Sensitive Areas and Natural Disasters

198. **Cyclones.** Many cyclones have passed over the country. Storm surges are more frequent on the east coast of Sri Lanka compared to the other parts of the island. The cyclones which occurred in the past have caused extensive damage, especially in the eastern part of Sri Lanka. However, the central parts of Sri Lanka, including the NCP, have not been affected much, and the incidences of disaster situations due to cyclones are low.

199. **Floods.** Occurrences of floods in the Polonnaruwa District is low. Exposure of infrastructure in the district has been categorized as no vulnerability. Extreme flood event records show that both Anuradhapura and Polonnaruwa Districts have experienced 16–27 flood events from 1990 through 2011. Polonnaruwa district experiences floods at a higher frequency than

Polonnaruwa. This can be considered as low to moderate incidence scenario. The vulnerability of infrastructure to the expected increase in frequency and intensity of floods due to climate change is widespread and prevalent in many parts of the country, however, out of the two districts in the NCP (Anuradhapura and Polonnaruwa Districts), Polonnaruwa has been categorized under no vulnerability.

200. **Landslide exposure.** With climate change, the vulnerability of infrastructure to landslides is expected an increase in frequency and intensity and is focused mainly on the central hills. These highlight that there are areas in the central parts of the country, which are hilly. However, Anuradhapura, as well as Polonnaruwa Districts, which are mostly flat in terrain, are exposed to low to minimal vulnerability. Landslides have not been recorded in the Polonnaruwa District.

201. **Droughts.** Much of the Anuradhapura District and Polonnaruwa Districts are relatively dry and located within Dry Climatic zone of Sri Lanka. Much of the areas of eastern parts of Polonnaruwa District had 271–300 days, with daily rainfall less than 1 mm.

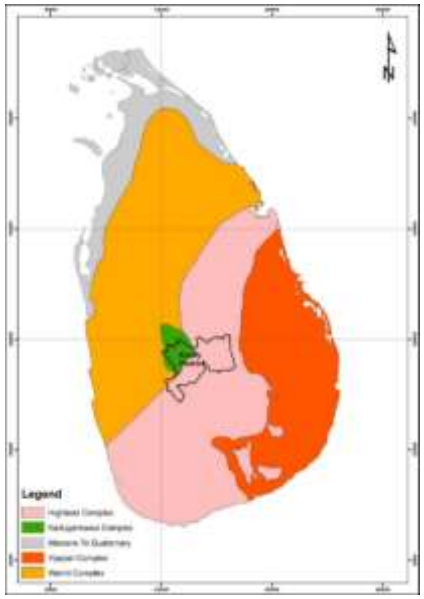
202. **Environmentally sensitive areas.** There are no environmentally sensitive areas within the proximity of the proposed site.

E. Kandy District

203. **Location.** The subproject involving civil works in Kandy District is presented in **Figure 1**.

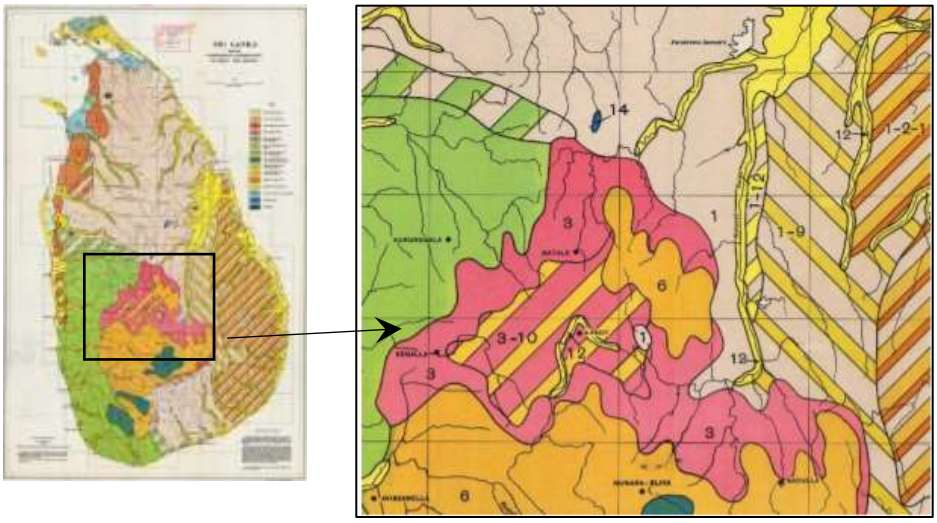
204. **Geology and geomorphology and soil.** Kandy district falls within the Highland and Wanni Complexes, Kadugannawa Complex and mainly consists of high-grade metamorphic rocks (crystalline) of Precambrian age. These rocks include quartzite, charnockites, granites, granitic gneisses, khondalites, quartzofeldspathic rocks (granulites and granulitic gneisses), gneisses migmatites, calcgranulites, calc gneisses, and marbles (crystalline limestones) which are of diverse origin. The folded structures in the area are open, tight, upright, and overturned anticlines and synclines which had been plastically deformed under the granulite facies conditions (Berger and Jayasinghe, 1976).[6] Furthermore, the linear features in the area are tectonic lineaments strike valleys and strike ridges. The strike valleys and strike ridges which are parallel to the general strike of the rocks represent rocks which are either susceptible to weathering or resistant to weathering.

Figure 35: Kandy District is located within Highland and Kadugannawa Complex



Source: Asian Development Bank.

Figure 36: Geomorphology Map of Kandy District



Note: Soil Types indicated by numbers: 1: Reddish Brown Earths; 2: Non-Calcic Brown Soils; 3: Reddish Brown Lateritic Soils; 6: Red Yellow Podzolic Soils; 9: Immature Brown Loams (Dry zone subgroup); 11: Regosolic Alluvial Soils; 12: Regosols and Alluvial Soils; 13: Solodised Solonetz and Solonchanks
Source: Survey Department of Sri Lanka

205. Reddish-brown lateritic soils and red-yellow podzolic soils in the wet zone in which Kandy district is located. Sri Lanka has been subdivided into different agro-ecological zones considering soil type, rainfall, and land use, etc. In the project area, reddish-brown earth, low humic gley soils, and grumusol soils are present.

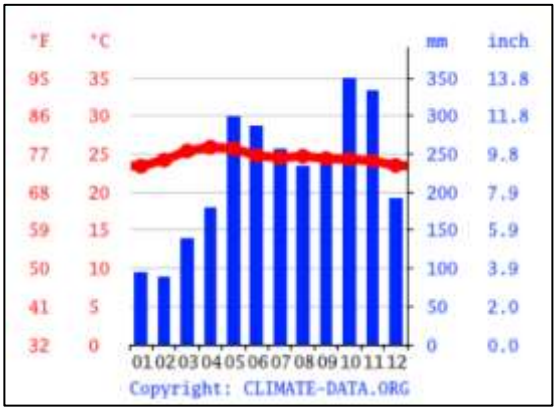
206. **Location and topography.** Kandy District is surrounded at the north by Laggala-Pallegama, Raththota, Ukuwela, and Wilgamuwa Divisional Secretariats of Matale District; at east by Mahiyanganaya Divisional Secretariat of Badulla District; at the south by Kandaketiya Divisional Secretariat of Badulla District and Ambagmuwa Korale, Hanguranketha, Kothmale, Nuwara Eliya, and Walapane Divisional Secretariats of Nuwara Eliya District; and at the west by Aranayake, Bulathkohupitiya, Mawanella and Rambukkana Divisional Secretariats of Kegalle District, and Rideegama Divisional Secretariats of Kurunagala District. The district is located between latitudes 06.56' and 06.29' and between longitudes 80.25' and 80.00. Since Kandy District is surrounded by Badulla, Kegalle, Kurunegala Nuwara Eliya, and Matale Districts, several access roads are present. Among them A1 Colombo – Kandy, A9 Kandy – Jaffna, A5 Peradeniya – Badulla – Chenkalady, and A026 Kandy-Mahiyangana-Padiyathalawa highway are prominent, and they are interconnected by several other class AB and AC roads.

207. Kandy is a plateau in the central mountainous region and lies 500 m to 700 m above sea level. The terrain in the Kandy City area does not contain many steeps, plunging slopes, except in the surrounding mountains. The topography in this plateau consists of undulating plains with hillocks formed by the drainage paths.

208. **Climate.** Climatologically, Kandy District is situated within wet zone and the intermediate zone. The most western part of the district towards the central highland of the island, depict wet climate conditions than the eastern slopes towards Hasalaka area. The most western parts of the Kandy District receives its major rainfall during the southwestern monsoon which receives during May and September. Furthermore the two inter-monsoonal periods, which extend from October to November, and March to April, also enrich the district with considerably high rainfall.

209. The average temperature in the Kandy District varies depending on the location. However, the average climatic patterns may misrepresent the conditions towards the eastern boundary of Kandy District, which are located very close to Uva Province. In a year, the rainfall is 1,937 mm. The driest month is June, with 16 mm of rainfall. In December, the precipitation reaches its peak, with an average of 373 mm. The warmest month of the year is May, with an average temperature of 28.1°C. At 25.2°C on average, January is the coldest month. The difference in precipitation between the driest month and the wettest month is 357 mm. The variation in annual temperature is around 2.9°C.

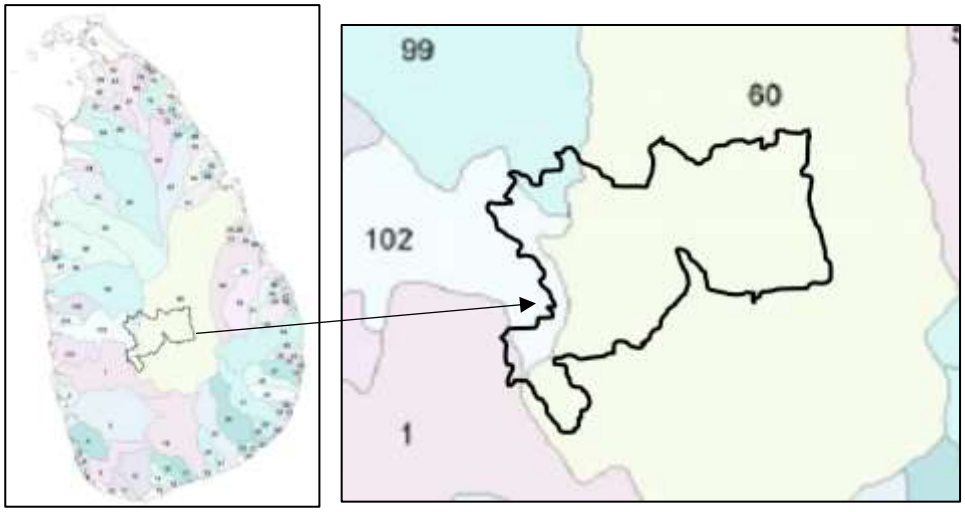
Figure 37: Monthly average rainfall pattern and the monthly average temperature in Teldeniya (Average for 20 years: 1999–2019)



Source: CLIMATE-DATA.ORG. Climate Teldeniya (Sri Lanka). Available at: https://en.climate-data.org/asia/sri-lanka/central-province/teldeniya-765902/. Accessed on 2 July 2021.

210. **Hydrology, drainage, and river basins.** The Kandy District is entirely located within the Mahaweli Ganga Catchment (zone 60). Small areas in the western boundaries of the District borders and/or are within Kelani Oya (zone 1), Deduru Oya (zone 99) and Maha Oya (zone 102) basins.

Figure 38: River basins in the Kandy District



(60: Mahaweli Ganga; 102: Maha Oya; 99: Deduru Oya; 1: Kelani Ganga)

Source: Asian Development Bank

211. **Air quality.** Since the subproject location is located within suburban areas sources of air pollutants are not significant. Therefore, air quality in such subproject areas appears to be good. However, there is a chance of deteriorating the air quality temporarily due to vehicular emissions and drifting of dust from gravel roads and other deteriorated roads.

212. **Existing noise levels.** The subproject sites are mostly located in suburban settings with a good vegetation cover. Therefore, the noise levels are ambient noise level of the areas can be considered as less than 55 decibels (dB) (A) during daytime (0600 hours to1800 hours) and less than 45 dB (A) nighttime (6:00 p.m. to 6:00 a.m.). Rich vegetation in the subproject sites observed to be relatively low.

213. **Bioregions.** In the Kandy District, there are three bioregions:

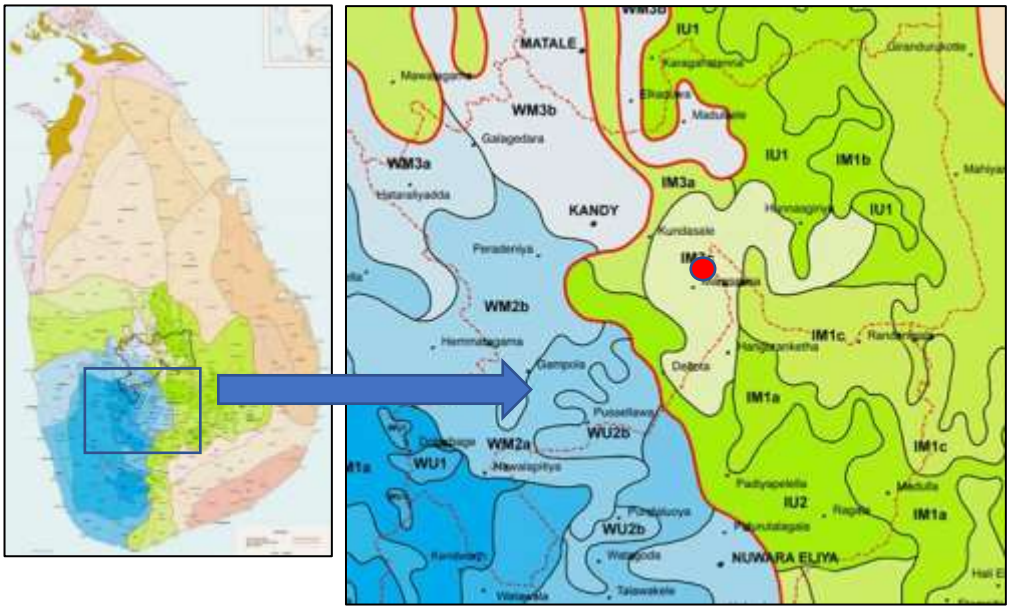
(i) Bioregion 3: intermediate zone, moist evergreen forest, altitude 0–1,000 m, annual rainfall 1,900 mm–2,500 mm, and less than 3 dry months;
(ii) Bioregion 4: lowland wet zone, tropical (lowland) wet evergreen forest, altitude up to 1,000 m; annual rainfall 2,500 mm–5,000 mm, and no dry months; and
(iii) Bioregion 6: highlands, montane evergreen forests, altitude 1,500 m–2,500 m, annual rainfall 2,500 mm–5,000 mm, and no dry months.

214. **Agro-ecological zones.** There are 14 agro-ecological zones are represented in the Kandy District. Teldeniya base hospital is located within IM3c.

215. It is evident that a significant portion of the Kandy District lies in the wet midlands and

uplands, and intermediate uplands and intermediate midlands; only a relatively small land area belongs to the wet highlands. As the district accommodates a broad wet and intermediate agro-ecological region, the cultivation of appropriate crops such as tea, spices, a variety of vegetable, papaya, and other fruits, etc. has been thriving.

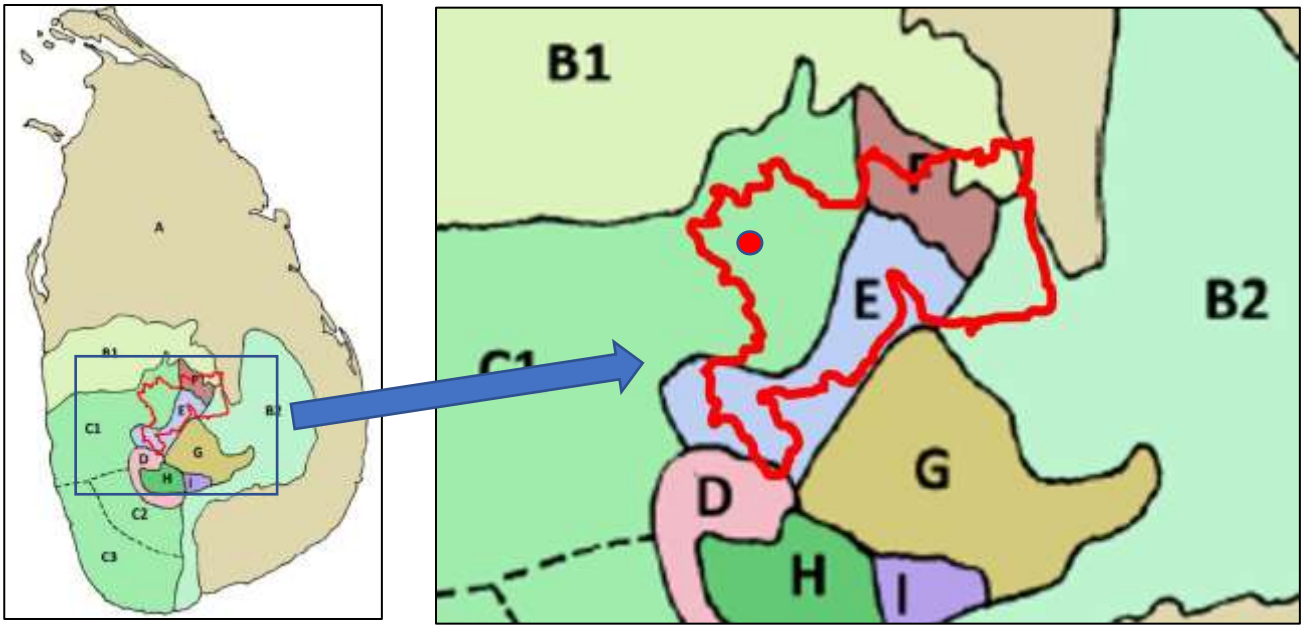
Figure 39: Agro-ecological regions of Kandy District



Source: Asian Development Bank

216. **Floristic Regions.** Out of the 15 floristic regions proposed by Ashton & Gunatilleke (1987), there are five floristic regions represented in the Kandy.

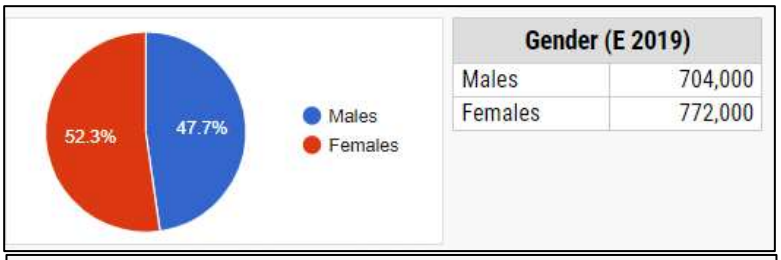
Figure 40: Floristic Regions in the Kandy District and Sub-project location and agro-ecological region where the project site is located



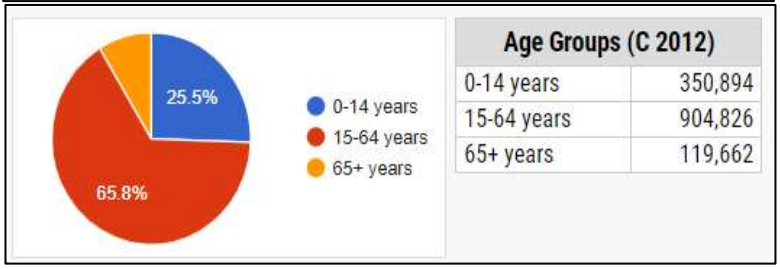
Floristic region B2: Eastern intermediate lowlands: Tropical mist semi-evergreen forests and Savanna forests; **Floristic region B1:** Northern intermediate lowlands; **Floristic region C1:** Northern wet lowlands; **Floristic region E:** Kandy-upper Mahaweli; **Floristic region F:** Knuckles
Source: Asian Development Bank

217. **Demography.** The total population in Kandy District was 1.48 million as per the population estimates of 2019. The population density is about 760.8/km^2. Percentage of the female population is slightly higher than the males, and more than 65% of the populations are within the age category of 15–64 years. More than a quarter of the population is below 15 years.

Figure 41: Population distribution in the Kandy District based on Gender and Age Groups



Gender (E 2019)	
Males	704,000
Females	772,000



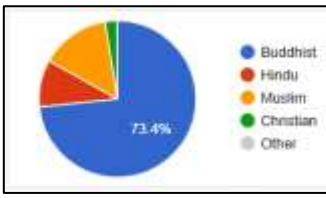
Age Groups (C 2012)	
0-14 years	350,894
15-64 years	904,826
65+ years	119,662

Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

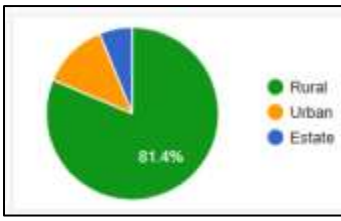
218. Majority of the population are Sinhalese (approximately 74%), and about 12% are Tamils and 14% are Muslims. Data related to population distribution in the Kandy district shows that at least 81.4% of the population live in rural areas and a small percentage in estate settlements.

Figure 42: Population Distribution in Kandy District with respect to Ethnicity, Religion and Urbanization

Ethnic Group (C 2012)	
Sinhalese	1,023,488
Tamil	154,321
Sri Lankan Moor	191,570
Other ethnic group	6,003



Religion (C 2012)	
Buddhist	1,009,220
Hindu	133,744
Muslim	197,076
Christian	35,177
Other religion	165



Urbanization (C 2012)	
Rural	1,119,221
Urban	170,544
Estate	85,617

Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021)

219. **Economy.** The province has been a central economic location from the time when British ruled. The Central Province provided the third highest contribution to the GDP, maintaining its relative position compared to 2018, and managing to increase its GDP contribution to 10.0% in 2019 (Central Bank). By taking advantage of its unique geography, the Central Province contributed 18.2% of the total in the agricultural sector in 2019 in Sri Lanka. Per capita income of Central Province is SLR 208,000 and it comfortably lies somewhere in the middle of the income continuum, manifesting fair income disparity.

220. There are about 180,000 farm families in 3,200 villages. Provincial contribution to the national agriculture GDP is 30.0%, and provincial GDP of agriculture is 14.2% while national gross domestic production of agriculture is 6.9% (Central Bank Annual Report, 2017). Employment in the agriculture sector is 53.3% (based on the Census and Statistics Department data for 2017). Paddy and other agriculture cultivations except plantation crops occupy 8.0% of the total land area of the district. The potential growth sectors of the Kandy District constitute crop agriculture along with agriculture-related industries and trades. Out of the total land area of the province, 35% is used for home garden crop cultivation. Paddy is the predominant crop followed by OFC and vegetables and floriculture.

221. **Education.** There are 35 national schools, 608 provincial schools, 63 pirivenas, and 13 private schools functioning in the Kandy District (2017 data).

222. **Health and Sanitation.** Healthcare services in the district are being provided to the community through a network of primary, secondary, and tertiary care institutions. These include 3 teaching hospitals, 1 district general hospital, 2 type-B base hospitals, 14 type-B divisional hospitals, 33 type-C divisional hospitals, and 85 primary care institutions.

223. It has been reported by the Regional Director's Office of Health Services that there are

7,107 beds available at the 347 health care facilities available at the district. The total number of outpatients that have obtained treatment from these governmental HCFs (in 2019) was 4,094,363 and number of inpatients was 756,160 (in 2019).

224. **Water supply.** Water supply in the Kandy District is operated under the Central RSC under the supervision of Deputy General Manager, RSC. The Central RSC is functioning with 16 water supply schemes.

225. **Roads and transport.** According to the data published in 2018 by Department of Census and Statistics, the total road length in Kandy District was 6,343.7 km that is under the purview of Central Provincial Road Development Department.

226. **Electricity.** Presently 100% access for electricity is ensured in Western and Southern Provinces. However, in Central Province, 3%–4% of the total households in the province are still unable to get the electricity supply from the national grid.

1. Environmentally sensitive areas and natural disasters

227. **Cyclones.** Many cyclones have passed over the country. Storm surges are more frequent on the east coast of Sri Lanka compared to the other parts of the island. The cyclones which occurred in the past have caused extensive damage, especially in the eastern part of Sri Lanka. However, the southeastern part of Sri Lanka, including the Central Province has not affected much, and incidences of disaster situations due to cyclones are low.

228. **Floods.** Occurrences of floods in the Kandy District is low. Exposure of infrastructure in the district has been categorized as no vulnerability. Extreme flood event records show that both Kandy and Matale Districts have experienced 7–15 flood events during the period of 1990–2011. This can be considered as low incidence scenario. The vulnerability of infrastructure to the expected increase in frequency and intensity of floods due to climate change is widespread and prevalent in many parts of the country, however, two districts in the Central Province (Kandy and Matale Districts) has been categorized under no vulnerability.

229. **Landslide exposure.** With climate change, the vulnerability of infrastructure to landslides is expected an increase in frequency and intensity and is focused mainly on the central hills. These figures highlights that there are areas in Kandy District which are exposed to moderate, low and minimal vulnerability. Landslides have been frequently experienced in some parts of the Kandy District.

230. **Droughts.** Much of the Kandy District and part of Badulla District are relatively dry and located within Intermediate and/or dry climatic zones of Sri Lanka. Much of the areas of eastern parts of Kandy District records nearly 200 days, where daily rainfall is less than 1.0 mm.

231. **Environmentally sensitive areas.** There are no environmentally sensitive areas within the proximity of the proposed site.

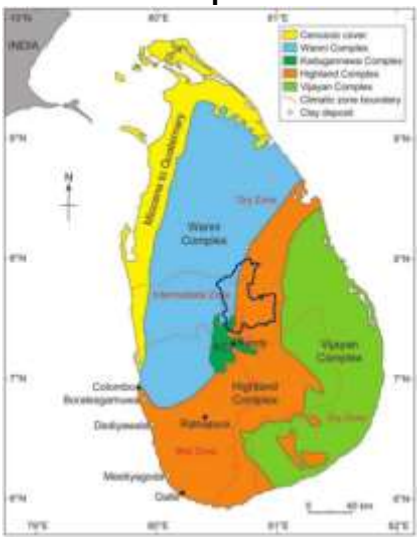
F. Matale District

232. **Location.** The subproject involving civil works in Matale District is presented in Figure 1**.**

233. **Geology and geomorphology and soil.** The Matale District falls within the Highland and

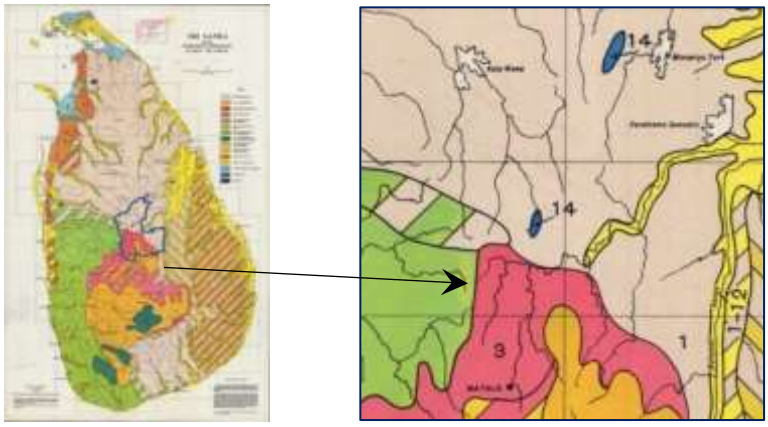
Wanni Complexes, and Kadugannawa Complex and mainly consists of high-grade metamorphic rocks (crystalline) of Precambrian age. These rocks include quartzite, charnockites, granites, granitic gneisses, khondalites, quartzofeldspathic rocks (granulites and granulitic gneisses), gneisses migmatites, calcgranulites, calc gneisses, and marbles (crystalline limestones) which are of diverse origin. The folded structures in the area are open, tight, upright, and overturned anticlines and synclines, which had been plastically deformed under the granulite facies conditions Berger and Jayasinghe, 1976 (footnote 3). Furthermore, the linear features in the area are tectonic lineaments (joint zones, fracture zones), strike valleys, and strike ridges. The strike valleys and strike ridges, which are parallel to the general strike of the rocks, represent rocks which are either susceptible to weathering or resistant to weathering. Reddish-brown earth, low humic gley soils and grumusol soils are present in the project area.

Figure 43: Matale District is located within Highland, Wanni and Kadugannawa Complexes



Source: Asian Development Bank

Figure 44: Geomorphology Map of Matale District

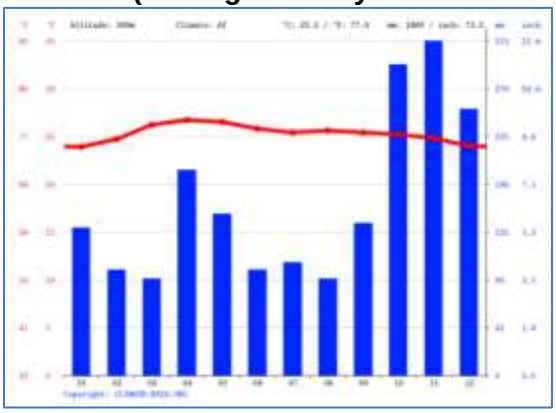


Note: Soil Types indicated by numbers: 1: Reddish Brown Earths; 3: Reddish Brown Lateritic Soils; 6: Red Yellow Podzolic Soils; 7: Red-Yellow Podzolic Soils; 10: Immature Brown Loams (Wet Zone Sub-group); 12: Regosols and Alluvial Soils; 14: Rendzina Soils
Source: Survey Department of Sri Lanka

234. **Location and topography.** Matale District covers an area of 1,993.3 km². It is located in the northern part of the Central Province, spreading from 80.28˚ to 80.59˚ eastern longitudes and from 7.24˚ to 8.01˚ northern latitudes. This area is bounded north by Anuradhapura, east by Polonnaruwa, Badulla and Ampara; West by Kurunegala; and south by Kandy Districts. There are four major geographical divisions of the district which are northern flat lands, Matale Valley and Knuckles Mountain Ranges, and Laggala Parallel Mountain Ranges, and northern flatlands containing Dambulla, Galewela, and Pallepola divisional secretary divisions. This land is typically flat land despite several mountain peaks. Much of the land is within an altitude of 500 feet (ft)–1,000 ft. There are several tanks located in this rough land since the ancient times including Dewahuwa, Inamaluwa, Kandalama, Talkote, and Sigiriya. The Matale area is nicely placed in a valley and surrounded by many mountains and hills. Guruluhela, Hunnasgiriya, Knuckles, Ovilikanda, and Pansaltenna are lying among huge mountains. Knuckles is 4,000 ft in height and is one of the highly protected areas and natural heritage on the island. Kalupahana and Lakegala are also some of the popular peaks of the area.

235. **Climate.** Climate of the district is greatly influenced by its topographic diversity. Matale Valley has its own topo-climate, while lowland Dambulla area is underlying typical dry zonal climate. The climate of the summits of Dumbara Hills is much colder and wetter. The district is experiences both monsoons. However, the northeast monsoon is heavier than the southwest monsoon. Matale is a city with significant rainfall. Even in the driest month, there is a lot of rain. According to the Köppen-Geiger climate classification, Matale district falls under Af category. The average annual temperature in Matale is 25.3°C, whereas the average annual rainfall is 1860 mm. Precipitation is the lowest in March, with an average of 86 mm. Most of the precipitation here falls in November, averaging 297 mm. At an average temperature of 26.7°C, April is the hottest month of the year. January is the coldest month, with temperatures averaging 23.9°C. Average annual rainfall at stations like St. Martin's estate records in most years as more than 5.000 mm. Figure 45 shows the average monthly temperature and rainfall in the Matale District.

Figure 45: Monthly average rainfall pattern; and the monthly average temperature in Matale (Average for 20 years: 1999–2019)

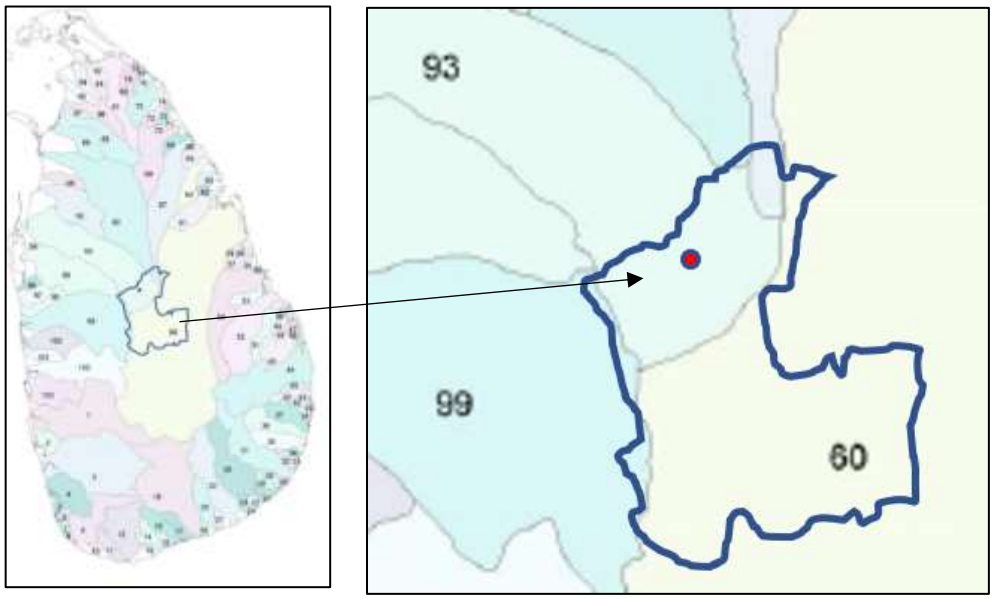


Source: CLIMATE-DATA.ORG. Climate Matale (Sri Lanka). Available at: https://en.climate-data.org/asia/sri-lanka/central-province/matale-26413/ (accessed on 2 July 2021).

236. **Hydrology, drainage and river basins.** The Matale District is almost entirely located within the Mahaweli Ganga and Kala Oya Catchment. Small areas in the western boundaries of the district borders and/or are within Aruvi Aru, Deduru Oya, and Yan Oya basins.

237. The southeast to the northwest alignment of the Dumbara Hills enables the area to receive rainfall from both monsoons. The geographical location of these hills around which the main streams of Mahaweli run on all sides makes it an important watershed. The Matale Valley and the Atipola hills from which the main tributaries to the Amban Ganga originates also contributes a significant share of water.

Figure 46: River basins in the Matale District



(60: Mahaweli Ganga; 67: Yan Oya; 90: Aruvi Aru; 93: Kala Oya; 99: Deduru Oya)
Source: Asian Development Bank.

238. **Air quality.** The subproject location at Dambulla is located within highly urbanized area, where vehicle emission is a major sources of air pollution.

239. **Existing noise levels.** The subproject site is located in the middle of highly urbanized area of Dambulla Town, with sparse vegetation cover. The Dambulla economic centre which is active almost 24 hours a day attract many vehicles and people causing high level of noise emissions. Therefore, the noise levels were observed to be relatively high.

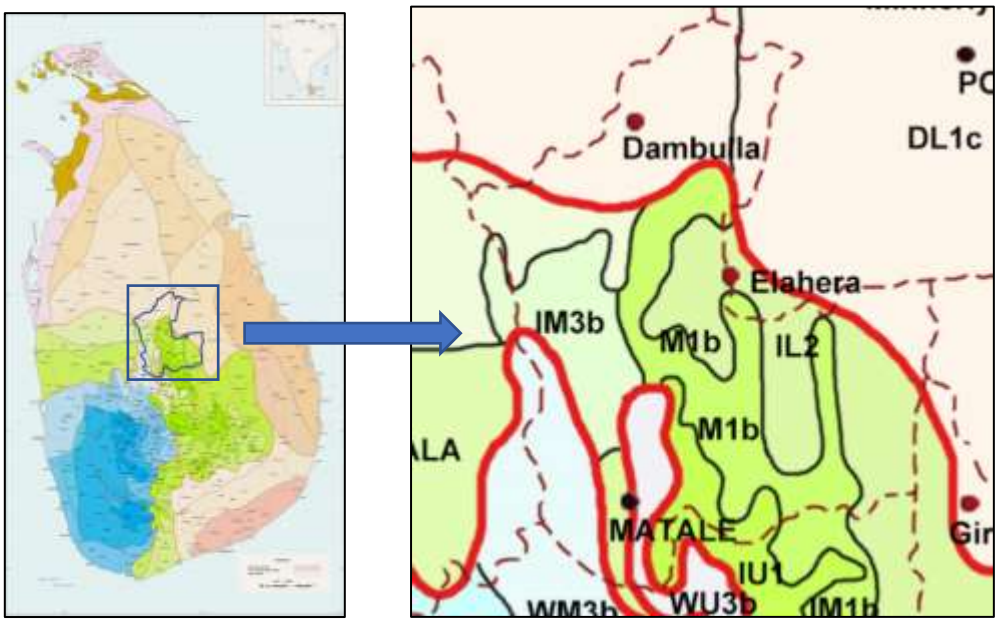
240. **Biogeography**. The topographic diversity of the Matale District has influenced its climate and biotic environments in a significant way. Each physiographic unit thus tends to have its climatic character. The Matale Valley, for example, surrounded by two mountain ranges, had developed its topo-climate. On the other hand, lowland Dambulla area has a typical dry zone climate. On the summits of the Dumbara Hills where the elevation exceeds 1,500 m, the climate is much colder and wetter. Such locations, however, form only a small part of the district.

241. Rainfall in the Matale District varies widely both temporally and spatially depending on elevation and aspect. The monthly rainfall figures for Matale indicates a dry zone regime predominantly with much of the rainfall concentrated in northeast monsoon months from October to December. However, the influence of the southwest monsoon is also felt in July and August occasionally when over 500 mm of rain was received in August. Rainfall at stations on high elevation is as high as that in the wettest part of Sri Lanka. At St. Martin's Estate (upper) for example, annual rainfall can exceed 5,000 mm in most years. The long-term trend, however, appears stable with hardly any significant changes).

242. The vertical zonation of vegetation with altitude is an essential biogeographic feature at high elevations. Thus, from deciduous hardwood forests of dry zone lowlands, vegetation varies through Pigmy and Elfin forests to mossy vegetation (old man's beard) near the summits of Knuckles.

243. **Agro-ecological zones.** As presented in Figure 47, Dambulla base hospital in the Matale District is located in the intermediate midland (DL1c). It is evident that a significant portion of the Matale District lies in the wet midlands and uplands, intermediate uplands and intermediate midlands, and only a relatively small land area belongs to the wet highlands. As the district accommodates a broad wet and intermediate agro-ecological region, the cultivation of appropriate crops such as tea, spices, a variety of vegetable, papaya, and other fruits, etc. has been thriving.

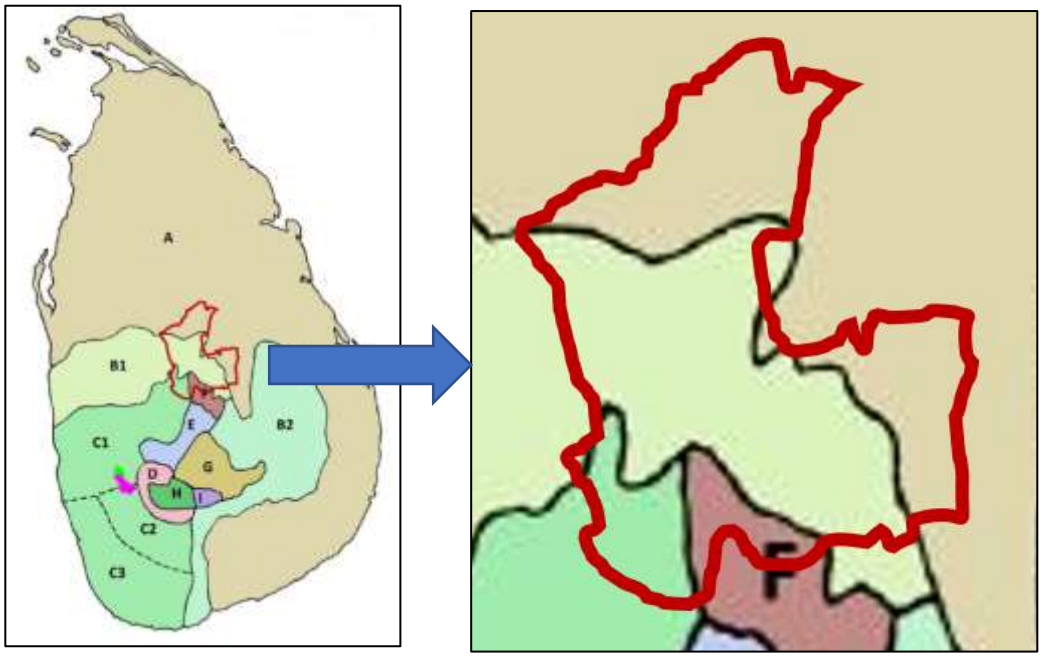
Figure 47: Agro-ecological regions of sub-project area in Matale District



Source: Asian Development Bank

244. **Floristic Regions.** Out of the 15 floristic regions proposed by Ashton and Gunatilleke 1987 (footnote 3) there are five floristic regions represented in the Matale District.

Figure 48: Floristic Regions in the Matale District

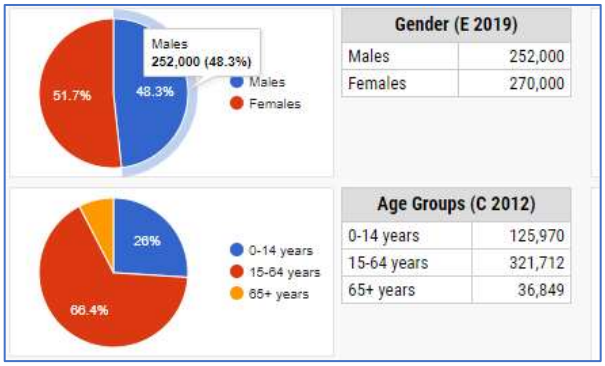


(Floristic region B1: Northern intermediate lowlands; Floristic region C1: Northern wet lowlands; Floristic region F: Knuckles)
Source: Asian Development Bank

245. **Demography.** The total population in Matale District was 1.48 million as per the population estimates of 2019. The population density is about 760.8/km^2.

246. Percentage of the female population is slightly higher than the males, and more than 65% of the populations are within the age category of 15–64 years. More than a quarter of the population is below 15 years.

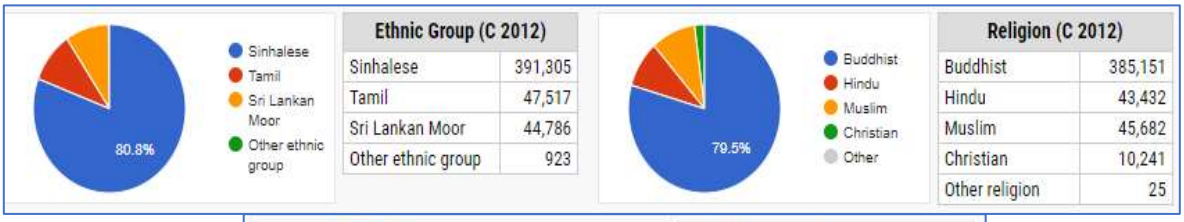
Figure 49: Population distribution in the Matale District based on Gender and Age



Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

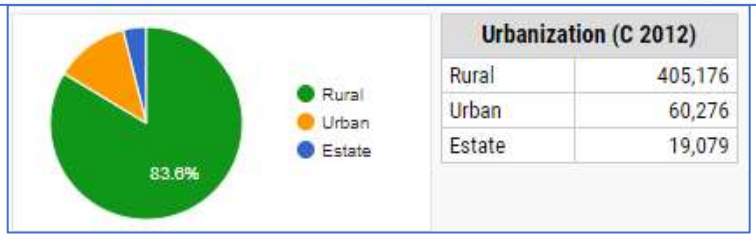
247. Majority of the population are Sinhalese (approximately 74%), about 12.0% are Tamils, and 14.0% are Muslims. Data related to the population distribution in the Matale district shows that at least 81.4% of the population live in rural areas and a small percentage in estate settlements.

Figure 50: Population distribution in Matale District based on Ethnicity, Religion and Urbanization



Ethnic Group (C 2012)	
Sinhalese	391,305
Tamil	47,517
Sri Lankan Moor	44,786
Other ethnic group	923

Religion (C 2012)	
Buddhist	385,151
Hindu	43,432
Muslim	45,682
Christian	10,241
Other religion	25



Urbanization (C 2012)	
Rural	405,176
Urban	60,276
Estate	19,079

Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

248. **Economy**. There are about 180,000 farm families in 3,200 villages. Provincial contribution to the national agriculture GDP is 30.0%, and provincial GDP of agriculture is 14.2% while national GDP of agriculture is 6.9% Central Bank Annual Report, 2017 (footnote7). Employment in the agriculture sector is 53.3% (based on the Census and Statistics Department data for 2017). Paddy and other agriculture cultivations except plantation crops occupy 8% of the total land area of the district. The potential growth sectors of the Matale District constitute crop agriculture along with agriculture-related industries and trades. Out of the total land area of the province, 35% is used for home garden crop cultivation. Paddy is the predominant crop in the province followed by OFC, vegetables, and floriculture.

249. The percentage of households living in poverty in Matale District was 3.2% in 2016, which shows a marked improvement from 11.4% in 2009-2010 and 6.0% in 2012-2013, respectively.

250. **Land use.** Matale District is a lower-middle-income region with a population of 1.47 million. Land extent is about 1,993.00 km^2 (3.05% of the total area of the country), out of which 70.50 km^2 (3.54% of the total area) comprise of large inland waters. The prominent land-use type in Matale District is forest lands which are about 38.44% of the land use, including forests (37.70%) and scrubs (0.70%). Home gardens rank second with a percentage of 18.90%. Agricultural lands include paddy (219.95 km^2), perennial crops (194.59 km^2), and major crops such as tea, rubber, and coconut (172.50 km^2). Other field crops occupy the land of about 67.16 km^2. Small areas of land are used for infrastructure (23.95 km^2) and chena cultivation (13.20 km^2). Abandoned land accounts for about 36.00 km^2.

251. **Education.** There are 12 national schools, 305 provincial schools, 26 pirivenas, and 9 private schools functioning in the Matale District 2018 data (footnote 5).

252. **Health and sanitation.** Healthcare services in the district are being provided to the community through a network of primary, secondary, and tertiary care institutions. These include 3 teaching hospitals, 1 district general hospital, 2 type-B base hospitals, 14 type-B divisional hospitals, 33 type-C divisional hospitals and 85 primary care institutions.

253. It has been reported by the Regional Director's Office of Health Services that there are 7,107 beds available at the 347 HCFs available at the district. The total number of outpatients that have obtained treatment from these governmental HCFs (in 2019) was 4.09 million and number of inpatients was 756,160 (in 2019).

254. **Water supply.** Water supply in the Matale District is operated under the Central RSC under the supervision of Deputy General Manager, RSC. The Central RSC is functioning with 16 water supply schemes.

255. **Roads and transport.** According to the data published in 2017 by the Department of Census and Statistics, the total road length in Matale District was 5,828.2 km that is under the purview of RDA, Central PRDA, and other local government institutions (Municipal Councils, Urban Councils and Pradeshiya Saba).

256. **Electricity.** Presently 100% access for electricity is ensured in Western and Southern Provinces. However, in Central Province, 3%–4% of the total households in the province are still unable to get the electricity supply from the national grid.

1. Environmental Sensitive Areas and Natural Disasters

257. **Cyclones.** Many cyclones have passed over the country. Storm surges are more frequent on the east coast of Sri Lanka compared to the other parts of the island. The cyclones which occurred in the past have caused extensive damage, especially in the eastern part of Sri Lanka. However, the southeastern part of Sri Lanka, including the Central Province has not been affected much, and the incidences of disaster situations due to cyclones are low.

258. **Floods.** Occurrences of floods in the Matale District is low. Exposure of infrastructure in the district has been categorized as no vulnerability. Extreme flood event records show that both Kandy and Matale Districts have experienced 7–15 flood events from 1990 through 2011. This can be considered as low incidence scenario. The vulnerability of infrastructure to the expected increase in frequency and intensity of floods due to climate change is widespread and prevalent in many parts of the country, however, two districts in the Central Province (Kandy and Matale Districts) have been categorized under no vulnerability.

259. **Landslide exposure.** With climate change, the vulnerability of infrastructure to landslides is expected to have an increase in frequency and intensity and is focused mainly on the central hills. These figures highlight that there are areas in Matale District which are exposed to moderate, low and minimal vulnerability. Landslides have been frequently experienced in some parts of the Matale District.

260. **Droughts.** Much of the Matale District and part of Badulla District are relatively wet in the southern parts of the district and located within wet and/or intermediate zones. In contrast, the northern parts of the district are mostly located in the dry climatic zone of Sri Lanka. Much

of the areas of northern parts of Matale District had nearly 200 days, where daily rainfall is less than 1.0 mm.

261. One disadvantage of the geographical location of eastern parts of Central Province is that it is in the leeward side of southwest monsoon winds which brings high rainfall during the May to September period to the western side of the hill country of Sri Lanka. The southwest monsoon winds pass the central mountain ridge and enter eastern parts of the Central Province as a dry and gusty wind. Most of these areas of the province experience a long drought period during May to September. A major part of the eastern and southern low land area of the Matale District and northern low land part of Badulla district has become a dry zone due to this effect**.**

262. **Environmentally sensitive areas.** There are no environmentally sensitive areas within the proximity of the proposed site.

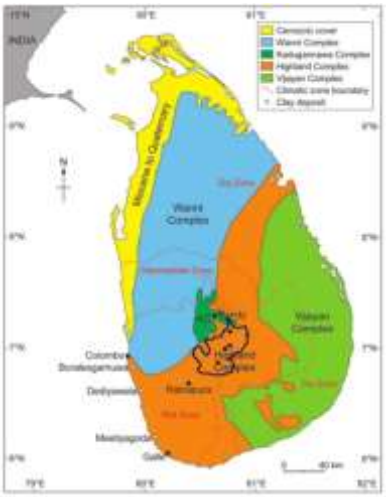
G. Nuwara Eliya District

263. **Location.** The subproject location involving civil works in Nuwara Eliya District is presented in Figure 1.

264. **Geology and geomorphology and soil.** Nuwara-Eliya District is located mainly within Highland Complex with a small area within Kadugannawa Complex. Charnockites, the predominant rock type, is generally confined to the mountains with the less resistant rocks at the valley bottoms. Quartzites found around Hatton, Maskeliya, Norton Bridge, and Nuwara-Eliya, and form parallel bands that can be sometimes traced for miles along the strike. The quartzites form prominent escarpments and ridges. The dark grey charnockitic gneiss occur in great quantities. Most of the Dimbulla Valley (as area around Talawakelle is known) is made of charnockitic gneiss and this is clearly noticed on the road from Dimbulla to Nanu Oya. A specific garnet sillimanite schist with large garnets can be seen in many parts. Corundum and spinel at the contact of marble and syenite have been recorded from Nonpareil Estate, Ohiya.

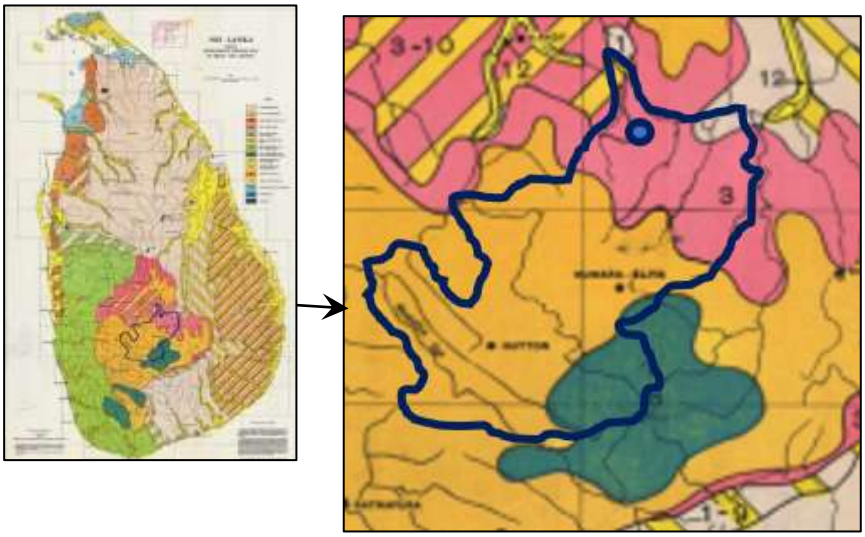
265. Red-yellow podzolic soils (modal) is the predominant type in the district, while red-yellow podzolic soils are found in the northeastern part and is the prominent soil type in the southeastern part of the district.

Figure 51: Nuwara Eliya District is located within Highland Complex and a small area in the Kadugannawa Complex



Source: Asian Development Bank

Figure 52: Geomorphology Map of Nuwara Eliya District



Note: Soil Types indicated by numbers: 1: Reddish Brown Earths; 3: Reddish Brown Lateritic Soils; 6: Red Yellow Podzolic Soils; 10: Immature Brown Loams (Wet Zone Sub-group)
Source: Survey Department of Sri Lanka

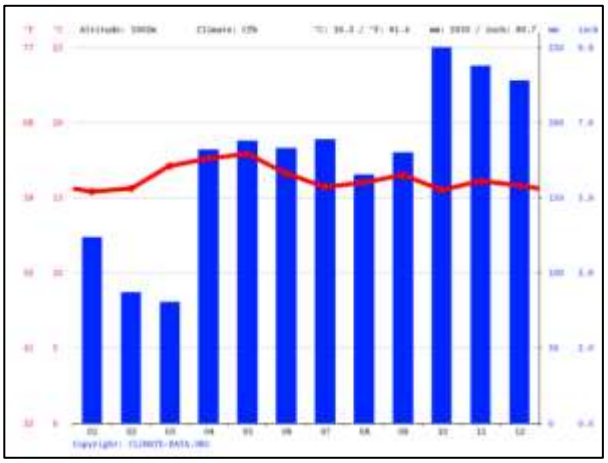
266. **Location and topography.** The district belongs to the highest peneplain in the island. The southern margin of this peneplain stretches for more than 50 miles from Adam's Peak (7,360 feet) on the west and rising from around 1,000 feet to more than 5,000 feet as at World's End. Running northwards from the center to the southern margin are the highest plateau regions and the high plains stretching from Kirigalpottha (7,859 feet) to Pidurutalagala (8,292 feet). This bare, gently undulating grassland includes the picturesque Horton Plains, Elk Plains, Moon Plains, and Kandapola. Sita Eliya plains all have an average elevation of 6,000–7,000 feet. On the east of these high plains is Hakgala (7,127 feet) and Totupola (7,741 feet).

On the west is the Hatton Plateau, a deeply bisected area with strong relief having an average slope between 3,500 and 4,500 feet. The remarkable appearance of 'flatness' in the Hatton Plateau is largely due to the nearly horizontal attitude of the rocks comprising much of the area. Long escarpments, some rising thousands of feet in sheer rock walls, are also common particularly in the Hatton area. Extremely steep slopes can be seen in the upper mountain regions that descend down through various slope categories to the lower parts of the mountain ranges. Hanguranketha area is in the mid-country intermediate zone and the elevation is about 3,000 –3,100 feet above mean sea level.

267. **Climate.** In Nuwara Eliya, it is visibly a sub-tropical highland climate. The climate here is mild, and generally warm in temperate. Rainfall in Nuwara Eliya is significant, with precipitation even during the driest month. According to Köppen and Geiger, this climate is classified as Cfb (subtropical highland climate). The average annual temperature varies between 11°C–20°C. The lowest recorded temperature is 4 C° and the recorded highest temperature is 27.7 C°.

268. Monthly rainfall is also varying between 70mm–225 mm and has an average annual rainfall around 2,000 mm. The maximum rainfall is generally in October and the minimum rainfall is in March. Unlike the wet zone of the district that receives rainfall during the main four seasons, the intermediate zone receives rainfall only during the northeast monsoon during the two inter-monsoonal months. Unreliable rainfall and frequent dry spells are all common features in the intermediate zone. Figure 53 shows the average monthly temperature and rainfall in the Nuwara Eliya District. The number of thunder days is highest for the month of April with 15 thunder days, characteristic of convectional activity during this period. Nuwara Eliya has experienced a significant decline in annual rainfall during the last 100 years. During the year, it has a relative humidity between 65%–87%. The temperature of Nuwara Eliya never approaches the tropical heat but can touch low temperatures that make ice flakes on grass patana in early mornings.

Figure 53: Monthly average rainfall pattern and Monthly average temperature in Nuwara Eliya (Average for 20 years: 1999–2019)



Source: CLIMATE-DATA.ORG. Climate Nuwara Eliya (Sri Lanka). Available at: https://en.climate-data.org/asia/sri-lanka/central-province/nuwara-eliya-909/ (accessed on 2 July 2021).

269. The terrain determines movement of wind over the area. The wind speed ranges from

5.76 km/hour (h)–13.3 km/h. Strong winds prevail during the southwest monsoons and blows in a zonal area to the north of central hill country. In Nuwara Eliya the wind speed per day for the months of January, April, and October prevail mostly in the range of less than 10 km/h. In July, during the southwest monsoon, the wind speed varies within ranges of 11 km/h–15 km/h to 16 km/h–20 km/h for each 12 hours of the day.

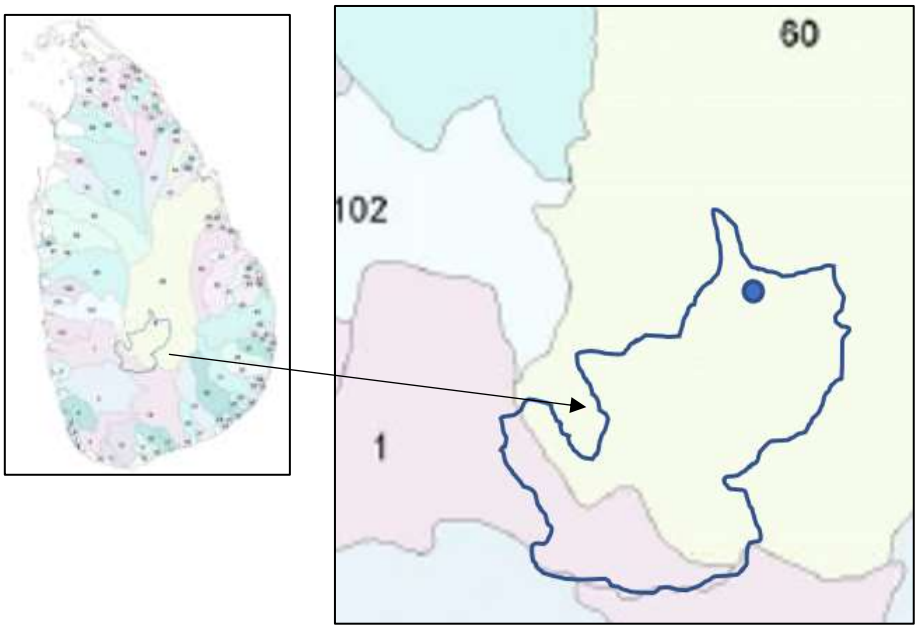
270. **Hydrology, drainage, and river basins.** There are two major river basins that originate within Nuwara Eliya District, namely the Kelani and Mahaweli Rivers.

271. The Kotmale Oya, one of the seven major tributaries of Mahaweli formed by its several head streams, arise in the core of the central highlands. The Dambagastalawa Oya originating in Ambewela hills, flows into Agra Oya (from Horton Plains) and joins Nanu Oya (from Pidurutalagala) to meet Kotmale Oya. Pundalu Oya has its source in the Great Western and Ramboda Mountain and Punna Oya in the Kikiliyamana Mountain. The many other tributaries of the Kotmale Oya are Devalhuru Oya, Ganthera Oya, Himal Oya, Nidahaskatuwa Oya, and Niyangandara Oya.

272. Maha Oya, one of the smaller tributaries of Mahaweli, drains the Hanguranketha. A network of minor elas feed Maha Oya, and the Ambaliyadda, Ela Mal Wewa, Huvan Arawa, Watuketiyawa Wewa, and Warang empty directly into Maha Oya.

273. Kelani Ganga is formed by the confluence of the Maskeli Oya and the Kehelgama Ganga which originates from the mountain range of Kirigalpotha. Other tributaries of We Oya, Gurugoda Oya, and Sitawaka Ganga join up bringing abundance of drainage. The characteristic feature of all these tributaries is their slope gradient dropping to about 200 ft per mile.

Figure 54: River basins in the Nuwara Eliya District



(60: Mahaweli Ganga; 67: 1: Kelani Ganga and the southern part of the District borders 18: Walawe Ganga basin)
Source: Asian Development Bank

274. The district is basically suited for the development of hydropower, the only source of indigenous energy in Sri Lanka. The harnessing of the flow in the upper reaches of the Kelani Ganga and Mahaweli Ganga for the generation of electric power that have already been carried out.

275. Rikillagaskada tertiary hospital and the area is located in the Mahaweli River Basin.

276. **Air quality.** The subproject location at Rikillagaskada base hospital is located within sub-urban and is about 250 m away from B413: Tennekumbura-Rikillagaskada-Ragala Road, which is a very busy transport corridor, and there is a chance of deteriorating the air quality temporarily due to vehicular emissions and drifting of dust from gravel roads and other deteriorated roads.

277. **Existing noise levels.** The subproject site is located in suburban settings with a good vegetation cover. Therefore, the noise levels were observed to be relatively low.

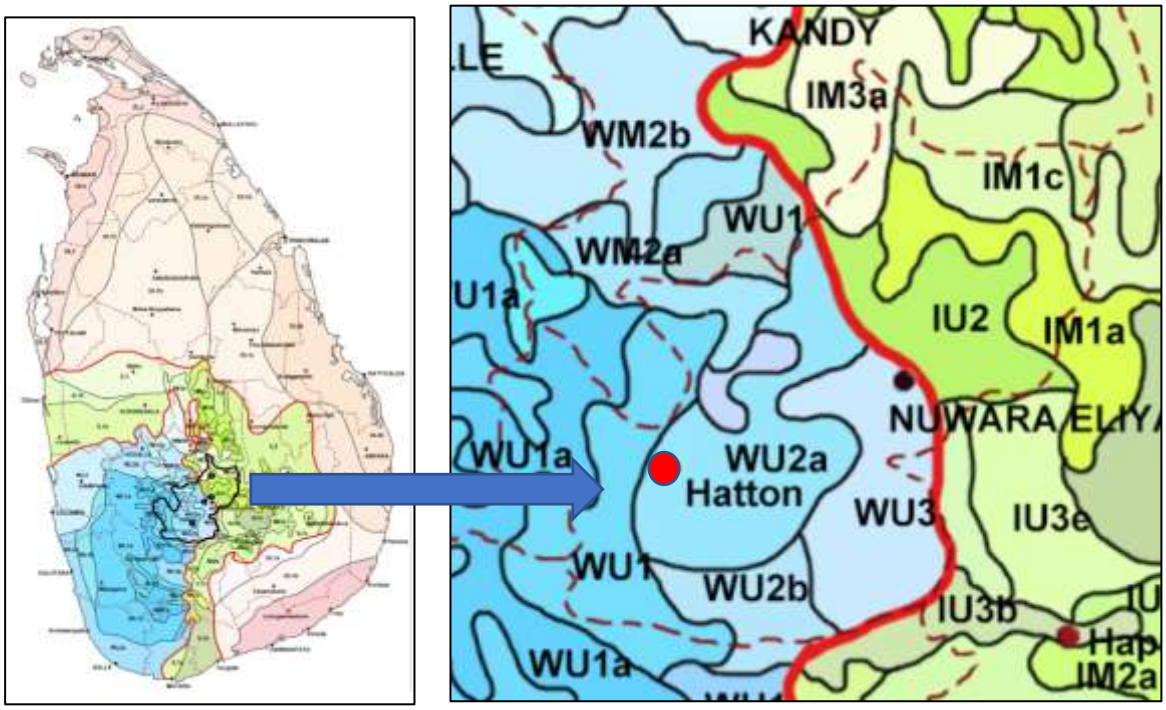
278. **Biogeography**. The topographic diversity of the Nuwara Eliya District has influenced its climate and biotic environments in a significant way. Each physiographic unit thus tends to have its climatic character. The Nuwara Eliya Valley, for example, surrounded by mountain ranges, had developed its topo-climate.

279. The vertical zonation of vegetation with altitude is an important biogeographic feature at high elevations. Thus, from deciduous hardwood forests of lowlands rainforests and vegetation varies through sub-montane, montane, moist monsoon forests, and Patana grasslands near the summits of mountain ranges.

280. **Agro-ecological zones.** Nuwara Eliya District falls within the eight agro-ecological zones (IM1a, IM1c, IM3c, IU2, WU1, WU2a, WU2b, WU3). Rikillagaskada base hospital is located in IM1c.

281. It is evident that a significant portion of the Nuwara Eliya District lies in the wet uplands and intermediate uplands and midlands, while only a relatively small land area belongs to the wet midlands. As the district accommodates a broad wet and intermediate agro-ecological region, the cultivation of appropriate crops such as tea, a variety of vegetables, fruits, flowers, and foliage, etc. has been thriving.

Figure 55: Agro-ecological regions of areas in Nuwara Eliya District

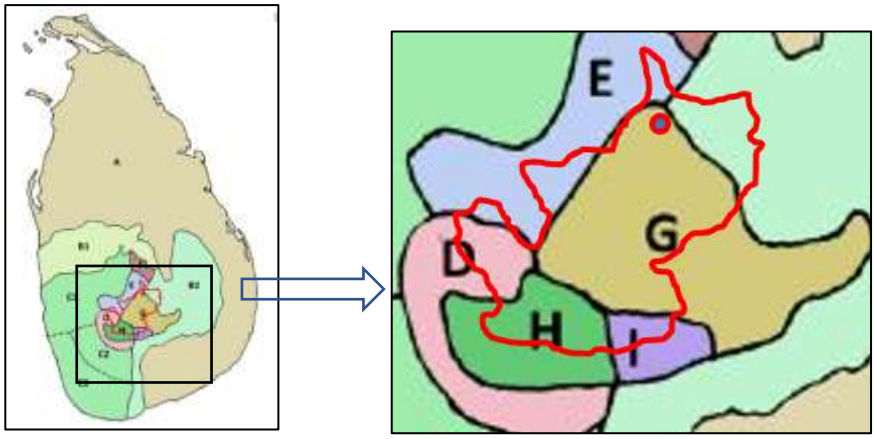


Source: Asian Development Bank

282. **Floristic regions.** Out of the 15 floristic regions proposed by Ashton and Gunatilleke (1987), there are five floristic regions represented in the Nuwara Eliya District.

283. The floristic regions in Nuwara Eliya are shown in Figure 56. Rikillagaskada area is located within the floristic region G: Central Mountains Ramboda-Nuwara Eliya. Agarapathana area is located close to the border between floristic region G: Central Mountains Ramboda-Nuwara Eliya, and H: Adam's Peak.

Figure 56: Floristic Regions in the Nuwara Eliya District



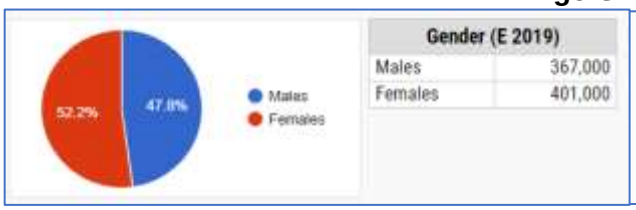
Floristic region D: Foothills of Adam's Peak North of Ratnapura-Ambagamuwa; **Floristic region E:** Kandy - upper Mahaweli; **Floristic region G:** Central Mountains Ramboda - Nuwara Eliya; **Floristic region H:** Adam's Peak; **Floristic region I:** Horton Plains

Source: Asian Development Bank

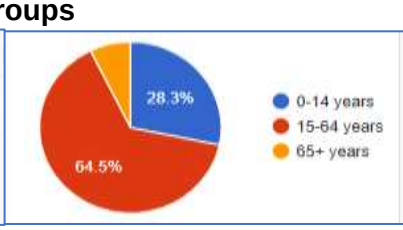
284. **Demography.** The total population in Nuwara Eliya District was 768,000 as per the population estimates of 2019. The population density is about 441.1/km^2. The population has changed by +1.05% during the period between 2012 and 2019.

285. Percentage of the female population is slightly higher than the males, and more than 64% of the population is within the age category of 15–64 years. More than a quarter of the population is below 15 years.

Figure 57: Population distribution in the Nuwara Eliya District based on Gender and Age Groups



Gender (E 2019)	
Males	367,000
Females	401,000



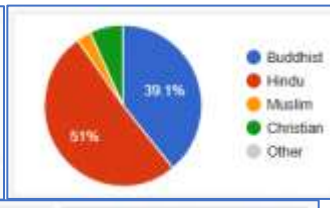
Age Groups (C 2012)	
0-14 years	201,133
15-64 years	459,150
65+ years	51,361

Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

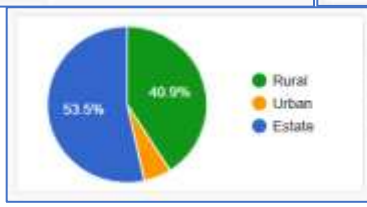
286. Majority of the population are Tamils (approximately 57.6%), Sinhalese (about 39.6%), and Muslims (2.3%).

Figure 58: Population distribution in the Nuwara Eliya District based on Ethnicity, Religion and Urbanization

Ethnic Group (C 2012)	
Sinhalese	282,053
Tamil	410,200
Sri Lankan Moor	17,652
Other ethnic group	1,739



Religion (C 2012)	
Buddhist	278,254
Hindu	363,163
Muslim	21,116
Christian	48,984
Other religion	127



Urbanization (C 2012)	
Rural	290,913
Urban	40,151
Estate	380,580

Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021)

287. **Economy**. The province has been a central economic location from the time when the British ruled. The Central Province provided the third-highest contribution to the GDP, maintaining its relative position compared to 2018, and managing to increase its GDP contribution to 10.0% in 2019 (Central Bank). By taking advantage of its unique geography, the Central Province contributed 18.2% of the total in the agricultural sector in 2019 in Sri Lanka. Per capita income of Central Province is SLR 208,000, and it comfortably lies somewhere in the middle of the income continuum, manifesting fair income disparity.

288. Poverty Headcount Index of the Central Province as well as the Nuwara Eliya District has drastically dropped since 1995-1996 to 2,916. However, the Index of Nuwara Eliya District in 2016 has been 6.3% which is higher than that of the Central Province (5.4%) and the national Index of 4.1%. This is true for Poor Household Percentage, too, of which the percentage for Nuwara Eliya District, Central Province, and the national average were 4.6%, 4.1%, and 3.1%, respectively. The reason for this higher poverty levels in Nuwara Eliya in relation to national and provincial levels is the fact that most of the population are estate sector workers (56.5%) and rural communities (40.9%) for which the poverty levels are below that of urban sectors.

289. **Land use.** Nuwara Eliya District is a lower-middle-income region with a population of 0.768 million. Land extent is about 1,741 km^2 (2.7% of the total area of the country).

290. According to the Land use Policy Planning Division in 2017, 32.45 % of the total land area in Nuwara Eliya District consists of tea cultivation being the most prominent agricultural activity in the district. The second most prominent land use type in the district is forest cover, along with 6.65% of the planted forest areas within the district. Compared to tea, other types of agricultural land use are considerably low. There are 8.34% of field crops, 3.23% of paddy, 0.25% of rubber, and 0.13% of coconut cultivation. Water bodies cover 3.00% of the total land, and only 7.62% belongs to home gardens.

291. **Education.** There are 7 national schools, 541 provincial schools, 10 pirivenas, and 8 private schools functioning in the Nuwara Eliya District (2018 data).

292. **Health and sanitation.** Healthcare services in the district are being provided to the community through a network of primary, secondary, and tertiary care institutions. These include 3 teaching hospitals, 1 district general hospital, 2 type-B base hospitals, 14 type-B divisional hospitals, 33 type-C divisional hospitals, and 85 primary care institutions.

293. It has been reported by the Regional Director's Office of Health Services that there are 7,107 beds available at the 347 HCFs available at the district. The total number of outpatients that have obtained treatment from these governmental HCFs (in 2019) was 4,094,363 and number of inpatients was 756,160 (in 2019).

294. **Water supply**. Water supply in the Nuwara Eliya District is operated under the Central RSC under the supervision of Deputy General Manager, RSC. The Central RSC is functioning with 16 water supply schemes.

295. **Roads and transport**. According to the data published in 2018 by the Department of Census and Statistics, the total road length in Nuwara Eliya District was 6,343.7 km that is under the purview of Central Provincial Road Development Department.

296. **Electricity**. Presently 100% access for electricity is ensured in Western and Southern Provinces. However, in Central Province, 3%–4% of the total households in the province are still unable to get the electricity supply from the national grid.

1. Environmental Sensitive Areas and Natural Disasters

297. **Cyclones**. Many cyclones have passed over the country. Storm surges are more frequent on the east coast of Sri Lanka compared to the other parts of the island. The cyclones

which occurred in the past have caused extensive damage, especially in the eastern part of Sri Lanka. However, the south-eastern part of Sri Lanka, including the Central Province, has not been affected much, and the incidences of disaster situations due to cyclones are low.

298. **Floods**. Occurrences of floods in the Nuwara Eliya District is low. Exposure of infrastructure in the district has been categorized as no vulnerability. Extreme flood event records show that both Kandy and Nuwara Eliya Districts have experienced 7–15 flood events during the period of 1990–2011. This can be considered as low incidence scenario. The vulnerability of infrastructure to the expected increase in frequency and intensity of floods due to climate change is widespread and prevalent in many parts of the country, however, two districts in the Central Province (Kandy and Nuwara Eliya Districts) have been categorized under no vulnerability.

299. **Landslide exposure**. With climate change, the vulnerability of infrastructure to landslides is expected to have an increase in frequency and intensity and is focused mainly on the central hills. These figures highlight that there are areas in Nuwara Eliya District which are exposed to moderate, low and minimal vulnerability. Landslides have been frequently experienced in some parts of the Nuwara Eliya District.

300. One disadvantage of the geographical location of southern parts of Central Province is that it is in the leeward side of southwest monsoon winds which bring high rainfall during the May to September period to the western side of the hill country of Sri Lanka. The southwest monsoon winds pass the central mountain ridge and enter eastern parts of the Central Province as a dry and gusty wind. Most of these areas of the province experience some drought period during May to September. A major part of the eastern and southern low land area of the Nuwara Eliya District and northern low land part of Nuwara Eliya District has become relatively dry due to this effect.

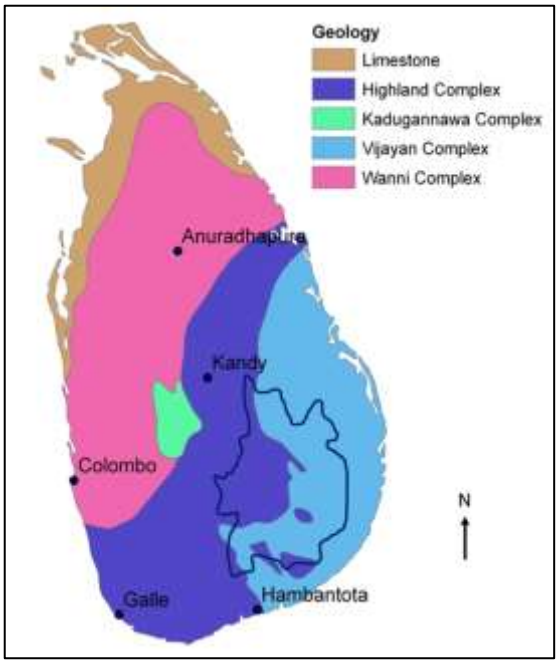
301. **Environmentally sensitive areas**. There are no environmentally sensitive areas within the proximity of the proposed site.

H. Uva Province (Badulla and Monaragala Districts)

302. **Location.** The subprojects involving civil works in Badulla and Monaragala Districts are presented in Figure 1.

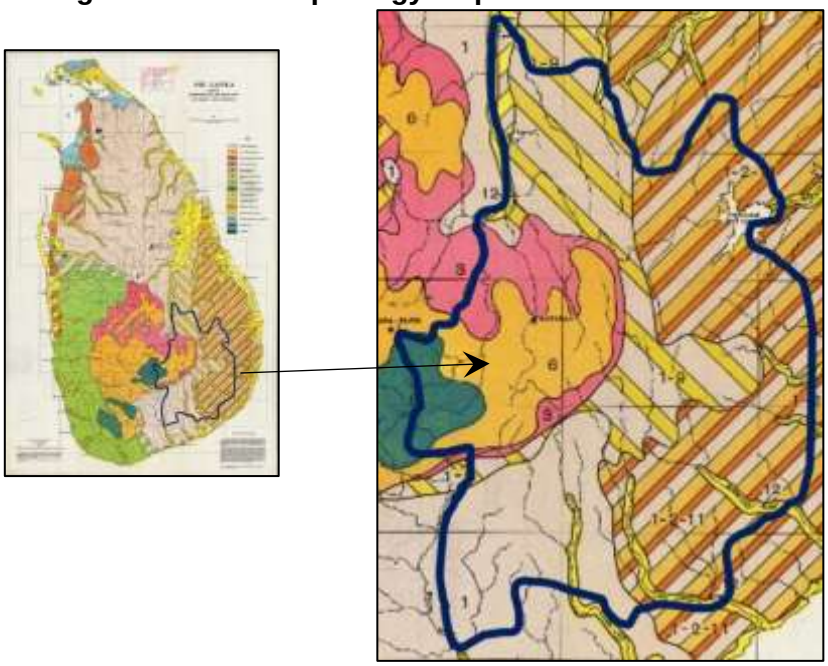
303. **Geology and geomorphology and soil.** Badulla and Monaragala Districts are located within a transitional zone that goes from the central highlands to flat lowlands. In particular, the study areas are situated between the mountains at the west and the flatter terrain that covers the broad eastern and southern plain. It combines different geographic and geological features and can be considered hilly and steep, but also as a rolling terrain in some areas within an elevation range of 160 m to 450 m. The information gathered from publicly available sources indicate that the underlying substrate is on Vijayan Complex, but within and near to the transition of the Highland Complex. In the project area, reddish-brown earth, low humic gley soils, and grumusol soils are present.

Figure 59: Uva Province is located within Highland Complex (mostly Badulla District) and Vijayan Complex (mostly Monaragala District)



Source: Asian Development Bank.

Figure 60: Geomorphology Map of Uva Province



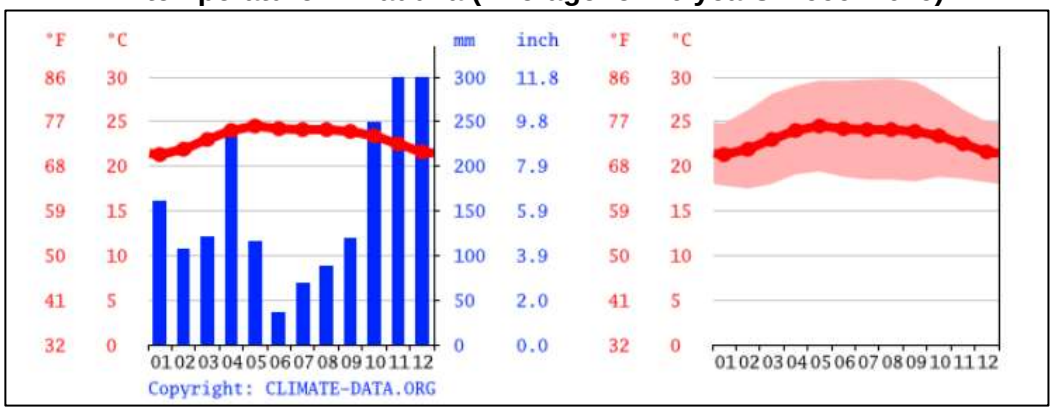
Note: Soil Types indicated by numbers: 1: Reddish Brown Earths; 2: Non-Calcic Brown Soils; 3: Reddish Brown Lateritic Soils; 9: Immature Brown Loams (Dry zone subgroup); 11: Regosolic Alluvial Soils; 12: Regosols and Alluvial Soils; 13: Solodised Solonetz and Solonchanks
Source: Survey Department of Sri Lanka.

304. **Topography.** The landscape of the Uva Province consists of: (i) Eastern plateau, (ii) High plans, (iii) Lowland plains, (iv) Lunugala Ridge, (v) Mahaweli River valet, (vi) Southern Mountains, and (vii) Uva Basin. However, Uva Basin contains three sub-basins: (i) Badulla sub-basin, (ii) Uva highlands, and (iii) Welimada sub-basin. Monaragala District generally has the flat and undulating terrain whereas the Badulla District has a more diverse landscape with high mountainous areas. In terms of altitude, the Upper Uva represents highlands reaching above 300 m. There is a general altitudinal descend from the southwest to northeast side, while the average altitude of Upper Uva regions is about 1,000 m. The western flank of the Uva Basin rises to over 2000 m up to Horton Plains Highlands, peaks up to 2,376 m at Hakgala, and extends across Uda Pussellawa ridges. The Lower Uva consisting of southern and eastern peripheries represents lowland plains below 300 m. Many sporadic isolated hills are ranging from 300 m–650 m are noted in the Monaragala and Kataragama areas. The mountains extending across the Haputale gap on the eastern side abruptly rises from the lowland of the dry zone up to an altitude of 1,000 m–1,500 m. High instability of the escarpment terrain is evidenced by the frequent landslides on southern aspects towards Beragala and Koslanda. The lowlands, especially the areas belonging to Monaragala district, are subjected to an intermediate zone climate and support extensive areas of grasslands. The landscape is undulating or gentle to moderate sloped low hills with some isolated hills.

305. **Climate.** Uva Province has many different climates but is dominated by Tropical savanna, monsoon, and rainforest climates. Badulla District belongs to the intermediate zone and small part in the wet zone, and an annual rainfall of the district range from 1,500 mm to 2,400 mm with the highest rainfall recorded during the northeast monsoon period from October to January. Places such as Welimada receive a rainfall of about 1,500 mm, whereas places such as Uda Pussellwa receive an annual rainfall exceeding 2,400 mm. A significant part of the Monaragala district belongs to the dry zone of Sri Lanka, and an annual rainfall of the entire district is in the range of 1,100 mm to 2,000 mm, with the highest rainfall recorded during the northeast monsoon period from October to January. Lower Uva generally exhibits a transition between dry and intermediate climatic conditions, which is evident from the climates prevailing in Bibile.

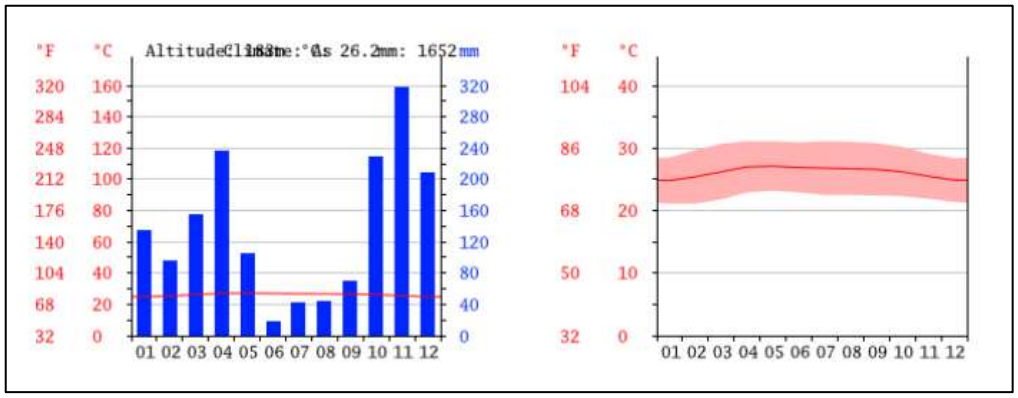
306. In locations in Upper Uva such as Haputale, the average temperature ranges from 15°C –23°C; in locations of intermediate altitude such as Badulla, the temperature ranges from 21°C–25°C; while in the dry lowlands it is about 26°C–29°C. The average temperature in the Monaragala District varies from 26°C to 29°C, while the average annual temperature of the project area is between 29°C–30°C. The highest temperature of 30°C is recorded from June to August of the year.

Figure 61: Monthly average rainfall pattern and the monthly average temperature in Badulla (Average for 20 years: 1999–2019)



Source: CLIMATE-DATA.ORG. Climate Badulla (Sri Lanka). Available at: https://en.climate-data.org/asia/sri-lanka/uva/badulla-764256/ (accessed on 2 July 2021).

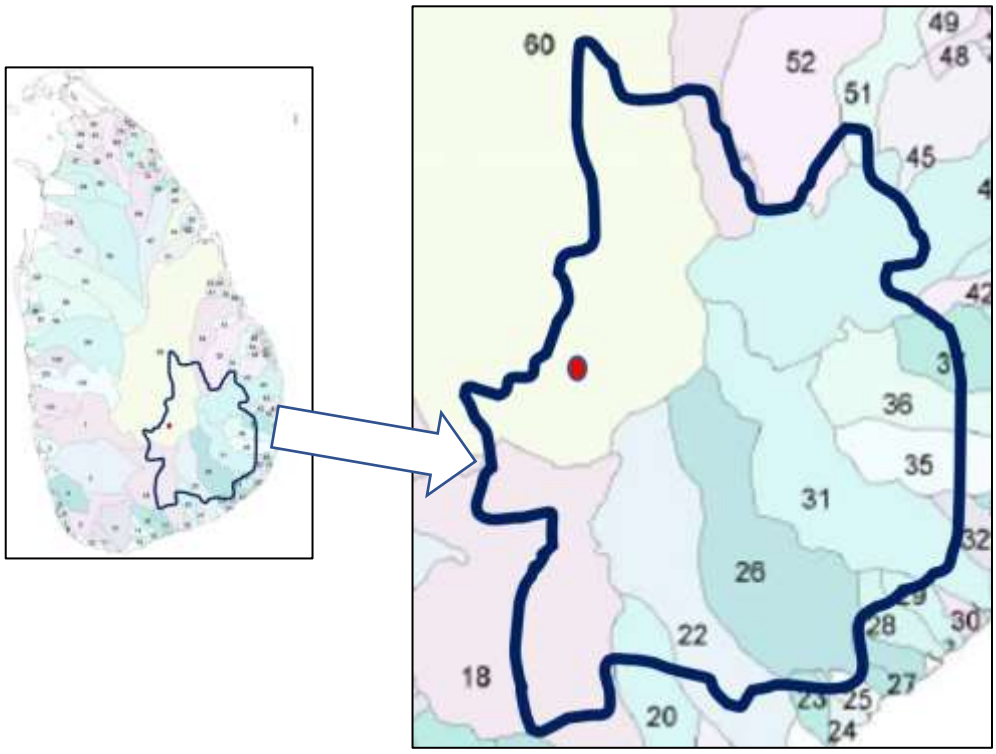
Figure 62: Monthly average rainfall pattern and the monthly average temperature in Monaragala (Average for 20 years: 1999–2019)



Source: CLIMATE-DATA.ORG. Climate Monaragala (Sri Lanka). Available at: https://en.climate-data.org/asia/sri-lanka/uva/monaragala-511297/ (accessed on 2 July 2021).

307. **Hydrology, drainage, and river basins.** The river basin system that originates from the stream network represented in the Uva Province is shown in Figure 63. The river systems located within the Uva Province mostly originate in the west highlands and traverse the dry lowlands zone. However, a majority of the stream network undergoes seasonal drying up during water-deficit periods as a significant portion of the Uva is subjected to a drier climate. The dominant water-surplus period is November to December, while the minor water-surplus period is March to April. Mahaweli Ganga is the main river that is nourished by some of its main branches such as Badulu Oya, Loggal Oya, Meda Oya, and Uma Oya which located in the province. Kirindi Oya, Kumbukkan Oya, and Menik Ganga, originate from the central hills within the Uva Province. At the same time, Heda Oya, Karanda Oya, and Vila Oya are small rivers that originate from the lowlands in this province and directly meet the sea.

Figure 63: River Basins originating from Uva Province



Source: Asian Development Bank.

308. There are many tanks found in the Uva Province, mostly located in the dry parts in the Monaragala District. The perennial and seasonal tanks in the Uva Province constitute 18,011 ha and 385 ha, respectively. There are eight tanks (and associated irrigation systems) in Badulla District (largest: Nagadeepa Scheme) and 17 in the Monaragala District (largest: Uda Walawe).

309. **Existing noise levels.** The subproject site is mostly located in urban settings (Welimada base hospital is located about 200 m from the town) with a sparse vegetation cover. Therefore, the noise levels are relatively high where significant volumes of traffic pass through these sections, causing frequent moderate levels of noise pollution.

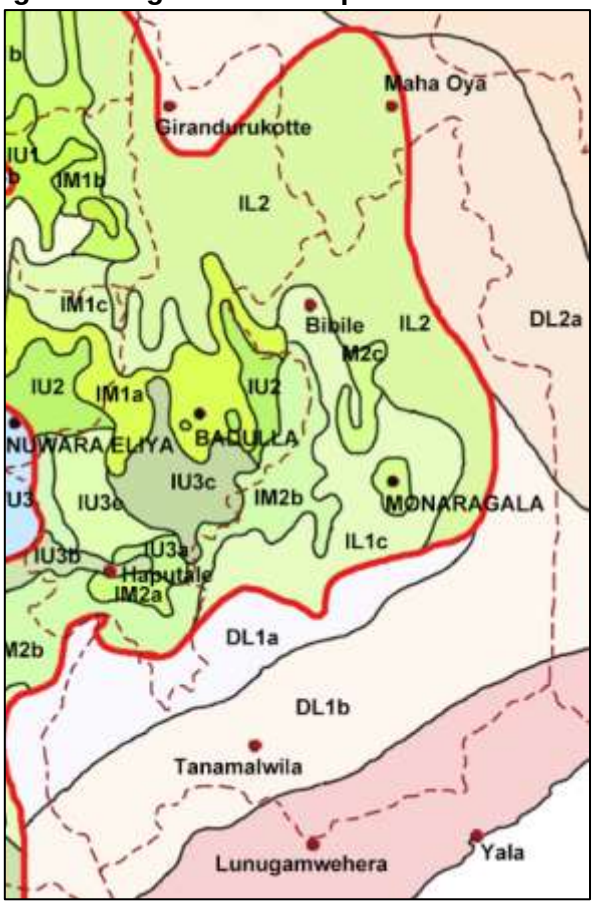
310. **Bioregions.** In the Uva Province, there are five bioregions:

(i) Bioregion 2: dry zone, dry mixed evergreen forest, altitude 0–500 m, rainfall 1,250 mm–1,900 mm (mainly from Oct. to Jan.), and 4–5 dry months;
(ii) Bioregion 3: intermediate zone, moist evergreen forest, altitude 0–1,000 m, annual rainfall 1,900 mm–2,500 mm, and less than 3 dry months;
(iii) Bioregion 4: lowland wet zone, tropical (lowland) wet evergreen forest, altitude up to 1,000 m, annual rainfall 2,500 mm–5,000 mm, and no dry months;
(iv) Bioregion 6: highlands, montane evergreen forests, altitude 1,500 m–2,500 m, annual rainfall 2,500 mm–5,000 mm, and no dry months; and

(v) Bioregion 7: intermediate highlands, dry patanas, altitude 1,000 m–1,500 m, annual rainfall 1,900 mm–2,500 mm, and less than 3 dry months.

311. **Agro-ecological zones.** There are 14 agro-ecological zones are represented in the Uva Province. It is evident that a significant portion of the Uva Province lies in the dry lowlands and intermediate lowlands and intermediate midlands, and only a relatively small land area belongs to the wet highlands. As the province accommodates a broad intermediate agro-ecological region, the cultivation of appropriate crops such as sugar cane, a variety of vegetable, papaya, banana, etc. has been thriving. The two apex hospitals identified in Welimada and Bibile are located within IM1a and IL1c agro-ecological zones.

Figure 64: Agro-ecological zones represented in the Uva Province



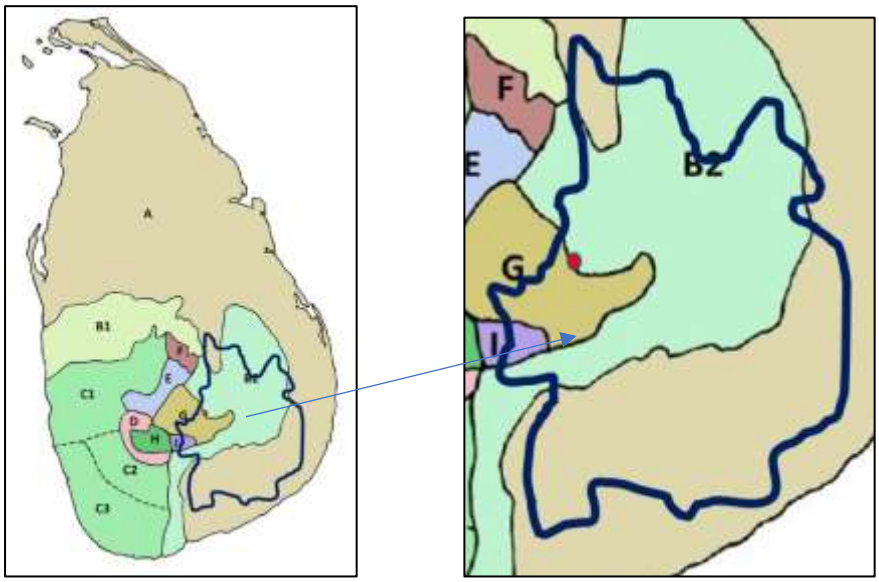
Source: Asian Development Bank.

312. **Floristic regions.** Out of the 15 floristic regions proposed by Ashton and Gunatilleke 1987 (footnote 3) there are four floristic regions represented in the Uva Province.

(i) **Floristic region A.** Dry and arid lowlands: (i) tropical dry mixed evergreen forests (Manilkara Community); (ii) mixed community (Chloroxylon-Vitex-Berrya-Schleichera series); (iii) tropical thorn forests (Manilkara-Chloroxylon-Salvadora-Randia series); (iv) Damana and Villu series; and (v) flood plain wetlands, riverine, and gallery forests;

(ii) **Floristic region B2.** Eastern intermediate lowlands: tropical mist semi-evergreen forests and savanna forests;
(iii) **Floristic region G.** Central mountains and Ramboda-Nuwara Eliya: tropical montane forests and upper wet patina grasslands; and
(iv) **Floristic Region I.** Horton Plains: tropical montane forests and upper wet patana grasslands.

Figure 65: Floristic Regions in Uva Province



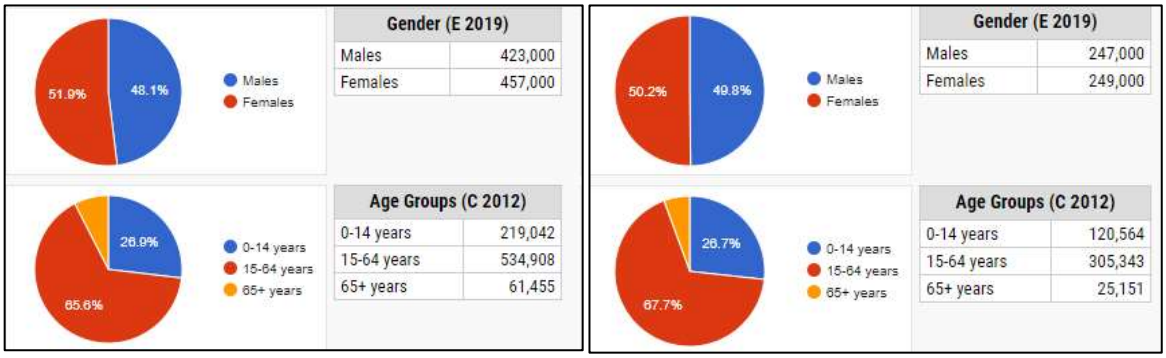
Source: Asian Development Bank

313. **Demography.** The total population in Badulla and Monaragala Districts were 815,405 and 415,058 persons as per the 2012 census. The estimated populations of the two districts as of 2019 July are 880,000 and 496,000 for Badulla and Monaragala, respectively.

314. The population density shows a marked variation between the two districts. Badulla District has a higher density, and there are dense population centres at Badulla (1,471/km^2), Bandarawela (923/km^2), and Haputale (692/km^2). However, Monaragala is sparsely populated, while Monaragala (173/km^2), Badalkumbura (174 per km^2), Medagama (153/km^2), and Sevanagala (238/km^2) DS Divisions have relatively a higher density. Kataragama (33/km^2), Madulla (44/km^2), and Thanamalwila (42/km^2) DS Divisions are the least populated areas.

315. Percentage of the female population is slightly higher than the males, and more than 65% of the population is within the age category of 15–64 years. More than a quarter of the population is below 15 years.

Figure 66: Population distribution in the two Districts in Uva based on Gender and Age Groups

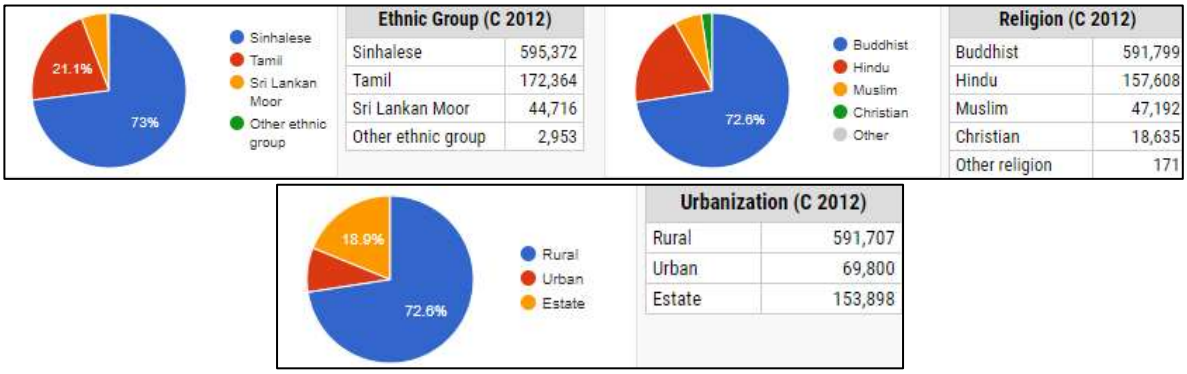


Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

316. Majority of the population are Sinhalese (approximately 73% in Badulla and 95% in Monaragala), and about 21% are Tamils in the Badulla District.

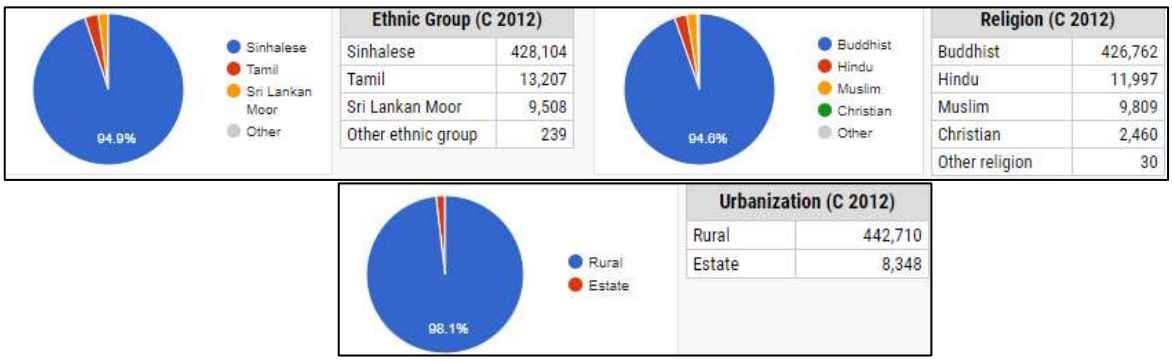
317. Monaragala District shows that at least 92% of the population live in rural areas and a small percentage in estate settlements. In contrast, in Badulla district, about 19% lives in estate settlements, about 10% in urban areas, and 73% in rural areas.

Figure 67: Population distribution in Badulla District based on Ethnicity, Religion and Urbanization



Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

Figure 68: Population distribution in Monaragala District based on Ethnicity, Religion and Urbanization



Ethnic Group (C 2012)	
Sinhalese	428,104
Tamil	13,207
Sri Lankan Moor	9,508
Other ethnic group	239

Religion (C 2012)	
Buddhist	426,762
Hindu	11,997
Muslim	9,809
Christian	2,460
Other religion	30

Urbanization (C 2012)	
Rural	442,710
Estate	8,348

Source: CITY POPULATION. 2020. Sri Lanka. Available at: https://www.citypopulation.de/en/srilanka/ (accessed on 3 July 2021).

318. **Economy.** Uva Province is one of the provinces recording the highest poverty rates in Sri Lanka. Compared to the rest of the country, the poverty index of Uva province is higher than 15.4%. The poverty index in the Badulla District is 12.3%, and 20.8% in the Monaragala District. The median monthly income of a household unit in the Badulla District was SLR. 36,870 and s SLR. 35,838 in 2016 (median income in Sri Lanka was SLR. 43,511) in the Monaragala District. Sri Lanka's second least-populous province, Uva, currently has a modest economy largely dependent on agriculture plantation crops, i.e., tea in the hills and sugar and maize on the plains; sizeable rural agriculture of the subsistence variety; and little industry.

319. The contribution to national GDP from Uva Province is 5.8% (2016). The growth rate of Uva Province nominal GDP was 13.1% in 2016. A significant contribution of over 13.0% of the GDP in the province derives from the primary sector which includes paddy, export crops (tea, rubber, and spices), sugar, livestock, fisheries, and forestry. The agriculture sector employs about 53.3% (2016) of the labor force in the province, while 9.2% for industry, and 27.6% for the service sector.

320. Agriculture is the main livelihood of over 55% of the Uva Province population. According to the census of economic activities conducted in 2014 by the Department of Census and Statistics, there were 370,276 agriculture operators in the rural agriculture sector in Uva Province. Out of these, 228,654 operators were doing holdings above 40 perch while 70,874 were doing holdings less than 40 perch (total operators in Uva Province was 299,528). The total cultivated area under these holdings was 484,778 acres. Off-farm employment opportunities are scarce. All these factors led to a situation of persistent abject poverty among the population of this province. According to calculations of the Department Census and Statistics, poverty headcount ratio in 2002 of Uva province was 37.0% (which was highest among provinces in Sri Lanka). Even though there has been some reduction in the poverty situation of Uva province in the last decade, the poverty index of Uva province is still higher than 15.4%. The poverty index in the Badulla District is 12.3%, while Monaragala District is 20.8%. Mean monthly income of a household unit in the Badulla district is SLR. 53,236.00, and SLR. 48,842 in Monaragala District in 2016 (mean income in Sri Lanka was SLR. 62,237).

321. **Land use.** The two administrative districts, namely Badulla and Monaragala, are vital agricultural areas since ancient times. Uva Province is a lower-middle-income region with a population of 1.3 million. Land extent is about 8,500 km^2 (7.71% of the total area of the country). There are about 200,000 farm families in 3,304 villagers. Provincial contribution to the national agriculture GDP is 30.00%, provincial GDP of agriculture is 14.22%, and national GDP of agriculture is 6.90% Central bank annual report, 2017 (footnote 7). Employment in the agriculture sector is 53.30% (based on the Census and Statistics Department data for 2017 [footnote 5]). Paddy and other agriculture cultivations, except plantation crops, occupy 17% of the total land area of the province. The potential growth sectors of the Uva province constitutes crop agriculture, livestock farming, and fisheries, along with agriculture-related industries and trades. Out of the total land area of the province, 31% is used for crop cultivation. Paddy is the predominant crop in the province followed by OFC, vegetables, and floriculture.

322. **Education.** There are 36 national schools, 864 provincial schools, 63 pirivenas, and 4 private schools functioning in the Uva Province (2017 data)[5].

323. **Health and sanitation.** Curative healthcare services in the province are being provided to the community through a network of primary, secondary, and tertiary care institutions. These include 2 tertiary care institutions, 6 secondary care institutions, and 85 primary care institutions. Out of these, 90 institutions come under the administration of the Provincial Department of Health Services. The Provincial General Hospital (PGH), Badulla and District General Hospital (DGH), Monaragala are the two health care institutions in the province that provide tertiary care services to the province. Both these institutions come under the line ministry administration.

324. **Water supply.** Uva Province comprises two districts, namely Badulla and Monaragala. Under the supervision of Deputy General Manager, RSC, the Regional Office, Bandarawela and Regional Office, Monaragala are functioning with 20 water supply schemes and 11 water supply schemes, respectively.

325. **Roads and transport.** Around 2,400 km of roads within Uva Province is managed by Uva Provincial Road Development Department. The department has six divisions,namely Badulla, Diyathalawa, Mahiyanganaya, Monaragala, Welimada, and Wellawaya, to monitor the provincial roads. Each division has a divisional engineer who has the responsibility to manage divisional roads.

326. **Electricity.** Presently 100% access for electricity is ensured in Western and Southern Provinces. However, in Uva, 4% of the total households in the province are still unable to get the electricity supply from the national grid.

1. Environmental Sensitive Areas and Natural Disasters

327. **Cyclones.** Many cyclones have passed over the country. Storm surges are more frequent on the east coast of Sri Lanka compared to the other parts of the island. The cyclones which occurred in the past have caused extensive damage, especially in the eastern part of Sri Lanka. However, the southeastern part of Sri Lanka, including the Uva Province, has not been affected much and the incidences of disaster situations due to cyclones are low.

328. **Floods.** Occurrences of floods in the Uva Province is low. Exposure of infrastructure in Uva has been categorized as no vulnerability, other than a small area in the north of the province. Extreme flood event records show that Uva Province (both Badulla and Monaragala Districts) has experienced 16–27 flood events during the period of 1990–2011. This can be considered as low

incidence scenario. Vulnerability of infrastructure to the expected increase in frequency and intensity of floods due to climate change is widespread and prevalent in many parts of the country, however, the Uva Province (Badulla and Monaragala Districts) has been categorized under no vulnerability.

329. **Landslide exposure.** With climate change, the vulnerability of infrastructure to landslides is expected to have an increase in frequency and intensity and is focused mainly on the central hills. These figures highlight that there are areas in Badulla District which are exposed to moderate, low, and minimal vulnerability. Landslides have been frequently experienced in some parts of the Badulla District.

330. **Droughts.** Much of the Monaragala District and part of Badulla District are relatively dry and are located within the intermediate and/or dry climatic zones of Sri Lanka. Much of the areas of Badulla and Monaragala had more than 200 days, where daily rainfall is less than 1.0 mm.

331. One disadvantage of the geographical location of the Uva Province is that it is in the leeward side of southwest monsoon winds which bring high rainfall during the May to September period to the western side of the hill country of Sri Lanka. The southwest monsoon winds pass the central mountain ridge and enter Uva Province as a dry and gusty wind. Most of the province experience a long and severe drought period during May to September. A major part of the eastern and southern low land area of the Monaragala District and northern low land part of the Badulla District have become dry zones due to this effect**.**

332. **Environmentally sensitive areas.** There are no environmentally sensitive areas within the proximity of the proposed site.

VI. KEY ANTICIPATED ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATON MEASURES

333. The HSEP will provide better health care services to the poor in the lagging regions of the country. As a result, both the country's health services, and the health status of the population will improve leading to a reduction in household expenditures and time spent seeking medical care with long-term indirect environmental benefits.

A. Planning and Pre-Construction and Location-Related Impacts

1. Proper scheduling and planning of work

334. The sites selected for implementing the subprojects are owned by the MOH. None of the land plots has any encroachments or other socio-economic activities that would be affected by implementing the project. No land acquisition is envisaged; therefore, there will be no physical or economic displacement leading to the involuntary resettlement of people.

335. The winning contractor will bid based on the concepts and details included in the bid documents. The bidders will be advised to make their due diligence study before bidding. Necessary documents and study reports will be made available to them for their evaluation. It will be up to the bidders to maximize the use of resources made available to them. The following criteria in Table 11 are salient features that the winning contractor is expected to follow.

Table 11: Aspects to Consider During Planning of Subprojects

Criteria	Description
1. Minimization of work delays due to improper planning	
- Proper coordination to ensure timely project completion - Minimizing work delays due to not obtaining prior approvals/ consents, etc	Scheduling, coordination, procurement, obtaining approvals, and project implementation will be expedited to the practicable extent. Standard and sound construction practices will be followed at all times. The possibility of deploying several gangs simultaneously should be pursued, which will allow the work to be completed within the least possible duration.
- Minimizing delays related to the selection of locations for project interventions	The contractor is expected to liaise closely with the design and supervision consultant (DSC) and the PIU to avoid any delays. Selection of the locations to site waste treatment plants (both wastewater treatment plants and HCW management sites are particularly pertinent and indispensable in the planning process as collection, proper processing, and subsequent disposal of treated effluent, waste residues, sludge, leachate, etc., and other emissions, especially air-borne pollutants, depending on where such facilities are located). Sensitive areas and/or locations nearby is a critical, decisive factor in selecting such sites.
- Selection of areas for work camps, stockpile areas, storage, and disposal areas	Priority should be given to people in the project area when selecting workers. If labour camps are needed, the preferable option is to locate these near the subproject locations. Sites to be considered will result in the least damage to property and vegetation, and the least disturbance to the HCF and the neighbourhood, including the traffic. The contractor is expected to liaise closely with the DSC when selecting such sites.
- Solving any issues that lead to delays in the finalization of the designs of the interventions	The contractor is expected to liaise closely with the DSC and the PIU to avoid any delays, and any approvals and consents shall be obtained without delay. Collection, storage, transport, processing, disposal of HCW, and operation of wastewater treatment plants may need SWL and EPL prior to their commissioning. This has to be given the highest priority during planning, to avoid any delays in commission such facilities. Laboratory safety and the safety of health care personnel at work (especially with upgraded facilities) should be given consideration.
- Planning the work with due consideration given to climatic conditions	Some areas receive considerably high rains, and some areas are prone to local flooding and high erosion. Rainfall and runoff in project areas may cause disruption or damage to ongoing works and cause public inconvenience. Furthermore, climatic conditions play an important role in dispersing noise/air pollutants. Seasonal climatic conditions have to be considered for scheduling construction activities.
2. Plans to ensure health and safety aspects are in place in compliance with standard practice	
- Health and safety of workers	Due consideration shall be given to Environmental, Health, and Safety (EH&S) aspects.

Criteria	Description
- Public safety	The health and safety of health care personnel at work should be given the highest priority, as per the standard practices recommended by the MOH, Ministry of Labour, WHO, ICRP, IAEA, ILO, and other authorities. The level of safety for laboratories (newly established and/or renovated) should be reviewed, and such safety measures, monitoring and contingency management measure should be planned and implemented appropriately. Subsequently, such health and safety measures should be reviewed and audited by an independent third party. Installation and operation of gas supplies (especially oxygen gas plants), operation of HCW collection, transport, storage and processing, operation of wastewater treatment plants, and disposal of effluents need special attention during the planning of safety measures. Environmental, health and safety aspects concerning the public (patients, visitors, and the neighbourhood) should also be considered during the planning stage as a priority. The selection of locations and facilities for labour camps will be reviewed by the DSC. Compliance with EH&S requirements (including measures to prevent the spreading of any pandemic situations, including COVID-19) will be thoroughly reviewed and a summary requirement shall be prepared (one for workers and another common one for the public, including the workers) by the contractor.
3. Optimal use of resources, waste management and minimization of physical impacts	
- Method of construction	All the works connected with building construction and provision of services will be carried out according to approved standard methods and drawings. Special attention has to be paid to the designs and construction and rehabilitation of wastewater treatment plants, HCW management systems, and laboratory spaces where the designs and subsequent operations should comply with relevant standards and regulations.
- Erosion control, slope stability, removal of boulders, and cut and fill activities	For subprojects in locations where the ground conditions are sloping terrain, unstable ground conditions or sites where specific structural interventions are needed (retaining walls, ground stabilization, large amounts of cuts and fills, removal of boulders, or any special consideration to be considered in the foundation designs, etc.), obtaining the concurrence and recommendations of the NBRO may be an essential part prior to finalization of designs and construction processes.
- Selection of construction material, fittings, and fixtures	The contractor is expected to liaise closely with the DSC and the PIU to avoid any delays. Building materials shall be procured from reputed suppliers who have obtained proper approvals for material sourcing. This is especially applicable to sand, rubble and aggregates, gravel, etc., and laboratory fixtures, safety equipment, gas supplies, and

Criteria	Description
	components of treatment plants.
- Labour gangs	Recruitment of labourers, both unskilled and skilled, from the locality will reduce the need for having large labour camps and will lead to lesser impacts due to such labour camps during the construction stage.
- Noise and vibrations	The time of operation of construction equipment and vehicles engaged in the transportation of construction materials will be planned well so as not to disturb the activities of the HCF.
- Air quality and odour	Dust and gaseous emissions are expected during construction (e.g., transportation, excavation, construction activities, and stockpiling). Proper planning of construction and transport activities shall be a priority. Proper mitigation methods shall be adopted to control obnoxious gases and dust generated if any.
- Water pollution	The selection of locations for wastewater treatment plants and HCW storage and processing sites should be selected with a view to avoiding any potential pollution issues and impacts that may arise related to water pollution, air quality and odour. Mitigation of impacts may not be technically possible and/or costly if site selection is properly done
- Drainage and hydrology	Sections of the new constructions need careful planning to avoid local flooding and any negative impacts. Other project components are not expected to have any negative impact on the rainwater drainage of the HCF premises. Any alterations to existing drainage canals should be done with proper planning.
4. Avoiding ecological impacts	
- Loss of vegetation and impacts on the natural environment	All the project components are proposed on lands that do not have any ecologically sensitive ecosystems. There are no interventions and activities proposed in areas of ecological diversity.
5. Minimizing social impacts	
- Obstructing access to the facilities of the HCF	Alternative routes shall be provided, if possible. If there are no alternative routes, access routes within and to the HFC shall never be obstructed at all times, regardless of any reason. This has to be taken into consideration during planning.

2. Minimizing the removal of trees

336. The selection of the site and the building footprints and wastewater treatment plants, and HCW processing sites shall be finalized by the DSC after visiting each of the hospitals, conducting discussions with the hospital authorities and the PIU. The best alternative shall be selected to satisfy the needs of the hospital authorities and the users and to avoid the removal of trees to the extent that is practicable.

337. A list of trees that needs removal should be prepared during the design stage prior to commencement of site preparation. A replanting program should be planned at this stage, and the contractor should submit the tree replanting program in consultation with the DSC to the PIU. The PIU should plan to implement the replanting program at the outset of the sub-project commencement.

3. Avoiding impacts due to landslides and slope instability

338. The site selection must be finalized by the DSC, considering the potential impacts that can arise due to land instability and landslides. The sites shall be selected to minimize such

incidences; however, slopes have to either stabilized or strengthened in a few sites by way of construction of proper retaining walls or any other suitable measures.

339. Some sites may need structural or non-structural interventions as appropriate to ensure slope stability and safety of the building/users of the hospital facilities. Recommendations of the National Building Research Organization should be obtained for such projects. For some sites, small amounts of cutting and filling may be needed; however, impacts due to landslides and slope instability may not be significant or major issues as the selected base hospitals have been functioning at the same locations for several decades without experiencing such dangers.

4. Planning for interruption of services of the health care facility due to the demolition/ removal of any existing structure/part of structures

340. Removal and/or demolition of parts of the structures are needed for all nine HCFs. Complete renovation of buildings is needed at all nine sites. Close coordination with the HCF authorities is needed so as not to disturb the day-to-day activities of the HCF. The hospital authorities should be given prior notice of the activities of the contractor so that any shifting of service functions (that are affected by renovations, removal/demolition work) and re-scheduling of the work of the hospital can be done.

341. Any interruption of utility services (water supply, wastewater collection and disposal, electricity, telecommuting services) should be restored with alternative means. Also, the functional connectivity of different hospital units needs to be restored for uninterrupted services of the hospital.

5. Designing of proper stormwater drainage systems

342. The rainwater drainage must be designed appropriately for all the sites before the commencement of the work. Any alterations, damages, and blockages caused to the existing drains should be considered in providing alternative drainage pathways. The contractor should obtain proper guidance from the DSC on such matters.

6. Designing of proper healthcare waste: sorting, storage, and disposal

343. Safe handling of HCW during collection, storage, transportation, treatment, and disposal of HCW is of paramount importance. Designs and plans for such safe handling and disposal of HCW have to be planned early. Details of safe handling of HCW is provided in section on “impacts of improper handling and disposal of healthcare waste”.

7. Designing of wastewater treatment systems

344. Wastewater generated from the facilities of the hospitals needs to be collected, treated, and disposed of appropriately. A properly located facility with appropriate designs of adequate wastewater collection and on-site treatment systems shall reduce water pollution and contamination.

345. The treated effluent quality should conform to regulatory limits, and the designs of the wastewater treatment plants should be capable of achieving such targeted effluent quality levels. The disposal method of treated effluents (treated wastewater and sludges) should also be part of the design. The designs also should include safety measures, contingency measures (including

backup capacities) and should incorporate processes that are cost-effective, less technically sophisticated yet operational to achieve expected standards and operation and maintenance procedures that are also less cumbersome.

8. Planning for provision of adequate and uninterrupted electricity, water, and telecommunication facilities

346. Any interruption of electricity, water, and telecommunication facilities to the HCF shall interrupt the operations of the newly constructed sections of the hospital and even cause damage to equipment.

347. The proposed facilities should be supplied by an appropriately laid out and designed electricity connection, water supplies, wastewater collection and disposal, and telecommunication facilities.

9. Conducting surveys prior to commencement of the proposed civil works

348. The following surveys must be completed before the start of construction:

(i) **Land surveys and contour map of the proposed land plot.** This is to be carried out by a licensed surveyor. The survey plans may be needed for subsequent approvals. Contour maps are needed for the design of the building and setting the formation levels. In addition, contour survey is an essential part when designing the sewerage network and selection of locations for manholes, pump stations and other appurtenances and the treatment plant (note: land survey plans, and contour maps to be finalized before tendering of work.

(ii) **Baseline monitoring of environmental parameters**. The measurement of several parameters are needed to establish baseline conditions. **Confirmatory ecological survey**. This is to check if any proposed facilities are located in sensitive habitats;

(iii) **Initial status photography and video and crack survey.** This is to be carried out by the contractor with the participation of engineers of the DSC. The objectives are to record all existing conditions of structures of nearby buildings and the periphery that are likely to be affected during construction due to physical impacts (e.g., dust, vibration damage, drainage impairment, etc.). Any damage that may happen to structures and services during the construction phase can be accurately identified and compensated (for hospital authorities and/or the contractor, as the case may be) using this information;

(iv) **Existing survey of utilities and shifting.** This is to be carried out by the contractor before site clearing. Water supply, wastewater collection and disposal, electricity and telecommunication connections, and rainwater drains that need shifting should be identified at this stage and shifting should be carried out in consultation with the engineer or DSC and the hospital authorities.

(v) **Visual surveys of the peripheral areas of the site**. All the sites are located within existing hospital premises. Therefore, most of the sites are located in confined spaces where patient and hospital activities are predominant. Any obstruction to the movement of the ambulance and vehicular access to the hospital premises, and movement of patients within the hospital premises should be avoided entirely. Therefore, site planning is of utmost importance. A visual survey has to be carried out collectively by the engineers of the DSC and PIU and the contractor. The objectives are to decide locations for material and spoil storage yards, labor huts , camps, temporary parking areas for construction vehicles that do not disturb the

functions of the hospital in whatsoever manner.

(vi) **Asbestos survey.** This shall be carried out by a competent person and contractor to identify the presence of asbestos-containing materials in the affected subproject site prior to any demolition and refurbishment works. The survey will help identify the risk and management plans as necessary.

10. Community and public awareness

349. Careful planning and extensive coordination with hospital users (most importantly, the hospital staff and the patients) must be established. Information transfer related to construction schedules must precede any site activity in order to make the public aware of the extent of the problem that might be present during the period of construction, mainly caused by changes of the entrance to the hospital, changes of units and venues of the hospital, dangers posed by construction-related activities and how to avoid such incidences, impacts such as dust and noise, etc. These should be appropriately announced. The contractor has to coordinate this with the hospital authorities. The community and public shall also be made aware about the GRM.

B. Impacts Anticipated During the Construction Phase and Mitigation of Impacts

1. Impacts due to site preparation activities

350. Construction activities envisaged under the project can be considered with impacts that are localized, temporary, and easily manageable with good construction practices.

351. The subproject activities will involve the demolition (partly or fully), alterations or renovation of existing buildings, construction of foundations and erection of new buildings (medium-scale building construction), and construction and provision of services including toilets and washrooms, together with the wastewater collection and sewerage systems and wastewater treatment plants and rainwater drains). The proposed construction and/or rehabilitation work is restricted to a relatively small expansion of the existing building footprint within hospital-owned premises.

352. Some sites need moderate amounts of cutting and site clearing. Sites that are located in sloping and hilly terrain need site preparation with caution to ensure that ground cover, especially on slopes, is not cut, excavated, or removed unnecessarily. The civil works proposed at all the nine sites need demolition and removal of parts of existing buildings. In all the sites, there is a need to remove ground vegetation and small to moderately large amounts of topsoil. Most of the work involve only rehabilitation of existing buildings; however, the land for material and spoil storage, labor huts, etc., may need land clearing. New sites will be developed for wastewater treatment plants which are all located in lands covered with vegetation and ground cover. Land clearing will produce reasonably moderate amounts of topsoil and vegetative matter.

353. Land preparation and removal of vegetation will result in minor to moderate impacts due to the alteration of the existing drainage pattern of the hospital premises.

a. Measures to mitigate the impacts

(i) Removal of vegetation on-site should be restricted to the bare minimum, and a strip of vegetation (at least 1 m in thickness) should be left around the disturbed area.

(ii) Erosion control during land preparation activities and cutting and filling within the site premises need attention. Rainy periods should be avoided to the extent possible for land clearing. If rains occur as unexpected events, then erosion control should be considered. Surface runoff should be diverted away from the site and/or construction site, and drainage should be diverted through silt traps (if needed). Any loose soil within site should be compacted as soon as possible, and soil/spoil heaps should be kept covered at all times.

(iii) Material transport in steep roads should be done with care as the access roads to some sites have high gradients.

(iv) The spoil heaps should be kept covered and should not be exposed to rain and/or wind.

(v) Re-use of excavated material is an excellent option to reduce the quantity of spoil being transported. Wherever possible, surplus spoil will be used to fill eroded gullies and depressed areas, etc., within the hospital premises (which has to be done with the consent of the hospital authorities). Any rocks and good quality soil can be used for backfilling and levelling.

(vi) Tree barks, stumps and wood debris can be distributed to be used as firewood to local people free of charge. Trees that are of commercial value should be felled by the Timber Corporation, and the timber should be disposed of according to their instructions. If such trees are being cut, proper consents or approvals need to be obtained from hospital authorities and the Divisional Secretariat, as appropriate, and inform the Timber Corporation to remove the tree. The contractor needs to coordinate this, and all original hard copies of consent letters and other correspondence should be lodged with the hospital authorities for record-keeping (note: if there are no commercially valuable tree species were found within any of the site premises, it is the responsibility of the contractor to verify this).

(vii) Excess spoil should be disposed of at specified tipping sites in a controlled manner. Spoils should not be disposed of on sloping areas, marshy areas, and public places, and the roadside and should not obstruct natural drainage paths, canals, and other infrastructures. The temporary debris storage sites should not be located in a manner that obstructs hospital facilities. Proper consents or approvals need to be obtained from hospital authorities and Grama Niladari and/or Divisional Secretariat, and local authority, as appropriate, for transportation of spoil and excess soil out of the site premises. The contractor needs to coordinate this, and all original hard copies of consent letters and other correspondence should be lodged with the hospital authorities for record-keeping, including record indicating how the spoil and excess soil has been disposed of.

2. Impacts due to the demolition of buildings and other structures

354. Parts of existing buildings at all the nine hospitals may need demolition of whole or part of existing structures to accommodate propped new buildings. Proposed work at these hospitals involves rehabilitation of existing buildings which could also include demolition of internal walls and roofs/ceilings. The first phase of all these civil works involves demolition work.

355. Demolition of parts of existing buildings and/or parts of existing buildings and related facilities could generate high levels of air-borne dust and noise and can therefore create potential inconveniences and health-related impacts to patients, other occupants of the hospital premises (including hospital staff), and workers. The use of machinery in the demolition activities may create high levels of noise and vibration, affecting the people occupying the hospital premises (especially the wards, OPD, ETU and clinic areas which have heavy people movements). The

patients and hospital staff who occupy the hospital premises during construction will have to endure such inconveniences for long hours, especially for patients who are more sensitive to such impacts, mainly if demolitions take place in the proximity of ward premises.

356. Demolition of existing structures produces fine particles which may be suspended in air and be washed away with surface drainage. There may even be greater risk if the materials to be demolished contain asbestos which is harmful to health, even in small quantities. Clearing the topsoil will generate a large amount of topsoil material which again needs storage. Such material, if exposed to surface runoff, will lead to erosion and siltation of drainage paths.

357. Transportation of construction debris and demolished and residual material for disposal could cause inconvenience to the neighborhood due to the noise, traffic, and potential creation of dust if not planned well. Loading and unloading of excavated material under dry conditions may cause dust emissions, creating an aesthetically unpleasant environment and health hazards for hospital users. The movement of vehicles within hospital premises also pose risks to hospital users if the transportation activities are not well managed.

358. The temporary storage of construction debris and demolished material and parking of transport vehicles may obstruct circulation paths and access roads to and within the hospital premises, especially emergency access to the hospital premises.

359. **Asbestos cement management.** Demolition and renovation work of buildings will generate asbestos cement waste from roofing and ceiling sheets. It is expected that a significant amount of asbestos waste will be generated at all nine sites as the asbestos cement ceilings and cement roofs need replacement. Renovations and demolition of roofs and ceilings (partly or fully) at all nine sites will generate fairly large quantities of asbestos cement waste.

a. Measures to mitigate the impacts

360. A competent person or contractor should develop a risk assessment and management plan to identify the level of risk and to determine the level of control measures to be used for the asbestos-containing materials. The following measures are required:

(i) The competent person or contractor will identify if the building materials of the demolished buildings, fittings, and fixtures removed during renovations are safe and can still be re-used (i.e., doors, windows, timber, roofing materials, and bricks). The competent person or contractor, if different from the project contractor, shall develop asbestos-specific measures to be incorporated in the project contractor's Construction Waste Management Plan. The contractor has to consult the hospital authorities after careful removal of such reusable or recyclable material and hand it over to the material stocks to them. It is the responsibility of the project contractor to keep records of such material that are handed over to the hospital authorities.

(ii) Once demolished, paving materials of the buildings (i.e., floor tiles), rubble work, plastering and weak masonry sections and concreted structures, and broken roof tiles may not fall into the useable category, other than to be used for landfills. Removal and disposal of all such demolished material (that cannot be reused or recycled) will be the responsibility of the competent contractor. The contractor needs to obtain all the approval from the relevant government authorities for the disposal sites. During the transportation of such materials, the trucks should be covered to prevent any spills and dust.

(iii) There should be no open burning of any demolished material, on-site or offsite.

(iv) Demolished material such as broken ceramic fittings and fixtures, parts of electrical wiring and plumbing material, other metal items, plastic items, etc., may need to be disposed of separately. The contractor should consult the local authority for disposal of such materials.

(v) Discarded asbestos cement sheets should be handled and disposed of with extreme care by competent persons or contractors. Removal of asbestos is a complex and multistage process. For materials containing asbestos cement, the following should be followed:

(a) Personal and respiratory protective equipment should be used by trained workers.

(b) The enclosure that surrounds the work that needs to be undertaken is constructed in a specific way to prevent fibre egress.

(c) In order to enter and leave the enclosure safely, a very specific design of airlocks have to be made and tested.

(d) To ensure that the whole enclosure is under negative pressure, an air mover with bespoke high efficiency particulate filters should be used. This means that any breach of containment generates a net influx of air.

(e) As asbestos will adhere to hair, skin, and clothes, it is a requirement that anyone undertaking asbestos removal decontaminate themselves thoroughly through a three-stage shower unit.

(f) Once the asbestos-containing material has been removed, then it is incumbent upon someone independent from those stripping the asbestos cement material to inspect visually that everything has gone and been left clean and that that air is devoid of airborne asbestos fibers before allowing the enclosure to be deconstructed and disposed of safely.

(g) Breaking the asbestos cement sheets while dismantling should be avoided or minimized.

(h) If the sheets are bolted in place, bolts should be dampened and cut while avoiding contact with the asbestos cement.

(i) Large pieces should be slowly lowered to the ground but not dropped or used as rubble.

(j) Once removed, the sheets should be wetted to minimize asbestos fiber getting air borne.

(k) The removed sheets should be stacked carefully on-site, temporarily away from areas that are used by people, and covered in thick polythene sheets.

(l) Remove the sheets to a permanent store either within the premises or in a central location for all asbestos cement waste in the district or province. Such sites should be identified prior to the commencement of demolition activities.

(m) Transport should be done carefully with the sheets covered in thick polythene or tarpaulin.

(n) Finally, transport the asbestos cement sheets in bulk to Sri Lanka’s first licensed sanitary landfill cell in Aruwakkalu once it is commissioned (or a suitable location after consultations with the local authority and/or the CEA).

361. Guidelines on managing asbestos waste is available in Annexure 4.

3. Impacts on soil due to excavation, transportation and storage of construction material, and disposal of spoil and construction debris

362. Site clearing, cuts, excavation for foundations, pipe networks, manholes, wastewater collection tanks and waste water treatment plants, stockpiling of excavated material and spoil, stockpiling of construction material and construction debris etc., are all expected to give rise to increased risk of soil erosion from the sites during wet weather, especially during the northeast monsoons (months of October to January) for sites located in Central, North Central, and Uva Provinces; southwestern monsoons (May to September) for sites located in Sabaragamuwa Province; and for all sites especially the month of April when first inter-monsoons and convectional rains, which are torrential in nature, are expected. Since the construction areas are relatively small and limited to one particular geographical location, the impacts are short-term and not expected to be significant. Moreover, the foundation construction will be over within a short period, and surface runoff is not expected to be severe as the project area is small. Additionally, such impacts are not severe for sites where lands are mostly flat terrain. The excavations and cuts shall be filled as soon as the construction work is over. This is more applicable to the construction of pipe networks and related appurtenances, including any work at the wastewater treatment plant.

363. Impact on soil could also occur due to construction machinery and vehicles operated at the site premises after the topsoil is already removed. Soil contamination may also result from the improper storage and disposal of concrete, chemicals such as paints and solvents, and other hazardous material. As the nature of construction envisaged is small and the duration to be short, these impacts are not significant as use of construction machinery and vehicles will be minimal.

364. Disposal of spoil (excess earth from excavations) with fine particles susceptible for washout can lead to erosion and siltation of drains or waterways. Large scale excavations or cutting of embankments are not expected for most of the sites the project, hence the quantity of excess soil requiring disposal will be very much less. For some of the hospitals, the excess earth (if any) can be levelled off on-site or elsewhere within the hospital premises. If there are natural streams or waterways located in any of the sites, extra care must be taken to prevent any soil laden surface run-off from polluting such water courses. However, the site is on the opposite side of the premises and the impacts due to construction on this canal are not envisaged.

365. These impacts would be general to all sites given the typical and similar type of design and construction envisaged.

a. Mitigation measures to avoid impacts on the soil environment

(i) Removal of vegetation on-site should be restricted to the bare minimum, and a strip of vegetation (at least 1 m in thickness) should be left around the disturbed area.
(ii) Earth stockpiled on-site should be fully covered on all sides with a suitable material, and weight should be placed at the base to prevent the cover from getting displaced and exposing the earth to erosion. They should be stored away from site and road drainage paths.
(iii) Drains bringing in stormwater towards the construction area should be prevented with earthen and sandbag berms during wet weather. Construction should be scheduled in a way that earthwork such as excavations, cut, and fill are carried out during the dry period.
(iv) On hilly terrain, vulnerable slopes in the disturbed areas should be covered with

mulch or plastic sheets fortified with a weight such as sandbags or rocks, or a silt fence should be erected at the base of the slope where it tapers to a drain or road. Retention walls shall be constructed on unstable slopes before the commencement of hospital construction work (may be applicable for steep embankments bordering the main roads).

(v) Construction should be scheduled in a way that earthwork such as excavations is carried out during dry weather. In contrast, all the preparations for foundation construction and pipe works, and septic tank and soakage pit construction are ready to commence immediately after excavations are over. This will allow the backfills to be completed without delay and minimize the need to stockpile the spoil or soil for a longer duration.

(vi) Explore the possibility of using ready mix concrete as it will avoid the need to bring much of the construction material, such as cement, sand, metal, etc. to the site (thus minimizing the vehicular movements within the site premises); and providing storage space on-site. This will also avoid the need to have cement mixed on-site, which will prevent further disturbance of the exposed soil surfaces in peripheral areas as it is now.

(vii) Oil and lubricant waste should not be buried or burnt in the project site but collected and stored in proper oilcans and disposed of for re-use or local authority -approved designated sites.

(viii) All other hazardous chemicals such as paint shall be stored in a safe place that is not subjected to floods or accidental spilling. Empty paint cans will be collected and removed to an authorized dumpsite.

(ix) Packing material, polyethene, wooden debris (e.g., used for shuttering work), etc. should be appropriately collected and stored, and the contractor should remove them from the site before handing over.

(x) Water collection basins and sediment traps shall be installed in areas where construction machinery and equipment (concrete mixers, buckets, containers and cans, and paintbrushes) must be washed daily.

4. Impacts due to activities creating noise and vibration

366. Noise and vibration are two key impacts that may result during construction work, which will be a nuisance to hospital staff, patients, and the neighborhood.

367. **Noise.** Major sources of noise are the movement of construction vehicles, haulage of material, concrete mixing, and other noise-generating activities (operation of cutters, drilling machines, riveting machines, compactors, concrete mixers, poker vibrators, etc.) at the site, which, cumulatively, can possibly produce noise levels exceeding the CEA Regulatory Limits and/or IFC Guideline Values.[8] Equipment used in clearing and demolition of the site, excavation, paving, and concreting is also known to generate moderate noise levels.

368. The elevated noise levels will be a localized and temporary impact that will last throughout the construction period. However, given that the worksite is close to the existing hospital facilities such as ETUs, OPDs, clinics, wards (especially intensive care unit wards and pediatric wards), and hospitals being sensitive receptors to impacts of noise and vibration, maximum mitigation will

[8] The noise levels should meet the limits of: (i) maximum permissible noise level at boundaries of the land in which the source of noise is located for construction activities specified in the National Environmental (Noise Control) Regulations, No. 1 of 1996, which is 75 dB L_{Aeq} (measurement time shall not exceed 5 minutes) during the daytime (8.00 am to 6.00 pm), or (ii) IFC Noise Level Guidelines value of 55 dBA L_{Aeq} (1 hour) during daytime (7.00 am to 10.00 pm).

need to be taken to keep it under acceptable limits. This is particularly applicable to sites where there are other building works are in progress, including any renovation. Such simultaneous work may lead to aggravating noise and vibration-related impacts as all these construction sites are located close to existing facilities in all the other hospitals.

369. There are many in-house wards in all nine hospitals. According to the World Health Organization (WHO) Guidelines on limits for community noise,[9] for most spaces in hospitals, the critical effects of noise are sleep disturbance, annoyance, and communication interference, including interference with warning signals. The L_{Amax} of sound events during the night should not exceed 40 dB indoors. For wardrooms in hospitals, the guideline values indoors are 30 dB L_{Aeq}, together with 40 dB L_{Amax} during the night. During the day and evening, the guideline value indoors is 30 dB L_{Aeq}.

370. Since patients have less ability to cope with stress, the equivalent sound pressure level should not exceed 35 dB L_{Aeq} in most rooms in which patients are being treated or observed. Particular attention should be given to the sound pressure levels in intensive care units and operating theatres. The sound inside incubators may result in health problems, including sleep disturbance, and may lead to hearing impairment in neonates. Guideline values for sound pressure levels in incubators must await future research.

371. **Vibration.** The Interim Standard on Vibration Pollution Control for Sri Lanka provides guidelines for the operation of machinery, construction activities, vehicular movements, acceptable human exposure to vibrations depending on the length of the vibration period (continuous, intermittent, and impulsive).

372. It should be noted that structures are sensitive to vibration, and the ground-induced vibrations and shocks can have severe damages to nearby properties when ground vibrations are exceeding certain limits.

373. **Vibration standards for Type 2 structures**. Single and two-story houses and buildings made of reinforced blockwork, pre-cast units, and with reinforced floor and roof construction, or wholly of reinforced concepts, not designed to resist seismic activities, should have a maximum of 4.0 mm per second (Peak Particle Velocity [PPV]) at 0–10 hertz (Hz) and an intermittent type of vibration. The building earmarked for renovation at some hospitals may fall into this category, as well as some other buildings in the periphery.

374. **Vibration standards for Type 3 structures.** Single and two-story residential houses and buildings made of lighter construction material such as bricks and cement blocks, not designed to resist seismic activities, should have a maximum of 2.0 mm per second (PPV) at frequency of vibration at 0–10 Hz, and an intermittent type of vibration. Most of the hospitals have such structures in the close periphery.

375. **Vibration standards for Type 4 structures.** Structures that, because of their sensitivity to vibration and declared as archaeologically preserved structures by the DOA, should have a

[9] The noise levels should meet the limits of: (i) maximum permissible noise level at boundaries of the land in which the source of noise is located for construction activities specified in the National Environmental (Noise Control) Regulations, No. 1 of 1996, which is 75 dB L_{Aeq} (measurement time shall not exceed 5 minutes) during the daytime (8.00 am to 6.00 pm), or (ii) IFC Noise Level Guidelines value of 55 dBA L_{Aeq} (1 hour) during daytime (7.00 am to 10.00 pm).

maximum value of 0.5 mm per second (PPV) at 0–10 Hz, and an intermittent type of vibration. Some buildings at some hospitals, though not archaeologically preserved buildings, are close to 60–70 years old.

376. Demolition of structures, especially concrete chipping, and excavation could create moderately high vibration in the area as well. Pneumatic drills and excavators can induce ground vibrations, which may lead to human disturbance and structural damage.

377. However, activities that generate high vibration levels are not expected. Even such activities are adopted, they will be limited to short durations.

a. Measures to mitigate the impacts

(i) Although the daytime (8.00 am to 6.00 pm) maximum permissible noise level at boundaries of the land in which the source of noise is located for construction activities specified in the National Environmental (Noise Control) Regulations, No. 1 of 1996 is 75 dB L_{Aeq}, it is clear that the criteria should be based on the WHO Guidelines on limits for community noise for noise levels within indoor spaces, to the extent that is practicable. This issue has to be discussed with individual hospital authorities, depending on the location of hospital facilities relative to the construction site.

(ii) High noise-generating activities should be scheduled after informing and securing the consent of the hospital authorities so that issues related to high noise can be overcome.

(iii) Noise barriers must be erected, if needed, to cut down high noise. However, the contractor can separate the site premises with a delineated barrier with the dual function of dust/noise containment and safety.

(iv) The use of noisy machines should be restricted, and where possible, noise-reducing means for construction machines should be used. Avoid using multiple high noise generating equipment and activities simultaneously.

(v) Noisy construction machines or activities should be scheduled to coincide with non-clinic and non-OPD days or times as much as possible or on days that patient visitation to the facility is minimum. All other construction activity should be between 8.00 am to 6.00 pm daily to avoid discomfort caused by noise and vibration that for in-patients and the neighborhood.

(vi) If certain nighttime construction activities are unavoidable, they should be done using noise-reducing means or low-noise technologies.

(vii) The use of ready-mix concrete will avoid the need to have manual mixers operated at the site. Ready-mix concrete mixer trucks and pumps can generate a similar kind of noise, however, the duration will be very much shorter than manual mixing of concrete.

(viii) Equipment used in construction work should meet industry standards for noise and vibration in Sri Lanka.

(ix) Liaising with the hospital authorities regarding the work schedules is always advisable. Prior notices of noise generating activities will avoid confusions among hospital authorities and the contractor.

(x) Conformity to the Interim Standard on Vibration Pollution Control for Sri Lanka provides guidelines to mitigate the vibration-related impacts due to the operation of machinery, construction activities, and vehicular movements, and also provides acceptable human exposure levels to vibrations depending on the length of the vibration period.

(xi) If vibration causes structural damages to nearby structures, the contractor is liable to rectify such damages. A prior crack survey has to be carried out as a precautionary measure so that both the contractor and the hospital authorities can resolve issues (if any) that may arise in an unlikely case.

5. Impacts due to activities creating emissions and impacts on air quality

378. Air quality within the sites will suffer temporarily due to fugitive dust generation from demolition, renovation, cutting, excavation, construction, stockpiling and transporting activities. Such impacts can be significant for all the interventions proposed (alterations, demolition work, construction work, etc.) for existing buildings or any sites located in any of the hospital facilities. These air-borne dust may fall on surfaces in hospital functional spaces, including laboratories, drug stores, consultation and treatment areas, wards premises, offices, kitchens, and canteens, waiting areas, etc. which can cause severe inconveniences, including health hazards—mainly respiratory problems for vulnerable persons (e.g., asthmatic patients). Clean and sterile surfaces can be contaminated which will affect the quality of samples, drugs and medical supplies, treatment equipment, etc. Dust falling on medical equipment can cause severe damage to the functioning of such equipment. Drugs and medical supplies can be adulterated due to such dust falling on them.

379. However, for the construction of treatment plants, the impacts will be localized and minor because most of the proposed sites are located at the backyards of other buildings of the hospitals, and the premises are not often visited by hospital staff and/or patients. Small amounts of dust can fall on areas that are located in windward direction of the sites (about 50 m–75 m away).

380. Other than the immediate surroundings of the hospital premises, the impact on the neighborhood can be considered minimal because there may be no houses located close to the sites other than the hospital staff quarters. Many of the sites have large trees with widespread canopies, which will act as barriers for dust blown away from the site. An increase in gaseous emissions such as carbon dioxide, nitrogen oxide, and sulfur dioxide from construction machinery and vehicles will be minor to make a severe impact on the air quality.

a. Measures to mitigate the impacts

(i) Effective dust barriers have to be erected to prevent dust from being blown towards other parts of the hospital (as mentioned above, this barrier can function as noise or dust containment as well as for fencing the site premises that is used for safety reasons). The height of the barrier, material (e.g., zinc-aluminum sheets, plywood sheets, tarpaulin, etc.) to be used for the barrier and the locations have to be decided in consultation with the hospital authorities under the instructions of the DSC. The dust barriers can be part of the temporary partition of the site premises. Any windows, openings, and louvres of adjacent buildings of the hospital which are most susceptible to fugitive dust fall have to be temporarily covered with polythene sheets until the construction work is over. Such areas include ward areas, intensive care units, ETU, OPD areas, drug stores, laboratories, clean and sterile areas, consultation rooms, clinic areas, waiting areas, canteens and kitchen areas, and staff quarters.

(ii) The site should be cleaned daily, especially surfaces that are affected by soil and dust.

(iii) The land clearing and other preparatory activities should be completed within the shortest possible time period. Any soil heaps (after excavations, cutting, and clearing of land) have to be kept covered. The construction debris should be disposed of without keeping them on-site.
(iv) Regular watering (at least twice a day during the mid-morning and mid-evening) should be carried out in the construction site for dust suppression.
(v) Excavated soil that is temporarily stored on-site should be covered in a tarpaulin or other locally sourced suitable material to prevent from dust particles getting airborne.
(vi) Where possible, construction stockpiles and debris piles should be stored away from the functional areas of the hospital.
(vii) During transportation, trucks carrying earth, spoil (if any), or construction material to and from the sites should be covered by a tarpaulin. Speed controls must be imposed on construction vehicles from about 500 m away from the site.
(viii) Any equipment and machinery which uses diesel shall be appropriately maintained to control emissions. The contractor has to ensure that the vehicles entering the site have obtained Vehicle Emission Certificates.

381. Vehicle Emission Test became mandatory from 15 July 2008 to enforce the environmental standards on vehicle emission provided in the Motor Traffic Act (Emission Control) Regulation of 1994, 817/6, Part I, Section I. This regulation applies to all construction vehicles as well.

6. Impacts due to activities that affect surface and groundwater quality and quantity

382. Construction work is commonly known to cause blockages in drains (both natural and human-made), leading to localized flooding and water stagnation. Impedance to drainage is often a result of poor site management and mishandling of construction material and debris. It is essential to identify the drain paths within the hospital that discharges stormwater outside and to ensure that these as well as the lead away drains are kept clear of debris for water to flow freely. Stagnant water also carries the risk of mosquito breeding.

383. Construction wastewater from concrete work and equipment washing can potentially pollute water sources, both ground and surface. Any contamination that occurs either directly through over-land surface runoff during rainfall or indirectly through contaminated soil can lead to the washing away of construction waste. Construction wastewater that ends up in the roadside drainage adjacent to the hospital can eventually lead to wetlands, paddy fields or surface streams in both hilly and flat terrain. Given the scale of construction planned, this is not considered a significant impact; nevertheless, it requires mitigation.

384. **Wastewater during construction.** Disposal of grey water and black water from the site and workers camps or temporary toilets within the project site could cause contamination of nearby watercourses, groundwater sources, and soil. Similarly, the disposal of municipal solid waste produced by workers could lead to leachate being generated, contaminating the surface runoff.

385. However, the number of workers will not be many in most of the sites (may be 10–15, maximum). Therefore, impacts due to the generation of wastewater are not significant. However, wastewater should be appropriately managed on-site.

a. Measures to mitigate the impacts

(i) Maintain cross drainage within site always during construction. Hence stockpiles and debris must be safely stored away from these drainage paths.
(ii) Where blockage of drainage is unavoidable, alternative paths must be created to facilitate stormwater flows from the site to the outside.
(iii) Lead away drains that collect water from the internal drainage system of the nearby buildings (if any) must be kept clean and free from any constrictions to ensure a smooth flow of stormwater.
(iv) The construction site/s should be checked daily (after wet weather) for any signs of water stagnation and cleaned.
(v) Collection and disposal of construction-related wastewater (i.e., mud water, water contaminated with cement, concrete other solvents, etc.) will be the responsibility of the contractor who shall conform to the standard practices in handling such construction-related wastewater. Such clauses shall be included in the contract agreement under Environmental Compliance.
(vi) A washing area for construction equipment should be delineated within hospital premises away from the construction area.
(vii) Wastewater from the construction site should not be directly discharged into roadside drains. It should be first directed to a pit to allow siltation and percolation before connecting to a lead away drain.
(viii) Grey and black water should be collected and disposed of appropriately. Temporary toilets should not be located close to shallow wells. Grey and black water should never be disposed to nearby drains, canals, including roadside drains. Such wastewater should be disposed of on-site by way of having an appropriate collection and disposal system (e.g., pit latrines, or septic tanks with soakage gullies or pits, etc.).
(ix) The workers may use existing toilets in the hospital premises with the consent of the hospital authorities. Such use of toilets should not affect other users of the hospital in any way. Also, it has to make sure that such use of toilets will not affect the health of the workers, as the toilets may be used by patients, thereby exposing workers to undue health risks.

7. Impacts due to extraction of water for construction purposes

386. The supply of good quality water to be used in adequate quantities for construction purposes was observed to be a problem in all of the sites. There are regular connections of treated water provided by the NWSDB for all the hospitals. In addition to this supply, some hospitals obtain water from a variety of sources such as treated/untreated water supply schemes, springs, shallow ground wells and tube wells.

a. Measures to mitigate the impacts

387. Availability of water for construction purposes will have to be assessed in a site-specific manner. However, where water stresses exist, the contractor should arrange his own supply for construction activities to avoid potential conflicts. If the contractor is compelled to share limited water supplies within the hospital or in the local area, necessary approvals shall be obtained from the hospital authority or the local authority, as required.

388. Water usage by the contractor must be priced, and the cost of the supply has to be claimed. DSC and the PIU must check this prior to payment of any claims of the contractor.

8. Impacts due to solid waste generation, collection, and disposal

389. **Municipal solid waste.** Improper disposal of municipal solid waste will create nuisance among the users of the existing hospital premises as well as neighboring communities. Impacts of poor municipal solid waste management include the breeding of disease vectors and vermin, leachate, public nuisance, and pollution—water, soil, and air.

390. **Construction waste and debris.** Solid wastes generated from the construction activities are vegetation cleared from the site, excess excavated earth (spoils), discarded construction materials, cement bags, wood, steel, oils, fuels, and other similar items. Improper waste management could cause odor and vermin problems, pollution, and flow obstruction of nearby watercourses and could negatively impact the landscape. Due to small-scale construction activities that are planned under the subprojects, the volumes of construction debris volumes are not significant.

391. There will be no significant physical changes at the construction sites, and these small quantities of waste could be disposed of (with the guidance of the local authority) without causing further physical impacts (on air quality, topography, soil quality, etc.) at the point of disposal. No particular action will, therefore, be needed to reduce physical impacts at both the construction and disposal sites. However, the contractor should take efforts to reduce the amount of waste that is discarded by following the mitigation measure proposed below:

a. Measures to mitigate the impacts

392. **Municipal solid waste.** Municipal solid wastes may be generated from the workers' camps. During the construction period, such solid waste shall be handed over to the local authority. However, the contractor shall be responsible for deploying the best domestic solid waste management practices at the site that should consist of the following:

(i) Solid waste should never be burnt in the open (on-site or elsewhere).
(ii) Waste separation within the site premises in CEA or local authority-approved color-coded bins. The bins should be tightly closed to prevent vermin and pest infestation.
(iii) Hand over the collected waste to the local authority and provide easy access for the waste collection truck and tractor of the local authority.
(iv) The technical officer or work supervisor of the contractor should make the workers aware of waste management practices and oversee compliance to such practices, and maintain a good communication system with the local authority
(v) Maintain the cleanliness of waste storage spaces.
(vi) Once the biodegradable waste and mixed waste is handed over to the local authority, sell the recyclable waste (if any) to selected collectors registered with the CEA in the area.

393. **Construction waste and debris.** Under the Environmental Compliance of the contract agreement, the following clauses shall be included to minimize the amount of construction waste generation.

(i) Use ready-to-use building materials to the extent as possible to make sure less processing at the project site (i.e., ready mixed concrete, doors, windows, timber fittings, railings, etc.).

(ii) Reduce the use of hazardous paints as much as possible at the site (such as the use of powder-coated doors and window frames purchased from the open market). Solvents and paints which are considered to be hazardous should also be separately stored for re-use.
(iii) Adopt the 5 S management tools in the construction site to make sure the separation of construction waste into clear categories (i.e., for re-use, re-sell, and disposal). Reuse as much waste soil in this project as possible and find alternative beneficial uses for any unused material (e.g., excess soil and damaged bricks and blocks can be used as infill in other construction works).
(iv) Adopt the best construction sites management practices to reduce the generation of 'mixed waste.
(v) The contractor should have an approved site (by the relevant authorities) for the construction waste disposal.
(vi) The disposal of all the construction waste is the responsibility of the contractor. The contractor should deploy the best environmental compliance methodologies following the CEA regulations/guidelines.
(vii) Once the construction is over, the contractor is responsible for cleaning up any waste material remaining in the site premises and conducting site clearance and restoration to original condition after the completion of construction work in and around the site. DSC must ensure that site is appropriately restored before issuing the construction completion certificate. If not, any remaining waste will be cleaned up, and the cost may be deducted from retention payments.

b. General comments on waste management

394. In general, the contractor is responsible for: (i) providing waste collection bins and other containers of all sorts; (ii) handling, emptying, and removal of those bins and containers; (iii) removal of waste of all sorts from the site; and (iv) pest and Vermin control.

395. The contractor has to prepare and submit a waste management plan to the DSC for approval. This plan should specifically address the proposed arrangements for:

(i) avoidance, reuse, recovery/recycling;
(ii) collection; and
(iii) storage, treatment, and disposal of each category of waste anticipated to arise from their works.

396. In addition, the proposed designation of areas for segregation and temporary storage of re-usable and recyclable material should be explicitly mentioned.

9. Impacts due to migrant laborers and operation of labor camps

397. A large labor force is not expected to be required for project purposes, and as such large labor camps having significant impacts are not anticipated. Also, the majority of the laborers may come from the local area itself, and therefore, there will be no need to provide them with accommodation facilities. However, the necessary mitigation measures will be taken in managing labor.

a. Measures to mitigate the impacts

(i) If there is a need to establish labor camps, they should be established in suitable locations away from the hospital's functional areas with consent from the hospital management. The laborers should be instructed to behave in the camps decently without creating disturbances to hospital users and others in the neighborhood. There can be conflicts between laborers from outside areas and the local community members. This issue should also be carefully handled by the contractors. The hiring of local people would be the most effective solution to avoid possible conflicts between migrant laborers and the local community members. This will also provide livelihood opportunities to the local community.

(ii) Laborers or workers should be provided with adequate sanitation facilities and receptacles for garbage collection. Domestic solid waste collected should be disposed of daily at a site approved by the local council or given to them where garbage collection services exist. Burying and burning domestic waste in the project sites should also be strictly avoided. A good supply of drinking water should be provided to the labor camps.

10. Impacts due to occupational health and safety

398. Occupational health and safety are critical risks of the project to be addressed. The scale of construction is small, and the risks are not significant. There will be no large machinery or equipment needed for construction purposes. Scaffolding will be mostly limited as the construction and renovation of buildings are only up to three-storied buildings. Only some sites have buildings of more than three floors proposed for civil works.

a. Measures to mitigate the impacts

(i) Three essential features of a safe construction site include (i) fully functional and well-maintained equipment, (ii) availability of emergency equipment and safety warnings, and (iii) worker PPE and a strong commitment to follow safety practices with proper supervision of labor with proper monitoring and feedback to support continuous improvement. Therefore, appropriate safety equipment, tools and protective clothing should be provided to workers, and the contractor must ensure that safe working method are applied.

(ii) Workers must be provided with first aid and health facilities. First aid training should be provided to the supervisor. The contractor should organize awareness programs about personal safety of the workers and the general public in the area with briefing and training on safety precaution and their responsibilities for the safety of themselves and others.

(iii) The constructors should carry out suitable training programs on occupational health and safety for workers.

(iv) Machinery and equipment that could easily electrocute should be kept safely within site and always under the supervision of an experienced worker. Arranging regular safety checks for vehicles and equipment is needed, including the labour huts.

(v) Allocation of responsibility to the relevant personnel is needed. Prohibition of alcohol and other narcotic substances which may impair the judgment of workers engaged in construction activities should be enforced.

(vi) Excavated areas for construction should be barricaded using barricading tapes and signboards. When work is done at higher elevations, the work should be carried out and supervised by experienced workers.

399. **Emerging concerns on the safety of workers to prevent the spreading of COVID-19.**

The contractor has to consult the HCF where the civil works are proposed and have to formulate a safety plan to prevent the spreading of COVID-19 before mobilization of workers for civil works.

400. This COVID-19 safety plan should consist of the information as proposed in Annexure 5.

11. Impacts on public health and safety

401. Public safety issues concerning the hospital staff and the patients who visit the hospital daily should be considered a priority. In all the HCFs, clinics are held several days a week/month for a range of issues including medical, non-communicable disease, asthma, well-woman, ante-natal, pediatric, and psychiatric when many patients in addition to the OPD use the hospital grounds. In some of the hospitals where civil works are proposed, these outreach, OPD, and emergency services will be relocated to different parts of the hospital to continue to serve the local community. In contrast, the construction and rehabilitation work going on. Hence, ensuring the safety of hospital staff and patients from risks of falling, injury, and all other forms of accidents is very important.

402. This impact is minor in some hospitals because the proposed sites are located separately from the other areas of the hospital and clinics, and the premises can be cut off for visitors, hospital staff, and/or patients. However, the impacts on the public will be severe in sites where the patient visits are relatively high, and there is not much space available in the periphery of the building and minimal space for construction-related work organization. The site works at some sites will obstruct access to the hospital and other facilities within the hospital, and also waiting areas of patients and parking spaces for vehicles. Access roads to the clinics should not be obstructed in any of the sites. Also, some site works will obstruct access to wards and emergency access to hospital facilities. Alterations to the entrance space to the buildings have to be carried out with care so as not to pose any dangers to the hospital users.

403. Cutting operations of the embankment (if any) will pose dangers to the public as access to the hospital facilities will be obstructed. Also, at some sites, any loose boulders may be removed safely, and the slopes should be made stable. Slope stabilization and strengthening to ensure public safety applies to these two sites as well.

a. Measures to mitigate the impacts

(i) The construction site should be delineated from the rest of the hospital, preferably using barricading tape or any other suitable material that separates the construction area from the rest of the hospital physically. Appropriate signages should be adopted to alert the public of any dangers posed by construction-related activities. Signs must be kept clean and well maintained if they are to be effective.

(ii) A safe pedestrian pathway to the hospital buildings should be provided if regular access along with the nearby gate and the hospital access road is blocked.

(iii) Signboards and directions for such detouring and shifting of facilities should be placed in all the two local languages, at prominent locations, and in large-sized lettering. The contractor should always keep in mind that the patients are very vulnerable and susceptible to risks, even when they are minor due to their physical and mental weaknesses. Therefore, the slightest disturbances which are considered tolerable to healthy persons should not be ignored. Providing safety precautions, therefore, is essential. This is again significant because the majority of the patients who visit the HCF are elderly persons. Safety of the peripheral areas

of the site and access paths should be ensured at all times, e.g., non-slippery surfaces, clear of any obstructions and dangers, maintaining clean, tidy, and well-managed sites and activities, etc.

(iv) Safety signs should be placed at appropriate locations, informing the public of any dangers posed by construction-related activities.

(v) Emergency access should never be obstructed. Alternative access for the ambulance and vehicular access should be provided whenever needed.

(vi) Strict entry controls to the site premises should be in place so that unauthorized entry is debarred.

(vii) Notices should be provided to hospital staff and users about the schedule of construction activities with particular hazards, and potential noise and dust episodes, etc. Advance public notices should be displayed so that the hospital users are informed of construction schedules.

(viii) Concrete mixer trucks or any other trucks or construction vehicles should not be parked outside the hospital premises, as the access roads are either narrow or busy.

(ix) Delineation devices such as cones, lights, tubular markers, barricades tapes, warning signposts, etc. should be erected to inform hospital users about work zones. Dangerous warning signs should be raised to inform the public of dangers and to keep them away from such hazards.

(x) Tree cutting should be done with care so as not to damage the existing structures and not to obstruct access roads. Advance public notices should be displayed so that the hospital users are informed of the tree cutting. Hospital authorities should be informed of the scheduled activities.

(xi) All slopes should be strengthened by appropriate engineering interventions. Access roads and access paths should be rehabilitated to their original conditions.

12. Site restoration (at the end of construction) and landscaping

404. Several additional works are necessarily needed at each hospital premises, and they have to be considered as essential parts of the sub-project activities or interventions. These include:

(i) providing a proper rainwater drainage network to the areas peripheral to the site, which will also prevent local flooding of low-elevation areas of the hospital premises and avoid soil erosion in the sloping terrain. Any lead away drains, roof gutters, and downpipes of other buildings, if damaged or altered during construction, should be restored.

(ii) rehabilitation of the areas used for labor huts, offices, water storage tanks, material storage yards, temporary drains, toilets, etc.; and

(iii) turfing any exposed ground area, especially sloping terrain, to avoid soil erosion and landscaping with selected trees. This will prevent soil erosion of the peripheral areas of the sub-project.

13. Impacts on biological resources

405. The proposed sites are not located within any environmentally sensitive area.

406. The only noticeable impact to biological resources will be the felling of a few trees to make way for the proposed infrastructure, which has been covered under pre-constructional impacts. All the sites are confined to existing hospital premises. Therefore, vegetation cover present in the proposed sites is secondary vegetation or bare land, and most of the flora observed during the

survey are common to the project area. Most of the trees are fruit-bearing trees that are commonly found throughout the country. Therefore, the impact on flora is negligible. The proposed sites are not connected with any sensitive habitats which are of ecological significance. No aquatic plants and vegetation will be cut, removed, or pruned and trimmed during the construction.

407. During the construction stage, soil erosion, water and air pollution, noise, and vibration could be expected at the low levels; therefore, a negative impact on both flora and fauna in aquatic and terrestrial is not anticipated. Fragmentation or modification of habitats is not expected due to the proposed development due to their small scale.

a. Measures to mitigate the impacts

408. It is recommended to plant at least three trees for each tree that is cut. The preferred number would be five trees for each tree that is cut. The PIU can (in consultation with Agrarian Development Office) provide fruit-bearing trees to be planted within the hospital premises. Trees such as jackfruit, breadfruit, mango, jambu, guava, and avocado are some of the species that are common in these hospitals. Trees such as ehala, mahogany, mee, and teak are also popular.

14. Impacts on the Cultural and historical environment

409. There can be archaeologically important sites and ruins found in some hospitals. Therefore, the contractor has to contact the DOA and get their views (and guidelines, consents, or approvals, if needed) prior to mobilization of work.

a. Measures to mitigate the impacts

410. All the staff and laborers of the contractor should be informed about the possible items of historical or archaeological value, which include old stone foundations, tools, clayware, etc. If something of this nature is uncovered, the DOA shall be contacted, and work shall be stopped immediately. The chance finds procedure of archaeological and cultural artefacts shall be followed in case such artifact is observed.

411. If instructed by the DOA, the contractor should undertake reconnaissance surveys with the DOA to identify any archaeological/historical weak structures (if any) that are likely to damage from high ground vibration levels during excavation work.

15. Renovation of Ambulance stations

412. All ambulance stations selected for renovation are located within police stations. Therefore, this activity shall also not involve acquisition of private land or lead to any physical or economic displacement of people. Renovation works shall include providing proper parking area with garage facilities. The following measures shall be applied during renovation works to minimize any undue environmental and social issue.

(i) Construction area shall be properly barricaded.
(ii) All construction material shall be properly stored.
(iii) If foundation and concrete works are required, such activities shall be conducted avoiding any wash off of excavated soil or concrete into nearby lands or water bodies.

(iv) All construction debris shall be stored properly and removed from site once the renovation works are completed.

C. Impacts During the Operational Stage of Newly Constructed Facilities

413. The potential adverse impacts envisaged during the operational phase are related to the generation, handling and disposal of wastewater and HCW. All types of solid, liquid, and gaseous waste that is generated during operations, diagnosis, treatment or in medical research that can cause detrimental effects on human health and the environment when discharged or disposed of is considered medical waste. Generally, only a small percentage of the wastes produced by HCFs is hazardous, while a large percentage is general or non-hazardous waste. Even though the proportion of hazardous HCW is relatively small, the risk they carry in terms of transmitting disease and polluting the environment due to careless disposal is very high.

414. The proposed project support will be provided to expand and improve the services of selected secondary care HCFs. With the expansion and improvement of facilities of these HCFs, there is a likelihood of generating more wastewater and HCW, which in the absence of safe management and disposal practices can lead to the following risks:

(i) **Occupational risks**. During handling of wastes and wastewaters, medical and ancillary staff (including sanitary laborers) can be injured if the waste has not been safely packed. Sharps are the most dangerous in this respect and can cause serious injury and transmit diseases such as HIV/AIDs, hepatitis B, and skin diseases.

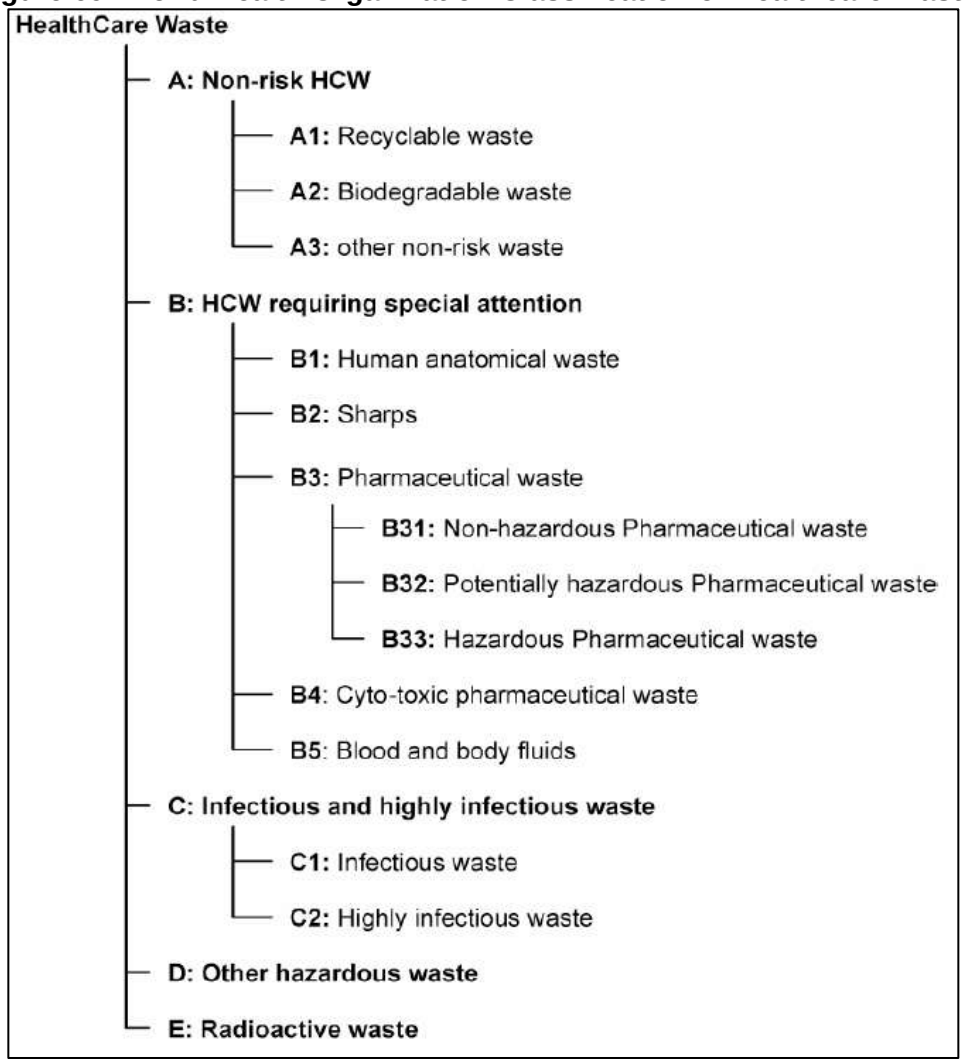
(ii) **Risks to the public and environment.** The public can be infected by hospital wastewater and HCW directly or indirectly through several routes of contamination. Direct discharge of untreated or partially treated wastewater, open dumping of untreated or inappropriately treated HCW within or outside hospital premises is one of the main causes of such contamination. With stormwater runoff, this wastewater and HCW can potentially find their way to surface water bodies, causing widespread pollution and the spread of diseases.

1. Impacts of improper handling and disposal of healthcare waste

415. HCW includes a significant component of general waste and a smaller proportion of hazardous and infectious waste. Infectious and anatomic wastes together represent the majority of the hazardous waste, up to 15% of the total waste from healthcare activities. Sharps represent about 1% of the total waste, but they are a significant source of disease transmission if not adequately managed. Chemicals and pharmaceuticals account for about 3% of waste from healthcare activities. In contrast, genotoxic waste, radioactive matter, and heavy metal content account for around 1% of the total HCW, depending on the types of services provided by the facility.

416. The types of waste generated in the HCF are classified in Figure 69.

Figure 69: World Health Organization Classification of Healthcare Waste



Note: This categorization follows Technical Guidelines on Environmentally Sound Management of Biomedical and Healthcare waste provided by the Conference of the Parties to the Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste and their Disposal (December 2002)
Source: World Health Organization

417. As mentioned above, many types of additional medical and hazardous waste are generated, including infected masks, gloves, and other protective equipment, together with a higher volume of non-infected items of the same nature.

418. The significant component of non-hazardous HCW is like municipal waste and should not pose any higher risk than waste produced in households. It is the smaller hazardous HCW component that needs to be appropriately managed so that the health risks from exposure to known hazards can be minimized.

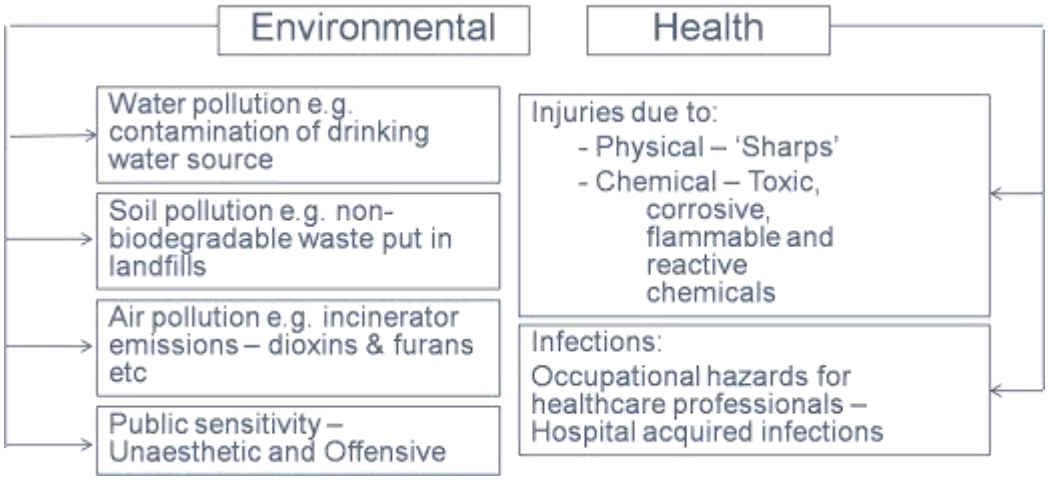
419. Excreted pharmaceuticals from patients do find their way into waterways, which can

contribute to potentially serious environmental effects, including toxicity to wildlife and the generation of antibiotic resistance in bacteria.

420. Medical and sanitary staff can be at risk of respiratory or dermal diseases caused by exposure to chemicals and pharmaceuticals. All individuals exposed to hazardous HCW are potentially at risk, including those within healthcare establishments that generate hazardous waste and those outside these sources who either handle such waste or are exposed to it as a consequence of careless management. The main groups at risk are the following:

(i) medical doctors, nurses, healthcare auxiliaries, and hospital maintenance personnel;
(ii) patients in healthcare establishments or receiving home care;
(iii) visitors to healthcare establishments;
(iv) workers in support services allied to healthcare establishments, such as laundries, waste handling, and transportation ; and
(v) workers in waste disposal facilities (such as dumping sites or incinerators), including scavengers.

Figure 70: Impacts of improper handling of waste disposal



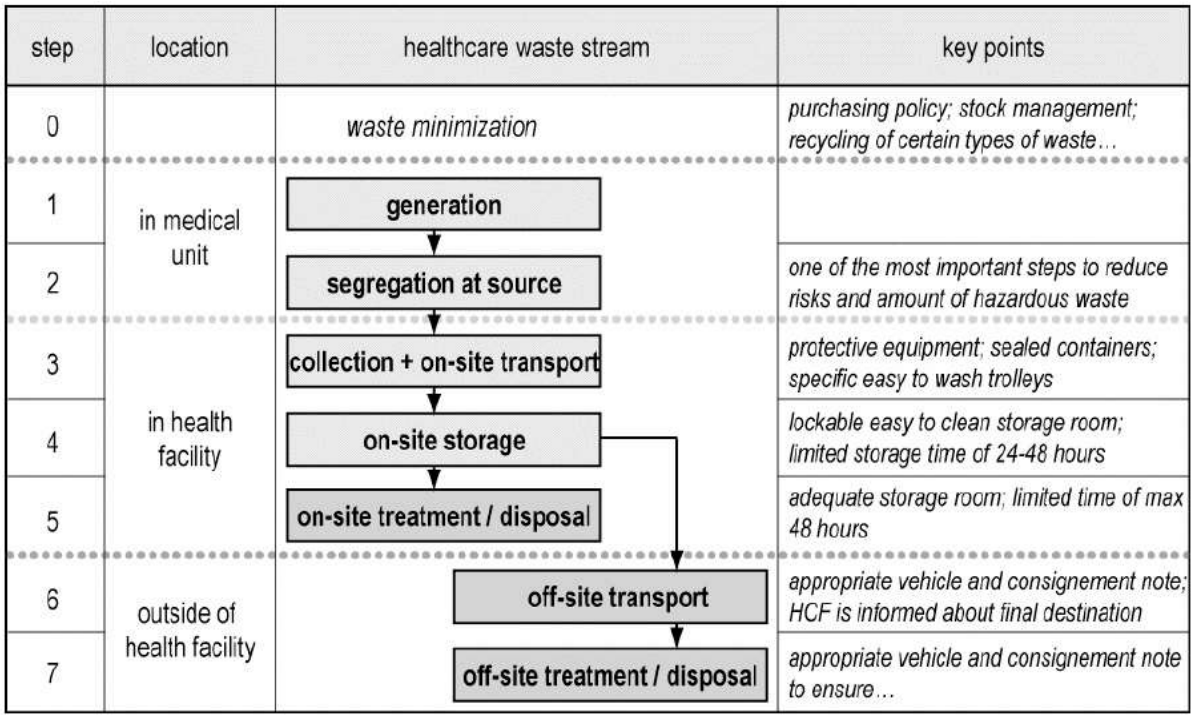
Source: Preparation of national healthcare waste management plans in Sub-Saharan countries guidance manual (2005). Secretariat of the Basel Convention and the World Health Organization.

a. Measures to mitigate the impacts

421. The design and functional layout of the HCF should ensure the following: separation of clean and sterilized and dirty or contaminated materials and people flows; development and inclusion of adequate disinfection and sterilization procedures and facilities; adequate space for the storage of (uncontaminated) recyclable materials (e.g. cardboard and plastic) for pickup; selection of heating, ventilation, and air conditioning systems that provide isolation and protection from airborne infections; design of water systems to provide adequate supplies of potable water to reduce risks of exposure to Legionella and other waterborne pathogens; provision of hazardous material and waste storage and handling areas; treatment and exhaust systems for hazardous and infectious agents; and selection of easily cleaned building materials that do not support microbiological growth, are slip-resistant, nontoxic, and non-allergenic, and do not include volatile material. The HCW that is generated within an HCF should always follow an appropriate and well-identified stream from their point of generation until their final disposal. This stream is composed

of several steps that include generation, segregation collection and on-site transportation, on-site storage, offsite transportation (optional), treatment and disposal of the HCW (Figure 71).

Figure 71: Synopsis of the HCW stream



Source: Preparation of national healthcare waste management plans in Sub-Saharan countries guidance manual (2005). Secretariat of the Basel Convention and the World Health Organization.

422. **Segregation of healthcare waste.** It is required to have a waste segregation facility in the HCF to have a better HCWM system. HCW is generated in the HCF should be segregated according to WHO recommended segregation and colour code (Figure 71).

423. Highly infectious waste, such as diagnostic laboratory samples and waste from infectious patients in isolation, should be collected separately and autoclaved at the point of generation. Once disinfected, the waste would leave a medical area in the infectious HCW container. Containers for infectious waste should not be placed in public areas because patients and visitors may use the containers and come into contact with potentially infectious waste items.

424. Waste bins should be located as close as possible to sinks and washing facilities because this is where most staff will deposit gloves and aprons after treating patients. If the general waste container is closest to the sink or under a towel dispenser, it will encourage staff to place towels into the non-infectious receptacle. Containers should be of similar size to overcome the observed tendency for staff to put waste in the largest receptacle.

Table 12: WHO Recommended Segregation Scheme

Black	Yellow	Brown
non-risk waste Category A	special waste of categories B1, B2, B4, B5	pharmaceutical waste of categories B3, classes B32 and B33
exceptionally, small quantity of waste of category B1	infectious waste and highly infectious waste of categories C1 and C2	
Pharmaceutical waste of category B3, class B31 only	radioactive waste of category E	category D such as chemicals, heavy metal waste

Source: Preparation of national healthcare waste management plans in Sub-Saharan countries guidance manual (2005). Secretariat of the Basel Convention and the World Health Organization.

Table 13: WHO Recommended Segregation and Collection Scheme

Waste categories	Color of container and markings	Type of container	Collection frequency
Infectious waste	Yellow with biohazard symbol (highly infectious waste should be additionally marked **HIGHLY INFECTIOUS**	Leak-proof strong plastic bag placed in a container (bags for highly infectious waste should be capable of being autoclaved).	When three-quarters filled or at least once a day.
Sharp waste	Yellow marked **SHARP** with biohazard symbol	Puncture-proof container	When fille to the line or three-quarters filled
Pathological waste	Yellow with biohazard symbol	Leak-proof strong plastic bag placed in a container	When three-quarters filled or at least once a day.
Chemical and Pharmaceutical waste	Brown, labelled with appropriate hazard symbol	Plastic bag or rigid container	On demand.
Radioactive waste	Labelled with radiation symbol	Lead Box.	On demand.
General health care waste	Black	Plastic bag inside a container which is disinfected after use	When three-quarters filled or at least once a day.

Source: Safe management of wastes from healthcare activities: a summary. Geneva: World Health Organization; 2017 (WHO/FWC/WSH/17.05). Licence: CC BY-NC-SA 3.0 IGO.

425. Any contaminated wash water should be autoclaved and disinfected before discharge to the septic tank. Such water must be disposed of into drains connected to a septic system or in a soak away pit. If greywater is disposed of in a soakaway pit, the pit should be fenced off within the HCF grounds to prevent tampering and to avoid possible exposure in case of overflow.

426. **Labelling of segregated healthcare waste.** A three-bin system should be established with appropriate labelling in all the HCFs: (i) general HCW (black bags/bins; no symbol); (ii) potentially infectious HCW (yellow bags or bins; biohazard symbol); and (iii) used sharps, including broken glass (yellow containers; biohazard symbol).

Figure 72: Labelling of HCW Containers

Category	Labelling	International symbols
B1	« Danger ! Anatomical waste, to be incinerated or deeply buried »	
B2	« Danger ! Contaminated sharps, do not open »	
B4, B5, C1	« Danger ! Hazardous infectious waste »	
C2	« Danger ! Highly infectious waste, to be pre-treated »	
B32, B33, D	« Danger ! To be discarded by authorized staff only »	
E	« Danger ! Radioactive waste »	

Source: Preparation of national health-care waste management plans in Sub-Saharan countries guidance manual (2005). Secretariat of the Basel Convention and the World Health Organization.

427. All the hospital that was visited practice segregation of waste, however, the colour code followed in the national colour code for segregation of solid waste, and they use only yellow bags for infectious waste. No labelling is being used in any of the hospitals.

428. **Storage.** The storage area should have an impermeable, hard-standing floor with good drainage (away from watercourses). The floor should be easy to clean and disinfect. It is required to include the facility to keep general waste separated from infectious and other hazardous wastes; a water supply for cleaning purposes, easy access for staff in charge of handling the waste, lockable premises to prevent access by unauthorized persons, easy access corridors for waste-collection vehicles; should be inaccessible to animals, insects, and birds; have good lighting and at least passive ventilation; not be situated in the proximity of fresh food stores and food preparation areas; have a supply of cleaning equipment, protective clothing, and waste bags or containers located conveniently close to the storage area; and have a washing basin with running tap water.

429. These storage areas should be sized according to the quantities of waste generated and the frequency of collection. The areas must be enclosed and separate from supply rooms or food preparation areas. Floors and walls should be sealed or tiled to allow easy disinfection. If present, the storage room should be connected to a particular sewage system for infectious hospital wastewater.

430. Where possible, hazardous waste generated in medical areas should be stored in utility rooms, which are designated for cleaning equipment, dirty linen, and waste. From here, the waste can be kept away from patients before removal.

431. **Transporting.** While transporting waste within the hospital premises, it is required to use separate floors, stairways, or elevators as far as possible. Waste, especially hazardous waste,

should never be transported by hand due to the risk of accident or injury from infectious material or incorrectly disposed sharps that may protrude from a container. Spare trolleys should be available in case of breakdowns and maintenance. The vehicles should be cleaned and disinfected daily. All waste bag seals should be in place and intact at the end of transportation.

432. Wastewater from washing hands, cleaning, laundry, bathing, flushing toilets, and teeth brushing activities should be safely collected and treated with chlorine before being infiltrated into a soak-away pit (providing the water table is at least 1.5 m under the bottom of the pit at any time). The potential of contamination to the sanitation crew, the general community, healthcare workers, and the environment is, of course, of critical concern.

433. To minimize any kind of occupational risk, less hazardous chemicals should be substituted whenever possible and protective equipment provided to all personnel likely to be exposed. Buildings in which hazardous chemicals are used should be adequately ventilated, and personnel handling hazardous materials should be trained in preventive measures and emergency care in case of an accident.

434. The hospital and the lab should derive a benefit from introducing and implementing environmental management systems. These benefits include cost reductions through reduced energy consumption, reduced quantities of waste, increased recycling and minimized negative impacts on the environment from waste handling and treatment, and an improved public image.

435. **Treatment.** Hazardous and infectious HCW can be treated on-site (i.e., in the HCF itself) or off-site (i.e., in another HCF or a dedicated treatment plant).

436. **On-site treatment**. This option is often the only one possible in the rural HCFs of the primary health care units, but on-site treatment can also be carried out for HCW generated in base hospitals. On-site treatment facilities are particularly appropriate in areas where hospitals are situated far from each other, and the road system is poor. The advantages of providing each healthcare establishment with an on-site treatment facility include convenience and minimization of risks to public health and the environment by confinement of hazardous and infectious HCW to the healthcare premises. However, the treatment costs may be high if there are many hospitals: extra technical staff may be required to operate and maintain the facilities, and it may be difficult for the relevant authorities to monitor the performance of many small facilities. This may result in poor compliance with operating standards, depending on the type of facilities, and increased environmental pollution.

437. **Off-site treatment**. The HCW generated in an HCF can be treated off-site when centralized regional facilities exist. Although off-site treatment increases the dependency of the HCF on an external actor and requires a finetuned transportation system, it provides many advantages:

(i) Small HCFs will not have to devote time and personnel to manage their own installations.
(ii) Efficient operation can be more easily ensured in one centralized facility than in several plants where skilled workers may not be readily available.
(iii) There is greater cost-effectiveness for larger units through economies of scale
(iv) Future modifications or expansions (relating to flue-gas cleaning systems of incinerators, for example) are likely to be less expensive.
(v) Where privatization of facilities is seen as a desirable option, this can be achieved more efficiently on a regional basis than for numerous small units.

(vi) It will be easier for the relevant government agencies to supervise and monitor the facilities.
(vii) Air pollution may be more easily kept to a minimum at a centralized plant (costs of monitoring and surveillance as well as flue-gas cleaning, for example, will be reduced).

438. The amounts of HCW generated at each of the hospitals, their collection, storage, and treatment methods must be recorded properly prior to planning and implementation of a proper HCWM plan.

2. Exposure to potential contamination and infections by health care staff

439. Occupational exposures to blood, body fluids, or laboratory specimens containing pathogens are considered possible cases of occupationally acquired infections.

440. The highest rates of occupational injury among all workers exposed to healthcare waste are reported by cleaning personnel and waste handlers. The most numerous work-related injuries among healthcare workers and waste collectors are sprains and strains caused by lifting and overexertion and not from the hazardous components of healthcare waste.

a. Measures to mitigate the impacts

441. The following are proposed as mitigation measures.

(i) Ensure yellow bags are properly closed and tied with an overhand balloon knot so that they are leak-proof before being moved.
(ii) Yellow bags should be placed in a container with a secure lid.
(iii) All sharps containers should be fully closed and placed in a bag and then in a container. Preferably, single-use disposable sharps containers should be used in place of reusable sharps containers. After use, hypodermic needles should not be recapped, clipped, or removed from disposable syringes. The complete assembly should be placed in a sharps disposal container. Disposable syringes used alone or with needles should be placed in sharps disposal containers and incinerated, with prior autoclaving if required.
(iv) Sharps disposal containers must be puncture-proof-resistant and must not be filled to capacity. When they are three-quarters full, they should be placed in “infectious waste” containers and incinerated, with prior autoclaving if laboratory practice requires it. Sharps disposal containers must not be discarded in landfills.
(v) Single-use gloves (nitrile or latex) and gowns should be discarded after each use and not reused.
(vi) No precleaning should be attempted of any contaminated (potentially infectious) materials to be autoclaved and reused. Any necessary cleaning or repair must be done only after autoclaving or disinfection.
(vii) Apart from sharps, all contaminated (potentially infectious) materials should be autoclaved in leakproof containers, e.g., autoclavable, and color-coded plastic bags, before disposal. After autoclaving, the material may be placed in transfer containers for transport to the incinerator. If possible, materials deriving from healthcare activities should not be discarded in landfills even after decontamination.
(viii) The contaminated waste should be placed in designated containers (e.g., color-coded bags) and transported directly to the incinerator. Reusable transfer

containers should be leakproof and have tight-fitting covers. They should be disinfected and cleaned before they are returned to the laboratory for further use.

(ix) Discard containers, pans, or jars, preferably unbreakable (e.g., plastic), should be placed at every workstation.

(x) When disinfectants are used, waste materials should remain in intimate contact with the disinfectant (i.e., not protected by air bubbles) for the appropriate time, according to the disinfectant used. The discard containers should be decontaminated and washed before reuse.

(xi) All who handle health care waste should wear appropriate PPE (boots, apron, long-sleeved gown, thick gloves, mask, and goggles or a face shield) and perform hand hygiene after removing it. Careful and continuous use of the relevant health and safety equipment (gloves, masks, etc.); an important measure here is to make sure that the workers are removing masks and gloves without getting in contact with them and usually, this means with the help of someone else. Protective equipment for the eyes is also very useful for avoiding coronavirus infections.

(xii) Frequently touched surfaces throughout the reception area should be cleaned regularly.

(xiii) Bathrooms should be cleaned and disinfected at least once a day. The healthcare workers and the laboratory staff should have separate toilets and bathrooms (which should never be used by infected persons)

(xiv) Well-trained permanent staff are responsible for packaging waste to transport for treatment facilities.

(xv) Each bag must be hand-tied by gathering and twisting the neck of the bag and using a tie or hand knot to secure the bag, and each container must be securely closed.

(xvi) Closed bags must not be visible once a secondary container (box or reusable tub) is closed.

(xvii) Improperly packaged containers or damaged containers will be denied pick up until packed them properly.

(xviii) Bins used for disposing of infectious waste must be disinfected prior to reuse by any means effective for the infectious substance the container previously contained.

(xix) Direct contact (without gloves) with bins or bags should be avoided in any case.

(xx) Uniforms should be changed daily. Cleaning of work clothes and shoes is minimizing the possibility of dispersing the virus in the air; make sure not to shake clothes; wash them at a temperature of at least 60°C with common detergents; and add disinfectants if possible.

(xxi) Put a disposable set of gloves, on a daily basis, in direct contact with skin, before wearing usual work gloves.

(xxii) Frequent hand-washing and increased cleaning in workers' facilities is a must.

3. Minimization of occupational risk of health care staff

442. To minimize any kind of occupational risk, less hazardous chemicals should be substituted whenever possible and protective equipment provided to all personnel likely to be exposed. Buildings in which hazardous chemicals are used should be properly ventilated, and personnel handling hazardous materials should be trained in preventive measures and emergency care in case of an accident.

(i) Making essential biosafety equipment available at the laboratory such as the following:

(a) pipetting aids: These will help prevent mouth pipetting. Many different designs are available;

(b) biological safety cabinets (to be used whenever):
1. infectious materials are handled; such materials may be centrifuged in the open laboratory if sealed centrifuge safety cups are used, and if they are loaded and unloaded in a biological safety cabinet;
2. there is an increased risk of airborne infection; and
3. procedures with a high potential for producing aerosols are used; these may include centrifugation, grinding, blending, vigorous shaking or mixing, sonic disruption, the opening of containers of infectious materials whose internal pressure may be different from the ambient pressure, intranasal inoculation of animals, and harvesting of infectious tissues from animals and eggs.

(c) plastic disposable transfer loops: Alternatively, electric transfer loop incinerators may be used inside the biological safety cabinet to reduce aerosol production;

(d) screw-capped tubes and bottles;

(e) autoclaves or other appropriate means to decontaminate infectious materials;

(f) plastic disposable Pasteur pipettes, whenever available, to avoid glass; and

(g) equipment such as autoclaves and biological safety cabinets must be validated with appropriate methods before being taken into use. Recertification should take place at regular intervals, according to the manufacturer's instructions; and

(ii) Implementing proper health and medical surveillance.

443. The employing authority, through the laboratory director, is responsible for ensuring that there is adequate surveillance of the health of laboratory personnel. The objective of such surveillance is to monitor for occupationally acquired diseases. Appropriate activities to achieve these objectives are:

(i) provision of active or passive immunization where indicated;

(ii) facilitation of the early detection of laboratory-acquired infections;

(iii) exclusion of highly susceptible individuals (e.g., pregnant women or immune-compromised individuals) from highly hazardous laboratory work;

(iv) provision of effective PPE and procedures;

(v) guidelines for the surveillance of laboratory workers handling microorganisms at Biosafety Level 2 as per the WHO recommendations are as follows:
(a) a pre-employment or preplacement health check is necessary. The person's medical history should be recorded, and a targeted occupational health assessment performed;
(b) records of illness and absence should be kept by the laboratory management; and
(c) women of childbearing age should be made aware of the risk to an unborn child of occupational exposure to certain microorganisms, e.g., rubella virus. The precise steps taken to protect the fetus will vary, depending on the microorganisms to which the women may be exposed; and

(vi) provision of appropriate training for the staff.

444. Human error and poor technique can compromise the best of safeguards to protect the laboratory worker. Thus, a safety-conscious staff, well informed about the recognition and control

of laboratory hazards, is key to the prevention of laboratory-acquired infections, incidents, and accidents. For this reason, continuous in-service training in safety measures is essential. An effective safety program begins with the laboratory managers, who should ensure that safe laboratory practices and procedures are integrated into the basic training of employees. Training in safety measures should be an integral part of new employees' introduction to the laboratory. Employees should be introduced to the code of practice and to local guidelines, including the safety or operations manual. Measures to assure that employees have read and understood the guidelines, such as signature pages, should be adopted. Laboratory supervisors play a key role in training their immediate staff in good laboratory techniques. The biosafety officer can assist in training and with the development of training aids and documentation.

445. Staff training should always include information on safe methods for highly hazardous procedures that are commonly encountered by all laboratory personnel and which involve:

(i) inhalation risks (i.e., aerosol production) when using loops, streaking agar plates, pipetting, making smears, opening cultures, blood or serum samples, centrifuging, etc.;
(ii) ingestion risks when handling specimens, smears, and cultures;
(iii) risks of percutaneous exposures when using syringes and needles;
(iv) bites and scratches when handling animals;
(v) handling of blood and other potentially hazardous pathological materials; and
(vi) decontamination and disposal of infectious material.

4. Management of wastewater from healthcare facilities

446. Health care wastewater in the primary sector consists of (i) black water containing high concentrations of fecal matter, urine and toxic chemicals with high potential for pollution; and (ii) greywater containing discharge from washing, cooking, bathing, and laundering with low potential for pollution. Sewage generated in HCFs is potentially hazardous and infectious as they carry pharmaceutical chemicals and disease-causing bacteria, viruses, and parasites. None of the institutions in the primary sector considered under the project has piped sewerage, and the sewage is disposed of in septic tanks. There are many risks associated with current sewage disposal practices, especially if septic tanks are not watertight, old and leaking, or if the groundwater table in the area is naturally high, such as (i) contamination of local drinking water sources, (ii) degradation of aquatic habitats, and (iii) outbreaks of water-borne diseases. In addition, pharmaceuticals, detergents, antiseptics in wastewater may act as endocrine disruptors, and antibiotics can breed antibiotic-resistant pathogens once they are released into the environment without prior treatment.

447. Mitigation measures for hospital sewage and wastewater are to implement a treatment system. The volumes of wastewater produced in primary HCFs are not significant compared to higher grade hospitals, and the treatment options should be evaluated in a site-specific way during project implementation.

a. Mitigation of impacts by proper implementation of wastewater management systems

448. Together with the wastewater that originates from sanitary conveniences (blackwater), an adequate system of drainage shall be provided to carry wastewater from all other discharge points and appliances (greywater) within the hospital to a wastewater treatment system with an appropriate form of primary, secondary, and (if needed) tertiary treatment, designed and certified

by a qualified engineer. Such treatment systems may consist of any pre-designed and prefabricated unit processes, packaged plants, etc. Preliminary treatment of wastewater, where needed, is essential, e.g., providing screens to remove gross solids, grease traps to remove oil and grease and primary treatment such as appropriate chemical treatment and dilution.

449. Proper designs have to be ensured to achieve the required effluent quality. Disposal of effluent subsequent to treatment should be in compliance with provisions of the National Environmental (Protection & Quality) Act, No. 1 of 2008, and any other regulations as imposed by national and provincial regulations, any regulations imposed by local authorities, or any subsequent amendments to such regulations.

450. To make sure that wastewater generated within the HCF is safely collected, wastewater pipe networks, including traps and water seals, branch discharge pipes and connections, discharge stacks and ventilation pipes, and any other component of the pipe network, have to be designed based on the maximum discharge of wastewater. In addition, the design of drains, sewers, manholes, and any appurtenances from buildings to the point of connection to an existing sewer system or a wastewater treatment system should be part of the design. Designs should propose suitable technical measures to protect drains and pipelines from the settlement, provide suitable access points for clearing blockages, rodent and vermin control, and any other foreseeable issues that need regular maintenance during operational activities of the building.

451. Reuse, reclamation and/or recycling of treated or partially treated wastewater for non-human consumption use should only be considered as long as:

(i) it is not prejudicial to the health of any person, persons or a community; and
(ii) it will not contaminate any surface watercourse, groundwater or water supply.

452. After ascertaining safety, in such cases of reuse, reclamation, and recycling of treated and partially treated wastewater, and separate plumbing and distribution network and storage systems should be suitably designed and constructed. These distribution and storage systems should be clearly identified from drinking water systems, and points where such non-potable water is used, especially the taps, appliances and/or fittings, should be visibly marked.

453. It is required that all types of sludge produced from the treatment plant be handled in an environmentally safe manner, and the designs should take into account the best methods of disposal of sludge with special emphasis on quantity and quality.

5. Contingency plan for any malfunctions of the wastewater treatment facility

454. Contingency measures plans have to be prepared for: (i) sewage treatment works that could reasonably be expected to cause significant environmental impacts as a consequence of operational disruption (i.e. maintenance, etc., or breakdown); and (ii) discharge of sub-standard wastewater into the environment from the treatment facility which could cause a significant public health impact, and which therefore requires a continuous system of influent/effluent monitoring to identify potential problems as and when they arise.

455. In the preparation of the contingency measures: the most likely causes of process disruption or breakdown have been identified: (i) an attempt must be made to estimate their probability of occurrence, (ii) the possible resultant environmental adverse impacts should be identified, (iii) the recommended courses of action to minimize the severity of the impacts have

to be highlighted, and (iv) the responsible agency who shall act in case of emergencies needs to be indicated.

456. Table 15 gives potential issues that can arise during operation and maintenance and corrective actions. Major risks which can result in breakdown and disruption are described below.

Table 14: Contingency Measures to be Adopted in Operations and Maintenance of the Treatment Facility

The issue to be addressed	Action to be taken
Breakdown or malfunctioning of the wastewater treatment plant	Continuous monitoring of the effluent quality of treated wastewater shall be carried out, and their acceptance shall be notified to the plant operator from time to time. The monitoring parameters and the frequency shall conform to the requirement provided in the Environmental Protection License (EPL). If the quality of the final treated wastewater is not acceptable, an immediate need to shut down the waste water treatment plant (WWTP) shall be anticipated. Until the final quality of the treated wastewater is acceptable, no effluent shall be discharged and pumped. A proper communication channel shall be worked out to initiate action during such incidences, if any, and all the occurrences and corrective action are taken shall be recorded for rectification purposes.
Failure of pumps	Stand-by pumps should be made available so that there shall be no issue arising to cause a complete stoppage of the treatment plant. Hence this type of failure seems to be manageable, although the frequency of occurrence is remote. However, preventive maintenance for all pumps is recommended to be carried out to ensure trouble-free operations.
Power failures	In the case of power failure, plant operations should not be interrupted. Stand-by generators with adequate capacities, equipped with automatic changeover switches, shall be provided so that risk of failure be minimal.
Accidental bursts of pipeline	The pipe material shall be selected in such a way that it withstands imposed and dead loads and internal build-up of pressure (nominal range with an acceptable factor of safety) to withstand pipe bursts, and fixtures are designed so that the joints are leak-proof. Since collector sewers and laterals are small-diameter short pipelines, which are connected to manholes and gulleys, there shall be no pressure build-up within these gravity-flow pipelines. The effluent discharge main shall carry treated effluent from the treatment plant to the outfall, which should be a short pipe in length, in which high pressures are not anticipated. However, subsequent haphazard excavation work may damage the pipes, and, in such case, pumping should be controlled or totally stopped until repair work is done. Any leaks or overflows of untreated wastewater shall be cleaned immediately, and the area shall be disinfected immediately, using chemicals
Effects of natural disasters on the collection of wastewater and operation of the treatment plant	The pipelines may span over areas vulnerable to flooding, but since they are buried with proper compaction, flooding shall not affect the integrity and stability of the pipeline. Piping should be fully sealed so that infiltration shall be not anticipated. Fire damage is not a risk for the pipes as the entire pipeline is buried underground.
Failure of the outlet structure	Accidental damages of the outlet structures may occur during regular maintenance, flood events, borrow animals or by debris, as the outlet structure may be buried or lie underwater. Periodic under-water observations are, therefore, recommended to be adhered to. Such observations should be examined by the maintenance staff for structural integrity, and if deformities are observed, immediate repair work shall be undertaken.
Accidental release of partially treated wastewater	It is usually expected that no partially treated wastewater is discharged through the outlet structure, but if it happens, people downstream should be informed so that they should be prevented from the use of water, including bathing. Until the

The issue to be addressed	Action to be taken
	conditions are brought back to normalcy, the affected population should be kept informed, and the impact zone shall be demarcated to avoid any activities causing health hazards.
Sabotage and willful damage to pipes and treatment units	There shall be a risk of sabotage, perhaps in the areas where the pipeline is laid on the surface or above the existing ground. For example, across the culverts, there may be aboveground pipes where air-release valves may be fixed. Such fixtures may be vulnerable to acts of sabotage, and such sensitive areas must, therefore, be checked on a periodic basis. A logbook must be maintained to notify such damages, and actions should be taken to avoid such situations as practical as possible.
Asphyxiation hazards during maintenance	In the case of repairs, workers may open the pipe fixtures for observations. In such a case, gases trapped, if found, may cause asphyxiation hazards causing even difficulties in breathing. Hence, personal protective gears suitable for such incidents shall be provided, without which any repair work should not be undertaken.
Accidents in the treatment plant and the pump house	Accidents may occur in the pump house if not maintained well. An operation manual encompassing the accidental preparedness plan shall be kept in the location where the treatment plant and pumping units are housed. All operators shall be given training and awareness sessions to make them prepared to handle such situations pragmatically.

6. On-site disposal of wastewater generated from the newly constructed building that is not connected to the central sewerage system

457. There can be parts of the hospitals that may not be connected to the central sewerage system and the treatment plant for technical and practical, and/or economic reasons. In such instances, wastewater generated from such facilities, if discharged directly to the environment, shall contaminate soil and groundwater. Health care wastewater generally consists of (i) black water containing fecal matter, urine, and toxic chemicals with high potential for pollution; and (ii) greywater containing discharge from washing, cooking, bathing, and laundering with low potential for pollution. At present, other than Theldeniya base hospital, the other eight hospitals included in the project have no piped sewerage or wastewater treatment, and they are disposed of in septic tanks and soakage pits built on-site. Currently, bed occupancy rates in base hospitals are very high. Moreover, this is expected to further improve after the project interventions, thereby contributing to an increased load of wastewater discharged.

458. Sewage generated in HCFs is potentially hazardous and infectious as they carry pharmaceutical chemicals and disease-causing bacteria, viruses, and parasites. There are many risks associated with current sewage disposal practices, which are likely to worsen with higher utilization of the primary sector, especially with septic tanks that are not watertight, old, and leaking and where the groundwater table is naturally high (seasonally or permanently). The risks include (i) contamination of local drinking water sources, (ii) degradation of aquatic habitats, and (iii) outbreaks of water-borne diseases. Besides, pharmaceuticals, detergents, and antiseptics in wastewater may act as endocrine disruptors, and antibiotics can breed antibiotic-resistant pathogens once they are released into the environment without prior treatment.

459. The wastewater generated at facilities that will not be connected to the proposed central sewerage system should be connected to existing wastewater treatment and disposal systems if they have the capacity for additional loads. Also, such a connection is possible only if the existing

systems are properly functional. If any of these prerequisites are not met, then there is a need to design an appropriately designed wastewater collection, treatment, and disposal system to avoid environmental pollution.

460. Connecting the new toilets to existing wastewater treatment systems (septic and soakage systems) may not be possible for some of the hospitals for the current condition of existing septic tanks.

a. Measures to mitigate the impacts

461. The wastewater treatment systems at a minimum should include a septic tank and a soakage pit or trench. All the designs of wastewater treatment systems should be designed and constructed based on the Code of Practice: Sri Lanka Standards (SLS) 745: Part I and Part II (2004). The following points should be noted.

(i) A soakage pit as the final disposal method is appropriate if the seasonal high groundwater table is at least 1.2 m (minimum) below the bottom level of the septic tank.
(ii) The blackwater should first be sent through a septic tank, and then the settled wastewater has to be transferred to the soakage arrangement. The greywater may be directly sent to the soakage arrangement.
(iii) The interval for desludging should be taken as one year. However, given the size of the septic tank and the small amount of blackwater generated at the newly constructed facilities, the desludging time is expected to be longer.
(iv) The volume of septic tanks should be at least 1 cubic meter, which is the minimum volume for a septic tank specified by the SLS745.
(v) Soakage pits should be located at a lower elevation with respect to shallow wells and should be at least 50 ft away from such wells.

462. The septic tank and soakage arrangement as the wastewater collection and disposal method is appropriate for most of the hospitals, and no adverse impacts are expected. Desludging should be done as and when needed. However, given the size of the septic tank and the small amount of blackwater generated at the laboratory, the desludging time is expected to be extended.

463. Soakage pits may not be an option for locations that are water logging and where existing soakage pits are overflowing during rainy days when the groundwater table is high during rainy days and/or due to capillary fringe. Seepage trenches, seepage beds, or constructed wetlands are more suitable for such locations. If the treated effluent is disposed to the nearby canals or drains, then constructed wetlands or biofilters are more appropriate. However, if constructed wetlands are used for wastewater treatment, edible plants should never be used as the emergent vegetation line.

464. The DSC is expected to design location-specific and appropriate wastewater collection, treatment and disposal systems based on the SLS745.

7. Provision of water supply

465. The proposed buildings must be supplied with a dependable water supply. There should be water storage of which should be sufficient for at least 1½ –2 days). The water quality of supplies should conform to SLS614 (2013): Sri Lanka Standards for Potable Water.

8. Breakdown of power, water, and telecommunication facilities

466. The HCF and its facilities have to be supplied by a reliable electricity connection, water supplies, and telecommunication facilities. There should be sufficient water storage which is sufficient for at least 1.5–2 days and a standby generator as backup power. Telecommunication facilities will include wired as well as wireless communication devices and services.

467. Therefore, the chances of a breakdown of power, water, and telecommunication facilities will be remote. The only concern is the breakdown of power, for which a contingency plan shall be devised, and secure temporary generators until the power supply is restored. However, if any patients, drugs, samples, reagents, cultures, etc. need to be removed due to the unavailability of air-conditioning, gas supplies or chilled or cooling, such patients and materials will be transferred to suitable locations without delay.

9. Maintenance of the new vehicle fleet including the ambulances

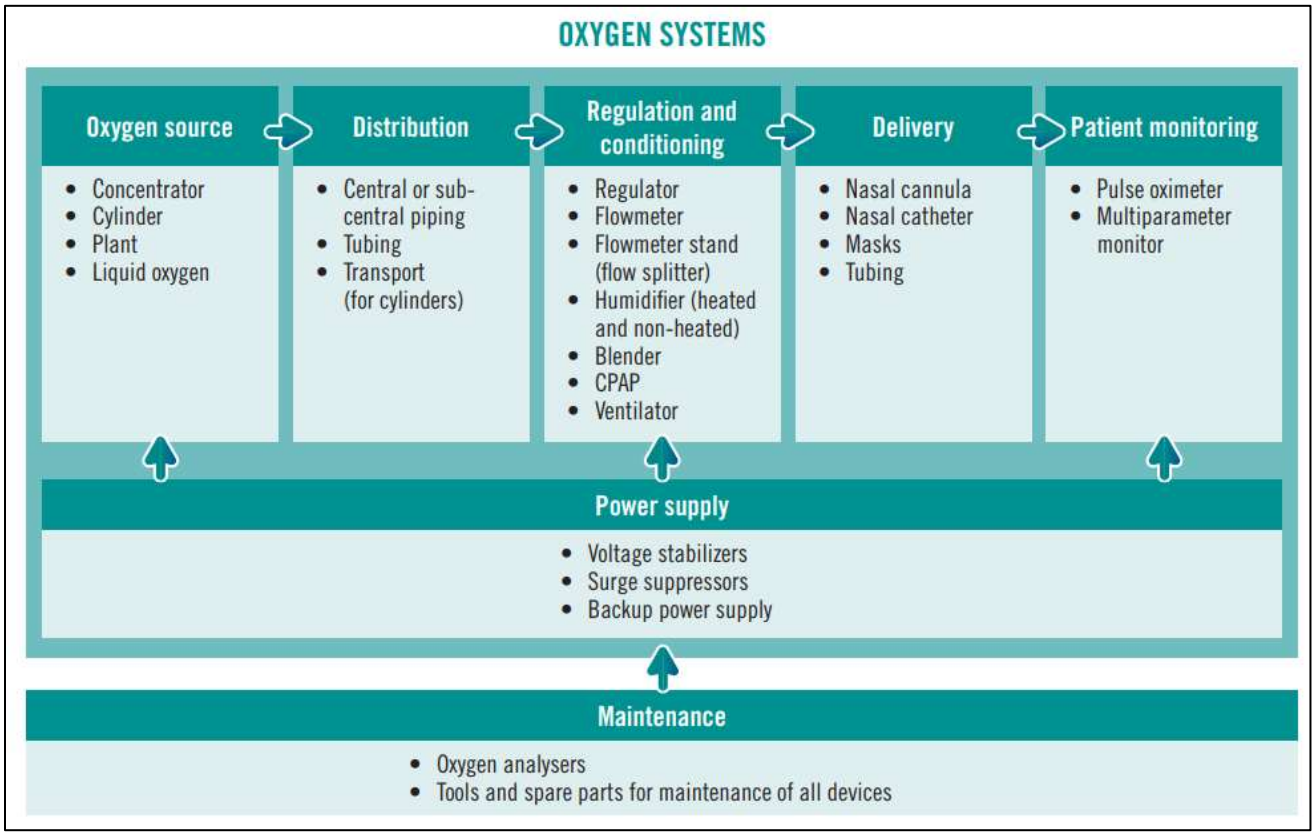
468. The newly added vehicle fleet including the Ambulances under the output 2 should be properly maintained if they are to provide a service for a long period. These vehicles should be serviced as instructed by the manufacturers and any repairs should be immediately attended to avoid any permanent breakdown of the vehicle.

10. Provision of medical oxygen

469. Oxygen concentrator plants (14 number) and civil works for a house these concentrator plants, and 14 numbers of liquid oxygen tanks (3,000 liters–20,000 liters) are planned to be installed in selected hospitals using funding available from HSEP additional financing (note: the list of hospitals that these should be constructed will need to be finalized based on the Cabinet approval).

470. Medical oxygen systems must consist of an oxygen source (i.e., equipment for oxygen production), storage, and delivery system to various medical units or patients. Common sources of oxygen are compressed gas cylinders, oxygen concentrators, oxygen-generating plants, and liquid oxygen in bulk storage tanks. Medical oxygen system components are shown in Figure 72**.**

Figure 72: Medical Oxygen System Components



Source: World Health Organization. 2019. *WHO-UNICEF Technical specifications and guidance for oxygen therapy devices*. Geneva

471. The appropriate choice of oxygen source is multifactorial; it is important to take into consideration the amount of oxygen needed at the health facility, available infrastructure, cost, capacity, and supply chain for local production (and delivery) of medicinal gases, reliability of electricity, access to maintenance services and spare parts, etc. In addition, the level of the health system at which these different sources might be used will depend on local policy, training, and capacity at the different levels of care. Figure 73 provides a comparison of these different oxygen source options.

472. **Oxygen concentrator plants (central oxygen supply system)**. An oxygen plant is a large, onsite, central source of oxygen that is piped directly to terminal units within patient areas. Plants can generate oxygen using pressure swing adsorption technology (similar to concentrators) or by cryogenic distillation. Plants can also be set up to refill cylinders for oxygen distribution or backup oxygen supply; these cylinders can be connected to sub-central manifold systems at the health facility or transported to neighboring health facilities. Note that oxygen plants require a reliable source of power. It is best practice to also have cylinders as a backup supply.

473. **Liquid oxygen.** Facilities can be equipped with large bulk liquid oxygen tanks that are refilled periodically by a truck from a supplier. The liquid oxygen tank supplies a centrally piped system throughout the health facility by self-vaporization, meaning that a power supply is not required. Although currently an economical option in some locations, liquid oxygen requires high technical knowledge and large, well-ventilated spaces, and can introduce risks in settings with

extreme temperature and humidity. It is best practice to also have cylinders as a backup supply.

Figure 74: Description and comparison of oxygen sources (WHO, 2019)

	Cylinders	Concentrators (PSA)	Oxygen plant (PSA)	Liquid oxygen
General characteristics				
Illustration/ image				
Description	A refillable cylindrical storage vessel used to store and transport oxygen in compressed gas form. Cylinders are refilled at a gas generating plant and thus require transportation to and from the plant.	A self-contained, electrically powered medical device designed to concentrate oxygen from ambient air, using PSA technology.	An onsite oxygen generating system using PSA technology, which supplies high-pressure oxygen throughout a facility via a central pipeline system, or via cylinders refilled by the plant.	Bulk liquid oxygen generated off-site and stored in a large tank and supplied throughout a health facility via a central pipeline system. Tank requires refilling by liquid oxygen supplier.
Clinical application and/or use case	Can be used for all oxygen needs, including high-pressure supply and in facilities where power supply is intermittent or unreliable. Also used for ambulatory service or patient transport. Used as a backup for other systems.	Used to deliver oxygen at the bedside or within close proximity to patient areas. A single concentrator can service several beds with the use of a flowmeter stand to split output flow.	Can be used for all oxygen needs, including high-pressure supply.	Can be used for all oxygen needs, including high-pressure supply and in facilities where power supply is intermittent or unreliable.
Appropriate level of health system	Primary, secondary, possibly tertiary (any medical unit requiring oxygen).	Primary, secondary, possibly tertiary (any medical unit requiring oxygen).	Secondary and tertiary.	Secondary and tertiary.
Product-specific characteristics				
Distribution mechanism	Connected to manifold of central/sub-central pipeline distribution system, or directly connected to patient with flowmeter and tubing.	Direct to patient with tubing or through a flowmeter stand.	Central/ sub-central pipeline distribution system, or can be used to refill cylinders that can be connected to manifold systems in the facility.	Central pipeline distribution system.
Electricity requirement	No.	Yes.	Yes.	No.
Initial costs	Moderate; cylinder, regulator, flowmeter, installation, training.	Moderate; concentrator, spares, installation, training.	High; plant and pipeline distribution system, installation, training.	Can be high; tank, pipeline installation, training.
Ongoing operating costs	High; cylinder deposit and leasing fees, refill costs, transportation from refilling station to health facility.	Low; electricity and maintenance (spare parts and labour).	Low/moderate; electricity and maintenance (spare parts and labour). May require additional staff to operate/manage if not operated by third party.	Moderate (can be high if tank is leased); refill costs, maintenance.
Maintenance requirement	Limited maintenance required by trained technicians.	Moderate maintenance required by trained technicians (1), who could be in-house.	Significant maintenance of system and piping required by highly trained technicians and engineers, can be provided as part of contract.	Significant maintenance of system and piping required by highly trained technicians and engineers, can be provided as part of contract.
User care	Moderate; regular checks of fittings and connections, regular checks of oxygen levels, cleaning exterior.	Moderate; cleaning of filters and device exterior.	Minimal; at terminal unit only.	Minimal; at terminal unit only.
Merits	• No power source needed.	• Continuous oxygen supply (if power available) at low running cost. • Output flow can be split among multiple patients.	• Can be cost-effective for large facilities. • Continuous oxygen supply.	• 99% oxygen obtained. • High oxygen output for small space requirement.
Drawbacks	• Requires transport/ supply chain. • Exhaustible supply. • Highly reliant upon supplier. • Risk of gas leakage. • Risk of unwanted relocation.	• Low pressure output, usually not suitable for CPAP or ventilators. • Requires uninterrupted power. • Requires backup cylinder supply. • Requires maintenance.	• High capital investments. • Requires uninterrupted power. • Needs adequate infrastructure. • High maintenance for piping. • Requires backup cylinder supply. • Risk of gas leakage from piping system.	• Requires transport/ supply chain. • Exhaustible supply. • High maintenance for piping. • High total cost. • Needs adequate infrastructure. • Requires backup cylinder supply. • Risk of gas leakage from piping system.

Source: World Health Organization. 2019. *WHO-UNICEF Technical specifications and guidance for oxygen therapy devices*. Geneva.

474. **General configuration of an oxygen supply system.** One of the main principles of EN ISO 7396-1 is that a medical gas pipeline supply system should comprise at least three independent sources of supply. EN ISO 7396-1 specifies the general requirements for all supply sources used with medical gas pipeline systems. The basic principle is that the supply system for gases used as patient life support should have three sources of supply (i.e., primary, secondary, and reserve source of supply) to ensure that gas will be available in the event of a single fault condition.

475. For a medical gas pipeline, these three sources of supply are classified and defined as:

(i) the primary source of supply intended to supply the pipeline distribution system;
(ii) the secondary source of supply, intended to supply the pipeline distribution system in the event of exhaustion or failure of the primary source of supply; and
(iii) reserve source of supply intended to supply the pipeline distribution system in the event of failure or exhaustion of both the primary and secondary sources of supply.

476. The medical oxygen supply proposed under this project falls into two configurations:

(i) Configuration A: oxygen only from concentrator plant:
    (a) primary and secondary sources are oxygen concentrator units, supplying oxygen; and
    (b) the Reserve source is oxygen in a permanently installed high-pressure reservoir. This reservoir would be re-filled using a high-pressure oxygen compressor using the oxygen supply from an oxygen concentrator units; and
(ii) Configuration B: where supplying both oxygen from concentrator plant and medicinal oxygen supplied by third parties in the same medical gas pipeline system is allowed, the secondary and/or reserve source can be one of the following:
    (a) primary and secondary sources are oxygen concentrator units, supplying oxygen; and
    (b) secondary and/or reserve source can liquid oxygen cryogenic storage (mobile or stationary), supplying medicinal oxygen (equal to or greater than 99%), and medicinal oxygen in cylinders or bundles of cylinders.

477. Therefore, the following requirements needs to be addressed in an efficient and continued Oxygen supply system:

(i) dependency on the electrical supply;
(ii) supplying two distinct qualities of gas in the same pipeline;
(iii) re-filling reserve source of supply;
(iv) responsibilities of the healthcare facility qualified personnel;
(v) installation and equipment: general supply system considerations; and
(vi) location of the oxygen concentrator plant.

478. Following environmental, health and safety measures shall also need to be in place in such facility such as:

(i) fire protection;
(ii) occupational safety guide and requirements;
(iii) selection of suitable material for construction of the facilities;
(iv) electrical requirements;

(v) availability of an emergency shutdown system;
(vi) automated operations;
(vii) reduction of noise generation;
(viii) venting of waste gas produced;
(ix) dusting the filtration system;
(x) fluid discharge and solid disposal;
(xi) air compression and filtration;
(xii) consideration of hazards involved in oxygen compression;
(xiii) storage of product; and
(xiv) plant piping.

11. Specifications and quality maintenance of medical oxygen supplies

479. The following standards have to be complied with as a mandatory requirement.

a. Standards applicable to the provision of medical oxygen

(i) Cylinders, either individual or permanently connected to a manifold system or a permanently installed high-pressure storage of liquid oxygen
(a) Standards applicable to the manufacturer and the manufacturing process:
1. ISO 13485 Medical devices – Quality management systems – Requirements for regulatory purposes;
2. ISO 14971 Medical devices – Application of risk management to medical devices; and
3. ISO 10993-1 Biological evaluation of medical devices – Part 1: Evaluation and testing within a risk management process;
(b) Standards applicable to the product:
1. Color coding ISO or ANSI for medical gases;
2. Conforms to ISO, NFPA and/or CGA standards, and/or UL or CSA approved;
3. ISO 11114 Gas cylinders – Compatibility of cylinder and valve materials with gas contents;
4. ISO 10524 Pressure regulators for use with medical gases;
5. ISO 15002 Flow-metering devices for connection to terminal units of medical gas pipeline systems;
6. ISO 15245 Gas cylinders – Parallel threads for connection of valves to gas cylinders;
7. ISO 10297 Gas cylinders – Cylinder valves – Specification and type testing;
8. ISO 17871 Gas cylinders – Quick-release cylinder valves – Specification and type testing;
9. ISO 17879 Gas cylinders – Self-closing cylinder valves – Specification and type testing;
10. ISO 407 Small medical gas cylinders – Pin-index yoke-type valve connections;
11. ISO 5145 Cylinder valve outlets for gases and gas mixtures – Selection and dimensioning;
12. ISO 11117 Gas cylinders – Valve protection caps and valve guards – Design, construction and tests;

13. ISO 11363 Gas cylinders – 17E and 25E taper threads for connection of valves to gas cylinders;
14. ISO 12209 Gas cylinders – Outlet connections for gas cylinder valves for compressed breathable air;
15. ISO 14246 Gas cylinders – Cylinder valves – Manufacturing tests and examinations;
16. ISO 22435 Gas cylinders – Cylinder valves with integrated pressure regulators;
17. ISO 7866 Gas cylinders – Refillable seamless aluminium alloy gas cylinders – Design, construction, and testing;
18. ISO 20701 Gas cylinders – Refillable welded aluminium-alloy cylinders – Design, construction, and testing;
19. ISO 9809 Gas cylinders – Refillable seamless steel gas cylinders – Design, construction, and testing;
20. ISO 11119 Gas cylinders – Refillable composite gas cylinders and tubes – Design, construction, and testing;
21. ISO 13341 Gas cylinders – Fitting of valves to gas cylinders;
22. ISO 32 Gas cylinders for medical use – Marking for identification of content;
23. ISO 7225 Gas cylinders – Precautionary labels;
24. ISO 10461 Gas cylinders – Seamless aluminium-alloy gas cylinders – Periodic inspection and testing;
25. ISO 11623 Gas cylinders – Composite construction – Periodic inspection and testing;
26. ISO 15223-1 Medical devices – Symbols to be used with medical device labels, labelling, and information to be supplied – Part 1: General requirements;
27. ISO 15996 Gas cylinders – Residual pressure valves – Specification and type testing of cylinder valves incorporating residual pressure devices; and
28. ISO 15001 Anaesthetic and respiratory equipment – Compatibility with oxygen;

(ii) Oxygen Concentrator plants and concentrators

(a) Standards applicable to the manufacturer and the manufacturing process

1. ISO 13485 Medical devices – Quality management systems – Requirements for regulatory purposes;
2. ISO 14971 Medical devices – Application of risk management to medical devices;
3. Standards applicable to the product ;
4. ISO 80601-2-69: 2020 Medical electrical equipment – Part 2-69: Particular requirements for basic safety and essential performance of oxygen concentrator equipment;
5. IEC 60601-1: 2012 Medical electrical equipment – Part 1: General requirements for basic safety and essential performance;
6. IEC 60601-1-2: 2014 Medical electrical equipment – Part 1-2: General requirements for basic safety and essential performance – Collateral Standard: Electromagnetic disturbances – Requirements and tests;
7. IEC 60601-1-6: 2013 Medical electrical equipment – Part 1-6: General requirements for basic safety and essential performance – Collateral standard: Usability;

8. IEC 60601-1-8: 2012 Medical electrical equipment – Part 1-8: General requirements for basic safety and essential performance – Collateral Standard: General requirements, tests and guidance for alarm systems in medical electrical equipment and medical electrical systems;
9. IEC 60601-1-9: 2013 Medical electrical equipment – Part 1-9: General requirements for basic safety and essential performance – Collateral Standard: Requirements for environmentally conscious design;
10. IEC 60601-1-11: 2010 Medical electrical equipment – Part 1-11: General requirements for basic safety and essential performance – Collateral Standard: Requirements for medical electrical equipment and medical electrical systems used in the home healthcare environment;
11. Compliance with ISO 8359 may be considered;
12. ISO 8573-1: Compressed air – Part 1: Contaminants and purity classes;
13. ISO 8573-2: Compressed air – contaminant measurement – Part 2: Oil aerosol content;
14. ISO 8573-4: Compressed air – contaminant measurement – Part 4: particle content;
15. ISO 5011: Inlet air cleaning equipment for internal combustion engines and compressors – performance testing;
16. ISO 21969: High-pressure flexible connections for use with medical gas systems; and
17. All pressurized vessels to be:
    24.1 designed according to PED or ASME VIII, or equivalent;
    24.2 certified PED or ASME III, or equivalent;
    24.3 cleaned according to ISO 15001, ASTM G93, or equivalent; and

(iii) Pipeline systems for distribution of medical gases
  (a) ISO 7396-1: Medical gas pipeline systems — Part 1: Pipeline systems for compressed medical gases and vacuum.

12. Monitoring of oxygen and medical gas leaks

480. The hospital should frequently and consistently monitor the gas delivery, production, storage and conveyance systems for any leaks. If there are any leaks, it should be attended to by competent personnel as soon as possible—as a matter of urgency. Once a leak is detected all the safety precautions as listed in the sections above should be taken until the leak is arrested and properly repaired.

481. In the event of a gas leak or suspected leak. as a basis safety precaution, turn off all naked flames and eliminate all sources of ignition, but do not turn electrical switches on or off. If leak is indoors, open all windows and doors to disperse the gas. In the case of cylinders, disconnect the cylinder and move it outdoors to an open area.

D. Procedures for Dealing with Chance Finds

1. Chance find - flora and fauna

482. The contractor will take reasonable precaution to prevent workers or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) and hunting of any animal.

483. If any wild animal is found near the construction site at any point in time, the contractor will immediately, upon discovery thereof, acquaint the consultants of the project and/or PIU and carry out the instructions for dealing with the same.

484. Only if needed, the PIU will report to the nearby Forest Department and Department of Wildlife Conservation (range office or divisional office) and will take appropriate steps and measures if required in consultation with the officials.

2. Chance find - archaeological property

485. All fossils, coins, articles of the value of antiquity, structures, and other remains or things of geological or archaeological interest discovered on the site shall be the property of the government. They shall be dealt with as per provisions of the relevant legislation.

486. The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal, acquaints the PIU through the supervision consultant of such discovery and carry out the instructions for dealing with the same, waiting which all work shall be stopped. The PIU will seek direction from the Archaeological Department of Archaeology of Sri Lanka and inform the supervision consultant to follow the chance find procedures set forth.

VII. INSTITUTIONAL ARRANGEMENTS AND ENVIRONMENTAL MONITORING PLAN

A. Institutional Arrangements

487. The MOH will be the executing agency for the proposed additional financing of HSEP. PMU and provincial level PIUs established for the ongoing HSEP shall continue implementing the project. The national project steering and coordination committee chaired by the Secretary, MOH, will continue providing policy direction to the project. The additional secretary, State Ministry of Provincial Councils and Local Government Affairs, will continue to act as the vice-chair of the steering committee and the provincial chief secretaries and provincial health directors will serve as committee members. The PMU, headed by a project director, will be continue the overall coordination, management, administration, project implementation, and monitoring. PIUs established at provincial level and operational under a DPD shall continue to assist the PMU.

488. The PMU will shall continue to function as the project office for the MOH, carry out subproject appraisal and approval, and ensure compliance with ADB loan covenants. A qualified specialist dedicated to environmental safeguards has been appointed by the PMU throughout the project implementation to:

(i) assist the PMU and PIUs in the overall implementation of the project's EARF;
(ii) review and endorse the safeguards screening checklist and conduct follow up assessments (IEE);
(iii) assist the PMU in checking the provisions of civil works contracts to ensure that EMPs are integrated into the bidding documents;

(iv) monitor compliance of the civil works contractors with EMP provisions;
(v) prepare and submit to the ADB environmental monitoring reports for review and disclosure;
(vi) in case unanticipated environmental impacts become apparent, advise the MOH and ADB the needed assessment to be undertaken and resources to implement mitigation measures; and
(vii) assist the project director in all matters pertaining to environmental safeguards.

489. A safeguards officer shall be appointed to assist the environmental specialist in the PMU in carrying out the tasks listed above and to conduct the screening on involuntary resettlement impacts.

490. The PMU will also be supported by a consultant specialized in HCW planning and management (which is part of the EMP requirement) who will be responsible for supporting the PMU in achieving its goals on HCWM in the primary health sector facilities selected under the project. The consultant will be reported to the project director and the environmental specialist at the PMU, who will manage the contract on a day-to-day basis.

491. The PMU environmental specialist with support from the safeguards officer will prepare monthly monitoring reports documenting the progress made in EMP implementation and implementation issues with an emphasis on compliance with HCWM planning and submit them to the project director for his review (alternatively, the geographic information system platform developed by the ADB can be used to report monitoring progress). Based on these, the PMU during the civil works period will prepare and submit to the ADB semi-annual environmental monitoring reports within 30 days from the end of each reporting period summarizing progress and issues for each province. Monitoring and reporting shall continue on an annual basis during project operational and maintenance, until a project completion report is issued. In the event of unanticipated environmental impacts during implementation, the IEE will have to be updated (or prepare a new IEE) in consultation with ADB. For any non-compliance issue in relation to the project environmental covenants, a time-bound, budgeted and corrective action plan should be agreed between ADB and the MOH. The corrective action plan will be reflected in the semi-annual environmental monitoring report.

B. Institutional Capacity Development

492. The environmental specialist at the PMU, with support from the safeguards officer, will continue designing and delivering training programs during the implementation of additional financing of HSEP to the staff of the PIU and selected contractors. The training will cover basic principles of screening and safeguards categorization, environmental assessment and management, monitoring methods and tools.

C. Environmental Management Plan

493. The impacts and mitigation measures discussed in chapter VI has been summarized into an EMP, which is presented as Annexure 6 of this IEE. This EMP is in line with the requirements as stipulated in the updated EARF. This EMP shall be updated with respect to each subproject including a costing of mitigation measures once detailed designs for each subproject is completed.

D. Environmental Monitoring Plan

494. An Environmental Monitoring Plan (EMOP) has been developed for monitoring the implementation of EMP. This EMOP is presented as Annexure 7 of this report. Project-specific budgets for implementing the EMP and EMP will be prepared during detailed study stage and will be presented in IEE reports prepared for each apex hospital.

495. Formats needed for environmental monitoring are provided in Annexure 8. This includes forms for monthly monitoring and quarterly monitoring to be filled by the contractor, DSC, and the environmental specialist.

VIII. INFORMATION DISCLOSURE, CONSULTATION, PARTICIPATION AND GRIEVANCE REDRESS MECHANISM

A. Consultation and Participation During Project Preparation

496. A comprehensive round of public and stakeholder consultation had been carried out during preparation of the ongoing HSEP and it is being continued. The same approach was adopted for the proposed additional financing, albeit virtually during the month of April and May 2021, and some of the key stakeholders were consulted during the preparation of this IEE (the list is available in Annexure 9), which included the following:

(i) officials of the HSEP at PMU level and PIU level;
(ii) director and key staff of the Provincial Directors of Health Services and Regional Directors of Health Services; and
(iii) most importantly, the medical officers of the beneficiary hospitals and several other key health care staff and hospital users.

497. Due to the COVID-19 restrictions, consultations were mostly done virtually for the additional financing. These consultations shall continue through the detailed designs and during implementation of each subproject. Face-to-face consultations will be done as permitted by the government considering the COVID-19 restrictions.

B. Disclosure of Information

498. Disclosure of information at an early stage of the project has many benefits, such as avoiding any objections by the public towards successful project implementation, passing of misinformation into the hands of the public through local nongovernment organizations. Information is disclosed through a public consultation and making relevant documents.

499. According to the requirements of the ADB SPS for environment category B projects, the following will be disclosed on the ADB website before the management review meeting is held or equivalent meeting or approval of the respective project if there is no management review meeting:

(i) final IEE; and
(ii) a new or updated IEE and corrective action plan prepared during project implementation, if any, and environmental monitoring reports.

500. While stakeholder consultations will be the primary source of information disclosure, the PMU will ensure that environmental safeguards documents prepared in support of project

implementation such as IEEs, HCWMPs, and monitoring reports are disclosed via its website. Besides, the PMU will take necessary steps to make these documents available in appropriate locations, in a manner that is timely and in a language that is understood by the local community or affected people for those who do not have access to the internet. The PMU will also send a written endorsement to ADB for disclosing these documents on the ADB website.

501. A project-specific GRM has been established to receive, evaluate, and facilitate the resolution of the affected person's concerns, complaints, and grievances about the social and environmental performance at the level of the project. It is important that the GRM is established before any site works commence.

502. The GRM of the project has been prepared and accepted by ADB and disclosed in the project website The GRM chart providing information on receipt of complaints and levels of redressal is displayed in all subproject sites, PIU offices, and other important places. The PIUs records all grievances received and address them on priority. To date all grievances are addressed at the stage of first tier.

C. Grievance Redress Mechanism

503. The ongoing GRM is structured to have two tiers as defined below and is shown in Figure 75. As on the present project the grievance redress committee (GRC) shall be appointed and established before the commencement of construction site works, and the design and supervision firm shall be briefed on the GRM system for the HSEP. Only written grievances (format for such is attached in the project administration manual) will be forwarded to the GRC, who will call a hearing, if necessary, with the complainant. The process will facilitate resolution through mediation. The GRC (both at PIU or PMU levels) will meet as required and direct the field level with clear instructions and responsibilities to attend to the agreed actions within one to two weeks of the meeting. If the grievance is related to construction, the contractor will sit in the GRC as an observer.

1. Levels of grievance redress mechanism resolution

(i) **Tier 1.** The PIU at the provincial level will be the first level to resolve grievances. The DPD will be the focal point for grievance redressal and will act as the chairman of GRC. Its members will include the respective district regional director of health, the social and responsible environment officers from the PIU (secretary to the committee), one nominated officer from the provincial council, and a representative of the community. The grievances should be resolved or addressed within 7 days upon receipt of the complaint/suggestion.

(ii) **Tier 2.** The DPD at the PIU, in consultation with the environmental specialist/social safeguards specialist, or any other relevant official of the PMU, will activate the second level for grievances that are not resolved at tier 1. In addition, via an officer of the local authority, chief secretary, Grama Niladhari, construction site office, or directly by a community member or any other individual, can also directly report a grievance to tier two. The GRC at the PMU level (second tier) will be headed by the project director of HSEP (Chairman of the committee), and its members will include: Deputy Director General (Planning) of the MOH, a nominated representative of Chief Secretary of the respective province, DPD of the respective province, environment officer and social safeguards officer (Secretary to the committee), and a representative from the respective community. The grievances

should be resolved or addressed within 14 days upon receipt of the complaint and suggestion.

504. The GRM will not impede the affected person's decision to use the legal system at any time.

505. On receiving a grievance (via an office of the local authority, chief secretary, Grama Niladhari, construction site office, or directly by a community member or any other individual), the PIU or the PMU will:

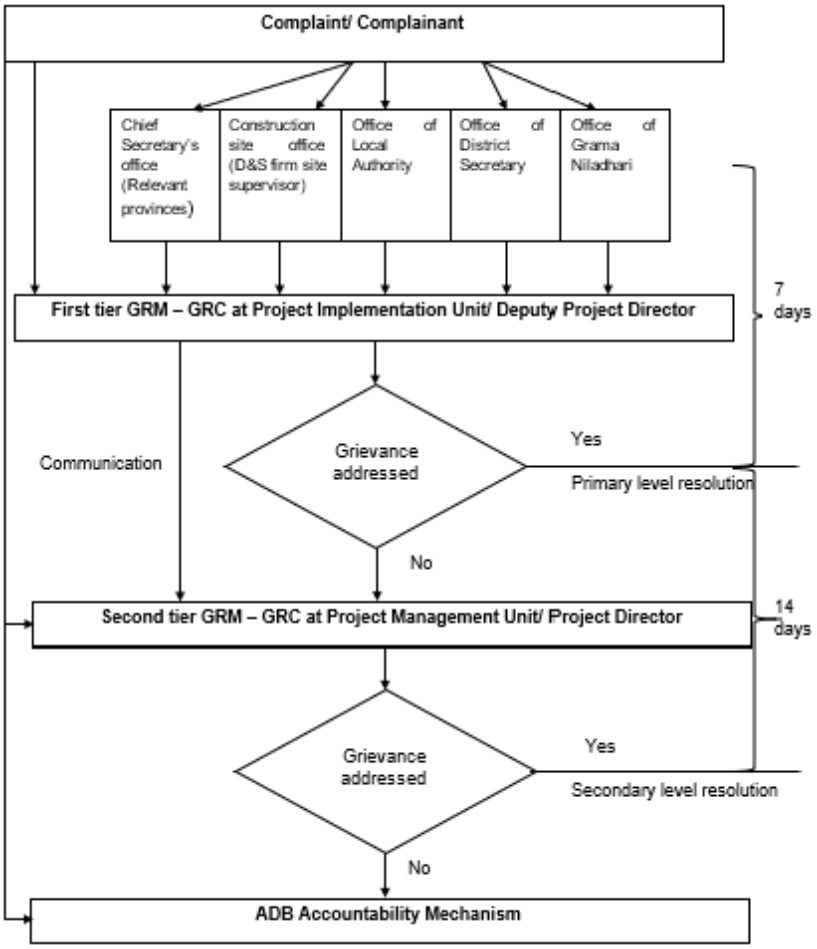
(i) enter the grievance in the complaints register of the respective PIU or the PMU;
(ii) open a grievance file for the specific case;
(iii) maintain records of the GRC meetings; and
(iv) close the grievance by filling a closure sheet that will be signed by the complainant agreeing that the concern has been satisfactorily resolved.

506. Grievances will be attended to within a week based on on-site investigations and consultations with relevant parties. All grievances will be properly recorded with personal details unless otherwise requested.

507. It is important to ensure that the project's mechanism for grievance redressal is widely disseminated to the public and other affected stakeholders through (i) public consultation meetings, (ii) media advertisement, (iii) locally erected notices and other means.

508. Where an affected person is not satisfied with the outcomes of all the levels of the project GRM, the affected person should make good faith efforts to resolve issues working with the South Asia Regional Department (through ADB's Sri Lanka Resident Mission). As a last resort, the affected person can access ADB's Accountability Mechanism (ADB's Office of Special Project Facility or Office of Compliance Review). The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of the project GRM.

Figure 73: Grievance Redress Mechanism of HSEP



Source: Asian Development Bank

IX. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

509. It was observed that the sites proposed for the civil works for additional financing of the HSEP are not located within or adjacent to areas that are ecologically or environmentally sensitive. The proposed plots either bare land or lands that are available after the demolition of parts buildings located within the boundaries of existing hospital premises or located at the backyards of the premises. At all nine locations, renovations are proposed on old buildings. Some sites are flat; however, peripheral areas of the sites at have mild to moderate slopes.

510. It is evident that most of the environmental issues during the construction phase is related to localized and temporary impacts such as (i) elevated levels of dust, noise, vibration; (ii) pollution due to solid waste disposal, including potentially hazardous components such as discarded construction material, construction wastewater, and operation of labor camps; (iii) onsite drainage

impairment; (iv) soil erosion and potential for alteration of surface drainage patterns; and (v) risk of occupational health and safety for construction workers. It has to be noted that the type of constructions proposed for all the nine subprojects are small in scale, and therefore these impacts can be minimized and mitigated with the adequate implementation of the provisions given in the EMP. Moreover, the period of construction is also not long due to the simple nature of the construction.

511. None of the hospitals, other than Teldeniya base hospital, has proper wastewater collection, treatment and discharge systems. It is essential that all these hospitals appropriately treat wastewater prior to its disposal. Most importantly, the treated effluent has to comply with regulatory limits and environmental protection licenses have to be obtained for each facility.

512. As documented in this IEE report, the current practices of hazardous HCWM in most of the hospitals are inadequate and unhygienic. While a reasonable attempt is made at segregating waste according to the category at the point of generation, the segregation is not maintained throughout. Finally, the waste is openly burnt at some of the sites that were visited. With the increased collection of clinical and infectious waste once the new facilities are established, such inappropriate waste management at HCFs are bound to increase, raising the risks for public health and the environment.

513. Further the proposed renovation of ambulance stations shall not create any adverse environmental or social impacts. Provision of medical oxygen shall need to comply with all operational level safety precautions of which some measures are relevant to construction and installation of such facilities.

514. Findings of the IEE confirm that the positive impacts of the project far outweigh any negative impacts arising out of establishing new facilities at the nine HCFs. None of the environmental impacts identified is irreversible and widespread; instead, they are localized, temporary in nature, and short term. With proper site management and safety practices, these impacts can be effectively managed. Stakeholder consultations have revealed that the demand for better and increased quality of healthcare services are urgently needed in the country. As such, the project will be a positive step towards providing better health services to the country as well as prepare the country to face emerging health sector challenges successfully in the coming decades.

B. Recommendations

515. Therefore, the IEE recommends that:

(i) Implementation of the EMP and the EMOP is essential to make sure that any environmental impacts are effectively mitigated. Noise, dust, and air-borne fugitive dust should be controlled effectively during construction.

(ii) Completion of the construction work at the shortest possible time would minimize most of the impacts that will affect the hospital users.

(iii) It is essential that all the hospitals appropriately treat wastewater prior to its disposal. Proper wastewater collection and disposal systems by installing an appropriately designed sewerage systems and treatment systems are needed for the HCFs, including the new facilities that are provided at each HCF. As septic tanks or soakage arrangements are not feasible, appropriately designed treatment systems should be installed. Most importantly, the treated effluent has to comply with regulatory limits and environmental protection licenses have to be

obtained for each facility.

(iv) HCWM be given priority and proper strategies to be developed and implemented to manage the issue as well as to build capacity and awareness within hospital staff for HCWM. The hospital has to implement an appropriate way of waste HCWM without delay.

(v) It is required to do a detailed waste audit in every unit of the hospitals to identify waste quantities generated, characterization, need for management, appropriate equipment and technology, and associated costs. Without such essential information, it is difficult to assess the need and introduce a sustainable healthcare waste management system.

(vi) Short- and long-term HCWM plans need to be established at the institutional level. There is an urgent need to implement the HCWM action plan and scale up HCWM by preparing HCWM plans for each facility, setting up monitoring procedures, and strengthening capacity at all hospitals.

(vii) It is required to have financial assistance along with technical guidance for installing sustainable technology for the management and disposal of healthcare waste and wastewater within the hospital premises.

(viii) Oxygen concentrators, concentration or generation plants, gas cylinders, and gas conveyance systems should be installed and used based on a strict standard operating procedure, maintenance schedules, regular risk assessments and safety audits, and with proper monitoring systems and contingency plan adopted and well established. Tasks related to gas handling and maintenance should be carried out only by trained personnel and maintenance work should be attended only by competent personnel who are authorized to attend to such maintenance work. Such procedures should be well-established and documented prior to implantation.

(ix) The new buildings are to be supplied by a dedicated electricity connection, water supplies and telecommunication facilities by the HCF.

(x) Additional water storage facilities are needed at all the HCFs. Water supply facilities be improved in HCFs that face severe water shortages and cannot even maintain basic hospital hygiene. This could be done through supporting feasibility studies for alternative water sources and implementing them on a priority need basis.

ANNEXURE 1: ENVIRONMENTAL SCREENING CHECKLIST

Sri Lanka: Health System Enhancement Project (HSEP) Additional Financing

Instructions:
Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Name of Subproject: Sri Lanka: Health System Enhancement Project (HSEP) - Subprojects proposed for Additional Financing.

A. Basic Information on the Health Care Facility (HCF)

• Name of the HCF	Thambuthegama (Anuradhapura district) Medirigiriya (Polonnaruwa district) Dambulla (Matale district) Theldeniya (Kandy district) Welimada (Badulla district) Bibile (Monaragala district) Kahawatte (Ratnapura district) Karawanella (Kegalle district) Other selected HCFs SLIBTEC NIHS
• Location	Nine districts (as indicated above) in four provinces (North Central, Central, Uva and Sabaragamuwa)
• Type of HCF	Base Hospitals (Cluster Apex) in each of the nine district clusters
• Number of beds and bed occupancy rate	
• No of outpatients a day	
• No of staff	
• Contact person in the HCF	Director/MS of each of the hospitals; PD and DPDs of the PMU; RDHS of each district
• Proposed rehabilitation interventions	See Table below

Name of HCF/Institution	Intervention
• Thambuthegama • Medirigiriya • Dambulla • Theldeniya • Welimada • Bibile • Kahawatte • Karawanella	• Civil works at the 9 Base hospitals in the 9 Districts: • Sewerage systems renovation/ upgrading at 8 of the Cluster Apex Hospital (except Theldeniya BH) • Medical equipment and furniture to 9 Base Hospitals (Cluster Apex) in each of the nine district clusters
Selected HCFs	• Strengthen PHC management for continuity of care
Selected HCFs	• Medical Equipment for COVID care

14 selected HCFs	• Oxygen Tanks / generators
Selected HCFs	• Lab equipment and vans to establish Mobile Laboratory for each RDHS
MOH	• PCR consumables for the Ministry
Selected HCFs	• HDU Development and support to treatment centres
Selected HCFs	• Transport services for COVID Home care support (hiring for six months and purchase of Ambulances)
SLIBTEC	• Lab Equipment for SLIBTEC
NIHS	• Upgrading, renovation and repairs to existing buildings and facilities

PART I

A. General Construction-Related Impacts

Screening Questions	Yes	No	Remarks
C. Project screening Is the project site within or adjacent to any of the following areas?			
• Densely populated area		X	Proposed interventions in all the HFCs shall only be within the existing hospital premises.
• Cultural heritage site		X	
• Protected Area		X	
• Wetland		X	
• Mangrove		X	
• Estuarine		X	
• Buffer zone of protected area		X	
• Special area for protecting biodiversity		X	
D. Potential Environmental Impacts Will the project involve or cause…			
Encroachment on historical/cultural areas?		X	
Encroachment on precious ecology (e.g. sensitive or protected areas)?		X	
Unsatisfactory raw water supply		X	The hospitals obtain water from the local authorities, NWSDB, community-based water supply projects, or shallow wells. No conflicts in abstraction of water with other users were observed or anticipated.
Conflicts in abstraction of water with other beneficial water uses of the same sources		X	
Over pumping of groundwater		X	
Increase in production of general solid waste		X	General waste production will not increase, as an increase in the residential capacities of hospitals is not proposed under the project.
Increase in production of hazardous waste	X		Personal protective equipment such as masks, disposable garments, disposable shoe covers,

Screening Questions	Yes	No	Remarks
			gloves, wastewater from washbasins, used paper towels, sharps such as needles/blades, waste after cleaning the hospital premises and wastewater from washrooms will increase
Increased sewage flow	X		The outpatient visits are expected to increase after providing new facilities for the HFCs. Therefore, an increase in sewage flow is expected, which should be proportional to additional patient visits.
Generation of sludge from waste treatment plants	X		Sludge will be generated from toilets, sinks and floor, and other equipment cleanings. However, the quantities are expected to be small.
Use of or dismantling of structures that contain Asbestos	X		Demolition and rehabilitation of existing roofs and ceilings of buildings earmarked for renovations and repairs will generate asbestos cement sheets which need careful dismantling, handling, storage and final disposal.
Noise and dust from construction activity?	X		Noise due to general construction activities and dust emissions can occur until the completion of work and site premises is turfed or paved. However, noise generation is not significant due to small-scale construction.
Soil erosion and silt runoff from construction activity?	X		Soil erosion and silt runoff can occur until the ground surface that is exposed to surface runoff is turfed. However, significant levels of soil erosion are not expected in any of the sites, where the topography is relatively flat However, the EMP still includes measures to mitigate the impacts. For example, construction contractors will be required to have proper drainage management where needed to prevent erosion/silt runoff.
Accident risks associated with increased vehicular traffic?		X	Vehicular movement signage shall be provided at the sites. All construction vehicles shall not be allowed to move outside of the demarcated construction area.
Increased noise and air pollution resulting from increased traffic volume?	X		Noise and air pollution will occur only during construction; however, the duration is short (approx. 9–12 months). A dedicated entrance shall be provided to the site premises wherever possible.
Risks and vulnerabilities related to occupational health and safety due to physical hazards during project construction and operation?	X		Due to the nature of construction, risks and vulnerabilities related to occupational health and safety due to physical hazards during project construction is minimal. During operations, risks and vulnerabilities related to occupational health and safety are high unless precautions are taken to avoid/mitigate such impacts. Providing proper training and appropriate PPE, establishing strict rules and practices for

Screening Questions	Yes	No	Remarks
			hazardous and clinical waste management, and maintaining strict adherence to standard industry practices are needed.
Requirements for disposal of fill, excavation, and/or spoil materials?	X		Cutting and filling of the sites are not needed for any of the sites. Excavations for foundations, sewerage lines, manholes and wastewater tanks are small volumes of soil, and the material can be used for filling and landscaping of the same premises. Small amounts of spoil will be generated due to excavations for foundations and wastewater collection pipes and tanks. This material can be used as a backfill, and the rest can be levelled and compacts in the peripheral areas.
Loss of large trees (more than 30 cm DBH); how many?	X		There are some trees (more than 30 cm DBH) that need cutting:
Long-term impacts on groundwater flows as result of needing to drain the project site prior to construction?		X	This does not apply to any of the sub-projects.
Long-term impacts on local hydrology as a result of building hard surfaces in or near the building?		X	Impacts are not significant as the interventions are limited to existing buildings. However, the construction of sewerage lines and the treatment plants have to take local hydrological conditions during planning, designing and construction. Therefore, stormwater drainage plans shall be included in the designs, and the collected stormwater shall be diverted to the existing drainage network of each hospital.
Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	The labour required will be about 20–30.
Risks to community safety caused by fire, electric shock, or failure of the building's safety features during operation?		X	The buildings or extensions will be constructed or rehabilitated within the hospital premises as attached or detached units. Therefore, there is no risk to community safety.
Risks to community health and safety caused by management and disposal of waste?	X		Mismanagement of waste and ad-hoc dumping are characterized by the scattered, uncontrolled deposit of wastes at a site. It is a practice that almost always leads to acute pollution problems, fires, higher risks of disease transmission and open access to scavengers and animals. Healthcare waste should not be deposited on or around uncontrolled dumps. The risk to people and animals coming into contact with infectious pathogens or hazardous materials is evident, with the additional risk of subsequent disease

Screening Questions	Yes	No	Remarks
			transmission through direct contact, wounds, inhalation, or ingestion, as well as indirectly through the food chain or a pathogenic host species.
Procurement of x-ray machines or any other equipment containing radioactive material		X	This has to be verified during later stages. If such equipment is purchased, radiation safety and related issues will be detailed in the revised IEE Reports.
Procurement of incinerators?		X	This does not apply to any of the sub-projects.
Is siting and/or routing the project (or its components) likely to be affected by climate conditions including extreme weather-related events such as floods, droughts, storms, landslides?		X	This does not apply to any of the sub-projects.

Part II

Health care waste assessment (for the existing HFC):
(Note: This information shall be provided once detailed assessment of each candidate hospital is completed)

Generation

Source	Waste type[1]					
	General	Sharps	Infectious	Chemical	Pathological	Pharmaceutical
OPD						
Medical ward						
Surgical ward						
Theatre						
ETU						
Laboratory						
Pharmacy/ Drug store						
Labor room						
Other						
kg/day						

Waste Segregation

Questions	Yes	No	Description
Is clinical waste segregated from general waste? If yes, into which categories are HCW separated?			No segregation
			General waste
			General Infectious waste

[1] Biological waste: consisting of tissues, organs, body parts, human fetus and animal carcasses, blood, and body fluids; Infectious waste: suspected to contain pathogens (bacteria, viruses, parasites, or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. Chemical waste: consists of discarded solid, liquid, and gaseous chemicals, used for diagnostic and experimental work and for cleaning, housekeeping, and disinfecting procedures; Pharmaceutical waste: expired, unused, spilt, and contaminated pharmaceutical products, drugs, vaccines, and sera that are no longer required and need to be disposed of; Radioactive waste: waste that contains radioactive material.

Questions	Yes	No	Description
Clinical, Sharps, Glass Polythene + Paper, General waste			sharps
			Pathological waste
			other
Where does the segregation take place?			
What type of bags/primary containers are used in segregating wastes?			
What type of labeling/color coding is used in segregation			
What types of equipment are used for internal transport of wastes?			
Where is the segregated waste stored until final disposal?			
Describe the final disposal method	Sharps		
	Infectious waste		
	Pathological waste		
	General waste		

Waste handling and treatment

Equipment	Yes	No	Description/ Capacity/ Number of units	Location (within hospital or nearest facility with approximate distance)	Status (used/ functioning or not)
Incinerator					
Metamizer					
Autoclave					
Lined burial pits					
Unlined burial pits					
Waste cards					
Colour-coded waste bins					
Waste storage space					

Waste handling

Questions	Yes	No	Remarks
Is there a designated person (s) responsible for organization and management of waste collection, handling, storage, and disposal at the hospital administration level?			
Does the waste management staff have job descriptions detailing their tasks?			
Has he/she received any training on hospital waste management?			
Are there clearly defined procedures for collection and handling of wastes from specified units in the hospital?			
Does your hospital have a written Waste Management Plan?			
Are waste handlers provided with adequate personal protective equipment (PPE)			

Water supply and sewerage

Questions	Yes	No	Remarks
Does the hospital have a sewer treatment plant? If not, is it disposed to on-site soakage pt.? If a sewer treatment is available, when was it built?			
Does the HCF have a water supply provided by drinking water scheme?			
Is the water treated?			
Is the water supply adequate?			
Does the HCF have Reverse Osmosis units for treating raw water supply?			

Screening decision and recommendation

Subproject	A	**B X**	C
	All potentially adverse effects can be classified as general construction-related impacts and can be mitigated with known technology. Standard clinical waste management practices shall be adopted for the storage and disposal of clinical waste. Public concern does not warrant further assessment. ***Therefore, an initial environmental examination with EMP would suffice.***		
	Any other		
Recommendations for improving health care waste management	(iii) Waste segregation should be done at each functional unit of the HCF. (iv) Waste audits need to be done in each section of the hospital. (v) All waste should be disinfected before transport to the central storage facility at the hospital premises (vi) All health care waste produced during patient care with infectious diseases should be collected safely in designated containers and bags, treated, and then safely disposed of or treated, or both, preferably on-site. (vii) Wastewater from washing basins, floor cleanings, toilets need to be disinfected before discharge to pits (viii) Waste generated from patients with infectious diseases should not burn in an open environment. Waste can be autoclaved and transported to the nearest incinerator (ix) HCWM training needs to be provided to each category of staff (x) Garden waste should not be burnt. (xi) It is required to locate a place for parking and cleaning waste collection carts and waste bins (xii) Preparing policy documents or guidelines for purchasing environmentally friendly products for day to day activities can help to reduce the overall impact on the environment, provide healthier conditions for patients, staff and community by switching to less hazardous materials (e.g., solvents, cleaning fluids, plastic brooms, etc.), and lower the costs related subsequently to waste disposal (xiii) Need to apply and obtain Scheduled Waste License (xiv) Wastewater from sinks should not be discharged to the open environment. (xv) Pedal-operated waste collection bins with liners should be available at the point of use in healthcare facilities as the preferred choice. In the absence of pedal-operated waste bins, bins with swinging lids can be opted as the alternative. Otherwise, open waste containers are better than those which require physical opening/covering by hands. Collection bins need to be provided according to the national colour code for waste segregation. Waste bin coding/labelling is key to identify infectious healthcare waste and home-based materials to prevent infection. Waste bin liners should also be procured.		

	(xvi) Waste record keeping is vital to understand how much waste is generated per day. (xvii) Storage location to cater for large volumes, transport mechanism in decontaminated trucks and final disposal arrangements through incineration and autoclaves should be arranged in advance. (xviii) Pit burning with the aid of fuel drops such as kerosene cannot be recommended without an incinerator and autoclave. (xix) Train waste handlers and sanitation crew on donning/doffing PPEs, decontamination, Infection Prevention and Control (IPC) measures (xx) Ensure the safe collection, treatment and final disposal of patient faeces and wastewater from screening and treatment HCFs. (xxi) Ensure availability of clean and adequate toilets or latrines dedicated for assigned medical/non-medical staff who are working in the lab Use chlorine solution to pre-treat wastewater from washing hands

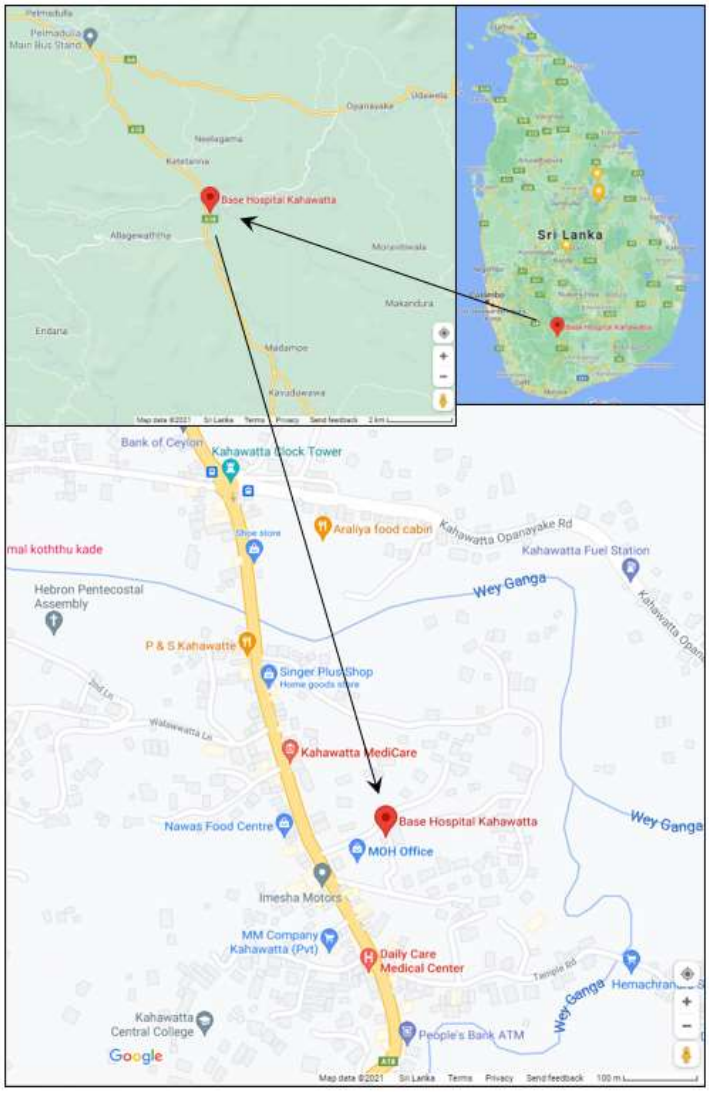
Details of person conducting screening

Screening checklist completed by Jagath Manatunge, Environmental Specialist *Name/ Designation/ Contact information*	Date June 10, 2021 *Signature*
Screening report reviewed and approved by *Name/ Designation/ Contact information*	Date *Signature*

ANNEXURE 2: DETAILS OF SELECTED APEX HOSPITALS AND AMBULANCE FACILITIES

1. Details of Kahawatta BH, Ratnapura District

Figure 2.1: Location map of Kahawatta BH(B) (6°34'43.62"N 80°34'30.62"E)



Source: Asian Development Bank

Table 2.1: Location details of Kahawatta BH

Province	Sabaragamuwa
District	Rathnapura
DS Division	Kahawatta DS Division
Local Authority	Kahawatta PS
GN Division	230 Nugawela East

Table 2.1: Number of patients used the hospital facilities in 2019

No. of wards	9
No. beds	253
No. of outdoor patients	205,198
No. of indoor patients	43,210

Source: District Statistical Handbook, Department of Census and Statistics;
http://www.statistics.gov.lk/ref/HandbookDictionary

The hospital is located by the side of Pelmadulla - Embilipitiya - Nonagama road (A018) about 600 m from Kahawatta clock tower junction towards Madampe. The river named Wey ganga meanders around the hospital surroundings within 250 m to 400 m periphery. R/Kahawaththa Primary school is located about 300 m away from the hospital and R/Kahawaththa central college is located about 450 m away both towards the Southwest. Kahawatta Pradeshiya Sabha Government office is located about 500 m away towards the Southeast direction and Kahawaththa Temple is also located about 800 m towards the Southeast. Kahawatta Sri Wijayaraja Piriwena is situated about 750 m North.

The land use of the area is mainly agricultural land, shrub land and homesteads closer to the main road.

The hospital is located in a semi-urban setting with some commercial establishments.

Figure 2.2: Photographs of Kahawatta BH

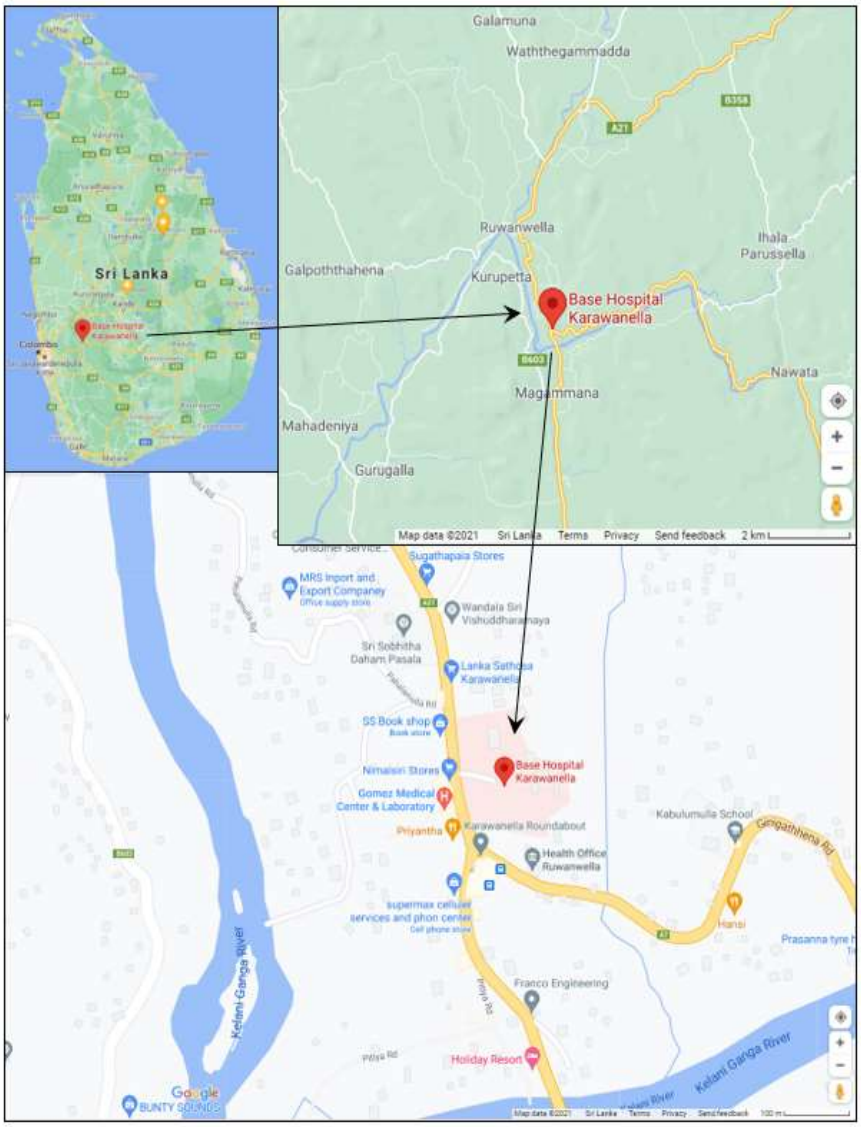
Source: Asian Development Bank

Proposed Civil works

New construction	Repairs/ Renovations	Sewage system
A complete 3 story building including Laboratories, Mental health care and Eye/ENT care.	Repairs to wards, clinics and all buildings, Corridor system linking all services, improving disability access of the hospital, Painting of all buildings, Placing a new name board etc	Sewage system will be funded by Government of Sri Lanka

2. Details of Karawanaella BH, Kegalle District

Figure 2.3: Location map of Karawanella BH(B) (7° 1'28.05"N 80°15'42.31"E)



Source: Asian Development Bank

Table 2.3: Location details of Karawanella BH

Province	Sabargamuwa
District	Kegalle
DS Division	Ruwanwella DS Division
Local Authority	Ruwanwella PS
GN Division	105 Wendala

Table 2.4: Number of patients used the hospital facilities in 2019

No. of wards	11
No. beds	357
No. of outdoor patients	109,980
No. of indoor patients	37,099

Source: District Statistical Handbook, Department of Census and Statistics;
http://www.statistics.gov.lk/ref/HandbookDictionary

Karawanella BH(B) is located facing Kegalle - Bulathkohupitiya – Karawanella road (A021) just after passing the Karawanella roundabout. A021 road starts at Karawanella roundabout on Avissawella - Hatton - Nuwara Eliya road (A007). The Kelani river meanders around the hospital premises within the 500 m periphery. Ruwanwella MOH is also located adjacent to the hospital premises. Wandala Sri Vishuddaramaya is located along A021 about 300 m away from the hospital towards Bulathkohupitiya. “Sri Sobhitharamaya” is also located opposite of Wandala Sri Vishuddaramaya about 300 m away from the hospital towards the North. Kabulumulla school is located about 700 m away facing A007 road towards the East.

The hospital is located in a semi-urban setting with some commercial establishments.

Figure 2.4: Photographs of Karawanella BH

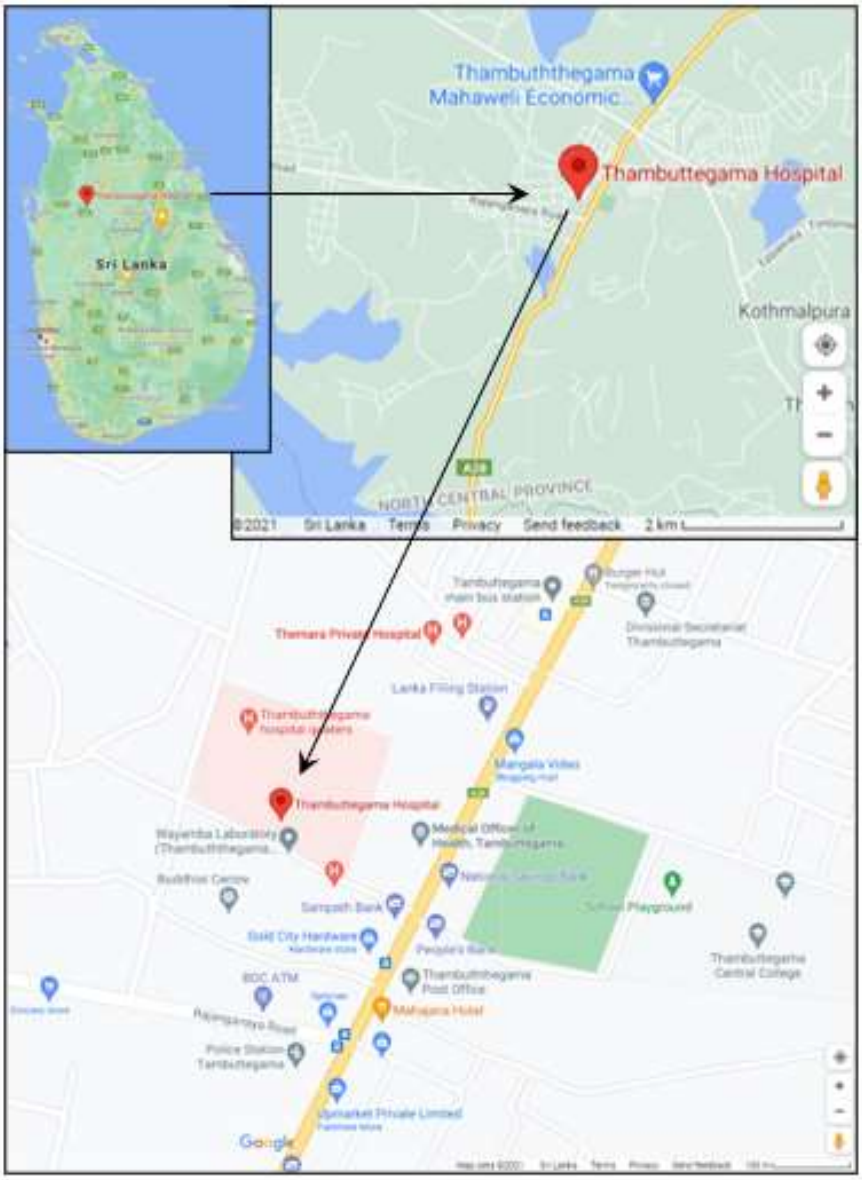
Source: Asian Development Bank

Proposed Civil works

New construction	Repairs/ Renovations	Sewage system
Expansion of OPD area to include facilities of A&E or ETU, Eye care, Physiotherapy services. New staff quarters and on call rooms	Renovations to the current OPD building, Repairs to wards, clinics and all buildings, Repairs to the drainage system, Corridor system linking all services, improving disability access of the hospital, Painting of all buildings, Placing a new name board etc	Sewage system will be funded by Government of Sri Lanka

3. Details of Thambuththegama BH, Anuradhapura District

Figure 2.5: Location map of Thambuththegama BH(B) (8° 9'13.93"N 80°17'37.45"E)



Source: Asian Development Bank

Table 2.5: Location details of Thambuththegama BH

Province	North Central
District	Anuradhapura
DS Division	Thambutttegama DS Division
Local Authority	Thambutttegama
GN Division	418 Thambutttegama

Table 2.6: Number of patients used the hospital facilities in 2019

No. of wards	7
No. beds	180
No. of outdoor patients	185,561
No. of indoor patients	35,185

Thambuththegama BH(B) can be accessed along the by-road (hospital road) after turning to the left from Padeniya - Anuradhapura road (A028) in Thambuththegama GND when heading towards Anuradhapura. The Veheragala Buddhist Center is situated just opposite the hospital. Divisional Secretariat - Thambuththegama is about 800 m away from the hospital towards the Northeast. Thambuththegama Central College and the Mahaweli playground are located about 450 m and 800 m towards east from the hospital, respectively. Police station - Thambuththegama is located along A028 road about 450 m away from the hospital towards South. There is an irrigation canal running parallel to the hospital road in the close vicinity.

The hospital is located in a peri-urban setting with several commercial establishments in the vicinity.

Figure 2.6: Photographs of Thambuththegama BH

Source: Asian Development Bank

Proposed Civil works

New construction	Repairs/ Renovations	Sewage system
A complete 3 story building with foundation laid only for 3 stories (including a lift) and that will be linked to the existing clinic building. The building shall include ETU and OPD Services, Physiotherapy and other rehabilitation services, Surgical theatre, Dental services and all Eye care services including an eye theatre.	Repairs to wards, clinics and all buildings, Repairs to the drainage system, Corridor system linking all services of the hospital, improving disability access of the hospital, Painting of all buildings, Placing a new name board etc	Renovate of the existing sewage system or if the existing system cannot be rehabilitated, a new system will be designed and constructed. ***Requires an environmental compliance audit if the existing system is expanded or upgraded.***

4. Details of Medirigiriya BH, Polonnaruwa District

Figure 2.7: **Location map of Medirigiriya BH(B) (8° 8'34.96"N 80°58'1.66"E)**

Source: Asian Development Bank

Table 2.7: Location details of Medirigiriya BH

Province	North Central
District	Polonnaruwa
DS Division	Medirigiriya DS Division
Local Authority	Medirigiriya PS
GN Division	87 Medirigiriya

Table 2.8: Number of patients used the hospital facilities in 2019

No. of wards	6
No. beds	177
No. of outdoor patients	131,281
No. of indoor patients	25,216

Source: District Statistical Handbook, Department of Census and Statistics;
http://www.statistics.gov.lk/ref/HandbookDictionary

Medirigiriya BH is located about 550 m away towards the Northeast from Medirigiriya bus stand on Batukotuwa – Medirigiriya road (B048). The Kaudulla Oya meanders closer to the hospital premises within the 500 m periphery. Medirigiriya Public library is located just opposite the road of the hospital while Medirigiriya - Divisional Secretariat and Medirigiriya Pradeshiya Sabha are located close, about 190 m and 250 m away from the hospital along the same access road. Medirigiriya Maha Vidyalaya is located about 550 m away from the hospital towards the East while the junior section of the Medirigiriya Maha Vidyalaya is located just opposite the hospital. Sirimavo Bandaranayake Primary school is located about 350 m towards the Northwest. Pashchimaramaya Buddhist temple is located 600 m away from the hospital towards East. Medirigiriya weekly fair premises is situated about 950 m away from the hospital towards the Southwest direction.

The hospital is located in a semi-urban setting with several commercial establishments located nearby.

Figure 2.8: Photographs of Medirigiriya BH

Source: Asian Development Bank

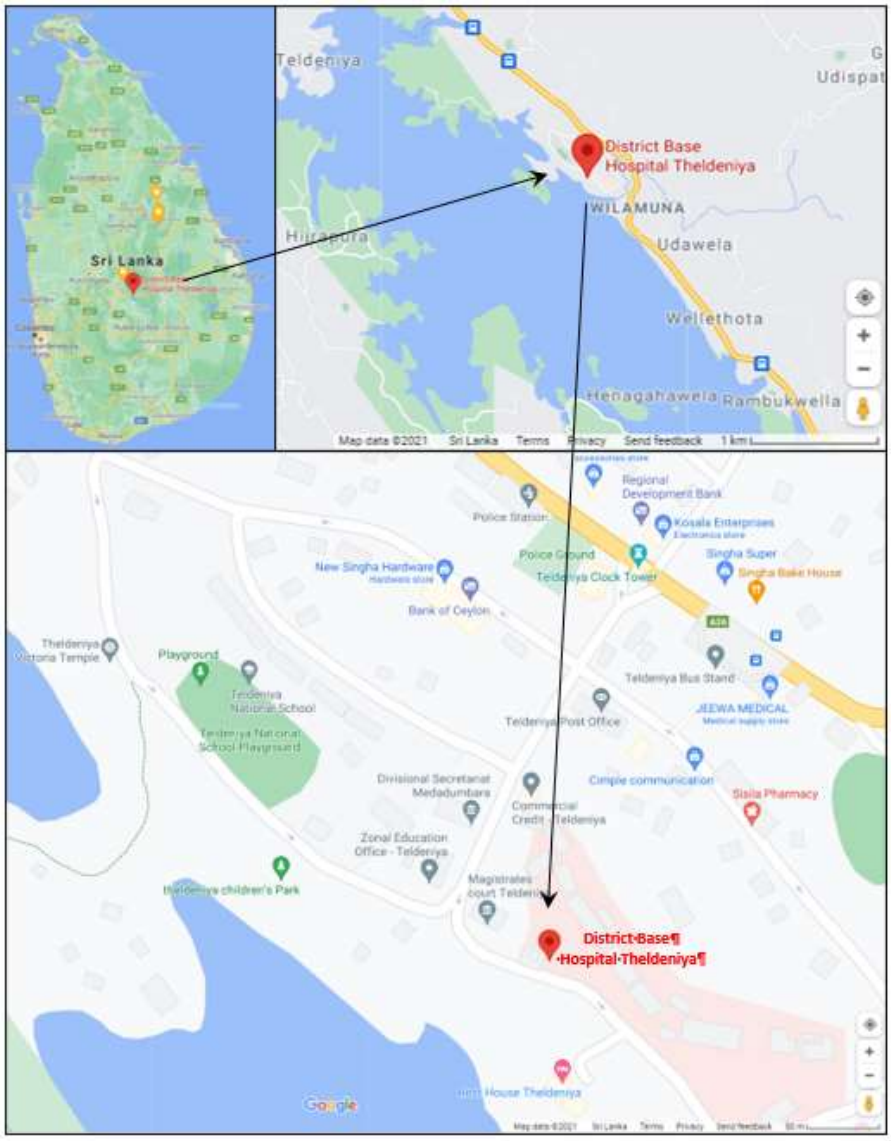
Proposed Civil works

New construction	Repairs/ Renovations	Sewage system
The first floor of the current drug store (next to the OPD building) will be constructed to include the clinic services, laboratory services for the patients. The first floor of the current Haemo-Dialysis unit will be	Repairs to Wards/Clinics and all building as required, Corridor System linking overall services of the hospital, Improving disability access of the hospital, Painting of all buildings, Placing a new name board etc.	A new sewerage system will be designed and constructed to cater the entire hospital sewer requirement (both grey and black water).

constructed to include eye clinic and eye ward. The first floor of the PBU building will be constructed to include PBU and supportive services.		

5. Details of Teldeniya BH, Kandy District

Figure 2.9: Location map of Teldeniya BH(B) (7°18'25.71"N 80°45'51.80"E)



Source: Asian Development Bank.

Table 2.9: Location details of Teldeniya BH

Province	Central
District	Kandy
DS Division	Medadumbara DS Division
Local Authority	Medadumbara PS
GN Division	764 Vilamuna

Table 2.10: Number of patients used the hospital facilities in 2019

No. of wards	7
No. beds	221
No. of outdoor patients	112,636
No. of indoor patients	21,722

Source: District Statistical Handbook, Department of Census and Statistics;
http://www.statistics.gov.lk/ref/HandbookDictionary

Theldeniya Base Hospital can be accessed along the by-road turning to the right from the Theldeniya Clock Tower junction on Kandy - Mahiyangana - Padiyatalawa road (A026) when heading towards Mahiyangana. It is situated about 350 m away towards Southwest from Theldeniya Clock Tower junction. Theldeniya-Magistrates' court is located just next to the hospital premises about 50 m away. Divisional Secretariat - Medadumbara is located about 130 m away from the hospital towards the North. Theldeniya Rest House is located closer to the hospital only about 130 m away. Theldeniya children's park is located about 210 m away towards the Northwest. Medadumbara Pradeshiya Sabha is located about 300 m away from the hospital towards the North. Theldeniya National school is located about 350 m away towards the Northwest. Theldeniya Victoria Temple is located about 400 m away towards the Northwest. Police station-Theldeniya is located about 450 m away from the hospital towards the North. The Victoria reservoir is located within the close proximity of the hospital. The hospital is located in a semi-urban setting with several commercial establishments.

Figure 2.10: Photographs of Teldeniya BH

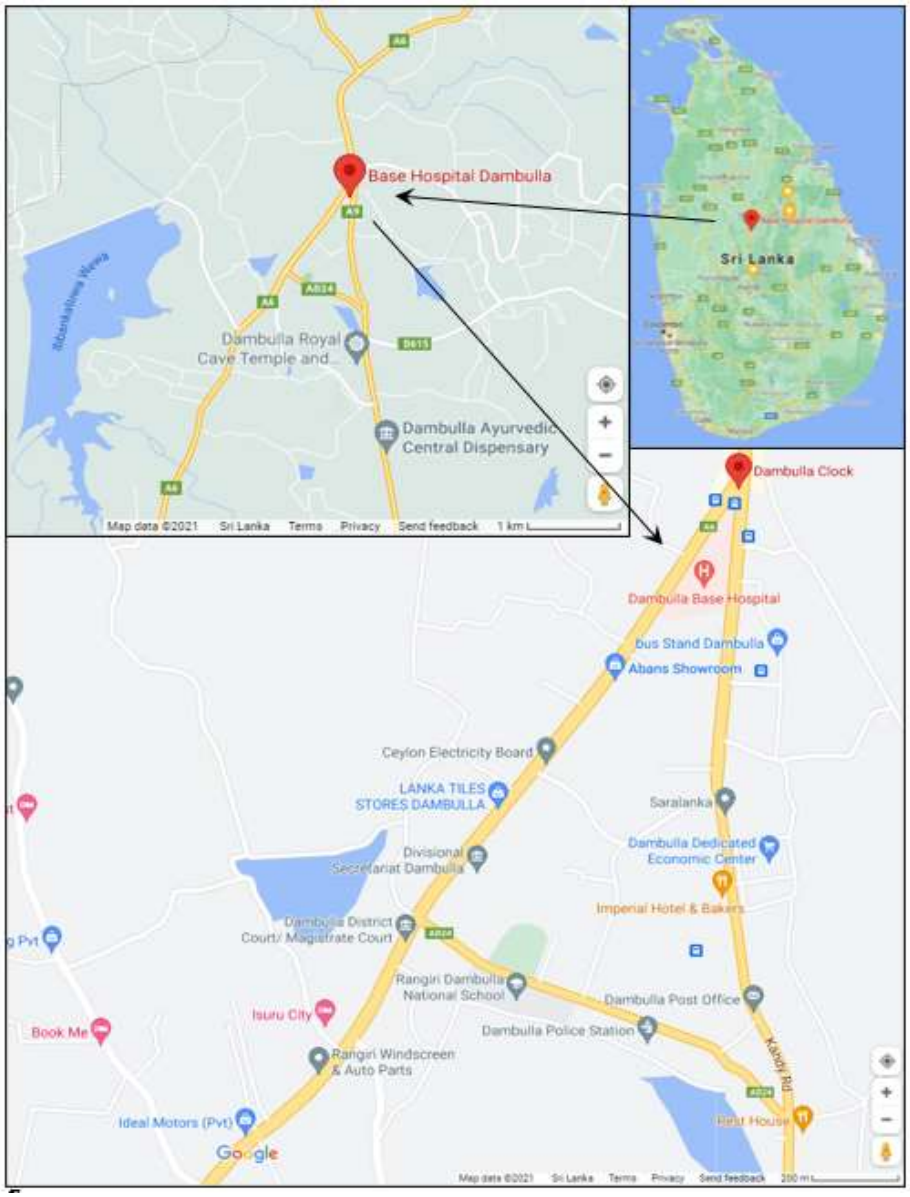
Source: Asian Development Bank.

Proposed Civil works

New construction	Repairs/ Renovations	Sewage system
A complete 3 story building including Eye services (ENT) and Eye theatre, Physiotherapy Medical wards and Clinic facilities. Staff quarters and on call rooms for different categories of staff	Repairs to medical wards, clinics and all buildings, Renovation of kitchen area, Corridor system linking all services, improving disability access of the hospital, Painting of all buildings, Placing a new name board etc	Sewerage system is functional.

6. Details of Dambulla BH, Matale District

Figure 2.11: Location map of Dambulla BH(B) (7°52'21.23"N 80°39'2.21"E)



Source: Asian Development Bank.

Table 2.11: Location details of Dambulla BH

Province	Central
District	Matale
DS Division	Dambulla DS Division
Local Authority	Dambulla PS
GN Division	445 Dambulla Town

Table 2.12: Number of patients used the hospital facilities in 2019

No. of wards	11
No. beds	311
No. of outdoor patients	203,179
No. of indoor patients	77,139

Source: District Statistical Handbook, Department of Census and Statistics;
http://www.statistics.gov.lk/ref/HandbookDictionary

Dambulla Base Hospital is located at the Dambulla clock tower junction between Kandy–Jaffna road (A009) and Ambepussa-Kurunegala-Trincomalee road (A006). Dambulla-District Court/Magistrate Court, Dambulla-Divisional Secretariat, Dambulla Police station, Rangiri Dambulla National school and Dambulla Primary school all are located between 1.0 km to 1.5 km towards the Southwards direction of the hospital. Dambulla Dedicated Economic Center is located about 850 m towards the South. Weera Mohan Jayamaha Maha Vidyalaya is situated about 1.1 km towards the North along A009 route.

The hospital is located within the highly urbanized city limits of Dambulla with many commercial and business establishments.

Figure 2.12: Photographs of Dambulla BH

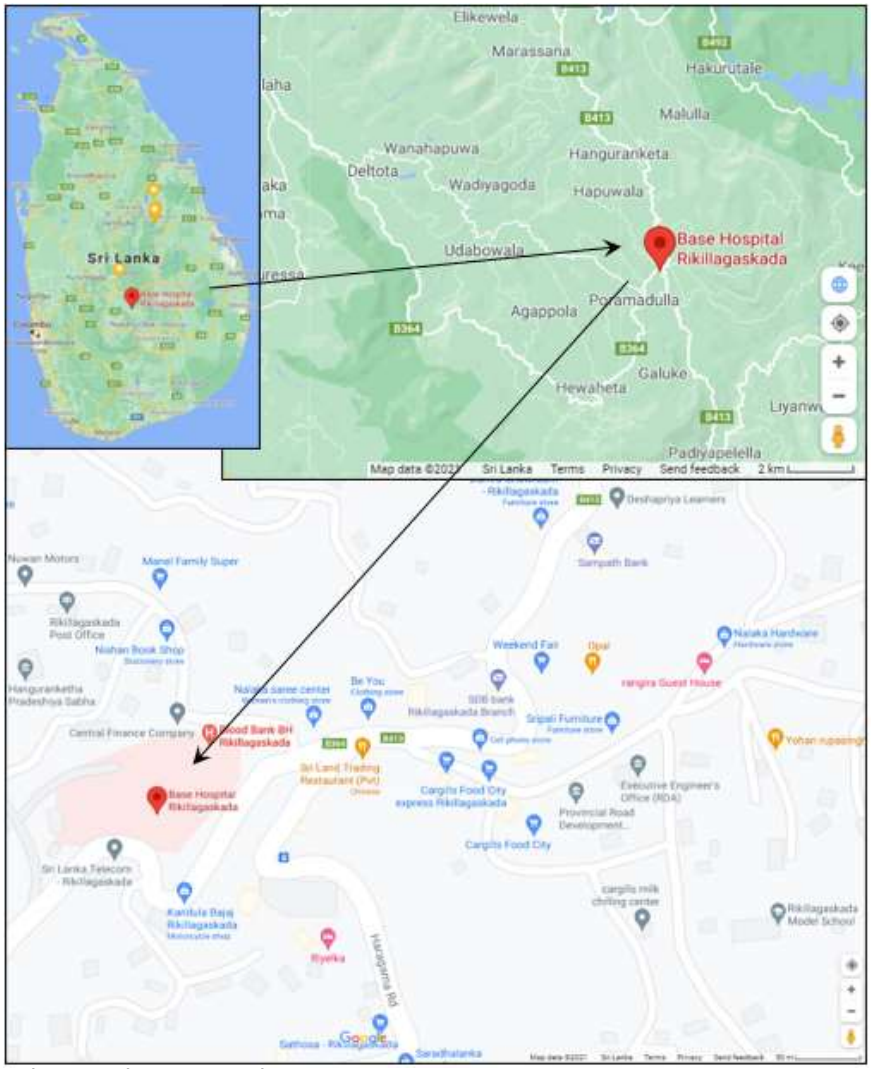
Source: Asian Development Bank.

Proposed Civil works

New construction	Repairs/ Renovations	Sewage system
A complete 5 story building including OPD and ETU facilities, Clinic area, Eye services, Physiotherapy, Medical wards (to be linked to the dialysis building) and Theatres. Staff quarters and on call rooms for different categories of staff. Hospital drainage system will be completely designed and constructed to divert the surface water.	Large scale repairs / expansion to mental health area, Repairs to wards, clinics and all buildings, Repairs to the administrative staff areas, drug stores, Repairs to water tanks, Corridor system linking all services, Improving disability access of the hospital, Painting of all buildings, Placing a new name board etc.	Sewerage system is included under the APVAX RECOVER Project of ADB

7. Details of Rikillagaskada BH, Nuwara Eliya District

Figure 2.13: Location map of Rikillagaskada BH (B) (7° 8'43.03"N 80°46'57.28"E)



Source: Asian Development Bank

Table 2.13: Location details of Rikillagaskada BH

Province	Central
District	Nuwara Eliya
DS Division	Hanguranketa DS Division
Local Authority	Hanguranketa PS
GN Division	492A Rikillagaskada

Table 2.14: Number of patients used the hospital facilities in 2019

No. of wards	6
No. beds	151
No. of outdoor patients	76,319
No. of indoor patients	24,670

Source: District Statistical Handbook, Department of Census and Statistics;
http://www.statistics.gov.lk/ref/HandbookDictionary

The hospital is located about 100 m towards the West direction from the junction where Peradeniya - Deltota – Rikillagaskada road (B364) meets Tennekumbura - Rikiligaskada – Ragala road (B413) (Rikillagaskada junction). Hanguranketha Pradeshiya Sabha is located about 600 m away from the hospital towards the Northwest. Rikillagaskada model school is located about 750 m away from the hospital towards Southeast via Dimbulkumbura road. Other than the sloping terrain there's no prominent environmentally sensitive features closer to the hospital.

The hospital is located in a semi-urban setting with several commercial establishments.

Figure 2.14: Photographs of Rikillagaskada BH

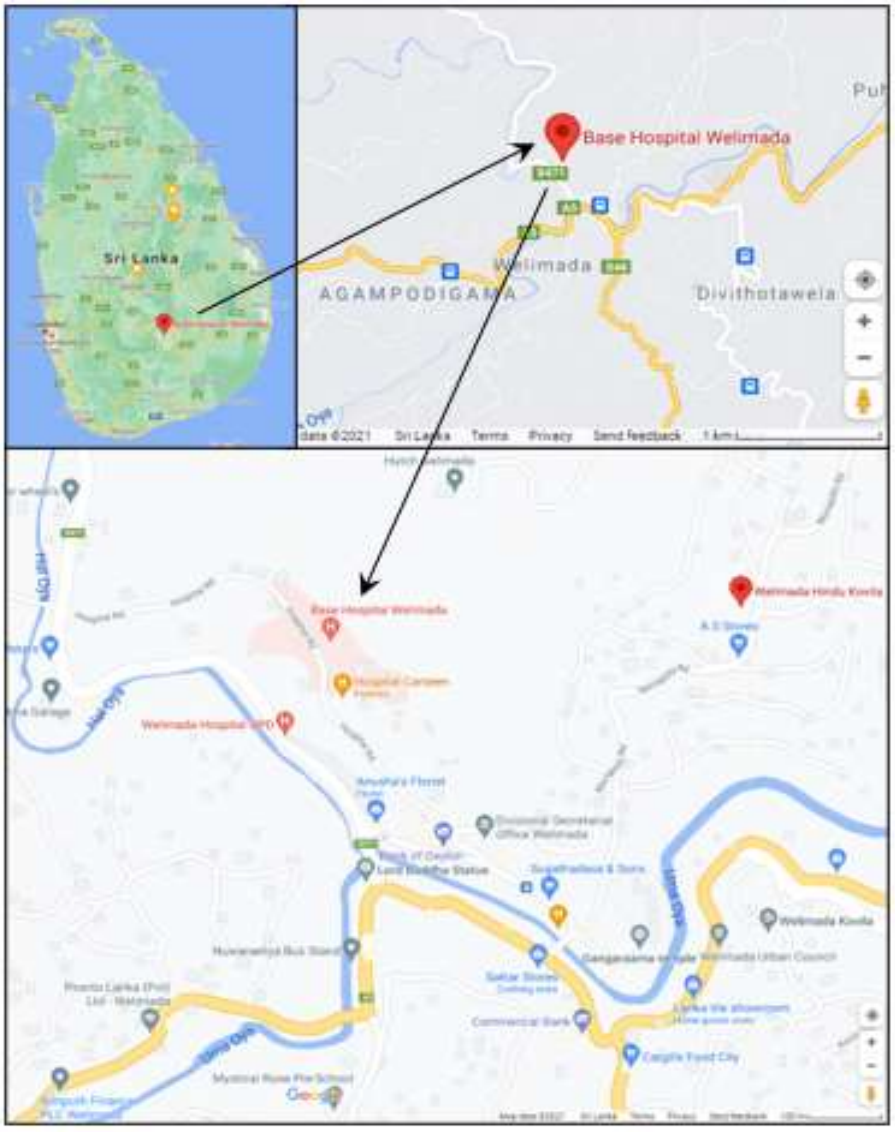
Source: Asian Development Bank

Proposed Civil works

New construction	Repairs/ Renovations	Sewage system
A complete 3 story building including Eye services, Theatre, Medical ward, Drug Stores and Laboratory services. Mortuary area with JMOs office and Police office.	Renovations at OPD area, clinic areas, dental area, administrative staff area; Repairs to administrative staff area; Renovation of kitchen area; Repairs to medical wards, clinics, and all buildings; Corridor system linking all services; Improving disability access of the hospital; Painting of all buildings; Placing a new name board etc	A new sewerage system will be designed and constructed to cater the entire hospital sewer requirement (both grey and black water).

8. Details of Welimada BH, Badulla District

Figure 2.15: Location map of Welimada BH(B) (6°54'31.64"N 80°54'33.10"E)



Source: Asian Development Bank.

Table 2.15: Location details of Welimada BH

Province	Uva
District	Badulla
DS Division	Welimada DS
Local Authority	Welimada PS
GN Division	52A Welimada Town

Table 2.16: Number of patients used the hospital facilities in 2019

No. of wards	4
No. beds	190
No. of outdoor patients	205,159
No. of indoor patients	25,067

Source: District Statistical Handbook, Department of Census and Statistics; http://www.statistics.gov.lk/ref/HandbookDictionary

The hospital is located within the township of Welimada on both sides of the Hospital Road which is a by-road connecting main Peradeniya - Badulla – Chenkaladi road (A005) and Udapussellawa - Welimada road (B471). Confluence of Hal oya and Uma oya is about 300 m away from the hospital towards the South. Divisional Secretariat - Welimada, Smyrna Special Needs School, Welimada and Gangaraama temple, Welimada are located towards the Southeast of the hospital at distances of 400, 450 and 600 m via hospital road, respectively. The British Academy School is located 650 m away from the hospital towards the Northwest. Welimada Magistrates' Court is about 1 km away from the hospital towards the Southeast. Welimada Hindu Kovil is located about 1 km away from the hospital via Hospital Road and Moragolla road towards the East.

The hospital is located in an urban setting with commercial and business establishments. The area is hilly with steep slopes and the surrounding land use consists of the road and built up area.

Figure 2.16 Photographs of Welimada BH

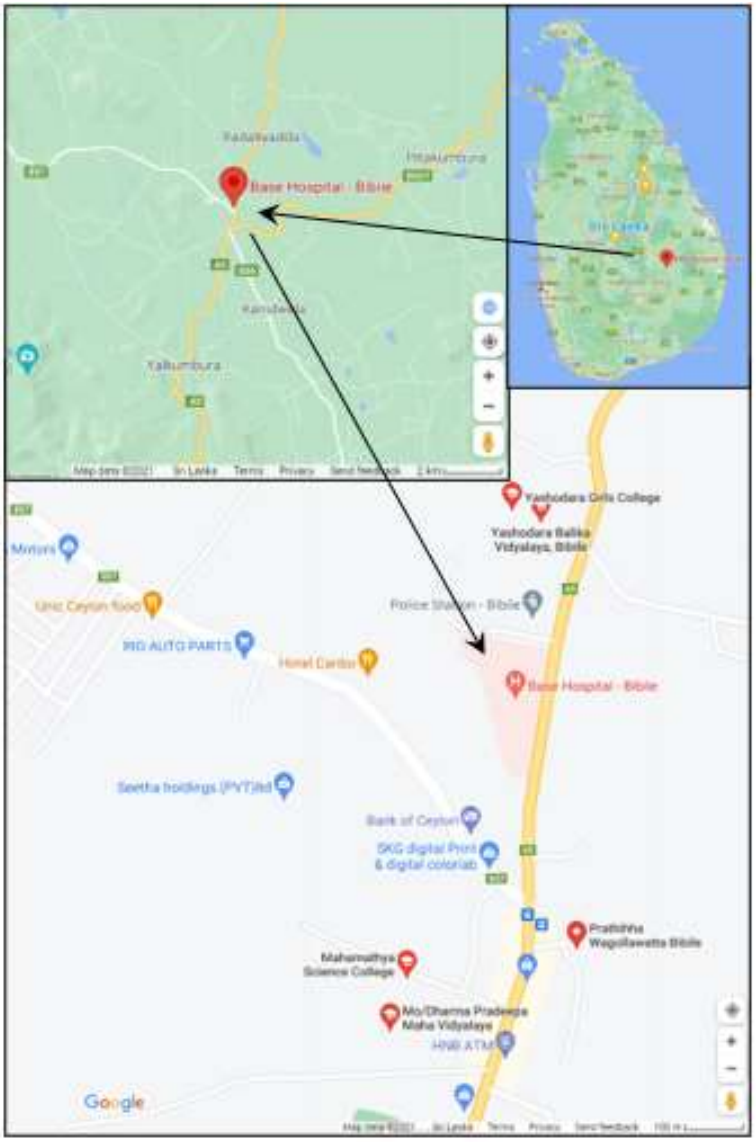
Source: Asian Development Bank

Proposed Civil works

New construction	Repairs/ Renovations	Sewage system
A complete 3 story building including Medical wards, Drug Stores, Mental Health services, Clinic area and Eye/ENT Services. Staff quarters and on call rooms for different categories of staff.	Renovations at OPD area, dental area, administrative staff area; Repairs to administrative staff area; Repairs to wards, clinics, and all buildings; Corridor system linking all services; Improving disability access of the hospital; Painting of all buildings; Placing a new name board etc.	A new sewerage system will be designed and constructed to cater the entire hospital sewer requirement (both grey and black water).

9. Details of Bibile BH, Monaragala District

Figure 2.17: Location map of Bibile BH(B) (7° 9'49.93"N 81°13'30.77"E)



Source: Asian Development Bank

Table 2.17: Location details of Bibile BH

Province	Uva
District	Monaragala
DS Division	Bibile DS
Local Authority	Bibile PS
GN Division	100 Bibile

Table 2.18: Number of patients used the hospital facilities in 2019

No. of wards	7
No. beds	261
No. of outdoor patients	179,529
No. of indoor patients	26,326

Source: District Statistical Handbook, Department of Census and Statistics;
http://www.statistics.gov.lk/ref/HandbookDictionary

Bibile BH is located by the side of Peradeniya - Badulla - Chenkaladi road (A005) about 400 m from the Bibile junction, where Bibile - Uraniya - Mahiyangana road (B057) meets A005 road. MOH office, Bibile also located adjacent to the hospital premises. The Police station, Bibile is located next to the MOH office, Bibile. Bibile-Pradeshiya Sabha, Bibile-Public Library, Bibila-Divisional Secretariat, Bibila-Magistrate's court, all are located southwards from the Hospital at about 500 m, 600 m, 800 m, 1.1 km distances, respectively.

Yashodara Balika Vidyalaya, Bibile is located about 300 m Northwards while Mahamathya Science College, Bibile is located about 750 m towards the Southwest. Mo/Dharma Pradeepa Maha Vidyalaya is located 800 m towards the Southwest of the hospital. Mahamevna Buddhist Monastery is located about 500 m towards the Northeast while Bodhirukkarama Viharaya is located about 500 m towards the Southwest of the hospital.

Topography of the area is flat and no surface water sources within the vicinity of the site are observed. The hospital is located in a semi-urban setting predominant with commercial establishments.

Figure 2.18: Photographs of Bibile BH

Source: Asian Development Bank

Proposed Civil works

New construction	Repairs/ Renovations	Sewage system
A complete 3 story building including Clinic areas, Medical wards, Drug stores and Eye services. Staff quarters and on call rooms for different categories of staff.	Repairs to wards, clinics and all buildings; Renovation of Nurses and other staff quarters; Corridor system linking all services; Improving disability access of the hospital; Painting of all buildings; Placing a new name board etc.	A new sewerage system will be designed and constructed to cater the entire hospital sewer requirement (both grey and black water).

Indicative list of Locations for Deployment of New Ambulances under JFPR component

District No.	District	Proposed New Location
1	Colombo	Pettah Police Station Dematagoda Police Station Padukka Police Station Agulana South Police Station Kahathuduwa Divisional Secretariat
2	Gampaha	Kochchikade Police Station Katunayaka Police Station Raddoluwa Police Station Ja ela Police Station Weliweriya Police Station
3	Kalutara	Wadduwa Police Station Moragahahena Police Station Kaluthara North Police Station Tebuwana Police Station
4	Galle	Neluwa Police Station Yakkalamulla Police Station
5	Matara	Malimbada Police Station Hakmana Police Station
6	Hambantota	Weeraketiya Police Station
7	Badulla	Haldummulla Police Station
8	Monaragala	Gonaganara Police Station
9	Anuradhapura	Thalawa Police Station
10	Polonnaruwa	Dimbulagala Police Station
11	Kurunegala	Maho Police Station Pothuhara Police Station Giriulla Police Station Alawwa Police Station
12	Puttalam	Dankotuwa Police Station
13	Kandy	Manikhinna Police Station
14	Matale	Alawathugoda Police Station
15	Nuwara Eliya	Mandaramnuwara Police Station
16	Rathnapura	Kiriella Police Station Weligepola Police Station Panamure Police Station Rakwana Police Station Pinnawala Police station
17	Kegalle	Dedigama Police Station
18	Batticaloa	Vellavelly Police Station
19	Ampara	Damana Police Station

20	Trincomalee	Lankapatuna Police Station
21	Jaffna	Kankesanthurai Police Station
22	Mannar	Silawathurai Police Station
23	Vavuniya	Poovarasankulam Police Station
24	Mullaitivu	Pudukuddiruppu Police Station
25	Kilinochchi	Akkarayankulam Police Post
Total No.		

Note: The locations to which the new Ambulances purchased under output 2 to be deployed will be selected by MOH and Suwa Seriya during the project implementation

List of candidate ambulance stations where the 20 stations to be renovated under the JFPR grant will be selected from

No	District	Location	Location Address
1	Putlam	Putlam	Putlam Police Station
2		Marawila	Marawila Police Station
3		Karuwalagaswewa	Karuwalagaswewa Police Station
4	Kurunegala	Galgamuwa	Galgamuwa Police Station
5		Gokarella	Gokarella Police Station
6		Hettipola	Hettipola Police Station
7	Kandy	Galagedara	Galagedara Police Station
8		Kadugannawa	Kadugannawa Police Station
9	Matale	Mahawela	Mahawela Police Station
10	Nuwaraeliya	Maskeliya	Maskeliya Police Station
11	Anuradhapura	Kebitigollawa	Kebitigollawa Police Station
12		Thirappane	Thirappane Police Station
13	Polonnaruwa	Medirigiriya	Medirigiriya Police Station
14	Kegalle	Kegalle	Keagalle Police Station
15	Ratnapura	Embilipitiya	Embilipitiya Police Station
16		Samanalawewa	Samanalawewa Police Station
17		Ratnapura	Ratnapura Police Station
18	Monaragala	Ethimale	Ethimale Police Station
19	Badulla	Passara	Passara Police Station
20	Killinochchi	Killinochchi	Killinochchi Police Station
21	Jaffna	Jaffna town	Jaffna Police station
22		Mulaankavil	Mullankavil police Station
23	Mullativu	Mulliyavalai	Mulliyavalai Police Station
24	Mannar	Madhu	Madhu Police Station
25	Colombo	Mulleriyawa	Mulleriyawa Police Station
26		Nawagamuwa	Nawagamuwa Police Station

27		Bambalapitiya	Bambalapitiya Police Station
28		Homagama	Homagama Police Station
29	Gampaha	Ragama	Ragama Police Station
30		Minuwangoda	Minuwangoda Police Station
31		Mirigama	Mirigama Police Station
32		Biyagama	Biyagama Police Station
33	Kalutara	Beruwala	Beruwala Police Station
34		Kalutara South	Kalutara South Police Station
35		Horana	Horana Police Station
36		Bandaragama	Bandaragama Police Station
37	Galle	Ahungalla	Ahungalla Police Station
38		Poddala	Poddala Police Station
39		Mahamodara	Mahamodara Police Station
40	Hambantota	Hambantota	Hambantota Police Station
41		Ambalanthota	Ambalanthota Police Station
42		Tangalle	Tangalle Police Station
43	Matara	Akuressa	Akuressa Police Station
44		Morawaka	Morawaka Police Station
45		Kamburupitiya	Kamburupitiya Police Station
46	Ampara	Ampara	Ampara Police Station
47	Trincomalee	Kuchchaweli	Kuchchaweli Police Station
48	Baticalo District	Karadiyanaru	Karadiyanaru Police Station

*All ambulance stations of the 1990 Suwa Seriya ambulance service are located at local police stations. This arrangement is based on a MOU between MOH and police department.

ANNEXURE 3: GUIDELINE FOR MANAGEMENT OF COVID-19 INFECTIOUS WASTE

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0112675011
தொலைபேசி) 0112698507 ,
0112694033
Telephone) 0112675449 ,
0112675280

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Fax)0112692913

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சுவசிரிபாய
SUWASIRIPAYA

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சுகாதார மற்றும் சுதேச வைத்திய சேவைகள் அமைச்சு
Ministry of Health & Indigenous Medical Services

To All PDHSs, RDHSs and
All Heads of Institutions

Guideline for Management of COVID-19 infectious waste

Infectious waste generated from healthcare institutions treating COVID-19 cases shall be treated using only the following methods.

1. Incineration
2. Using a metaMizer

These two methods of treatment should be used in all healthcare institutions designated for treating COVID-19 cases.

1. Handover the infectious waste generated in Healthcare institutions in Western, Central and Southern Provinces to Sisili Hanaro Encare (Pvt) Ltd for incineration.
2. Use either incinerators or metaMizers to treat the clinical waste in all other provinces.

Please advise the staff to adhere to the following in managing infectious waste from COVID-19 cases /wards.

Infectious waste generated from suspected and confirmed COVID-19 cases should be collected in yellow polythene bags of minimum 300 gauge and tied well. It should then be put in another yellow bag (double bagged) and tied and sealed with appropriate adhesive tape. Mark the waste bag with a red label as "COVID-19 waste" for easy identification and prioritized disposal.

Sharps should be placed in cardboard sharp boxes which should be puncture proof and leak proof. Sharp boxes should be designed with a small inlet so that items can be dropped in but no item can be removed. It should be closed when ¾ full.

Make sure that the sharp box has a handle. Mark the sharp box with a red label as "COVID-19 waste" for easy identification and prioritized disposal.

COVID-19 waste containing yellow polythene bags and sharp boxes should be transported separately in a trolley or a cart which is easy to load, clean and disinfect and treated on priority basis on the same day.

The staff transporting this waste needs to wear proper personal protective equipment (PPE) such as gloves, masks, boots and overalls at all times.

The staff at the treatment facility needs to wear proper personal protective equipment such as industrial gloves, masks, boots and overalls.

Infectious waste handling staff need to be educated on how to protect them and should be provided with washing facilities with adequate soap and water.

Arrangements need to be made to treat COVID-19 infectious waste within 24 hours.

Waste management process needs to be supervised by a team nominated by the Head of the Institution

For any clarifications please contact the Director (E&OH)

Dr. Lakshman Gamlath

DDG (EOH &FS)

385, පූජ්‍ය බද්දේගම විමලවංස ස්වාමි මාවත, කොළඹ 10. 385,வணக்கத்துக்குரியபத்தேகமவிமலவன்சதேரோமாவத்தை,கொழும்பு 10.
385, Rev. Baddegama Wimalawansa Thero Mawatha, Colombo 10, Sri Lanka.

ANNEXURE 4: GUIDELINES FOR REMOVING ASBESTOS CEMENT (AC) SHEETS FROM BUILDINGS

Background: Asbestos cement sheets are still widely used as roofing material in Sri Lanka, which accounts for most of asbestos use in the country. While many countries have banned the use of all forms of asbestos, Sri Lanka has not yet imposed a total ban, although many policy level discussions are going on in assessing this risk and identifying how to address it. In AC, the chrysotile (or white asbestos) fibre is encapsulated in a cement matrix. While this fibre-cement bond is regarded to be relatively safe, if it is released into the air during (I) assembling, cutting, removing asbestos sheets during construction and (ii) ageing and fungal attacks on AC sheets or (ii) the process of ageing and fungal attack, and is inhaled over a long period of time, it can cause great risks to public health. The Rotterdam Convention of Hazardous chemicals lists asbestos-containing material as hazardous that requires to follow a prior informed consent procedure in importation etc. The National Environmental Act of Sri Lanka identifies 'waste arising from repairing/renovation processes and demolition/construction debris containing asbestos' as a scheduled waste in Part II (specific sources) requiring licensed approval for disposal.

Under HSEP, the renovation of PHC facilities that will generate AC sheets will not be disposed of in an irresponsible way. The following note is a further guide to the provisions contained in the EMP for the safe handling and disposal of used AC sheets.

Asbestos roofing sheets & ceiling sheets to be removed during demolition at Kahawatta BH

Asbestos roofing sheets & ceiling sheets to be removed during demolition at Welmada BH

Asbestos roofing sheets & ceiling sheets at Medirigiriya BH

Asbestos roofing sheets at Karawanaella BH

The following guidelines have been extracted from the Health and Safety Executive (http://www.hse.gov.uk/), which is an independent regulator for safe working environments in the UK.

Preparing the work area

- Ensure safe access to the roof. If necessary, use a mobile access platform.
- Restrict access to the working area to minimize the number of people present. This is extremely important as the construction sites are sensitive receptors constantly used by those who are sick.
- Delineate the area using tape and notices to warn others.
- Ensure adequate lighting.

Equipment needed

- Thick polyethene sheeting and duct tape
- Barricade tape and warning signs
- Bolt cutter
- Straps and ropes
- Water sprayer
- Buckets of water and rags
- Sealable bags for large AC pieces broken away from the roof
- Personal protective equipment such as masks, overalls, gloves and boots

Guidelines during removal

- Avoid or minimize breaking the AC.
- If fasteners hold the sheets in place, dampen and remove them and place them in the asbestos waste bag.
- If the sheets are bolted in place, dampen and cut the bolts while avoiding contact with the AC.
- Remove the bolts or fixings carefully and place them in the asbestos waste bag.
- Unbolt, or use cutters to release gutters, drain pipes, ridge caps etc. Avoid contact with the AC.
- Lower large pieces to the ground. Don't drop them or use rubble chutes. Stack sheets carefully.
- Where there are several AC sheets and other large items, place them in a lockable skip.
- Double-wrap large pieces in 1000-gauge polythene sheeting. Seal with duct tape.
- Attach asbestos warning stickers.
- Place small pieces in the asbestos waste bag.

Guidelines for cleaning and disposal

- Clean the equipment and the area with damp rags.
- Check for debris in fasteners or bolt holes. Clean with damp rags.
- Put debris, used rags, polythene sheeting and other waste in the asbestos waste bag and tape it closed.
- Dispose of contaminated webbing and rope as 'asbestos waste'.
- Put the asbestos waste bag in a clear polythene bag and tape it closed.
- For disposal of the discarded AC sheets;
    - Store the sealed asbestos sheets in a safe corner of the hospital premises or transport them to a central disposal yard where waste from all sites in the district can be stored.
    - Transfer to the sanitary landfill at Aruwakkalu, which will be ready for operation in 2019
    -

1 – Safe wrapping of removed asbestos in thick polythene
2 – Construction workers wearing full PPE
3 – Asbestos bags
4 – Walking on AC sheets can crack them and release fiber into the air. Here they use plans to walk on
5 – Using a mobile platform to remove the sheets minimizing the risk of breaking up AC sheets

ANNEXURE 5: RECORDING AND MONITORING THE PROCEDURES ADOPTED BY THE CONTRACTORS TO ENSURE HEALTH AND SAFETY TO PREVENT THE SPREADING OF COVID-19

1. What activities were considered when the site work commences?
   Commencement of site works and mobilising the workers
   Awareness creation, routine, and regular health/ hygienic practices
   Emergency preparedness

2. What precautions have been taken so that workers are not at risk to expose/infect the virus
   Note: workers at a site near a hospital are more vulnerable to be infected

3. List out the activities that will be carried out at sites and (practical) measures that shall be adopted to contain any infection or spread of disease.

4. List out the measures that will be adopted at the site to record the health condition of workers upon reporting to work and their whereabouts and specific activities they had got involved in during the previous 2–3 week period.

5. List out the measures that would be adopted to monitor the health condition of the worker force.
   Note that workers/ staff with the following conditions should not be allowed to the site.
   Those who are having fever, with or without acute onset respiratory symptoms such as cough, runny nose, sore throat and/or shortness of breath.
   Those who have had contact with suspected or confirmed case of COVID-19 for the last 14 days.
   Those who are quarantined for COVID-19
   If a sick person reports for work, he/she is sent back home immediately.

6. Include the procedure/s that will be followed with respect to managing visitors and other deliveries to the site.

7. Include measures that will be taken to provide required PPE to workers, measures taken to enforce them to wear them at site and measures used to dispose of the used items such as face masks.

8. List out the routine and regular measures that would be adopted at sites to maintain the health, hygiene and safety of the workforce, including office staff (including social distancing where possible).

9. How awareness programmes shall be conducted for the workforce on spread and containment of COVID 19, and on good health and hygienic practices and for workers who return home, and the precautionary measures they should be taking.

10. Provide information on how accommodations, kitchens, meal rooms, labour billets shall be improved to restrain any possibility of contamination.

11. Include procedures that would be adopted in case an infected persons/ suspected case is found at the site.

The Contractor or site supervisor may consult the Medical Officer of the healthcare facility (of the sub-project) before mobilisation and obtain his/her opinion/advice. Contact the medical officer and record his/her opinion on on-site organisation and health & safety plans to prevent COVID-19 and safeguard the general health of the workers.

ANNEXURE 6: ENVIRONMENTAL MANAGEMENT PLAN

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
Pre-construction stage					
1	Proper scheduling and planning of work (Refer to Table 5.1 for detailed descriptions)	Proper coordination to ensure timely completion of the completion and minimising work delays by obtaining prior approvals/ consents	DSC to obtain Permits/approvals/ consents/no-objection letters for sub-projects (Refer to Table 1.4 for the list)	DPD and Project Engineer of PIU of each Province	Included in the DSC's contract Any regulatory fees or tax payments associated with obtaining approvals/permit s should be borne by the PIU as part of the project cost
		Minimising delays related to the selection of locations for project interventions	DSC The Contractor is expected to liaise closely with the DSC	Project Engineer, PIU of each Province to monitor to avoid delays	No costs involved
		Selection of areas for work camps, stockpile areas, storage, and disposal areas	The Contractor is expected to liaise closely with the DSC when selecting such sites.	Hospital Authorities Project Engineer, PIU of each Province and Environme ntal Specialist, PMU to monitor	No costs involved
		Solving any issues that lead to delays in the finalisation of the designs of the interventions	DSC The Contractor is expected to liaise closely with the DSC	Project Engineer, PIU of each Province to monitor to avoid delays	No costs involved
		Planning the work with due consideration given to climatic conditions	The Contractor	DSC to check	No costs involved

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
2	Minimising the removal of trees	All the project components/ interventions /activities proposed should ensure minimum disturbance to the removal of trees	DSC during design stages The Contractor during mobilization and construction stages	Hospital Authorities Project Engineer, PIU of each Province and Environmental Specialist, PMU to monitor	No costs involved
3	Avoiding impacts due to landslides and slope instability	Recommendations of the NBRO should be obtained for any projects that are likely to be prone to landslides and/or slope failures once the designs are completed Note: This may not be applicable for sub-projects in the Anuradhapura, Polonnaruwa and Monaragala Districts	DSC	Project Engineer, PIU of each Province	No additional costs involved
4	Planning for interruption of services of the HFC due to the demolition/ removal of any existing structure/part of structures of the HCF and shifting of utilities	Any interruption of utility services (water supply, wastewater collection and disposal, electricity, telecommunication services) should be restored with alternative means. Also, the functional connectivity of different hospital units needs to be restored for uninterrupted services of the hospital.	The Contractor	DSC to monitor and report to Project Engineer, PIU of each Province	Cost for shifting and/or alternative supply of utilities has to be costed by the Contractor
5	Designing proper stormwater drainage systems	The rainwater drainage has to be designed appropriately for all the site before the commencement of the work. Any alterations, damages, blockages caused to the existing drains should be considered in providing	DSC for designs The Contractor to obtain proper guidance from DSC	Project Engineer, PIU of each Province	Design costs included in DSC's contract. Cost for shifting and/or new surface drainage networks has to be costed by the Contractor

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		alternative drainage pathways.			
6	Designing of proper healthcare waste (HCW): sorting, storage, and disposal	Safe handling of HCW during collection, storage, transportation, treatment, and disposal of HCW is of paramount importance. Designs and plans for such safe handling and disposal of HCW have to plan early.	This aspect is supposed to be addressed separately as another activity under the HSEP and will be reported elsewhere. However, the DSC should ensure that proper spaces are provided for collection and storage. The Project Engineer, PIU of each Province need to verify this aspect before approval of designs.		
7	Designing of a wastewater collection and treatment system, including safe disposal	Wastewater generated from the hospital, including newly-constructed facilities, needs to be disposed of appropriately. The design of an adequate wastewater collection and on-site treatment system shall reduce such contamination. (This may not apply to Teldeniya BH)	DSC to design wastewater collection, treatment, and disposal systems for the hospital and related facilities	Project Engineer, PIU of each Province	Design costs included in DSC's contract
8	Planning for the provision of adequate and uninterrupted electricity, water, and telecommunication facilities.	The proposed facilities should be supplied by an appropriately laid out and designed electricity connection, water supplies, wastewater collection and disposal, and telecommunication facilities. Impacts during construction	DSC to plan the systems for newly constructed facilities	Project Engineer, PIU of each Province	No additional costs involved
9	Conducting surveys prior to commencement of the proposed civil works	Land surveys and contour map of the proposed land plot	DSC	Project Engineer, PIU of each Province	No additional costs involved
		Initial status photography and video and crack survey (only if needed)	The Contractor	DSC and hospital authorities	Need for additional costs involved in the crack survey LKR 25,000–75,000
		Existing survey of utilities and shifting	The Contractor	DSC and hospital	No additional costs involved

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
				authorities	
		Visual surveys of the peripheral areas of the site are needed for planning of shifting the access paths, need to erect of barriers, location of labour huts, parking, and material stockpiles, etc.	The visual survey has to be carried out collectively by the engineers of the DSC and PIU and the Contractor.	The plans have to be submitted to the hospital authorities for their comments/ approval	No additional costs involved
10	Health and Safety of workers and the public	Due consideration shall be given to Environmental, Health, and Safety (EH&S) aspects.	Compliance with EH&S requirements will be thoroughly reviewed, and a summary requirement shall be prepared (one for workers and another common one for the public, including the workers) by the Contractor.	The selection of locations and facilities for labour camps will be reviewed by the DSC.	No additional costs involved
11	Community and public awareness	Careful planning and extensive coordination with hospital users must be established. Hospital users should be of the period of construction, and changes of the entrance to the hospital, changes of units/venues of the hospital, dangers posed by construction-related activities and how to avoid such incidences, impacts such as dust and noise, etc.	The Contractor has to coordinate this with the hospital authorities.	DSC and Project Engineer, PIU of each Province to monitor	No additional costs involved
Construction Phase					
1	Impacts due to site preparation activities, clearing of vegetation and ground preparation	• Removal of vegetation on-site should be restricted to the bare minimum, and a strip of vegetation should be left around the disturbed area. • Erosion control during land preparation	The Contractor	DSC and Project Engineer, PIU of each Province to monitor	Cost included in the preliminary works

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		activities and cutting/filling within the site premises is needed. Rainy periods should be avoided to the extent possible for land clearing. Surface runoff should be diverted away from the site and/or construction site, and drainage should be diverted through silt traps (if needed). Any loose soil within site should be compacted as soon as possible. • All spoil, topsoil, demolition waste, and cut vegetation should be covered by secure tarpaulins whenever stored on-site and transported offsite to prevent material from being blown away by trucks • Avoid stockpiling any excess spoils at the site for long periods. Such material should be disposed of at approved/designated areas without delay • Prohibit burning of vegetative matter and domestic waste; Ensure that wastes are not haphazardly thrown in and around the site; provide proper collection areas/bins/craters, etc. • Conduct site clearance and restoration to original condition after the completion of construction work before issuing of completion certificate.			

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
2	Removal of large trees	• Tree barks, stumps and wood debris can be distributed to be used as firewood to local people free of charge. • Trees that are of commercial value should be felled by the Timber Corporation, and the timber should be disposed of according to their instructions. If such trees are being cut, proper consents/approvals need to be obtained from hospital authorities and Divisional Secretariat, as appropriate, and inform the Timber Corporation to remove the tree. • Plant at least three trees each to compensate for the loss of each tree. Trees can be planted along the newly built access roads, close to the wastewater treatment plants, etc. and as part of the landscaping of the hospital premises.	Hospital Authority (Director, MS, MOIC, MO) The Contractor to coordinate this, and all original hard copies of consent letters and other correspondence should be lodged with the hospital authorities for record-keeping.	PIU of each Province to monitor	Small budgets needed for the planting of a few trees. The Hospital Authorities should contact the local Agrarian Services Office and/or Timber Corporation for plants. Hospital and/or the Contractor can ideally take this up as a CSR project with local sponsorship.
3	Impacts due to the demolition of buildings and other structures	• Prepare and implement a Construction Waste Management Plan (C-WMP); include waste minimisation measures in the plan • Consult the hospital authorities after careful removal of such reusable/recyclable material and hand over to the material stocks to them. It is the	The Contractor	DSC to supervise and keep records and report to Project Engineer, PIU of each Province	Covered under the contract budget

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		responsibility of the Contractor to keep records of such material that are handed over to the hospital authorities. • Reuse as much demolition waste and material as much as possible • Asbestos sheets should be reused rather than disposing of. Extra care should be exercised in removing and, if need when disposal of asbestos products (See Annex 4: Asbestos Management Plan). • Find alternative beneficial uses for any unused building material, e.g., fills in other construction works; fixtures and fittings to be reused. • There should be no open burning of any demolished material, on-site or offsite. • Workers should be provided with appropriate safety wear, Worker Personal Protective Equipment (PPE) during demolition, and disposal. Control of Noise & Vibration: See #5 Control of Dust and Air Pollution: See #6 Transport-related impacts: See #4			
4	Impacts on soil due to excavation, transportation and storage of construction material and disposal of spoil	• Earth stockpiled on-site should be fully covered on all sides with a suitable material, and weight should be placed at the base to prevent	The Contractor	DSC to supervise and keep records and report to Project Engineer, PIU of each Province	Covered under the total construction cost.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
	and construction debris	the cover from getting displaced and exposing the earth to erosion. They should be stored away from site/road drainage paths. • Drains bringing in stormwater towards the construction area should be prevented with earthen/sandbag berms during wet weather. • Construction should be scheduled in a way that earthwork such as excavations is carried out. In contrast, all the preparations for foundation construction and pipe works, septic tank and soakage pit construction are ready to commence immediately after excavations are over. This will allow the backfills to be completed without delay and minimise the need to stockpile the spoil/soil for a longer duration. • Oil and lubricant waste should not be buried or burnt in the project site but collected and stored in proper oil cans and disposed of for reuse or LA approved designated sites. • All other hazardous chemicals such as paint shall be stored in a safe place that is not subjected to floods or accidental			

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		spilling. Empty paint cans will be collected and removed to an authorised dumpsite. • Packing material, polyethene, wooden debris (e.g., used for shuttering work), etc., should be appropriately collected, stored and the Contractor should remove them from the site before handing over. • Water collection basins and sediment traps shall be installed in areas where construction machinery/equipment (concrete mixers, buckets, containers and cans, paintbrushes) must be washed daily.			
5	Impacts due to activities creating noise and vibration	• Construction work within the site, vehicles and equipment used in construction work should meet CEA standards for noise and vibration in Sri Lanka (see Annex 5). • High noise-generating activities should be scheduled after informing and with the consent of the hospital authorities. • Noise barriers must be erected, if needed, to cut down high noise. However, the Contractor can separate the site premises with a delineated barrier with the dual function of dust/noise containment and	The Contractor The height of the noise barrier, material (e.g., zinc-aluminium sheets, plywood sheets, tarpaulin, etc.) to be used for the barrier and the locations to erect such barriers have to be decided in consultation with the hospital authorities under the instructions of the DSC. A prior crack survey has to be carried out as a precautionary measure so that both the Contractor and the hospital authorities can resolve issues (if any) that may arise in an unlikely case.	DSC to supervise and keep records and report to Project Engineer, PIU of each Province	This item has already been absorbed into the total construction cost. Rs. 25,000–75,000 for the crack survey (if needed) It is the Contractor's liability to cover any damages to third party property during construction.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		safety. • The use of noisy machines should be restricted, and where possible noise-reducing means for construction machines should be used. • Construction activity should be between 8.00 am to 6.00 pm daily to avoid discomfort caused by noise and vibration that for in-patients and the neighbourhood. • If certain nighttime construction activities are unavoidable, they should be done using noise-reducing means or low-noise technologies. • Noisy construction machines/ activities should be scheduled to coincide with non-clinic and non-OPD days/times as much as possible or on days that patient visitation to the facility is minimum. • Liaising with the hospital authorities regarding the work schedules is always advisable. Prior notices of noise generating activities will avoid confusions among hospital authorities and the Contractor • Conformity to the Interim Standard on Vibration Pollution Control for Sri Lanka is needed (see Annex 5).			

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		• If vibration causes structural damages to nearby structures, the Contractor is liable to rectify such damages.			
6	Impacts due to activities creating emissions and impacts on air quality	• Effective dust barriers have to be erected to prevent dust from being blown towards other parts of the hospital (this barrier can function as noise/dust containment as well as for fencing the site premises that is used for safety reasons). • The louvres/pergolas of nearby buildings must be temporarily covered with polythene sheets until the construction work is over. • The site should be cleaned daily, especially surfaces that are affected by soil and dust. • Regular watering (at least twice a day during the mid-morning and mid-evening) should be carried out in the construction site for dust suppression. • Excavated soil that is temporarily stored on-site should be covered in a tarpaulin or other locally sourced suitable material to prevent from dust particles getting air-borne. • Where possible, construction stockpiles and debris	The Contractor The height of the noise barrier, material (e.g., zinc-aluminium sheets, plywood sheets, tarpaulin, etc.) to be used for the barrier and the locations have to be decided in consultation with the hospital authorities under the instructions of the DSC.	DSC to supervise and keep records and report to Project Engineer, PIU of each Province	This is part of the total construction cost.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		piles should be stored away from the functional areas of the hospital. • During transportation, trucks carrying earth, spoil (if any), or construction material to and from the sites should be covered by a tarpaulin. • Any equipment and machinery which uses diesel shall be appropriately maintained to control emissions. The Contractor has to ensure that vehicles entering the site have obtained Vehicle Emission Certificates (VEC).			
7	Impacts due to activities that affect surface and groundwater quality and quantity	• Maintain cross drainage within site always during construction. Hence stockpiles and debris must be safely stored away from these drainage paths. • Where blockage of drainage is unavoidable, alternative paths must be created to facilitate stormwater flows from the site to the outside. • Lead away drains that collect water from the internal drainage system of the nearby buildings must be kept clean and free from any constrictions to ensure a smooth flow of stormwater. • The construction site/s should be	The Contractor	DSC to supervise and keep records and report to Project Engineer, PIU of each Province	This is part of the total construction cost.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		checked daily (after wet weather) for any signs of water stagnation and cleaned. • A washing area for construction equipment should be delineated within hospital premises away from the construction area • Wastewater from the construction site should not be directly discharged into roadside drains. It should be first directed to a pit to allow siltation and percolation before connecting to a lead away drain. • Temporary toilets should not be located close to shallow wells. Wastewater should be disposed of on-site by way of having an appropriate collection and disposal system (e.g., pit latrines, or septic tanks with soakage gullies/pits, etc.). • The workers may use existing toilets in the hospital premises with the consent of the hospital authorities. Such use of toilets should not affect other users of the hospital in any way. Also, it has to make sure that such use of toilets will not affect the health of the workers, as the toilets may be used by patients, thereby exposing workers to undue health risks.			

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
8	Impacts due to extraction of water for construction purposes	Availability of water for construction purposes will have to be assessed in a site-specific manner. However, where water supply is limited, the Contractor should arrange his own supply for construction activities to avoid potential conflicts. If the Contractor uses water supplies available at the hospital, necessary approvals shall be obtained from the hospital authority or the water supply provider, as required.	Contractor to seek approval from relevant authorities and secure water supplies	DSC to approve and keep records and report Project Engineer, PIU of each Province	Water usage by the Contractor has to be priced, and the cost of the supply has to be claimed. DSC and the PIU have to check this prior to payment of any claims of the Contractor.
9	Impacts due to solid waste generation, collection, and disposal	• Solid waste should never be burnt in the open (on-site or elsewhere) • Waste separation within the site premises in colour-coded bins. The bins should be tightly closed to prevent vermin and pest infestation • Hand over the collected waste to the local authority. • The Contractor should make the workers aware of waste management practices and oversee compliance to such practices, and maintaining a good communication system with the local authority • Maintaining the waste storage spaces clean	The Contractor	DSC to supervise and keep records and report to Project Engineer, PIU of each Province Hospital Authorities to monitor	No additional costs involved. Any costs in the collection, disposal and transportation should be borne by the Contractor.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		• Once the biodegradable waste and mixed waste is handed over to the local authority, sell the recyclable waste (if any) to selected collectors registered with the CEA in the area Note: For construction waste management: refer to #3 above mitigation of impacts due to the demolition of buildings and other structures			
10	Impacts due to migrant labourers and operation of labour camps	• If there is a need to establish labour camps, they should be established in suitable locations away from the hospital's functional areas with consent from the hospital management. • The labourers should be instructed to behave decently without creating disturbances to hospital users and others in the neighbourhood. • Local labour should be recruited as much as possible to minimise the social consequences of migrant labour and to provide livelihood opportunities to the local community. • Labourers/workers should be provided with adequate sanitation facilities and receptacles for garbage collection. • Domestic solid waste	The Contractor	DSC to supervise and keep records and report to Project Engineer, PIU of each Province	No additional costs involved. This is part of the total construction cost.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		collected should be disposed of daily at a site given to them. • Burying and burning domestic waste in the project sites should also be strictly avoided • A good supply of drinking water should be provided to the labour camps.			
11	Impacts due to occupational health and safety	• A safe construction site should include: (i) fully functional and well-maintained equipment, (ii) availability of emergency equipment and safety warnings, and (iii) worker personal protective equipment (PPE) and a strong commitment to follow safety practices with proper supervision of labour with proper monitoring and feedback • Workers must be provided with first-aid and health facilities. First aid training should be provided to the supervisor. • The constructors should carry out suitable training programs on occupational health and safety for workers • Machinery and equipment that could easily electrocute should be kept safely within site and always under the supervision of an experienced	The Contractor The safety plan to prevent COVID-19 should consist of the information as proposed in Annex 6.	Hospital authorities and PHI (MOH) to check the Safety Plan and comment and advice. DSC to monitor implementation of the provisions of the safety plan and report to PIU.	The cost is included in the total construction cost. Allow for Contractor's liability insurance for workers' health and safety and third party injuries and damages.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		worker. Arranging regular safety checks for vehicles and equipment is needed, including the labour huts. • Allocation of responsibility to the relevant personnel is needed. Prohibition of alcohol and other narcotic substances which may impair the judgment of workers engaged in construction activities, should be enforced. • Excavated areas for construction should be barricaded using barricading tapes and signboards. When work is done at higher elevations, the work should be carried out and supervised by experienced workers. • The Contractor should pay attention to and prepare a safety plan to address 'emerging concerns on the safety of workers to prevent spreading of COVID-19':			
12	Impacts on public health and safety	• The construction site should be delineated from the rest of the hospital, preferably using barricading tape or any other suitable material that separates the construction area from the rest of the hospital physically. • A safe pedestrian pathway to the	The Contractor	Hospital authorities and PHI (MOH) to check the provisions of the Contractor to ensure publish health and safety, and comment and advice. DSC to monitor	This is part of the total construction cost. Allow for Contractor's liability insurance for public health and safety and third party injuries and damages.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		hospital buildings should be provided if regular access along with the nearby gate and the hospital access road is blocked. • Signboards and directions for such detouring and shifting of facilities should be placed in all the two local languages, at prominent locations and in large-sized lettering. Safety of the peripheral areas of the site and access paths should be ensured at all times, e.g., non-slippery surfaces, clear of any obstructions and dangers, maintaining clean, tidy, and well-managed sites and activities, etc. • Safety signs should be placed at appropriate locations, informing the public of any dangers posed by construction-related activities. • Emergency access should never be obstructed. Alternative access for the ambulance and vehicular access should be provided whenever needed. • Strict entry controls to the site premises should be in place so that unauthorised entry is debarred. • Notices should be provided to hospital staff and users about the schedule of		implementation of the public health and safety provisions report to PIU.	

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		construction activities with particular hazards, and potential noise and dust episodes, etc. • Concrete mixer trucks or any other trucks/construction vehicles should not be parked outside the hospital premises, as the access roads are either narrow or busy. • Advance public notices should be displayed so that the hospital users are informed of the tree cutting. • All slopes should be strengthened by appropriate engineering interventions. Access roads and access paths should be rehabilitated to their original conditions.			
13	Site restoration (at the end of construction) and landscaping	• Provide proper rainwater drainage network to the areas peripheral to the site, which will also prevent local flooding of low-elevation areas of the hospital premises, avoid soil erosion in the sloping terrain. • Any lead away drains, roof gutters and downpipes of other buildings, if damaged or altered during construction, should be restored. • Rehabilitation of the areas used for labour huts, offices, water storage tanks, material storage yards,	The Contractor	Hospital authorities to check and report to PIU DSC to supervise and report to Project Engineer, PIU of each Province	This is part of the total construction cost.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		temporary drains, toilets, etc. • Turfing any exposed ground area, especially sloping terrain, to avoid soil erosion and landscaping with suitable trees (see #2 of this list). This will prevent soil erosion of the peripheral areas of the sub-project.			
14	Impacts on biological resources	No impacts are envisaged other than the removal of three trees. Planting of trees as specified above – See # 2	See #. 2 of this list.		
15	Safety issues related to wild animals	The Contractor is advised not to put up labour camps near forested areas. Also, vigilance and care should be exercised during the nighttime if any employees stay within the site premises. Also, the haphazard disposal of MSW will attract wild animals.	The Contractor	DSC and hospital authorities	No additional costs involved
16	Impacts on the Cultural and historical environment	All the staff and labourers of the Contractor should be informed about the possible items of historical or archaeological value, which include old stone foundations, tools, clayware, etc. If something of this nature is uncovered, the Department of Archaeology shall be contacted, and work shall be stopped immediately. The	If instructed by the Department of Archaeology (DOA), the Contractor should undertake reconnaissance surveys with the DOA to identify any archaeological/historical weak structures (if any) that are likely to damage from high ground vibration levels during excavation work.	DSC and PIU to follow up with the Department of Archaeology	Additional costs to be ascertained on a case-by-case basis (only if such instances arise)

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		chance find the procedure of archaeological and cultural artefacts are described in Chapter VI.			
Operational Stage					
1	Impacts of improper handling and disposal of healthcare waste: Increased generation of hazardous health care waste which is improperly disposed of can put public health at risk from accidental infections and contaminate the natural environment.	Infectious waste should be collected separately and autoclaved at the point of generation. Once disinfected, the waste would leave a medical area in the infectious healthcare waste container. Containers for infectious waste should not be placed in public areas. Waste bins should be located as close as possible to sinks and washing facilities. Containers should be of similar size to overcome the observed tendency for staff to put waste in the largest receptacle. Where possible, hazardous waste generated in medical areas should be stored in utility rooms, which are designated for cleaning equipment, dirty linen, and waste.	DSC for designs The Contractor for the construction	Hospital authorities and PHI of the relevant MOH area to check PIU and RDHS to follow up	Costs for designs and construction involving the project components proposed by the HSEP are part of the total design and construction costs. Subsequent operations and maintenance is part of the recurrent cost of running the HFC.
2	Possible contamination of infections by health care staff	• Ensure yellow bags are correctly closed and tied with an overhand balloon knot so that they are leak-proof before being moved. • Yellow bags should be placed in a container with a secure lid. • All sharps containers should be fully closed and placed in a bag	DSC for designs The Contractor for the construction	Hospital authorities and PHI of the relevant MOH area to check Hospital authorities and PHI of the relevant MOH area to check PIU and RDHS	Costs for designs and construction involving the project components proposed by the HSEP are part of the total design and construction costs. Subsequent operations and maintenance is

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		and then in a container. Preferably, single-use disposable sharps containers should be used in place of reusable sharps containers. • Single-use gloves (nitrile or latex) and gowns should be discarded after each use and not reused • All who handle health care waste should wear appropriate PPE and perform hand hygiene after removing it. • Frequently touched surfaces throughout the reception area should be cleaned regularly. • Bathrooms should be cleaned and disinfected at least once a day. • Well-trained permanent staff are responsible for packaging waste to transport for treatment facilities. • Each bag must be hand-tied by gathering and twisting the neck of the bag and using a tie or hand knot to secure the bag, and each container must be securely closed. • Improperly packaged containers or damaged containers will be denied pick up until packed them properly. • Bins used for disposing of infectious waste must be		to follow up	part of the recurrent cost of running the HFC.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		disinfected before reuse by any means effective for the infectious substance the container previously contained. • Direct contact (without gloves) with bins or bags should be avoided in any case. • Uniforms should be daily changed - cleaning of work clothes and shoes is minimising the possibility of dispersing the virus in the air – make sure not to shake clothes – wash them at a temperature of at least 60 ° C with conventional detergents, add disinfectants if possible. • Put a disposable set of gloves, on a daily basis, in direct contact with skin, before wearing usual work gloves.			
3	Generation, collection, treatment and disposal of wastewater generated from the newly constructed building	A proper sewerage network including collection gulleys, manholes, pump stations and other appurtenances should be designed based on the estimated flow capacities of the existing wastewater generation and should be extrapolated to include an extra contribution from future expansion of hospital facilities (at least for the next 15–20 years). The wastewater treatment system should be designed and constructed so that	DSC for designs The Contractor for the construction and subsequent commissioning and operations during the defects liability period. Hospital authorities during subsequent operations, or the service provider if the operation of the wastewater treatment system is entrusted with a third-party contractor	Hospital authorities and PHI of the relevant MOH area to check PIU and RDHS to follow up Obtaining the EPL is the responsibility of the hospital. The hospital should regularly measure discharge quantities and check effluent quality at intervals	Costs for designs and construction involving the project components proposed by the HSEP are part of the total design and construction costs. Subsequent operations and maintenance is part of the recurrent cost of running the HFC.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		effluent discharge conforms to regulatory limits (See Anne 5 for these regulatory limits). Environmental protection license should be obtained, and all the conditions contained therein should be consistently adhered to and complied with. All contingency measures (as described in Table 5.5) should be implemented. Regular maintenance of all the components in the wastewater collection and treatment system is needed as per the manufacturers' specifications. This is particularly important for proper maintenance of the treatment system and to ensure that wastewater is appropriately treated before its disposal. Any malfunctioning of the wastewater collection and/or treatment system should be rectified without delay, and any pollution that occurred as a result of such malfunctioning should be cleaned up and restored. Such malfunctioning will include instances such as breakdown or malfunctioning of the wastewater treatment plant and its components/processes , failure of pumps,		stipulated in the EPL, and maintain all such records which are needed to submit to authorities (CEA and the local authority) The CEA and the local authority monitor the discharge of effluents and eluent quality monitoring.	

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		malfunctioning due to power failures, accidental bursts of a pipeline, etc. For any section/facility of the hospital that cannot be connected to the sewerage system due to practical/technical and economic reasons, then appropriately designed on-site collection and disposal system should be designed, e.g., a septic tank and a soakage pit or septic tank/constructed wetland, etc. (See SLS 745 for options). Such on-site methods as the wastewater collection and disposal method should be appropriately designed so that no adverse impacts are expected. Desludging should be done as and when needed.			
4.	Increased generation of sewage and wastewater from the hospital that can contaminate groundwater with disease-causing pathogens, pharmaceutical chemicals, endocrine-disrupting chemicals, etc.	AS described above, a properly designed wastewater collection system *sewerage system) and a treatment system should be designed and installed. Both greywater and blackwater should be directed to the treatment system. All wash water shall be disinfected and aerated (if needed) first before being sent to the soakage pit. If not connected to the sewerage system, all wastewater from washing hands,	DSC for designs The Contractor for the construction	Hospital authorities and PHI of the relevant MOH area to check PIU and RDHS to follow up	Costs for designs and construction involving the project components proposed by the HSEP are part of the total design and construction costs. Subsequent operations and maintenance is part of the recurrent cost of running the HFC.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		cleaning, laundry, bathing, flush toilets, and other washing activities should be safely collected and treated with chlorine before being sent to sewer lines or infiltrated into a soak-away pit.			
5	Provision of water supply	There should be water storage of which should be sufficient for at least 1½ –2 days). The water quality of supplies should conform to SLS614 (2013): Sri Lanka Standards for Potable Water.	DSC for designs The Contractor for the construction	Project Engineer, PIU of each Province Hospital authorities and PHI of the relevant MOH area to check	Costs for designs and construction involving the project components proposed by the HSEP are part of the total design and construction costs. Subsequent operations and maintenance is part of the recurrent cost of running the HFC.
6	Safety issues related to supply of oxygen for medical use	As oxygen concentrator units are dependent on the electrical supply, there needs to be either an emergency electrical supply, using a backup generator, or a second electrical supply to the facility that would not be impacted by the failure conditions of the primary supply. It is feasible to utilise the oxygen concentrator supply system (used as the primary and or secondary supply) to fill a high-pressure gas storage system (either using individual cylinders permanently connected to a manifold system or a permanently installed	Specialised Contractor for design, supply, and installation and commissioning Rectification of any defects during the liability period is the responsibility of the contractor/supplier Regular maintenance to be done based on maintenance/service contracts	Specialist appointed by the PMU to check designs, installation, and quality assurance of installations. Trained staff of the hospital to operate and maintain the systems and to regular monitoring of the system to ensure proper functioning.	Costs included in the contract sums PMU to cover costs for Specialist for checking and approval of designs and installations. Costs involved in regular maintenance and services should be part of the recurrent costs of the hospital.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		high-pressure storage system) to act as the reserve source of supply. This system shall comply with the ISO regulations and standards related to high pressure filling systems. Where this configuration is used, it shall be noted that the re-filling of the third source of supply is also dependent on the electrical supply. On healthcare sites where oxygen is manufactured, the healthcare facility qualified personnel (as may be determined to be adequate by the management) is responsible for the quality and safety of the oxygen administered to patients. Site selection for the oxygen supply system shall begin with a safety assessment of the proposed location. In the rooms where they are located, the oxygen concentrators and oxygen compressors shall be fitted with fire suppression systems, including smoke detection and sprinkler systems. Typically, the primary fire protection for generators is from fire hydrants. Depending on the system size, there shall be an adequate number of fire hydrants, chemical-type fire extinguishers, hoses, or a combination of these should be strategically located close to the oxygen			

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		concentrator units, compressors, and boosters so that a fire can be approached from any direction. All safety measures should be in place to ensure occupational health and safety. Sufficient space shall be maintained around the equipment to allow for personnel access for maintenance. Personnel protection such as guard rails, platform gates, and ladder enclosures should be provided to prevent falls from elevated locations. Specific means shall be provided to protect the personnel in case of an emergency. Example of this includes emergency lighting, emergency remote shutdown, safe multiple exit routes, fire retardant clothing, alarm systems, and equipment isolation valves. The national and international standards have to be complied with as a mandatory requirement. The hospital should frequently and consistently monitor the gas delivery, production, storage and conveyance systems for any leaks. If there are any leaks, they should be attended to by competent personnel as soon as possible – as a matter of urgency. Once			

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		a leak is detected, all the safety precautions listed in the sections above should be taken until the leak is arrested and properly repaired.			
7	Occupational health and safety - Emergency Response Procedures For comprehensive emergency response procedures, refer to Laboratory quality management system: handbook published by the WHO[5]	**(a) Emergencies** The HCF needs to have procedures in place for how staff should deal with accidents and emergencies. Generally, written procedures for first aid should be developed and made available to all staff so they know the first things to do and who to call or notify in case of minor cuts and bruises, major wounds, or skin contamination. **(b) Chemical spills** A chemical spill is considered to be minor only if the person who spilt it is familiar with the chemical, knows the associated hazards and knows how to clean up the spill safely. The recommended steps for dealing with a minor spill include: • alert coworkers, then clean up the spill • follow procedures for disposal of materials used to clean up the spill • absorb free liquids with an appropriate absorbent, as follows - caustic liquids—use polypropylene pads	PIU (during commissioning) Hospital Authorities (Director/MS/MOIC, MO) (during operations of the laboratory)	Hospital Authority Director/MS/MOIC, MO) (during commissioning) Laboratory-in-charge (during operations of the laboratory/clinics /theatres, etc.)	Provision of safety equipment is part of the HSEP project cost. The provision of consumables to be used in emergencies is part of the recurrent cost of running the HFC.

[5] ISBN 978 92 4 154827 4 © World Health Organization 2011

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		or diatomaceous earth - oxidising acids—use diatomaceous earth - mineral acids—use baking soda or polypropylene pads - flammable liquids—use polypropylene pads • neutralise residues and decontaminate the area Anything beyond a minor spill and that requires help from outside of the laboratory group constitutes a major spill. Steps to deal with major spills include alerting coworkers, moving to a safe location, and calling authorities to report the situation. **(c) Biological spills** When surfaces are contaminated by biological spills, the appropriate actions to take are: (vii) Define/isolate the contaminated area (viii) Alert coworkers (ix) Put on appropriate PPE Remove glass/lumps with forceps or scoop (xi) Apply absorbent towel(s) to the spill; remove bulk and reapply if needed (xii) Apply a disinfectant to the towel surface			

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		(xiii) Allow adequate contact time (20 minutes) (xiv) Remove towel, mop-up, and clean the surface with alcohol or soap and water (xv) Properly dispose of materials (xvi) Notify the supervisor, safety officer, and other appropriate authorities. Disinfectant: For most spills, use a 1:50 solution (1 g/l chlorine) of household bleach (sodium hypochlorite solution containing 50 g/l chlorine). For spills containing large amounts of organic material, use a 1:10 solution (5 g/l chlorine) of household bleach, or an approved mycobactericidal[6] Alcohols are not recommended as surface decontaminating agents because they evaporate quickly, thus decreasing contact time. If laboratory personnel become contaminated with biological hazards due to splashes or spills, immediate steps to take include: 1. Clean exposed skin or body surface with soap and water, eyewash (for eye exposures) or saline (for mouth exposures). 2. Apply first aid and treat it as an emergency.			

[6] See World Health Organization. Laboratory biosafety manual, 3rd ed. Geneva, WHO, 2004

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		3. Notify supervisor, safety officer, or security desk (after hours). 4. Follow appropriate reporting procedures. 5. Report to the physician for treatment or counselling. **(d) Laboratory fires** Laboratory personnel need to be alert for conditions that might pose a risk for fires. Keep in mind that liquids with low flash points may ignite if they are near heat sources such as hotplates or equipment that might produce a spark or heat. A small laboratory fire is considered to be one that is extinguishable within 1–2 minutes. The appropriate action to take is to cover the fire with an inverted beaker or wet paper towels. If this fails, use a fire extinguisher. For large fires, call the appropriate local authorities, usually the fire department and the police department. The laboratory should have the appropriate class of extinguisher for the fire hazards in the laboratory. In general, a class BC or class ABC extinguisher is appropriate. Fire extinguishers must be inspected annually and replaced as needed. Laboratory personnel should be trained in the various classes of fires and basic fire			

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
		extinguisher use in annual laboratory safety and hazardous waste management training. All laboratory personnel must learn how to operate a portable fire extinguisher. **(e) General safety** Ensure that HCF staff do not have common pathways. This may be needed to prevent or reduce risks of cross-contamination, follow the path of the sample as it moves through the laboratory during the pre-examination, examination, and post-examination phases of testing. The design of laboratory work areas should ensure proper ventilation and surfaces that can be cleaned and disinfected. In establishing a safety management programme, it is essential to appoint a responsible supervisor. The lab should have a safety manual that establishes policy and describes standard procedures for handling safety and emergency issues. Personnel need to be trained in how to apply safety practices and techniques and to be aware of potential hazards			
8	Impairment of surface drainage	Construction of a stormwater drainage management system is needed for some of the hospitals.	Hospital Authority (DMO, MOIC, MO)	RDHS	This item is not part of the sub-project.

No	Activity/Env. impact	Mitigation measures	Implementation responsibility	Monitoring responsibility	Indicative cost of mitigation
9	Soil erosion	The areas peripheral to the new buildings need turfing to prevent soil erosion.	Hospital Authority (DMO, MOIC, MO)	RDHS	This item is not part of the sub-project.
10	Breakdown of power, water, and telecommunication facilities	The newly constructed buildings should be supplied by a dedicated electricity connection, water supplies and telecommunication facilities by the HCF. The HCF should have contingency measures to endure the uninterrupted supply of such facilities.	Hospital Authority (DMO, MOIC, MO)	RDHS	This item is not part of the sub-project.

ANNEXURE 7: ENVIRONMENTAL MONITORING PLAN

Impact/mitigation	Parameters to be monitored	Location	Measurement	Frequency	Monitoring Responsibility and sources of funds
Pre-construction and Construction Stage					
1. Minimise the need to remove large mature trees	Final layout plan Number of trees that need removal	Site premises	Number of large trees that need removal	Once after designs are completed	DSC to report to PIU Costs covered under design cost
2. Soil erosion control during excavation and construction	Final layout plan	Construction area Material stockpiles	Check design layouts Inspection of the site for the adequacy of soil erosion control measures, possibility of soil erosion	Once after designs are completed	The Contractor's liability to implement DSC to monitor and report to PIU
	Soil washed away with surface runoff		Visual observation	Daily	The Contractor's liability to implement DSC to monitor and report to PIU Costs covered under construction cost
3. Air-borne particulate matter and air quality deterioration due to excavation, construction work, stockpiling, and movement of heavy vehicles	Air-borne particle in the air Dust collected at the windowsills of the nearby buildings	Construction site Nearby buildings	Visual observation of dust in the air Feedback from hospital authorities	Daily - Continuous Weekly	The Contractor's liability to implement DSC to monitor and report to PIU Costs covered under construction cost

Impact/mitigation	Parameters to be monitored	Location	Measurement	Frequency	Monitoring Responsibility and sources of funds
4. Controlling noise and vibration levels due to excavation, construction work and movement of heavy vehicles	Noise and vibration levels		Qualitative observation of Noise/Vibration level Feedback from hospital authorities	Daily - Continuous Weekly	The Contractor's liability to implement DSC to monitor and report to PIU Costs covered under construction cost
5. Containment of contamination	Storage of potential contaminants and any spills	Storage areas	Inspection of the site for the adequacy of contamination control measures, the possibility of contamination	Daily	The Contractor's liability to implement DSC to monitor and report to PIU Costs covered under construction cost
6. Proper disposal of construction waste (non-hazardous)	Collection, storage and disposal of non-hazardous waste	Construction site, areas of waste storage	Inspection of the site for availability of waste collection bins, records of waste removed from the site, an inspection of disposal sites Events of open burning of waste	Daily	The Contractor's liability to implement DSC to monitor and report to PIU Costs covered under construction cost
7. Control of on-site drainage impairment	Surface Runoff patterns	Site premises and the peripheral areas	Visual observation and inspection of the site for stagnant water; blocked drains etc.	Daily	The Contractor's liability to implement DSC to monitor and report to PIU Costs covered under construction cost

Impact/mitigation	Parameters to be monitored	Location	Measurement	Frequency	Monitoring Responsibility and sources of funds
8. Containment of construction wastewater discharge	Discharge of construction wastewater	Site premises	Visual observation and inspection of the site for the open discharge of wastewater and pollution	Daily	The Contractor's liability to implement DSC to monitor and report to PIU Costs covered under construction cost
9. Pollution from labour camps, including proper collection and disposal, including MSW	Waste and wastewater generated due to labour gangs at site, collection and disposal methods Measures to prevent mosquito breeding and vermin infestations	Site premises	Visual observation and inspection of the activities of labour gangs, feedback from construction workers Observation of collection and disposal of MSW and whether wild animals are attracted. Locations and objects with potential for mosquito breeding; cleaning schedules should be checked.	Daily	The Contractor's liability to implement DSC to monitor and report to PHI (MOH) and PIU Costs covered under construction cost
10. Occupational health and safety issues This also should include wild animal attacks	Records of accidents	Site premises	Visual inspection of the site, adequacy of signage and delineation barriers, number of accidents and complaints registered in the GRM	Daily	The Contractor's liability to implement DSC to monitor and report to PHI (MOH) and PIU Costs covered under

Impact/mitigation	Parameters to be monitored	Location	Measurement	Frequency	Monitoring Responsibility and sources of funds
					construction cost
11. Occupational health and safety issues	Personal protective equipment (PPE) for workers should be provided as appropriate, which is mandatory Maintenance record of equipment Availability of first-aid and safety warnings	Site premises	Inspection of the site premises for proper use of PPE by workers and its enforcement procedures Inspection of availability of first-aid, adequacy of signage and delineation barriers, number of accidents and actions taken	Daily	The Contractor's liability to implement (compulsory) DSC to monitor and report compliance to PHI (MOH) and PIU Costs covered under construction cost
12. Complaints registered in the Grievances Redress Mechanism	Records of complaints		Nature of complaint and providing a proper solution	Continuous	PIU and Grievance Redress Committee of PIU, North Central Province No additional funds are needed.
Operational stage Note: Costs involved in environmental monitoring during the operations stage is part of the recurrent cost of running the HFC.					
1. Proper collection, treatment and disposal of wastewater	Leaking drains and pipelines, overflowing of drains and catch pits, septic tanks,	Locations where such wastewater is generated, collected,	Any signs of leaking drains and pipelines, overflowing of drains and septic tank	Daily	Hospital authorities to monitor and PHI of the relevant MOH area to check

Impact/mitigation	Parameters to be monitored	Location	Measurement	Frequency	Monitoring Responsibility and sources of funds
	manholes, and collection tank	treated, and disposed of.			
	Microorganisms	Monitoring of surface and groundwater located at close proximity of the discharge point	Test the surface and groundwater samples collected regularly	Semi-annual	Hospital authorities to monitor and PHI of the relevant MOH area to check
	All the parameters as stipulated in the EPL for regular monitoring	Treated effluent at point of discharge	Microorganisms and chemical presence	As stipulated in the EPL or monthly	Hospital authorities to monitor and CEA to check
	The volume of wastewater discharge	Treated effluent at point of discharge	Quantity of wastewater discharged		
2. Proper collection, storage, and disposal of healthcare waste (hazardous)	Method of collection, sorting, storage, and disposal of HCW	Locations where such waste is generated, collected, treated, and disposed of.	Inappropriate methods or lapses in methods collection, sorting, storage, and disposal of HCW	Daily	Laboratory staff and hospital authorities to monitor and PHI of the relevant MOH area to check
3. Soil erosion control during excavation and construction	Soil washed away with surface runoff	Peripheral areas of the HCF	Visual observation Check for the adequacy of soil erosion control measures, possibility of soil erosion	Continuous	Officer responsible for maintenance of the HCF
4. Control of on-site drainage impairment	Surface Runoff patterns	Site premises and the peripheral areas	Visual observation and inspection of the site for stagnant water, local flooding, blocked drains etc.	Continuous	Officer responsible for maintenance of the HCF

Impact/mitigation	Parameters to be monitored	Location	Measurement	Frequency	Monitoring Responsibility and sources of funds
5. Occupational Health and Safety Issues	• Emergency procedures • Events of chemical spills • Events of biological spills • Events of laboratory fires • General safety issues, including ventilation and tidiness • Gas leaks from the medical supply of oxygen, concentrators, concentrator plants, cylinders, etc.	HCF premises Washrooms, waste storage areas and peripheral areas of the lab. At all locations where medical gases are generated, stored and supplied.	Regular review of emergency preparedness procedures Regular review of emergency response procedures Regular review of emergency events, log entries, and safety logs and reports Stocks of consumables needed to be used during emergencies and spill events, firefighting equipment, etc., checks for their expiry dates Indoor air quality Quality control procedures as outlined in Standard Practices[7]	Continuous	Staff who is in charge of safety H&S Committee of the HCF

[7] Laboratory quality management system: handbook published by the WHO, ISBN 978 92 4 154827 4 © World Health Organization 2011

ANNEXURE 8: FORMS TO BE USED FOR ENVIRONMENTAL MONITORING

Environmental Field Monitoring Data Sheet

Health Sector Enhancement Project
Project Management Unit

Date of visit:
Name of HCF:
Location:

	EMP COMPLIANCE						
	Mitigation measures from the EMP	Progress Level (Activity Implementation Status)		Level of Execution (Environmental Rank)		Remarks - During this Field Visit	
		%	Color	Rank	Color	Photo Taken*	Observations
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Color code	Level of execution
	Good
	Moderate
	Poor

IMPLEMENTATION OF THE ENVIRONMENTAL MONITORING PLAN
– To be filled by the PIU/Design Supervision Consultant (at least monthly during

after each site visit/ Environmental Specialist (after each site visit)

PIU:

Name of Hospital and District:

Round:

Monitoring Period (Week/Month/Year):

Impact/mitigation	**Parameters to be monitored**	**Measurement**	**Frequency**	**Status of Monitoring:** - **Satisfactory** - **Partially satisfactory: Improvements needed** - **Not satisfactory** **(Mention any Standards/ Regulations that are referred to)**	**Remedial measures suggested for better monitoring (if the status of monitoring is not or partially satisfactory)**
Slope protection and soil erosion control in ground clearing	Final layout plan and detail designs for each site	Check design layouts	Once after designs are completed		
	Adherence to EMP	Visual observation	Once a week		
Minimising air quality deterioration due to demolition, reconstruction work, stockpiling and movement of heavy vehicles	Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.	Visual observation Feedback from hospital users	Weekly		
Controlling noise and vibration levels due to demolition, reconstruction work and movement of	Adherence to EMP	Visual observation	Weekly		
	Noise and vibration measurements	Noise/Vibration level	Twice during construction		

heavy vehicles					
Containment of soil erosion and contamination	Identify the type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures, including if these were intact following heavy rain	Inspection of the site for adequacy of soil erosion/ contamination control measures, evidence of soil erosion and contamination	Weekly		
Proper disposal of construction waste (non-hazardous)	Identify designated areas for concrete works, chemical storage, construction materials, and refuelling. Attach photographs of each area.	Inspection of the site for the presence of dumps or waste fires, records of waste removed from the site, an inspection of disposal sites	Weekly		
Proper disposal of construction waste (hazardous and discarded asbestos cement waste)	Identify any chemical stored on-site and provide information on storage condition. Attach photograph.	Visual observation of the site for adequacy of measures followed, feedback from contractor team	Weekly		
Proper dismantling, storage and disposal of asbestos cement waste	Method of removal and storage	Visual observation of the site for adequacy of measures followed, feedback from contractor team			
Control of on-site drainage	Adherence to EMP	Visual observation	Weekly		

impairment		and inspection of the site for stagnant water blocked drains etc.			
Containment of construction wastewater discharge	Identify muddy water was escaping site boundaries or muddy tracks were seen on adjacent canals/roads	Visual observation and inspection of the site for open discharge of wastewater and pollution	Weekly		
Pollution from labour camps	Adherence to EMP	Visual observation and inspection of the labour camps, feedback from construction workers	Weekly		
Occupational health and safety issues and complaints registered in the GRM	Adherence to EMP	Visual inspection of the site, adequacy of signage and delineation barriers, number of accidents and complaints registered in the GRM	Weekly		
Public health and Safety	Provide information on barricades, signages, and on-site boards. Provide photographs.	Visual inspection of Site and surroundings; Checking if there are any activities being undertaken out of working hours and how that is			

		being managed.			

Any other relevant details:

Name

Designation

Signature

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

DISTRICT
HOSPTIAL

NAME: _____ DATE: _____
TITLE: _____

WEATHER CONDITION:
_____

SITE CONDITION (Provide details)

Satisfactory _____ Unsatisfactory _ Partially satisfactory_____

Inspection

Water pollution	Waste Minimisation
Wastewater collection and discharge	Reuse and Recycling
Air Quality	Dust and Litter Control
Noise and vibration	Trees and Vegetation
Hazardous Substances	Nuisance

Site conditions acceptable Yes ☐ ☐

INCIDENTS (Provide details – attach additional sheets, if needed)

Resolved Unresolved

INCIDENT 1

Nature of incident:

Intervention Steps to Resolve and conditions

Method of Monitoring

INCIDENT 2

Nature of incident:

Intervention Steps to Resolve and conditions

Method of Monitoring

Signature_____

ADB Financed Health System Enhancement Project (HSEP)
Quarterly Progress Report – Grievance Redressal Issues

PIU: …… **Period (Quarter ending and Year)** ……

During the Reporting Period, the following are the details of complaints received and complaints redressed.

(i) Details of Complaints Received during the reporting Period

Serial No.	Sub-project (HCF)	Summary of Grievances	Name and address of the complainant	Date of Receipt	Register Number

(ii) Details of Meetings (GRC and other meetings) held to solve the Grievances:

Serial No.	Date and Venue of the Meeting	Details of Participants	Outcome of meetings

(iii) Details of Grievances addressed fully during the reporting period, including those which have been carried forward from the previous quarter[1]

Serial No.	Details of the Grievances	Date Received	Date Redressed completely

[1] Provide details of any grievances not addressed fully during the previous quarter but addressed fully

during this reporting period

Report Prepared by:
Date:

ANNEXURE 9: LIST OF PERSONS CONSULTED

Central Province
Provincial Director/Deputy Project Director – Dr. M. Nihal Weerasooriya
Regional Director – Kandy – Dr. Senaka Thalagala
Regional Director – Matale - Dr. Chaminda Weerakoon
Regional Director – Nuwareliya – Dr. M.S.N. Manatunge
Medical Superintendent – Theldeniya – Dr. Nimesh Prathapasinghe
Medical Superintendent – Dambulla – Dr. Gamini Wimalasena
Medical Superintendent – Rikillagaskada – Dr. W. A. Nishshanka
Project Engineer – Eng. Hemali Alagiyawanna

North Central Province
Provincial Director/Deputy Project Director – Dr. Palitha Bandara
Regional Director – Anuradhapura – Dr. N.C.D. Ariyarathna
Regional Director – Polonnaruwa - Dr. W.K.W.S. Kumarawansa
Medical Superintendent – Medirigiriya – Dr. J.M.S.A. Jayasinghe
Medical Superintendent – Thambuttegama – Dr. N.H. Dharmatilake

Sabarabamuwa
Provincial Director/Deputy Project Director - Dr. Kapila Kannangara
Deputy Regional Director – Kegalle – Dr. Nandika Wickramasinghe
Regional Director – Rathnapura - Dr. N.G.S. Panditharathna
Deputy Regional Director – Rathnapura – Dr. Shreeni Alahapperuma
Medical Superintendent – Karawanella – Dr. Manel Wimalaratne

Uva
Provincial Director/Deputy Project Director - Dr. Janitha Tennakoon
Regional Director – Badulla – Dr. L.A.A.H.K. De Silva
Regional Director – Monaragala - Dr. A.M.T.K. Attanayake
Medical Superintendent – Welimada – Dr. N. Samuruthilake
Medical Superintendent – Bibile – Dr. U.M.M. Pushpalatha