

M-5 Flora and Fauna Monitoring Plan

Aim and Objective							
<p>The aim of M-5 Flora and Fauna Monitoring Plan is to outline the environmental monitoring requirements for terrestrial flora and fauna during the construction phase of the Project, and to ensure that ecosystem function and terrestrial biodiversity values within the Project Area (including Core Land) are protected and maintained.</p> <p>This plan was informed by the P-2 Biodiversity Management Plan which provides additional background on terrestrial flora and fauna and conservation significant species. Monitoring of aquatic biota is covered in the M-3 Fish, Algae and Macroinvertebrate Monitoring Plan.</p>							
Summary of Impacts and Risks							
<p>The Project will result in the clearance of approximately 114.55 ha of terrestrial vegetation, comprising of 106.51 ha of Critical Habitat and 8.04 ha of Modified Habitat. An additional 82.38 ha will be subject to edge effects, caused by permanent disturbance around the dam and powerhouse, access roads and the transmission line corridor. Impacts may include the degradation and loss of terrestrial species and habitat (including Critical Habitat trigger species), soil pollution, noise, dust and vehicle/machinery activities, and the introduction of weeds and pests.</p> <p>The following terrestrial species and habitats were identified as triggering Critical Habitat:</p> <ul style="list-style-type: none"> • Vegetation communities and plant species: <ul style="list-style-type: none"> ◦ Solomon Islands Rainforest ◦ Actinodaphne (<i>Actinodaphne solomonensis</i>) CR ◦ Cryptocarya (<i>Cryptocarya medicinalis</i>) CR ◦ Rosewood (<i>Pterocarpus indicus</i>) EN • Birds and mammals: <ul style="list-style-type: none"> ◦ King Rat (<i>Uromys rex</i>) EN ◦ Guadalcanal Monkey-faced bat (<i>Pteralopex atrata</i>) EN ◦ Guadalcanal Honeyeater (<i>Guadalcanaria inexpectata</i>) LC ◦ Guadalcanal Hooded-Whistler (<i>Pachycephala implicata</i>) LC 							
Mitigation and Management Actions							
#	Issue or Risk	Action	Timing / Frequency	Responsibility			
M-5-1.	Loss of flora and fauna species and/or habitats	Implementation of management actions specified in the other ESMPs, particularly P-2 Biodiversity Management Plan, C-3 Forest Clearance Plan, P-12 Waste Management and Point Source Pollution Plan, P-13 Hazardous Materials Management Plan; P-14 Spill Prevention and Emergency Response Plan; C-8 Watercourse Crossing Management Plan; C-9 Spoil and Topsoil Management Plan; and C-10 Drainage, Erosion and Sediment Control Plan.	Throughout construction	HEC Construction Manager HEC HSE Manager			
M-5-2.	Targets / performance indicators not met	Adaptive management: Review the results of biodiversity monitoring on a six-monthly basis, with a more detailed review every 3 years. Should targets and performance indicators not be met, or a continuing declining trend is observed, amend the biodiversity management, mitigation and monitoring undertaken. It is noted that biodiversity may decline as a direct result of main construction works and the high degree of disturbance occurring, but this is expected to be short term, with longer term gains to be achieved through restoration and conservation activities to be undertaken throughout the life of the Project.	Every 6 months to coincide with convening of the expert Biodiversity Advisory Group	HEC HSE Manager THL/OE Biodiversity Advisory Group			
Monitoring Requirements							
#	Title	Description/Target Species	Location	Survey Methods	Target / Performance Indicator	Timing / Frequency	Responsibility
M-5-A.	Flora Monitoring: Plant Propagation and Revegetation	Propagation of 700,000 cover crops, native species and successful revegetation of 66.29 ha as per the C-4 Post-construction Rehabilitation and Revegetation Plan.	<ul style="list-style-type: none"> • All areas to be cleared and revegetated. 	<p>The following will be reported on a quarterly basis:</p> <ul style="list-style-type: none"> • Number of seeds, plants and/or cuttings collected for propagation, recorded by species. • Number of plants planted, recorded by species. • Area replanted in hectares. • Fixed photo-point monitoring of revegetation areas. • Labour hours spent in the nursery, replanting, weed and pest control, or other maintenance activities (reported separately). 	Seeds, seedlings and cuttings collected and propagated. 66.29 ha revegetated and stabilised by Commercial Operation Date.	Prior to vegetation clearance. Revegetation complete by Commercial Operation Date. Quarterly monitoring and reporting.	HEC HSE Manager Ecologist
M-5-B.	Flora Monitoring: Revegetation Monitoring and Maintenance	As per C-4 Post-construction Rehabilitation and Revegetation Plan , planted and revegetated areas will be monitored monthly in the dry season following establishment, thereafter quarterly, until a full groundcover is established.	<ul style="list-style-type: none"> • All revegetation and rehabilitation areas 	<p>Routine monitoring of revegetation sites:</p> <ul style="list-style-type: none"> • Conduct surveillance and weed control. • Identify areas that require stabilisation, pest control and replanting, and implement these actions. • Weed control, using physical, mechanical and/or chemical control methods may be used. • Pest control may also be required to limit plant losses. 	Maintenance conducted to ensure effective stabilisation, revegetation, weed and pest control conducted. Full cover of vegetation achieved by Commercial Operation Date.	Monthly maintenance in the first dry season, thereafter quarterly. Revegetation complete by Commercial Operation Date.	HEC HSE Manager Ecologist

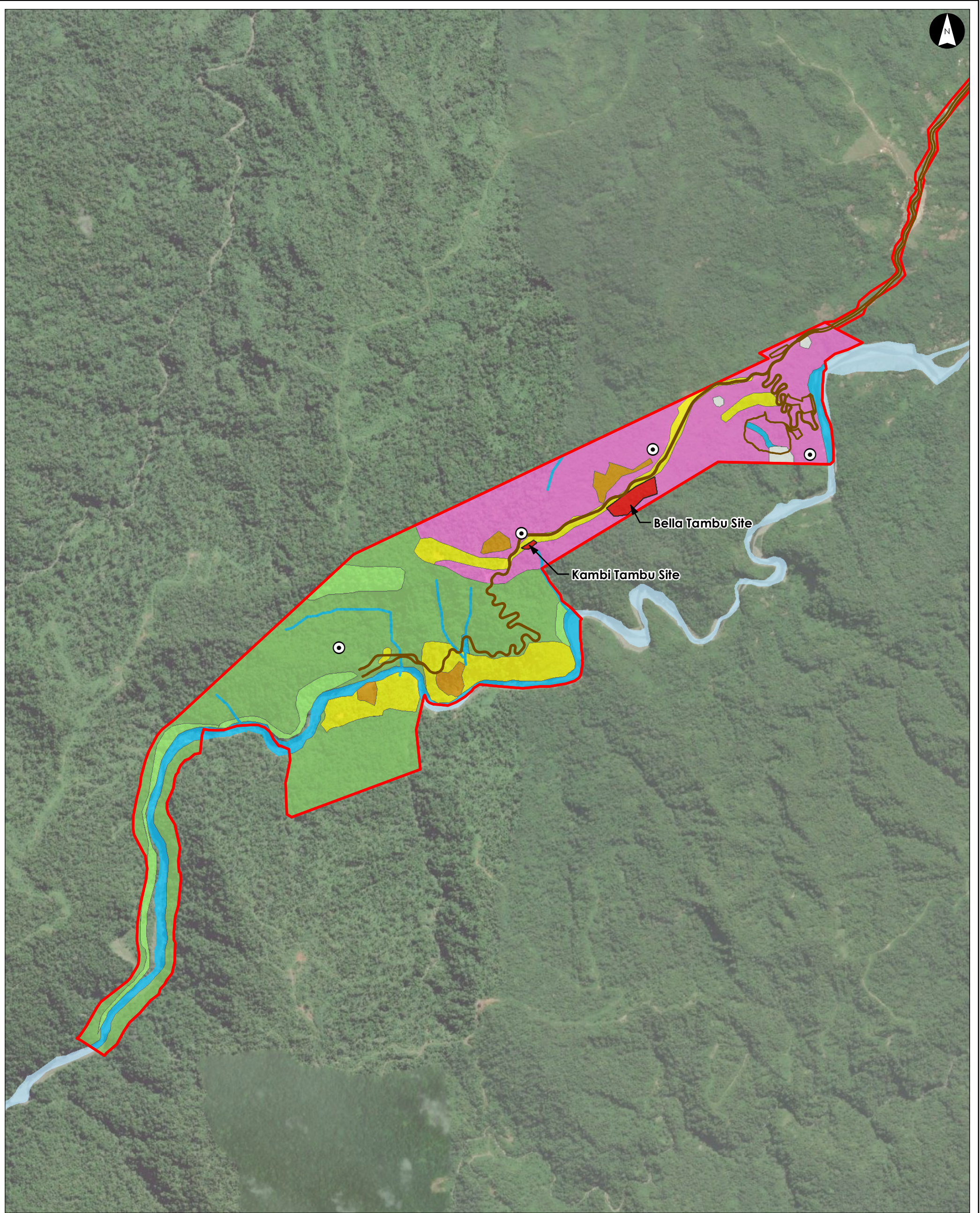
M-5-C.	Flora Monitoring: Critical Habitat Trigger Species	Targeting threatened flora including Critical Habitat trigger species: <ul style="list-style-type: none"> Actinodaphne (<i>Actinodaphne solomonensis</i>) Cryptocarya (<i>Cryptocarya medicinalis</i>) Rosewood (<i>Pterocarpus indicus</i>) 	<ul style="list-style-type: none"> Areas to be cleared and revegetated. 	<u>Pre-clearance Surveys:</u> <ul style="list-style-type: none"> Complete targeted surveys for threatened flora species as per C-3 Forest Clearance Plan. Whenever a threatened species is located: <ul style="list-style-type: none"> Take a GPS waypoint, collect a photographic record, and clearly mark the plant or area. Record in the Field Data Sheet the species name, number of individuals and an estimated cover area. Complete collection of seeds or seedlings if present. <u>Revegetation / Rehabilitation phase:</u> <ul style="list-style-type: none"> Conduct quarterly monitoring of revegetation sites for seedling survival and natural seedling regeneration. 	Record all <i>Pterocarpus indicus</i> , <i>Actinodaphne solomonensis</i> and <i>Cryptocarya medicinalis</i> trees in areas to be cleared. Avoid clearance wherever possible by modifying the clearance footprint as per C-3 Forest Clearance Plan . Ensure propagation and revegetation of these species.	Prior to vegetation clearance. Quarterly monitoring and reporting.	HEC HSE Manager Ecologist
M-5-D.	Fauna Monitoring: Mammals	Targeting threatened fauna including Critical Habitat trigger species: <ul style="list-style-type: none"> King Rat (<i>Uromys rex</i>) Guadalcanal Monkey-faced Bat (<i>Pteralopex atrata</i>) 	<ul style="list-style-type: none"> Areas to be cleared. Routine monitoring at a minimum of four (4) sites to be established within representative vegetation types as per Annex M-5-1 Terrestrial monitoring sites. Monitoring locations are subject to change following the results of the pre-clearance surveys 	<u>Pre-Clearance Surveys</u> Use indirect methods to confirm the presence of <i>Pteralopex</i> spp. and <i>Uromys rex</i> based on advice of Lavery (2019) and additional non-invasive options for <i>Pteralopex</i> spp. (acoustic recording, if viable): <ul style="list-style-type: none"> Conduct search for chewed ngali nuts in October-January to confirm the presence of <i>Uromys</i> spp., likely to include <i>Uromys rex</i>. Determine presence of <i>Pteralopex</i> spp. by surveying for chew plugs, created when chewing leaves, bark and tough fruits, and ejecting the tough pulp onto the forest floor. <u>Routine Monitoring:</u> <ul style="list-style-type: none"> Plot counts: <ul style="list-style-type: none"> Visual and auditory survey for <i>Pteralopex</i> spp. at a minimum of 4 set locations (refer Annex M-5-1) for a duration of 20 minutes. All fauna species seen or heard are to be recorded. A diurnal (day) and a nocturnal (night) plot count is to be undertaken at each location per survey. Camera trap surveys: <ul style="list-style-type: none"> Trial the use of 5 cameras at selected sites: <ul style="list-style-type: none"> 1 x camera at the fauna underpass to monitor that it is effective and unobstructed. 4 x cameras located along a transect at 100m spacing, secured on the trunk and/or in the canopy of mature lowland forest trees (especially <i>Canarium indicum</i>, <i>Canarium salomonsense</i> and <i>Dillenia salomonense</i>) located in Undisturbed Primary Forest. Use a lure of fibre wadding soaked in ngali nut oil (peanut or sesame oil if unavailable) placed in a secured, perforated, canister in the field of view. Deploy cameras at the underpass for 3 months, checked monthly. Deploy transect cameras for 1 month duration, then move to provide a total of 3 months data at 3 separate transects within Undisturbed Primary Forest. Repeat at the same sites each survey. Include monitoring during the fruiting season of <i>Canarium indicum</i> during September-November. Ensure cameras are active during nocturnal hours. All species detected are to be recorded. If species identification of small mammals is not possible via camera recordings, trial the use of ink pad trakka tunnels and/or trapping using Elliot traps. 	No consistent declining trend in diversity and abundance of target species is detected.	Prior to vegetation clearance during pre-clearance surveys. Routine monitoring biannually (twice per year) wet and dry seasons. Quarterly monitoring and reporting.	HEC HSE Manager Ecologist

M-5-E.	Fauna Monitoring: Birds	Targeting threatened fauna including Critical Habitat trigger species: <ul style="list-style-type: none"> Guadalcanal Honeyeater (<i>Guadalcanaria inexpectata</i>) Guadalcanal Hooded whistler (<i>Pachycephala implicata</i>) 	<ul style="list-style-type: none"> Routine monitoring at a minimum of four (4) sites to be established within representative vegetation types as per Annex M-5-1 Terrestrial monitoring sites. 	<ul style="list-style-type: none"> Point Counts: <ul style="list-style-type: none"> 2 km transect starting at the 4 set locations (Annex M-5-1), stopping every 200 m for 10 min, with species and distance of bird (0-25m, 25-50m, >50m). Record all avifauna in addition to target species. Optional audio recordings can also be taken during survey to provide opportunity to expand list post-survey. 	No consistent declining trend in diversity and abundance of target species is detected.	Biannually (twice a year) wet and dry seasons. Quarterly monitoring and reporting.	HEC HSE Manager Ecologist
M-5-F.	Invasive Species Monitoring: Flora	The IUCN lists 287 introduced and invasive species in the Solomon Islands. ¹ These include: <ul style="list-style-type: none"> Merremia (<i>Merremia peltata</i>) Paper mulberry (<i>Broussonetia papyrifera</i>) "Mile-a-minute" (<i>Mikania micrantha</i>) Giant sensitive plant (<i>Mimosa invisa</i>) Shameplant (<i>Mimosa pudica</i>) Common water hyacinth (<i>Pontederia crassipes</i>) Devil's fig/eggplant (<i>Solanum</i> sp.) Water morning glory (<i>Ipomoea aquatica</i>) 	<ul style="list-style-type: none"> Roadsides and revegetation/rehabilitation areas. 	<ul style="list-style-type: none"> Surveillance and weed control with a focus on the access road and rehabilitation sites. eDNA results from biannual aquatic surveys as per M-3 Fish, Algae and Macroinvertebrate Monitoring Plan. 	<ul style="list-style-type: none"> No new invasive species are recorded on site vs. baseline and pre-clearance surveys. No notable increase in abundance of existing invasive species at a given site. Rehabilitation monitoring to ensure stabilisation, rehabilitation and pest control is successful. 	<ul style="list-style-type: none"> Opportunistic records during surveys of terrestrial flora, fauna, and revegetation sites. eDNA biannually (twice a year) wet and dry seasons. Quarterly monitoring and reporting. 	HEC HSE Manager Ecologist
M-5-G.	Invasive Species Monitoring: Animals	The IUCN lists 287 introduced and invasive species in the Solomon Islands. These include: <ul style="list-style-type: none"> Feral pig (<i>Sus scrofa</i>) Giant African snail (<i>Lissachatina fulica</i>) Feral cat (<i>Felis catus</i>) Cane toad (<i>Rhinella marina</i>) Black rat (<i>Rattus rattus</i>) 	<ul style="list-style-type: none"> Roadsides and revegetation/rehabilitation areas. 	<ul style="list-style-type: none"> Prior to entry to Core Land, wash and check all vehicles, including construction equipment and machinery at the washing station for mud, seeds, plant and animal material including African Snails and their eggs (to prevent further upstream spread) and other organisms. Assess camera trap data for presence of invasive species. eDNA results from biannual aquatic surveys as per M-3 Fish, Algae and Macroinvertebrate Monitoring Plan. 	<ul style="list-style-type: none"> No new invasive species are recorded on site vs. baseline and pre-clearance surveys. No notable increase in abundance of existing invasive species at a given site. Control of invasive species where required, adhering to best practice. 	<ul style="list-style-type: none"> Vehicle checks daily prior to entry to Core Land. Opportunistic records during surveys of terrestrial flora, fauna and revegetation sites. eDNA biannually (twice a year) wet and dry seasons. Quarterly monitoring and reporting. 	HEC HSE Manager Ecologist

Supporting Documents

Annex	Name	Description
M-5-I.	Terrestrial monitoring sites	Recommended flora and fauna monitoring sites within targeted habitat

¹ Pagad S, Wong L J, Myer B, Moverly D (2023). *Global Register of Introduced and Invasive Species - Solomon Islands*. Version 1.6. Invasive Species Specialist Group ISSG. Checklist dataset <https://doi.org/10.15468/eepekj2> accessed via GBIF.org on 2023-06-07.



Proposed Monitoring Sites
Solomon Islands

Project Code: 300203604-GS-004
 Drawn By: MMM, Checked By: {Initials}
 Rev: 01
 Date: 2022-10-14



Legend

- | | |
|---------------------------|----------------------------|
| Project Area | Riparian Habitat |
| Selected Monitoring Sites | Garden Habitat |
| TRHDP Boundary | Remnant Forest |
| Tambu Sites | Guadalcanal Watercourses |
| Cliff Habitats | Disturbed Secondary Forest |
| Fallow Habitats | Undisturbed Primary Forest |

Notes:
 1. Coordinate System: WGS 1984 UTM Zone 57S

References:
 1. Basemap Supplied by Esri and Third Party Suppliers
 2. Layers provided by INOGEN

DRAWING NOT FOR CONSTRUCTION

