Duqm Liquid Bulk Berths Project

Addendum to IEP for Onshore Disposal

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RESPONSIBILITIES
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APPENDICES

DEFINITIONS

Owner	Special Economic Zone Authority at Duqm
Contractor	Boskalis Duqm LLC
Project	Duqm Liquid Bulk Berths Project
Q-Aid	RBW Corporate SHE-Q Management System

ABBREVIATIONS

BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CEMP	Construction Environmental Management Plan
EIA	Environmental Impact Assessment
FEED	Front-End Engineering Design
HOP	Hand Over Package
HSSE-Q	Health, Safety, Security, Environment and Quality
IBA	Important Bird Area
IEP	Initial Environmental Permit
RBW	Royal Boskalis Westminster
SEZ	Special Economic Zone
SEZAD	Special Economic Zone Authority at Duqm
TSHD	Trailing Suction Hopper Dredge
WP	WorleyParsons

1 INTRODUCTION

1.1 PROJECT BACKGROUND

The Government of The Sultanate of Oman is in the process of developing Duqm town and the Port of Duqm, as a strategic dry dock, free trade zone, industrial and tourism destination.

The Special Economic Zone Authority at Al Duqm – SEZAD – was established to oversee the planning vision and strategic development of Duqm as a result of Royal Decree No. 119/2011, which was further re-defined through Royal Decree No. 44/2014 and No. 5/2016.

Oman is located on the east side of the Arabian Peninsula and surrounded by the Sea of Oman to the north, by the United Arab Emirates to the north-west, by the Kingdom of Saudi Arabia to the west, by Al Yemen to the south-west and by the Arabian Sea to the east. The existing Duqm town occupies an area of 10km^2 and is located at the eastern coast of Al Wusta region approximately 600km south of Muscat on the Arabian Sea coast. Refer to Figure 1-1.

The Port of Duqm is seen as a catalyst for the development of the Al Wusta region. The Port and Dry Dock are being developed to increase the trade; i.e. cargo trans-shipments, ship repair, manufacturing and tourism. The site enjoys proximity to the busy regional sea-lanes of Oman's coastal waters and is characterised by a friendly climate. The Duqm Master Plan is shown in Figure 1-2.

Duqm Refinery & Petrochemical Industries Company – Duqm Refinery – is a major new greenfield industry which will build a new oil refinery at Duqm, as phase 1 of an overall Refining and Petrochemical Complex. The refinery, which is currently being developed, will have a planned capacity of 230,000 BPD.

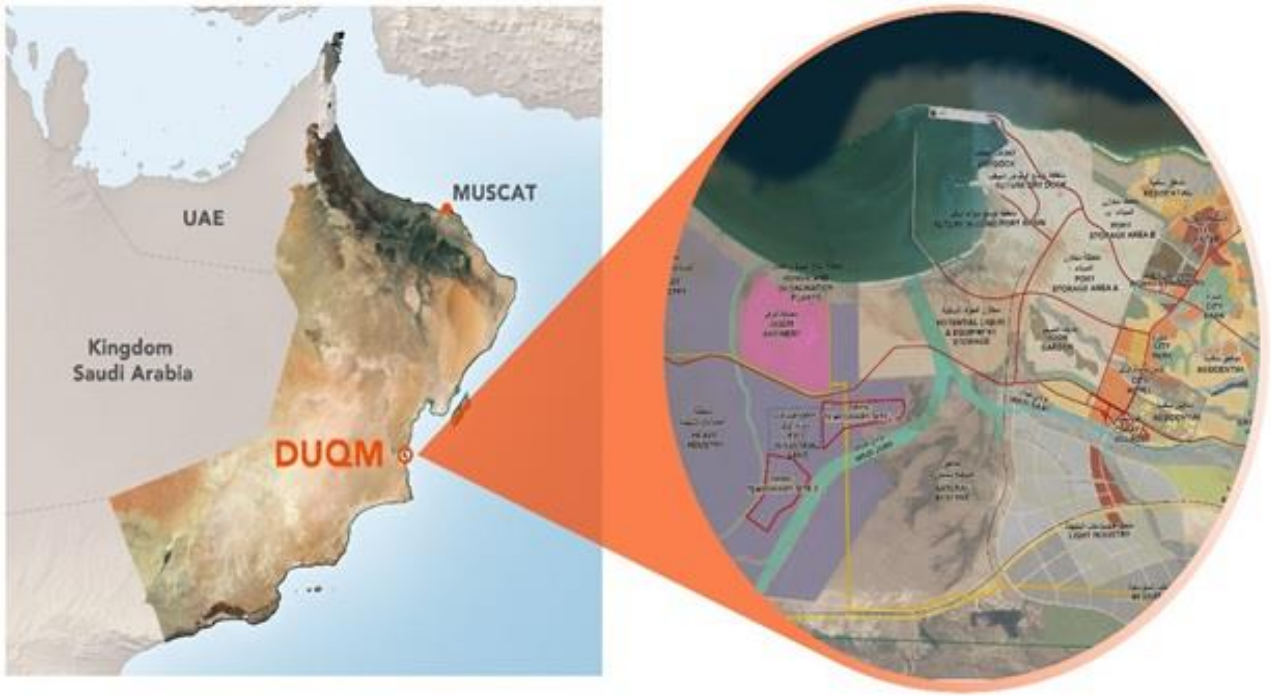

Figure 1-1: Location map and Master Plan detail

Figure 1-2 - Duqm Master Plan

The Duqm Liquid Bulk Berths Project involves the design and construction of marine structures and dry bulk and tank facilities for the export of finished petroleum products from the Duqm Refinery.

The finished liquid products to be handled at the terminal are Naphtha, Jet A1, Diesel Oil, High Sulphur Fuel Oil (HSFO), Pressurized Liquefied Petroleum Gas (PLPG); the finished dry bulk products are Pet Coke and Solid Sulphur Pellets.

Boskalis Duqm LLC was awarded with the EPC1 Contract comprising the design, dredging and marine infrastructure works for the Port.

1.2 SCOPE OF WORK

The Scope of Work for the EPC1 Design, Dredging and Marine Infrastructure Contract includes the Detailed Design, Procurement and Construction of the marine structures and associated berths, dredging works and permanent reclamation areas as summarized in

Table 1.1.

Figure 1-3 presents a schematic overview of the works.

Table 1.1: Summary of the Scope of Work

Contractor's Work Packages	Summary of the Scope of Work
Project Site	
Detailed Design and Engineering	Execution and interpretation of all necessary studies, site surveys and investigations
Dredging (Figure 1-3, A)	Design, procurement and construction of permanent dredging
Reclamation and Ground Improvement (Figure 1-3, B)	Design, procurement and construction of permanent reclamation and associated ground improvements
Continuous Quay Wall (Figure 1-3, E)	○ Design, procurement and construction of continuous Quay Berths at Berth 900, Berth 901 and Berth 902, including: ○ associated quay furniture; ○ oil spill response equipment; ○ various seawater intakes and outfalls.
Double Berth Island Jetty (Figure 1-3, D)	Design, procurement and construction of Double Berth Island Jetty structures at Berth 903, Berth 904, Berth 905 and Berth 906 including: ○ loading platforms; ○ access trestles; ○ dolphins; ○ associated quay furniture; ○ navigation aids.
Breakwater and Revetment (Figure 1-3, C)	• Design, procurement and construction of permanent modifications to the existing Lee Breakwater • Design, procurement and the construction of permanent revetments and scour protection
Temporary Contractor Facilities and Works	

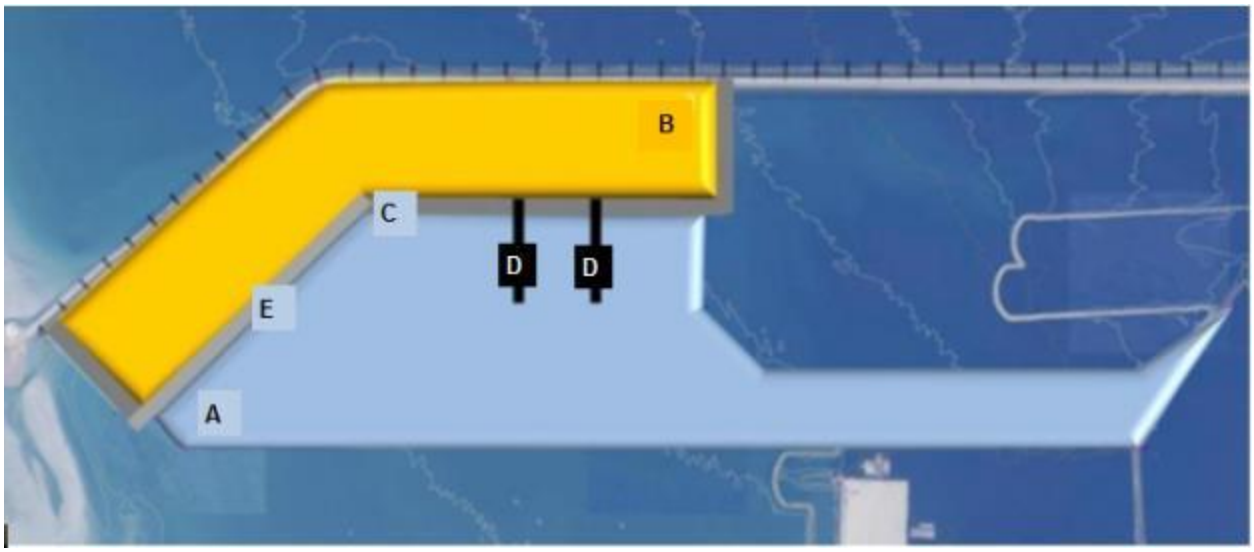

Figure 1-3: Schematization of the Works (A dredging, B reclamation, C revetment, D jetties and E quaywall)

1.3 DOCUMENT SCOPE

The following items will be addressed in this document:

- Work Method Onshore Disposal (Chapter 2);
- Quantities and type of excavated material which will be disposed onshore and the area where it will be disposed (Chapter 3);
- A high level impact assessment of onshore disposal of dry excavated material compared to offshore disposal (Chapter 4);
- Monitoring and mitigation measures for onshore disposal activities (Chapter 5).

1.4 REFERENCE DOCUMENTS

1.4.1 Contract/Owner's Documents

[A.1] SEZAD-DPTC-00-WP-EV-REP-3001-B2 Environmental Impact Assessment, WorleyParsons Oman Engineering LLC (22 September 2015)
[A.2] SEZAD-DPTC-00-WP-EV-REP-2004-B3 Marine Environmental Baseline Survey, WorleyParsons Oman Engineering LLC (December 2015)
[A.3] DUQM/2016/0000231 DLBB EIA Study Approval with Permit Conditions (28 January 2016)
[A.4] DUQM/2016/0000330 DLBB Permit Clarification EIA Study Approval (11 February 2016)
[A.5] 1161631 DLBB Initial Environmental Permit

1.4.2 Contractor's Documents

[B.1] SEZAD-IP7-00-BO-EV-PLN-4001-00 Construction Environmental Management Plan
[B.2] SEZAD-IP7-00-BO-HS-PLN-4002-00 HSSE Plan
[B.3] SEZAD-IP7-00-BO-HS-PLN-4001-00 Emergency Response Plan
[B.4] SEZAD-IP7-11-BO-EM-CMM-4001-00 Method Statement Dredging and Reclamation
[B.5] SEZAD-IP7-11-BO-EM-CMM-4002-00 Method Statement Excavation and Dewatering
[B.6] SEZAD-IP7-11-BO-EM-CMM-4003-00 Method Statement Ground Improvement
[B.7] SEZAD-IP7-00-BO-HS-PLN-4009-00 Traffic Management Plan
[B.8] SEZAD-IP7-00-BO-HS-PLN-4006-00 Waste Management Plan
[B.9] SEZAD-IP7-00-BO-HS-PLN-4003-00 Spill Contingency Plan

1.4.3 Standards, Codes of Practice and Scientific Publications

[C.1] ANZECC, 2000. *Australian and New Zealand Recommended Sediment Quality Guidelines, Australian and New Zealand Environment Conservation Council*

2 WORK METHOD ONSHORE DISPOSAL

This Chapter provides a description of the work method for the onshore disposal of dry excavated materials for the Duqm Liquid Bulk Berths Project – EPC1. For a detailed description of the work method for dry excavation and dewatering reference is made to [B.5]. More detail on the work method for the dredging, reclamation and ground improvement works for the Project reference is made to [B.3] and [B.6]. This section briefly describes the source of the material that will be disposed of onshore, as well as the onshore disposal method.

2.1 DESCRIPTION OF THE SOURCE OF MATERIAL FOR ONSHORE DISPOSAL

The material that will be disposed onshore will be excavated in the dry from the areas where the quay wall and the jetty islands will be constructed. This is the area between the yellow (permanent) and red (temporary) bunds shown in Figure 2-1 below. These bunds will be constructed by means of hydraulically placed sand by Trailing Suction Hopper Dredger. For further details on the bund construction method, please refer to the Work Method Statement Dredging, Reclamation and Ground Improvement (ref [B.3]). The purpose of the dry excavation is to create a construction pit that will allow for the construction of the quay wall and jetty islands in the dry. This work method has several advantages to building these structures in the wet, including:

- faster construction schedule;
- beneficial re-use of the excavated material onshore for the creation of land in the future Port development area, instead of disposing this material offshore;
- no underwater noise from marine piling, as the piling for the jetty islands will take place in the dry.

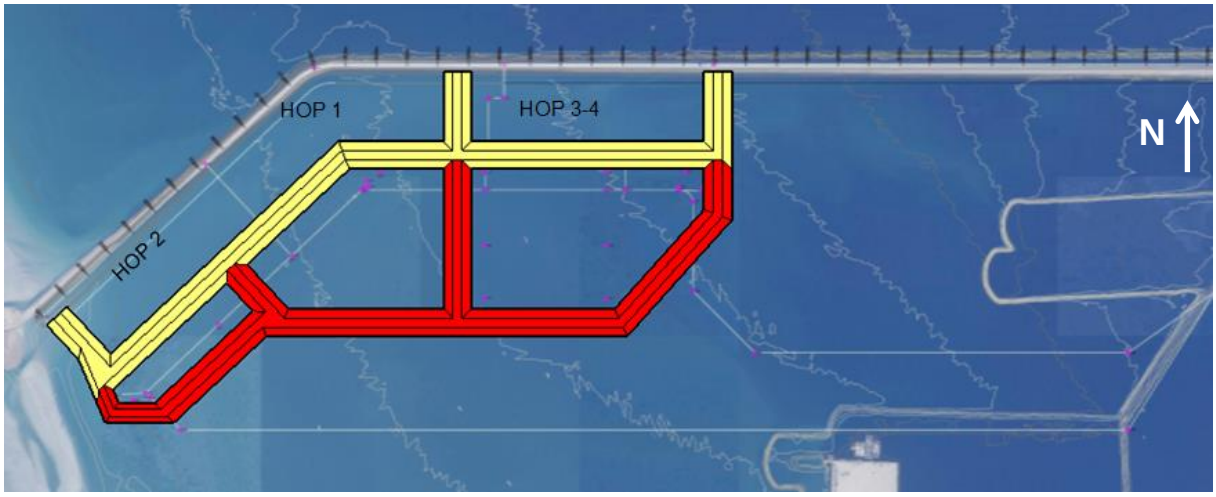

Figure 2-1: Preliminary design for the construction of permanent reclamation bunds (yellow) and temporary bunds (red) [B.3]

Figure 2-2: Example of bund construction by pumping dredged material from TSHD ashore [B.3]

Figure 2-3: Example of bund construction by dump trucks [B.3]

As soon as the area within the (temporary) bunds has been made dry by means of a well point dewatering system, the material located on the seabed, consisting of silty sand and mudstone, will be excavated by means of hydraulic excavators and bulldozers equipped with rippers. The bulldozers with rippers are mainly useful during excavation of the mudstone layer. Utilization depends on the hardness of the soil.

2.2 DESCRIPTION OF DISPOSAL METHOD

The excavated soil will be transported by means of dumper trucks (example shown in Figure 2-4) and tipper trucks from the excavation area to the designated onshore disposal location as indicated in section 3.2. The placed material will be levelled by means of Bulldozers.

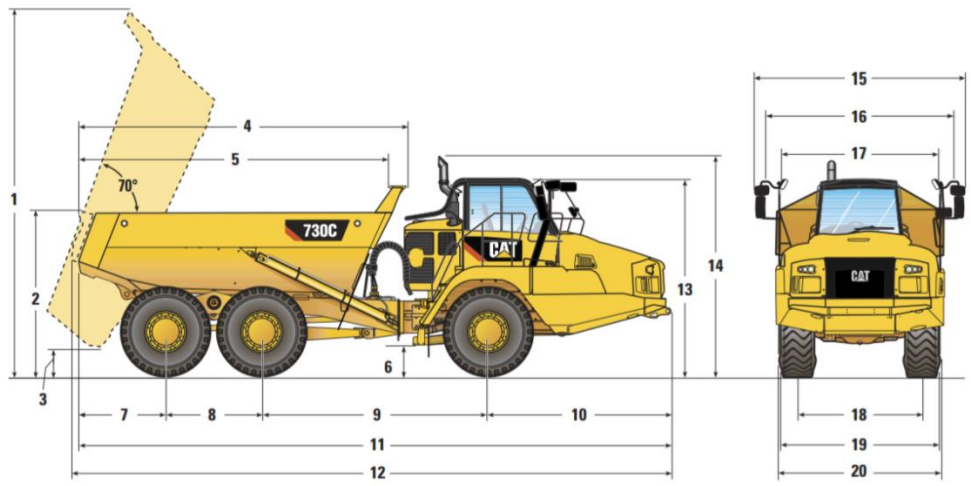

Figure 2-4: Example of dumper truck used (CAT 730C). Other types of trucks will be used as well [B.5]

Figure 2-5: Example of a bulldozer leveling a disposal area

3 DESCRIPTION OF MATERIAL AND AREAS INVOLVED

3.1 VOLUME OF DRY EXCAVATED MATERIAL

The estimated amount of excavated material is indicated in Table 3.1. This is based on the current excavation and slope design of the bunds and the dewatering strategy and may change. Of this material, roughly 1.9Mm3 is expected to be suitable for reuse in the reclamation. The total amount of volume which will be used for permanent onshore disposal is estimated to be at a minimum 3,900,000m^3, with potentially an upward volume of 6 million m^3. As indicated in Table 3.1 the current estimated upward volume is 5.5 million m^3, subject to finalisation of design. The disposal of quantities above 3.9 million m^3 may be considered in future, after discussion with Owner.

Areas have been subdivided into excavation necessary for “HOP 1”, “HOP 2” and the installation of jetties (“Jetty Area”) and revetment as indicated in Figure 3-1.

Onshore disposal activities are scheduled to start late June, early July 2017, and continue until July 2018.

Table 3.1: Estimated dry excavated volumes included in the contract, and potential additional volumes based on current design of the bund construction and slope design of the excavation [B.2]. Volumes subject to changes in bund and slope design.

HOP	EXCAVATION VOLUMES CONTRACT	CURRENT POTENTIAL ADDITIONAL EXCAVATION VOLUMES	EXCAVATION TOTAL	UNIT
1	485,000	140,000	625,000	[m^3]
2	640,000	295,000	935,000	[m^3]
Jetty Area	2,825,000	1,125,000	3,950,000	[m^3]
Total	**3,950,000**	**1,560,000**	**5,510,000**	**[m^3]**

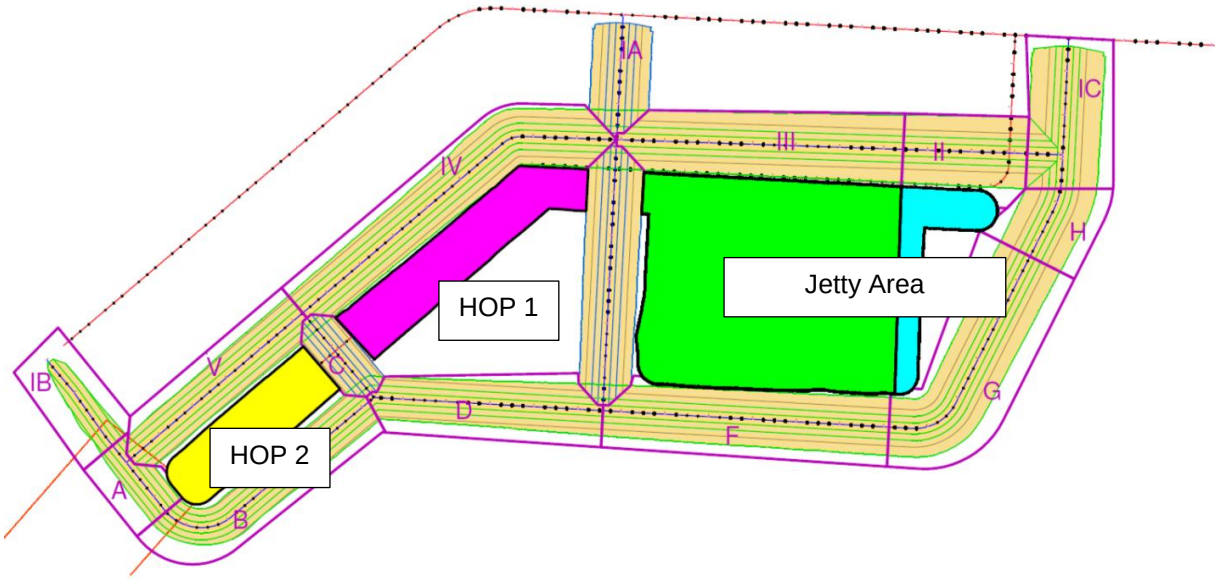

Figure 3-1: Preliminary bund layout and excavated areas

3.2 DESIGNATED AREA FOR ONSHORE DISPOSAL

The dry excavated soil will be disposed onshore for beneficial reuse in the future port development area of Port of Duqm, instead of being disposed at sea. The dry excavated material will be transported near the base of the Lee Breakwater and the Spare area of the Port Future Basin. Port of Duqm identified several areas for the placement of fill material, indicated in green and orange in Figure 3-2. As part of the EPC 1 contract, Contractor is focussing on placing the material in the area indicated in Figure 3-3, as Contractor's laydown area and offices will be located in this area, with potential additional filling works being done in the green area west of Road no. 5 and the wadi diversion. Permission was received from Port of Duqm to use the area indicated in Figure 3-3 for disposal of dry excavated material.

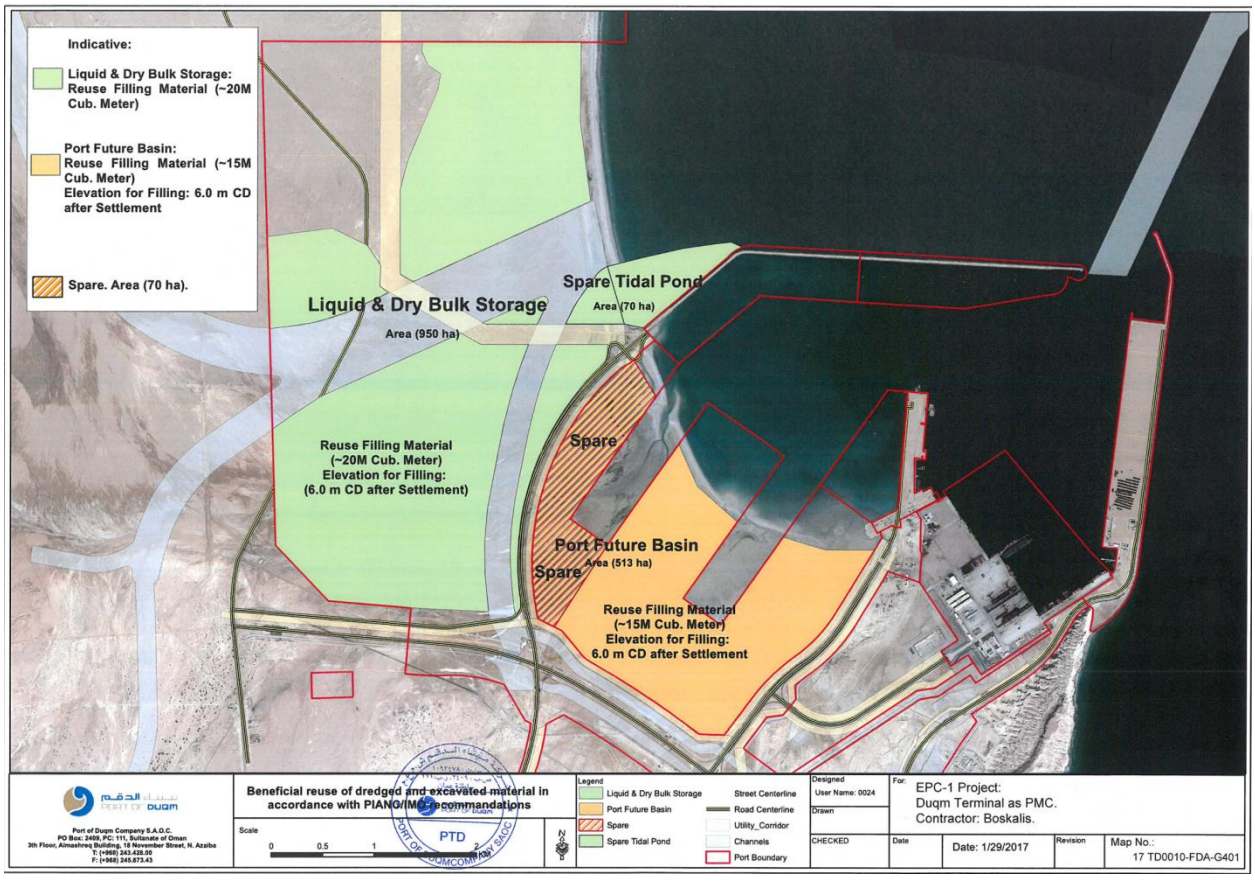

Figure 3-2: Areas identified by Port of Duqm for placement of filling material (revision of 29/01/2017).

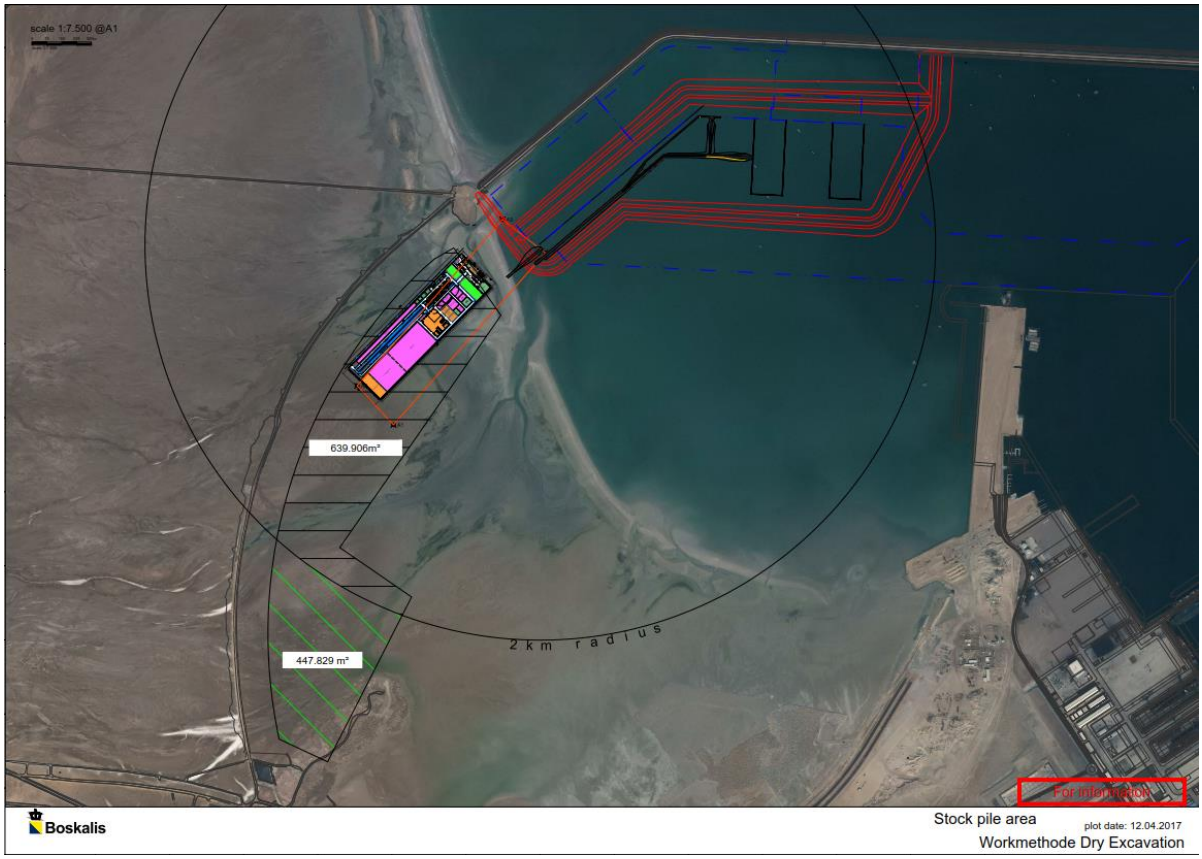

Figure 3-3: Area designated for disposal of dry excavated material (black hatched area, green hatched area to be discussed)

3.3 QUALITY OF EXCAVATED MATERIAL

3.3.1 Geotechnical quality

Excavated material consists of silty sand, weathered stone consisting of mudstone and calcarenite. Material which will be disposed will therefore consist in large part of lumps and crushed stones. Detailed geotechnical information on the material to be excavated is limited to date. Soil tests are therefore being executed by Contractor at the time of writing this Addendum.

3.3.2 Sediment quality (chemical analysis)

As part of the EIA sediment samples have been taken in the port area which have been analysed for:

- Metals and Metalloids;
- BTEX;
- Petroleum Hydrocarbons (VPH C5 - C10 and EPH C10 – C40);
- Organics; and
- Organometallics.

The results were compared with internationally recognized standard [C.1], as no quality standard for sediment currently exists in Oman.

Samples were taken inside the port in June 2015. The results were all below detection limits and/or

adopted guideline values at all samples. For results of the analysis see [A.2].

4 IMPACT ASSESSMENT

This chapter presents a high level impact assessment for the onshore disposal of dry excavated material in comparison to offshore disposal. The assessment is based on a desk study using the studies carried out for the EIA (ref [A.1]).

4.1 IMPACT ASSESSMENT METHODOLOGY

A similar method as adopted in the EIA for assessments of impacts has been adopted for this assessment, see also EIA [A.1] section 7.2. Impacts are assessed based on planned and unplanned impacts. Where, planned environmental impacts result from routine operation and maintenance, while unplanned result from accidents or non-routine operation and maintenance.

4.1.1 Planned impacts

The impact significance of planned impacts is evaluated according to:

Significance = Severity of Impact x Consequence

Impacts will be rated 'Low', 'Medium' or 'High' significance based on the area of influence, spread and duration of the impacts, according to (and illustrated in Figure 4-1):

- Area of influence (spatial/ geographical extent):
  - **Local spread**: when an impact is restricted to immediate surroundings i.e. within the DLBB Project boundaries;
  - **Moderate spread**: when the impact from the Project extends from the DLBB Project to about 10 km from the Project site;
  - **Regional spread**: extends beyond a distance of 10 km from the Project site.
- Duration:
  - **Short term**: impacting for a duration of a few days to few weeks;
  - **Medium term**: impacting for few months to a year;
  - **Long term**: extends beyond a year.
- Intensity:
  - **Low**:
    - Within statutory or prescribed criterion;
    - No damaging toxic effects recorded only irritable and behavioural avoidance related effects by animals.
    - Damage sufficient to produce a noticeable but short-lived effect on the environment or community: no permanent effects to the environment or the ecosystem services and resources it supplies;
    - Change in ecosystem services, habitats and species which can be seen and measured but at a same scale as natural variability.
  - **Moderate**:
    - Exceedance of statutory or prescribed limit and/or with possible toxicity effects

over short term: causing localized nuisance both on and off site.

- Noticeable effects on the environment are recorded and reversible over the following medium duration: moderate degradation of ecosystem services, resources and habitats restricting potential for usage.
- Moderate decline in profit in local businesses and livelihoods as a result of the impact.

- **High**:
  - Constant, high exceedance of statutory or prescribed environmental quality limits, and/or of a toxicity level representing a very severe and widespread threat to human health and the environment chronically and/or acutely and in terms of commercial impact and reputation, a major economic loss for the company due to the persistence and bioaccumulation of the pollutants causing the environmental impact.
  - Such intensity is likely to cause an irreversible environmental effect, direct loss of ecosystem services, resources and protected habitats and species mortality.
  - Business livelihoods of communities will be lost.

- Type of impact:
  - Beneficial impact: would improve resource condition;
  - Adverse impacts: would deplete or negatively alter resources.

Duration	Area								
	Regional Spread			Moderate Spread			Local Spread		
Long	H	H	H	H	H	M	H	M	M
Medium	H	H	M	H	M	M	M	M	L
Short	H	M	M	M	M	L	M	L	SS
	High	Moderate	Low	High	Moderate	Low	High	Moderate	Low
	Intensity								

Figure 4-1: Impact assessment matrix - planned impacts [A.1]

4.1.2 Unplanned impacts

Unplanned impacts are assessed according to severity of impact and likelihood of the impact as illustrated in Figure 4-2.

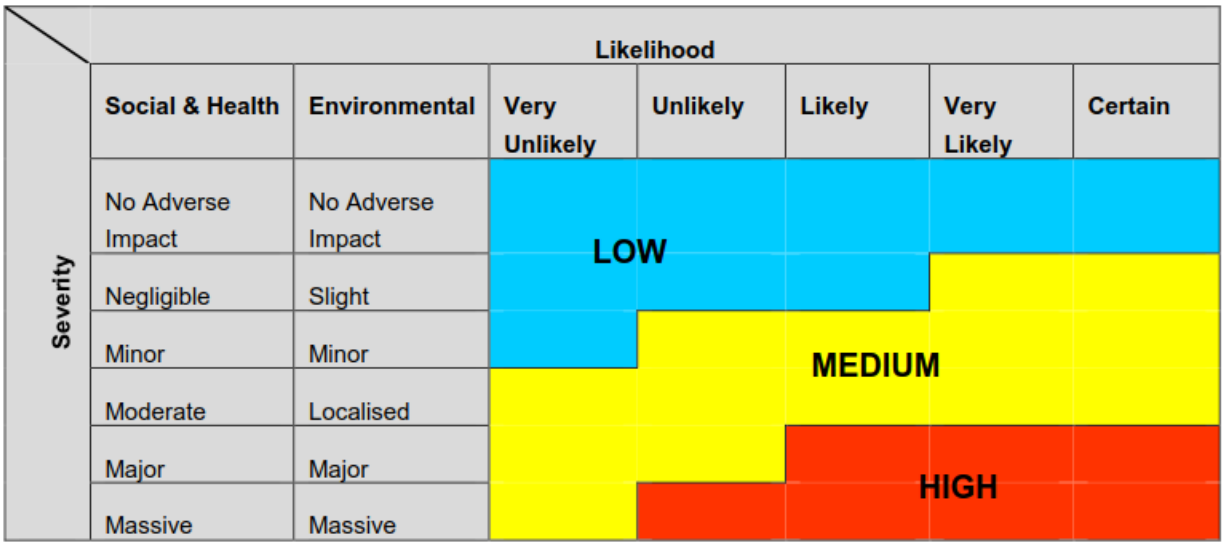

Figure 4-2: Impact assessment matrix – unplanned matrix [A.1]

Where likelihood is defined as:

- Very Unlikely: never heard of in the industry;
- Unlikely: heard of in the industry;
- Likely: may occur at the location;
- Very Likely: may occur several times a year at the location;
- Certain: will occur several time a year at the location.

4.2 IMPACTS

Impacts are evaluated for onshore and offshore disposal of excavated material in order to obtain a good comparison between the two work methods. For the impacts of offshore disposal the same impact assessment is taken into account as defined in the EIA (ref [A.1]).

4.2.1 Land Take and Soil Quality

The total land take associated with the reclamation activities of the Project was estimated in the EIA (ref [A.1]) as 86 ha.. Temporary land take for laydown or stockpiling for the construction activities of EPC1 was estimated to about 12 ha, resulting in a total land take of 100 ha.

The current estimated area required for the onshore disposal of dry excavated material in the Port Future Basin area is around 60-100 ha. An area of similar size may be filled on the western side of Road no. 5 and the wadi diversion in the Liquid & Dry Bulk Storage area. By beneficially reusing this material for the future expansion of Port of Duqm, less material is being disposed offshore. Therefore impact rate is ranked as *Medium* significance.

Table 4.1: Impact on soil quality due to land take for onshore and offshore disposal

DISPOSAL AREA	AREA OF INFLUENCE	DURATION	INTENSITY	SIGNIFICANCE
Offshore	Local Spread	Long term	Low	Medium Impact
Onshore	Local Spread	Long term	Moderate	Medium Impact

The mitigation measures to manage the impacts on soil quality due to land take are outlined in section 5.2.1.

4.2.2 Terrestrial ecology

The Project is located adjacent to an Important Bird Area (IBA). Land take, lighting and noise during construction phase could impact the bird habitat.

In comparison to the offshore disposal, the land take is larger and the impacts from lighting and noise can be larger. However, it should be born in mind that according to the EIA (ref [A.1]) the total area of the bird habitat is 1,000 ha and the permanent and temporary land take as a result of onshore disposal of dry excavated material represents about 10-20% of the total area.

Furthermore, it should be noted that the area where material is being disposed is demarcated by PDC and SEZAD for development as part of the Port of Duqm. Many infrastructure developments are already ongoing in the area. Temporary Road no. 5 (which will become permanent in the next few years) has been cutting the wadi off from the sea since early 2013, and filling of the Port Future Basin (see Figure 3-2) from the west has been going on just as long (see Figure 4-3 and Figure 4-4).

Figure 4-3: Google Earth satellite image dated 22 January 2013, showing construction of temporary Road n. 5 through the wadi area, and filling of the wadi area in the southwest of the Port Future Basin.

Figure 4-4: Google Earth satellite image dated 17 December 2015, showing filling of the wadi along temporary Road n. 5, and continued filling of the wadi in the southwest of the Port Future Basin

Figure 4-5: Aerial photograph of ongoing filling works in the wadi area, May 2017

The impact from onshore disposal for the EPC1 contract is defined as *High* significance, while for offshore disposal it was marked as *Medium* significance.

Table 4.2: Impact on terrestrial ecology from land take for onshore and offshore disposal

DISPOSAL AREA	AREA OF INFLUENCE	DURATION	INTENSITY	SIGNIFICANCE
Offshore	Local Spread	Long term	Moderate	Medium Impact
Onshore	Local Spread	Long term	High	High Impact

Lights and noise from the Project construction would disturb the birds and animals around the project site. Compared to offshore disposal, additional noise and light impact is expected from additional earth-work movements. However the disturbance due to noise and light is temporary, only during the course of the disposal activities. Therefore intensity is rated as Moderate, resulting in *Medium* Significance impact.

Mitigation measures to manage the impacts to terrestrial ecology are outlined in section 5.2.2.

Table 4.3: Impact to terrestrial ecology from light and noise for onshore and offshore disposal

DISPOSAL AREA	AREA OF INFLUENCE	DURATION	INTENSITY	SIGNIFICANCE
Offshore	Local Spread	Medium term	Moderate	Medium Impact
Onshore	Local Spread	Medium term	Moderate	Medium Impact

4.2.3 Air quality

Air emissions during construction are related to operation of tug boats, dredging vessels, earthmoving equipment, vehicles, etc and fuel storage. Compared to offshore disposal activities, the onshore disposal will result in more earthmoving equipment, resulting in higher dust generation. Therefore the impact to terrestrial ecology from dust is defined as *Medium* significance.

Table 4.4: Impact dust for onshore and offshore disposal

DISPOSAL AREA	AREA OF INFLUENCE	DURATION	INTENSITY	SIGNIFICANCE
Offshore	Local Spread	Short term	Low	Low Impact
Onshore	Local Spread	Medium term	Moderate	Medium Impact

Onshore disposal results in more emissions from land-based equipment, however this is minimal with respect to emission from vessels and has a *Local* instead of *Moderate* spread. Therefore the impact for onshore disposal in comparison to offshore disposal is rated similar with *Medium* significance.

Table 4.5: Impact from gaseous emissions for onshore and offshore disposal

DISPOSAL AREA	AREA OF INFLUENCE	DURATION	INTENSITY	SIGNIFICANCE
Offshore	Moderate Spread	Medium term	Low	Medium Impact

Onshore	Local Spread	Medium term	Low	Medium Impact

Monitoring and mitigation measures to manage the air quality emissions are outlined in section 5.1, 5.2.2 and 5.2.3.2.

4.2.4 Noise impact

As the jetty islands will be constructed in the dry, no marine piling will be conducted, hence no underwater sound will be generated from marine piling activities which may harm marine mammals. However, due to additional earthmoving equipment ambient noise impact will be slightly higher compared to offshore disposal.

The nearest village is located approximately 5.5 km away, therefore impact from noise to residences is expected to be minor.

Table 4.6: Impact from noise for onshore and offshore disposal

DISPOSAL AREA	AREA OF INFLUENCE	DURATION	INTENSITY	SIGNIFICANCE
Offshore	Local Spread	Medium term	Low	Low Impact
Onshore	Local Spread	Medium term	Low	Low Impact

Monitoring and mitigation measures to manage the impact from noise are outlined in section 5.1.2 and 5.2.4.

4.2.5 Waste

Waste is managed according to Contractor's SHE-Q system and in detail described in Contractor's Waste Management Plan [B.8]. Both for onshore and offshore activities the impact is therefore ranked as *Low*.

Table 4.7: Impact from waste for onshore and offshore disposal

DISPOSAL AREA	AREA OF INFLUENCE	DURATION	INTENSITY	SIGNIFICANCE
Offshore	Local Spread	Medium term	Low	Low Impact
Onshore	Local Spread	Medium term	Low	Low Impact

4.2.6 Marine Ecology

Onshore disposal results in less impact to marine ecology compared to offshore disposal as material is not disposed in the marine environment. Therefore resulting in less fines released in the marine environment which may impact marine ecology by reduced light penetration and/or burial. The impacts on marine ecology from the dewatering required for the dry excavation is low, as described in section [B.5]. The resulting impact from onshore disposal on marine ecology is ranked as *Low*.

Table 4.8: Impact to Marine Ecology from onshore and offshore disposal

DISPOSAL AREA	AREA OF INFLUENCE	DURATION	INTENSITY	SIGNIFICANCE

Offshore	Moderate Spread	Medium term	High	Medium Impact
Onshore	Local Spread	Medium term	Low	Low Impact

4.2.7 Socio-economical

By disposing the excavated material onshore this allows for re-use of the material for future construction activities within the SEZAD development. When disposing the material offshore, good quality material is lost. By reusing this dry excavated material, costs for PDC/SEZAD will be reduced, as additional material will not have to be sourced from elsewhere (possibly offshore) at a later stage. Therefore intensity for onshore disposal is ranked as *Low* and socio-economically beneficial.

Table 4.9: Impacts to socio-economy for onshore and offshore disposal

DISPOSAL AREA	AREA OF INFLUENCE	DURATION	INTENSITY	SIGNIFICANCE
Offshore	Moderate Spread	Medium term	Moderate	Medium Impact
Onshore	Moderate Spread	Medium term	Low	Low Impact

4.2.8 Chemical/fuel spills

Spill from chemicals or fuel are accidental events. Contractor has implemented spill prevention and maintenance procedures to prevent any leakages. Should a spill however occur, Contractor has implemented emergency response procedures as described in Contractor's HSSE plan [B.2].

Table 4.10: Impact from chemical/fuel spills (for the whole project) for onshore and offshore disposal

DISPOSAL AREA	LIKELIHOOD	SEVERITY	SIGNIFICANCE
Offshore	Unlikely	Major	Medium Impact
Onshore	Unlikely	Major	Medium Impact

4.3 CONCLUSION

Impact from onshore disposal has mostly similar effect on environmental aspects in comparison to offshore disposal. Slightly higher impact is expected for terrestrial ecology as more land is taken. However it should be noted that the area where the material will be disposed is dedicated for future development of the Port of Duqm. In fact, many infrastructure projects have already been underway in the wadi area since 2013, already resulting in the loss of this bird habitat.

Also, more dust will be generated, however this impact will be only during the course of the construction phase and can be managed by implementing dust suppression measures as described in section 5.2.3.1. Benefits of the onshore disposal are:

- less impact to marine ecology;
- beneficial re-use of excavated material for future construction works within the SEZAD development, resulting in less material having to be sourced at a later stage of the port development; and
- no marine piling will be conducted, as due to dry excavation of the reclamation area the double berth jetty islands will be constructed in the dry, resulting in less underwater noise and therefore less impact to marine mammals.

5 CONTROL & MITIGATION MEASURES

5.1 MONITORING

As per Contractor's Construction Environmental Management Plan (CEMP) [B.1] air quality and noise monitoring will be carried out as described in below sections.

5.1.1 Air quality

Air quality measurements will be carried out on a quarterly bases for:

- Dust;
- Diffusion tubes for NO_X, SO_2, VOC, O_3.

These measurements are compared to baseline monitoring data, conducted in the EIA, to indicate trends as agreed with Owner and Engineer during environmental meeting held 26th of March 2017. Measurements will be carried out at the project fence line at similar locations as the EIA baseline study, see also [B.1].

Measurements will be carried out by a local MECA/SEZAD approved Environmental Consultant.

In addition, visual observations of dust will be made during daily site inspections. If increased dust generation is observed, mitigating measures will be implemented to reduce dust generation and improve traffic safety. These observations are part of the routine site inspections and will not be recorded or reported separately.

5.1.2 Noise

Noise measurements will be carried out along the project fence line on a monthly frequency or when high noise activity is undertaken. MD 79/94 states a limit of 70 dB (A) holds for industrial, plants and public works areas which should be complied with.

Noise measurements will be carried out by a local MECA/SEZAD approved Environmental Consultant, similar as air quality measurements.

Measured noise levels will be: equivalent continuous ($L_{A\text{-}eq}$), maximum and minimum sound levels ($L_{A\text{-}max}$ and $L_{A\text{-}min}$). Environmental conditions (e.g. wind) and construction activities not related to Contractor's work at time of measurements will be noted.

5.2 MITIGATION MEASURES

Mitigation measures to reduce the environmental impacts as described in section 4.2 are described in the following sections. For further detail on management of environmental impacts by other activities conducted by Contractor reference is made to Contractor's Construction Environmental Management Plan (CEMP) [B.1].

5.2.1 Land use and soil quality

Mitigation measures to be followed during construction works are described below:

- All materials that can contaminate soil will be stored in container or paved surface.
- High priority on equipment and training to be given in order to reduce the chance of accidental releases. Also training in spill response measures to be provided to relevant staff.
- Equipment inspection and maintenance program shall be implemented.
- Spills response plan and emergency response plan to be developed and implemented as part of

Project HSSE Plan during construction and operation to minimise discharges into surface water and groundwater and where accidental spills occur, they are immediately identified and contained.

- The waste water from the site facilities will be regularly collected and disposed in a suitable way by sewage truck to local STP for treatment.
- Drip trays or suitable bunds shall be utilized by Contractor and its Sub-Contractor in conjunction with items of fixed and portable (mobile) plant, such as generators, to prevent contamination of surface soils and run-off. The drip trays shall be positioned away from any watercourse or drains and surrounded by an earth or sand bund with an impervious base of plastic sheet, and inspected daily and emptied as required. Any spillage shall be cleaned up and contaminated soil removed from site for proper disposal.

5.2.2 Terrestrial ecology

Mitigation measures to manage the impact to terrestrial ecology include:

- All reasonably practical measures to minimise injury and disturbance to wildlife caused by any work, light, noise, vibration, dust, other air pollution, and pollution incidents to be undertaken and all other management plans to be followed as these provide measures which will also protect wildlife.
- Other measures of particular note include pollution prevention and spillage control, where use of designated refuelling areas, use of drip trays, and availability of spill kits close to works are key, and sediment/ erosion control and stockpile management.
- Deep excavations to be covered or fenced to prevent fauna from falling in and being unable to escape.
- Artificial lighting will be kept to a minimum. The major lighting sources shall be pointed inward and downwards where practicable to reduce light spill
- Erect fences along the boundary of the works area before the commencement of works to prevent vehicle movements, and encroachment of personnel, onto adjacent areas
- Regularly check the work site boundaries to ensure that they are not breached and that damage does not occur to surrounding areas.
- Hunting or trapping of birds or animals by DLBB EPC1 Project personnel is Prohibited.

5.2.3 Ambient air

5.2.3.1 Dust control

There is a potential for dust to arise during the earthworks material loading and hauling, vehicle movements over unpaved surfaces and excessive vehicle speeds. The use of effective dust mitigation techniques, including good site planning will minimize the potential for dust emissions and impact upon surrounding receptors.

Mitigation measures to reduce dust problems shall include the following:

- All access roads to the site shall be watered as required to minimise dust generation.
- The surrounding roads and sidewalks to be kept free from construction debris and cleaned on a regular basis.
- Dusty materials (aggregates, bulk earth from excavations) to be stored and handled in ways to minimise nuisance. Materials storage to be kept away from the site boundary and taking under consideration local wind patterns.
- The loading, unloading, handling, transfer or storage of other raw materials which may generate airborne dust emissions such as crushed rock, sand, stone aggregate, shall be carried out in

such a manner to prevent or minimize dust emissions. Measures such as water spraying and keeping drop heights to a minimum are to be adopted to minimise dust.

- Footprint of disturbance from construction operations at the working area to be kept to a minimum and movement of vehicles, mobile equipment and machinery to be restricted within the work areas.
- Haul roads to be paved and / or watered (i.e. sprayed) as much as possible. The frequency of watering to be determined by weather conditions.
- The speed of vehicles on haul road will be limited.
- The quantity of dusty materials stored onsite to be reduced or stored materials to be covered to minimise the amount of dust being blown.
- Uncovered stockpiles and the areas other than haul roads if they are a source of dust to be watered. Non-potable water sources to be used as an alternative to potable water use.
- Enclosed chutes and covered skips to be used, where practical, in order to minimise dust generation.
- Awareness training for drivers to only use designated roads and avoid off-road driving or driving on non-designated surfaces.
- Any soil arising's during the bulk excavations will be reused as much as possible for backfilling and surplus material to be removed and stored at suitable locations for possible future use or disposed onshore.
- Visual inspection to be conducted of dust-generating activities to be maintained on site to ensure that impacts from any dust plumes on neighbouring sites and receptors are acceptable.
- Dust monitoring to be conducted as required by the regulator.

5.2.3.2 Gaseous emissions

The following measures shall be adopted during the construction works as part of the implementation of the Gaseous Emissions Management:

- All construction vehicles and machinery to have up to date inspection certificates to demonstrate that they are in good working condition before they can be used on site. All maintenance records to be kept in accordance with the Manufacturers' requirements.
- Whenever excessive smoke is identified from any construction vehicle or machinery, it shall be serviced as soon as possible and taken out of use until the maintenance has been satisfactorily completed.
- All activities, related to engine idling (trucks, vehicles, machinery) to be limited as much as practical.
- Open burning of any material or waste stream is strictly prohibited on site or in unauthorised/licensed facilities.
- All equipment to be turned off when not in use.
- Driver training to be implemented to minimise fuel consumption and vehicle emissions.

5.2.4 Noise

Following are the proposed mitigation measures from the EIA the Contractor will minimize (exposure to) high noise activities by:

- Scheduling high noise activity for the day time as much as feasible;
- Shielding of equipment and use of enclosures to reduce noise;
- Regular maintenance of equipment to protect from noise;

- PPE shall be provided to workers in high noise areas as per MD 80/94.

As regulated by the MD 79/94 Noise Pollution, the maximum noise emission allowed in Industrial areas is 70 dBA.

In order to minimise and manage noise and vibration during main construction works the following shall be undertaken:

5.2.4.1 Scheduling

Where practical, noise generating activities will be scheduled to avoid impacts on noise sensitive receivers. The following are to be considered when planning the schedule of works:

- Construction activities (such as piling and material deposition) to be minimised on windy days, particularly when blowing in the direction of sensitive receptors;
- Avoid simultaneous use/operation of noisy equipment, if possible;
- Erect noise source screening structures (e.g. temporary perimeter fence, mounds, plywood) or purpose build structures where practical to shield the noise sensitive receivers.
- Monitoring measurements during works to be undertaken under the required survey conditions and using appropriate equipment in accordance with relevant guidance and legal requirements.

5.2.4.2 Equipment and plant lay-out

Positioning of land-based equipment away from noise sensitive areas will be considered. The following have to be considered when positioning and installation:

- Inherently quiet equipment to be selected / used, wherever possible.
- Equipment that is fit for the required tasks in terms of power requirements shall be used.
- Inspection and maintenance of machines/ plan and vehicles should be undertaken on a regular basis.
- All engines covers shall be kept closed while equipment is operating.
- Machines should be switched off when not in use rather than left idling for prolonged periods.

5.2.4.3 Construction Methods and Plant

- Careful selection of plant and construction methods. Working methods selected that produce the least amount of noise practicable.
- A register of plant and equipment and statutory certification to be completed.
- Avoid dropping of materials from height (e.g. during materials delivery).
- Noise-producing signals (e.g. horns, whistles, alarms and bells) should be for safety warning purposes only.

5.2.4.4 Location of Land-based Plant and Barriers

- Temporary noise barriers to be used to reduce noise levels where appropriate and practicable. Such measures can be particularly appropriate for stationary or near-stationary plant such as pile breakers, hydraulic vibrator, pile boring machine and compressors. Barriers to be located as close to the plant as possible and, in order to provide adequate attenuation. The screens may include soil mounds, site offices, site huts, acoustic sheds or partitions.
- Consider the use of at-source noise controls, as much as practicable, so that any noisy equipment is suitably enclosed with an acoustic barrier or other noise reducing method.

5.2.4.5 Sound and Vibration Reduction Measures

Vibration on site will be generally from pile drilling activities. In order to minimize this impact the following control measures will be considered and implemented as much as practicable:

- Compressors and generators to be “sound reduced” models fitted with properly lined and sealed acoustic covers which will be kept closed during operation.
- Acoustic covers to be fitted on all machine engines that generate excessive noise levels, generators and stationary plant including batch plants, and closed during operation.
- All pneumatic percussive tools to be fitted with mufflers or silencers of the type recommended by the manufacturers.
- If practicable low vibration plant to be used. Have anti-vibration mounts in place on plant.
- If elevated noise / vibration levels are encountered, the source of noise or vibration is to be identified and alternative methods or additional control measures are to be implemented.
- In the event of vibration becoming a concern, an assessment will be undertaken in accordance with local regulations and standards, if applicable.
- In some instances it may be possible to reduce transmitted vibration by cutting a structure to separate site work from sensitive premises. Clearly, it is important to take account of safety and structural issues before carrying out any work of this nature.
- All vehicles and plant used during the works will be maintained in good working order to ensure optimum performance. A record of maintenance shall be kept.
- If equipment or vehicles are seen to have an excessive amount of vibration, they will be given defect notices and taken out of service until repaired and approved for re-deployment by site supervisor representative.
- Plant and equipment that are idling or being used on an intermittent basis (such as a parked car) will be shut or throttled down when not in use to avoid vibrations.
- Minimize unnecessary operation of construction machinery (which cause vibrations), including efficiency of trip times and reduction of double handling through appropriate placement of stockpiles, haul roads, works depots and work areas.
- Proper and efficient use and operation of construction machinery and vehicles by qualified and skilled personnel (as per manufacturer’s instructions).

5.2.4.6 Traffic Management

Managing the traffic during construction will be considered to help reduce noise problems due to transporting or delivering of materials and equipment on site. The following control measures will be implemented (for a detailed description how logistics are managed reference is made to [B.7]):

- Traffic movement to be minimised outside the site.
- Awareness training to be provided to vehicle drivers.
- Speed limits at the site to be adhered to.
- Tyres and tyre pressure to be maintained to reduce friction between the wheel and surface.
- As far as reasonably practicable, noise from reversing alarms to be managed through the following hierarchy of techniques: site layout designed to limit and where reasonably practicable, avoid the need for the reversing of vehicles; use of banks men to avoid the use of reversing alarms. reversing alarms incorporating a feature for example self-adjusting output sounders; and reversing alarms set to the minimum output noise level required for health and safety compliance.
- Light and heavy vehicle movement will be separated as much as practical possible.

5.2.5 Chemical/fuel spill

In addition to the specifications detailed in other sections, the following measures are to be implemented by the Contractor:

- All chemicals and materials on site to be properly logged and stored in dedicated areas, including bunded areas detailed in this CEMP.
- All chemicals and hazardous materials used on site, to have a Material Safety Datasheet (MSDS) which can be inspected at any time.
- Materials with hazardous components, such as asbestos containing materials, lead based paints and PCBs are not to be used during the Construction Works.
- All accidents and spills to be carefully monitored and were these happen, immediate clean up and/or remediation shall be carried out and documented.

For further detail reference is made to Contractor's HSSE Plan [B.2], Waste Management Plan [B.8] and Spill Contingency Plan [B.9].

APPENDIX 1 – SEDIMENT QUALITY ANALYSIS RESULTS PORT BASIN FROM THE EIA BASELINE STUDY

PARAMETER	UNIT	GUIDELINE ISQG LOWER EXCEEDANCE VALUES	SS12	SS13
Aluminium	mg/kg		3390	4211
Arsenic	mg/kg	20	1.6	1.4
Cadmium	mg/kg	1.5	<1	1.4
Chromium	mg/kg	80	16.5	17.8
Copper	mg/kg	65	3.5	3.9
Lead	mg/kg	50	1.4	1.3
Mercury	mg/kg	0.15	<0.010	<0.010
Nickel	mg/kg	212	12.8	15.6
Zinc	mg/kg	200	8.4	7.3
Sulphate	(%)(g/L)		0.9	0.6
Benzene	mg/kg		<0.05	<0.05
Toluene	mg/kg		<0.05	<0.05
Ethyl Benzene	mg/kg		<0.05	<0.05
m&p-Xylene	mg/kg		<0.01	<0.01
o-Xylene	mg/kg		<0.05	<0.05
VPH C5 – C10	mg/kg		<0.05	<0.05
EPH C10 – C40	mg/kg		<50	<50
Total Organic Carbon	%		0.6	0.3
Acenaphthene	mg/kg	0.016	<0.5	<0.5
Acenaphthylene	mg/kg	0.044	<0.5	<0.5
Anthracene	mg/kg		<0.5	<0.5
Benz(a)anthracene	mg/kg		<0.5	<0.5
Benzo(b)pyrene	mg/kg		<0.26	<0.26
Benzo(b)Fluoranthene	mg/kg		<0.26	<0.26
Benzo(g.h.i.)perylene	mg/kg		<1	<1
Benzo(k)fluoranthene	mg/kg		<0.5	<0.5
Chrysene	mg/kg	0.384	<0.5	<0.5
Dibenz(a.h.)anthracene	mg/kg		<0.5	<0.5
Fluoranthene	mg/kg		<0.5	<0.5
Fluorene	mg/kg	0.019	<0.5	<0.5
Indeno(1.2.3cd)pyrene	mg/kg		<0.5	<0.5
Napthalene	mg/kg	0.16	<0.5	<0.5
Phenanthrene	mg/kg	0.24	<0.5	<0.5
Pyrene	mg/kg	0.665	<0.5	<0.5
Dibutyltin (DBT)	mg/kg		<0.04	<0.04
Monobutyltin (MBT)	mg/kg		<0.15	<0.15
Tributyltin (TBT)	mg/kg	0.0005	<0.04	<0.04
Tetrabutyltin	mg/kg		<0.04	<0.04