



# Specialist Consultancy Services for Environmental Impact Assessment (EIA) at Woodlands Neighbourhood 1

Executive Summary

Housing & Development Board (HDB)

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# 1 Executive Summary

## Project Description and Objectives

AECOM Singapore Pte. Ltd. was appointed by the Housing and Development Board (HDB), through the Letter of Acceptance dated 17<sup>th</sup> February 2023 (Contract Number L/074/23), to provide *Specialist Consultancy Services for Environmental Impact Assessment at Woodlands N1*. An Environmental Impact Assessment (EIA) is required to understand the current environmental baseline conditions in Woodlands Neighbourhood 1 (N1), referred to as 'the Project'. This study will include an assessment of topography, biodiversity, airborne noise, and water resources (such as hydrology, surface water quality and groundwater). The EIA will predict and evaluate the potential impacts on biodiversity, including habitat degradation, mortality, and accidental injury. It will also assess the impacts caused by changes in other environmental baseline conditions, such as water resources and airborne noise, arising from and associated with the construction and operational phases of the proposed developments within the Project area.

The Project site spans across approximately 7.27 hectares (ha), and it is located in the northern part of Singapore. The Project site is bounded by Marsiling Road in the south, low-laying vegetation and Woodlands Centre Road in the west, Admiralty Road in the north and existing urbanised areas in the east (Woodlands Secondary School).

The proposed future developments within the Project will require: (1) the identification and understanding of baseline conditions of biodiversity, water resources (i.e., hydrology, surface water quality, groundwater), airborne noise, as well as topography of the Study Area; (2) the assessment of potential impacts on identified ecological receptors and other environmental conditions of the site; (3) the assessment of indirect potential impacts (i.e., due to changes in water resources and airborne noise) on ecological receptors and other environmental conditions of the site; (4) the proposal of mitigation measures to minimise potential significant adverse impacts; and (5) the development of an Environmental Management and Monitoring Plan (EMMP).

As shown in Urban Redevelopment Authority (URA)'s gazetted Master Plan 2019 [M-1], the Project site is zoned "Residential (Subject to Detailed Planning)" and "Road".

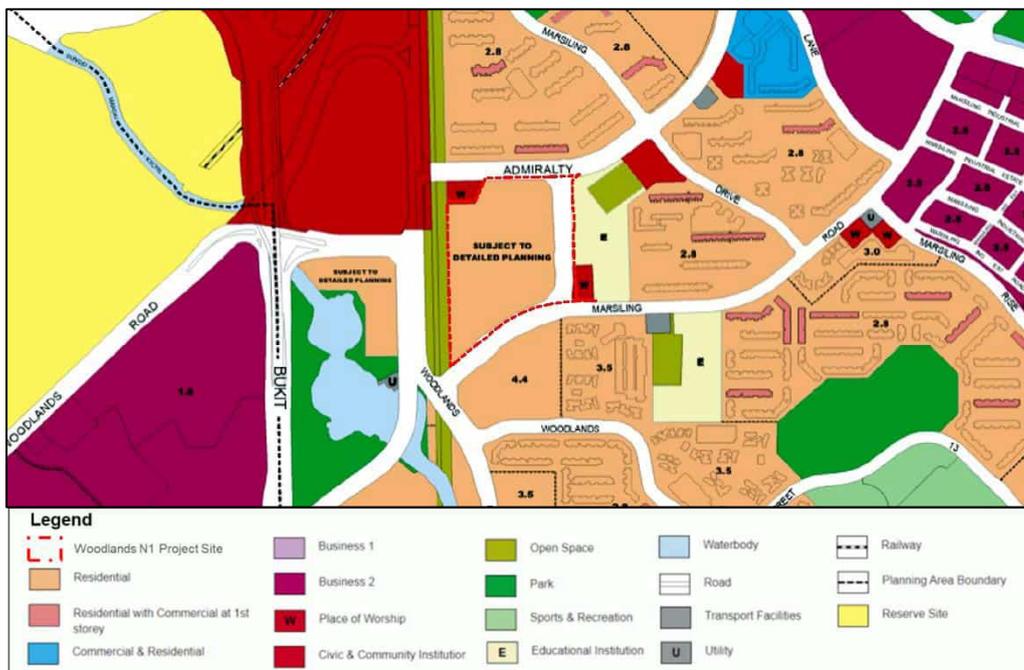


Figure 1.1 Proposed land use of the Project site and its surroundings (Source: URA's gazetted Master Plan 2019 [M-1])

## Environmental Baseline Findings

Baseline studies on biodiversity, water resources (hydrology, surface water quality, groundwater quality and level) and airborne noise were conducted for the respective Study Areas. A summary of the findings is provided below, detailed information can be obtained from Section 6 of the Report.

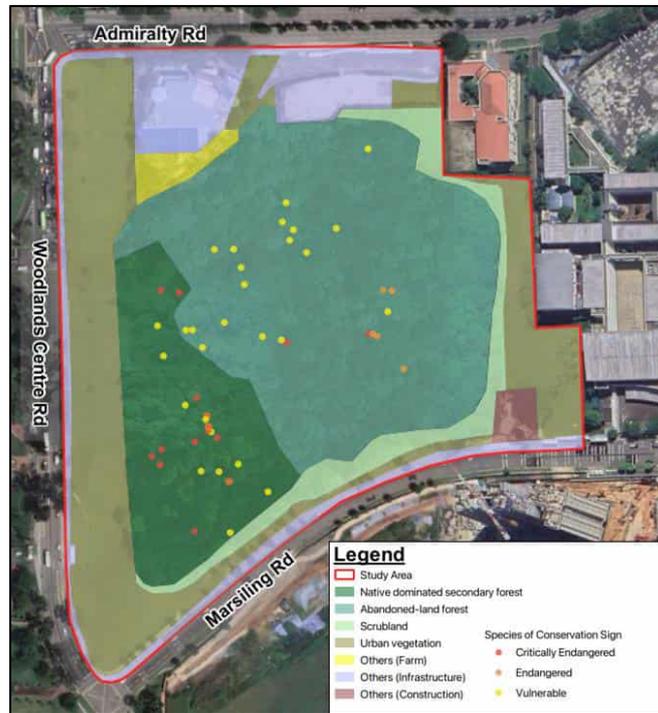


Figure 1.2 Habitat map of the biodiversity Study Area with distribution of flora species of conservation significance

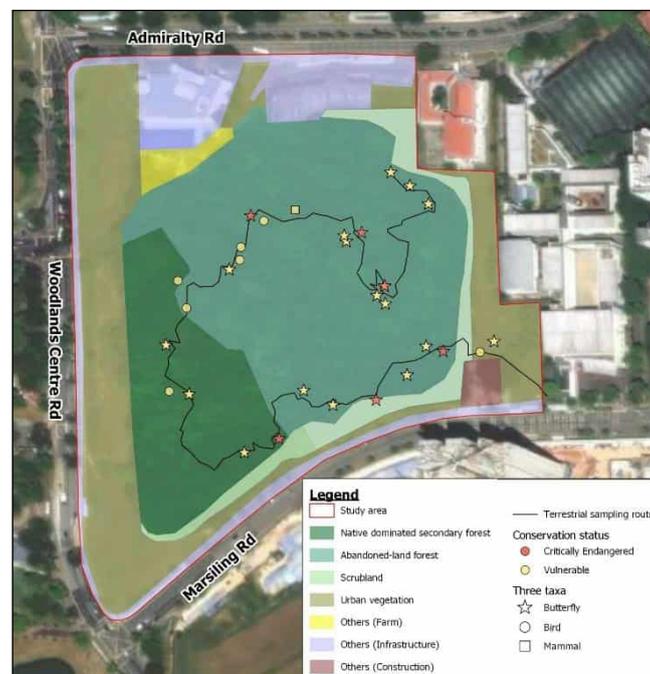


Figure 1.3 Habitat map of the biodiversity Study Area with location of faunal species of conservation significance

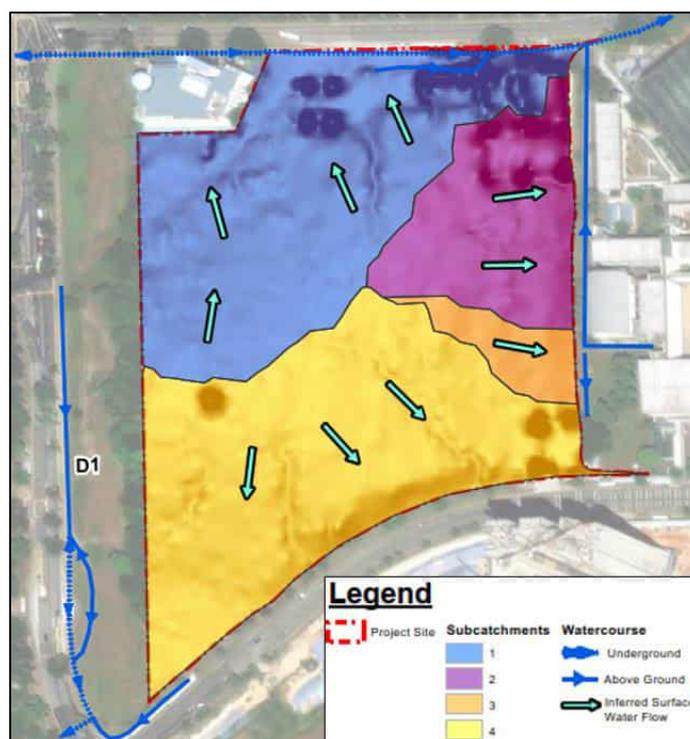


Figure 1.4 Catchment map of the Project site

- Habitats and Vegetation Distribution** (see Figure 1.2) – The Study Area currently consists of 4 vegetation habitats: abandoned-land forest (38.1%), urban vegetation (24.2%), native-dominated secondary forest (15%) and scrubland (5.5%). Other habitats include farmland (3.1%), infrastructure (13.2%) and construction area (1%). As there are no watercourses within the Study Area, no aquatic habitats were observed.
- Biodiversity, Flora, Large Plant Specimens and Other Specimens of Value** (see Figure 1.2) – In total, there are 195 species recorded, out of which 89 are native, 99 are exotic and 7 are cryptogenic. Ten species of conservation significance were recorded. These species include (1) *Aporosa falcifera*, (2) *Baccaurea polyneura*, (3) *Bouea oppositifolia*, (4) *Curculigo latifolia*, (5) *Dioscorea hispida*, (6) *Gymnacranthera farquhariana* var. *farquhariana*, (7) *Lindera lucida*, (8) *Litsea umbellata*, (9) *Microlepis speluncae*, and (10) *Psychotria polycarpa*. In total 28 large specimens were recorded (9 native, 18 exotic and 1 cryptogenic). No bamboo bats were found during the roost emergence survey.
- Biodiversity, Fauna** (see Figure 1.3) – In total, 95 species were recorded, mainly dominated by birds and butterflies. Four species of conservation significance were recorded across 3 taxa (birds, mammals and butterflies). Bird species of conservation significance include Swinhoe’s white-eye (*Zosterops simplex*). Mammal species of conservation significance include Cave nectar bat (*Eonycteris spelaea*). Butterfly species of conservation significance include sky blue (*Jamides caeruleus caeruleus*) and common birdwing (*Troides helena cerberus*).
- Hydrological Conditions** (see Figure 1.4) – No watercourses were observed within the Project site. The site is surrounded by opened/ partially opened drains in the north (i.e. along Admiralty Road), east (i.e. between the site and Woodlands Secondary School) and west (i.e. along Woodlands Centre Road). Catchment delineation shows that the site can be divided into 4 sub-catchments (northern, northeastern, eastern and southern). The water from northern, northeastern and eastern sub-catchments eventually gets discharged into the drain along Admiralty Road north of the Project site, while the surface runoff from the southern catchment gets channelled via roadside drains and culverts to the Marsiling Park Pond. In the northern end, the water from the Pond flows over the bund into the canal, eventually reaching Sungei Mandai Kechil. In addition, the water from the pond partially gets channelled and eventually reaches Upper Seletar Reservoir.
- Surface Water Quality** – The surface water sample was collected at one (1) water quality station, located at the junction of Drain D1 and the southern roadside drain. It is to be noted that drain D1 has ephemeral flow, hence the water sample was collected only during wet-weather conditions. All the tested surface water quality

parameters were within the adopted criteria (i.e. NEA Trade Effluent and Aquatic Life Criteria), except for aluminium which was above the adopted aquatic life criteria.

- Groundwater Level and Quality** – The groundwater elevations within the site ranged from 18.17m reduced level (mRL) to 10.37 mRL, while the groundwater depths ranged from 5.26m below ground surface (mbgs) to 5.43mbgs. The groundwater seepage velocity was calculated to be around 1.1 m/yr., with inferred radial flow direction from the central portion of the site, generally flowing towards the southeast. The groundwater is moderately acidic, with low conductivity and TDS concentrations, indicating freshwater conditions. All of the detected parameters in groundwater were reported within their respective DIVs, where applicable.
- Airborne Noise** – Baseline airborne noise monitoring was conducted at one (1) location to capture the ambient noise conditions experienced by ecological receptors in the vicinity of the Project Site. Baseline noise levels showed relatively low variation across weekends and weekdays, as well as during different times of the day—day, evening, and night.

## Impact Assessment Methodology

Section 5 of this EIA Report discusses the methodologies used for impact identification, prediction and assessment on environmental parameters including biodiversity, water resources (surface water quality, groundwater quality and level) and airborne noise during the construction and operational phases of the Project.

## Minimum Controls and Recommended Mitigation Measures

Table 1-1 lists the minimum controls and key mitigation measures that have been developed to minimise the adverse impacts throughout the course of the Project. More details can be found in Section 7 and 8 of the Report for proposed mitigation measures during the construction and operational phase respectively.

The main mitigation measures for biodiversity are implemented based on the mitigation hierarchy in the following order: (1) avoidance, (2) minimisation, and (3) enhancement/rehabilitation as well as compensation. Under avoidance, an area of high ecological value (AHEV) is recommended to be avoided from development. However, based on the recommendation in Section 7.4.4.1, not all of AHEV will be retained due to development plans. Ultimately, only about 90% of the AHEV (i.e., native-dominated secondary forest) will be retained. The area proposed to be retained also included a 15m buffer from the last line of native trees within the native-dominated forest patch. This helps to reduce the impact for habitat loss, plant mortality, loss of/reduction in habitats and food sources and overall connectivity for the fauna species.



Figure 1.5 Proposed area to be retained

Other measures were also recommended to minimise biodiversity impacts. For habitat, there should be infill planting within the 15 m buffer of the proposed retained area. The planting palette should take reference from native-dominated secondary forest species composition; planting species that would attract fauna such as butterflies and birds could reduce the impact of loss of/reduction in habitats and food sources. Threatened and/or rare flora species that will be impacted due to the site clearance should be transplanted or salvaged.

To minimise impact for accidental injury or mortality and human-wildlife conflict, directional site clearance to shepherd fauna during construction phase should be adopted together with road calming measures along the main road abutting the worksite. Other mitigation measures such as regular biodiversity awareness training, regular site inspections, good housekeeping controls should also be adopted within the construction site. To reduce impact for humans and light disturbance, other than no encroachment into proposed retained AHEV, a 6m noise barriers and light management plans should be implemented. Subsequently, with future plans for road widening works along Marsiling Road, further assessment should be undertaken to understand the impacts to biodiversity in the vicinity which includes the AHEV.

To minimise the impact due to the noise generated during the construction phase, the construction inventory list is to be analysed, and equipment causing high noise levels should be checked. Equipment with lower noise levels should be prioritized. Where source control is infeasible, acoustic enclosures or sheds are to be introduced to mitigate noise at the source by covering the machine as fully as possible. Noise barriers are proposed at the construction boundary fronting noise-sensitive receptors. If noise persists despite the recommended mitigation measures, proprietary noise barriers with high noise reduction capabilities should be implemented. The impacts due to traffic noise from Marsiling Road should be mitigated by reducing traffic speed through the installation of low-speed postings, speed humps, and speed limit signage.

**Table 1-1 Summary of minimum controls and key recommended mitigation measures**

Environmental Parameter	Minimum Controls and Key Recommended Mitigation Measures	
	During Construction Phase	During Operational Phase
<b>Biodiversity</b>	<p><u>Minimum controls</u></p> <ul style="list-style-type: none"> <li>Any trees that are to be retained within worksite would require a certified arborist to clearly mark out Tree Protection Zones where no works are allowed. The Tree Protection Zones should be set up in accordance with NParks guidelines (NParks, 2019)</li> <li>Before vegetation clearance, pre-felling fauna inspection should be conducted by an Ecologist who is able to identify wildlife or nesting structures that are being actively used such as bird nests, tree hollows, burrows, and bamboos clusters; in compliance with Section 10 Wildlife Act</li> <li>Soil erosion control measures (e.g. implementation of biodegradable erosion control blankets, ECM tanks etc) are to be executed once vegetation has been removed and soil is exposed as described in Section 7.3.2 under Water Resources</li> <li>Implement dust control measures as defined by NEA's regulated Environmental Protection and Management Act and its regulations</li> <li>Implement noise barrier as described in Section 7.3.3 under Airborne Noise</li> <li>Proper storage of materials that are likely to leech harmful chemicals and fuel-powered equipment away from waterbodies or sensitive habitats as described in Section 7.3.2 under Water Resources</li> <li>Installation of hoarding to delineate worksite</li> <li>Execute wildlife response plan when a trapped/ injured/ dead/ dangerous animal is encountered around or within the worksite according to Section 10 of the Wildlife Act</li> <li>Fogging is not recommended. To implement preventive measures against mosquito breeding by removing sources of stagnant water or water-bearing receptacles</li> <li>Providing well-maintained pitched roof, clearing discarded items daily, store materials appropriately,</li> </ul>	<p><u>Minimum controls</u></p> <ul style="list-style-type: none"> <li>Ensure noise levels are within approved limits (refer to Section 8.5 under airborne noise-related impacts)</li> <li>Ensure dust levels are within approved limits as defined by NEA's regulated Environmental Protection and Management Act and its regulations</li> </ul> <p><u>Mitigation measures</u></p> <ul style="list-style-type: none"> <li>Advisories can be displayed near HDB's lift lobbies or near-by bus stops to educate the residents on how to identify and respond to wildlife. Sign boards should include information on rescue hotline i.e., ACRES or NParks</li> <li>Limit public accessibility to the proposed area to be retained</li> </ul>

Environmental Parameter	Minimum Controls and Key Recommended Mitigation Measures	
	During Construction Phase	During Operational Phase
	<p>level up ground depression/ uneven surfaces, ensure effective drainage flow</p> <ul style="list-style-type: none"> <li>• Daily checks by Environmental Control Officer on site.</li> <li>• Use only fully biodegradable erosion control blankets (ECB) to avoid trapping fossorial fauna such as snakes</li> <li>• In the event of night works, development of Light Management Plan to minimise light disturbance to sensitive receptors</li> </ul> <p><u>Mitigation measures</u></p> <ul style="list-style-type: none"> <li>• Infill planting within the 15m buffer. Planting palette should take reference from native-dominated secondary forest species composition and include plant species that would attract fauna such as butterflies and birds</li> <li>• Transplantation / salvaging of threatened and/or rare plant species that would be impacted</li> <li>• Directional site clearance to shepherd fauna to an area allowing them to leave by themselves or through rescue and relocation if needed</li> <li>• To minimise entry of fauna into the site, the integrity of hoarding must be maintained at all times. Gaps in hoarding facilitates entry of fauna into the construction site. Regular inspections should be conducted to ensure there are no gaps in hoarding at all times</li> <li>• Adopt road calming measures such as speed bumps and speed limits (15km - 20km/h) to minimise roadkill accidents</li> <li>• Conduct biodiversity awareness training to worksite personnel and educate on actions to take when encountering wildlife</li> <li>• Ensure good housekeeping controls such as provision of wildlife-proof bins and indoor eating areas</li> <li>• Conduct regular inspections to ensure contractor compliance to the EMMP and identify potential faunal entrapments</li> <li>• Conduct roost emergence prior to bamboo felling works, ecologist to be present during bamboo felling to ensure that any bamboo bats will not be injured in the process and bamboo bat translocation</li> <li>• No encroachment into proposed area to retain</li> <li>• Develop and implement light management plan as there will be night works</li> </ul>	
<b>Impacts on Biodiversity due to Changes in other Environmental Parameters</b>		
<p><b>Water Resources</b></p> <p><b>(Surface Water Quality)</b></p>	<ul style="list-style-type: none"> <li>• Finalise a full inventory of all anticipated wastewater streams and volumes before the onset of construction phase works</li> <li>• Maintain daily records of wastewater volume, as well as the volumes of sludge and other wastes produced onsite</li> <li>• Ensure containment ponds are made of impervious material and designed with sufficient capacity to hold volumes of wastewater produced on site, accounting for stormwater runoff and firefighting needs as well</li> <li>• Provide temporary storage volumes for overflow situations of untreated wastewater. This temporary storage should have sufficient capacity to capture any unexpected additional volumes, ensuring that untreated wastewater is not released to watercourses unless it complies with NEA guidelines on trade effluent discharge concentrations.</li> <li>• Equip containment ponds, as well as wastewater generating areas on site with spill clean-up kits.</li> </ul>	<ul style="list-style-type: none"> <li>• Geotechnical aspect of site's slope stability (such as Earth Retaining Stabilising Structure [ERSS]) to be included in detailed design engineering for the operational phase</li> <li>• Providing more softscape area should be considered in the design of the development which will help to reduce the peak flow and reduce flood risk at downstream area. Active, Beautiful, Clean (ABC) Water design approach can be considered to reduce the peak flow</li> <li>• Provide more pervious areas to increase the seepage of surface water into the soil</li> <li>• Adequate drainage, piping and/ or channelling of stormwater runoff to be assured through detailed design [e.g. ABC Water design approach] for</li> </ul>

Environmental Parameter	Minimum Controls and Key Recommended Mitigation Measures	
	During Construction Phase	During Operational Phase
	<ul style="list-style-type: none"> <li>Design adequate drainage systems, including cut-off drains, sump pit, road kerb, piping and toe walls to channel construction process wastewater streams (e.g. wash water) and stormwater runoff separately through detailed design to capture and treatment in the containment pond(s)/ kerb(s). Where applicable, include oil-water separators.</li> <li>Seek approval from relevant authorities (i.e. PUB and NEA) in accordance with PUB Sewerage and Drainage (Trade Effluent) Regulations, if the wastewater is planned to be disposed to public sewer, or NEA's Trade Effluent Discharge Limits to watercourse if disposal to surface watercourses is intended. If such discharges are not approved, the trade effluent will be stored, treated or recycled on site and finally disposed off-site.</li> <li>Obtain comments and approval from relevant authorities (e.g., Singapore Civil Defence Force [SCDF] and NEA) for the use of treated wastewater for firefighting purposes.</li> <li>Provide appropriate concrete washout areas, ensuring these are not located near watercourses.</li> <li>All vehicles are to undergo a wheel washing process before leaving the site to prevent earth, mud, and debris from being disposed of on surrounding roads. The wastewater generated from this activity should be stored and removed for treatment and disposal offsite by an approved Waste Management Contractor.</li> <li>Establish regular and dedicated procedures for the inspection and maintenance of wastewater collection, storage, and treatment infrastructure (e.g., pipes, oil-water separators).</li> <li>Implement regular and dedicated procedures for the management of stormwater collection, settling, testing, and eventual discharge to watercourses.</li> <li>Develop a training program for all onsite workers, including subcontractors, to educate them on their obligations regarding proper water quality management.</li> <li>Prohibit the discharge of pumped groundwater from soil dewatering and other wastewaters into aquatic habitats.</li> <li>Prohibit the unmanaged discharge of any wastewater stream.</li> <li>No trade effluent other than the nature or type approved by the NEA Director-General will be discharged into any watercourse or soil.</li> <li>Apply the principles of reduce, reuse, and recycle to wastewater management onsite.</li> <li>Store hazardous wastewater, such as oil water, thinners, solvents, or paints, on a hard stand under shelter with a curb around the storage area. Ensure this wastewater is removed for treatment and disposed of offsite by an approved Waste Management Contractor. Handle hazardous liquids as Hazardous Waste.</li> <li>Implement a construction Environmental Management and Monitoring Plan (EMMP) and ensure full preparation of associated plans and procedures.</li> </ul>	<ul style="list-style-type: none"> <li>capturing and treatment before discharge into receiving watercourses</li> <li>Regular and dedicated procedures for the inspection and maintenance of stormwater collection, storage, and treatment infrastructure, such as pipes, oil water separation, silt screens, etc</li> <li>Regular and dedicated procedures for the management of stormwater collection, settling, testing and eventual discharge of 'clean' water to surface waters, including associated measures required to prevent high sediment concentration stormwater drainage to surface waters</li> <li>Prepare sufficient disposal bins surrounding the Project to avoid improper disposal of waste</li> <li>Conduct regular inspection on wastes' storage system of the Project</li> <li>Monitor the proposed watercourses and its surroundings with CCTV surveillance regularly to ensure no contamination occurred</li> <li>Develop an Emergency Response Plan and conduct adequate training to maintenance workers to cope the accidental water contamination</li> <li>Raise awareness of various stakeholders with community/ stakeholder engagement (e.g. signage boards, warning signs, etc.)</li> </ul>
<b>Water Resources (Groundwater)</b>	<ul style="list-style-type: none"> <li>Install piezometers to monitor the changes in groundwater level in compliance with Building Control Regulations 2003 as part of its instrumentation and monitoring plan to be endorsed by the Qualified Professional</li> <li>Conduct a construction risk assessment and prepare a comprehensive construction health,</li> </ul>	<ul style="list-style-type: none"> <li>Incorporate more pervious surfaces in the development plan</li> <li>Installation of recharge wells, if necessary</li> <li>Ensure no trade effluent other than that of a nature or type approved by NEA Director-General shall be</li> </ul>

Environmental Parameter	Minimum Controls and Key Recommended Mitigation Measures	
	During Construction Phase	During Operational Phase
	<p>safety and environment plan. If health impacts to workers are foreseen due to the handling of such waste, necessary precautionary measures as per the safety data sheets (SDS) including personal protective equipment should be implemented on site</p>	<p>discharged into any watercourse or land; and</p> <ul style="list-style-type: none"> <li>Conduct regular inspections on waste storage system within the Project to prevent system's clogging and leachate entering the underlying soil and/or surrounding watercourses, if any.</li> </ul>
<b>Airborne Noise</b>	<p><u>Best Management Practices</u></p> <ul style="list-style-type: none"> <li>Shut down machines (such as trucks) that may be in intermittent use between work periods or throttle down to a minimum</li> <li>Label all machinery and equipment used with a weather-proof sticker clearly indicating its noise emission level (at source) under normal operating conditions</li> <li>Utilize only well-maintained construction plants on-site, and service construction plants regularly during the entire construction period</li> <li>Reduce the number of Powered Mechanical Equipment (PME) as far as practicable when carrying out construction works at areas close to the noise-sensitive receivers.</li> <li>Utilize and properly maintain silencers or mufflers on construction equipment during the construction programme.</li> <li>Ensure behavioural practices including no shouting, no loud stereos/radios on site, no dropping of materials from height, and no throwing of metal items.</li> </ul> <p>Restrict high noise-generating drilling activities only to continuous blocks not exceeding 3 hours each, with a minimum respite period of one hour between each block, if possible.</p> <ul style="list-style-type: none"> <li>Conduct periodic noise monitoring by an independent third party to establish compliance with requirements and to advise on equipment causing concern, and additional potential mitigation measures.</li> <li>Apart from advance works/site clearance approved by Agencies, minimise noisy works after 6pm to reduce noise disturbance to nocturnal animals.</li> <li>Plan the layout of the site by considering the use of materials and other large structural equipment as noise barriers.</li> <li>Orient construction plants that are known to emit noise strongly in one direction, wherever possible, so that the noise is directed away from the nearby noise-sensitive receptors.</li> <li>Utilize material stockpiles and other structures effectively, wherever practicable, to screen noise from on-site construction activities.</li> <li>Ensure all handheld percussive breakers and air compressors used on-site comply with local legislation and requirements.</li> <li>Schedule activities to minimize noise generated at certain areas during periods particularly sensitive to noise.</li> <li>Prohibit works using machines or vehicles that generate noise during the night and at dawn.</li> <li>Personnel operating the plant or equipment should use appropriate hearing protectors, which must attenuate the user's exposure to sound pressure levels below 85dB (A). Put up signage to remind personnel to use hearing protection at work areas that emit excessive noise. Choose hearing</li> </ul>	<p><u>Best Management Practices</u></p> <p>Minimum Controls below should be applied at the prelim design stage of the development by the appointed M&amp;E consultants. An appointed Noise consultant should validate the noise in accordance with the NEA ACMV Guideline, 2018 [R-37]. In addition, mitigation measures will be provided by the appointed Noise Consultants during the prelim design stage</p> <ul style="list-style-type: none"> <li>Ensure that any exhaust outlet or intake from the mechanical ventilation system is designed to be adequately set back as far as possible from the boundary line of the development</li> <li>Acoustic treatment if any to be designed and implemented</li> <li>The building design should include provisions to ensure that the condensers of individual air-conditioning systems are positioned away from noise-sensitive areas</li> <li>Acoustic enclosures for outdoor equipment</li> <li>Consider road design as part of land use planning to minimise potential impact of land traffic noise on Noise Sensitive Receptors (NSRs)</li> <li>Consider the use of low-noise pavement mix for sections of new road networks near NSRs</li> <li>Consider alternative siting of new road networks away from noise sensitive receptors at pre-design stage</li> <li>Mitigate traffic noise at drop-off points and parking areas with low-speed postings, speed humps and speed limit signages. The addition of these speed control measures will likely lower noise levels for traffic as the vehicles would be cruising at lower speeds</li> </ul> <p>Due to the lack of information at this juncture of reporting, assessment, minimum controls, and mitigation will be provided by the appointed Noise Consultant during the prelim design stage and in accordance with the NEA TNIA Guideline, 2016 [R-39]</p> <p><u>Key Mitigation Measures</u></p> <ul style="list-style-type: none"> <li>Mitigate the impacts due to the traffic noise from Marsiling Road by reducing the traffic speed with the installation of low-speed postings, speed humps and speed limit signages</li> </ul>

Environmental Parameter	Minimum Controls and Key Recommended Mitigation Measures	
	During Construction Phase	During Operational Phase
	<p>protectors such as ear plugs (for &lt; 100 dB (A)), earmuffs (for 100 dB (A) to 120 dB (A)), or ear plugs and earmuffs (for &gt; 120dB (A)) according to various noise exposure levels.</p> <ul style="list-style-type: none"> <li>Conduct noise awareness briefings regularly and highlight the noise mitigation measures such as positioning machinery, using portable noise barriers, and the dos and don'ts for using machinery at night.</li> </ul> <p><u>Key Mitigation Measures</u></p> <ul style="list-style-type: none"> <li>Control of noise sources at the source from construction site – Analyse construction inventory list and check equipment causing high noise levels. Prioritize the equipment with lower noise level; and</li> <li>Where controlling noise sources at the source is not feasible, acoustic enclosures or sheds are to be introduced to mitigate noise at the source. Typical acoustic enclosure covers the machine as fully as possible (with or without ventilation where applicable) to provide sound insulation</li> <li>Noise barriers are proposed at the construction boundary fronting noise sensitive receptors; and</li> <li>The construction of buildings of staggered heights with low-rise, mid-rise, and high-rise buildings should be considered</li> <li>If noise remains an issue even after implementation of recommended mitigation measures such as noise barriers, contractor should consider implementation of proprietary noise barriers of high noise reduction capabilities to further reduce noise to acceptable levels</li> </ul>	

**Note:**

As current means of noise impact assessment were only performed qualitatively, quantitative noise impact assessment must be conducted by the developer/ developing agent at a later stage to assess noise impacts arising from the construction phase related activities applying a 3D simulating software such as SoundPLAN and CadnaA before the commencement of construction works as mandated by law at later stages of the Project.

## Summary of Impact Assessment

With the implementation of mitigation measures, the overview of impact evaluation for both construction and operational phases are summarised in Table 1-2.

**Table 1-2 Summary of impact significance for construction and operational phases (range, if applicable)**

Environmental Parameter	Impact Significance (with Minimum Controls/ Best Practices)	Residual Impact Significance (with Mitigation Measures)
<b>Impacts on Biodiversity</b>		
<b>Biodiversity</b>	<u>Construction Phase</u> Negligible to Major <u>Operational Phase</u> Negligible to Moderate	<u>Construction Phase</u> Negligible to Major <u>Operational Phase</u> Negligible to Minor
<b>Impacts on Biodiversity due to Changes in Other Environmental Parameters</b>		
<b>Water Resources (Surface Water Quality)</b>	Minor	Minor
<b>Water Resources (Groundwater)</b>	Negligible	Negligible
<b>Airborne Noise</b>	<u>Construction Phase</u> Moderate to Major <u>Operational Phase</u> Negligible to Moderate	<u>Construction Phase</u> Moderate to Major <u>Operational Phase</u> Negligible to Minor

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