



Deep Sea Tailings Placement (DSTP) long Huon Gulf Sol Wara

# Ol askim na bekim bilong ol stadi bilong solwara na envairomen bilong en

August 2018

Wafi-Golpu Projek em i mekim wok painim aut long kamapim wanpela andagraun kopa-gol main stap olsem 65 kilomita south-west long Lae siti insait long Morobe Province, Papua New Guinea. Wafi-Golpu Joint Venture i gat opis tu long 11 mile arasait long Lae, na long Brisbane.

Kampani i gat website: [www.wafigolpujv.com](http://www.wafigolpujv.com)

## Q Wanem samting em teilings? Teilings em wanem samting na bilong wanem olgeta mainin Kampani laik menesim teilings disposal.

- Wok bilong maining em long rausim ol mineral rok o ston na Wafi-Golpu Project bai mekim dispela wok insait long giraun, ol i kolim andagraun maining.
- Nambawan samting em long brukim mineral rok or ston i gat gol/kopa stap insait i go liklik stret na kamap wankain olsem wesana, na bihain miksim wantaim wara (lukim Figure 1).
- Bihain bai ol i seperetim o rausim gol na kopa long wesana ol i bin miksim wantaim wara. Long mekim olsem ol bai yusim marasin wankain olsem londri (laundry) sop long frothing. Frothing em ol liklik babol olsem yu putim londri pauda long wasim kolos na miksim wantaim wara na waitpela babol i kamap. Dispela waitpela babol rausim gol/kopa long wesana. Bai ol i nonap yusim saienaid kemikol long rausim gol.
- Wesana we i nogat gol na kopa bihain long taim ol i seperetim pinis em teilings o pipia wesana. Dispela wesana em yumi mas lukautim gut bikos i ken bagarapim envairomen taim em i stap longpela taim outsait long eya.



Figure 1 – Ball mill used to grind ore



Figure 2 – Concentrate production

## Q Wanem ol opsen bilong lukautim main teilings?

I gat tripela wei long lukautim gut dispela ol wesana:

- Namba wan em long mekim wanpela dem antap long giraun ol i kolim 'Tailings Storage Facility' (TSF), na bungim olgeta dispela ol pipia wesana na wara.
- Namba tu em long rausim olgeta wara na putim ol teilings stap long wanpela hap, ol i kolim 'dry stacking'.
- Namba tri em long rausim i go long dip solwara. Dispela em ol i kolim Deep Sea Tailings Placement (DSTP).

## Tailings Storage Facilities (TSFs)

- TSF em wanpela bikpela dem na wok bilong em, em long holim pipia wesana.
- I gat gutpela samting o stori TSF i gat long ol planti main long planti hap long narapela kantri. Tasol TSF em i no planti long PNG bikos enginiarin na conditions bilong envairomen em had tumas long menesim TSF.
- Stadi i soim olsem taim ol i putim teilings insait long TSF, bai bikpela hap giraun tru bai bagarap, sais bilong giraun i winim Lae City (>600 ha) o 1,200 futbol fild. Taim bikpela giraun i bagarap, em bai bagarapim tu sindaun bilong ol man na meri long ples na dispela bai bagarapim sampela kalsa bilong ol lain long ples, wantaim olgeta bus, diwai na olgeta animal ol i stap long bus na diwai.
- WGJV i mekim bikpela stadi o wok painim aut long 45 hap, long sekim sapos dispela ol hap ol i gutpela long mekim TSF.
- Dispela stadi i tokaut o mekim kamap ples klia olsem ol dispela hap i no gutpela long kamapim TSF. Ol bikpela salens long ol hap; em giraun save guria olgeta taim, i gat planti wara long giraun, na em ples bilong planti ren.
- TSF straksa o dem bai stap longpela taim tru bihain main i pas.

## Deep Sea Tailings Placement (DSTP)

- DSTP em i proses we kampani bai i rausim teilings na putim i go insait long dip solwara tamblo stret, we i nogat san lait long en. Sampela mining kampani insait long PNG na long narapela kantri tu ol i yusim DSTP.



Figure 3 – An example of fine sand tailings

## Q Wai na WGJV selectim DSTP sistem?

- WGJV em i mekim planti stadi na wok painim aut long kainkain rot long menesim teilings long graon (TSF) na tu long usim DSTP.
- Em painim aut olsem DSTP em mo orait long lukautim teilings long main laif. DSTP em imo orait long impek long sosol – sindaun bilong ol ples man na meri, kalsa na olgeta bus, diwai na animal.
- Kampani i lukluk pinis long TSF options tasol i gat bikpela risk long sait bilong enginiarin, seifti, rehabilitesen, guria na graun i malomalo, na hevi ren na tu long ol hevi bai kamap taim main i pas.

### An example of an operating DSTP facility



Figure 4 – Batu Hijau Copper Gold Mine in Indonesia

- WGJV i wokim pinis stadi na usim infomesen long meps bilong flo bilong solwara, ol karent, wesana, na gravol em wara Markham na Busu karim i go long Huon Gulf na painim aut hap we i ken putim DSTP sistem. Em i lukluk long solwara na tu long ol bikpela wara olsem Markham, Busu na ol narapela long hamas wesana na pipia i wok long go insait long solwara.

## Q DSTP i save wok olsem wanem?

- Ol i bai miksim teilings wantaim solwara na dispela em bai mekim teilings i hevi moa long solwara, na taim oli pamim dispela teilings mix igo long solwara, em bai pudaun igo tamblo long flo long solwara.
- Dispela teilings ol i miksim wantaim solwara bai bihainim paip i go tamblo tru long solwara olsem 200 mita we ol i bai rausim teilings i go insait long dip solwara.
- Bikos dispela teilings mix i hevi stret em bai ron olsem wara long flo bilong solwara na em bai go dip stret, na sindaun long flo bilong solwara (lukim Figure 5).

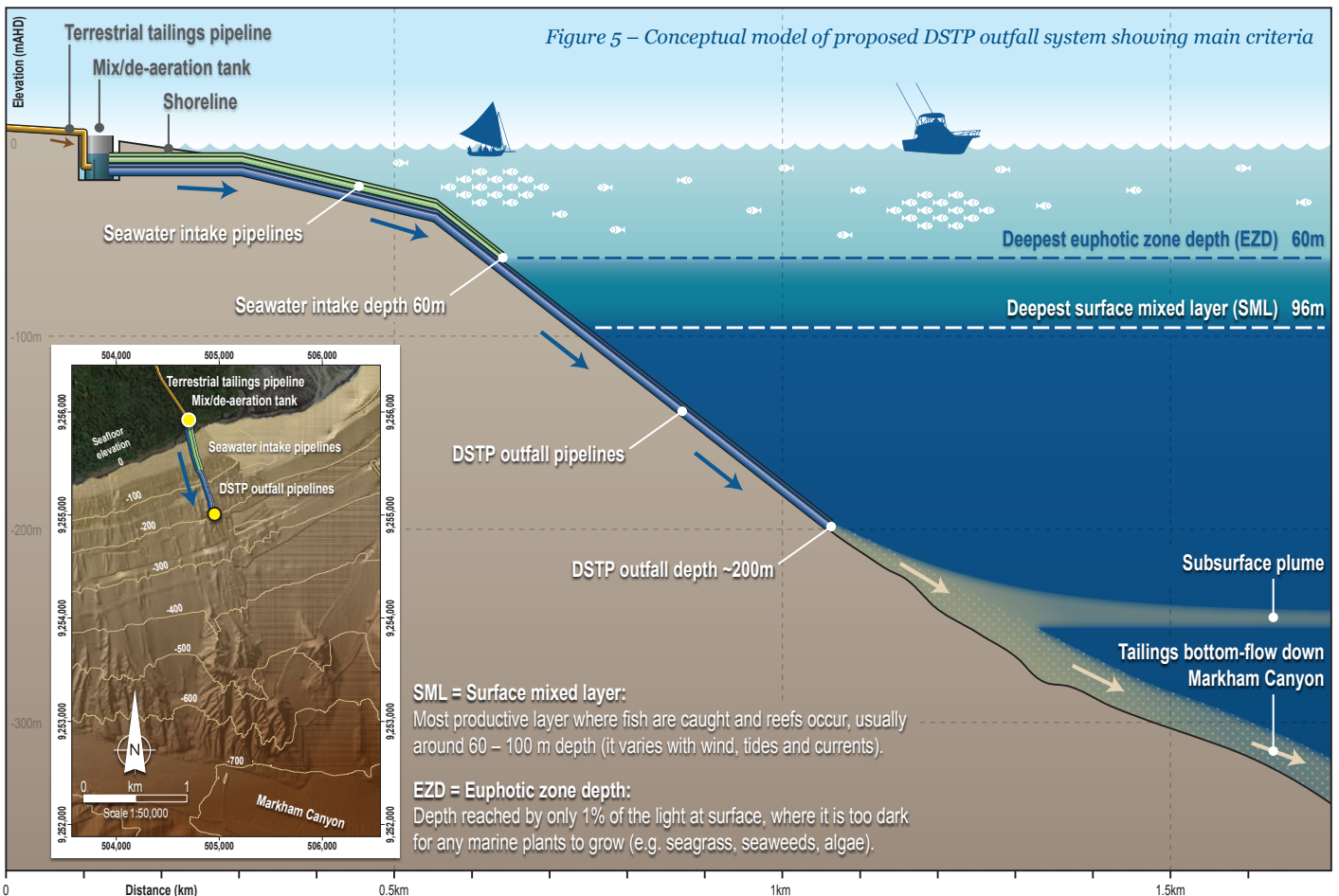






Figure 6 – River sediment plumes in the north-west Huon Gulf

## Q Long wanem as na DSTP em bai wok long Huon Gulf?

Kampani i painim aut olsem Huon Gulf em raitpela hap bilong putim DSTP i go insait.

- Solwara em i dip tru long hap stap klostu long outfall hap.
- Planti ol wesana na pipia bilong ol bikpela wara (winim wesana bilong teulings) bai go insait long solwara, miksa wantaim teulings na karamapim teulings.
- Olgeta wesana na pipia bilong ol bikpela wara na bilong teulings tu bai olgeta bung na go insait long Markham Canyon, dip bilong em olsem 1,000m na go yet.
- Nogat planti animol stap long flo bilong Markham Canyon.
- Taim maining bai pinis, dispela ol wesana na pipia bilong ol bikpela wara olsem Markham na Busu bai go insait long canyon na karamapim teulings.

## Natural sedimen i stap insait long Huon-Gulf

- Wara Markham na wara Busu wantaim olgeta narapala wara i save karim planti giraun, wesana, gravel na traipela ol ston go long solwara long Huon Gulf (lukim long figure 6 na figure 7).
- Surface plumes em deti wara i kam long Markham na Busu i go mix wantaim klin wara na yu ken lukim dispela long solwara.
- Long wanpela yia, 60 million tonnes bilong sedimen na pipia em ol dispela wara i karim i go long solwara. WGJV projek bai i salim klostu olsem 16 million tonnes tasol i go long solwara long wanpela yia (lukim long Table 1).
- Ol traipela ston na wesana i save suruk long stip flo i go insait long Markham Canyon. I had liklik long makim o save long namba bilong dispela (dispela i no stap insait long table 1). Ol namba bilong Table 1 em soim suspended sedimen load tasol.

Table 1 – Estimated amount of suspended sediment discharged into the Huon Gulf from rivers

Period	Mean flow (m <sup>3</sup> /s)	Mean daily load (t/d)	Estimated annual load (Mt/a)
Markham River gauging station			
2016 – 2017	545	117,970	43
Busu River gauging station			
Oct16 – Sep17	105	12,300	4.5
Estimated load for all rivers*			60

\* Markham, Bumbu, Busu, Sitem, Bunga, Buiem, Buso, Bulu, Buhem, Busa, Bukang and Mongi



Figure 7 – Markham River (left) and Busu River (right)



## Q Aninit long flo o bed bilong solwara i luk olsem wanem?

- Ol i putim kamera i go insait long solwara na kisim piksa. Long dispela kamera tu ol i putim strongpela lait. Ol i putim long planti hap stret insait long solwara (lukim Figure 8 na piksa tamblo).
- Piksa i soim olsem long hap we wara em klia na klin em soim olsem i gat wesana em liklik nogut tru na giraun malomalo em i no planti.
- I gat sampela ol bikpela ston na ol raupela ston ol i painim insait long Huon-Gulf. Dispela i soim olsem ol wara i wok long rausim dispela ol ston i go insait long Huon-Gulf solwara.
- I had tru long lukim flo or bed bilong Markham Canyon. Ol i putim kamera i go daun long planti hap long dispela wok painim aut na piksa i soim olsem wara em deti nogut tru na i gat planti pipia wesana i stap long flo bilong Markham Canyon.
- Long hap we teilings bilong main bai go na sindaun, i gat wanwan pis na kindam, liklik ol narapela animol, na liklik namba bilong ol lekma na hol we ol dispela liklik animol i digim.
- Tasol long ples we i autsait long Markham Canyon na igo klostu long Salamaua, ol piksa i soim olsem i gat wesana na planti lekma na hol dispela ol liklik animol i save stap long flo o bed i mekim.

## The Markham Canyon

Figure 8 i soim mep bilong flo bilong Huon Gulf, we DSTP bai i ken stap long dispela hap:

- Solwara em i dip tru long hap stap klostu long nambis (200m na go yet).
- Sait wol bilong canyon em i stap stip (20 degrees) long nambis bilong Lae i go olsem long Busu. Dispela i soim olsem em i isi long teilings i go daun insait long solwara na nogat wanpela samting bai blokim paiplain.
- Olgeta wesana na pipia bilong ol bikpela wara na bilong teilings tu bai olgeta bung na go insait long Markham Canyon, dip bilong 1,000m na go yet. Bihain nau dispela ol teilings na wesana ol karents bai karim go long New Britain Trench we em i 9,000 mita dip na go yet. Markham Canyon em olsen wanpela traipala barret long karim olgeta sedimen na wesana na pipia igo long New Britain Trench.

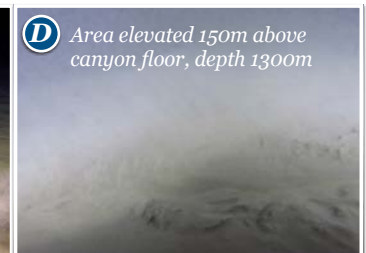
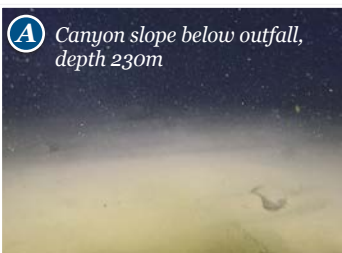
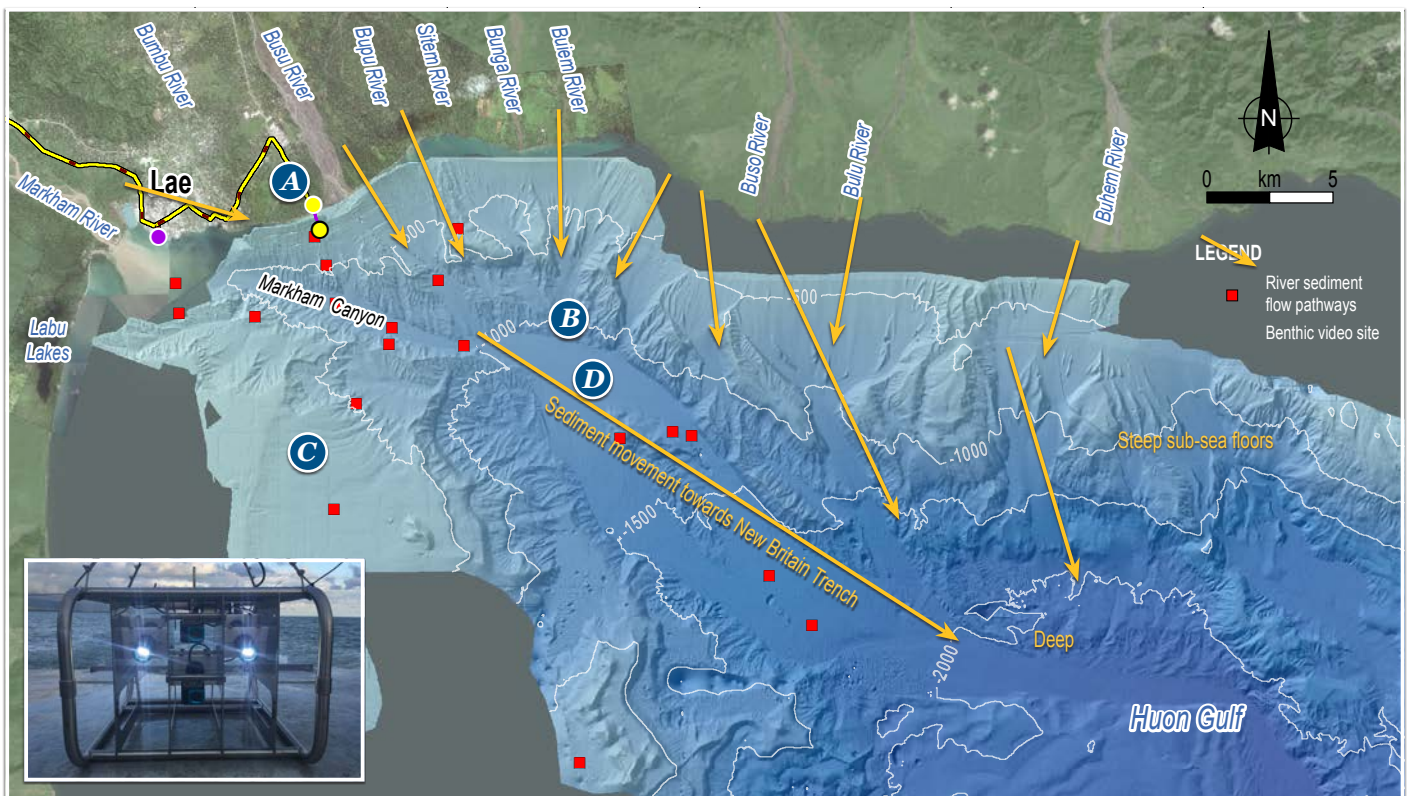


Figure 8 – Map of the video camera sampling locations on the seafloor of the Huon Gulf and images from four locations as shown

**Q** Hau tru na ol i makim outfall, ples bilong rausim teilings/pipia wesana wara bilong maining aninit tru long solwara?

Insait long PNG Gavaman pepa bilong DSTP, em i gat toktok bilong wanem samting bai mitim mak bilong dip we teilings bai go daun:

- Tamblo tru long surface mixed layer. Surface mixed layer em dispela hap we em i gat planti pis, na rif stap. Em long 60 mita i go inap 100 mita (dispela save senis taim win, taid na karent bilong solwara).
- Tamblo tru long hap we lait bilong san i go pinis aninit long solwara (euphotic) – ples i go tudak tumas long ol kain plants olesem seagrass, seaweed and algae long kamap.
- Stap aninit long wara o karent we i noken tanim tanim (upwelling) na sut bek i go antap long solwara (lukim Figure 9 na 10).

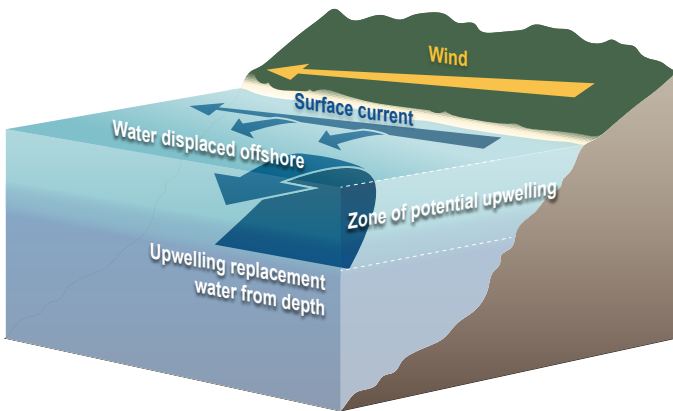


Figure 9 – Diagram of coastal processes that have the potential to lead to upwelling

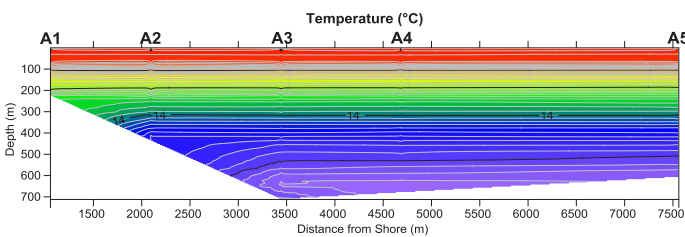


Figure 10 – Temperature profile Transect A, 8 August 2017

If upwelling occurred, cooler water (yellow, green or blue, depending on depth of upwelling) would rise towards the surface and replace the warmer (red) coastal waters at the surface (around A1 and A2).]



Figure 11 – Oceanographic vessel MV Xiang Jian



Figure 12 – The Munin – an Autonomous Underwater Vehicle (AUV), which is about 3.5m in length and was used for very high resolution seabed mapping

**Wanem kain stadi WGJV i bin mekim**

WGJV i bin wokim stadi long mepim flo bilong solwara long 2012 na bihain statim stadi bilong EIS long mun August 2016. Dispela stadi kampani kamapim long painim aut wanem hap em raitpela hap bilong DSTP. Dispela stadi i mekim:

- Stadi wantaim wanpela bikpela sip ol i kolim MV Xiang Jian (Figure 11) na wanpela AUV (Autonomous Underwater Vehicle) (Figure 12) long mepim flo bilong solwara. Dispela stadi usim sonar (sound waves) long mepim flo bilong solwara.
- WGJV i mekim stadi long tempetsa (hot na kol bilong wara), sekim level bilong sol bilong solwara (salinity), sekim sanlait long wanem hap tru long solwara lait i go na pinis. Dispela ol i mekim wantaim wanpela masin nem bilong em Conductivity, Temperature, Density (CTD). Dispela kamap long October 2016 (lukim Figure 13 na Figure 14).
- Long sait bilong solwara tanim tanim na kamap long tamblo stret long dip solwara (upwelling), WGJV i stadim tempetsa bilong tenpela hap insait long canyon long 12pela mun.
- Figure 10 i soim dispela long 8 August 2017 na risalt i soim nogat wanpela upwelling i bin kamap.

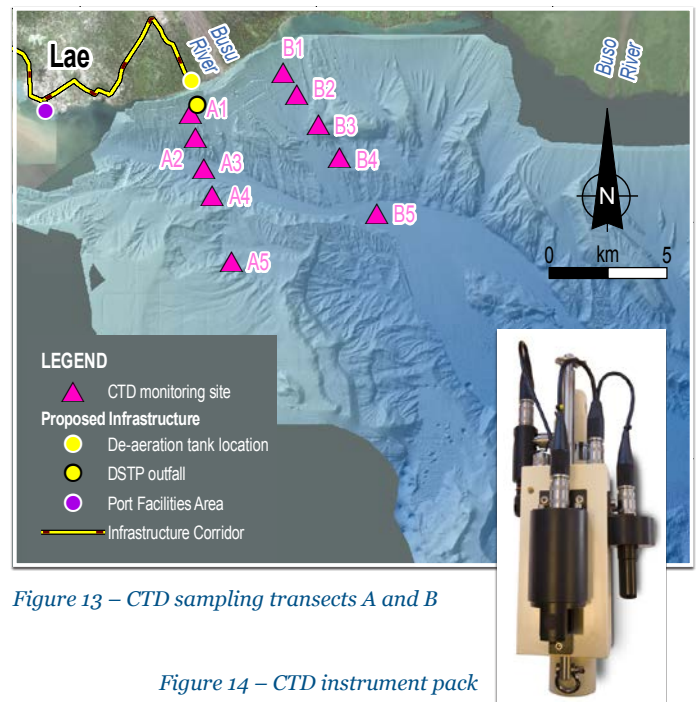


Figure 13 – CTD sampling transects A and B

Figure 14 – CTD instrument pack



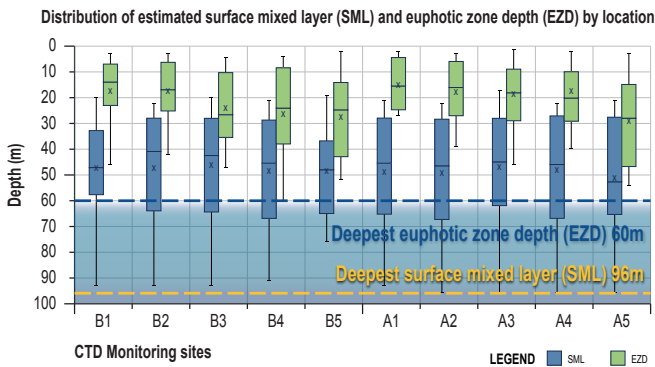
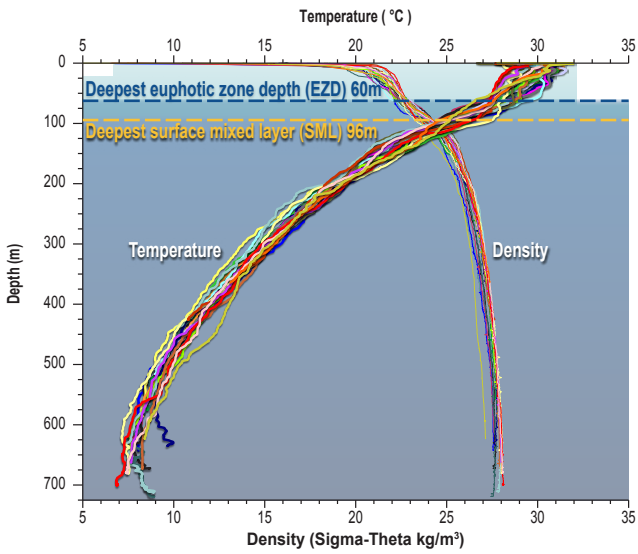


Figure 15 – CTD temperature and density profiles and ranges of surface mixed layer (SML) (top graph) and the associated calculated ranges for the SML depth (blue) and euphotic zone depth (EZD)(Green) in the bottom graph at the ten transect locations.

Ol mesamen long Figure 15 i soim painim aut bilong 25pela hap long October 2016 go long December 2017:

- Pinis bilong surface mixed layer(SML) em i stap long 96 mita.
- Sanlait bai i go inap olsem 60 mita aninit long solwara, na tamblo long 60 mita mak ples bai go tudak.
- Aninit long PNG Gavaman DSTP gaidlains , i tok olsem outfall hap, mak bilong em i mas 120 mita o wanem dip bilong sufrace mixed layer i mas i go 50% moa yet.
- Aninit long dispela gaidlain, dispela outfall hap i mas 144m.
- Lait bilong san go na pinis aninit long solwara na tu dip bilong surface mixed layer, dispela tupela samting em kampani painim aut olsem ol i no dip tumas bikos long deti wara (Figure 15).
- Stadi soim nogat wanpela upwelling kamap.
- Long dispela olgeta toktok o painim aut, kampani i lukim olsem Wagang em i mitim ol DSTP gaidlains bilong PNG Gavaman, na Wagang em i raitpela hap we DSTP bai sindaun.

## Dip bilong teulings discharge mak

Long dispela ol painim aut, WGJV i lukluk long putim paip bilong teulings go daun 200 mita insait long solwara. Dispela paip bai stap long wei yet tambelo long surface mixed layer (Figure 16).

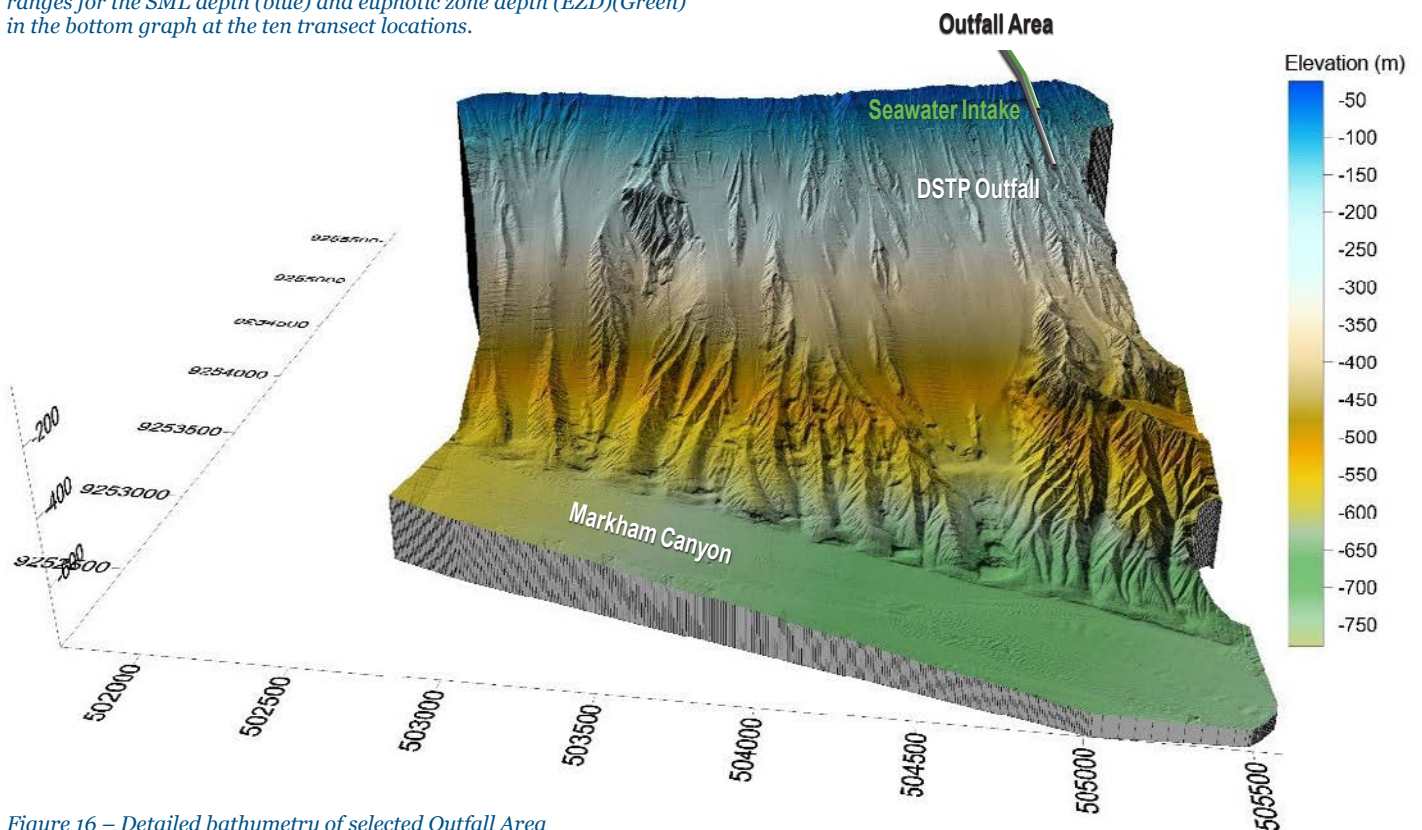


Figure 16 – Detailed bathymetry of selected Outfall Area



## Q Ol dispela teilings bai go long wanem hap stret?

- Kampani wokim wanpela kompiuta model long lukim we teilings na ol pipia bilong ol wara bai go insait long Huon Gulf.
- Planti ol teilings bai go tamblo bihainim bed bilong Markham Canyon. Sem taim tu dispela ol teilings bai miks wantaim sedimen ol wara i karim i kam insait long solwara.
- Stadi tu i painimaut olsem sampela ol teilings bai i raun liklik long ol karent dip aninit stret long solwara (plumes) na bihain bai ol i go sindaun lo flo bilong solwara.

- Taim dispela i save kamap sedimen i save ron igo hariap tru i go daun long bed bilong Markham Canyon.
- Table 2 i soim sampela ol lenslaid ol i meserim wantaim karent meter.
- Sampela ol lenslaid i kamapim spid olsem 8m/s (spid bilong wanpela Olympic sprinta) na strong bilong dispela lenslaid i bin surukim wanpela 900kg anka igo olsem 15km insait long canyon.
- Dispela ol lenslaid aninit long solwara save surukim bikpela sedimen insait long Markham Canyon na save suruk yet i go long New Britain Trench (Figure 18).
- Long mun October long yia 2016 go long December 2017, i bin gat fifti lenslaid kamap long dispela hap.
- Dispela ol lenslaid i kamapim ples bagarap o birua long ol enimol save stap insait long canyon

## Planti sedimen tru i wok long go daun long Markham Canyon long lenslaid ananit long solwara

- Kampani i putim pinis sampela monitoring stations long Markham Canyon, long hap bilong Outfall, Wave, Canyon A, B and C, Basin A and B, Far Field na Trench (Figure 17). Ol mesamen bilong ol monitoring stations ol i yusim ADCP (Acoustic Doppler Current Profiler) masin (Figure 19).
- Insait long hap bilong Markham Canyon, stadi i painimaut olsem bikpela ol lenslaid (giraun buruk) aninit long solwara i save kamap. Taim sedimen ol wara i save karim i go daun long solwara, em i save go na bung long wanpela hap long maus bilong ol wara na bihain long sampela taim em save buruk na kamapim traipela lenslaid.

Table 2 – Speeds of the turbidity currents (up to 8m/sec), calculated from the timing of the recorded current bursts between sequential moorings

Date	Canyon section	Time of travel (min)	Distance (km)	Estimated turbidity current speed (m/s)
8 Jan 2017	Canyon A to Basin A	40	18.7	7.8
3 Jun 2017	Canyon B to Basin B Basin B to Trench	87 262	43.9 60.0	8.4 3.8
1 Aug 2017	Canyon C to Basin B	302	32.7	1.8
2 Sep 2017	Canyon C to Basin B Basin B to Trench	188 857	32.5 59.7	2.9 1.1

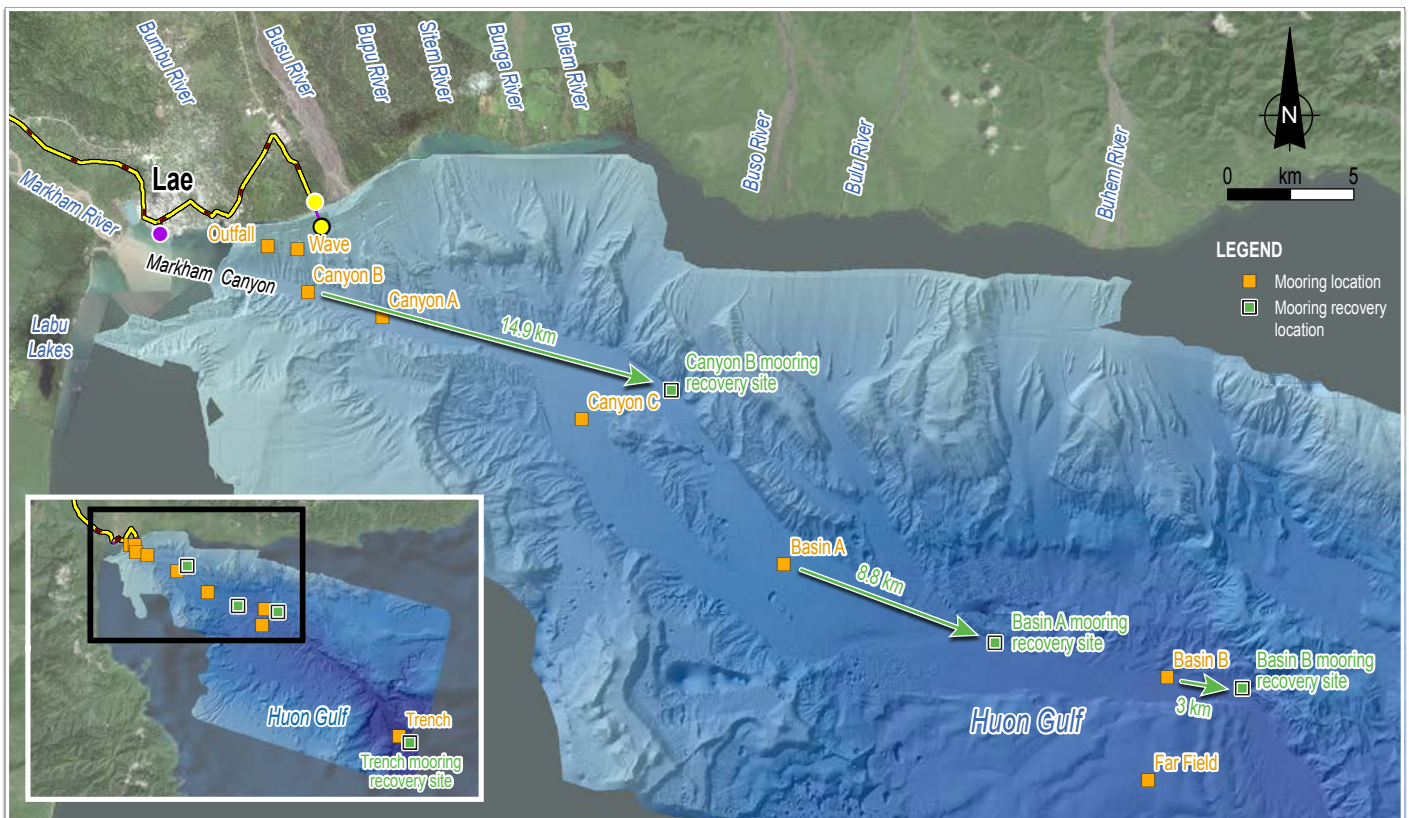


Figure 17 – Current monitoring locations. Arrows show locations where subsea landslides have been recorded

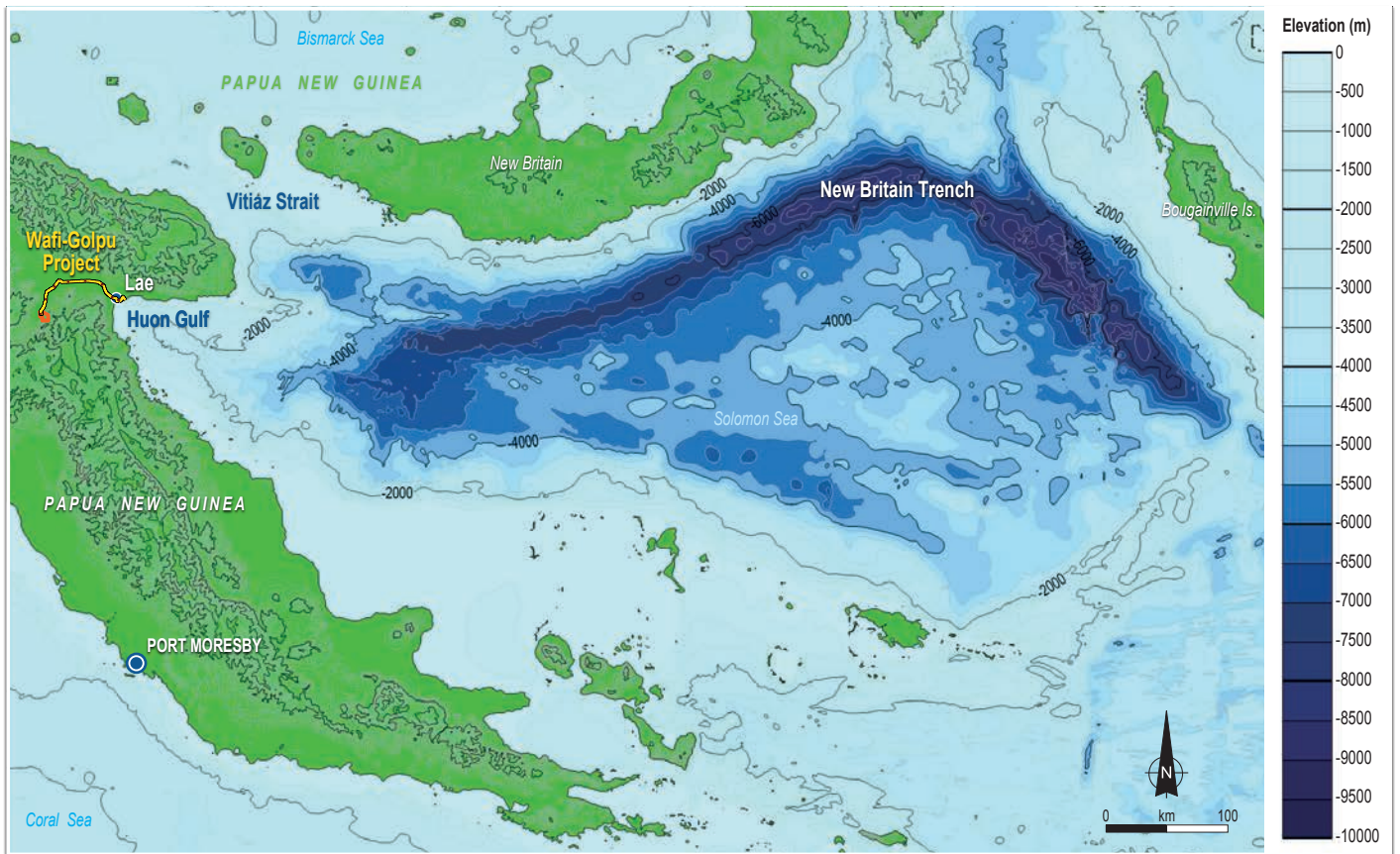


Figure 18 – Water depth in the Huon Gulf and Solomon Sea

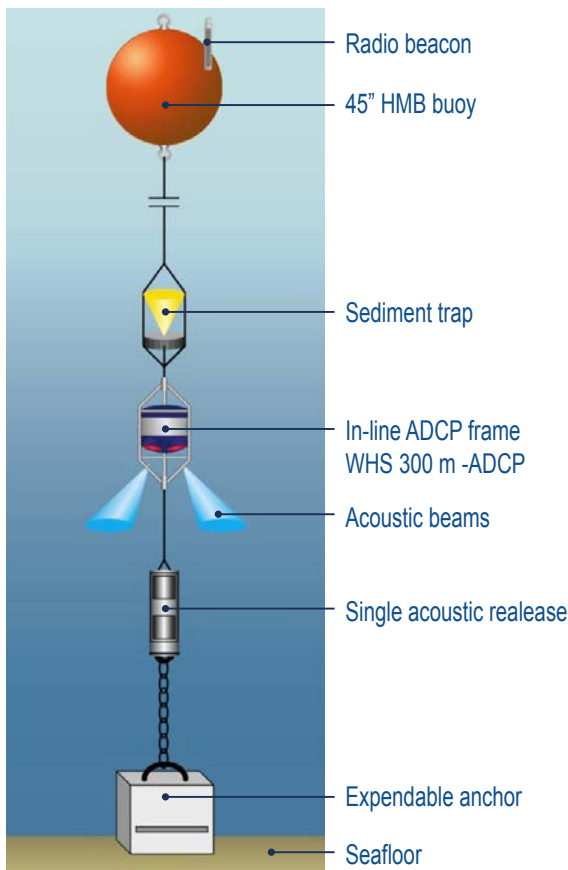


Figure 19 – ADCP (Acoustic Doppler Current Profiler) instrument pack

## Wesan aninit long flo bilong solwara

- Wok bilong echo sounding i soim olsem i gat bikpela sedimen waves stap aninit long solwara (waitpela ero long Figure 20) long mak bilong 3,000 m.
- Sampla ol dispela sedimen wave i sanap olsem 80m na longpela bilong ol i olsem 700 mita
- Hau dispela sedimen i wok long suruk aninit long solwara long canyon i soim hau teilings bai i suruk go daun insait long dip wara bilong Huon Gulf, na go yet long New Britain Trench.

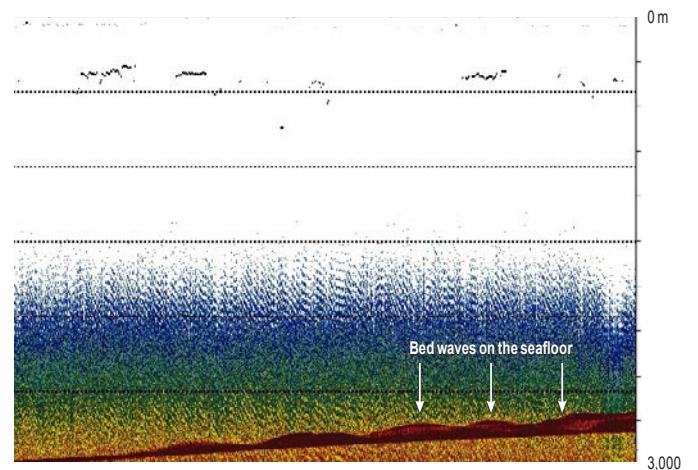


Figure 20 – Sand waves on Markham Canyon floor



## Hap we sedimen bai i go sindaun long em – em bai kamap olsem wanem? Komputa modelin long we solwara i karim sedimen bai i go insait long Huon Gulf

WGJV i kamapim komputa model bilong wanem hap sedimen bai i go insait long Huon Gulf.

- Stadi bilong solwara ol i kolim bathymetry.
- Hamas tru ol teulings na suspended sedimen bilong wara i save go insait long Huon Gulf.
- Na bai mesarim ol karent, temperetsa, level bilong sol, win na tides na hau ol dispela samting i efektim ron bilong ol teulings na sedimen insait long solwara.
- Ol ron bilong giraun aninit na lenslaid long flo bilong Markham Canyon.

Figure 21 na 22 i soim lukluk bilong dispela giraun guria na suruk bilong en, long wanpela yia na long 27pela yia wantaim. Figure 22 i soim lenslaid or giraun suruk long wanwan yia bilong teulings na tu ol wesam kam daun long ol bikpela wara.

Dispela ol figure i soim:

- Sampela ol teulings (namba olsem 38%) bai stat long spred aut olsem feda bilong pisin (plume), tasol dispela bai stap namel long 300 metres go long 500 metres dip aninit long solwara.

- Bihain nau dispela ol plume antap bai go daun na sindaun long aninit long flo, long wei yet olsem 5 to 6 kilometre, long sem hap we ol plumes bilong ol wara save go na stap.
- Ol giraun suruk long ol sait bilong Markham Canyon bai surukim dispela wesam na teulings go yet insait long dip solwara.
- Komputa modelin i soim long bathymetry stadi olsem bikpela komponen long ol teulings bai i bung wantaim dispela ol sedimen bilong wara na bai i go daun long Markham Canyon na i go daun yet long dip solwara.

## Q DSTP bai bagarapim pis na ples bilong painim pis tu o nogat?

I gat tupela bikpela wok bilong pis i stap insait long Huon Gulf. Dispela em:

1. Ol wanwan ples i stap arere long solwara save painim pis bilong kaikai long haus na tu long salim long maket.
2. Game fishing long painim ol kain pis olsem marlin na Spanish mackerel.

## Bai ol lokol pis bagarap o nogat?

- Ol pis bilong Huon Gulf i wanpela bikpela samting insait long wanwan ples arere long nambis. Ol lain long ples i save kaikai na tu ol i save go salim long maket na kisim moni. Ol i save kisim planti pis long ples we em i no dip tumas namel long 0 na 100 mita long nambis, Labu Lakes na ol rif i stap long Salamaua. Ol i save hukim pis na trapim ol kindam, kuka na lobsta long ol mangro stap long Labu Lakes. (Lukim long Figure 23 go long 26).

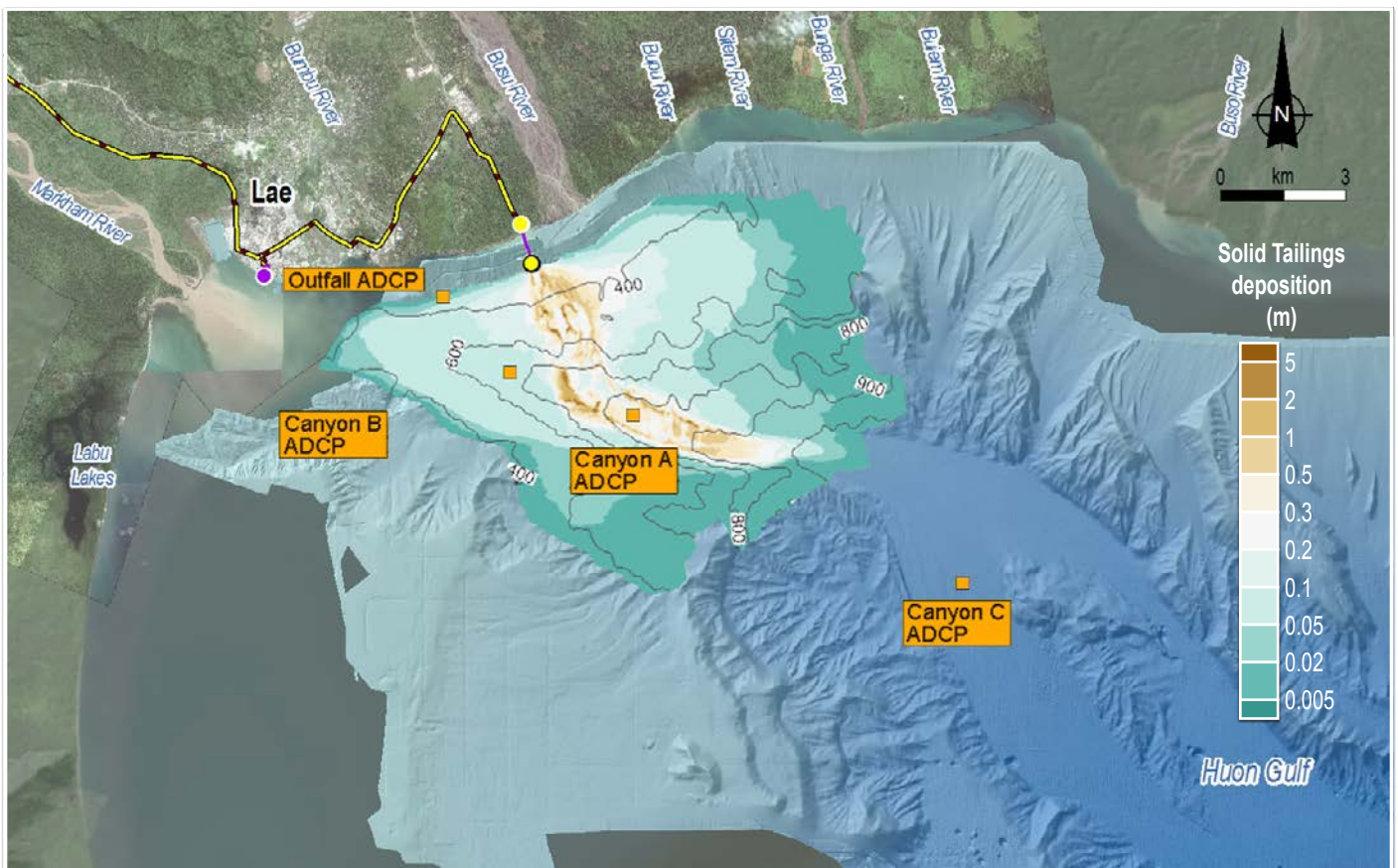


Figure 21 – Modelled total tailings footprint after 1 year of DSTP operation (cut-off at 5mm)



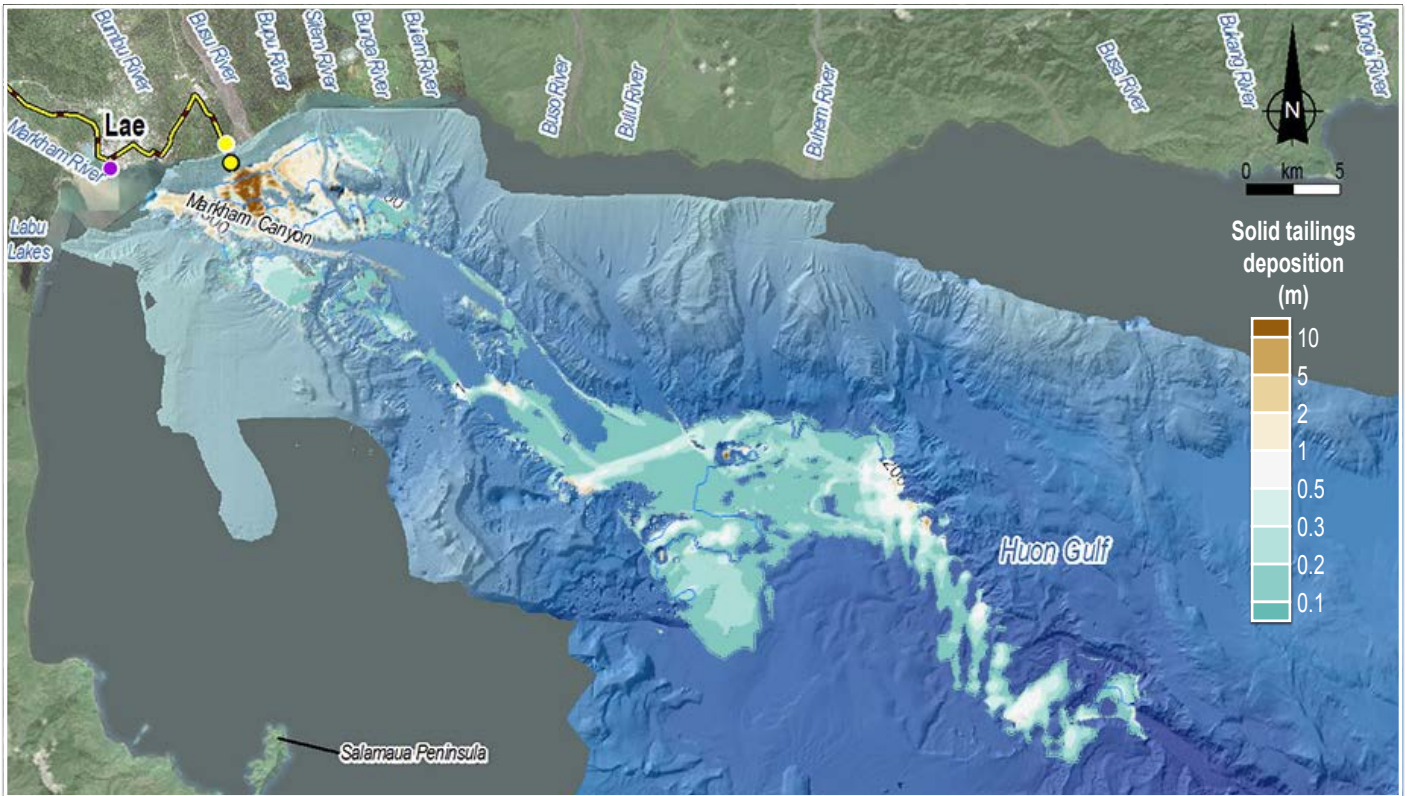


Figure 22 – Modelled total tailings footprint after 27 years of DSTP operation (~450Mt) and inclusive of one mass movement event per year (cut-off at 10cm)

- Toktok wantaim ol fisamen bilong ples i soim olsem ol i save painim pis long solwara mak olsem 100 mita na kam bek long nambis. Ol i no save abrusim 100 mita na go daun. Ol pis we ol man na meri long ples i save kisim long kaikai na salim long maket klostu o arere long nambis. Sapos teiling i go insait long dip solwara klostu long ~200 mita bai i nonap bagarapim dispela ol pis. Hau na ol i save kisim dispela pis:
  - Ol i save sanap long nambis na tromoi huk na yusim net tu.
  - Pul kanu i go arasait long rif na tromoi huk.
  - Troll long painim bikpela pis olsem mackerel.
  - Trapim ol pis.
- I nogat rif long hap we ol bikpela sedimen i save kam daun long bikpela wara, long olgeta hap klostu long DSTP outfall. Ples we i gat rif na ol pis i stap long dispela rif em long Salamua na i go olsem. Dispela em stap 20 kilomita longwei tru long hap we DSTP outfall o ples we pipia wesana na wara bilong main bai sindaun insait long dip solwara.
- Kampani bai putim wanpela stadi long rekodim ol kainkain ol pis ol manmeri i pulim long solwara. Na tu kampani bai kisim 'baseline' infomesen long sekim helt bilong dispela pis, long wanem ol metol i stap insait long bel bilong pis.
- Lae i gat bikpela wof na tu i gat ol bikpela fektori bilong mekim tin pis. I gat fopela tin pis fektori (tuna na mekerel) insait long Lae. Ol bai konstraktim tupela moa fektori long Malahang Industrial Centre. Dispela ol fektori i saptim ol sip bilong kisim tuna, namba bilong em 27 olgeta. Dispela ol bikpela sip bilong kisim pis i no save painim pis klostu long Huon Gulf. Ol i save painim pis autsait long Huon Gulf, long boda bilong PNG autsait olgeta, long hap ol i kolim Exclusive Economic Zone (EEZ).
- Ol nambawan pis ol i save kisim em skipjack na yellowfin tuna. Dispela ol pis ol i no save kisim long Huon Gulf. Ol sip bilong tuna save painim tuna autsait long hap ol i kolim Western na Central Pacific Fishery na kisim kam bek long tin pis fektori long Lae.
- Long ol namba stap (Figure 31) i soim ples we dispela ol pis i save go na kamapim niupela pis (breeding grounds) i stap long olgeta hap long Western Central Pacific. Ol Commercial fishing em i stap longwei stret na DSTP bai i nonap bagarapim ol wok bilong painim tuna na mackerel.

## DSTP i bai kamapim sampela hevi long 'commercial fishing' o nogat?

- Stadi i soim olsem bai i nogat wanpela hevi or bagarap bai kamap long tuna indastri. Dispela ol bikpela sip bilong painim tuna ol i no wok painim tuna insait long Huon Gulf olsem.

## DSTP i bai kamapim sampela hevi long Game Fishing o nogat?

- Lae Game Fishing Club em wanpela klab we ol lain i save go painim pis insait long Huon Gulf. Em wanpela lain i save go aut na traim long hukim ol bikpela pis. Ol sip ol i save yusim long dispela geim i save yusim beit ol i putim long huk na tromoi i go insait long solwara. Ol pis ol i save hukim em wahoo, black na blue marlin, sailfish, dolphinfish, trevallies, spanish mackerel na tuna.
- Planti bilong ol dispela liklik sip i save go huk arasait stret, stap long wei tru. Nogat wanpela bagarap bai kamap long Game Fishing.



Figure 23 – Typical outrigger canoe



Figure 24 – Shallow estuarine lakes at Labu



Figure 25 – Foreshore near Wagang



Figure 26 – Examples of fish sold at DCA Point fish market

## Q Wanem kain ol pis i stap long dip solwara insait long Huon Gulf?

- WGJV i pinisim wok painim aut long lukim wanem kain pis i stap insait long dip solwara insait long Huon Gulf. Dispela ol pis i stap tamblo moa long hap we planti ol manmeri i save painim pis. Dispela ol pis i stap long hap we kampani bai rausim teilings insait long dip solwara.
- Long painim dispela ol pis, ol i yusim batri long pawarim huk (lukim Figure 27). Ol i tromoi huk i go daun klostu 800 mita long 30pela hap insait long Huon Gulf (lukim Figure 30).
- I no gat wampela lain husait i save painim pis long dispela dip solwara. Tasol em i gutpela long save wanem kain pis tru i stap long dispela hap.
- Insait long Huon Gulf wok painim aut i tok olsem i nogat planti pis i stap olsem long narapela hap stadi bin kamap long en insait long PNG. Ol kain pis olsem snappers, emperors na groupers i nogat tru.
- Long stadi bilong WGJV, 58pela pis tasol ol i bin ketsim namel long 100 mita na 540 mita insait long dip solwara. Dispela ol pis em sak tasol (54). Dispela ol sak em ol kolim gulper sharks (lukim Figure 28 na 29). Ol lain long Wagang wanwan taim i save lukim dispela sak tasol ol i no save go painim pis long dispela kain dip solwara we dispela ol sak i save stap.
- Ol i painim tu wampela pis tasol, saddletail snapper, ol i painim long ol dip slop. Ol i no painim ol narapela pis femili ol i rekodim insait long PNG long dispela ol dip hap.
- I nogat planti pis long dispela hap em bicos dispela ol dip hap em sedimen/pipia i kam long ol wara olsem Markham na Busu wara i bagarapim dispela hap na hat long planti bilong dispela ol pis long stap long hap. Dispela ol pipia bilong wara Markham na Busu i bagarapim ol hap bilong ol flo bilong solwara na mountain aninit long solwara, we ol dispela kain pis i save stap long narapela hap long PNG.



Figure 27 – Deep water fishing gear



Figure 28 – Dwarf Gulper Shark





Figure 29 – Long-finned Gulper Shark (note the longer dorsal fin)

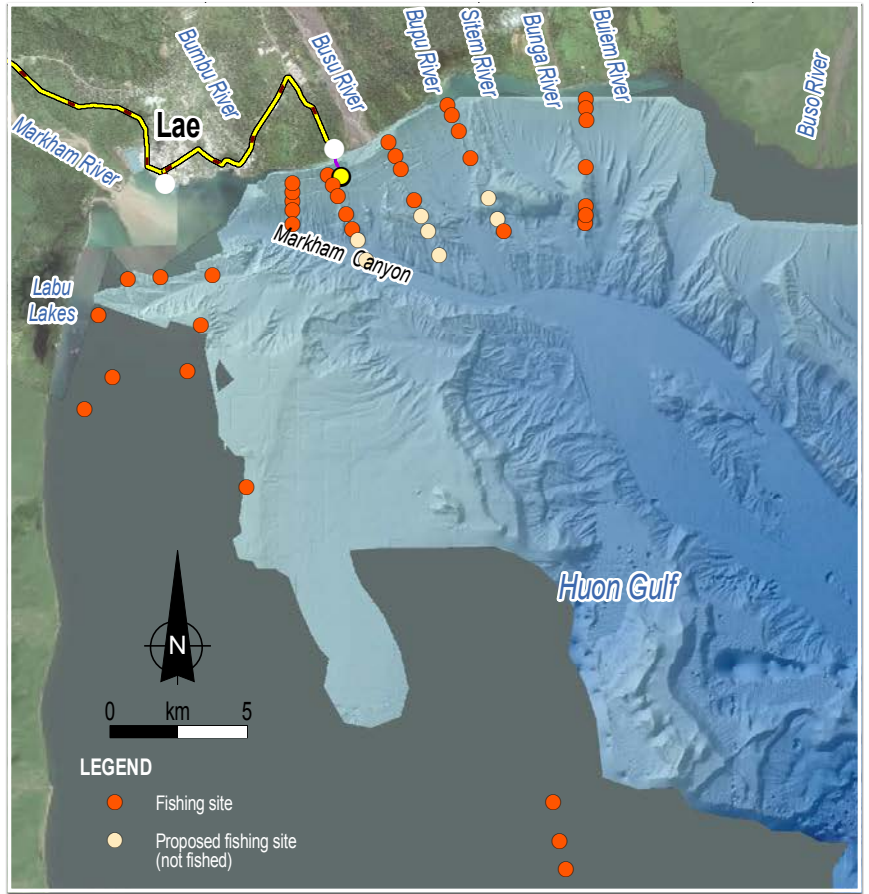


Figure 30 – Fishing sampling sites

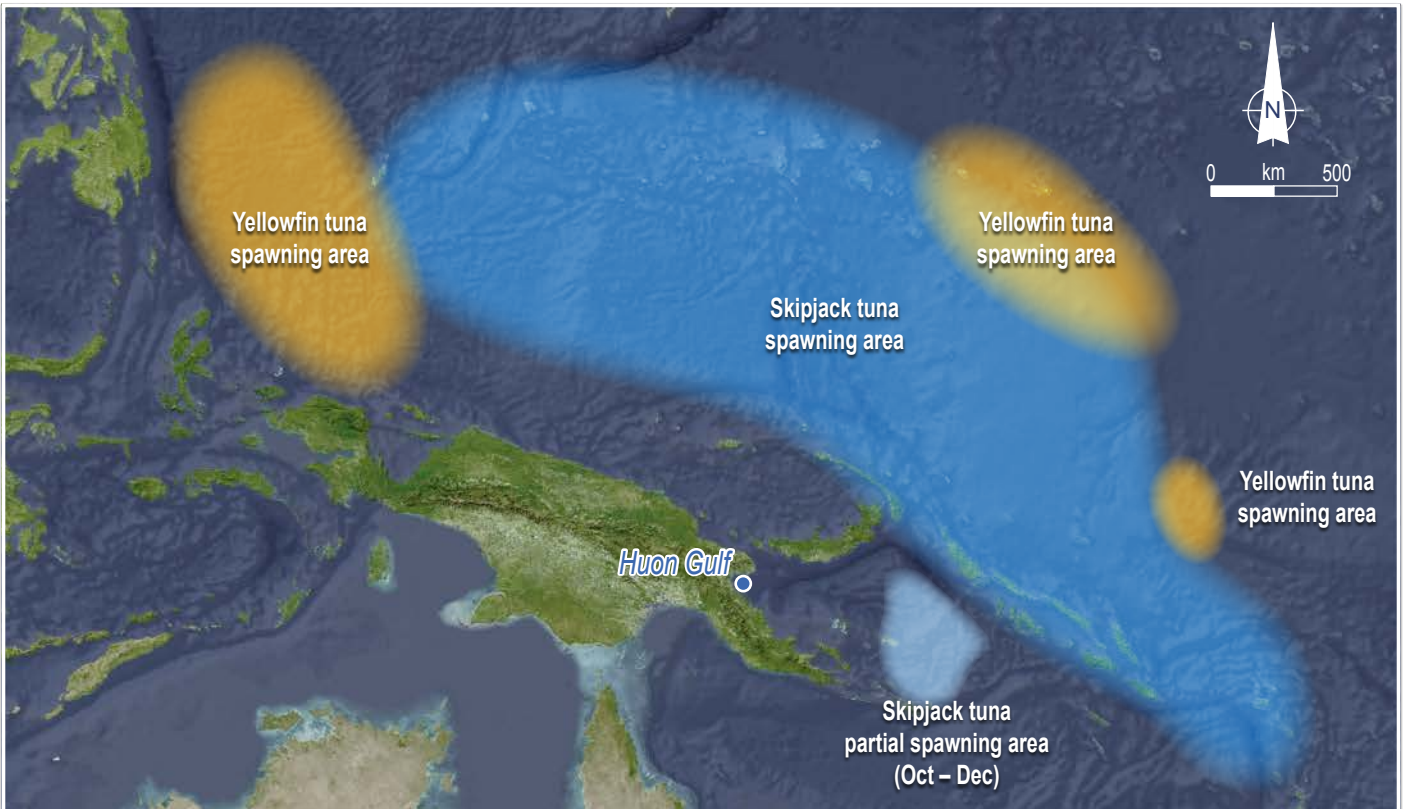


Figure 31 – Skipjack and yellowfin tuna spawning areas (taken from Figure 3.15 in Appendix S to the EIS)



## Q Teilings em i poisen o nogat?

- Dispela DSTP sistem Kampani i disainim em olsem em bai i nogat hevi or bagarap bai kamap long solwara, nambis na olgeta hap solwara, antap na aninit.
- Dispela ol toxicity tes ol i mekim i stap insait long stended bilong CSIRO, na ripot i stap insait long EIS ripot.
- Dispela tes ol i mekim wantaim eitpela animol - microalgae, crustaceans na pis, na copepods, we ol i testim dispela ol animol long teilings (lukim Figure 32).
- Stadi i soim olsem teilings bai i gat sans long rilisim or rausim sampela ol metol taim teilings i go sindaun long aninit long flo bilong solwara. Dispela ol metol bai i gat liklik posen insait long en taim ol i stap insait long solwara.
- Wanpela bikpela benefit bilong putim teilings aninit long solwara em taim teilings go sindaun aninit tru long solwara, i nogat sans long bagarapim ol pis na animol.
- Ol CSIRO stadi i soim olsem bai i gat liklik risk bilong toxicity taim teilings miks wantaim sedimen kam olsem long wara (olsem Markham na Busu) na taim teilings go sindaun aninit long mak olsem 1000m na moa yet.
- Wanpela bikpela benefit bilong putim teilings aninit long solwara em taim teilings go sindaun aninit tru long solwara, i nogat sans long oxygen bai holim.
- Olgeta stadi soim teilings bai i no i gat hevi or bagarapim solwara, nambis na olgeta hap solwara, antap na aninit.

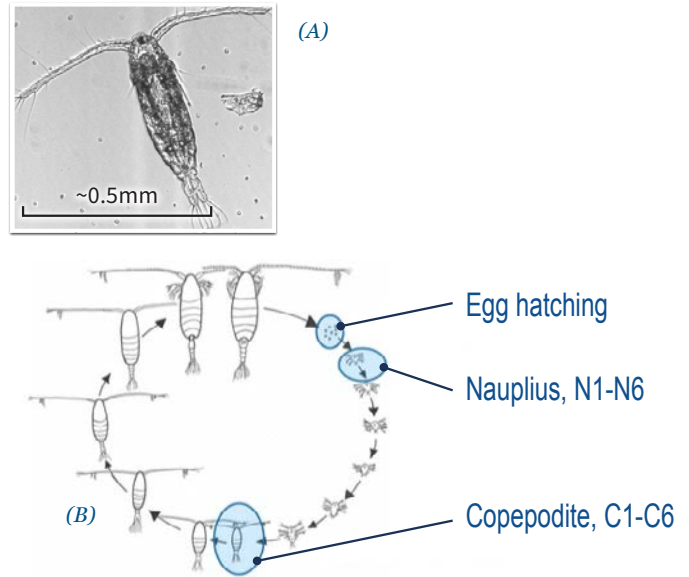


Figure 32 – Marine copepod adult (A) and life cycle (B). The copepod toxicity test measured copepod survival and hatching success from egg to juveniles (from CSIRO report: EIS Appendix L)

Source CSIRO report to GDA Consult and IHA Consult October 2017.

## Q Em i orait long kaikai pis taim teilings kamaut aninit long solwara?

Yes. WGJV i save olsem ol pipol na kominiti i gat planti toktok (concern) long pis sapos DSTP go het. Olsem na WGJV mekim wok painim aut na stadi i tok o soim olsem bai i nogat wanpela bagarap o senis bai kamap long pis bilong solwara.

- Stadi i panim aut olsem ol nogat manmeri husait i save huk long pis long hap we em i 200 mita dip.
- Stadi i panim aut olsem ol sak save raun long dip solwara long kain dip olsem 200 mita na moa yet, dispela ol sak i nogat wanpela ol painim long maket or ples.
- Commercial fishing na game fishing ektiviti em long wei long hap bilong DSTP.
- Ol stadi long narapela kantri na long PNG i soim olsem ol pis stap long hap bilong DSTP i nogat wanpela bagarap o senis, long sait bilong metol insait long bel or bodi bilong ol.
- WGJV i statim pinis stadi (baseline) na bai i go yet wantaim stadi long pis na givim gutpela ripot igo long ol asples, na wok wantaim ol tu long strongim stadi wok.

## Q Enap teilings bai bagarapim pis na kaikai bilong pis?

- WGJV i mekim stadi long ol plankton na stadi painim aut olsem ol zooplankton na liklik tru ol pis save raun long dip hap we mak olsem 350 mita. (Figure 33 soim hap kampani i stadim ol plankton, Figure 34 i soim ol masin na net kampani i yusim, na Figure 35 i soim piksa bilong ol plankton animol).
- Stadi i soim olsem sapos plankton go daun long 300 mita o moa, ol i gat liklik posen tasol long bel bilong ol. Em minim olsem i nogat sans bilong plankton bai posenim ol pis husait i kaikaim ol.
- Stadi i soim olsem ol metol insait long pis i stap tamblo tru, na foodchain (lukim Appendix N long EIS ripot) o kaikai bilong pis bai i nogat bagarap kamap.
- Dispela ol stadi i soim olsem ol metol insait long ol pis bai i no inap givim hevi long ol manmeri husait bai kaikai pis. WGJV statim stadi na bai wokim monitoring program go yet long strongim dispela toktok.

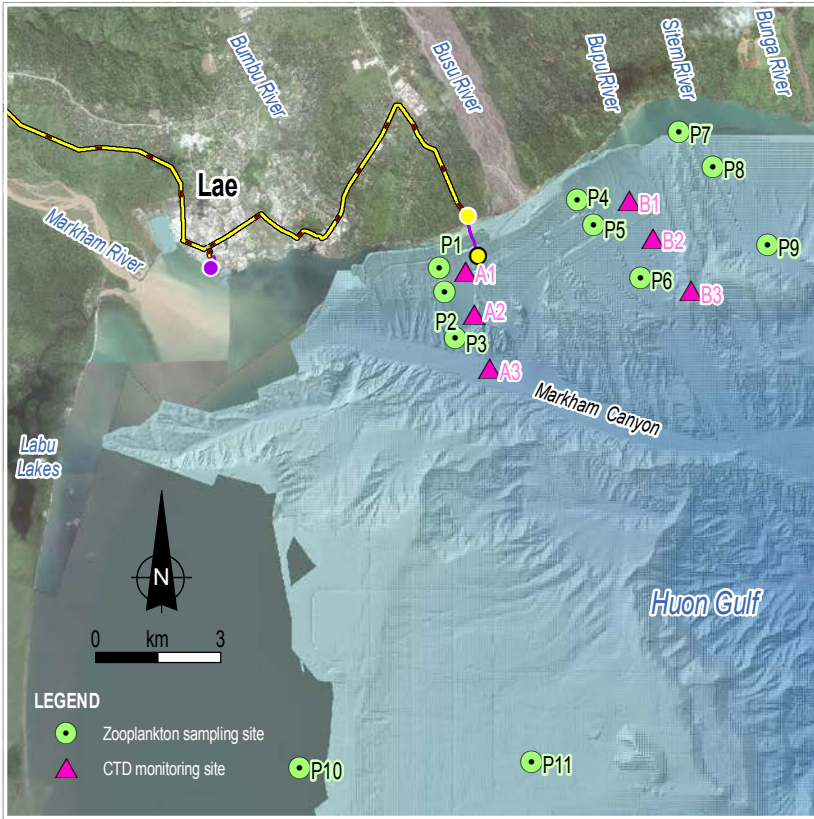


Figure 33 – Plankton sampling locations

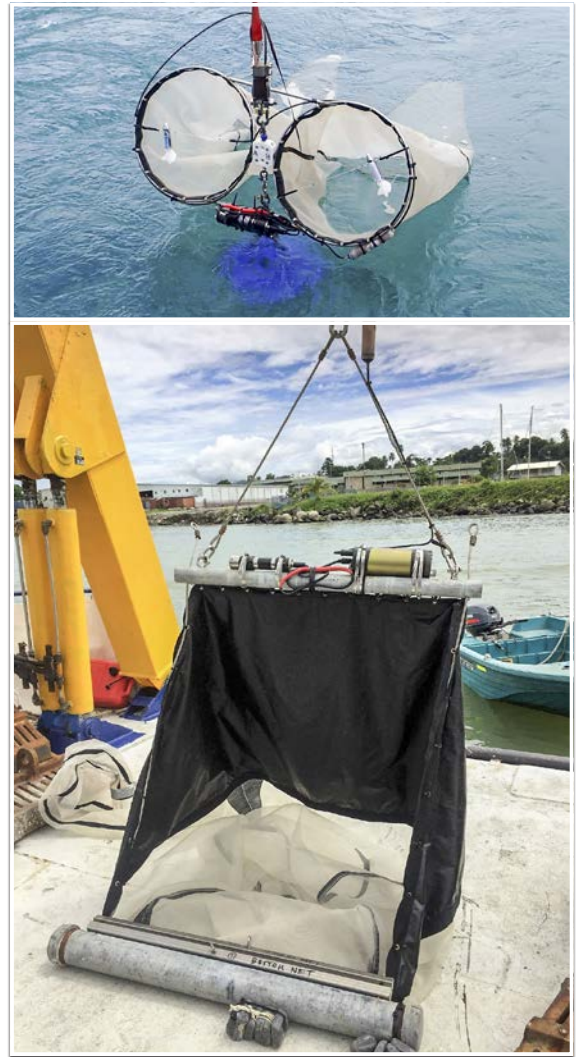


Figure 34 – Different nets used in the plankton sampling program

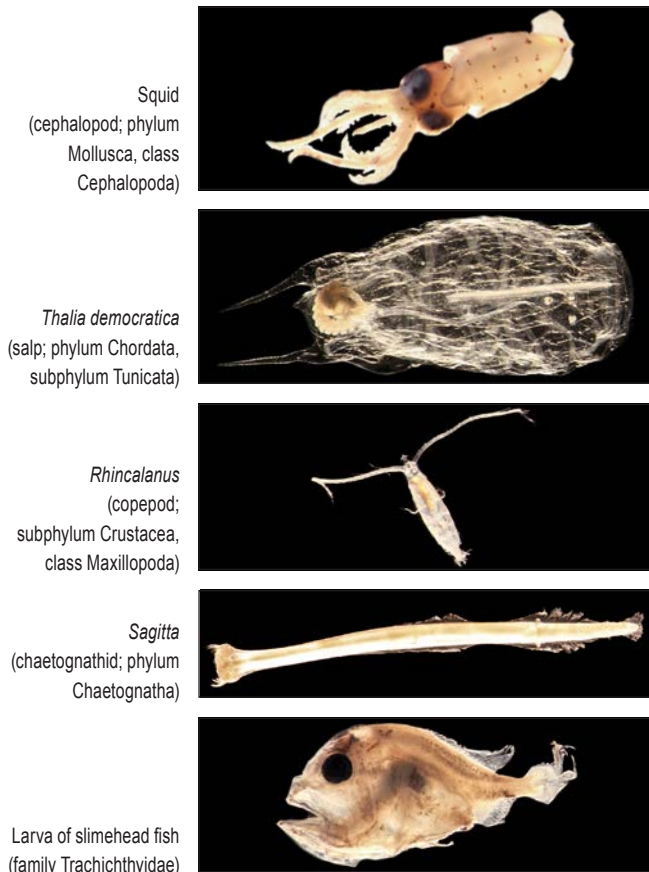


Figure 35 – Some typical planktonic animals (zooplankton) caught in the Huon Gulf

## Q Bai i gat sampela bagarap kamap long ol torosel?

- WGJV i save olsem i gat liklik populesen bilong ol torosel i save stap long ol planti hap nambis insait long Huon Gulf. Em i impoten long lukautim dispela ol torosel, long lukautim nambis na ol nest bilong ol.
- Paip bilong teilings na paip bilong kisim solwara go long Mixing Tank ol i bai stap aninit long giraun. Dispela ol paip bai i no inap stap ples kliia, na i nogat wei long ol bai bagarapim ples bilong ol torosel. WGJV bai putim planti proses long taim bilong konstraksen we bai nogat wanpela asua or hevi bai kamap long ol torosel, animol na long ol manmeri.
- Long sait bilong kaikai bilong torosel, bai i nogat bagarap kamap long ol. Ol torosel save painim kaikai bilong ol arasait olgeta na i no save painim kaikai insait long Huon Gulf.



## Q Wanem samting i stap insait long sedimen long flo bilong dip solwara?

- WGJV i yusim video camera long painim ol animol na wantaim dispela i kisim ol sempol tu. Stadi soim olsem i nogat planti ol animol stap insait long canyon long flo bilong dip solwara.
- Figure 36 na 37 is soim piksa bilong ol bokis na ol samting ol i yusim long kisim wesan we i gat ol liklik animol stap long en.
- WGJV karim aut stadi long ol binatang na animol i save stap long giraun aninit long solwara bilong Huon Gulf, long mun February na December long yia 2017. Stadi i lukluk long ol liklik liklik (microscopic) animol ol i kolim meiofauna we planti save i stap long dip solwara. Stadi painim aut namba bilong dispela ol meiofauna i olsem 10 go long 500 stap insait long 10cm<sup>2</sup>. Size bilong 10cm<sup>2</sup> i oslem size bilong wanpela tin Ox & Palm. Planti namba bilong dispela ol meiofauna em ol nematode worms na copepods, tasol namba save senis liklik taim ol niupela stadi save kamap.
- Figure 38 is soim ol piksa bilong ol liklik animol o sinek (long bilong em 10mm) long piksa antap na ol copepods (long bilong ol 0.2mm o liklik moa) long tamblo piksa.
- Dispela liklik animol i planti tru moa long ol bikpela kindam na kuka. Na em gutpela long lukluk long ol long taim bilong maining na taim main i pas.
- Stadi i putim ples klia olsem ol ron bilong sedimen na lenslaid insait long canyon i kamapim bikpela hevi long ol animol husait i stap long canyon na i mekim hat tumas long ol animol stap insait long dispela enviromen.

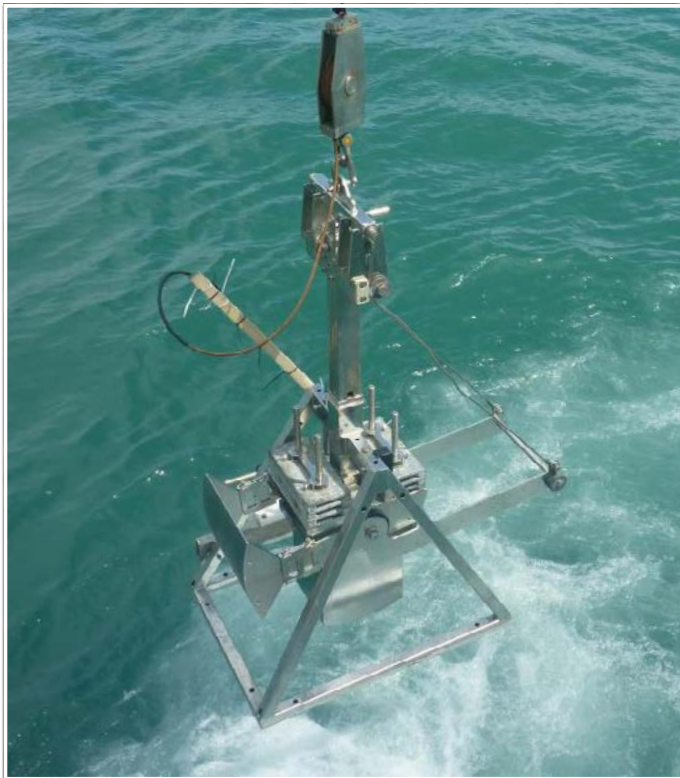


Figure 36 – A box corer

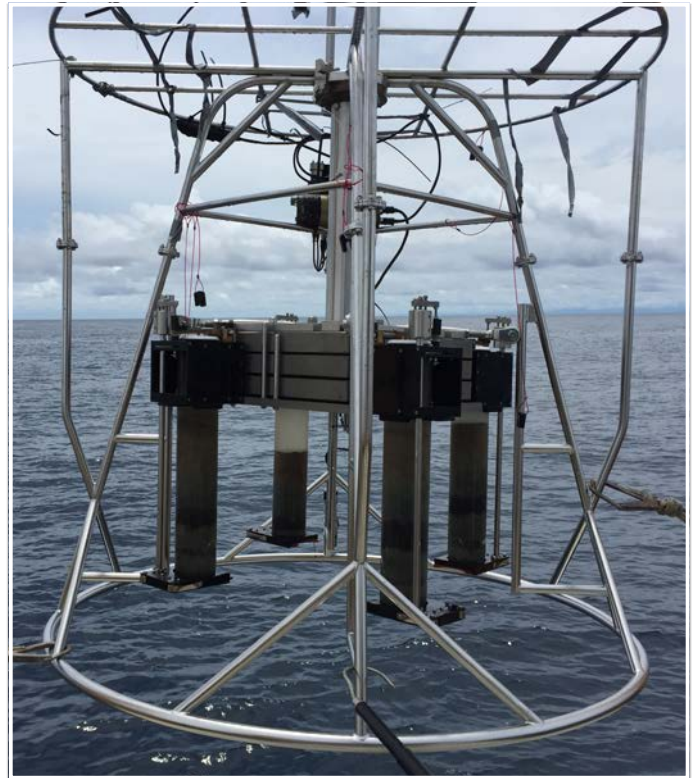


Figure 37 – A multicorer



Figure 38 – Microscope pictures of nematode worms (top) and a copepod (below)



## Q Wanem ol painim aut i bin kamaut long ol stadi?

- Stadi i tok olsem solwara bilong Huon Gulf i orait long kamapim DSTP.
- Dip long solwara we kampani i lukluk long putim teilings long outfall (moa long 200 mita), dispela hap i mitim seifti na envairomen requirements long sait bilong rausim teilings
  - Mak bilong putim teilings i go moa yet olsem 200 mita
  - Long dispela hap, ol DSTP stadi i no painim or ditektim wanpela upwelling.
  - Hap we teilings bai pundaun i go long pinis bilong paip long flo bilong solwara, dispela hap em teilings ba i ino inap stak long wanpela hap. Teilings bai go yet long flo bilong Markham Canyon.
  - Long hap we teilings bai discharge i go long Markham Canyon, impek long ecosystems na envairomen, em bai liklik.
- Ol bikpela wara olsem Busu na Markham i save karim planti bikpela sedimen (ston, wesan, giraun, mad) i go long solwara long wan wan krismas, na dispela sedimen namba bilong en i bikpela (faivpela taim) moa long teilings. Dispela sedimen bai i halivim miksim wantaim teilings na karim ol i go insait long canyon.
- Aninit long canyon i gat planti ol giraun buruk o lenslaid i save kamap na dispela ol lenslaid bai i halivim karim ol sedimen na teilings i go daun olgeta na kamap long New Britain Trench.
- Ol teilings i no inap bagarapim kaikai bilong pis.
- Teilings o DSTP i no inap bagarapim or senisim ol kominiti na ol commercial fisheries.
- Ol stadi i tok olsem DSTP em i seif long solwara na envairomen wantaim.

## Q Bai mi go kisim moa infomesen long we?

WGJV i bin wokim wanpela Envairomen Impek Stadi (EIS) we i gat olgeta infomesen na wok painim aut risalts long envairomen, sosel na kalsa heritage, wantaim stadi long dip solwara we ol teilings bai go insait long Huon Gulf Canyon .

Yu ken kisim dispela EIS ripot wantaim ol arapala infomesen long website bilong WGJV long: [www.wafigolpujv.com](http://www.wafigolpujv.com)

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### Figure sources

Ol foto na ol namba i kam long Coffey Consultants na ol stadi Coffey i bin mekim.









Deep Sea Tailings Placement (DSTP) long Huon Gulf Sol Wara

## Ol askim na bekim bilong ol stadi bilong solwara na envairomen bilong en

August 2018

Please contact WGJV for further information as follows:  
Environmental Impact Statement – [ESQuestions@wafigolpujv.com](mailto:ESQuestions@wafigolpujv.com)  
General enquiries – [Communityquestions@wafigolpujv.com](mailto:Communityquestions@wafigolpujv.com)