



Ecological Assessments and Services

TRACK RECORDS OF ENVIRO PRO GREEN INNOVATIONS (S) PTE LTD | 2021



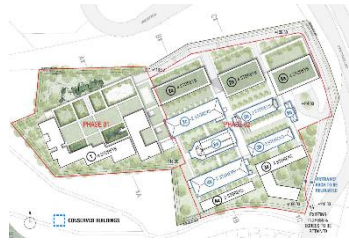
Biodiversity Study for Proposed Development of a Catholic Hub at 49, Upper Thomson Road, 2020 – Present

Enviro Pro was awarded a project by Catholic Archdiocese Singapore to conduct an environmental impact assessment for the development of Catholic Hub at 49, Upper Thomson Road. The proposal aims to present an integrated community & institutional development of GPR 1.2, with the conservation of selected structures on site as recommended by URA. In compliance with the Master Plan, the Catholic Archdiocese intends to build integrated facilities to accommodate all the different organisations that come under the Catholic Archdiocese together with a Home for the Aged Clergy and Ancillary Commercial spaces.

Enviro Pro has successfully submitted Form A for the proposal and will be conducting a detailed biodiversity study.

Key Study Methods

- Form A/ B Submission , environmental assessment consultation with key stakeholders.
- **Environmental Impact Assessment:**
- Fixed Position Camera Trapping – 18 camera traps will be installed for a period of 10 months. Camera traps
- maintenance and data analysis are performed every two
- weeks.
- Active Transect Survey – 6 taxa groups of fauna will be surveyed for a total of 115 transect survey days by 5
- individual surveyors.
- Belt Transect Surveys – Flora will be surveyed using belt transects by an experienced plant surveyor.
- **ABC Waters Design.**
- **Ecological Restoration Design.**



Proposed Master Plan



Trees spotted within the site



Proposed ABC Waters Feature's Location (red circle)

Environmental Impact Assessment (EIA) for MOE Rifle Range Outdoor Adventure Learning Centre (RROALC), 2020-Present



Enviro Pro was awarded a project by Interconsultants to conduct an environmental impact assessment for the construction of the proposed Outdoor Adventure Learning Centre for school going kids. The new MOE Outdoor Adventure Learning Centre is situated at Rifle Range Road with a total study area of approximately 6 hectares (including the site of 3.1 hectares), taking into account the potentially affected surrounding sensitive areas.

Following the environmental consultation process, an environmental impact assessment will be conducted to collect environmental baseline data and assess if the project may cause significant pollution or harmful changes to the terrestrial environment of the site and other sensitive receptors. The study will provide an environmental management and monitoring program to mitigate any adverse environmental impacts. This includes ABC Waters and ecological restoration designs.

Key Study Methods

- Form A/ B Submission , environmental assessment consultation with key stakeholders.
- **Environmental Impact Assessment:**
- Fixed Position Camera Trapping – 18 camera traps will be installed for a period of 10 months. Camera traps maintenance and data analysis are performed every two weeks.
- Active Transect Survey – 6 taxa groups of fauna will be surveyed for a total of 115 transect survey days by 5 individual surveyors.
- Belt Transect Surveys – Flora will be surveyed using belt transects by an experienced plant surveyor.



Strategy to minimize the footprint of the camping deck by elevating the decks



Major tree cluster within the site



Natural drainage spotted along the boundary of the site

Environmental Impact Assessment for the Proposed Coastal Protection Measures on Sentosa Island, 2018 – Present

Sentosa is a 500 ha resort island located half a kilometre off the southern coast of mainland Singapore. Despite the developments over the years, the island still retains a portion of ecologically significant natural areas. 70% of the island was historically covered by secondary rainforest, providing the habitat to species such as monitor lizards, monkeys, peacocks and other flora and fauna.

Enviro Pro will examine how the projected rise in sea level will affect the coast around Sentosa Island, and what measures are needed to be implemented to safeguard the island. The EIA will assess the predicted environmental impacts on Sentosa due to climate change and associated sea level rises, and it will assess how the environmental impacts identified can be reduced and mitigated against.

Key Study Methods

- **Literature Review & Site Inspections** – Government authorities may be consulted to ascertain if data capture under previous studies can be shared with the study team.
- **Risk Identification & Recommendation of Coastal Protection Measures** – To see the detailed modelling works carried out and to identify potential flooding for various climate scenarios. A cost-benefit analysis will be carried out .
- **Conceptual Design** – This stage focuses on developing the potential solution to a concept level of design including build schedule and cost planning.





MegaAdventure Park Detailed EIA, 2018 – 2020

The project studies the environmental impacts of the MegaAdventure Park at Imbiah Hill on Sentosa Island. It will assess potential adverse environmental impacts on MegaAdventure's development plans and will propose measures that will mitigate environmental impacts with focus on environmentally sensitive receptors.

Enviro Pro is required to scope, evaluate and quantify environmental impacts associated with the construction and operational phases of the re-development of the park attraction and zip-line to ensure that any significant environmental impacts are mitigated to acceptable levels.

Key Elements of Study

- **Active Transect Survey** – both diurnal (day) and nocturnal (night) surveys were conducted, and a checklist of species has been produced and evaluated for species conservation status based on “The total vascular plant flora of Singapore”.
- **Ambient Noise Monitoring** – Monitoring was carried out for at least 30 minutes at three different time slots of the day.
- **Water Quality Monitoring** – For water bodies identified in the area, such as drains, samples have been collected and analysed using a SINGLAS accredited laboratory.
- **Air Quality Monitoring** – Samples of air have been collected for analysis of sulphur dioxide, nitrogen dioxide, carbon monoxide and particulate matter using a SINGLAS accredited laboratory.





Biodiversity Study for Sentosa Island, 2017 – 2018

With the completion of Sentosa Cove residential precinct and the Integrated Resort fully in Sentosa Development Corporation (SDC) has invited Enviro Pro to carry out a Biodiversity Study for Sentosa Island with the purpose of determining the status of various species present on the island and providing recommendations that will assist in future conservation efforts.

Enviro Pro is currently conducting a detailed biodiversity study of the island over 10 months. Aves, Mammals, Herptiles, Odonates, Butterflies, intertidal fauna, and flora will be studied. After the study, possible measures to enhance biodiversity will be proposed to SDC.

Key Study Methods

- **Fixed Position Camera Trapping** – 18 camera traps will be installed for a period of 10 months. Camera traps maintenance and data analysis are performed every two weeks.
- **Active Transect Survey** – 6 taxa groups of fauna will be surveyed for a total of 115 transect survey days by 5 individual surveyors.
- **Belt Transect Surveys** – Flora will be surveyed using belt transects by an experienced plant surveyor.



A pond rich in Odonate species in Sentosa



Photo of Grenadier found in one of the ponds in Mt. Imbiah



Photo of Oriental Pied Hornbill in Central Sentosa



Biodiversity Impact Assessment (BIA) of Proposed Railway Development at Tengah, 2017

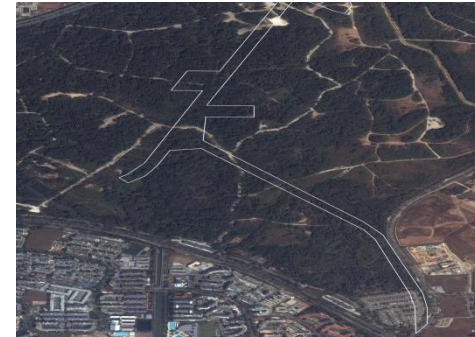
Tengah is set to become Singapore's 24th Housing Board Town. Plans of developing Tengah into Singapore's largest smart, sustainable town are in place, with its surrounding greeneries giving rise to the name "Forest Town".

Tengah is a secondary forest patch and previous military training ground that connects the Western catchment area to the Central catchment. Enviro Pro is conducting the Biodiversity Impact Assessment under contract of Parsons Brinckerhoff for the proposed railway alignment.

Enviro Pro is tasked with compiling a biodiversity inventory, assessing the impacts to biodiversity and recommending mitigation measures for the construction and operation phase of the development.

Key Study Methods

- **Active Transect Survey** – 6 taxa groups of fauna and flora will be surveyed
- **Camera Trapping** - 8 camera traps will be installed for a period of 4 weeks.



Proposed railway track



Existing forest cover of Tengah



Dark-tipped forest skimmer



Environmental Management and Monitoring Plan (EMMP) for Supply and Laying of Additional Outlet Pipes at Bukit Kalang Service Reservoir Area, 2016 - 2017

The proposed project at Bukit Kalang Service Reservoir (BKSr) aims to construct a set of new potable water pipelines and the retro-fitting of existing pipelines. National Parks Board (NParks) and Public Utilities Board (PUB) called for an Environmental Management and Monitoring Plan (EMMP) to mitigate against impacts caused by the construction work and the use of machinery.

Enviro Pro conducted the pre-construction biodiversity monitoring of fauna and the development of Biodiversity Management Plan as part of the EMMP under the contract of Singapore Environmental Consultancy and Solutions (SECS).

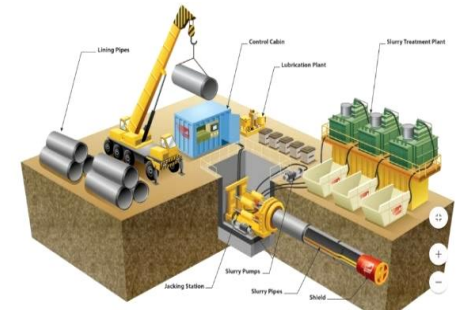
A total of 154 species were recorded in the area, including the Nationally Critically Endangered Lesser Mousedeer (*Tragulus kanchil*) and Sunda Pangolin (*Manis javanica*). Due to the survey methods undertaken, the data was analysed spatially to identify areas of high sensitivity within the project area.

Key Study Methods

- **Fixed Position Camera Trapping** – 9 camera traps were installed for a period of 12 weeks. Camera traps maintenance and data analysis were performed every two weeks.
- **Active Transect Survey** – 5 taxa groups of fauna have been surveyed and a total of 43 transect survey days were undertaken by 5 individual surveyors.



Camera trap installed by Enviro Pro



Pipe jacking works for laying of pipelines



Photo of Lesser Mousedeer captured by camera trap



Ecological/ Biodiversity Management and Monitoring for Proposed Road Construction from TPE to Punggol Central at Lorong Halus, Singapore, 2015 - 2018

Hwa Seng Builder Pte Ltd is in the midst of constructing a road to connect the Tampines Expressway (TPE) and the Kallang-Paya Lebar Expressway (KPE) to Punggol Central. The road will traverse the Lorong Halus area, a discontinued solid waste landfill site that has regenerated into a habitat rich in aquatic and terrestrial biodiversity.

Enviro Pro conducted the BIA under the contract of Singapore Environmental Consultancy and Solutions (SECS) for the proposed road construction and monthly EMMP monitoring. Following one year from the BIA, Enviro Pro conducted an annual biodiversity study in order to understand the changes in abundance and diversity of fauna species at Lorong Halus. This Annual Biodiversity Report reviews the data collected during the previous 13 months of EMMP Monitoring and a recent Annual Study conducted in 2017, and compares such data with the Baseline Study conducted in 2015.

Of particular note, fireflies which are Critically Endangered in Singapore, were found in a single grass patch, close to the stream diversion of the project area, further highlighting the importance of ecological conservation in the area.

Key Study Methods

- **Active Transect Survey** – 8 taxa groups of fauna have been surveyed and a total of 43 transect survey days were undertaken by 5 individual surveyors.
- **Point Counts** – Freshwater fishes and invertebrates at Sungai Blukar were identified using the catch and release method.



Sungai Blukar – Main study area in Lorong Halus



Bird surveyor at site



Firefly spotted during survey



Ecological Enrichment Works at Windsor Nature Park, 2014 - 2016

Windsor Nature Park, the sixth nature park in Singapore, was opened on 22 April 2017. Located off Venus Drive at the Upper Thomson area, Windsor Park acts as a green buffer for the Central Catchment Nature Reserve of Singapore. The existing habitat and biodiversity of the nature park was sensitively enhanced over two years.

The park consists of new nature trails that feature raised boardwalks and a sub-canopy walk where visitors can explore. Other features of the park include a wetland that was built considering the existing topography. The wetland was planted with reeds and plants such as *Cyperus haspan* and *Canna glauca* to provide ecological habitat and enhance the biodiversity.

Enviro Pro conducted the Biodiversity Impact Assessment of the development of Windsor Nature Park. Furthermore, Enviro Pro designed the wetland features to create an ecological rich habitat for diverse biological species of the nature park.

Key Study Methods

- **Active Transect Survey** – 6 taxa groups of flora and fauna have been surveyed by 9 individual surveyors.
- **Ecological Enrichment** – Snags are placed in the wetland for birds perching. The wetland environment attract and provides suitable habitat for various dragon flies and butterflies.



Wetland in Windsor Nature Park



Snags are placed within the wetland to attract birds to enhance biodiversity



Construction of boardwalk in Windsor Nature Park



Ecological Enrichment of Sungai Satu River Rehabilitation, 2010 - 2016

Sungai Satu River is a river located in Batu Ferringhi, Penang which was heavily clogged with litters and pollutants. The river rehabilitation involved a 200m section of the river. This project is an initiative by Selangor Dredging Berhad (SDB) in conjunction with their residential project, By The Sea.

This rehabilitation project aimed to rehabilitate, beautify the riverine environment and improve the water quality of the river. The project also produced a valuable and enjoyable landscape as well as a more diverse habitats. Ecological restoration to increase riverine biodiversity is one of the key objectives of this project. Enviro Pro is involved in the design and built as well as the ecological enrichment of the river rehabilitation system with the implementation of bio-engineering technology.

Key Design Concepts

- **Bio-engineered slope** – Rock chamber mattresses were placed on the river banks so that it can be used as a slope stabilisation method. The bio-engineered slope can also be re-greened and provides a natural looking appearance.
- **Cleansing Wetlands** – Provides water treatment which improves water quality by means of filtration and phyto-remediation. Beautification of river, making it aesthetically pleasing and providing dense habitat for wildlife.

Awards

- **FIABCI – Winner of Best Environmental Malaysia Property Award (Rehabilitation/Restoration) - 2016**



Overview of the river rehabilitation



Cleansing wetlands



A pair of otters were spotted for the first time in Sungai Satu, one year after completion of project



Environmental Management and Monitoring Plan (EMMP) For Construction of Changi Collector Drain 2, 2016

In order to accommodate the increase of air traffic in Singapore, new airport facilities such as the Changi Airport's Terminal 5 and new airfreight centre will be constructed. The additional widening works at Changi Collector drain 2 will be able to deal with the increasing runoff from airfield catchment.

Enviro Pro is engaged in this project as a biodiversity specialist, under the contract of Setsco Services Pte Ltd. Enviro Pro conducted a baseline survey for both intertidal and coral habitats during the pre-construction phase. This study up-dated the ecological baseline data for intertidal and coral reef habitats prior to the commencement of construction works at the Changi Collector Drain 2 outfall.

Enviro Pro assisted in the development of EMMP and will be conducting biodiversity monitoring during the construction phase.

Key Study Methods

- **Marine Line Intercept Transect (LIT)** – LIT was used by a diving team to survey corals.
- **Marine Belt Transect** – Five 20m tape measures were laid by divers and belt transects were carried out to survey for fishes and invertebrates.
- **Intertidal Belt Transect** – Intertidal seagrass and invertebrates were surveyed using a 50m belt transect sampled every 5 meters with a quadrat.



*Changi
Collector
Drain 2*



*Quadrat
survey
along the
transect*



*Enhalus
acoroides*



Rapid Faunal Assessment on GLS Land Parcel at Fernvale Road, 2016 - 2017

Fernvale Green Pte Ltd is proposing the development of a new residential establishment on an Urban Redevelopment Authority (URA) land parcel at Fernvale Road that is largely covered in young secondary forest vegetation.

Enviro Pro conducted the Rapid Faunal Assessment in order to develop mitigation measures for animals deemed to be a cause for concern.

The assessment included visual transects in the day and night, small mammal trapping and camera traps. Mitigation measures proposed by Enviro Pro includes the 'Pre-stressing' of fauna in combination with the schedule of hoardings installation and the use of uni-directional flaps to allow fauna to leave the hoarded area.

Key Study Methods

- **Rapid Field Survey** – Visual transects were conducted in the day and night to survey both diurnal and nocturnal species.
- **Mammal Trapping** – 17 locations were sampled using ENTA wire mesh mammal traps with 3 sizes over 2 trapping nights (30 trap-nights in total).
- **Camera Trapping** – 2 camera traps were installed.



Development site mainly consists of young secondary forests



Wildlife management plan for the development



Night surveys carried out by surveyor



Limited Scope Biodiversity Impact Assessment (BIA) for Physical Barrier along the Coastline of Tanjung Irau & Yishun Ave 1 Army Training Ground, 2015 - 2016

The construction works by Ministry of Home Affairs (Police Coast Guard) involved the installation of a new coastal security fence along the coastline of Tanjung Irau and Yishun Avenue 1 Training Ground.

Enviro Pro conducted the limited scope BIA under the contract of Setsco Services Pte Ltd to determine the possible impacts due to the construction of the security fence on the biodiversity of the mangrove and coastal ecosystem in and around Tanjung Irau.

One of the most pressing ecological impact identified is the restriction of migration through the barrier for animals and mangrove associated seeds and propagules. Preventing exchange of biological matter through the barrier will likely isolate the mangrove system upstream from the surrounding coastal and marine habitats. Thus, the fence was proposed to be designed with passages large enough to allow fish and floating seeds to pass through, and be at intervals frequent enough to facilitate free movement.

Key Study Methods

- **Active Transect Survey** – Species of flora and fauna were identified by surveyors.



Satellite imagery of the fence layout



Example of a coastal fence in Singapore



Upstream mangrove system



Rapid Biological Assessment of Palawan Lagoon in Sentosa Island, 2015 - 2016

A study was conducted at Palawan Beach, Singapore to determine the feasibility for conversion of the bay to a lagoon with controlled water exchange. Based on the design proposal, the lagoon will be closed up and turned into an underwater coral garden and safer swimming area with controlled water quality for visitors.

An important element of the project is the assessment of marine life in the existing situation and how the desired marine life could thrive in the future management scenarios for the lagoon.

Enviro Pro conducted the rapid biological assessment of Palawan Lagoon under the contract of Singapore Environmental Consultancy and Solutions (SECS) to assess the biological diversity of the lagoon and review the feasibility of the proposed lagoon.

Key Study Methods

- **Line-Intercept Transect (LIT)** – 5 transects of 100m were used to examine the substrate and marine benthic life forms. Other marine organisms were observed and recorded out to 1 meter from either side of the transect line.



Palawan Beach with its users



Photo of Tachypleus gigas taken during LIT Survey



Photo of Stereonephthya sp & blue Neopetrosia sp taken during LIT Survey



Biodiversity Impact Assessment (BIA) Around Proposed Upgrading Works at Chestnut Avenue Waterworks, 2015 - 2016

Chestnut Avenue Waterworks (CAWW) is one of the largest drinking water plants in Singapore. Due to its close proximity with a nature reserve (Chestnut Nature Park), any upgrade development or construction activities could potentially lead to a direct or indirect impact to the environment. Thus, an Environmental Impact Study (EIS) was needed for the course of this development project.

Enviro Pro conducted the Biodiversity Impact Assessment (BIA) as part of the EIS under the contract of Singapore Environmental Consultancy and Solutions (SECS) for the upgrading works, which included the erection of an ammonium sulphate dosing plant and underground water pipeline system at CAWW.

A flora and fauna inventory was produced. The data was used to produce a map of biodiversity “hotspots”, where mitigation measures should be focused.

Key Study Methods

- **Belt Transects for Flora Inventory** – Trees bigger than 5 cm diameter at breast height (DBH) were surveyed along 10m wide transects.
- **Active Transect Survey for Fauna Inventory** – 5 taxa groups of fauna have been surveyed by 6 individual surveyors.



Impact Zones identified by Enviro Pro



Photo of Sunda Pangolin taken during Transect Survey



One of the water quality sampling point



Environmental Impact Assessment For the Development of The Outpost and Village Hotel at Artillery Avenue, Sentosa Island, 2014 - 2015

The development of two distinctive hotels – Outpost Hotel Sentosa and Village Hotel Sentosa with a site area of 44685 m² is expected to be completed in 2018.

Enviro Pro conducted an Environmental Impact Assessment (EIA) for the development. The principal objective of the EIA is to provide technical information for decision-making on the potential environmental impacts associated with the proposed development.

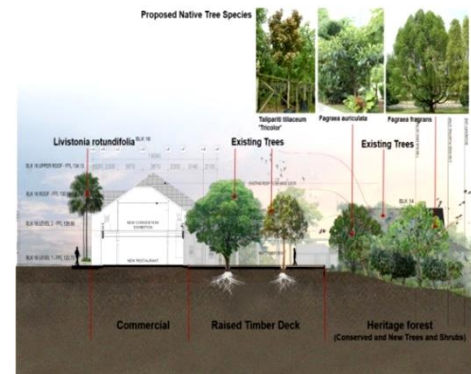
The development site contained some forest / tree areas of ecological value. These trees of conservation value were incorporated into the landscape of the hotel development and this is expected to mitigate the loss of habitat for the fauna. A green corridor was also proposed to be one of the mitigation measures for ecological enrichment of the development.

Key Study Methods

- **SINGLAS accredited laboratory testing for Water Quality** – Baseline condition obtained were compared with established guidelines to predict future impacts.
- **Sound Level Meter for Noise Quality** – Baseline condition obtained were compared with established guidelines to predict future impacts.
- **Arborist Survey for Flora Inventory** – Trees of conservation value were recommended for retention by arborist.
- **Rapid Site Survey** – A rapid biodiversity study was undertaken.



Artis impression of Outpost and Village Hotel



Enrichment planting with native and ornamental tree species was proposed



Green corridor was proposed to link conservation sites of Sentosa island



Biodiversity Impact Assessment (BIA) for Development of Chestnut Nature Park, 2014

This Biodiversity Impact Assessment was conducted in response to the Development of Chestnut Nature Park, located next to Central Catchment Nature Reserve of Singapore. Chestnut Nature Park was developed to include amenities such as shelters, pavilions, information map boards, toilets as well as a separate hiking and mountain biking trails.

Enviro Pro conducted the BIA, including a detailed biodiversity inventory of the local flora and fauna and then quantitatively assessed the potential biodiversity impacts that may occur. Lastly, Enviro Pro recommended feasible mitigation steps and measures to reduce the impact of both construction and operation phase of the development.

A total of 84 flora species and 147 fauna species were recorded in the area over a duration of three and a half weeks.

Key Study Methods

- **Belt Transects for Flora Inventory** – Trees bigger than 5 cm diameter at breast height (DBH) were surveyed along 10m wide transects.
- **Active Transect Survey for Fauna Inventory** – 5 taxa groups of fauna have been surveyed by 8 individual surveyors.
- **Horiba U-52 Multi-parameter Probe for In-situ Water Quality** – Temperature, turbidity, dissolved oxygen, salinity and conductivity were measured to associate water quality with aquatic biodiversity.
- **SINGLAS accredited laboratory testing for Ex-situ Water Quality** – Total suspended solids, zinc and biochemical oxygen demand were measured to associate water quality with aquatic biodiversity.



Tree surveyor at site



One of the water quality sampling points



Biking trails in Chestnut Nature Park



Environmental Monitoring and Management Plan (EMMP) for Redevelopment of Sungei Buloh Wetland Reserve, 2011 - 2014

Sungei Buloh Wetland Reserve was reopened on 6 December 2014. It was redeveloped to include a 31 hectare extension which allows visitors to visit mudflats at low tide. Some of the other new features include the mid-canopy walk, coastal boardwalk as well as the mangrove gallery.

Sungei Buloh Wetland Reserve is home to many wildlife and the EMMP acted as the primary control to ensure that construction activities do not cause any impacts on the biodiversity as well as the environment.

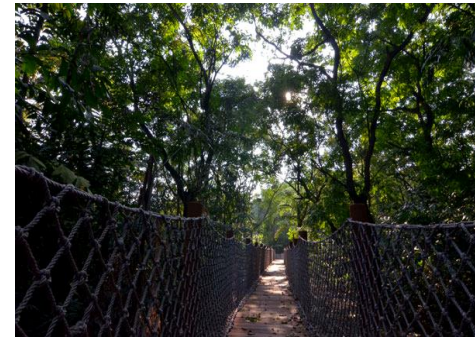
Enviro Pro was tasked with providing environmental and water quality monitoring services to ensure that mitigation measures were effective during the entire construction phase.

Key Study Methods

- **SINGLAS accredited laboratory testing for Water Quality** – Baseline condition obtained were compared with established guidelines to predict future impacts.



Mangrove swamp



Mid Canopy Walk



Water Quality Sampling Points



Limited Scope Biodiversity Assessment (BIA) for Kranji Reservoir Crossing Project, 2011

The Kranji Crossing of the New Natural Gas Transmission Pipeline from Tuas Power Station to Senoko Metering Station was a project by PowerGas Ltd in a bid to connect the SLNG terminal to the existing gas network for the conveyance of re-gasified LNG to Power Stations by laying gas transmission pipelines from Tuas Power Station to Senoko Metering Station.

The Limited Scope Biodiversity Impact Assessment (BIA) was carried out to ensure that the project does not cause any substantial pollution of or significant and harmful changes to the terrestrial and marine environment of Singapore.

Enviro Pro was tasked with conducting a Biodiversity Baseline Assessment covering two of the proposed work sites, determining some to the potential impacts on biodiversity, conducting environmental monitoring from the pre-construction phase to the post-construction phase and providing mitigation methods to prevent significant impacts to the environment during the entire course of the project.

Key Study Methods

- **Biodiversity Assessment** – Transect techniques were used during the principle detailed field surveys which was carried out for a month.
- **SINGLAS accredited laboratory testing for Water Quality** – Baseline condition obtained were compared with established guidelines to predict future impacts.



Kranji Marshlands



Existing Canal next to Jacking Shaft Site for Aquatic Biota Testing



Location of monitoring programme



Biodiversity Impact Assessment for NIP at Mandai Hill No. 68, 2008

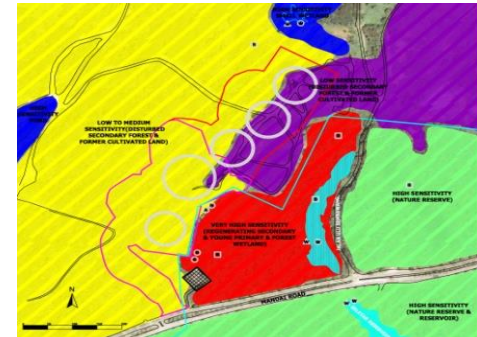
This Biodiversity Impact Assessment was conducted in response to a development proposal for the construction of the NEWater Service Reservoir at Mandai Hill 68 as part of the NEWater Infrastructure Plan (NIP) by Public Utilities Board (PUB). The project site is abutting the Central Catchment Nature Reserve in Singapore.

The construction activities were occurring in environmental sensitive areas which could have led to disturbances and severe impacts on both biodiversity and the environment.

Enviro Pro was tasked with conducting a BIA by Public Utilities Board (PUB). The BIA helped to identify habitats and species relevant for biodiversity conservation in the study area and to minimize potential adverse impacts in remaining environmentally sensitive areas in Singapore. Enviro Pro recommended a detailed environmental monitoring programme as well as a series of mitigation measures which was carried out during the entire construction phase.

Key Study Methods

- **Biodiversity Assessment** – Visual transects were conducted in the day and night to survey both diurnal and nocturnal species. Species of flora with value were identified as well for biodiversity conservation.



Monitoring area and environmental sensitive areas



Secondary jungle species and fruit trees



Malayan Giant Frog



Biodiversity Impact Assessment (BIA) for Mangrove Boardwalk and Pedestrian Access improvements at Berlayer Creek, Singapore, 2007 - 2008

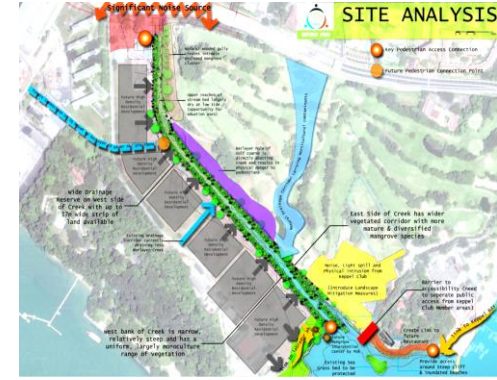
The 5.61 ha Berlayer Creek is part of the Labrador Nature and Coastal Walk and currently contains one of two remaining mangroves in the south of mainland Singapore. The creek is also home to a diverse group of flora and fauna with mainly three types of habitats – mangroves, rocky shores and mudflats.

Enviro Pro was assigned by Urban Redevelopment Authority (URA) to conduct a BIA for the development of a 960 m nature mangrove boardwalk at Berlayer Creek. This BIA helps to determine the optimal arrangement and design of the boardwalk such that the impact to the existing ecosystem is minimal. The advantages and disadvantages for all possible designs of the boardwalk was discussed in the BIA.

A number of mitigation measures were also suggested by Enviro Pro to ensure that species of flora and fauna of conservation concern can still be found at Berlayer Creek after the development of the nature mangrove boardwalk.

Key Study Methods

- **Biodiversity Assessment** – Species of flora and fauna were identified by surveyors. Mangrove vegetation and avifauna surveys involved walks and boat surveys. Specific walks through the mangroves and inter-tidal flats were made during low tide to survey for mollusk and crustacean groups.



Site analysis to determine the optimal design of nature boardwalk



Mature *Avicennia rumphiana* trees with aerial roots



Berlayer Creek mangrove boardwalk and its users



Design Services for Eco-tourism Attraction at the Singapore Zoological Gardens, 1999-2000

The Singapore Zoological Gardens was first opened in 1973 operating on a land area of 26 hectares. The Zoo, together with the Night Safari were one of the tourist hotspots in Singapore and soon gained recognition as being one of the most beautiful wildlife park in the world.

In year 1999-2000, the Singapore Zoological Garden engaged Enviro Pro as a biodiversity enrichment specialist, tasked with brainstorming features to improve eco-tourism attraction.

Enviro Pro provided detailed construction drawings and design of a rainforest canopy bridge and a constructed wetland system. Enviro Pro was further tasked to install a test canopy walkway in the Singapore Night Safari.

Key Designs Concepts

- **Rainforest Canopy Walkway Bridge (Trial)** – Provides visitors with a panoramic view of the zoo, closer interactions with animals and a tinge of adventurousness.
- **Constructed Wetland System** – Provides treatment of stormwater and recycling of animal husbandry wastewater.



Example of a canopy walkway



Example of a canopy walkway



Canopy walkway in a primate national park