

EXECUTIVE SUMMARY

The Public Utilities Board (PUB), Singapore's National Water Agency has proposed to lay a total of 4600m of twin 1800mm diameter potable water pipelines from the Bukit Kalang Service Reservoir (BKSR) to Upper Thomson Road along Island Club Road (hereinafter referred to as "Project"). The proposed pipelines will increase the supply of potable water from the service reservoir to meet the demand for water supply in the eastern part of Singapore.

PUB has commissioned EnviroSolutions & Consulting Pte Ltd (ESC) as the Environmental Impact Assessment (EIA) and Environmental Monitoring and Management Plan (EMMP) Consultant and AECOM as the Engineering Consultant. A number of feasible pipelines routes were proposed and studied during the feasibility and detailed design study. The pipelines will be located partially within and adjacent to Singapore's highly bio-diverse Central Catchment Nature Reserve (CCNR) and Windsor Nature Park (WNP). Relevant stakeholders were engaged by PUB, ESC and AECOM for comments and the final pipeline alignment for the Project, based on approval received from the relevant stakeholders is shown in Figure 1 below.



Figure 1: Potable Pipeline Alignment chosen for the Project

EIA Requirements

PUB submitted an environmental consultation for the Project to the Urban Redevelopment Authority (URA) and Technical Agencies which comprises of the National Parks Board (NParks), National Environment Agency (NEA), Agri-Food and Veterinary Authority (AVA) (subsequently renamed as the Singapore Food Agency (SFA)), and the Maritime and Port Authority of Singapore (MPA) in 2017.

Based on the responses from the various Technical Agencies, it was recommended that an EIA be conducted to assess the impacts of the Project and an EMMP be developed to minimize the potential impacts from the Project. A scoping meeting was carried out with the Technical Agencies and the EIA study area and scope of the EIA was established.

The EIA study area is specified as follows and shown in Figure 2.

- For fauna and other impacts study:
 - (a) All terrain extending 50m outwards from the existing fence line and gates of the BKSr compound;
 - (b) All terrain extending 50m from the proposed hoardings (worksite boundary) for construction of all pipelines, chambers, cascading drains and other associated fittings and ancillaries outside the BKSr compounds;
 - (c) The area of Singapore Island Country Club (SICC) affected by the proposed Project;
 - (d) All terrain extending 50m outwards from both sides of the access road from BKSr, along Island Club Road leading up to Upper Thomson Road (i.e. along the proposed pipeline alignment), including diversion of existing services, construction of all pipelines, chambers, and other associated fittings and ancillaries;
 - (e) and Streams within WNP.
- For flora and tree study:
 - (f) 50m buffer from shaft hoarding boundary (worksite boundary) and 5m buffer towards both sides from the edge of the proposed twin 1800mm dia. pipelines, along the pipeline alignment.

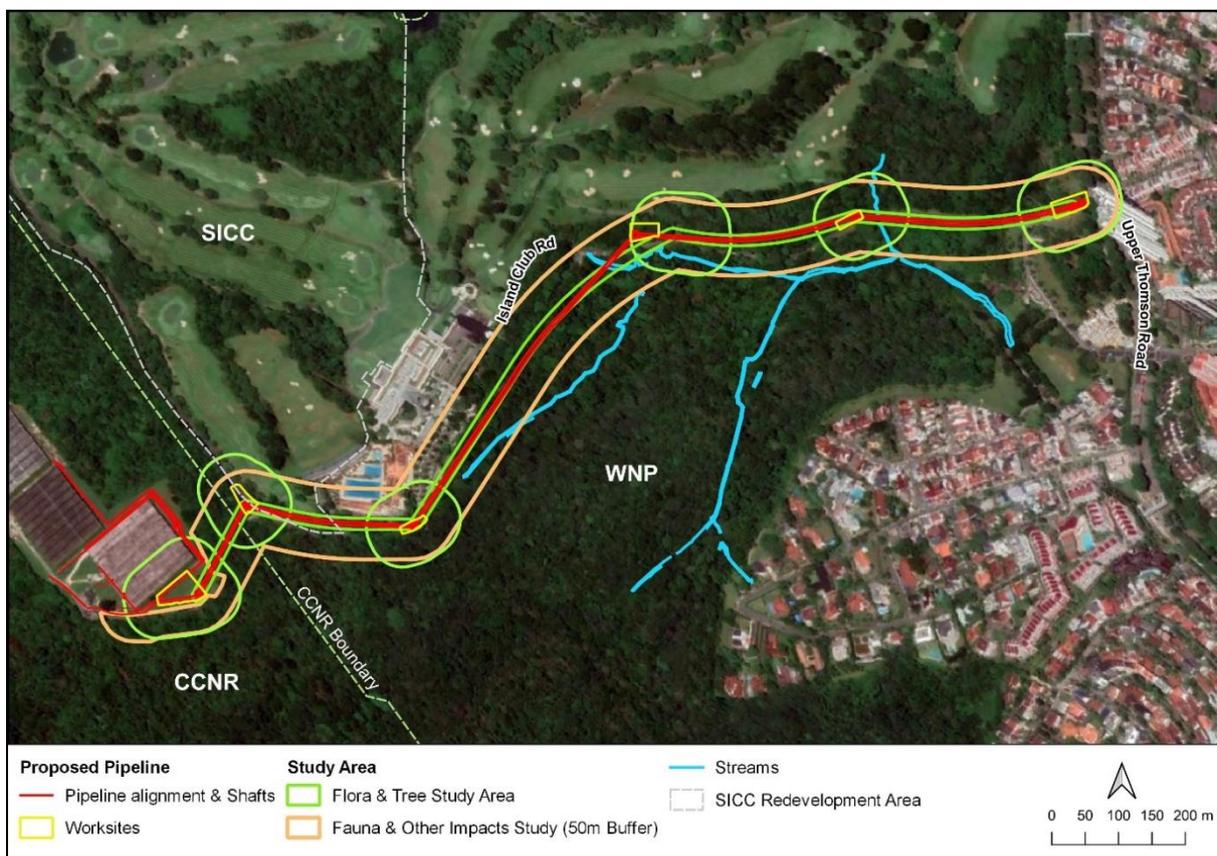


Figure 2. Proposed Study Area of EIA

The items to be covered under the EIA's scope are as follows

- (a) Comparison exercise to identify the optimal construction method of implementing the project;
- (b) Identification of all potential receptors within the vicinity of the site of works, including the ecosystem of all nearby streams and water bodies;
- (c) Review of EIA scope with relevant agencies;
- (d) Establishment and implementation of a baseline study to collate and confirm the environment conditions of the area stipulated in tender specifications;

- (e) Identification of the potential impacts and recommendation of corresponding mitigation measures and Environmental Monitoring and Management Plan (EMMP) to reduce the impacts;
- (f) Preparation of EIA reports for review, submission and public disclosure;
- (g) Engagement of stakeholders.
- (h) Preparation of the written scope, specifications and drawings of the recommended mitigation measures and EMMP for compilation into the construction tender of the Project.

Project Description

The Project is expected to commence in Q2 2022 and complete around Q2 2026. The construction works will involve the construction of seven shafts, one shaft will be within the BKSr compound and the other six will be along Island Club Road. This EIA study scope will stop at Shaft 7. The pipeline will be laid by open cut for a small section within BKSr to Shaft 1, pipe-jacking method for the alignment along Island Club Road between Shafts 1 and 6, and open cut method for a short section between Shaft 6 and Shaft 7. The location of the shafts and its respective worksites are shown in Figure 3.

There will also be an upcoming Land Transport Authority (LTA) project, the Cross Island Line. The single bored tunnel will be constructed at depths of up to 70 m below average ground level within the CCNR. A stretch of the tunnel alignment for the CRL is in the vicinity of the proposed water pipelines in this project. The LTA's worksite area and construction period will overlap with Worksite 4 of this Project. Design considerations have been taken to ensure that the alignment and the construction works do not interfere with each other.

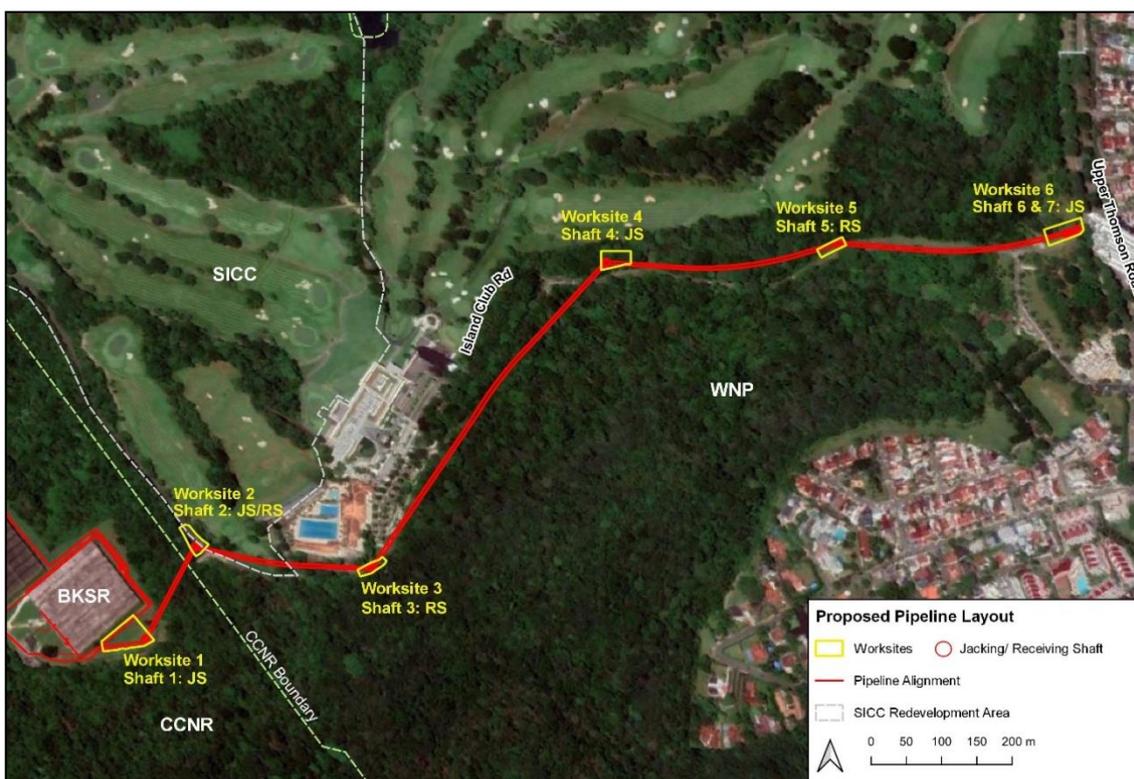


Figure 3: Layout Plan of the Shafts and Pipeline

During the operational phase of the pipeline, there may be routine pipeline inspection, maintenance, and repair (due to pipeline leakage or water contamination) which will be conducted from within the pipeline via the access manholes that will be constructed at Shaft 1 to 7.

Environmental Baseline

Baseline studies were carried out to understand the existing ecological and physical environmental conditions of the Site and its vicinity that will potentially be affected by the Project. The surveys were carried out from

December 2018 to January 2021 and covered soil investigation, surface hydrology, water quality, flora (including arboriculture study), fauna, noise, and vibration. Soil investigation results showed that the underground soil conditions were suitable for the proposed pipe-jacking method. The proposed work area was found to be occupied by secondary forest and managed vegetation which are rich in biodiversity. Stream water quality, noise and vibration levels were also shown to be within acceptable limits of Singapore's regulations or within tolerable levels for human comfort. The established baseline conditions were used as basis for impact assessment while the soil investigation results were used to further refine the pipeline alignment and jacking depth.

Environmental Impact Assessment

Prediction and assessment of potential environmental impacts arising from the Project development were based on the sensitivity of the receptors and magnitude of the impacts, with its criteria developed by ESC using existing national environmental regulations and international standards specific to each environmental aspect. Impact assessments were carried out for air quality, noise and vibration, water quality and hydrology, biodiversity, waste generation, insects and vectors, and social aspects.

Mitigation measures have been recommended for each potential impacts on the environment in order to minimise the environmental impacts during construction, including:

- a) Environmental considerations in the routing and design process, and construction methods selection of the pipeline, considering alternatives;
- b) Optimisation of area and locations of temporary working space;
- c) Biodiversity mitigation measures to minimise potential detrimental impacts to flora and fauna especially those of conservation significance;
- d) Pollution control measures and good practice of construction and operation to minimise deterioration of air and water quality, and to reduce noise and vibration levels; and
- e) Engineering considerations to minimise likelihood of unplanned events.

The details of the impact assessment, proposed mitigation measures, and residual impacts are further described in the EIA Report.

An EMMP has also been developed to be implemented before, during and after the construction in order to ensure that any potential impacts arising from the Project are minimised, as well as to monitor the efficacy of the mitigation measures and prepare/ implement any contingency plans as needed. The EMMP includes stringent monitoring of biodiversity, water quality, noise and vibration, and frequent site audits for all environmental aspects. Details of the EMMP are further described in the EIA Report.

Key Environmental Impacts

The pipeline design involves site clearance, hoarding installation, pipe laying by open cut and pipe-jacking in managed vegetation and secondary forest habitats. Open cut will only be carried out in less environmentally sensitive area (i.e., within BKSR and managed vegetation between Shaft 6 and 7). For all environmentally sensitive areas (i.e., within or adjacent to CCNR and WNP), the pipe-jacking method will be used, which significantly reduces the area of vegetation loss by 1ha (66% reduction) and prevent the loss of trees and vegetation within WNP and CCNR. The locations of the Worksites were also sited at open spaces as much as possible.

Despite the detailed design considerations, the pipeline installation will result in a loss of approximately 6000m² of vegetation (4500m² of managed vegetation and 1500m² of secondary forest) and affect an estimated 15 species of flora, of which 5 have conservation status. Majority of the secondary forest loss is at worksite 4 and 5 where moderate impacts are also expected on surface water quality, hydrology and soil erosion, and fauna (i.e., increase in noise levels and increased chances of road kills). To further reduce the impacts of the Project, mitigation measures and EMMP have been recommended. All residual impacts have been assessed to be either Minor or Negligible.

Conclusion

This EIA was conducted by ESC based on national and international regulations and guidelines. It incorporated the assessments and recommendations from various specialists, such as ISA-certified arborist, local fauna species specialists and freshwater biologists, and included a baseline study to identify and document the sensitive receptors surrounding the proposed pipeline alignment. Due to the sensitivity of the site, detailed engineering considerations were carried out at the early design stage to avoid causing significant environmental impacts, and alternative pipeline alignments and construction methods have been compared to choose the option that is the least environmentally damaging. It was found that using a mix of open-cut and pipe-jacking methods (as opposed to solely open-cut method) and the current proposed alignment of the twin 1800mm diameter pipeline along Island Club Road has the lowest direct environmental impact. The EIA has formulated mitigation and monitoring measures, to be adopted before, during and after the construction works, to ensure that impacts will be minimized throughout the entire project. The assessment indicates that with the adoption of the mitigation measures established by the EIA process, the overall environmental and social impacts of the construction and commission of the proposed water supply pipelines are not expected to be significant.