



Kampala-Jinja Expressway PPP Project Phase 1 Environmental and Social Impact Assessment Volume D: Revegetation Plan

prepared for

Uganda National Roads Authority (UNRA)

by

Earth Systems and Atacama Consulting



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1. INTRODUCTION

This *Revegetation Plan* for the Kampala-Jinja Expressway PPP Project Phase 1 (hereafter 'the Project') has been prepared for the Ugandan National Roads Authority (UNRA) by Earth Systems and Atacama Consulting. The Revegetation Plan has been prepared in accordance with Ugandan legislation as well as International Finance Corporation (IFC) and other relevant international best practice and guidelines. This Plan provides a framework for the implementation of revegetation measures during pre-construction, construction and operation phases of the Project.

UNRA has committed, through their Green Right of Way (GROW) program, to conduct roadside revegetation along the expressway. Phase 1 is expected to involve the clearing of approximately 593 ha of land within the Right of Way (ROW). The road reserve areas along the expressway, including embankments, will be able to be revegetated along much of the alignment, as will areas cut off by junctions or roundabouts along the expressway as well as temporary construction areas/tracks. Additional Project Footprint areas such as quarries, borrow pits and temporary accommodation camps may also require revegetation at the end of the Construction Phase depending on the outcomes of stakeholder consultation regarding these areas.

This document outlines a proposed revegetation scheme which, if implemented appropriately, could lead to a reduction in the extent and severity of some residual environmental and social impacts associated with the Project.

The key objectives of the Revegetation Plan are to outline:

- ▶ The approach to revegetation for the Project;
- ▶ Specific measures to implement the revegetation activities including revegetation trials, nursery establishment, planting, maintenance and weed/pest control;
- ▶ Roles and responsibilities for revegetation;
- ▶ A monitoring plan to evaluate the efficiency and success of the revegetation activities and to enable modifications and maintenance to be conducted where required.

It is expected that revegetation activities will be primarily managed and implemented by the primary construction contractor/concessionaire for the Project (hereafter referred to as the 'Contractor').

This Revegetation Plan forms part of the ESIA documents for the Project and has cross-linkages to a number of other reports and management plans. As such the Revegetation Plan should be considered in conjunction with the:

- ▶ ESIA Report (Volume B);
- ▶ Environmental and Social Management and Monitoring Plan (ESMMP, Volume D);
- ▶ Biodiversity Action Plan (Volume D); and
- ▶ Water Management Plan (WMP, Volume D).

1.1 Benefits of Revegetation

A successfully implemented road reserve revegetation scheme could have multiple environmental and social benefits in both the urban and rural environments passed by the expressway. The revegetation

scheme will aim to maximise these benefits but also help reduce the detrimental environmental and social impacts associated with the road's construction and operation. Potential benefits include:

- ▶ **Visual Amenity / Healthy Urban Environment** – Kampala has rapidly urbanised over the past few decades and this expansion has occurred in a largely unplanned manner meaning that apart from the remaining wetland areas, green space is now in short supply throughout the city (Vermeiren et al, 2012). Tree cover and vegetation can improve the livelihoods of urban populations by improving visual amenity, psychological wellbeing and general public health as well as providing important ecosystem services (Wolch et al, 2014).
- ▶ **Biodiversity Conservation** – A successful revegetation scheme along the ROW has the potential to create a green corridor comprising a long stretch of vegetated habitat that can act as corridors to facilitate movement of fauna between remnant patches of habitat and increase the forest cover in the landscapes passed by the ROW. This wooded vegetation would likely be used by reptiles (snakes, lizards, chameleon, geckos, and snakes) and generalist bird species in the Project Area. In urban areas near Kampala, trees may be utilised by wetland bird species as roosting sites and provide habitat for bird and plant species which currently struggle to survive in the urban environment. The revegetation works will also reduce the residual impacts of land clearance for the Project and thus reduce the need for biodiversity offsets (refer Biodiversity Action Plan, Volume D).
- ▶ **Stability of steep embankments and river/stream banks** – grasses, shrubs and trees can significantly increase the stability of steep topography and river/stream banks depending on the depth of the rooting system. The rooting system provides the main form of reinforcement especially when toe erosion occurs at river/stream banks and when the steep embankments become saturated during and after a heavy down pour (rain). This will assist in reducing the risk of landslips in sloping areas and riparian zones within the Project Footprint.
- ▶ **Erosion Control** – The establishment of vegetation on slopes and embankments exposed during road construction can reduce soil erosion rates and associated sedimentation of drains and waterways. The root systems of trees, shrubs, and grasses help to absorb the force of the flow of surface run-off which, reduces its ability to erode soils. This is a particular issue in Uganda where severe storm events during the wet season can cause high levels of soil erosion on exposed surfaces, especially in areas of steep topography. Additionally, trees, shrubs, and grasses form ground cover that shields top soils from being exposed to wind erosion.
- ▶ **Noise management** – Vegetation surrounding a road can reduce the noise pollution created from expressway vehicles by absorbing and blocking some of the sound waves produced. This can be an effective and less costly way to reduce noise pollution than conventional noise barriers. For example Kalansuriya et al (2009) found that vegetative barriers could reduce noise levels of traffic by an average of 4dB(A), corresponding to an approximately 40% reduction in acoustic energy. Noise reduction benefits will be more pronounced in urban areas for the Project due to the presence of more sensitive receptors. Effective design of vegetative barriers in these areas will reduce noise impacts on local communities.
- ▶ **Carbon Sequestration** - Revegetation of temporarily disturbed areas and establishment of roadside vegetation for the Project will result in carbon sequestration, which will partially offset the greenhouse gas emissions from the Project related to vegetation clearance. An assessment of greenhouse gas emission from the Project is conducted in Chapter 12 of the ESIA Report (see Volume B).

- **Air Quality** – Vegetation intercepts airborne particulate matter (PM₁₀) - a pollutant that is associated with the use of roads and industrial activity in urban environments. High levels of exposure of human populations to particulate matter can lead to adverse health effects such as alveolar inflammation, respiratory infections and cardiovascular disease. The level of pollutant removal depends on the surface area of the vegetation which differs markedly with plant communities. Trees, in particular coniferous evergreen trees, can remove large amounts of urban air pollution compared to grassland or shrub communities which have a lesser surface area. For example, trees in Chicago are estimated to remove 5575 tons of air pollutants, providing air cleansing worth \$9.2 million (as cited in Forest Research, 2010). The revegetation scheme may therefore be able to help combat particulate matter and dust pollution in the urban environment, and reduce the dust impacts from the Project.

2. REVEGETATION APPROACH

2.1 Factors to Incorporate into Landscape Design / Species Selection

Several factors should be incorporated into the design of the vegetation scheme. This will include environmental and social considerations to help achieve the benefits outlined in Section 1.1 and will also include a consideration of technical and economic feasibility. Factors to be considered in the design and selection of species include:

- ▶ Ability to grow on poor soils;
- ▶ Aesthetic qualities;
- ▶ Biodiversity conservation value;
- ▶ Ease of planting;
- ▶ Erosion control capability;
- ▶ Maintenance of traffic visibility;
- ▶ Maintenance required;
- ▶ Noise absorption capacity;
- ▶ Particulate matter interception;
- ▶ Invasive / weed-like properties;
- ▶ Rate of establishment/growth;
- ▶ Cost of plants/nursery establishment/planting/maintenance; and
- ▶ Seed/seedling availability.

Revegetation should entail successful establishment/re-establishment of a variety of native vegetation types that should be site matched to particular areas where the vegetation could do well to ensure that the aims of revegetation are fulfilled. The approach to revegetation for the Project should include the following key principles:

- ▶ Selection of native vegetation of local provenance that will rapidly establish to ensure stabilisation and colonisation of disturbed areas should be used (e.g. grass and legume species), particularly in areas prone to erosion (e.g. steep slopes and embankments) and near watercourses;
- ▶ The use of exotic species should be avoided wherever possible. To the extent practicable, threatened species should be included in the planting plan;
- ▶ Vegetative communities in rural areas disturbed during Project construction and operations should be restored where feasible, in a 'like-for-like' manner. Rehabilitation and revegetation will favour re-creation of these habitats to the extent practicable.
- ▶ In areas of degraded vegetation and urban areas passed by the ROW, revegetation should be utilised to improve green/vegetative cover in the landscape and reduce the residual impacts of the Project's construction and operation;
- ▶ In urban areas, aesthetic qualities of the vegetation should be considered in order to maximise cultural benefits provided by the vegetated areas;
- ▶ Native flora of differing structural characteristics and successional stage should be selected to promote quick establishment and provide a diverse, resilient floristic assemblage of multiple canopy layers (i.e. herbaceous, shrub and tree cover). This should include a mix of trees, shrubs, annual grasses, perennial grasses, annual forbs, perennial forbs, sedges and rushes;
- ▶ Areas of wetland habitat degraded during the construction of the road should be fully restored and revegetated with wetland flora wherever possible;



- ▶ In areas of high noise and air quality impacts on local communities, vegetative communities should be designed to maximise noise and air pollution abatement by providing a barrier of thick vegetation between the road and likely receptors;
- ▶ Plant selection for rehabilitation of road reserves near wetland habitat will consider species of known habitat/biodiversity value. This will include trees utilised as nesting habitat for wetland bird species.
- ▶ Following vegetation clearance during construction, topsoil should be removed and stockpiled in a brownfield location. The topsoil can then be used in areas to be revegetated areas (e.g. embankments, road reserves) and will facilitate the establishment of native flora species which have been stored in the seed bank. Mulch can also be stockpiled for use (as long as it is derived from weed free sources).
- ▶ Revegetation should be conducted progressively over the Project life and undertaken as soon as possible after the exposure of bare ground surfaces in order to reduce rates of soil erosion and associated sedimentation of waterways.
- ▶ Utilisation of some fast growing pioneer species, which rapidly establish in disturbed areas (e.g. grasses and legumes), for planting on steep slopes, embankments or riparian areas. Shrubs and trees should be interspersed for long-term succession and the creation of a thicker vegetative layer which will act as a noise barrier, enhance particulate matter interception and create habitat for some fauna;
- ▶ The selection of species for planting should also consider the local availability of the plant species in large quantities and the feasibility of methods that should be employed to facilitate shrub/tree establishment;
- ▶ Weed free seed sources of plants should be procured to the extent possible;
- ▶ Species selection will consider soil conditions and microclimate. Species mixes will include plants suitable for rapid ground stabilisation and erosion control and nitrogen-fixing species which can grow in degraded soils; and
- ▶ The scheme will utilise species suitable to the physiographic and hydrological features of the landforms including soil chemistry, physical soil properties, drainage and fertility.


2.2 Proposed Revegetation Scheme for the Project


The preferred approach to revegetation for the Project is to rehabilitate areas with a 'like-for-like' strategy, revegetating with species typical of the vegetative community that was disturbed during Project implementation. Locally occurring species that typically inhabit the respective communities should be selected. However some areas along the alignment the vegetation should be improved from their previous state. For example degraded or cleared forest areas that are disturbed along the alignment should be revegetated with a multi-layer forest resembling a natural forest ecosystem as closely as possible. In all areas revegetated, the revegetation approach should consider multiple criteria including aesthetics, biodiversity value, erosion control and maintenance.


Planting schemes to be considered along sections of the alignment with varying environmental and social characteristics (e.g. slope and width of road reserve) are outlined in Table 2-1 and Figure 2-1.

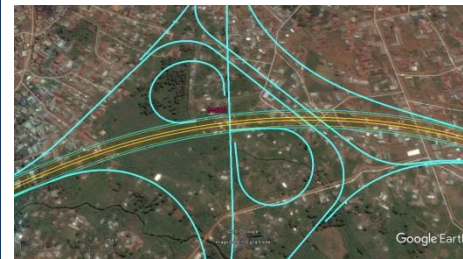

Table 2-1: Proposed Revegetation Scheme for Various Types of Areas to be Revegetated


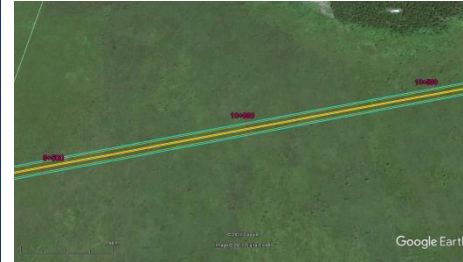
| Environment to be revegetated | Description | Key Benefits | Potential Flora Species | Example of ROW section where revegetation could be employed: |
|---|--|-------------------------|--|--|
| Urban environment with buildings either side (narrow ROW) | The expressway in these locations are flanked by business structures and settlements directly adjacent to the Project Footprint with a very narrow road reserve. This limits the applicability of the revegetation scheme in this area but there may still be opportunity to plant tree individuals adjacent to the road including aesthetically pleasing plant species. This may include trees placed at regular intervals along the road reserve, such as ornamental shrubs on the roadside or ornamental plants/shrubs in the central reservation. | ► Aesthetics | <ul style="list-style-type: none"> ○ <i>Bougainvillea spectabilis</i> ○ <i>Callistemon citrinus</i> ○ <i>Encephalartos whitelockii</i> ○ <i>Grewia similis</i> ○ <i>Hibiscus rosa-sinensis</i> ○ <i>Leucaena leucocephala</i> ○ <i>Tabebuia pentaphylla</i> ○ <i>Terminalia catapa</i> ○ <i>Terminalia mantaly</i> | <p>KJE Chainage 0 + 000 – 2 + 000</p>  |
| | | ► Air pollutant control | <ul style="list-style-type: none"> ○ <i>Aziderachta indica</i> ○ <i>Tectona grandis</i> | |
| Urban environment – relatively flat surfaces | <p>For the majority of the road's length there will be road reserve area adjacent to the tarmacked surface which will be cleared of vegetation and structures during construction. Some of these areas will be relatively flat surfaces. These areas should be planted with tall shrub and tree communities wherever possible to act as a noise and air pollution barrier to reduce impacts on surrounding communities.</p> <p>Near wetland ecosystems passed by the line, tree species favourable for the nesting of wetland bird species should be utilised.</p> | ► Aesthetics | <ul style="list-style-type: none"> ○ <i>Aleurites moluccana</i> ○ <i>Arundinaria spp</i> ○ <i>Callistemon citrinus</i> ○ <i>Grewia similis</i> ○ <i>Hibiscus rosa-sinensis</i> ○ <i>Jacaranda Mimosfolia</i> ○ <i>Leucaena leucocephala</i> ○ <i>Markhamia lutea</i> ○ <i>Podocarpus milanjanus</i> ○ <i>Sapium ellipticum</i> ○ <i>Tabebuia pentaphylla</i> ○ <i>Terminalia catappa</i> | <p>KJE Chainage 7 + 500 – 8 + 000</p>  |

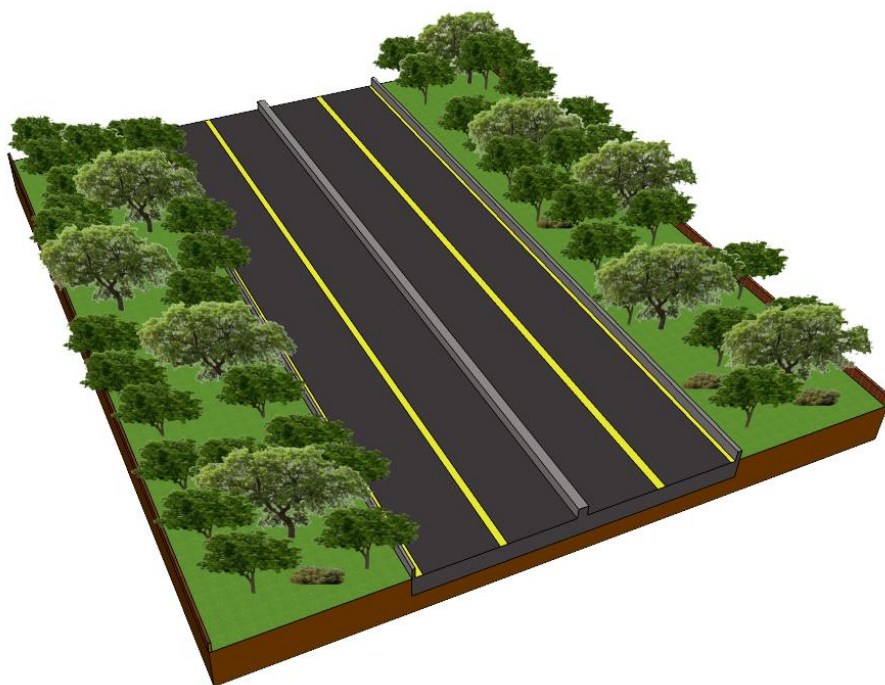
| Environment to be revegetated | Description | Key Benefits | Potential Flora Species | Example of ROW section where revegetation could be employed: |
|---------------------------------------|--|---------------------------------------|---|---|
| | | | <ul style="list-style-type: none"> ○ <i>Terminalia mantaly</i> | |
| | | ► Noise control | <ul style="list-style-type: none"> ○ <i>Arundinaria alpina</i> ○ <i>Hibiscus rosa-sinensis</i> ○ <i>Sapium ellipticum</i> | |
| | | ► Air pollutant control | <ul style="list-style-type: none"> ○ <i>Aziderachta indica</i> ○ <i>Tectona grandis</i> | |
| | | ► Nesting of birds | <ul style="list-style-type: none"> ○ <i>Acacia sieberiana</i> ○ <i>Canarium schweinfurthii</i> ○ <i>Cassia grandis</i> ○ <i>Ficus benjamina</i> ○ <i>Ficus exasperata</i> ○ <i>Ficus glumosa</i> ○ <i>Ficus glumosa</i> ○ <i>Milicia excelsa</i> | |
| Urban environment – steep embankments | Some areas surrounding the road will form embankments with steep slopes running towards or away from the road surface (e.g where road cuttings are required). These embankments should be revegetated with quick growing early successional species as soon as possible to reduce levels of soil erosion. Once established tree and shrub species should be planted to further stabilise the soil and act as a barrier to reduce noise, air and visual pollution associated with the road. | ► Erosion control ► Aesthetics | <ul style="list-style-type: none"> ○ <i>Brachiaria decumbens</i> ○ <i>Cynodon dactylon</i> ○ <i>Eremochloa ophiuroides</i> ○ <i>Paspalum spp</i> ○ <i>Jacaranda Mimmosforia</i> ○ <i>Leucaena leucocephala</i> ○ <i>Markhamia lutea</i> ○ <i>Podocarpus latifolius</i> ○ <i>Tabebuia pentaphylla</i> | KSB Chainage 14 + 000 – 14 + 300  |

| Environment to be revegetated | Description | Key Benefits | Potential Flora Species | Example of ROW section where revegetation could be employed: |
|---|---|-----------------------------|--|---|
| | Near wetland ecosystems passed by the line tree species favourable for the nesting of wetland bird species should be utilised. | | <ul style="list-style-type: none"> ○ <i>Terminalia catappa</i> ○ <i>Terminalia mantaly</i> | |
| | | ► Noise control | <ul style="list-style-type: none"> ○ <i>Arundinaria spp</i> ○ <i>Hibiscus rosa-sinensis</i> ○ <i>Sapium ellipticum</i> | |
| | | ► Air pollutant control | <ul style="list-style-type: none"> ○ <i>Aziderachta indica</i> ○ <i>Tectona grandis</i> | |
| | | ► Nesting of birds | <ul style="list-style-type: none"> ○ <i>Canarium schweinfurthii</i> ○ <i>Cassia grandis</i> ○ <i>Ficus benjamina</i> ○ <i>Ficus exasperata</i> ○ <i>Ficus glumosa</i> ○ <i>Ficus glumosa</i> ○ <i>Milicia excelsa</i> | |
| Rural environment – relatively flat surface in road reserve | <p>In these areas, native shrub and tree vegetation typical of native forests should be developed to create a buffer zone surrounding the road. This will act to reduce visual and noise pollution for rural communities and also provide biodiversity benefits (e.g. forested habitat for use by small mammals and generalist bird species).</p> <p>Near wetland ecosystems passed by the line tree species favourable for the nesting of wetland bird species should be utilised. In other rural areas, trees bearing fruit utilised by canopy bird species can be prioritised.</p> | ► Noise control | <ul style="list-style-type: none"> ○ <i>Arundinaria spp</i> ○ <i>Hibiscus rosa-sinensis</i> ○ <i>Sapium ellipticum</i> | <p>KJE Chainage 11 + 500 – 12 + 500</p>  |
| | | ► Biodiversity Conservation | <ul style="list-style-type: none"> ○ <i>Albizia grandibracteata</i> ○ <i>Capparis erythrocarpos</i> ○ <i>Cassia grandis</i> ○ <i>Celtis zenkeri</i> ○ <i>Diospyros abyssinica</i> ○ <i>Ficus exasperata</i> | |

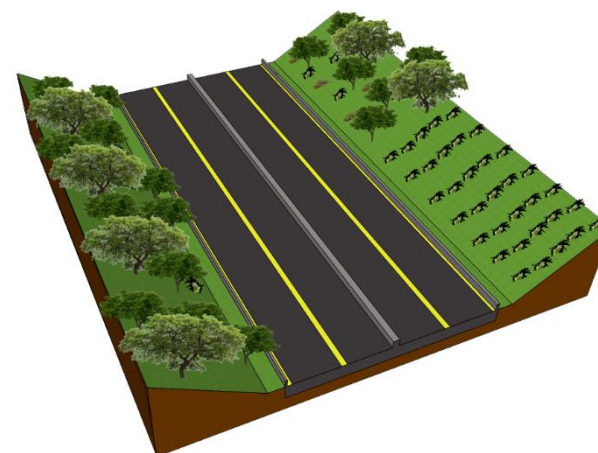
| Environment to be revegetated | Description | Key Benefits | Potential Flora Species | Example of ROW section where revegetation could be employed: |
|--|---|-----------------------------|---|--|
| | | | <ul style="list-style-type: none"> ○ <i>Ficus glumosa</i> ○ <i>Jacaranda Mimmosforia</i> ○ <i>Mangifera indica</i> ○ <i>Markhamia lutea</i> ○ <i>Podocarpus milanjanus</i> ○ <i>Prunus Africana</i> ○ <i>Sapium ellipticum</i> ○ <i>Syzygium cumini</i> | |
| Rural environment – steep embankments. | These embankments should be revegetated with quick growing early successional species as soon as possible to reduce levels of soil erosion. Once established tree and shrub species should be planted to further stabilise the soil and act as a barrier to reduce noise, air and visual pollution associated with the road. Near wetland ecosystems passed by the line tree species favourable for the nesting of wetland bird species should be utilised. | ► Erosion control | <ul style="list-style-type: none"> ○ <i>Brachiaria decumbens</i> ○ <i>Elymus repens</i> ○ <i>Panicum maximum</i> ○ <i>Pennisetum purpureum</i> | <p>KJE Chainage 14 + 000 – 14 + 500</p>  <p>Google Earth</p> |
| | | ► Noise control | <ul style="list-style-type: none"> ○ <i>Arundinaria spp</i> ○ <i>Hibiscus rosa-sinensis</i> ○ <i>Sapium ellipticum</i> | |
| | | ► Biodiversity Conservation | <ul style="list-style-type: none"> ○ <i>Albizia grandibracteata</i> ○ <i>Capparis erythrocarpos</i> ○ <i>Celtis zenkeri</i> ○ <i>Diospyros abyssinica</i> ○ <i>Ficus exasperata</i> ○ <i>Jacaranda Mimmosforia</i> ○ <i>Mangifera indica</i> ○ <i>Markhamia lutea</i> ○ <i>Podocarpus milanjanus</i> ○ <i>Prunus Africana</i> | |

| Environment to be revegetated | Description | Key Benefits | Potential Flora Species | Example of ROW section where revegetation could be employed: |
|--|---|---|--|---|
| | | | <ul style="list-style-type: none"> ○ <i>Sapium ellipticum</i> | |
| Land cut off by junctions / roundabouts – urban | Large amounts of land that are currently urbanised or degraded wetland or agricultural land will be completely cut off from human access due to the development of junctions. These areas should be revegetated with grass, shrub and tree species to increase green cover in the urban environment, ensuring lines of sight for turning vehicles are maintained. | <ul style="list-style-type: none"> ▶ Aesthetics ▶ Noise control ▶ Air pollutant control ▶ Biodiversity Conservation | <ul style="list-style-type: none"> ○ <i>Canarium schweinfurthii</i> ○ <i>Ficus benjamina</i> ○ <i>Jacaranda Mimmosforia</i> ○ <i>Milicia excelsa</i> ○ <i>Prunus Africana</i> ○ <i>Spathodea companulata</i> ○ <i>Terminalia mantaly</i> | <p>Butabika Interchange</p>  |
| Land cut off by junctions / roundabouts – rural. | Small areas of land will be cut off by junctions in rural areas passed by the ROW. These should be revegetated with grass, shrub and tree species wherever possible, ensuring lines of sight for turning vehicles are maintained. | <ul style="list-style-type: none"> ▶ Noise control ▶ Biodiversity Conservation | <ul style="list-style-type: none"> ○ <i>Canarium schweinfurthii</i> ○ <i>Ficus benjamina</i> ○ <i>Markhamia lutea</i> ○ <i>Milicia excelsa</i> ○ <i>Podocarpus milanjanus</i> ○ <i>Prunus Africana</i> ○ <i>Spathodea companulata</i> ○ <i>Tamarindus indica</i> | <p>Mukuno Junction</p>  |
| Embankments adjacent to wetland areas | These should be planted with wetland species in any areas inundated with water. In areas of the embankment close to the fringes of the wetland, species characteristic of wetland fringes should be planted. In areas further away from the wetland, trees suitable for nesting birds can be planted. | <ul style="list-style-type: none"> ▶ Erosion control | <ul style="list-style-type: none"> ○ <i>Cyperus difformis</i> ○ <i>Cyperus latifolius</i> ○ <i>Cyperus papyrus</i> ○ <i>Mithcanthus</i> ○ <i>Panicum maximum</i> ○ <i>Phragmites spp</i> ○ <i>Typha spp</i> | <p>KSB Chainage 8 + 200 – 8 + 800</p> |

| Environment to be revegetated | Description | Key Benefits | Potential Flora Species | Example of ROW section where revegetation could be employed: |
|--|---|---|--|---|
| | | | <ul style="list-style-type: none"> ○ <i>Vigna reticulata</i> |  <p>Google Earth</p> |
| | | <ul style="list-style-type: none"> ► Biodiversity Conservation | <ul style="list-style-type: none"> ○ <i>Papyrus spp.</i> ○ <i>Acacia sieberiana</i> ○ <i>Encephalartos whitelockii</i> ○ <i>Ficus benamina</i> ○ <i>Ficus exasperata</i> ○ <i>Ficus glumosa</i> ○ <i>Milicia excels</i> ○ <i>Phoenix reclinata</i> ○ <i>Podocarpus latifolius</i> | |
| Wetland areas outside the ROW affected by construction activities. | Areas of wetland may be temporarily infilled during the construction of the road embankments and viaducts. All soil and construction material should be removed from these areas after construction to allow the wetland and native vegetation to recover. Locally occurring wetland plants should be actively planted in these disturbed areas to facilitate recovery. | <ul style="list-style-type: none"> ► Biodiversity Conservation | <ul style="list-style-type: none"> ○ <i>Papyrus spp.</i> ○ <i>Cyperus spp</i> ○ <i>Ficus exaperta</i> ○ <i>Ficus glumosa</i> ○ <i>Miscanthedium violaceum</i> ○ <i>Mithcanthus</i> ○ <i>Phoenix spp</i> ○ <i>Phragmites spp.</i> ○ <i>Typha spp.</i> | <p>KJE Chainage 9 + 500 – 10 + 500</p>  <p>Google Earth</p> |



A)



B)



C)

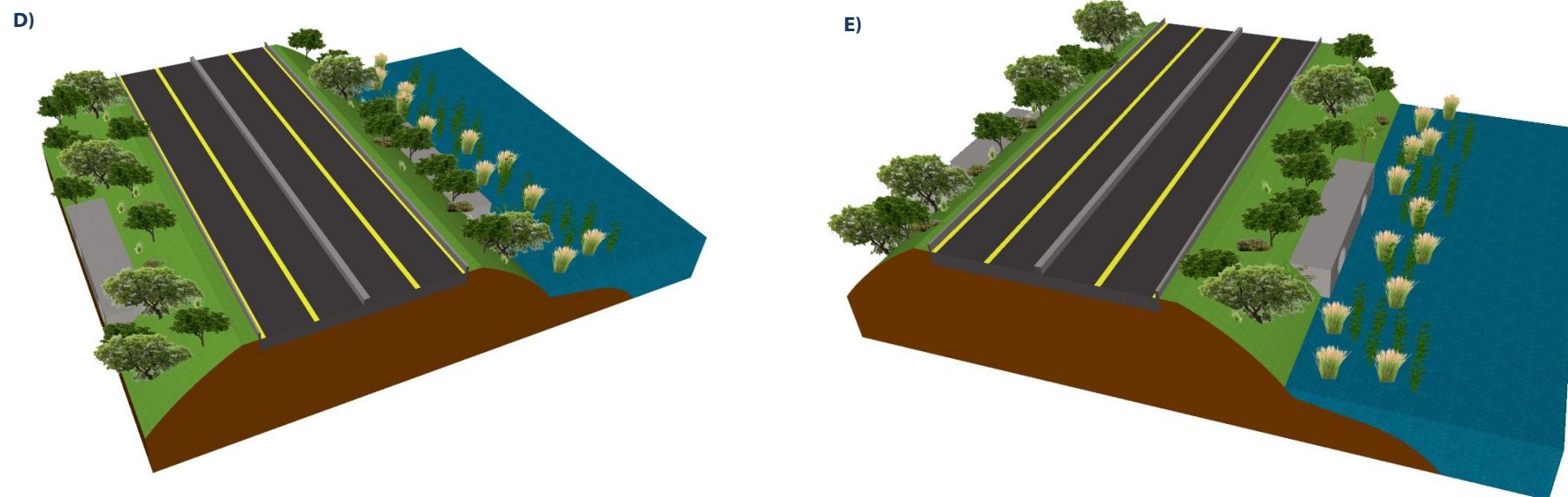


Figure 2-1: Schematic diagrams of the proposed revegetation scheme.

The diagrams in Figure 2-1 in the pages above illustrate some of the different types of revegetation proposed in Table 2-1.

Figure 2-1A illustrates the revegetation that should be implemented along much of the alignment where the full road reserve on a relatively flat surface would be revegetated with native tree and shrub communities. Areas close to the road should be revegetated with grass / herb species to ensure lines of sight are maintained.

Figure 2-1B illustrates a revegetation scheme on embankment slopes where a similar plant community can be developed in the long term. However, in these areas there should be more focus on the quick establishment of deep rooted pioneer grass species to reduce rates of erosion on the embankments. A multilayer shrub/forested community would be planted to develop over time once embankments are stabilised.

Figure 2-1C illustrates a revegetation scheme which could be considered in urban areas passed by the alignment where there is only a minimal road reserve and settlements/businesses present either side of the alignment (e.g. KJE Chainage 0 + 000 to KJE Chainage 2 +500). In these areas there should be a greater focus on aesthetics and maximising green space in the small areas that are available.

Figure 2-1D and E illustrate a revegetation program that could be implemented in raised areas of the alignment and near to wetlands. Similar to the approach illustrated in Figure 2-1B, on steep embankments near wetlands there should be rapid establishment of quick-growing grass species but then a shrub/forested community would be planted to develop over time. For wetland areas, wetland fringe species should be considered close to the wetland edges and in areas permanently inundated with water, specialist wetland species (e.g. Papyrus spp.) should be considered.

3. REVEGETATION TRIALS

Revegetation trials should be undertaken for multiple species on a variety of substrates, including on different soil types and on embankments. Early progressive revegetation efforts will also be utilised as informal vegetation trials to test nursery and planting methods and the viability of species selected.

The objectives of revegetation trials are:

- ▶ To monitor results from early-phase revegetation efforts to enhance the effectiveness of later rehabilitation efforts as the Project progresses;
- ▶ To identify methodologies that will achieve an effective and sustainable vegetation cover at minimal cost using technology available on site; and
- ▶ To identify and trial vegetation types that are suited to local climatic conditions and growing medium so as to avoid ongoing management and maintenance costs.

An experimental approach should be adopted to trial different methods of revegetation including:

- ▶ Differences in species selected;
- ▶ Variations in topsoil depth;
- ▶ Use of different fertilisers (or quantity of fertiliser);
- ▶ Use of different pesticides (if required); and/or
- ▶ Use of matting/blankets/plastic sheeting/HECPs to reduce erosion and weed growth in revegetated areas.

Much of the information required for successful revegetation should be attainable through consultation with Government departments/agencies, local botanists or in literature. It would be expected that the Contractor would conduct extensive consultation with relevant stakeholders (e.g. UNRA staff with experience in road reserve revegetation) and have staff with direct experience in revegetation that can guide the implementation of the revegetation trials and develop the final revegetation approaches to be used for the Project.



Plate 3-1: Revegetation using Coir Erosion Control Mats (Triton Environmental)

4. SEED MANAGEMENT AND NURSERY

The Contractor conducting the revegetation activities should maintain a consistent supply of quality seed for use during progressive revegetation. Seed should be collected from the local area or purchased off-site (if inadequate seed stock is available). Seed purchased off-site should be from similar elevations / region and should be weed-free, to the extent possible.

Depending upon the species, its growth habit and the quantity of seed required; the methods used to collect seed will vary. The following criteria should be considered for a successful seed collection program:

- ▶ The seed collectors should be suitably qualified to correctly identify the species from which seed is collected, and the correct time to collect seed for each plant;
- ▶ Seed should be collected from individual plants that are healthy, robust and have desirable characteristics; and
- ▶ Seed from multiple plants should be collected from multiple local sub-catchments to maximise genetic diversity.

Seed should be cleaned before storage to remove as much debris and chaff as possible and should be stored in dry and insect/vermin-proof containers. Seed containers should be clearly labelled with details of the species, date collected or purchased and collection location (including elevation).

If this is not possible, seed purchased off-site should be bought from reputable merchants to avoid contamination with weed species and non-viable seed. Advice will also be sought from research institutes to identify the most appropriate seeds and species to be used for revegetation activities.

It is recommended that the Contractor construct and maintain a Project nursery (or adapt an existing nursery) where seedlings should be grown at a sufficient capacity to sustain its revegetation program. The nursery would be supplemented by commercially supplied native seed mixes or seedlings from reputable nurseries, if necessary. The following nursery management measures should be incorporated into the program:

- ▶ A nursery inventory and purchasing and planting schedule should be maintained to anticipate planting requirements at least 18 months in advance of anticipated planting;
- ▶ The nursery inventory and the purchasing and planting schedule should be evaluated each year prior to ensure enough seed to be planted is available for future revegetation works along the ROW;
- ▶ The seedling inventory requirements will account for yearly die-off of planted seedlings; and
- ▶ The operators of the Project nurseries should be suitably qualified to manage nursery beds.

The core objectives of the plant nursery are to:

- ▶ Process and store seed;
- ▶ Produce healthy seedlings in a timely and cost-efficient manner and in sufficient quantity to meet progressive and final rehabilitation requirements;
- ▶ Supply a range of plant species capable of achieving the proposed final land uses;
- ▶ Develop and maintain a plant species database that contains information on seed collection locations and date of seed harvest; and
- ▶ Provide employment and training opportunities for the local community by developing seed collection and storage capabilities, plant propagation and nursery management skills.



Plate 4-1: Example of seedling nursery with shade cover and irrigation systems

5. ESTABLISHMENT

Depending on the particular location and the availability of seedlings/saplings in the nursery, plant species should be established in disturbed areas using one or more of the following methods:

- ▶ Sowing seed (hand broadcasting, hydro seeding);
- ▶ Planting nursery raised seedlings/saplings;
- ▶ Transplanted individuals from areas that will be cleared of vegetation; and / or
- ▶ Establishment via propagules (seeds, lignotubers, corms, bulbs, rhizomes and roots) stored in the topsoil (i.e. natural establishment).

The timing of planting of nursery raised seedlings and/or direct seeding should be carried out with consideration of the seasonal distribution of temperature and rainfall. If planted at the correct time of year germination rates and seedling survival will be maximised, and impacts on revegetation due to soil erosion will be minimised.

5.1 Planting of Seedlings

Planting should be conducted in line with best practice approaches including the following:

- ▶ Planting along contours to limit erosion;
- ▶ Ensuring that seedlings are properly handled in the nursery (e.g. sun hardened) and in out-planting (e.g. moist roots / straight roots);
- ▶ Clearing the area around the seedling and/or using matting/plastic sheeting to minimise competition from weeds;
- ▶ Placing protective guards around individual seedlings to prevent animal damage and/or fencing-off revegetated areas to prevent livestock, community or vehicular access (if required);
- ▶ Erosion control techniques should be utilised in areas prone to soil erosion and sedimentation of waterways (e.g. near rivers and wetlands). This may for example utilise ground stabilisation fabrics (e.g. coir matting, geotextiles, see plate 4-1);
- ▶ Coir matting can also be formulated into 'rolls' which can be inoculated with wetland plant species. These mats can be placed in the wetland environment to facilitate restoration of the ecosystem; and
- ▶ The planting design should be determined on a case-by-case basis, however in general plant understorey life forms in dense patches to create a mosaic effect and to provide some competitive advantage against weeds, while ensuring that disturbance to any existing native ground cover areas is minimised.

5.2 Direct Seeding

If direct seeding is utilised for revegetation the following points should be considered during the process:

- ▶ Seed should be sown at the onset of the wet season if possible or where this is not possible, seed should be watered to ensure effective establishment of the seedlings;
- ▶ Seed beds should be carefully prepared to ensure that the soil is well aerated to provide a medium for root establishment; and

- Hydroseeding should be considered as a potential methodology for the broadcast of seeds. This process utilises a wet slurry of seeds and mulch material which is broadcast onto the area to be revegetated. Hydroseeding machinery can reduce the amount of time required for seed broadcasting and the amount of time required for the vegetation to establish. This can also be particularly useful for embankment areas where manual planting is difficult.



Plate 5-1: Tree guards (left) and hydro seeding (right) which could be utilised during revegetation efforts (Photo Source: www.treemax.com.au)

6. ADDITIONAL REVEGETATION ACTIVITIES

In addition to the business-as-usual revegetation activities to meet legislative requirements and international standards, the following additional revegetation activities are proposed for the Project to maximise the ecosystem service benefits from revegetation and minimise the residual impacts of the Project:

- ▶ Establishment of green corridors; and
- ▶ Additional wetland revegetation in areas surrounding the ROW.

An additional budget for these activities has been provided in the Biodiversity Action Plan (Volume D). Each of these activities is described below.

6.1 Establishment of Green Corridors

It is proposed that the revegetation activities for the Project should go above and beyond the requirements of standard revegetation and aim to create a 'green corridor' along the majority of the expressway. The key difference to standard revegetation is that the scheme would aim to create continuous corridors of vegetation where possible, and link these corridors to existing patches of vegetation along the alignment (e.g. Sezibwa forest). This is expected to require additional areas to be rehabilitated / revegetated to assist in creating continuous corridors.

This will likely have many benefits to biodiversity in the urban environment. For example, if appropriately implemented, the scheme will include:

- ▶ The re-establishment/creation of nesting habitat for a variety of bird species;
- ▶ The creation of green space and large trees in the city environment of Kampala;
- ▶ Benefits to Critical Habitat-qualifying fauna and other priority fauna through creation of suitable habitat;
- ▶ Utilisation of threatened species in the replanting scheme if appropriate;
- ▶ Potential habitat links / biodiversity corridor between areas of forested habitat and wetlands in the rural environment; and
- ▶ Where appropriate, the provision of fruiting trees and shrubs that can provide food resources to canopy bird species.

Habitat should be recreated in a like-for-like manner where appropriate. Along particular sections of the alignment, areas of previously degraded land (e.g. cleared land, fallow land) will be converted into an ecosystem with higher shrub and tree cover – likely providing benefits to biodiversity and ecosystem services.



Figure 6-1: Schematic diagram of the proposed revegetation scheme in areas with a fully revegetated areas along the Expressway.

6.2 Additional Wetland Revegetation

Additional revegetation of wetland areas adjacent to the ROW should be conducted, with a focus along discharge lines downstream of the ROW. This will reduce the residual impacts of the Project on wetlands, and reduce the need for biodiversity offsets (refer Biodiversity Action Plan, Volume D). As wetlands act as efficient filtration systems, additional revegetation of wetland areas focusing on discharge lines downstream of the ROW will also help improve water quality from Project discharges, and may also assist in minimising flood risk for downstream areas. Additional areas to be revegetated outside the ROW should be identified in consultation with Government authorities and local communities.



Plate 6-1: Examples of wetland revegetation (Photo sources: EBS Restoration; <https://darrp.noaa.gov/>)



Plate 6-2: Examples of drainage line revegetation (Photo sources: Habitat Creations; i-Sportsman)

7. MAINTENANCE

Revegetated areas should be appropriately maintained after planting. Fences should be placed around the vegetation areas and maintained appropriately to prevent grazing and the use of planted vegetation for firewood or charcoal production. Additional maintenance requirements will likely include:

- ▶ Replanting failed or unsatisfactory areas (gap filling);
- ▶ Repairing eroded landforms including embankments where previous revegetation attempts have been hampered by high rainfall events;
- ▶ Pest and weed control along the alignment;
- ▶ Removal of large branches / trees which pose a danger to traffic utilising the expressway;
- ▶ Removal of large shrubs and trees which are blocking adequate driver visibility along the expressway or visibility of signs/gantries;
- ▶ Pruning and general gardening activities of areas managed for aesthetic qualities;
- ▶ Mowing of areas directly adjacent to the tarmacked surface (road verges);
- ▶ Maintenance of fencing alongside the ROW boundary to protect revegetated areas;
- ▶ Clearance of litter and rubbish from the revegetated areas;
- ▶ Applying soil amendments and fertilisers to control pH, improve soil structure, or improve fertility; and
- ▶ Supplementary watering may be required following completion of revegetation activities particularly during dry spells.

Maintenance inspections should be undertaken following major rainfall events and at the start and completion of each wet season. The need for maintenance should be determined during routine inspections and monitoring (refer Section 9.3).

8. WEED AND PEST CONTROL

The Contractor will need to manage the spread and introduction of invasive in revegetated areas to help ensure the success of revegetation activities. This should involve:

- ▶ Preventing or minimising the introduction of exotic weeds to road reserve areas;
- ▶ Minimising the spread of existing weeds present within the Project footprint and surrounds; and
- ▶ Controlling weed colonisation that may occur during revegetation efforts.

Regular monitoring of revegetated areas should be undertaken to identify species and cover of weeds (see Section 9.3). Maximum allowable weed infestation targets should be set as a key performance indicator for revegetated areas, with areas approaching or not meeting criteria managed accordingly.

To prevent or minimise the introduction of exotic weeds into the road reserve:

- ▶ Construction contractors should be required to wash-down all heavy equipment before mobilisation to the site under the standard terms and conditions of their contract;
- ▶ A vehicle wash-bay should be installed adjacent to the equipment storage site to enable routine cleaning of mud and dirt from vehicle tyres and chassis; and
- ▶ Exotic species will not be used for revegetation efforts.

Invasive species will become more difficult to control after each year of establishment and growth. When the growth of invasive species is identified, weed control options should be quickly implemented and may include:

- ▶ Mechanical control including hand removal or tractor mowing for example;
- ▶ Hand weeding for smaller areas; and
- ▶ Herbicide treatments for larger infestations.

Some examples of invasive species recorded along the alignment by Bulafu (2018) are provided in the plates below.

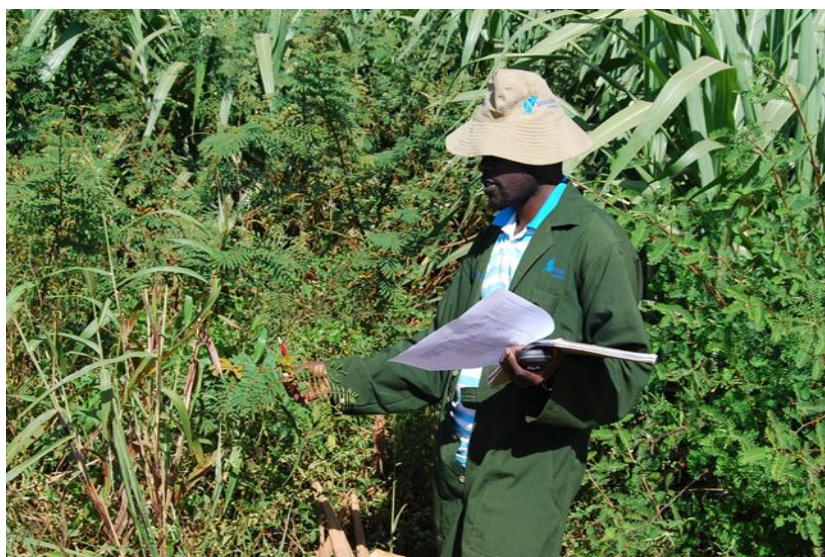


Plate 8-1: *Mimosa pigra* at Munyonyo

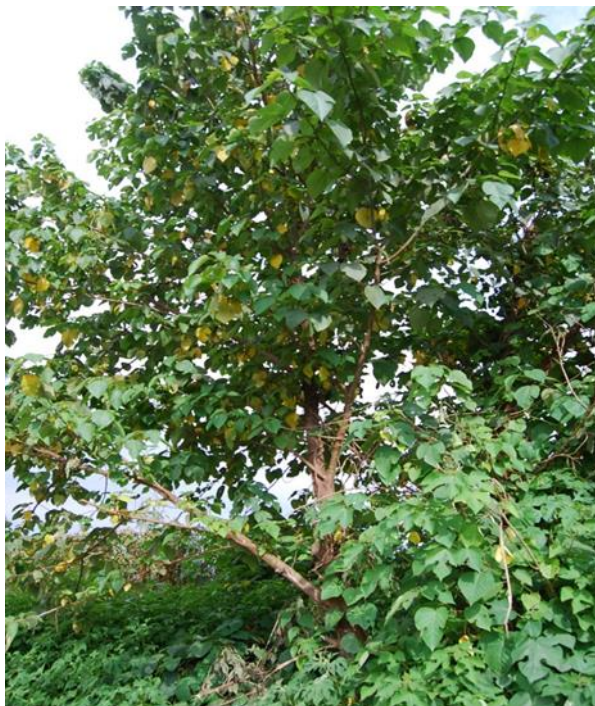


Plate 8-2: *Broussonetia papyrifera*



Plate 8-3: *Senna spectabilis* at Sezibwa forest



Plate 8-4: *Tithonia diversifolia*



Plate 8-5: *Eichhornia crassipes* at Munyonyo



Plate 8-6: *Lantana camara* at Sezibwa



Plate 8-7: *Parthenium hysterophorus* in Nakivubo wetland



Plate 8-8: *Ricinus communis* in Nakivubo wetland (Ggaba)

9. IMPLEMENTATION

9.1 Planning

Detailed plans and procedures for revegetation activities should be prepared as part of the CEMP for the Project. The key early planning activities should include:

- ▶ Areas to stockpile topsoil and mulch¹ from vegetation clearance activities to be identified, for use in future revegetation activities;
- ▶ Species selection and design of revegetation areas (e.g. vegetation structure, layout, species composition);
- ▶ Areas to be revegetated to be mapped in GIS to assist in the planning process. This should include prioritisation of key areas for revegetation, including:
 - Areas of the ROW close to sensitive receptors such as settlements (to maximise noise reduction and air quality benefits of revegetation, and minimise visual amenity impacts);
 - High erosion risk areas, such as steep slopes (e.g. embankments) and sites close to rivers, creeks and wetlands; and
- ▶ Design and establishment of revegetation trials;
- ▶ Planning for nursery establishment;
- ▶ A nursery inventory and purchasing and planting schedule should be developed and maintained to anticipate planting requirements;
- ▶ Develop detailed success criteria/targets for re-vegetation and habitat restoration (e.g. species diversity and density, % cover of weeds).

9.2 Roles and Responsibilities

The general roles and responsibilities for the environmental and social management of the Project are outlined in the ESMMP (refer to Volume D).

Implementation of the Revegetation Plan will require appropriate staff, financial resources, equipment and support systems. The responsibilities of Project contractors and suppliers will need to be defined through standard terms and conditions of contracts that are consistent with the commitments of the Revegetation Plan.

The key roles, responsibilities and other requirements for the implementation of the Revegetation Plan are outlined below.

9.2.1 UNRA Project Director

The UNRA Project Director would:

- ▶ Ensure that appropriate resources are allocated to the Revegetation Plan, including budget and human resources.

¹ Note only mulch derived from weed free sources should be reused for revegetation activities.

- ▶ Review and approve the revegetation plans prepared as part of the Construction Environmental Management Plan (CEMP) and Operations Environmental Management Plan (OEMP) for the Project by the primary contractor/concessionaire, and any major revisions to these documents.
- ▶ Check that UNRA staff are appropriately trained in revegetation practices.
- ▶ Have overall responsibility for the implementation of the Revegetation Plan.

9.2.2 UNRA Project Environmental and Social Manager

The UNRA Project Environmental and Social Manager would be in charge of overseeing the implementation and continued improvement of the Revegetation Plan. The UNRA Project Environmental and Social Manager should be supported by Environment, Community Relations and OHS teams. Key responsibilities of the UNRA Project Environmental and Social Manager related to revegetation should include:

- ▶ Ensure that the required environmental and social management and monitoring measures identified in the Revegetation Plan are undertaken.
- ▶ Ensure compliance is achieved with relevant national and international legislative and policy requirements and other Project environmental and social commitments (e.g. UNRA policies, standards or commitments).
- ▶ Oversee the coordination and conduct of consultations related to revegetation, and management of any related Project grievances and incidents through the UNRA management systems.
- ▶ Coordinate the engagement of specialists where required to provide advice regarding revegetation activities.
- ▶ Manage the Project Environmental, Social and OHS staff (see below) responsible for the effective implementation and continued improvement of environmental and social policies, procedures, and management plans.
- ▶ Ensure all necessary permits for UNRA are obtained.

9.2.3 UNRA Project Environmental, Social and OHS Staff

As outlined in the ESMMP (Volume D) UNRA should employ qualified and experienced Environment, Social and OHS staff for the Project comprised of a Project Environment Officer, Project Biodiversity Officer, Project Community Officer and Project OHS Officer. These Officers should be supported as needed by a team of professional specialists and technicians. Key responsibilities of these Officers in relation to the Revegetation Plan would include:

- ▶ Ensure that the requirements in Revegetation Plan as well as national and international standard requirements are incorporated into the contract specifications for construction.
- ▶ Check that contractors fulfil the requirements of the Revegetation Plan, including for monitoring, surveillance and auditing requirements.
- ▶ Approval of relevant contractor's documents, new ancillary sites' opening, building plans for water management, etc. as needed for the Project.
- ▶ Conducted consultations required for the Revegetation Plan.
- ▶ Log, manage and investigate Project incidents and grievances through UNRA's incident reporting and grievance management systems as needed.

- ▶ Undertake regular on-site inspections / audits of work to check compliance and performance with the contract specifications and the contractor's CEMP/OEMP/OHS Plan.
- ▶ Review and report environmental and social data regarding the progress of implementation, effectiveness of management measures and monitoring data, and recommended actions or modifications required for non-compliance and continual improvements concerning the Revegetation Plan implementation.
- ▶ Report to the appropriate regulatory authorities on significant reportable incidences and other Project reporting commitments (i.e. NEMA) as per regulations.
- ▶ Provide advice on revegetation, as required, to the contractor.
- ▶ Plan and carry out as needed environmental and social training programs for Project contractors.

9.2.4 Contractors

The primary contractor / concessionaire for the Project (referred to herein as the 'Contractor') would:

- ▶ Develop a CEMP in line with this Revegetation Plan prior to construction, including detailed plans and procedures for the implementation of revegetation activities.
- ▶ Prior to the Operations Phase, an OEMP will also need to be developed outlining the revegetation activities for the Operations Phase.
- ▶ Effectively implement and manage the revegetation aspects of the CEMP and OEMP to the satisfaction of UNRA's Project Director.
- ▶ Monitor, record, audit and conduct surveillance of the implementation and effectiveness of the revegetation activities and report their effectiveness to UNRA's Project Director.
- ▶ Report regularly to the UNRA Project Environmental and Social Manager regarding environmental and community performance.
- ▶ Engage an independent, suitably qualified and experienced auditor to conduct audits of implementation of the contract specification.
- ▶ Engage specialist environmental advice where required.
- ▶ Check that all contractual commitments regarding revegetation are honoured.
- ▶ Report environmental incidents to UNRA's Project Director and relevant government lead agencies. Document actions taken to rectify the situation.
- ▶ Review and update the revegetation aspects of the CEMP/OEMP during construction/operations annually or if any significant changes occur.
- ▶ Check that Contractor's staff and subcontractors have been appropriately trained in revegetation procedures, are fully informed of the CEMP/OEMP and understand the required measures for revegetation of disturbed areas.

9.2.5 Public and Government Agency Involvement

The participation of external parties in the monitoring programme of the Project should be the subject of consultation and should be agreed between UNRA, the Contractor and other Government agencies. In additional

to monitoring of Contractor activities by UNRA, monitoring of revegetation activities may involve the following Government authorities:

- ▶ National Environment Management Authority (NEMA)
- ▶ Ministry of Water and Environment (MWE)
- ▶ Ministry of Works and Transport - Environment Liaison Unit (ELU)
- ▶ Ministry of Lands, Housing and Urban Development (MLHUD)
- ▶ Ministry of Tourism, Wildlife and Antiques (MTWA)
- ▶ Uganda Wildlife Authority (UWA)
- ▶ Directorate of Water Resources Management (DWRM)
- ▶ National Forest Authority (NFA)
- ▶ Wetlands Management Department (WMD)

Communities should also be involved in monitoring where possible, through relevant groups such as Local Environment Committees and/or Road Committees.

9.3 Monitoring

Rehabilitated/revegetated areas should be monitored regularly. Key proposed monitoring measures are outlined in Table 9-1.

Table 9-1: Proposed revegetation monitoring program

| Method | Frequency | Locations | Component | Indicator | Threshold | First Response/s | Adaptive Response |
|---|---|---|--------------|--|--|---|---|
| Visual monitoring of the success of vegetation establishment in areas to be revegetated. | Construction – ongoing (at least weekly) Operations – during routine maintenance and after strong wet season rains | Revegetated road reserves (and other revegetated areas e.g. wetlands, junctions, roundabouts) | Revegetation | The success of vegetation establishment | <ul style="list-style-type: none">Success criteria for re-vegetation and habitat restoration not achieved.Areas of failed establishment where vegetation has died or poorly established.Areas where soil has not stabilised by vegetation and / or been washed away / damaged during high rainfall events. | Establish cause of failure. This could include: inadequate planting technique, high rainfall events, poor soil quality, herbivory, weeds, harvesting by local communities. | Revegetate areas where revegetation was unsuccessful taking measures to ensure the cause of the previous failure is combatted. This may include: <ul style="list-style-type: none">Erosion and sediment control measuresProtection from herbivoryThe maintenance and creation of fencing to protect the vegetation. |
| Visual inspection of levels of degradation in revegetated areas | Operations - during routine maintenance | | | Removal of vegetation from ROW areas | Evidence of land clearance, logging activity and charcoal production within the revegetated zones. | Determine cause and individual/organisation responsible, e.g. Project-related, local community. | If appropriate, enhance protection measures along the road reserves (e.g. more regular patrols). Conduct community awareness programs regarding the vegetation and permitted land use in the ROW. If repeated offences occur, notify the local authorities. Revegetate damaged / affected areas |
| Monitoring of invasive species | Monitor invasive species in the revegetated areas as is outlined in the Biodiversity Action Plan (Volume D). | | | | | | |
| Monitor the rate of vegetation establishment and the success of revegetation regarding growth rates, erosion control etc. | Construction – ongoing (at least weekly) Operations – during routine maintenance | Revegetated road reserves (and other revegetated areas e.g. wetlands, junctions, roundabouts) | Revegetation | Growth rates, species failing to establish, poor erosion control, difficulty obtaining seed/seedlings. | <ul style="list-style-type: none">Success criteria for re-vegetation and habitat restoration not achieved.Poor rates of growth of particular species in the planting schemePoor erosion control provided by some vegetative communities.Inadequate supply of particular stock for revegetation. | Establish likely causes e.g.: <ul style="list-style-type: none">Poor soil qualitySpecies unsuitable for revegetation of road reserves, or location usedParticular speciesCompetition from weedsExtreme weather events | Amend planting scheme to ensure rapid successful establishment of vegetative communities. This may include changes to: <ul style="list-style-type: none">Timing of plantingSpecies utilised in revegetation effortsPlanting methodologyUse of weed control matting |

| Method | Frequency | Locations | Component | Indicator | Threshold | First Response/s | Adaptive Response |
|---|---|-----------|--------------|--|---|--|---|
| Monitor vegetation to ensure driver visibility / safety | Operations – during routine maintenance | | Revegetation | Height of vegetation, overhang, visibility around corners. | Visibility of drivers on the expressway is blocked by vegetation Overhanging branches on the expressway. | Remove and maintain vegetation appropriately e.g. remove overhanging / dead branches, mow road verges. | If the problem is a general problem with the revegetation scheme i.e. large trees placed too close to the expressway, the revegetation program can be modified accordingly. |
| Monitoring of litter / waste revegetated areas | Operations – during routine maintenance | | Revegetation | Litter presence in the revegetated zones | High levels of litter in the road reserve and in revegetated areas. | Remove litter in regular patrols Identify likely causes. | If necessary, put measures in place to reduce littering in road reserves. This could include public awareness campaigns and/or signs on the expressway. |

9.4 Reporting and Record Keeping

Reporting on revegetation should be conducted in line with the reporting framework outlined in the ESMMP (Volume D).

Records maintained during monitoring activities should include the following, as a minimum:

- ▶ Area revegetated/rehabilitated (recorded in a GIS database);
- ▶ Number of type of seeds/seedlings planted in each area;
- ▶ Source of seeds/seedlings;
- ▶ Outcomes of inspections, including health of revegetated areas and notes on invasive species recorded;
- ▶ Records of maintenance conducted in each area; and
- ▶ Photographs from inspections (with date and location).

9.5 Budget

The general budget for implementing the environmental and social management of the Project is outlined in the ESMMP (refer ESMMP in Volume D). The primary budget for the revegetation activities is expected to be included as part of the Operational budget for the Project. An additional revegetation budget is provided in the Biodiversity Action Plan (Volume D) which covers additional revegetation activities outlined in this plan that go beyond standard operational requirements including:

- ▶ Establishment of green corridors; and
- ▶ Additional revegetation of wetlands downstream of discharge lines (refer Section 6).

9.6 Priorities for Implementation

The key next steps for implementation of this Revegetation Plan include:

- ▶ Detailed revegetation plans and procedures to be prepared as part of the Construction Environmental Management Plan (CEMP) for the Project by the primary contractor/concessionaire, in consultation with relevant stakeholders. This should include success criteria for re-vegetation and habitat restoration.
- ▶ Areas to be revegetated, and the type of vegetation proposed in each area to be mapped in GIS as part of the detailed design process for the Project;
- ▶ Nursery to be established, or current nurseries used, to supply plants for the revegetation activities;
- ▶ A nursery inventory and purchasing and planting schedule to be developed;
- ▶ Topsoil to be stockpiled during vegetation clearance for use in revegetation activities;
- ▶ Revegetation trials to be established; and
- ▶ Progressive revegetation to commence as soon as practicable following commencement of construction activities.

10. REFERENCES

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