

Environmental Monitoring Report

Semi-Annual Report no. 3
For the period covered January–June 2018
Project Number: 47381-002
July 2018

SRI: Mahaweli Water Security Investment Program – Tranche 1

Upper Elahera Canal Project (UECP)

Prepared by Ministry of Mahaweli Development and Environment with the assistance of Program Management, Design and Supervision Consultant (Joint Venture Lahmeyer International GmbH – GeoConsult ZT GmbH) for Democratic Socialist Republic of Sri Lanka and the Asian Development Bank.

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Mahaweli Water Security Investment Program

SEMI ANNUAL ENVIRONMENTAL MONITORING REPORT No. 3 FOR UECP January to June 2018

JULY 2018



Program Management, Design and Supervision Consultant

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SEMI ANNUAL ENVIRONMENTAL MONITORING REPORT FOR UECP - JANUARY to JUNE 2018

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ABBREVIATIONS

ADB	Asian Development Bank
AIS	Alien Invasive Species
CEA	Central Environmental Authority
CEMP	Contractor's Environmental Management Plan
D&B	Drill and Blast
D/S	Down Stream
DS	Divisional Secretary
DWC	Department of Wildlife Conservation
EARF	Environmental Assessment Review Framework
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Method Statements
	Environmental Monitoring Specialist
EO	Environmental Officer
EPL	Environmental Protection License
FAM	Facility Administration Manual
FD	Forest Department
GoSL	Government of Sri Lanka
GRC	Grievance Redress Committee
GSMB	Geological Survey and Mines Bureau
ICB	International contractor bidding
IML	Industrial Mining License
KMTC	Kaluganga Moragahakanda Transfer canal
MIT	Mahakithula Inlet Tunnel
MLBCRP	Minipe Left Bank Canal Rehabilitation Project
MMDE	Ministry of Mahaweli Development and Environment
MRB	Mahaweli River Basin
MWSIP	Mahaweli Water Security Investment Program
NATM	New Austrian Tunnelling Method
NCB	National Contractor bidding
NWPCP	North Western Canal Project
PD	Program Director/Project Director
PIU	Project Implementation Unit
PMDSC	Project Management Design Supervision Consultant
PMU	Program Management Unit
RE	Resident Engineer
SAEMR	Semi Annual Environmental Monitoring Report
SPS	Safeguard Policy Statement
SEO	Senior Environmental Officer
STC	State Timber Cooperation
TBM	Tunnel Boring Machine
UECP	Upper Elahera Canal Project

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1. INTRODUCTION

1.1 Mahaweli Water Security Investment Program (MWSIP) and Upper Elahera Canal Project (UECP)

1. The **Upper Elahera Canal Project (UECP)** comprises two components. The first component is the 9 km Kalu Ganga-Moragahakanda Transfer Canal (KMTC) which includes 8 km tunnel that transfers water between the Kalu Ganga and Moragahakanda reservoirs. The second component is the Upper Elahera Canal that connects the Moragahakanda reservoir to the existing reservoirs: Huruluwewa, Eruwewa and Mahakanadarawa via 92 km of canals (including a 27.7-km tunnel). These reservoirs supply existing irrigation and water supply schemes. The UEC is to be implemented in 3 Tranches:

- (i) Tranche 1 is to construct the UEC from 0+100 km to 6+226 km (UEC-ICB-1)
- (ii) Tranche 2 will include construction of UEC Tunnel 3 and Tunnel 4 from 27+509 km to 55+600 km (UECP-ICB-2A), and the Kaluganga – Moragahakanda Transfer Canal (KMTC) from 0+000 km to 8+830 km (UECP-ICB-2B)
- (i) Tranche 3 will include construction of UEC from 6+226 km to 27+700 km including Kongketiya level crossing (UECP-ICB-3), UEC from 55+600 km to 65+500 km (UECP-ICB-4), and UEC-ICB-5 will include construction of feeder canal from the end of UEC to Mahakanadarawa reservoir (0+000 km to 30+535 km)

2. Construction contract UECP-ICB-1 (MMDE/MWSIP/ADB/MLBCRP/NCB-5/3267-3268/SRI/NCB/2016/019) commenced on 11 January 2017 by CML-MTD Construction Limited; the expected completion date is 08 January 2020.

3. UECP-ICB-1 package is the initial section of the UEC connecting with the Moragahakanda Reservoir, which includes construction of 3+760 km water conveyance system. The construction work includes 1,313 m of closed canal with Rectangular Double Conduit and 2,404 m of cut and cover section with Circular Conduit. The physical construction progress by June 2018, i.e. after 18 of 36 months, is 22.6 %.

4. The construction contract with Sinohydro Corporation Limited for UECP-ICB-2B (KMTC) under Tranche 2, was signed on 16 May 2018; the commencement is expected in September 2018.

1.2 Scope of the Report

5. This Semi-Annual Environmental Monitoring Report (SAEMR) is prepared addressing following aspects, based on the available information with respect to the monitoring period from January to June 2018:

- (ii) Background/context of the monitoring report (adequate information on the project, including physical progress of project activities, scope of monitoring report, reporting period, and the monitoring requirements including frequency of submission as agreed upon with ADB);
- (iii) Changes in project scope and adjusted safeguard measures;
- (iv) Qualitative and quantitative monitoring data;
- (v) Monitoring parameters/indicators and methods based on the EMP previously agreed upon with ADB;
- (vi) Monitoring results compared against previously established benchmarks and compliance status (e.g., obtaining necessary approvals for establishment of certain facilities, national environmental

- emission and ambient standards and/or standards set out in the WB's EHS guidelines; timeliness and adequacy of environmental mitigation measures; and training, capacity building, etc.);
- (vii) Monitoring results compared against the objectives of safeguards or desired outcomes documented (environmental impacts avoided or minimized, etc.);
 - (viii) Corrective action plan in any case of non-compliance or any major gaps identified;
 - (ix) Records on disclosure of monitoring information to affected communities;
 - (x) Identification of key issues, or grievances from affected people, or recommendations for improvement;
 - (xi) Monitoring adjustment measures recommended based on monitoring experience/trends and stakeholder's response;
 - (xii) Information about actual institutional arrangements for implementing the monitoring program;
 - (xiii) Proposed items of focus for the next reporting period and due date.

6. This SAEMR No. 3 is prepared to update the progress of UECP with respect to environmental safeguard aspects for the period from January to June 2018, which fulfils an ADB requirement to submit a SAEMR to ADB and Central Environmental Authority (CEA) for the "Category A" projects as documented in FAM¹ and EARF².

7. The purpose of this report is to ensure that the Project is implemented with due concern for environmental and social safeguards according to the ADB's Safeguard Policy Statement (SPS) 2009, and specifically to ensure that these issues are adequately addressed in compliance with the requirements of ADB. Further, this report is to assess the progress with implementation of the program in complying with the approved Environmental Impact Assessment (EIA) including Addendum to the EIA: UECP Tranche 1 and Tranche 2 packages (July 2017) and Environmental Management Plan (EMP)³ as per the stipulation No. 14.1 of the EIA approval No. 08/EIA/WATER/04/2012 issued by CEA on 31 March 2016 and approval for the addendum (Ref.08/EIA/Water/04/2012/Vol. 2 dated as 23 April 2018).

8. This SAEMR for UECP is prepared by the Environmental Specialist of PMDSC based on the monthly monitoring and progress reports received from the Environmental Monitoring Specialist (EMS), and the updates which were received from the Environmental Specialist of PMU and Senior Environmental Officer of PIU.

¹ Paragraph 60 of Facility Administration manual (FAM), June 2015 prepared by MMDE.

² Paragraph 111 of Environmental Assessment Review Framework (EARF) November 2014 (updated in June 2017) by MMDE.

³ Environmental Impact Assessment Report (EIAR) dated June 2015 and approved by CEA on 31.03.2016.

2. OVERALL PROGRESS OF UECP

2.1 UECP at a Glance

9. The UECP-ICB-1 contract under Tranche 1 has been awarded, and the UECP-ICB-2B contract, under Tranche 2, has been signed. The details of the respective Contracts and Contractors are summarized in Table 2-1.

Table 2-1: Summary of the UECP Contract Packages under Tranche 1 and Tranche 2

Package	UECP-ICB-1	UECP-ICB-2B
Work Description	Construction of Upper Elahera Canal From 0+100 km to 6+226 km	Construction of Upper Elahera Canal, Kaluganga - Moragahakanda Transfer Canal (KMTC) 0+000 km to 8+830 km
Package No.	MMDE/MWSIP/ADB/UECP/ICB-1/3267-3268-SRI/ICB/2016/002	MMDE/MWSIP/ADB/UECP/ICB-2B/P47381-005-SRI/ICB/2016/026
Name of the Contractor	CML-MTD Construction Limited – Sri Lanka	Sinohydro Corporation Limited - China
Address	No. 155, Dharmapala Mawatha, Colombo - 07	5th - 7th Floor, No. 456, R. A. De Mel Mawatha, Colombo 3
Contract Amount LKR (incl. VAT)	3,742,442,875.47	8,218,575,075.94

10. Table 2-2 summarizes the status of contract bidding of UECP Tranche 3 contract packages by end June 2018.

Table 2-2: Progress of Tranche 3 UECP Packages

Contract Package	Progress	Status of Environmental Safeguard Documentation
UEC-ICB-2A: Construction of Upper Elahera Canal from 27+509 km to 55+600 km, long tunnel	6 th revision of the bid documents addressing ADB comments submitted in Feb 2018	<ul style="list-style-type: none"> Design changes were addressed in the Addendum to EIA including updated EMP prepared in July 2017, followed by a rapid environmental survey subjected to the design changes, and the CEA and ADB approval granted by April 2018
UECP-ICB-3: Construction of Upper Elahera Canal from 3+860 km to 17+700 km	1 st revision of the bid documents addressing TRC comments submitted in December 2017	<ul style="list-style-type: none"> Updated EMP prepared in October 2017 to be submitted with the draft bidding documents Structural mitigations proposed by WMP were included into the designs
UECP-ICB-4: Construction of Upper Elahera Canal (UEC) from 17+700 km to 27+509 km, including two tunnels (955 m)	2 nd revision of the bid documents addressing TRC comments submitted in January 2018	<ul style="list-style-type: none"> Addendum to EIA addressing design changes to be prepared and submitted, and based on the rapid ecological baseline surveys, the updated EMP to be revised and submitted to ADB and CEA

2.2 Safeguard Documentation and Approvals

2.2.1 EIA Addendum and updated EMPs

11. UECP is classified as Category “A” according to ADB’s SPS (2009) and the conditional approval (EIA approval No. 08/EIA/WATER/04/2012 issued by CEA) is valid for a period of 3 years commencing from 31 March 2016.

12. As updated in the previous SAEMR, the design changes made in comparison to the approved EIA with respect to UECP Tranche 1 and Tranche 2 packages (which included UECP-ICB-1, UECP-ICB-2A and UECP-ICB-2B) were submitted in an Addendum to EIA to CEA in October 2017 and to ADB in August 2017. CEA held the Technical Review Committee (TRC) meeting on 30 November 2017 on the submitted report, and the letter summarizing comments and clarifications required were sent to PMU on 30 January 2018. CEA and DWC approval of the EIA addendum was granted on 23 April 2018 (Ref. 08/EIA/Water/04/2012/ Vol. III given in **Annex 1**).

13. The updated EMPs have been completed and submitted to CEA and ADB, for the Tranche 1 and Tranche 2 packages of UECP-ICB-1, UECP-ICB-2A and UECP-ICB-2B.

2.2.2 Other Safeguard Compliances

14. The compliance status related to the CEA approval conditions related to UECP - followed up by the Senior Environmental Officer (SEO) of PIU and Environmental Monitoring Specialist of PMDSC - is summarized in **Table 2-3**.

Table 2-3: Compliance with CEA Conditional Approval

No.	Approval Condition	Compliance Status	Remarks
1	Preparation of Wildlife Management Plan (WMP)	Plan prepared & submitted to CEA for approval	Accepted for implementation at stake holder meeting on 17 May 2018 by CEA subject to further improvements, which are being undertaken now
2	Implementation of WMP recommendations	Implementation of the WMP is in progress	<ul style="list-style-type: none"> 20 signboards were erected by the Contractor as per the request of the Wildlife Department of Elahera. Above signboards were erected to raise awareness of the surrounding community for elephant migration routes, elephant corridors etc.
		Work plan & activity plan prepared for implementation	Refer Annex 2
3	Design changes for the Tranche 1 and Tranche 2 UECP packages (UECP-ICB-1, ICB-2A and IC- 2B) were addressed in the Addendum to EIA including	Approval was issued in April 2018	

	updated EMP prepared in July 2017		
4-a	Implementation of EIAR recommendations (non-construction based)	<ul style="list-style-type: none"> • Small scale rural nurseries (3 nos.) have been established to produce 5,000 plants for restoration of the canal trace after completion of the construction work • Completed sections of the canal trace will be rehabilitated, and appropriate tree planting will be carried out by the Contractor in 2018 • Memoranda of Understanding (2 MoUs) were prepared for reforestation of 150 ha under ICB-1 	
4-b	Construction based events: e.g. key events of site monitoring with responsive actions in case of non-compliances	<ul style="list-style-type: none"> • Non-significant environmental issues were corrected by joint field inspection with Resident Engineer, Environmental Monitoring Specialist and relevant officials of Contractor and PIU • Monthly Environmental Progress Review meetings followed by a joint site inspection with the Contractor, PMDSC (ES and EMS), PIU (SEO) and PMU relevant staff commenced since June 2018 • Non-compliance reports (NCR) / warning letters / instructions to rectification were raised for non-compliance issues through RE UECP • Regular site monitoring is being conducted by EMS of PMDSC 	

3. STATUS OF CONTRACT PACKAGE UECP-ICB-1

3.1 Physical Progress

15. The summary highlighting the construction progress of contract package UECP-ICB-1 (Upper Elahera Canal from near Moragahakanda Dam up to Level Crossing for Kongetiya Tank from 0+100 km to 3+980 km), as of June 2018 is given in **Table 3-1**.

Table 3-1: Construction Progress of Contract Package UECP-ICB-1 by June 2018

Rectangular Section					Circular Section				
Description	Section 01		Section 04		Description	Section 02		Section 03	
	From km 0+916 to km 1+420		From km 0+100 to km 0+916			From km 1+420 to km 2+320		From km 2+320 to km 3+980	
	Total Length (m)	504	Total Length (m)	816		Total Length (m)	900	Total Length (m)	1,660
	Work completed (m)	%	Work completed (m)	%		Work completed (m)	%	Work completed (m)	%
Site Clearing	504	100%	312	38%	Site Clearing	900	100%	1,368	82%
Excavation	456	90%	108	13%	Excavation	276	31%	396	24%
Screed Concrete	408	81%	108	13%	Screed Concrete	276	31%	384	23%
Base Concrete	384	76%	84	10%	Base Concrete	228	25%	384	23%
Wall Concrete	372	74%	48	6%	Circular Concrete	156	17%	180	11%
Roof Concrete	288	57%	0	0%	Backfilling	0	0%	60	4%
Backfilling	108	21%	0	0%	-		0%		0%

Source: RE UECP, dated 04.07.2018

16. Tree felling is completed in all the 4 sections except between 2+800 km to 3+450 km. The section 3 clearing was delayed intentionally until the backfilling is completed in sections 1 and 2, to avoid any disturbances for the animal movements across the canal.

17. Backfilling is completed only for 21 % of section 1 (rectangular section). The restoration and landscaping has not yet started. A Variation is under preparation for canal reservation habitat enrichment by the Engineer simultaneously with the backfilling work as shown in **Figure 3-1**.

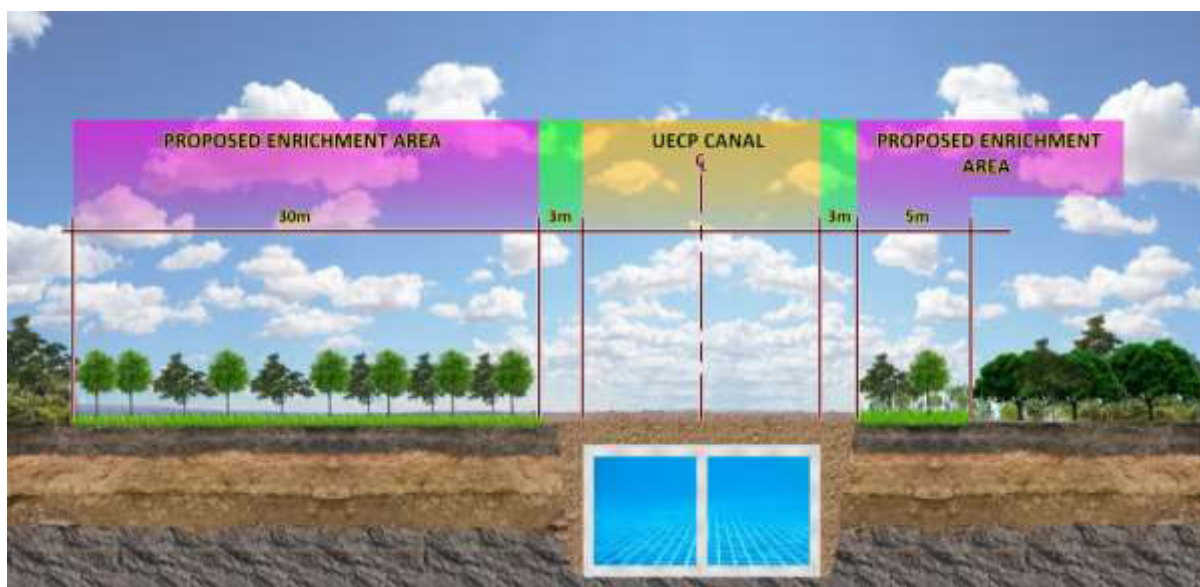


Figure 3-1: Layout Plan for Ecological Restoration through Reforestation along Canal Reservation

3.2 Changes in Project Scope and Adjusted Safeguard Measures

18. **Table 3-2** summarizes the actions taken due to change of project scope in the UECP-ICB-1 contract package.

Table 3-2: Actions Taken due to Change of Project Scope in UECP-ICB-1

Change in Scope	Safeguard Measure Adjusted / Required
<ul style="list-style-type: none"> The rock excavation quantity increased by 5 times compared to the original BOQ, and hence, the area for temporary and permanent disposal sites had to be increased Out of the three originally proposed temporary disposal areas as included in the bidding document, only one site is used. According to PIU, Wildlife Department has not given their concurrence to use the other two sites, one near Kongetiya tank, and the site proposed at the right side of Section 1 between 1+000 km and 1+500 km (Figure 3-2). 	<ul style="list-style-type: none"> Site surveys were carried out to identify the used temporary disposal areas and the approval status by EMS/ES of PMDSC and SEO of PIU (Annex 3) Contractor and the Engineer to jointly workout mass balance on reuse of quantities from the excavated material Based on the mass balance findings, request PD-PIU to identify additional areas for disposal; identify a permanent disposal area

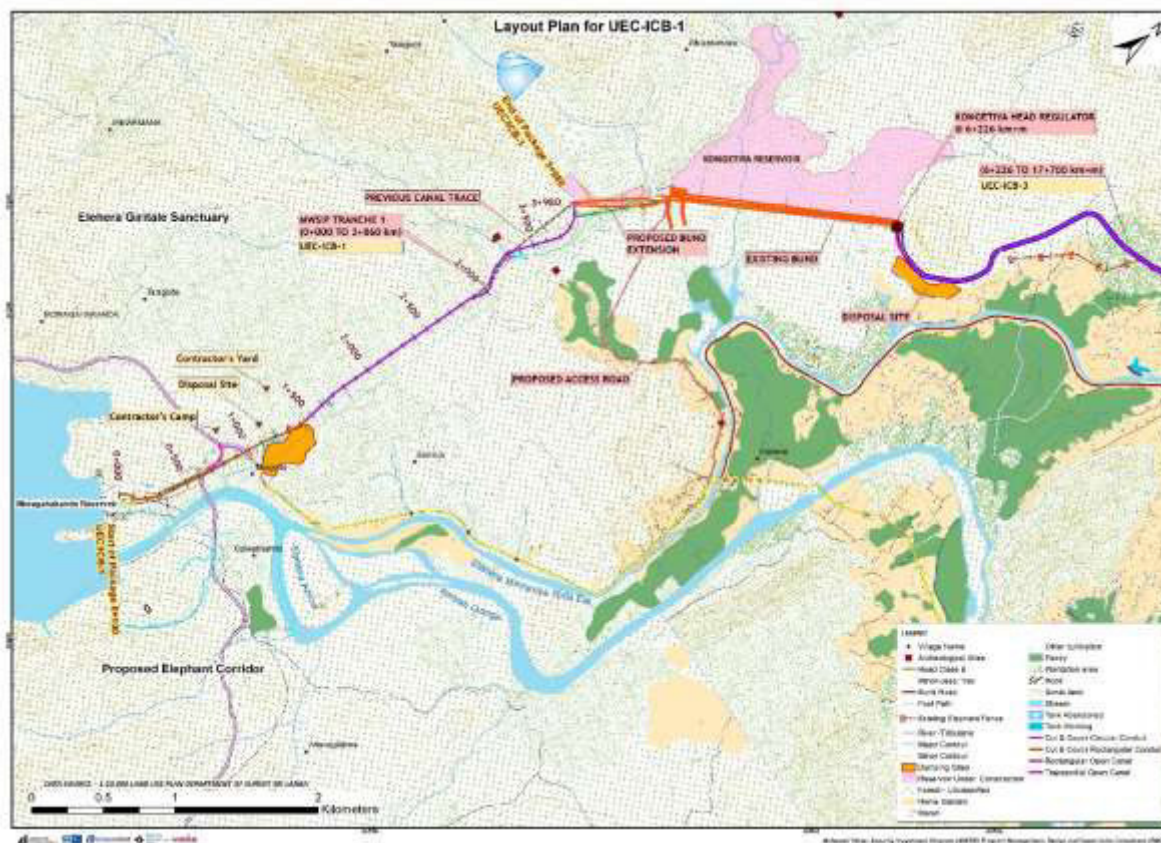


Figure 3-2: Proposed Temporary Disposal Sites for UEC-ICB-1 as in the Contract Document

3.3 Approval Status

19. A summary of the approval status related to ongoing construction activities is given in **Table 3-3**.

Table 3-3: Summary of Approval Status under UEC-ICB-1

Project Activity / Facility	Type of Approval	Responsible Institution	Compliance Status Update (Reference No. and Expiry Date)
Implementation of the Project	Approval	CEA	Obtained (refer letter No. 08/EIA/Water/04/2012); valid until 30.03.2019
Land for the Construction Activities	Approval	DWC	Obtained (refer letter No. WL/6/1/1/266 of DWC)
Land for the Accommodation Facilities	Approval	DWC	Obtained (refer letter No. WL/6/1/1/255-1 of DWC); valid until 23.05.2020
Accommodation	EPL	CEA	Obtained, May 2021
Removal of Trees	Approval	DWC/FD	Obtained (refer letter No. WL/6/1/1/266 of DWC)
Site Clearing	Permission	DWC	Obtained (refer letter No. WL/6/1/1/266 of DWC to PD)

Project Activity / Facility	Type of Approval	Responsible Institution	Compliance Status Update (Reference No. and Expiry Date)
Implementation of the Project	Permission	Department of Archaeology	Obtained (refer letter No. ARCH/PO/EXP/04/11/2017)
Electric Fencing	Approval	PMDSC	Obtained (refer letter No. PMDSC-UEC-Site/ICB-1/CMLMTD/067); valid for the project period
Handling of Explosives	Explosive Licenses	MoD	Obtained (received 19/08/2017, refer letter No. 275258); expired on 13.02.2018
Rock Blasting Activities	Permission	DWC	Obtained (refer letter No. WL/6/1/1/255-1 of DWC); valid for the project period
Test Blast		GSMB	Obtained (refer letter No. CME/TB/IML/A/CP/MQUR/2017/25052/119/23.06.2017)
License for Rock Excavation	IML	GSMB	Obtained (refer letter No. IML/A/HO/10778, 24.07.2018)
Concrete Batching Plant	EPL	CEA	Obtained (refer letter No. CEA/CPO/ MT/07/403/2017); valid until 16.10.2018
Mobile Crusher Plant	EPL	CEA	Obtained (refer letter No. 14564 (RO)); valid until 16.10.2018
Water extraction from Ambanganga	Permission	MDP	Obtained (refer letter No. CEA/CPO/ MT/07/402/2017); valid for total project period
Disposal Sites	Approval	DWC	Obtained (refer letter No. 14566 (RO))

3.4 Site Inspections, Training and Awareness

3.4.1 Site Inspections and Consultative Sessions Carried Out during Monitoring Period

20. A summary of meetings, site visits and consultative sessions carried out with the participation of the Environmental Specialist (ES) and/or the Environmental Monitoring Specialist (EMS) of PMDSC is given in **Table 3-4**.

Table 3-4: UECP-ICB-1 - Site Inspections, Consultative Sessions, Meetings during Monitoring Period

Date	Location	Participants	Objective
25.01.2018	ICB-1 Construction area	- CML: EO and SS - PMDSC: CRE, RE, SCE and EMS	Site inspection for observing invasive plants
25.01.2018	ICB-1 Construction area	- PIU staff - ADB -team - PMDSC-CRE, RE and his staff - CML-PM and his staff	Joint site inspection with ADB team
07.02.2018	RE Office	- PIU: PD and his staff - CML: PM, EO and his staff - PMDSC: CRE, RE, his staff, and EMS	Progress reviewing of all project activities including environmental safeguards
16.02.2018	Moragahakanda Project Office	- Secretary, Ministry of Mahaweli - Staff of DWC, FD and DSs - CML: PM and his staff - PMDSC: CRE, RE, his staff, and EMS	Meeting for discussion of the current issue of the project
07.03.2018	ICB-1 Construction area	- PIU staff - ADB mission team - PMDSC: CRE, ES, EMS, RE and his staff - CML: PM and his staff	Attending ADB mission meeting at UECP, field inspection with ADB team
14.03.2018	RE Office	- PIU: PD and his staff - CML: PM, EO and his staff - PMDSC: CRE, RE, his staff, and EMS	Progress review of all project activities including environmental safeguards
06.04.2018	DWC Ranger Office	- DWC: Ranger officer and his staff - CML: EO - PMDSC: EMS	Discussing maintenance of the elephant fence
11.04.2018	RE Office	- PIU: PD and his staff - CML: PM, EO and his staff - PMDSC: CRE, RE, his staff, and EMS	Progress review of all project activities including environmental safeguards
09.05.2018	RE Office	- PIU: PD and his staff - CML: PM, EO and his staff - PMDSC: CRE, RE, his staff, and EMS	Progress review of all project activities including environmental safeguards
10.05.2018	Laggala, RFO Office	- FD: Ranger officer and his staff - PMDSC: EMS	Location identification for reforestation programme
17.05.2018	CEA Office Battaramulla	- PMU: PD and ES - PIU: PD and SEO - PMDSC: ES, EMSs - CEA staff - DWC-staff	Attended Stakeholder review on Wildlife Management Plan at CEA for UECP

Date	Location	Participants	Objective
		- FD staff	
23.05.2018	UECP area	- ES of PMDSC together with contractor's EO	Site monitoring
13.06.2018	RE Office	- PIU: PD and his staff - CML: PM, EO and his staff - PMDSC: CRE, RE, his staff, and EMS	Progress review of all project activities including environmental safeguards
23.06.2018 and 24.06.2018	<u>UEC-ICB-2B:</u> - Proposed land area for inlet tunnel portal No. 1 - Areas for tunnel portals and construction of aqueduct - Contractor's camp, Engineer's office	- ES and EMS of PMDSC, Field team	Visit to priority areas for tree felling and access road preparation under KMTC; Participation in species translocation program in KMTC priority areas for site clearance

3.4.2 Training and Awareness Carried Out during Monitoring Period

21. An awareness program commemorating "World Environmental Day" was organized on 05 June 2018, to make the Contractor's staff aware about the effects due to plastic pollution and how to reduce plastic waste.

22. The contractor's EO carried out the 'Tool Box'-meeting once a week; minutes were shared with the Engineer (**Figure 3-3**). Environmental / safety introduction training was also carried out by the EO-Contractor with the Safety Officer for new labours. In the introduction training, a separate session is carried out to raise the awareness of the workers on "How to avoid elephants during work". The Monthly Environmental Training has not been carried out for the past 2 months, as no new recruitments took place.



Tool box meeting conducted by EO of the contractor (May 2018)



Environmental Protection Training (March 2018)

Figure 3-3: Awareness and Training Sessions Conducted by the Contractor

3.5 Summary of Construction Monitoring Findings in UECP-ICB-1

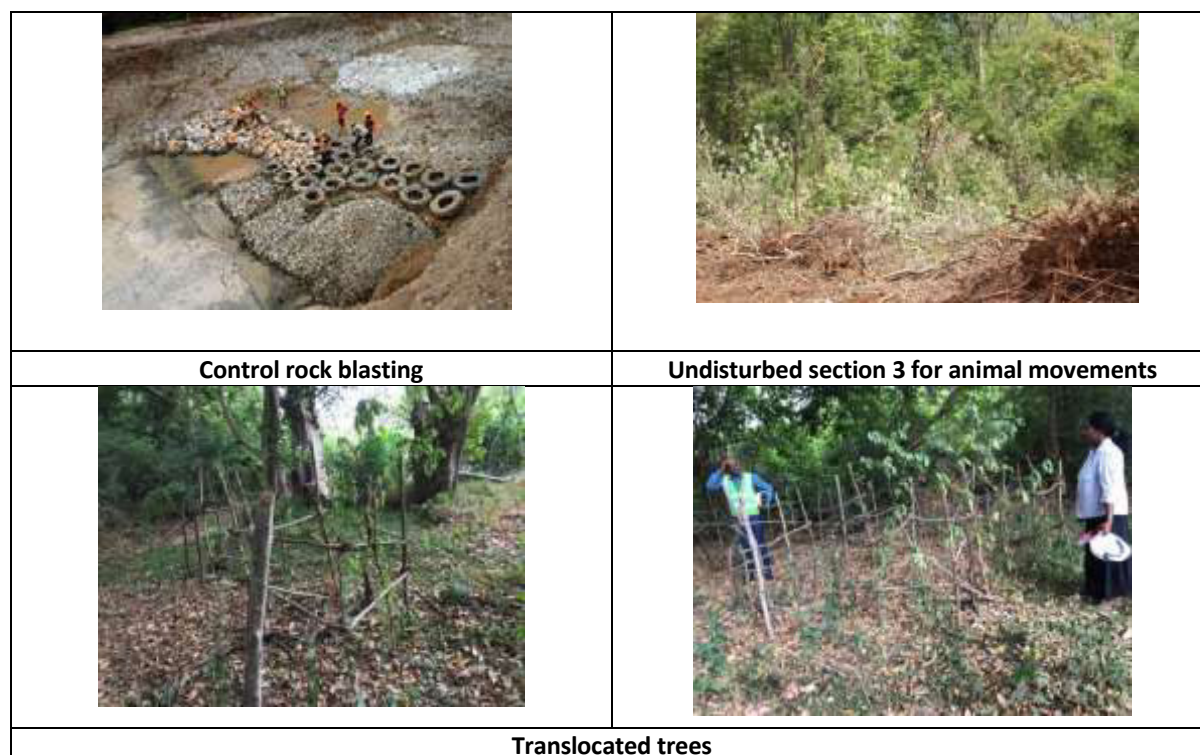
3.5.1 Best Environmental and Engineering Practices Implemented by UECP-ICB-1 Contractor

23. The Contractor is always trying his best to implement and maintain environmental protection measures complying with the EMP recommendations. Photographic evidences for some of the key environmental mitigation measures adopted by the Contractor are shown in **Figure 3-4**.



Maintenance of electric fence and safety fence preventing animal falling into excavated sections

Water sprinkling to avoid dust

**Figure 3-4: Best Environmental Practices by UECP-ICB-1**

3.5.2 Prioritised List of Non-Conformance Findings and Recommended Corrective Actions Related to UECP-ICB-1

24. The prioritised list of non-conformances recorded during the monitoring visits of the ES and EMS are summarised in **Table 3-5** with the corrective actions recommended to the Contractor.

Table 3-5: Non-conformances Recorded in UECP-ICB-1 Area and Recommended Corrective Actions

Non-conformance Records	Recommended Corrective Actions	Compliance Progress
Dust generation from crusher plant (throughout the monitoring period)	<ul style="list-style-type: none"> Fixing of water sprinklings and cover dust creating places of the plant 	No adequate water browsers; warning raised in writing in May 2018
Poor maintenance of electric fence encircling the deep excavated sections and construction area (throughout the monitoring period)	<ul style="list-style-type: none"> Actions taken to obtain service from the Elahera Range office of DWC paid by the Contractor 	Rectified by end of June 2018
Safety fence established at the edge of the excavated area damaged; records of small animals (Cobra snake) falling into the excavated area on 11.06.18	<ul style="list-style-type: none"> DWC to be informed Cobra removed from the site by DWC PSO No. 6 issued end of June 2018 asking the Contractor to establish safety and maintenance of the safety fence using the provisional sum budget allocated for additional environmental mitigation measures 	Immediately

Non-conformance Records	Recommended Corrective Actions	Compliance Progress
Stock piling and excess dumping areas operating without proper restoration plan	<ul style="list-style-type: none"> EMS prepared inventory for the existing disposal areas in the construction area (Annex 3) EMS worked out identifying additional areas for permanent dumping areas through PD-PIU Required areas to be identified by the Contractor 	In progress by end of June 2018
Backfilling was initiated without specific Method Statement (MS)	<ul style="list-style-type: none"> Instruct the Contractor to submit MS for backfilling and restoration 	In progress by end of June 2018
Dust emission from batching plant	<ul style="list-style-type: none"> Fixing of water sprinklers and covering the plant 	Not rectified up to the end of June 2018
Placing concrete waste in the site	<ul style="list-style-type: none"> Concrete was removed 	Rectified immediately

3.5.3 Photographic Monitoring Records for Key Non-Compliance Issues Recorded in UEC-ICB-1 Area





	
Dust issues	
	
Cobra inside of the canal (11.06.18)	Placing concrete waste in the site

Figure 3-5: Non-Compliance Issues Recorded in UECP-ICB-1 Contract

3.6 Contractor's Reporting, Documentation Progress, Comments

CEMP approval / update status	:	CEMP to be updated as per the ongoing construction activities.
Self-monitoring records of the Environmental Officer	:	<ul style="list-style-type: none"> • Test reports under self-monitoring for background vibration levels has been carried out. • The Contractor has been instructed by the Engineer to carry out self-monitoring for environmental parameters on ambient air quality (particulate matter) and background noise.
Submission and approval of Environmental Method Statement	:	<p>The following Environmental Method Statements have been submitted:</p> <ul style="list-style-type: none"> • UEC-CML-EN-M-003 - EMS for reinforced concrete work • UEC-CML-EN-M-002 - EMS for earth work • UEC-CML-EN-M-001 - EMS for site clearance <p>The Contractor has been informed to submit the Environmental Method Statements including site restoration plans for the backfilling, stream diversion and restoration and management and restoration of disposal areas.</p>
Environmental Issue Log	:	<p>The Environmental Issue Log is maintained by the Contractor; the following key issues have been recorded for the months of May and June:</p> <ul style="list-style-type: none"> • Dust generation • Falling small animals into the excavated sections due to the damage of safety fence • Improper stream diversion
Grievance Log	:	Not maintained
Submission of Monthly Environmental Monitoring Report	:	Yes

4. DISCLOSURE AND ADDITIONAL MITIGATORY MEASURES

4.1 Disclosure of Monitoring Information to Affected Communities

25. During the reporting period PIU and PMU have conducted one community awareness and consultation program related to UECP project activities (**Table 4-1**).

Table 4-1: Summary of the Awareness Session and Community Consultation

No .	Type of Event	Purpose	No. of Participants	Location (GN-DS)	Date	Resource Persons
1	Awareness meeting	Raising awareness for environment conservation and safety and social safeguard under ICB-1	School Children and Teachers (50 nos.)	Elahera Vidyalaya	14.03.2018	Senior Env. Officer, Senior Resettlement Officer, Senior Communication Officer and Env. & Safety Officer of the Contractor

4.2 Habitat Enrichment through Reforestation

26. Variation No. 7 is being prepared to be issued to the Contractor to enrich approximately 15 ha land, which is disturbed due to construction, by planting native trees (**Annex 4**). A separate specification is being prepared by PMDSC to guide the Contractor on the reforestation work.

4.3 Additional Surveys Carried Out under UECP within the Reporting Period

27. The site clearance and access road preparation related to the Kaluganga Moragahakanda Transfer Canal (KMTC) under UECP-ICB-2B was required as a priority activity. Complying with the CEA and ADB requirements, a species translocation program was carried out from 17 to 30 June 2018 in the following areas (**Figure 4-1**): (i) Proposed land area for inlet tunnel portal No. 1 (1.46 ha), (ii) Areas for tunnel portals and construction of aqueduct (3.83 ha), (iii) Contractor's camp, engineer's office (4.8 ha).

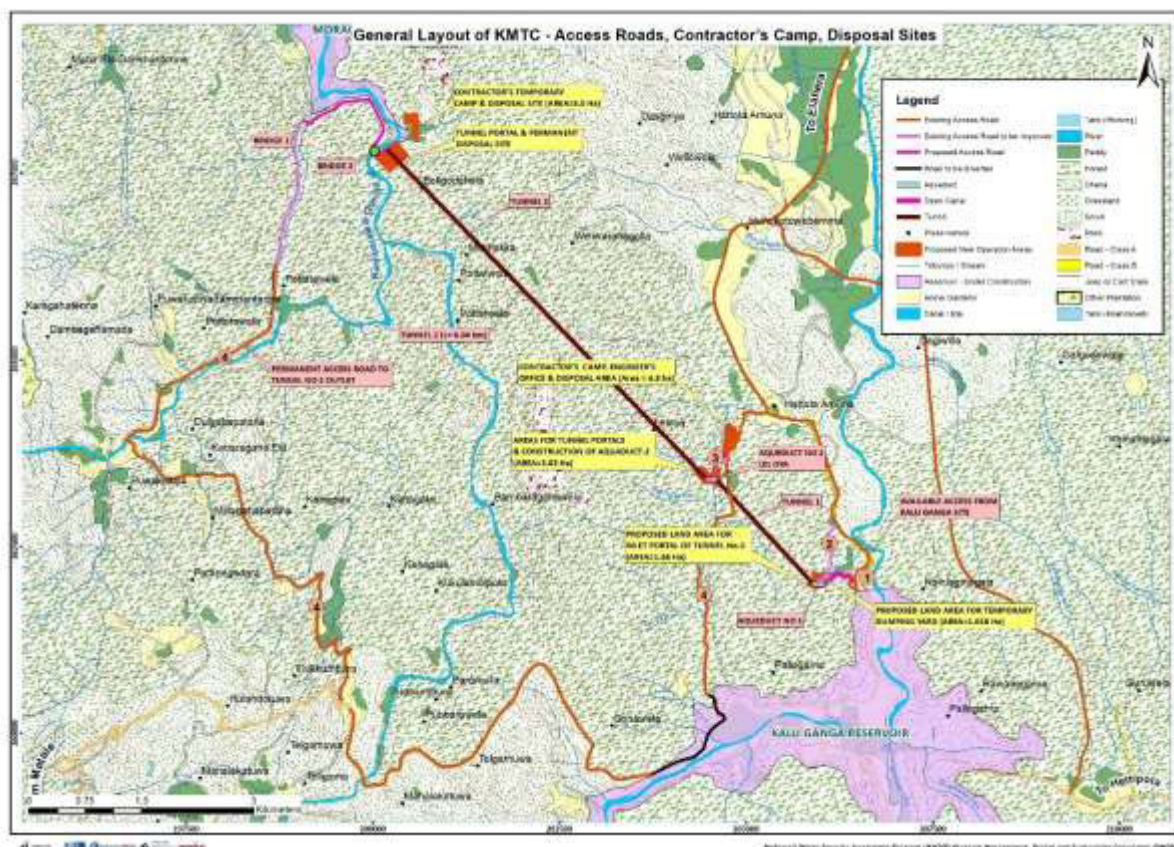


Figure 4-1: Map Showing the Priority Areas for Species Translocation as per PIU/PMU Request

28. The survey was carried out by Nalinda Peries, Environmental Monitoring Specialist, with the involvement of three Ecologists (P. Ananda Lal, Rohana Jayasundara, Rohan A. K. Piris) specialized for identification, handling and translocation of different faunal groups. Some photographic evidences for the survey carried out are given in **Figure 4-2**.



	
<i>Otocryptis nigristigma</i> – Collected Endemic Lizard	<i>Cyclophorus involvulus</i> - Collected Nationally Endangered Land Snails
	
	<i>Eutropis bibronii</i> – Collected Nationally Endangered Skink

Figure 4-2: Translocation Survey in UECP-ICB-2B Contract

5. KEY ACTIVITIES FOR NEXT REPORTING PERIOD (JULY - DECEMBER 2018)

29. The Environmental Action Plan, given in **Annex 2**, shall be implemented.
30. In addition, following activities are planned by PMDSC Environmental Team to comply with the ADB SPS (2009) and GoSL environmental regulations:
 - Completion of ecological baseline survey and species rescue program in the areas within UEC-ICB-2B package.
 - Initiation of relevant habitat enrichment and biodiversity conservation programs in the UEC-ICB-1 area.
31. Although it was targeted, the environmental quality baseline data collection in the UECP area could not be completed yet. It is planned to be completed through an 'Accredited Laboratory' within the next reporting period.
32. Additional surveys following up on the design changes introduced for the Tranche 3 packages shall be carried out
33. Establishing Grievance Redress Committee (GRC) in the KMTC area.

Annex 1

ඔබේ යොමුව
உமது தொடர்பு
Your Ref.

අපේ යොමුව
ஏமது தொடர்பு
Our Ref.

දිනය
திகதி
Data

මධ්‍යම පරිසර අධිකාරිය

மத்திய சுற்றாடல் அதிகாரசபை

Central Environmental Authority



08/EIA/Water/04/2012/Vol. III

“පරිසර පියස”, 104, ඩෙන්සිල් කොබ්බෑකඩුව මාවත, බත්තරමුල්ල, ශ්‍රී ලංකාව.

“பரிசர பியச”, 104, டென்சில் கொப்பேகடுவ மாவத்தை, பத்தரமுல்ல, இலங்கை.

“Parisara Piyasa”, 104, Denzil Kobbekaduwa Mawatha, Battaramulla, Sri Lanka.

Web : www.cea.lk

Director General
Mahaweli Authority of Sri Lanka
500, T B Jayah Mawatha
Colombo 10.

PROPOSED UPPER ELAHERA CANAL (UEC) PROJECT

This is to inform you that the CEA, after study of the original environmental approval letter dated 31st March 2016 issued by the CEA, your letter No. MMDE/MWSIP/PMU/UECP/Gen dated 16.10.2017, the study report dated 1st February 2018 submitted to this Authority on 15.02.2018 and the comments of the members of the Technical Evaluation Committee appointed by the CEA on the above study report, has decided to grant environmental approval for the proposed alterations made to the above project subject to following conditions.

A. General

- A.1 This environmental approval is valid for the implementation of the proposed alterations to the UEC project as described in the study report dated 01.02.2018 submitted by the Programme Director, Mahaweli Water Security Investment Programme on your behalf.
- A.2 This environmental approval is issued on the assumption that the information provided in the study report dated 01.02.2018 submitted by you to the CEA is true and accurate.
- A.3 This approval is valid until 30.03.2019 from the date of issue of this letter.

B. Construction of Access Roads

- B.1 Necessary approvals from the Forest Department shall be obtained for construction of 1.8 km long new access road section to the Kalu ganga - Moragahakanda Link Tunnel and any other area fallen within the Forest Department.

Chairman	Tel : 2872361, 2872348 Fax : 2872347	Director General	Tel : 2872359 Fax : 2872608	Gen. Office	Tel : 2872278, 2873447, 2873448 7877277-280	Complain Unit : 2888999
Deputy Director Generals	HRD, Admin & Finance Division Tel : 2865296 Fax : 2877515	Env't. Pollution Control Division Tel : 2873453 Fax : 2872605	Env't. Mgt & Asses. Division Tel : 2872388 Fax : 2872296	Env't. Edu. & Awareness Division Tel : 2872297 Fax : 2872609		
Directors	2872607 (Admin), 7877290 (Finance) 2872301 (HRD), 7877288 (Planning) 2872601 (Admin), 2863984 (Finance)	2873452 (EPC) 2872606 (Lab) 2882335 (WM)	2872346 (NRM), 2876643 (ELA) 2867263 (R&D) Fax : 2872296	2867266 (EEA) Fax : 2872609 Media Unit : 2873449	2872604 (Legal) (Western Province) Tel : 2862831 Fax : 2865293	



- B.2 A separate tree enumeration survey shall be carried out along the road segment under the supervision of Forest Department.
- B.3 Minimum number of trees should be cut during construction. Trees should be preserved as far as possible along the road trace. Trees may be removed only in cases where it is absolutely essential. The MASL should take required action to remove such trees in consultation with the FD.
- B.4 Construction activities should be undertaken with minimum disturbances to fauna and flora during construction.

C. Ground water/ hydro geological aspects

- C.1 A detailed hydro geological study should be carried out for the all tunnel sections including the tunnel - 4 (chainage 54+303 km to 55+400 km) prior to commencing tunneling activities.

This study should cover the baseline hydro geological set up of the tunneling area including the peripheral impacted areas (important sites such as community water supply sources, common wells, favourable ground water potential zones used by the community etc.). Necessary guidance in this regard shall be obtained from the Water Resources Board.

- C.2 Monitoring programme should be set up in order to assess periodic variation of groundwater level and ground water quality of the impact area at proposed new tunneling areas during construction and operation of the project.

D. Wildlife / Ecological aspect

- D.1 All the conditions stipulated by the Department of Wildlife Conservation letter No. WL/6/1/1/255-I dated 04.04.2018 should be adhered to.
- D.2 Proposed disposal sites as indicated DPS 01 and DPS 02 in table 2 of the study report dated 01.02.2018 are not recommended.
- D.3. Proposed disposal site indicated as DPS 03 in table 2 of the study report dated 01.02.2018 is recommended on temporary basis and it should be managed to have minimum environment impact and properly rehabilitated before completion of the project.



- D.4 Necessary approval shall be obtained from the relevant state agency for the disposal site named as DP-03 in table 2 of the study report dated 01.02.2018.
- D.5 Debris/ unwanted material should not be disposed at any area managed by the Forest Department/ Department of Wildlife Conservation.
- D.6 Baseline ecological condition of all tunneling areas should be established.
- D.7 Monitoring programme should be set up in order to assess ecological conditions of the impact area of the tunneling areas during construction and operation of the project.

E. Waste Disposal

- E.1 A suitable debris/ residual disposal plan should be submitted to the CEA prior to commencing the project activities. This plan should indicate the following:
 - Types and quantity of waste generated
 - Temporary Storage and transportation (locations and extents of the sites)
 - Final disposal (locations, extents and types of disposal material and quantities to be disposed)
 - Time schedule for each activity
 - Pollution control methods (human, biodiversity, water and air)
 - Rehabilitation procedure/ techniques
 - New sites proposed in addition to the approved sites

F. Geological Aspects


- F.1 A pre crack survey should be carried out of houses located on either side of the all tunnel traces covering potential impact area.
- F.2 A detailed survey on slope instabilities and subsidence should be carried out in the proposed tunnel areas and required mitigation measures adopted. Necessary guidance in this regard shall be obtained from the National Building Research Organization.

G. Environmental Management Plan (EMP)

An amended EMP should be submitted to the CEA incorporating additional mitigation measures suggested due to alterations.



All the terms and conditions already stipulated by the CEA letter No. 08/EIA/Water/04/2012 dated 31.03.2016 issued under regulation 13 of the National Environmental (Procedure for approval of projects) Regulation No 1 of 1993 to the Irrigation Department shall be adhered to.


P B Hemantha Jayasinghe
Director General

CC :

Secretary / Ministry of Mahweli Development and Environment
Conservator General of Forest / Forest Department
Commissioner General / Department of Agrarian Development
Director General / Dept. of Wildlife Conservation
Director General / Irrigation Department
Director General / National Building Research Organization
Director General / Department of Archeology
Director General / Department of Agriculture
Director General / Geological Surveys and Mines Bureau
Divisional Secretary, Elahera / Galenbindunuwewa / Palugaswewa /
Hingurakgoda / Dambulla / Naula / Kekirawa
Chairman, Pradeshiya Sabha, Elahera / Galenbindunuwewa /
Hingurakgoda / Dambulla / Naula / Kekirawa
Director / Central Province / CEA
Deputy Director / North Central Province / CEA
Project Director / Mahaweli Water Security Investment Programme

for information

emaanu\f\ē\mydoc\nk\approval for the alteration - final

Annex 2

[illegible]



Annex 3

Annex 3: Record of active Disposal Areas UEC ICB 1

#	Site Location (chainage / GPS coordinates)	State whether Temporary (T) or Permanent (P) site, within protected areas/not	Type of disposal (rock/ top soil/ aggregates/ earth etc.)	Approximate Area and height (m)			Approval status (Pls mention the approval details)			
				L	W	H	Approving agency	Approval Ref No.	Validity period	
									from	to
01	581212.960 N 499758.066 E	Temporary	Soil	4690.94 m2 1.16 ac 0.47 ha Average Height- 2.9m			PIU verbal approval No DWC approval	No		
02	581181.782 N 499634.950 E	Temporary	Rock	5400.30 m2 1.33 ac 0.54 ha Average Height 3.7m			PIU verbal approval No DWC approval	No		
03	578794.046 N 499708.367 E	Temporary	Rock and soil	14630.25 N 3.6 ac 1.46 ha Average Height 4.5m			No objection from Moragahakanda Dev. Project and approval letter from DWC	MKD/PD/ENG/44 WL/1/	Up to end of the project	
04	580004.431 N 499881.570 E CH2+640 to CH2 +800	Temporary	Rock	5713.16 m2 1.41 ac 0.57 ha Height 1.8m			RE's verbal consent	No		

Any Other Remarks, photographic evidences

#	Remarks	Photographic Evidences
01	It has not been taken any written approval from DWC and soil is used for back-filling right now.	
02	It has not been taken any written approval from DWC and not to reuse for other purposes.	

03	Dumped rock and soil as well.	
04	Basis on RE's verbal consent, dumped on the proposed canal trace as temporary dumping and for next excavation	

Note: Use same Site identification Number for each disposal site

Annex 4

CONTRACT: **Construction of Upper Elahera Canal from 0+100 km to 6+226 km:
CONTRACT PACKAGE UECP-ICB-1**

Contract No. MMDE/MWSIP/ADB/UECP/ICB-1/3267-3268-SRI/ICB/2016/002

VARIATION NO. 7

To: **CML-MTD Construction Ltd**
7 155, Dharmapala Mawatha, Colombo 7, Sri Lanka

IN ACCORDANCE WITH Sub-Clauses 13.1 and 13.5 sub-paragraph (a) of the Conditions of Contract you are hereby instructed to submit a proposal for the execution of the work as set out in this Variation to be paid under the following Provisional Sum item in the Bill of Quantities:

Bill No.	Item No.	Item Description
3	3.4.4	Implementation of specific additional environmental mitigation measures proposed by the EIA Study as instructed by the Engineer

1 BRIEF DESCRIPTION OF WORK

The work covered by this Variation comprises some or all of the following activities as directed by the Engineer:

- reforestation of degraded lands (due to spreading of invasive species or other exotic tree species that does not support the sustenance of respective habitat or the ecosystem) for habitat enrichment or to prepare an arboretum;
- ecological restoration or habitat enrichment of the identified protected areas to function as an ecological corridor to facilitate gene flow between forest restricted species that occupy in such protected areas;
- tree planting along canal banks or other land areas to minimize erosion, prevent future encroachment of the canal reservation.

Since the Contractor lacks adequate experience and competence in the planning and implementation of such reforestation activities, the Contractor shall appoint full time properly qualified **Forestry Specialists**, as defined in the attached Specification Section 4B, who shall manage and direct the reforestation work and shall be subject to the direction of Environmental Specialists in the Engineer's and Employer's organisations.

2 DOCUMENTS DESCRIBING THE WORK UNDER THE VARIATION ORDER

The documents comprising this Variation Order describing the work to be done thereunder are as follows:

- (i) this Variation form
- (ii) Specification Section 4B [*Ecological Restoration through Reforestation*] – included as Annex 1 hereto
- (iii) Bill of Quantities Bill No. 3B – included as Annex 2 hereto
- (iv) form of Letter of Quotation – included as Annex 3 hereto
- (v) details of forest enrichment – included as Annex 4 hereto
- (vi) details of seeds and trees to be planted – included as Annex 5 hereto.

3 SUBMISSION REQUIREMENTS

3.1 General

The Contractor shall be responsible for ensuring that his proposal submitted to the Engineer for this work is strictly in accordance with the following requirements:

- the entire proposal shall be in the English language;
- the entire proposal shall be typed or written in indelible ink, and each page shall be initialled by the Contractor's Representative;
- the Letter of Quotation shall be printed on the Contractor's letterhead and duly signed by the Contractor's Representative, and shall not deviate in format or content from the form of the Letter of Quotation provided as an annex to the Variation Order issued for this work;
- the technical and price information to be submitted as constituting the proposal shall be in strict accordance with the requirements of Sub-Clauses 3.2 and 3.3;
- the proposal shall be submitted in a sealed envelope to the Engineer no later than the deadline stated in this Variation Order.

3.2 Technical Information

In order to demonstrate, to the satisfaction of the Engineer, the suitability of the Contractor's proposed **Forestry Specialists** and associated staff for this work, the Contractor's proposal shall include as a minimum the following information:

- full curriculum vitae for the proposed candidate for each of the **Forestry Specialist** positions (the *Biologist/Reforestation Team Leader* and the *Reforestation Awareness Trainer*) specified in Specification Section 4B including:
 - personal information (name, age, address, contact details),
 - full details of secondary and further education (educational institutions, dates, courses),
 - titles and dates of academic and professional qualifications awarded,
 - periods and types of relevant technical training undertaken,
 - in reverse chronological order, each subsequent work appointment, including details of the employer, the title/position of the candidate, and details of each individual assignment undertaken (start and finish dates, location, type of project/contract, client, explanatory details of the work involved, and the scope of the individual's actual responsibilities);
- where a nursery is to be established, suitable information on the qualifications and experience of the Contractor's proposed **Nursery Supervisor**;
- list of all further personnel proposed by to be assigned to site to work under the management and direction of the nominated **Forestry Specialists**, together with their designations and principal tasks and responsibilities.

3.3 Quotation

The Contractor's quotation shall contain the following:

- the completed Bill of Quantities (BOQ) Bill No. 3B issued with this Variation, with each unit rate or price filled in and all amounts correctly calculated and all totals correctly summated as indicated in the BOQ Bill No. 3B without amending anything else of the original Bill No. 3B;
- the Letter of Quotation completed in accordance with the requirements of Sub-Clause 3.1, in which the total price of the proposal is identical with the correctly calculated overall total of the BOQ Bill No. 3B;
- All rates, prices and amounts shall be in Sri Lankan Rupees (LKR).

3.4 Engineer's Evaluation of Proposal

The Engineer will evaluate the submitted proposal (provided it has been determined to be substantially responsive) and may, at his discretion, instruct the Contractor to submit further information to clarify the submitted proposal in order to confirm whether or not the requirements of this Variation are satisfied. Following the evaluation process the Engineer will instruct the Contractor to execute this Variation provided that the submitted proposal:

- (i) has been determined to be substantially responsive and to satisfy the requirements of this Variation, and
- (ii) has been evaluated to be reasonably priced.

In case the Engineer determines that the submitted proposal is unreasonably priced, he may request the Contractor to review his proposal and submit an amended Quotation (including Bill of Quantities) for the work under this Variation. If the Engineer determines that the amended Quotation is still unreasonably priced, he may determine a reasonable Quotation and instruct the Contractor to execute the Variation on that basis.

The Engineer reserves the right to accept or reject the Contractor's proposal at any time prior to the issue of the instruction to execute the Variation, without thereby incurring any liability to the Contractor.

4 RELEVANT CONTRACT PROVISIONS

The work covered by this Variation shall be executed by the Contractor, through the management and direction of the approved **Forestry Specialists**, in every respect in full compliance with all requirements of the Contract including Specification Section 4B and all other relevant information provided together with this Variation.

Payment for the work under this Variation shall be made at the rates and prices in the final Quotation as agreed or amended by the Engineer, and entered into the final Bill of Quantities Bill No. 3B [*Reforestation*], pursuant to Sub-Clause 3.4 in accordance with Sub-Clause 13.5 sub-paragraph (a) of the Conditions of Contract.

Variation issued by Engineer:

Signature:

Date:

Variation received by Contractor:

Signature:

Date:

Mahaweli Water Security Investment Program (MWSIP)

Construction of Upper Elahera Canal from 0+100 km to 6+226 km

Contract Package UECP-ICB-1

Contract No.:

MMMDE/MWSIP/ADB/UECP/ICB-1/3267-3268-SRI/ICB/2016/002

VARIATION NO. 7

Annex 1

Specification Section 4B

Ecological Restoration through Reforestation

Mahaweli Water Security Investment Program (MWSIP)

Construction of Upper Elahera Canal from 0+100 km to 6+226 km

Contract Package UECP-ICB-1

Contract No.: MMMDE/MWSIP/ADB/UECP/ICB-1/3267-3268-SRI/ICB/2016/002

Employer's Requirements

SPECIFICATION

Section 4B

Ecological Restoration through Reforestation

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SECTION 4B ECOLOGICAL RESTORATION THROUGH REFORESTATION

4B.1 General

The Mahaweli Water Security Investment Program (MWSIP), under the Ministry of Mahaweli Development and Environment of the Government of Sri Lanka (GoSL), is a project funded by the Asian Development Bank (ADB) (Loan No. 47381-002-SRI (SF) and GoSL) with the goal of maximizing the productivity of the Mahaweli River Basin (MRB) water resources including by transferring available water to the north and north western dry zone areas for irrigation, drinking and commercial purposes. The investment program will implement Phase I of the North Central Province Canal Project (NCPCCP), using the Asian Development Bank's (ADB's) Multi Tranche Financing Facility (MFF) modality, loaned to the government in three tranches. The updated Mahaweli Development Program (MDP) comprises three main individual investment projects: the Upper Elahera Canal Project (UECP); the Minipe Left Bank Canal Rehabilitation Project (MLBCRP); and the North-Western Province Canal Project (NWPCP).

This specification is prepared as a guideline on carrying out following activities as directed by the Engineer;

- Reforestation of degraded lands (due to spreading of invasive species or other exotic tree species that does not support the sustenance of respective habitat or the ecosystem) for habitat enrichment or to prepare an arboretum
- Ecological restoration or habitat enrichment of the identified protected areas to function as an ecological corridor to facilitate gene flow between forest restricted species that occupy in such protected areas
- Tree planting along canal banks or other land areas to minimize erosion, prevent future encroachment of the canal reservation

4B.2 Background

4B.2.1 Intended Outcome of Reforestation

For the purpose of this work "reforestation" means the planting of native trees in existing degraded areas within the protected areas, or in other identified state lands, replacing potentially invasive or exotic species in order to enrich the habitats with suitable native trees and thereby increase the natural forest cover.

The Environmental Impact Assessment (EIA) and Initial Environmental Examination (IEE) studies conducted during the project preparatory stage, as well as the Wildlife Management Plan (WMP) prepared by the MWSIP, included an assessment of the project impact area and consequential forest habitat loss. The approximate loss of forest and wildlife habitats according to these studies, and the proposed mitigation by reforestation and ecological restoration measures, are summarized below, nevertheless the actual extent to be subject to reforestation will depend on the availability of land and the area finally allocated in the Contract.

Project	Approximate habitat loss	Expected outcome through reforestation as recommended in IEE/EIA
MLBCRP	25 ha of habitat due to increased inundation area after raising the Minipe anicut and reduction of flow in the Mahaweli River due to the implementation of this project	<p>Total of 145 ha as compensatory reforestation in the following areas:</p> <ul style="list-style-type: none"> • Minipe LB canal reservation and adjacent areas with indigenous plant species to function as an ecological corridor between three protected areas (Victoria-Randenigala-Rantambe sanctuary, Knuckles Conservation Forest and Wasgomuwa National Park) which would facilitate gene flow between forest restricted species that occupy these three protected areas. • Further, it will prevent future encroachment of the canal reservation as well as reduce sediment runoff to the canal during rainy season.

Project	Approximate habitat loss	Expected outcome through reforestation as recommended in IEE/EIA
NWCP	Potential permanent loss of about 400 ha of natural habitat in Kahalla-Pallekelle Sanctuary by constructing the Mahakithula and Mahakirula reservoirs.	<p><u>Total of 450 ha</u> to be reforested in the following areas:</p> <ul style="list-style-type: none"> About 100 ha in the Mahakithula and Mahakirula reservoir reservation (100 m strip from the HFL demarcated by the Irrigation Department). Planting about 350 ha of native tree species in the degraded teak plantations in the Kahalla Palllekele area.
UECP	Potential permanent loss is approximately 160 ha of natural habitats mainly in the protected areas under Department of Wildlife Conservation	<p><u>Total of 500 ha</u> to be reforested in the following areas:</p> <ul style="list-style-type: none"> Degraded areas within the protected areas (approximately 250 ha), especially within the Elahera-Girithale Sanctuary, and replacing potential invasive species and the degraded teak planted areas within the three wildlife reserves to enrich the habitats with suitable indigenous trees and thereby increase the carrying capacity of these reserves for indigenous species. Another 250 ha for compensatory planting in the area between the UEC canal and Huruluwewa FSL.

4B.2.2 General Arrangement of the Reforestation Work

The overall reforestation programme has been planned to be carried out over a period of eight years starting in 2018. The proposed extent of the reforestation to be executed under the three Projects is approximately 1,100 ha, with the key aspect of the aligned programme being the planting of indigenous forest trees appropriate for the respective habitat conditions and ecosystems.

In order to compensate for the habitat loss and the damage to the existing wildlife and forest reserves, the extended reforestation programme proposed by the EIA/IEE as explained above is to be executed initially under a number of selected construction contract packages, with payment being under provisional sum items in the respective Bills of Quantities. Since the construction contractors involved in the selected contract packages have construction and engineering capabilities but lack adequate experience and competence in the planning and implementation of large scale reforestation activities, the reforestation work shall be executed by the Contractor under the management and direction of properly qualified **Forestry Specialists** and subject to the direction of Environmental Specialists in the Engineer's and Employer's organisations together with two Environmental Monitoring Specialists.

4B.3 General Scope of Work

The reforestation programme requires close monitoring until the plants have reached their "self-survival" stage, in order to achieve sustainable reforestation in the identified areas. Planting and habitat enrichment has been planned for a total of 1,100 ha, of which some 145 ha is in the MLBCRP area, 450 ha is in the NWPCP area and about 500 ha is in the UECP area, thereby compensating the habitat loss due to respective Project activities.

The reforestation programme under the MWSIP is merely a habitat restoration programme, designed to compensate for the ecological damage occurring in the prime wildlife protected areas of the VRR sanctuary in Minipe, the Kahalla Palllekele sanctuary (proposed National park), the Elahera Girithale sanctuary, the Minneriya-Girithale nature reserve and primary forest areas associated with the Knuckles Forest Range. As a result the site assessment and the selection of native species suitable for planting in the identified sites (based on their ecological functions) play a key role in the programme – these activities are therefore to be carried out in accordance with the conditions and recommendations stated in the IEE/EIA studies for each MWSIP Project (MLBCRP, NWPCP and UECP).

4B.3.1 Definitions

The following definitions shall apply for the purposes of this Specification:

- Degraded land:** Forest or other land with vegetation cover but which suffers from a decline in species diversity or is affected by IAS, leading to reduced quality survival and/or reproductive success of the native plants or animals in the specific area.
- Invasive species:** An invasive alien species (IAS) is a species that becomes established outside the limits of its past and present distribution, the introduction and/or spreading of which threatens the biological diversity in the country.
- Seed:** A small embryonic plant enclosed in a covering (the seed coat), which is the product of the ripened ovule of gymnosperm and angiosperm plants occurring after fertilization and some growth within the mother plant. Following the development of flowers and pollination, the formation of the seed represents the completion of the process of reproduction in seed plants with the development of the embryo from the zygote (and the seed coat from the integuments of the ovule). Seeds may have different sizes, shapes and colours. The success of plantation depends to a major extent on the availability of sufficient good quality seeds.
- Seedling:** A young plant that is grown from a seed especially one grown in a nursery for transplanting. Seedling development starts with germination of the seed.

4B.3.2 Mechanism of Implementation

4B.3.2.1 Contractor's Forestry Specialists

The reforestation programme is to be executed by the Contractor under the full time management and direction of specifically qualified and experienced **Forestry Specialists**, both of whom are to be qualified Biologists. These Forestry Specialists will be directed by environmental specialist staff from the Engineer, the Employer and stakeholder agencies (such as the Department of Wildlife Conservation, the Forest Department, as well as local authorities and community-based organizations).

The minimum qualification and experience requirements of the Contractor's **Forestry Specialists** are as follows:

Forestry Specialist Position	Minimum Requirements
Biologist / Reforestation Team Leader	BSc degree/Diploma in Biology from a recognised university/college
	Not less than 5 years professional experience in the implementation and management of environmental improvement projects or development projects related to environmental protection
Reforestation Awareness Trainer	BSc degree/Diploma in Biology from a recognised university/college, and a recognised qualification trainer and facilitator
	Fluency in spoken and written Sinhala, Tamil and English, and presentation level in Sinhala. Proven familiarity with and a strong conceptual understanding of similar reforestation activities. Not less than 5 years experience in developing and presenting forestation awareness training

4B.3.2.2 Key Activities

The key activities involved shall be as follows.

- (i) Site assessment and selection
 - Clarification of land ownership
 - Obtaining approval from relevant authority
 - Site assessment in ecological and physical environmental perspective
 - Selection of planting species based on the habitat type, location and climatic conditions of the identified area

- (ii) Site Planning
 - Seedling collection and plant nursery establishment
 - Preparation of planting configuration and density
 - Preparation of planting sequence
- (iii) Implementation (Planting of Trees)
 - Preparation of site including site clearance
 - Clearance for site access
 - Provision of site protection/fencing
 - Implementation of Irrigation/watering system establishment and scheduling
 - Planting of trees
- (iv) Operation, Maintenance and Monitoring
 - Planting inspection
 - Moisture conservation and shading
 - Manuring and watering
 - Monitoring seedling survival
 - Weeding
 - Gap filling
 - Invasive plant control
 - Awareness training

4B.3.2.3 Implementation Responsibilities

The Contractor and his approved Forestry Specialists shall work closely with the environmental monitoring specialist staff of the Engineer and the Employer's Project Implementation Unit (PIU), who will provide technical direction and continuous monitoring of the development of the reforestation plan for each project component. The Contractor's Forestry Specialists shall also provide formal training of selected personnel from the relevant stakeholders in order to achieve sustainable management and conservation of the reforested areas. The general implementation responsibilities for each activity are shown in the table below.

Key Activity	Responsible Agency
(i) Site assessment and selection	Environmental specialist staff of Engineer and Employer (PMU and PIU)
(ii) Site planning	Contractor (under management/direction of approved specific qualified and experienced Forestry Specialists)
(iii) Implementation	Contractor (under management/direction of approved specific qualified and experienced Forestry Specialists)
(iv) Maintenance and monitoring – short term (usually 6 to 12 months)	Contractor (under management/direction of approved specific qualified and experienced Forestry Specialists) – until Completion Date of the construction Contract
(v) Maintenance and monitoring – long term	Relevant stakeholder Agency / Government Department – after Completion Date of construction Contract
(vi) Awareness training	Contractor (under management/direction of approved specific qualified and experienced Forestry Specialists)

4B.3.3 Submittals

4B.3.3.1 Establishment of Nursery

Prior to the commencing the works associated with the establishment of the nursery, in accordance with Sub-Clause 4B.5, the Contractor shall prepare and submit for the approval of the Engineer a detailed method statement for that work including:

- full details of the equipment to be used at each location;
- a detailed work plan showing the proposed procedures for achieving access (if necessary), the activity sequences and equipment operating cycles, material handling procedures, and the labour and other resources required;
- layout plan showing nursery beds, access paths, water tank location(s), and any other associated implementation details.

During the progress of the work the Contractor shall submit to the Engineer a separate dedicated monthly report showing the actual progress on the nursery establishment work during the month, together with cumulative values of each type of work achieved, at each location. This report shall be submitted not later than 48 hours after the end of the reported month.

As part of each monthly report the Contractor shall submit plan and cross section drawings for each excavation and fill location showing the interim excavation profiles and fill levels achieved by the end of the reported month.

4B.3.3.2 Tree Planting

Prior to the commencing the works associated with tree planting, as in accordance with Sub-Clause 4B.6, the Contractor shall prepare and submit for the approval of the Engineer a detailed method statement for that work including:

- full details of the equipment to be used at each location;
- detailed survey plan;
- a detailed work plan showing the proposed procedures for achieving access (if necessary), the activity sequences and equipment operating cycles, material handling procedures, and the labour and other resources required;
- layout plan showing locations of the plant holes, access paths and any other relevant ground details and landmarks.

4B.3.3.3 Maintenance and Monitoring

Within 3 calendar days after the end of each month the Contractor shall submit to the Engineer a Monthly Maintenance Report, which shall describe the relevant activities and status during the previous month and contain as a minimum the following to a format which is to be agreed with the Engineer:

- detailed maintenance schedule, including each individual activity as specified and the actual personnel allocation;
- monitoring records including records of individual plant growth, identification and description of dead or defective plant details;
- full photographic records of all work performed during the month.

4B.4 Planting Site Assessment and Selection of Plant Species

4B.4.1 Site Selection

The selection of tree planting sites will depend on the purpose of the reforestation, as indicated in table below. The restoration of relatively small areas suffering from severe degradation may have a substantial environmental benefit, for example landslide or landslip areas, severely eroded gullies etc., old mine sites etc. Such limited areas may be a source of sediments or pollutants affecting a much wider environment.

Area	Purpose
Riparian areas (river, stream and canal banks, periphery of reservoirs, tanks and other water bodies or wetlands)	Bank stabilisation: to control erosion and siltation, to create habitats for riparian species, to improve water quality
Steep areas, erosion-prone sites, landslide-prone sites	Soil surface stabilisation: to control erosion and prevent landslides
Mine sites	Stabilisation of sites: to prevent them becoming sources of water sedimentation, acidification or heavy-metal pollution
Degraded areas in, or buffer areas around, protected areas	Re-establishment of habitats of protected species: to eradicate habitats of weed species, to reduce edge effect
Habitats of particular species	Increase in the availability of habitat and resources for vulnerable or threatened species
Corridors between protected areas or forest fragments	Provision of linkages between forest areas: to provide opportunities for species movement and genetic interchange
Buffer strips within and around plantations	Creation of linkages between areas of natural vegetation: for firebreaks or watershed protection
Over-logged or secondary regrowth forests	Hastening the recovery of biodiversity and/or productivity
Other degraded areas (e.g. abandoned agricultural lands, sites with infertile soils)	Increase in landscape heterogeneity, biodiversity and sustainability

4B.4.2 Species Selection for Restoration

4B.4.2.1 General

The reforestation programme is to be divided into two phases. In the first phase (years one and two) efforts will be concentrated on the development of shade and soil quality, which are prerequisites for achieving an increase in diversity in the second phase (years three, four and five). Therefore in the first phase more pioneers, shady and rapid growth trees will be planted, with the remaining tree species being planted in the second phase.

Native species from the immediate area are clearly the most desirable.

4B.4.2.2 Unaided Colonization

Unaided colonization may be facilitated by planting species from early successional stages so as to create conditions suitable for the subsequent arrival of a more diverse community. The species for planting would be chosen because they are tolerant of the site conditions, are attractive to wildlife and are able to reproduce quickly and spread across the site.

Intensive ecological reconstruction may then be achieved by using dense plantings of a number of species, some of which are indicated in table below, at up to 4,000 plants per hectare. These include fast-growing species able to exclude weeds, species which establish themselves in a poorly dispersed pattern, species which form mutually dependent relations with wildlife, and (if relevant) rare or endangered species which are present only in small numbers or in small geographic areas.

Suitable species may be selected from late successional stages rather than early pioneer species, or may be short-lived species which then create canopy gaps and provide regeneration opportunities. A range of types of plant would be included (trees, shrubs, herbs etc.), although since this method can only utilise some of the plants occupying a particular site, colonization from outside is still necessary.

Species Type	Purpose
Native species	Enhancing biodiversity
Species attractive to frugivores	Encouraging seed dispersal
Species forming mutualistic relationships with animals	Fostering wildlife populations
Poorly dispersed species (large fruit)	Facilitating colonization of these species
Rare or threatened species	Increasing the populations of these species
Fast-growing species	Occupying sites and excluding weeds
Species tolerant of poor soils	Facilitating rehabilitation
Nitrogen-fixing species	Improving soil fertility
Economically or socially beneficial plants	Providing economic "goods"
Fire tolerant trees	Creating new forests or forming buffers around restored forests in fire-prone landscapes

4B.5 Establishment of Nursery

4B.5.1 General

4B.5.1.1 Criteria for Nursery

The criteria to be applied by the Employer or the Engineer for identifying each nursery site will depend on whether it is to be a small scale nursery or a permanent nursery, and will be governed by the following main factors:

- **Water** – Availability of reliable and continuous supply of water throughout the year, and quality of water with a pH between 5.5 to 7. Water with pH > 7 favours the growth of 'damping off' fungi in the seed beds and tends to raise the pH of the soil, which in turn can reduce the growth of seedlings.
- **Location** – Nursery should have a central location as near to the planting site or demand centre as possible to avoid the transportation of seedlings over long distances. Sites with exposure to excessive wind as well as valleys and old watercourses that may be liable to flooding should be avoided.
- **Topography** – The ideal nursery setting would be on a gentle slope sufficient to allow excess water to run off without causing soil erosion, otherwise a proper drainage system must be built to avoid water logging and damage during periods of heavy rainfall.
- **Size of Nursery** – The size of the nursery will depend on the number of seedlings required each year and the availability of water.
- **Soil** – The most important soil properties affecting plant production are: (i) particle size; (ii) organic matter content; (iii) soil porosity; (iv) moisture content; and (v) pH. The presence of organic matter usually indicates a healthy soil and is an essential ingredient in maintaining satisfactory moisture relationships necessary for plant growth. Soil that is not porous encourages waterlogging, thereby preventing access to oxygen which is essential for root development and respiration.

A permanent nursery must normally be designed to accommodate the administration and operations facilities in addition to the necessary production areas, including as a minimum the following:

- Office with changing room and shower
- Parking area
- Operations and storage area
- Bare root production area / potting soil storage / compost area
- Boundary fence
- Weed-free buffer strip
- Entrance gate.

The operations and storage area shall be used for extracting, drying and processing the seeds, and therefore the surface of this area shall be provided with a smooth, dense concrete floor adjacent to covered facilities. These facilities shall be suitable for multiple operational functions including preparing germination trays and potting mixtures, screening compost and soil and filling pots etc.

The Contractor shall designate a **Nursery Supervisor**, who shall be highly experienced in the establishment and operation of similar nurseries for the production of similar types of trees, for the approval of the Engineer. The Nursery Supervisor shall have the continuous responsibility for the all activities associated with the nursery.

4B.5.1.2 Site Preparation

Immediately after the Employer or Engineer notifies the Contractor of the selected site, the Contractor shall reform the topography in order to result in level area and carry out the following site preparation activities:

(i) Removal of tree and vegetation cover

All vegetation including shrubs and small plants as well as trees (particularly mature trees which give unnecessary shade and trees of the same species as those being grown in the nursery which are a potential source of fungal and insect pests) shall be completely removed.

(ii) Removal of top soil

The topsoil layer as directed by the Engineer shall be trimmed and removed from the site before levelling to avoid muddy conditions during wet weather and after prolonged watering. The topsoil shall be carefully stockpiled on a clean surface for later use in the potting soil mixture or for the production of compost. The Contractor shall ensure that erosion problems, pollution of nearby streams and water logging conditions are at no time caused by any work associated with the preparation of nurseries.

(iii) Erosion control

All exposed slopes and the ridges of terraces shall be grassed in accordance with the relevant provisions of the Specification as soon as possible, including during the dry season if necessary utilising irrigation water wherever available.

(iv) Surface dressing

Unless agreed by the Engineer as being unnecessary in a specific location due to the nature of the nursery soils, a firm hard surface material shall be applied over the whole area or between the transplant lines as directed which must resist wear and be sufficiently porous to allow drainage of excess water.

(v) Shape of nurseries

Each nursery shall be set out in a compact shape, either square or rectangular. A rectangular shape is preferable in order to allow for longer working lines, however the final shape shall also comply with the area available and the topography.

(vi) Temporary Fencing

The individual nursery beds shall be surrounded by a temporary fence of approved design in order to keep out animals and to provide a reasonable level of security. Unless approved otherwise by the Engineer (and only for small nursery areas), an open strip of land about 5 m wide shall be provided encircling the inside perimeter of the fence to serve as a roadway and buffer zone between the neighbouring land and the nursery, and the Contractor shall ensure that this buffer zone is kept free of weeds.

4B.5.1.3 Preparation of Nursery Beds

The majority of the nursery area will be occupied by nursery beds for growing bare rooted plants or for standing containers, where transplanted or direct sown seedlings are allowed to grow until they are ready for planting in the field. The normal width of a bed is between 1 and 1.2 m, in order to facilitate hand-tending, and the length of the beds should not exceed 20 m in order to facilitate moving from one bed to the next. Bare root production beds should be located where the soil has the best chemical and physical properties.

4B.5.1.4 Watering System

Although the single most important factor in germination and seedling production is water, too much water (i.e. heavy doses) can be harmful since this not only leaches out the soil nutrients but can expose the seeds or even wash them out before germination begins.

Watering may be either by hand or by irrigation. Hand-watering with cans fitted with a rose spray or knapsack mist nozzles would be acceptable methods for small nurseries. The Contractor shall prepare and submit for the Engineer's approval a detailed design of the proposed water supply system including the provision of a temporary overhead tank, the pipe network and the water pumps. The design shall include calculations of the water requirements for the nursery, which shall be subject to the approval from the Engineer before implementation. The relevant requirements of Specification Section 13 [*Hydromechanical and Electrical Works*], if relevant to this Contract, shall apply to the materials and equipment involved in this water supply system.

4B.5.2 Planting of Seeds and Seedling Collection

4B.5.2.1 Seedling Production

Although seeds serve as the delivery system for the transfer of genetic sequence of each forest species, the complexity of the entire process from formation of a seed, to dispersal and to germination results in some trees being more easily generated through seeds and others more easily propagated through cuttings.

The most common methods of raising tree seedlings from seed include the following:

- seedling plants are lifted from an open bed and planted with roots bare of soil – unless otherwise directed or approved by the Engineer, the seedlings shall be raised and planted by this method;
- seedlings are grown in containers, either singly or in multi-cavity trays, which are taken to the planting site – the seedlings are then planted with a ball or plug of soil around the roots;
- natural regeneration seedlings, often found under mature trees, are transplanted into containers.

Seedlings are propagated, grown and managed to plantable size in the nursery to be healthy and good quality materials for planting in the field, avoiding the production of seedlings of the wrong size or poor health since those are among the major causes of seedling mortality in a forestry programme. When exposed to their new environment after planting, good quality and healthy seedlings are essential to compete with weeds for water and nutrients, to withstand harsh or extreme environmental conditions (direct sunlight, temperature, drought, rain or flood, fire etc.), and to withstand animal attacks (grazing, pests). The Contractor shall be responsible for ensuring that the seedlings produced in the nursery and transplanted to the field are healthy and of good quality, as defined in Sub-Clause 4B.5.2.2.

The Contractor shall submit a detailed method statement to the Engineer for approval for each of the following stages of the production of seedlings in the nursery from seeds, taking into account also any variations made necessary by differences in the seed type and/or quality:

- seed handling
- germination process
- transplanting young seedlings
- tending the seedlings
- establishment and management of the seedling nursery.

4B.5.2.2 Seedling Quality

The definition of seedling quality is a combination of height, diameter, plant nutrition, general health, root size and shape. These characteristics in combination determine how well the plant will establish itself in the field and therefore the rate of survival. Good quality tree seedlings have the following characteristics:

- healthy, vigorously growing and free of diseases;
- a robust and woody (lignified) single stem free of deformities;
- a sturdy stem which has a large root collar diameter;
- a crown that is symmetrical and dense;
- a root system that is free of deformities;
- a dense root system with many fine, fibrous hairs with white root tips;
- a 'balance' between shoot and root mass;
- leaves which have a healthy, dark green colour;

- the plants are accustomed to short periods without water;
- the plants are accustomed to full sunlight.

A diagram of good quality and bad quality seedling and root system is given as Schedule 1.5.2.3 to this Section of Specification.

The Engineer will determine the quality of the seedlings produced in the nursery and transplanted into the field on the basis of the above-mentioned requirements.

4B.5.3 Operation and Maintenance

The Contractor shall be completely responsible for the operation and maintenance of the nursery from its establishment until the date of issue of the Taking-Over Certificate for the whole of the Works under the Contract.

Operation and maintenance of the nursery shall include constant weed control, pruning roots, cutting back transplants, production of stumps, grading of the plants, control of damping-off, and successful prevention of any detrimental effects from insects or other pests.

All plants which do not satisfy the following criteria, as confirmed by the Engineer, shall not be taken from the nursery but shall be destroyed in an approved manner:

- Health:** Plants shall be free of disease and insect attack, there shall be no discolouration of leaves or weak crowns (indicative of improper nursery treatment) and no abnormal roots.
- Injuries:** Plants shall be free from any mechanical injuries except for minor types of damage which can be rectified by normal pruning.
- Stems:** Stems shall be straight but not etiolated and shall be able to stand firm without support (curved stems are usually indicative of abnormal rooting).
- Size:** Each planting unit shall receive plants of the same size, and therefore plants of different sizes shall not be mixed. Unless otherwise directed by the Engineer, the appropriate height of mature seedlings for most species would be between 25 cm and 35 cm, plus the container, in consideration of the vigour and subsequent hardiness of the plants.

The Contractor shall ensure that watering of the young seedlings shall be kept to a minimum and only carried out in the mornings, since heavy watering – and particularly in the afternoon and evening hours – encourages disease.

The seedbed shall be watered once per week during pre-germination and post-germination periods using a solution of a copper based fungicide (preferably by means of a knapsack sprayer), and in case of fungal attack the fungicide shall be applied every three days until the fungal attack has been brought under control or as directed by a recommended supplier.

Whenever there is an infestation of grasshoppers, slugs or any other leaf-eating insects, the Contractor shall apply approved commercially available formulas as recommended by qualified distributors as the most suitable chemical for the particular problem. The Contractor shall submit to the Engineer a list of chemicals available locally and their sources.

4B.6 Tree Planting

4B.6.1 Land Allocation and Approvals for Tree Planting

The Engineer will notify the Contractor of each tree planting site selected by the Employer in accordance to the Sub-Cause 4B.4.1, and thereafter the Contractor shall commence reforestation work within the allocated land area as directed by the Engineer.

The Contractor shall, with the assistance of the Employer, be responsible for obtaining all necessary statutory approvals required for land preparation, tree planting and associated activities from the relevant government authorities before commencing any development of the planting sites.

4B.6.2 Land Preparation

4B.6.2.1 Land and Ecological Surveys

As soon as each planting area has been identified for reforestation, a land survey shall be carried out to provide a topographical plan as the basis for land preparation and planning/setting out the planting area. The boundaries of the area shall also be clearly demarcated on the ground.

Immediately thereafter, and before the planting area has been further disturbed, the Contractor's approved Forestry Specialist **Biologist/Reforestation Team Leader** shall rapidly carry out a careful ecological survey over the whole area to identify the habitat conditions, for which guidance will also be given by the Engineer's Environmental Specialist. The outcome of this survey shall be the identification all trees and the establishment of a complete tree list, related to the habitat conditions, and the identification of any IAS or other unwanted vegetation which is to be cleared.

4B.6.2.2 Clearing and Ploughing

(i) Removal and disposal of invasive species

Unless otherwise instructed by the Engineer, all identified IAS shall be removed and disposed of in accordance with the Contract and by the specific method, approved by the Engineer, which ensures that no further spreading of such species can occur in the nearby area. This method of disposal is likely to require completely uprooting the identified IAS and either burning or deep burial in such a way that the IAS is eradicated.

(ii) Removal of tree and vegetation cover

Vegetation, including shrubs and small plants, as well as any individual mature trees which give unnecessary shade shall be completely removed.

(iii) Ploughing top soil

The topsoil layer throughout the entire planting area shall be thoroughly ploughed to the appropriate depth as approved by the Engineer.

4B.6.2.3 Planting Holes

Lines shall be established on a grid system across the entire planting area which shall be used to measure and adjust the locations of the holes to be dug for the seedlings. Planting in straight rows is required to make maintenance activities such as weeding, pest control and treatment easier to perform.

4B.6.2.4 Firebreak

A firebreak with a minimum clear width of not less than 5 m shall be established around the planting area by clearing and cutting the bush and removing all easily inflammable materials. The firebreak can also be used as a road.

4B.6.2.5 Fencing

The Contractor shall provide an approved system of continuous fencing around the boundary of each planting area or, where appropriate and directed by the Engineer, around individual plants, which shall be suitable for ensuring that the replanted seedlings are protected from animals.

Unless otherwise directed by the Engineer, the most appropriate form of fencing shall be wire mesh netting with a maximum 15 mm gauge, 4 mm thickness and a roll width of 2 m, type Anton Poultry Net Hard NZ4 2GN or approved equivalent, supported on 25 mm minimum diameter wooden poles mounted firmly into the ground at spacings of not more than 1.5 m.

The bottom approximately 70 mm width of the mesh shall be folded to lay flat on the ground and securely fixed to the ground with a sufficient number of wooden pegs ensuring that small animals including reptiles are unable to pass beneath the fence.

Attachment of the wire mesh to the wooden poles shall be by galvanised staple nails or other approved method. No any live plant material is to be used for the poles to ensure that no invasive plants are introduced to the area.

4B.6.3 Purchase of Tree Seedlings from Existing Nurseries

In specific cases where sufficient space is not available to establish sufficient nursery capacity, or where, in the opinion of the Engineer, insufficient time remains under the construction Contract to establish a nursery, the Contractor shall, subject to the prior approval or instruction from the Engineer, purchase good quality tree seedlings to satisfy the planting requirements as stipulated by the Engineer. The quality of the purchased seedlings shall satisfy all requirements of Sub-Clause 4B.5.2.2.

4B.6.4 Transport and Handling

The Contractor's **Nursery Supervisor** shall remain responsible for the plants to ensure that their handling and transportation to the planting area is carried out with the necessary preparation and care. The most common problems to be avoided are damage to the root collar, poorly performed lifting, vibration of the plants while underway, wind damage, drying out and sun scorch, and inappropriate storage and holding facilities.

Seedlings are to be handled as little as possible in order to minimise physical damage. The use of a temporary holding site for the seedlings shall therefore not be permitted, in order to eliminate the need for additional handling, unless specifically approved by the Engineer.

Seedlings shall at no stage be lifted by holding their stem.

Care must be taken with handling of seedlings at every step of the transporting process:

- carrying between the transplant beds and the waiting area in the nursery;
- loading at the waiting area into the trailer/truck;
- unloading from the truck at the plantation site;
- carrying from the plantation site unloading area to the individual planting hole.

It is to be stressed that unless the Contractor takes due care in handling the seedlings, their survival in the field may be severely compromised (possibly less than 40%), even if the plants produced in the nursery are of good quality and planting in the field takes place under otherwise favourable conditions.

Container-grown plants shall be packed and moved always in open top boxes until they arrive at the planting hole, and the boxes must be packed tightly such that the seedlings cannot move about in the truck.

4B.6.5 Spacing and Number of Plants Required

The planting spacing of the seedlings in each direction will be confirmed by the Engineer depending on the local conditions and the plants, however for planning purposes it is expected that for tree species this will usually be between 2 m and 3 m and for shrub species between 2 m and 4 m.

On the basis of the spacings notified by the Engineer, the Contractor shall be responsible for calculating the total number of seedlings required in each planting area in order to ensure that the nursery and all other production and transportation facilities have the necessary capacity.

As a guide, the total numbers of tree species seedlings required for a net planting area of 1 ha are shown in the following table:

Planting Spacing (m)		Total Seedlings Required per ha
between rows	along each row	
2	2	2,500
2	3	1,666
3	2	1,666
3	3	1,111
5	5	400

4B.6.6 Holes for Planting

The Contractor shall dig the planting holes at least one week before planting, in order that sunlight can decompose the organic elements in the hole and destroy viruses or other diseases. Immediately prior to digging each hole, an area of ground of 1 m radius around the hole location shall be thoroughly cleared of vegetation and weeded. The hole shall be dug sufficiently large to enable the seedlings to root deeply to allow more nutrients to be absorbed (see Figure A of Schedule S1.6.5):

- for smaller seedlings, in 9" x 6" polybags, the hole shall have a minimum clear dug section of 30 x 30 cm and a depth between 20 cm and 30 cm;
- for larger seedlings, in 18" x 12" polybags, the hole shall have a minimum clear dug section of 45 x 45 cm and a depth between 30 cm and 45 cm.

The depth to which holes on slopes or along steep inclines are to be dug shall be determined as shown in Figure D of Schedule S1.6.5.

The soil removed from the upper and lower portions of the hole shall be placed in separate mounds (see Figure B of Schedule S1.6.5), and the soil at the bottom of the hole shall then be loosened (see Figure C of Schedule S1.6.5).

In order to avoid any mistakes in identifying the different soil portions, hole digging work shall always start from the same end of the plantation area, and while proceeding towards the other end the top portion soil from each hole should be placed in mounds to the right of the hole and the bottom portion soil should be placed to the left of the hole.

Soil dug from each hole shall be allowed to dry in the sun for two weeks in order to: (a) sterilize the soil of fungal and insect spores; and (b) help pulverization of soil clods (essential for plant root penetration and aeration to root zones). The dug soil shall then be pulverized by breaking the clods and removing all debris, grass roots, brickbats, stones etc.

4B.6.7 Planting of Trees

In the case of severely infertile soil, the majority of the soil excavated from the top portion of the hole ("top soil") is to be mixed with 1 – 2 kg of compost for each hole see (Figure E of Schedule S1.6.6, as instructed by the Engineer.

An approved amount of NPK fertilizer shall be applied to the bottom of the hole, and then a layer of top soil shall be placed on the bottom of the hole. The plastic bag is to be torn carefully in order not to break off the earth before the seedling is placed into the hole (see Figure F of Schedule S1.6.6). The seedling shall be placed firmly into the hole, on top of the first layer of top soil, following which the remainder of the top soil (or soil mixed with compost, as the case may be) shall be backfilled around the plant. The soil excavated from the lower portion of the hole shall then be backfilled into the hole, and the soil in the hole compressed firmly by hand so that the soil will not be further compacted by rain (Figure G, H, I of Schedule S1.6.6).

The entire process of placing the seedling into the hole and backfilling with soil shall be performed with care in order to ensure that the roots do not grow "turned" – i.e. such that they do not form "J" roots (see Figure J of Schedule S1.6.6).

4B.6.8 Stake Fixation

Without delay following planting, a stout stake shall be placed firmly into the ground alongside the seedling (see Figure K of Schedule S1.6.6). The stake shall provide support against leaning or from wind-shake during the early stages, before the new roots have been able to develop sufficiently to firmly anchor the newly planted seedling.

The stake shall be good quality bamboo with an approved minimum thickness projecting not less than 2 m above ground. The bamboo stake shall be driven into the ground to a depth of between 30 cm and 40 cm at a distance of between 15 cm and 20 cm from the base of the seedling.

The planted seedling shall then be tied to the stake with a twine of jute fibre or an approved polymer product, with the sling length of the twine being the same as the distance between the plant and the stake.

4B.6.9 Mulching

"Mulching" means the placing of a thick circular mat of organic matter (either decomposed or undecomposed) on the ground around the stem of the planted seedling, to a distance of about 30 cm, in order to reduce moisture loss from the soil around the seedling from direct sun action (see Figure K of Schedule S1.6.6). Mulching conserves the soil moisture, which therefore prevents plant mortality as well as hindering grass invasion into the worked soil around the plant, and must therefore be done without delay as soon as the seedling has been planted.

Mulching shall be accomplished by using organic matter such as straw, farm waste, grass or water hyacinth, as approved by the Engineer.

4B.6.10 Shading to Planted Trees

As an intrinsic component of the tree planting process, and unless otherwise directed by the Engineer, the Contractor shall provide an appropriate shading mechanism such as the placing of plastic shade netting, 5 mm x 4 mm mesh gauge and 1.5 mm thickness, type Flower Net – I (NZ 8) or approved equivalent, around each plant or covering groups of plants as appropriate.

The planting of *Gliricidia sepium* (Weta Mara), which is an exotic species, or any other live plant or offcut to act as shade trees shall not be permitted since this may result in the introduction of invasive species to the area.

4B.6.11 Operation and Maintenance

4B.6.11.1 General Care of Planted Trees

The Contractor shall institute a programme of intensive continuous caretaking of the planted trees for the first six months after planting. Thereafter the Contractor may, subject to the approval of the Engineer, reduce the intensity caretaking to a periodic – albeit thorough – inspection every 3 months until the issue of the Certificate of Completion of the Works for all the Works under the Contract.

At the same as the caretaking inspections, but not more frequently than once per month, the Contractor shall work the soil around the base of the sapling in order to achieve better aeration, easier root penetration, and improved percolation of rain and irrigation water to the sub-soil.

4B.6.11.2 Weeding and Cleaning

Weeding and cleaning detritus or other foreign bodies from around the foot of each planted seedling shall be done whenever weeds become noticeable. The required frequency of weeding cannot be fixed in advance since it will vary with the season – it may be required every 2 to 3 weeks during the rainy season, and about once a month during the dry season.

4B.6.11.3 Caring for Defective Plants

Seedlings may become defective for any of the following common reasons:

- (i) the apex of the leading shoot or branches may become broken and/or shattered due to storm wind gusts or deliberately by humans;
- (ii) by cattle, where allowed to enter the plantation and browse the seedlings;
- (iii) through die-back (i.e. dying of the plant from the apex downwards) – this may be the consequence of a number of causes: severe root injury at the time of seedling uprooting from the nursery beds, root exposure due to breaking of the earth ball or defective planting, or infestation of the plant by shoot-boring insects.

However caused, the dead/defective top section of the sapling must be minutely examined and the distance down the stem to which the defect has reached must be correctly identified. Thereafter the stem must be cut sharply and at a slant at a green and healthy point of the stem or branch about a centimetre below the limit of the defect, such that the plant is left completely free from disease or infected injury. The cut surface shall then be sealed off by a suitable paint or by applying raw cow dung paste in order to prevent fresh attack by insect or fungus. A sharp and clean cut made at a healthy point on the stem or branch usually heals quickly and further deterioration is thwarted, with the eruption of fresh sprouting and a continuation of height growth.

4B.6.11.4 Gap Filling / Vacancy Planting

Any plant which is so defective that recovery is not possible, and any dead or severely damaged plant, shall be replaced by means of gap filling ("vacancy planting"). The Contractor is therefore required to maintain at all times adequate stocks of seedlings ready to be used for such vacancy planting, whenever the need arises.

4B.6.11.5 Fertilizer Application – Top Dressing

It is expected that, provided the Contractor has made the proper preparations and carried out the replanting correctly, no additional fertilizer will be needed. Nevertheless, if the parent soil is particularly poor in nutrient content and a quick rate of growth is required, chemical fertilizer shall be applied where instructed by the Engineer as top dressing in strict accordance with the manufacturer's instructions.

4B.6.11.6 Pest Control

Any incidence of pest infestation and diseases of any type shall be constantly monitored through careful inspections, including the rapid confirmation of all affected locations and an accurate assessment of the nature and severity of the infestation or disease.

4B.6.11.7 Name Boards

Wherever a reforestation planting area lies outside a protected area, such that the replanted area will eventually be managed by a local community or other state organisation, name boards shall be provided in each planting area. In each planting area, in locations and of a type of fabrication as directed by the Engineer, three name boards for each plant species shall be provided and erected which present educational information about the native species for the benefit of the residents in the vicinity. The name board for each species shall include the scientific name (in italics) and the common name in a format to be directed by the Engineer.

4B.7 Awareness Training

4B.7.1 General Requirements

The awareness training is to be carried out for the benefit of the local population surrounding the planting areas, and shall include the demonstration of procedures and operational activities, displaying nursery and plantation records and providing information during consultation sessions related primarily to the caring, monitoring and record keeping of the enriched or forested area as well as the establishment of the plantations themselves.

In order for the training to be successful, the Contractor's Forestry Specialist **Reforestation Awareness Trainer**, to be responsible for the training, will be required to have excellent facilitator characteristics, such as:

- managing and interacting easily with the trainee groups, including maintaining control over the efficiency and relevance of discussions, the flow of information, and the integrated coherence of contributions;
- the ability to elicit a constructive reaction and ideas from the trainees;
- a high level of competence in collating and summarising the contributions from others in order to be easily assimilated and informative for everybody involved.

The respective awareness training should be conducted prior to the initiation of tree planting in each area, and the date for training at each location will be notified to the Contractor by the Engineer depending on the actual planting programme.

4B.7.2 Target Groups and Locations

The target groups to receive awareness training are those communities or stakeholder agencies in the vicinity of each planting area to which will be assigned the responsibility for the long-term maintenance and monitoring of the reforested land. Typical examples of such target groups are school staff and students, farmer organisations, village or community based organisations, or the maintenance personnel of government or non-government institutions etc.

It is expected that the maximum number of participants at any awareness training session would not exceed 100 people.

A suitable and conveniently situated training location for each planting area shall be identified and proposed by the Contractor for the approval of the Engineer. Wherever such a suitable location is a venue owned by the Government or is a local community hall or facility, at the Contractor's request the Employer will provide appropriate assistance in obtaining the necessary permissions etc.

Following approval of each training location, the Contractor shall be responsible for all related logistical arrangements including the preparation of the venue for the number of participants expected, the provision of refreshments/meals for the participants, and all presentation arrangements (such as sound systems, projection systems/equipment, screens, boards etc.) to the satisfaction of the Engineer.

4B.7.3 Details of Awareness Training

The duration of each training session shall be agreed with the Engineer to suit the needs of the target group, however it is expected that one training session would last for about half a day. The Reforestation Awareness Trainer shall maintain an attendance register for each training session containing information on each participant including his/her name, title and occupation, and personal contact details, with entries on the register to be signed by the respective participant.

All training shall be conducted in Sinhala, however the Reforestation Awareness Trainer must be equally capable of discussing all aspects of the training content in Tamil and English where required, depending on the language proficiency of the participants.

The Contractor shall be responsible for the provision and preparation of all training materials and presentation facilities needed by the Reforestation Awareness Trainer and all the participants, including customised versions of pamphlets, course notes, posters, a monitoring guidebook, a multi-media presentation content and equipment, ordinary stationery etc. as approved by the Engineer.

The detailed content (and method) of each awareness training session shall be determined depending on the occupations, social structure, and learning aptitude of the participants, however in all cases it shall include a multi-media presentation and discussions coupled with a small field session. Sufficiently in advance of date of each training session, the Contractor shall submit to the Engineer for review and approval the details of the particular training session content, clearly identifying all ways in which the respective training content has been customised or amended to suit the particular target group.

4B.7.4 Training Outputs and Quality Control

Following each training session the respective participants group should have a clear understanding of the program of ecological restoration through reforestation, and must be able to demonstrate the following:

- a raised awareness of key ecological aspects related to reforestation and environmental issues;
- full comprehension of the relevant specific reforestation activities involved in the local planting area;
- contributions to discussions on the sustainable management and monitoring of these reforested areas;
- a commitment to promote successful reforestation in the area;
- an awareness of the national policy on forest conservation.

At the end of the awareness training session the Reforestation Awareness Trainer shall distribute and explain a feedback form which shall be filled in by all the participants, and all completed feedback forms shall be collected, collated and checked and subsequently submitted to the Engineer.

The Engineer will provide the Contractor in advance with the feedback form, however all costs of materials and reproduction associated with the feedback procedure shall be borne by the Contractor. The Reforestation Awareness Trainer shall perform an assessment of the success of the training sessions by means of an analysis of each returned feedback form, and his assessment shall be submitted to the Engineer together with the completed forms. The Engineer shall then determine actual degree of success of each session.

4B.8 Measurement and Payment

4B.8.1 Establishment of Nursery

4B.8.1.1 Site Preparation

- (i) Measurement of the preparation of the nursery area shall be made as the net plan area in square metres (m²) of the ground surface which is required for the establishment of the nursery as directed by the Engineer.

Payment for preparation of the nursery area will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include for the cost of all things necessary for the clearance and removal of shrubs and other vegetation, removal of topsoil, any hard surfaces and rubbish, and the disposal of all material removed including the preservation of any items identified by the Engineer as having value, levelling of the ground area, planting protective grassing and establishing windbreaks where required and directed by the Engineer, all labour, materials, Contractor's Equipment, setting-out, and other costs incurred.

- (ii) Measurement of the preparation of nursery beds shall be made as the net length in metres (m) of beds of the specified width as required, in accordance with the Specification and as directed or agreed by the Engineer, in order to provide the correct number of seedlings for transplantation to the planting area, irrespective of the orientation of the beds.

Payment for the preparation of nursery beds will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include the costs of all labour, Contractor's Equipment, setting-out, materials and all things necessary including for the construction of the necessary drainage works, and provision and placing of surface dressing, and temporary fencing of the nursery blocks required.

- (iii) Measurement of the establishment of the nursery watering system shall be made as a Lump Sum to be paid on completion of the entire functional system for the nursery.

Payment for the establishment of the nursery watering system will be made at the respective price entered in the Bill of Quantities Bill No. 3B, which shall include the costs of provision and erection of approved PVC water tanks and supporting structures, provision and installation of the necessary water pumps, PVC pipes fittings, valves, and associated materials. The price shall also include for all costs of handling, cutting, laying and joining (including couplings) of pipes, and all labour, Contractor's Equipment, materials and all things necessary for the establishment of the functioning watering system.

4B.8.1.2 Planting of Seeds and Seedling Collection

- (i) Measurement of the purchase/provision of seeds shall be made as the number (No) of good quality seeds obtained and planted in the seed beds in the nursery in accordance with the Specification and which have been accepted by the Engineer, including fertilizer application as necessary.

Payment for the purchase/provision of seeds will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include all costs associated with the purchase of the seeds, their handling and transport to the nursery area, storage, handling and planting in the seed beds including fertilizer.

- (ii) Measurement of the operation and maintenance of the nursery shall be by the complete month calculated from the time at which the Engineer confirms that the establishment of the nursery has been satisfactorily completed until the end of seedling production or the Completion Date of the Contract, whichever is earlier.

Payment for the operation and maintenance of the nursery will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include the costs of provision of electricity, water, security, cleaning, garbage disposal, and all labour, materials and Contractor's Equipment necessary to satisfy the requirements of the Specification.

4B.8.2 Tree Planting

4B.8.2.1 Site Preparation

- (i) Measurement for carrying out the land survey and the ecological survey shall be made as the net plan area in hectares (ha) of the ground surface of the designated tree planting area over which the survey is required as directed by the Engineer.

Payment for carrying out the land survey and the ecological survey will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include for the cost of all activities associated with the topographic surveying, including fieldwork and preparation of the topographic plan of the area to the format agreed with the Engineer, and fieldwork for the ecological survey as specified and preparation of the results, the clear demarcation of the boundary of the designated planting area, and all labour, materials, Contractor's Equipment and any other associated costs.

- (ii) Measurement for the clearance of the tree planting areas shall be made as the net plan area in hectares (ha) of the ground surface of the planting area on which clearing is to be performed as directed by the Engineer.

Payment for the clearance of the tree planting area will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include for the cost of all things necessary for the removal and disposal of weeds, shrubs, small plants and individual mature trees giving unnecessary shade, ploughing topsoil, establishment of fire breaks, provision of fencing system, and establishment of planting grid system, labour, materials, Contractor's Equipment, setting-out and all other costs associated with this work.

- (iii) Measurement for the removal of invasive alien species shall be made as the number (No) of IAS trees identified and instructed for removal by the Engineer within the designated planting area.

Payment for the removal of invasive alien species will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include for the cost of all things necessary for the complete uprooting, removal and disposal of the entire plant in accordance with the Specification and as directed by the Engineer, refilling the hole with suitable soil with hand compaction up to the ground surface, and all labour, materials, Contractor's Equipment and all other costs associated with this work.

- (iv) Measurement of the boundary fencing to the planting areas as well as the alternative of fencing around individual plants shall be by the number of plants (No) enclosed by the fencing measured when complete and erected in situ.

Payment for the boundary fencing to the planting areas as well as the alternative of fencing around individual plants will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include the costs of wire mesh, fence posts, pegs, and any other materials and fixings required for the approved fencing system, firmly mounting the posts into the ground, bending and pegging the mesh and attaching the mesh to the posts, and all works necessary to complete the fence as directed by the Engineer.

- (v) Measurement of the provision and fixing of tree name boards shall be according to the number (No) of name boards as specified and as directed by the Engineer.

Payment for the provision and fixing of tree name boards will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include the costs of provision of the name boards as specified, complete with all text printing indelibly on a plain background as agreed with the Engineer, and fixing the name boards firmly to the trees as directed by the Engineer.

4B.8.2.2 Planting Trees and Maintenance

- (i) Measurement of the provision of seedlings for planting by purchasing from existing nurseries shall be according to the number (No) of good quality seedlings in accordance with the Specification purchased as directed by the Engineer and transported carefully and without damage and replanting in the Contractor's nursery.

Payment for the provision of seedlings for planting by purchasing from existing nurseries will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include the costs of purchase of the good quality seedlings as required and directed by the Engineer, handling, transport, planting in the Contractor's nursery and the replacement at the Contractor's

cost of any seedlings so purchased and damaged prior to or during replanting in the Contractor's nursery, and all labour, Contractor's Equipment, and materials.

- (ii) Measurement of the provision of seedlings for planting by purchasing from forest department shall be according to the number (No) of good quality seedlings in accordance with the Specification purchased as directed by the Engineer and transported carefully and without damage and replanting in the Contractor's nursery.

Payment for the provision of seedlings for planting by purchasing from existing nurseries will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include the costs of purchase of the good quality seedlings as required and directed by the Engineer, handling, transport, planting in the Contractor's nursery and the replacement at the Contractor's cost of any seedlings so purchased and damaged prior to or during replanting in the Contractor's nursery, and all labour, Contractor's Equipment, and materials.

- (iii) Measurement of the planting of tree seedlings in the selected land area shall be according to the number (No) of good quality tree seedlings satisfactorily transferred from the nursery to the planting area and planted in accordance with the Specification and as directed by the Engineer.

Payment for the planting of tree seedlings in the selected land area will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include the costs of removing from the nursery bed and transporting to the planting area, excavation of the planting hole, handling and planting the seedling in the hole including backfilling, stake fixation and mulching, complete as specified, and all labour, Contractor's Equipment, fertilizer and other materials.

- (iv) Measurement of the provision and erection of plastic shade netting around individual plants or covering groups of plants as appropriate shall be as the number (No) of plants for which shade netting is provided as directed by the Engineer in accordance with the Specification.

Payment for the provision and erection of plastic shade netting around individual plants or covering groups of plants as appropriate will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include the costs of supply of the plastic netting and all other materials required for erection and for the careful erection around individual plants or covering groups of plants as appropriate.

- (v) Measurement of the operation and maintenance of the tree planting area shall be by the complete month calculated from the time at which the Engineer confirms that all site preparation work for the area has been satisfactorily completed until the end of Completion Date of the Contract.

Payment for the operation and maintenance of the tree planting area will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include the costs of the provision of general care of the planted trees, weeding and cleaning, cutting back defects in plants and, where necessary, removal and replacement of severely defective or dead plants (gap filling), pest control, watering and fertilizer application as required, and provision of security until hand over to the Employer, all in accordance with the Specification and as directed by the Engineer.

4B.8.3 Awareness Training

- (i) Measurement of the provision and preparation of all training facilities, equipment and materials as required for the awareness training of all types of target groups shall be made as a Lump Sum to be paid on provision of the facilities and equipment and submission to the Engineer of a complete bound set, together with a complete electronic version, of all awareness training materials.

Payment for the provision and preparation of all training facilities, equipment and materials as required for the awareness training will be made at the respective price entered in the Bill of Quantities Bill No. 3B, which shall include for all personnel, material and other costs involved in such provision and preparation.

- (ii) Measurement of the conducting of awareness training sessions shall be as the number (No) of sessions successfully conducted, irrespective of the type of target group, in accordance with this Specification.

Payment for the conducting of awareness training sessions will be made at the respective unit rate entered in the Bill of Quantities Bill No. 3B, which shall include all costs for personnel, transportation, provision of venues, reproduction and distribution of materials, setting up and dismantling the training facilities and equipment, and any other costs associated with the training sessions.

Seventy percent (70%) of the unit rate for awareness training session will be paid on successful conducting of the session at the agreed venue, and the remaining thirty percent (30%) of the unit rate for each session will be paid on the submission of all trainee feedback information as specified to the Engineer from that specific session and the evaluation of this information by the Engineer as satisfying the requirements of this Specification.

4B.8.4 Other Requirements

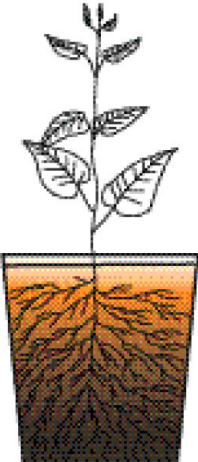
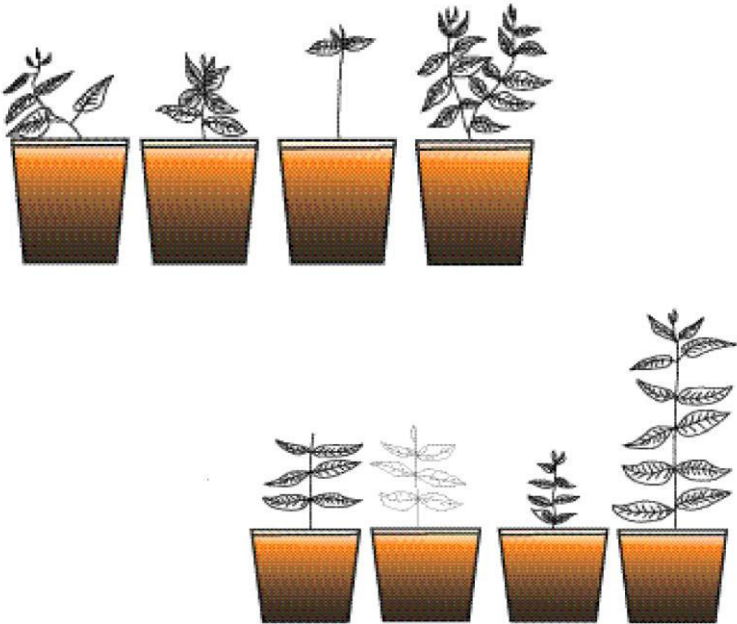
- (i) Payment for the preparation and submission of all nursery establishment progress reports, Monthly Maintenance Reports, photographs and any other documentation required in accordance with the Specification will be made at the monthly unit rate entered in the Bill of Quantities Bill No. 3B, except that the Engineer shall be entitled to make an appropriate deductions from any monthly payment in the event that any documentation or photographs have not been submitted in the required quality or quantity or at the correct time.

Schedule 1.5

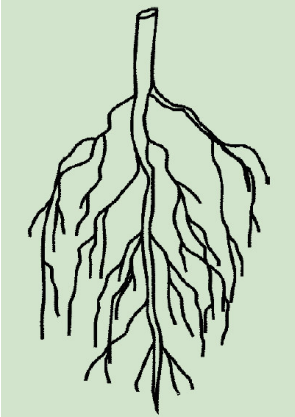
Establishment of Nursery

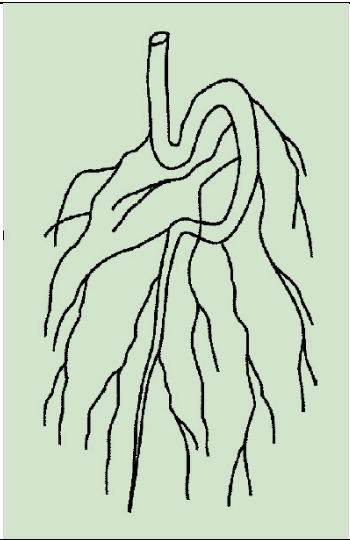
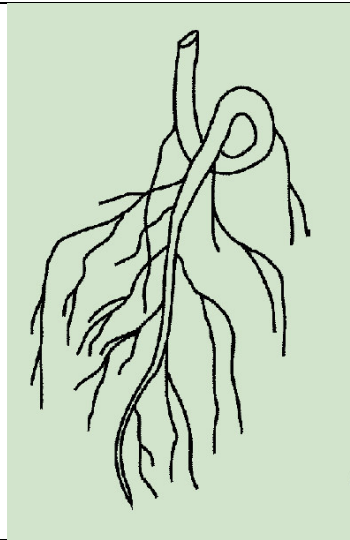
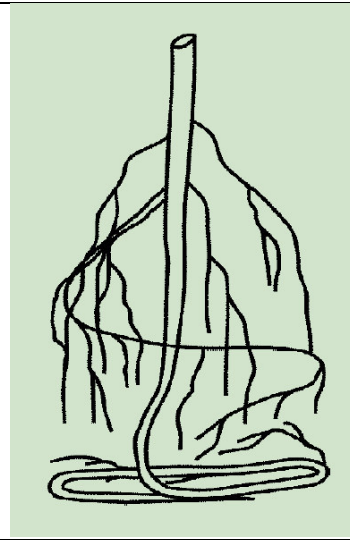
S1.5.2.3 Seedling Quality

S1.5.2.3.1 Good Quality and Poor Quality Seedlings

	
	
Good Quality Seedling	<p>Poor Quality Seedlings</p> <p>Starting at the top left they have the following problems: bent stem; too small; too few leaves; two stems; dead main shoot; yellow leaves (nutrient deficient); extremely small leaves; overgrown (unbalanced shoot and root system)</p>

S1.5.2.3.1 Good Quality and Poor Quality Root System

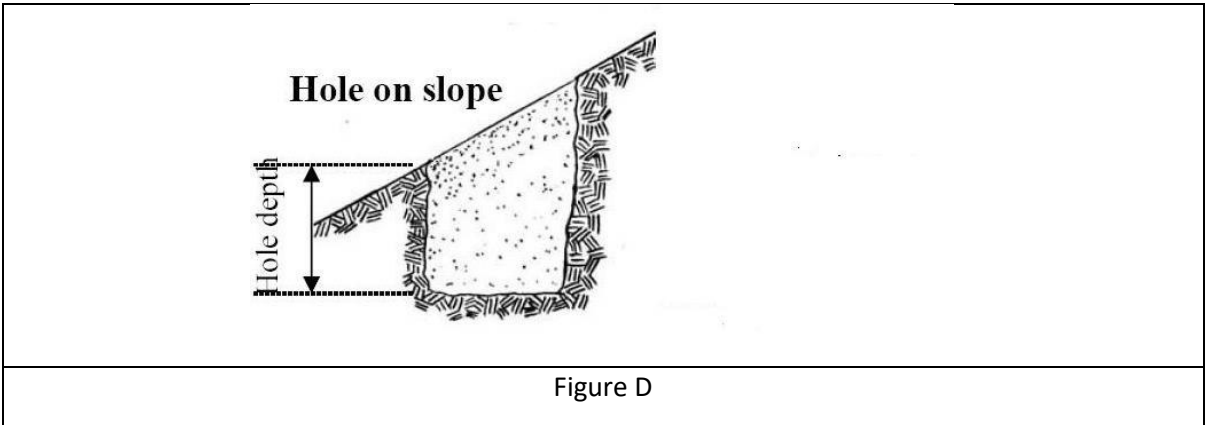
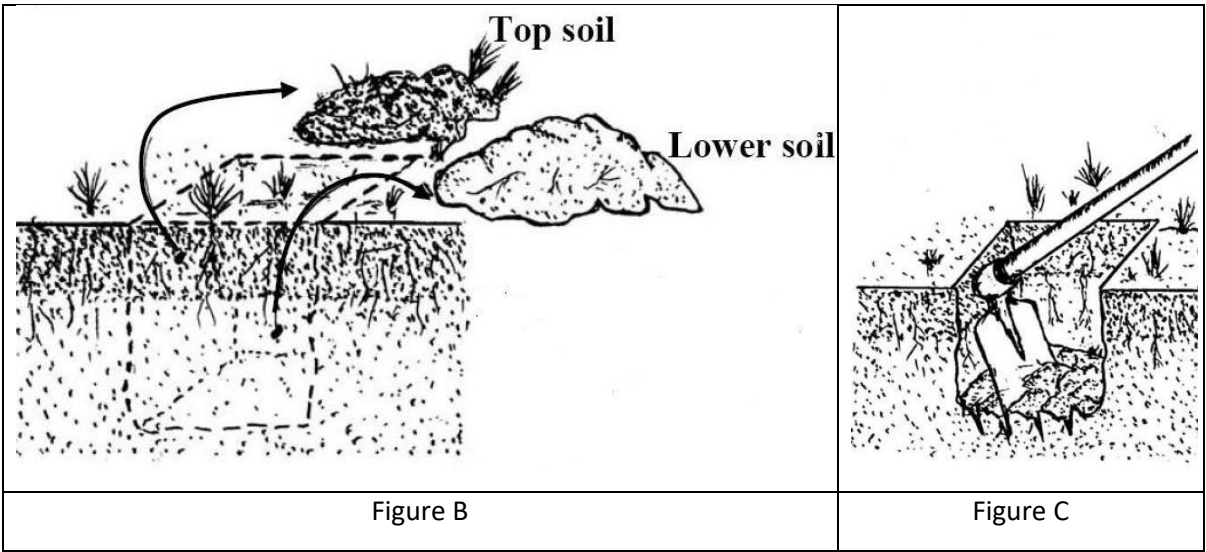
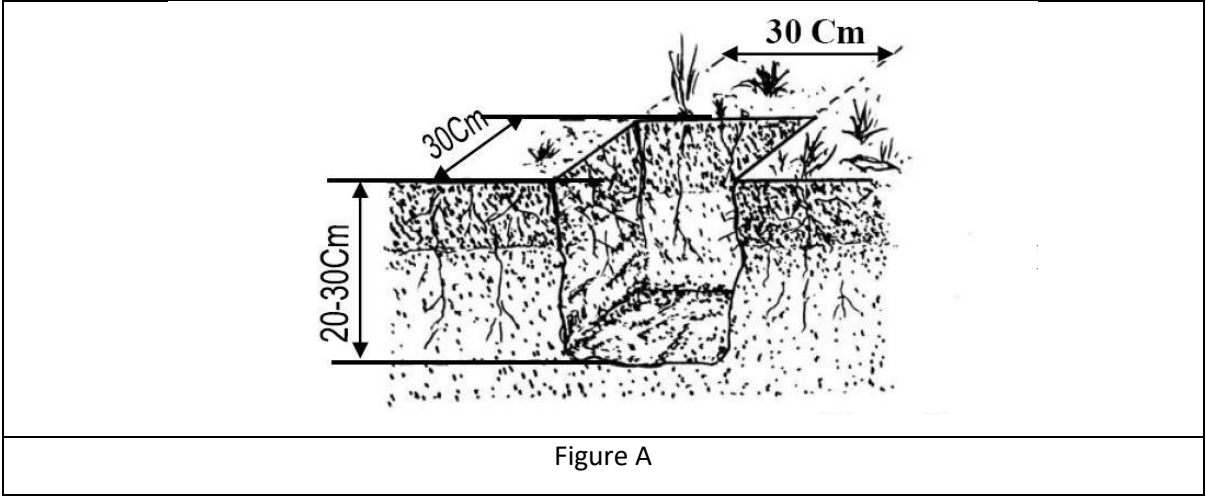
Good Root System	
	
<p>A good root system free of deformities. The tap root is straight, like a carrot. Notice the many fine root hairs that are important for the absorption of water and nutrients.</p>	

Deformed Root Systems		
		
<p>A deformed root system caused by poor pricking out. Notice that the roots are twisted close to the surface of the container.</p>	<p>A deformed root system caused by poor pricking out. Here the main root was stuffed into a hole too small and the roots were twisted upwards. As the roots began to grow downwards, they formed a complete loop.</p>	<p>A spiralled root system caused by the smooth surface of the bag. Notice that the roots are coiled at the bottom of the bag — not near the soil surface.</p>

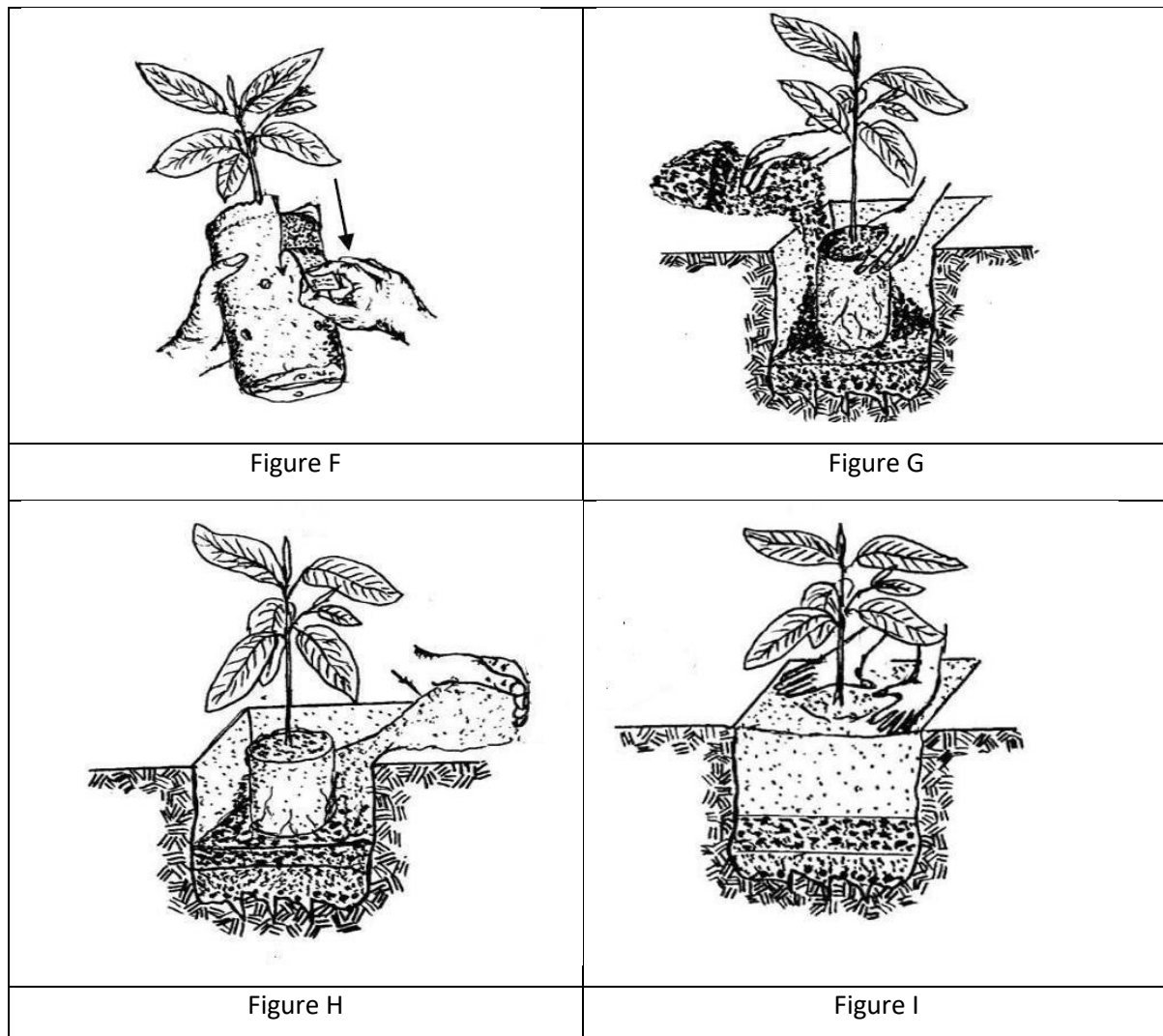
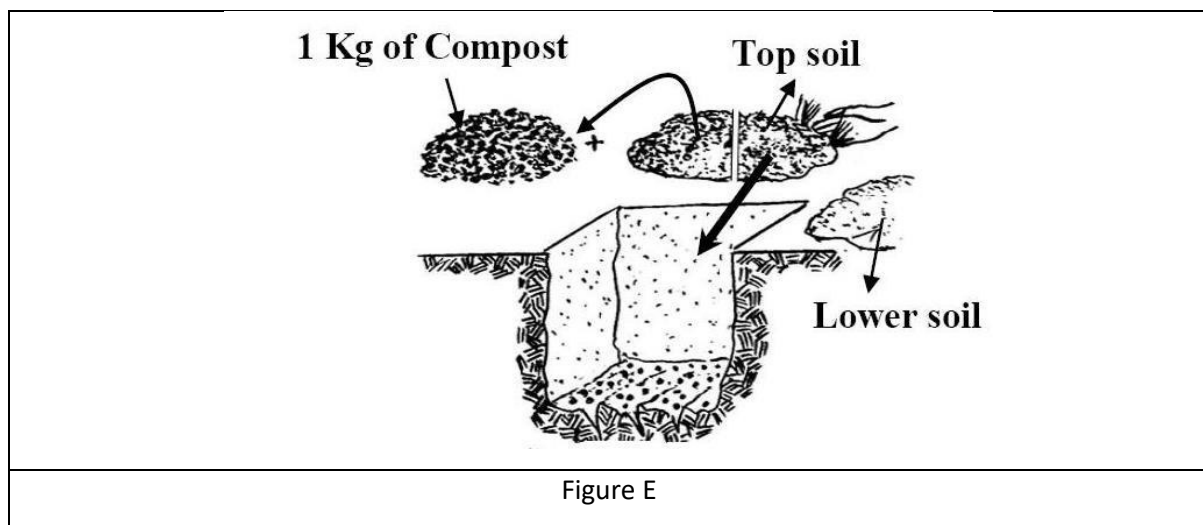
Schedule 1.6

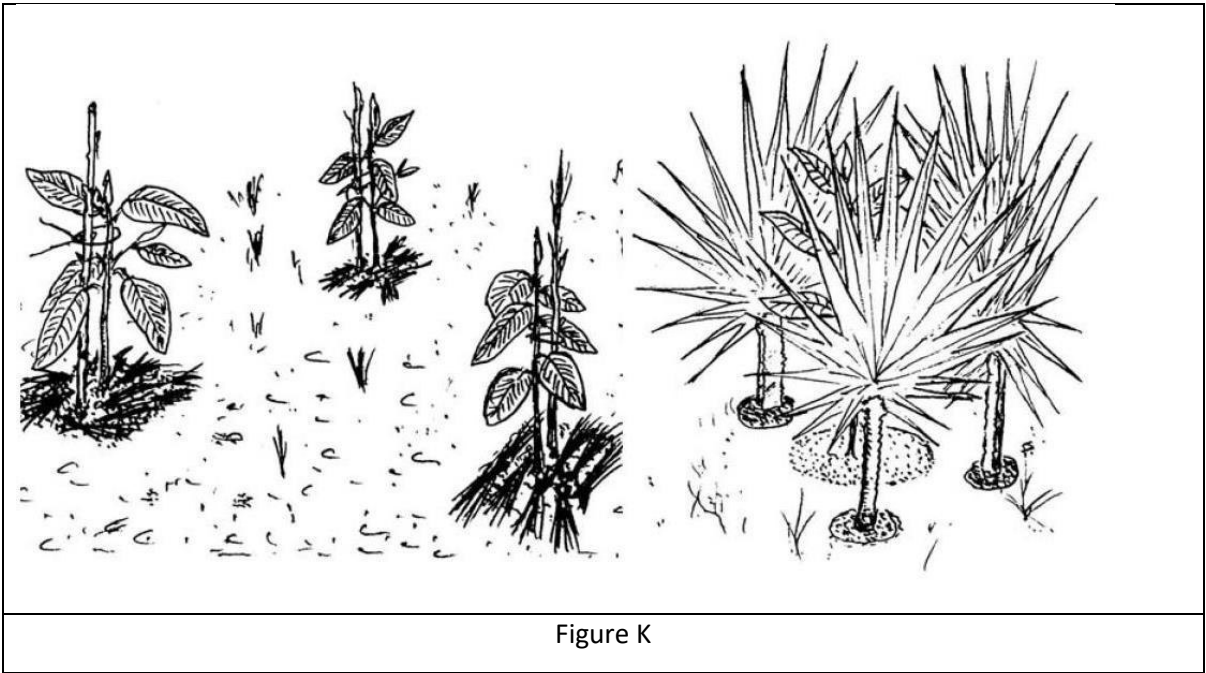
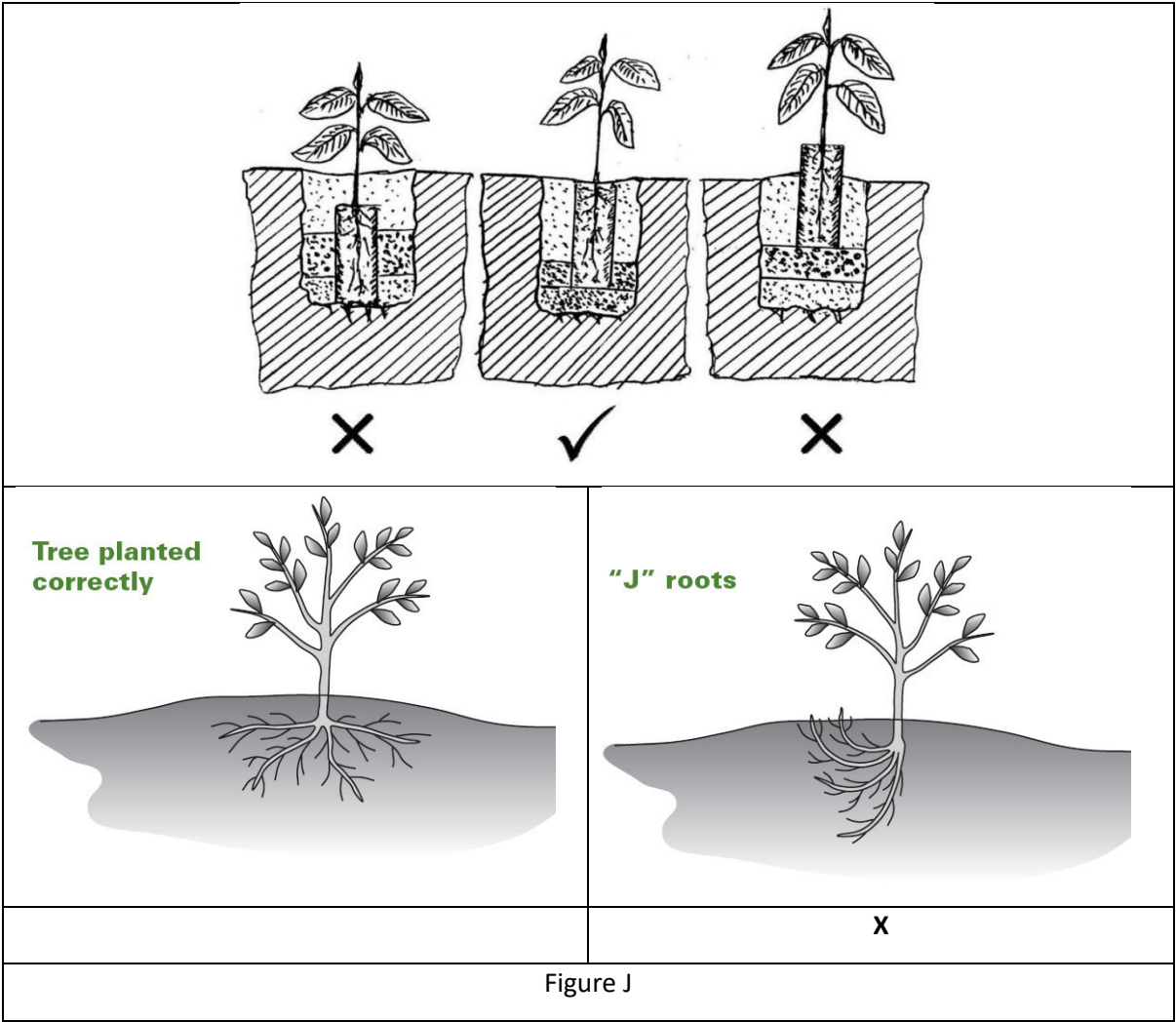
Tree Planting

S1.6.5 Planting Hole



S1.6.6 Planting of Tree





Mahaweli Water Security Investment Program (MWSIP)

Construction of Upper Elahera Canal from 0+100 km to 6+226 km

Contract Package UECP-ICB-1

Contract No.: MMMDE/MWSIP/ADB/UECP/ICB-1/3267-3268-SRI/ICB/2016/002

VARIATION NO. 7

Annex 2

Bill of Quantities – Bill No. 3B

Reforestation

BILL OF QUANTITIES

Mahaweli Water Security Investment Program
Construction of Upper Elahera Canal from 0+100 km to 6+226 km

Bill No. 3B - Reforestation

Item	Description of Works	Unit	Total Quantity (1)	Rate (LKR) (3)	Amount (LKR) (1) x (3)
3B.1	Tree Planting				
3B.1.1	Site Preparation				
3B.1.1.1	Carrying out land survey, preparation of topographical plan and demarcation of area	ha	15		
3B.1.1.2	Clearance of tree planting areas including removal and disposal of weeds, shrubs, small plants and individual mature trees giving unnecessary shade, ploughing topsoil, establishment of fire breaks, and establishment of planting grid system all as specified and as directed by the Engineer	ha	15		
3B.1.1.3	Removal and disposal of invasive alien species as specified where directed by the Engineer	No	100		
3B.2.1.4	Approved system of fencing around planting area perimeters or around individual plants complete as specified and as directed by the Engineer	No	16,700		
3B.1.2	Planting Trees and Maintenance				
3B.1.2.1	Provision for purchasing of seedlings for planting from existing nurseries where directed by the Engineer including transportation to the site	No	16,700		
3B.1.2.2	Planting tree seedling in the selected land area complete including removing from nursery bed, loading and transporting to planting area, excavation of hole, handling and planting seedling in hole including backfilling, stake fixation and mulching, complete as specified	No	16,700		
3B.1.2.3	Provision and erection of plastic shade netting around each plant or covering groups of plants as appropriate complete as specified and as directed by the Engineer	No	16,700		
3B.1.2.4	Operation and maintenance of the tree planting area including general care of planted trees, weeding and cleaning, cutting back defects and, where necessary, removal and replacement of severely defective or dead plants (gap filling), pest control, watering and fertilizer application as required, and provision of security until hand over to the Employer	month	6		
3B.2	Other Requirements				
3B.2.1	Preparation and submission of all progress reports, Monthly Maintenance Reports, photographs and any other documentation required in accordance with the Specification	month	6		
Total for Bill No. 3B - Reforestation carried to LETTER OF QUOTATION					

June 2018

Signature of Bidder:

Name of Bidder:

Variation No. 7

Mahaweli Water Security Investment Program (MWSIP)

Construction of Upper Elahera Canal from 0+100 km to 6+226 km

Contract Package UECP-ICB-1

Contract No.:

MMMDE/MWSIP/ADB/UECP/ICB-1/3267-3268-SRI/ICB/2016/002

VARIATION NO. 7

Annex 3

Form of Letter of Quotation

LETTER OF QUOTATION

The Letter of Quotation must be accomplished on the Contractor's letterhead.

Date: 20.....

To: *[Address of Engineer]*

Mahaweli Water Security Investment Program Contract Package UECP-ICB-1

- (a) We have been requested by you to submit a Quotation in accordance with the specific requirements set out in the following Variation

Variation No. 7

(hereinafter referred to as the "Variation").

issued to you by the Engineer in accordance with Sub-Clause 13.3 of the Conditions of Contract, for the following works:

Implementation of specific additional environmental mitigation measures proposed by the EIA Study as instructed by the Engineer – specifically ecological restoration through reforestation

- (b) We have examined the following documents related to the work to be executed under this Variation:
- (i) Specification Section 4B *[Ecological Restoration through Reforestation]* (included as Annex 1 to the Variation)
 - (ii) Bill of Quantities Bill No. 3B (included as Annex 2 to the Variation)
 - (iii) details of forest enrichment (included as Annex 4 to the Variation)
 - (iv) details of seeds and trees to be planted (included as Annex 5 to the Variation).
- (c) We offer to execute in conformity with the Contract and the documents listed in sub-paragraph (b) above the works covered by this Variation. Our quotation shall be valid and shall remain binding upon us and may be accepted at any time.
- (d) The total price of our quotation, not including VAT, on the basis of the estimated quantities of work given in the Bill of Quantities Bill No. 3B annexed to the Variation and submitted fully completed together with this quotation is

LKR

For and on behalf the Contractor:

Signed:

Name:

Contractor's Representative

Mahaweli Water Security Investment Program (MWSIP)

Construction of Upper Elahera Canal from 0+100 km to 6+226 km

Contract Package UECP-ICB-1

Contract No.: MMMDE/MWSIP/ADB/UECP/ICB-1/3267-3268-SRI/ICB/2016/002

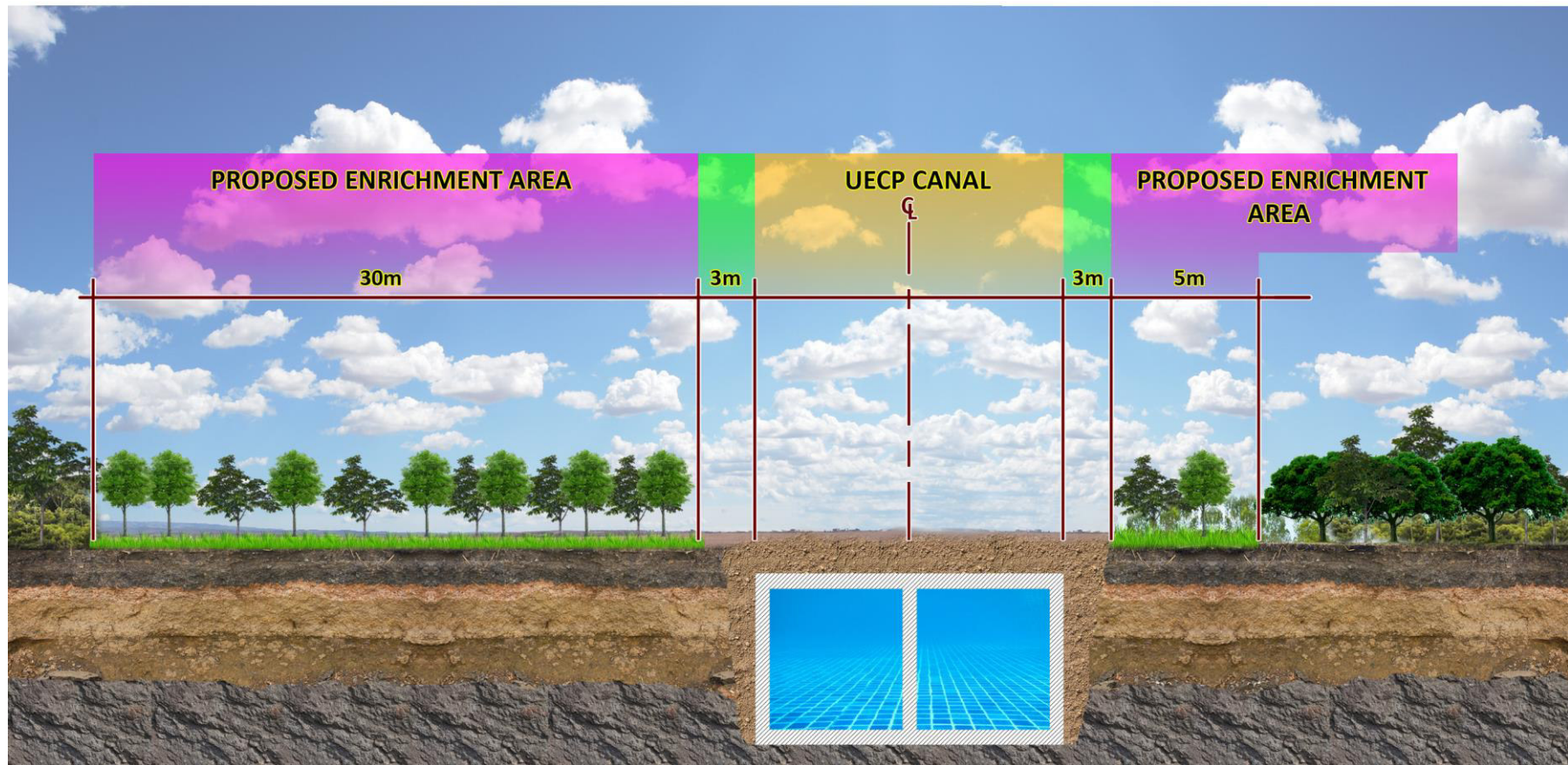
VARIATION NO. 7

Annex 4

Details of Forest Enrichment

DETAILS OF FOREST ENRICHMENT:

**PROPOSED ENRICHMENT PLAN FOR UECP
FROM 1+000km TO 3+980km**



Mahaweli Water Security Investment Program (MWSIP)

Construction of Upper Elahera Canal from 0+100 km to 6+226 km

Contract Package UECP-ICB-1

Contract No.:

MMMDE/MWSIP/ADB/UECP/ICB-1/3267-3268-SRI/ICB/2016/002

VARIATION NO. 7

Annex 5

Details of Seeds and Trees to be Planted

Details of Seeds and Trees to be Planted

ABBREVIATIONS:

HA – Habit TS – Taxonomic Status NCS – National Conservation Status (EN – Endangered; VU – Vulnerable; NT – Near Threatened)

Family – Old	Family – New	Scientific Name	Common Name	HA	TS	NCS	Notes
Anacardiaceae	Anacardiaceae	<i>Mangifera zeylanica</i>	Etamba	Tree - Large	Endemic		close to water
Annonaceae	Annonaceae	<i>Miliusa indica</i>	Kekili Messa	Tree - Small	Native		
Annonaceae	Annonaceae	<i>Polyalthia coffeoides</i>	Omara	Tree - Medium	Native		
Annonaceae	Annonaceae	<i>Polyalthia korinti</i>	Ui Kenda	Tree - Small	Native		
Apocynaceae	Apocynaceae	<i>Alstonia scholaris</i>	Ruk Attana	Tree - Large	Native		
Bignoniaceae	Bignoniaceae	<i>Stereospermum colais</i>	Dunu Madala	Tree - Large	Native		
Celastraceae	Celastraceae	<i>Cassine glauca</i>	Neralu	Tree - Medium	Endemic		
Celastraceae	Celastraceae	<i>Pleurostyliya opposita</i>	Panakka	Tree - Small	Native		
Clusiaceae	Clusiaceae	<i>Garcinia spicata</i>	Ela Gokatu	Tree - Small	Native	NT	close to water
Combretaceae	Combretaceae	<i>Terminalia arjuna</i>	Kumbuk	Tree - Large	Native		close to water
Ebenaceae	Ebenaceae	<i>Diospyros affinis</i>	Eta Thimbiri, Kalu Wella	Tree - Medium	Native	NT	
Ebenaceae	Ebenaceae	<i>Diospyros ebenum</i>	Kaluwara	Tree - Medium	Native	EN	
Ebenaceae	Ebenaceae	<i>Diospyros malabarica</i>	Timbiri	Tree - Large	Native		close to water
Ebenaceae	Ebenaceae	<i>Diospyros ovalifolia</i>	Kunumella	Tree - Medium	Native		
Ebenaceae	Ebenaceae	<i>Maba buxifolia</i>	Kalu Habaraliya	Tree - Small	Native		
Euphorbiaceae	Phyllanthaceae	<i>Bridelia retusa</i>	Ketakala	Tree - Medium	Native		
Euphorbiaceae	Euphorbiaceae	<i>Dimorphocalyx glabellus</i>	Weli Wenna	Tree - Small	Native		
Euphorbiaceae	Putranjivaceae	<i>Drypetes sepiaria</i>	Weera	Tree - Large	Native		
Euphorbiaceae	Euphorbiaceae	<i>Mallotus rhamnifolius</i>	Molabe	Tree - Small	Native		
Euphorbiaceae	Phyllanthaceae	<i>Margaritaria indicus</i>	Karawu	Tree - Medium	Native	VU	
Euphorbiaceae	Picrodendraceae	<i>Mischodon zeylanicus</i>	Tammanna	Tree - Medium	Native		
Fabaceae	Fabaceae	<i>Bauhinia racemosa</i>	Mayila	Tree - Small	Native		
Fabaceae	Fabaceae	<i>Erythrina fusca</i>	Yak Erabadu	Tree - Small	Native	NT	

Family – Old	Family – New	Scientific Name	Common Name	HA	TS	NCS	Notes
Fabaceae	Fabaceae	<i>Pongamia pinnata</i>	Magul Karanda	Tree - Medium	Native		close to water
Flacourtiaceae	Achariaceae	<i>Hydnocarpus venenata</i>	Makulu	Tree - Medium	Endemic		close to water
Lauraceae	Lauraceae	<i>Alseodaphne semecarpifolia</i>	Wewarana	Tree - Large	Native	VU	
Lauraceae	Lauraceae	<i>Litsea glutinosa</i>	Bomeya	Tree - Small	Native		
Loganiaceae	Loganiaceae	<i>Strychnos nux-vomica</i>	Godakaduru	Tree - Medium	Native	VU	
Loganiaceae	Loganiaceae	<i>Strychnos potatorum</i>	Ingini	Tree - Medium	Native	VU	
Melastomataceae	Melastomataceae	<i>Memecylon angustifolium</i>	Kora Kaha	Shrub	Native	EN	close to water
Melastomataceae	Melastomataceae	<i>Memecylon capitellatum</i>	Dedi Kaha, Weli Kaha	Shrub	Endemic		
Melastomataceae	Melastomataceae	<i>Memecylon umbellatum</i>	Kora Kaha	Shrub	Native		
Meliaceae	Meliaceae	<i>Walsura trifoliolata</i>	Kirikon	Tree - Medium	Native		
Moraceae	Moraceae	<i>Streblus asper</i>	Geta Netul	Tree - Small	Native		
Myrtaceae	Myrtaceae	<i>Eugenia willdenowii</i>	Tembiliya	Tree - Small	Endemic		
Myrtaceae	Myrtaceae	<i>Syzygium cumini</i>	Madan	Tree - Large	Native		
Rubiaceae	Rubiaceae	<i>Haldina cordifolia</i>	Kolon	Tree - Large	Native		
Rubiaceae	Rubiaceae	<i>Ixora coccinea</i>	Ratambala	Shrub	Native		close to water
Rubiaceae	Rubiaceae	<i>Ixora pavetta</i>	Maha Ratambala	Tree - Small	Native		
Rubiaceae	Rubiaceae	<i>Mitragyna parvifolia</i>	Helamba	Tree - Large	Native		close to water
Rubiaceae	Rubiaceae	<i>Morinda coreia</i>	Ahu	Tree - Small	Native		
Rubiaceae	Rubiaceae	<i>Nauclea orientalis</i>	Bakmi	Tree - Medium	Native		close to water
Rubiaceae	Rubiaceae	<i>Tarenna asiatica</i>	Tarana	Shrub	Native		
Rutaceae	Rutaceae	<i>Chloroxylon swietenia</i>	Buruta	Tree - Large	Native	VU	
Rutaceae	Rutaceae	<i>Glycosmis mauritiana</i>	Bolpana	Shrub	Native		
Rutaceae	Rutaceae	<i>Pleiospermium alatum</i>	Tumpat Kurundu	Tree - Medium	Native		
Sapindaceae	Sapindaceae	<i>Dimocarpus longan</i>	Mora	Tree - Medium	Native		
Sapindaceae	Sapindaceae	<i>Lepisanthes tetraphylla</i>	Dambu	Tree - Medium	Native		
Sapindaceae	Sapindaceae	<i>Sapindus emarginata</i>	Kaha Penela	Tree - Medium	Native		

Family – Old	Family – New	Scientific Name	Common Name	HA	TS	NCS	Notes
Sapindaceae	Sapindaceae	<i>Schleichera oleosa</i>	Koon	Tree - Large	Native		
Sapotaceae	Sapotaceae	<i>Madhuca longifolia</i>	Mi	Tree - Large	Native	NT	close to water
Sapotaceae	Sapotaceae	<i>Manilkara hexandra</i>	Palu	Tree - Large	Native	VU	
Sterculiaceae	Malvaceae	<i>Pterospermum suberifolium</i>	Welan	Tree - Large	Native		
Sterculiaceae	Malvaceae	<i>Sterculia foetida</i>	Telembu	Tree - Large	Native		
Tiliaceae	Malvaceae	<i>Berrya cordifolia</i>	Hal Milla	Tree - Large	Native		
Tiliaceae	Malvaceae	<i>Diplodiscus verrucosus</i>	Dik Wenna	Tree - Small	Endemic		
Tiliaceae	Malvaceae	<i>Grewia damine</i>	Daminiya	Tree - Small	Native		
Tiliaceae	Malvaceae	<i>Grewia helicterifolia</i>	Bora Daminiya	Tree - Small	Native		
Ulmaceae	Ulmaceae	<i>Holoptelea integrifolia</i>	Goda Kirilla	Tree - Large	Native	NT	
Verbenaceae	Lamiaceae	<i>Vitex altissima</i>	Milla	Tree - Large	Native	NT	

