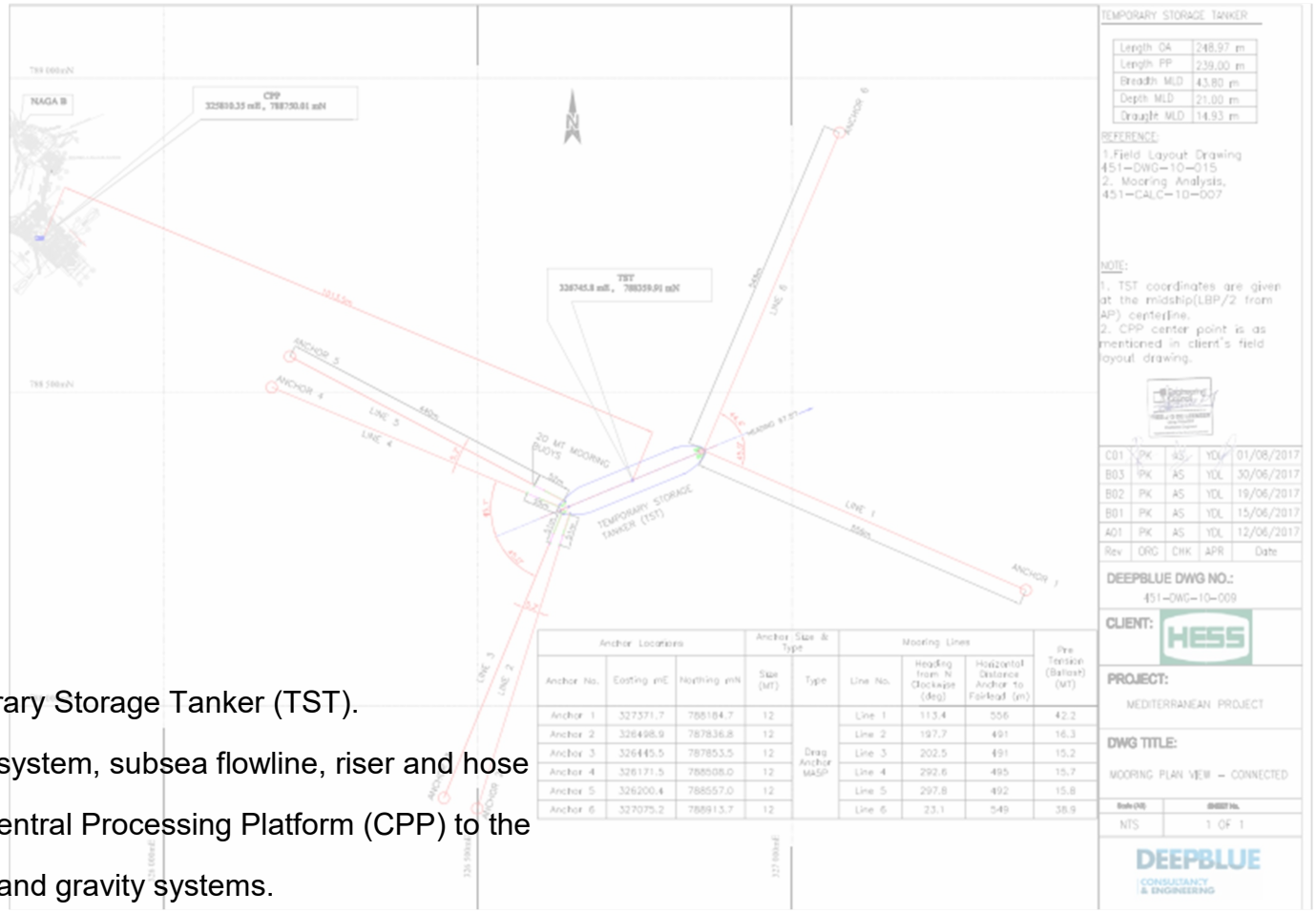
DEEPBLUE
CONSULTANCY & ENGINEERING

Temporary mooring & riser systems for Marginal and short life fields.

Client	HESS
Field	Bergading
Location	Malaysia
Waterdepth	56 m
Type	Disconnectable spread moored
Items	Mooring , flowline, risers, subsea bases.



Scope of Design

1. Complete EPIC contract of the Temporary Storage Tanker (TST).
2. Design of the disconnectable mooring system, subsea flowline, riser and hose system for condensate transfer from Central Processing Platform (CPP) to the TST. Design of subsea support bases and gravity systems.
3. Structural modifications to install 2 chain stoppers and 1 QRH on the TST.
4. Provision of all design, engineering, equipment and personnel for installation.
5. Preparation of operations manuals.

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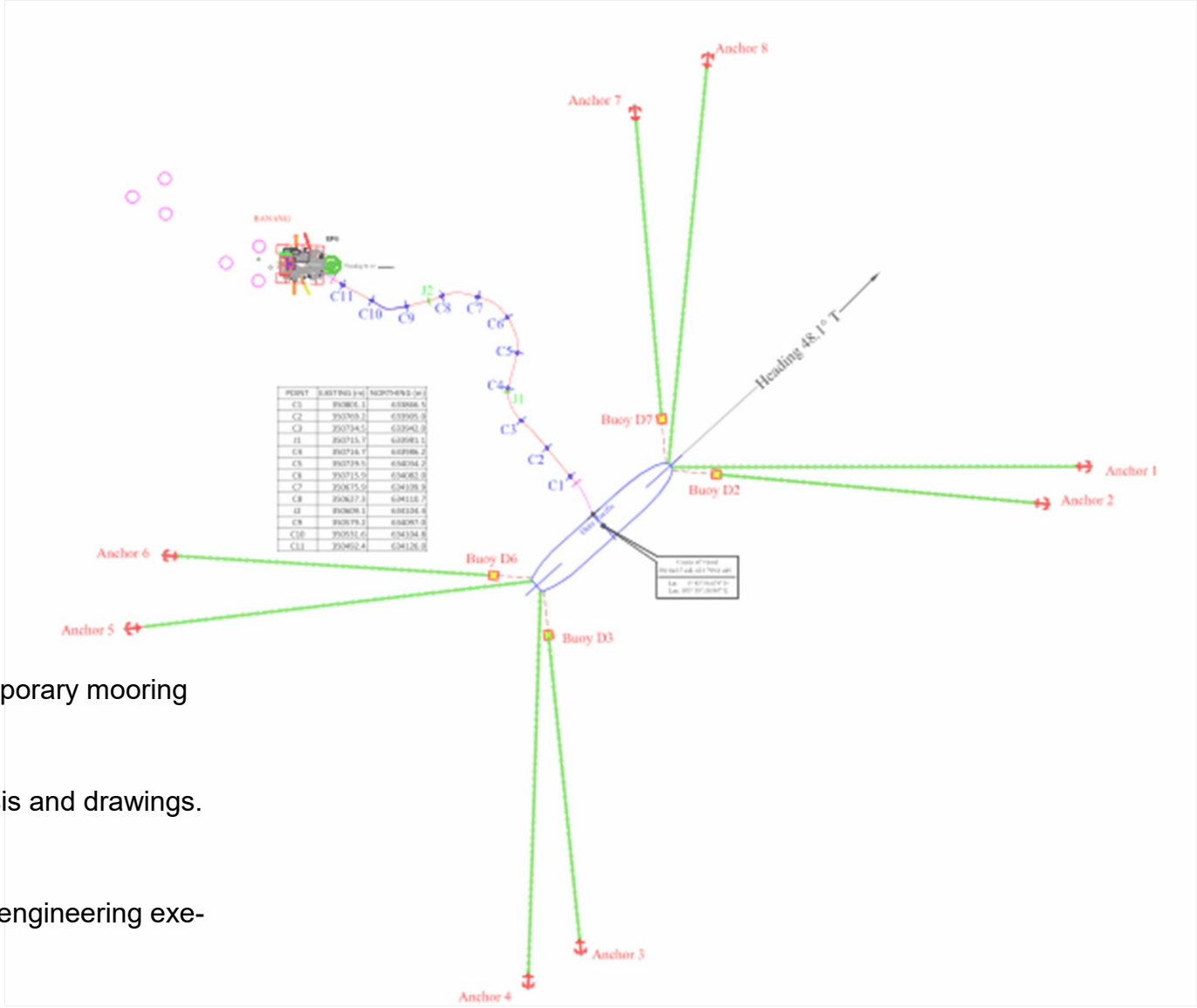
Temporary mooring & riser systems for Marginal and short life fields.

Client	Coastal Energy
Field	Banang
Location	Malaysia
Waterdepth	70 m
Type	Disconnectable spread moored
Items	Mooring and offshore installation



Scope of Design

1. Engineering & Detailed design of a temporary mooring system for the tanker.
2. Detailed installation procedures, analysis and drawings.
3. MWS approval
4. Offshore Installation management and engineering execution by DEEPBLUE personnel.

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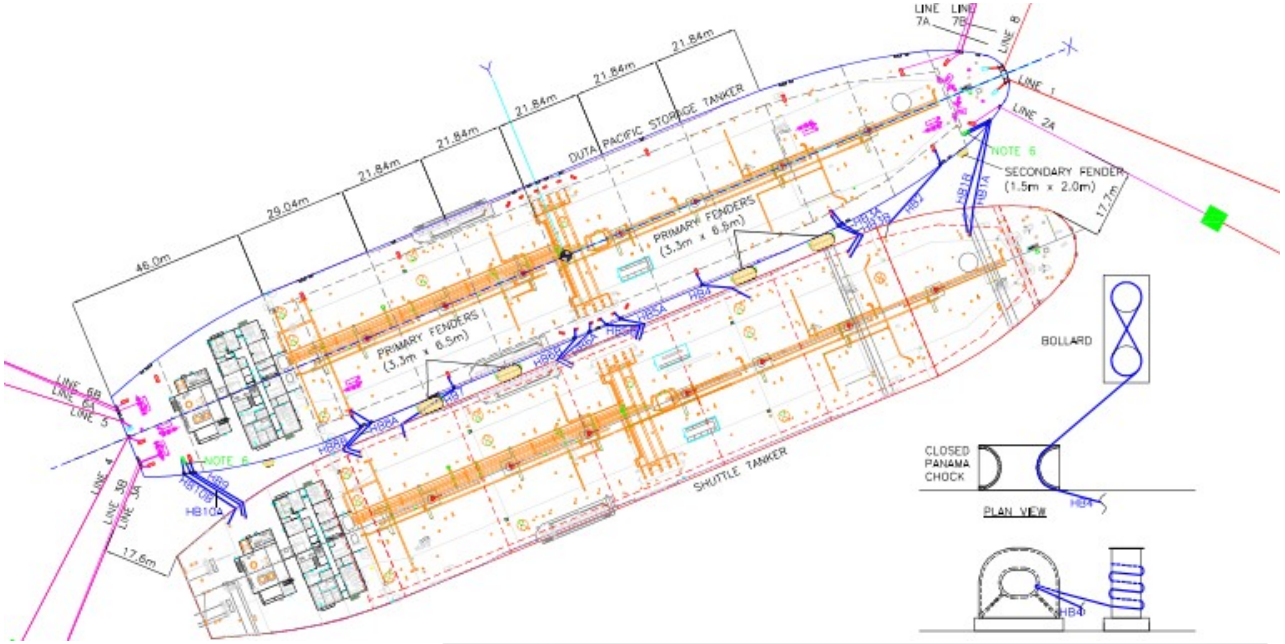
3 x Temporary mooring & riser systems for Marginal and short life fields.

Client	Coastal Energy
Field	Kapal Songkhla –B Songkhla-H
Location	Malaysia
Waterdepth	70 m
Type	Disconnectable spread moored
Items	Mooring and offshore installation



Scope of Design

1. Engineering & Detailed design of a temporary mooring system for the tanker.
2. Detailed installation procedures, analysis and drawings.
3. MWS approval
4. Offshore Installation management and engineering execution by DEEPBLUE personnel.

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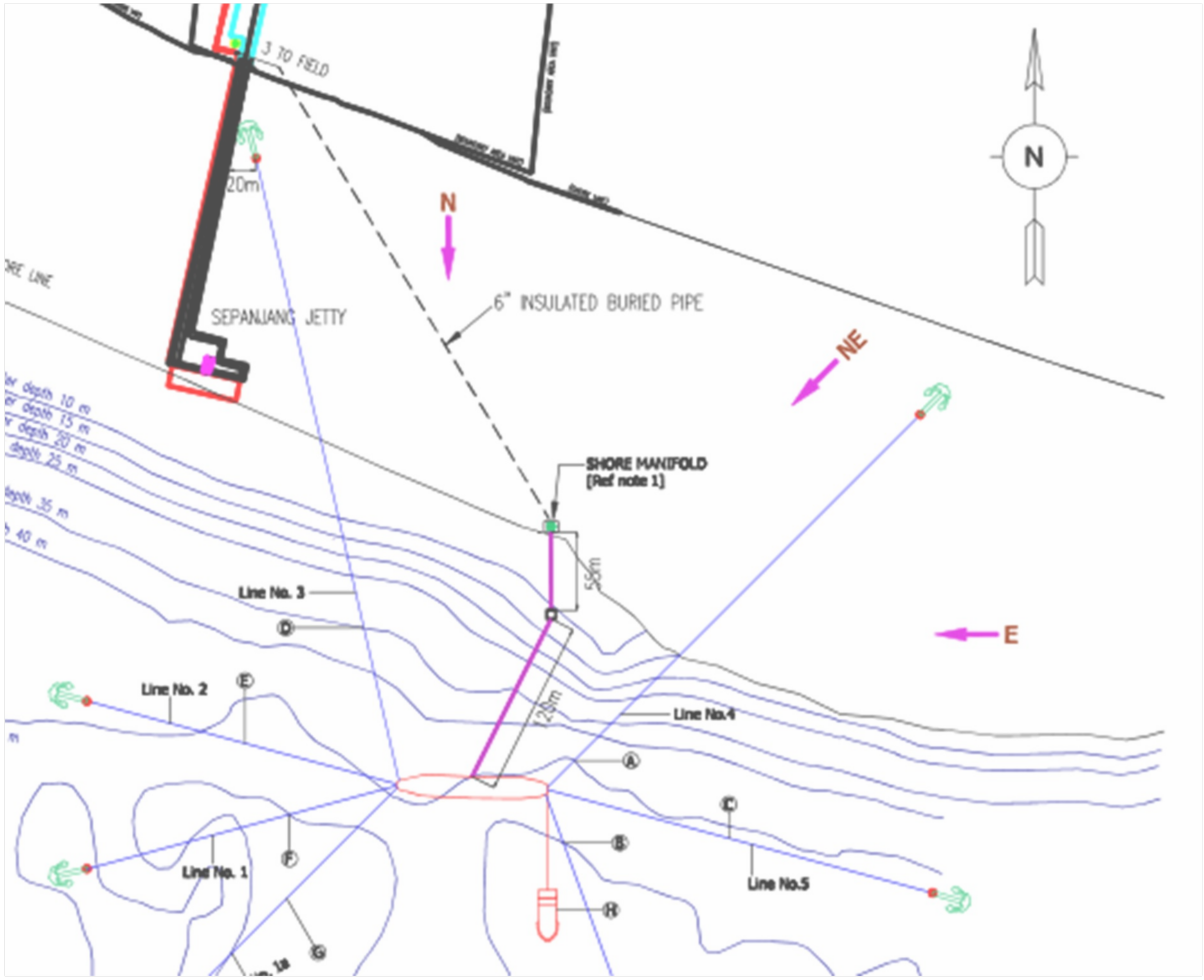
Temporary mooring & riser systems for Marginal and short life fields.

Client	KEI
Field	Sepanjang
Location	Indonesia
Waterdepth	45 m
Type	Disconnectable spread moored, 6” Riser
Items	Mooring, riser and off-shore installation



Scope of Design

1. Mooring, SURF, installation, naval architecture:
2. Design and engineer of mooring system and riser system for the FSO.
3. Offshore installation engineering and provision of support personnel for the offshore phase.

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C02	**9.2**	**14**	**Updated track record**
C03	**9.2**	**14**	**Updated track record**

DOCUMENT HOLDS			
REV	**SECTION**	**PAGE**	**CHANGE DESCRIPTION**
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ATTACHMENTS		
ITEM NO.	**DESCRIPTION**	**DOCUMENT NO.**
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1. INTRODUCTION

DEEPBLUE Pte. Ltd. (DB) was set-up in 2006 and provides Engineering and Design as well as offshore personnel support and provision of systems for the Offshore, Oil & Gas and Industry.

We have been asked by several clients to design and deliver a simple, easy to install mooring system.

DEEPBLUE proposes a simple system which can be used for the mooring of tankers in field; we have called it the **Versatile Mooring System** or **VMS**.

2. ABBREVIATIONS

AHT Anchor Handling Tug

CALC Calculation

DB DEEPBLUE Pte Ltd

DOC Document

DWG Drawing

ETA Emergency Towing Arrangement

RPT Report

TBC To be confirmed

VMS Versatile Mooring System

3. VERSATILE MOORING SYSTEM PRINCIPLE

The VERSATILE MOORING SYSTEM is composed of existing and proven technology; it is a simple way to moor a tanker for a certain period of time to allow oil & Gas production for midsize and marginal fields.

The design and the different components of the VERSATILE MOORING SYSTEM have been standardized in order to be the most effective from a cost and schedule point of view.

The VERSATILE MOORING SYSTEM uses as much as possible existing equipment and features available on the tanker, making it extremely simple to use, implement, operate and requiring minimal changes to the vessel.

The tanker is moored in a spread moored pattern, the mooring system is designed for a maximum environmental condition, typically between 1-5 years, as such the tanker must be able to be disconnected and reconnected to its mooring system rapidly.

The system uses the vessel existing ETA and additional ETA's to create a strong mooring point at the bow, using conventional chain and anchors.

The stern mooring lines are connected to DB's floating buoys which in turn are connected to standard chains and anchors.

The buoys are fitted with a Pelican Hook which van be activated mechanically from the stern of the tanker.

The Pelican hook is suitable to receive 2-3 Nylon lines which are connected to the vessel Bollards.

4. USE AND SUITABILITY

The VMS is called Versatile Mooring System because it allows the following;

1. Vessels of different sizes can be moored
2. Different environmental conditions can be applied depending on the size of the vessel.
3. An installed VMS can be interchanged with minimum or no changes to the system
4. The VERSATILE MOORING SYSTEM can be de-installed, relocated and reused on a different field or location.
5. Most equipment used is standard and available within a reasonable time period
6. For low CAPEX fields the complete system is cost effective or can be rented from DB on OPEX base.

DEEPBLUE Pte Ltd has successfully designed, engineered and installed the Versatile Mooring Systems for several vessels and projects in South East Asia. The VMS was implemented for 3 Clients and 6 vessels.

Figure 1 Tanker Moored with the VERSATILE MOORING SYSTEM and in production in the Gulf of Thailand

5. MOORING SYSTEM

5.1 Tanker

The tanker is reviewed as is in order to establish the limitation of its existing components that will be used with the mooring system.

Vessel Information required:

- GA
- Q88
- Stability book
- Capacity Plan
- Structural drawings

Sometimes an additional ETA has to be installed on the bow of the vessel, this is done using our engineering capabilities and can be performed extremely fast since ETA's are available in the market.

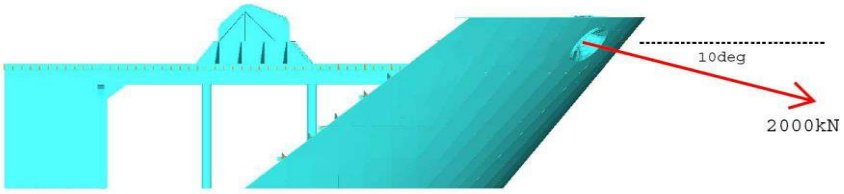

Figure 2 Extract from vessel analysis performed for the addition of an ETA

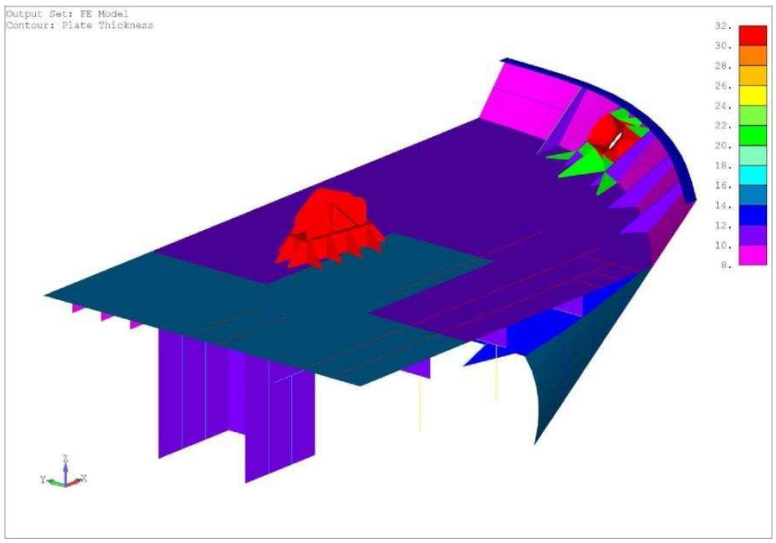

Figure 3 Design and reinforcement of Deck and Panama chock

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5.2 Buoy

In order for the VERSATILE MOORING SYSTEM to be safe it must be easily disconnected and reconnected

A Buoy system was designed, to allow this.

Figure 4 3D view of VERSATILE MOORING SYSTEM Buoy with quick disconnection system

Figure 5 3D view of VERSATILE MOORING SYSTEM Buoy with quick disconnection system

Figure 6 Installation of the Buoys and VERSATILE MOORING SYSTEM

Figure 7 Buoy and hawser under tension as used in the VERSATILE MOORING SYSTEM

5.3 Mooring System

The capacity of the mooring system depends most of the time on the existing capacity of the tanker bollards, their location and their amount.

Chains, anchors and the buoy system can be built and chosen for the right loads; the vessel bollards on the other hand are fixed and will normally dictate the environmental conditions the VERSATILE MOORING SYSTEM is suitable for.

Figure 8 Small Vessel being installed and connected to the VERSATILE MOORING SYSTEM

FOUR SKY

Figure 9 Latest VMS system for a 700,000 bbls Aframax tanker

As can be seen from the pictures above the vessel withstood some rough weather while being safely moored in the field.

6. DESIGN & ENGINEERING

The following design & Engineering will be performed traditionally when a client request us to provide them with a VERSATILE MOORING SYSTEM and Fluid transfer system:

1. Hydrodynamics of the vessels involved
2. Mooring Analysis
3. Offloading Analysis, side by side and tandem
4. Design and engineering of the full systems, including drawings, class approval etc.
5. Limitation Analysis
6. Riser & Hose analysis
7. On-bottom analysis
8. PLEM design
9. Jack-up requirements for the risers / hoses
10. Installation analysis, engineering & procedures

7. SCOPE OF SERVICES

Since a moored tanker is usually only used to produce oil from a field; DEEPBLUE offers in addition and together with the VERSATILE MOORING SYSTEM the following scope of Services

1. Design and Engineering of the Versatile Mooring System.
2. Provision of the Versatile Mooring System.
3. Fabrication and purchase of all components.
4. Rental of the VERSATILE MOORING SYSTEM.
5. Naval Architecture, Design & Engineering of the tanker and upgrades and changes required. (ETA's, deck reinforcements, panama chock design etc.)
6. Design and engineering of a fluid transfer line from the Jack-up to the tanker.
7. Engineering & Design of the PLEM
8. Fabrication of the PLEM.
9. Design & engineering for the Offshore Installation phase.
10. Personnel Support for the Offshore Installation Phase.
11. Project and Technical Management.

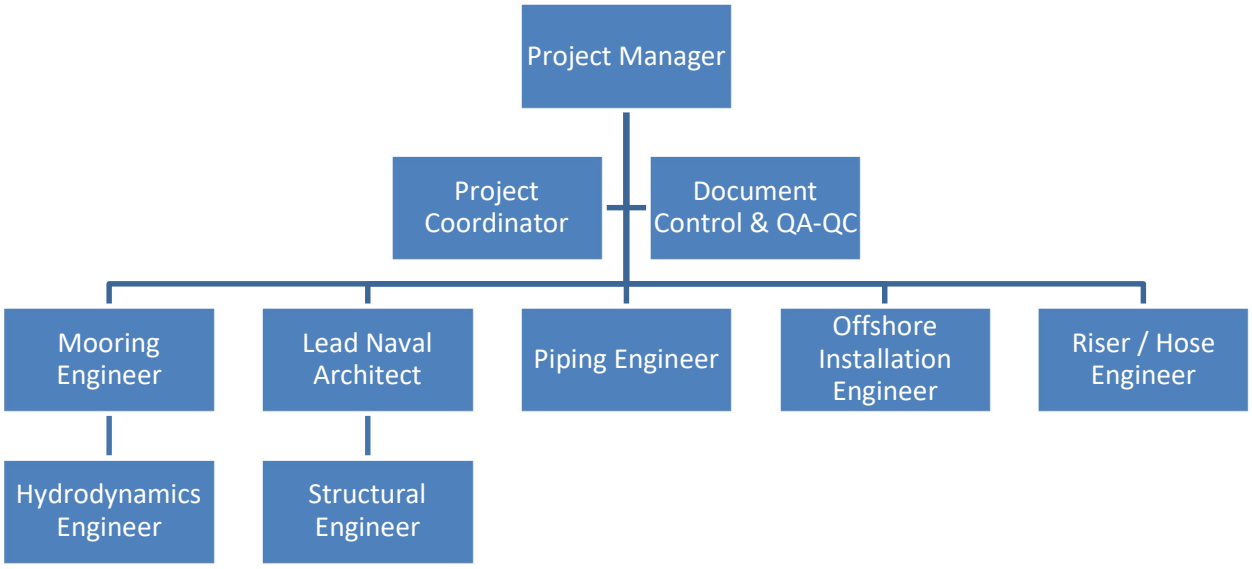
8. PROJECT MANAGEMNT AND QA-QC

Perform all relevant project management and QA/QC tasks to ensure that the project is managed effectively to achieve the planned completion date and project milestones.

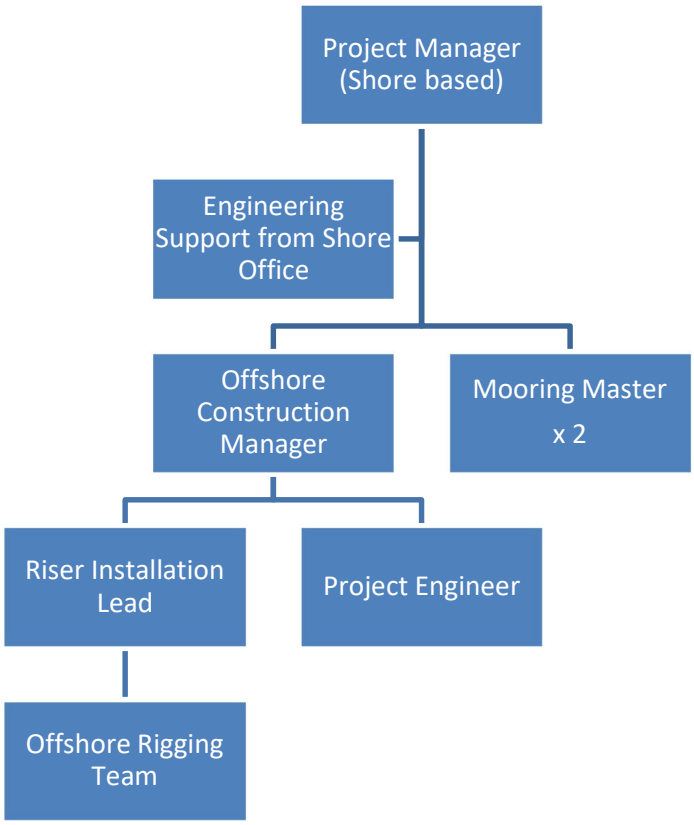
Assure that CLIENT is informed on an on-going basis of project progress (Issue short Project Progress update to CLIENT). Participate in project meetings as required; allowance has been made for meetings as and when required in Singapore.

Assure that the quality of all aspects of the job, including design calculations, output data, fabrication, testing, documentation and reports are performed in accordance with DEEPBLUE's and CLIENTs' QA-QC requirements.

8.1 Organisation Chart for Engineering, Design & PM



8.2 Organisation Chart for Offshore Installation



9. TRACK RECORD

9.1 VERSATILE MOORING SYSTEM track record

The following Clients have used the VERSATILE MOORING SYSTEM,

- Kangeang Energy Indonesia, Java Sea
- NuCoastal Thailand, Gulf of Thailand, Songkhla A &C
- Coastal Energy International, Gulf of Thailand, Songkhla D & F
- Coastal Energy KBM SDN BHD, Kapal Field
- Coastal Energy KBM SDN BHD, Banang Field
- HESS Malaysia Temporary Storage Tanker (TST) Bergadin field

9.2 Company track record

DEEPBLUE has extensive experience in the design of mooring, riser, hose, subsea systems and their installation.

CLIENT	PROJECT	COUNTRY	CLASS SOCIETY	WATERDEPTH	DESCRIPTION OF PROJECT	TYPE	YEAR
HESS Exploration & Production	Temporary Storage Tanker	Malaysia	ABS	56 m	1. Complete EPIC contract of the Temporary Storage Tanker. 2. Design of the mooring system for a Temporary Storage Tanker (TST) for condensate storage. 3. Design of the subsea flowline, riser and hose system for condensate transfer from Central Processing Platform (CPP) to the TST. 4. Design of subsea support bases and gravity systems. 5. Upgrading of 6-point mooring system to 8-point mooring system to + 6. increase the operability. 7. Structural modifications to install 2 chain stoppers and 1 QRH at the stern of the TST. 8. Installation engineering for the tanker, mooring and SURF. 9. Provision of all personnel for installation, management, Flowline installation management 10. EPIC of the Offshore installation of the tanker, mooring system and SURF. 11. Offshore TST changeout of 6-point moored tanker with a new 8-point moored tanker. 12. Design engineering and offshore procedures for offloading of condensate.		2017-2018
Optima Energy	Multi Buoy Mooring for LPG Offloading	Cameroon	-	20 m	1. Feasibility and FEED study for the mooring of LPG Offloading System 2. Preliminary costing for equipment and installation		2017
Optima Energy	Multi Buoy Mooring for LPG Offloading	Nigeria	-	8 m	1. Feasibility and FEED study for the mooring of LPG Offloading System 2. Preliminary costing for equipment and installation		
Coastal Energy	Banang Field	Malaysia	ABS	70 m	1. Engineering & Detailed design of a temporary mooring system for the tanker. 2. Detailed installation procedures, analysis and drawings. 3. MWS approval 4. Offshore Installation management and engineering execution by DEEPBLUE personnel		2016

CLIENT	PROJECT	COUNTRY	CLASS SOCIETY	WATERDEPTH	DESCRIPTION OF PROJECT	TYPE	YEAR
Exon Mobile / Amaniaga	Mooring system Installation	PNG	ABS	15 m	Mooring Offshore installation detailed engineering and design and execution: 1. Detailed design and engineering of mooring system installation. 2. Sea-fastening of all equipment. 3. Detailed installation procedures, analysis and drawings. 4. HAZID – SIMOPS. 5. Offshore management and engineering support by DEEPBLUE personnel		2016
Coastal Energy	Banang Field	Malaysia	ABS	70 m	Mooring and Offshore installation detailed engineering and design and execution: 1. Detailed design and engineering of mooring system. 2. Detailed design and engineering of Side by Side offloading, simulation of SBS. 3. Detailed installation procedures, analysis and drawings. 4. Offshore Installation 5. Offshore management and engineering support by DEEPBLUE personnel		2014
Coastal Energy	Kapal Field	Malaysia	ABS	70 m	Mooring system for production tanker: 1. Detailed design and engineering of mooring system. 2. Detailed design and engineering of Side by Side offloading, simulation of SBS.		2013
Coastal Energy	Songkhla	Thailand	ABS	20 m	Detailed design, support at procurements and installation: 1. Field lay-out, mooring design and analysis, SURF design and analysis, offshore installation. 2. Hydrodynamic analysis of vessels 3. Continuous EPIC support for the for the different. Songkhla FSOs.		2011 – 2012
KEI – TJS	Sepanjang FSO	Indonesia	ABS	45 m	Mooring, SURF, installation, naval architecture: 1. Design and engineer of mooring system and riser system for the FSO. 2. Offshore installation engineering and provision of support personnel for the offshore phase.		2010 - 2011

CLIENT	PROJECT	COUNTRY	CLASS SOCIETY	WATERDEPTH	DESCRIPTION OF PROJECT	TYPE	YEAR
Coastal Energy	Songkhla FSO	Thailand	ABS	20 m	Mooring, SURF, field lay-out: 1. Design of new and review of existing system with respect to mooring, risers, offshore and subsea arrangement. 2. Mooring analysis and design. 3. Offloading analysis and design. 4. Riser analysis and design. 5. Hose analysis and design. 6. Vessel mooring requirements and Installation requirements.		2009 – 2010