3.1 OVERVIEW OF PROJECT COMPONENTS

The information presented in Section 3 is taken from the preliminary design for the Project, and will be subject to further study and development during the implementation stage of the Project.

As outlined in Section 2, the Project involves the construction of an offshore LNG Terminal and its supporting infrastructure to enable LNGCs to deliver cargoes of LNG that are then transferred into the FSRU Vessel’s LNG storage tanks, and then the LNG is regasified onboard to supply natural gas to the BPPS and the LPS. The key components are summarised as follows:

- An offshore LNG Terminal that comprises of the Jetty and the FSRU Vessel;
- Two subsea gas pipelines, namely:
  - The BPPS Pipeline, connecting the LNG Terminal with the GRS at the BPPS; and
  - The LPS Pipeline, connecting the LNG Terminal with the GRS at the LPS
- The GRS facilities, namely:
  - The GRS located within the BPPS; and
  - The GRS located within the LPS.

An overview of the key components of the Project and their locations is shown in Figure 3.1.

The Project Site area also includes the provision of a Safety Zone surrounding the LNG Terminal.

The following information in Section 3 gives a general description of the location of the Site selected for the LNG Terminal Jetty, the routes of the BPPS Pipeline and the LPS Pipeline, and the location of the GRSs at the BPPS and the LPS and associated access arrangements and auxiliary facilities.

Information is also provided on the design and size parameters of these key components, and their construction methods and the nature and methods of future operational activities of the Project.
3.2 LNG TERMINAL LOCATION AND HISTORY

3.2.1 LNG Terminal

The proposed Site for the LNG Terminal Jetty that was selected following the processes described in Section 2 is located offshore Hong Kong in open waters about 4km east of Tau Lo Chau, near the Soko Islands (the closest land mass).

The water depth at the Site is at least 15m which is suitable for the safe transit approach and departure of the FSRU Vessel and a visiting LNGC, and their safe berthing.

To the northwest of the LNG Terminal Site there is the proposed SLMP, and the LNG Terminal Jetty is in relatively close proximity to its southeastern corner.

To the south of the Site there is open water for approximately 500m, until the boundary of the HKSAR waters is reached, and thereafter lies the South China Sea.

To the east of the Site there is the Sediment Disposal Area, which is operational and used for the disposal of uncontaminated sediment.

3.2.2 BPPS Pipeline Route

The proposed BPPS Pipeline will connect the LNG Terminal with the GRS at the BPPS and is approximately 30 inches (30") in diameter, 45km in length, with a design life of 50 years. It is located entirely within HKSAR waters.

The BPPS Pipeline departs the LNG Terminal and heads west running to the south of the Soko Islands towards the southwest Lantau cable corridor where there are ten (10) existing subsea cables that have to be crossed.

Thereafter, the BPPS Pipeline continues to run westwards parallel to the southern boundary of the proposed SLMP. It then turns northwards and unavoidably crosses the Southwest of Fan Lau and part of the LCTSS, then continues northwards and runs parallel to, but outside of, the LCTSS, passing to the west of the proposed Southwest Lantau Marine Park. The route then continues northwards and unavoidably crosses under the HongKong-Zhuhai-Macao Bridge Hong Kong Link Road to the west of the Airport’s restricted area.

The BPPS Pipeline route then continues to run northwards, passes to the west of the proposed Southwest Lantau Marine Park, then runs parallel and within the western boundary of the proposed marine park related to the HKIA Three Runway System project (to be designated after the construction of the BPPS Pipeline), then passes to the west of the Sha Chau and Lung Kwu Chau Marine Park.

In order to approach the BPPS, the pipeline turns eastwards and unavoidably crosses the Urmston Road marine shipping channel before reaching landfall at the BPPS in the vicinity of the existing GRSs.
The BPPS Pipeline will come ashore at the existing seawall within the boundary of the BPPS. The seawall is of sloping armour rock form and was constructed in 1993.

3.2.3 **LPS Pipeline Route**

The proposed LPS Pipeline will connect the LNG Terminal with the GRS at the LPS and is approximately 20 inches (20”) in diameter, 18km in length, with a design life of 50 years. It is also located entirely within HKSAR waters.

The LPS Pipeline route departs the LNG Terminal and heads north passing between the eastern boundary of the proposed SLMP, and the western boundary of the Sediment Disposal Area.

Thereafter, the LPS Pipeline route turns eastwards and runs between the southern boundary of the South Cheung Chau Traffic Separation Scheme and the northern boundary of the Sediment Disposal Area.

The LPS Pipeline then continues to run eastwards and, en route, crosses two (2) existing subsea cables to the north of the HK Electric proposed wind farm in southwest Lamma.

It is proposed that the LPS Pipeline will tie-in to an existing pipeline located approximately 1km from the LPS landfall point adjacent to the existing Dapeng Pipeline.

3.2.4 **Gas Receiving Station at the Black Point Power Station**

The proposed location for the new GRS at the BPPS is within the existing boundary of the BPPS as shown in Figure 3.2 on vacant land between the two existing GRS facilities for the Yacheng Pipeline and the Hong Kong Branch Line.

3.2.5 **Gas Receiving Station at the Lamma Power Station**

The proposed location for the new GRS at the LPS is within the existing boundary of the LPS southern platform extension site as shown in Figure 3.3. The land area has been used for material storage, and there are no other facilities or utilities within this land area.

3.3 **PROJECT DESIGN**

The design aspects of the preferred scenarios for the Project to be taken forward in this EIA Report are described below, and the associated construction activities are described in Section 3.4.

3.3.1 **LNG Terminal**

The LNG Terminal will comprise of the FSRU Vessel that is permanently moored at the Jetty (except under adverse weather conditions).
Jetty

The design parameters for the Jetty marine structure have been set to accommodate the simultaneous mooring of an FSRU Vessel and a visiting LNGC, both of up to a maximum LNG storage capacity of ~270,000m³.

The design parameters ensure that the widest range of FSRU Vessels / LNGCs that are available in the market today are able to safely berth at the Jetty.

The Jetty includes mooring facilities that will be designed for the simultaneous mooring of the FSRU Vessel and a visiting LNGC.

The footprint of the Jetty marine structure including its mooring facilities is approximately 500m long and 50m wide i.e. approximately 2.5ha.

As described in Section 2, the conceptual layout of the Jetty consists of the following structures:

- **Jetty Substructure** – Including eight Breasting Dolphins (four on either side) for mooring the FSRU Vessel and a visiting LNGC;

- **Jetty Platform** – Including its topsides piping and equipment, namely LNG unloading / reloading arms and inter-connecting cryogenic piping, high pressure natural gas send-out arms and inter-connecting high pressure gas piping, and metering, valve and control equipment;

- **Mooring Dolphins** – Comprising of six individual mooring dolphins for mooring the FSRU Vessel and a visiting LNGC;

- **Walkways / Pipe Racks** – Comprising of two north and south Walkways (with three support structures) that interconnect the Jetty Platform with the Mooring Dolphins to provide operational access. The north Walkway also contain the Pipe Racks that support the high pressure piping that connects to the BPPS Pipeline and the LPS Pipeline; and

- **Vent Stack** – Comprising of the Vent Stack with its single support structure.

As stated in Section 2, the proposed Site of the Jetty and its orientation was chosen based on an extensive Site Selection Study followed by engineering and met-ocean and studies.

The proposed Site of the Jetty with its 165°N orientation is located to the west of the Sediment Disposal Area as shown in Figure 3.4.

The orientation of 165°N has been chosen so that both the FSRU Vessel and a visiting LNGC can be berthed with their bows facing south.

Therefore, for planned departures or in the event of any unplanned departures from the Jetty, the FSRU Vessel can move off its berth and sail due south out of HKSAR waters, safely, with limited manoeuvring. Similarly a visiting LNGC has an unimpeded safe transit to the Jetty, and also has the same
straightforward safe manoeuvre off the berth to sail due south out of HKSAR waters.

The marine studies have confirmed that the waters surrounding the Site of the Jetty are an area of minimal vessel traffic, and there are no hazards acting on, or created by the long-term location of the Jetty, or navigation to/from the Jetty by the FSRU Vessel and a visiting LNGC. Additionally, the use of a Safety Zone (see Section 3.3) around the Jetty would not constitute a significant impact on the minimal marine trafficked waters around the Jetty. Navigation simulation studies were conducted in adverse environmental conditions above what the FSRU Vessel and a visiting LNGC will (in practice) be berthing / operating at, which demonstrated that the Site of the Jetty and its orientation provided suitable safe access and departure for the FSRU Vessel and LNGCs.

As mentioned in Section 2, at this stage in the development of the Project, a detailed geotechnical site investigation has not been carried out to assess the subsurface conditions of the seabed at the Site of the Jetty. Therefore, the conceptual designs for the Jetty presented below will be checked and verified during the implementation stage of the Project when the detailed design is carried out based on the results of the site investigation.

For the purposes of the EIA Report, the conceptual design for the Jetty based on jacket structure has been developed and is further described below. The conceptual layout of the Jetty structures is shown in Figure 3.5.

**Jacket Structures**

The conceptual design for the Jetty Platform (including the Breasting Dolphins), Mooring Dolphins, Walkways and Vent Stack structures considered water depth, tidal range, storm surge, and extreme water levels together with design loads requirements.

Extreme environmental conditions with a return period of 100 years were also considered for the Jetty structures that will have a design life of 50 years, and the maximum effects from winds, currents and waves occurring simultaneously.

**Jetty Platform (including Breasting Dolphins)**

The Jetty Platform will be supported by approximately ten Jackets, with each Jacket designed to resist the required design loads.

Eight of the ten Jackets will act as Breasting Dolphins while supporting the Jetty Platform, while the remaining two Jackets will act to support the Jetty Platform only.

The Jetty Platform will comprise of two deck levels with an overall size of approximately 150m x 50m. The Jackets would be fabricated onshore in a series of modules, and then transported to the Site of the Jetty for installation.

A series of steel truss structures will be installed on top of the Jackets and inter-
locked to form the Jetty Platform.

**Mooring Dolphins**

Each of the six Mooring Dolphins that would typically be required for the Jetty mooring system will be supported by a single Jacket designed to resist the mooring load and the equipment / environment load.

The Mooring Dolphin deck where the topsides mooring equipment will be installed would be approximately 20m x 10m, and will be formed by a steel truss installed on each Jacket (similar to the type used for the Jetty Platform).

**Walkways / Pipe Rack Supports and Vent Stack Support**

The Walkways connecting the Jetty Platform with the Mooring Dolphins to provide access for Jetty operations personnel will also require to be supported by three individual Jackets, two for the north Walkway to support the high pressure Pipe Racks, and one for the south Walkway that will also support the Vent Stack structure.

The decks that will support the Walkway / Pipe Racks and the Vent Stack will be approximately 10m x 8m, and will be formed by a steel truss installed on each Jacket.

**Jetty Topsides**

The Jetty Platform will support the topsides cryogenic equipment and piping for LNG unloading/ reloading, and the topsides high pressure gas equipment and piping for sending-out natural gas through the gas arms and piping to connect with the BPPS Pipeline and the LPS Pipeline.

The Jetty Platform will also contain the standby diesel generator, the local control room and be equipped with firewater monitors, an operator shelter, maintenance crane and an environmental (e.g. meteorological) monitoring system.

**FSRU Vessel**

The key ‘on-board’ features of an FSRU Vessel are:

- **LNG Storage Tanks** – Membrane containment system where the tanks are comprised of strengthened panels, resistant to cryogenic temperatures, or MOSS containment system where the tanks are spherical. To enhance the physical protection of the LNG containment system, the FSRU Vessel is double-hulled on all sides in a manner similar to LNGCs;

- **LNG Regasification Units** – Comprising of LNG booster pumps, heat exchangers and LNG vaporizers, and a high pressure gas send-out system;
• **Seawater Intake and Outfall System** – Provides water to the regasification system by drawing water from the sea, and discharging back in the sea after use;

• **Freshwater Generator** – To produce freshwater required for the FSRU Vessel;

• **Sewage Treatment System** – To treat the waste generated on board; and

• Other equipment and facilities such as the control room, crew accommodation, power generation system, drainage systems etc.

The FSRU Vessel to be used for the Project is proposed to be an existing or a ‘new build’. In its appearance, design and operations, the FSRU Vessel will at all times remain a maritime vessel, and will be moored in place at the Jetty for the lifetime of the Project, except for departure under emergency conditions such as a tropical typhoon (when the FSRU Vessel will transit outside HKSAR waters to avoid the path of the typhoon).

The indicative key dimensions of the FSRU Vessel that is proposed for the Project are listed in *Table 3.1*.

**Table 3.1  Key FSRU Vessel Maximum Dimensions**

<table>
<thead>
<tr>
<th>Key Dimensions</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length Overall (LOA)</td>
<td>345m</td>
</tr>
<tr>
<td>Fully Loaded / Design Draft</td>
<td>12m</td>
</tr>
<tr>
<td>Beam</td>
<td>55m</td>
</tr>
<tr>
<td>Maximum Total Installed Capacity of the Regasification Units</td>
<td>1,000mmscfd</td>
</tr>
<tr>
<td>Maximum Total LNG Storage Capacity</td>
<td>270,000m³</td>
</tr>
</tbody>
</table>

**Design Safety**

The FSRU Vessel design and operations will be under internationally accepted merchant shipping standards such as the International Maritime Organization (IMO) International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC code) and ship classification society regulations. FSRU Vessels are required to comply with the same strict international regulations and industry guidelines for LNGCs that have been in place since the start of the LNG industry over 50 years ago, an industry that has since grown substantially worldwide and has an outstanding safety record.

The typical safeguards that are present in FSRU Vessel design and operations are as follows:

• Design is in accordance with International Gas Carrier regulations and ship classification society requirements;

• Double hull and double bottom construction;

• Forward collision bulkhead;
• Independent, separated LNG cargo storage areas;

• Fire protection system;

• Speed limitation according to regulations and practices;

• Pilots on board during berthing /un-berthing;

• Tug assistance to control berthing /un-berthing operations;

• Quick release mechanisms for fast separation of either FSRU Vessel or a visiting LNGC; and,

• Standby vessel in attendance for safety and security patrols.

The Jetty and the FSRU Vessel will both be lit, and navigation aids will be installed.

Safety Zone

As presented above, the Project Site area includes the provision of a Safety Zone surrounding the LNG Terminal in which vessels are not allowed to enter without authorization (see Figure 3.7). It is important that safe and secure 24 hour operations occur at the LNG Terminal to avoid any safety incidents, and to avoid disturbance to gas send-out operations. Consequently, it is a standard practice throughout the LNG industry globally for an LNG terminal to establish and maintain some form of Safety Zone. The Safety Zone is established by following best industry practice and guidelines, and protects the integrity of the LNG Terminal by preventing any external interference with LNG Terminal operations, and reduces the chances of potential collisions between passing marine vessels and the Jetty, FSRU Vessel and a visiting LNGC when it is delivering an LNG cargo.

The purpose, dimensions, management controls and implementation of the proposed Safety Zone are discussed further in Table 3.2.

Table 3.2 Proposed Safety Zone of the Offshore LNG Terminal

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Safety Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>• To ensure safe and secure 24 hour operations occur at the LNG Terminal to avoid any safety incidents, and to avoid disturbance to gas send-out operations.</td>
</tr>
<tr>
<td></td>
<td>• Protects the integrity of the LNG Terminal by preventing any external interference with LNG Terminal operations, and reduces the chances of potential collisions between passing marine vessels and the Jetty, FSRU Vessel and a visiting LNGC when it is delivering an LNG cargo.</td>
</tr>
<tr>
<td>Dimension</td>
<td>• A radius of approximately 250m from the centre of the LNG Terminal Jetty, which is consistent with industry best practices and guidelines for LNG terminals of a similar nature</td>
</tr>
</tbody>
</table>
### Aspect: Safety Zone

<table>
<thead>
<tr>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>• All access into the Safety Zone must be authorized by the Terminal Operator in order to not allow any unauthorized access by vessels or non-essential personnel.</td>
</tr>
<tr>
<td>• Restrict vessel speed to below 6 knots.</td>
</tr>
<tr>
<td>• Any authorized vessels and any equipment deployed on board such vessels within the Safety Zone should be intrinsically safe.</td>
</tr>
<tr>
<td>• No anchoring within the Safety Zone</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Details and procedures of the implementation of the Safety Zone with reference to relevant legislation (e.g. Shipping and Port Control Ordinance Cap. 313, Merchant Shipping (Local Vessels) Ordinance Cap. 548, Gas Safety Ordinance Cap. 51, etc.) will be discussed and agreed with the relevant authorities.</td>
</tr>
<tr>
<td>• The Safety Zone will be monitored and managed by the LNG Terminal Operator through active safety and 24-hour security patrols by its Standby Vessel and monitoring by the LNG Terminal Operator’s staff, including visual observation, the use of radar and CCTV cameras, an automatic system (Automatic Identification System AIS broadcasts) to monitor passing vessel and usage of Very High Frequency (VHF) radio and deployment of Standby Vessel to ‘warn-off’ any unauthorized vessels that may be encroaching into the Safety Zone.</td>
</tr>
<tr>
<td>• Navigation warnings including contact from FSRU Vessel watch officers (e.g. VHF radio) who are on duty 24 hours/day are effective measures typically utilized in the industry and can be deployed by the LNG Terminal Operator to inform third parties of the presence of the Safety Zone.</td>
</tr>
<tr>
<td>• The coordination and implementation of the above activities will be undertaken in line with best industries practices employed in other FSRU terminal safety zones and by consent with the relevant local authorities. Details and procedures of such implementation will be discussed and agreed with the relevant authorities.</td>
</tr>
</tbody>
</table>

Consequently, the implementation of the Safety Zone around the LNG Terminal is established in line with best industry practices and guidelines. The implementation will be further reviewed and determined with the relevant authorities during the implementation stage of the Project.

#### 3.3.2 Subsea Pipelines

As stated in Section 3.2.2 and Section 3.2.3, the BPPS Pipeline and the LPS Pipeline are to be constructed to supply natural gas from the LNG Terminal to the GRSs at the BPPS and the LPS.

**Pipeline Trench Design**

It is a requirement that all subsea pipelines in HKSAR waters must be buried below the seabed. Burial depth when considered with rock armour provides the required level of pipeline protection. The actual burial depth below seabed is dependent on the marine and subsoil conditions along the pipeline routes. For areas that are considered to pose a threat to the integrity of the pipeline through anchor drop/drag, additional protective measures are required such as rock armour placement. The pipelines would be externally coated with an anti-corrosion coating and would also be concrete weight coated.
A number of pipeline trench designs have been developed to provide the range of pipeline protection required for each anchor size, and these are shown in *Figure 3.6a and b*.

There are five types of pipeline protection trench design that are proposed to be used for the construction of the BPPS Pipeline and the LPS Pipelines, as described below:

- **Trench Type 1** – (1.5m top of pipe (TOP) burial with rock armour and 0.4m sand bedding): This trench is to be pre-formed by DREDGING and provides pipeline protection against an anchor size of less than 5 Metric Tonnes (MT);

- **Trench Type 2** – (1.3m TOP burial with armour rock): This trench is to be pre-formed by DREDGING and provides pipeline protection against an anchor size of up to 7.3MT;

- **Trench Type 3** – (1.8m TOP burial with armour rock): This trench is to be pre-formed by DREDGING and provides pipeline protection against an anchor size of up to 10.6MT;

- **Trench Type 4** – (3m TOP burial with rock armour): This trench is to be pre-formed by DREDGING and provides the maximum pipeline protection against an anchor size of up to 23.6MT; and

- **Trench Type 5** – (3 to 6m bottom of pipe (BOP) burial with armour rock and natural backfill): This trench is to be post-formed by JETTING and provides protection against an anchor size of less than 5MT.

### 3.3.3 Gas Receiving Stations (GRSs)

As stated in *Section 2.6*, the GRSs at the BPPS and the LPS are to be constructed to receive natural gas from the LNG Terminal via the BPPS Pipeline and the LPS Pipeline respectively.

The metering and regulating units in the GRSs then reduce the pressure of the natural gas so that it can be sent out to supply the gas-fired CCGT units at the BPPS and the LPS.

**Design Parameters**

The facilities that comprise the GRSs at the BPPS and LPS are similar and are described below:

- Emergency Shutdown valve;
- Pig Trap receiver, with associated service piping;
- GRS inlet header;
- Filter-separators (duty and standby runs);
• Metering runs (duty and standby runs);
• Water bath gas heaters (duty and standby runs);
• Pressure reduction units runs (duty and standby runs);
• Gas send-out header, check valve and Emergency Shutdown (ESD)/isolation valve; and
• Connecting facilities, such as fuel pipes, pipe racks, utility pipes, etc.

All GRS piping and equipment will generally be skid-mounted modules and be placed on prepared concrete footings. The modules will be delivered to the GRS site and assembled. Control and instrumentation equipment will be housed in an air-conditioned local control room close to the GRS.

The GRS will receive natural gas via the BPPS Pipeline and the LPS Pipeline and the first piece of equipment at the GRS is the Emergency Shutdown (ESD) valve, which can be closed in the event of an emergency, isolating the GRS from the incoming natural gas.

Downstream of the ESD valve is the GRS inlet header that distributes the natural gas to the inlet filter units. Parallel to the inlet filters oriented in-line with the incoming pipeline will be a pig receiver, enabling the running of cleaning and inspection pigs in the pipeline. For the GRS at LPS, a unitized design with separate gas supply streams to individual CCGT units is adopted to enhance the operational reliability.

3.4 CONSTRUCTION ACTIVITIES

The proposed sequence of the construction activities for the Project is presented below based on the conceptual design work that has been carried out to date. This will be subject to further assessment during the implementation stage of the Project.

3.4.1 FSRU Vessel Construction

The FSRU Vessel will be constructed and pre-commissioned outside of Hong Kong at an existing fabrication/shipbuilding yard, and will arrive at the Jetty ready for its commissioning, followed by the commissioning of the Jetty Topsides, then the BPPS Pipeline and the LPS Pipeline, completing with the commissioning of the GRSs at the BPPS and the LPS.

3.4.2 Jetty and Topsides Construction

FSRU Vessel / LNGC Transit to Jetty and Turning Area

The Site for the Jetty is located in water depth of up to 15m therefore there is unlikely to be any dredging required around the Jetty to enable the FSRU Vessel and a visiting LNGC to transit to and berth at the Jetty. However, due to the presence of the Sediment Disposal Area to the east of the Jetty, marine
sediments may migrate during the operation of the LNG Terminal therefore this will be regularly monitored.

**Jetty Construction – Jacket Structures**

The Jackets and their steel truss decks will be constructed offsite at a fabrication yard outside of Hong Kong.

When complete, each Jacket will be loaded onto a flat top barge and transported to the Site of the Jetty where it will be lifted and installed at the location required using a derrick barge. Each Jacket will have a mudmat installed on its base and therefore will be able to stand by itself prior to the installation of the piles that will anchor it to the seabed.

The derrick barge will progressively install all of the Jackets. Once each Jacket is secured in the template on the seabed, at its required position / angle, the open-ended steel tubular piles are inserted in turn into each of the jacket legs, and the hydraulic vibrator/hammer is placed on the pile head by the crane barge and the pile is pushed/driven into its required penetration depth. Based on the conceptual design of using 20 Jackets for Jetty construction, a total of about 80 piles (diameter of around 1.5m each) will be installed.

Once all of the Jackets are in place, the derrick barge will be used to install the steel truss decks, and lock these into position.

Once all of the Jackets and the steel truss decks are in place, the various topsides equipment can be installed.

**Jetty Construction – Topsides**

In sequence, once the Jetty Platform and each of the decks for the Mooring Dolphins, Walkways and Vent Stack structures are constructed and in place, the construction of the various topsides equipment and mooring facilities can be carried out.

### 3.4.3 BPPS Pipeline and LPS Pipeline

**Typical Pipeline Construction Sequence**

The typical sequence of pipeline construction methods to be used for the BPPS Pipeline and the LPS Pipeline based on the combination of dredging and jetting is shown below:

- **Dredging** – Pre-forming the required trench design profile by using either a grab dredger or a TSHD;
- **Pipelaying** – Using a conventional pipeline laybarge;
- **Jetting** – Post-forming the required trench design profile by using a jetting machine to install the pipeline to the required depth;
• **Rock Armour Placement** – Covering the installed pipeline with the required rock armour using a conventional derrick barge, or side dump vessel;

• **Testing** – Carrying out the required hydrotesting to ensure the integrity of the installed pipeline; and

• **Commissioning** – Carrying out the commissioning of both pipelines as part of the overall commissioning plan for the FSRU Vessel, the Jetty topsides and the GRSs at the BPPS and the LPS.

A summary of the BPPS Pipeline and LPS Pipeline construction methods together with their dredging and jetting lengths are shown below in Table 3.3 and Figure 3.9. The proposed selection on the dredging or jetting construction methods along different sections of the two subsea pipelines represents a construction scheme in which marine dredging has been avoided and reduced as far as practicable, considering other potential environmental impacts on water quality, ecology, fisheries, etc.

Anchor patterns for the vessels involved in all pipeline construction activities will be adjusted to avoid encroachment into nearby marine parks.

**Table 3.3**  
**Overview of Project Pipeline Construction Methods and Trench Designs**

<table>
<thead>
<tr>
<th>Description</th>
<th>Section Length [km]</th>
<th>KP (km) From</th>
<th>To</th>
<th>Anchor Size for Trench Protection (MT)</th>
<th>Proposed Trench Type*</th>
<th>Construction Method*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jetty Approach to South of Soko Islands</td>
<td>8.9</td>
<td>0.0</td>
<td>0.1</td>
<td>&lt;23.6</td>
<td>Type 4 Dredging</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1</td>
<td>5.0</td>
<td>&lt;5</td>
<td>Type 5 Jetting</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.0</td>
<td>8.9</td>
<td>&lt;5</td>
<td>Type 5 Jetting</td>
<td></td>
</tr>
<tr>
<td>Southwest of Soko Islands</td>
<td>3.2</td>
<td>8.9</td>
<td>12.1</td>
<td>&lt;5</td>
<td>Type 5 Jetting</td>
<td></td>
</tr>
<tr>
<td>Adamasta Channel</td>
<td>3.5</td>
<td>12.1</td>
<td>15.6</td>
<td>&lt;5</td>
<td>Type 5 Jetting</td>
<td></td>
</tr>
<tr>
<td>Southwest Lantau</td>
<td>5.7</td>
<td>15.6</td>
<td>21.3</td>
<td>&lt;7.3</td>
<td>Type 2 Dredging</td>
<td></td>
</tr>
<tr>
<td>West of Tai O</td>
<td>4.9</td>
<td>21.3</td>
<td>25.7</td>
<td>&lt;5</td>
<td>Type 5 Jetting</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>25.7</td>
<td>26.2</td>
<td>&lt;5</td>
<td>Type 5 Jetting</td>
<td></td>
</tr>
<tr>
<td>West of HKIA</td>
<td>3.3</td>
<td>26.2</td>
<td>29.5</td>
<td>&lt;5</td>
<td>Type 5 Jetting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.0</td>
<td>29.5</td>
<td>31.5</td>
<td>&lt;5</td>
<td>Type 5 Jetting</td>
<td></td>
</tr>
<tr>
<td>West of Sha Chau</td>
<td>4.5</td>
<td>31.5</td>
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<td>Description</td>
<td>Section Length [km]</td>
<td>KP (km)</td>
<td>Anchor Size for Trench Protection (MT)</td>
<td>Proposed Trench Type*</td>
<td>Construction Method*</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------------------</td>
<td>---------</td>
<td>--------------------------------------</td>
<td>-----------------------</td>
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</tr>
<tr>
<td></td>
<td>From</td>
<td>To</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>0.1</td>
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</table>

*Note: Proposed pipeline construction methods and trench types are subject to further review with Government Departments.

**Pre-forming the Trench by Dredging**

Approximately 9km of the BPPS Pipeline and 1km of the LPS Pipeline (under Alternative Shore Approach Option) is proposed to be dredged. The depth of dredging differs for each type of trench design, but generally the pre-formed trenches will be about 3-4m below the existing seabed to allow adequate rock cover on top the pipeline for protection.

Where dredging is used for the subsea pipeline construction, the volume of the marine sediment that is excavated is required to be disposed of. For the BPPS Pipeline, the total volume of dredged sediments that have to be disposed of is approximately 0.33Mm³, and for the LPS Pipeline, the total volume of dredged sediments that has to be disposed of is approximately 0.02Mm³. Full details of the dredged sediment disposal requirements are provided in Section 8.

**Pipelaying**

The laybarge method is the most common form of pipeline construction. It is a ‘production line’ process where individual pipes are systematically welded and inspected for quality assurance purposes, then the pipeline coating is applied to the joint sections before laying onto the seabed. In the pipelaying operation, the laybarge winches itself forward as pipeline welding / coating is being completed.

The pipeline then leaves the laybarge over a curved ramp, before entering the sea as a suspended span in the water and touching down on the seabed. The curvature of the pipeline in the suspended span is controlled by tension, applied through a tracked or wheeled tensioner system.
Jetting

Approximately 36km of the BPPS Pipeline and 17km of the LPS Pipeline is proposed to be constructed by jetting. The depth of jetting is anticipated to be about 3-6m below existing seabed to the BOP.

Rock Armour Placement

Rock armour is necessary to provide the pipeline protection against the anchor drop and drag as explained above. The rock armour materials will be transported to the required locations along the routes of the BPPS Pipeline and LPS Pipeline and then carefully placed on top of the installed pipelines in the pre-formed trenches (by dredging) and the post-formed trenches (by jetting).

Approximately 0.84Mm³ and 0.26Mm³ of rock fill material (typically D50 = 330 ~380mm; fines content < 10%) shall be required to protect the BPPS Pipeline and LPS Pipeline from anchor drop or drag, respectively.

The procedure for the placement of the rock armour, including the vessels that will be used, will be determined during the implementation stage of the Project. Typically, a derrick lighter, fall-pipe barge or side dump vessel will be used.

It should be noted that many similar subsea pipelines have been installed in Hong Kong using the above pipelay sequence i.e. HK Electric Shenzhen to Lamma pipeline, AAHK PAFF pipeline, Towngas Shenzhen to Tai Po pipeline and the Hong Kong Branch Line.

Subsea Pipeline / Cable Crossings

The BPPS Pipeline has to cross ten (10) subsea cables that span approximately 4.5km across the existing southwest Lantau cable corridor. The LPS Pipeline has to cross two (2) subsea cables east of the Sediment Disposal Area.

Given the importance of the subsea cables to many industries in Hong Kong, in order to preserve the integrity of the subsea cables during the subsea pipeline construction, jetting is preferred over dredging as the construction works can be better controlled and present less risk to the existing subsea cables. To install the pipeline across the cables, after each cable crossing location is determined, jetting will be used to prepare the works area and expose the cable. Pipe bridges, concrete mattresses or concrete cable shields might be installed to support the pipeline to cross over the cables. The cable crossing locations will finally be covered with rock armour for pipeline protection purposes.

It should be noted that the crossings of the existing subsea cables and making provisions for the future installation of new or replacement cables will be subject to further study and development during the implementation stage of the Project. The Project Proponent will seek input and agreement with the Subsea Cable Owners on the design and construction of the existing and future subsea pipeline / cable crossings.
Pipeline Landfall

Set forth below is an outline of the proposed construction method to complete the shore approach of the BPPS Pipeline and the LPS Pipeline. This will be fully assessed and developed during the implementation stage of the Project.

BPPS Pipeline Shore Approach

The landfall point of the BPPS Pipeline is beyond the existing sloping seawall. The shore approach construction method requires a section of the existing sloping seawall to be removed to allow the pipeline to pass through. A sheet-piled cofferdam would then be installed and then the marine sediments within the shore approach cofferdam will be removed using a grab dredger.

A holdback anchor will be installed at the landfall point for the barge pull of the shore approach pipeline section. A temporary platform will also be erected at the shore transition section to lift the end of the incoming BPPS Pipeline, so as to connect the transition pipeline spool and the onshore pipeline section.

The tie-in point of the BPPS Pipeline and nearshore pipeline section is proposed to be at location approximately 100m away from the BPPS landfall point.

The pipeline laybarge will be moored in vicinity of the BPPS landfall point and the pipeline section will be welded on-board the pipeline laybarge in the same way as for conventional pipelaying.

Once the pipeline construction operation has been completed, the section of seawall will be reinstated by backfilling, and the sheet piles in the cofferdam will be removed. Rock armour will then be placed over the front of the seawall and around the BPPS Pipeline.

LPS Pipeline Shore Approach

There is an existing 20” pipeline of approximately 1km in length that is buried in a common trench together with the existing 20” Dapeng Pipeline. The pipeline is backfilled and protected by rock armour.

The pre-installed pipeline has been installed and preserved with nitrogen gas for over 10 years, therefore its condition is uncertain. It is therefore proposed to evaluate the current condition (internal and external) of the pipeline to assess its technical and structural integrity to determine whether it can be used for the LPS Pipeline tie-in.

In the event that the pre-installed pipeline cannot be used for the LPS Pipeline tie-in, an alternative landfall point will be used (as detailed below) for the LPS Pipeline and its construction will require pre-forming of a pipe trench of approximately 1km in length using a grab dredger (1). And then the LPS Pipeline

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(1) The requirement for dredging of this 1km shore approach route represents the worst scenario and as such this dredging will not be required unless the original plan of surface tie-in with the pre-installed subsea pipeline is found technically not feasible during implementation stage of the Project.
The tie-in section will be built using the same construction method as the BPPS Pipeline as presented above.

The construction of the LPS Pipeline tie-in using the pre-installed pipeline will be carried out as detailed below.

Firstly, a jetting machine will be used to uncover the last 100m of the pre-installed pipeline.

The pipeline laybarge will lay the new LPS Pipeline up to the location of the pre-installed pipeline which will then be lifted to the surface and welded to the new LPS Pipeline on the laybarge.

Once welding is complete the LPS Pipeline will be lowered to the seabed back into the trench created by the jetting machine, and the remainder jetted into the seabed to the required depth. Thereafter, rock armour will be installed to complete the construction of the LPS Pipeline.

**Alternative LPS Pipeline Tie-in**

The landfall point of the LPS Pipeline is beyond the existing sloping seawall. The shore approach construction method requires a section of the existing sloping seawall to be removed to allow the pipeline to pass through. A sheet-piled cofferdam would then be installed and then the marine sediments within the shore approach cofferdam will be removed using a grab dredger.

A holdback anchor will be installed at the landfall point for the barge pull of the shore approach pipeline section. A temporary platform will also be erected at the shore transition section to lift the end of the incoming LPS Pipeline, so as to connect the transition pipeline spool and the onshore pipeline section.

The tie-in point of the LPS Pipeline and nearshore pipeline section is proposed to be at location approximately 100m away from the LPS landfall point.

The pipeline laybarge will be moored in the vicinity of the LPS landfall point and the pipeline section will be welded on-board the pipeline laybarge in the same way as for conventional pipelaying.

Once the pipeline construction operation has been completed, the section of seawall will be reinstated by backfilling, and the sheet piles in the cofferdam will be removed. Rock armour will then be placed over the front of the seawall and around the LPS Pipeline.

**Onshore Sections of Pipelines**

The onshore pipeline construction works required to connect the BPPS Pipeline and the LPS Pipeline to their GRS facilities includes laying the pipelines in a trench followed by direct burial. These pipeline sections would, typically, be buried at about 1m cover below ground level within a trench approximately 1m to 2m wide. An open cut method of construction would be used. The
onshore pipelines at the BPPS and the LPS would be coated with a protective coating and provided with cathodic protection.

**Pipeline Hydrotesting**

Once the BPPS Pipeline and the LPS Pipeline have been installed and are mechanically complete, both pipelines will have to be hydrotested using seawater to check their integrity and ensure that there are no leaks. Environmental friendly or biodegradable chemicals (oxygen scavenger) / corrosion inhibitors / antifoulants will be used for the hydrotesting. Discharge from the hydrotests will be at the LNG Terminal and this has been assessed in Section 7.

A detailed hydrotesting procedure will be developed during the implementation stage of the Project that will detail how the process will be carried out, how it will be carefully controlled and monitored, and how the discharge of the hydrotesting water will be managed.

### 3.4.4 GRSs at BPPS and LPS

#### Construction of GRS at the BPPS

As stated above, the GRS at the BPPS is to be located between the existing GRS facilities.

The existing GRS facilities at the BPPS will need to be slightly modified to accommodate the new GRS. Such modification works will be undertaken prior to, and will continue in parallel with, the construction of the GRSs.

Construction of the new GRS within the BPPS will require limited land clearance to accommodate the new GRS facilities.

Construction of the GRS at the BPPS will involve the following stages of modification and construction works:

- New independent pipe racks will be constructed along-side the existing GRS facilities.
- Preparation works will be undertaken at the vent header for the tie-in of the new GRS to the existing vent stack at the BPPS.
- New fences will be constructed at the boundary of the new GRS site, as needed. Minor fencing modification works will also be undertaken at the existing GRSs for accommodating the new GRS.
- All new pipe racks and pipe rack modification would be erected.
- New gas receiving facility (e.g. heating station, metering station, filtering station, pressure reduction facility and pig receiving station) and a blast wall will be constructed at the new GRS site, and the new pipeline will be
connected to the new GRS. Provision for a future mixing facility tie-in would be provided at the proposed location.

**Construction of GRS at the LPS**

Construction of the new GRS with the LPS will require limited land clearance to accommodate the new GRS facilities.

Construction of the new GRS at the LPS will involve the following stages of modification and construction works:

- New independent pipe racks will be constructed.
- Preparation works will be undertaken at the vent header for the tie-in of the new GRS to the existing vent stack at the LPS.
- New fences will be constructed at the boundary of the new GRS site, as needed. Minor fencing modification works will also be undertaken at the existing GRS for accommodating the new GRs.
- All new pipe racks and pipe rack modification would be erected.
- New gas receiving facility (e.g. heating station, metering station, filtering station, pressure reduction facility and pig receiving station) will be constructed at the new GRS site, and the new pipeline will be connected to the new GRS. Provision for a future mixing facility tie-in would be provided at the proposed location.

3.5 **OPERATION AND MAINTENANCE ACTIVITIES**

3.5.1 **LNG Terminal**

**Operational Processes**

The LNG Terminal will serve as an LNG import, storage, regasification and natural gas supply facility. It will operate 24 hours a day, all year round continuously, to send out a consistent and reliable supply of natural gas to the BPPS and the LPS.

The LNG Terminal will carry out the following operational processes:

- LNGC approach and arrival at the Jetty, and safe mooring, followed by LNG unloading and departure when this has been completed (LNGC Transit);
- LNG unloading at the Jetty, and transfer on to the FSRU Vessel (LNG Unloading and Loading);
- LNG storage in the FSRU Vessel tanks (LNG Storage);
- Re-gasification of LNG to natural gas in the vapouriser units on the FRSU Vessel (Regasification); and
- High pressure natural gas send-out from the FSRU Vessel via the Jetty topsides into the BPPS Pipeline and LPS Pipelines for delivery to the BPPS and the LPS (Send-out).

LNGC Transit

Visiting LNGCs will arrive at the LNG Terminal to deliver their LNG cargoes. Based on the estimated annual gas demand at the BPPS and the LPS that will drive FSRU Vessel throughput, the frequency of LNG deliveries (on average) will be one LNGC arriving every five to eight days.

The proposed LNGC Transit Route from international waters into HKSAR waters to arrive at the LNG Terminal Jetty is shown in Figure 3.7. This is also the Transit Route that the FSRU Vessel will follow to arrive at the LNG Terminal Jetty.

On arrival in HKSAR waters, the LNGC will pick up a Pilot en route to the Jetty, and tugs will accompany the LNGC in a passive mode along the designated Transit Route to the Jetty, available to assist the LNGC, if necessary. The tugs will provide assistance in aligning the LNGC in its approach to the Jetty and will control the LNGC speed to enable safe berthing onto the Jetty Breasting Dolphin fenders, until the LNGC is safely and securely moored to the Mooring Dolphins. A ‘guard’ tug will remain on stand-by in close proximity to the LNG Terminal throughout the LNG Unloading and Loading operations described below.

Once safely moored at the Jetty, the required safety checks will be carried out and LNG Unloading and Loading operations will not commence until the Safety Checklist included in the ‘International Guide for Oil Tankers and Terminals’ (1) has been completed satisfactorily. In addition, the requirements of the LNGC’s security plan shall be implemented consistent with the "International Ship & Port Facility Security Code" (2) (ISPS).

LNG Unloading and Loading

Once an LNGC has been safely moored at the Jetty and the Safety Checklist approved, the LNG Unloading and Loading operations can commence. The LNGC will be connected to the FSRU Vessel through the cryogenic LNG unloading and loading arms and the LNG transfer piping on the Jetty topsides.

LNG will then be transferred into the FSRU Vessel’s LNG storage tanks using the LNGC’s discharge pumps. The LNG unloading operation from a typically sized LNGC with a capacity between 150,000m³ and 180,000m³ will take approximately 24 hours including cool down, connecting the LNG unloading arms, LNG cargo measurement, and then when the LNG unloading process has been completed, pressurised nitrogen will be used to purge the LNG unloading arms before their disconnection and the LNGC departs the berth.

(1) International Chamber of Shipping Oil Companies, 2006
(2) International Maritime Organization (IMO); July 2004
During the LNG Unloading and Loading operations, ballast water will be taken on-board the LNGC from the surrounding sea and pumped into its double hull ballast tanks to compensate for the LNG cargo unloading process. No ballast water will be discharged from the LNGC on berth at the Jetty.

**LNG Storage**

LNG will be stored on the FSRU Vessel at near atmospheric pressure in cryogenic, full containment LNG storage tanks until it is required to be brought back into its gaseous state prior to being sent-out from the FSRU Vessel.

During the LNG loading and Regasification processes, ballast water will be taken on-board the FSRU Vessel from the sea and pumped into its double hull compartments to compensate for the discharge of LNG, and discharge back to the sea on receipt of LNG, respectively.

**Regasification**

As mentioned above, on board the FSRU Vessel, the LNG is re-gasified by a simple heat exchange process using seawater. Common types of vaporizers that are used on an FSRU Vessel include generic Intermediate Fluid Vaporizer (IFV) and Shell & Tube Vaporisers (STV).

In response to the gas demand nominations from the BPPS and the LPS, LNG will be pumped from the FSRU Vessel’s LNG storage tanks and pressurised using the booster pumps, before entering the vaporizer units where it will be regasified into natural gas using the above regasification process.

During the regasification process the seawater that is used for warming the LNG in the vapourizer units is discharged back into the sea, at maximum about 9°C cooler than the ambient temperature of the intake seawater, and this includes a small quantity of sodium hypochlorite that is used as an anti-foulant.

**Send-out**

The high pressure natural gas send-out from the FSRU Vessel is via the gas arms on the Jetty into the piping that connects with the BPPS Pipeline and the LPS Pipeline for transportation to the BPPS and LPS for use in the gas-fired CCGT units.

**Modes of Operation**

The LNG Terminal will operate in two main modes of operation:

- **Combined Mode** – This is when LNG Unloading and Loading is being carried out simultaneously with Regasification and Send-out.

- **Send-out Mode** – This is when no LNG unloading and loading is taking place, when the Regasification and Send-out of high pressure gas into the BPPS Pipeline and the LPS Pipeline is taking place. When the LNG Terminal is in this Send-out mode, cryogenic conditions are maintained...
throughout the FSRU Vessel LNG unloading/loading and circulation system. LNG will be circulated to the Jetty topsides unloading/loading equipment in advance of an LNGC arrival in order to prepare this equipment for cryogenic conditions.

During both of these modes of operation, LNG will be continuously pumped out of the FSRU Vessel LNG storage tanks and boosted to the pressure required by the end user before being regasified in the LNG vaporizer units and sent out into the subsea pipelines.

**Equipment and Facilities of the FSRU Vessel**

The FSRU Vessel will be a fully self-contained vessel with accommodation for up to approximately 50 crew members.

The typical equipment and facilities that will be located on board the FSRU Vessel are described below.

**Seawater Intake / Outfall**

The seawater intake and outfall system is expected to operate at a maximum rate of about 20,000m$^3$ per hour. It is expected that a small amount of Sodium Hypochlorite will be released in the discharge as part of the antifouling protection system.

**Freshwater Supply by Freshwater Generator**

Freshwater required on board the FSRU Vessel will be provided by an on-board freshwater generator. The capacity of the freshwater generator is 60m$^3$ per day. It is expected that a low dose of non-toxic and biodegradable carboxylate-based anti-scalant would be dosed and be discharged with the concentrated seawater.

**Effluent Discharge**

A sewage treatment unit will be provided on-board the FSRU vessel for the treatment of sewage and grey water. Sewage treatment shall be via chemical or biological treatment methods. Domestic sewage from the FSRU Vessel workforce is estimated to be approximately 15m$^3$ per day and this will be treated in the sewage treatment unit. The treated effluent will be discharged into the sea via an outfall.

**Other Discharges and Drainage Systems**

The FSRU Vessel will operate an open drain system that will collect discharges and rainwater from all equipment skids and across the main deck and cargo area. Drain fluids will be collected in an oily water sump and pumped to a Corrugated Plate Interceptor (CPI) type oily water separator unit for separation. Oil and hydrocarbon liquids shall be collected and discharged into a waste collection barge for transportation to an onshore waste disposal facility.
Clean water from the separator will be monitored for oil content before being discharged.

Drainage from open areas that are not subject to hydrocarbon spills will flow back into the sea via outfalls. Should a hydrocarbon spill in these areas occur from mobile equipment fuel, oil or hydraulic hoses, spill will be cleaned will using spill clean-up supplies.

**Waste Generation**

Wastes such as lube oil, hydraulic fluid and engine coolant etc. shall be properly stored on board the FSRU Vessel to await collection by barge and transportation to an onshore waste disposal facility.

**Power Supply**

For normal operation, the FSRU Vessel will utilize boil off gas to generate the power supply for the FSRU Vessel and the Jetty, therefore emissions will be on a continuous basis.

On the Jetty, there is a diesel-fired generator to provide any back-up power that is needed, therefore it will be used intermittently so emissions will also be on an intermittent basis.

A visiting LNGC will be operated using boil off or low sulphur marine fuel oil and will be a self-contained vessel that will only be within HKSAR waters for 24 – 48 hours during LNG Unloading and Reloading operations and other that being moored at the Jetty, it will not be provided with any services from the LNG Terminal.

**Service Vessels**

In addition to tug boats to support the manoeuvring and berthing of the FSRU Vessel and a visiting LNGC, a dedicated standby vessel will be in attendance of the Terminal which will monitor the area and assist in implementing control measures in the proposed Safety Zone, in addition to providing other services such as emergency response. Other service vessels will be used to transport personnel to and from the LNG Terminal, deliver the required supplies and fuel to the FSRU Vessel, and also collect and take away materials for disposal such as waste and treated effluent.

**Maintenance Dredging of Marine Access**

Maintenance dredging may be required for the LNG Terminal about once every five years (subject to actual site conditions) to ensure continued access and maneuverability by the FSRU Vessel and LNGC.

**Subsea Pipelines**

Operation of the BPPS and LPS Pipelines will include the transportation of natural gas from the LNG Terminal to the GRSs at the BPPS and LPS. It is
envisaged that maintenance activities will include running of cleaning and inspection pigs in the pipelines, which will be scheduled and will be routine in nature. Natural gas will be used for driving of the pig during pipeline cleaning and inspection. As no water or liquid other than natural gas is involved in these processes, pipeline cleaning and inspection activities will not involve effluent discharge. Maintenance dredging is not expected to be required for the subsea pipelines.

3.5.3 *Gas Receiving Stations (GRSs)*

Operation of the GRSs will include the following aspects:

- Receipt of natural gas via subsea pipelines; and
- Send out for use by the BPPS and LPS.

The proposed GRS facilities are expected to be automated and unmanned during the operation phase. However it is expected that during the early operation phase a few personnel will work at the GRSs. The gas heaters within the new GRSs are the key air emission sources associated with the operation of the new GRSs. It is also envisaged that maintenance activities will be scheduled and will be routine in nature.

3.6 *Tentative Project Programme*

To meet the targets and drivers discussed in Section 1 there is an urgent need for alternative gas supplies, and the timely permitting and construction of the Project to bring this gas to Hong Kong is of prime importance. The planning and development stage of the Project, including the EIA Study, engineering and marine studies commenced in mid 2016. Subject to obtaining HKSAR Government approval of the Project and a final investment decision on the Project being taken, the construction works of the Project would commence in 2019, dependent on timely receipt of various regulatory approvals and statutory permits.

The preliminary construction programme is provided below in Figure 3.8. The overall construction duration is anticipated to be approximately 21 months. It is expected that construction of the LNG Terminal, pipelines and GRSs will be constructed concurrently.
Based on the preliminary construction programme as shown above, the start of commercial operation of the Project is estimated at the earliest the end of 2020.

3.7 **CONCURRENT PROJECTS**

Committed or planned projects in the five areas below may potentially interface with the construction and operation of this Project:

1. LNG Terminal that will be located in the southern waters of Hong Kong, where it will operate, and the transit route for the FSRU Vessel and a visiting LNGC is expected to be from the southern boundary of HKSAR waters to the LNG Terminal;

2. Subsea pipeline that will connect the LNG Terminal with the BPPS and hence will traverse the south-western, western and north-western waters of Hong Kong;

3. Subsea pipeline that will connect the LNG Terminal with the LPS and hence will traverse the southern waters of Hong Kong;

4. GRS that will be constructed and operated at the BPPS, within the existing power station footprint; and

5. GRS that will be constructed and operated at the LPS, within the existing power station footprint.

The committed or planned projects in the vicinity of the above areas are described in *Annex 3A*. Where sufficient information is available, the cumulative impacts from these projects, if any, are addressed in the technical assessments in this EIA Study if these projects are located within the Study Area for the respective technical aspects. Existing operations in these areas which may also interact with the construction and operation of this Project (e.g. air emissions from the BPPS, the LPS and other sources, discharges from sewerage systems, etc.) are considered in the technical assessments as baseline/background conditions as relevant and are therefore not summarised in *Annex 3A*. 
Figure 3.1
Indicative Location of Key Project Components

Legend
- Boundary of HKSAR
- Proposed GRS Location at BPPS
- Proposed GRS Location at LPS
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal
- Proposed LNG Terminal Safety Zone
Figure 3.2

Indicative Location of the Gas Receiving Station at Black Point Power Station
Figure 3.3

Indicative Location of the Gas Receiving Station at Lamma Power Station

Legend

- Proposed GRS Location at LPS
Proposed South Lantau Marine Park
Cheung Chau Sediment Disposal Area

Legend
- Boundary of HKSAR
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal
- Proposed LNG Terminal Safety Zone
- Proposed Marine Park
- Marine Vessel Fairway
- Sediment Disposal Area

Figure 3.4
Indicative Location of the LNG Terminal

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Date: 7/5/2018

Environmental Resources Management
Conceptual Layout of the LNG Terminal

Figure 3.5

Environmental Resources Management

FILE: 0359722o2.cdr
DATE: 12/03/2018
Typical Cross Sections of the Proposed Pipeline Trench Designs (1)

Type 1 Trench

Type 2 Trench

Type 3 Trench

MINIMUM REQUIREMENTS FOR RECOMMENDED ROCK COVER CONFIGURATION FOR TYPE 4 PIPELINE BURIAL DEPTH - BOP TRENCH BOTTOM WIDTH MIN. ROCK COVER THICKNESS - TOP MIN. TOP WIDTH OF ROCK COVER

- Type 1 Trench: 0.4m
- Type 2 Trench: TOP WIDTH: 18.8m
- Type 3 Trench: TOP WIDTH: 21.8m

SCALE: 1:75
**Type 4 Trench**

* Subject to detailed design. Trench top width will be increased from 2m for 6m burial depth (BOP) to 8m for 3m burial depth (BOP).

**Type 5 Trench**

* Subject to detailed design. Trench top width will be increased from 2m for 6m burial depth (BOP) to 8m for 3m burial depth (BOP).
Figure 3.7

Indicative LNG Carrier Marine Access Route

Legend
- Boundary of HKSAR
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal
- Proposed LNG Terminal Safety Zone
- Indicative Berthing Route
- Indicative Transit Route
- Marine Vessel Fairway

Depth (m)
- 0-2
- 2-5
- 5-10
- >10

Kilometres
0 1 2

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Date: 8/5/2018

Environmental Resources Management
Overview of Project Pipeline Construction Methods

Legend
- Boundary of HKSAR
- Proposed GRS Location at BPPS
- Proposed GRS Location at LPS
- Proposed Route of BPPS Pipeline
- Proposed Route of LPS Pipeline
- Proposed Site for LNG Terminal

Construction Method
- Dredging
- Jetting

Figure 3.9

Environmental Resources Management

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Date: 1/6/2018
Annex 3A

Review of Potential Concurrent Projects
3A REVIEW OF POTENTIAL CONCURRENT PROJECTS

3A.1 INTRODUCTION

Committed or planned projects in the five areas below may potentially interface with the construction and operation of this Project:

1. LNG Terminal that will be located in the southern waters of Hong Kong, where it will operate, and the transit route for LNGCs is expected to be from the southern boundary of Hong Kong waters to the LNG Terminal;

2. Subsea pipeline that will connect the LNG Terminal with the BPPS and hence will traverse the south-western, western and north-western waters of Hong Kong;

3. Subsea pipeline that will connect the LNG Terminal with the LPS and hence will traverse the southern waters of Hong Kong;

4. GRS that will be constructed and operated at the BPPS, within the existing power station footprint; and

5. GRS that will be constructed and operated at the LPS, within the existing power station footprint.

The committed or planned projects in these areas are described below. Where sufficient information is available, the cumulative impacts from these projects, if any, are addressed in the technical assessments in this EIA if these projects are located within the study area for the respective technical aspects. Existing operations in these areas which may also interact with the construction and operation of this Project (e.g. air emissions from the BPPS, LPS and other sources, discharges from sewerage systems, etc.) are considered in the technical assessments as baseline/background conditions as relevant and are therefore not summarised in this Annex.

3A.2 OVERVIEW OF CONCURRENT PROJECTS

The developments that may have the potential to interact with the construction and/or operation of this Project include:

- **Additional Gas-fired Generation Units Project (Register No.: AEIAR-197/2016):** the scope of this project involves the construction and operation of up to two 600 MW class additional gas-fired generation units at the BPPS. The construction of the project is implemented in stages commencing from the second half of 2016, with commercial operation of the first unit anticipated by the end of 2019. The implementation of the second unit remains to be confirmed.

- **West New Territories (WENT) Landfill Extensions (Register No.: AEIAR-147/2009):** this landfill extension is at least 60m away (at the nearest site
boundary) from the BPPS. It is currently under a Design and Construction Consultancy Study, but the programme remains uncertain.

- **Decommissioning of West Portion of the Middle Ash Lagoon at Tsang Tsui, Tuen Mun (Register No.: AEIAR-186/2015):** this project involves the decommissioning of the pulverized fuel ash (PFA) lagoon at the west portion of the Middle Ash Lagoon at Tsang Tsui, Tuen Mun, which was operated by CAPCO for the placement of water and PFA. The decommissioning will provide buildable land for future developments by the HKSAR Government. A columbarium has been proposed to be built at the site. The tentative decommissioning period would be from early 2016 and the construction of columbarium is targeted for completion by 2018/2019. It is about 500m away from the BPPS (at the nearest site boundary).

- **Development of the Integrated Waste Management Facilities Phase 1 (Tsang Tsui Option) (Register No.: AEIAR-163/2012):** this project is to construct and operate a modern facility for managing municipal solid waste through an advanced thermal incineration process. It comprises an incineration plant, a mechanical treatment plant, and ancillary facilities, which may be constructed at the Tsang Tsui Ash Lagoon in Nim Wan, about 600m from the BPPS (at the nearest site boundary). The construction programme at this site is yet to be confirmed.

- **Landfill Gas Power Generation Project at the West New Territories (WENT) Landfill (DIR-251/2017):** this project involves the construction of up to seven containerised landfill gas power generation units (each with a generation capacity of 2MW) in the north-western part of the existing WENT Landfill for using unutilised landfill gas from the WENT Landfill as fuel for electricity generation. The project, which is located about 1.3km from the BPPS (at the nearest site boundary), is anticipated to be implemented in phases, with construction of the first phase tentatively scheduled to commence in Q2 2017 for operation in Q3 2018.

- **Pyrolysis Plant at EcoPark (EPD Study Brief ESB-259/2013):** this project consists of four pyrolysis furnace systems, with each system having a handling capacity of 5 tonnes of waste plastics per day. It is currently under the EIA stage and the implementation timing is uncertain at this stage (although the corresponding EIA Project Profile submitted by the project proponent indicated the construction is expected to commence in 2015). It is about 5 km away from the BPPS.

- **Engineering Feasibility Study for Industrial Estate at Tuen Mun Area 38 (EPD Study Brief ESB-277/2014):** this project includes the development of an Industrial Estate with temporary loading and storage of petrochemical feedstock site and other road modification works in Tuen Mun Area 38, and involves the marine construction of a subsea sewage outfall. This project is about 5 km away from the BPPS, and its construction period is tentatively scheduled from 2019 to 2023. It is currently under EIA stage and details of this project are not publicly available at the time of preparation of this EIA.
• **Planning and Engineering Study for Tuen Mun Areas 40 and 46 and the Adjoining Areas (EPD Study Brief ESB-255/2012):** the study aims to investigate the potential for re-planning Tuen Mun Areas 40 and 46 and the adjoining areas for uses such as commercial, office and hotel uses, logistics uses, high technology, industry uses, residential use, etc. According to the latest information from the project website, the feasibility study commenced in May 2013 and is anticipated for completion in 2015; however the future development proposal is yet to be determined. It is about 5 km away from the BPPS (at the nearest site boundary).

• **Potential Reclamation Site at Lung Kwu Tan:** this site is located along the coastal waters of Lung Kwu Tan and Lung Kwu Sheung Tan, which is about 500m away from the BPPS (at the nearest site boundary) and more than 1.5km from the proposed BPPS Pipeline. With an area of about 200 – 300 ha, this proposed site would potentially be used for residential development (1). Technical study for this potential reclamation would be completed in 2017 (2), followed by a planning and engineering study, but details of its implementation are uncertain at this stage.

• **Enhanced Ash Utilisation and Water Management Facilities at Castle Peak Power Station (CPPS) (EP-441/2012):** this project involves the re-construction of the two existing water lagoons at CPPS by lowering their base slabs and the construction of a new one to increase the storage capacities of the water lagoons at CPPS. The water lagoons are used for temporary storage of storm water runoff collected from the coal stockyard and process water from the operation of the CPPS which in turn can be reused for the operation of the CPPS. The project is expected to be constructed between 2017 and 2020. It is more than 3.5km away from the BPPS Pipeline.

• **Expansion of Hong Kong International Airport into a Three-Runway System (Register No.: AEIAR-185/2014):** this project includes various marine activities that could interact with the installation of the BPPS Pipeline which is about 1km away. This includes the diversion of existing subsea utilities and land formation works. Information from the EIA and EM&A programme indicates that marine construction works would cover late 2015 through 2021. A compensatory marine park has also been proposed in the EIA. The BPPS Pipeline routing runs parallel within the western boundary of this proposed marine park, though designation is expected to be after the subsea pipeline to the BPPS has been installed.

• **Tung Chung New Town Extension (Register No. AEIAR-196/2016):** this project involves approximately 130 hectares of reclamation along the shoreline northeast of Tung Chung, about 9km from the BPPS Pipeline. Marine

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construction for reclamation would be non-dredged and marine filling would be conducted behind seawall with at least 200 m leading edge and silt curtain. Reclamation works would be undertaken from late 2017 to late 2023.

- **Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road (Register No.: AEIAR-144/2009):** this project provides the necessary linkage in the form of viaducts/bridgework between the Hong Kong-Zhuhai-Macao Bridge Main Bridge and the Hong Kong boundary crossing facilities (HKBCF). Located to the north of Lantau Island over the Airport Channel and the BPPS Pipeline route, it is currently under construction. The marine viaduct connected with the Hong Kong-Zhuhai-Macao Bridge Main Bridge is completed in January 2017 (1).

- **Tonggu Waterway:** information from the Shenzhen Port Tonggu Channel Developing Office indicates that maintenance dredging may take place annually. No updated information is available at the time of preparing this EIA Report.

- **Outlying Islands Sewerage Stage 2 - Upgrading of Tai O Sewage Collection, Treatment and Disposal Facilities (Register No. AEIAR-209/2017):** this project provides new sewers to unsewered areas in Tai O, upgrading the sewage treatment level of the existing Tai O Sewage Treatment Works (STW), expanding the STW by increasing its design capacity, and replacing the existing subsea outfall with a new subsea outfall. According to the approved EIA of this project, the marine construction of the subsea outfall, which is about 1.5km from the BPPS Pipeline (at the nearest site boundary), would be completed before 2019.

- **Southwest Lantau Marine Park (SWLMP) and South Lantau Marine Park (SLMP):** Agriculture, Fisheries and Conservation Department (AFCD) is proceeding with the statutory approvals required to designate these two proposed Marine Parks. The draft map of the proposed SWLMP was published in the Gazette on 23 June 2017 (2). Given the close proximity of the Soko Islands Marine Park (SIMP) and the compensatory marine park for the Integrated Waste Management Facilities (IWMF) Phase 1 Project in terms of their geographical location and designation timeline, it is proposed to combine them into one single marine park of approximately 2,067 hectares, to be named as the South Lantau Marine Park (SLMP). Based on information available at the time of preparing this EIA report, the proposed boundaries of SWLMP and SLMP do not overlap with the proposed locations for the LNG Terminal and the two subsea pipeline routes. With reference to Country and Marine Parks Board Working Papers (WP/CMPB/2/2017 and WP/CMPB/12/2017), the designation of SWLMP and SLMP is anticipated to come in effect in 2018 and 2019 respectively.

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• **Potential Spa and Resort Development at Soko Islands**: Civil Engineering and Development Department (CEDD) is undertaking a feasibility study on developing a spa and resort on South Soko which is over 1km from the BPPS Pipeline and over 5km from the LNG Terminal. The development itself is on land and hence does not overlap with this Project. Details of its implementation programme are uncertain at this stage. It is noted that this potential development is not mentioned in the latest Sustainable Lantau Blueprint (1) by the Development Bureau (DevB).

• **Development of the Integrated Waste Management Facilities Phase 1 (Shek Kwu Chau Option) (Register No.: AEIAR-163/2012)**: based on latest correspondence with the proponent of this project, EPD, the marine works for this project, which primarily involves the formation of about 15.9 ha of reclamation adjacent to Shek Kwu Chau (about 1.5km away from the LPS Pipeline and over 4km from the LNG Terminal) by non-dredged methods, is anticipated to commence in 2018 for completion in around 2022. Submarine cable laying works associated with the project currently do not have a confirmed programme. Also, a key requirement from the EIA was the development of a compensatory marine park of at least 700 ha. EPD is at present conducting a study on the siting and management of the compensatory marine park. Given the close proximity of the SIMP and the compensatory marine park for the Integrated Waste Management Facilities (IWMF) Phase 1 Project in terms of their geographical location and designation timeline, it is proposed to combine them into one single marine park of approximately 2,067 hectares, to be named as the South Lantau Marine Park (SLMP). Based on information available at the time of preparing this EIA report, the LNG Terminal and the two subsea pipeline routes are located outside of the proposed boundary of SLMP. As advised by the AFCD, the designation of this marine park is anticipated to come in effect in 2019.

• **Outlying Islands Sewerage Stage 2 - South Lantau Sewerage Works (Register No. AEIAR-210/2017)**: this project involves the construction and operation of a sewerage system for proper collection, treatment and disposal of the sewage arising from South Lantau. According to the approved EIA of this project, the marine construction of the subsea outfall, which is about 6.5km from the LPS Pipeline (at the nearest site boundary), would be conducted in 2018.

• **Outlying Island Sewerage Stage 2 - Upgrading of Cheung Chau Sewage Collection, Treatment and Disposal Facilities (Register No.: AEIAR-181/2013)**: this project involves the expansion and upgrade of existing sewerage facilities in Cheung Chau. Treated effluent is proposed for non-potable reuse, with remaining portion discharged via an outfall. The project is about 4.5km away from the LPS Pipeline.

• **Providing Sufficient Water Depth for Kwai Tsing Container Basin and its Approach Channel (Register No.: AEIAR-156/2010)**: this project involves the deepening

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(1) CEDD (2017) Sustainable Lantau Blueprint. 64 pp.
of seabed level at the Kwai Tsing Container Basin, the northern and western fairways to -17.5 mCD. Based on publicly available information on the project EM&A website (1), the capital dredging works under this project would be completed by 2017. Maintenance dredging under the project may be required, the nearest dredging area would be at least 4.4 km away from the LPS Pipeline route, while the majority of the dredging area would be more than 6.6 km away.

- **Additional Gas-fired Generation Units at LPS**: HK Electric has started the construction of two new gas-fired units (known as "L10" and "L11") at the Lamma Power Station Extension, which are expected to be commissioned in 2020 and 2022 respectively.

- **Improvement Dredging for Lamma Power Station Navigation Channel (EIA-251/2017)**: this Project involves improvement dredging of the Lamma Power Station Navigation Channel adjacent to the LPS to meet the requirements for continued safe passage and berthing of associated vessels. According to the EIA submitted for public inspection, the proposed maintenance dredging work involves deepening the existing Channel to -16.5 mPD, with the first maintenance dredging scheduled to commence in 2019 and last for 12 to 18 months.

- **Development of a 100MW Offshore Wind Farm in Hong Kong (Register No.: AEIAR-152/2010)**: HK Electric propose to develop an offshore wind farm in the waters between Lamma Island and Cheung Chau lying adjacent to the Southwest Lamma Channel, at approximately 4 km southwest of the LPS. The subsea pipeline to the LPS will not overlap with the infrastructure of the wind farm. Details of its implementation programme are uncertain at this stage.

- **Planning and Engineering Study on Future Land Use at Ex-Lamma Quarry Area at Sok Kwu Wan, Lamma Island (EPD Study Brief ESB-270/2014)**: The Project comprises tourist and recreational facilities and housing developments accompanied by supporting infrastructure at the Ex-Lamma Quarry Area at Sok Kwu Wan, Lamma Island, which is about 3 km from the LPS. Details of its implementation programme are uncertain at this stage.

- **Potential Reclamation Sites at Siu Ho Wan and Sunny Bay, and Artificial Islands Southeast of Lantau Island**: As part of the Sustainable Lantau Blueprint and the Enhancing Land Supply Strategy studies, CEDD is investigating the feasibility of enhancing the long-term land supply through, amongst a number of options, reclamation outside the Victoria Harbour. Nearshore reclamation sites, namely Siu Ho Wan and Sunny Bay, artificial islands potentially in the central waters southeast of Lantau Island, are being considered. Details of the implementation programmes of these sites are uncertain at this stage.

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(1) Project EM&A Website available at http://www.ktd-monitoring.com/
- **New Contaminated Mud Marine Disposal Facility at Airport East / East Sha Chau Area (AEIAR-089/2005):** This project involves the construction, backfilling and capping of the contaminated mud marine disposal facility at East Sha Chau Area, which is around 7 km away from proposed BPPS pipeline alignment. Based on the approved EIA, a number of mud pits (namely pit Va, Vb, Vc and Vd), were proposed to be dredged, backfilled and then capped consequentially to fulfil the demand for marine sediment disposal. Pit Vd is currently in operation in 2017 and it is expected that disposal at Pit Vd will be ended in 2019; subsequently Vb then Vc will be utilised. The marine works under this project are taken into account as appropriate in the construction phase sediment plume modelling exercise under this EIA Study according to the modelled maximum production rates.

- **Open Sea Disposal Area for Uncontaminated Sediment at South Cheung Chau:** This open sea disposal area covers a large swath of waters south of Cheung Chau and Shek Kwu Chau east of Soko Islands and the Project Site. This open sea disposal area receives uncontaminated sediment from various projects and is operated on an as-needed basis by CEDD. Forecasts for operations in 2019 from CEDD for disposal activities under this project have been taken into account as appropriate in the construction phase sediment plume modelling exercise under this EIA Study.