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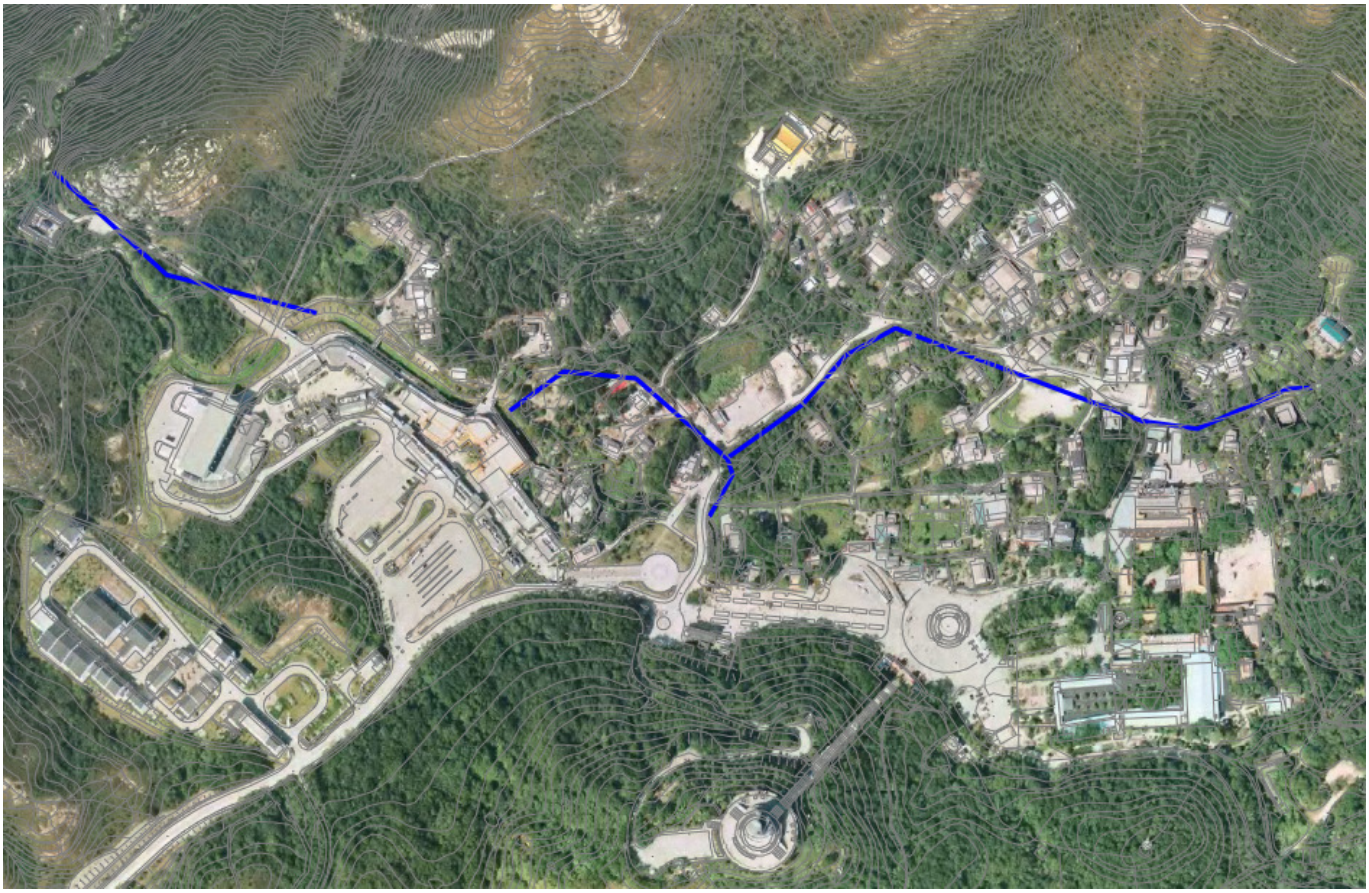
Drainage Services Department

AGREEMENT NO. DP 06/2011

ENVIRONMENTAL IMPACT ASSESSMENT FOR DRAINAGE IMPROVEMENT WORKS AT NGONG PING

Final Environmental Impact Assessment Report

Executive Summary



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FIGURES

TABLES

1 INTRODUCTION

1.1.1.1 The flooding incident at Ngong Ping, arising from a heavy rainstorm on 7 June 2008, had seriously affected the Po Lin Monastery, Ngong Ping Bus Terminus, Ngong Ping Village and areas in the vicinity of the Ngong Ping 360 Terminal. Drainage Services Department (DSD) then commissioned a "Drainage Study for Ngong Ping" to identify and quantify the flood hazard and formulate cost-effective drainage improvement plans in order to set out a comprehensive strategy and programme for safeguarding the Ngong Ping area from future flood risks. The drainage study identified several drainage bottlenecks at the existing watercourses and there was therefore a need to bring the existing drainage system up to the current flood protection standard to alleviate the potential flood risk in the community.

1.1.1.2 Short-term drainage improvement measures were implemented in 2009. On the other hand, long-term drainage improvement schemes have also been recommended for implementation under the "Drainage Improvement Works at Ngong Ping" to enhance the capacity of the trunk drainage system so as to reducing the flood risk in Ngong Ping. The general layout of this Project is shown in ***Figure 1.1***.

1.1.1.3 This Executive Summary highlights the key findings of the Environmental Impact Assessment (EIA) for the Project to comply with the EIA Ordinance (EIAO).

2 PROJECT DESCRIPTION

2.1 Project Nature and Scope

2.1.1.1 The proposed long-term drainage improvement measures would include the construction of an upstream interception drain, a loop system and a downstream flood relief drain to divert the storm-water away from the existing drainage system. Upon completion of the Project, the trunk storm-water drainage system in Ngong Ping will have sufficient capacity to cater for a rainstorm with a 50-year return period.

2.1.1.2 The Project involves drainage works which constitute the following designated projects under Part I, Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) and, therefore, requires an Environmental Impact Assessment (EIA) to be undertaken and an Environmental Permit (EP) to be obtained prior to the commencement of the proposed works:

(a) Item I.1(b)(i) - A drainage channel which discharges into an area which is less than 300m from the nearest boundary of an existing site of special scientific interest;

(b) Item I.1(b)(vii) - A drainage channel which discharges into an area which is less than 300m from the nearest boundary of an existing conservation area; and

(c) Item Q.1 - Earthworks and other building works partly or wholly in an existing country park.

2.1.1.3 A Project Profile was submitted in 14 April 2011 under the EIAO and the Director of Environmental Protection (DEP) issued the EIA Study Brief No. ESB-227/2011 in 26 May 2011 accordingly.

2.2 Project Scheme Selection

2.2.1 Alignment Design Options / Drainage Improvement Scheme

2.2.1.1 The primary purpose of the proposed drainage improvement works is to reduce the flooding risk of the area and bring the local flood protection up to the current standard (with a 50-year return period), specifically in areas which are particularly prone to high flooding risk. Two main drainage improvement alternatives (Option A and Option B) have been considered for the Project and detailed in ***Figure 2.1***. The key features of these two options are summarised in ***Table 2.1*** below.

Table 2.1 Key Features of the Alignment Design Options

Water Course	Option A	Option B
Upstream Section	- an underground DN1500 drain pipe (interception drain) connecting Portions A and E. - about 500m long.	- an underground DN1500 drain pipe (interception drain) connecting Portions A and E. - about 440m long.
Midstream Section	- widening and realignment of natural stream section in Portion E. - about 140m long with channel top width of about 8.65m to align with the existing gabion channel.	- a loop system in the form of underground box culvert. - about 223m long.
Downstream Section	- widening of natural stream section at Portion G. - about 240m with channel top width of at least 8.65m to align with the existing gabion channel.	- an underground DN1800 drain pipe (flood relief drain) connecting Portion F and bypassing Portion G. - about 198m long.

2.2.1.2 As the works will not involve any widening or re-alignment on the existing natural stream, the Option B drainage scheme is considered to have less environmental dis-benefits compared to Option A during both the construction and operation phases, by avoiding ecological impacts to the natural stream and associated riparian habitats, as well as ecological impacts associated with the permanent loss of aquatic habitats. For the construction phase air quality and noise impacts, Option B also provides sufficient space between the alignment and the sensitive receivers to allow mitigation and noise attenuation measures to be applied during the works. Therefore, Option B would be the preferred and recommended option for the Project.

2.2.1.3 Further modification on the drainage alignment has been made throughout the preliminary design process aiming at minimizing further on the associated environmental impact and the modifications have concerned the alignment of the DN1800 drain pipe (flood relief drain) between the Ngong Ping 360 Terminal and the

Columbarium area in Works Section 6. Three sub-options of Option B were developed. Taking account of the various technical concerns, the selected option can avoid affecting floral species of conservation interest outside and within the Lantau North Country Park as much as possible, and has reduced landscape and visual impacts, as well as avoiding the adjacent burial ground including a grave.

2.2.1.4 The preferred alignment as shown in ***Figure 2.2*** overall represents a better balance of the various construction and operational aspects, including environmental performance, site condition, engineering and technical requirements, as well as cost-effectiveness.

2.2.2 Construction Methods

2.2.2.1 The cut-and-cover (C&C) method and trenchless method have been proposed for this project. With due consideration to the site constraints including land use status, engineering requirements of the construction method and the drainage alignment, the construction method for each Works Section is suggested and detailed in ***Figure 2.3*** and ***Table 2.2*** below.

Table 2.2 Preferred Construction Methods

Drainage Requirement	Works Section (1)	Construction Method	Selection Reasons
Circular DN1500 drain pipe (interception drain)	1	C&C	Engineering constraints associated with catering for alignment changes
Circular DN1500 drain pipe (interception drain)	2	Pipe jacking	Environmental preference associated with minimising the directly affected area and environmental impacts e.g. air, noise and visual
Circular DN1500 drain pipe (interception drain)	3	C&C	Engineering constraints associated with catering for alignment changes
Square 2.5m x 2.5m box culvert (loop system)	4	C&C	Engineering constraints associated with catering for alignment changes and also the traditional method for construction of box culvert
Rectangular 3.0m x 2.5m box culvert (loop system)	5	C&C	Engineering constraints associated with catering for alignment changes and also the traditional method for construction of box culvert

Drainage Requirement	Works Section (1)	Construction Method	Selection Reasons
Circular DN1800 drain pipe (flood relief drain)	6	Pipe jacking	Environmental preference associated with minimising the directly affected area and associated environmental impacts e.g. air, noise and visual

Notes:
1. Please refer to ***Figure 2.3*** for the location of Works Section.

2.2.3 Preferred Option

2.2.3.1 The preferred option of the proposed drainage system has been selected as summarised below and shown in ***Figure 2.2*** based on which the detailed design of this project will proceed:

- An upstream Interception Drain - an approximately 440m long underground drain pipe (size 1500mm diameter) and associated inlets. The interception drain starts at a location near the water storage tank located at northeast of Po Lin Monastery and is aligned underneath the existing footpath/access/ adjacent vegetation land as far as practicable. The drain ends at the north of Lin Ping Drive;

- A Loop System - an approximately 174m long (size 3m(W) x 2.5m(H)) box culvert, an approximate 49 m long (size 2.5m(W) x 2.5m(H) box culvert and associated inlet and outfall. The loop system starts at the bridge of Lin Ping Drive and is aligned underneath the existing access road and government land. It ends at the north-east of "Walking with Buddha". The loop system provides a bypass connecting the existing water channel at Lin Ping Drive to the north of the Tian Tan Buddha Statue and the gabion channel next to Ngong Ping 360 Terminal; and

- A downstream Flood Relief Drain - an approximately 198m long underground drain pipe (size 1800mm diameter) and associated inlet and outfall. The flood relief drain starts at the exiting gabion channel to the north of Ngong Ping Village and ends at the existing stream adjacent to the Columbarium. The flood relief drain provides a bypass to the existing natural stream section between the Ngong Ping 360 Terminal and the Columbarium.

2.3 Preliminary Construction Programme

2.3.1.1 The construction works will begin in around the second quarter of 2014 and last for about 30 months.

3 ENVIRONMENTAL IMPACT ASSESSMENT

3.1 Introduction

3.1.1.1 The EIA Study has been conducted in accordance with the EIAO Study Brief No. ESB-227/2011, following the guidelines on assessment methodologies in the Technical

Memorandum on Environmental Impact Assessment (EIAO-TM). The major findings of the EIA study are summarised below.

3.2 Air Quality

Construction Phase

3.2.1.1 The major dust sources of Ngong Ping drainage improvement works would come from construction activities such as site clearance, excavation and backfilling activities as a result of the use of the open cut-and-cover method for open trenches for construction of the underground drainage pipelines and box culvert, construction and reinstatement of jacking pits and receiving pits for the pipe-jacking process, mucking-out activities at the jacking pits, loading and unloading activities at the stockpile areas and wind erosion at construction sites and stockpile areas.

3.2.1.2 A total of 10 air sensitive receivers (ASRs) were identified for the construction phase assessment. With the implementation of specific mitigation comprising watering of exposed soil areas in active works areas and paved haul roads once per hour for 12 hours a day to reduce dust emissions by 91.7% and those under the auspices of the Air Pollution Control (Construction Dust) Regulation, the maximum predicted 1-hour and 24-hour results of the Tier 1 screening test at representative ASRs are 209 $\mu g/m^3$ and 95 $\mu g/m^3$ respectively, which showed no exceedance of the TSP criteria and Tier 2 assessment was not required. The predicted annual average maximum cumulative TSP concentration at representative ASRs is 69.1 $\mu g/m^3$ which also indicated no exceedance of the criterion even assuming the absolute worst case situation where 100% of every works site would be active and emitting dust, with all impacts being confined to the works area.

3.2.1.3 With the implementation of these mitigation measures, insignificant adverse residual impacts on air quality would be anticipated during the construction phase.

Operational Phase

3.2.1.4 Air quality impacts during the operational phase are not envisaged.

3.3 Noise

Construction Phase

3.3.1.1 The potential source of noise impact during the construction phase of the Project would mainly be the use of powered mechanical equipment (PME) for various construction activities, including site formation, construction/demolition of site office, and construction of drainage pipelines, box culverts, pits, manholes, intakes and outfalls. Construction noise assessment was conducted in accordance with the EIAO-TM and the Technical Memorandum (TM) on Noise from Construction Work other than Percussive Piling. Due to close proximity to the NSRs from the works areas, in the absence of any control measures, construction noise levels exceeding the EIAO-TM air-borne construction noise criteria would be expected at all the noise sensitive receivers (NSRs) in the vicinity of the works areas.

3.3.1.2 Construction noise control measures have been incorporated into the construction method design, such as the use of quieter equipment, movable and temporary noise barriers, and noise enclosure for equipments. With these measures in place, there would be compliance with the noise criteria at most NSRs. There would nevertheless be some exceedances of the noise criteria at 1 NSR in close proximity to the works areas during tree removal works and the sheet piling works during the box culvert construction at Works Section 5. Further mitigation has been proposed to install a temporary noise barrier of 2.5m in height or in a height which can provide sufficient screening of the vibrating hammer between the NSR and the open cut trench along the 44m segment in order to further mitigate noise impacts**.** No further practical mitigation measure is considered to be available for the tree removal works after the use of electric chain saw. Residual impacts up to 4dB(A) during normal periods would be expected for tree removal works but for short duration of 2-3 days only. For sheet piling works of box culvert construction, residual impact up to 6dB(A) will be expected for a duration of 3 days. Given the benefits of the project to the local community and the very short term nature of the residual impacts predicted, the residual impacts associated with the construction phase exceedances for the drainage improvement works would be considered minor and acceptable.

Operational Phase

3.3.1.3 Noise impacts during the operational phase are not envisaged.

3.4 Water Quality

Construction Phase

3.4.1.1 Potential water pollution sources have been identified as construction site run-off, direct disturbance to water courses, sewage from the workforce, potential risk of contamination from materials, chemicals and bentonite slurry. Mitigation measures including the implementation of the construction site practices in accordance with the EPD's ProPECC PN 1/94 Construction Site Drainage, provision and management of portable toilets on-site and preventive measures to avoid accidental chemical spillages are recommended to mitigate any adverse water quality impacts, based on which residual impacts would not be anticipated. Water quality monitoring is recommended during the construction period to check for compliance with water quality limit levels and effectiveness of the proposed mitigation measures.

Operational Phase

3.4.1.2 The maintenance operations to remove debris from the intakes of the drainage channels are not expected to result in adverse impacts to water quality. However, good practice measures have been recommended to minimise any potential impacts. Hydraulic jetting shall be avoided and the maintenance activities shall also only be undertaken during the dry season when flow in the watercourse is low. The disposal of the removed debris and vegetation materials shall be properly handled in accordance with the recommendations in Section 9 Waste Management of the EIA Report.

3.5 Ecology

Construction Phase

3.5.1.1 The potential ecological impacts have been substantially reduced by adoption of the terrestrial by-pass routing instead of direct widening and training of the natural Ngong Ping Stream. Permanent impacts have been further reduced by the adoption of an underground drainage system instead of open channel. Potential ecological impacts during the construction phase have been identified as temporary loss of mostly relatively low to moderate ecological value habitats although a small amount of woodland habitat will also be affected. A total of 0.47ha of vegetated area is predicted to be temporarily lost. Permanent losses have been minimised through the design of the drainage scheme and permanent losses of relatively low ecological value habitats are limited to 0.02ha. Landscape compensatory planting has been recommended for the loss of landscape and this will, also, serve the function as an enhancement to the tree and habitat loss as a result of drainage improvement works. Hence, with the implementation of enhancement planting, adverse ecological impacts to the habitats in the Project Area are not anticipated.

3.5.1.2 Ecological mitigation measures have focused on the protection of species of conservation interest that may be affected. Two floral species of conservation interest in Works Area WA4 will be transplanted. Three aquatic faunal species that could be affected by the trench crossing section in Works Section 1 or as a result of works in WA4/Outfall B in Works Section 6 will be translocated prior to the works. Two species near Works Area WA4 will, also, require suitable protection.

3.5.1.3 Species specific mitigation measures including an “Updated Baseline Vegetation Survey”, a “Floral Protection Plan” and a “Floral Transplantation Plan” have been recommended to avoid and minimise direct and indirect impact on floral species of conservation interest. If required, a “Compensatory Planting Plan” shall be prepared before implementing the recommendations of the “Floral Transplantation Plan”. In terms of aquatic fauna, an “Aquatic fauna Translocation Survey” and an “Aquatic Fauna Translocation Plan” are recommended for translocation of aquatic fauna species of conservation.

3.5.1.4 The implementation of the good construction site practices in accordance with the EPD’s ProPECC PN 1/94 Construction Site Drainage to control indirect impacts due to sedimentation and contamination is of equal importance. Specific restriction of works at the Lantau North Country Park is, also, recommended. With the above measures, residual impacts would not be anticipated.

Operational Phase

3.5.1.5 Weir walls, of at least 500mm in height or equivalent, shall be constructed at all intakes and outfalls as planned to ensure the normal flow of existing watercourse is not interrupted during the operational stage. Hence, the aquatic ecology of the Study Area will not be affected by the proposed project.

3.5.1.6 Since Outfall A and Intake C and the associated works area are within the gabion channel, the construction and operation (maintenance works, if any) of both shall comply with the Specific Conditions of EP-192/2004.

3.6 Landscape and Visual

Construction Phase

Landscape Impacts

3.6.1.1 Mitigating against impacts to landscape resources has been focused to avoid conflict with resources through careful route planning and construction methods. Potential losses of trees in Works Sections 1, 2, 3, 4, 5 and 6 are expected, which result predominantly from clearance for temporary works access, particularly those areas required for stockpiling. Construction phase impact to trees has been addressed by minimising the requirements of Works and Stockpile Areas for the Project and carefully designating the extents of works areas to avoid as many trees as possible. Further work during construction should also focus on this and in identifying minor alignment adjustments to the permanent works which may also assist in this regard. Only one Landscape Character Area is impacted by the project and construction works are of a small scale such that they can be easily absorbed in the landscape character, either with or without mitigation measures.

Visual Impacts

3.6.1.2 The works are located close to village areas and local residents are most affected by the project. Where the works can be screened by sensitive use of hoardings, this will assist in mitigation. For elevated views over the works, residual landscape and visual impacts during construction are minor and for a short duration only.

Operational Phase

Landscape Impacts

3.6.1.3 The extent of water courses temporarily impacted is minor and after reinstatement any changes from the baseline condition shall be hard to perceive. The loss of vegetation can be suitably compensated within the project area. The use of native shrub and tree species will be able to bring long term benefits to the natural environment. No *Significant* Adverse Impacts are anticipated during Operation Stage.

Visual Impacts

3.6.1.4 With the works being located underground, other than the intakes and outfalls there will be few visual indications of the project works. Where vegetation has been lost this shall be substantially reinstated at completion and no *Significant* residual visual impacts in the longer term will be recorded.

3.7 Cultural Heritage

Construction Phase

3.7.1.1 The archaeology assessment did not identify any areas of archaeological potential and no impacts are predicted. However, any antiquity or supposed antiquity discovered during the course of the excavation works will be reported to the AMO immediately.

3.7.1.2 The Built Heritage Impact Assessment identified six built heritage resources that will require mitigation (NP-10, NP-11, NP-19, NP-20, NP-21 and NP-26). Mitigation in the form of a condition survey will be required for NP-10, NP-11 and NP-19 and the condition survey will recommend if vibration monitoring is required. A buffer zone will be required for NP-19, NP20, NP-21 and NP-26. The construction and operation of the drainage improvement works will not cause any insurmountable adverse impacts if the above mitigation measures are implemented properly and insignificant residual impacts are predicted.

Operational Phase

3.7.1.3 No impacts were identified for cultural heritage resources during the operational phase and no mitigation measures will be required.

3.8 Waste Management

Construction Phase

3.8.1.1 Construction wastes of the Project would include construction and demolition (C&D) materials including excavated C&D materials suitable for public fill, C&D waste including cleared vegetation which is not suitable for public fill, chemical waste, and general refuse. The materials will be reused as far as practicable or as public fill and a portion of waste that will require disposal to landfill or a licensed landfill facility.

3.8.1.2 The estimated quantity of the C&D material generated by the project is approximately 14,800m^3, of which approximately 7,700m^3 of excavated soil would be reused on-site for backfilling of trenches and pits. The balance of approximately 7,100m^3 of excavated soil, excavated rocks and other inert C & D material (including less than 15m^3 of bentonite slurry) would be delivered to the Tseung Kwan O Area 137 Fill Bank via the Public Fill Reception Facility in Mui Wo for the use of other project. It is anticipated that there would be about 100 tonnes of C&D wastes and 16 tonnes of general refuse generated from this project that require the disposal at the WENT Landfill. There would also be small quantity of chemical wastes (about 3,000 L) arising from the Project which would be disposed at the Chemical Waste Treatment Centre in Tsing Yi.

3.8.1.3 With the implementation of the recommended waste management measures, the handling, collection, transportation and re-use/disposal of wastes will not cause adverse impacts on potential hazard, air and odour emissions, noise, wastewater discharge, ecology and public transport. In addition, implementation of waste management control measures include on-site sorting and segregation of C&D waste, as well as storage of waste in separate containers or skips to facilitate the reuse or recycling of

materials and to minimise the waste generation. General refuse should be properly stored and collected by approved waste collector, with engagement of a licensed chemical waste collector to handle the chemical waste as outlined in the Waste Disposal (Chemical Waste) (General) Regulation and to transport the wastes to a licensed facility Chemical wastes for disposal.

Operational Phase

3.8.1.4 During the operation phase, the quantity of waste mainly debris and possibly vegetation removed from the maintenance of the intakes will be limited and the estimated amount of material is not likely to exceed $5m^3$ per annum. Inert material such as excess soil, sand and rocks will be delivered to the Tseung Kwan O Area 137 Fill Bank via the Public Fill Reception Facility in Mui Wo or to WENT Landfill. Non-inert materials such as fallen vegetation and garbage will be disposed to WENT Landfill via the OITF in Mui Wo. With implementation of the mitigations for handling, transportation and disposal of waste, no adverse environmental impact would be anticipated.

4 ENVIRONMENTAL MONITORING AND AUDIT

4.1.1.1 An environmental monitoring and audit (EM&A) programme will be implemented during the construction and operation of the Project, to check the effectiveness of the recommended mitigation measures and compliance with relevant statutory criteria. The EM&A procedures are required during construction and operational phases of the project implementation. The EM&A requirements are divided into environmental monitoring and/or project auditing in the form of site inspection and supervision. Only monitoring for noise, water quality, ecology, landscape and visual, and cultural heritage has been recommended but regular auditing for all other parameters would be required.

5 CONCLUSIONS

5.1.1.1 This EIA study has identified and assessed potential environmental impacts of the Project, in accordance with the EIA study brief and EIAO-TM guidelines. Overall, the EIA study has concluded that the Project would be environmentally acceptable, in compliance with environmental legislation and standards. With the implementation of environmental control measures during construction and operational phases, there would be insignificant adverse residual impacts from the Project. This will be checked by a comprehensive EM&A programme.