EXECUTIVE SUMMARY

1 PROJECT OVERVIEW

This Second Schedule Environmental Impact Assessment (EIA) report has been prepared for the ***Proposed Onsite Secure Landfill (Prescribed Premise) for the Storage of Neutralisation Underflow (NUF) Solids within the Existing Lynas Advanced Materials Plant (LAMP) Site located on PT 17212, Gebeng Industrial Estate (GIE), Pahang, Malaysia***, hereafter referred to as the Project. The secure landfill will cover an area of 39 hectares and located within the eastern sector of the existing LAMP, and has sufficient space to store up to 10 years' worth of the NUF produced from the plant's operations. Whilst this EIA has been prepared for the storage of NUF in a secure landfill, it is only a temporary measure pending commercialisation. Studies including research projects and field studies have been completed on the application of NUF as a soil enhancer and an alternative raw material for the cement industry.

The LAMP, operated by Lynas Malaysia Sdn. Bhd. (Lynas), was commissioned in the fourth quarter of 2012 and began operations in the first quarter of 2013. It has been in operation for the past six years. The plant site (PT 17212) encompasses an area of 100 ha (247 acres) and currently processes up to 95,000 tonnes per annum (tpa) wet weight basis of lanthanide concentrate (equivalent to 83,000 tpa dry weight basis) to produce 20,000 to 23,400 tpa (LnO or lanthanide oxide basis) of high purity lanthanide compounds. These compounds are in the form of different product suites which are exported directly to the company's global customers based in the Japan, China, Europe and North America. The products are as follows:

- SEG-HRE Oxide
- Lanthanum (La) Oxide
- Cerium (Ce) Carbonate
- Cerium oxide
- LaCe Carbonate
- LaCe oxide/LaCePr oxide,/LaCeNd oxide
- Didymium Oxide
- Praseodymium oxide
- Neodymium oxide

The term 'secure landfill' refers to five engineered cells, each referred to as Dry Storage Facility (DSF) constructed for the storage of NUF, comprising:

- One **existing** cell (DSF 1) (constructed in 2007 and operational since the first quarter of 2013)
- Four **future** cells (DSF 2, DSF 3, DSF 4 & DSF 5) (to be constructed between 2019 and 2029)

The secure landfill is designated only for the storage of NUF residue generated from the LAMP process operations. No other third-party scheduled waste will be disposed within this onsite landfill.

The NUF is essentially synthetic gypsum formed as a by-product of LAMP's operations and classified as scheduled waste (SW205). Currently, LAMP generated a monthly average of 32,790.83 metric tonnes with a total production of 0.867 million metric tonnes as of 30th November 2018.

Located within the existing LAMP complex in Gebeng Industrial Park, Pahang, **Figures ES-1** and **ES-2** shows the location of the proposed secure landfill.

2 LEGAL REQUIREMENT

An EIA was previously conducted for the construction of the LAMP in which approval was given on 15th February 2008 and compliance has been maintained since then. Pursuant to the EIA, an EMP had also been submitted and approved in 2008. As part of the EIA approval conditions and EMP, Lynas currently undertakes an environmental monitoring programme covering air quality, water quality, boundary noise and groundwater quality.

The proposed secured landfill falls under ***Second Schedule, item 14, Waste Treatment and Disposal (a): Scheduled Waste (iv): Construction of Landfill Facility*** therefore requires the preparation of an EIA report to be submitted to DOE for approval.

3 PROJECT PROPONENT

The Project will be developed by Lynas Malaysia Sdn. Bhd within the existing LAMP Complex in Gebeng Industrial Estate, Pahang. Details of the Project Proponent are included as below:

Address	:	**Lynas Malaysia Sdn. Bhd.** PT 17212, Jalan Gebeng 3, Kawasan Perindustrian Gebeng, 26080 Kuantan, Pahang Darul Makmur, Malaysia
Tel & Fax	:	+609-582 5200 & +609-582 5291
Contact Person	:	Grant McAuliffe, General Manager, Dr. Ismail Bahari, General Manager, Radiation Safety, Regulations & Compliance
E–mail	:	IBahari@lynascorp.com

4 STATEMENT OF NEED

Historically, the NUF produced from LAMP's operation was classified as a radioactive material and regulated by the Atomic Energy Licensing Board (AELB) and therefore contained in slurry form with strict compliance to the requirements imposed by AELB. The impacts of the NUF were addressed in the Radiological Impact Assessment carried out in 2007 while its management was captured in the EIA Approval Condition no 41. An application by Lynas in July 2013 had resulted in AELB releasing the NUF from its control as Lynas had duly complied with the requirements of AELB and DOE.

Following this, DOE had instructed the NUF to be disposed as scheduled waste in a prescribed premise. In response, Lynas had proposed for the construction of the secured landfill within its own complex, in which the proposal was accepted and Lynas to apply for a prescribed premise license. Following an application by Lynas on 28th January 2015, the construction of the DSF was approved by DOE on 11th February 2015. The DSF not only satisfy the requirements of EIA Approval Condition no 41 in terms of design and construction, it is also geotechnically stable, poses minimal environmental risk and abides to the safety requirements from a number of international requirements including from the Australian National Committee on Large Dams (ANCOLD).

Subsequently, due to the readily available space within the LAMP site, construction of the secure landfill will enable full utilisation of the 4.9 million m^3 of ample space located within the site. As Lynas is confident the NUF can be commercialised within 10 years, the gradual removal of the NUF will enable the built-up space to be continually reused to store more NUF as LAMP's operation progresses. Progressing further, as the DSF utilises a dual liner system comprising of 2mm HDPE liner and either clay or geosynthetic clay, the NUF can be effectively separated from the groundwater and therefore preventing any leaks and breaches that may contaminate the groundwater. This is further proven by water and groundwater records from Lynas where no non-compliance or significant exceedances were experienced within 6 years.

Furthermore, the implementation of this secured landfill is aligned with DOE's 'cradle to cradle' philosophy as extensive R&D had been conducted to enable the commercialisation of NUF. Due to its gypsum-rich nature, the NUF can be used as an alternative raw material for other industrial applications such as cement-making. This in turn reduces the need for its disposal which synchronises greatly with the fact that three (3) out of four (4) of the prescribed premises that allows offsite storage of SW205 are either located in East Malaysia or Labuan. The only option located in Bukit Nenas, Negeri Sembilan however is economically unfeasible due to its distance as well as its annual capacity of 100,000 MT which will not be able to cater to Lynas's daily NUF production of 1,000 MT.

As a signatory of the Basel Convention, Malaysia's exportation of scheduled waste is governed by the stipulations of the convention. This is further enforced by the two Orders under the Custom Act 1967 that prevents the exportation of scheduled waste without a written consent for DOE's Director General. Hence the export of the NUF which is classified as a scheduled waste SW205 needs to undergo a rigorous process involving both the governments of the exporting country (Malaysia) as well as the importing country. Success in obtaining the approval for export is not readily given and determined by numerous factors. Hence, the export of the NUF is not a viable alternative. Also, because the residue can be used for commercialisation purposes in Malaysia.

5 PROJECT OPTIONS

5.1 Site Selection

Several options were considered in terms of selecting the most suitable location to construct the secured landfill but based on the degree of benefits and impacts, onsite construction was chosen. Onsite construction of the secured landfill was preferred based on the following reasoning:

1. LAMP has sufficient land, storage capacity and expertise to design, construct and manage the secured landfill on their own.
2. LAMP is properly equipped to manage any contaminated runoff through their own IETS.
3. Operating within the LAMP site will enable the secured landfill to be designated only for the NUF as well as eliminating negative social perception due to its transportation
4. Operating onsite also reduces LAMP carbon footprint due to the reduction in transporting activities.

5.2 Storage Method

As of current, Lynas has stored NUF using three (3) different methods; the Residue Storage Facillity (RSF), Geotube and the Dry Storage Facility (DSF). With the implementation of the secured landfill, Lynas has decided to proceed with only the DSF method due to it being more advantageous over the other two (2) albeit at a higher cost. The DSF is recognised as the best storage system due to:

1. Dry stacking provides more stability and robustness for long term storage
2. Dry stacking provides better structural integrity hence eliminating the need for a containment structure
3. Dry stacking enables easier and less riskier removal once end use for the NUF is identified

5.3 Build-Out v No-Build

Proceeding with the Build-Out option enables a continued use of DSF 1 with its function supported and complemented by an additional 4 DSF. This allow the NUF to be stored effectively while awaiting approval from the relevant agencies for its commercialisation. Environmental impacts are expected in the form of surface and groundwater contamination and reduced air quality among others. However, such impacts will only materialise should the mitigating measures are not implemented effectively.

Under the No-Build option, storage capacity for the NUF is expected to be depleted by June 2018 and therefore the residue will not be able to be stored safely. At the current generation rate of 1,145 metric tonnes per day, the need for a secure landfill is critical.

Considering both options, it is recommended for the Project to proceed with the Build-Out option due to the many beneficial long term benefits; both environmentally and socially, accrued with the construction of the secure landfill.

6 PROJECT DESCRIPTION

6.1 Project Location

The LAMP site covers an area of 100 hectares (247.1 acres) within the GIE with the proposed secured landfill located within the eastern sector of the LAMP plant for an area of 39 hectares (89 acres). The GIE is located 4km west of Kuantan Port and approximately 30km north of the Sultan Ahmad Shah Airport and 35km north of Kuantan Town.

6.2 Existing Operation

The main feedstock (lanthanide concentrates) for LAMP's operations are imported from the Mt. Weld mine in western Australia and operated by Lynas Corporation Ltd. (Australia). Here the mined lanthanide ores are stockpiled, crushed and concentrated to produce the lanthanide concentrated. The produced concentrates are then placed in bulker bags and prepared for transport via sea from the Freemantle Port in Australia to Kuantan Port, Malaysia and upon reaching the country, transported by land to the LAMP site in Gebeng Industrial Estate. The concentrate is then further refined to produce high purity lanthanide of either individual or mixed elements; at an annual maximum volume of 95,000 wet tonnes (as imposed by DOE)

6.2.1 Process Description

The lanthanide concentrate will undergo three (3) stage of processing; Cracking and separation, Solvent extraction and Product finishing. The first stage will see the concentrate being roasted with hydrochloric acid in rotary kilns to produce lanthanide chloride solution. WLP residue produced during this stage is then sent to the existing RSF. In the second stage, the lanthanide chloride solution will be purified and the lanthanides elements separated and concentrated. The elements will then be selectively extracted from the aqueous phase into an organic phase using a battery of mixer-settlers. In the third and final stage, the lanthanide chloride strip solution is then further purified and precipitated into carbonate or oxalate forms, producing the products mentioned earlier.

Upon completion of the processing, two (2) main process residue steams are created; namely the WLP and the NUF. The NUF is produced at a monthly average of 32,790.83 metric tonnes totalling up to 1.44 million metric tonnes (wet weight) or 0.867 million metric tonnes (dry weight) as of August 2018.

6.2.2 NUF Physical and Chemical Properties

The NUF residue is mainly consist of 75-85% calcium sulphate (dihydrate), 15-20% magnesium hydroxide and <0.5& silica, which makes it a magnesium-rich gypsum. Physically, in terms of particle size, the NUF residue is compost of 69% silt-sized particles, 26% clay-sized particles and 5% sand-sized particles and therefore classifies as inorganic silt. In terms of Atterberg limit, NUF has a liquid limit of 105.3%, a plastic limit of 48.3% and a shrinkage limit of 33%. Moisture content is pressure-filtered to 46% and gradually drains to 30% where it can be compacted and shaped. In terms of stability, NUF has sufficient strength to support a 1:1.5 vertical to horizontal slope ratio design which produces a safety ratio of 1.39:1.

Chemically, the NUF samples were subjected to four (4) different tests; Corrosivity, Ignitability, Reactivity and Toxicity. All tests produced negative results in that the NUF did not exhibit any of the physical hazards with dioxin and furan content lower that DOE limit threshold with a notable absence of harmful microorganism making it non-infectious as well.

6.3 Construction of the Secure Landfill

As DSF1 has already been constructed and currently in operation, the design description provided below will only apply to DSF2 and subsequently DSF3, DSF4 & DSF5 over a 10-year period. Emphasis has been given on the design to satisfy DOE's regulatory requirements as well as Lynas's operational requirements in terms of storage and removal.

6.3.1 Best Practice in Residue Storage

Lynas has invested in the dry stacking method to store the NUF residue. The method has been recognised as a world's best practice for gypsum storage due to:

- The dry stacked solids provide a far more stable and robust platform for long-term storage;
- As the residues are in solid form, they provide their own structural integrity. Therefore, the construction of large storage structures is not required for containment; resulting in less area required for a given volume of residues;
- The dry stacking method results in less water loss; and
- In the event the residues can be commercialised and used as alternative raw material for other industrial applications, the removal of the gypsum residue (in dry solid form) is more effective.

6.3.2 Design of the NUF DSF

The secured landfill will be designed using a combination of two (2) different liners and equipped with an engineered leak detection system. A total of seven (7) layers; including the two (2) lining material, will be constructed for the landfill. Starting from the surface, the layers will be made of sand of 300mm thickness, a 2mm HDPE liner coated with UV protected polymer, a geosynthetic liner, a high tensile woven geotextile, a 300mm-thick underline leak detection system (ULLD), a geonet drainage filter and lastly compacted soil.

6.3.3 Secure Landfill Phasing Plan

Construction of the secured landfill will be confined within a continuous area in the eastern section of LAMP over a period of 10 years (2019-2029). The secured landfill will comprise of DSF 1 to DSF 5, with DSF 1 already constructed and in operation in the southern section of the site. In sequence, construction will begin with DSF 2 that will generate an additional storage volume of 874,000 m^3, followed by DSF 3 & DSF 4 for an additional storage volume of 412,990 m^3 and 824,697 m^3 respectively. DSF 5 will be the last to be constructed as a means of achieving the final contour of 34m rather than being its own storage area.

6.3.4 DSF Construction Methodology

During the early stages of constructing the DSF 2, a 2m (width) by 0.3m (depth) trench will be dug for the installation of the ULLD. The base of the trench will be graded to a gradient of 1V:400H towards a collection sump. The ULLD will first be covered with a layer of high strength woven geotextile PET 200 and followed by a secondary geosynthetic clay liner (GCL). Above the GCL will be a double-textured, 2mm thick HDPE liner which acts as the primary lining system. Both the primary and secondary liners will be anchored in a 0.5x0.5m trench.

DSF 2 will also be furnished with three (3) bunds of either 2m or 1.5m in height and will be constructed using silty gravelly sandy soil at 1V:2H slope gradient. As the bunds will be shared with the WLP lagoon and WLP RSF, an efficient pumping system will be deployed to ensure at least 500mm freeboard is available for the WLP Lagoon. As a secondary precaution, a 0.5m high bund will be located on the crest between the WLP Lagoon and the NUF DSF 2 to act as a buffer in case the pump malfunctions.

Access road to the NUF DSF 2 will be constructed at a 1V:10H gradient using silty gravelly sand material with a layer of protective geotextile. The top 400mm of the road will be layered with compacted crusher-run material to ensure road integrity.

6.3.5 Management of NUF Residue

Lynas had come up with a comprehensive stockpile management plan to ensure the allocated space along the eastern sector is managed effectively hence enabling the drying of the NUF with ease. As NUF DSF 2 will merge with Geotube 1 & 2, NUF residue will be stacked on top of the Geotubes beginning from the embankments inner toe at a distance of 2-3m and contoured at a slope ratio of 1V:2.5H. the inner slopes will be contoured at a ratio of 1V:2H with a 5m wide berm for every 5m increase in height.

6.3.6 Safety Provisions Considered in the Design of the Secure Landfill

The geotechnical design of the embankments currently satisfies the minimum Factor of Safety (FoS) for various aspects of the ANCOLD guideline as stated below:

Case Analysed	Remark	Minimum FOS
Construction Phase	Applicable during initial construction prior to commissioning	1.2
Short-Term Static Loading	Post-initial construction, operating conditions.	1.3
Long-Term Static Loading	Post operating conditions, closure	1.5
Pseudo-Static (Earthquake Loading)	Applicable at any time	1.1

Additional testing will also be conducted based on both Malaysian and international standards & guidelines (in absence of Malaysian standard/guidelines) to ensure the DSF remain structurally viable.

6.3.7 Access Road and Transportation of NUF Residue

NUF DSF 2 will be accessible via the current road leading to NUF Geotube 1 while transportation of the NUF residue from the processing area to NUF DSF 2 will utilise same route as NUF DSF 1. The NUF residue will be transported using open top tipper trucks which will be closely monitored and controlled to prevent overloading and spillage. As NUF tend to amalgamate rather than aggregate, under normal transportation conditions, its moisture content will be maintained so as to minimise the generation of fugitive dust.

6.3.8 Secure Landfill Surface Water Management

All the surface water will be contained within NUF DSF 2 due to the presence of the three (3) bunds and therefore can be managed and treated as a single source. It is expected that most of the accumulated water will be that of rainfall as NUF has low permeability thus restricting rainwater from infiltrating through its structure. As such all the accumulated runoff and to a lesser extent, leachate, will be directed to the sump pit. Water samples from the sump pit will be taken and analysed daily for Mn, TSS and pH and compared against Standard B limits of the Environmental Quality (Industrial Effluents) Regulations 2009 for compliance. Should it comply, the water will be released to the clear well before being discharged at the final discharge point that connects with the unlined earth drain flowing along the LAMP's southern boundary. In the event of non-compliance, the water will be redirected to the Surge Lagoon and subsequently the high-density sludge area and the IETS for further treatment.

The NUF DSF 2 has a water retaining capacity of 35,803 m^3 along with a 250m^3/hr sump pump which is deemed sufficient. However, an additional portable diesel pump of capacity 300m^3/hr will be installed during the monsoon season to cater to the increase in rainfall.

6.3.9 Waste Water Control and Monitoring

IETS technicians will carry out waste water sampling as below to ensure strict compliance to regulatory requirements.

No	Control point	Sampling frequency	Responsible person	Remark
1	NUF DSF 1 Sump pit	Before pumping	OUR Prod Technician	Analyse for pH and Mn
2	3T1106/3T1156 (HDS area)	Every shift	OUR Prod Technician	If NUF DSF 1 sump not meet standard B – Abnormal condition
3	Surge Lagoon	Every shift	IETS Prod Technician	Take sample at mixing chamber.
4	Sequential Batch Reactor (SBR)	Every shift	IETS Prod Technician	IETS lab testing
5	Clear Well	Every shift	IETS Prod Technician	IETS lab testing
6	FDP 3T4403	Once / day	IETS Prod Technician	Central lab testing
7	FDP 3T4403	Every shift	OUR Prod Technician	Check for Na, Mg, Ca, Cl, SO_4, Si, TDS, Mn, Fe, COD, TSS, pH
8	FDP 3T4403	Once a week: Saturday	OUR Prod Technician	Analyse for all 31 parameters standard B
9	FDP 3T4403	Daily	Third party contractor- Under SHES team	Check for Cod, TSS, Temp, pH
10	FDP 3T4403	Weekly	Third party contractor- Under SHES team	Analyse for Standard B parameter
11	SRP	Every shift	OUR Prod Technician	Check pH at several points at entire SRP
12	SRP – Outfall	Daily	Third party contractor- Under SHES team	Check for Cod, TSS, Temp, pH
13	SRP– Outfall	Weekly	Third party contractor- Under SHES team	Analyse for Standard B parameter

6.4 Environmental Monitoring System

LAMP currently has in place an environmental monitoring program covering air quality, groundwater quality, noise level and surface water monitoring that is carried out on a monthly basis. They also monitor the discharge from the final discharge point as per scheduled.

6.5 Research and Development Towards NUF Commercialisation

Through diligent and extensive research and development efforts, Lynas managed to develop two types of products utilising LAMP process residue; as road base material (RB10, RB10SA) and as soil conditioner (CondiSoil). As road base material, the product is found to be a suitable substitute for aggregates and sand and usable in road construction and landfill material in land reclamation and rehabilitation.

As a soil conditioner, CondiSoil is composed of WLP, NUF and filler material at a ratio of 1:2:7. As NUF is highly rich in gypsum, it provides much needed nutrients to the soil in the form of magnesium, sulphide, calcium and phosphorus. Aside from being a great limiting agent, the calcium sulphate in CondiSoil also helps combat aluminium toxicity in the soil. Research on the viability of NUF as soil conditioner was pre-approved by DOE and AELB and was conducted in collaboration with various academic and research institutes as well as independent bodies, in and out of the country. Due to the favourable outcome of these researches, commercialisation efforts for the Product will commence once the approval for the Special Management of Scheduled Waste from DOE is received.

6.6 Secure Landfill Closure Plan

The Proposed capping design for the secured landfill is a combination of several engineered cover systems.

- The proposed capping design will include a double liner system to prevent escape of residue to external environment. In addition, the dry stacking method used by Lynas results in a far more stable contour compared to slurry-based tailings dams.
- The proposed capping design will include erosion controlling measures (rock mulch, plant species), gradients for surface run off, infiltrated water collection and drainage, and slopes designed with recommended safety factors.
- The proposed capping design will include drainage and surface run off controls.
- Materials required for the closure plan are not exotic and are available in close proximity to the plant.

Upon reaching its capacity, the closure of the DSF will utilise the following capping system.

- The total height of the cap will be nominally 1000 mm.
- The vertical cross section of layers for the cap will be:
  - 0.7 mm (or similar) HDPE liner
  - 200 mm drainage layer (coarse river sand) with drainage pipe at 50m spacings
  - 300 mm bio-barrier (cobble-stones), eliminating burrowing animals
  - 400 mm top-soil
  - 100 mm layer of rock mulch, planted with Vetiver grass at 2m spacings. Natives are expected to naturally infiltrate once the vetiver establishes sufficient shade to promote germination.
- Drainage pipe will be used at 50 m intervals to assist in movement of water through the drainage layer.
- The drainage pipe will drain to stormwater drains surrounding the facility, with the stormwater drains draining to the Balok River through existing stormwater drainage infrastructure on site.

6.7 Abandonment Plan

With the final height of the secure landfill reaching 34m with a relatively flat top, it is proposed that for the area to be revitalised as a solar farm that not only benefits Lynas day-to-day operations but also improves the public's perception towards the company while also preserving the economic value of the industrial land. it is also proposed for the storm water retention pond to be converted into a natural wetland biofilter as an added level of treatment before discharging.

6.8 Project Requirement

The proposed secure landfill in GIE is accessible via Jalan Kuantan-Kemaman and Jalan Gebeng Bypass. Jalan Kuantan-Kemaman is located at the south of the development site while Jalan Gebeng Bypass is to its north. Connection to Jalan Kuantan-Kemaman is via Jalan Gebeng 1/1, Jalan Gebeng 1/11 and Jalan Gebeng 2/5 while a road to the west of the site is connected to the Gebeng Bypass. The operation of the secured landfill is expected to consume a total of 31,536 kWh of electricity during its construction with a daily consumption of 350.4 kWh during it operational phase.

6.9 Project Implementation Schedule

The construction of the four (4) DSF is expected to total up to 10 years with DSF 2 just recently approved for construction in February 2019. Following this will either be DSF 3 or DSF 4 in either 2021 or 2020 respectively. Construction of DSF 5 on the other hand is expected to commence in November 2025.

7 EXISTING ENVIRONMENT

7.1 Topography

Regionally, the GIE is located in the Kemajuan Tanah Merah area where Bukit Tanah Merah was flattened to construct the industrial estate. The GIE is located within the low-lying and predominantly swampy Sungai Balok catchment area with an average land elevation of 7m above mean sea level.

7.2 Hydrology and Hydrogeology

7.2.1 Hydrology

The hydrology and drainage system of the LAMP site is characterised by the Sungai Balok catchment with the main tributaries of rivers in the area being Sg. Balok and Sg. Tunggak. Sg. Balok originates as Sg. Batang Panjang from the hilly area northwest of the Project site and serves as the catchment area for the Project site. Sg. Balok catchment is estimated to be 10 km long and km wide. Sg. Tunggak on the other hand originates from the Tanah Merah peat swamp forest and flows south along the eastern boundary of the Project site.

7.2.2 Hydrogeology

The LAMP site is situated on alluvial deposits with very high aquifer potential based on the Hydrogeological Map of Pahang (2007) published by Jabatan Mineral dan Geosains (JMG) Malaysia. The extent, nature and composition of the alluvium vary at different localities. Along the stretch of the Gebeng coast from Sg. Ular to Beserah in the south, it is known to be highly productive aquifers of more than 20 m thick and consists of sand/gravel. However, there is no deep drilling carried out in the area, other than in Sg. Ular area where groundwater wells are capable of producing 15 – 20 m^3/hour. Areas underlain by granite and sedimentary rocks have lower groundwater potential.

7.3 Geology and Soil

7.3.1 Geology

According to the Geology map of Peninsular Malaysia (2014), the Quaternary deposits consist of marine and continental sediments made up of clay, silt and gravel. The marine Gula formation occupies most of the coastal areas throughout the peninsular. In the coastal area in Kuantan, including the GIE where the Project site is located, the Quaternary deposits is estimated to be up to a depth of approximately 38 m and consist of peat, humic clay and silts of the Beruas and continental Simpang Formations. As described in the previous sub-section, the alluvial deposits in the area have an estimated potential yield of between 4,000 and 6,000 gallons/hour/well.

7.3.2 Soil

The Kuantan Series is a member of the Kuantan Family which is a very fine, oxidic, iso-hyperthermic, brown Tipik Akrolemoks. It typifies the family which developed over basalt. These are deep (>100 cm), very friable and uniformly brown soils with thin dark brown to brown A horizons and dark yellowish brown, clayey B oxic horizons. The depth of this type of soil exceeds two metres deep where iron-coated basalt parent material normally occurs. The Effective Cation Exchange Capacity (ECEC) value is less than 1.5 centimole/kg in the oxic horizon.

In 2017, an investigation was carried out, 8 boreholes (GWBH1- GWBH8) were drilled at the LAMP site. These boreholes were drilled for the data acquisition of geotechnical / soil information and hydraulic characteristics of the aquifer. Based on the 39-m explored depths of borehole drilled at the site, the Project site comprises of six (6) stratigraphic unit:

(i) Reconstructed layer of gravelly sandy SILT or fill material which is about 1.88 m thickness. This layer is underlain by the Quaternary Alluvium and Marine Sands of the area which comprises of five main soil formations.

(ii) Sandy CLAY that grades into SILT in some locations. This second layer is named as sandy CLAY/SILT and is about 4.22 m thick. ***Layer 3*** is silty SAND (6.80 m) and the upper aquifer at the site. The ***Layer 4*** is another sandy CLAY/SILT (5.74 m). The bottom of this ***Layer 4*** is the top of ***Layer 5***. ***Layer 5*** is the deeper silty SAND aquifer (5.20 m) and the main aquifer were the greatest potential for ground water could be located. ***Layer 6*** is SILT but grades into CLAY and is named as SILT/CLAY. The thickness is about 5.94 m.

7.4 Climate and Meteorlogy

Based on the climatological data obtained from the meteorology station in the Sultan Ahmad Shah Airport (2011-2017), the highest temperature recorded was 27.6°C while the lowest was 26.6°C. Humidity levels were recorded at a maximum of 87.5% and a minimum of 82%. Maximum rainfall on the other hand was recorded at 640.4 mm with a maximum of 28 raindays while minimum rainfall was recorded at 3.6 mm with minimumof 4 rain days. On average wind speed was recorded between 1.2 m/s to 2.4 m/s.

7.5 Flood Risk

Gebeng and its surrounding areas are classified as low risk in natural disaster such as flooding; with a possible frequency of a single flooding event per 100 years.

7.6 Erosion Risk

The proposed Project will be undertaken within the existing 100 hectares LAMP site in GIE. As the Project site is generally topographically flat and considerably built-up on the western portion of the LAMP site, soil erosion is not anticipated to be an area concern for the Project.

7.7 Waste Management

Municipal waste, which includes office waste (paper, plastics, etc.,) generated by the existing SMR plant will be collected by a local waste collector hired by Majlis Perbandaran Kuantan (Local Authority) and disposed at an approved disposal site. Currently, Lynas does not produce significant quantities of scheduled waste apart from the NUF residue.

7.8 Ecology

The proposed Project site has been largely built-up and is currently located within an operating industrial plot. Therefore, terrestrial ecology is not an issue of concern.

7.9 Land Contamination

The operation of the plant will result in the generation of two major residue steams, namely the NUF and WLP. The NUF waste streams had been classified as scheduled waste and thus will be handled and stored in accordance to the requirements of DOE. At present, these wastes are stored within the engineered residue cells constructed within the plant site.

7.10 Land Use

Based on the environmentally sensitive area classification in the National Physical Plan 3, the Project site does not fall within any of the three (3) categories of sensitivity criteria hence is classified as a non-environmentally sensitive area.

The Project site is located within an existing industrial area known as Gebeng Industrial Estate and is therefore in line with the designated industrial land use of the area. At present, the LAMP is bordered by mainly industrial build-up to its immediate northern and southern sections while to its west are mainly vegetated area and to its east is a mix of vegetated land and mining activities. Ten (10) settlements had been identified within the 5-km radius ZOI of the LAMP site's boundaries and consist of the following:

1. Kampung Hulu Balok
2. Akademi Maritim Ahmad Shah
3. Kampung Gebeng
4. Kampung Padang Serai
5. Taman Balok Perdana
6. Taman Balok Makmur
7. Kampung Berahi
8. Kampung Selamat
9. Kampung Seberang Balok
10. Kampung Darat Sg. Ular

7.11 Human Environment

Pahang has a population of 1,500,817 in year 2010 which represents 5.3 % of the total population in the country (28,334,135). The average annual population growth rate of Pahang between the years 2000 and 2010 is 1.37%. Pahang has a considerably low population density of 41 per km^2, living in a land area of 35,840 sq. km. Presently, the population is unevenly distributed over the state. The population density varies from 12 people/ km^2 in the Jerantut district, to 156 people/ km^2 in the Kuantan district. Of the 11 districts in 2010, Kuantan was the most populated with 461,906 people (19.6%) and Cameron Highlands, the least populated with 38,471 (1.6%).

7.12 Environmental Baseline Monitoring

7.12.1 Ambient Air Quality

All the criteria pollutant parameters measured are compared against the limit stipulated in the new MAAQS, IT-2 (2018) limits published by the DOE. Hydrogen fluoride (HF) and sulphuric acid (H_2SO_4) are compared against the Arizona Ambient Air Quality Guidelines and carbon dioxide (CO_2) against USEPA 1991.

From the monitoring data, it can be seen that in all four (4) locations, parameters that were compared against MAAQS IT-2 (PM_{10}, SO_2, NO_2, CO) were well within their prescribed limits with no exceedance recorded throughout the 6-year period. Similarly, CO_2, also exhibited zero exceedance throughout the monitoring period when compared against the USEPA 1991. However, H_2SO_4 and HF, that were compared against the Arizona Ambient Air Quality Guidelines, exhibited minor exceedances (1 – 2 exceedance out of 71 monitoring events) at all four (4) locations within the same period. This may be contributed by off-site emissions within the Gebeng Industrial Estate. GIE houses several companies that produces concentrated chemicals within 3.5 km of LAMP's boundary. Among the chemicals manufactured are sulphuric acid and acid-activated catalyst that are widely used in petrochemical industries.

7.12.2 Stack Emission

Lynas has installed a Continuous Emissions Monitoring System (CEMS) to two stacks arising from the Waste Gas Treatment Plant to monitor flue gas released to the atmosphere. Lynas has provided the CEMS data from January 2013 to September 2018. The CEMS monitors four parameters, namely SO_2, SO_3, PM and HF. The results obtained were compared against current DOE limits.

Of the four (4) parameters monitored, only HF exhibited full compliance for both Stack 5 and Stack 34 throughout the 6-year period. The remaining three (3) parameters on the other hand, showed periodical exceedance for both stacks but otherwise complies to the prescribed limit for a majority of the monitoring period. However, gradual improvements can be seen towards the end of 2018 for the three (3) parameters due to the upgrades implemented to the existing Spray Tower in 2017.

7.12.3 River Water Quality

Water quality monitoring was conducted at 11 locations along Sg. Balok as well as the unlined earth drain along LAMP's southern boundary. Samples were collected during low-tide periods in order to emulate the worst-case scenario for the Project and analysed for 10 parameters; pH, Dissolved oxygen (DO), Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Total suspended solid (TSS), Ammoniacal nitrogen (AN), Calcium (Ca), Iron (Fe), Manganese (Mn) and Conductivity. Results from the analysis (2013-2018) were then compared against the limits of Class III of the National Water Quality Standards (NWQS).

It can be seen that none of the six (6) parameters regulated under the NWQS; pH, DO, BOD, COD, TSS and NH_3-N, fully complies with their respective limits for all 11 stations. All six (6) parameters recorded at least 50% compliance out of a minimum of 30 monitoring events at each station over a six (6) year period. However, three (3) parameters; DO, COD and NH_3-N, recorded constantly high values at all 11 stations which may be attributed to the peat soil and swampy nature of the area, causing regular spikes for these three (3) parameters.

7.12.4 Final Discharge Quality

The final discharge point for the LAMP plant is located near surge lagoon B and is monitored by Lynas on a monthly basis. Parameters for monitoring were based upon and compared against the requirements of Standard B of the Environmental Quality (Industrial Effluent) Regulations 2009. From the results obtained, it can be seen that while most parameters are in compliance with the limits of Standard B, although several parameters including Barium (Ba), Phenol and Manganese (Mn) recorded minor exceedances throughout the monitored period. This could be due to occasional process upsets and exceedances do not last long as appropriate measures are taken to rectify the situation.

7.12.5 Groundwater Quality

Most of the heavy metal parameters analysed including Barium (Ba), Lead (Pb), Chromium (Cr), Mercury (Hg) and Zinc (Zn), were not detected i.e. below their respective detection limits. The results show that most of the heavy metals were either very low or undetected, but from the year 2015 onwards, the values indicated fluctuation in the concentrations of the measured heavy metals.

The concentration of Ba in GW1 reached 839 µg/L in February 2015 and 847 µg/L in GW12 which were above the DIV. GW1, GW2 and GW12 show distinct fluctuation of Ba from the year 2015 onwards. The DOE 2018 groundwater standards do not prescribe limits for Ba.

Initially Pb reading in GW1, GW2 an GW3 showed some fluctuations but from April 2011 to early 2015 the readings seem to be constant with very low readings or non-detection. However, after January 2015 most stations indicated significant fluctuation particularly for GW1, GW11, GW12 and GW13. The concentration of Pb in GW12 reached 177 µg/L in May 2018, GW11 at 112 µg/L in August 2015 and GW1 reached 115 µg/L in August 2016 which is above the DIV. GW12 shows the most peaked values of Pb concentration. The DOE 2018 groundwater standards for Pb at 50 µg/L was breached at GW1, GW11 and GW12.

Since early 2015, Cr readings seem to be much higher than the initial monitoring in 2011 which recorded very low readings or non-detection. However, after January 2015 most stations indicated significant fluctuation particularly at GW12 and GW13. The concentration of Cr in GW13 shows the highest value at 657 µg/L in July 2018, GW 12 reached 97.1 µg/L in May 2018, which exceeded both the DIV and .DOE 2018 standards of 50 µg/L is similar to DIV

From early 2015, the Zn readings seem to be much higher than the initial monitoring in 2011 which recorded very low or not detected readings. However, in January 2015 most stations registered significantly high values of Zn with 44800 µg/L at GW3, which was-exceptionally high. The Zn concentration show very little fluctuation in comparison with other monitored heavy metals. The concentration of Zn in GW13 had a high value of 7738 µg/L in June 2017, while GW2 recorded 6233 µg/L, which exceeded the DIV of 800 µg/L. The DOE (2018) value for Zn of 3000 µg/L was breached at GW12 and GW 13.

Concentrations of Hg from January 2015 to October 2015, seem to be much higher than the initial monitoring in 2011 which recorded very low readings or non-detection. The trend reverted back to low readings after the 10 months period in late 2015. From January 2015 to October 2015, most stations indicated significant fluctuation especially GW1, GW5, GW11, GW12 and GW13. The concentration of Hg in GW11 shows the highest value at 11.3 µg/L in March 2015, and GW5 reached 11.1 µg/L in March 2018. Significantly high values of Hg in May 2015 and October 2015 in most of the wells may indicate a surge of contamination from the source or from the surrounding areas, or contamination during either sampling and/or analysis. There is no DIV for Hg in groundwater, whilst DOE 2018 groundwater standard for Hg is 1 µg/L.

Most of the exceedances are attributed to offsite sources and natural occurrences.

7.12.6 Noise Level

Noise level monitoring is conducted on a monthly basis by Lynas at four (4) locations along its site boundary **(Table 6.23)**. Recorded noise levels were compared against Schedule 1 of the Planning Guidelines for Environmental Noise Limits and Control with day and night time limits of 70 dBA and 60 dBA respectively. The daytime noise levels for Leq measured predominantly complied with the limits stipulated under Schedule 1 Maximum Permissible Sound Level (LAeq) by Receiving Land Use for Planning and New Development in The Planning Guidelines for Environmental Noise Limits and Control (Dedicated Industrial Zones: 70 dBA) at all stations (0.31% non–compliance). The non – compliance was observed to be due to vehicular movements.

The night time noise levels for Leq measured complied with the limits stipulated under Schedule 1 Maximum Permissible Sound Level (LAeq) by Receiving Land Use for Planning and New Development in The Planning Guidelines for Environmental Noise Limits and Control (Commercial Business Zones: 55 dBA) at all stations except at N1 station which recorded a non–compliance of 5.41%. The sources of noise at N1 during night time are most likely due to nocturnal insects and animals.

8 Evaluation of Impacts

8.1 Geotechnical Impacts

For slope stability assessment limit for the NUF final contour, equilibrium computer software SLOPE/W was used to assess the long-term stability of embankments. Embankment stability is presented in terms of a Factor of Safety (FOS) against slope failure. It is the ratio of de-stabilizing forces in the embankment compared to the total strength of the soil structure.

A value greater than 1 indicates strength is more than the destabilizing forces. As the factor of safety increases, the probability of an embankment failure is reduced. The strength parameters selected for embankment materials and sub-surface profile are based on results of the previous site investigation that included visual inspection of materials, *in situ* testing (SPT and CPT), and laboratory testing on recovered samples and laboratory testing of fill samples from potential borrow pits.

The output of the modal indicates that the maximum settlement under the proposed loads is 1.02 m. The minimum safety factor to be used is 1.56 (or 1.54 with seismic consideration). This slightly exceeds the FOS of 1.5 which is recommended by the Public Works Department Malaysia (*Jabatan Kerja Raya*, JKR) for man-made slopes.

In addition, the embankment design includes the provision of geotextiles to improve embankment stability.

8.2 Water Quality

Impacts During Construction

The main sources of water quality impacts during the construction period include site preparation works and contaminated construction runoff

Impacts During Operation

During the operational phase, storm water runoff from the secure landfill area will be the main source of water quality impacts. If uncontrolled without proper storm water management system in place, the impacts to the internal storm water drainage system will be potentially significant in terms of increased loading of suspended solids. For mitigation, Lynas has designed an effective storm water management system.

8.3 Groundwater Quality

Groundwater modelling was carried out to understand the hydrogeological conditions at the site and the fate transport of pollutant for worst-case scenario in the event that the landfill liner is breached. The objective of the groundwater modelling are described below:

Impact assessment during Construction Phase

It is important to note that the secure landfill at the LAMP site is an existing secure landfill. Construction of landfill is expected to have insignificant impacts to groundwater. However, precautionary measures must be considered as groundwater level on site may be affected by the landfill construction activities and vice-versa. Based on groundwater flow investigation, regional groundwater is known to flow towards the coastal line. However, reverse flow may occur during the high tide. Groundwater flow simulation have shown that groundwater level at the site is very shallow. Therefore, any shallow excavation of less than 1 m will potentially reach the groundwater level.

Impact Assessment during Operational Phase

Groundwater impact during the operational phase is expected to be absent as the engineered secure landfill (Level IV) is equipped with a dual liner system, leachate collection and IETS. However, groundwater contamination can still occur if the GCL is punctured or the liner membrane is not correctly installed. Potential impacts from the uncontrolled flow of contaminant into the groundwater system include degradation of groundwater quality, soil contamination and adverse impacts to both surface water and marine quality due to hydraulic interaction between these water resources.

For the worst-case scenario, heavy metals will likely be the major contaminants in terms of groundwater contamination. The movement of contaminants from the stored materials is likely to be consistent with the potential particle path line which corresponds to groundwater head gradient near the secure landfill site and storm water retention ponds.

8.4 Air Quality

Impact during Construction Phase

Air pollutants are generated by a variety of activities that are likely to take place during the construction period. These include:

- Site preparation and earthworks for the construction of the new cells (DSF 2, 3, 4, and 5);
- Wind-blown dust from exposed areas of the construction area;
- Fugitive dust emissions from transportation activities; and
- Dust from construction related activities.

Impact during Operational Phase

Based on the periodic ambient air quality monitoring results particularly at **A5: Taman Desa Ular Jaya, A6: Taman Balok Perdana** and **A7: Kg. Seberang Balok** with the adoption of the current Lynas's Management and Mitigation of Fugitive Dust Plan and also with the high moisture content i.e. more than 50% of the filter NUF cake, it is anticipated that there will be insignificant Particulate Matter contribution from the Project site to the identified air sensitive receptors during the Secured Landfill operation.

8.5 Noise Assessment

Impacts During Construction Phase

During the construction phase, the boundary noise level is expected to increase mainly due to construction activities within the Project site such as movement and operation of heavy machineries, transportation of construction equipment and materials for the following activities:

- Site preparation work; and
- Transportation of construction equipment and materials.

Impacts During Operational Phase

During the operational phase, sources of noise will be similar to the construction phase as similar machineries and vehicles will be used during the operational phase to stack and compact the NUF within the secure landfill. Therefore, noise impacts during the operational phase is also expected to be localised and insignificant.

8.6 Socio-Economy

The findings of the study revealed that the Project is not expected to receive objection from the local communities and stakeholders within the 5 km population catchments, including the working population within the GIE. In addition, the Lynas employees were supportive and had no objections towards the Project. The only possible objection is expected from certain Non-Governmental Organisations and individuals known to protest and object the operation of the LAMP. In conclusion, the Project is not expected to generate negative impact with regards to the social environment of the population catchment.

8.7 Ecology

The GIE has been a designated industrial area since the early 90s with many existing industries occupying the estate. Hence, flora and fauna species of conservational value is expected to be very low within the GIE. In addition, the Project is an existing secure landfill located within the existing LAMP site. Expansion of the secure landfill cells (DSF 3, DSF 4 and DSF 5) will also be constructed within the existing LAMP site. Therefore, the Project is not expected to have any significant impact on the surrounding ecology.

9 Mitigating Measures

9.1 Geotechnical Consideration

In ensuring the stability of the DSF slopes, routine monitoring and maintenance will be carried out. Maintenance inspection is generally sub-divided into the following categories:

- Routine maintenance inspection carried out by any responsible person with non-professional geotechnical knowledge.
- Engineer inspection for maintenance carried out by a professional qualified and experienced geotechnical engineer.
- Regular monitoring of special measures carried out by a firm with specialised expertise. Such monitoring is only necessary where the long-term stability of the slope relies on specific measures, which are liable to become less effective or deteriorate with time.

9.2 Water Quality

Mitigating Measures During Construction Phase

The main source of water impacts during the construction phase will be sediment from construction surface runoff. The following mitigating measures will be adopted by Lynas:

- Separate store will be provided for chemicals (spent oil, diesel) and scheduled wastes equipped with secondary containment;
- To establish an Emergency Response Plan (ERP) outlining actions required to respond to spills and other hazards on-site; and
- Portable chemical toilets will be installed for use by the construction workforce in the event that onsite facilities at the existing plant are not sufficient (to install only when existing toilet not sufficient). These toilets will be regularly maintained.

Mitigating Measures During Operational Phase

The secure landfill is integrated with the plant's IETS. The waste water treatment system at Lynas encompasses multiple stages of treatment, including neuralisation, flocculation, thickening, filtration, pH adjustment, and bacterial oxidation. NUF residue water runoff encompasses only 20% of the IETS influent and will be directed to the clear well and storm retention pond prior to discharge to Sg. Balok via the unlined earthen drain located along the southern boundary of the LAMP site. All discharges from the effluent final discharge point will be treated to meet the Standard B limits of the Environmental Quality (Industrial Effluent) Regulations 2009.

9.3 Groundwater Quality

The groundwater flow and contaminant transport of Pb, Cr and Ba for LAMP site have been developed using numerical model and its impact discussed elaborately in Chapter 7. The assessment suggests that, the proposed secure landfill will have a very minimum impact on the Project site's groundwater quality and its surrounding. Nevertheless, this following mitigating measures are deemed necessary as a precaution based on the findings of the models:

- Project site has a high groundwater table which is due to confined conditions and relatively flat terrain. Continuous heavy rainfall can raise the water table beyond the present level. Engineering design of the secure landfill to apply appropriate correction factors and landfill base to be raised to at least 1 meter above ground level;
- Implementation of quality work procedures/inspection checks to ensure the dual liner system is installed with integrity. If the integrity of the double liner is not compromised, the groundwater systems will not be contaminated any leaching in the landfill at the site; and
- A more comprehensive groundwater level monitoring program to be carried out the same time as groundwater quality monitoring. This will be a good indicator of the effect of groundwater levels in correlation to groundwater quality

9.4 Air Quality

Mitigating Measures During Construction Phase

In order to minimise the fugitive particulate matters generation during the construction phase of the secure landfill, Lynas has formulated a ***Management and Mitigation of Fugitive Dust Plan.*** Where applicable, the following mitigating measures will be adopted by the Project Proponent.

- Water trucks will be used to suppress dust on construction roads when required (especially dry period);
- Every construction road will be compacted using a roller compactor to minimise the fugitive dust emissions; and
- Only operating and authorised vehicles will be allowed on the designated roads and tracks in the Project site.

Mitigating Measures During Operational Phase

Potential air pollution that may arise during the operational phase may be due to a structural failure of the secure landfill itself, to which the Project Proponent will refer to "*Guidance Document on Fugitive Emission Control".* Where applicable, the following mitigating measures will be adopted by the Project Proponent for the proposed Project:

- The height from which an aggregated material is dropped will be reduced to a safe minimum height during the stacking and contouring period

- All aggregated material will maintain certain moisture content prior to any loading, unloading or transfer operation to avoid dispersion of dust

9.5 NOISE GENERATION

Noise impacts during the construction phase are expected to be minimal, short term and can be mitigated with the implementation of appropriate mitigation measures.

Mitigating Measures During the Construction Phase

The recommended mitigating measures for the management of noise impacts are described below:

- All the equipment and machineries will be well-maintained to avoid emitting excessive noise. Lynas will regularly inspect the maintenance record provided by the appointed contractors
- Construction work and movement of heavy vehicles will be confined to day-time hours between 0700 to 1900 hours. Depending on the need, construction work will continue on throughout the night
- Vehicles and construction vehicles will be maintained appropriately to prevent high noise level.

Mitigating Measures During Operation Phase

Noise pollution are not expected to be significant due to the proposed Project design and overall nature of the Project which does not utilise heavy machinery that produces high noise levels. The only intermitted noise sources are the roller compactor/trucks that access the Project site to compact and contour the NUF residues in the secure landfill

9.6 SOCIO-ECONOMY

Based on the location of the proposed Project site and Project development process and the findings of the study, no significant negative impact on the social environment is anticipated. Thus, no mitigation measure is necessary. Nevertheless, mitigating measures are proposed to minimise the impact to minimum as highlighted in the following section.

Mitigating Measures During Construction Phase

To prevent undue aberrations with the local community, Lynas will ensure that the foreign workers are registered with the Department of Immigration. This will ensure that foreign workers have medical and health certificates attesting to their personal health. Under the procedures of the department, regular medical check-ups are necessary for the renewal of their work permits, which is carried out every year.

Mitigating Measures During Operation Phase

As the economic situation is expected to improve with the operation of the proposed Project, mitigation measures are needed to counter or reduce social problems that might arise from development activities or those that occur as arising from the physical and economic activities in the area. The measures recommended above also apply to mitigate social issues during the operation of the Project.

To ensure good relations with the local communities, Lynas will engage and work with the local development and security committee (Jawatankuasa Kemajuan dan Keselamatan Kampung (JKKK)). Regular interactions through organised social functions involving the local communities will help to build a good relationship and avoid social conflicts. The residents will be kept notified of the Project's progress and subsequent outcome to address any issues or concern regarding the Project without conflict.

9.7 Ecology

The GIE houses a world-class chemical and petrochemical industrial zone, with a total land area estimated at 8,600 hectares. Located about 5 km from the Kuantan Port, GIE is strategically located with excellent infrastructure and facilities. GIE is rapidly expanding to become the leading chemical and petrochemical hub of the region – due to this exponential growth since the early 90s, there are very little to no faunal/floral species of conservational value around the Project site. Therefore, no mitigating measures of any kind will take place to preserve the ecology of the Project site.

10 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Effective management and monitoring of activities on the site are essential to ensure environmental objectives are achieved and in accordance to regulatory requirements and best management practices. The mechanism for ensuring that these mitigation measures are implemented, and are effective is through implementation of an Environmental Management Plan (EMP). The element of self-regulation is to be incorporated in the EMP to enhance effectiveness in mitigating impacts.

The implementation of the mitigating measures is the responsibility of the parties concerned, namely the Project Proponent, Contractors and the appointed Environmental Officer (EO). The main elements of an effective EMP are regular environmental monitoring, periodic compliance audits, and an emergency response plan.

11 CONCLUSION

The main environmental concerns associated with the Project, are related to geotechnical stability, groundwater contamination and surface water quality. The other areas of potential impacts namely air quality, noise generation, ecology and socio-economy were determined to be not significant. The assessment demonstrate that all the potential impacts to the surrounding environment were predicted to be minimised and mitigated to within acceptable levels and comply with the stipulated environmental standards and guidelines.

With careful planning and adherence to sound mining practices and design, combined with prudent implementation of all recommended mitigating and control measures, the proposed Project will be able to reduce the predicted adverse impacts to a low level of significance. The Project is expected to have important economic benefits both locally and regionally