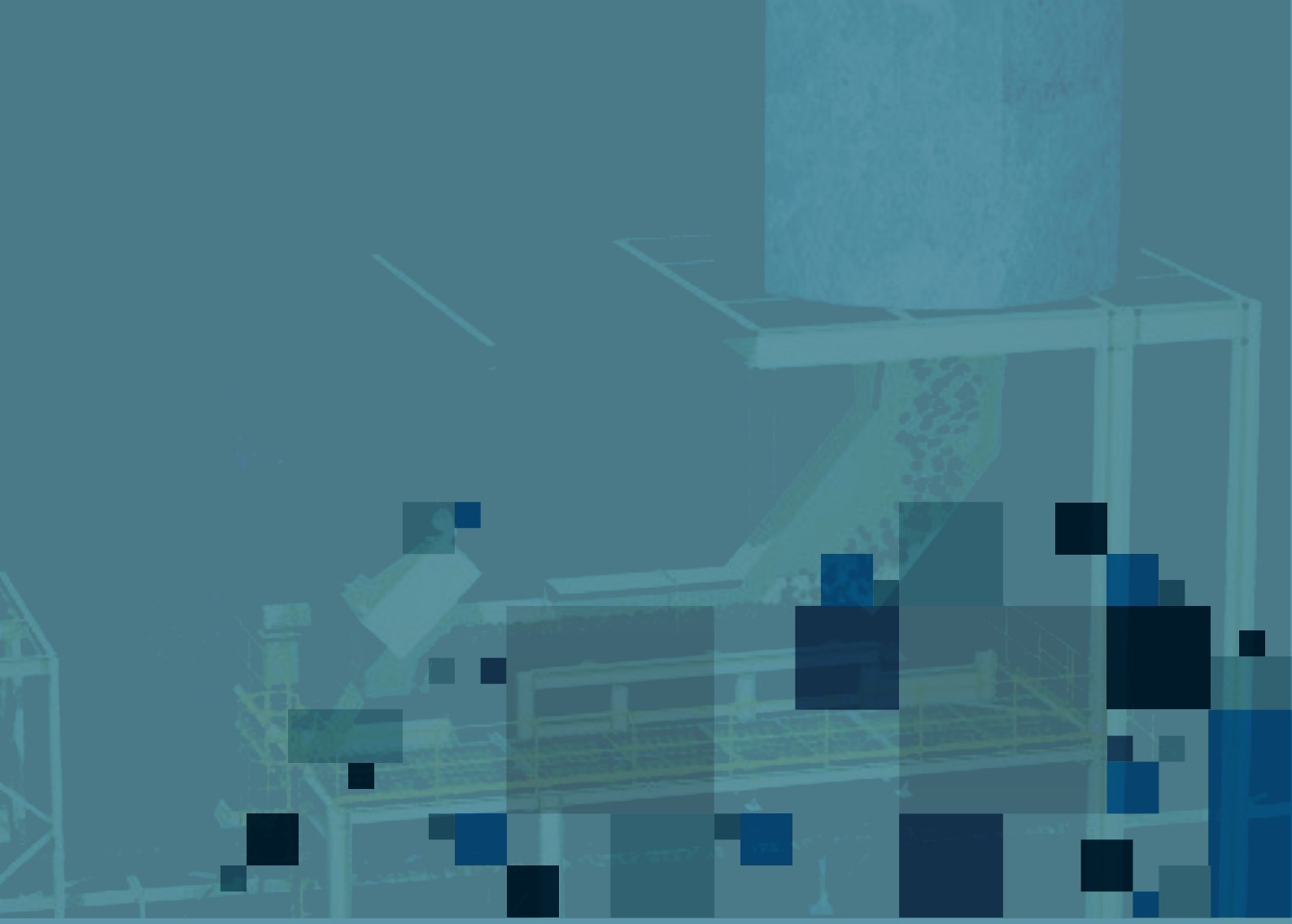
Wafi-Golpu Projek Envairomen Impek Stetmen

Ekseketiv Samari

June 2018

WAFI-GOLPU
JOINT VENTURE



This document is a translation into Tok Pisin of the Executive Summary of the Environmental Impact Study (EIS) prepared by Wafi Mining Limited and Newcrest PNG2 Limited in support of the Wafi-Golpu Project. Due to the limitations of translation, it is not a perfect reflection of the source document (which is in English), and also omits portions of the source document where required (including footnotes) to improve Tok Pisin efficency. It has been prepared solely in order to make the general contents of the source document available to as wide an audience as possible, and it is not intended to supplant or replace the English version of the Executive Summary contained in the EIS, which will prevail at all times and in all respects. To see footnotes please refer to the source document.

Dispela Ekseketiv Samari documen em translesen igo long Tok Pisin bilong Envairomen Impek Stadi (EIS) em Wafi Mining Limited na Newvrest PNG2 Limited i redim long Wafi-Golpu Projek. Bikos tok pisin ino nap tanim tok long olgeta hap bilong repot, dispela translesen ino karamapim olgeta samting insait long bikpela repot (dispela em inkludim ol footnotes) em i stap long tok Inglis. Dispela documen em karamapim ol bikpela hap tasol long EIS repot inap long planti manmeri ken ridim na kliaim tingting bilong ol long projek. Dispela documen ino senisim Tok Inglis repot long Ekseketiv Samari bilong EIS, we istap ofisal olgeta taim, na bai i no gat senis long em. Sapos yu laik lukim ol footnotes, yu mas lukluk long Ekseketiv Samari long tok Inglis.

Dispela Envairomen ImpekStetmen (EIS) i tok klia long ol bikpela hap bilong Wafi-Golpu Projek. Mo developmen bilong dispela Projek bai kam bihain long sampela mo drilling wok i kamap, wataim ol teknikal stadi, wantaim Gavamen i givim pemit na tok orait ikam long Govanmen na WGJV Kampani. Ol engineering disain na arapela stadi bai go het yet na ken kamapim sampela mo senis long disain wantaim taimtebol insait long EIS.

DISCLAIMER

This disclaimer applies to and governs the disclosure and use of this Environmental Impact Statement ("EIS"), and by reading, using or relying on any part(s) of the EIS you accept this disclaimer in full.

This Environmental Impact Statement, including the Executive Summary, and all chapters of and attachments and appendices to it and all drawings, plans, models, designs, specifications, reports, photographs, surveys, calculations and other data and information in any format contained and/or referenced in it, is together with this disclaimer referred to as the "**EIS**".

Purpose of EIS

The EIS has been prepared by, for and on behalf of Wafi Mining Limited and Newcrest PNG 2 Limited (together the "**WGJV Participants**"), being the participants in the Wafi-Golpu Joint Venture ("**WGJV**") and the registered holders of exploration licences EL 440 and EL1105, for the sole purpose of an application (the "**Permit Application**") by them for environmental approval under the Environment Act 2000 (the "**Act**") for the proposed construction, operation and (ultimately) closure of an underground copper-gold mine and associated ore processing, concentrate transport and handling, power generation, water and tailings management, and related support facilities and services (the "**Project**") in Morobe Province, Independent State of Papua New Guinea. The EIS was prepared with input from consultants engaged by the WGJV Participants and/or their related bodies corporate ("**Consultants**").

The Permit Application is to be lodged with the Conservation and Environment Protection Authority ("**CEPA**"), Independent State of Papua New Guinea.

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The EIS is the sole property of the WGJV Participants, who reserve and assert all proprietary and copyright ©2018 interests.

Reliance and Use

The EIS is intended and will be made available to CEPA, for review by CEPA and other applicable agencies of the Government of the Independent State of Papua New Guinea ("**Authorised Agencies**"), for the purpose of considering and assessing the Permit Application in accordance with the Act ("**Authorised Purpose**"), and for no other purpose whatsoever.

The EIS shall not be used or relied upon for any purpose other than the Authorised Purpose, unless express written approval is given in advance by the WGJV Participants.

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The EIS is meant to be read as a whole, and any part of it should not be read or relied upon out of context.

Limits on investigation and information

The EIS is based in part on information not within the control of either the WGJV Participants or the Consultants. While the WGJV Participants and Consultants believe that the information contained in the EIS should be reliable under the conditions and subject to the limitations set forth in the EIS, they do not guarantee the accuracy of that information.

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While the WGJV Participants, their Related Bodies Corporate and Consultants believe that the information (including any opinions, forecasts or projections) contained in the EIS should be reliable under the conditions and subject to the limitations set out therein, and provide such information in good faith, they make no warranty, guarantee or promise, express or implied, that any of the information will be correct, accurate, complete or up to date, nor that such information will remain unchanged after the date of issue of the EIS to CEPA, nor that any forecasts or projections will be realised. Actual outcomes may vary materially and adversely from projected outcomes.

The use of the EIS shall be at the user's sole risk absolutely and in all respects. Without limitation to the foregoing, and to the maximum extent permitted by applicable law, the WGJV Participants, their Related Bodies Corporate and Consultants:

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- expressly disclaim any liability for any consequential, special, contingent or penal damages whatsoever.

The basis of the Consultants' engagement is that the Consultants' liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of their engagement with the WGJV Participants and/or their related bodies corporate.

Disclosure for Authorised Purpose

The WGJV Participants acknowledge and agree that, for the Authorised Purpose, the EIS may be:

- copied, reproduced and reprinted;
- published or disclosed in whole or in part, including being made available to the general public in accordance with section 55 of the Act. All publications and disclosures are subject to this disclaimer.

Development of Project subject to Approvals, Further Studies and Market and Operating Conditions

Any future development of the Project is subject to further studies, completion of statutory processes, receipt of all necessary or desirable Papua New Guinea Government and WGJV Participant approvals, and market and operating conditions.

Engineering design and other studies are continuing and aspects of the proposed Project design and timetable may change.

NEWCREST MINING LIMITED DISCLAIMER

Newcrest Mining Limited ("**Newcrest**") is the ultimate holding company of Newcrest PNG 2 Limited and any reference below to "Newcrest" or the "Company" includes both Newcrest Mining Limited and Newcrest PNG 2 Limited.

Forward Looking Statements

The EIS includes forward looking statements. Forward looking statements can generally be identified by the use of words such as "may", "will", "expect", "intend", "plan", "estimate", "anticipate", "continue", "outlook" and "guidance", or other similar words and may include, without limitation, statements regarding plans, strategies and objectives of management, anticipated production or construction commencement dates and expected costs or production outputs. The Company continues to distinguish between outlook and guidance. Guidance statements relate to the current financial year. Outlook statements relate to years subsequent to the current financial year.

Forward looking statements inherently involve known and unknown risks, uncertainties and other factors that may cause the Company's actual results, performance and achievements to differ materially from statements in this EIS. Relevant factors may include, but are not limited to, changes in commodity prices, foreign exchange fluctuations and general economic conditions, increased costs and demand for production inputs, the speculative nature of exploration and project development, including the risks of obtaining necessary licences and permits and diminishing quantities or grades of reserves, political and social risks, changes to the regulatory framework within which the Company operates or may in the future operate, environmental conditions including extreme weather conditions, recruitment and retention of personnel, industrial relations issues and litigation.

Forward looking statements are based on the Company's good faith assumptions as to the financial, market, regulatory and other relevant environments that will exist and affect the Company's business and operations in the future.

The Company does not give any assurance that the assumptions will prove to be correct. There may be other factors that could cause actual results or events not to be as anticipated, and many events are beyond the reasonable control of the Company. Readers are cautioned not to place undue reliance on forward looking statements. Forward looking statements in the EIS speak only at the date of issue. Except as required by applicable laws or regulations, the Company does not undertake any obligation to publicly update or revise any of the forward looking statements or to advise of any change in assumptions on which any such statement is based.

Non-IFRS Financial Information

Newcrest results are reported under International Financial Reporting Standards (IFRS) including EBIT and EBITDA. The EIS also includes non-IFRS information including Underlying profit (profit after tax before significant items attributable to owners of the parent company), All-In Sustaining Cost (determined in accordance with the World Gold Council Guidance Note on Non-GAAP Metrics released June 2013), AISC Margin (realised gold price less AISC per ounce sold (where expressed as USD), or realised gold price less AISC per ounce sold divided by realised gold price (where expressed as a %), Interest Coverage Ratio (EBITDA/Interest payable for the relevant period), Free cash flow (cash flow from operating activities less cash flow related to investing activities), EBITDA margin (EBITDA expressed as a percentage of revenue) and EBIT margin (EBIT expressed as a percentage of revenue). These measures are used internally by Management to assess the performance of the business and make decisions on the allocation of resources and are included in the EIS to provide greater understanding of the underlying performance of Newcrest's operations. The non-IFRS information has not been subject to audit or review by Newcrest's external auditor and should be used in addition to IFRS information.

Ore Reserves and Mineral Resources Reporting Requirements

As an Australian Company with securities listed on the Australian Securities Exchange (ASX), Newcrest is subject to Australian disclosure requirements and standards, including the requirements of the Corporations Act 2001 and the ASX. Investors should note that it is a requirement of the ASX listing rules that the reporting of Ore Reserves and Mineral Resources in Australia comply with the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the JORC Code) and that Newcrest's Ore Reserve and Mineral Resource estimates comply with the JORC Code.

Competent Person's Statement

The information in the EIS that relates to Golpu Ore Reserves is based on information compiled by the Competent Person, Mr Pasqualino Manca, who is a member of The Australasian Institute of Mining and Metallurgy. Mr Pasqualino Manca, is a full-time employee of Newcrest Mining Limited or its relevant subsidiaries, holds options and/or shares in Newcrest Mining Limited and is entitled to participate in Newcrest's executive equity long term incentive plan, details of which are included in Newcrest's 2017 Remuneration Report. Ore Reserve growth is one of the performance measures under recent long term incentive plans. Mr Pasqualino Manca has sufficient experience which is relevant to the styles of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the JORC Code 2012. Mr Pasqualino Manca consents to the inclusion of material of the matters based on his information in the form and context in which it appears.

HARMONY GOLD MINING COMPANY LIMITED DISCLAIMER

Harmony Gold Mining Company Limited ("**Harmony**") is the ultimate holding company of Wafi Mining Limited and any reference below to "Harmony" or the "Company" includes both Harmony Gold Mining Company Limited and Wafi Mining Limited.

Forward Looking Statements

These materials contain forward-looking statements within the meaning of the safe harbor provided by Section 21E of the Securities Exchange Act of 1934, as amended, and Section 27A of the Securities Act of 1933, as amended, with respect to our financial condition, results of operations, business strategies, operating efficiencies, competitive positions, growth opportunities for existing services, plans and objectives of management, markets for stock and other matters. These include all statements other than statements of historical fact, including, without limitation, any statements preceded by, followed by, or that include the words "targets", "believes", "expects", "aims", "intends", "will", "may", "anticipates", "would", "should", "could", "estimates", "forecast", "predict", "continue" or similar expressions or the negative thereof.

These forward-looking statements, including, among others, those relating to our future business prospects, revenues and income, wherever they may occur in this EIS and the exhibits to this EIS, are essentially estimates reflecting the best judgment of our senior management and involve a number of risks and uncertainties that could cause actual results to differ materially from those suggested by the forward-looking statements. As a consequence, these forward-looking statements should be considered in light of various important factors, including those set forth in these materials. Important factors that could cause actual results to differ materially from estimates or projections contained in the forward-looking statements include, without limitation: overall economic and business conditions in South Africa, Papua New Guinea, Australia and elsewhere, estimates of future earnings, and the sensitivity of earnings to the gold and other metals prices, estimates of future gold and other metals production and sales, estimates of future cash costs, estimates of future cash flows, and the sensitivity of cash flows to the gold and other metals prices, statements regarding future debt repayments, estimates of future capital expenditures, the success of our business strategy, development activities and other initiatives, estimates of reserves statements regarding future exploration results and the replacement of reserves, the ability to achieve anticipated efficiencies and other cost savings in connection with past and future acquisitions, fluctuations in the market price of gold, the occurrence of hazards associated with underground and surface gold mining, the occurrence of labour disruptions, power cost increases as well as power stoppages, fluctuations and usage constraints, supply chain shortages and increases in the prices of production imports, availability, terms and deployment of capital, changes in government regulation, particularly mining rights and environmental regulation, fluctuations in exchange rates, the adequacy of the Group's insurance coverage and socio-economic or political instability in South Africa and Papua New Guinea and other countries in which we operate.

For a more detailed discussion of such risks and other factors (such as availability of credit or other sources of financing), see the Company's latest Integrated Annual Report and Form 20-F which is on file with the Securities and Exchange Commission, as well as the Company's other Securities and Exchange Commission filings. The Company undertakes no obligation to update publicly or release any revisions to these forward-looking statements to reflect events or circumstances after the date of this EIS or to reflect the occurrence of unanticipated events, except as required by law.

Competent Person's Statement

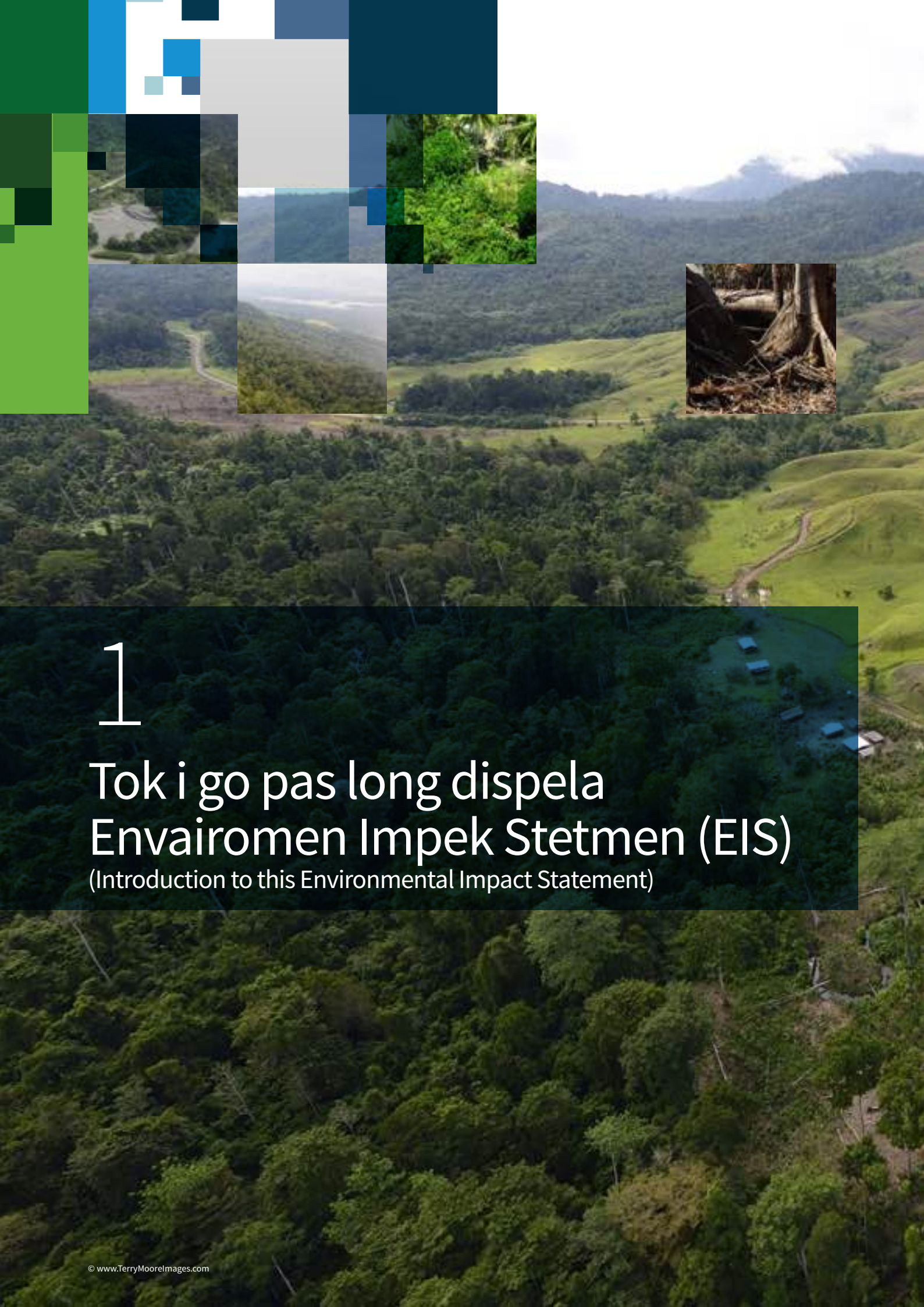
The Wafi-Golpu Joint Venture is an unincorporated joint venture between a wholly-owned subsidiary of Harmony Gold Mining Company Limited and a wholly-owned subsidiary of Newcrest Mining Limited.

The information in the EIS that relates to Golpu Ore Reserves is based on information compiled by the Competent Person, Mr Pasqualino Manca, who is a member of The Australasian Institute of Mining and Metallurgy. Mr Pasqualino Manca, is a full-time employee of Newcrest Mining Limited or its relevant subsidiaries, holds options and/ or shares in Newcrest Mining Limited and is entitled to participate in Newcrest's executive equity long term incentive plan, details of which are included in Newcrest's 2017 Remuneration Report. Ore Reserve growth is one of the performance measures under recent long term incentive plans. Mr Pasqualino Manca has sufficient experience which is relevant to the styles of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the JORC Code 2012. Mr Pasqualino Manca consents to the inclusion of material of the matters based on his information in the form and context in which it appears.

Contents

LIS BILONG OL PIKSA

LIS BILONG OL TEBOL



1

Tok i go pas long dispela Envairomen Impek Stetmen (EIS)

(Introduction to this Environmental Impact Statement)

1.1 Lukluk long projek
(Overview)

WGJV kampani i mekim ol wok painim long kamapim wanpela andagraun kopa na gol main. Dispela wok painim i lukluk tu long konstraksen, operesen bilong main na long wei long pasim main bihain long taim kopa na gol i pinis. WGJV Kampani tu lukluk long kamapim kopa na gol, na long trenspotim gol kopa konsentret igo long Lae wof, lukluk tu long pawa, wara na plen bilong rausim pipia wesan bilong main na ol narapela fesiliti long sapotim main. Insait long dispela ripot, olgeta samiting Kampani bai mekim yumi kolim 'Wafi-Golpu Projek' o kolim Projek tasol.

Dispela andagraun kopa-gol main bai i stap ananit long Mt Golpu, klostu olsem 300 kilomita north-north west long Port Moresby na 65 kilomita southwest long Lae siti insait long Morobe Province, Papua New Guinea (PNG). Ol sapot fesiliti we Kampani bai mekim em rot bilong igo long main, ol paiplain long main igo long Lae wof na paiplain igo olgeta long weist fesiliti long ples Wagang.

Projek bai karamapim bikpela hap tru, stat long Wafi main eria i go daun long Infrasturcture Corridor olgeta long Lae wof na Wagang ples. Olgeta dispela hap kampani bai wok long em bai kamap projek eria. Hap we main bai stap wantaim ol fesiliti long sapotim wok mining bai i stap long Lower Watut Wara i go long Markham Wara na i go olgeta long Lae wof na Wagang ples. Kampani bai expotim kopa-gol konsentret long Lae Wof na outfall bilong pipia wesan bilong main bai i go aut insait long solwara yusim deep sea talings placement (DSTP).

Dispela projek bai rausim klostu 360 million tons (Mt) pipia wesan (tailings) ikam long main insait long 28-pela yia. Kampani i wokim wanpela bikpela wok painim aut long lukautim gut wei bilong rausim pipia bilong main. Ol i mekim wok painim aut long mekim dem bilong holim pipia wesan klostu long main sait na bikpela stadi tu long deep sea tailings placement (DSTP). Ol wok painim aut kamapim tingting olsem main pipia wesan bai igo inside long solwara usim DSTP metod. As tingting bilong usim dispela DSTP metod, em kamap long lukluk na skelim tingting long ol infomasin bilong sefti, engenirin, envairomen, sosal, kalsa heritaj na ekonomi.

Eria we projek bai yusim i klostu olsem 1,405 hekta. Dispela em istat long main, bihainim rot kam daun long Lae wof na Wagang ples.

Kampani i bin putim wanpela aplikesen i go long Mineral Resources Authority (MRA) long givim Special Mining Lease (SML) na ol narapela lis long giraun we kampani i laik usim.

1.2 As tingting bilong Exeketiv Samari
(Purpose of the EIS Executive Summary)

Dispela EIS WGJV i mekim em wanpela bikpela samting gavaman i laikim kampani long mekim long assessmen karamapim envairomen, sosal na kalsa wantaim heritej. Dispela EIS i kam ananit long *Environment Act 2000* long lukluk long envairomen, sindaun bilong ol man na meri long kominiti (sosal) na kalsa o lukluk long samting bilong tumbuna i stap long projek (kalsa na heritej).

EIS Ekseketiv Samari i karamapim toktok bilong:

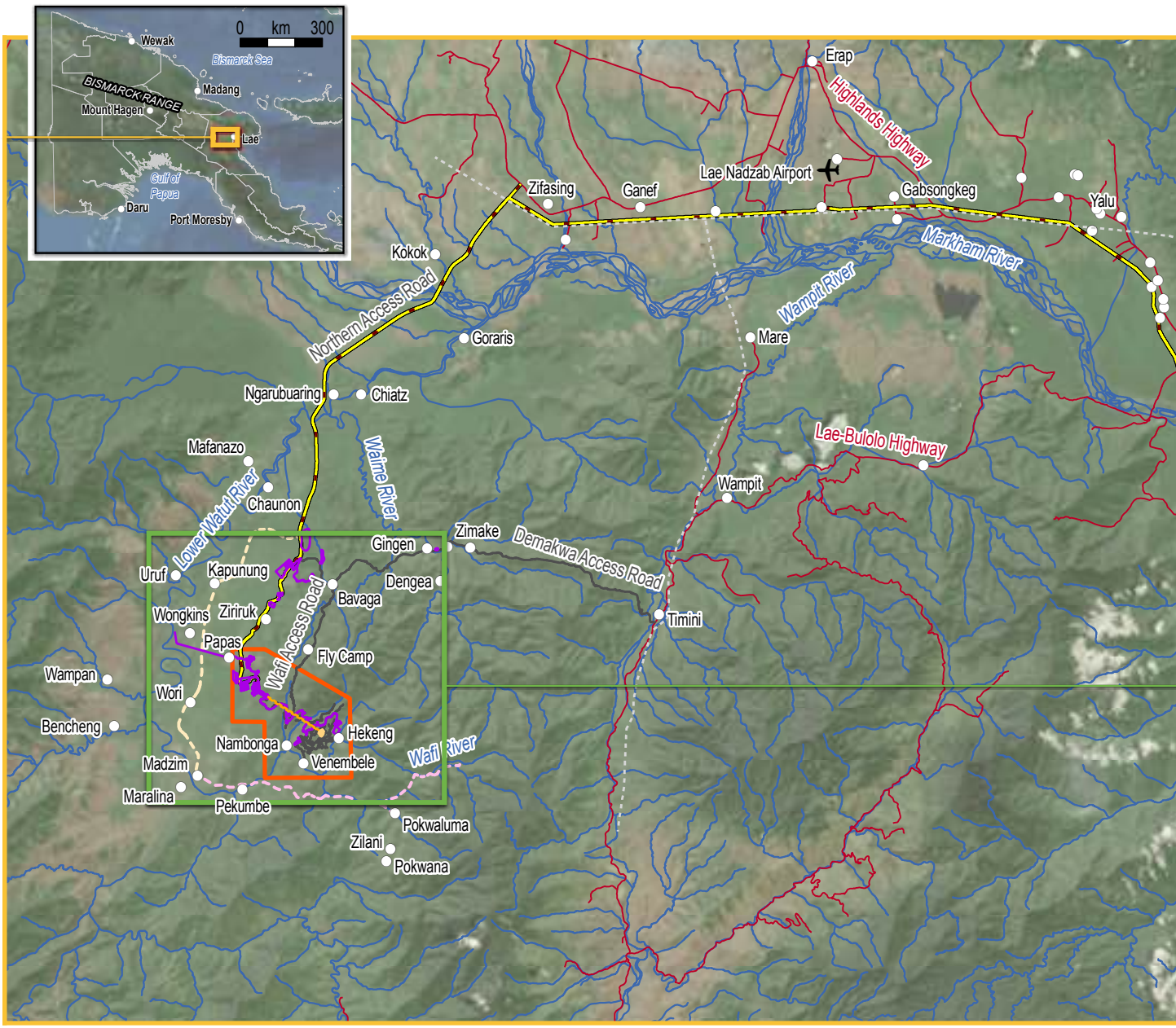
- As tingting bilong EIS.
- Wafi-Golpu Joint Venture (Kampani).
- Envairomen, sosal or sindaun bilong man/meri long kominiti na tumbuna samting insait long projek eria.
- Hap Kampani kamapim Projek waitaim ol wok kamap na ol faciliti.
- Ol wok kamap Kampani wokim na wok bung wantaim ol stekholda na soim tu rekot bilong dispela ol stekholda na wanem kain toktok na tingting ol i mekim.
- Wanem samting Kampani i ting bai kamap long envairomen, sindaun bilong ol man na meri long ples na ol samting bilong tumbuna. Sapos sampela impek i kamap, wanem samting stret bai Kampani i mekim bilong stretim dispela hevi.
- Wanem samting Kampani bai mekim taim main i pas.
- Rot bilong ol stekholda i ken givim tingting long dispela EIS.

1.3 EIS bai i luk olsem wanem
(Structure of the EIS)

Insiat long EIS i gat:

- **Ekseketiv Samari** Dispela wanpela ripot long Tok Pisin na Tok Inglis. Dispela ripot em givim samari long dispela projek, ol wanem kain impek ken kamap na rot WGJV menesmen bai wokim long stretim.
- **Volum 1 – Bikpela Ripot.** Dispela ripot i toktok long envairomen, sosal na pasin tumbuna. Kampani i bin mekim ol planti stadi na wok painim aut na kamapim dispela EIS repot.
- **Volum 2 – Attachments.** Sampela moa ripot i go wantaim dispela EIS. Dispela ol ripot em long bihainim toktok na wokmak bilong Gavaman. Dispela tu bai karamapim toktok na plen bilong envairomen, sosal na ol samting na pasin tumbuna.
- **Volum 3 to 8 – Appendices.** Planti moa teknikol ripot long ol wok painim aut we WGJV i raitim pinis insait long bikpela EIS ripot.

Sapos yu laik ridim moa long EIS yu ken go long EIS volum 1 igo long 8 long Tok Inglis.



Piksa 1.1: Lukluk long Projek (Project Overview)

LEGEND

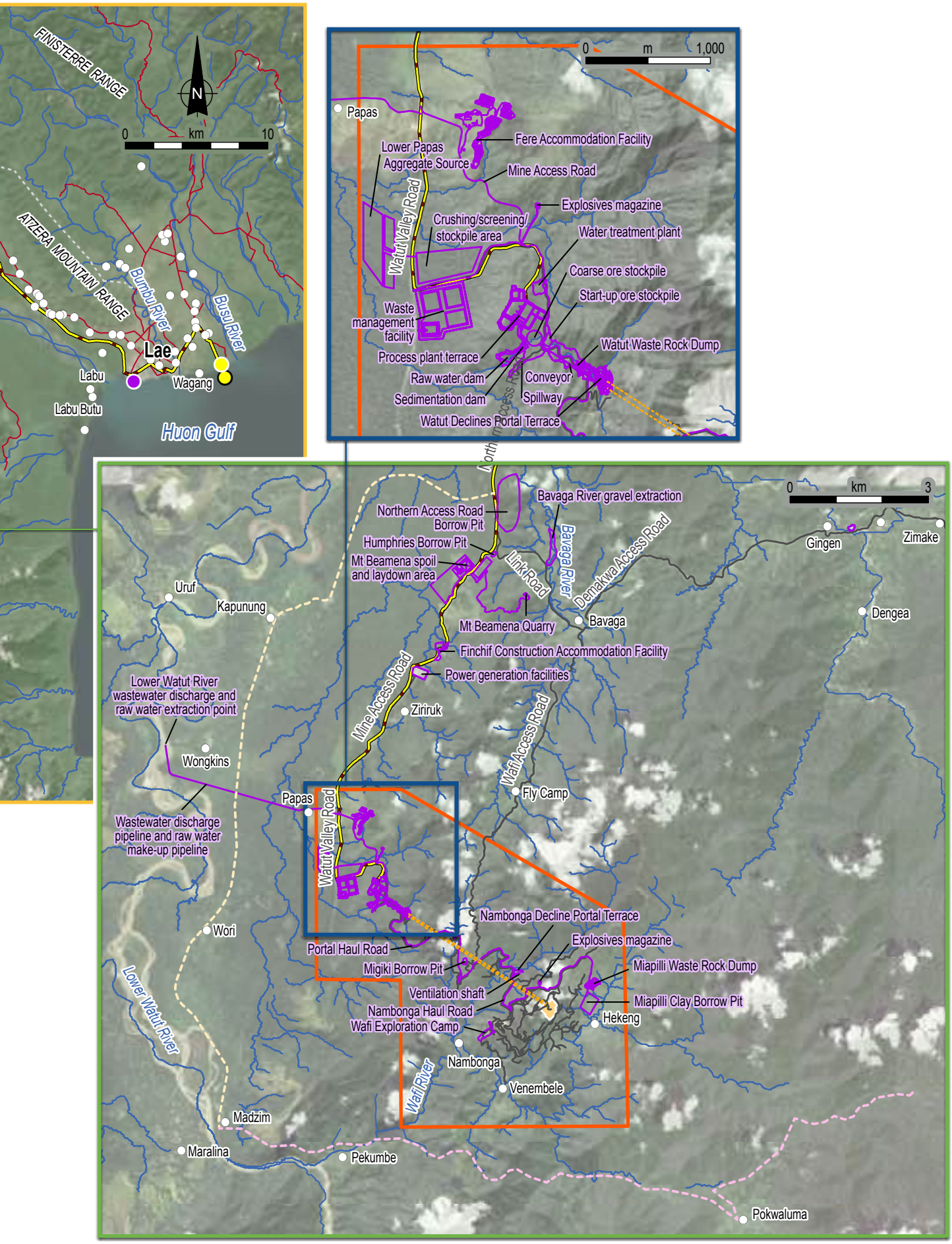
- Village/Settlement
- Existing power network
- Project road
- Road
- Watercourse
- Orebody
- Special Mining Lease (SML) 10 application area

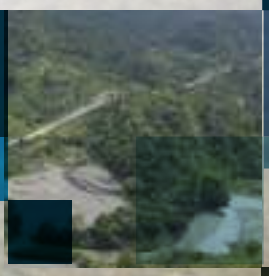
PROPOSED INFRASTRUCTURE

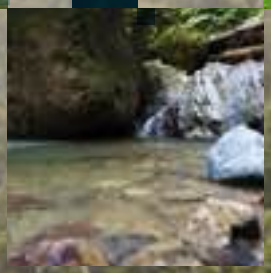
- Outfall Area
- DSTP outfall
- Port Facilities Area
- Infrastructure Corridor
- Infrastructure footprint
- Watut Declines

INDICATIVE RESETTLEMENT ROADS

- Potential Resettlement Road
- Potential Watut Services Road


FINISTERRE RANGE
N
0
km
10
ATZERA MOUNTAIN RANGE
Bumbu River
Busu River
Lae
Labu
Wagang
Labu Butu
Huon Gulf
0
m
1,000
Papas
Lower Papas Aggregate Source
Fere Accommodation Facility
Mine Access Road
Watut Valley Road
Explosives magazine
Crushing/screening/ stockpile area
Water treatment plant
Coarse ore stockpile
Start-up ore stockpile
Waste management facility
Watut Waste Rock Dump
Process plant terrace
Raw water dam
Conveyor
Sedimentation dam
Spillway
Watut Declines Portal Terrace
Northern Access Road
Bavaga River gravel extraction
Northern Access Road Borrow Pit
Humphries Borrow Pit
Mt Beamena spoil and laydown area
Link Road
Bavaga River
Demakwa Access Road
0
km
3
Gingen
Zimake
Uruf
Kapunung
Mt Beamena Quarry
Bavaga
Dengea
Finchif Construction Accommodation Facility
Power generation facilities
Lower Watut River wastewater discharge and raw water extraction point
Mine Access Road
Ziriruk
Wafi Access Road
Wongkins
Fly Camp
Papas
Watut Valley Road
Wastewater discharge pipeline and raw water make-up pipeline
Nambonga Decline Portal Terrace
Explosives magazine
Wori
Portal Haul Road
Migiki Borrow Pit
Miapilli Waste Rock Dump
Ventilation shaft
Miapilli Clay Borrow Pit
Nambonga Haul Road
Hekeng
Wafi Exploration Camp
Lower Watut River
Nambonga
Wafi River
Venembele
Madzim
Maralina
Pekumbe
Pokwaluma





2

Kampani WGJV

(The Wafi-Golpu Joint Venture)

Tupela kampani i bung wantaim na kamapim WGJV Participants. Wafi Mining Limted na Newcrest PNG2 Limited tupela equal partner (50:50) insait long Wafi-Golpu Joint Venture (WGJV). WGJV Participants i ownim 100% dispela Projek. Operata bilong dispela Projek em Wafi-Golpu Services Limited em equal owner bilong WGJV Participants.

Ol papa kampani bilong WGJV Participants em Harmony Gold Mining Company Limited (long sait bilong Wafi Mining Limited) em kampani bilong South Africa na Newcrest Mining Limited (long sait bilong Newcrest PNG2 Limited) em kampani bilong Australia.

3

Ol samting i stap insait long Projek
(Setting of the Project)

Ol wok painim aut na toktok bilong Projek ikamap long envairomen, sosal na kalsa na stori tumbuna insait long projek eria. Ol dispela stadi wantain stekholda miting istap insait long EIS Volum 1.

3.1 Envairomen (Environmental)

Dispela hap we main bai istap long en, em stap insait long bikpela bus na maunten bilong Owen Stanley Range we exploresen wok i bin kamap olsem 50-pela yia pinis. Yu ken lukim ol hanmak bilong dispela ol wok exploresen long Wafi Camp yet, ol sampela rot na ol hap we drilin masin i bin wok long en.

Rot we infrastrakta bai bihainim (Infrastructure Corridor) em stat long Lower Watut Wara, igo long Markham Wara na behainim rot i go olgeta long nambis long Lae Pot. Ol wok long nambis bai i kamap namel long maus bilong wara Markham na maus bilong wara Busu klostu long Lae Siti long western sait bilong Huon-Gulf. Long wara Markham na igo antap long hap we kampani bai wok long em (infrastructure corridor) i stap insait long sampela hap we i gat cattle farm, oil palm plantation, na ol gaden bilong ol ples lain.

Long Lower Watut, wara Watut i ron long stretpela hap (fladplen) na long taim bilong ren, dispela hap wara save kam antap long giraun. Rot bilong wara tu i no go stret. Rot bilong wara i tanim tanim olsem sinak (meandering

Piksa 3.1: Wara Watut na fladplen, na alluvial fores (Watut River floodplain and alluvial forest)

channels) na i go bung wantaim wara Markham. Long sampela hap rot bilong wara i senis i go long narapela hap na dispela wara i kamapim raun wara (oxbow lakes). Na tais tu i save kamap. Ol narapela kain bus na giraun tu i stap insait long hap wei kampani bai mekim wok long em. Ol dispela kain giraun na bus em ol tais na mangro na nambis long solwara.

Wok bai kamap long nambis em long tupela hap long Lae Pot eria na DSTP Outfall eria. Lae Pot eria istap insait long Lae siti indastriol eria. DSTP Outfall eria istap olsem 6 km autsait long Lae, klostu long ples Wagang. Dispela eria igat kain bus bilong nambis waintaim mixed-swamp bus long maus bilong Busu Wara.

Klaimat
(Climate)

Papua New Guinea em igat tropikal klaimat. Ol nambis eria wantain ol ailans em i hot na i save ren planti. De taim temperature i save stap olsem 20 degrees celsius (20 °C) long mun June, July na August i go antap long 32 degrees celsius (32 °C) long mun November, December na January.

Hap we main i stap long en, em ples bilong ren na igat tupela sisons; drai sison long June igo nap September na wet sison long December igo nap long mun March. Ren pudaun kamapim olsem 2,836 millimeters (mm).

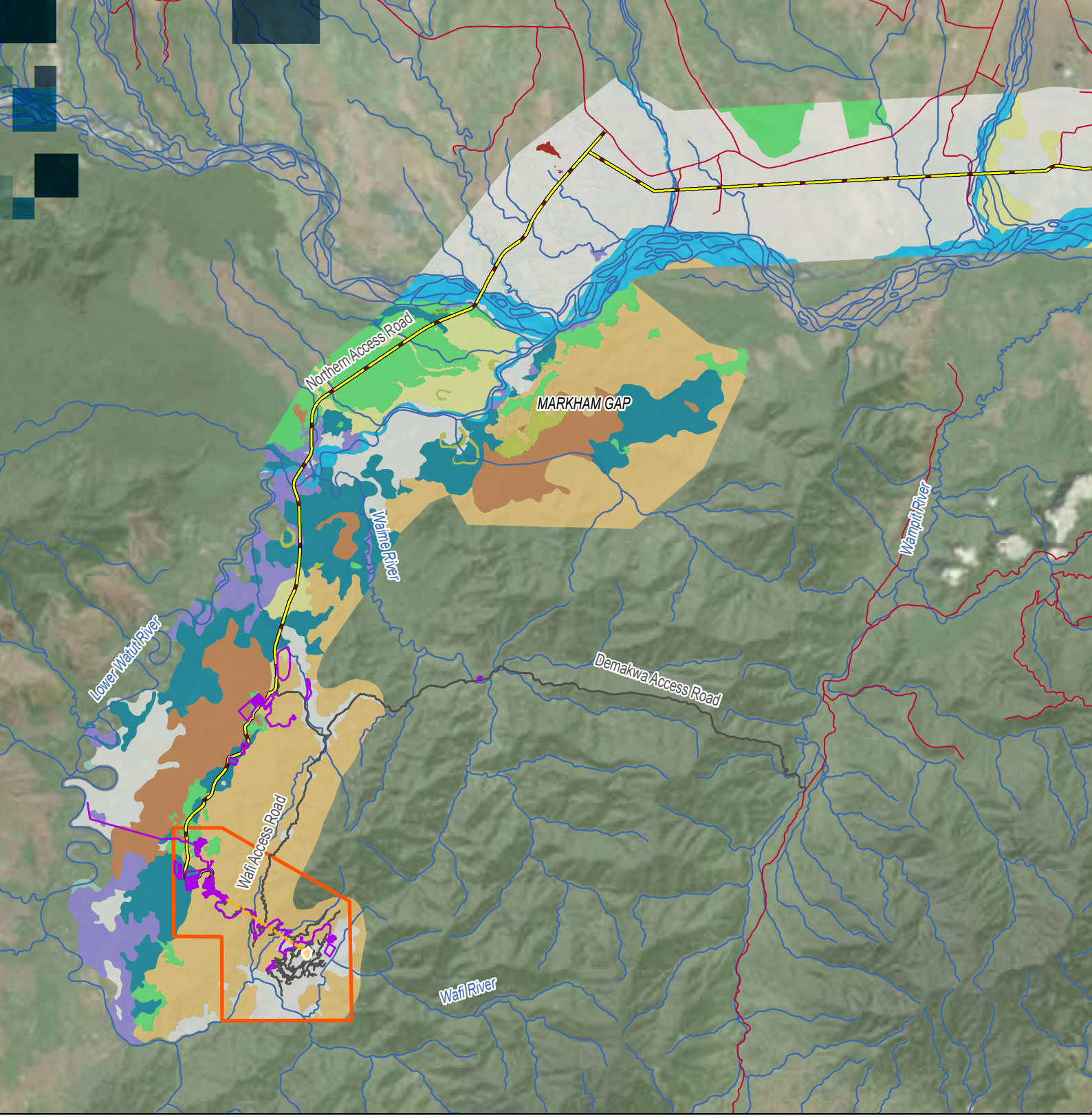
Main eria tu em gat temperature namel long 21 degrees celsius (21 °C) na 28 degrees celsius (28 °C) wantain win em no strong tumas, na humidity em i stap antap tru.

Long nambis eria em save kisim strongpela win namel long mun May i go long October. Ren pudaun insait long wanpela yia i kamap klostu olsem 3,900mm i go 4,500mm stat long mun May i go inap long August. Long Disemba i go inap long April, em monsoon sison kam wantaim bikpela ren.

Air na Nois
(Air and Noise)

Air kwaliti na nois levol insait long main eria em makim bik bus na laif bilong ol ples. Air kwaliti i kamap pasin bilong kukim bus bilong wokim gaden na kukim kaikai long haus ples. Ol kar tu usim Demakwa rot igo long Wafi-Golpu main sait ol i save wokim das long drai sison. Nois ikam tasol long ol pisin na binatang nabaut na animols bilong ples.

Kampani i no lukluk long air kwaliti na nois bihainim Infrastructure Corridor igo i nap long Outfall Area long wanem ino gat bilpela wok ikamap long dispela eria. Kampani i nogat tingting olsem bai i gat bikpela impek tumas long air kwaliti bilong dispela eria. Air kwaliti na nois levol long Port Facilities Area em kam long ol pot ektivitis wantaim ol narapela commercial na indastriol ektivitis insait long Lae Siti.



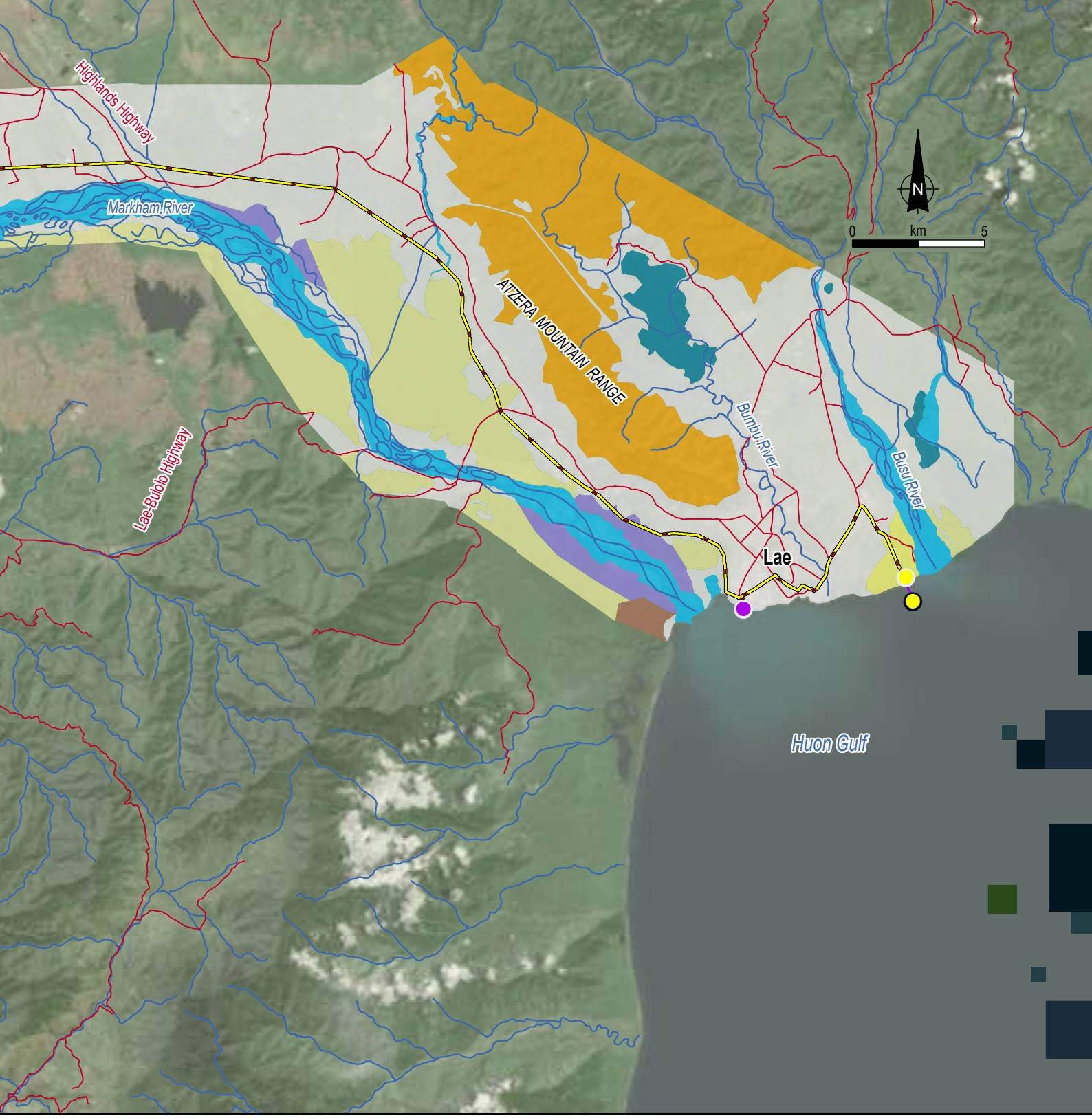
Piksa 3.2: Vegetation Communities

Terrestrial ecology bilong Morobe Provins (Terrestrial Ecology)

Morobe Province i gat planti kainkain bus na giraun bilong ol diawai na ol animol. I gat tupela kain giraun em ol maunten na fletpela giraun we igat wara na wesan we i save kamapim kaikain bus na diwai wantain ol kainkain animol bilong em yet.

Bikpelka hap bilong main eria i karamap wantaim lowland bus. Tasol Infrastructure Corridor namel long Markham Wara na nambis eria em ol man meri sindaun pinis long em na wokim gaden na farming olsem bulmakau na planim ol kain kumu olsem rais na oil palm. Pawa lain tu i ron long dispela hap wantain planti ol setelmen.

Long ol maunten em igat bus ol kolim 'Small na Medium Crowned Forest' i save karamapim. Bus long Lower Watut igat 'Large to Medium Crowned Forest', 'Mixed Swamp Forest' na 'Swamp Woodland'. Ol bus istap long hap bilong swamp em i 'Riverine Mixed Successions' na 'Mixed Swamp Forest'. Graslan tu istap long south sait long Lower Watut Wara na north sait long Wara Markham. Dispela piksa bilong ol kainkain bus na diwai i stap long Piksa 3.2.



LEGEND

- Project road
- Road
- Watercourse
- Orebody
- Special Mining Lease (SML) 10 application area

PROPOSED INFRASTRUCTURE

- Outfall Area
- DSTP outfall
- Port Facilities Area
- Infrastructure Corridor
- Infrastructure footprint
- Watut Declines

VEGETATION TYPE

- Grassland (G)
- Lakes and Larger Rivers (E)
- Large to Medium Crown Forest (Pl)
- Littoral (Beach) Communities (B)
- Mangrove (M)
- Medium Crowned Forest/Small Crowned Forest (Hm/Hs)
- Medium to Large Crowned Forest (Hm/Hl)
- Mixed Swamp Forest (Fsw/FswC)
- Other Non-Forest Areas Dominated by Land-use (O)
- Riverine Mixed Successions (Fri)
- Riverine Successions Dominated by Grass (Gri)
- Scrub (Sc)
- Swamp Grassland (Gsw)
- Swamp Woodland (Wsw)
- Woodland (W)

Ol bus na animol
(Plants and Animals)

Long 2010 i kam inap long 2017, kampani i bin mekim sevenpela wokpainim aut long ol bus na ol wanem kain animol i save stap long Projek eria. Dispela wok painim aut em long givim wanpela beslain data o givim kampani gutpela save na tingting long ol wanem kain samting tru i stap long dispela hap. Ol i laik luksave gut long wanem kain samting tru i stap long dispela bus na sapos em stap gutpela yet o nogat.

Long hap we main bai stap long em na bihainim Northern Ekses Rot ol i rekodim 885 flawa na diwai species bilong bus. Long dispela 885 species, 103 species ol i rekodim long Eastern hap sait long Wara Watut na arere long main eria.

Insait long main eria na Northern Ekses Rot dispela wok painimaut ol i rekodim 262 vertebrate animol or long tok English ol i kolim "terrestrial vertebrate fauna". Long dispela 262 species, 44 em mammal species, 170 species em kainkain pisin, 33 reptile species (sinek, krokodail, palai), 15 kainkain amphibian o rokrok. Long eastern sait, bilong hap we kampani bai bildim ol infrastraksa bilong sapotim wok maining, dispela stadi i painim 155 kainkain vertebrates (terrestrial vertebrate fauna). Long dispela 155 vertebrates, 140 species em oli kainkain pisin, 7 pela reptile species, 6 pela mammal species na tupela amphibian species.

Long lukluk gut long is dispela ol animol na plants, wok painim aut i lukluk go long 'International Union for Conservation of Nature (IUCN) Red List of Threatened Species (2017) long kisim klia tingting. Ol i lukluk tu long *Fauna (Protection and Control) Act 1966*.

Lukautim ol impotent flawa na diwai species (Conservation Significant Terrestrial Plants)

I gat 18 flawa na diwai species yumi nid long lukautim gut. Long dispela stadi, ol i rekodim 18 flawa na diwai i nogat planti i stap insait long bus na, ol i gat impotent conservation significance.

- Sevenpela species stap long "threatened species lis". Sapos yumi no lukautim gut, dispela olgeta bai pinis: *Diospyros lolinopsis* na *Halfordia papuana* stap long "Critically Endangered" lis; wan pela species; *Flindersia pimenteliana* ems stap long "Endangered" lis; na foa pela diwai species *Aglaia brownii*, Kwila (*Intsia bijuga)*, New Guinea Rosewood (*Pterocarpus indicus)* na *Myristica buchneriana* olgeta stap long "Vulnerable" lis.
- Ninepela species oli stap long "Near Threatened" lis na name bilong ol em: *Aglaia euranthera*, *A. sexipetala*, *A. silvestris*, *Cycas apoa*, *C. campestris*, *C. scratchleyana*, *C. schumanniana*, *Flindersia amboinensis* na *Myristica globosa*.

I gat 32 plant species i stap long IUCN Red lis dispela stadi i ting olsem, ol ken stap long dispela stadi eria, tasol ol i no lukim dispela ol species.

Lukautim ol impotent animol species (Conservation Significant Terrestrial Animals)

Long dispela wok painim aut tu ol i painim faivpela vertebrate animol species i gat nid long lukautim. Dispela em:

- Papuan eagle (*Harpyopsis novaeguineae*) na Pesquet's parrot (*Psittrichas fulgidus*), tupela stap long IUCN "Vulnerable" lis.
- Gurney's eagle (*Aquila gurneyi*), i stap long IUCN "Near Threatened" lis.
- Blue-black kingfisher (*Todiramphus nigrocyaneus*) na Papuan hawk-owl (*Uroglaux dimorpha*), tupela stap long IUCN "Data Deficient" lis.

Goodfellow's tree kangaroo (*Dendrolagus goodfellowi*; Critically Endangered) na New Guinea pademelon (*Thylogale browni*; Vulnerable) ol i rekodim long ples Madzim we ol lain i lukautim (pet). Madzim em wanpela ples i stap insait long projek eria. Ol i kisim dispela tupela animol long Upper Watut Wara valley.

Ol i painim tu narapela tupela near-threatened species: Doria's goshawk (*Megatriorchis doriae*) na forest bittern (*Zonrodius heliosylus*). Doria's goshawk ol i lukim olsem i ken kamap insait na arere long Projek eria na forest bitten i luk olsem em bai kamap. Ol i no rekodim dispela ol species taim ol i mekim stadi. Ples bilong eastern long-beaked echidna (*Zaglossus bartoni*) i bai stap long lower montane forest na i stap ausait long hap ol i mekim wok painim aut long em. Tasol em i stap insait long hap we ol lain long ples i save go painim abus.

Ananit long PNG *Fauna (Protection and Control) Act 1966* i gat 13 pela species yumi i mas lukautim gut. Dispela em ol birds of paradise, raptors na waterbirds.

Ron bilong wara na wara ananit long giraun
(Watercourses and Groundwater)

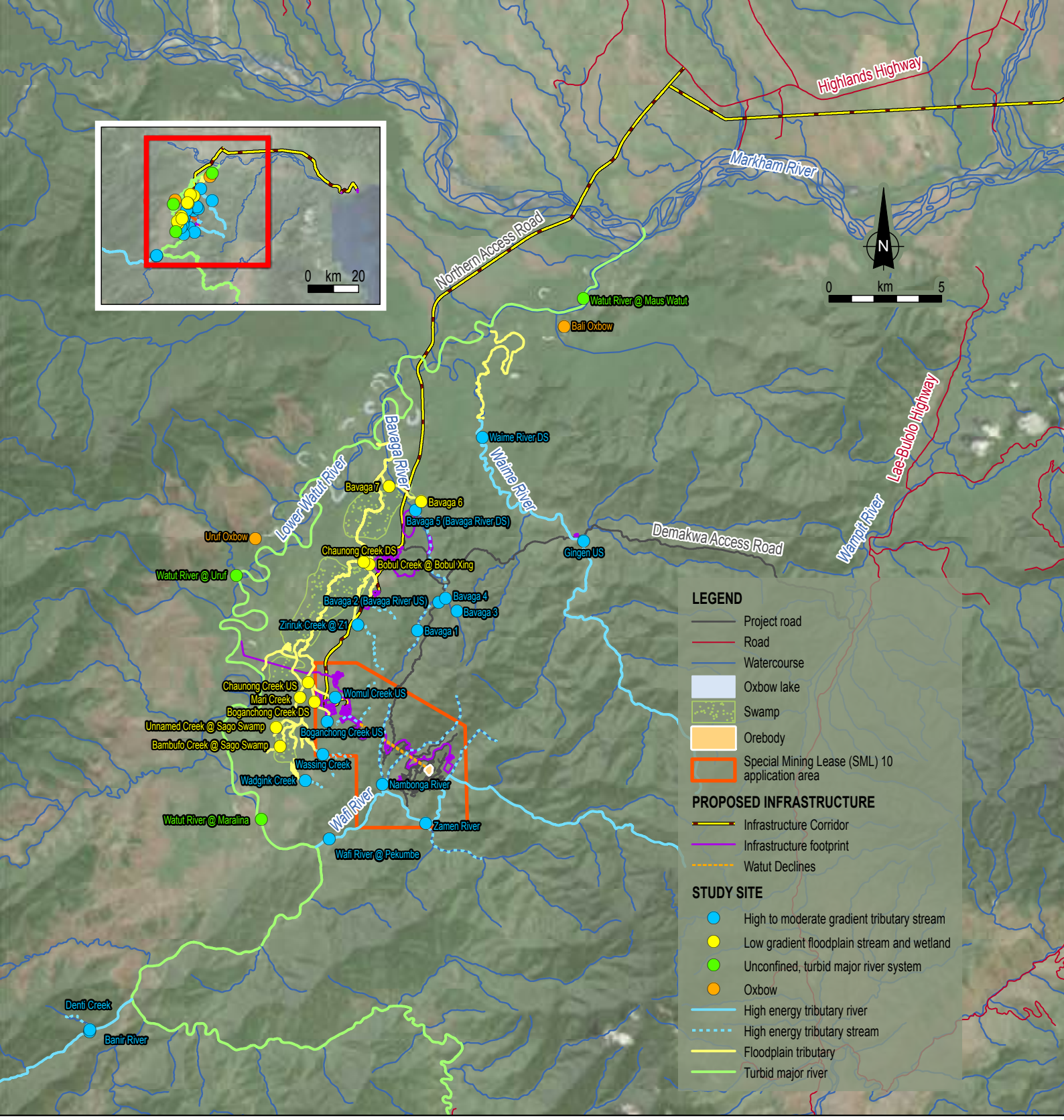
Insait long projek eria, i gat ol wara i save ron strong olsem wara Wafi, wara Boganchong and Womul na tu i gat ol bikpela wara i gat planti wesan olsem wara Watut na wara Markham. Long hetwara na ol liklik hanwara i stap long stip maunten na long dispela ol wara i gat traipela ston, wesan, kobel na gutpela klinpela wara. Tasol long taim bilong ren dispela ol hanwara i save deti na wesan pulap. Insait long ol bikpela wara, ol hap we ol pis save stap long en, em long ol raunwara (pools), riffles na backwater na ol liklik hanwara i ron igo insait long bikpela wara. Long wara Lower Watut i go daun olsem long wara Markham, i gat gravol na wesan pulap na taim em go klostu long wara Markham em mad na clei pulap.

Ol floodplain bilong wara Markham i stap namel long 3 kilomita i go inap 8 kilomita. Long taim bilong ren, wara Makham i ken senisim hap em ron long em na go long narapela hap. Long lower wara Markham em ples bilong tais na saksak i grow long dispela hap. Arere long dispela wara i gat ol man na meri sidaun na ol i mekim gaden and i gat rot stap.

Long traipela ren ol wesan i bung stap arere long wara Markham na namel tu long wara Markham i gat ol liklik ailan i pulap long wesan i save buruk na go insait long wara Markham. Dispela i save mekim na wara Markham na wara Watut i save senisim hap wei ol i save ron. Ron bilong wara long dispela tupela bikpela wara tu i mekim hat long wara i ron long dispela hap. Dispela i save mekim na sedimen o wesan i no save stap longpela taim. Dispela ol wesan em wara i save karim igo olgeta long nambis.

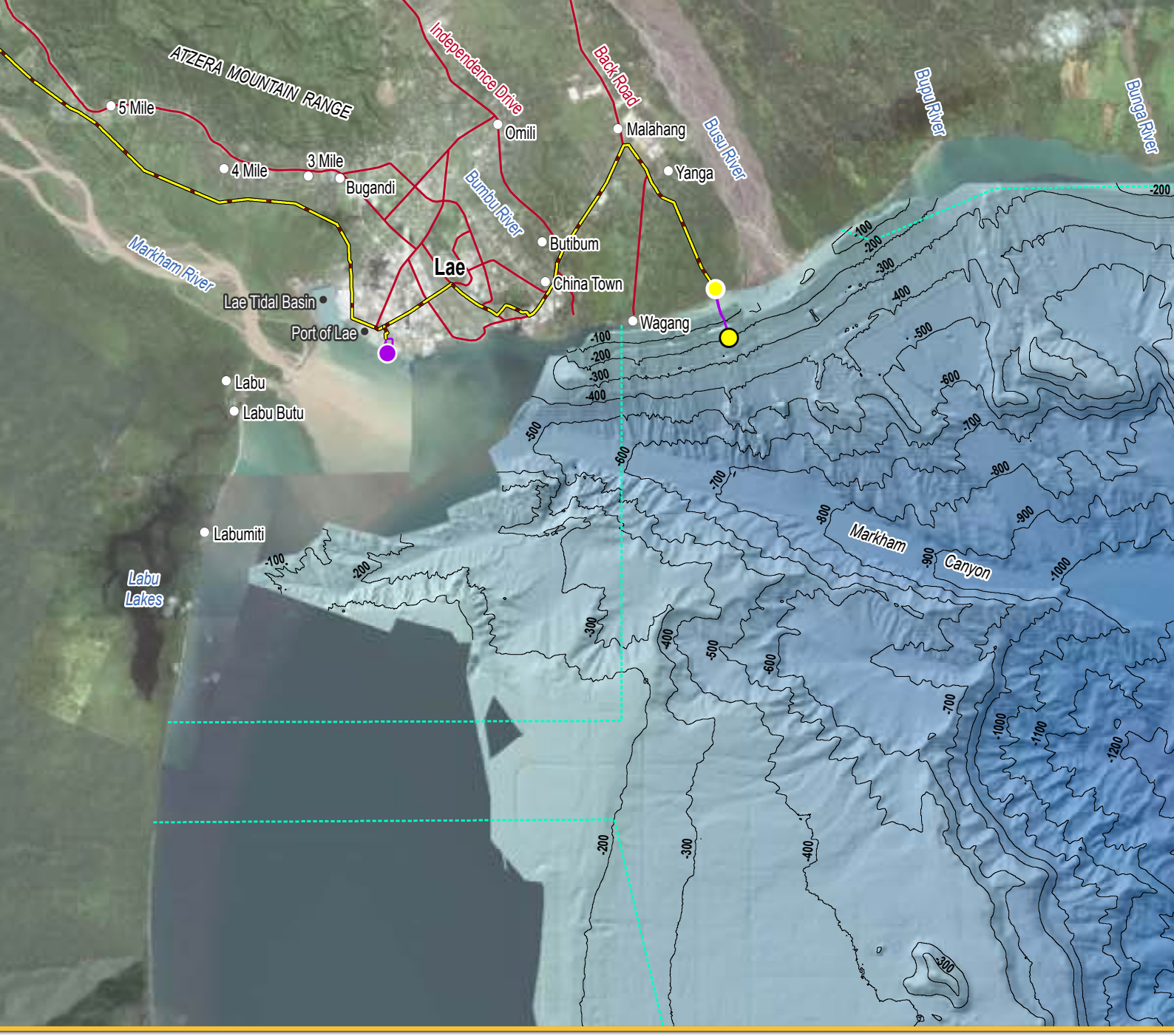
Kwaliti long wara na wesan lebol i stap insait long olgeta wara long Projek Eria, em wankain long olgeta hap long PNG.

Insait long Projek Eria, wanpela pis name bilong em largetooth sawfish (*Pristis pristis*) em stap long IUCN "critically endangered" lis or i nogat planti bilong dispela



pis i stap long wara. Sampela taim dispela pis ken i stap long wara Markham na wara Watut. Wanpela taim tasol long 1988, ol i rekodim dispela pis long Lower Watut Wara tamblo long maus bilong Wara Wafi. Bihain 1988 i kam nau, olgeta stadi long Projek long 2007 na 2015, ol no painim o rekodim dispela kain pis. Tupela trosel i save stap long wara, Schultz's snapping turtle (*Elseya schultzei*) na New Guinea giant softshell turtle (*Pelochelys signifera*) na tupela kain krokodail em solwara krokodail (*Crocodylus porosis*) na New Guinea freshwater krokodail (*C. novaeguinea*) ol tupela stap long IUCN Red List long "least concern".

Wara i stap ananit long giraun insait long Projek eria i gat tupela kain: ol alluvial aquifers ol i kamap wantaim floodplains bilong wara Watut na wara Markham, na narapela kain giraun wara em ol aquifers o wara i kamap long faults na fractured zone insait long weathered o partially weathered bedrock (ston). Taim bilong bikpela ren wara i save go insait gen long dispela ol aquifer na tu i gat ol wara i save ron igo insait long dispela aquifer. Dispela ol wara i stap ananit long giraun i save kam antap na go bung wantaim ol spring na wara long eastern flanks bilong Mt Golpu. Ol man na meri long ples i stap klostu long hap we main bai kamap long em i save dringim dispela wara i stap ananit long giraun



Solwara Envairomen
(Marine Environment)

Long 2016 i go inap 2018, WGJV i mekim mo long 20-pela wok painim aut na lukluk gut long wanem samting i stap insait long solwara bilong Huon Gulf. Wanpela bikpela lukluk em long dip Solwara envairomen. Dispela wok i makim tu wanpela bikpela wok kampani i mekim long lukluk long wanem samting i stap insait long solwara, long taim mekim wok bilong EIS bilong DSTP projek insait long PNG.

Ol stadi metod kampani i yusim em wankain olsem ol narapela wok painim aut i bihainim intanesional na PNG standards waintaim ol conventions na gaidlains. Kampani i lukluk tu long Draft General Guidelines bilong DSTP long PNG.

Solwara klostu long Nambis
(Nearshore Marine Environment)

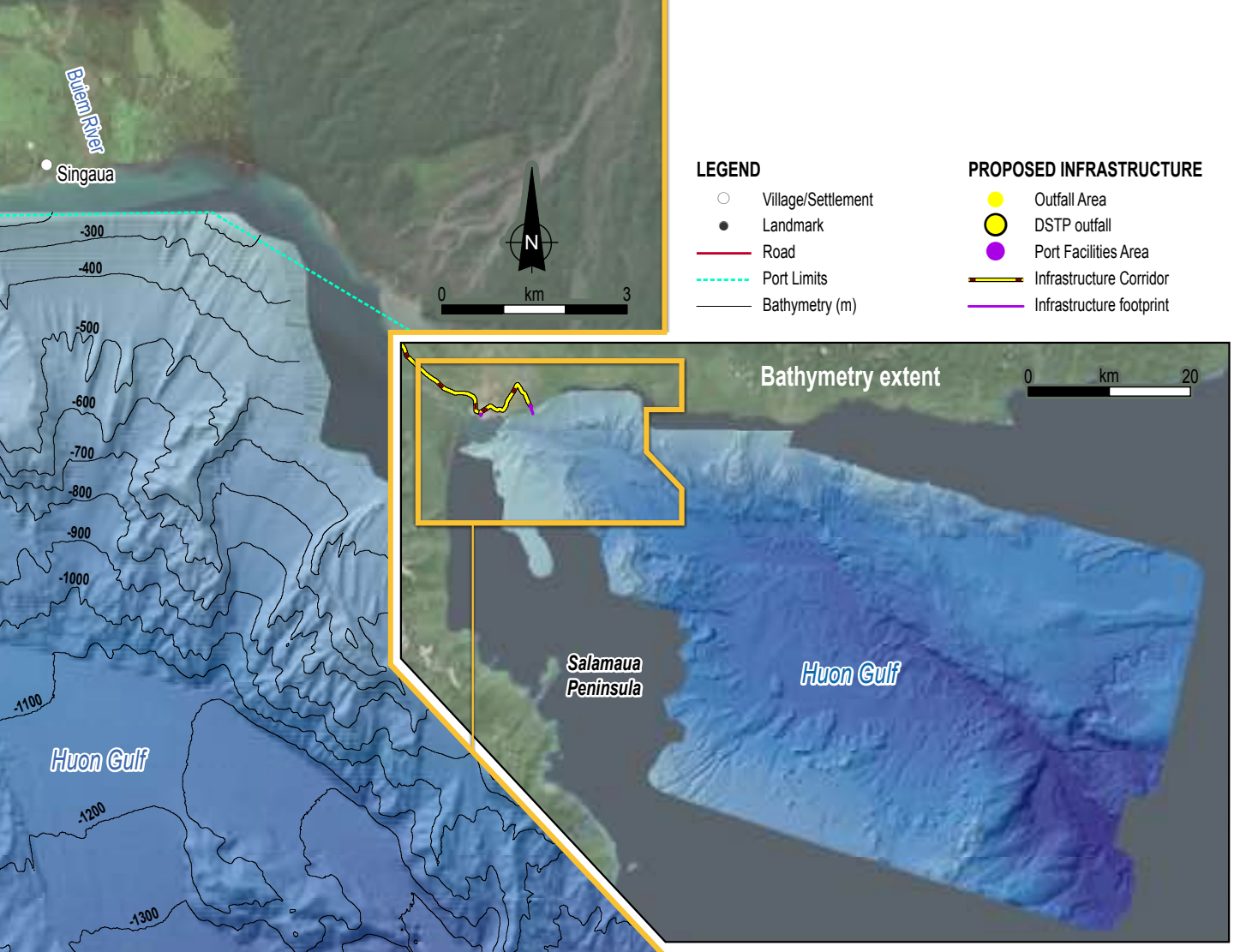
Coastal Area marine environment klostu long Lae siti em senis olgeta, em second bikpela siti insait long PNG na wof bilong em bisi nogut tru. Projek Port Facilities Area em indastriol eria stap insait long Pot bilong Lae. Outfall Area em nambis envairomen we man meri iusim planti boats igo ikam long Lae siti, na envairomen blong em, em tu em senis.

Tu long en, nambis envairomen long Coastal Area em gat bikpela das, wesan na giraun ikam long Markham, Busu na Bumbu wara. Olsem na koral rip na sigaras ino grow long wanem ol bikpela wara tromoi bikpela das wantain wesan na giraun igo insait long solwara. Asua olsem na pis ino planti long dispela Coastal Area.

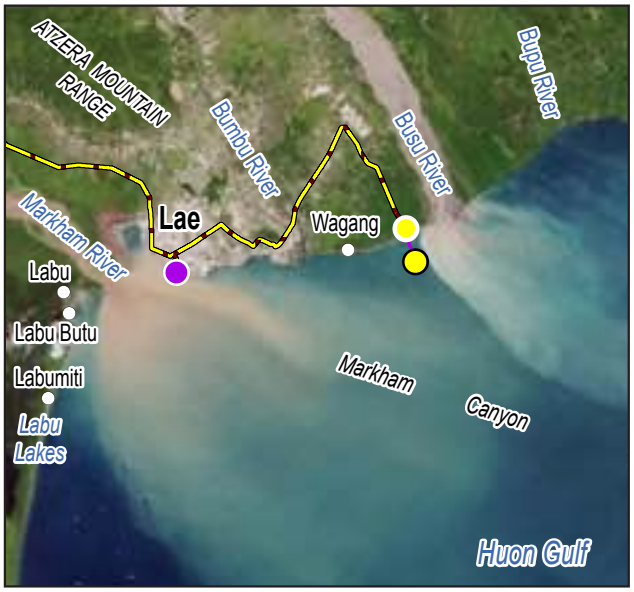
Kominiti bilong Wagang ol i tok, dispela IUCN Critically Endangered trosel species, “Pacific leatherback turtle” em putim kiao bilong em long nambis 3 pela time long wan wan year. Dispela hap nambis em igat bikpela impek long planti manmeri bilong Lae siti ikam piknik na waswas long hap olgeta taim. Stadi team i bin wokim stadi long November 2016, ol no lukim dispela trosel long dispela nambis. Trupela ples bilong dispela trosel species, em istap 15km south long Lae Siti.

Huon Gulf Envairomen
(Huon Gulf Physical Environment)

Wara Markham em ron igo insiat long Huon Gulf long west sait bilong Lae siti. Markham wara em namba 4 bikpela wara insait long PNG. I gat narapela 20-pela liklik wara kam daun long Finisterre Range long Huon Peninsula long north kos ol tu ikam na go insait long solwara bilong Houn Gulf. Ananit long solwara, seafloor i pudaun igo insait long submarine



Piksa 3.4: Bathymetry bilong western Huon Gulf (Bathymetry of western Huon Gulf)



Piksa 3.5: Deti wara insait Huon Gulf klostu long Lae (Turbid plumes in the Huon Gulf near Lae)

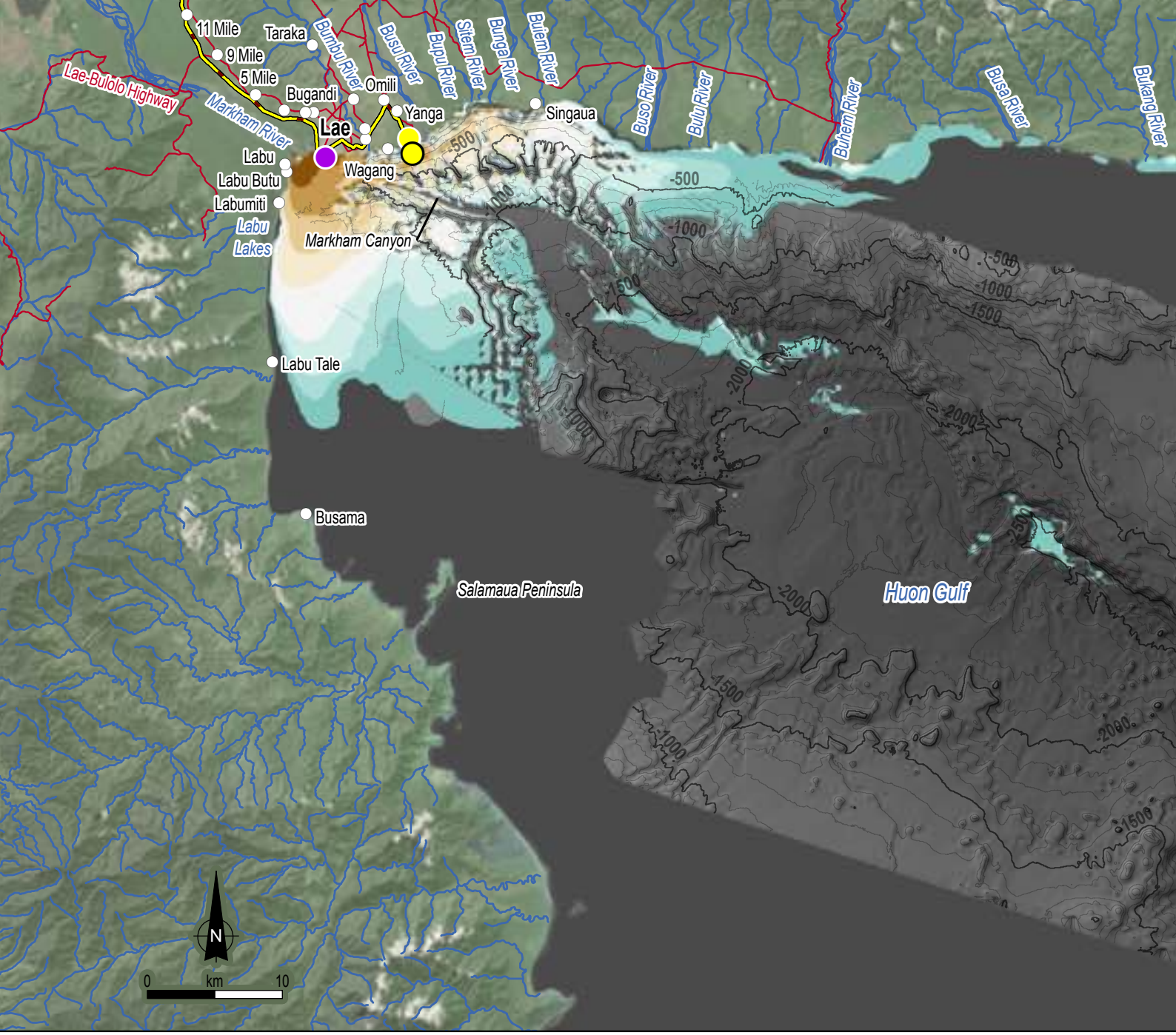
canyon ol i kolim Makham Canyon. Dispela canyon i pundaun igo daun, klostu 100km stat long Huon Gulf na go long New Britain trench na em dip mo long 9,000m.

Long taim bilong bikpela ren, ol dispela wara i ron igo insait long solwara na i kamapim wara i gat das wantaim wesan na giraun. Ol stadi i estimate olsem klostu long 60 milion tonne wesan na giraun i go insait long Huon Gulf long wanpela yia. Piksa bilong das wara igo insait long Huon Gulf stap long Piksa 3.5.

Ol i bin mekim sampela model long komputa i soim o prediktim olsem dispela ol pipia wesan arere long nambis long ol wara long north kos bai i surik i go moa inap long 20 kilomita southwest long west kos bilong Huon Gulf.

I bin gat sampela priliminari wok painim aut i go insait long lukim Huon Gulf i stap olsem wanem long 2012. Long 2016 i go inap long 2018 tupela bikpela stadi long oceanographic(solwara) and sedimentological (wesan na giraun). Dispela stadi i painim olsem i gat wanpela layer bilong wesan klostu long 300 mita thick i stap pas wantaim flo bilong solwara long Markham Canyon. Ron bilong solwara insait long Markahm Canyon i narapela kain. Klostu long flo bilong Markham Canyon wara i save ron go daun ol i kolim “downward canyon flows”. Long tok moa long dispela, karent flow igo daun long canyon i spid nogut tru, klostu long 2 knots i go inap 16 knots na dispela i save brukim ol wesan i stap insait long solwara na kamapim ol liklik mauten i go daun olgeta long Markham Canyon.

Long ol narapela wok painim aut olsem, lukluk long poto bilong setolait solwara temprisa, insait long wanpela yia ol i mekim upper ocean conductivity-temperature-density profile data, temperature logging data na insait long wanpela yia ol



i mekim tu ocean vertical current measurements. Ol i painim olsem i nogat evidens olsem dispela ol wesan i go ananit tru long Markham Canyon i no kam antap bek gen (no evidence of an upwelling) long nambis na ol ples i stap klostu long nambis. Dispela nambis em klostu long hap we kampani tingting long mekim DSTP outfall.

Long Piksa 3.6, soim prediksen o givim tok piksa bilong pipia wesan ol wara i rausim i go insait long Huon Gulf. Dispela piksa i soim ples bai stap olsem wanem long bihaim long 27 yia wara i ron i go insait long solwara. Long piksa 3.6 is soim tu klostu 1,620 milion tans bilong pipia wesan na kainkain deti ol wara bai i rausim i go insait long Huon Gulf. Dispela model o tok piksa i soim olsem 5 mita i go inap long 10 mita wesan i bai go insait long solwara long sait bilong maus bilong wara Markham. Dispela wesan bai suruk yet i go na sindaun long flo bilong Markham Canyon.

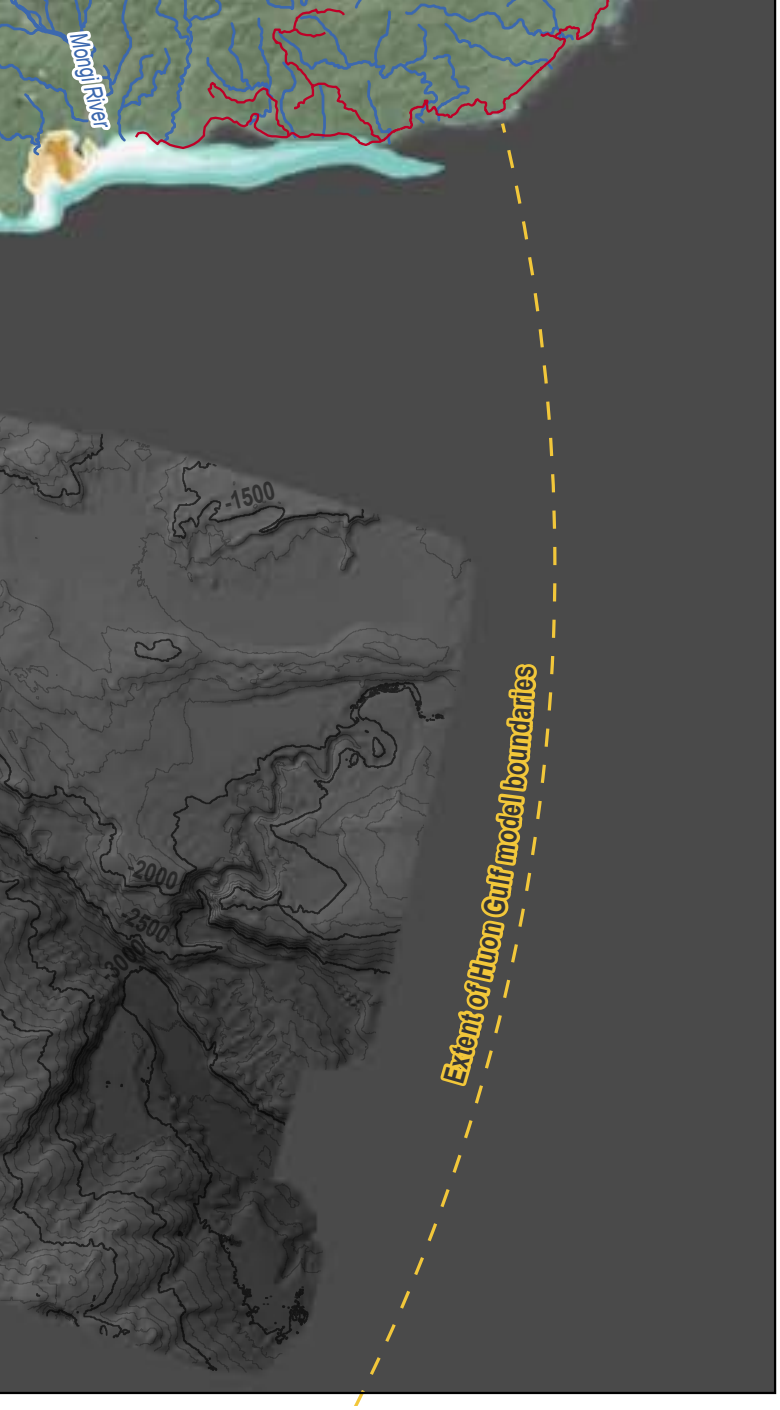
Huon Gulf Kemikol na Ekotoksikolojikol Envairomen (Huon Gulf Chemical and Ecotoxicological Environment)

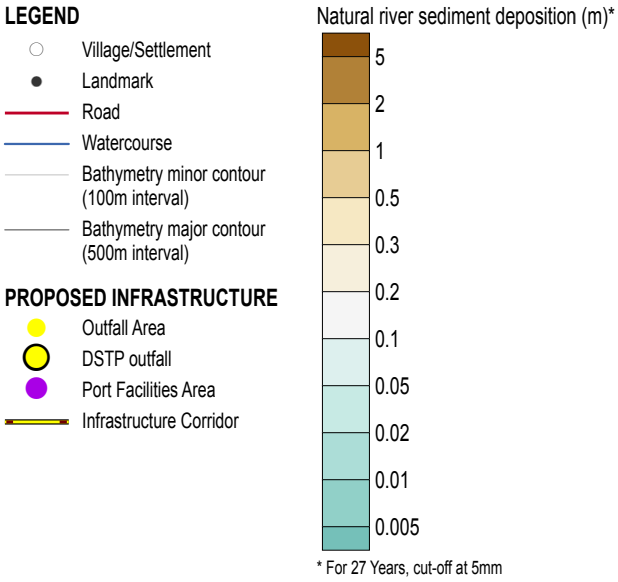
Stadi long metol kontent bilong wesan insait long fopela bikpela wara i ron go insait long Huon Gulf, i soim olsem konsentresen bilong metol i antap liklik. Olgeta metal konsentresen long dispela stadi ol i komparim wantaim "average crustal abundance values". Metol olsem arsenic stap insait long Wara Markham na copper na nickel insait long olgeta fopela wara i soim olsem levol bilong ol nau yet i stap antap pinis na sampela ekotoksikolojikol impek i kamap pinis.

Kampani i kisim wesan long sedimen trep long fopela moorings stap long solwara klostu long Markham Canyon na insait tu long flo bilong Canyon, na tu long 15pela dip solwara flo sempol. Result bilong sempol analysis i soim natural konsentresen bilong particulate copper na nickel, em abrusim mark long sediment quality guidelines. Na tu dispela toxicity testing i soim olsem natural toxicity em ken kamap long dispela solwara envairomen.

Huon Gulf Biological Envairomen (Huon Gulf Biological Environment)

Stadi i soim olsem i nogat planti pis spisis i stap long 100 mita igo daun olsem 800 mita insait long Huon Gulf. Namba bilong pis kampani hukim i tamblo tru moa long ol narapela stadi ol i mekim long ol DSTP hap olsem Woodlark, Misima, Ramu na Lihir. Stadi i mekim 23pela troling inap long 16pela awa long tupela sevei na ol i no painim ol narapela pis femili ol i rekodim.





Piksa 3.6: Predicted deposition of natural sediment discharged into the Huon Gulf as suspended sediment load from rivers (without DSTP) after 27 years

Piksa 3.7: Macrofauna ol i stadim insait long Huon Gulf (Macrofauna sampled in the Huon Gulf)

Piksa 3.8: Meiofauna ol i stadim insait long Huon Gulf (Meiofauna sampled in the Huon Gulf)

Narapela stadi kampani i wokim i lukluk long zooplankton na micronekton (binatang o liklik tru ol kuka na pis). Em fes taim long dispela kain stadi insait long PNG long sait bilong DSTP. Stadi painim aut olsem i gat planti zooplankton long olgeta sempling hap tasol ol i nogat koneksen wantaim lokesen, dip bilong solwara, na sempling taim. Wanpela samting tasol ol i painim aut em plankton isave stap long dip hap bilong solwara long san taim, na long nait taim ol plankton isave kam bek antap long solwara. Ol zooplankton stap klostu long nambis i gat metol konsentresen i stap antap, na konsentresen i go daun long zooplankton stap long wei long nambis, na insait long dip solwara. Stadi i tok dispela i kamap bikos long ol planti pipia wesan bilong wara klostu long maus bilong wara Busu na Markham. Taim WGJV stadim micronekton na zooplankton, ol i painim aut olsem metol konsentresen i antap moa long micronekton, na dispela i soim olsem i gat sampela bioaccumulation o biomagnification iwok long kamap taim ol micronekton ikaikai zooplankton. Dispela em yet emi kamap long natural environmental background levels.

Dispela stadi i kisim sempol long flo na sait wol bilong Markham Canyon na stadim ol macrofauna (Piksa 3.7) na meiofauna (Piksa 3.8). Macrofauna em ol liklik tru binatang stap insait long wesan na size bilong ol em olsem 500 µm.

Size bilong meiofauna em ol liklik moa (63 µm – 500 µm) long macrofauna. Olgeta stadi Projek i wokim fest taim, oli soim olsem, olgeta animol i stap insait long giraun aninit long solwara (deep-sea infauna), 50% moa long sempols ol i no gat macrofauna. Bihain long tenpela mun i pinis, kampani wokim stadi gen na painim aut olsem namba bilong meiofauna i go antap liklik tasol olgeta i stap nambaut nambaut na i no long wanpela hap tasol long flo bilong Markham Canyon.

3.2 Sosioekonomik (Socioeconomic)

Ol sosioekonomik stadi makim fopela eria bilong Projek em olsem:

- Stadi Eria 1: Main eria wantaim ol rot
- Stadi Eria 2: Infrastructure Corridor stat long Zifasing igo long Lae
- Stadi Eria 3: Lae (wantaim Port Facilities Area na Infrastructure Corridor inside long Lae)
- Stadi Eria 4: Wagang wantaim Yanga ples (wantaim Outfall Area na Infrastructure Corridor klostu long Lae siti)

Socioekonomic stadi soim olsem ol samting ino wankain insait long dispela fopela stadi erias.

Stadi Eria 1 em stap longwe long bus na rural hap tru long olgeta fopela stadi erias. Stadi Eria 3 istap long urban eria. Stadi Eria 2 na 4 em rural wantaim urban erias.

Stadi Eria 1 i gat 28 pela ples. Ol ples klostu long Main Eria em ol hauslain bilong Babuaf, Hengambu na Yanta. Populesen bilong dispela olgeta ples em klostu 3,900. Populesen bilong ol ples long Lower Watut na Lower Markham (wantaim ol ples stap long Demakwa Access Road na Northern Access Road) em klostu 6,000. Dispela ol ples em bilong ol pipol Wampar.

Stadi Eria 2 i karamapim klostu 50km long ol ples na setolment insait long Infrastructure Corridor namel long Zifasing na Lae. Stadi Eria 2 istap klostu long Highlands Highway na mekim isi long man meri igo long lae, Madang na highlands.

Stadi Eria 3 i karamapim Lae Siti. Stadi lukluk long Pot bilong Lae na Malahang insait long Lae siti. Infrastructure Corridor bai karamapim southern na eastern hap bilong Lae.

Stadi Eria 4 i karamapim ples Wagang na Yanga. i lukluk long Outfall System, na hap bilong Infrastructure Corridor go olsem long Outfall System, long ples Wagang na Yanga.

Long Stadi Eria 1, 2 na 4, giraun em customary na long sampela hap, i gat land dispute. Klostu olgeta giraun long Lae siti (Stadi Eria 3) em bilong Gavaman, na i gat liklik hap we em customary. Lae siti residential em gat taun na ol settlement wantaim.

Ol pipol bilong Stadi Eria 1 na 2 ol pipol i yusim envairomen bilong kaikai, wokim haus, kisim paiawud, na tumbuna marasin. Ol i wokim ol haus long bus meteriel olsem diwai, mambu bilong wol, na saksak lif bilong ruf. Planti ol dispela hap ol i yusim kerosene lamp long nait na paia bilong kuk. I gat wanwan manmeri i yusim generator na sola pawa. Na tu ol manmeri insait long Stadi Eria 1 wok long painim gol.

Long Stadi Eria 1 na 2, ol manmeri kisim wara bilong dring long ol springs na ol liklik wara. sampela ples ol i usim tenk wara. sampela ples ol i kisim wara supply ikam long paip. Ol pipol usim bikpela wara tasol bilong waswas, painim pis, na transpot.

Pipol long Stadi Eria 1 ol i stap long rural eria long we long taun o siti. Ol planti bus rot bilong go kam long ol ples na ol pipol save yusim kanu long Wara Watut bilong go bilong maket. Ol pipol save yusim tu Wafi Access na Demakwa Access rot long go long Lae na ol narapela hap. Ol pipol long long Stadi Eria 1, dispela problem wantaim trenspot em wanpela bikpela hevi long ol, tasol ol pipol stap long Stadi Eria 2 ol i gat Highlands Highway stap na ol i ken wokim bisnis.

Sampela ples long Stadi Eria 1 ol i nogat ekses long edukesen bikos skul i stap long wei. Long Stadi Eria 1 wanpela stadi long 2014 na 2015, i painim olsem 31% ol boi na 41% ol gel krismas bilong ol 7 igo 14 yia ol i no go long skul. Planti ples insait long Stadi Eria 1 i gat ekses long ol haus sik, wantaim Wafi helt klinik, Zindaga helt sab-senta na Wongkins, Timini na Pokwaluma aid post em WGJV i bin wokim. Ol ples lain save wokabaut tupela awa long go kisim helt sevis. Ol pipol husait istap insait long Stadi Eria 2 ol i gat gutpela ekses long ol edukesen na helt fesiliti, tasol sampela taim ol ino gat helt wokman na drag suplai.

Lae siti (Stadi Eria 3) em senta bilong trenspot, bisnis, edministresen, indastriol, residensel, na edukesen bilong Morobe Provins na PNG. Ol manmeri stap insait Stadi Eria 3 ol i gat wok long siti. Tasol, yet i gat planti youth nogat wok insait long Lae. Planti ol siti residens tu ol i wokim gaden na growim kaikai bilong salim ol i kolim infomol ekonomi. Klostu haf bilong giraun bilong Lae, em i gat infomol setolmen (minim olsem ol manmeri sindaun bilong dispela hap, ol i nogat rait long sindaun long dispela hap). Lae i gat gutpela wara sistem na pawa saplai, tasol ol infomol setolmen ol i no igat gutpela ekses long dispela sevis.

Wagang na Yanga ples (Stadi Eria 4) em ol stap klostu long Lae siti tasol planti bilong ol wokim gaden yet, na painim abus long bus na pis long solwara. Planti bilong ol tu painim wok pinis long Lae o i gat liklik bisnis. Residens long dispela stadi eria ol i gat ekses long pawa na kisim wara long tenk, wel, na ol liklik wara ron long ples.

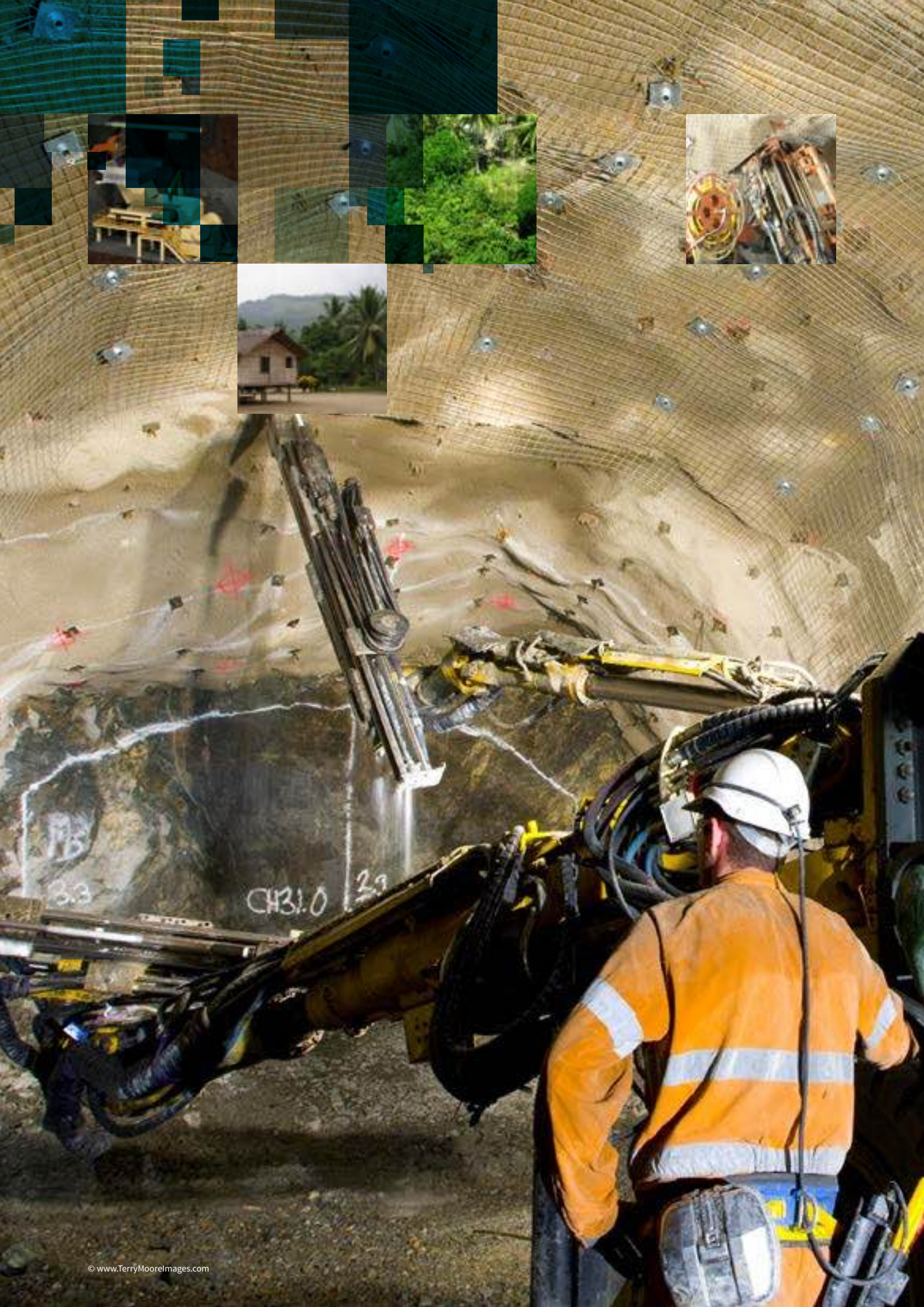
Long wanpela helt stadi Projek i wokim long 2013, i soim olsem ol pipol long Stadi Eria 3, ol i ekspos long high level mercury na lead insait long subsistence kaikai bilong ol. Beslain conditions soim olsem mercury na lead stap insait long pis na selpis, na cominiti long Stadi Eria 3 kaikai planti pis na selpis. Long Stadi Eria 1, levol bilong arsenic em i antap liklik long ol ples lain na Stadi Eria 2, bikos long kaikai planti pis.

3.3 Kalsa Heritej
(Cultural Heritage)

Kalsa Heritej i gat 'tangible' na 'intangible aspects'. Tangible heritej em ol atifek we ol manmeri i ken rausim o i no inap rausim. Intangible heritej em minim ol toktok bilong bipo taim, stori bilong tumbuna o tredisen ol tumbuna i givim. Long PNG, kalsa heritej em i gat tredisenol hap bilong toktok, ples bilong wok o koloniel, na archaeological eria we ol kle pot, ston na bun stap.

Ol lenona grup i gat faifpela kalsa grup insait long Projek. Ol men grup em Babuaf, Hengambu na Yanta husait sindaun klostu long Main Eria. Infrastraksa Korido i stap antap long giraun bilong Babuaf, Wampar na Ahi ples. Outfall Eria em stap long hap bilong ol Ahi lain.

12pela kalsa heritej sevei kamap long Wafi-Golpu Projek long 1996 inap long nau. Stadi painim aut olsem i gat 351 kalsa heritej hap o eria insait long Hengambu, Yanta, Babuaf, Wampar na Ahi kalsa grup. Dispela ol kalsa heritej hap stap nambaut insait long Main Eria, Infrastraksa Korido na Outfall Eria. I gat 289-pela orol tredisen hap, 59 pela archaeological hap na 3 pela historikol hap. Orol tredisen hap em stap long ol hap olsem olpela setolmen, stori, ples matmat, planim dai man, rokselta na kemp.



4

Projek Toktok
(Description of the Project)

Golpu kopa na gol orebody em i wanpela long sampela moa long ol kopa na gol diposit long Main Eria. WGJV i putim application long Special Mining Lease (SML) long Golpu, Wafi na Nambonga diposit, wantaim tu ol application bilong ol narapela tenements.

Dispela Projek i bai kamapim:

- Tupela tanel go insait long Golpu orebody stap ananit long Mt Golpu
- Wanpela tanel long Nambonga
- Andagraun block cave main, krasa na konveyas
- Ol sapot fesiliti long andagraun main olsem refregaration plants, ventilation shafts na cooling fans
- Ol Sapot infastraksa olsem haus bilong fuel, weist rok dump, treatment plant bilong wara, koncrit plants na explosive storage
- Ol wokshops, edministresen na ples bilong slip
- Hap bilong kisim ston, na kisim grevol
- Watut Process Plant na copa-gol flotation plant
- Power station na pawa lain
- Infrastructure Corridor stat long main igo long Port Facilities Area na Outfall Area em bai igat ol rot olsem (Northern Access Road na Main Access Road), laydown eria na tripela paip insait long giraun long karim consentret go long Pot Feseliti na telings go long Outfall Eria, na karim fuel go long Main.
- Port Facilities Area, hap bilong holim na export long copa konsentret
- Outfall Area, wantaim DSTP paiplain bilong telings

Dispela ol fesiliti i kamaut long disain taim kampani i mekim stadi long engineering, ekonomik, envairomen, sosol na kalsa. Dispela EIS i skelim na givim gutpela infomesen long disain bilong Projek.

Wafi-Golpu Joint Venture bai kisim pemit na bihain develop na kamapim Projek olsem:

- Konstraksen
- Operesen
- Pasim main

4.1 Pemiting
(Permitting)

WGJV i putim application pinis long Special Mining Lease (SML) long Gavaman na dispela SML i karamapim Main Eria stap insait long Exploration Licence (EL) 440 na EL 1105, ananit long *Mining Act 1992* wantaim ol narapela tenements karamapim olgeta Projek infrastructure insait long Projek Eria. WGJV i lukluk tu long kisim envairomen pemit ananit long *Environment Act 2000* long olgeta Projek wok ikamap.

Taimtebol bilong Projek divelopmen stap long Tebol 4.1. Dispela ol taimfrem em bai kamap taim gavaman i givim tok orait na WGJV i tok orait tu. Kampani i lukluk long Gavman bai givim special mining lease long June 2019 taim gavman i pinisim olgeta asesmen bilong em.

Tebol 4.1: Projek taimtebol

Key Milestones	Taimfrem
PEMITING	
EIS submison	June 2018
Gavman i givim orait long Levol 3 Envairomen Pemit	By June 2019
Gavman i givim orait long Special Mining Lease	By June 2019
KONSTRAKSEN	
Konstraksen stat (wok bilong tanol)	1 yia bihain long SML gavaman i givim
OPERESEN	
Ol Main Operesen (main developmen, ore extrexen na processing)	5pela yia behain long SML gavaman i givim, na 28pela yia karapim mine operasen
PASIM MAIN	
Pasim Main	Taim maining i pinis

4.2 Konstraksen
(Construction)

Konstraksen bilong main bai kisim olsem 5 pela yia bihain long Gavman i givim special mining lease (SML). Wok bai istat long Main Eria long yia 1 igo long yia 5 na wok long Port Facilities Area na Outfall Area long yia 4 na 5. Konstraksen long ol paiplain bai i stat long yia 4 na kisim olsem 1.5 yia.

Konstraksen bai bihainim gut ol wok kamap olsem:

- Mekim gut rot long go insait long Main Eria na ples bilong silip na kaikai bilong ol wokman.
- Katim na kliarim bus.
- Stretim giraun long hap bilong statim tanel na eria bilong ol fasiliti.

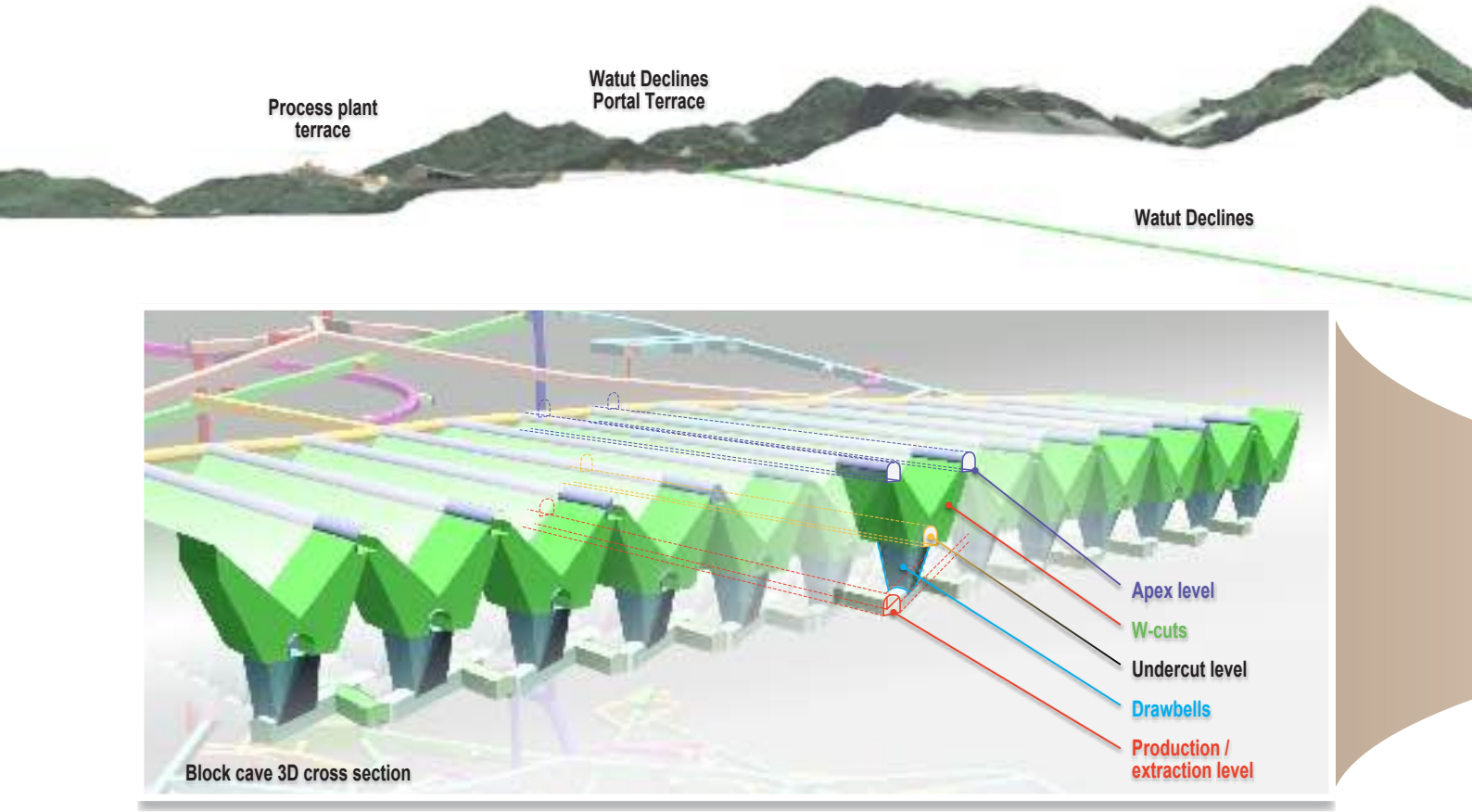
Kampani bai wokim tupela tanel long go insait long Golpu orebody bai stat long Watut na Nambonga. Wok long tupela tanel bai usim drill na blasting na usim trucks long kisim waste ston igo long waste rock dump.

Golpu orebody em stap dip tru na i sanap stret olsem na gutpela long usim block cave mining. Block cave i usim pasin bilong long brukim ston na pudaon igo insait long main (Piksa 4.1) na tu daonim kos bilong operatim main. Block cave tu em igat liklik impek long enviromen bikos long liklik eria long wok na liklik waste rock dump taim skelim wantaim bikpela open pit main olsem Ok Tedi na Lihir mains. Tripela block cave (BC) BC44, BC 42 na BC 40, ol i stap wanwan tamblo long narapela ananit long Mt Golpu soim long Piksa 4.1. BC 40 em moa dip long tupela narapela na stap olsem 1,740m ananit long Mt Golpu.

Bai i gat ol tanels igo insait long Mt Golpu wantaim conveya tanel na 'return air system'. Dispela return air system bai stap insait long wanwan block cave bilong rausim das win long taim ol brukim giraun na tu kisim gutpela win igo insait long main.

Long taim bilong main operesen samplela haus lain insait long SML bai muvim ol igo long nupela ples. Ol ples Hekeng, Nambonga na Venembele em yumi lukluk long resetlement long nupela ples outsait long SML. Kampani tu lukluk long wokim tupela nupela rot ol kolim (Watut Services Road) na (Resettlement Road) lukim Piksa 1.1 long halivim ol comuniti igo long Northern Access Road. Ol dispela rot em bilong halivim husait bai stap long ol nupela ples taim ol i lusim tumbuna ples. Ol plenning na toktok long resetlemen em stat pinis.

Piksa 4.1: Piksa bilong tanel na Block Cave
(Schematic of the declines (tunnels) and block caves)



4.3 Operesen
(Operations)

Taim konstraksen i pinis, wok bilong mining bai kamap klostu long 28 pela yia.

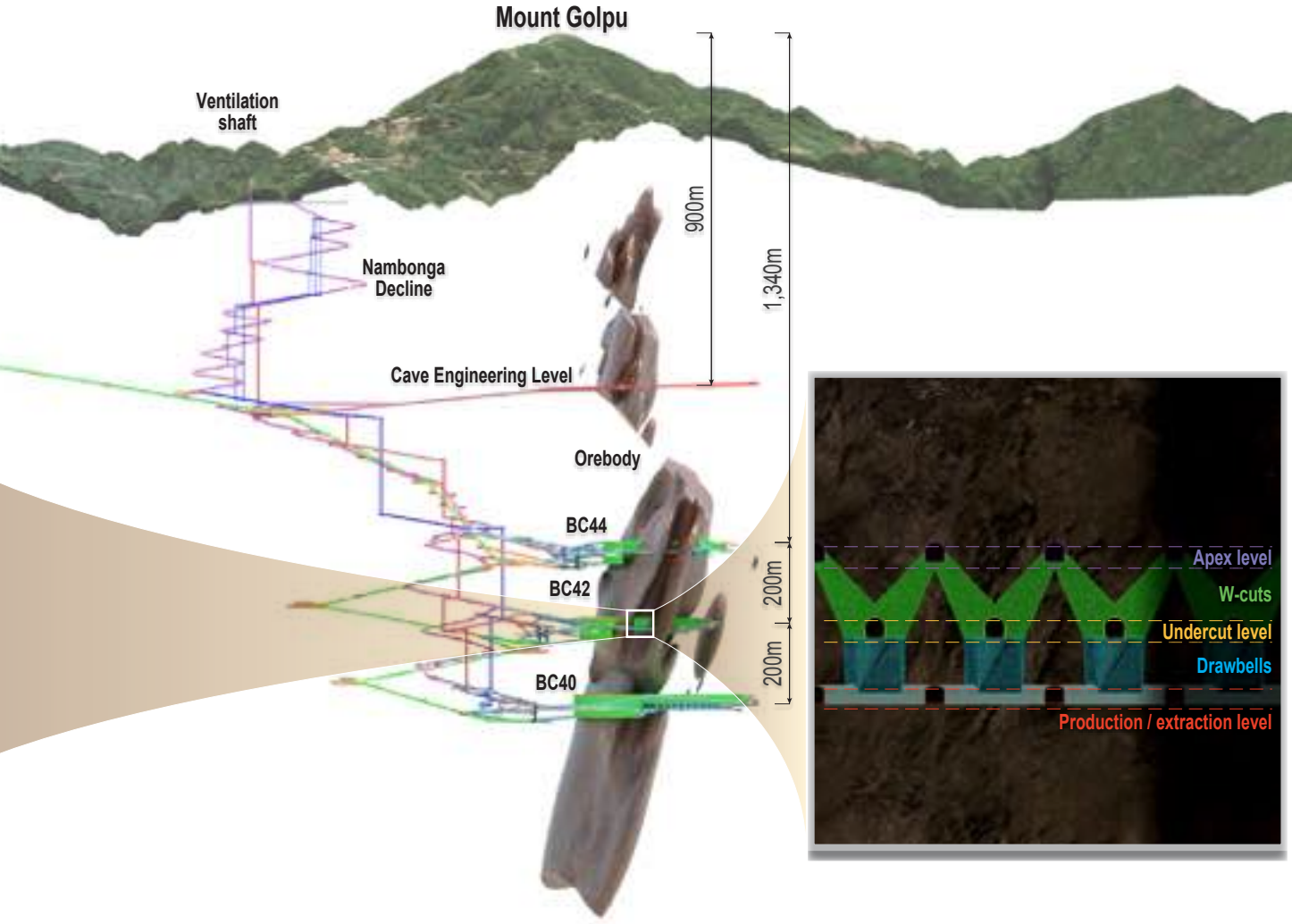
Block Cave 44 bai i operate mo long seven pela yia. Bock Cave 42, i stap olsem 200m ananit long Bock Cave 44, bai i stat faivpela yia bihain long Block Cave 44 na operate long nainpela yia. Bikpela Block Cave 40 bai operate long sixtinpela yia wantain tripela yia antap long BC 42.

Long taim bilong mining, ol loaders bai kisim ore insait long block cave igo long andagraun crusher. Conveyor tanel bai igat ore conveyor wantaim ol narapela sevises olsem pawa na wara long kisim ore insait long block cave igo antap long Watut Process Plant. Watut access tanel em bilong kisim ol wokman meri na masin long antap igo daon long andagraun main eria.

Long taim main prodaksen istat olgeta ore na ol geta kain ston ikam long andagraun main bai kisim igo long Watu Process Plant. Nogat mo ston bai igo long ewaste Rock Dump.

Wok mining bai istap long 24pela hour long wanwan dei na long yia olgeta. Wok bai stop tasol long taim ol makim long wok maintenance.

Wok bilong block cave bai kamapim giraun buruk antap long Mt Golpu behain long 38 pela mun na kamapim crater antap long Mt Golpu.


Mount Golpu
Ventilation shaft
Nambonga Decline
Cave Engineering Level
Orebody
BC44
BC42
BC40
900m
1,340m
200m
200m
Apex level
W-cuts
Undercut level
Drawbells
Production / extraction level

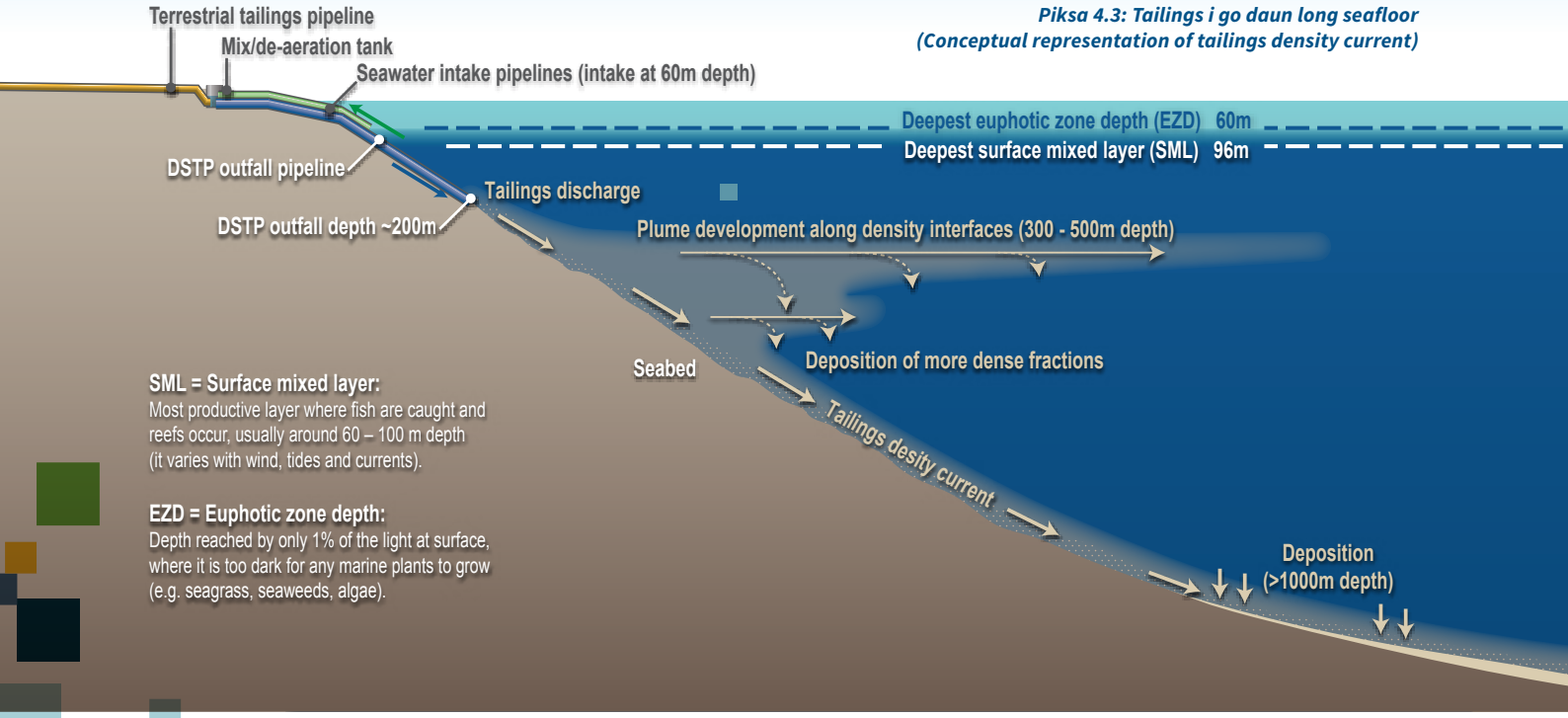
Piksa 4.2: Process plant wantaim infrastructure
(Process plant terrace and associated infrastructure)

Ore Prosesing
(Ore Processing)

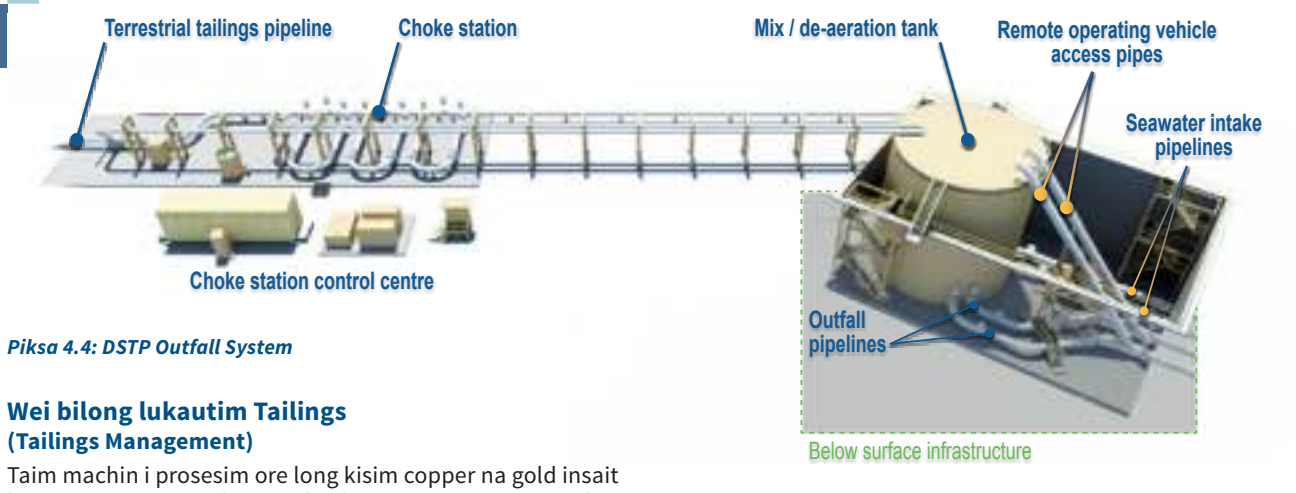
Ore na ston ikam long andagraun main bai igo long Watut Process Plant na brukim liklik igo long wesan na treatim wantain marasin long rausim pipia na kamapim copper-gold concentrate. Concentrate i luk olsem bilakpela wesan dispela em valuable mineral na bai pamim olsem slurry igo long Lae Port Facilities Area. Long Port Facilities Area bai rausim wara na dry copper-gold concentrate bai ship kisim igo long overseas refinery.

Watut Process Plant bai stap long eria em klostu 6 hekta long side bilong mountain west long Watut Declines Portal Terrace soim long Piksa 4.2. Long dispela hap i bai gat ol ofis olsem control room, ol oficce, laboratory, warehouse, haus senis na security.

Dispela process plant bai operate long 24 pela hour long wanwan dei na 365 de long yiar. Wan wan taim tasol bai i pas long wokim maintenance wok.



Piksa 4.3: Tailings i go daun long seafloor (Conceptual representation of tailings density current)



Piksa 4.4: DSTP Outfall System

Wei bilong lukautim Tailings (Tailings Management)

Taim machin i prosesim ore long kisim copper na gold insait long Watut Process Plant em bai kamapim pipia wesan ol kolim tailings. Tailings slurry bai i gat wara we i gat sampela liklik marasin ol usim long processim ore. Klostu long 360 Mt long tailings bai kamap long process ore ikam long ol block caves, BC 44, BC 42 na BC 40, i go long 28 years.

WGJV Kampani em mekim planti stadi na wok painim aut long kainkain rot long lukautim dispela tailings long graon na tu long usim DSTP na painim olsem DSTP em mo orait long lukautim tailings long life olgeta bilong main. DSTP em imo orait long sait bilong safety, engineering, envairomen, sosal, kalta na ekonomik. Tailings menesmen usim DSTP olsem:

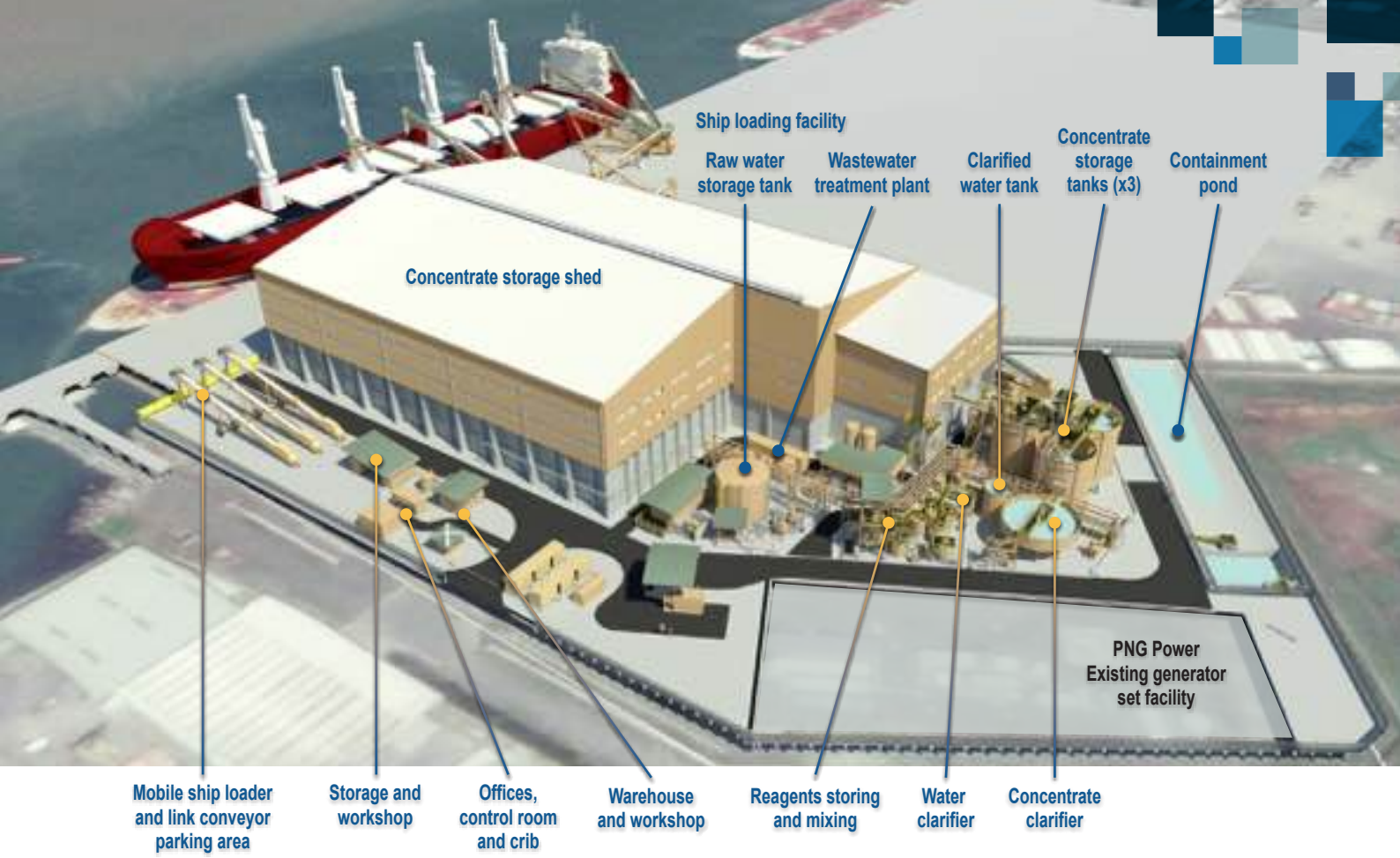
- Em long paipim tailings slurry igo long Outfall eria
- Long Outfall eria, tailings slurry bai kontinu long paip gen igo long dip solwara olsem 100m long arapela hap long world tasol Wafi-Golpu Projek bai usim 200m ananit long solwara.
- Taim tailing ikam out long paip insait long Solwara long dip 200m bai hevi bilong tailings bai kisim igo daun na settle long seafloor em mo long 1000m. Piksa 4.3 soim dispela toktok.

Deep sea tailings placement em igat sixpela main insait long fopela country long world em nau oli usim. Long PNG ol main em i usim DSTP em, Misima (closed pinis), Lihir, Ramu na Simberi. Gavman tu appruvim Woodlark long usim DSTP tasol main konstrakson ino stat yet.

Long WGJV i selektim DSTP metod long tailings menesmen, em olsem olgeta stadi kampani i wokim soim:

- Location o hap bilong Outfall Area em fit stret long DSTP metod.
- Ol tailings ken mix wantaim wesan o sedimen i kam daun long wara Markham, wara Busu na olgeta narapela wara ol karim sedimen or wesan (natural) i go long Markham Canyon na Huon Gulf (co-deposit).
- Namba bilong ol animol na plants species (biodiversity) stap long solwara (pelagic), na dip solwara (deep-slope) na sea floor, em i no planti tumas. Dispela em bicos dispela olgeta sedimen i kam long wara (Markham, Busu etc), em karamapim seafloor, na long solwara antap long sea floor, na tu i gat giraun i buruk na kapsait long sea floor planti taim (regularly) na olgeta giraun i suruk i go tamblo long dip wara long Markham Canyon.
- Bihain main i pas, natural sedimen bai karamapim dispela co-deposit sedimen na dispela em bai halivim ol animol kam bek na stap long en gen, olsem bipo mine impek.
- Em nogat risk long kaikai pis ol i kisim long Huon Gulf. Dispela risk levol em bai stap sem levol olsem nau. Kampani em i no expektim DSTP bai senisim levol long risk.

Moa toktok long dispela stap long Seksin 6 long dispela Ekseketiv Samari.



Piksa 4.5: Port Facilities Area

Kampani em disain na saiting long Outfall System i bihainim ol Gavman Draft General Guidelines bilong PNG.

Tailings bai pamim olsem slari igo long DSTP Outfall System long Wagang east long Lae city (Piksa 4.4). Tailings paiplain ikam long Watut Process Plant bai karamapim ananit long giraun bihainim Infrastructure Corridor. Insait long paiplain em bai gat anti-corrosion na ekwipmen we bai ditektim tailings lik sapos paip buruk.

Konstraksen bilong DSTP Outfall System seawater intake paip na tailings outfall paiplain long seafloor bai usim trenching na lus graon protekson long nabis crossing. DSTP Outfall System mixing tank long rausim air insait long tailings na addim solwara long wokim tailings i hevi bihain pamim igo down long paiplain igo long 200m dip insait long solwara long Huon Gulf. Ol data na stadi long solwara long 12 pela mun i soim olsem tailings outfall istap ananit mo long mixing zone na euphotic zone long moa long fifty percent em sefti margin istap insait long Draft General Guidelines bilong DSTP long PNG.

Ol stadi tu i soim olsem bai nogat tailings bung long maus bilong paip na blokim outfall paip.

Concentrate Paiplain

Copper-Gold concentrate bai pamim olsem slari insait long paiplain stat long Watut Processing Plant na bihainim paiplain long 100km igo long Port Facilities Area long Lae (Piksa 4.5) Paiplain bai i ron long ples we igat ektiviti kamap pinis bai liklik impek long envairomen, sosal na kalta. Paiplain bai ron namel tu long samplela wara na sampela rot. Paiplain tu igat sistem bilong stopim rast wantain narapela sistem bilong ditektim lik.

Port Facilities Area

Ol faciliti long Port Facilities Area em bai gat masin bilong rausim wara long concentrate, ol masin bilong loadim ship, conveyors na storage.

Rausim wara long concentrate slurry em bai usim pressure filter na storim dry concentrate insait long haus wetim taim bilong loadim ship usim ol conveyors long export.

Pawa Generation (Power Generation)

Long taim bilong konstrakson bilong Projek, bai usim ol diesel generators long givim pawa.

Long taim bilong main opereson, Kampani tingting long constrak na operatim pawa stesen long saplaim ol pawa igo long main na ol ples bilong wokman long silip. Pawa generesen bai istat wantaim 56 MW na behain surukim igo antap long 100MW. Pawa generesen bai usim “intermediate fuel oil” (IFO) bikos em ekonomikal na sustainable long laif bilong main. Pawa stesen bai istap 6.5 km north long Watut Process Plant na pawa lain bai behainim Mine Access Road na usim tupela 132kV circuits. Wanpela pawa lain bai ron antap na narapela bai planim ananit long giraun.

WGJV bai asesim narapela pawa saplaia kampani taim Projek i go het.

Lukautim Wara
(Water Management)

Kampani bai lukluk long gutpela wara menesmen long wanem bikpela ren pudaon long Mt. Golpu na ken fomim acid-forming rocks. Acid-forming roks ken kamap long andagraun main, ore stockpiles, waste rock dumps na subsidence zone na acid ken go insait long wara na kosim samting ol kolim long “acid and metalliferous drainage”

Objectiv bilong dispela wara menesmen bilong Projek em long ol levol bilong sedimen mas stap wankain olsem nau na stopim bikpela sedimen igo insait long ol wara. WGJV Kampani i bai mekim dispela wok i olsem:

- Wokim sedimen kontrol straksa, olsem sedimen pond, klostu long Projek infrastraksa pastaim long konstrakson wok ikamap.
- Banisim acid-forming material, noken expose long air, ren na sun.
- Holim na tritim ol nogut main waste wara, wantaim andagraun wara na runoff ikam long stock pile na waste rock dump, bepo wara i go long Wara Watut. Long fespela tripela yia, olgeta andagraun wara long konstraksen long Nambonga Decline Portal, na wara bilong Miapilli Waste Rock Dump, dispela wara kampani bai tritim pastaim na putim i go long Nambonga creek.

Long taim bilong konstraksen, olgeta treated main wara na sewage, kampani bai yusim gen long main sevis na ekses wara bai go long Wara Watut o Nambonga Creek. Long taim bilong operesen, kampani bai yusim gen olgeta weist wara na kisim wara long Wara Watut. Wara kampani bai kisim long Watut Wara em bai olsem 1% tasol long flow bilong Wara Watut.

4.4 Main i Pas
(Closure)

Long taim bilong mining na processing wok i pinis, main wantaim ol facilitis bai pas. Main klosa em bai gat decommissioning, rehabilitation behain long main i pas wantaim monitoring, maintenance na relinquishment.

Koncep bilong main Klosa na Rihebilitesen Plan em Kampani wokim pinis wantaim ol dispela klosa envairomen objectivs:

- Stopim genereson na lusim bilong acid wara na suspended solids igo long envairomen.
- Rehabilitate Projek Eria wataim ol self sustaining na stable landforms.
- Mitim ol post-klosa land use objectivs we Kampani na Gavman i agree long en.

Ol ki sosal objectivs bilong Conceptual Closure and Rehabilitation Plan em long ol local komuniti noken rely tumas long main long painim ekonomik na indastriol activiti na promotim ol narapela rot long wokim business na kisim wok.

Post-closure management em stap tu long Section 6.4 bilong dispela EIS Ekseketiv Samari.

5

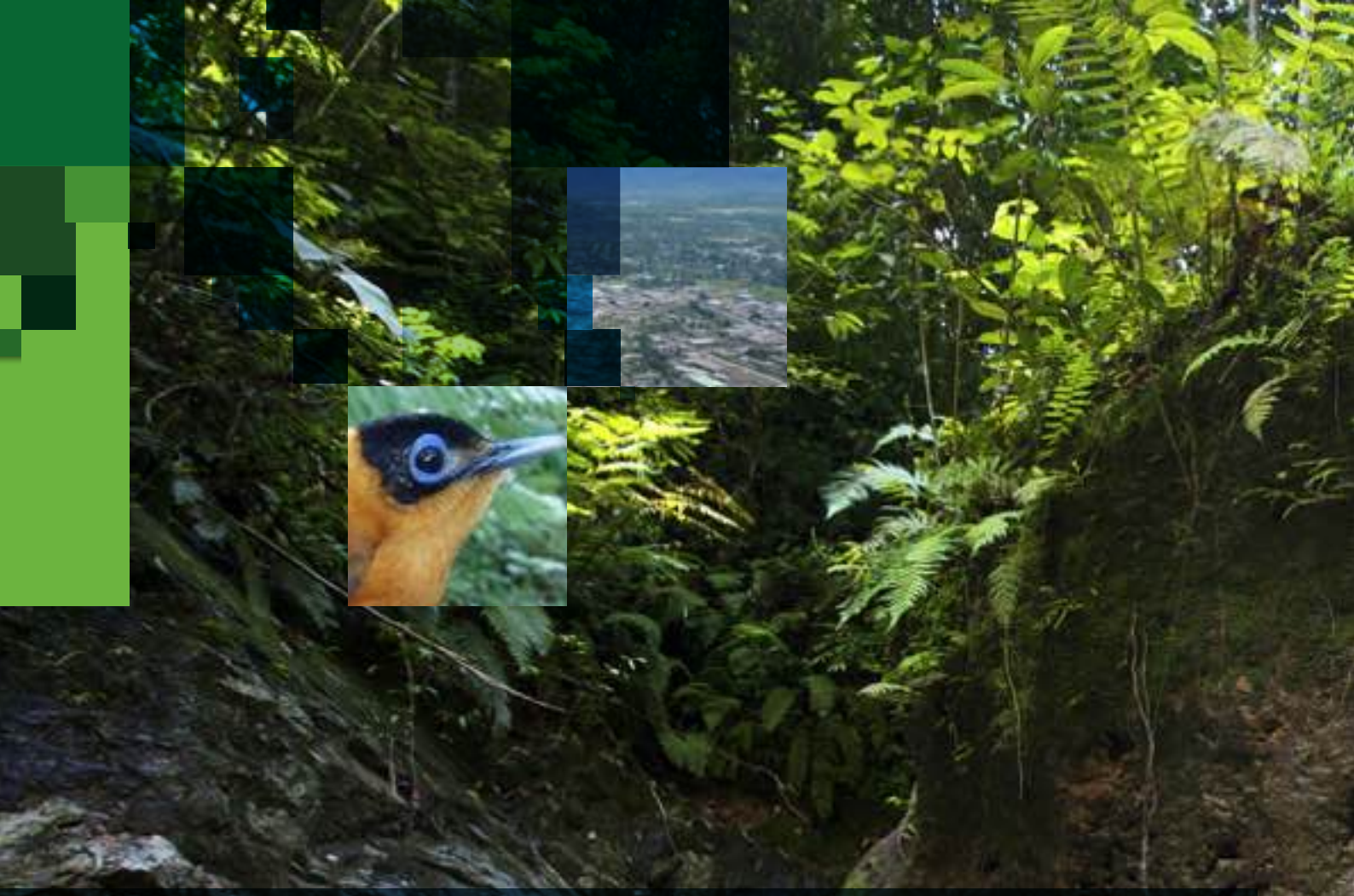
Stekholda Wok Bung
(Stakeholder Engagement)

Ol wokbung wantaim ol stekholda long pasin em transparent na accountable em bikpela hap tru bilong WGJV Kampani long developim na operatim dispela Projek. Ol toktok na harim ikam long ol stekholda long taim bilong ol bung wantaim na meeting em kamapim scope bilong dispela EIS. Ol stadi na assessmen long wanem kain impek bai i ken kamap em formim dispela devlopmen na menesmen rot long adresim ol dispela impeks. Dispela ol toktok na harim em halivim long projek desain na halivim Kampani long kliaim tingting long lukluk long ol concerns bilong komuniti wantaim respek na transparency. Stekholda wok bung bai igo het yet long laif bilong dispela Projek.

Kainkain stekholda wok bung wantaim em Kampani wokim long harim na kisim tingting bilong ol stekholda.

Ol kain wok bung wantaim em long ol meeting long ol ples klostu long main eria, gavmen, ol stekholdas, komuniti meetings na projek awareness long envairomen, sosal na kalta. Ol tingting bilong ol komuniti na stekholdas insait long ol stadi bilong envairomen, sosal, na kalta em igo insait long dispela EIS.

Planti ol stekholdas na komuniti stap klostu long Main Eria ol givim strongpela sapot long projek mas go het long givim benefit na oppotuniti long ol. Same taim tu ol givim wari bilong ol long wanem kain impek tu ken kamap long projek, olsem envairomen bagarap, law na oda, hevi long femili na marit, na ol sosal problem kamap long bikpela senis main projek bai kamapim.



6

Projek Asesmen
(Assessment of the Project)

6.1 Envairomen
(Environment)

Long 1980 ikam, stadi kamap pinis long makim Projek envairomen setting na how Projek bai senisim dispela setting na rot bilong stretim sampela senis na wanem kain impek bai kamap.

Ol key envairomen impek kamap long Projek long sait bilong ecology, ol wara, nois na air kwaliti wantaim dip solwara envairomen. Ol samting we bai ken kamapim sampela hevi em:

- Kliarim bus
- Bikpela masin (olsem bulldozer na ekskaveita) wok na stretim giraun
- Giraunwara igo insait long ol tanels na andagraun main na em I ken kisim igo bagarapim wara long hap.
- Mak bilong graunwara i go daun, taim masin rausim giraun wara bilong aquifers.
- Acid na metalliferous drainage bai kamap bikos long ol Projek wok
- Senis bai kamap long ol resources bilong komuniti long taim niupela rot i kamap long ol komuniti
- Yusim DSTP long tailings menesmen

EIS tu i lukluk long ol narapela hevi or impek long envairomen olsem greenhouse gas emmissions, air kwaliti, nois, na ol niupela giraun main i konstraktim olsem; liklik access rot insait long main lis, waste rock dump, stock pile, na subsidence em tu ken kamapim impek long komuniti.

Ol narapela hap bilong dispela repot toktok long bikpela impek long envairomen em ken kamap long Projek na tu givim toktok long wei Kampani i ken menesim ol dispela hevi sapos i kamap.

Kwaliti bilong Air na Impek bilong Nois
(Air quality and noise impacts)

Kampani i ken pridiktim kwaliti long air na nois insait long Projek Eria, tasol em bai i no inap prediktim long sampela ples olsem; Ziriruk (air na nois), Fly Camp (air tasol), Papas (nois) na Hekeng (nois).

Stadi pridiktim bai i gat impek long air kwaliti long Ziriruk na Fly Camp. Dispela impek i ken kam long ol generators long time bilong operesen.

Nois levol em bai go antap na lusim levol Kampani i makim bilong nait taim long taim bilong konstrakson long Ziriruk, Papas na Hekeng. Nois levol tu bai senis long Main Eria na long Hekeng long ol moning na apinun na nait taim

Long taim bilong operason, nois levol bai igo antap na lusim mak long Ziriruk. Nois bai kam long ol generatas em stap olsem 800 mita north long ples.

Kampani igat plen long daunim air kwaliti na nois impek insait long Projek Envairomen Menesmen Plen. Dispela em:

- Long air kwaliti, long das long rot - ol kar na masin ino ken speed long rot long time ples in drai na nogat ren long ol hap klostu long ol ples.
- Long air kwaliti, long simuk ikam long ol masin – bai kontrolim simuk ikam long ol masin long mitim mak Kampani i makim.
- Long nois – mekim liklik wok long nait na givim toksave long bikpela nois bai kamap, blasting em bai long de taim tasol na givim toksave long ol ples long taim bilong blasting.

Ol bus na abus antap long giraun
(Terrestrial Ecology)

Dispela projek bai kamapim sampela impek long bus na diwai, ol animol na habitat. Dispela impek bai olsem:

- Ples bilong ol animol bai i lus long taim bilong klinim bus na stretim ples bilong Projek bai kamap. Na tu taim ol manmeri kam insait long projek eria bihainim nupela rot i kam na stap insait long main eria (in-migration).
- Habitat or ples bilong ol animol na bus/diwai bai bagarap long taim ol man kliarim bus na dispela kamapim samting ol scientist kolim edge effects, barrier effects, na wesan wara karim ikam, na kain kain pest animol na weeds. Dispela ol weeds, em ol diwai/flawa we i no i bin stap bipo long bus bai kam insait, na tu acid metalliferous drainage or kapsaitim oil na ol narapela kain marasin i ken impek long ol animol na bus. Bus na giraun i ken kisim impek tu we ol pipol bihainim rot na kam insait long main eria na kisim ol samting bilong bus long wokim haus, na gaden.
- Namba bilong ol animol na diwai bai i go daun. As bilong en em olsem bus bilong ol i no i stap moa o bikpela hap ol rausim taim wok bilong rot na main kamap, kisim bagarap or dai long ol kar kilim taim ol ron long rot, ol narapela abus i kam na kilim ol na tu manmeri husait i kam na stap painim kaikai na kilim ol. Narapela impek tu em nois bilong ol masin poretim ol na ol bai ron awei.

Eria we constraksen phase bai kamap em olsem 1,405 hectare. Long dispela 1,405 hectare 862 hectares em wok gaden na ol bulumakau fam kisim pinis. Olsem na dispela eria, 61% long em i senis or disturbed pinis.

Long potential direct or indirect impek Projek kamapim, impek long ol floodplain forest i stap long alluvial plains, EIS stadi soim olsem ecological impek levol em bai bikpela. Sapos yu comperim floodplain forest wantaim narapela kain forest olsem hill forest, floodplain forest i karamapim liklik eria, na em in o strong long senis long envairomen olsem flood pattern na kliarim bus.

I no olgeta animol na diwai/bus bai pilim wankain impek levol long populesin bilong ol, taim habitat bilong ol bagarap. Ol species stap long bus (forest interiors) i ken kisim bikpela moa impek.

Impek long ol diwai/flawa species i stap insait long bus we wok bilong kampani bai kamap EIS stadi i ting olsem dispela species ken kisim impek long population bilong ol: *Diospyros lolinopsis*, *Calophyllum morobense*, *Halfordia papuana* na *Helicia subcordata*. Na ol narapela diwai ol kwaliti timba diwai ol man bai katim na kisim kisim timba long wokim haus. Nem bilong ol olsem Kwila (*Intsia bijuga*), New Guinea Rosewood (*Pterocarpus indicus*) na *Mangifera altissima*.

Projek bai i no inap sanapim haus long ples bus i stap 1000 mita na go antap, tasol hap ples bilong resettlement villages na nupela rot bai kamap i opim rot i go long ples we man i no save go insait tumas na katim diwai long hap bilong wara Wafi. Ol montane mammal community (olsem Goodfellow's tree kangaroos na nilnil kapul (echidna)) long dispela hap, i ken kisim bikpela impek na sapos ol man painim na kilim bilong kaikai. Impek levol long ol narapela animol species em i no bikpela tumas.

Long traim long noken kamapim bikpela hevi long bus, giraun na wara, wok painim aut em soim olsem wok noken kamap long hap bilong Markham Gap na Lower Watut Wara ples.

Kampani checkim olgeta wei long manegim dispela impek na wokim stadi long Projek alternatives na siting long Projek infrastaksa. Examples long dispela Projek Envairomen Menesmen Plen em soim rot we i ken makim ol wei long bikpela hevi noken kamap long sait bilong bus, giraun na wara:

- Traim long noken mekim planti bagarap taim kliarim giraun.
- Strongim long bihainim rot bilong ol wara insait long projek eria.
- I mas traim hat long noken larim giraun noken bruk na kontrolim ron bilong giraun.
- I mas putim was long ol diwai, gras, binatang na ol animol noken kam insait long projek eria long ausait.
- Kamapim long bilong yusim rot bilong kampani.

Olgeta wara antap long giraun na Freswater Ecology (Surface Waters and Freshwater Ecology)

Projek impek long ol kainkain wara antap long giraun na freshwater ecology bai i no inap kisim bikpela impek insait long Lower Watut Wara catchment. Tasol EIS stadi i pridiktim bikpela impek long hydrology, sediment transport na kwaliti long wara (suspended sediment) we ol i ken kamapim impek long aquatic ecology long wan wan hap insait long Main Eria.

Bikpela long ol pridikted residual impek long wara (aquatic ecology) bai kamap long stat bilong Projek or construction phase. Ren em bikpela rot we bai karim giraun, ol metol i go long wara. Dispela tu i ken kamapim impek na senisim aquatic habitat, hydrology, lusim liklik plant species wantaim macroinvertebrates, pis na ol binatang stap long wara.

Ol han wara we bai kisim impek bilong projek em Boganchong na Womul na tu daunblo bilong bikpela Bavaga na Wafi wara. Wankain stori olsem antap, long impek i bai kamap long hia.

Ol dispela short term residual impek na senis long wara, EIS stadi pridiktim ol bai stap long construction phase i go long 18 pela mun or 2 pela Christmas. Levol bilong impek em bai go daun taim Projek planim gras na diwai antap lon giraun we bus ol bin kliarim.

Ol giraun na ston ol rausim long taim bilong construction wok bai go insait long han wara Boganchong tasol bai i no inap go long han wara Chaunong o daunblo bilong wara Bavaga na bikpela Watut wara. Wok painim aut em soim dispela giraun na ston bai pudaun long baksait bilong wara Watut namel bilong han wara Chaunong na eria kampani wokim long holim giraun. Ol diwai na bus gro long arere bilong wara halivim long holim giraun na ston ron insait long wara. Na tu stron na spid bilong wara Boganchong em liklik tasol.

Long daunim hevi bilong ol pipia ston we i ken kamapim acid mine drainage, i gat tingting bilong planim long waste rock dumps. Taim wok kamap long construction na operesens, ol pipia na deti wara bai bungim na stretim long treatment plant. Bihain ol bai testim kwaliti long wara gen na sapos results soim long mak long Papua New Guinea Water Quality Criteria na tu long ANZECC/ARMCANZ (2000) ambient water quality guidelines em orait. Dispela kain kwality long wara em bai lukautim ol gras, diwai, binatang na pis bilong wara.

Bihain taim long main i pas, ol block caves ananit long giraun, bai pulap wantaim wara. Ol stadi long model soim olsem dispela wara insait long subsidence zone, kwality bilong en, em bai i no gutpela tumas, olsem pH bai go tamblo, na levol bilong ol sulphate, metals, na metalloids bai kam antap. Kampani mas menesim gut olgeta wara long subsidence lake. Sapos wara kam autsait long subsidence lake, kwaliti bilong em i mas stap long mak Papua New Guinea Water Quality Guidelines.Tasol Projek i gat moa wok painim aut long taim main i stap long operesen phase.

Bihain olgeta pipia wara bai stretim or treatim long treatment plant stadi soim olsem em bai gat liklik impek bilong envairomen. WGJV em bai treatim wara bipo l em i go bung wantaim ol bikpela wara bilong ples Wafi.

I gat sampela rot i stap insait long Projek Envairomen Menesmen Plen em toktok long ol rot bilong lukautim wara antap long giraun na wok bilong lukluk long wara

- Lukluk long ol rot bilong daunim impek insait long plen bilong kontrolim giraun nawesan long wara.
- Planim diwai na gras antap long ol ples we wok masin ibin kliarim bus.
- Banisim ol wara nogut kam aut long main eria na sapos em i gat ol marasin bilong wok gol i stap, klinim long mak bilong envairomen pemit na larim em i ken kam aut.
- Menesim gut olgeta potentially acid forming material wantaim pipia wara long main eria.

Wara ananit long giraun
(Groundwater)

Giraunwara bai ron igo insait long ol tanel, shafts na block caves bihainim ol cracks na faults inside long ston. Wok long ol block caves bai incrisim wara ron igo insait long main taim painim mo long ol cracks na faults inside long ston.

Rausim wara long surface water dewatering bores na drains na kolektim wara na rausim wara igo insait long tanel, na shafts wantaim block caves, bai kamap long giraun wara i go daun long Mt Golpu eria. Ol i pridiktim "maximum drawdown", bai kamap long ten pela yia bipo main i pas. Dispela maximum drawdown em bai stap antap long tanels na ol pridiksen em bai kamap olsem 40 mita igo 150 mita laterally. Maximum drawdown antap long block caves ol i pridiktim sais bilong em, bai go 500 mita inap i go 1,400 mita.

Taim ol rausim dispela wara i save ron ananit long giraun, em bai sotim ol wara we het bilong ol i save stat long Mt Golpu. Wok painim aut soim olsem wara Buvu na Nambonga bai lusim planti wara olsem long mak 34% na 26% long wan wan wara. Ol samting we ol save kisim kaikai na wara long wara save raun ananit long giraun bai stap ples kilia long taim bilong ples drai. Wara ananit long giraun bai i no inap ron long taim main em ron inap pinis bilong em na i go inap 80 pla krimas bihain nau wara bai ron ken. Sapos wara i save kam aut long giraun stat long pulap long wara, ol ples i bai i go bek long olsem long taim bipo main em stat.

I gat sampela tingting olsem wara em ron namel long ston klostu long ol bloc hol bai kamap olsem acit wara taim ston stap ples kilia. Dispela wara bai ol wokman bungim na stretim inap em kamap long mak we enivironmen pemit itok em orait long larim ron ananit long giraun na i go bungim ol bikpela wara. Dispela ol acit wara bai i no planti taim ol daun ples na bloc hol kam pulap long wara inap fopela krismas bihain long main ipas na tu wara long antap long giraun ol putim i go daun long ples wara bung ananit long daun ples na bloc hol bai halivim moa long acit wara bai nogat. Dispela wok em bai i gat sampela moa wok painim aut yet long lukluk long ol narepla rot bilong klinim na stretim acit wara.

Sampela rot we i stap insait long Projek Envairomen Menesmen Plen long putim daun hevi long giraun i save ron ananit long giraun em olsem:

- Mekim plen bilong taim acit wara kam aut wanem samting bai kamap long stopim o stretim dispela hevi.
- Long stopim, kisim na stretim acit wara long mak we i stap insait long envrionmen plen, bipo long em i go na bung wantaim gutpela wara i save ron ananit long giraun.
- Long stopim na kisim ol wara kam aut long ples we insait long main eria we i gat ol marasin bilong wok gol i stap long en, na stretim/klinim long bungim mak we i stap insait long envairomen plen.

Solwara klostu long Nambis
(Nearshore Marine Environment)

Wok stadi soim olsem wok bilong projek bai i gat liklik impek long solwara klostu long nambis na ol ples.

Konstrasen bilong Outfall Eria bai gat liklik distabance na impek long nabis long Wagang Taim bilong bildim dispela ples i bai i gat nois na solwara bai deti long we paip bai i go daun long solwara. Nambis na ol samting insait long solwara bai i no kisim bikpela bagarap. Ol torosel tasol we ol save ron long solwara long kam putim kiau bilong em long nambis bai mipela i mas was gut long ol na putim banis. I bai i gat plen bilong abrusim torosel, mekim liklik nois na tu long noken i go klostu long hap ol putim kiau bilong ol sapos wok bilong paiplain kamap long taim bilong torosel putim kiau.

Taim wok em kamap, long Port Facilities Area Projek bai putim aut wara we klinim kopa na gol i go insait long solwara klostu long hap sip bai kam stap long en. Wanem pipia i stap insait long dispela wara em bai ananit long mak we PNG long save toktok long klinpela bilong wara, olsem na WGJV bai i no inap wokim hap we em bai nid long stretim na klinim dispela wara bipo long em i go insait long solwara long wof. Na tu wok painim aut soim olsem dispela wara i gat ol pipia we i save stap long solwara pinis na inonap mekim bikpela mak insait long solwara.

I gat luksave olsem ol sip bilong projek i go kam long wof, bai karim ol sampela ol samting bilong narepla hap i kam insait long solwara bilong mipela. Tasol dispela ino nap i gat bikpela hevi tumas sapos sip em bihainim ol lo bilong quarantin na sekim sip gut. Na tu wof bilong Lae i save kisim planti sip i go kam na nogat bikpela hevi kamap. Em soim olsem ol i gat gutpela long i stap na lukautim gut solwara insati long wof.

Sampela rot long lukluk long abrusim hevi long solwara na ples nambis em olsem:

- Bihain long wok bilong wokim DSTP Outfall System, i mas putim gut ol giraun i go bek na karapim gut ol eria.
- Putim banis long hap ol torosel putim kiau namel long ples Wagang na Wara Busu long taim wok kamap long wokim paip lain.
- Long lainim ol samting i stap long solwara long nois. Bai olsem nois bai stat liklik na i go bikpela. Long dispela rot ol torosel na samting long solwara bai i no inap kirap nogut.
- Karamapim gut ol masin na belt we copa na gol konsentret bai ron antap long i go insait long sip. Dispela em long stopim na banisim dast na ren long bagarapim ol na tu long banisim copa na gol noken lus wantaim win na ren.

Dip Solwara Ples
(Offshore Marine Environment)

Pasin na Wok Kamap bilong DSTP
(Physical Behaviour and Effects of DSTP)

Tailings em kam out long Wafi-Golpu Projek main em olsem fine wesan. Bifo long pampim aut long DSTP paiplain bai tailings igo insait long mixing/rausim air tank na rausin air na mixim wantaim solwara pastaim long papim aut long DSTP outfall long 200m dip insait long solwara samting olsem 800m wes long maus bilong Busu Wara igo daon olgeta long bikpela baret kolim Markham Canyon.

Tailings mix wantaim solwara i hevi na taim kam out long paip em bai sink igo daon olgeta insait long Markham Canyon. Dispela wara kam aut long paip taim em i go daun, , na hevi mekim nau, em bai ron i go daun moa insait long baret. Na tu, taim em i go daun, em i bai bung wantaim ol dast bilong Wara Makam wea em i save istap pinis long giraun daunbolo bilong solwara.

Wok painim aut em soim olsem i save igat bikpela giraun guria i save kamap long Markham Canyon wanwan taim. Dispela guria i save mekim na wanem ol giraun, pipia na dast i save istap sait sait bilong dispela baret i save pudaun i go daunbolo moa insait long dip solwara. Dispela luksave soim olsem long taim bilong main istap i go inap pinis bilong main, dispela giraun guria i bai istap yet, na wanem dast wara ikam aut long paip long maus bilong Markham Canyon, em bai bung yet wantaim dast bilong Wara Makam na solwara bai pusim ol i go daun moa insait long dip solwara.

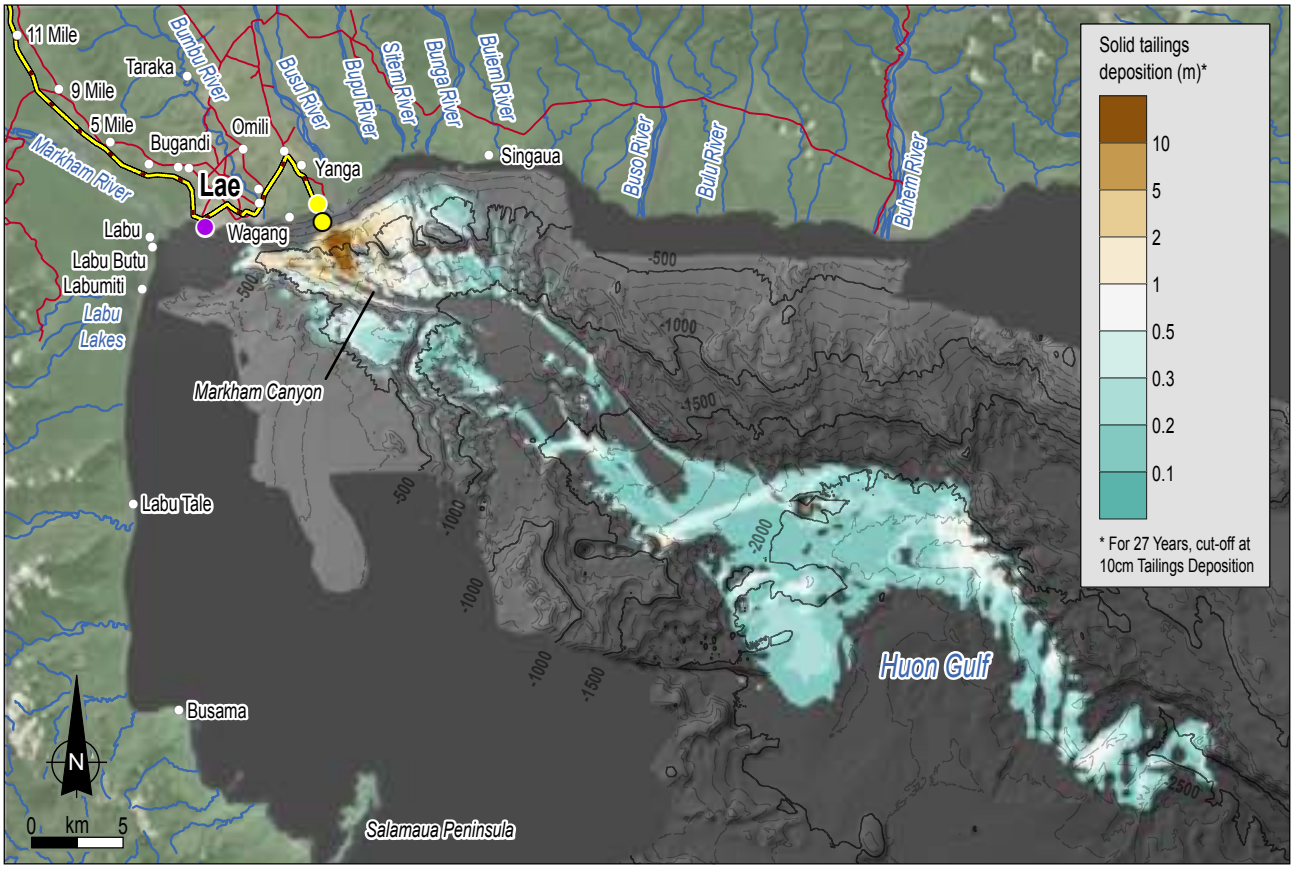
Wok painim aut tu soim olsem insait bilong laip bilong main, olsem tupela ten krimas, dast wara bilong main em pudaun long Markham Canyon na hapsait bilong baret em bai olsem 408,000 cubic mita. Dispela namba em kamap tu waintaim dispela luksave na pasin bilong giraun guria bilong Markham Canyon wea em i save kamap long isait long wanwan yia.

Piksa 6.1 em soim dispela toktok antap. Em soim tingting wea wok painim aut, soim dast insait long wara bilong main em bai bikpela insait long solwara, wea bikpela bilong em bai olsem 10pela mita. Dispela olsem tingting em kamap long wok painim aut na ino lukluk long guria i save kamap saitsait bilong Markham Canyon. Ol dast, giraun na wesan wea bai bung long taim main em wok bai bung daunbolo long as bilong solwara long mak olsem 1,500 mita-i go 2,500 mita ananit long solwara. Olsem lukluk o stadi wantaim model i soim tailings pudaun long Markham Canyon, em bai suruk i go moa dip long New Britain Trench bicos olgeta natural wesan, sedimen na deti wara i suruk i go tamblo olgeta taim long New Britain Trench.

Piksa 3.6 Tingting bilong wok painim aut wea em skelim na soim lekmak bilong dast na pipia bilong Wara Makam wantaim wara ikam long main.

Bilong gutpela tinging na luksave, Piksa 6.2 em soim mak bilong dast wara bilong main waitaim wara bilong Makam. Braunpela kala soim tailings na grinpela kala soim dast ikam long wara Makam taim ol bung wantaim.

Bihain taim main i pas, das wara bilong Markham Wara na Busu Wara na ol giraun guria long Markham Canyon i bai kamap yet na karamapim ol tailings. Em samting ibin istap bipo long main ibin stat. Ol mep wea ibin kamap long taim bilong wok painim aut, em soim olsem pul bilong wara ananit long solwara bai karem ol pipia dast bilong main i go long dip solwara wea igat narapela bikpela moa baret insait long solwara ol kolim New Britain Trench. Piksa 6.3 soim tingting kamap insait long wok painim aut olsem dast nating bilong Makam Wara i bai bihainim rot dast bilong main ibin i go daun long em long Markham Canyon i bai olsem 10-100pela mili mita long wanwan yia. Ol dispela das i bai i go daun olgeta long 1000 pela mita na silip i go daun tasol dast na pipia bilong Wara Makam na ol liklik han wara bai stil kam pulap na istap yet long Markham Canyon, na giraun guria nau, i bai i go daun long dip solwara.



▲ ***Piksa 6.1: Simulated depositional footprint after 27 years of discharge of tailings solids***

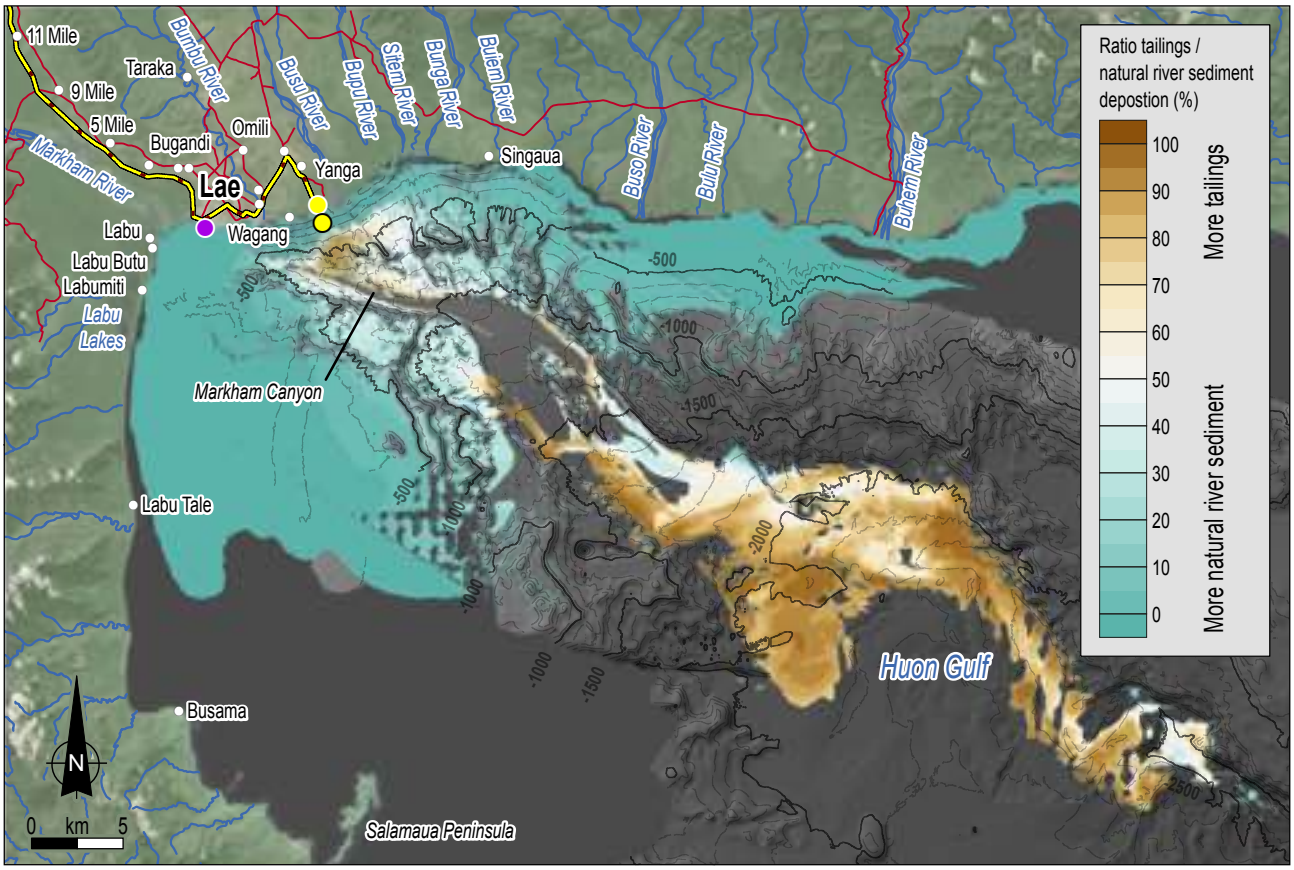
▼ ***Piksa 6.2: Ratio of tailings solids to natural sediments***

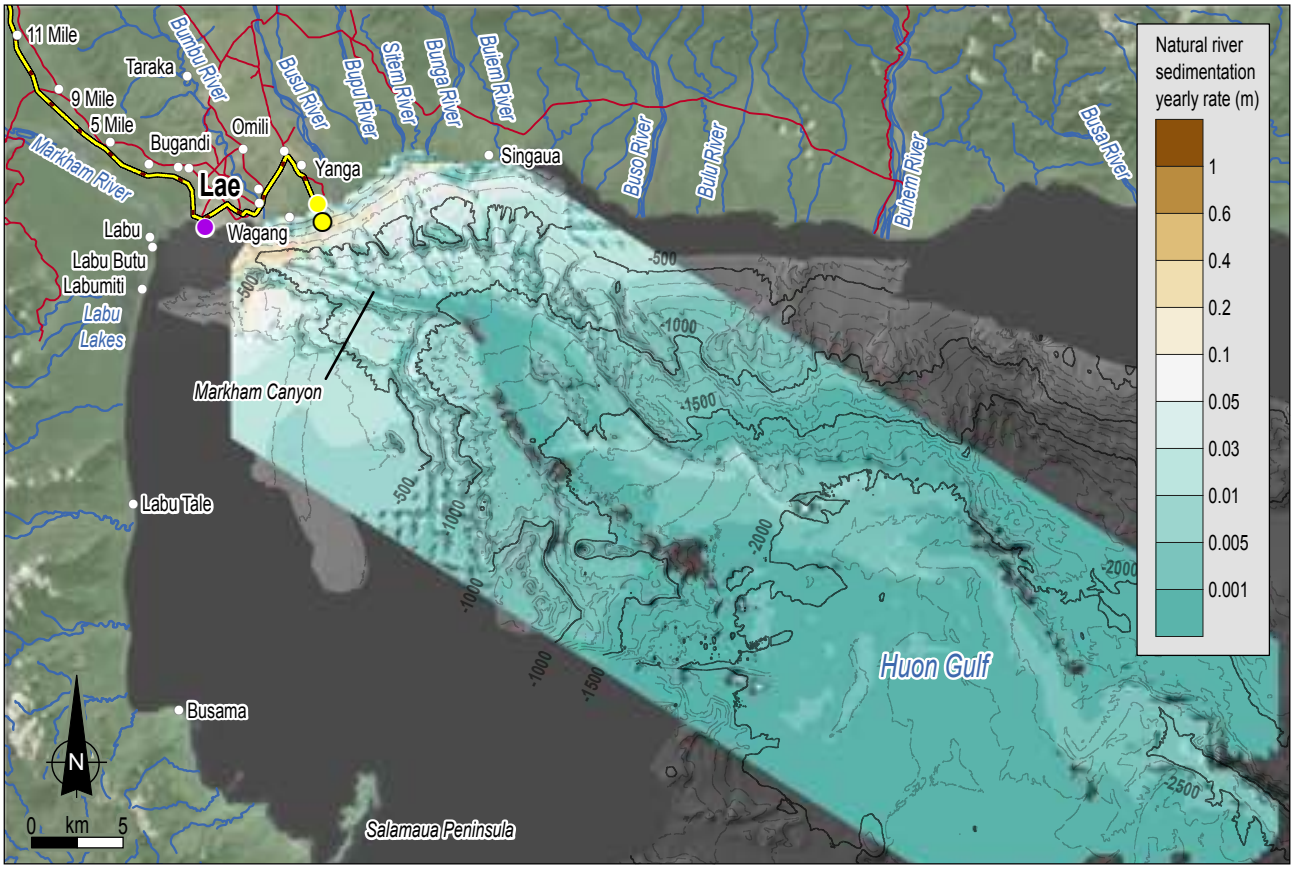
LEGEND

- Village/Settlement
- Landmark
- Road
- Watercourse
- Bathymetry minor contour (100m interval)
- Bathymetry major contour (500m interval)

PROPOSED INFRASTRUCTURE

- Outfall Area
- DSTP outfall
- Port Facilities Area
- Infrastructure Corridor





▲ *Piksa 6.3 Predicted annual rate of natural sedimentation post closure*

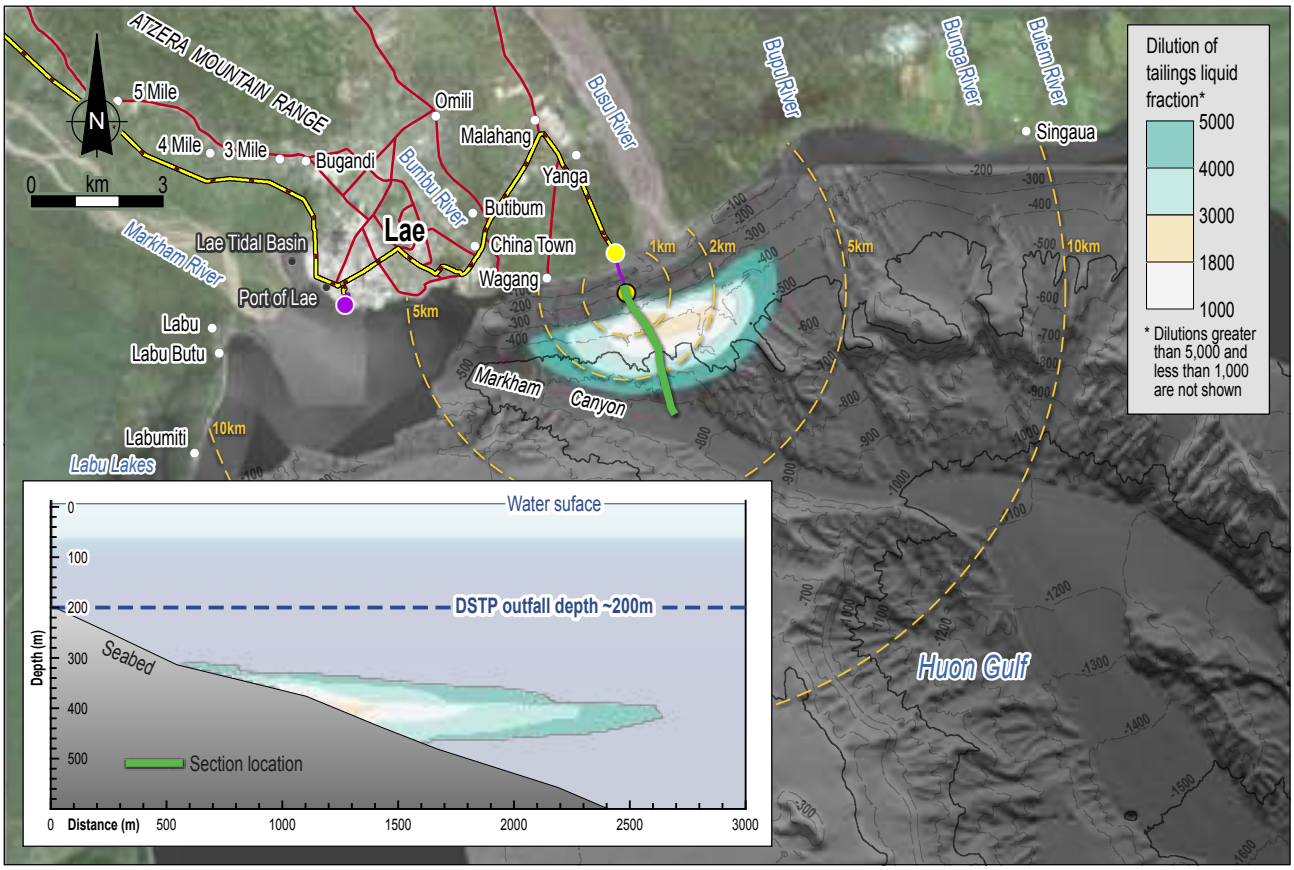
LEGEND

- Village/Settlement
- Landmark
- Road
- Watercourse
- Bathymetry minor contour (100m interval)
- Bathymetry major contour (500m interval)

PROPOSED INFRASTRUCTURE

- Outfall Area
- DSTP outfall
- Port Facilities Area
- Infrastructure Corridor

▼ *Piksa 6.4 Modelled extent of the liquid fraction of tailings subsurface plumes*



Kemikal na Giraun Ecotoxicological impek bilong DSTP (Chemical and Ecotoxicological Effects of DSTP)

Long stadi bilong CSIRO (wanpela Scientific Research grup long Astralia i save lukluk long ol chemistry bilong tailings) em soim olsem dispela kemikal ol kolim cobolt em bai nidim bikpela moa solwara long daunim o dailutim konsentration bilong em insait long "PNG ambient marine water quality criteria.". Dispela dailusen i mas gat 1 pela part tailings na 1,799 parts solwara bipo em i ken daunim metol konsentresen na protektim ol laip long solwara. Ol narapela kemikal olsem copper em nidim 27 dailusen, na Nickel i nidim 1.2 dailusen, na zinc em nidim 1.6 dailusen. Dailusen em bai daunim konsentration long ol metol. Olsem na sapos Projek usim dailusen fekta bilong cobalt long mixing zone, em inap long protektim laip klostu long tailings discharge point?

Dispela stadi em kalkuletim dailusen factor bilong ol 3 pela metol; cobalt, nickel na zinc bihain em painim aut konsentresen bilong wan wan taim dispela 3 pela metol kam aut long tailings (dissolved from the tailings tests).

Piksa 6.4 Em soim dispela piksa bilong taim ol tailings bung wantaim solawara i bai sanap olsem wanem insait long solwara. Wok stadi soim tu olsem 95 pela pesen bilong dispela tailings bai lus na pinis taim em istap olsem 2,174pela mita longwe long maus bilong DSTP discharge point.

Olsem nau tingting em kamap olsem long yusim dispela 95pela pesen na 2,174pela mita olsem mak long mixing zon. Long mekim wok i go isi makim mixing zone long 2,200 mita.

Long luksave long pasin bilong tailings liquor (i.e., after filtration removal of solids through a 0.45µm membrane), CSIRO em wokim eitpela toxicity tests wantaim ol tropikal animol species istap insait long solwara wea ol bipo stadi soim sensitivity bilong ol dispela animol long toxicity tests. Ol stadi tu lukluk long availability long dispela test animol species.

Results bilong ol ecotoxicological soim olsem tailings i mas usim 1,053 dilutions wantaim solwara bipo tailings konsentration bai kisim 95(%) pesen protection long solwara animol species. Dispela em gutpela result olsem em tamblo long mak bilong PNG ambient solwara kwaliti criteria.

Long lukluk long hevi bilong kemikal na mak bilong em insait long ol samting bilong solwara, ol kisim sampela tailings na ol dast giraun bilong Huon Gulf. Dispela wok painim aut soim olsem ol liklik binatang ol kolim ampipod na copopod bai kisim bikpela hevi long karim pikinini taim mak bilong kemikal wara abrusim 10% Tailings 1: 90 % porphyry (ston) na 10 % metasediment (ol liklik ston) na moa long 1%Tailings 2: 25% porphyry (ston) na 75% metasediments (liklik ston).

Dispela bioaccumulation tests soim olsem Tailings 1 na Tailings 2 tests ol ikilim olgeta selpis taim ol istap wea tailings na wesan bilong main konsentresen em antap (mak olsem 60%tailings na abrusim i go antap) wea dissolved copper na zinc kam aut long dispela tailings i gat konsentresen em inap long kilim ol selpis long test. Bicos olgeta selpis bilong test ol i die, stadi bai no nap wokim test bilong bioaccumulation.

CSIRO wokim moa stadi long konsentresen bilong ol metol we ol wokim test insait long kondisen or enviromen i olsem tru solwara. Dispela test em usim niupela tailings olsem tailings sempol oli kisim hariap bihain long ol i drillim long giraun. Ol i wokim test wok i go inap long 17 pela wik na stadi asesim hau copper na zinc kam aut long tailings na mix wantaim solwara. Dispela 2 pela metol, stadi i soim konsentresen bilong ol em moa long mak bilong ANZECC/ ARMCANZ water quality guidelines (preliminary work). Olsem na oli ken mekim solwara i kamap nogut (toxic) na kamapim impek long laip insait long solwara.

Nau dispela stadi em i go yet na em asesim mix sempol olsem 20% tailings wantaim 80% sedimen bilong Huon Gulf solwara. Na tu oli asesim sempol mix olsem, 80% tailings mix wantaim 20% Huon Gulf solwara sedimen. Dispela stadi em i no pinis yet.

Sampela result kam long 20% tailings na 80% Huon Gulf sedimen mix test (long taim bilong publishim dispela EIS Ripot), i soim olsem copper levol i go antap long mak bilong ANZECC/ARMCANZ water quality guidelines, em in no toxic o bioaccumulate insait long test species. Na tu dispela asesmen long 20% tailings wantaim sedimen em soim:

- Nogat "acute or chronic" toxicity long amphipod o liklik kindam long dai o karim bebi taim oli stap insait long test mix i go long 10 pela dei.
- Nogat "acute" toxicity long liklik selpis ol i kolim "mussels" long tok English. Dispela test soim tu ol mussels i nogat bioaccumulation long metol taim ol i stap long test i go long 30 pela dei.

Dispela stadi soim senis long hamas tailings mix wantaim Huon Gulf sedimen i afektim results bilong short term na long term toxicity tests. Em soim copper na zinc konsentresen i go tamblo stret insait long long-term stadi taim yu komperim wantain short-term stadi. Na tu em soim sapos tailings stap longtaim autsait, dispela exposure ken affektim geology na results bilong toxicity test.

Mak bilong DSTP Antap long ol Animel na Ples Solwara (Biological Effects of DSTP)

Olgeta impek bai kamap llong solwara, stori bilong em bai kam long tupela rot: bikpela solwara (pelagic) na samting istap bilong giraun long as bilong solwara (benthic).

Bikpela Solwara
(Pelagic Ecology)

Het tingting bilong Bikpela solwara long taim bilong DSTP em long senis bilong wara bilong solwara:

- Taim planti moa pipia na dast wara pulap insait long solwara em i ken givim bagarap long ol binatang bilong bikpela solwara.
- Taim bikpela namba bilong ol kemikal istap olsem dast long solwara em i ken bagarapim ol animel na pis.
- I bai igat ol kemikal i go insait long ol animel bilong bikpela solwara.
- Namba bilong kemikal isait long ol animel bai i go bikpela.

Tingting bilong wok painim aut soim olsem ol bikpela na liklik binatang, ol pis wea ol i ken i go daun insait long solwara long mak namel long 200pela i go long 400pela mita bai ino kisim bagarap long ol dast bilong main wara bilong wanem taim ol i go daun ol ino istap longpela taim tumas long kisim bagarap. Ol sampela animel wea nogut ol kisim sampela hevi em igat planti bilong ol istap.

Namel long 300pela na 450pela mita ananit long solwara em ples wea olgeta kemikal dast wara bilong main bai kam daun, bung na wea pul bilong solwara bai karim i go aut. Ol kemikal i ken kamapim sampela hevi long ol liklik binatang olsem zooplankton na maikroniton. Dispela ol liklik binatang i save kam wantaim stronpela pul wara na i go aut ken. Ol i bai orait taim ol i go long wea long hap dast bilong main istap.

Dispela mak bilong kemikal long ol animel na binatang bai ino nap kam long olgeta hap bilong ananit long long wara. Em bai kamap long hap were paip ikam daun insait long solwara. Ol binatang wea bai kisim hevi em ol zooplankton na maikroniton. Wok painim aut soim olsem ol bikpela animel wea olsave muv tumas olsem pis, torosel na ol narapela animel. Wok paim aut soim olsem em bai nogat bagarap o hevi bai kamap long tuna. Bilong wanem ol dispela pis ino save istap long Huon Gulf eria na ol toktok i go pas em tok pinis olsem kemikal kisim ol samting insait long hap wea main wara i bai kam aut long paip.

Mak bilong kemikal insait long ol animel insait long solwara bai bikpela long ol liklik binatang na i bai i go daun taim em i go long ol kainkain bikpela pis na torosel. Ol torosel bai nogat kemikal long ol, olsem em igat bikpela hap wea em i save painim kaikai autsait long hap main paip i go daun na tu kaikai bilong em tu istap long bikpela solwara. Tuna pis tu wankain. Kaikai bilong em istap autsait long bik solwara. Wok painim aut soim olsem namba bilong kemikal insait long ol pis bai inonap abrusim mak bilong itok em orait long kaikai.

Ples antap long wesan, sait bilong baret na rip ananit long solwara
(Benthic Ecology)

Samting wea bai i ken kamap long ol animol kominiti or grup ananit long solwara taim DSTP stat wok:

- Olgeta habitat bilong animol na plants stap long as bilong solwara (benthic habitat or ground surface of the ocean) bai karamap wantaim tailings.
- Olgeta benthic habita bai senis wantaim niupela giraun bilong tailings karamapim.
- Species namba bilong ol binatang, animel, pis bai i go daun.
- Bioaccumulation na biomagnification long sampela metal bai kamap long benthic food web.

Taim main i operate tailings bai ron na kam aut long paip, em ken mekim impek long Markham Canyon na dip solwara ananit. Na antap long dispela tu, ol sedimen bilong Makam Wara i bai bung wantaim na sedimen. Mipela i ken brukim dispela hevi i go long tripela zon: Zon 1-Hap wea ol bikpela pipia wea ol save pudaun i go daun hariap; Zon 2-ol pipia ol pundaun isi moa liklik. Em ino olsem Zon 1 wea ol save pudaun hariap: Zon 3-em ol dast stret wea ol save muv wantaim pul bilong wara.

Bikpela dast bai karamapim ples antap long wesan, sait bilong baret na rip ananit long solwara. Planti ol liklik pis na binatang wea ol ino save muv hariap i bai dai. Ol animel na pis wea i save silip insait long wesan, ol i bai muv i go long narapela hap.

I bai igat sampela ol liklik animel na binatang, ol bai ino nap dai, na bai kam na stap wea ol pipia ston bilong main pudaun na istap long en insait long solwara. Ol dispela lain i bai igat bikpela mak bilong kemikal insait long ol. Tasol insait long Huon Gulf eria, ol bikpela wara olsem Busu na Makam i save wokim na nogat planti ol pis bilong bik solwara save raun tumas na kaikai ol dispela ol liklik pis na binatang.

Taim ples longwe long DSTP na dast bilong main i go daun, igat luksave olsem, ol liklik ol animel na binatang i save kam na stap long ol dispela ples. Dispela luksave em kamap long ol narapela ples wea igat DSTP sistem stap. Isi isi ol animel na pis bai kam wokim haus bilong ol na giraun ananit long dip solwara na tu saitsait bilong Markham Baret.

Ples antap long wesan, sait bilong baret na rip ananit long solwara, wea pipia bilong DSTP bin bagarapim long en, bai kamap ken. Dispela em bai ples kilia wea dast bilong bikpela wara save kam na pudaun (lukim Piksa 6.3). Niupela CSIRO stadi long dispela Projek em painim aut wanem kain impek i gat long mixim natural sedimen wantaim tailings.

Em soim olsem natural sedimen layer 5mm tik antap long 100% tailings ken stopim copper long kam aut long tailings. Dispela CSIRO na ol narapela stadi tu ol soim hau copper ken kam aut long tailings, na dispela proces em impek long dissolved oxygen(oxidation). Sapos yu mi ken blokim dissolved oxygen long go insait na mix wantaim tailings o putim natural sedimen 20mm tik antap long tailings, em bai stopim copper long kam autsait.

Ol sampela rot insait long Projek Envairomen Menesmen Plen long putim daun hevi bilong DSTP:

- Painim ples wea igat bikpela daun ples ananit long solwara wea i go daun olgeta long dip solwara, wea ol pipia ston, rabis na dast bilong main i ken i go daun n bai ino blokim paip.
- Painim ples bilong DSTP outfall wea dip bilong solwara wea em:
  - Moa dip long surface mixed layer wantaim euphotic zone we solwara i no gat san lait long em.
  - Moa dip na tamblo stret long, abrusim upwelling o ples solwara kam antap.
- Sanaim ples wea bai rausim gut win istap insait long tailings ikam long main.
- Sekim olsem hevi bilong dast wara bilong main em bikpela moa long solwara. Em olsem taim tailings kam aut long paip em bai i go daun long dip solwara.
- Save wanem hap maus bilong DSTP paip istatp na sekim olsem ol pipia ston ikam long main bai bihainim dast na i go daun long insait long baret. Dispela i ken halivim long traim holim giraun bilong baret.
- Luksave gut long ples daun na Markham Canyon wea em bai karim ol pipia na dast/giraun i go daun.
- Bihainim gut bilong gutpela wara long ples wea main dast wara bai mix waintaim solwara.
- Lukluk gut long compliance long bandri bilong “mixing zone” em mak bilong PNG gavaman (CEPA).

6.2 Sosioekonomik
(Socioeconomic)

Dispela Projek em bai wanpela bikpela main tru long PNG na ken kamapim bikpela na longpela taim benefit igo long komuniti, province na national gavman.

Long taim bilong konstraksen, klostu 2,500 pela manmeri bai wok long dispela Projek. Long taim bilong operason klostu 850 pela manmeri bai wok long main.

Ol sosioekonomik stadi i soim olsem Projek bai kamapim gutpela na ken kamapim sampela nogut impek tu.

Potensel Benefit
(Potential Benefits)

Stadi i soim olsem Projek bai kamapim planti gutpela benefit ikam long PNG ekonomi long planti rot olsem:

- Direk benefit long moni, olsem:
  - WGJV baim takis igo long PNG Gavaman.
  - Royelti go long PNG Gavaman. Skeleim bilong royalty bai kamap long Development Forum taim Mining Minister i singautim.
  - Special support grant ikam long PNG Gavaman igo long Morobe Province long sapotim infrastrakta divelopmen.
- Baim ol ekwipmen na meteriel insait long Morobe Provins na long PNG, we igat long en. WGJV bai strongim dispela wantaim National Content Plan, we bai kampani i lukluk long we i ken kamapim o sapotim ol lokol bisnis.
- Kisim wokmanmeri na trenim ol long wok. Kampani bai lukluk long ol as ples pastaim, na lukluk tu long edukesen, trenin na strongim wok bilong meri.
- Wok moni o weijes bilong ol WGJV wok manmeri na ol kontrakta.
- Kampani bai kontribiut long nesenol minerol ekspot reveniu, totol ekspot reveniu na gros domestik prodak.
- Kontribut long provinsel na lokol kominiti divelopmen projek olsem helt, edukesen, strongim sindaun bilong ol manmeri, envairomen na ol narapela progrem eria.

Bikpela moni em bai Kampani i spenim long developim dispela Projek long longpela taim. Dispela ekspendisa long taim bilong konstraksen na operesen i gat bikpla potensel long sapotim ol bisnis insait long Morobe Provins, na givim wok long ol asples na pipol bilong Morobe Provins.

Dispela Projek tu bai strongim Lae olsem em wanpela ki sevis senta bilong mining indastri insait long PNG.

Nesenol, provisol na lokol levol gavaman i gat bikpela wok long sait bilong lukautim na putim ples klia long sait bilong serim projek royelti. Na tu ol i gat bikpela wok long kamapim ol progrem na polisi we bai kamapim gutpela senis na sindaun long taim bihain.

Ol samting we bai i ken kamapim birua
(Potential Adverse Impacts)

Kampani i stadim gut ol samting we i ken kamapim birua or bagarap insait long projek. Dispela ol stadi em:

- In-maigresen – Bikpela lain manmeri bilong autsait long projek eria kam insait long projek eria long painim wok na wokim bisnis aim planti autsait manmeri kam insait, dispela i ken kamapim bagarap long ples, pasin nogut, pasim speis bilong skul na haus sik o pinisim marasin, na tu dispela ol autsait manmeri kam kisim giraun, diwai na bus bilong ol asples.
- Seifti long rot – Lukluk bilong stadi i soim olsem bai i gat planti manmeri na kar wantaim bai yusim ol rot na ekses rot, na planti birua o bagarap ken kamap long rot.
- Kominiti helt na kominiti seifti – Taim ol manmeri gat planti moni, bagarap ken kamap na ol ken bungim birua olsem kisim sik nogut. Dispela ken kamap tu taim ol asples i no lukautim ol yet na wokabaut bilong ol.
- Giraun Projek i kisim – Taim Projek i kisim giraun na tambuim manmeri long yusim giraun, dispela ken kamapim hevi olsem ol asples bai lusim ples bilong ol na go sindaun long niupela ples.
- Bilong Law na oda – I gat potensel long ol papa giraun bai tok pait long giraun, na dispela bai i givim sampela hevi long kampani long kompensesen na projek benefit. Bai i gat potensel hevi tu long ol manmeri dring bia o simuk drag, pait na stil, na tu domestik vailens we man paitim meri. Bai i gat tok pait namel long kominiti taim ol autsait manmeri kam sindaun long ples.

Stadi soim olsem Eria 1 bai i gat bikpela impek bai kamap bikos long bikpela wok bai kamap long Main Eria. Hekeng, Nambonga na Venembele ol ples bilong spesel mine lis na olsem ol i bai reloket.

Kampani i mekim stadi bilong helt risk ananit long Human Health Risk Assessment. Dispela stadi i lukluk long beslain (or existing) risks long helt bilong manmeri na tu ol risks sapos Projek i go het. Dispela kain stadi, ol scientist kolim long tok English "potential exposure pathways". Long dispela stadi, kampani painim aut olsem sampela helt risks i stap pinis long wanwan kominiti insait long Projek Eria:

- I gat toktok long stap long sait bilong arsenic na mercury insait long pis na ol abus long bus, wantaim narapela kaikai long garden we ol manmeri i kaikai.
- Stadi soim olsem levol bilong mercury na zinc insait long bodi bilong ol yangpela pikinini i ken go antap. Dispela bai kamap taim ol pikinini kaikai abus bilong solwara na bus.
- Stadi soim olsem levol bilong mercury insait long bodi bilong ol manmeri long nambis hap em i stap antap pinis. Dispela em kamap taim ol manmeri kaikai abus bilong solwara, freshwater na bus.
- Mercury insait long pis i kamapim exposure pathway long ol yanpela pikinini na manmeri long olgeta stadi eria.

Bihainim dispela beslain stadi, kampani i lukluk long ol helt risk i ken kamap taim Projek i stat. Dispela ol painim aut em:

- Ol pridikted konsentresen long "contaminents of concern" insait long wara we pipia wara bai go, ol i gat lo levol long dispela "contaminents of concern". Konsentresen em tamblo long "adopted screening criteria"
- Stadi long ol metol bioaccumulation olsem mercury na arsenic i soim olsem dispela 2 pela metol konsentresen bilong ol bai stap sem olsem na tu bai i no inap go antap taim DSTP i kamap long Huon Gulf. DSTP i no inap kamapim helt risk long manmeri. Metol manganese, em bai go antap liklik tasol i no inap kamapim bagarap long kaikai bilong ol manmeri.
- Taim main i pas levol bilong giraunwara insait long block cave wantaim wara insait long subsidence lake bai kamap bikpela na niupela lake bai kamap. Stadi o model soim olsem, kwaliti bilong dispela wara em bai nogut (olsem pH levol bai go tamblo, na sulphate konsentret bai go antap). Olsem na sapos wara bilong niupela lake igo insait long narapela raun wara or liklik hanwara em bai bagarapim kwaliti bilong ol. Projek lukluk long dispela asua na em plen long tritim dispela wara long daunim risk bilong impek long helt bilong ol manmeri na mitim objektivs bilong main i pas.
- Stadi long sulphur dioxide levol long taim bilong opereson bai igo antap long tupela ples Ziriruk na Fly camp. Dispela ikam long ol pawa generates. Kampani komplai wantain ol mak bilong air kwaliti gutpela banisim olsem skrubas long haus pawa.

Lukautim ol Sosioekonomik Impek (Management of Socioeconomic Impacts)

WGJV igat menesmen plan Projek Sosal Menesmen Plen long managim ol despela sosioekonomik impek na tu strogim ol gutpela samting em kamap. Insait long dispela plen, i gat klia toktok na wei long lukautim na edresim sosioekonomik impek, na tu i gat ol eksen plen stap long strongim dispela wok. Dispela Projek Sosal Menesmen Plen i gat tripela eksen plen we i lukluk long in-maigresen, resetolmen, helt bilong kominiti, seifti na sikuriti.

Antap long dispela Projek Sosal Menesmen Plen, i gat sampela plen long lukluk na stretim ol dispela sosioekonomik impek. I gat Projek Envairomen Menesmen Plen, KalsaKalsa na Heritej Menesmen Plen, Stekholda Engegmen Menesmen Plen, na Nesonal Content Plen (toktok bilong givim wok, painim suplaia bilong guds na sevisis, na invesment progrem bilong strongim kominiti divelopmen).

6.3 Kalsa Heritej
(Cultural Heritage)

Long stadi bilong Kalsa Heritej i kamap long 1996 go inap long 2017, i soim olsem i gat 351 kalsa heritej hap o eria insait long Hengambu, Yanta, Babuaf, Wampar na Ahi kalsa grup. Insait long dispela, 60 kalsa heritej eria (41pela orol tredisen hap na 19pela archaeological hap) bai i gat sampela impek kam long Projek ektiviti.

Taim kampani i implimentim dispela Projek Kalsa na Heritej Menesmen Plen long konstraksen na operesen, em i no inap impektim 15pela hap, na bai daunim impek long 45pela hap (32pela orol tredisen (oral tradition) hap na 13pela archaeological hap). Dispela wok bai kamap ananit long strongpela menesmen plan.

Dispela wei bilong menesem i olsem:

- Kalsa awenes trening bilong Projek wokman na kontrakta.
- Rejistarim o rekodim olgeta hap na wok wantaim wanpela qualified archaeologist o anthropologist long mekim moa wok long lukautim ol kalsa heritej eria.
- Wok bung wantaim lokol kominiti long kalsa heritej sapos i gat hevi, na tu sapos i gat sampela bel hevi i kam tru long Concerns, Complaints and Grievance Procedure bilong WGJV.
- Inspektim na rekodim archaeological na ol narapela kalsa heritej hap long Projek Eria na konfem lukautim o menesmen long olgeta kalsa heritej saits.
- Itambu tru long olgeta kar or truck bai go insait long eria ol i makim or putting banis long en.

Hap we i bai gat sampela potensel impek, kampani bai putim dispela ol mesa:

- Makim bandri na sanapim strongpela banis na putim narapela ol mesa olsem givim skul toktok long wokman na kontrakta na givim mep wantaim GPS namba long taim bilong tulboks mitin long wan wan dei.
- Qualified anthropologist bai rekodim toktok bilong ol ples manmeri taim i kisim tok orait long kominiti.
- Taim kampani konfemim bandri em bai kisim wanpela qualified archaeologist long kam na kisim ol kalsa heritej samting.
- Taim ol painum bun or sleleton bilong, ol mas kisim tok orait bilong ol as ples manmeri na bihainim law bilong gavaman (PNG National Musem and Art Gallery) pas taim na bihain reloketim ol skeleton/bun.

Kampani bai sapotim ol ples lain long ol wok kastom pastaim long kampani statim wok konstraksen. Kampani bai givim tok orait long dispela ol mesa taim em toktok wantaim ol kominiti na PNG National Museum and Art Gallery.

I gat sampla moa sans long painim moa ol kalsa heritej meteriel ol i kolim ‘chance finds’ long taim bilong konstraksen. WGJV i gat Kalsa na Heritej Chance Find Procedure stap pinis long Projek Kalsa na Heritej Menesmen Plen we i soim hau long ripot, painim na menesim ol chance find.

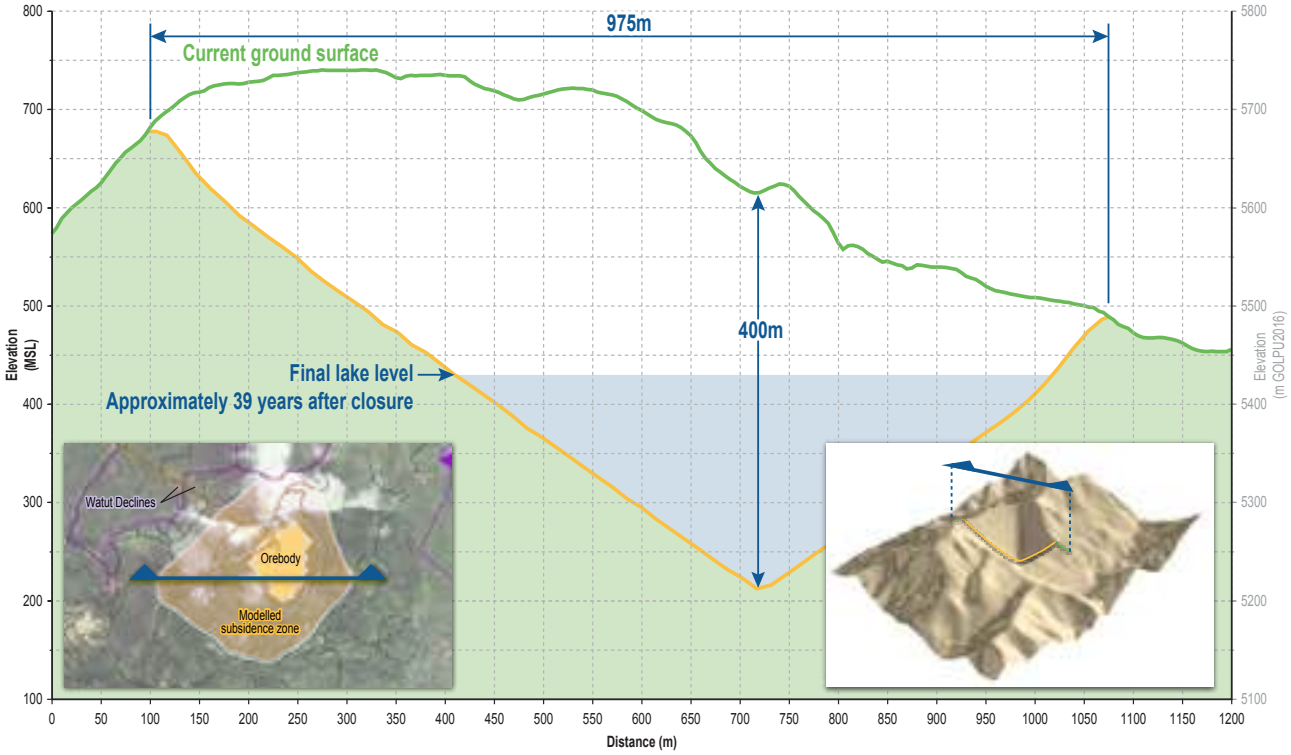
6.4 Menesmen wok bihain main i pas
(Post-closure Management)

WGJV i gat Closure and Rehabilitation Plan long menesim main taim i pas. Long nau yet, dispela plen Kampani i no kamapim yet tasol em bai wok long en taim projek i ron. Dispela “detailed Rehabilitation and Mine Closure Plan” bai redi faifpela yia bipo main i pas.

Wok pasim main i bai ron olsem:

- Wok mining o operesens i pinis
- Olgeta masin i mas stap seif
- Dikonteminetim ol masin or ekwipmen
- Rausim masin o planim long giraun
- Givim ol infrastraksa go long ”third party” (as applicable)
- Makim infrastraksa long narapela wok (as applicable)
- Olgeta landform i mas stap seif olsem “geotechnically and geochemically stable”
- Stretim ples na planim gen ol diwai, gras na flawa long olgeta hap we ol bus i bin kliarim
- Putim infrastraksa bilong menesim wara
- Wokim moniterin

WGJV bai toktok wantaim kominiti na givim toksave olgeta yia long laif bilong Projek.



Piksa 6.5: Lukluk bilong painol subsidence zone na wara (Modelled final subsidence zone and final lake)

Rihebilitesen o stretim giraun na bus (Rehabilitation)

Rihebilitesen em wok bilong stretim giraun na bus i go bek long lukluk bilong em taim Projek i no stat yet. Dispela wok bai lukluk long stretim giraun na planim ol flawa, diwai, frut diwai na gras. Dispela wok bai kamap long olgeta yia long laif bilong Projek.

Dispela "Conceptual Closure and Rehabilitation Plan" i gat inventri long olgeta Projek infrastraksa na wanem ol infrastraktra bai kampani rausim o stretim na yusim gen long wok bilong pasim main. Bifo main bai pas, WGJV bai i toktok wantaim ol stekholda na givim fesilitis sapos i gat long givim i go long gavaman o kominiti long yusim.

Subsidence Wara na Hap long Rausim Wara (Subsidence Zone Lake and Discharge)

Stadi i soim olsem bai i gat wanpela subsidence zone bai kamap antap long Mt Golpu behain long 38pela mun long main operasen. Taim main i pinis, sais bilong dispela subsidence zone bai olsem 400m dip na longpela bilong em, em 975m. Piksa 6.5 i soim dispela sais bilong subsidence zone na tu soim seip na sais bilong Mt Golpu.

Taim main i pas na kampani rausim wara insait long main, i bai putim samting ol i kolim hydraulic plugs long Watut tanel na Nambonga tanel long stopim wara long kam aut long maus bilong tanel. Wara insait long block cave na subsidence zone bai stat long kam antap, na masin bai halivim long pampim wara long stopim acid mine drainage (AMD). Stadi i soim olsem kwaliti bilong wara insait long subsidence lake bai tamblo tumas olsem na bai i gat gutpela menesmen long lukautim dispela wara. Sapos dispela wara i ron go insait long ol graunwara na ol liklik wara, kampani bai painim na tritim long mak long PNG water quality criteria. Bai i gat planti moa wok stadi bai kamap long dispela subsidence lake taim operesen i stat.

Kampani bai banisim dispela subsidence wara long seifti bilong ol manmeri na pablik.

Sosol Impek bilong Main Pas (Social Impacts of Closure)

Ol Regulesen na polisi bilong PNG ananit long draft Mine Closure Policy and Guidelines (2005), toktok strong long ol sosal na ekonomik benefits long go het yet taim main operesen i pinis.

Dispela ol sosol na ekonomik benefit i bai lukluk na kam long ol narapela sektas. Ol dispela planning na kamapim ol dispela narapela sektas long sapotim sosal na benefits mas stat bipo long main i pinis wok na wok wantaim Nesenol, Provinsel na Lokol Levol Gavaman, ol impek kominiti, na ol narapela stekholda. Dispela wok bai i kamapim trening bilong wokman go long narapela hap wok, divelopim bisnis na indastri, na menesim moni.

7

Moa Infomesen

(Further Information and Submissions)

Ol kopi bilong dispela EIS pepa bai stap long pablik displei long ol dispela hap:

- Conservation and Environment Protection Authority (CEPA), Port Moresby
- Mineral Resources Authority (MRA), Port Moresby
- Morobe Provincial Government, Lae

Long sait bilong EIS asesmen, PNG Gavaman bai askim manmeri o pablik long rait i go long Conservation and Environment Protection Authority (CEPA) sapos ol i gat sampela tingting o toktok long mekim long dispela EIS pepa. Sapos pablik laik save long hau ol i ken mekim dispela asesmen, ol i ken kisim moa infomesen long:

Managing Director

Conservation and Environment Protection Authority (CEPA)
Stratos Avenue, Savannah Heights
PO Box 6601
Waigani, National Capital District
Papua New Guinea

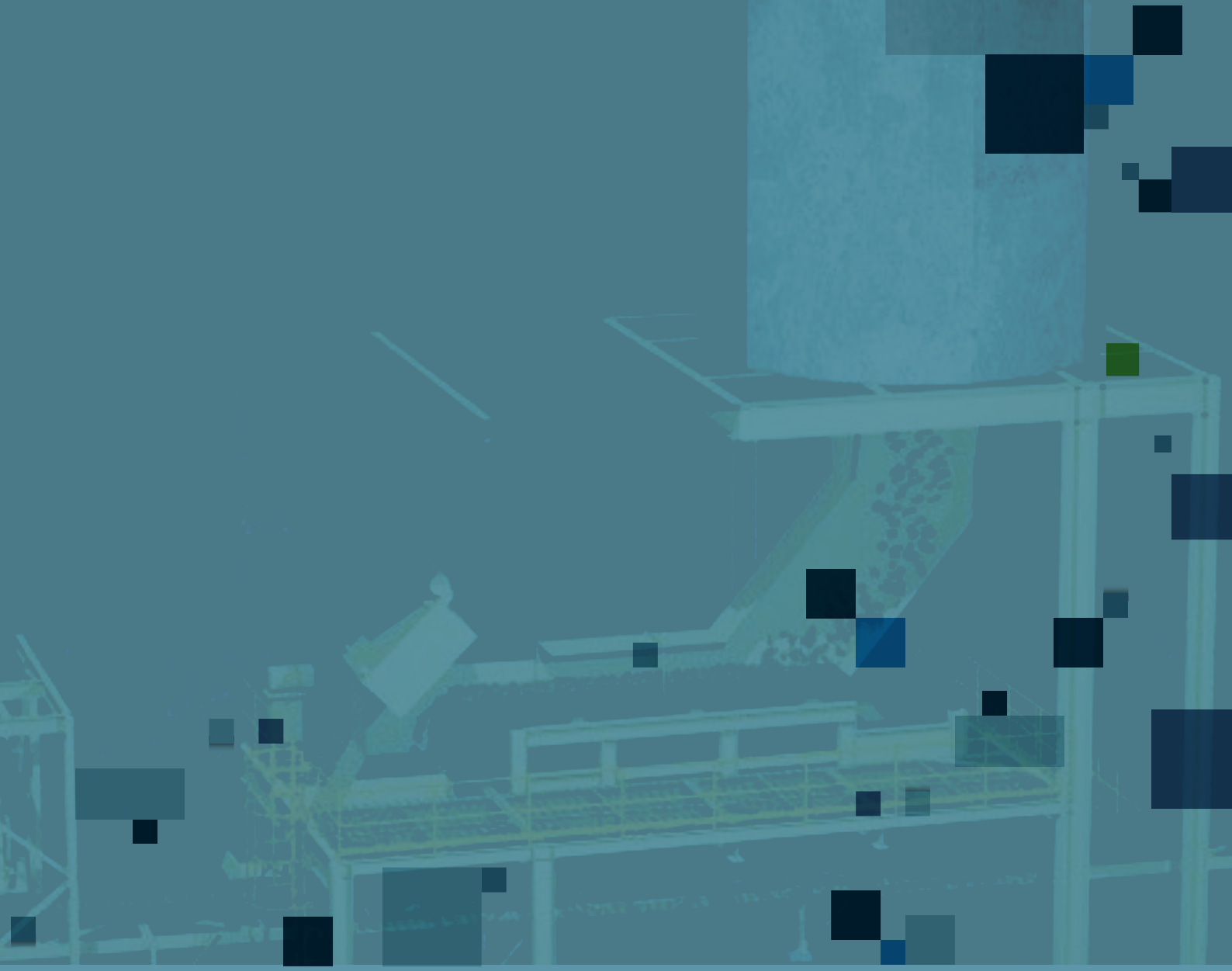
Taim Conservation and Environmental Protection Authority (CEPA) i apruvim or i tok orait, WGJV bai wokim pepa kopi or putim electronic kopi long website bilong em:

- Pepa kopi bai stap long WGJV Ofis long Lae na olgeta man na meri long publik ken lukluk long en.
- Electronic kopi yu ken daunlodim long: http://www.wafigolpujv.com.

Sapos yu laikim sampela moa infomesen, yu ken kontektim:

Wafi-Golpu Joint Venture

EISquestions@wafigolpujv.com



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