TABLE OF CONTENTS

ANNEXES

LIST OF ABBREVIATIONS

AMD	:	Acid Mine Drainage (aka Acid Rock Drainage)
AMSL	:	Above Mean Sea Level
BBOP	:	Business & Biodiversity Offsets Programme
BOD	:	Biochemical Oxygen Demand
COD	:	Chemical Oxygen Demand
CSP	:	Crushing & Screening Plant
CSR	:	Corporate Social Responsibilities
DO	:	Dissolved Oxygen
EIA	:	Environmental Impact Assessment
EMS	:	Environmental Management System
ESC	:	Erosion & Sediment Control
FR	:	Forest Reserve
gm	:	gram
ha	:	hectare
HIA	:	Health Impact Assessment
ICMM	:	International Council on Mining & Metals
JAS	:	Jabatan Alam Sekitar
JKKP	:	Jabatan Keselamatan & Kesihatan Pekerjaan
JMG	:	Jabatan Mineral & Geosains
JPAS	:	Jabatan Perlindungan Alam Sekitar
JPBW	:	Jabatan Perancang Bandar & Wilayah
JPS	:	Jabatan Pengairan & Saliran
JTU	:	Jabatan Tanah & Ukur
JUPEM	:	Jabatan Ukur & Pemetaan Malaysia
km	:	kilometre
km^2	:	square kilometre
μm	:	micron
MAAQG	:	Malaysian Ambient Air Quality Guidelines (JAS)
MIBC	:	Methyl Isobutyl Carbinol
ML	:	Mining Lease
MNRE	:	Ministry of Natural Resources & Environment
mt	:	metric tonne
MOH	:	Ministry of Health
MSDS	:	Material & Safety Data Sheet
MSMA	:	Manual Saliran Mesra Alam
NE	:	Northeast
NH_3-N	:	Ammoniacal nitrogen
NWQSM	:	National Water Quality Standards for Malaysia (JAS)
O&G	:	Oil and Grease
OPP	:	Ore Processing Plant
OSY	:	Ore Storage Yard
OTP	:	Ore Treatment Plant
OWP	:	Ore Washing Plant

LIST OF ABBREVIATIONS (cont)

PAC	:	Poly Aluminium Chloride
PAX	:	Potassium Amyl Xanthate
PL	:	Prospecting Licence
PPE	:	Personal Protection Equipment
PPV	:	Peak Particle Velocity
QRP	:	Qualified Registered Professional
RIL	:	Reduced Impact Logging
ROM	:	Run-Of-Mine
SAPS	:	Successive Alkalinity Producing System
SFD	:	Sabah Forestry Department
SHE	:	Safety, Health & Environment
SO_4	:	Sulphate
SOP	:	Standard Operating Procedures
SWD	:	Sabah Wildlife Department
SWR	:	Scheduled Waste Regulation
TAS	:	Tactical Air Sampler
TDS	:	Total Dissolved Solids
TSF	:	Tailings Storage Facilities
TSP	:	Total Suspended Particulates
TSS	:	Total Suspended Solids
UF	:	Ultra Filtration
WQI	:	Water Quality Index (JAS)
WWF-MY	:	World Wildlife Organization (Malaysia)

1 INTRODUCTION

1.1 The Project

This is a gold mining project entitled "**THE PROPOSED GOLD MINING (PHASE 1) AT PT.20-13100442, MT WULLERSDORF, TAWAU, SABAH**", and shall be hereinafter referred to as 'the Project'.

The current TOR is a revision to the previous (**Tor-Sgd-15-001** dated 09.01.2015) with amendments referenced to JPAS comments *vide* **JPAS/PP/21/600-1/04/1/2 KLT.2(55)** dated 19.03.2015 (**Annex B1-1**). The TOR is also hereby revised to covering only Phase 1 of the mining proposed herein under the Project.

1.2 The Stakeholders

Proponent

Name	:	**Southsea Gold Sdn Bhd**
Address	:	Lot 4, Block E, Bandar Nam Tung, Jalan Leila P O Box 2112, 90724 Sandakan, Sabah
Contact number	:	089-611 133, 611 633 089-613 633 (fax)
Contact person	:	**Datuk Lo Fui Min** (Managing Director)

The proponent is the owner of the Project, and has pledged (**Annex B2**) to abide by the ISO 14001 EMS standard and ICMM principles for sustainable development and environmental performance for the mining operations.

1.3 The Consultants

Environmental Impact Assessment

Name	:	**GMC Environmental Sdn Bhd** (**No: F005/ Exp: 30.09.2015**)
Address	:	Lot 41, 3rd Floor, Block F Damai Plaza Phase IV 88300 Kota Kinabalu, Sabah
Contact number	:	088-233 821 088-231 820 (fax) gmc_environmental@live.com
Contact person	:	**Tan Han Meng**

Mining Scheme (Preliminary)

Name	:	**KF Lee Mining Consultant & Surveyor**
Address	:	A-4 812 Level 8 Leisure Commerce Square No 9 Jalan PJS 8/9 46150 Petaling Jaya, Selangor
Contact number	:	03-7875 1799 03-7875 1793 (fax)
Contact person	:	**Ir Lee Kam Fatt**

1.4 Statement of Need

The Project proposes to:

- Expand mineral resource industry in Sabah feasibly through development of a sustainable gold mine
- Generate alternative and/ or additional revenue (through direct royalty payment) to the Sabah Government
- Enhance socio-economic development through chain contracting jobs and employment for Sabahans, particularly the Tawau people
- Provide CSR contributions (eg research funding)
- Redevelop the mined-over area into an international resort and eco-theme park

1.5 Environmental Requirements

The Project will observe the following environmental compliance to effect the mining operations.

- A mandatory EIA approval from JPAS under Prescribed Activity 7 of the Second Schedule of the Environment Protection (Prescribed Activities) (Environment Assessment Impact) Order 2005, Environment Protection Enactment 2002, for ***Mining including open cast mining for minerals pursuant to any mining lease:***

  (i) Covering an area of 20 ha or more
  (ii) Any form of mining which is likely to affect the landscape of the mining area so as to require rehabilitation thereof upon the cessation of the mining activities, or which involves the use of chemicals or explosives.

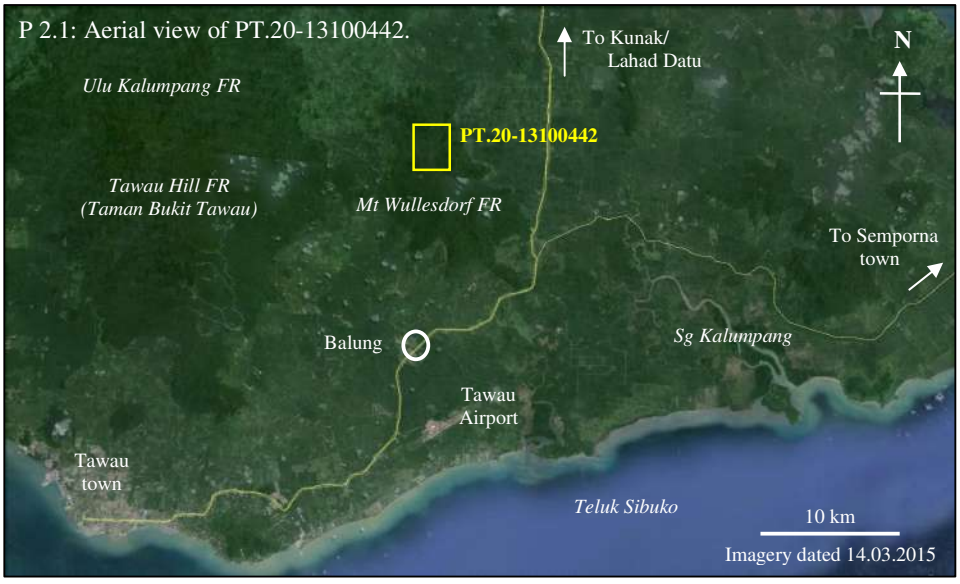
2 BACKGROUND INFORMATION

2.1 Project Location

PT.20-13100442 (**Figure A1**) consists of 1,000 ha (**Table 2.1**) in the Mt Wullersdorf area, and is located about 30 km northwest and 17½ km north of Tawau town and the airport respectively. However, the Project comprises only about 475 ha covering the northwestern area of PT.20-13100442, which currently is readily accessible through Jalan Bukit Bald – Bukit Mull –Bukit Kawa off the main road (Jalan Tawau – Lahad Datu) at Balung.

Table 2.1: PT.20-13100442 boundary coordinates (**Figure A2**)

Point	Marker	Latitude (N)	Longitude (E)
A	994/178A	04°30'19.5"	118°06'21.4"
B	186/181A	04°30'51.0"	118°07'06.6"
C	731/849	04°30'35.4"	118°07'53.0"
D	346/181A	04°30'33.5"	118°07'41.0"
E	417/181A	04°30'23.7"	118°07'38.9"
F	272/181A	04°30'23.6"	118°07'52.9"
G	945/178A	04°28'44.4"	118°07'51.5"
H	167/181A	04°28'44.9"	118°06'41.7"
J	391/181A	04°29'33.1"	118°06'42.2"
K	713/176A	04°29'32.4"	118°06'10.3"



P 2.1: Aerial view of PT.20-13100442.

P 2.2a: Typical view of the access road through Mt Wullersdorf FR to the site.
21.08.2014

P 2.2b: The graveled estate road leading to the site from Jalan Bukit Bald.
21.08.2014

P 2.2c: Jalan Bukit Bald.
21.08.2014

P 2.2d: Jalan Bukit Mull.
21.08.2014

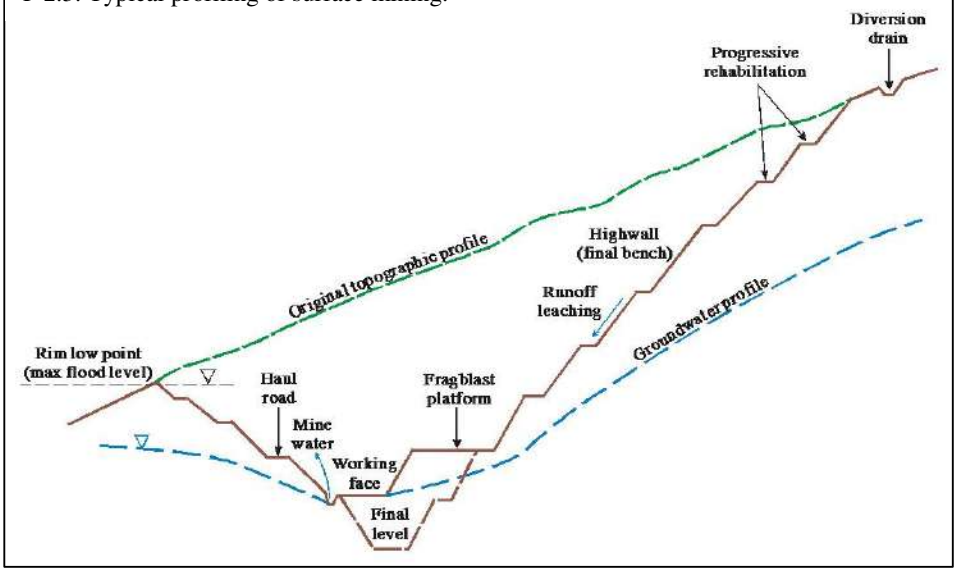
P 2.2e: Jalan Bukit Kawa.

21.08.2014

2.2 Project Concept

The Project proposes surface mining for the mineralized areas, working from the surface downwards by way of excavations and fragblasts (fragmentation by blasting).

P 2.3: Typical profiling of surface mining.



The overburden and intraburden materials will be disposed on-site at the waste dumps while the run-of-mine (ROM, ie the excavated ore materials) further processed into ore concentrates at the ore processing plant (OPP) through washing, sizing, screening and separation then trucking out to the nearest jetty for export, with the tailings retained at the tailings storage facilities (TSF) and the mine water treated on-site for reuse.

The Project will assume a typical organization line-up (**Annex B3**) for the mine operations, and will provide direct employment and contracting activities to some 400 people.

2.3 Project Status

The prospecting (**Annex B4**) has to-date delineated workable ore reserves (**Section 3.1.4**) at PT.20-13100442, with the mining lease (ML, **Annex B5**) recently granted for the Project subject to statutory compliance for the mining. The ML covers the entire PT.20-13100442 area for 1,000 ha, which at present is already demarcated (**Annex B6**) and a preliminary mining scheme also cleared (**Annex B7**) for the proposed mining (**Table 2.2**).

Table 2.2: Statutory compliance status (pre-TOR approval)

Compliance requirement	Status	Auditing/ approving authority	Clearance status
ML demarcation	Completed	JTU	Pending
Mining scheme (preliminary)	Completed	JMG	Cleared
EIA	In progress	JPAS	Pending

Upon granted the TOR approval, the Project will further observe the additional compliance requirements (**Table 2.3**).

Table 2.3: Additional statutory compliance (post-TOR approval)

Compliance requirement	Auditing/ approving authority
Mining scheme (detailed)	JMG
Geological, hydrological & hydrogeological	JMG
Erosion & sediment control (ESC)	JPS
Health impact assessment (HIA)	MOH

Land Status

The site was degazetted in 2013 from the Mt Wullersdorf – Ulu Kalumpang Protection Forest Reserve, and alienated in 2014 by way of an ML granted for the Project.

2.4 Project Activities

These activities are categorized in the following general procedural order of implementation.

- Site investigations
- Site preparation and development
- Operations
- Cessation

2.4.1 Site investigations

The investigative assessments (**Table 2.3**) are essentially the geological, hydrological, mining engineering, ESC, EIA and HIA. The geological includes mineral exploration for delineation of the ore reserves, and the hydrogeological, engineering geological and geohazards for the mining. The mining engineering through preliminary mining scheme provides an overview of the possible mining development concept and environment, while the detailed scheme thereafter details the mine design and operations with reference to the geological, hydrological and environmental assessments, ESC for the mining, and the redevelopment options for the mined-over area. At present, additional mineral exploration is still in progress at the site, which typically will remain on-going into the mining operations. On the other hand, the HIA will indicate the possible health effects of mining on the local communities across the influence areas.

2.4.2 Site preparation and development

The mine equipment and machinery (**Table 2.4**) will be mobilized to the site where the affected surface areas (**Figure A2**) will be cleared to necessarily establish and install the mine structures and infrastructures such as the mine block, waste dumps, processing and storage sites, TSF and the mine roads.

Table 2.4: Proposed primary mine equipment and machinery (KMCS, 2014)

No	Equipment/ machinery	Oxidized ores	Sulfide ores
1	Hydraulic excavator	6	
2	Bulldozer	1 – 2	
3	Dump truck	10	
4	Backhoe tractor	1	-
5	Hydraulic driller	-	2
6	OWP	1	-
7	Hopper feeder	-	1
8	CSP	-	1
9	Scrubber	1	
10	Ball mill	2 – 4	
11	Screener	2 – 4	
12	Shaking table	2	-
13	Flotation cell	-	4 – 8
14	Centrifugal concentrator	1	-
15	Classifier	-	1
16	Water pump	2	
17	Power generator	1	1

NB: OTP consisting of items (9) – (15); items & quantity subject to detailed mining scheme

The mine development will be implemented over several stages, with the first anticipated completion in about 4 months prior to commencing the mining operations concurrent with the subsequent stages. The initial development will include the following installations and preparations.

- Mine quarters and workshop
- Infrastructures (mine roads)
- TSF (tailings dam and treatment/ polishing pond)
- Surge pond, sediment basin and drainage
- Ore storage yard (OSY)
- Ore washing plant (OWP)

2.4.3 Mining Operations

The mining operations will consist of surface excavations and processing for both the surface and sulfide ores. The surface ores essentially are confined to the near surface area comprising mainly weathered rock materials with oxidized sulfides and are underlain by the sulfide ores in solid rock formation. Essentially, the mineralized areas within PT.20-13100442 will be mined in phases, with Phase 1 involving the Mantri Block, commencing possibly during the OWP installation.

Mining of the surface ore

The surface ores are literally oxidized sulfides and are confined to the near-surface area (**Section 3.1.4**), where the overburden materials will be first removed by excavations to uncover the surface ores layer. The run-of-mine (ROM) consisting of the surface ores will be then trucked to the processing plant to undergo a series of physical segregation including washing, sizing and screening to eventually free the heavier ore particles. The processing of the surface ores essentially will be mechanical and will not involve chemicals.

Mining of the sulfide ore

The sulfide ores become extractable after removing the surface ores layer. The mining of the sulfide ores will require fragblast, where the shot fragments will then undergo a series of segregation processes involving sizing through crushing to pulverizing (150 μm) to concentrating the ores through froth flotation separation using PAX (**Annex B8**) as the flotation agent and MIBC as the frother. In the flotation, PAX preferentially attaches to sulfides to thus allowing the lighter gold particles floated on the froth and collected in the flotation cells. PAX and MIBC essentially do not chemically react with each other or the sulfides in the process, and that the used reagents shall be categorized (**Table 2.5**) for disposal according to SWR (2005) where unrecoverable.

P 2.4: Process flow of the mining operations.

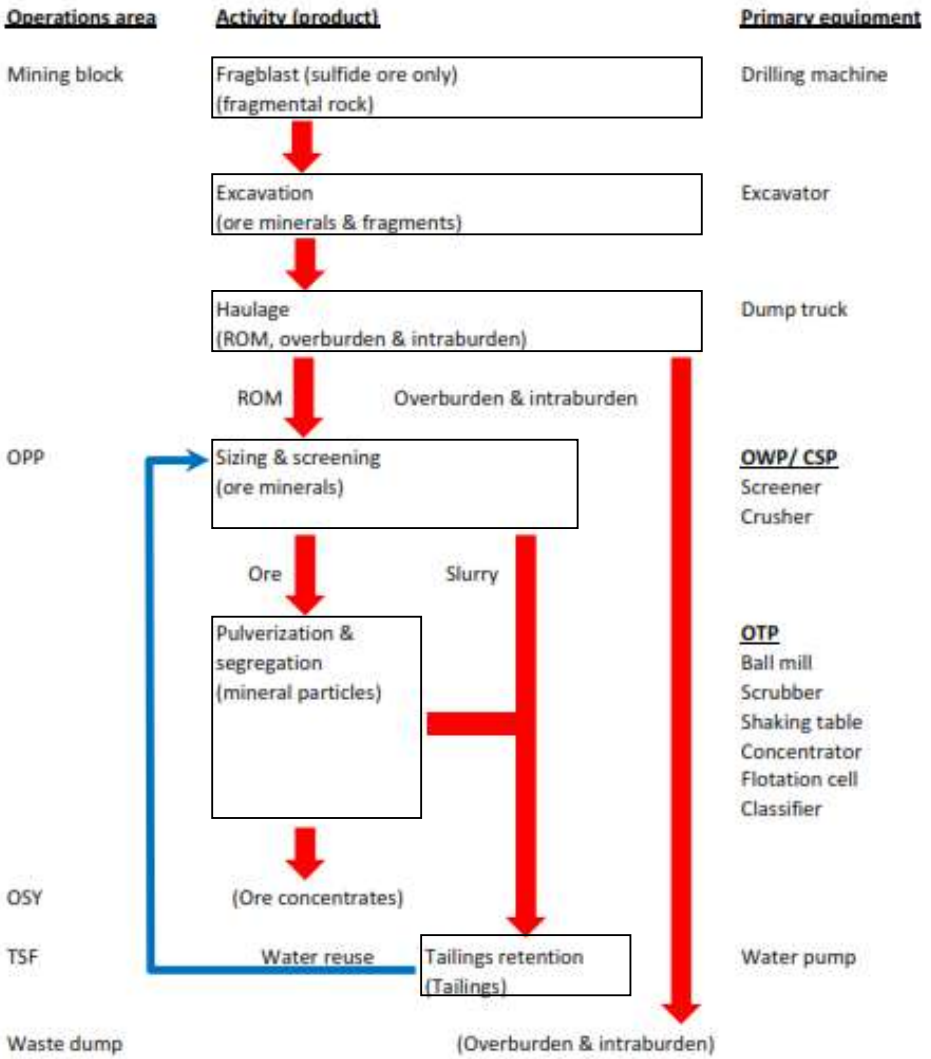


Table 2.5: Scheduled waste categorization (SWR, 2005)

Code	Description
SW1	Metal & metal-bearing wastes
SW2	Waste containing principally inorganic constituents which may contain metals & organic materials
SW3	Waste containing principally organic constituents which may contain metals & inorganic materials
SW4	Waste which may contain either inorganic or organic constituents
SW5	Other wastes

Overburden and intraburden clearance

The overburden and intraburden are essentially waste earth and rock materials, with the former forming the surface layer overlying the ore body and the latter mainly the host rocks. The overburden will be progressively displaced mainly during the mine development while the intraburden during the operations, and that such materials hence removed will be then tipped at the waste dumps.

Waste tipping

Mineral processing essentially separates the ore minerals from the gangue (ie materials other than the wanted minerals in the ore deposit), and undesired tailings thus produced will be retained at the TSF consisting of a tailings dam and polishing ponds. The solid overburden and intraburden waste materials otherwise will be tipped at the waste dumps.

Stockpiling

Shot fragmental rocks may be temporarily stockpiled in open air at the excavation area prior to further processing, while the processed concentrates otherwise at the sheltered storage yard for scheduled shipment.

Haulage and transportation

Mining trucks will be used for hauling the raw deposits to the processing plant, while tipper trucks for transporting the processed concentrates from the storage yard to the designated jetty.

Routine maintenance

The routines will include infrastructural maintenance covering the haul roads and waste dump, and necessary servicing and repairs of the mine machinery and equipment *in situ* or at the workshop.

2.4.4 Cessation

Cessation of the mining operations will require the Project to *inter alia* rehabilitating the disturbed areas such as the waste dumps, removing the structural hazards as appropriate, and necessarily maintaining the TSF secured and functional over an extended period of time. Essentially, the rehabilitative process may be progressive over the course of mining to eventually realize the mined-over area into the proposed resort and theme park.

3 DESCRIPTION OF THE EXISTING ENVIRONMENT

3.1 Physical Environment

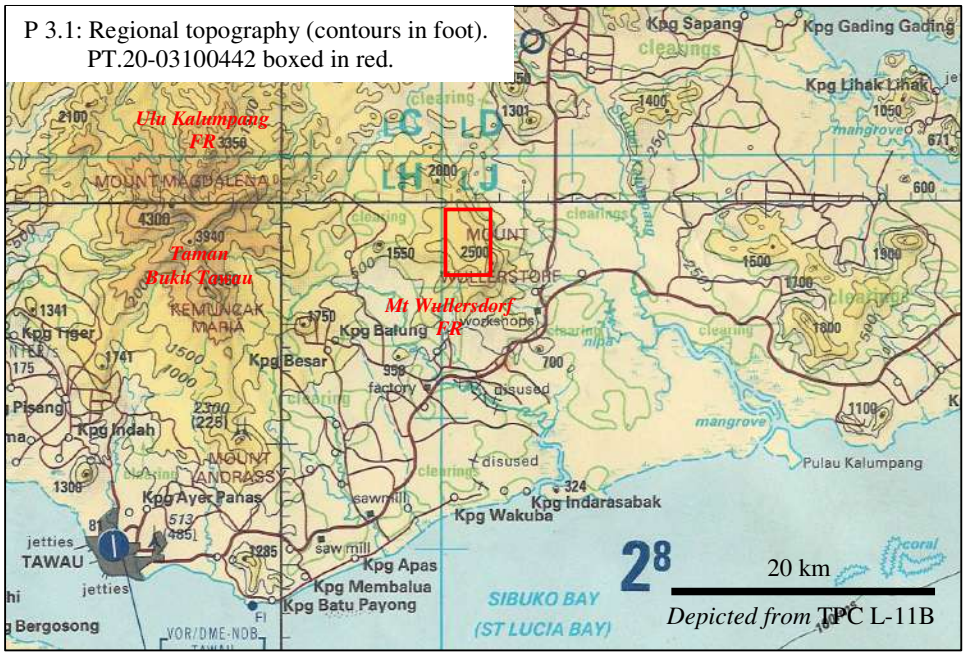
3.1.1 Meteorology

Rainfall is convectional with monsoonal influence for an annual average about 1,826 mm over 172 wet days typical with increasing rain towards the year end.

3.1.2 Topography

PT.20-13100442 (**Figure A2**) consists of the southwesterly and northeasterly dipping slope areas, separated by a curvilinear ridge grossly running through Bukit Mantri and Bukit Tundung. The Mantri peak is located just northwest off-site at an elevation about +564 m AMSL while the Tundung peak within the site at about +600 m AMSL edging the eastern boundary towards southeast.

P 3.1: Regional topography (contours in foot). PT.20-03100442 boxed in red.



The Mantri Block is located on the southwesterly dipping slope that gradually descends into Sg Mantri Kanan along the southwestern border areas lowest at about +200 m AMSL.

PT.20-13100442 partly covers the peak area of Mt Wullersdorf which is located east of Taman Bukit Tawau and separated by Sg Mantri.

3.1.3 Hydrology

PT.20-13100442 is located at about the centre area of Kalumpang Basin, which covers an area about 1,006 km^2 encompassing Sg Kalumpang and its tributaries consisting mainly of Sg Malati and Sg Mantri where the latter branches into Sg Mantri Kanan originating in Mt Wullersdorf FR and Sg Mantri Kiri in Taman Bukit Tawau along with Sg Malati further upstream of Sg Kalumpang.

Sg Mantri Kanan is truncating the southwesterly dipping slopes along the southwestern site boundary areas, where the stream is about 6-m wide and is the main stream at the site. Sg Mantri Kanan runs westerly to eventually merge with Sg Mantri Kiri about 10 km downstream off-site before turning into Sg Kalumpang about 12 km further downstream. Sg Mantri Kanan originates in Mt Wullersdorf FR, while Sg Mantri Kiri and Sg Kalumpang in Taman Bukit Tawau and Ulu Kalumpang FR respectively.

The other stream at the upper eastern area cuts through the northeasterly dipping slopes of the site and is a tributary of Sg Tundong that also eventually runs into Sg Kalumpang about 10 km east off-site.

Water quality

Water samples (**Table 3.1**, **Figure A1**) from Sg Mantri Kanan at the entry (SGD-WLF-WS1) and exit (SGD-WLF-WS2) points along the site boundary have generally indicated the ambient water quality (**Annex B9**) not inferior to WQI Class III (**Table 3.2**), with traces of heavy metals (**Table 3.3**) grossly conforming to NWQSM Class II except with higher aluminium (0.4%) and manganese (0.16%) from the site.

Table 3.1: Baseline water samples*

Sample no	WS1	WS2	WS3	WS4
Lat (N)	04°28’46.8”	04°29’46.4”	04°30’02.1”	04°36’03.7”
Long (E)	118°06’55.8”	118°06’02.8”	118°04’00.7”	118°09’51.2”
River	Sg Mantri Kanan			Sg Kalumpang
Position	Entry point	Exit point	Off-site tributary 5 km downstream west of WS-2	32 km off-site downstream NE of WS-3
Immediate influence	Mt Wullersdorf Forest Reserve	Mineral exploration	Oil palm plantation activities	

*refer **Figure A1**

Table 3.2: Water quality index (WQI)

Parameter	WQI Class II	WS1	WS2	WS3	WS4
NH_3-N (mg/l)	0.1 – 0.3	0.29	0.25	0.26	(0.37)
BOD (mg/l)	1 – 3	(5)	(6)	(4)	(5)
COD (mg/l)	10 – 25	3	< 2	14	11
DO (mg/l)	5 – 7	-	-	-	-
pH	6 – 7	-	-	7.6	7.8
TSS (mg/l)	25 – 50	8	14	5	4

NB: Disqualified parameters in brackets

P 3.2a: Water sampling (SGD-WLF-WS1) at the Sg Mantri Kanan entry point of the site. 11.11.2014

P 3.2b: Water sampling (SGD-WLF-WS2) at the Sg Mantri Kanan exit point of the site. 11.11.2014

The stream water has maintained about the similar quality further downstream (SGD-WLF-WS3 & SGD-WLF-WS4), despite the presence of oil palm estates in the neighbouring areas invariably immediate to the streams.

Table 3.3: Baseline water quality

No	Parameter	WS1	WS2	WS3	WS4
1. Physical (mg/l unless stated otherwise)					
1.1	Temperature (°C)	-	-	26.0	27.3
1.2	Turbidity (NTU)	18	16	15	20
1.3	Coliforms (MPN/100ml)				
1.3a	Total coliform	23	17	350	280
1.3b	Faecal coliform	13	11	33	20
1.4	pH	-	-	7.6	7.8
1.5	BOD	5	6	4	5
1.6	COD	3	ND (< 2)	14	11
1.7	TDS	46	47	83	109
1.8	O&G	ND (< 1)	ND (< 1)	ND (< 1)	ND (< 1)
1.9	DO	-	-	10.3	68.1
1.10	TSS	8	14	5	4
2. Chemical (%)					
2.1	Ag (silver)*	ND[2]	ND[2]	ND[2]	ND[2]
2.2	Al (aluminium)	1.3	0.4	0.17	0.82
2.3	As (Arsenic)*	0.012	0.012	ND[3]	ND[3]
2.4	Cd (cadmium)*	ND[2]	ND[2]	ND[2]	ND[2]
2.5	CN (cynide)	ND[3]	ND[3]	ND[3]	ND[3]
2.6	Cr (chromium)*	ND[1]	ND[1]	ND[1]	ND[1]
2.7	Cu (copper)*	ND[2]	ND[2]	ND[2]	0.04
2.8	Fe (iron)	1.21	0.68	0.54	0.65
2.9	Mg (magnesium)	1.3	1.6	1.6	3.3
2.10	Mn (manganese)	0.06	0.16	0.06	ND[2]
2.11	Na (sodium)	1.5	1.6	2.3	4.2
2.12	NH_3-N	0.29	0.25	0.26	0.37
2.13	Ni (nickel)*	ND[2]	ND[2]	ND[2]	ND[2]
2.14	Pb (lead)*	ND[3]	ND[3]	ND[3]	ND[3]
2.15	Sb (antimony)*	ND[4]	ND[4]	ND[4]	ND[4]
2.16	Se (selenium)*	ND[4]	ND[4]	ND[4]	ND[4]
2.17	SO_4	12	21	16	8.2
2.18	Zn (zinc)*	ND[4]	0.02	ND[4]	ND[4]

*Heavy metals; ND: Not Detectable; detection limits: 1 (0.001), 2 (0.01), 3 (0.05), 4 (0.1)

P 3.2c: Water sampling (SGD-WLF-WS3) along an off-site tributary of Sg Mantri Kanan. 04.12.2014

P 3.2d: Water sampling (SGD-WLF-WS4) along Sg Kalumpang. 04.12.2014

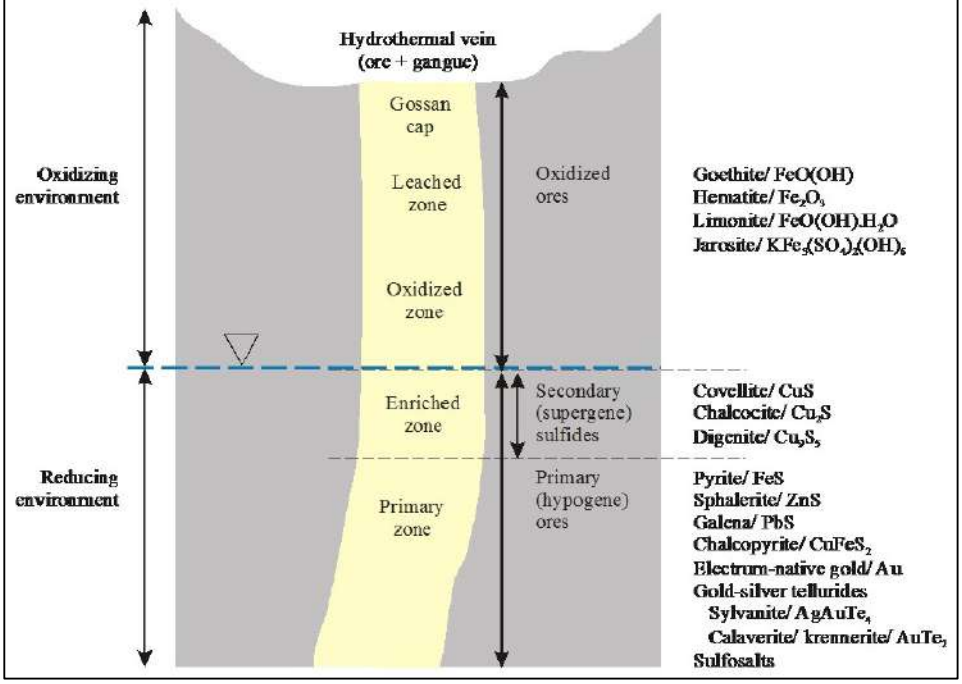
3.1.4 Geology

The Mantri Block is immediately underlain by the Pliocene andesitic flows and pyroclastics, intercalated with sedimentary clastics and intruded by granodiorite – dioritic dykes with auriferous (gold-bearing) veins, and further underlain by the older Kalumpang Formation.

Mineralization

The ore mineralization is essentially epithermal that occurs as a series of quartz-sulfide hydrothermal veins coalesce in tension fractures in the rock formation, where the ore mineralogy generally is characterized by pyrite, sphalerite, galena, chalcopyrite, electrum-native gold, sulfosalts and gold-silver tellurides. However, the sulfide ore is susceptible to oxidation through weathering upon prolonged exposure and may be thus replaced by goethite, haematite, jarosite, limonite, covellite, chacocite, digenite and manganese oxides. Consequently, the oxidized ore is confined to the near-surface area and is about 20-m thick, while the sulfide ore probably reaching 280-m deep.

P 3.3: Generalized mineralization at the site.



3.2 Biological Environment

3.2.1 Flora

PT.20-13100442 consists of an area about 1.67% previously in the Mt Wullersdorf – Ulu Kalumpang FR (30,021 ha), and is presently covered with secondary forest vegetation and surrounded by the forest reserves immediately south and north. Oil palm is otherwise predominant, with neighbouring plantation estates covering the northern area notably from the northeast to northwest.

The Ulu Kalumpang – Mt Wullersdorf forest trees are mainly dipterocarps and non-dipterocarps. The dipterocarps comprise typically *Cotylelobium* (eg Resak Tempurung), *Dipterocarpus* (eg Keruing), *Dryobalanops* (eg Kapur), *Parashorea* (eg Urat Mata) and *Shorea* (eg Selangan Batu, Seraya, Kawang and Melapi) while the non-dipterocarps *Anthocephalus* (eg Laran) and *Octomeles spp.* The Ulu Kalumpang and Mt Wullersdorf FR were previously estimated (SFD, 2011) about 16.3% and 9.4% already encroached by the oil palm plantations (**Table 3.4**).

Table 3.4: Forest stratification & oil palm encroachment (*after* SFD, 2011)

Forest reserve	Ulu Kalumpang FR		Mt Wullersdorf FR	
	Area (ha)	%	Area (ha)	%
Encroachment	8,528	16.34	734	9.37
Stratification				
Stratum 1	6,412	12.29	4,222	53.89
Stratum 2	8,172	15.66	2,879	36.75
Stratum 3	28,266	54.16	-	-
Stratum 4	808	1.55	-	-
Total	52,186	100.00	7,835	100.00

3.2.2 Fauna

Orangutan was reportedly (SWD, 2011) present and projected (Alfred et al, 2010) a population about 5 – 15 per km^2 for the coverage area under PT.20-13100442 then in the Mt Wullersdorf – Ulu Kalumpang FR, with clouded leopard, Bornean sun bear, pig-tailed macaque and banteng (SFD, 2012) and some common wild boar, deer, porcupine, greater mousedeer, Malay civet, long-tailed macaque, Bornean yellow muntjac, banded linsang and monitor lizard (WWF-MY, 2012 – unpublished, with permission).

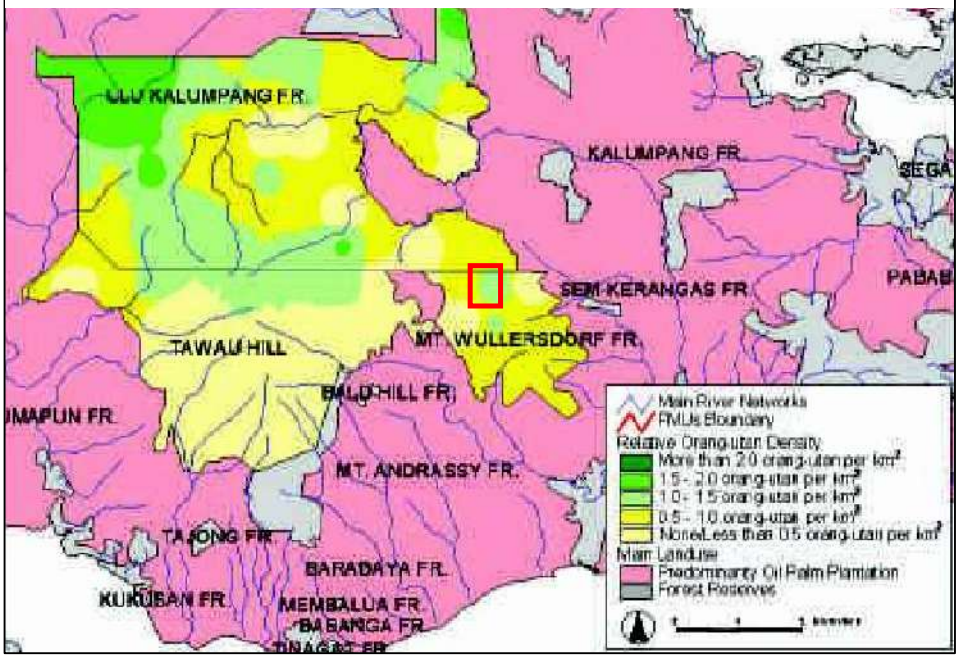
The Proponent has commenced mineral explorations at PT.20-13100442 since 2013, with further explorations still currently on-going at the site. There were since no reported presence of orangutans at the site, nor recent reconnaissance to the exploration areas indicated otherwise.

3.3 Socio-economic Environment

3.3.1 Existing land use and water use

PT.20-13100442 (**Figure A1**) is immediately surrounded by Ulu Kalumpang – Mt Wullersdorf FR, with otherwise mainly oil palm plantations immediately further off-site along the existing feeder roads to the main road. Taman Bukit Tawau (Tawau Hill Forest Reserve) is located about 4 – 5 km southwest and is separated from the site by an isolated oil palm estate. The existing access road essentially cuts through Taman Bukit Tawau then the isolated oil palm estate before entering Mt Wullersdorf FR to then reaching the site.

P 3.4: Orangutan population estimate (*after* Alfred et al, 2010 *as in* SWD, 2011). PT.20-13100442 boxed in red.



P 3.5: Kg Bukit Kawa by the main road roundabout.

04.12.2014

P 3.6: Sipadan Mangrove Resort near Sg Kalumpang estuary.

04.12.2014

There are no indigenous communities within 5 km from the site. Kg Airport Batu 10 (04°36'30"N, 118°10'26"E) the nearest and is about 13 km northeast while Kg Bukit Kawa about 14 km south by the main road junction. Kg Pinang (04°24'43"N, 118°06'00"E) is the only riparian community while Sipadan Mangrove Resort (04°21'24"N, 118°19'12"E) the only resort establishment along Sg Kalumpang, both located amidst the mangrove forest about 70 and 80 km downstream respectively from the site (about 15 and 5 km from river mouth), with an isolated island community (Kg Bakakau) and a police base by the north and south coast respectively on Pulau Kalumpang just by the estuary.

Oil palm predominantly covers the massive area neighbouring Sg Mantri – Kalumpang other than the mangroves at the downstream area, along with some oil palm nursery and a local aquaculture farm by the coast of the estuary.

There are 6 potable water intake stations (**Table 3.5**) downstream (≥ 18 km) from the site along Sg Mantri – Kalumpang for the plantation communities and Kunak mains. The downstream riparian and coastal communities and resort do not derive potable water from the river but rainwater and other alternative sources.

Table 3.5: Potable water intakes*

Intake no	Lat (N)	Long (E)	Supply radius
LW1	04°33'28.0"	118°05'33.1"	Local plantation quarters
LW2	04°36'03.0"	118°09'43.1"	Kg Airport Batu 10 & quarters
LW3	04°35'07.4"	118°11'13.2"	Kunak mains
LW4	04°35'56.3"	118°11'36.2"	Local palm oil mill & quarters
LW5	04°31'41.1"	118°14'01.0"	Local plantation quarters
LW6	04°28'49.0"	118°14'43.1"	Local plantation quarters

*refer **Figure A1**

3.3.2 Gazette (designated) land use

PT.20-13100442 covers an area degazetted from Mt Wullersdorf – Ulu Kalumpang FR (Class 1). At present, the forest reserve still covers a larger extent (**Figure A1**) of the surrounding areas immediately south and northwest, with the remaining otherwise designated Countryside Area.

4 SCOPE OF STUDY

The EIA will predict and evaluate the adverse environmental impacts from the mining operations and proposing mitigation measures against such impacts along with recommended monitoring programmes to maintain compatibility of the Project with protection of the environment.

The environmental impacts (**Table 4.1**) are categorized main or potential subject to the primary effects, some of which long-term dependent upon their characteristics (**Section 5**). Other impacts not readily hereby identifiable shall be accordingly determined during the course of EIA.

Table 4.1: Environmental impacts and the primary effects

No	Impact	Primary effects (associated impact)
Physical impacts		
1	Water pollution	
	Sedimentation	Health risk
	Chemical	Chemical, safety & health risks
2	Waste disposal	
	Earth dumps	Safety (erosion) & health (sedimentation) risks
	Tailings	Chemical, safety & health risks
	Scheduled waste	Chemical, safety & health risks
3	Soil erosion	Safety (failed slope) & health (sedimentation) risks
4	Air pollution (dusting)	Health risk
5	Noises	Health risk
6	Fragblast (inclusive)	
	Airblast	Safety risk
	Ground vibration	Safety (failed slope) risk
	Flyrocks	Safety risk
7	Landscape	Aesthetic depreciation
Biological impacts		
8	Ecological (inclusive)	
	Habitat	Destruction (site clearance, arson)
	Biodiversity	Safety (poaching, road kill) & health risks
Socio-economic impacts		
9	Haulage traffic	Safety & health (dusting, noises) risks
10	Safety & health	Safety & health risks (as per 1 – 6 & 9 above)

4.1 Main Environmental Impacts

The following environmental impacts are prioritized for the Project.

- Water pollution (physicochemical)
- Waste disposal (earth waste, tailings, scheduled waste)
- Soil erosion
- Ecological impacts
- Safety and health hazards

4.2 Other Potential Impacts

Other adverse environmental impacts are as follows:

- Air pollution
- Noises
- Fragblast
- Haulage traffic (with related dusting and noises)
- Landscape alteration

4.3 EIA Matrix

The EIA matrix (**Table 4.2a**) provides an indicative significance of the impacts from the various activities during the development (**Section 2.6.2**), operations (**Section 2.6.3**) and cessation (**Section 2.6.4**) without mitigation and rehabilitation, with respect to the magnitude, permanence, reversibility and cumulative extent of the effects of such impacts (**Table 4.2b**).

Table 4.2a: EIA matrix

Environmental Aspect	Impact	Assessment Rating				Score
		M	P	R	C	
Development						
Physical	Water pollution					
	Sedimentation	3	3	2	2	Medium
	Chemical (not applicable)					
	Waste disposal					
	Earth dumps	1	3	2	3	Medium
	Tailings (not applicable)					
	Scheduled waste (not applicable)					
	Soil erosion	1	3	3	3	Medium
	Air pollution (dusting)	1	2	2	2	Medium
	Noises	2	2	1	1	Minor
	Fragblast (not applicable)					
	Landscape	1	3	3	2	Medium
Biological	Ecological					
	Habitat	1	3	3	3	Medium
	Biodiversity	3	2	2	3	Medium
Socio-economic	Haulage traffic	3	1	2	3	Medium
	Safety & health	3	3	2	2	Medium
Operations						
Physical	Water pollution					
	Sedimentation	3	3	2	2	Medium
	Chemical	3	3	3	2	Major
	Waste disposal					
	Earth dumps	1	3	2	3	Medium
	Tailings	1	3	2	3	Medium
	Scheduled waste	1	3	2	3	Medium
	Soil erosion	1	3	3	3	Medium
	Air pollution (dusting)	2	2	2	2	Medium

Table 4.2a: EIA matrix (cont)

Environmental Aspect	Impact	Assessment Rating				Score
		M	P	R	C	
Operations						
Physical	Noises	2	2	1	1	Minor
	Fragblast					
	Airblast	2	2	1	2	Minor
	Ground vibration	2	2	3	3	Medium
	Flyrocks	2	2	1	1	Minor
	Landscape	1	3	3	2	Medium
Biological	Ecological					
	Habitat	1	3	3	3	Medium
	Biodiversity	3	2	2	3	Medium
Socio-economic	Haulage traffic	3	2	2	3	Medium
	Safety & health	3	3	2	2	Medium
Cessation						
Physical	Water pollution					
	Sedimentation	3	2	2	2	Medium
	Chemical	3	2	3	2	Medium
	Waste disposal (not applicable)					
	Soil erosion	1	2	3	3	Medium
	Air pollution (dusting)	1	1	2	2	Minor
	Noises (not applicable)					
	Fragblast (not applicable)					
	Landscape (not applicable)					
Biological	Ecological (not applicable)					
Socio-economic	Haulage traffic (not applicable)					
	Safety & health	1	3	2	2	Medium

Table 4.2b: Impact rating and score

Rating	1	2	3
Impact Aspect			
Magnitude (M)	Within site	Local	Regional
Permanence (P)	Negligible	Temporary	Permanent
Reversibility (R)	Negligible	Reversible	Irreversible
Cumulative (C)	Negligible	Non-cumulative	Cumulative
Impact Potential			
Score (sum of rating)	Minor (≤ 6)	Medium (7 – 10)	Major (> 10)

Note: Insignificant impacts are indicative as not applicable

The *magnitude* (M) indicates the change/ effect of the impact relative to the spatial boundaries, and is designated (1) for effect affecting only the Project site, (2) for effect limited to the immediate local surroundings and (3) for effect with regional (≥ 3 km) influence.

The *permanence* (P) indicates the temporary or permanent state of the impact, and is designated (1) for negligible effect/ no change/ not applicable, (2) for temporary effect and (3) for permanent effect.

The *reversibility* (R) indicates if the condition of the impact can be changed or controllable over its effect, and is designated (1) for negligible effect/ no change/ not applicable, (2) for reversible (restorable) effect and (3) for irreversible (non-restorable) effect.

The *cumulative* (C) extent indicates if the impact will have a single direct effect or cumulative effect over time, or a synergistic effect with other conditions (associated impacts), and is designated (1) for negligible effect/ no change/ not applicable, (2) for non-cumulative/ single effect and (3) for cumulative effect.

In considering the matrix, specific impact (eg haulage traffic) shall be inclusive of the associated residual impacts (eg noises) and the assessment rating hence indicated under such specific impact. The residual impacts are basically water, air and noise pollutions, which may persist after cessation of the operations if unattended.

4.4 Zone of Impact (ZOI)

The environmental impact influence or ZOI can be far-reaching and is hereby categorized (**Table 4.3**) according to development, operations and cessation stages for the worst case scenario based upon the existing environmental, topographical and geological settings.

Table 4.3: Potential ZOI*

No	Impact	Potential ZOI		
		Development	Operations	Cessation
Physical impacts				
1	Water pollution			
	Sedimentation	Sg Mantri – Kalumpang – estuary		
	Chemical	NA	Sg Mantri – Kalumpang – estuary	
2	Waste disposal			
	Earth dumps	Project site		NA
	Tailings	NA	Project site	
	Scheduled waste	NA	Project site	
3	Soil erosion	Project site		
4	Dusting	Project site	Mine surroundings	Project site
5	Noise	Mine surroundings		NA
6	Fragblast	NA	Mine surroundings	NA
7	Landscape	Project site		NA
Biological impacts				
8	Ecological			
	Habitat	Project site		NA
	Biodiversity	Mt Wullersdorf – Ulu Kalumpang FR – Taman Bukit Tawau		NA
Socio-economic impacts				
9	Haulage traffic	Haul road surroundings		NA
10	Safety & health	Project site – haul road surroundings		Project site

*refer **Table 4.2a** (assessment rating for *magnitude*); NA – Not applicable

5 DESCRIPTION OF THE IMPACTS AND PROPOSED ASSESSMENT METHODOLOGY

5.1 Main Environmental Impacts

5.1.1 Soil erosion

Soil erosion is the function of erosivity of rainfall and erodibility of soil, whereby the rains essentially scour away, loosen and break soil particles then washed down by the force of gravity and get carried away to hence resulting in soil loss, leaving behind an altered bare surface. Consequently, an altered bare slope surface with the formation of sheet, rill and gully erosion features will easily become destabilized and eventually lead to slope failure or landslide. Soil loss (A) often may be estimated using RUSLE (**Equation 1**).

$$A \text{ (mt/ ha)} = R*K*LS*C*P \quad \text{- Equation 1}$$

where
R = Rainfall erosivity factor
K = Soil erodibility factor
LS = Slope length & steepness factor
C = Cover management factor
P = Erosion control practice factor

Soil erosion is natural, but the process often may be invariably accelerated under anthropogenic influence, inevitably at the mine site (43 ha) and waste dump (20 ha), and may hence seriously affect stability of the exposed slopes and trigger collapse and mass wasting but essentially will be confined to the site. Soil erosion is permanent and irreversible and the effects often are cumulative with associated impacts and may persist beyond the operations.

However, the associated sedimentation can be devastating and may result in physical water pollution (**Section 5.1.2**) that covers a much larger influence along the rivers.

Aim of mitigation

- To minimize soil loss that may otherwise lead to physical water pollution by way of sedimentation
- To maintain stable mine benches, waste dumps and TSF

Assessment methodology

- Soil loss estimation using RUSLE as a basic instrument to identifying the best erosion control practice
- Engineering and geological assessments to designing stable and sustainable mine slopes, waste dump and TSF
- Identification of monitoring stations and frequency requirements based upon the above assessments

Monitoring programmes

- Compliance monitoring on the engineered slopes and such related stability enhancement installations
- Reporting on slope/ design failure and the restorative rectification

5.1.2 Water pollution

Water pollution is residual and covers the physical and chemical aspects of contamination. Physical pollution essentially is an after-effect of soil erosion hence resulting in sedimentation while chemical pollution primarily owing to AMD from the mine and effluents from mineral processing.

Physical

Eroded soil materials typically get carried by the surface runoff and deposited downstream through sedimentation, whereby the sediment yield (Y) may be estimated using MUSLE (**Equation 2**) and is specific to a storm event. Sediment yield is defined as the amount of eroded soil delivered to a point in the watershed that is remote from the original of the detached soil particles, which includes the erosion from slopes, channels and mass wasting but excluding the deposition amount before reaching the point. Serious downstream sedimentation often causes the rivers and waterways to shallow and prompting flash and regular floods in the low-lying areas.

$$Y \text{ (mt)} = 89.6(V*Q_p)^{0.56}(K*LS*C*P) \quad \text{- Equation 2}$$

where
V = Runoff volume
Q_p = Peak discharge
K = Soil erodibility
LS = Slope length & steepness
C = Cover management
P = Erosion control practice

Sedimentation is a typical after-effect of soil erosion (**Section 5.1.1**) that may seriously affect the downstream of Sg Mantri – Kalumpang. The effects may be permanent but non-cumulative and possibly reversed. Sedimentation essentially may persist beyond the mining operations.

Geochemical

AMD generally refers to acid drainage resulted from sulfide oxidation through mining. AMD may have significant impacts affecting the economics of the mining operations owing to its corrosive effects on infrastructure and equipment, the limitations on water reuse and discharge, and mine closure options, in as much the potential long-term impacts from decreasing pH and possibly increasing concentrations of heavy metals in the nearby water and soils.

The oxidation of the sulfide ores through weathering is a natural process that eventually leads to minerals replacement through chemical reactions and the beginning of acid (H^+) forming process such as follows:

FeS_2 (pyrite) + $3½O_2 + H_2O \rightarrow Fe^{2+} + 2SO_4^{2-} + 2H^+$ - Reaction 1A
$Fe^{2+} + ¼O_2 + H^+ \rightarrow Fe^{3+} + ½H_2O$ - Reaction 1B
$Fe^{3+} + 3H_2O \rightarrow Fe(OH)_3 + 3H^+$ - Reaction 1C

Oxidation (**Reaction 1B**) of Fe^{2+} (ferrous iron) to Fe^{3+} (ferric iron) in the mine water may take several travelling kilometres downstream under natural influence to result in precipitation (**Reaction 1C**) of $Fe(OH)_3$ (ferric hydroxide) through hydrolysis of Fe^{3+}, which may thereafter accelerate further sulfide oxidation (**Reaction 2**) in the presence of sulfide such as follows:

FeS_2 (pyrite) + $14Fe^{3+} + 8H_2O \rightarrow 15Fe^{2+} + 2SO_4^{2-} + 16H^+$ - Reaction 2

The precipitation of $Fe(OH)_3$ is a key stage producing AMD, and would be inevitable with oxidation of Fe^{2+} to Fe^{3+} and the subsequent hydroxide formation upon oxidation (**Reaction 1A**) of the sulfides to sulfates.

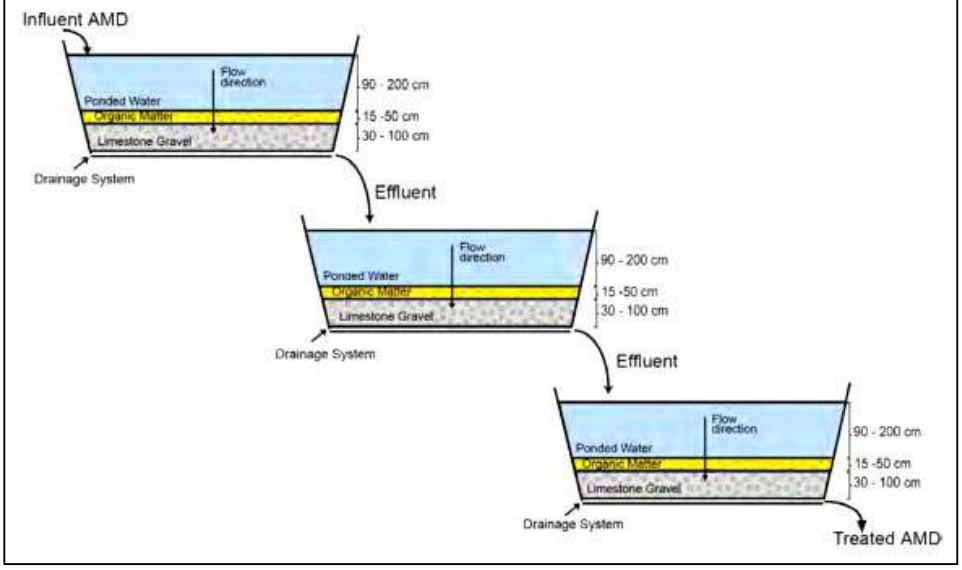
Chemical pollution from the discharge of tailings or untreated mine water can be detrimental to safety, health and environment, and the impact influence widespread along the downstream of Sg Mantri – Kalumpang to possibly reaching the estuary. Although some chemical effects can be permanent and non-reversible, it is possible to prevent the chemical reactions or contain the chemicals from producing the harmful effects. Essentially, chemical pollution may persist beyond the mining operations.

Henceforth, the Project has proposed adopting an active approach of water treatment with UF filtration system (**Figure A3**) additional to SAPS passive treatment (as previously proposed) for the mine water. The SAPS system essentially consists of a series of ponds lined with limestone gravels for treatment of AMD, while the UF system works on the principle of coagulation using PAC (**Annex B8**) as the coagulant.

Aim of mitigation

- To regulate surface runoff prior to entering natural waterways
- To maintain effluent quality conforming to JAS standard
- To contain sedimentation and chemical pollution
- To retard AMD formation for possible water reuse in mineral processing

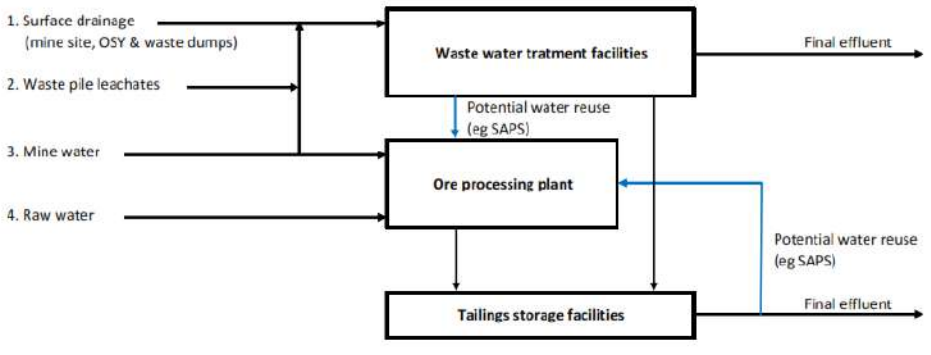
P 5.1: Schematic cross section of SAPS.



Assessment methodology

- Erosion and sedimentation assessment with reference to MSMA guideline
- Engineering assessment to designing the mine layout, drainage and TSF
- Analysis on the baseline water quality (refer **Section 3.1.3**) to establishing conformance requirement with reference to NWQSM and MOH standards
- Geochemical assessment to identifying potential mineral-related hazards
- Analysis on the viable AMD impoundment and feasible treatment (active/ passive) options for possible reuse of water in mineral processing
- Influence assessment on hydrogeology and Sg Mantri – Kalumpang
- Identification of monitoring stations and frequency requirements based upon the above assessments

P 5.2: Conceptual water balance & potential water reuse.



Monitoring programmes

- Conformance monitoring of the water quality of effluent from TSF with reference to established limits
- Compliance monitoring on the proposed water pollution mitigation and such related installations
- Reporting on spills and leaks of influent, effluent or such other hazardous materials and the restorative rectification

5.1.3 Waste disposal

The disposable waste materials may be categorized as liquid (aqueous) or solid, and hazardous or non-hazardous in nature. The hazardous materials essentially are more damaging to the environment and hence classified scheduled wastes regulated under SWR (2005), with the non-hazardous materials remaining notwithstanding possible environmental risks. Eventually, waste disposal will cease but the associated water pollution may persist beyond the mining operations.

Overburden and intraburden

The overburden consists of the surface earth materials and the intraburden the non-mineralized rocks (gangue). These overburden and intraburden materials are generally non-toxic and shall be tipped at the waste dump where they may be thus indiscriminately susceptible to erosion.

Tailings

Tailings are slurries and slimes derived from the OPP consisting mainly of AMD, and will be contained at the TSF prior to treatment through SAPS and UF systems for possible recycle and reuse of the water. Tailings may produce significant chemical pollution in the event of leaching into the rivers.

Scheduled waste

The scheduled waste (**Table 2.4**) from the mining operations will consist of spent oils and lubricants, the used chemical reagents from the OPP and the water treatment plant, that which shall be disposable or possibly recyclable for reuse. These materials can be damaging to the environment and the impact widespread in the event of spills and leaks into the rivers.

Aim of mitigation

- To minimize environmental hazards through compliance with SWR (2005)
- To contain the waste materials within physical limits

Assessment methodology

- Assessment on site suitability for the proposed waste dumps and TSF with reference to local environmental setting, topographic reliefs and foundation stability

Monitoring programmes

- Compliance monitoring on the structural integrity of the containment facilities

5.1.4 Ecological impacts

The chain mining activities from development to cessation of the mining operations will inevitably have impacts on the ecological environment. The impacts can be potentially long-term and widespread, with some effects possibly irreversible. Drastic ecological impacts will invariably lead to broken food chain, hence further endangering the rare species.

Ecological changes and adaptations often are accelerated with habitat destruction and changing biodiversity, which can be significant as influenced by the various impacts associated with the mine activities, and thereby the potential fragmentation effect and decreasing population to some species. However, the ecological impacts will cease upon cessation of the mining operations.

Habitat loss

The loss of habitat to some species will be inevitable, locally at the mining site and the facilities areas, and along the haul roads. The loss of the natural habitats will be permanent and the effects irreversible and cumulative with possible changing biodiversity. Incidentally, potential arson and uncontrolled activities also risk losing more habitats.

Biodiversity

The various mining activities will disturb the biodiversity in the influence area, such as fragmentation with truncation of the forest reserve area with haul roads potentially affecting some species as are also road kills with trucking and poaching activities, or heavy dusting possibly affecting the health being, or water pollution affecting the aquatic species.

Aim of mitigation

- To minimize disturbance onto the existing ecosystem
- To possibly sustain floral and faunal conservation

Assessment methodology

- Analysis on biodiversity conservation with reference to BBOP principles, with an option for wildlife corridor and alternative access road bypassing Taman Bukit Tawau
- Pre-developmental surveillance (eg transect analysis)
- Fire risk assessment
- Identification of monitoring stations and frequency requirements based upon the above assessments

Monitoring programmes

- Compliance monitoring on the forest reserve (100 m) and riparian (50 m) buffers
- Compliance monitoring on land clearance with reference to RIL specifications
- Compliance monitoring and policing on prohibition against poaching and disposal of waste materials with harmful chemical composition

5.1.5 Safety and health hazards

The safety and health hazards from the mining will affect the mine workers and the public, indiscriminately associated with soil erosion (**Section 5.1.1**), water pollution (**Section 5.1.2**), waste disposal (**Section 5.1.3**), dusting (**Section 5.2.1**), noises (**Section 5.2.2**), fragblast (**Section 5.2.3**) and trucking haulage (**Section 5.2.4**).

Consequently, a sound management with stringent safety, health and environmental policy will be critical along with stern policing and enforcement to necessarily maintaining a conducive environment beyond the mining operations.

Aim of mitigation

- To minimize safety and health risks
- To promote environmental performance

Assessment methodology

- Risk analysis on workplace
- Impact assessment on the local communities
- Applicability analysis on PPE with reference to JKKP standard
- Practicability analysis on SOP for the mining activities and handling of equipment

Monitoring programmes

- Compliance monitoring as per regulatory requirements

5.2 Other Potential Impacts

5.2.1 Air pollution

Air pollution includes dusting and exhaust smokes, which are inherent to the mining operations. Dusting will inevitably come from the various mining activities from drilling to crushing and screening to trucking, while the exhaust smokes from the running working machines.

Except with heavy wind, dusting and exhaust smokes from the mine activities will be likely confined to the immediate neighbouring areas of the Mantri mine, and the effects decreasing into cessation of the mining operations.

Aim of mitigation

- To suppress excessive dispersion of dusting
- To reasonably control exhaust emissions

Assessment methodology

- Assessment on the mining equipment options, prioritizing machinery with dusting suppression and low exhaust emissions
- Assessment on the ambient air quality (TSP) using TAS
- Assessment on periodic/ continuous monitoring requirement for the mining operations
- Identification of monitoring stations and frequency requirements based upon the above assessments

Monitoring programmes

- Conformance monitoring of dusting (TSP) with reference to MAAQG
- Compliance monitoring on the proposed air pollution control/ suppression mitigation and such related installations

5.2.2 Noises

Noises are inherent to running machinery and the mine activities, and the impact is naturally inevitable. The mining operations will hence introduce noises, invariably through the working machines and the various mining and processing activities throughout the mine development and operations. These inherent noises are audible and non-destructive, but often can be disturbing or hazardous to occupational safety and health.

Aim of mitigation

- To maintain noise levels within permissible boundary, and within environmental and safe working limits

Assessment methodology

- Forestry and cadastral buffer assessment
- Assessment on the mining and processing activities to establishing the conformance requirement on permissible operating hours with reference to prevailing JAS and JKKP standards, and to identifying monitoring stations
- Identification of monitoring stations and frequency requirements based upon the above assessments

Monitoring programmes

- Conformance monitoring of the noise levels with reference to established limits
- Compliance monitoring on the proposed noise mitigation and such related installations

5.2.3 Fragblast

Fragblast refers to rock blasting for fragmentation and will be imperative during the mining operations, where the shot rocks can be then sized into smaller fragments for further mineral processing. Specifically, fragblast produces airblast, ground vibration, flyrocks and some rather limited extent of noxious fumes (CO, NO_X and SO_X) from the use of explosives.

Airblast

Airblast consists essentially of noises with very low frequencies, typically beyond our audible spectrum. It is potentially structurally destructive owing to that very low frequency, more particularly when the resonance of the vibration is amplified by the structures with similar natural frequency and that if such resultant amplitude and PPV of the vibration are sufficiently high. Airblast is directional and the effect short-lived and limit to the immediate neighbouring area to the blast site.

Ground vibration

Ground vibration is generated by shockwaves released from detonation of explosives. Depending upon the blast design and rock characteristics, the immense amount of explosive energy may be transformed into ground vibration and/ or flyrocks to thus not only causing rock fragmentation but also potentially structural damages and possibly collapsing slopes and undermining safety at work. Ground vibration from blasting is non-directional and momentary, but the effects may be permanent although typically may only confine to the immediate areas neighbouring the blast site.

Flyrocks

Flyrocks are literally projectiles of fragmental rocks resulted from uneven confinement of explosive energy in the blastholes, and thus are potentially a safety hazard. The influence coverage of the projectiles often varies dependent primarily upon the geological characteristics of the local geology, in as much also the design for the blasts.

Eventually, improper blast designs not only produce excessive ground vibration but also indiscriminate airblast and flyrocks, while good designs trigger minimum ground vibration, less airblast and flyrocks, and more importantly optimizing fragmentation.

Aim of mitigation

- To optimize fragblast with appropriate blast design

Assessment methodology

- Engineering and geological assessments to designing the blast based upon characteristics of the rock formation with reference to the local environmental setting, cadastral and structural buffering requirements
- Assessment on explosives and blast initiation options with SHE prioritization
- Formulation of blast design based upon local environmental setting with reference to prevailing JMG guideline
- Assessment on scheduling of fragblast and explosives storage options
- Influence assessment on ecology and work safety
- Identification of monitoring stations and frequency requirements based upon the above assessments

Monitoring programmes

- Conformance monitoring of blast vibrations with reference to established JAS and JMG limits
- Compliance monitoring of fragblast with reference to established buffering requirements
- Reporting on environmental hazards triggered by blasting

5.2.4 Haulage traffic

Trucking is the priority option for hauling the processed ores *en route* from the site to the jetty. Essentially, trucking along the existing roads will incur an increase in the traffic density, where these roads currently appear chiefly used by the plantations as the main haul route to the main road.

Essentially, the mine equipment will be trucked to the site starting the development stage, with increasing trucking frequency during the operations for transporting the ore materials for export. The haulage traffic will be relatively low during the development and cessation stages, but can be significant during the operations and the associated effects with dusting and noises possibly risking public safety and health.

Aim of mitigation

- To minimize traffic impact for the affected communities
- To possibly avoid accidents and road kills

Assessment methodology

- Traffic observations and prediction on foreseeable changes
- Assessment on the environmental and operational feasibility of using the existing feeder roads conforming to JKR requirement for trucking haulage, with an option for alternative route

Monitoring programmes

- Compliance monitoring on the proposed dusting and traffic safety mitigation and such related installations

5.2.5 Landscape alteration

Surface mining essentially changes the surface topography, forming depressions across the excavation areas and raising elevations of the other such as the waste dump. Massive landscape changes are typically permanent and irreversible.

The Project has to-date delineated about 43 ha of extractable mineralized area for the Mantri mine, and proposed about 20 ha for the waste dump and 15 ha for the TSF. The topographic features of these areas eventually will be permanently altered and impossibly restorable upon cessation of the operations, but possibly subject to rehabilitation for further redevelopment such as a resort and eco-theme park.

Aim of mitigation

- To appreciate environmental aesthetics of the mined-over/ disturbed areas
- To contain environmental hazards from the mined-over/ disturbed areas

Assessment methodology

- Assessment on progressive rehabilitation with reference to the proposed redevelopment option
- Residual impact assessment for the mined-over and/ or disturbed areas

Monitoring programmes

- Compliance monitoring on the proposed rehabilitation

6 DATA COLLECTION

The TOR was based upon the following findings and sources of reference.

6.1 Activities

- Preliminary assessments on 21.08.2014, 11.11.2014, 04.12.2014 and 31.03.2015 to correlating the environmental settings with the proposed mining concept for the operations
- Baseline water sampling at the entry and exit points of Sg Mantri Kanan along the proposed border area of the site, and downstream at the immediate river junction offsite and Sg Mantri – Kalumpang junction (refer **Section 3.1.3**)
- Land use and water use assessment along Sg Kalumpang up to estuary and along the access road from the main road junction (refer **Section 3.3.1**)
- Liaison with SFD, SWD and WWF-MY on floristic and faunal researches, references and findings (refer **Section 3.2**)

6.2 Data

6.2.1 Maps and plans

Cadastral

- *District of Tawau map.* Scale 1:12,500. JTU, KK

Geological

- *Geological map of Sabah.* Scale 1:500,000. 1985; *Hydrogeological map of Sabah & Labuan Island.* Scale 1:500,000. 2007. JMG, KK

Soil

- *The soil of Sabah – Tawau NB 50-15.* Scale 1:250,000. 1974. UK

Topography

- *Restricted map Apas Balung 4/118/9 & Mastyn 4/118/5.* Scale 1:50,000. 1985. JUPEM, KK
- *Tactical pilotage chart TPC L-11B.* Scale 1:500,000. 1989. DGMS, London

6.2.2 Documents and reports

Legislation

- *Environment Protection Enactment.* 2002. State Gov of Sabah, KK
- *Environment Protection Enactment (Prescribed Activities) (EIA) Order.* 2005. State Gov of Sabah, KK
- *Mineral Development (Operational Mining Scheme, Plans & Record Books) Regulations. PU(A)067/2007*. 2007. JMG, KL
- *Mineral Enactment.* 1999. State Gov of Sabah, KK
- *Wildlife Conservation Enactment.* 1997. State Gov of Sabah. KK

Reporting guidelines

- *Handbook on EIA in Sabah.* 2005. JPAS, KK
- *EIA guidelines for mines & quarries. EG 7/95.* 1995. JAS, KL

Other references

- *A summary of passive & active treatment technologies for AMD.* 2005. ACMER
- *Forest conservation management plan – Ulu Kalumpang Forest Reserve, Mt Wullersdorf Forest Reserve, Kalumpang FR & Madai Baturong FR (01.01.2011 – 31.12.2020).* 2011. SFD
- *Introduction mining engineering*. 2002. JWS
- *Malaysia's 5th national report to convention on biological biodiversity (CBD).* 2014. MNRE
- *Orangutan Action Plan (2012 – 2016)*. 2011. SWD
- *Proposed opencast mining scheme in Mining Lease of 1,000 ha for gold mining operation in Mount Wullersdorf area, Tawau.*. 2014. KMCS, PJ
- *Rainfall data for Tawau.* 2011. JMM, KK
- *Report on clouded leopard survey in Ulu Kalumpang FR, Sabah.* 2012. WWF-MY
- *The Ulu Kalumpang – Wullersdorf sustainable forest management project. In Forestry Annual Report.* 2012. SFD
- *TOR (SEIA) for the proposed gold mining at Mt Wullersdorf, Tawau, Sabah.* 2015. Tor-Sgd-15-001. GME

6.3 Consulting Authorities

The proposed consulting authorities include but not limit to the following listing.

- Jabatan Alam Sekitar
- Jabatan Hidupan Liar Sabah (SWD)
- Jabatan Kerja Raya
- Jabatan Meteorologi Malaysia
- Jabatan Mineral & Geosains
- Jabatan Pengairan & Saliran
- Jabatan Perancang Bandar & Wilayah
- Jabatan Perhutanan Sabah (SFD)
- Jabatan Perikanan Sabah
- Jabatan Perlindungan Alam Sekitar
- Jabatan Tanah & Ukur
- Majlis/ Pejabat Daerah Tawau

7 WORK SCHEDULE

The Special EIA is anticipated (**Table 7.1**) completion in about 20 weeks from TOR approval, subject to available information and data and such other additional inputs as may be determined by JPAS.

Table 7.1: EIA scheduling and reporting

Activity \ Week	1	3	5	7	9	11	13	15	17	19
Field surveys, sampling & data collection										
Data collation, analyses & interpretation										
Drafting report										
Draft report review										
Finalizing report & submission to JPAS										

8 STUDY TEAM

Table 8.1 lists the EIA team members for the Project.

Table 8.1a: EIA team members (registered)

No	Name	Registered expertise	Responsibilities & contributions
1	**Tan Han Meng** CPESC, MIGM, FIQ S0018 Exp: 30.09.2015	Geology & blasting	Project manager, blasting, geological, erosion & sediment control
2	**Hillery Niting** S0019 Exp: 30.09.2015	Socio-economics & land use	Socio-economic & land use
3	**Freddy Lee** S0023 Exp: 30.09.2015	Survey & mapping/ GIS	GIS
4	**Eng Weng Hong** S0032 Exp: 30.09.2016	Forestry & hydrology	Forestry & hydrology
5	**Ng Ling Pheng** CHRA S0179 Exp: 12.02.2016	Air, noise & water quality	Air, noise & water quality, chemical health risk
6	**Betsy Sylvester** S0012 Exp: 30.09.2016	Forestry & biology (Flora & fauna)	Biological & wildlife

Table 8.1b: EIA team members (non-registered)

No	Name	Responsibilities & contributions
1	**Ir Lee Kam Fatt** P Eng (Mining) M Sc (Surveying)	Mining engineering (**Annex B1-2**)
2	**Albrecht P Raphael** B Engr Chemical Engineering	Chemical health risk & waste management
3	**Ivoni Felix** B Sc (Hons) Conservation Biology	Biological & ecological
4	**Mohd Afinday Ahmad** B Sc (Hons) Conservation Biology	Air, noise & water quality