Environmental and Social Impact Assessment Report (ESIA) – Part 1

Project Number: 51112-001
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INO: Jawa-1 LNG to Power Project

Prepared by ERM for PT Jawa Satu Power (JSP)

PLTGU Jawa 1 Independent Power Project

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA):

Prepared for: PT Jawa Satu Power (JSP)

5th August 2018

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LIST OF ABBREVIATIONS

°C	Degrees Celsius
%	Percentage
>	Greater Than
<	Less Than
≥	Greater Than or Equal To
≤	Less Than or Equal To
µT	Micro Tesla
µPa	Micro Pascal
2D	Two-dimensional
3D	Three-dimensional
3R	Reduce, Reuse, Recycle
A.C.	Alternating Current
ACB	ASEAN Centre for Biodiversity
ACI	American Concrete Institute
ADB	Asian Development Bank
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AIS	Air Insulated Switchgear
ALARP	As Low As Reasonably Practicable
AMBI	AZTI Marine Biotic Index
AMDAL	*Analisis Mengenai Dampak Lingkungan Hidup* (Indonesian Environmental Impact Assessment)
ANDAL	*Analisis Dampak Lingkungan Hidup* (Environmental Impact Analysis)
AoI	Area of Influence
AQS	Air Quality Standards
ARPA	Automatic Radar Plotting Aid
ASEAN	Association of Southeast Asian Nations
ASTM	American Society for Testing and Materials
AVO	Amps–Volts–Ohms meter
BAP	Biodiversity Action Plan
BAPEDAL	*Badan Pengendalian Dampak Lingkungan* (Environmental Impact Controlling Agency)
BAPPEDA	*Badan Perencanaan Pembangunan Daerah* (Development Planning Agency at Sub-National Level)
BAT	Best Available Technology
bgs	Below Ground Surface

BKKBN	*Badan Kependudukan dan Keluarga Berencana Nasional* (National Population and Family Planning Board)
BKPM	*Badan Koordinasi Penanaman Modal* (Indonesia Investment Coordinating Board)
BL/PL	Code for Existing Pipeline area from CCGT to shoreline
BMKG	*Badan Meteorologi, Klimatologi, dan Geofisika* (Meteorological, Climatology, and Geophysical Agency)
bn	Billion
BOD	Biological Oxygen Demand
BOG	Boil Off Gas
BP	British Petroleum
BPI	*Berita Pelaut Indonesia* (Notice To Mariners)
BPPKB	*Badan Pembinaan Potensi Keluarga Besar Banten* (Banten Extended Family Potential Development Agency)
BPN	*Badan Pertanahan Nasional* (Indonesian Land Agency)
BPS	*Biro Pusat Statistik* (Statistical Centre Bureau)
BS	British Standards
BSDG	Black Start Diesel Generators
BUMDES	*Badan Usaha Milik Desa* (Village-Owned Enterprise)
BWRO	Brine Water Reverse Osmosis
CBR	California Bearing Ratio
CBO	Community-Based Organisation
CCGT	Combined Cycle Gas Turbine
CCCW	Closed Cycle Cooling Water
CD	Communicable Disease
CEB	Control and Electrical Building
CEMS	Continuous Emission Monitoring System
CFC	Chlorofluorocarbon
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CNN	Cable News Network
CNMP	Construction Noise Management Plan
CO	Carbon monoxide
COD	Chemical Oxygen Demand
COD	Commercial Operation Date
COLREGS	The International Regulations for Preventing Collisions at Sea
COMP	Compartment
CPI	Corrugated Plate Interceptor
CR	Critically Endangered

CSR	Corporate Social Responsibility
CT	Combustion Turbine
DA	Data Available
DAF	Dissolved Air Flotation
dB	Decibels
dBA	Decibels (Acoustics)
D.C.	Direct Current
DD	Data Deficient
DD	Detailed Design
DTM	Digital Elevation Model
Dia.	Diameter
DIN	Deutsches Institut für Normung
DKI	*Daerah Khusus Ibukota* (Capital Special Region)
DLHK	*Dinas Lingkungan Hidup dan Kebersihan* (Environmental and Sanitary Agency)
DMRB	UK Highway Agency Design Manual for Roads and Bridges
DMU	Discrete Management Unit
DNV	Det Norske Veritas
DO	Dissolved Oxygen
DTM	Digital Terrestrial Model
EBA	Endemic Bird Area
EDI	Electro deionisation
EEZ	Exclusive Economic Zone
e.g.	Example Given
EMF	Electromagnetic Force
EN	Endangered
ESD	Emergency Shutdown
etc.	Et Cetera
EHS	Environment, Health and Safety
EHS&S	Environment, Health, Safety and Social
EHV	Extra High Voltage
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
ENSO	El Niño Southern Oscillation
EP	Equator Principles
EPA	Environmental Protection Agency (US)
EPC	Engineering, Procurement and Construction
EPFI	Equator Principles Financing Institution

ERM	Environmental Resources Management
ERP	Emergency Response Plan
ERS	Emergency Release System
ESD	Emergency Shutdown System
ESHIA	Environmental, Social and Health Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EU	European Union
F	Total Fluorides
FAO	Food and Agricultural Organisation
FEED	Front End Engineering and Design
FGD	Focus Group Discussion
FI	Financial Intermediary
FSRU	Floating Storage and Regasification Unit
g	gram
GC	Gas Chromatography
GDP	Gross Domestic Product
GE	General Electric
GEN	Generator
GHG	Greenhouse Gas
GIS	Gas Insulated Switchgear
GISD	Global Invasive Species Database
GM	Grievance Mechanism
GMBI	*Gerakan Masyarakat Bawah Indonesia* (Indonesian Low Class Community Movement)
GN	Guidance Note
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
GSF	Gas Supply Facilities
GT	Gas (or Combustion) Turbine
GTG	Gas Turbine Generator
GTRM	Grievance Tracking Redress Mechanism
H_2	Hydrogen gas
H&S	Health and Safety
ha	Hectares
HAT	Highest Astronomical Tide
HAZOP	Hazard and Operability Study
HC	Hydrocarbon

HDPE	High Density Polyethylene
HDV	Heavy-Duty Vehicle
HEC-HMS	Hydrologic Engineering Center-Hydrologic Modelling System
HGV	Heavy-Good Vehicle
HH	Household
HIV	Human Immunodeficiency Virus
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
HP	High Pressure Turbine
hr	Hour
HRH	Hot Reheat
HRSG	Heat Recovery Steam Generator
HSE	Health, Safety and Environment
HSSE & SP	Health, Safety, Security, the Environment and Social Performance
HV	High Voltage
Hz	Hertz
IA	Impact Assessment
IAQM	Institute of Air Quality Management
IBAT	Integrated Biodiversity Assessment Tool
IDF	Intensity-duration-frequency
IDR	Indonesian Rupiah
i.e.	That is
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IFC EHS	International Finance Corporation's Environmental Health and Safety
IFC PS	International Finance Corporation Performance Standards
IFPRI	International Food Policy Research Institute
IKAPUD	*Ikatan Putra Daerah* (Native Youth League)
ILO	International Labour Organisation
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organisation
IMS	Invasive Marine Species
INIRC	International Non-Ionising Radiation Committee
INPEX	INPEX Holdings Inc.
ISO	International Organisation for Standardisation
IP	Intermediate Pressure
IP	Indigenous Peoples
IPFC	Indo-Pacific Fisheries Commission

IPP	Indigenous Peoples Plan
IPP	Independent Power Project
ISPA	*Infeksi Saluran Pernafasan Akut* (Acute Respiratory Tract Infection)
IUCN	International Union for Conservation of Nature
JBIC	Japan Bank for International Corporation
JNCC	Joint Nature Conservation Committee
JSP	PT. Jawa Satu Power
JSR	PT. Jawa Satu Regas
KA ANDAL	*Kerangka Acuan Analisis Dampak Lingkungan Hidup* (Terms of Reference or Environmental Impact Assessment)
Kanwil	*Kantor Wilayah* (Regional Office)
KBA	Key Biodiversity Area
kg	Kilogram
kgal	Kilo gallon
kg/capita/day	Kilogram Per Capita Per Day
kg/year	Kilogram Per Year
kHz	Kilohertz
km	Kilometre
km²	Square Kilometre
kPa	Kilo Pascal
KPS	*Keluarga Pra Sejahtera* (Pre-Prosperous Family)
KS	*Keluarga Sejahtera* (Prosperous Family)
KUD	*Koperasi Unit Desa* (Village Unit Cooperative)
kV	Kilovolt
kVA	Kilovolt-ampere
kW	Kilowatt
kWh	Kilowatt-hour
L	Litres
lb	*Libra* (Pound weight)
LAeq	Equivalent Sound Level
Leq	Equivalent Continuous Noise Level
LAT	Lowest Astronomical Tide
LC	Least Concern
LCI	Life Cycle Inventory
LCT	Landing Craft Tank
LFP	Land Fall Point
LNG	Liquefied Natural Gas
LNTP	Limited Notification to Proceed

LP	Low Pressure Turbine
Lm	Night equivalent noise level
Ls	Day equivalent noise level
LV	Low Voltage
LW	Sound power level
m	Metre
mg/kg	Milligrams Per Kilogram
mg/l	Milligrams Per Litre
ml	Millilitre
mm	Millimetre
m^2	Square Metre
m^3	Cubic Metre
m/s	Metre Per Second
mm/year	Millimetre Per Year
mmscfd	Million Standard Cubic Feet per Day
MAE	Major Accident Event
MARPOL	International Convention for the Prevention of Pollution from Ships (Marine Pollution)
MCC	Main Combustion Chamber
MCW	Main Cooling Water
MHHW	Mean Higher High Water
MHLW	Mean Higher Low Water
MLHW	Mean Lower High Water
MLLW	Mean Lower Low Water
MMBTU	One Million British Thermal Unit
MMO	Marine Mammal Observer
MDO	Marine Diesel Oil
MGO	Marine Gas Oil
MoEF	Ministry of Environment and Forestry
MPN	Most Probable Number
MSDS	Material Safety Data Sheet
MSL	Mean Sea Level
mT	Milli Tesla
MT	Metric Tonnes
MV	Medium Voltage
MW	Megawatt
MWe	Megawatts Electric
nT	Nano Tesla

N/A	Not Applicable
NA	Not Assessed
NaCl	Salt (Sodium Chloride)
NaOCl	Sodium Hypochlorite
NCD	Non-Communicable Disease
NDA	No Data Available
NDE	Non Destructive Examination
NDT	Non Destructive Testing
NEA	National Environment Agency
NEXI	Nippon Export and Investment Insurance
NE (IUCN)	Not Evaluated
NFPA	National Fire Protection Association
NGO	Non-Governmental Organisation
NJOP	*Nilai Jual Objek Pajak* (Taxable Value of Property)
NMFS	National Marine Fisheries Service
No.	Number
NO_2	Nitrogen dioxide
NO_3-N	Nitrate
NOx	Oxides of nitrogen
NRL	Naval Research Laboratory
NT	Near Threatened
NTFP	Non-Timber Forest Products
NTM	Notice to Mariner
NTP	Notice To Proceed
O_3	Ozone or Oxidant
O&G	Oil and Gas
OECD	The Organisation for Economic Co-operation and Development
ODF	Open Defection Free
ORF	Onshore Receiving Facility
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OSRP	Oil Spill Response Plan
OSV	Offshore Support Vessel
OT	Once Through
PAM	Passive Acoustic Monitoring
PAH	Polycyclic Aromatic Hydrocarbon
PC	Process Contribution
PCB	Polychlorinated biphenyls

PDAM	*Perusahaan Daerah Air Minum* (State Water Service Company)
PE	Polyurethane
PEC	Predicted Environmental Concentration
PEL	Probable Effect Level
PELNI	*Pelayaran Nasional Indonesia* (Indonesian National Shipping Company)
Pertagas	PT Pertamina Gas (a subsidiary company of Pertamina)
pH	Potential of Hydrogen
PHE ONWJ	Pertamina Hulu Energi Offshore North West Java
PLN	*Perusahaan Listrik Negara* (State-Owned Electricity Company)
PLTGU	*Pembangkit Listrik Tenaga Gas dan Uap* (Combined Cycle Gas and steam Turbine)
PM	Particulate Matter
PM_{10}	Particulate matter less than 10 µm
$PM_{2.5}$	Particulate matter less than 2.5 µm
POP	Persistent Organic Pollutant
PPA	Power Purchase Agreement
ppm	Parts Per Million
ppt	Parts Per Trillion
PP	*Pemuda Pancasila* (Pancasila Youth)
PP	*Peraturan Pemerintah* (Government Regulation)
PR	People's Republic (of China)
PS	Performance Standard
PSD	Particle Size Distribution
PT	*Perseroan Terbatas* (Limited Company)
PTS	Permanent Threshold Shift
PUPR	*Pekerjaan Umum dan Perumahan Rakyat* (Public Works, Human Settlements and Spatial Planning
Q1	First Quarter
Q2	Second Quarter
QRA	Quantitative Risk Assessment
RAM	Risk Assessment Matrix
REWS	Radar Early Warning System
RMAE	Relative Mean Absolute Error
RKL	*Rencana Pengelolaan Lingkungan Hidup* (Environmental Management Plan)
rms	Root Mean Square
RO	Reverse Osmosis
ROW	Right-of-Way

RP	Resettlement Plant
RPJPD	*Rencana Pembangunan Jangka Pendek Daerah* (Short term Regional Development Plan)
RPL	*Rencana Pemantauan Lingkungan Hidup* (Environmental Monitoring Plan)
s	Second
sec	Second
SCS	Soil Conservation System
SEL	Sound Exposure Level
SEP	Stakeholder Engagement Plan
SEZ	Special Economic Zone
SFC	Static Frequency Converter
SIL	Safety Integrity Level
SKG	*Sistem Kompresi Gas* (Gas Compression Station)
SLB	Shallow Laying Barge
SNI	*Standar Nasional Indonesia* (Indonesian National Standards)
SLM	Sound Level Meter
SO_2	Sulphur dioxide
SOLAS	Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
SPAM	*Sistem Penyediaan Air Minum* (Drinking Water Supply System)
sp.	species
SPL	Sound Pressure Level
SPMT	Self-Propelled Modular Transporter
SPR	School Participation Rate
SPS	Safeguard Policy Statement
SPT	Standard Penetration Test
SR	Safeguard Requirement
SSS	Synchronous Self Shifting
ST	Steam Turbine
STI	Sexually Transmitted Infection
SV	Space Vehicle
SW	Southwest
SWRO	Seawater Reverse Osmosis
t	Ton
TB	Tuberculosis
TDS	Total Dissolved Solid
THPS	Tetrakis(Hydroxymethyl) Phosphonium Sulfate
TOM	Total Organic Matter

TOR	Terms of Reference
TP	Totally Protected
TPA	*Tempat Pembuangan Akhir* (Landfill)
TPH	Total Petroleum Hydrocarbon
trn	Trillion
TSP	Total Suspended Particulate
TSS	Total Suspended Solid
TTS	Temporary Threshold Shift
UK	United Kingdom
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCLOS	The United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Program
UNESCO	The United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
USAEC	United States Army Corps of Engineers
USD	United States Dollar Currency
USEPA	United States Environmental Protection Agency
V	Volt
VCE	Vapour Cloud Explosion
VEC	Valued Environmental and Social Components
VES	Visual Encounter Survey
VOCs	Volatile Organic Compounds
VTS	Vessel Traffic Surveillance System
VU	Vulnerable
WALHI	*Yayasan Wahana Lingkungan Hidup* (Indonesian Environmental NGO)
WBG	World Bank Group
WHO	World Health Organisation
WMP	Waste Management Plan
WRI	World Resources Institute
WT	Wall Thickness
WWTP	Wastewater Treatment Plant
ZEEI	*Zona Ekonomi Ekslusif Indonesia* (Indonesian Exclusive Economic Zone)
ZVI	Zones of Visual Influence

ES.1 Introduction

The PLTGU Jawa-1 Project (the "Project") involves the development of a Combined Cycle Gas Turbine (CCGT) Power Plant, a Liquefied Natural Gas (LNG) Floating Storage and Regasification Unit (FSRU) and a 500kV power transmission lines and a Substation. These Project elements will be developed within the Karawang, Bekasi and Subang Regencies of West Java, Indonesia. The construction of this Project is expected to commence in late 2018 with operation of the 1,760 MW CCGT Power Plant expected to commence in 2021.

PT Pertamina (Persero), Sojitz Corporation and Marubeni Corporation (together, the "Sponsors") have concluded an agreement to develop the Project via a Project company named PT. Jawa Satu Power (JSP)[1]. Sponsors have commissioned three (3) main contractors, namely the Engineering Procurement and Construction (EPC) Consortium composed of General Electric (GE) Power, Samsung C&T Corporation and PT Meindo Elang Indah (Meindo). The EPCs will form an EPC Consortium, led by GE Power.

The Sponsors are seeking financial investment from a number of international "Lenders" i.e. a consortium of financial institutions comprising the Japan Bank for International Corporation (JBIC), Nippon Export and Investment Insurance (NEXI), the Asian Development Bank (ADB) as well as a group of Equator Principles Financing Institutions (EPFIs) led by Société Générale. As such, the Project is required to comply with the applicable bank's environmental, social and community health policies, developed for managing the environmental and social risks. In meeting the applicable international standards to appropriately manage the project's impacts; largely through the development of an Environmental and Social Impact Assessment (ESIA) Report.

The Sponsors have commissioned PT. ERM Indonesia (ERM) to assist them in meeting these applicable standards to appropriately manage the Project's impacts; largely through the development of an Environmental and Social Impact Assessment (ESIA) document. The objectives of this ESIA are:

- To identify, describe and assess all direct/indirect/induced potential environmental, social and community health impacts on the sensitive receptors associated with the Project activities through a risk-based assessment process; and
- To identify at a strategic level measures to avoid, minimise, reduce or compensate for potential adverse environmental and social effects, and to optimise potential positive effects.

[1] PT Jawa Satu Regas will be established amongst the IPP Sponsors and the shipping company.

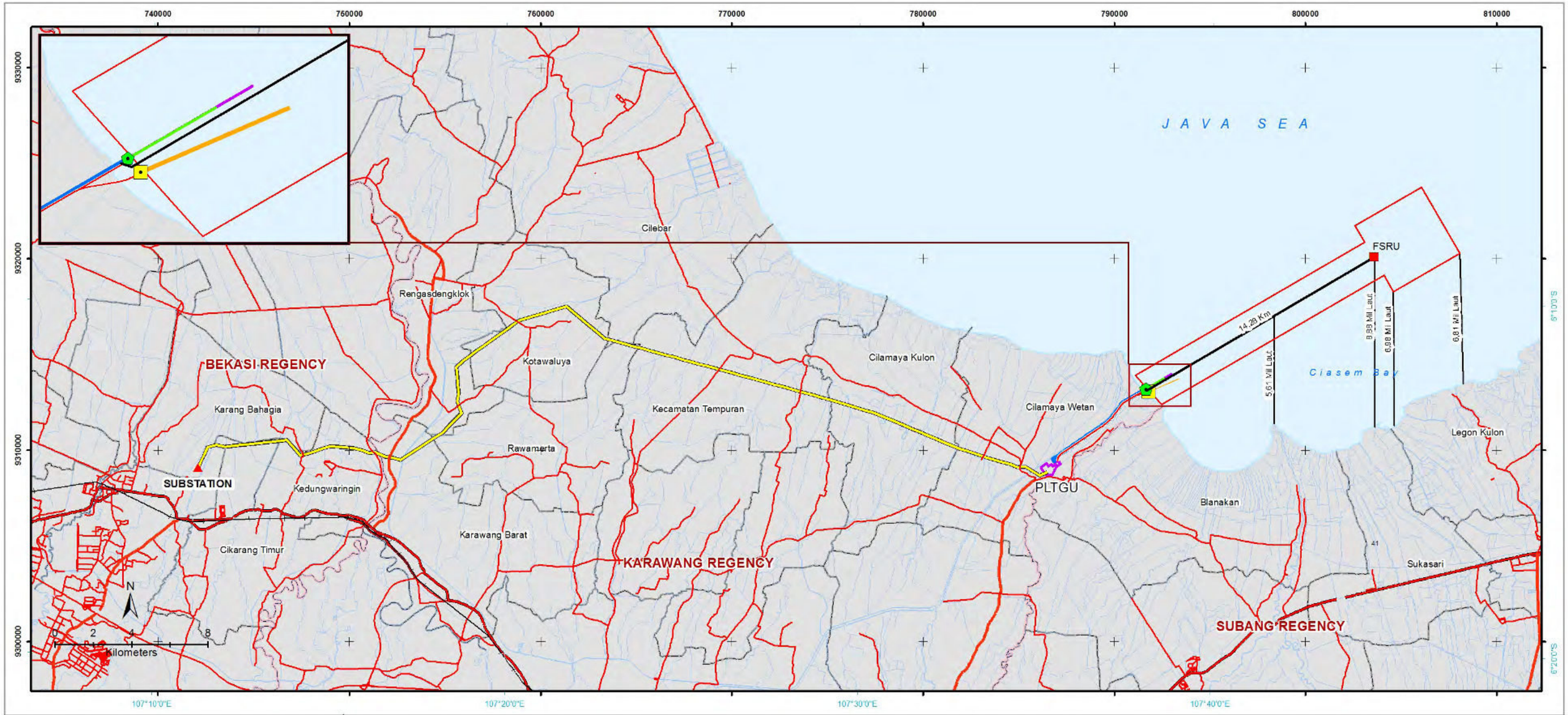
The outcomes of this assessment will be taken into account in JSP and its EPCs' decision-making, engineering design, to identify and manage appropriate mitigation measures and subsequently to incorporate the proposed measures into the implementation process during pre-construction, construction and operations. The ESIA process also includes a range of community consultation and disclosure activities (presented in the Stakeholder Engagement Plan [SEP]) to ensure community perceptions concerns and expectations are factored into the process and that Project information is shared and discussed with the impacted communities.

ES.2 Project Description

The Project is located within the Karawang and Bekasi Regencies of West Java, Indonesia, approximately 108 km east of Jakarta. Administratively, the Project is located within Subang, Bekasi and Karawang Regencies. The Project includes the following main components:

- Installation and operation of an FSRU;
- Construction and operation of seawater intake and seawater discharge pipelines;
- Construction and operation of an onshore gas receiving facility (ORF);
- Construction and operational emergency jetty;
- Gas supply pipelines i.e. 14 km offshore pipeline and seven (7) km onshore pipeline;
- 1,760 MW CCGT power plant;
- A 52 km 500 kV transmission line; and
- An electricity substation in Sukatani, Bekasi.

The FSRU will be located and moored offshore of Ciasem Bay within the Subang Regency at a distance of approximately of eight (8) km off the north Ciasem Bay coast.. The Power Plant is located in the administrative area of Cilamaya Village, Cilamaya Wetan District, Karawang Regency. The 500 kV transmission line then traverses Karawang Regency for a distance of 52 km before joining the Cibatu Baru II /Sukatani Extra High Voltage (EHV) Substation in Sukatani, Bekasi Regency. **Figure ES 1** illustrates the overview plan of Project location.



LEGEND

- TOL Road
- Arterial Road
- Collector Road
- Local Road
- River/Irigation
- Villlage Boundary
- Distict Boundary
- Regency Boundary

Project Plan

- FSRU Loaction
- Jetty Location
- Pump Station
- Offshore Gas Pipeline from FSRU
- Outflow Pipeline
- Intake Pipeline
- Dredging Plan for Jetty Access
- Onshore Pipeline (Gas, Intake, and Outflow)
- Access Road to Pump Station and Jetty
- Transmission Line
- CCGT Power Plant
- FSRU Permite Zone

Source:
- ESRI Online Imagery, 2017
- Jawa Satu Power, 2017
- Administgration Map of Bekasi Regency, Government ofBekasi Regency 2011
- Indonesia Topographical Map Sheet1209-631 Cilamaya, First Edition, 1990
- Indonesia Topographical Map Sheet1209-542 Purwajaya, First Edition, 1990
- Indonesia Topographical Map Sheet1209-541 Rengasdengklok First Edition, 1999
- Indonesia Topographical Map Sheet1209-532 Sukatani, First Edition, 2001
- Indonesia Topographical Map Sheet1209-514 Cikarang, First Edition, 2000
- Indonesia Topographical Map Sheet209-523 Karawang,First Edition,1999
- Indonesia Topographical Map Sheet1209-524 Lemahabang, First Edition, 1999
- Indonesia Topographical Map Sheet1209-613 Jatisari, First Edition,1999

JAWA SATU POWER

Development of Integrated 1760 MW Gas and Steam Powerplan, Transmissionline, Floating Facilities, and Regasification Unit

PROJECT LOCATION

ERM

Drawn By :	IA	Client :	Jawa Satu Power
Checked By :	AD	Date :	06/11/2017
Revision :		Map Number :	

ES.3 Administrative Framework

There are two (2) levels of regulatory provisions applicable to the Project. The first is the Indonesian assessment and approvals process. The second is the international environment and social standards of the lending consortium. Therefore, the administrative framework that applies to the Project comprises Indonesian and international legislation, company-specific policies, and guidelines.

ES.3.1 Indonesian Regulation

The regulatory structure in Indonesia is based on a tiered system, which is beneficial in prioritising the regulatory obligations and in understanding the regulatory implementation and enforcement. Compliance with the full range of these regulatory provisions, including key permitting and approvals requirements are fundamental requirements of any project within Indonesia.

The *Environmental Management and Protection Law No. 32 of 2009* is the main environmental law covering important environmental issues, which includes the Environment Impact Assessment (*Analisis Mengenai Dampak Lingkungan* or AMDAL), Environmental Management/ Monitoring Effort (known as *Rencana Pengelolaan Lingkungan/ Rencana Pemantauan Lingkungan* or RKL-RPL), environmental permitting, and environmental audits.

Additionally, a spatial plan details what development/industry may occur in established areas. Karawang Regency is currently in the process of revising the spatial plan. While this process was occurring, Sponsors submitted a request to the *Minister of Agrarian and Spatial/Head of the National Land Agency in 2017* to have the spatial plan reflect the proposed development.

A recommendation on Spatial Aspect of Development Plan of Java-1 CCGT 1,760 MW, Transmission Line 500 kV, and Gas Pipeline FSRU (Floating Storage Regasification units) in the Karawang Regency as well as Transmission Line 500 kV and Substation in Bekasi Regency was approved via the recommendation on *Spatial Aspects Number 3272/11.3/VIII/2017*. This confirms the planning suitability of the Project.

ES.3.2 International Lender Environment and Social Standards

The International Environmental and Social frameworks and standards, which are applicable to this ESIA, are summarised in **Table ES.1**.

Table ES.0.1 Applicable International Lender Standards

Items
Equator Principle, 2013
Asian Development Bank Safeguard Policy Statement, 2009
International Finance Corporation Performance Standards, 2012
Japan Bank for International Co-operation
Nippon Export and Investment Insurance

ES.3.3 International Treaties and Agreements

Indonesia is a signatory to a variety of environmental treaties and agreements, which contain commitments to safeguard the environment, as detailed in **Table ES.2.**

Table ES.0.2 Applicable International Treaties and Agreements

Items
Biodiversity and Environmental
• *Convention on Wetlands of International Importance (Ramsar Convention, 1971)* • *Convention on the Protection of the World Cultural and Natural Heritage* • *Convention on International Trade of Wild Fauna and Flora Endangered Species* • *Convention on Biological Diversity* • *United Nations Framework Convention on Climate Change – UNFCCC – as Non-annex party and the Paris climate accord within the United Nations Framework Convention on Climate Change* • *Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia*
Marine Resource Management and Protection
• *Agreement for the establishment of the Asia-Pacific Fishery Commission* • *Convention on Fishing and Conservation of the Living Resources of the High Seas* • *United Nations Convention on the Law of the Sea (UNCLOS III)* • *Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks*
Marine Pollution
• *International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78).* • *Montreal Protocol on Substances that Deplete the Ozone Layer* • *Basel Convention on the control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention)*
Chemicals and Wastes
• *Stockholm Convention on Persistent Organic Pollutants* • *Vienna Convention on the Protection of the Ozone Layer (1985) and related Montreal Protocol on Substances that Deplete the Ozone Layer*

Importantly Indonesia has ratified a number of International Labour Organisation (ILO) treaties and the key ones including:

- *Forced Labour Convention, 1930 (No. 29);*
- *Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87);*
- *Right to Organise and Collective Bargaining Convention, 1949 (No. 98);*
- *Equal Remuneration Convention, 1951 (No. 100);*
- *Abolition of Forced Labour Convention, 1957 (No. 105);*
- *Discrimination (Employment and Occupation) Convention, 1958 (No. 111); Minimum Age Convention, 1973 (No. 138);* and
- *Worst Forms of Child Labour Convention, 1999 (No. 182).*

Other important United Nations (UN) treaties include:

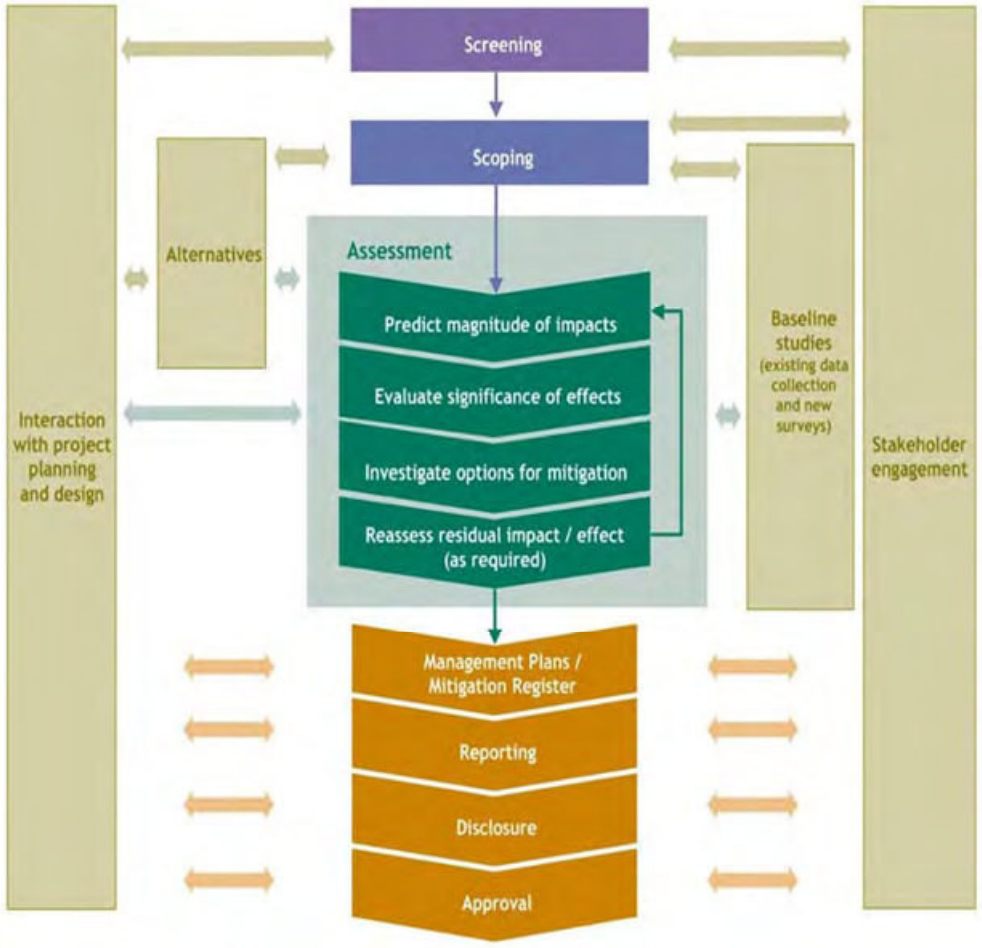
- *Convention against Torture and Other Cruel Inhuman or Degrading Treatment or Punishment ratified on 28 October 1988;*

- *International Covenant on Civil and Political Rights ratified on 23 February 2006;*
- *Convention on the Elimination of All Forms of Discrimination against Women ratified on 13 September 1984;*
- *Convention on the Elimination of All Forms of Discrimination ratified on 25 June 1999;* and
- *CESCR International Covenant on Economic, Social and Cultural Rights ratified on 23rd February 2006.*

ES.4 ESIA Approach and Methodology

The ESIA is undertaken following a systematic process that predicts and evaluates the impacts the Project could have on aspects of the physical, biological, social/ socio- economic and cultural environment, and identifies measures that the Project will take to avoid, reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The methodology follows the approach illustrated in **Figure ES.2**.

Figure ES.2 ESIA Process



Source: ERM, 2015

The criteria for assessing the significance of impacts have been drawn, where available, from the applicable legislation and standards. It takes into account

issues specifically associated with construction and operation of the Project and to present impact identification and evaluation mechanism which is specific to the development type, thereby allowing for much more focused and refined assessment.

ES.5 Stakeholder Engagement

Stakeholder engagement is the process of communicating with and seeking feedback from stakeholders. This helps to ensure that stakeholder interests are taken into consideration in the decision-making process. It typically forms an integral part of an organisation's approach to business, including the development and implementation of projects and activities.

A Stakeholder Engagement Plan (SEP) was prepared to document the methods and process by which its stakeholders and other interested parties are consulted in relation to the proposed Project. It was developed based on the following guidelines in terms of stakeholder engagement and disclosure:

- *International Finance Corporation (IFC) – Stakeholder Engagement; A Good Practice Handbook for Companies Doing Business in Emerging Market*s;
- *Asian Development Bank (ADB, 2006 - Strengthening Participation for Development Results: A Staff Guide to Participation and Development*; and
- *World Bank EHS Guidelines for Electric Power Transmission and Distribution, 2007*.

Considering the stakeholders' interest, influence or power and perception in relation to the Project and whether they are a party who will be affected or who will be affecting the Project. **Table ES.*0.3*** summarises the key Project stakeholders based on their group:

Table ES.0.3 Key Project Stakeholders

Group	Stakeholders
Central Government	Ministry of Environmental and Forestry
Provincial / Regencies Government	• Environmental Agency (DLHK) of Karawang Regency; • Bekasi dan Karawang Energy and Mineral Resources Agency; • Kanwil BPN (National land Agency in Jawa Barat Province; • Development Planning Agency at Sub-National Level (BAPPEDA); • Department of Industry and Commerce; • Department of Spatial Planning; • Directorate of Sea Spatial Planning; and • Directorate General of Sea Spatial Management.
Sub-District / Local Government	Head of Districts of: • Cilamaya Wetan; • Tempuran; • Cilamaya Kulon; • Cilebar; • Kutawaluya; • Rawamerta; • Rengasdengklok; • Karawang Barat; • Kedung Waringin; • Cikarang Timur; and • Karang Bahagia
Law Enforcement Agency	District Sector Police and District Military Command of: • Cilamaya Wetan; • Cilamaya Kulon; • Tempuran; • Pedes; • Rawamerta • Kedungwaringin; • Cikarang Timur; and • Karang Bahagia
Host Communities	• Community of Cilamaya village; and • Communities residing along the transmission line and substation and coastal areas.
Traditional Institutions	Community Leaders of Sub-Districts of: • Cilamaya Wetan; • Cilamaya Kulon; • Tempuran; • Pedes; • Rawamerta • Kedungwaringin; • Cikarang Timur; and • Karang Bahagia
Landowners	Landowners impacted by the development of the following Project's component: • 500 KV High Voltage Transmission Line and Substation in Cibatu Baru II/Sukatani; • Access road; • Project's Jetty; and • Onshore pipeline.
Fishermen Groups	• Fishermen of Muara Village; and • Fishermen of Blanakan Village

Group	Stakeholders
National Level Non-Governmental Organisations	• Yayasan Wahana Lingkungan Hidup (WALHI)
Local Level Non-Governmental Organisation	• *Karang Taruna* (Local Youth Organisation); • *Gerakan Masyarakat Bawah Indonesia* (GMBI); • *Badan Pembinaan Potensi Keluarga Besar Banten* (BPKB); • *Ikatan Putra Daerah* (IKAPUD); and • *Pemuda Pancasila* (PP).
Former cultivators of Pertagas land	• Farmers and local residents who conducted farming activities on Pertagas land that will be used for powerplant development.
Vulnerable Group	• Vulnerable affected households (identified in the RP) due to Project land acquisition (elderly, female headed households with low income and those whose income is below the minimum wage of the Regency) etc; • Female Craftsmen; and • Owners of stalls located around the Project area in Cilamaya village.
Local Small Medium Enterprises Group	• Local Entrepreneurs from Cilamaya Wetan and Manggung Jaya Village
Private and Public Users of the Marine Environment	• Existing users of the transportation routes such as oil and gas companies, shipping companies, port authorities and commercial fishing operators.
General Public	• A broad range of people largely those residing outside the Project area. Interests may be related to employment, environmental protection, etc.

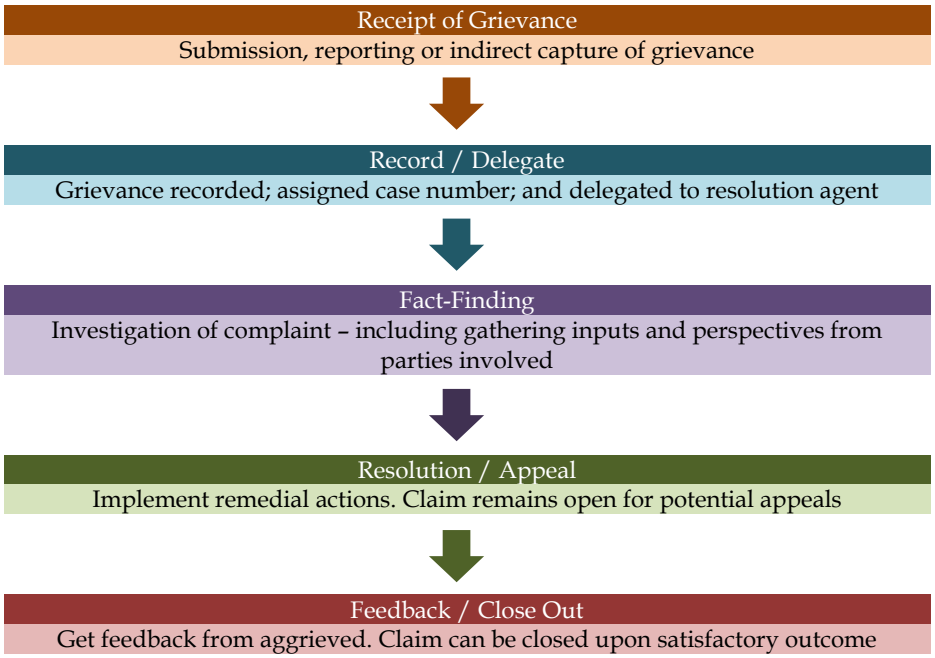
Stakeholder identification and engagement also seeks to identify any potentially vulnerable or disadvantaged individuals and groups in local communities which include the followings:

- Skewer Maker Female Group;
- Owners of Kiosks Next to the CCGT Plant; and
- Communities Residing within the Protected Forest.

The SEP document also outlines the Grievance Mechanism (GM), which should be adopted and implemented by JSP, the EPC and other subcontractors. The GM provides a process by which stakeholders and/or interested parties can raise their complaints, concerns and observations and for the Project to address genuine items in a timely and agreeable manner.

The grievance process designed for the Project is characterised by five basic steps and activities, which are easy to follow and understand as illustrated in **Figure ES.3.**

Figure ES.3 Grievance Tracking Redress Mechanism



A number of consultation activities during the project planning phase were conducted, largely with various government agencies as well as communities in the vicinity of the Project facilities. This consultation will continue throughout the project development.

ES.5 Environmental and Social Baseline

The environmental baseline conditions within the Project Study Area were based on primary data collected during survey and monitoring activities conducted on July 2017 – January 2018 as well as secondary data from published sources collected to fill data gaps.

Information from the baseline studies carried out by the Sponsors in 2014 to 2017 were also incorporated as part of the Key Environmental Baseline.

This environmental baseline data includes as per **Table ES.4**.

In addition, the following approaches were adopted to gather a robust social and community health baseline:

- A thorough review of available published secondary data such as governmental statistics and existing Project information;
- A series of field surveys were also undertaken to support the ESIA including key informant interviews in villages along the transmission line, household surveys in the vicinity of the power plant and focus group discussions in the fishing communities along the coastline near to

the jetty and pumping station locations. The data was gathered between July 2017 and February 2018;

- The land acquisition process is still underway as of July 2018. All impacted land owners have been identified and compensation agreed and paid for all tower footing land owners. A number of livelihood surveys were also conducted to gain a robust understanding of the land owners and land users impacted by the Project (for the transmission line tower footings and the coastal area); and
- Disclosure of the ESIA commenced in June 2018 and is continuing throughout July and August 2018.

Table ES.0.4 Environmental and Social Baseline Data Collection

Items
Physical Environment
• General Climate and Meteorological Conditions. • Effects of Climate Change. • Onshore Physical Environment: - Topography and Geology; - Seismicity; - Flooding, River System and Drainage Pattern; - Soil and Groundwater; - Surface and River Water; - Air Quality; - Nosie and Vibration; and - Electromagnetic Field (EMF). • Offshore Physical Environment - Bathymetry; - Hydro oceanography i.e. Tides, Currents, Waves, Wind Conditions, Weather & Temperature; - Marine Water Quality; and - Marine Sediment Quality.
Terrestrial and Marine Biodiversity
• Background Assessment including EcoRegion Description, Regional Marine Environment, and Key Biodiversity Areas & Protected Areas. • Forest Protection and Species of Conservation Significance. • Area of Influence for Biodiversity Value. • Natural Habitat and Modified Habitat. • Flora. • Terrestrial Fauna. • Marine Biodiversity. • Invasive Species. • Critical Habitat.
Ecosystem Services
• Provisioning Services. • Regulating Services. • Cultural Services. • Supporting services.
Social and Community Health
• Socioeconomics • Sociocultural System • Community Health

ES.6 Summary of Environmental and Social Impact Assessment (ESIA) and Unplanned & Non-Routine Events

ES.6.1 Environmental Impact Assessment (EIA)

Environmental Impact Assessment (EIA) identifies and discusses the predicted positive and significant negative environmental impacts associated with construction and operation of the Project. The Project receptors are defined as per **Table ES.5**.

Table ES.5 Summary of the Routine Project Activities and Key Environmental Receptors

Phase	Issues
Planned activities during Pre-Construction and Construction	• Climate Change; • Air Quality; • Acoustics & Vibration; • Soil and Groundwater; • Surface Water Quality; • Terrestrial Biodiversity; • Waste Management; • Marine Water Quality; and • Marine Biodiversity.
Planned activities during Operations	• Climate Change; • Air Quality; • Greenhouse Gases Emission; • Acoustics & Vibration; • Soil and Groundwater; • Surface Water Quality; • Terrestrial Biodiversity; • Waste Management; • Landscape & Visual; • Electric and Magnetic Fields (EMF); • Marine Water Quality; • Sedimentation and coastal processes; and • Marine Biodiversity.

Summary of the activities that were rated as **Major** significance, the proposed mitigation measures, management and monitoring as well as the significance of residual impact rating are tabulated in **Table ES.6**.

ES.6.2 Social Impact Assessment (SIA)

Social Impact Assessment (SIA) identifies and discusses the predicted positive and significant negative social and community health impacts associated with land acquisition activities, construction and operation of the Project.

The Project receptors are defined as villagers located within the AoI that may be impacted or influenced by the Project as a result of their proximity to the Project site and/or associated facilities.

Based on the analysis of the Area of Influence (AoI), the Project will impact total of 39 villages in three (3) regencies, Karawang, Bekasi, and Subang in the West Java Province, Indonesia.

Summary of the activities that were rated as **Major** significance, the proposed mitigation measures, management and monitoring as well as the significance of residual impact rating are tabulated in in **Table ES.7.**

Note that no **Major** impacts on the social receptors were assessed during projects land acquisition activities and operations.

ES.6.3 Unplanned & Non-Routine Events

An unplanned event is defined as 'a reasonably foreseeable event that is not planned to occur as part of the Project, but which may conceivably occur as a result of Project activities (e.g. accidents), even with a low probability.

The summary of Unplanned and Non-Routine Events that was rated as **Major** significance, the proposed mitigation measures, management and monitoring as well as the significance of residual impact rating are tabulated in **Table ES.7**.

Table ES.6 EIA – Major Significance

Receptors - Activity	Risk Significance Rating	Mitigation Measures, Management and Monitoring	Significance of Residual Impact
During Construction			
GHG - Transportation/ operation of vehicles (construction, materials/supplies and workforce)	**Major**	• Optimisation of construction schedule and placement of laydown areas/temporary camp sites to reduce overall traffic movements/distance travelled, thus reducing GHG emissions from transport.	**Major**
GHG & Climate Change - General Land Clearance (all sites)	**Major**	• Actual land clearing/disturbance will be minimised to the greatest extent possible. Net GHG emissions could also be reduced by revegetation in many areas that will be cleared only for temporary activities such as laydown areas and temporary camps for construction.	**Major**
Air Quality - General construction activities (all sites)	**Major**	• Develop and Implement a Dust Management Plan (DMP). The DMP will contain the measures outlined in this document and a plan for implementation. • Regular site inspections will be performed to monitor compliance with the DMP. All inspection results will be recorded and corrective actions taken where mitigation and management measures are not being implemented effectively. • Daily onsite and offsite inspections will be undertaken to visually assess the dust emissions from earthwork and construction activities, and from vehicles exiting the construction sites. Results from the inspection will be recorded and appropriate measures will be taken to reduce emissions where necessary. • All dust and air quality complaints will be recorded, the cause identified and the appropriate measures taken to reduce emissions in a timely manner. • The frequency of site inspections will be increased when activities with a high potential to produce dust are being carried out and during prolonged dry and windy conditions. • Use of site watering to suppress wind and physical disturbance dust generation. • Only cutting, grinding, or sawing equipment fitted with suitable dust suppression techniques such as water sprays will be used. • All chutes, conveyors and skips will be covered at all times. • Drop heights from conveyors, loading shovels and hoppers will be minimised.	**Minor**

Receptors - Activity	Risk Significance Rating	Mitigation Measures, Management and Monitoring	Significance of Residual Impact
Air Quality - General construction activities (CCGT Power Plant)	**Major**	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top cover in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape. • Real time PM_{10} monitoring will be undertaken at two fenceline locations. Monitoring will commence 3-months prior to the earthwork phase commencing. • Wind breaks will be erected around the construction site at least the height of any stockpile on site. • Use of site watering to suppress wind and physical disturbance dust generation. • The construction site will be planned so that machinery and dust causing activities are located away from air sensitive receptors as far as possible. • All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required. • Deliveries of ready-made cement and other fine powders will be delivered in enclosed tankers and stored with suitable emission controls to prevent escape of material and overfilling during delivery. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.	**Minor**

Receptors - Activity	Risk Significance Rating	Mitigation Measures, Management and Monitoring	Significance of Residual Impact
Air Quality - General construction activities (Onshore Pipeline)	**Major**	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top cover in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable. • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.	**Minor**
Air Quality - General construction activities (Substation)	**Major**	• Re-vegetate earthworks and exposed areas including stockpiles to stabilise the surfaces as soon as is practicable. • Use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. • Only remove the top cover in small and specific areas during the construction phase and not all at once. • Stockpiles will be places as far as reasonably practicable from air sensitive receptor locations. • The design of stockpiles will be optimised to retain a low profile with no sharp changes in shape. • All sand and aggregates will be stored in bunded areas and are not allowed to dry out unless specifically required. • Ensure that all vehicles entering and leaving the site are covered to avoid fugitive emissions during transport. • Inspect on-site haul roads for integrity and instigate the necessary repairs to the surfaces as soon as reasonable practicable. • Implement a wheel washing system. • Regularly dampen/clean the site access and local roads to remove any materials tracked out of the site. • Access gates will be located at least 10m away from air sensitive receptors where possible.	**Minor**

Receptors - Activity	Risk Significance Rating	Mitigation Measures, Management and Monitoring	Significance of Residual Impact
Noise - High noise generating construction activities (CCGT Power Plant e.g. bulk earthworks)	**Major**	• CCGT construction work and activities should be carried out during the IFC daytime hours (i.e. 7am to 10pm). Any work that is performed outside these hours (i.e. during the night time period, 10pm to 7am) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (45 dBA), at all potentially affected sensitive receptors. Where this is not possible it may be necessary to undertake the night works with agreement from nearby and potentially affected neighbours. • Where unforeseen works will occur in close proximity to a receptor and these works are anticipated to generate high levels of noise (e.g. >75 dBA), potential respite periods (e.g. three hours of work, followed by one hour of respite) should be considered. Respite should be implemented if they are the preference of the affected receptors and if they are feasible and reasonable, and practicable, to implement during the works. In some circumstances respite may extend the duration of works and inadvertently increase noise impacts, hence due care should be taken when considering this management measure. • Construction road traffic should be limited to the IFC daytime hours (i.e. 7am to 10pm). Any traffic that is required outside these hours (i.e. during the night time period, 10pm to 7am) should be suitably managed with a goal of achieving levels compliant with the most stringent night time IFC 1.7 Noise criteria (45 dBA), at all potentially affected sensitive receptors. • During the construction design, choose appropriate machines for each task and adopt efficient work practices to minimise the total construction period and the number of noise sources on the site. Select the quietest item of plant available where options that suit the design permit. • During the works, avoid unnecessary noise due to idling diesel engines and fast engine speeds when lower speeds are sufficient. • During the works, instruct drivers to travel directly to site and avoid any extended periods of engine idling at or near residential areas, especially at night. • During any night works, any activity that has the potential to generate impulsive noise should be avoided. These types of events are particularly annoying, especially at night and have the limited potential to generate sleep disturbance or awakening impacts.	**Moderate**
During Operation			

Receptors - Activity	Risk Significance Rating	Mitigation Measures, Management and Monitoring	Significance of Residual Impact
Air Quality - Deposition of salt (Sodium Chloride (NaCl)) on the surrounding agriculture from the operations of two (2) wet cooling tower systems during the operational of CCGT Power Plant	**Major**	• Installation of two salt deposition gauges are recommended within 500 m of the Project area where the dispersion modelling has indicated highest deposition; and in an area representative of the existing baseline. The monitoring should be designed to determine the level of salt deposition from the Project relative to the existing background. Monitoring of foliage on vegetation within the 500 m boundary is also to occur to determine the extent of leaf damage (leaf necrosis). • Where impacts to vegetation is determined from the monitoring, engagement within affected parties is to occur to determine appropriate actions. These actions may include (but are not limited to): investigation and support of alternative cropping methods/species; adoption of spray irrigation methods; and/or compensation for lost agricultural production or impacts on households. • Regarding impacts on plant and equipment, it is recommended that all exposed surfaces be coated or painted to reduce corrosion from salt deposition. Regular maintenance of exposed surfaces is also required. • Salt tolerant vegetation should also be planted within the Project area and within 500 m of the Project.	**Minor**
GHG and Climate Change - Increased GHG Emissions (National Level) from the operational of CCGT Power Plant	**Major**	• Cold venting of gas directly to atmosphere will be avoided where possible. If significant quantities are emitted, the project should consider flaring, as this converts the CH_4 to CO_2 and thereby reduces the net GHG emissions in terms of CO_2-e emissions	**Major**

Table ES.7 SIA – Major Significance

Receptor - Activity	Risk Significance Rating	Mitigation Measures, Management and Monitoring	Significance of Residual Impact
During Construction			
Local communities residing near Project activities - Managing Community Expectations	**Major**	• Provide and communicate clear and factual information about the Project's needs; • To avoid over committing or promising employment; • To have clear stipulation of using local labour in the EPC contracts; and • To ensure the EPC liaise closely with the local village leaders and local government authorities to agree on the appropriate procedures for recruitment and hiring.	**Minor**
Local villages in close proximity to construction activities - Adverse interaction with non local workers	**Major**	• Compulsory medical examinations for Project workers; • Training for all workers on the expected workforce behaviours; • Appropriate management of worker accommodation adhering to the IFC/EBRD guidelines, national and ILO specifications including mitigating impacts to community from waste disposal and effluent discharges; • Accommodation will be sited away from known sex worker hotspots (including the village of Blankan); • Conduct inductions and training refreshers on the Project's Code of Conduct and STIs; • Provision of onsite health clinic and resources for all workers and sib contractors; and • Conduct regular consultations with village leaders and implement a grievance mechanism (accessible to community and workers).	**Minor**
Non-Local Workforce - Poor working and accommodation conditions	**Major**	• All workers will have a contract in place that adheres to Indonesian requirements that cites fair working terms and conditions, salary conditions, contract duration and worker rights. • All accommodation identified for use by construction workers comply with Indonesian, IFC and ILO standards i.e. safe structures, clean, and sanitary conditions, and easy access with separate arrangements for females and males; • Where large number of workers are involved transportation to and from the site is provided to manage congestion impacts; • Are impacts to the environment well managed i.e. proper disposal of wastes and effluents; • All workers have access to clean water for consumption and washing; • Appropriate H&S measures are in place such as access to a first aid kit, fire extinguishers and alarms and security; and • All workers have access to a grievance mechanism.	**Minor**

Receptor - Activity	Risk Significance Rating	Mitigation Measures, Management and Monitoring	Significance of Residual Impact
Local villages in close proximity to construction activities and residing along transportation routes - Traffic congestion and incidents with community members and other road users	**Major**	• Consultation with the communities on key Project traffic routes; • Traffic safety signs along routes and hot spots; • Undertake road improvements; • Ensure all Project drivers are trained in safety awareness; and • Enforce speed limit regulations.	**Moderate**

Table ES.8 ***Unplanned & Non-Routines Events – Major Significance***

Receptor - Activity	Risk Significance Rating	Mitigation Measures, Management and Monitoring	Significance of Residual Impact
Vehicle Incident (Onshore)	**Major**	• Project ERP to incorporate Project vehicle activities; • Develop and implement a traffic management plan. This should detail access routes, quality of existing roads, measures that will be implemented to minimise the risks associated with transporting materials and workers to and from site, including factors such as fatigue management and ensuring all employees observe recommended speed limits; Bus workers between the accommodation camp and the Project area. This will reduce the amount of traffic generated by the Project; • Ensure all employees complete training prior to driving any Project vehicle. The content of the training should be tailored to the employee's role; • Explore opportunities to work with local stakeholders to increase awareness within local villages about the hazards associated with traffic; • Develop, communicate and implement Journey Management Plans for heavy equipment, construction and transport vehicles and worker buses; and • Undertake stakeholder engagement with the local community for both traffic road user groups and stakeholders living at settlements adjacent to traffic roads used during construction including updating and inform the community in the Traffic Management Plan.	**Moderate**

ES.7 Cumulative Impact Assessment (CIA)

The cumulative impact assessment (CIA) for the Project is undertaken in accordance with the IFC Performance Standards, the IFC's Good Practice Handbook: Cumulative Impact Assessment and Management Guidance for Private Sector in Emerging Markets (the "IFC Handbook") and ADB's Safeguards Policy Statement 2009.

The CIA were assessed in regards to the following key impact types:

- Air Quality;
- Noise;
- Biodiversity;
- Employment and Business Opportunities;
- Increased Pressure on Community Infrastructure and Services; and
- Community Health and Safety.

The remainder of impacts either have already been assessed in a cumulative manner within the ESIA, or the Project will only have negligible impacts and therefore will not contribute to any broader cumulative impacts

ES.8 Environmental and Social Management Plan (ESMP)

The ESIA process has identified the key environmental, social and community health issues, impacts associated with the Project requiring the implementation of a wide range of mitigation measures.

The necessary actions required to manage these issues, impacts and risks are presented in this Environmental and Social Management Plan (ESMP); these are the mitigation and monitoring measures that have been identified through the impact assessment, and other best practice measures designed to avoid, minimise or reduce negative impacts and enhance positive impacts.

The key parties and their primary roles in implementing the ESMP are as follows:

- **Sponsors**: Responsibility for the implementation of the Project to the required Applicable Standards of the Government of Indonesia and Lender consortium;
- **EPC Contractors –** responsible for complying with ESMP requirements under the contract; and

- **Sub-contractors** – responsible for complying with ESMP requirements as applicable under the EPC contracts.

ES.8.1 Outline of ESMP

Based on the assessment and discussions regarding design adjustments and mitigations the following plans will be developed (separately or combined) either by the JSP or the EPCs:

- Air Quality Management Plan;
- Community Development Plan/Corporate Social Responsibility;
- Change Finds Procedure;
- Biodiversity Offset Plan;
- Emergency Response Plan;
- Local Recruitment and Procurement Plan;
- Noise and Vibration Management Plan;
- Oil and Chemical Spill Contingency Management Plan;
- Security Plan;
- Soil and Groundwater Management Plan;
- Stakeholder Engagement Plan;
- Surface Water Management Plan;
- Traffic Management Plan;
- Waste Management Plan (Hazardous and Non Hazardous);
- Occupational Health and Safety Management Plan;
- Worker Training Plan; and
- Worker Management Plan.

These plans are set out further in the subsequent two (2) sections covering construction and operational impacts. They will be the responsibility of the EPCs and Sponsors to develop, implement and monitor.

This ESMP will be updated, revised and reviewed internally on regular basis to ensure the management plans remain relevant and are effectively mitigating the risks set out in this ESIA.

The ESMP will be monitored and reviewed on a bi-annual basis. Furthermore, in the event of an unforeseen impact and design change with respect to the Project Standards (including the Indonesian Government, ADB and IFC requirements), the ESMP would be updated as necessary.

ES.8.2 Environmental and Social Management Systems (ESMS)

The ESMP will form one element of the Project's Environmental and Social Management System (ESMS). The Project has already commenced a number of the element of the ESMS including:

- Identification of the Projects potential environmental and community impacts in the AMDAL and ESIA documents;

- Development of the ESMP Chapter (in this ESIA) and the RKL RPL;
- Development and implementation of the SEP with the project impacted communities;
- Development, disclosure and implementation of the Project's grievance mechanism;
- Ongoing consultation with the Projects land owners, village leaders and local community through formal consultations; and
- Identification and recruitment of personnel to support the implementation of the ESMS.

Prior to the construction activities commencing the Project and its EPCs will develop the additional management plans as set out in this chapter, continue engaging with its key stakeholders around the project, its impacts and mitigation measures whilst addressing grievances submitted. During construction activities the project will undertake monitoring activities to oversee the implementation of the Project's environmental and social commitments.

ES.8.2.1 Monitoring and Verification

A monitoring, review and auditing program is required to be implemented during construction to monitor implementation of the Projects HSE requirements and environment and social commitments. Ultimately the Sponsor is responsible for ensuring that all EPC contractors are complying with the applicable HSE and social requirements.

A robust reporting system will provide the Project with the necessary feedback mechanisms to ensure quality and timely implementation of the ESMP. Reporting will be required for AMDAL compliance (quarterly RKL RPL reporting) and also for Lenders' compliance (typically quarterly during construction and bi annually during operations).

This will typically be associated with Lender audits and the implementation not only of the ESMPs but the follow on Environmental and Social Action Plan (ESAP) developed by the Lenders' environmental and social advisors following the first monitoring audit prior to financial close. Reporting will provide a mechanism to ensure that the measures proposed in the RKL RPL and the ESMP are well implemented.

Prior to the commencement of the construction activities, the Sponsors will finalise the format and frequency for reporting on the status and progress of environmental and social monitoring. The EPCs will be required to provide relevant EHS and community data to the Sponsors in a timely manner to enable the Sponsors to conduct the necessary reporting.

1 INTRODUCTION

1.1 OVERVIEW

The PLTGU Jawa-1 Project (the "Project") involves the development of a Combined Cycle Gas Turbine (CCGT) Power Plant, a Liquefied Natural Gas (LNG) Floating Storage and Regasification Unit (FSRU) and a 500kV power transmission lines and a Substation. These Project elements will be developed within the Karawang, Bekasi and Subang Regencies of West Java, Indonesia.

PT Pertamina (Persero), Sojitz Corporation and Marubeni Corporation (together, the "Sponsors") have concluded an agreement to develop the Project via a Project company named PT. Jawa Satu Power (JSP)[1].

The Sponsors are seeking financial investment from a number of international "Lenders" i.e. a consortium of financial institutions comprising the Japan Bank for International Corporation (JBIC), Nippon Export and Investment Insurance (NEXI), the Asian Development Bank (ADB) as well as a group of Equator Principles Financing Institutions (EPFIs) led by Société Générale. As such, the Project is required to comply with the applicable bank's environmental, social and community health policies, developed for managing the environmental and social risks.

The Sponsors have commissioned PT. ERM Indonesia (ERM) to assist them in meeting these applicable international standards to appropriately manage the Project's impacts; largely through the development of an Environmental and Social Impact Assessment (ESIA) document.

In addition to the ESIA and associated documents, the Sponsors are also producing an integrated local Environmental Impact Assessments (EIAs) or *Analisis Mengenai Dampak Lingkungan* (AMDAL) to meet local regulations and to secure the Environmental Permit. The AMDAL documentation (and ESIA) cover all Project aspects including the transmission line sub-station, power plant, FSRU and associated pipelines.

1.1.1 Project Proponent

The Project is a joint venture between PT Pertamina (Persero), Sojitz Corporation and Marubeni Corporation, referred to previously as the Sponsor Group.

PT Pertamina (Persero) is a state-owned oil and gas company, which also has interests in the Power sector. Pertamina operates the Arun LNG Plant Unit (Aceh) and Bontang LNG Plant Unit (East Kalimantan) and geothermal power

[1] PT Jawa Satu Regas will be established amongst the IPP Sponsors and the shipping company.

assets in Indonesia. It is also a major downstream supplier of fuel in Indonesia.

Sojitz Corporation is a general trading company that is active in a broad range of industries throughout Asia and globally. In Indonesia, Sojitz has a stake in the BP Tangguh Project via its LNG Japan Corporation consortium with Sumitomo. It also has interests in methanol export and real estate within Indonesia.

Marubeni Corporation is a Japanese headquartered trading house which operates in food and consumer goods, energy, transportation, chemicals and power businesses within Asia and globally. In Indonesia, Marubeni currently has investments in a number of thermal power assets.

In order to design and construct the Project the Sponsors have commissioned a number of contractors, namely the Engineering Procurement and Construction Consortium composed of General Electric (GE) Power, Samsung C&T Corporation and PT Meindo Elang Indah (Meindo). The EPCs will form an EPC Consortium, led by GE Power. The consortium is responsible for developing the construction management plans including Labour and Workforce Management, Waste Management and Traffic Management.

1.1.2 Project Development and Location

The Project is located within the Karawang and Bekasi Regencies of West Java, Indonesia, approximately 108 km east of Jakarta. Administratively, the Project is located within Subang, Bekasi and Karawang Regencies. The Project includes the following main components:

- Installation and operation of an FSRU;
- Construction and operation of seawater intake and seawater discharge pipelines;
- Construction and operation of an onshore gas receiving facility (ORF);
- Construction and operational emergency jetty;
- Gas supply pipelines i.e. 14 km offshore pipeline and seven (7) km onshore pipeline;
- 1,760 MW CCGT power plant;
- A 52 km 500 kV transmission line; and
- An electricity substation in Sukatani, Bekasi.

The FSRU will be located and moored offshore of Ciasem Bay within the Subang Regency at a distance of approximately of nine (9) km off the north Ciasem Bay coast.. The Power Plant is located in the administrative area of Cilamaya Village, Cilamaya Wetan District, Karawang Regency. The 500 kV transmission line then traverses Karawang Regency for a distance of 52 km before joining the Cibatu Baru II /Sukatani Extra High Voltage (EHV) Substation in Sukatani, Bekasi Regency.

The construction of this Project is expected to commence in late 2018 with operation of the 1,760 MW CCGT Power Plant expected to commence in 2021.

Figure 1.1 and **Figure 1.2** illustrate the overview plan of Project location overlay with the spatial planning of Bekasi and Karawang Regencies.

1.2 OBJECTIVE AND PURPOSE

This ESIA has been undertaken to identify the potentially significant environmental and social impacts to the sensitive receptors that could arise from the Project activities.

The main aim of this Report is to provide impact assessment and management plans regarding the proposed Project in meeting the international environmental and social standards required by the Lenders.

The objectives of this ESIA are:

- To identify, describe and assess all direct/indirect/induced potential environmental, social and community health impacts on the sensitive receptors associated with the Project activities through a risk-based assessment process; and

- To identify at a strategic level measures to avoid, minimise, reduce or compensate for potential adverse environmental and social effects, and to optimise potential positive effects.

The outcomes of this assessment will be taken into account in JSP and its EPCs' decision-making, engineering design, to identify and manage appropriate mitigation measures and subsequently to incorporate the proposed measures into the implementation process during pre-construction, construction and operations.

The ESIA process also includes a range of community consultation and disclosure activities (presented in the Stakeholder Engagement Plan [SEP]) to ensure community perceptions concerns and expectations are factored into the process and that Project information is shared and discussed with the impacted communities.

Figure 1.1 Project Location – Bekasi Regency

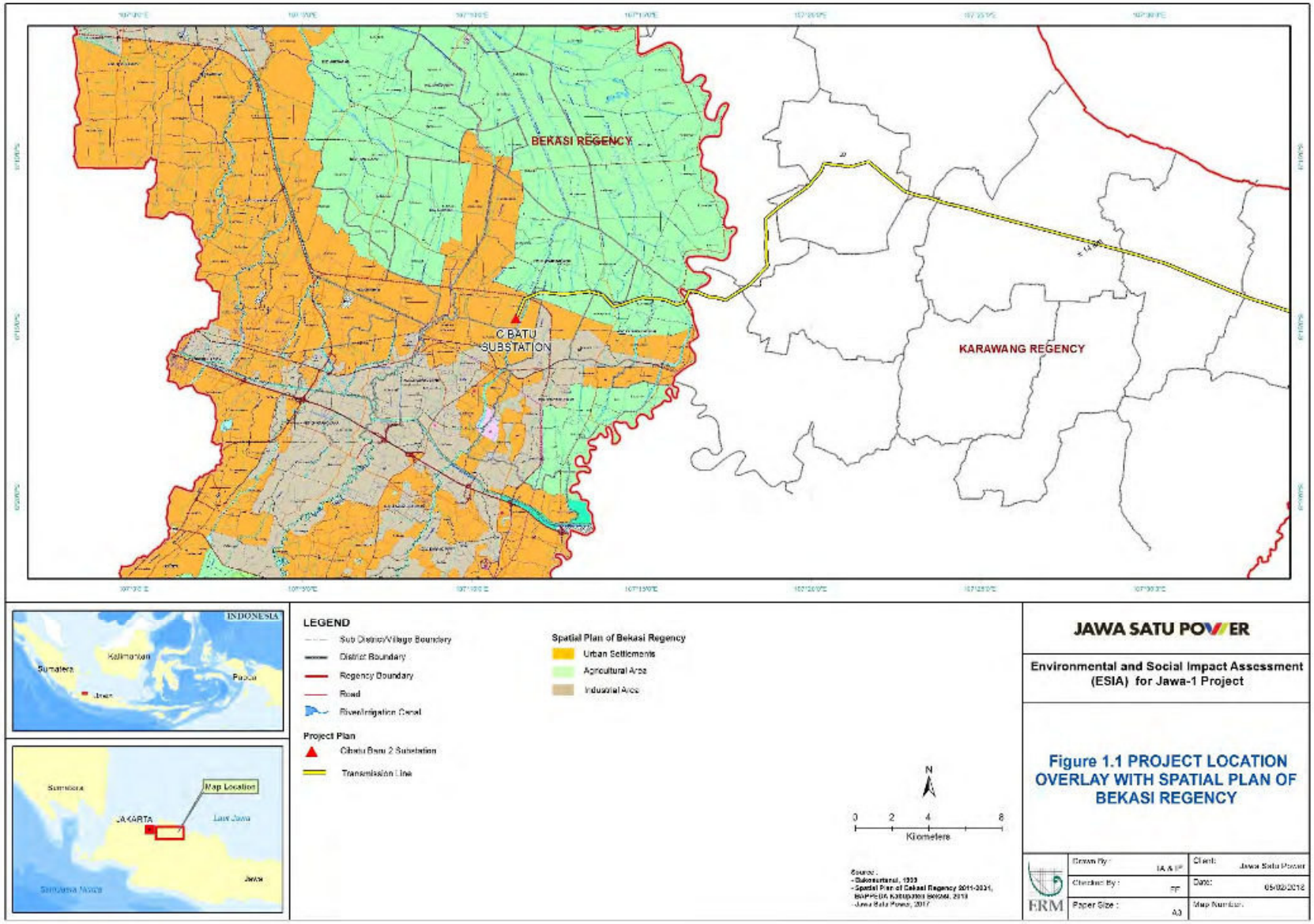
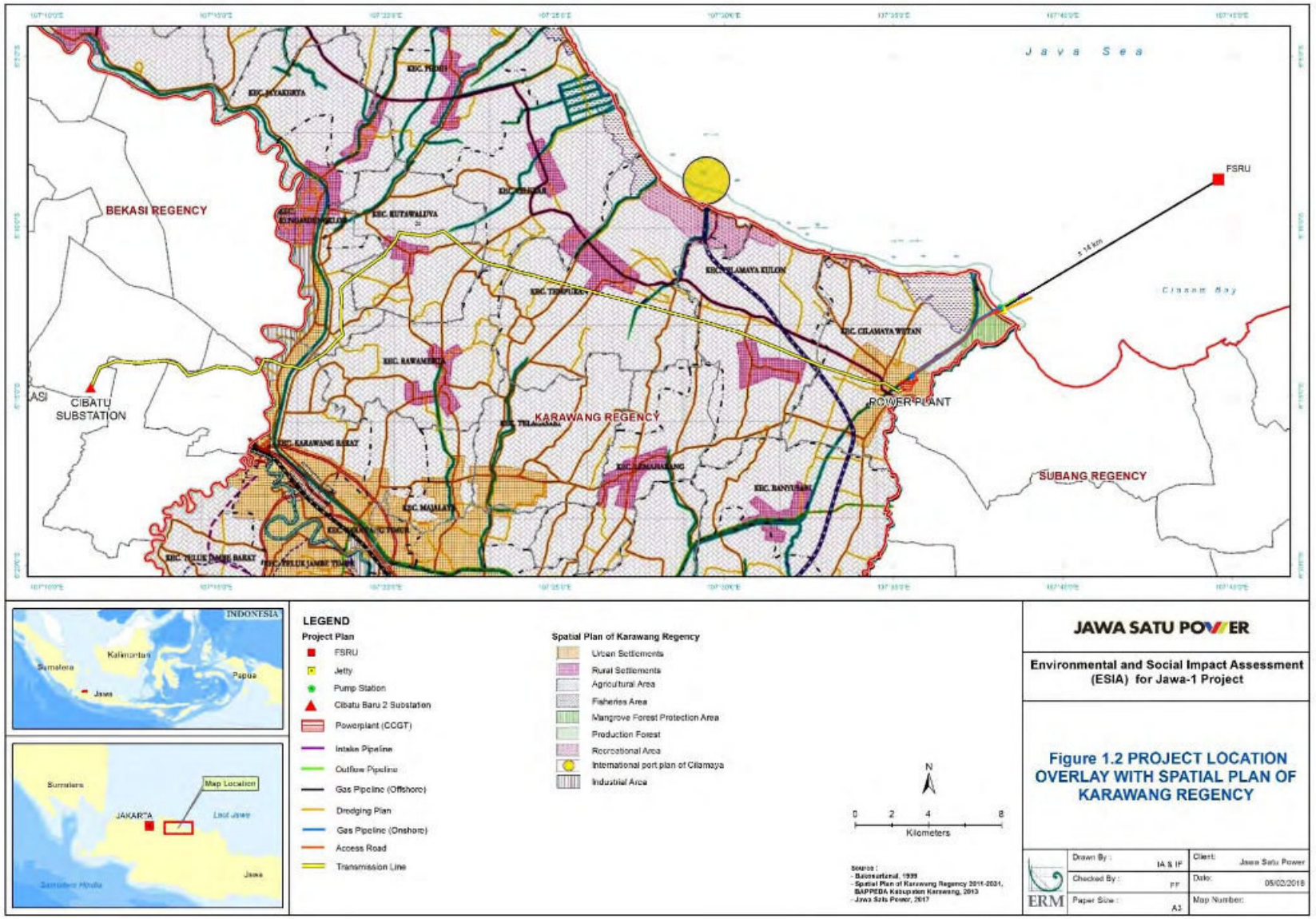


Figure 1.2 Project Location – Karawang Regency



1.3 REPORT STRUCTURE

This report has been prepared by a range of international subject matter experts (SMEs) with inputs from the Sponsors, Lenders and Lenders' consultant (Jacobs). It has been developed based on existing secondary data from the Sponsors and its EPCs, available public data and additional primary data gathered at the Project site.

This report should be viewed as a standalone document that will be utilised to manage and monitor potential Project impacts against the Lenders' requirements.

This remainder of this report presents the following:

- **Chapter 2** outlines the applicable international environmental and social legal standards and guidelines to be adopted by the Project;
- **Chapter 3** presents the ESIA methodology;
- **Chapter 4** provides an overview of the Project and alternatives considered by the Project;
- **Chapter 5** presents the preliminary review of Project impacts and the results of the screening and scoping processes;
- **Chapter 6** outlines the recommended stakeholder engagement activities;
- **Chapter 7** describes the existing environmental and social baseline conditions;
- **Chapter 8** provides the Environmental Impact Assessment;
- **Chapter 9** provides the Social Impact Assessment;
- **Chapter 10** addresses unplanned and non-routine events;
- **Chapter 11** describes the Cumulative Impact Assessment;
- **Chapter 12** describes the Environmental and Social Management Plan framework;
- **Chapter 13** outlines the list of references;
- **Annex A** presents the compilation of Numerical Standards between Indonesian Regulations and the World Bank EHS Guidelines;
- **Annex B** presents the compilation of Baseline Survey Results;

- **Annex C** presents the Stakeholder Engagement Plan (SEP) Report;
- **Annex D** presents Air Quality Assessment Technical Report;
- **Annex E** presents the Acoustics Assessment Technical Report;
- **Annex F** lists the applicable Waste Regulatory Documents;
- **Annex G** presents the Visual Impact Assessment (VIA) Technical Report;
- **Annex H** presents the Quantitative Risk Assessment (QRA) Report;
- **Annex I** presents the Resettlement Plan (RP) Report;
- **Annex J** summarises the Biodiversity Assessment and Management Planning;
- **Annex K** presents the Electromagnetic Field Assessment Report;
- **Annex L** presents the Flood Risk Analysis Report;
- **Annex M** presents the Greenhouse Gas Assessment Report;
- **Annex N** presents the Sedimentation Modelling;
- **Annex O** presents the RKL RPL; and
- **Annex P** presents the Avifauna study for the EBA and project area and the Coral Survey findings.

2 ADMINISTRATIVE FRAMEWORK

2.1 OVERVIEW

The regulatory framework that applies to the Project comprises national and international legislation, company-specific policies, and guidelines.

There are two (2) levels of regulatory provisions applicable to the Project. The first is the Indonesian assessment and approvals process. The second is the international environment and social standards of the lending consortium.

The Project is currently seeking Regulatory Environmental Approval and several Permits through the Ministry of Environment and Forestry (MOEF) in Jakarta; with the Environmental Permit has been issued in July 2018. Other outstanding permits are summarised in **Table 2-1**.

Table 2-1 Outstanding Project Permits (as of July 2018)

Type of Permit	Expected Date
Analisis Dampak Lalu Lintas or ANDAL LALIN (Traffic Impact Analysis) under the Karawang Regency authority	July 2018
A wastewater discharge permit to the sea under the MoEF authority	April 2020
Izin Pinjam Pakai Kawasan Hutan or IPPKH (Forest License Use Permit) under the MOEF authority	September 2018
An offshore Location Permit under the West Java Province	• Location Permit for Jetty: September 2018 • Location Permit for Mooring Facility & FSRU: July 2018
A construction permit for the Transmission Line under the West Java Province	September 2018
A construction permit for the CCGT Power Plant under the Karawang Regency	July 2018
Permit for dumping of dredged sand to the sea	To be confirmed
Permit for the temporary storage of B3 Hazardous Waste	January 2020
Construction & Operation Permit for Jetty	October 2018

Note:

- Construction Permit & Operation Permit for pipelines was issued in January 2018
- Onshore Location Permit (Regulation of the Ministry of Agrarian Affairs No.5.2015) was issued in January 2018.

Given the involvement of the international lenders, international standards apply to the Project - these additional standards and expectations will be adhered to throughout the planning, construction and operational activities.

A summary of applicable key legal requirements to the Project relevant is presented in this Chapter.

2.2 INDONESIAN REGULATIONS

2.2.1 AMDAL Process

In Indonesia, the *Environmental Management and Protection Law No. 32 of 2009* is the main environmental law covering important environmental issues which includes the Environment Impact Assessment (*Analisis Mengenai Dampak Lingkungan* or AMDAL), Environmental Management/ Monitoring Effort (known as *Rencana Pengelolaan Lingkungan/ Rencana Pemantauan Lingkungan* or RKL-RPL), environmental permitting, and environmental audits.

Indonesia's Environmental Law requires a Project proponent to undertake an AMDAL where it is considered that the Project has the potential to result in potential significant environmental or social impacts. The *Law No. 32 (Article 22) of 2009*, followed by *Government Regulation No. 27 of 2012* regarding environmental permit concerning AMDAL stipulates that an AMDAL should be carried out for proposed activities that are expected to have significant environmental impacts.

Thereafter, various legislation and guidelines have been issued to specify the activities that require a full AMDAL process as defined in the *Minister of Environment Decree No. 05 Year 2012* which specifies the types of commercial plan or activities that need to undertake an AMDAL.

The Project activities that fall under the AMDAL requirements include the FSRU construction and operation within the capacity ≥ 10,000 DWT, and the CCGT Power Plants within the capacity of ≥ 100 MW. The same applies for Transmission Lines more than 150 kV. The AMDAL document's format is defined in the *Minister of Environment Decree No. 16 Year 2012*.

The AMDAL process comprises an assessment of major and significant impacts of a Project or activity, taking into account ecological, socio-economic-cultural, and public health aspects. It aims to evaluate the environmental feasibility of a project or activity and is used as a provision by the authority for granting an Environmental Permit for the project or activity.

The Project has received government approval of the Terms of Reference (TOR or locally referred to as a KA-ANDAL). The TOR forms the basis of agreement with the designated approval authority on environmental and social impacts relevant to the Project and how these should be assessed.

The approval authority for the Project is the Ministry of Environmental and Forestry in Central Jakarta. The KA ANDAL was submitted in November 2017 and approved on 11th January 2018. The Project has submitted the ANDAL RKL-RPL for approval in January 2018; the final regulatory approval was obtained in July 2018.

Following approval, the Project will be required to submit a report to the Ministry of Environmental and Forestry (MOEF) twice a year, which includes

reporting on the Project's implementation of environmental and social commitments specified within the RKL-RPL.

The regulatory structure in Indonesia is based on a tiered system, which is beneficial in prioritising the regulatory obligations and in understanding the regulatory implementation and enforcement.

Compliance with the full range of these regulatory provisions, including key permitting and approvals requirements are fundamental requirements of any project within Indonesia.

The Project has obtained its Regulatory Environmental Approval and several permits through the Ministry of Environment and Forestry (MOEF) in Jakarta. The *Analisis Dampak Lalu Lintas* or ANDAL LALIN (Traffic Impact Analysis) approval has also been obtained from the Karawang Regency authority. Current outstanding permits include:

- A wastewater discharge permit to the sea under the MoEF authority;
- *Izin Pinjam Pakai Kawasan Hutan* or IPPKH (Forest License Use Permit) under the MOEF authority;
- An offshore Location Permit under the West Java Province;
- A construction permit for the Transmission Line under the West Java Province;
- A construction permit for the CCGT Power Plant under the Karawang Regency;
- Permit for dumping of dredged sand to the sea; and
- Permit for the temporary storage of B3 Hazardous Waste.

Table 2-2 Primary Relevant Indonesian Regulations

Rules/ Regulations	Description	Relevance
President Regulation of Republic Indonesia Number 3 Year 2016	Acceleration of National Strategic Implementation	Basic references in for Java-1 CCGT Power Plant Project
Decree of Energy and Mineral Resources Number 5899 K/20/MEM/2016	Legitimation of Electricity Power Supply Plan year 2016 - 2025	The Java-1 CCGT is located in West Java
Government Regulation Number 13 Year 2017	National Spatial Plan	Development of power infrastructure in every regency/city
President Regulation Number 28 Year 2012	Java-Bali Spatial Planning	Development of gas pipeline infrastructure and Transmission Line to support the power supply in Java-Bali

2.2.2 *Regional Planning Context*

A spatial plan details what development/industry may occur in established areas. Karawang Regency is currently in the process of revising the spatial plan. While this process was occurring, the Project proponent submitted a request to the Minister of Agrarian and Spatial/Head of the National Land Agency in 2017 to have the spatial plan reflect the proposed development.

A recommendation on Spatial Aspect of Development Plan of Java-1 CCGT 1,760 MW, Transmission Line 500 kV, and Gas Pipeline FSRU (Floating Storage Regasification units) in the Karawang Regency as well as Transmission Line 500 kV and Substation in Bekasi Regency was approved via the recommendation on *Spatial Aspects Number 3272/11.3/VIII/2017*. This confirms the planning suitability of the Project.

2.3 *INTERNATIONAL LENDER ENVIRONMENT AND SOCIAL STANDARDS*

The International Environmental and Social frameworks and standards which are applicable to this ESIA are summarised under each of the following subsections.

2.3.1 *Equator Principles*

The Equator Principles (EPs) is a voluntary risk management framework, adopted by 92 financial institutions in 37 countries (Equator Principle Financial Institutions or EPFIs including ING Bank N.V. and Société Générale) to date, for determining, assessing and managing environmental and social risk in projects; primarily to provide a minimum standard for due diligence to support responsible risk decision-making.

The EPs were developed by private-sector banks and launched in June 2003. They were first revised in July 2006 and new revisions, known as EP III, took effect on June 4, 2013.

The EPs establish principles for addressing environmental and social risks and issues in global project finance transactions, including adherence to IFC Performance Standards. They are designed to serve as a benchmark for the financial industry to manage social and environmental risks in project financing. They apply to all new project financings with total project capital costs of USD $10 million or more, and across all industry sectors and geographies. The Principles (EPs 1 to 10) include:

- Principle 1: Review and Categorisation with A being resulting in potentially significant impacts, B limited impacts that can be mitigated and C minimal/no impacts;

- Principle 2: Environmental and Social Assessment i.e. an ESIA is required for all Category A and B projects;

- Principle 3: Applicable Environmental and Social Standards, for example in this case, the ADB safeguard policy, the IFC performance standards and the EHS guidelines etc.;

- Principle 4: Environmental and Social Management System and Equator Principles Action Plan, as set out in **Chapter 12** of this report an ESMP with associated management plans must be developed by Project and its EPCs to manage all identified impacts;

- Principle 5: Stakeholder Engagement, in order to conduct effective and meaningful consultation the SEP outlines consultation to be undertaken during the ESIA process and beyond (**Annex C**);

- Principle 6: Grievance Mechanism, this mechanism is to be developed and implemented by the Project and its EPCs to manage stakeholder complaints appropriately;

- Principle 7: Independent Review is typically undertaken by a consultant acting on behalf of the lenders to assess compliance;

- Principle 8: Covenants and provisions are included in the loan documentation related to environmental and social compliance ;

- Principle 9: Independent Monitoring and Reporting will be undertaken by an independent party; and

- Principle 10: Reporting and Transparency is required to ensure all relevant reports are publically available.

Under Principle 1, the Project is categorised to ensure that the required level of environmental and social due diligence is commensurate with the nature, scale and stage of the Project, and with the level of environmental and social risks and impacts. The categories are:

- Category A – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented;

- Category B – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and

- Category C – Projects with minimal or no adverse environmental and social risks and/or impacts.

Given the scale and level of impacts associated with this Project it will be considered a Category A level.

Under Principle 2, all Category A and Category B Projects are required to conduct an Assessment process to address the relevant environmental and social risks and impacts of the proposed Project.

Principle 3 requires that the Project comply with relevant host country laws, regulations and permits that pertain to environmental and social issues. The principle also brings into consideration compliance with the IFC Performance Standards on Environmental and Social Sustainability (IFC PS) and the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).

Principles 4 through 7 and Principles 9 and 10 apply to all Category A and, as appropriate, Category B Projects. Principle 8 applies to all Category A and Category B Projects.

2.3.2 Asian Development Bank Safeguard Policy Statement

The *Asian Development Bank (ADB) Safeguard Policy Statement (SPS), 2009* (*ADB, 2009*) governs the environmental and social safeguards of ADB's operations and articulates the safeguard policy principles for three (3) key safeguard areas:

- Environmental safeguards (SPS, Appendix 1);
- Involuntary resettlement safeguards (SPS, Appendix 2); and
- Indigenous Peoples safeguards (SPS, Appendix 3).

The SPS 2009 applies to all ADB-supported projects reviewed by ADB's management after 20 January 2010. The objective of the SPS is to ensure the environmental and social soundness and sustainability of projects and to support the integration of those considerations into the project decision-making process. The SPS overall objectives are three-pronged:

(i) Avoid adverse impacts of projects;
(ii) Minimise, mitigate, and/or compensate for adverse project impacts; and
(iii) To help clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

The ADB adopts a set of specific safeguard requirements that borrowers/clients are required to meet in addressing environmental and social impacts and risks.

The Safeguard Requirements (SR) is described in the following:

- Safeguard Requirements 1 (SR1): Environment Safeguards. A Good Practice Sourcebook (Draft Working Document November 2012);

- Safeguard Requirements 2 (SR2): Involuntary Resettlement Safeguards. A Planning and Implementation Good Practice Sourcebook (Draft Working Document November 2012);

- Safeguard Requirements 3 (SR3): Indigenous Peoples (IP) Safeguards. A Planning and Implementation Good Practice Sourcebook (Draft Working Document Revised June 2013), and

- Safeguard Requirements 4 (SR4): Special Requirements for Different Finance Modalities (Appendix 4).

Based on available information SR4 is not relevant to the Project and thus not assessed further within this Report. Although no IPs are considered present in the Project area the ESIA will examine the potential for impact on IPs as well as ethnic minorities and vulnerable peoples.

The SPS also uses a categorisation system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally and socially sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence.

The SPS uses a categorisation system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally and socially sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence.

Table 2-3 describes the environmental and social category definitions for proposed projects (Financial Intermediary (FI) category projects are not discussed).

Table 2-3 SPS' Environmental and Social Categories

Safeguard	Category		
	A	B	C
Environment	Project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA), including an Environmental and Social Management Plan (ESMP), is required.	Project's potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An Initial Environmental Examination (IEE), including an ESMP, is required.	Project is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.
Involuntary Resettlement	Project is likely to have significant involuntary resettlement impacts. A resettlement plan which includes assessment of social impacts is required.	Project includes involuntary resettlement impacts that are not deemed significant. A resettlement plan, which includes assessment of social impacts, is required.	Project has no involuntary resettlement impacts. No further action is required.
Indigenous Peoples	Project is likely to have significant impacts on indigenous peoples. An Indigenous Peoples Plan (IPP), including assessment of social impacts, is required.	Project is likely to have limited impacts on indigenous peoples. An IPP, including assessment of social impacts, is required.	Project is not expected to have impacts on indigenous peoples. No further action is required.

Based on the information assessed the Project is considered a Category A for Environment and Category B for Involuntary Resettlement.

This is because involuntary resettlement impacts are considered significant if 200 or more persons experience major impacts, which are defined as:

(i) Being physically displaced from housing, or
(ii) Losing 10% or more of their productive assets (income generating).

The significance of Indigenous Peoples impacts is determined by assessing

(i) The magnitude of impact in terms of (a) customary rights of use and access to land and natural resources; (b) socio-economic status; (c) cultural and communal Integrity; (d) health, education, livelihood, and

social security status; and (e) the recognition of indigenous knowledge; and

(ii) The level of vulnerability of the affected Indigenous Peoples community.

In addition to the *ADB Safeguard Policy Statement, 2009*, the following ADB policies and strategies are considered to be applicable to the Project:

- *Social Protection Strategy, 2001* – under this policy, ADB projects are designed and implemented in accordance with national labour laws and internationally-recognised Core Labour Standards (CLS). With respect to CLS, the Borrower is expected to take the following measures to comply with the CLS for the ADB financed portion of the Project:
  a) carry out its activities consistent with the intent of ensuring legally permissible equal opportunity, fair treatment and non-discrimination in relation to recruitment and hiring, compensation, working conditions and terms of employment for its workers (including prohibiting any form of discrimination against women during hiring and providing equal work for equal pay for men and women engaged by the Borrower);
  b) not restrict its workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment; and
  c) engage contractors and other providers of goods and services:
     - who do not employ child labour or forced labour;
     - who have appropriate management systems that will allow them to operate in a manner which is consistent with the intent of (A) ensuring legally permissible equal opportunity and fair treatment and non-discrimination for their workers, and (B) not restricting their workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment; and
     - whose subcontracts contain provisions which are consistent with paragraphs (i) and (ii) above.

- *Policy on Gender and Development, 199*8 - supports mainstreaming as a key strategy in promoting gender equity in ADB's projects. The key elements of this policy include gender sensitivity, analysis and planning as well as mainstreaming and agenda setting; and

- *Public Communications Policy, 2011* - which aims to enhance stakeholders' trust in and ability to engage with ADB. It recognises the rights of people to seek, receive, and impart information about ADB operations and supports knowledge sharing and enables participatory development with affected people. The policy is based on a presumption in favour of disclosure unless there is a compelling reason for nondisclosure.

2.3.3 *International Finance Corporation Performance Standards*

In April 2006, the International Finance Corporation (IFC), a member of the World Bank Group, released a set of Performance Standards (PSs) based upon the original World Bank Group Safeguard Policies, which further recognised the specific issues associated with private sector projects.

The EP Principle 3: Applicable Social and Environmental Standards requires that projects in non-OECD countries be undertaken in accordance with IFC Performance Standards, General EHS Guidelines and Industry Specific Guidelines.

The IFC PSs have been broadened to include issues such as greenhouse gases, human rights, community health, and safety and security. A revised set of Performance Standards came into force on January 1, 2012. The complete list of PS's is provided in **Figure 2-1**.

Figure 2-1 IFC Performance Standards

Source: IFC, 2017

PS1: Social and Environmental Assessment and Management Systems is one of the key drivers behind the development of this ESIA and associated management plans.

In particular, the following key steps as outlined within PS1 have been adhered to as basic principles within the ESIA preparation:

- Project definition;
- Initial screening and risk assessment of the Project;
- Scoping of the assessment process based upon the outcomes of the initial screening and risk assessment;
- Stakeholder identification;

- Gathering of social and environmental baseline data;
- Impact identification and analysis;
- Generation of mitigation or management measures; and
- Development of management action plans.

This ESIA has been prepared to be consistent with the expectations of the Performance Standards and the World Bank Group Environmental, Health and Safety (EHS) Guidelines. All the Performance Standards, accept PS7, are applicable to this Project and have been considered as part of the assessment.

IFC EHS Guidelines

The IFC EHS Guidelines apply their own set of standards for specific effluents, emissions and discharges. Application of the IFC PS requires that when host country regulations differ from the levels and measures presented in the World Bank Group EHS Guidelines, projects are required to achieve whichever is the more stringent.

If less stringent levels or measures than those provided in the EHS Guidelines are appropriate in view of specific project circumstances, a full and detailed justification must be provided for any proposed alternatives through the environmental and social risks and impacts identification and assessment process. This justification must demonstrate that the choice for any alternate performance levels is consistent with the objectives of IFC Performance Standard 3.

The EHS Guidelines contain performance levels and guidance measures that are generally considered to be achievable by new facilities using existing technology at a reasonable cost.

The following World Bank Group EHS Guidelines are applicable to the Project:

- *World Bank Group (WBG) International Finance Corporation (IFC) General Environmental, Health, and Safety (EHS) Guidelines, 2007* (*IFC, 2007a*); and
- *World Bank Group (WBG) International Finance Corporation (IFC) for Construction and Decommissioning, 2007* (*IFC, 2007b*);

These Guidelines contain standards relating to [1]:

- Environment: air, energy and water conservation, solid waste management and wastewater discharges, hazardous materials management, noise and vibration, and contaminated land;
- Ambient Air Quality;
- Occupational Health & Safety; and
- Community Health & Safety.

The General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines that provide guidance to users on EHS issues in specific industry sectors. This includes the Environmental, Health, and Safety Guidelines for the following specific activities, which are relevant to this Project:

a) *WBG IFC EHS Guidelines for Thermal Power Plants, 2008, and 2017* (in Draft) (*IFC, 2017a*);

b) *WBG IFC EHS Guidelines for Liquefied Natural Gas (LNG) Facilities, 2017 (IFC, 2017b)*;

c) *WBG IFC EHS Guidelines for Ports, Harbours and Terminals, 2017 (IFC, 2017c)*;

d) *WBG IFC EHS Guidelines for Offshore Oil and Gas Development, 2015 (IFC, 2015)*;

e) *WBG IFC EHS Guidelines for Electric Power Transmission and Distribution, 2007 (IFC, 2007c)*; and

f) *WBG IFC EHS Guidelines for Shipping, 2007* (*IFC, 2007d*).

The Offshore Guideline has been adopted given that it makes specific reference to procedures for unloading of LNG and Floating Storage Units (FSRUs).

The requirements of each of these guidelines have been factored into the scoping of potential impacts and assessment requirements.

(1) It is noted that a number of the World Bank Group EHS Guidelines are currently going through review. For this ESIA, ERM propose to adopt those that are inforce at the time of preparation of this report.

A comparison of numerical standards between Indonesian regulations and World Bank EHS Guidelines is provided at **Annex A**. The most stringent standard is highlighted for ease of reference and is applicable to the Project.

2.3.4 Japan Bank for International Cooperation

The Japan Bank for International Cooperation (JBIC) adopted the *Guidelines for Confirmation of Environmental Considerations* on 1st October 2009 through the Japan Finance Corporation (referred to as the JFC Guidelines). In 2002, they were revised as the *JBIC Guidelines for Confirmation of Environmental and Social Considerations* (The Guidelines), to include detailed provisions.

The Guidelines were revised in 2007, 2012 and 2015 to take account of global developments and trends on environmental matters and broad opinions from stakeholders (*JBIC, 2017*).

The Guidelines state that Project proponents are responsible for undertaking "a*ppropriate environmental and social considerations so as to prevent or minimise the impact on the environment and local communities, and not bring about unacceptable impacts which may be caused by the projects for which JBIC provides funding*."

Environmental and social considerations refer not only to the natural environment, but also to social issues such as involuntary resettlement and respect for the human rights of indigenous peoples. It is important to confirm that adequate measures have been taken to mitigate adverse environmental impacts proactively and that understanding has been obtained from all the stakeholders regarding environmental effects, especially when significant environmental impact is foreseen from the proposed Project. These are crucial points for proceeding with the proposed Project or approving a loan for the Project.

Regarding World Bank Safeguard Policy and IFC Performance Standards, the Environmental Guidelines stipulates "J*BIC also ascertains whether a project meets the relevant aspects of World Bank Safeguard Policy regarding environmental and social considerations. On the other hand, for private sector limited or non-recourse project finance cases, or for where appropriate, JBIC ascertains whether the project meets the relevant aspects of International Finance Corporation Performance Standards*". Further reference to IFC Performance Standards in this document also represents in meeting the JBIC standards (*ERM, 2018a*).

2.3.5 Nippon Export and Investment Insurance

Nippon Export and Investment Insurance (NEXI) encourages the Project sponsors in the projects that are subject to NEXI's insurance services, via the applicants for insurance services such as exporters and others (hereinafter referred to as the "Applicants"), to undertake appropriate environmental and social considerations in accordance with the nature of the Project, based on the principles adopted by NEXI.

NEXI confirms whether the Project sponsors implement appropriate environmental and social considerations, so as to prevent or mitigate potential impacts on environment (i.e. not only on the natural environment, but also on social issues such as involuntary resettlement and respect for the human rights of indigenous peoples: hereinafter referred to as the "environment") which may be caused by the projects relating to insurance (two (2) years or more) services from NEXI.

NEXI's confirmation of environmental and social considerations is one of the most important components in its risk assessment. NEXI incorporates the outcomes of its confirmation of environmental and social considerations in its decisions on issuance of commitment (or on conclusion of an insurance contract if application for commitment is not made. The same applies hereafter).

If, as a result of its confirmation of environmental and social considerations, NEXI judges that the relevant project will cause adverse impacts on the environment, it encourages the project sponsors, through the Applicants, to undertake appropriate environmental and social considerations, and there may be cases where a commitment letter is not issued.

NEXI prescribes its procedures for confirmation of environmental and social considerations such as to classify the projects into three (3) categories through screening and to implement Environmental Review for each category and engages to disclose information.

Even after making a decision on issuance of commitment, NEXI will take appropriate actions to confirm the status of monitoring by the Project sponsor via the Applicants when necessary (*ERM, 2018a*).

2.4 INTERNATIONAL TREATIES AND AGREEMENTS

Indonesia is a signatory to a variety of environmental treaties and agreements, which contain commitments to safeguard the environment, as detailed in **Table 2-4.**

Importantly Indonesia has ratified a number of International Labour Organisation (ILO) treaties and the key ones including:

- *Forced Labour Convention, 1930 (No. 29);*
- *Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87);*
- *Right to Organise and Collective Bargaining Convention, 1949 (No. 98);*
- *Equal Remuneration Convention, 1951 (No. 100);*

- *Abolition of Forced Labour Convention, 1957 (No. 105);*
- *Discrimination (Employment and Occupation) Convention, 1958 (No. 111); Minimum Age Convention, 1973 (No. 138);* and
- *Worst Forms of Child Labour Convention, 1999 (No. 182).*

Other important United Nations (UN) treaties include:

- *Convention against Torture and Other Cruel Inhuman or Degrading Treatment or Punishment ratified on 28 October 1988;*
- *International Covenant on Civil and Political Rights ratified on 23 February 2006;*
- *Convention on the Elimination of All Forms of Discrimination against Women ratified on 13 September 1984;*
- *Convention on the Elimination of All Forms of Discrimination ratified on 25 June 1999;* and
- *CESCR International Covenant on Economic, Social and Cultural Rights ratified on 23rd February 2006.*

Table 2-4 International Treaties and Agreements of Reference

Name	Year	Author	Description	Applicable Commitments
Biodiversity and Environmental				
Convention on Wetlands of International Importance (Ramsar Convention, 1971)	1971	Ramsar Convention Bureau	Intergovernmental treaty that provides the framework for international cooperation for the conservation of wetland habitats. Under this Convention, each Contracting Party commit to work towards the wise use of all their wetlands, designate suitable wetlands and ensure their effective management, and also cooperate internationally on transboundary wetlands, shared wetland systems and shared species. On 8 August 1992, The Convention entered into force in Indonesia where Indonesia currently has 7 sites designated as Wetlands of International Importance. They are Danau Sentarum Wildlife Reserve, Berbak National Park, Pulau Rambut Wildlife Reserve, Rawa Aopa Watumohai National Park, Tanjung Puting National Park, Wasur National Park, and Sembilang National Park. *Source: https://www.ramsar.org*	Avoids progressive intrusion and loss of wetlands, recognising their essential ecological functions and their scientific, cultural, economic and recreational value. Potential relevance to shore support and potential accidental as coastal wetlands are found to be present in the area.
Convention on the Protection of the World Cultural and Natural Heritage	1972	UNESCO	Framework to identify, protect, conserve all natural and cultural heritage to future generation, including prepare appropriate effective and efficient measures to mitigate and prevent further damage to natural and cultural heritages belong to all States signed this convention. The Convention encourages States Parties to integrate the protection of natural and cultural heritage into their regional planning programmes. It also explains how the World Heritage Fund is to be managed and stipulates the obligation of States Parties to report regularly of conservation of their natural and cultural heritage.	The Convention aims to establish an international framework for the identification, protection, conservation, presentation and transmission to future generations of the international cultural and natural heritage. There are no World Heritage Sites in the proposed Project Area.
Convention on International Trade of Wild Fauna and Flora Endangered Species	1973	International Union for Conservation of Nature and Natural	It regulates It regulates the international trade in animals and plants that may be threatened by trade. CITES entered into force in 1975 and currently regulates the trade of approximately 30,000 species of plants and 5,600 species of animals.	Establishes conditions for the importation, export, re-export and in general terms, the movement of wild fauna and flora endangered species. No specific commitments applicable to the Project.

Name	Year	Author	Description	Applicable Commitments
		Resources (IUCN)	The Convention obligates each Party to designate Management Authorities in charge of administering licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species. *Source: https://www.cites.org*	
Convention on Biological Diversity	1992	United Nations Environment Programme (UNEP) Ad Hoc Working Group of Experts on Biological Diversity	Its objective is to develop strategies for the conservation and sustainable use of biological diversity and equitable benefit sharing of genetic resources utilization. It is often seen as the key document regarding sustainable development since it provides a global legal framework for action on biodiversity. The Convention reminds decision-makers that natural resources are not infinite and sets out a philosophy of sustainable use. While past conservation efforts were aimed at protecting particular species and habitats, the Convention recognizes that ecosystems, species and genes must be used for the benefit of humans. *Source: https://www.cbd.int/*	Promotes the conservation of biological diversity; the sustainable use of the components of biological diversity; and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources. This convention constitutes the very first international agreement that considers biological diversity as a resource. No specific commitments applicable to the Project other than general provisions to conserve biodiversity.
United Nations Framework Convention on Climate Change – UNFCCC – as Non-annex party and the Paris climate accord within the United Nations Framework Convention on Climate Change	1992 2016	United Nations Conference on Environment and Development (UNCED) and United Nations Framework Convention on Climate Change (UNFCCC)	UNFCCC objective is to "stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The framework set no binding limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms. Instead, the framework outlines how specific international treaties (called "protocols" or "Agreements") may be negotiated to set binding limits on greenhouse gases. The Paris Agreement aims long-term goal of keeping the increase in global average temperature to well below 2°C above pre-industrial levels; and to aim to limit the increase to 1.5°C, as this would significantly reduce risks and the impacts of climate change.	Negotiated at the United Nations Conference on Environment and Development (UNCED), or Earth Summit in an endeavour to find solutions to the complex problems of securing sustainable development across a wide spectrum of environmental issues. Legally non-binding as no set limits to greenhouses gases. Indonesia developed its Nationally Determined Contribution (NDT) and committed to reduce emissions by 29%. The energy sector category is stipulated to reduce GHG emissions by 2030 to 1,669MTonCo2e. This is applicable to the Project given the scale of GHG emissions.
Marine Resource Management and Protection				
Agreement for the establishment of the	1948	Food and Agriculture	Food and Agriculture Organisation (FAO) Article XIV Regional Fisheries Body that covers fisheries, aquaculture and related aquatic	Originally the Indo-Pacific Fisheries Council (IPFC). Establishes a Food and Agriculture Organisation (FAO)

Name	Year	Author	Description	Applicable Commitments
Asia-Pacific Fishery Commission		Organisation (FAO)	resource issues in the Asia-Pacific region. Functions as a Regional Consultative Forum raising awareness amongst member countries, fisheries organisations and fisheries professionals in the Asia-Pacific region. Under the provisions of Article XIV of the FAO Constitution, seventeen conventions or agreements were approved. APFIC has covered a range of regional fisheries issues, including co-management of fisheries, low value/trash fish, illegal, unreported and unregulated fishing (IUU) and fishing capacity management, certification in fisheries and aquaculture, ecosystem approach to fisheries and aquaculture and improving resilience of fishery livelihoods. *Source: http://www.fao.org/legal/treaties/treaties-under-article-xiv/en/ http://www.fao.org/fileadmin/user_upload/legal/docs/001s-e.pdf*	Article XIV Regional Fisheries Body to cover fisheries, aquaculture and related aquatic resource management issues in the Asia-Pacific region.
Convention on Fishing and Conservation of the Living Resources of the High Seas	1958	United Nations	Agreement that was designed to solve through international cooperation the problems involved in the conservation of living resources of the high seas, considering that because of the development of modern technology some of these resources are in danger of being overexploited. The Convention stipulates all States have the right for their nationals to engage in fishing on the high seas, subject (a) to their treaty obligations, (b) to the interests and rights of coastal States as provided for in this Convention, and (c) to the provisions contained in the following articles concerning conservation of the living resources of the high seas. *Source: https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXI-3&chapter=21&clang=_en https://www.gc.noaa.gov/documents/8_1_1958_fishing.pdf*	An agreement that was designed to solve through international cooperation the problems involved in the conservation of living resources of the high seas, considering that because of the development of modern technology some of these resources are in danger of being overexploited.
United Nations Convention on the	1973	United Nations	The Law of the Sea Convention defines the rights and responsibilities of nations with respect to their use of the world's oceans, establishing	Sets limits, navigation, archipelagic status and transit regimes, exclusive economic zones (EEZs), continental shelf jurisdiction, and exploitation regime, protection of the

Name	Year	Author	Description	Applicable Commitments
Law of the Sea (UNCLOS III)			guidelines for businesses, the environment, and the management of marine natural resources. The convention set the limit of various areas, namely internal waters, archipelagic waters, contiguous zone, exclusive economic zones (EEZs), and continental shelf. Aside from its provisions defining ocean boundaries, the convention establishes general obligations for safeguarding the marine environment and protecting freedom of scientific research on the high seas, and also creates an innovative legal regime for controlling mineral resource exploitation in deep seabed areas beyond national jurisdiction. *Source: https://en.wikipedia.org/wiki/United_Nations_Convention_on_the_Law_of_the_Sea#UNCLOS_III*	marine environment, scientific research, and settlement of disputes. Specifically, it defines rights within territorial water (12 nautical miles (nm) from the coastline) and a 200 nm Exclusive Economic Zone (EEZ).
Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks	1995	United Nations	Multilateral treaty created by the United Nations to enhance the cooperative management of fisheries resources that span wide areas, and are of economic and environmental concern to a number of nations. The Agreement sets out the legal regime for the conservation and management of straddling and highly migratory fish stocks, with a view to ensuring their long-term conservation and sustainable use. Under the Agreement, regional fisheries management organizations and arrangements are the primary vehicle for cooperation between costal States and high seas fishing States in the conservation and management of straddling fish stocks and highly migratory fish stocks. *Source: http://www.un.org/depts/los/convention_agreements/convention_overview_fish_stocks.htm*	The Convention aims to ensure the long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks by encouraging a more efficient implementation by individual states of management measures to enhance the cooperative management of fisheries resources that span wide areas, and are of economic and environmental concern.

Name	Year	Author	Description	Applicable Commitments
Marine Pollution				
International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78).	1978	International Maritime Organisation	Developed by the International Maritime Organisation in an effort to minimise pollution of the oceans and seas, including dumping, oil and air pollution. The objective of this convention is to preserve the marine environment in an attempt to completely eliminate pollution by oil and other harmful substances and to minimise accidental spillage of such substances. The original MARPOL was signed on 17 February 1973, but did not come into force at the signing date. The current convention is a combination of 1973 Convention and the 1978 Protocol which entered into force on 2 October 1983. *Source: https://en.wikipedia.org/wiki/MARPOL_73/78*	**Annex I: Prevention of pollution by oil from ships –** It contains the following key provisions: • Machinery space bilges: Oil and all oily mixtures retain on-board for on shore disposal or discharge permitted where the vessel is proceeding en route and has in operation equipment of an approved design that ensures oil content of less than 15 parts per million. • Discharging sewage that is not comminuted or disinfected at a distance of more than 12 nautical miles from the nearest land. **Annex IV: Prevention of pollution by sewage from ships –** It contains the following key provisions where vessels are of 400 gross tonnage or above: • Sewage discharge into the sea is allowed when the ship operates an approved sewage treatment plant; or is discharging comminuted and disinfected sewage using an approved system at a distance of more than 3 nautical miles from the nearest land; or • Discharging sewage which is not comminuted or disinfected at a distance of more than 12 nautical miles from the nearest land.

Name	Year	Author	Description	Applicable Commitments
				Annex V: Prevention of pollution by garbage from ships – It contains the following key provisions if vessels are of 400 gross tonnage or above: • Ships of 12 meters long or more need to display a placard informing the garbage disposal requirements of this Annex. • Use the port's waste reception facilities, if any as a primary mean to dispose of garbage from the ships. • Prohibition to dispose of plastics anywhere in the sea. • Garbage Record Book must be provided in the vessel. • Garbage Management Plan must be provided in the vessel. This plan documents written procedures for the collection, storage, processing, disposal, and equipment to handle the garbage on board the vessel. • Disposal of garbage into the sea is prohibited if the distance from the nearest land is less than: – 25 nautical miles for dunnage, lining and packing materials which will float; 12 nautical miles for food wastes and all other garbage including paper products, rags, glass, metal, bottles, crockery and similar refuse; and disposal of this garbage may be permitted when it has passed through a comminuter or grinder and is disposed at a distance of no less than 3 nautical miles. This comminuted or ground garbage shall be capable of passing through a screen with openings no greater than 25 millimetres.
				Annex VI: Air Emissions – It contains the following key provisions applicable for all vessels: • Ozone depleting substances are prohibited. • Nitrogen Oxides: Operation of diesel engines >130kW prohibited unless engine is certified to meet prescribed emission standards. • Sulphur Oxides: Fuel oil is to be purchased from a registered supplier. Sulphur content of fuel oil is not to exceed 4.5% (from 1 January 2012, sulphur content of fuel oil is not to exceed 3.5%).

Name	Year	Author	Description	Applicable Commitments
				• Incinerators: Incinerators installed after 1 January 2000 must be of a type approved and certified to meet prescribed emission standards.
Montreal Protocol on Substances that Deplete the Ozone Layer	1989	United Nations Conference on Environment and Development	The Montreal Protocol sets out a mandatory timetable for the phase out of ozone depleting substances. This timetable has been reviewed regularly, with phase out dates accelerated in accordance with scientific understanding and technological advances. The Protocol sets binding progressive phase out obligations for developed and developing countries for all the major ozone depleting substances, including CFCs, halons and less damaging transitional chemicals such as HCFCs. The Montreal Protocol targets 96 chemicals in thousands of applications across more than 240 industrial sectors. The Multilateral Fund has provided financial assistance to developing countries to phase out production and consumption of ozone depleting substances since the Protocol's inception in 1987. As at 1 February 2017 on Beijing Amendment, register status of Indonesia ratification was on 26 January 2006. *Source: http://www.environment.gov.au/protection/ozone/montreal-protocol*	Prohibition of procurement any new materials or equipment (new or used) containing/using ozone depleting substances.

Name	Year	Author	Description	Applicable Commitments
Basel Convention on the control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention)	1992	UNEP	The overarching objective is to protect human health and the environment against the adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as "hazardous wastes" based on their origin and/or composition and their characteristics, as well as two types of wastes defined as "other wastes" - household waste and incinerator ash. The Basel Convention provides for cooperation between parties, ranging from exchange of information on issues relevant to the implementation of the Convention to technical assistance, particularly to developing countries. The Convention also provides for the establishment of regional or sub-regional centres for training and technology transfers regarding the management of hazardous wastes and other wastes and the minimization of their generation to cater to the specific needs of different regions and sub regions. The Convention entered into force in Indonesia on 19 December 1993. *Source: http://www.basel.int/*	Establishes an international framework for the protection of public health and the environment against hazardous waste. The convention regulates the industrial sector and the issues raised by toxic waste imported from abroad. Some of the key objectives are : • The control and the reduction of transboundary movements of hazardous wastes. • The treatment, enhancement and disposal of hazardous wastes in respect with the environment and the reduction of transport. • Limits the production of waste and their toxicity by the implementation of clean production technologies. • Assist the Member States in the management of hazardous wastes. • No specific commitments applicable to the proposed Project since no hazardous wastes will be imported or exported.
Chemicals and Wastes				
Stockholm Convention on Persistent Organic Pollutants	2004	Governing Council of the United Nations Environment Programme (UNEP)	A global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of humans and wildlife, and have harmful impacts on human health or on the environment. The objective is to protect human health and the environment from persistent organic pollutants. The Convention entered into force in Indonesia on 27 December 2009. *Source: http://chm.pops.int/*	Aims to protect human health and the environment against effects of chemical products of long life (remaining in the environment for long periods). The Convention allows the prohibition of the commercialisation and utilisation of the most harmful Persistent Organic Pollutants (POPs).
Vienna Convention on the Protection of	1995	United Nations	Acts as a framework for the international efforts to protect the ozone layer. However, it does not include legally binding reduction goals for the	Aims at structuring at the international scale, a legal, scientific and technical framework to ensure the protection of

Name	Year	Author	Description	Applicable Commitments
the Ozone Layer (1985) and related Montreal Protocol on Substances that Deplete the Ozone Layer		Environment Programme (UNEP)	use of CFCs, the main chemical agents causing ozone depletion. These are laid out in the accompanying Montreal Protocol. The Convention entered into force in 1988 and having been ratified by 197 states as well as the European Union. The Convention's accession of Indonesia was on 26 June 1992. *Source: https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-2&chapter=27&clang=_en*	the environment against activities that modify the Ozone layer. Associated to this Convention, the Protocol of Montreal ensures the control of the production and utilisation of substances commercialised implying a major risk of modifying the Ozone layer.

3 ESIA METHODOLOGY

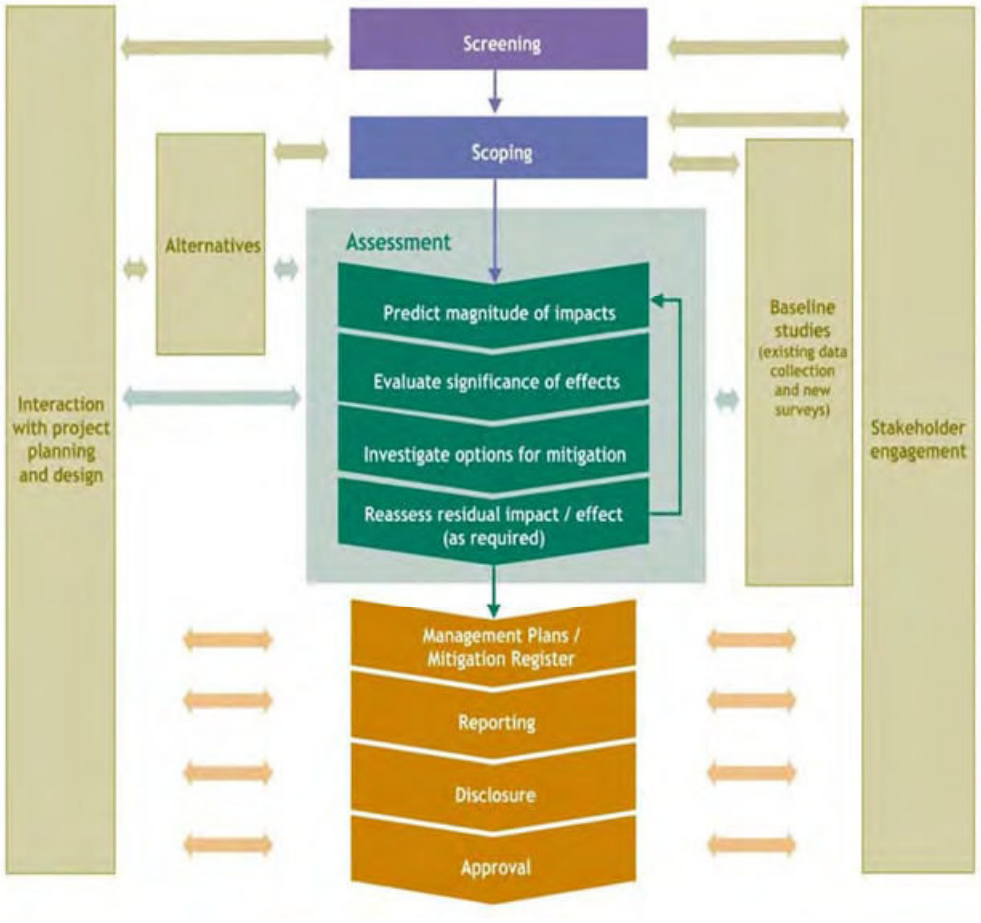
3.1 OVERVIEW

This section presents the methodology that will be to conduct the Integrated Environmental and Social Impact Assessment (ESIA).

The Impact Assessment (IA) is undertaken following a systematic process that predicts and evaluates the impacts the Project could have on aspects of the physical, biological, social/ socio- economic and cultural environment, and identifies measures that the Project will take to avoid, reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable.

The methodology follows the approach illustrated in **Figure 3-1**.

Figure 3-1 ESIA Process



Source: ERM, 2015

The criteria for assessing the significance of impacts have been drawn, where available, based on the IFC Performance Standards, IFC EHS Guidelines and national Indonesian legislation and standards, with the most stringent

requirement applying. It takes into account issues specifically associated with development of power plants, transmission lines and associated infrastructure to present impact identification and evaluation mechanism which is specific to the development type, thereby allowing for much more focused and refined assessment.

This ESIA Report will be developed and submitted to the consortium of Lenders to demonstrate how the Project aligns with the expectations of the following international Lender Environmental and Social standards and expectations.

As such, the ESIA was conducted with reference as appropriate at this strategic level to internationally recognised best practice and to the following standards and guidelines:

- *The Asian Development Bank (ADB) Safeguard Policy Statements (SPS)*;
- *Equator Principles III (EPIII) 2013*;
- *2012 IFC Performance Standards 1-8 (IFC PS)*;
- *The World Bank Group EHS Guidelines*; and
- *Japan Bank for International Cooperation (JBIC) Guidelines for Confirmation of Environmental and Social Considerations (The Guidelines)*.

Note: Relevant international standards and treaties such as the World Health Organisation (WHO); International Maritime Organisation (IMO), International Labour Organisation (ILO) and others are also applied, where applicable. These are discussed in **Chapter 2** of this report.

Furthermore, JSP's value drivers have been incorporated into the assessment and analysis in order to support the Project Team and the stakeholders in selecting the most cost-effective and responsible solution, whilst minimising JSP's future liabilities.

3.2 SCREENING AND SCOPING PHASE

The first stage in any impact assessment is screening. The primary objective of screening is to identify what Impact Assessment (IA) requirements apply to the Project.

In addition, scoping exercise is undertaken:

- to identify the potential Area of Influence for the Project (and thus the appropriate Study Area);

- to determine potential interactions between the Project and resources/receptors in the Area of Influence and the impacts that could result from these interactions; and

- to enable these potential impacts to be evaluated in terms of their likely significance.

In order to have an informed and Project specific impact assessment, it is important to select resources/receptors based on the understanding and evaluation of environmental, social and health conditions specific to the Project and proposed activities, with consideration of the potential Area of Influence.

This stage is intended to ensure that the IA identifies and focuses on those issues that are most important for design, decision-making and stakeholder interest.

ERM has conducted screening and scoping activities (*ERM, 2017*) and **Chapter 5** of this Report presents the overview result of screening and scoping exercise and key sensitivities associated with Project activities.

3.3 PROJECT DESCRIPTION

In order to establish the scope of the Project features and activities, with particular reference to the aspects, which may impact the environment, a Project Description is prepared. Details of the Project facilities' design characteristics, as well as planned and unplanned Project activities, are provided in **Chapter 4** of this Report.

3.4 STAKEHOLDER ENGAGEMENT

Achieving effective stakeholder engagement involves building and maintaining constructive relationships over time. Therefore, the Project has committed to an ongoing consultation and engagement process. The process focuses on a broad range of activities, including information sharing, consultation to negotiation and partnership building.

A Stakeholder Engagement Plan (SEP) has been developed with the aim of providing a platform for consultation and disclosure with Project stakeholders throughout all phases of the development (*ERM, 2017*) and **Chapter 6** of this Report presents the summary of recommended Stakeholder Engagement Plan.

The SEP sets out the approach that the Project will adopt in order to implement an effective engagement program with stakeholders over the life of the Project. Good relations between the Project and its surrounding

communities and relevant stakeholders will be an essential condition for the Project to acquire a social license to operate.

It is also an important means of receiving community feedback on Project related concerns and disseminating Project related information to the community.

3.5 BASELINE STUDIES

To provide a context within which the impacts of the Project can be assessed, a description of physical, biological, social / socio-economic and cultural conditions that would be expected to prevail in the absence of the Project is required.

The Baseline includes information on all resources/receptors in the Project Area of Influence, i.e. as having the potential to be affected by the Project. The preliminary environmental and social baseline conditions of the Project are reported in **Chapter 7** of this report.

3.6 IMPACT ASSESSMENT

Impact identification and assessment starts with scoping and continues through the remainder of the IA Process. The principle steps are:

- *Impact prediction*: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities;
- *Impact evaluation*: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor;
- *Mitigation and enhancement*: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts; and
- *Residual impact evaluation*: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

3.6.1 Impact Prediction

Prediction of impacts is essentially an objective exercise to determine what is likely to happen to the environment as a consequence of the Project and its associated activities.

From the potentially significant interactions identified in Scoping, the impacts to the various resources/receptors are elaborated and evaluated. The diverse

range of potential impacts considered in the IA process typically results in a wide range of prediction methods being used, including quantitative, semi-quantitative and qualitative techniques.

3.6.2 Impact Evaluation

The purpose of the impact assessment is:

- to identify and evaluate the significance of potential impacts on identified receptors and resources;
- to develop and describe mitigation measures that will be taken to minimise any potential adverse effects and enhance potential benefits; and
- to report the significance of the residual impacts that remain following mitigation.

3.6.2.1 Impact Magnitude

The term 'magnitude' covers all the dimensions of the predicted impact including:

- Type of impact: a description indicating the relationship of the impact to the Project (in terms of cause and effect) e.g. direct, indirect, induced;
- Extent of the impact: the "reach" of the impact (for example confined to a small area around the Project footprint, projected for several kilometres) e.g. local, regional, international; and
- Duration of the impact: the time period over which a resource / receptor is affected e.g. Temporary, Short-term, Long-term, Permanent.

The scale of the impact, the likelihood and the frequency of the impact will also be used to assess the magnitude of the impact.

An assessment of the overall magnitude of an impact is provided by taking into account all the dimensions of the impact described above to determine whether an impact is of negligible, small, medium or large magnitude.

3.6.2.2 Receptor Sensitivity

The significance of the impacts resulting from an impact of a given magnitude will depend on the sensitivity (terms and definitions of vulnerability and importance may also be used with defining sensitivity) of resources and receptors to that impact, i.e. the extent to which the receptor will undergo a change – negative or positive – as a result of the Project.

The quality or importance of a resource will be judged taking into account, for example, national or international designation, its importance to the local or wider community, its ecosystem function or its economic value.

The assessment of the sensitivity of human receptors, for example a fishing community or wider social group, will consider their likely response to the change and their ability to adapt to and manage the effects of the impact.

3.6.2.3 *Evaluation of Significance*

The assessment of impacts aims at providing information to decision makers and other stakeholders on the importance of each impact, to facilitate decision-making on the Project, and to facilitate the identification and design of impact reduction or mitigation measures.

The evaluation of impacts presented in the ESIA is based on the judgement of the ESIA team, informed by legal standards, national and regional government policy, current industry good practice and the views of stakeholders.

Where specific standards are either not available or provide insufficient information on their own to allow grading of significance, the evaluation of significance has taken into account the magnitude of the impact and the quality, importance or sensitivity of the affected resource or receptor.

Magnitude and receptor quality/importance/sensitivity are looked at in combination to evaluate whether an impact is, or is not, significant and if so its degree of significance (defined in terms of Negligible, Minor, Moderate or Major).

Impacts classed as negligible include those that are slight or transitory, and those that are within the range of natural environmental and social change. This principle is illustrated in **Figure 3-2**.

Figure 3-2 Impact Significance Matrix for Planned Events

Evaluation of Significance		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

Source: *ERM, 2015*

3.6.3 Mitigation and Management

One of the key objectives of an ESIA is to identify and define environmentally acceptable, technically feasible and cost-effective mitigation measures. Once the significance of a given impact had been characterised using the above matrix (**Figure 3-2**), the next step was to determine whether mitigation measures were necessary, and if so, what they should involve.

Mitigation measures were developed to reduce the significant negative impacts identified during the ESIA process to a point where they have no adverse effects, and to create or enhance positive impacts such as environmental and social benefits. In this context, the term "mitigation measures" includes operational controls as well as management actions.

Where a significant impact is identified, a hierarchy of options for mitigation is explored as summarised in **Table 3-1**. It is important to note that avoiding at source through design or selection of appropriate equipment should be the first consideration in the process of reducing impact significance.

Table 3-1 Hierarchy of Options for Mitigation and Management

Hierarchy	Description
Avoid at Source; Reduce at source	Avoiding or reducing at source through the design of the Project e.g. avoiding by siting activity away from sensitive areas or reducing by restricting the working or changing the time of the activity.
Abate on Site	Add something to the design to abate the Impact e.g. pollution control, equipment, traffic controls, perimeter screening and landscaping.
Abate at Receptor	If an impact cannot be abated on-site then controls measures can be implemented off-site e.g. noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the Project site.
Repair or Remedy	Some impacts involve unavoidable damage to a resource e.g. agricultural land and forestry due to creating access, work camps or materials storage areas; and these impacts can be addressed through repair, restoration or reinstatement measures.
Compensate in Kind; Compensate through other Means	Where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate e.g. planting to replace damaged vegetation, financial compensation for damages crops or providing community facilities for loss of fisheries access, recreation and amenity space.
Offset	Offsetting refers to the consideration of measures over and above rehabilitation to compensate for the residual negative effects on biodiversity, after every effort has been made to minimise and then rehabilitate impacts.

Source: ERM, 2015

3.6.4 Residual Impact Evaluation

In the context of ESIA, residual impacts are those remaining after the effects of all reasonable mitigation measures have been taken into account. Where possible impacts will be reduced to a level that residual impacts are considered 'not significant'; the objective of an ESIA is to identify means of reducing them to As Low as Reasonably Practicable (ALARP) levels for the circumstances of the activity under consideration.

Reporting the significance of a residual impact in this Report was based on the predicted magnitude of an impact, taking into consideration all the mitigation measures and the quality/importance/sensitivity of the receptor. Constraints arising from applicable regulations and standards were also taken into account in the evaluation of residual impacts and their acceptability.

3.7 MANAGEMENT, MONITORING AND AUDIT

The final stage in the ESIA Process is to define the basic management and monitoring measures that are needed to identify whether:

- Impacts or their associated Project components remain in conformance with applicable standards; and

- Mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

An Environmental and Social Management Plan (ESMP) will be compiled which summarises all actions which the Sponsor Group has committed to executing with respect to Environmental, Social and Community Health performance for the Project.

The ESMP includes the mitigation measures and management and monitoring activities together with details of who is responsible for implementation, how these measures are evaluated for performance, timing and reporting responsibilities.

The Engineering, Procurement and Construction (EPC) Contractors and Sponsor Group will then conduct further development of specific ESMPs during the construction and operation phases. Based on the assessment and discussions regarding design adjustments and mitigations the following plans will be developed (separately or combined) either by the EPCs or JSP:

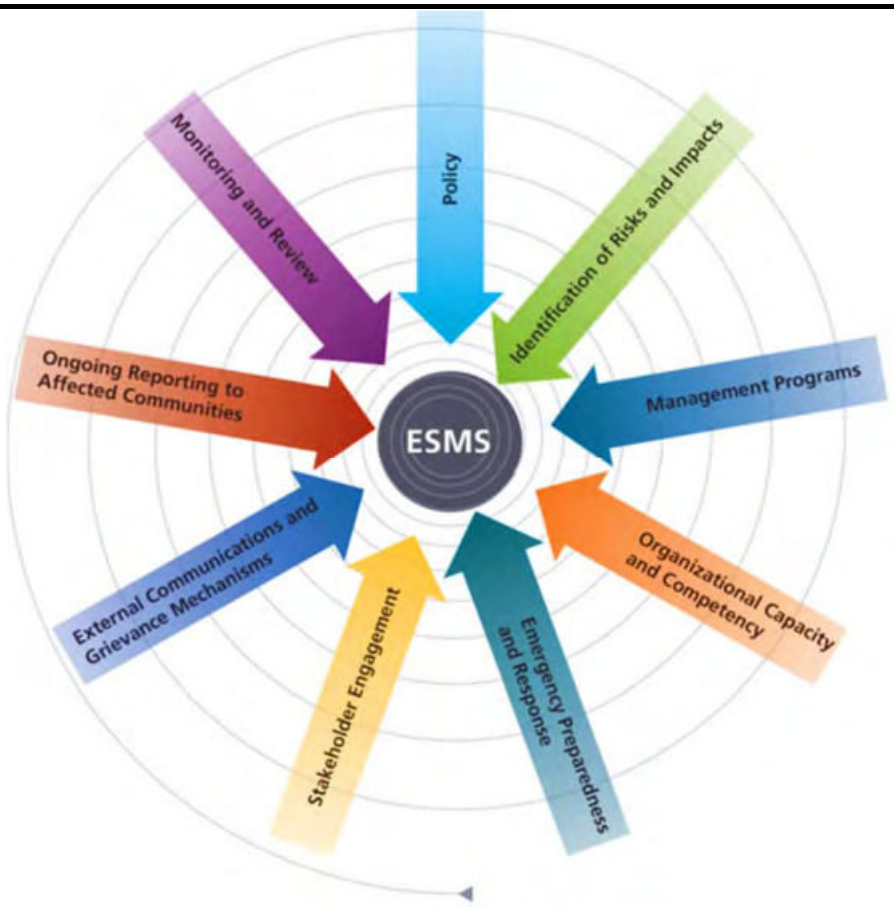
- Air Quality Management Plan;
- Corporate Social Responsibility Plan
- Livelihood Restoration Plan;
- Change Finds Procedure;
- Emergency Response Plan;
- Local Recruitment and Procurement Plan;

- Noise and Vibration Management Plan;
- Oil and Chemical Spill Contingency Management Plan;
- Security Plan;
- Soil and Groundwater Management Plan;
- Stakeholder Engagement Plan;
- Surface Water Management Plan;
- Biodiversity Action Plan;
- Traffic Management Plan;
- Waste Management Plan (Hazardous and Non Hazardous);
- Occupational Health and Safety Management Plan;
- Worker Training Plan; and
- Worker Accommodation and Management (including access to a grievance mechanism and retrenchment) Plan.

JSP and EPCs will also develop Human Resource policies setting out recruitment processes and employment terms and conditions based on the Applicable Standards.

These management plans will form one element of the Project's environmental and social management system (ESMS). **Figure 3-3** presents the nine (9) elements of the Project's proposed ESMS including this ESIA, SEP and grievance mechanism.

Figure 3-3 Elements of the Environmental and Social Management System (1)



Source: IFC, 2015

(1) ESMS Implementation Handbook, IFC 2015

4 PROJECT DESCRIPTION

The purpose of this chapter is to describe the components of the Project from construction to operation and eventual decommissioning. This chapter summarises the Project in terms of the following main sections:

- *Section 4.1: Project Overview;*
- *Section 4.2: Floating Storage And Regasification Unit, Mooring Facilities and Offshore Unloading Platform;*
- *Section 4.3: Pipelines;*
- *Section 4.4: Jetty;*
- *Section 4.5: Access Roads;*
- *Section 4.6: CCGT Power Plant;*
- *Section 4.7: 500 kV Transmission Line & Cibatu Ii/Sukatani Substation;*
- *Section 4.8: Project Decommissioning and Closure;*
- *Section 4.9: Project Traffic Management;*
- *Section 4.10: Project Waste Management; and*
- *Section 4.11: Project Consideration of Alternatives.*

The Engineering, Procurement and Construction (EPC) Contractors are currently refining the Project design and management plans (as of 1 August 2018). Where specific information is currently unavailable or has not yet been defined, conservative assumptions and estimates have been inserted into this Project description, which has been used as the base case for this Report.

4.1 OVERVIEW

The Project involves the following main components:

- *Floating Storage and Regasification Unit (FSRU)* - An FSRU with a nominal capacity of approximately 82,000 metric tons at design draught (or 86,400 metric tons at summer draught); 295 m in length and 43m in width will be permanently moored 9 km offshore perpendicular to the coastline of Subang Regency. The FSRU will receive LNG deliveries via Carriers, mainly from BP Tangguh's LNG Carriers. The FSRU will be equipped with facilities to regasify the LNG for delivery gas via the Gas Delivery pipelines to an Onshore Receiving Facility (ORF);

- *Mooring Facilities and Offshore Unloading Platform* - The Project offshore facilities includes a construction of mooring arrangement i.e. mooring dolphins and a gas offshore unloading platform.

- *Gas Delivery Pipelines* – A subsea gas pipeline of approximately 14 km will be required to deliver gas from the FSRU to the shore. An onshore pipeline of approximately seven (7) km from the landfall point on the shorefront to an Onshore Receiving Facility (ORF) located at the CCGT Power Plant site. Both pipelines will be buried 2m below the surface;

- *Seawater Water Intake and Wastewater Discharge Pipelines* – A submerged seawater intake will deliver seawater via gravity to a seawater pumping station located on the shorefront and nearby the jetty. A seawater supply pipeline of approximately seven (7) km will deliver seawater from the seawater pumping station to the CCGT Power Plant. A water pipeline of similar length will discharge wastewater from the CCGT Power Plant to a submerged wastewater outfall. All pipelines will be buried;

- *Jetty* – A Jetty will be built to support delivery of heavy equipment and material during construction activities. After the construction is complete, the Jetty will remain to support emergency operations and CCGT Power Plant maintenance activities;

- *1,760 MW Combined Cycle Gas Turbine (CCGT) Power Plant* – The CCGT Power Plant will occupy an area of approximately 36.7 Ha. This will house the gas and steam turbine buildings, heat recovery steam generators, cooling towers, a 500kV substation and associated facilities and infrastructure. A staff housing complex for approximately 85 persons will be constructed on a 12,100 m^2 of land located at 720 m to the west of power plant. An Onshore Receiving Facility (ORF) will also be developed to treat gas prior delivery to the Gas Turbines within CCGT Power Plant. In addition, CCGT Power Plan will also include Main Buildings i.e. Turbine Buildings, Control and Electrical (CEB) Buildings, Administration Building, Workshop and Warehouse and associated facilities e.g. Gas and Steam Turbines, Generator, Heat Recovery Steam

Generator (HSRG), ORF, Cooling Towers etc.

- *500 kV Transmission Line* – Approximately 52 kilometre transmission line will be developed to transfer electricity from the CCGT Power Plant to the Cibatu Baru II/Sukatani substation;

- *Cibatu Baru II/Sukatani Substation* – A 500kV substation will be developed to connect the 500kV transmission line to the Java-Bali grid; and

- *Construction and Access Roads* – The construction road will be a temporary road between the CCGT Power Plant and the shore front which will be used for the installation of pipelines. A permanent access road will then be constructed between the Jetty and the CCGT Power Plant. Initially, this will be used for the delivery of heavy equipment and materials during construction. After the construction is complete, the Jetty will remain to support emergency operations and CCG Power Plant maintenance activities. The access road will be six (6) m in width and have a one (1) m slope on both sides.

The Principal Permit for the CCGT Power Plant, 500 kV Transmission Line Development Plan has been issued by Capital Investment Coordinating Board (*Badan Koordinasi Penanaman Modal/BKPM*) No. 3552/I/IP/PMA/2016 dated on 5th of December 2017.

The Principal Permit for the FSRU is expected during the month of June 2018.

Figure 4-1 provides a schematic incorporating all Project components.

The main components of the Project are grouped together and discussed as of the overall Project. These are defined below, and a discussion of these Project components is summarised throughout **Sections 4.2** to **Section 4.7***:*

- Floating Storage and Regasification Unit (FSRU), Mooring Facilities and Offshore Unloading Platform;

- Gas Pipeline;

- Jetty;

- Access Road;

- CCGT Power Plant;

- 500kV Transmission Line and Cibatu Baru II/Sukatani Substation.

The indicative Project layout is illustrated in **Figure 4-2**.

The Project is located in close proximity in some areas to residential housing, community infrastructure and facilities. These areas and their potential impact are discussed detail in *Chapter 8* and *Chapter 9*.

Prior to mobilisation of the equipment and personnel, the EPC Contractor will prepare the plan of site establishment and submit for approval. This will include the management plan of the proposed construction access, set-up of the construction equipment and the proposed location of temporary utility supplies i.e. power, water, fuel, etc. All equipment and tools will be thoroughly selected based on economically and environmentally feasible options and in operable condition prior to mobilisation. In addition, all material arrival/shipment schedules shall be monitored and audited.

4.1.1 Land Acquisition

The land acquisition activity will be conducted in accordance with Indonesian President Regulation No. 149 Year 2015 on *Land Procurement for Development Implementation for the Public Interest*. However, the Sponsors have also applied the principle of wiling buyer willing seller along with a fair and transparent negotiated settlement process.

The total area required for the development of the Project is approximately 2,684,969 m^2. This includes not only lands procured from individual private owners and private entities, but also land leased from government owned private entities and land compensated for due to restrictions on use or access. The land acquired for the Project is 762,671 m^2, leased lands total 180,000 m^2 and land with restrictions due to the transmission line construction of 1,742,298 m^2.

Table 4-1 Required Land for the Project

Project Facilities	Private Owners (m^2)	Private Entities (m^2)	Government land (m^2)	TOTAL (m^2)
A. Land Acquired				
Power plant	0	367,000	0	367,000
Onshore pipe and access road	10,000	0	163,000	173,000
Jetty and pump house	0	0	27,000	27,000
Tower Footings of TL	115,671	0	0	115,671
Substation	80,000	0	0	80,000
Subtotal	205,671	367,000	190,000	762,671
B. Land Leased				
Onshore pipe and permanent access road	0	180,000	0	180,000
Permanent access road	0		0	

Project Facilities	Private Owners (m²)	Private Entities (m²)	Government land (m²)	TOTAL (m²)
Laydown area for onshore pipeline construction	to be determined			
Laydown area and access road for TL construction	to be determined			
Subtotal		180,000		180,000
C. Restriction of Land Use and/or Land Access				
TL Row	1,612,272	2,275	127,751	1,742,298
TOTAL				**2,684,969**

No physical displacement is anticipated due to the above land acquisition activities however, economic displacement will occur, primarily due to the loss of paddy fields and fishponds. In total, 132 landowners and 27 land users will be impacted by the land required for the tower footings, substation and coastal area project components. While there are approximately 724 landowners who will receive compensation for lands within the transmission line Right of Way.

A Resettlement Plan (RP) has been prepared in accordance with laws, regulations and policies related to land acquisition of the Indonesia National Policy on Land Acquisition as well as the Involuntary Resettlement of Safeguard Policy Statement of ADB (SPS 2009), Japan Bank for International Cooperation (JBIC) and International Finance Corporation (IFC). This is presented in **Annex I**.

Compensation for the lands will be calculated based on the Regulation of Ministry of Energy and Mineral Resources Indonesia (MoMR) Number 38/2013. The compensation value (based on market value) is calculated by independent appraiser proposed by the Project and approved by the MoEMR. The land acquisition process for the transmission line tower and substation has been underway since May 2017 and will continue until July 2018 when all compensation is expected to be completed with the transfer of all deeds finalised. Meanwhile, the land acquisition in the coastal area is expected to be completed by September 2018.

4.1.2 Project Schedule

The Power Purchase Agreement (PPA) became effective on 15th September 2017 and as such the deadline for Financial Close is 15th September 2018 with Commercial Operation Date (COD) estimated before September 2021. This schedule has been developed considered external factors such as approvals from the local authority i.e. MOEF and the Lenders (especially the ADB's 120 day disclosure period). Should these processes take less time, the schedule may be reduced.

The Notice to Proceed (NTP) of Project construction is expected to commence

in September 2018 with operation of the CCGT Power Plant expected to commence in Q1/Q2 2021.

4.1.3 Project Workforce

It is estimated that during construction, the total workforce throughout the construction phase will be more than 4,800 skilled and semi-skilled workers. The recruitment of the construction workforce will be sourced through each of the EPC's internal recruitment process i.e. workforce requirements and skills will be announced at the local community levels with suitable notice.

Preference, where feasible, will be made for those directly impacted by the Project i.e. those impacted by the Project's land acquisition, construction activities and operations (fence line communities). In addition, the appointed subcontractors and service providers will be sourced locally. This is also to comply with the local authority requirements, of which Project shall hire at a minimum of 40% local content from the total workforce and is targeting 5% of their construction workforce to be female and 10% during operations.

All recruitment processes will be reported to the Department of Manpower and Transmigration of Karawang Regency and Department of Manpower of Bekasi Regency.

Table 4-2 summarise the breakdown of required workers that will be present during the Project construction.

Table 4-2 Indicative Workforce during Construction

Facilities	Number of Workforce
FSRU	30
ROW, pipelines and Jetty	500
CCGT Power Plant and associated facilities	Skilled 1,400* (peak) & Semi skilled 2,100 (peak)
500kV Transmission Line and Substation	826
TOTAL	**~4,856**

Source: ERM, 2018b

*Note: including 60 – 70 skilled expatriates.

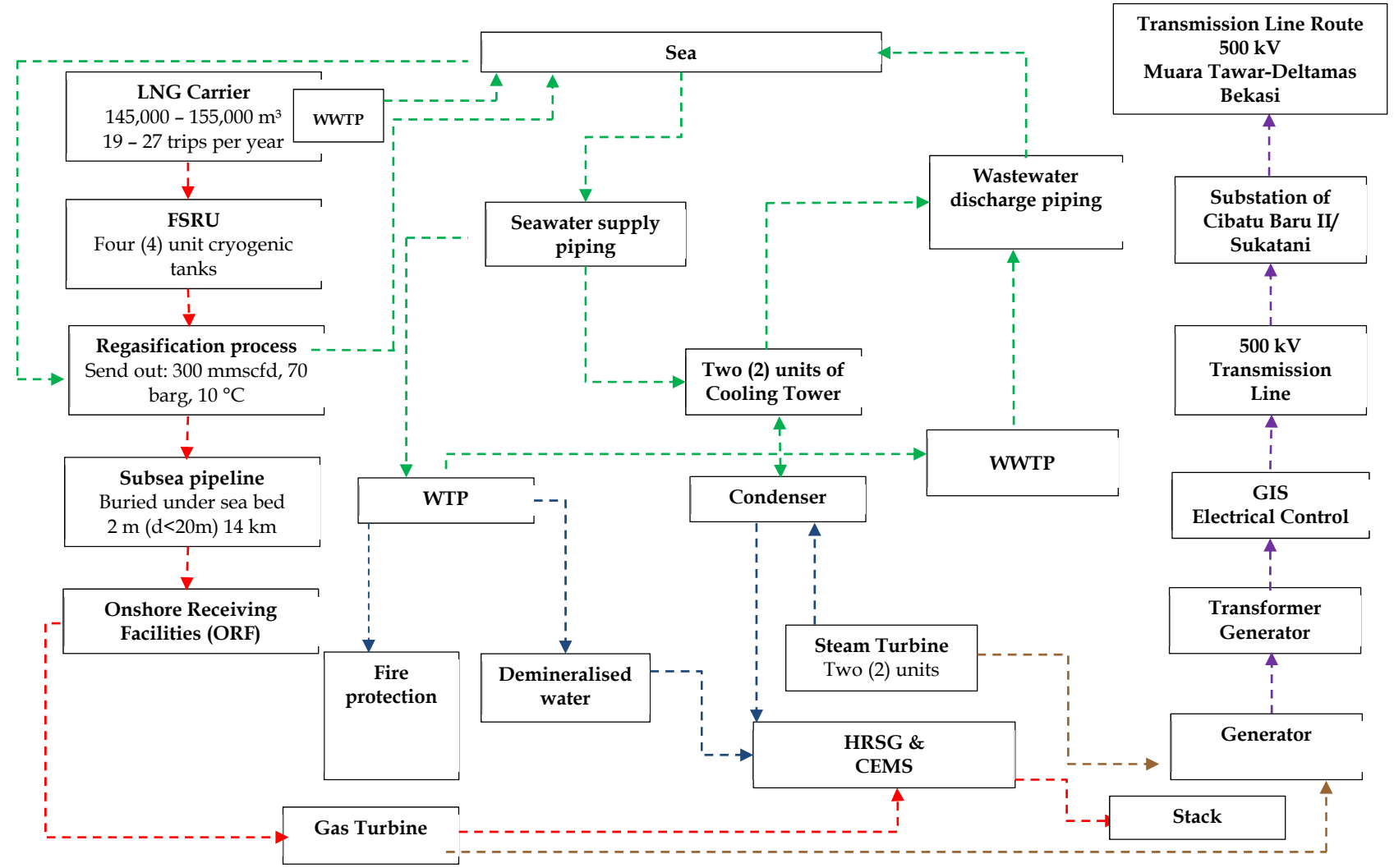
Table 4-3 summarises the breakdown of required workers that will be present during the Project operations.

Table 4-3 Indicative Workforce during Operations

Facilities	Number of Workforce
FSRU and associated subsea pipeline	30
CCGT Power Plant and associated facilities	95
500kV Transmission Line and Substation (PLN)	Likely existing PLN employees
TOTAL	**~125**

Source: ERM, 2018b

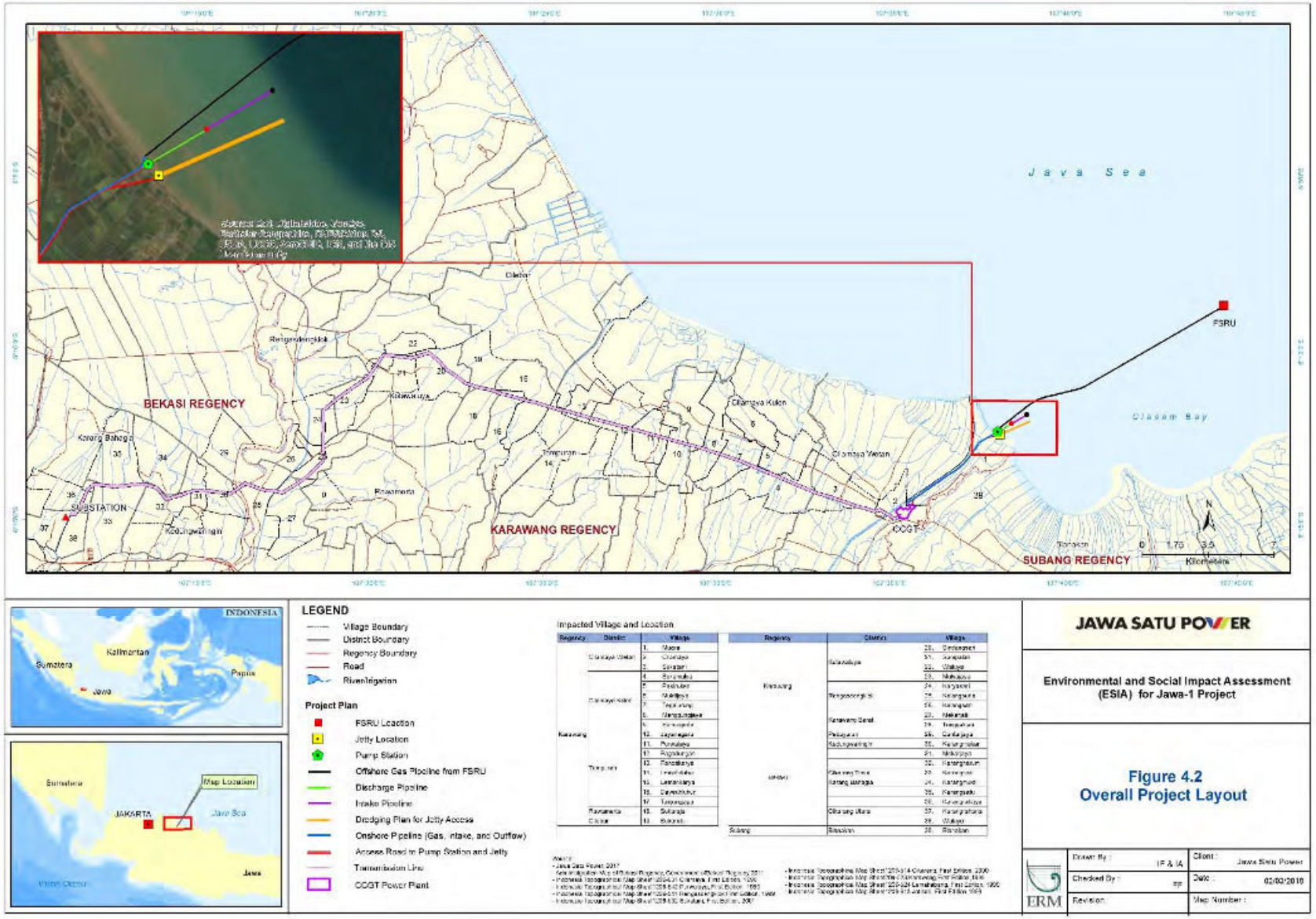
Figure 4-1 Project Flowchart



Source: ERM, 2018b

Note:
- *Gas flow line*
- *Treated water flow line*
- *Seawater flow line*
- *Mechanical power flow line*
- *Electrical Power flow line*

Figure 4-2 Overall Project Layout



4.2 *FLOATING STORAGE AND REGASIFICATION UNIT (FSRU), MOORING FACILITIES AND OFFSHORE UNLOADING PLATFORM*

4.2.1 *Project Location*

The FSRU will be located and moored offshore of Ciasem Bay within Subang Regency at a distance of approximately of eight (8) km off the north Ciasem Bay coast and at depth of 16 m of sea level.

The proposed location is located at an approximate distance from the general shipping lines including:

- 19 km from Jakarta-Semarang Line;
- 38 km from the PELNI Jakarta-Surabaya cruise line; and
- 45 km from a tanker's cruise line.

Figure 4-3 provides a layout location of the proposed FSRU.

4.2.2 *Installation*

The Project offshore facilities includes a construction of mooring facilities arrangement i.e. mooring dolphins, breasting dolphins and a gas offshore unloading platform. The dolphins and platform will be fixed to the seabed utilising cast iron piling arrangement. PT Meindo Elang Indah, the responsible Engineering, Procurement and Construction (EPC) contractors, is responsible for the construction of mooring arrangement and the offshore unloading platform.

The construction materials will be transported/installed via support barge, tug and crane barge. This includes a hydraulic hammer, power winch, water pump, mooring and offshore unloading platform reinforcement frame, associated pipes, cement, sand, gravel etc. Construction materials will be fabricated in Bintan and Handil in Kalimantan and transported via sea using barges (*Meindo, 2018*). Upon completion of the mooring arrangement, the FSRU, constructed at a South Korean shipyard, will then sail to the Project area and be permanently moored.

The proposed FSRU will be 292.5 m in length, and 43.4 m in breadth with deadweight of approximately 82,000 MT. It will be equipped with four (4) regasification trains; each train having a capacity of 100 mmscfd. The nominal capacity will be 300 mmscfd with a peak capacity of 400 mmscfd. Additionally, the FSRU will be equipped with the following utility and supporting facilities:

- Power generation system including three (3) x 3.65 MW and one (1) x 2.75 MW capacity dual fuel generator;

- An emergency diesel fuel generator with a capacity of 0.85 MW;

- Temporary storages for hazardous waste and waste management systems that will periodically be delivered to third-parties;

- Diesel oil storage and transfer system, to store Marine Diesel Oil (MDO) and Marine Gas Oil (MGO). Bunkering of diesel oil will be conducted within reach of the supply crane on the FSRU to handle bunker hoses. A bunker hose reel will be provided;

- Lube oil storage and settling tanks to store lube oil that is used for the power generation prime movers and for major rotating equipment;

- Nitrogen generators to generate nitrogen for the purpose of inert gas purging;

- Seawater system to vaporise LNG in the heat exchanger. The seawater will be filtered by intake screens, and pumped by seawater pumps. The seawater used from the LNG vaporisation system will return to the sea via gravity discharge off the FSRU;

- Redundant air compressors to generate the utility and instrument air for the FSRU. An instrument air receiver will also be provided for specified hold-up volume;

- Fuel gas system. The BOG from the LNG storage tanks will be sent to BOG Compressor. Part of the compressed BOG will be used for fuel gas for power generation. In addition, LNG/ forcing vaporisers are also provided for forced BOG generation to provide fuel gas for the FSRU. Under normal circumstances, power generation will consume BOG treated by the fuel gas skid and delivered at approximately six (6) barg; and

- Fresh water generation system and sterilisation system for domestic water. A demineralised water system will be required for the boilers. Demineralised water generator will be provided to ensure sufficient demineralised water is available for the boilers.

The FSRU/LNG Carrier will be in full compliance with MARPOL Annex I, VI, V, VI:

- Annex I (IOPP- International Oil pollution prevention) – Certificate issued from Shipyard at the time of ship delivery;
- Annex IV(ISPP- International Sewage pollution prevention) – Certificate issued from Shipyard at the time of ship delivery;
- Annex V (Garbage management plan) – Ship Manager prepares the plan and obtains approval of class; and
- Annex VI (IAPP- International Air Pollution prevention) – Certificate issued from Shipyard at the time of ship delivery.

The ship builder's specification covers full compliance with MARPOL regulations and relevant certificates to be delivered to the Project at the time of ship delivery.

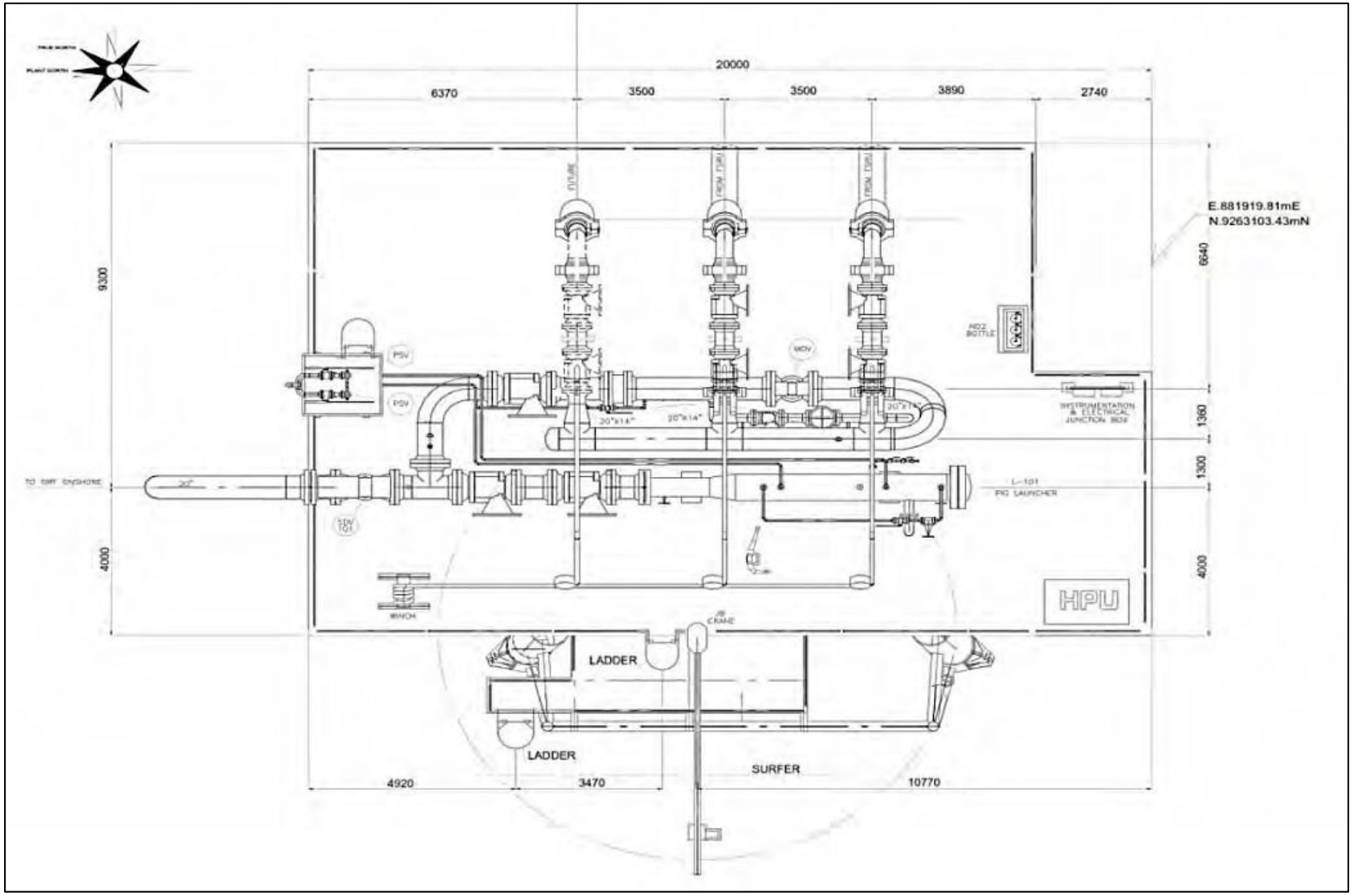
These regulations include MARPOL 73 / 78 Convention and its six Annexes:

- International Oil Pollution Prevention Certificate (IOPP Certificate) under MARPOL Annex I;
- Noxious Liquid Substances Certificate (NLS Certificate) under MARPOL Annex II;
- Document of Compliance for carriage of packaged Dangerous Goods under MARPOL Annex III;
- International Sewage Pollution Prevention Certificate (ISPP Certificate) under MARPOL Annex IV;
- Certificate / Document of Compliance for approved Garbage Management Plan under MARPOL Annex V;
- International Energy Efficiency Certificate (IEEC) under MARPOL Annex VI;
- International Air Pollution Prevention Certificate (IAPP Certificate) under MARPOL Annex VI; and
- Engine International Air Pollution Prevention Certificate (EIAPP Certificate) under MARPOL Annex VI and NOx Technical Code for marine diesel engines.

4.2.2.1 Mooring Dolphin / Offshore Unloading Platform

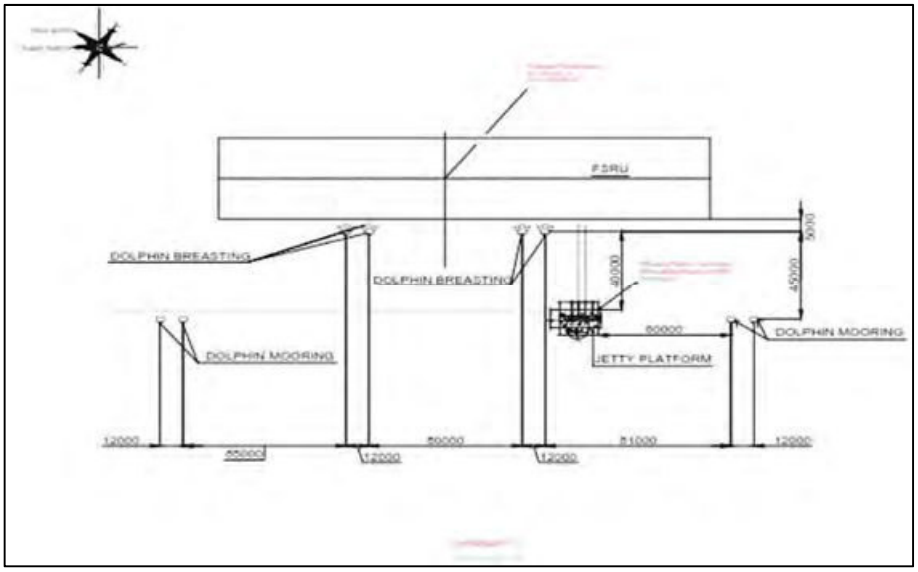
Construction of the mooring dolphin / offshore unloading platform is undertaken through the creation of mooring masts and an offshore unloading platform through deep-sea drilling. Mobilisation of equipment will be via a crane barge, support barge, tug, and dive vessel. All materials will be transported via barges from the port of Tanjung Priok. The offshore unloading platform will be 20 m in length and 14 m wide with a pig launcher and safety shutdown system. The riser for the subsea gas pipeline will be connected to this system as will a flexible high pressure.

Figure 4-3 Unloading Building Construction Offshore Platform



Source: Detailed Technical Information, Java Power Plant-1, 2016

Figure 4-4 Building Construction Mooring and Breasting Dolphin



Source: Detailed Technical Information, Java Power Plant-1, 2016

The LNG transfer will occur between 19 and 27 times a year with a total capacity of 125,000 m^3 to 155,000 m^3. The LNG will be delivered to the FSRU via tankers; it is expected that the LNG will be supplied mainly from the BP Tangguh project located within West Papua in Indonesia. The FSRU will also contain four (4) cryogenic tanks with a total capacity of 170,000 m^3 and store LNG at a temperature of -160^{0}C.

The FSRU will be constructed in a South Korea shipyard, with part of the fabrication facilities in China under the supervision of South Korean's management. Once completed, the FSRU will be mobilised to the mooring facilities area. The EPC will assist to perform hook-up FSRU to berthing and mooring dolphin including connection of flexible and cables termination. The workforce required during mooring activity is considered to be non- intensive i.e. approximately 30 personnel.

In general, workforces required for permanent mooring and offshore unloading platform require specific expertise workforces designated for working on the sea. Approximate maximum manpower is around 500. This can be changed as per Project progress (*Meindo, 2018*).

The EPC Consortium has yet to agree and determine the location of centralised basecamp and its design layout in meeting the requirements of IFC Performance Standard 2 – Labour and Working Conditions (*IFC, 2012*).

4.2.3 *Operations*

Based on *Ministry of Transportation Regulation No. 129 2016*, a secure and safe zone must be established around offshore facilities, including the FSRU and its mooring facilities. The FSRU will also be permanently moored and during installation of the vessel and a prohibited zone will be established around the FSRU area. Such zone covers both prohibited zone and restricted zone i.e. the prohibited zone is an area with a radius of 500 m starting from the outmost side of the installation; the restricted zone is the area with radius of 1,250 m starting from the prohibited zone.

The FSRU is planned for 25 years and will be taken away for dry dock inspection and maintenance to a suitable port e.g. in Singapore at least once during the operational life-time. Furthermore, maintenance activities i.e. painting will be conducted periodically to prevent rust on vessel body, deck and on-board equipment. In addition, to ensure the stability of vessel hull, underwater survey will be carried out periodically. Septic tank suction from the ship will also be conducted by a third-party.

Figure 4-5 General Profile of FSRU

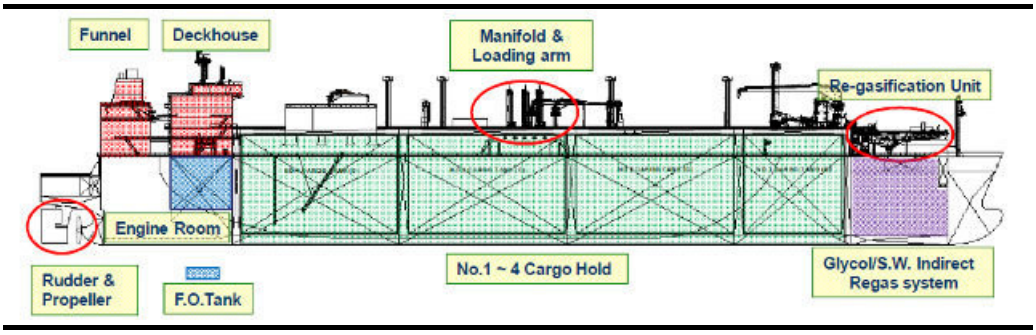
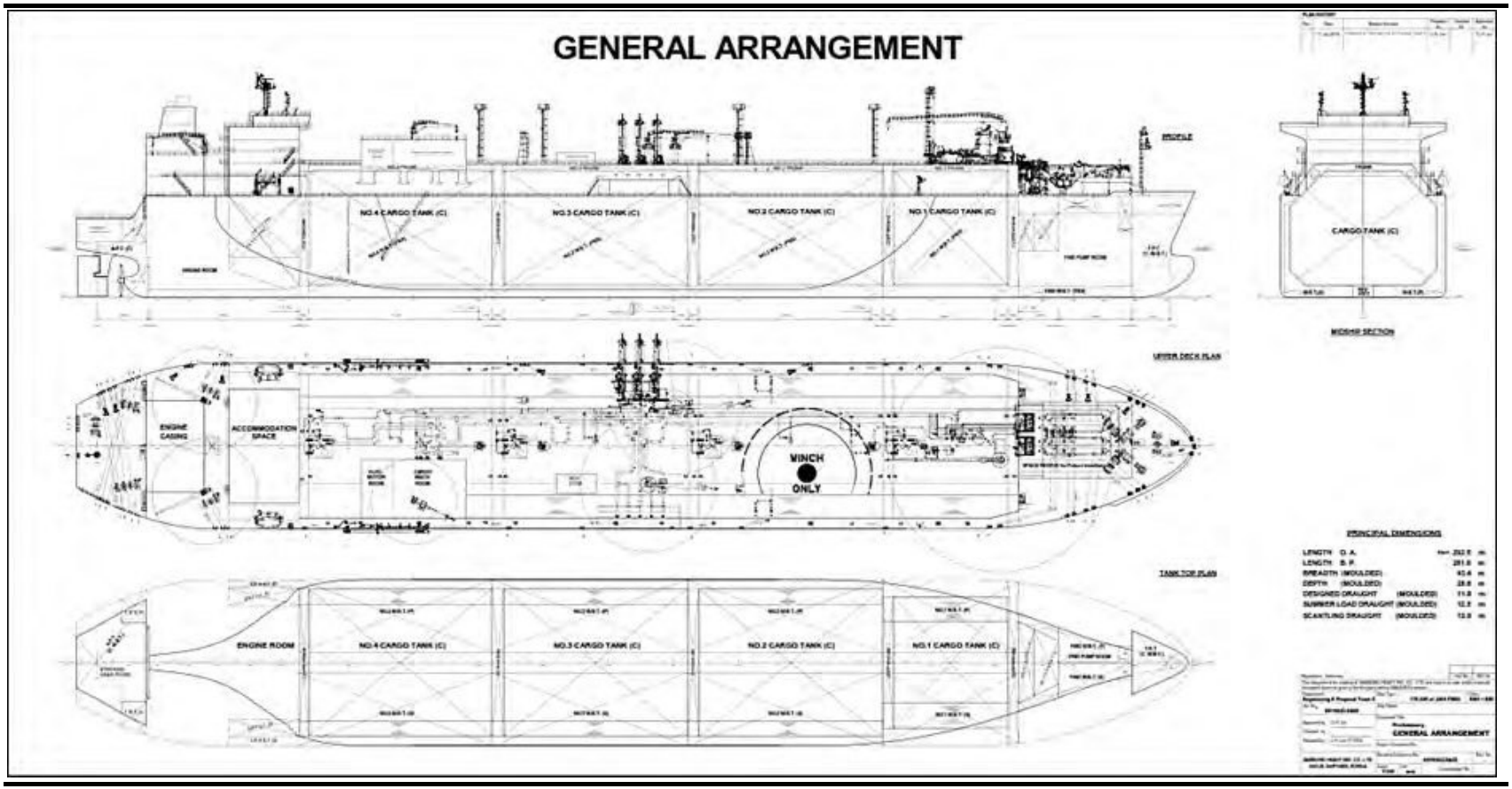


Figure 4-6 General Arrangements for the FSRU Vessel



The following section summarises the operations of the associated facilities on the FSRU.

4.2.3.1 LNG Transfer from LNG Carrier to FSRU and Storage

The LNG transfer from LNG Carrier (LNGC) to the FSRU is carried out under cryogenic conditions (ambient temperature of -160°C and pressure of about 3-5 barg) using an unloading pump and channelled through a loading arm or cryogenic expansion hose. The duration of the offloading process ranges from one (1) to two (2) days.

The FSRU consists of four (4) cryogenic tanks that have a total capacity of 170,000 m^3 LNG and maintain the LNG at a temperature of - 160^0C. The LNG spray pumps will be utilised to help maintain the temperature.

In order to compensate the volume depreciation of the LNGC and to avoid the vacuum occurrence due to the LNG offloading process, a Boil off Gas (BOG) management system via a vapour line is utilised.

During the transfer process, the ship-wall around the loading arm will be watered continuously using a water curtain. This is to prevent damages to the FSRU hull due to leakage of low-temperature liquids.

The LNG loading line and vapour return line arms will be mounted on the FSRU loading arm. In the event of an unsafe condition an Emergency Shutdown System (ESS) and Emergency Release System (ERS) are in operation for the LNG transfer and also the FSRU gas export line. The ESS will be connected between the offshore unloading platform and the FSRU and LNGC, so it can be activated from both sides.

In order to maintain the balance and draft condition of the LNGC and FSRU during offloading operations, ballast water will be fed to the ballast tank and vice versa, ballast water will be removed from the FSRU ballast tank and discharged to the sea. No chemicals will be added in the ballast water.

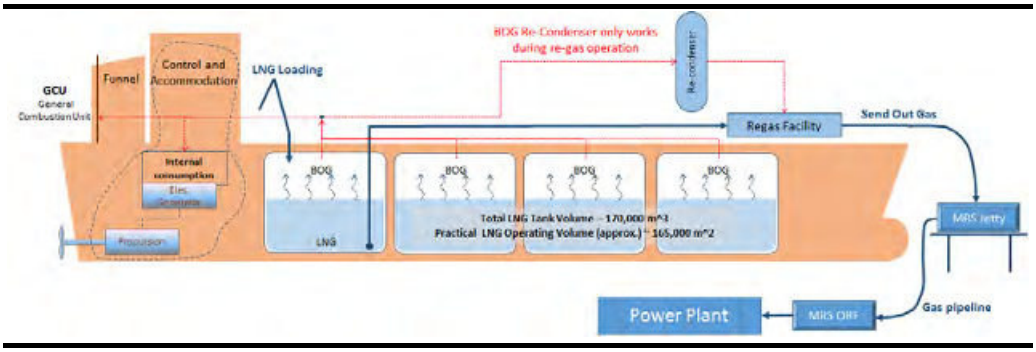
After the offloading process is completed, the LNGC will return to the loading port. The LNG that has been transferred to the FSRU tank will be temporarily stored in a cryogenic saturation, at an estimated -160°C and about 3-5 bar before it is pumped into the vaporiser system. Once the LNG supply in the FSRU tank is low, the LNG tanker will voyage for additional offloading.

4.2.3.2 Boil off Gas (BOG) System

As the LNG will be stored under a cryogenic saturated condition, BOG will form as a result environmental heat. The BOG will be removed from the cryogenic tank to prevent excess pressure and managed by either channelling into a fuel gas system via BOG recondenser, utilised to power FSRU auxiliaries or absorbed in the general combustion unit. The excess BOG will be processed in BOG combustion unit. BOG venting system is also equipped in

each cargo tank, which enable FSRU to release tank pressure during emergency event only.

Figure 4-7 BOG Management



4.2.3.3 *Regasification Unit Operation*

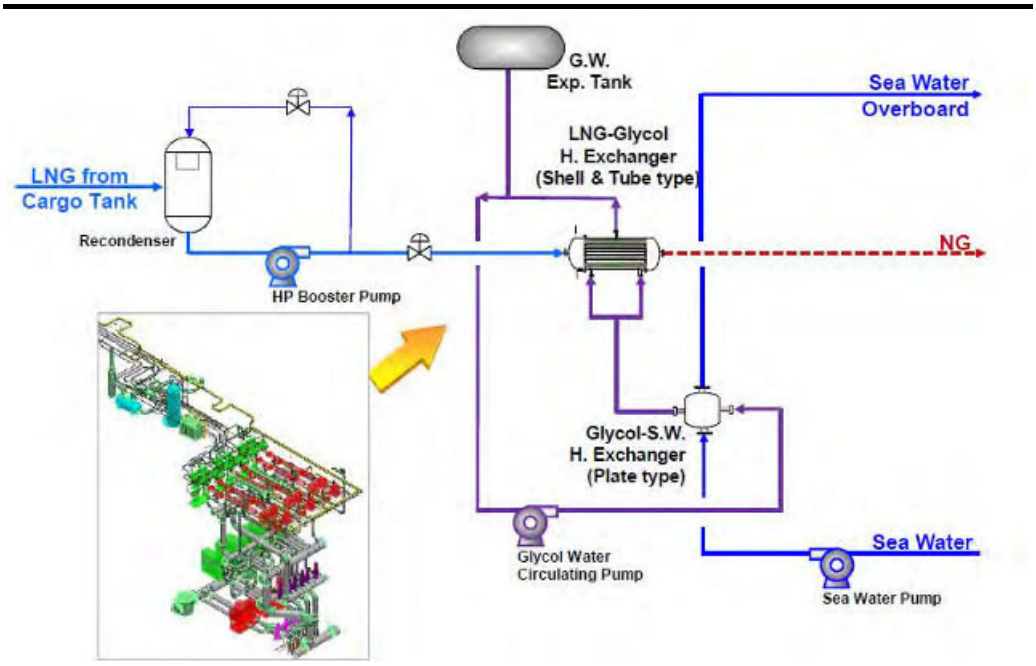
The regasification process includes the conversion of liquid LNG to gas by heating the LNG from a temperature of about -160°C to 10°C using a medium through a heat exchanger.

A LNG send out system will be used to pump LNG from the FSRU tank to the regasification unit which is also installed on FSRU. During this process, the ballast water will be pumped into the FSRU ballast tank to compensate for the decrease in LNG volume in the tank.

The regasification unit consists of four (4) trains with a maximum regasification capacity of 100 mmscfd or a total of 400 mmscfd with an optimum regasification result of 300 mmscfd. The regasification unit working system will be based as an open loop system and uses seawater as a heat source in its regasification process. Additionally, the regasification unit consists of a suction drum, LNG booster pump, heat exchanger and intermediate glycol system. The regasification technology is an open-loop sea water system with and a close-loop system using glycol as the intermediate fluid.

Once regasification has occurred, the gas will be channelled to the ORF via both subsea and onshore pipelines.

Figure 4-8 FSRU Regasification System



A total of 30 workers will be crewed on the FSRU.

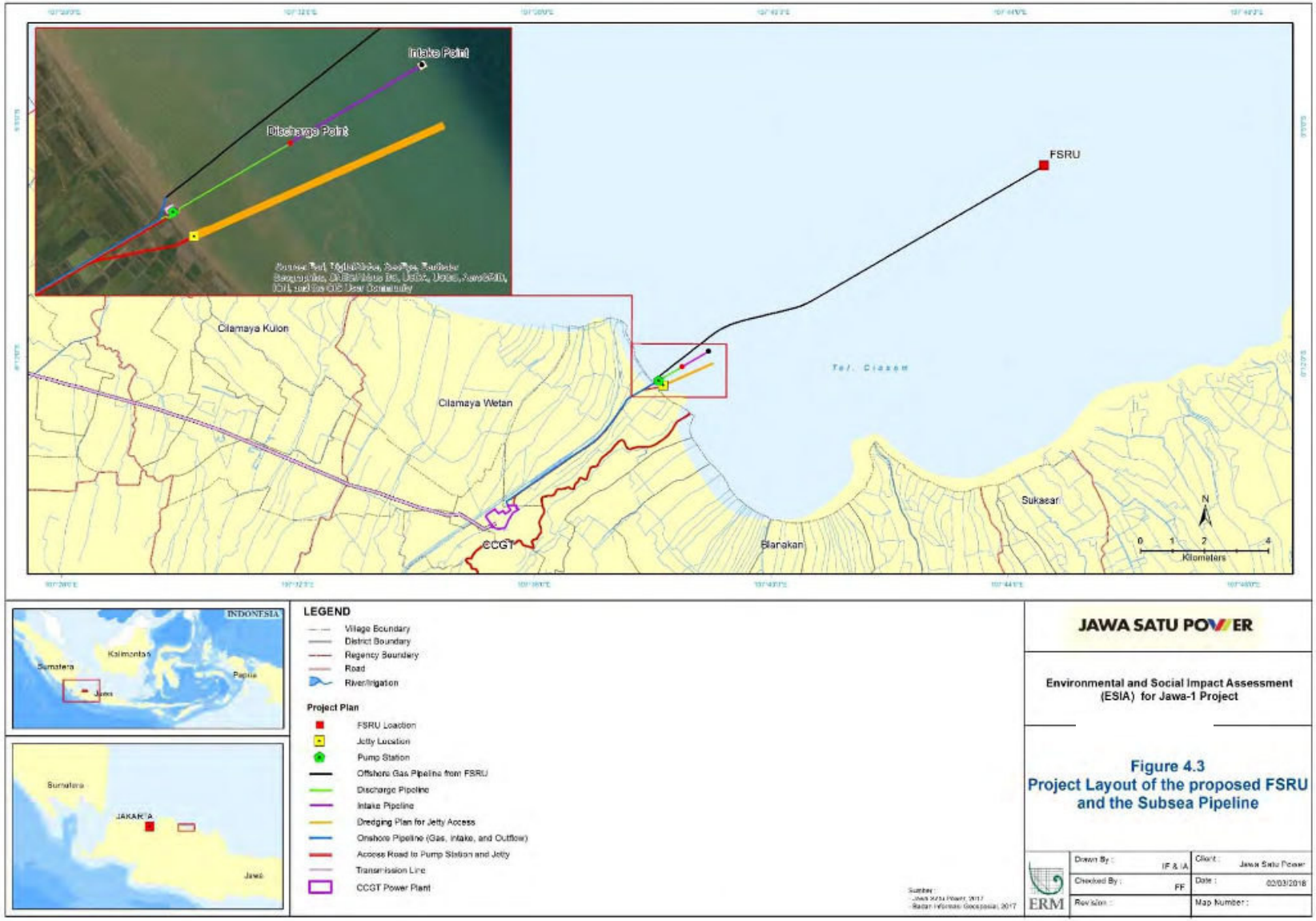
4.3 PIPELINES

4.3.1 Project Location

The proposed subsea gas pipeline will be around 14 km long and 20 inches in diameter. The pipeline will be buried at 2m depth and run from the coast of Cilamaya to the FSRU mooring location. A safety exclusion zone will be in place of 500 m based on Act Number 1 1973.

The subsea gas pipeline will connect from the FSRU to the landfall point where a buried onshore gas pipeline will connect the landfall point to the Onshore Receiving Facilities (ORF) located within the Jawa-1 CCGT Power Plant in Cilamaya Village, Cilamaya Wetan, Karawang Regency. The Project area is pre-dominantly wetland and agricultural area. **Figure 4-9** provides a layout of the proposed subsea gas pipeline.

Figure 4-9 Project Layout of the proposed FSRU and the Subsea Pipeline



4.3.2 Construction

All aspects of the proposed pipelines (i.e. design, construction, commissioning and operation) will comply with the international and local requirements of the latest versions of all relevant regulatory requirements as applicable. These include, but not limited to:

1) SNI 3474 *Sistem Penyaluran dan Distribusi Pipa Gas*;
2) SNI 1726 *Tata Cara Perencanaan Ketahanan Gempa Untuk Struktur Bangunan Gedung dan Non Gedung*;
3) 300.K/38/M.PE/1997 *Keselamatan Kerja Pipa Penyalur Minyak dan Gas Bumi*;
4) 84K/38/DJM/1998 *Pedoman dan Tatacara Pemeriksaan Keselamatan Kerja Atas Instalasi, Peralatan dan Teknik Yang Dipergunakan Dalam Usaha Pertambangan Minyak dan Gas Bumi dan Pengusahaan Sumber Daya Panas Bumi*;
5) PM 68 *Tahun 2011 Peraturan Menteri Perhubungan Tentang Alur Pelayaran di laut;*
6) American Petroleum Institute (API): API Spec 5L Specification for Line Pipe, API RP 5LW Recommended Practice for Transportation of Linepipe on Barges and Marine Vessels, API RP 5L1 Recommended Practice for Railroad Transportation of Line Pipe, API RP 1102 Liquid Petroleum Pipelines Crossing Railroad and Highways, API RP 1104 Welding of Pipelines and Related Facilities, API RP 1110 Recommended Practice for the Pressure Testing of Liquid Petroleum Pipelines and API RP 1111 Design, Construction, Operation, and Maintenance of Offshore Hydrocarbon Pipelines.
7) American Society of Mechanical Engineer (ASME): ASME B 31.8 Gas Transmissions and Distribution Piping Systems, ASME B16.5 Pipe Flanges and Flanged Fittings, ASME B16.9 Factory Made Wrought Steel Butt-weld Fittings, ASME B16.10 Face to Face and End to End Dimensions of Valves, ASME B16.20 Metallic Gaskets for Pipe Flanges - Ring Joint, Spiral Wound, Jacketed, ASME B16.21 Non-Metallic Flat Gaskets for Pipe Flanges, ASME B16.49 Factory-Made Wrought Steel Butt Welding Induction Bends for Transportation and Distribution Systems.
8) Det Norske Veritas (DNV): DNV OS F101 Submarine Pipeline Systems, DNV RP F103 Cathodic Protection of Submarine Pipelines by Galvanic Anodes, DNV RP F109 On-Bottom Stability Design of Submarine Pipelines, DNV RP F105 Free Spanning Pipelines, DNV RP F106 Factory Applied External Pipeline Coatings for Corrosion Control, DNV RP F102 Pipeline Field Joint Coating and Field Repair of Linepipe Coating, DNV RP F107 Risk Assessment of Pipeline Protection, DNV RP F110 Global Buckling of Submarine Pipelines Structural;
9) International Organization for Standardization (ISO): ISO 15590-1 Induction Bends, ISO 15589-1 Petroleum, petrochemical and natural gas industries – Cathodic protection of pipeline systems - Part 1: On-land pipelines, ISO 15589-2 Petroleum and Natural Gas Industries-Cathodic Protection of Pipeline Transportation Systems - Part 2: Offshore

pipelines, ISO 13819-1 Petroleum and natural gas industries - Offshore structures - Part 1: General requirements;

10) Manufacturers Standardization Society (MSS): MSS- SP-5 Standard Finishes for Contact Faces of Pipe Flanges and Connecting End Flanges of Valves and Fittings, MSS- SP-44 Steel Pipeline Flanges, MSS- SP-53 Quality Standard for Steel Castings and Forgings - Magnetic Particle Examination Method, MSS- SP-54 Quality Standard for Steel Castings - Radiographic Examination Method, MSS- SP-55 Quality Standard for Steel Castings - Visual Method, MSS- SP-75 Specification for High Test Wrought Butt- Welding Fitting;
11) BS 8010-1: 2004 Code of practice for pipelines: Part 1: Steel pipelines on land; and
12) NACE SP0169 Control of External Corrosion on Underground or Submerged Metallic Piping Systems.

4.3.2.1 Subsea Gas Pipeline

A 20" pipeline will be constructed from the Land Fall Point (LFP) to the Offshore Unloading Platform where the FSRU will be moored.

The total length of the subsea gas pipeline is 14 km. The total length i.e. from the FSRU location towards the shore will be installed and be buried two (2) m below the seabed. The installation of subsea pipeline will comply with pipe deployment standards and regulations, and underwater works according to *Minister of Transportation Regulation no. 129 of 2016* on the Navigation Flow on Sea and Building and/or Installation in Waters and Indonesian Standard SNI regarding Transmission Pipeline System and Gas Distribution as Mandatory Standard.

In addition, the determination of the depth of pipe burial is based on the *Minister of Transportation Regulation no. 129 of 2016* on the Navigation Flow on Sea and Building and/or Installation in Waters, i.e. two (2) m deep from the seabed to sea depths of <20 m. The construction of the subsea gas pipelines i.e. trenching and burial of the pipelines will be scheduled in April - July 2020. The location of subsea pipelines has taken into consideration of the low existence of coral reef i.e. the coral reefs location is approximately at a distance of more than five (5) km from the west of proposed location.

The following summarises the activities involved during the deployment and construction of the proposed subsea gas pipeline.

4.3.2.2 Work on the Pipe Sheath

Before the pipeline is deployed, the pipe will be coated with an anti-corrosion coating and concrete coating which serves to prevent corrosion and as a pipe weighing to stabilise the existence of pipes on the seabed. Before corrosion coating, the pipe is cleaned through a sand blasting process. Pipe coating work is conducted in the pipe vendor's factory.

4.3.2.3 *Pipe Deployment and Coordination*

The pipe deployment plan will be coordinated with *Kantor Kesyahbandaran Tanjung Priok* and the Port Authority Class II in Tanjung Priok and published in *Berita Pelaut Indonesia* (BPI) with a Notice to Mariners (NTM) issued.

This will provide awareness to the shipping line users of the pipe deployment activities at the site and know the existence of the pipe after the deployment. Furthermore, pipe deployment report will be submitted to relevant institutions such as Directorate General of Oil and Gas, Indonesian Ministry of Energy and Mineral Resource, Directorate General of Sea Transportation, Indonesian Ministry of Transportation, and Indonesian Navy Hydrography and Oceanography Centre.

For the security of Subsea Pipe and shipping safety, PT Jawa Satu Power shall coordinate with the Port Authority Class II in Pamanukan. Data of the burial position and pipeline route according to real conditions in the field (*as per-laid*) will be submitted to relevant institutions, i.e. after pipe installation finishing.

All systems including pipelines will have information in the form of images that correspond to real conditions in the field (*as built drawing*). Information of burial position will be published in *Berita Pelaut Indonesia* (BPI) and Notice to Mariners (NTM).

Thus, the local shipping line users can know the existence of sea facilities and can anticipate for the safety of shipping associated with the existence of pipe installation activities and pipelines belong to the Project.

The subsea gas pipeline deployment includes the 20" pipeline and approximately ± 1200 pipeline joints. The material will be mobilised for five in three (3) trips using the 210 ft transportation barge. Transportation will start from a pipeline laydown area to the Project area by two (2) pontoon logistic barge. In every three (3) days, a pontoon lay barge will sail for pipe welding activities. The pipeline laydown area will be located along the ROW area.

In addition, the pipe installation process requires two (2) unit of Tugs. Other heavy equipment i.e. two (2) unit Cranes will be placed on the pontoon and two (2) other units are on land and four (4) units of sideboom dozers.

4.3.2.4 *Construction of the Subsea Gas Pipeline*

A Pre-Engineering Survey will be carried out prior construction activities to allow the update of engineering documentations. Following the pre-survey, the preparation works will be carried out onshore at the vicinity of the Land Fall Point (LFP), in order to perform the shore pull and the tie-in point between onshore and offshore pipelines. This includes preparation of the foundation and installation of winch and associated equipment for back push pull activities; and the installation of protection system over existing pipelines by steel plates.

A pre-trench of minimum three (3) m depth from seabed will be executed by swamp back hoes working from the LFP up to water depth of about 1.2 m LAT. Prior to the pre-trench survey, backfilling operations may be required in cases where the sedimentation has not achieved the 2m top burial at the pre-trench area.

For water depth 1.20 m to 1.60 m LAT, the work will be completed by long arm excavators resting on a flat barge or a LCT to obtain two (2) m bottom width and eight (8) m upper opening with total length of about 600 m. An approximate of 10,000m^3 of seabed will be excavated and side casted.

A Shallow Laying Barge (SLB) will be then positioned at distance of approximately 800m/1,000m from the LFP for push-pull operation. The pulling operation will be deployed and then recovered on board in order to connect the pulling cable to the pulling head. The pulling operation will be start together with the pipe welding on the barge. Only minimum amount of coated pipes will be stored on the barge, in order to minimise the barges operating draft.

The barge will start laying at very shallow water with one fix 15 m long stinger until and 24 m ballasting type stinger. Additionally, near the termination point, all welds will be completed and checked, the abandonment head will be connected/flanged to the pipeline. Once the head reaches the sea bottom, the co-ordinates of the head will be taken in order to evaluate the position inside the target box. On completion of laying operation, an As Laid Survey will be conducted in order to establish the as laid conditions of the pipeline.

Post trenching activities may be performed via the using a diver less jet sled equipment. Jet sled will perform the post trenching activities in order to achieve the required burial depth after setting jet tubes, educators and sensors as per relevant calculations. The As – Trenched Survey will also be performed immediately after Post Trenching activities.

The construction of subsea pipeline will then include a hydrotest procedure. This will be performed by propelling a gauge pig the entire pipeline from permanents pig receiver at ORF to permanent pig launcher at Offloading Platform.

4.3.2.5 Offshore Seawater Intake and Wastewater Discharge Pipeline

The seawater will be abstracted using one (1) offshore intake pipe connected to a submerged intake head located in a dredged pit located at -4.5 meters MSL. The offshore intake pipe is preliminary sized at 1.3 m diameter. The approximate length of the intake pipe is 2,000 m.

The CCGT Power Plant process wastewater will be discharged using one (1) offshore discharge pipe connected to a submerged discharge diffuser located at -2.5m MSL. The offshore wastewater discharge pipe is preliminary sized at 0.9 meter diameter. The approximate length of the discharge pipe is 1,000 m.

The seawater intake pipeline and wastewater discharge pipeline will be made of HDPE material.

4.3.2.6 Onshore Seawater, Gas Supply and Waste Water Discharge Pipelines

A temporary construction road will be constructed along the proposed onshore pipeline ROW, which includes six (6) m + two (2) of shoulder (road). This road will be converted into a permanent access road upon the completion of construction phase. This temporary road will be backfilled within six (6) months period in a kilometre sequence (i.e. starting point is from the CCGT Power Plant) and up to the locations of nearshore facilities locations. The backfill materials will be transported from a quarry located approximately 40-50 km from the proposed Project area using dump trucks with an 8 m^3 capacity. The dump trucks will be sourced both by the EPC and the local service providers.

All pipes will be stored in the laydown area. The laydown area will be located along the ROW area on a Leased Land. **Figure 4-10** illustrates the proposed Leased Land layout (*Meindo, 2018; Pöyry, 2018*).

The ROW for pipeline installation will be cleared and will be graded to same level using Bulldozer or Excavator. All roots and stumps shall be removed by grubbing, digging or such other means. All unwanted stumps, roots and other vegetation shall be disposed outside of the worksite boundaries. A Soil Compactor will be utilised to compact the opened ROW after land grading activity.

Trenching will be then conducted based on the approved engineering design procedures and will be conducted by the EPC Contractor. Backhoes will be used to trench the area where proposed pipeline is buried.

During the construction phase, the associated pipes that will be stored in the laydown area will be coated with the coating manufacturer's recommendations. The EPC Contractor will protect the external coating of pipe from ultraviolet degradation during storage, since the pipelines will be exposed to the environment. From the laydown area, the pipelines will be transported using trailer trucks and/or truck crane are loaded with the pipes on trailer or truck bed. A flagman will be standby along the route in order to safeguard the construction road and notify for any potential disturbance during transfer of pipes.

Prior to lowering the pipeline, a holiday test will be performed. Any damages shall be repaired immediately. Pipelines will be then lifted and stringing

equipment i.e. side-boom or crawler crane) will be utilised to unload and line-up the pipelines at the proposed ROW location. The quality of pipelines, its fittings and valves will be checked prior to the fit-up, alignment or installation. A shield will also be installed to protect the pipelines from rain and dust.

A safe gap of 30 cm will be provided between pipe and soil surface during fit-up and welding activity using temporary pipe support. The welding activities of carbon steel pipelines will follow the approved Welding Procedure and only the qualified welders are allowed to perform the work. For the HDPE pipelines, the fusion welding will be conducted by the trained and certified third-party welders. All completed welded pipelines will be inspected in ensuring the pipelines are free from defects e.g. undercut, cracks etc. and to ensure the pipelines are constructed in accordance to the Project specification, referenced code and standards.

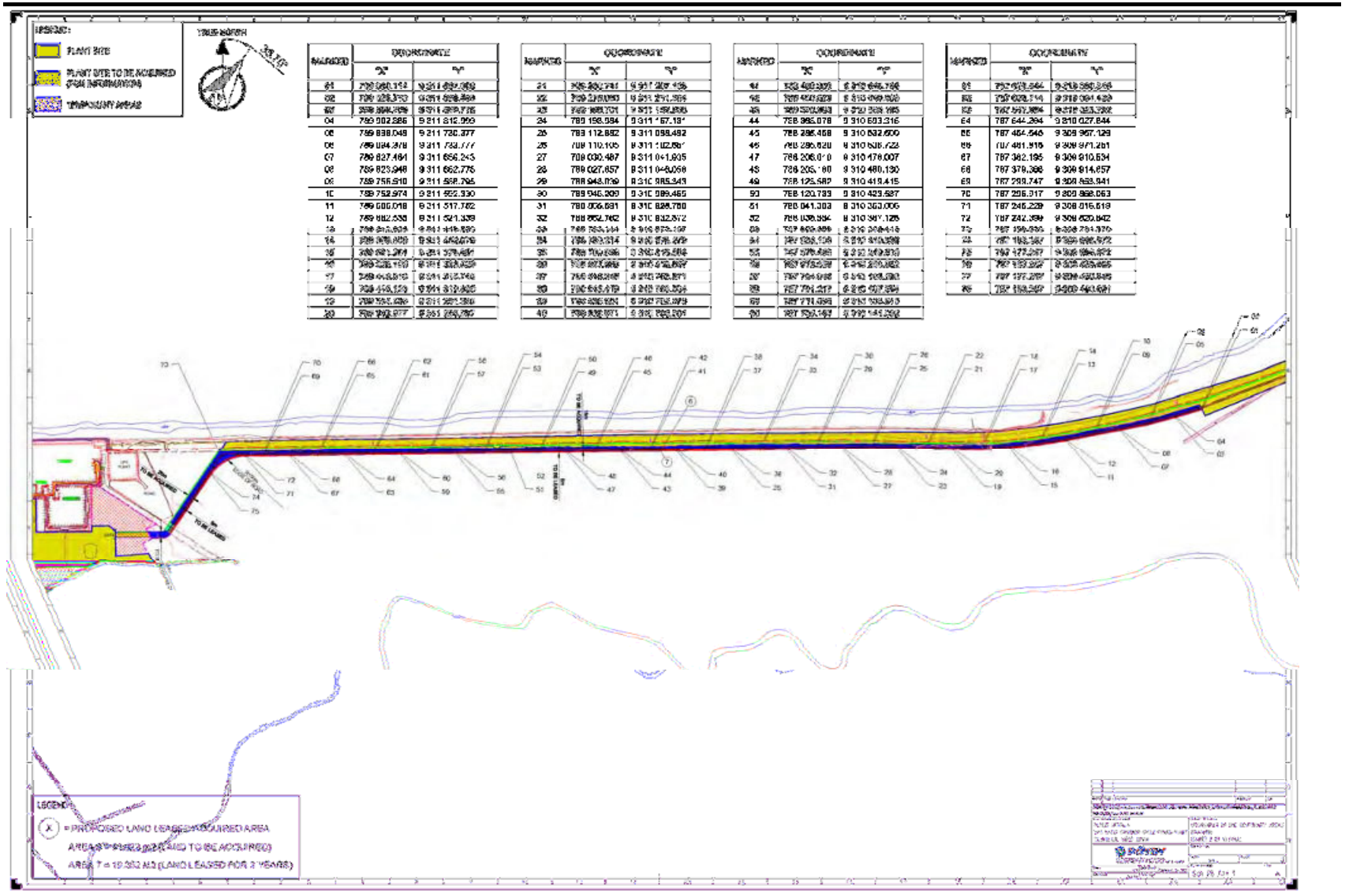
The NDT aluminium gauging plate will be then used for the Non Destructive Examination (NDE) to ensure that no dent or excessive weld is presence and to remove debris. This includes Radiography Test, Dye Penetration Inspection and Magnetic Particle Inspection. After visual and NDT results are approved, the joint coating will then be carried out in accordance to the Joint Coating and Pipe Wrapping Procedure. The backfilling then will be conducted using an excavator to bury the pipeline. The soil used will be supplied from the existing native soil from trenching activities.

4.3.2.7 Protected Forest Area

A 2.8 km of the proposed onshore pipelines will be located in Ciasem-Pamanukan Protected Forest Area (1). According to the Government Regulation *No. 105 Year 2015 and Minister of Environment and Forestry Regulation No. P.50/MenLHK/Setjen/Kum.1/6/2016 regarding Borrow-to-Use Forestry Permit*, the process in obtaining the permit is currently on going and anticipated before September 2018. **Figure 4-11** illustrates the overlay of the proposed onshore pipeline and the Protected Forest area.

(1) Refers to Indonesian *Minister of Environment and Forestry Decree No. SK.3287/MenLHK-PKTL/KUH/PLA.2/2016* issued on 13 July 2016 regarding Affirmation of Protected Forest Area in Ciasem-Pamanukan Forest Group Area by 7,666.87 Ha in Karawang Regency and Subang Regency, West Java Province.

Figure 4-10 Proposed Layout of the Pipelines Laydown Area



Source: Meindo, 2018; Adopted from Pöyry, 2018

Figure 4-11 Onshore Pipeline within the Protected Forest Area

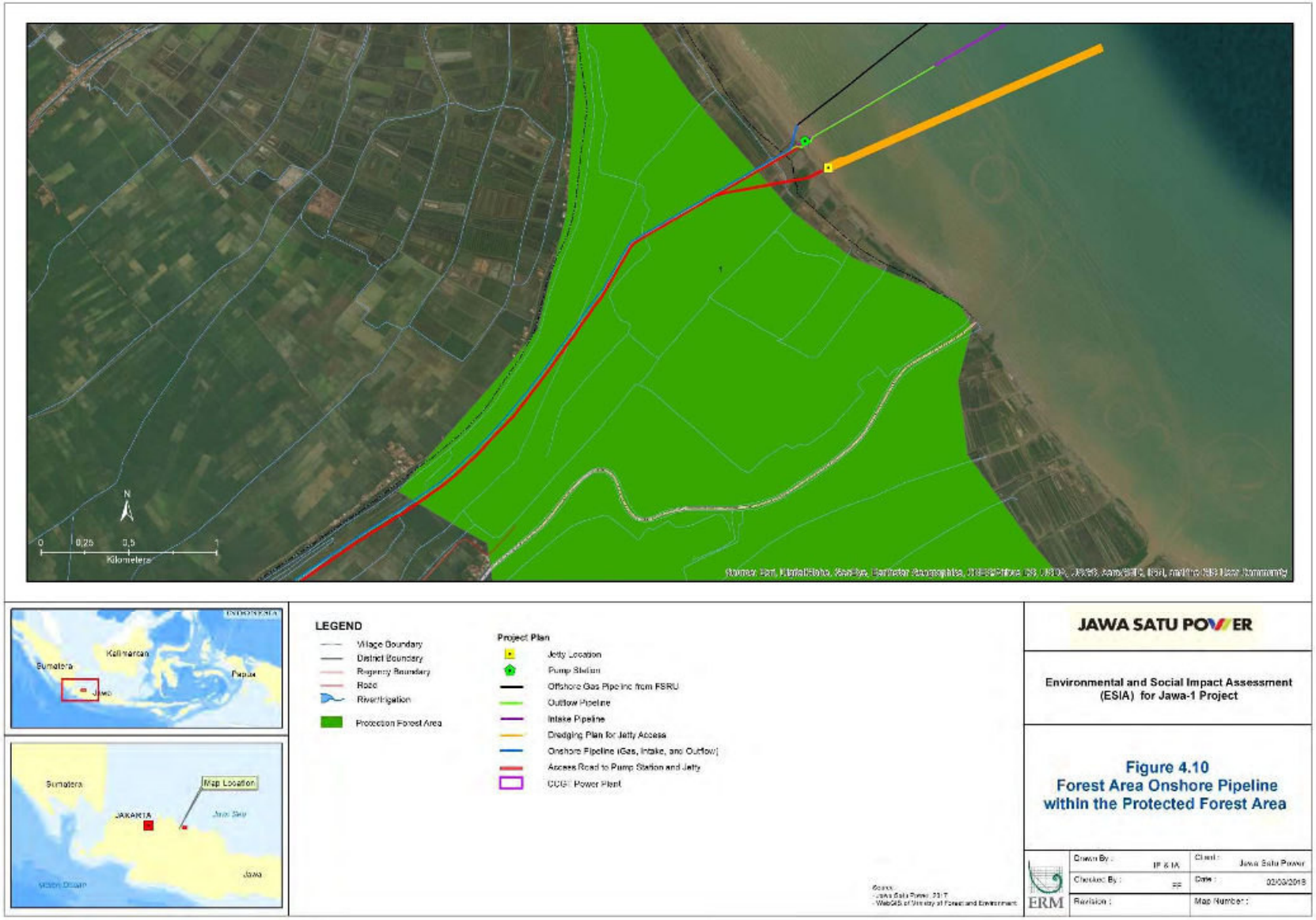
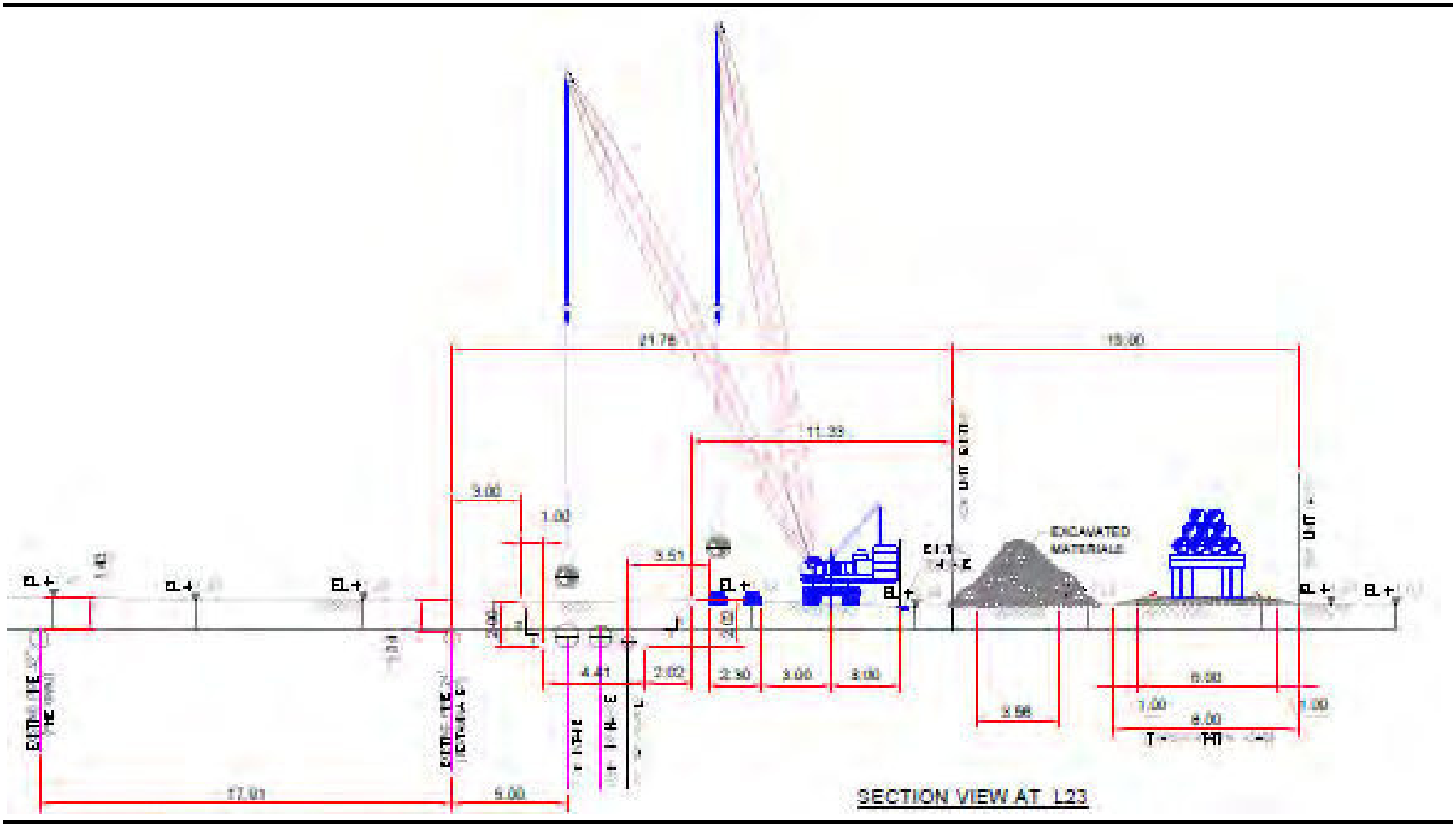


Figure 4-12 Section View of Onshore Pipeline ROW Construction



4.3.3 Commissioning

4.3.3.1 Gas Pipeline Hydrotest

Prior to commissioning, the structural integrity of the subsea gas pipeline will be determined using a hydrostatic pressure test, in which the pipeline will be are filled with seawater i.e. approximately 10,000 m^3, pressurised above the intended operating pressure and monitored for leaks or pressure loss over a specified time period. Additives such as oxygen scavengers and biocides will be added as a preventative measure to control the risk of potential corrosion and microorganism growth in the pipes.

After a pressure test is completed, the pressure is released and the pipelines dewatered by pushing a 'pig' through the line. Pigging is conducted by inserting a Polyurethane (PE) pig into an air-driven pipe from the compressor until the pig reaches the end of the pipe. The pigging facility is in the form of a pig launcher located in the Mooring System; the Pig Receiver will be installed in the ORF. Pigging is conducted twice, once when the pipeline is connected to each part and twice after completion of the hydrostatic test.

During dewatering, the pig will flow the water from the ORF to the offloading platform; water will be discharged to the Java Sea at the offloading platform. Before the disposal, water sampling and analysis shall be done in order to ensure it is acceptable for discharge directly to the sea (and complies with the international marine water quality standards).

Additionally, to ensure that all water and water vapour are not present in the pipe, a drying process will be carried out by passing dry air along the pipelines.

4.4 JETTY

4.4.1 Project Location

The jetty will be constructed on the outskirts of Muara Village's fish ponds, approximately < two (2) km from the mouth of the Cilamaya River. The proposed Project area is pre-dominantly community fish ponds and a few mangrove areas. The jetty will serve as the point of the imported maintenance equipment and materials for emergency situations. **Figure 4-19** provides a Project layout of the proposed jetty.

4.4.2 Construction

A Jetty will be built to support mobilisation delivery of heavy equipment and material during construction activities. After the construction is complete the Jetty will remain to support emergency operations and CCGT Power Plant maintenance activities. The jetty will be established on an area of 500 m^2. The proposed schedule for the construction activities of the jetty will be in April - July 2020.

Dredging activities are required for the construction of the jetty and clearance of an access channel from the shoreline location. There are a number of options for dredging and the Project will adopt use of a floating barge and swamp back hoe, with the dredge material side-casted.

The jetty structure is planned to be installed at an angle across a drainage channel**.** The original position of the jetty was adjacent to the shoreline as shown in **Figure 4-13**. The jetty location has been moved 100 m seaward (**Figure 4-14**) from this original location, further from the drainage channel and reducing the amount of dredging required around the structure.

The original dredging plan was to achieve a 4 m water depth for the vessel draft. This resulted in an estimation of 80,000 m^3 of dredge material. The equipment mobilisation plan has been revised to reduce the amount of dredging required for the access channel by selecting a vessel with operating draft of 2.0-4.0 m and reducing the channel depth from the original plan of 4.0 m to 3.0 m at Lowest Astronomical Tide (LAT) conditions. Equipment offloading at the jetty is planned for Highest Astronomical Tide (HAT). The amount of dredging required as a result of these changes is reduced to 45,981m^3 (57%).

Figure 4-13 Construction Jetty Orientation – Original location

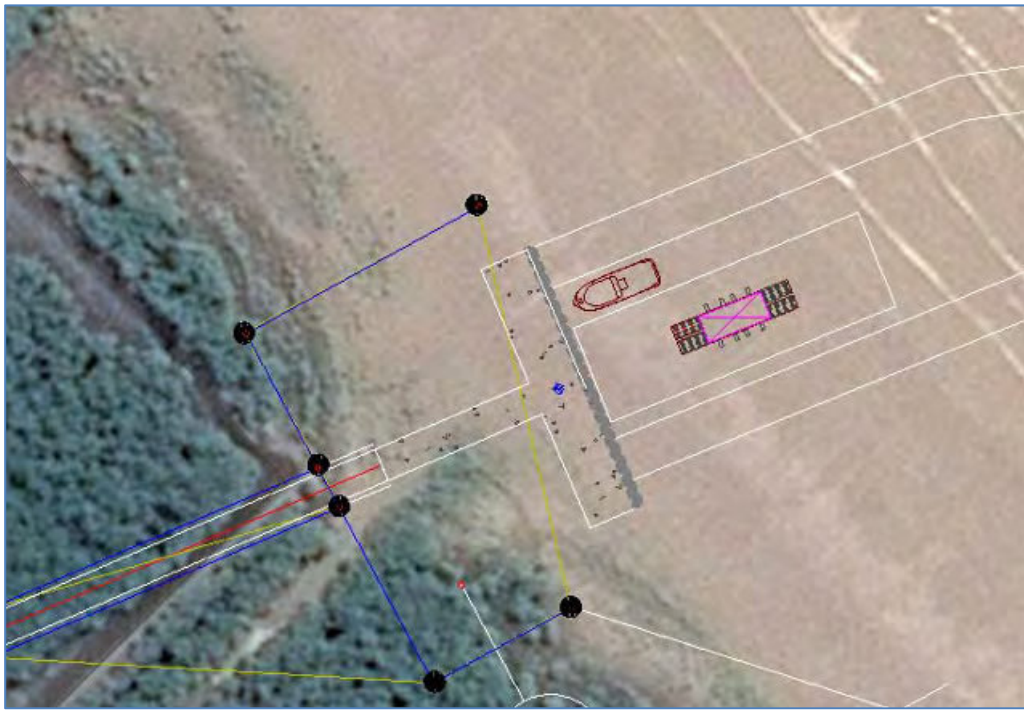
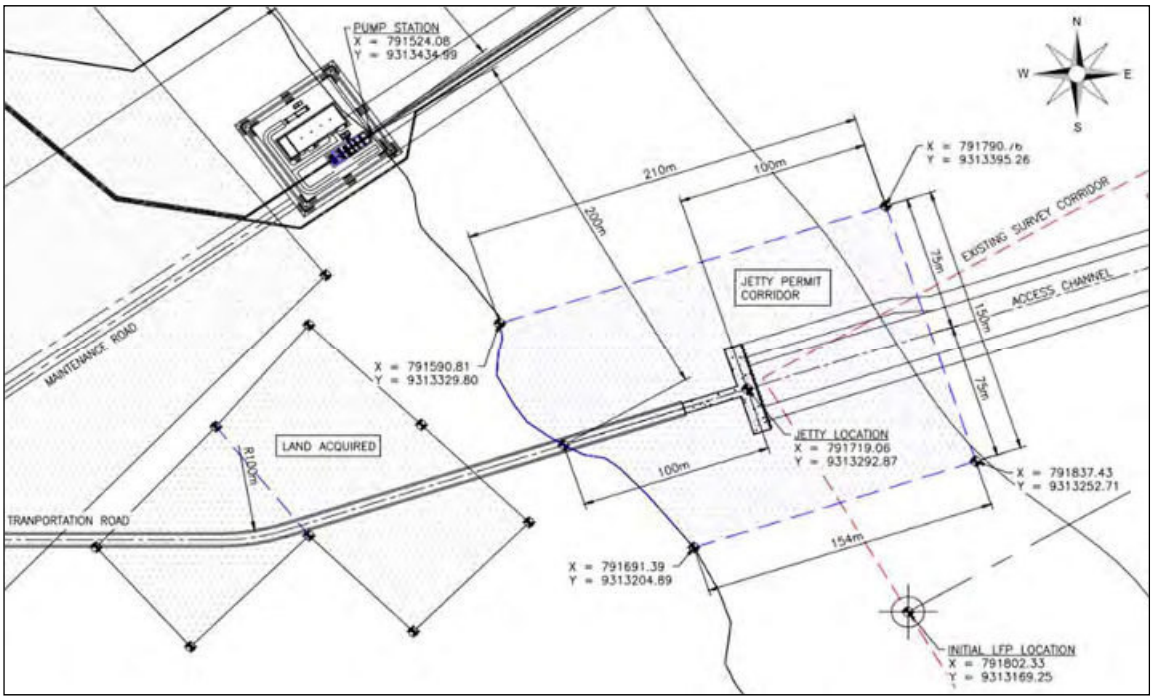


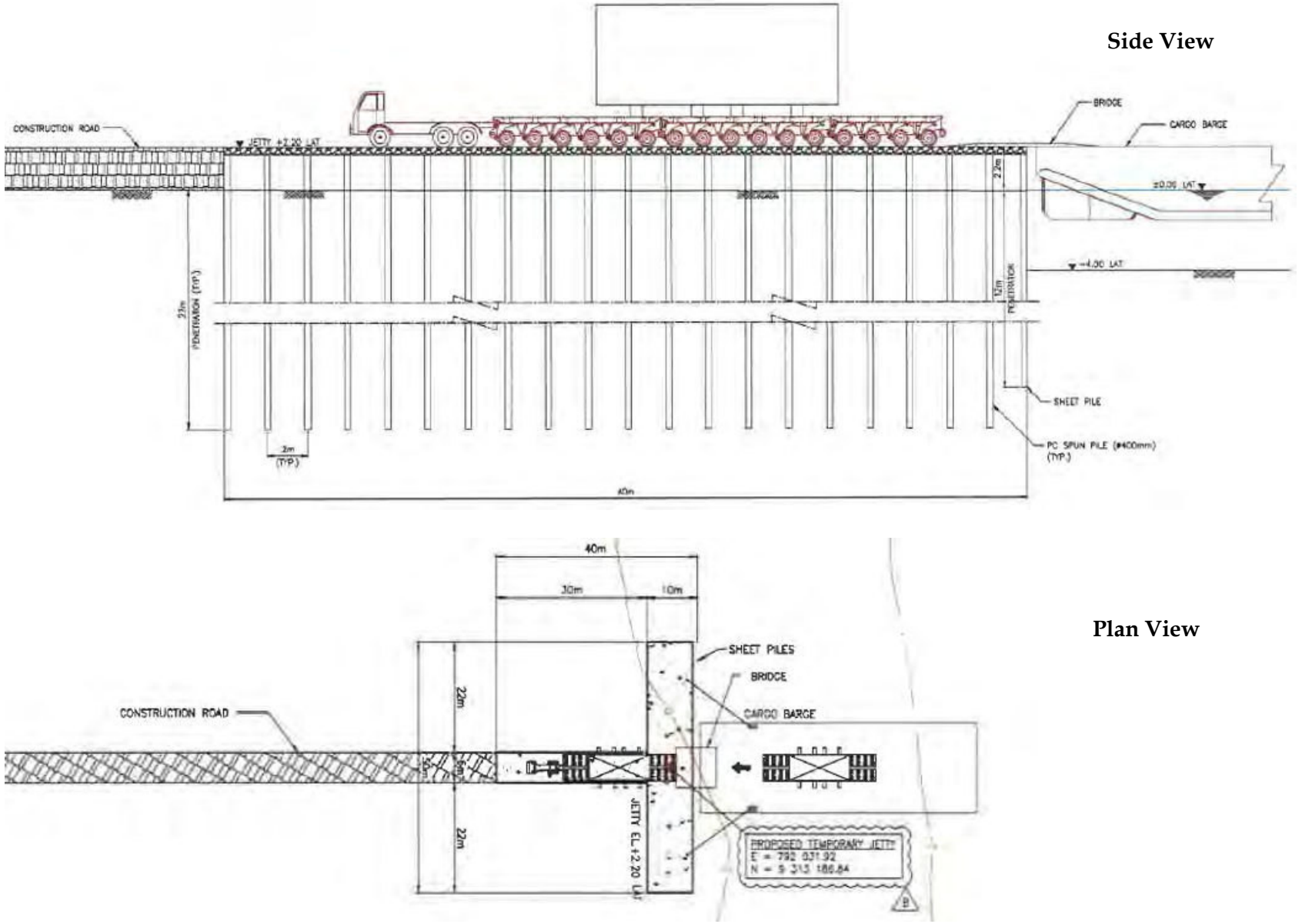
Figure 4-14 Revised Jetty Orientation



The jetty design consists of a concrete pile structure, fronted by a steel sheet pile retaining wall. The total length of the jetty is 40 m and 6 m width, with a perpendicular T-shaped front of 50 m length (**Figure 4-15**).

The concrete pile of 400 mm outer diameter will have a total length of 24 m embedded in the soil. The spacing of the piles will be 2 m x 2 m. On top of the piles at laid down area a concrete slab of about 30 cm thickness will be poured.

Figure 4-15 Construction Jetty Design



Dredging activities for the construction of the jetty and the access channel will be conducted from the shoreline location of the jetty seaward to a water depth of – 3 m, with a total length of the access channel of 1,750 m. The dredging activities and placement of the dredging material is as follows:

1. The depth of the access channel will be -3.00 m on condition of the Lowest Astronomical Tide (LAT), without affecting the burden in activities with a shallow pull selected with the operating concept of 2.0-4.0 m.
2. Dredging up 1.00 m water depth by the Swamp Back Hoe to minimise the effects of turbulence generated by the Pontoon.
3. Dredging Material produced by the Swamp Back Hoe (up to a water depth of 1.00 m) will be disposed to the back of the jetty location.

The jetty installation and access channel trenching plan is illustrated in **Figure 4-16** and the dredging plan in **Figure 4-17**.

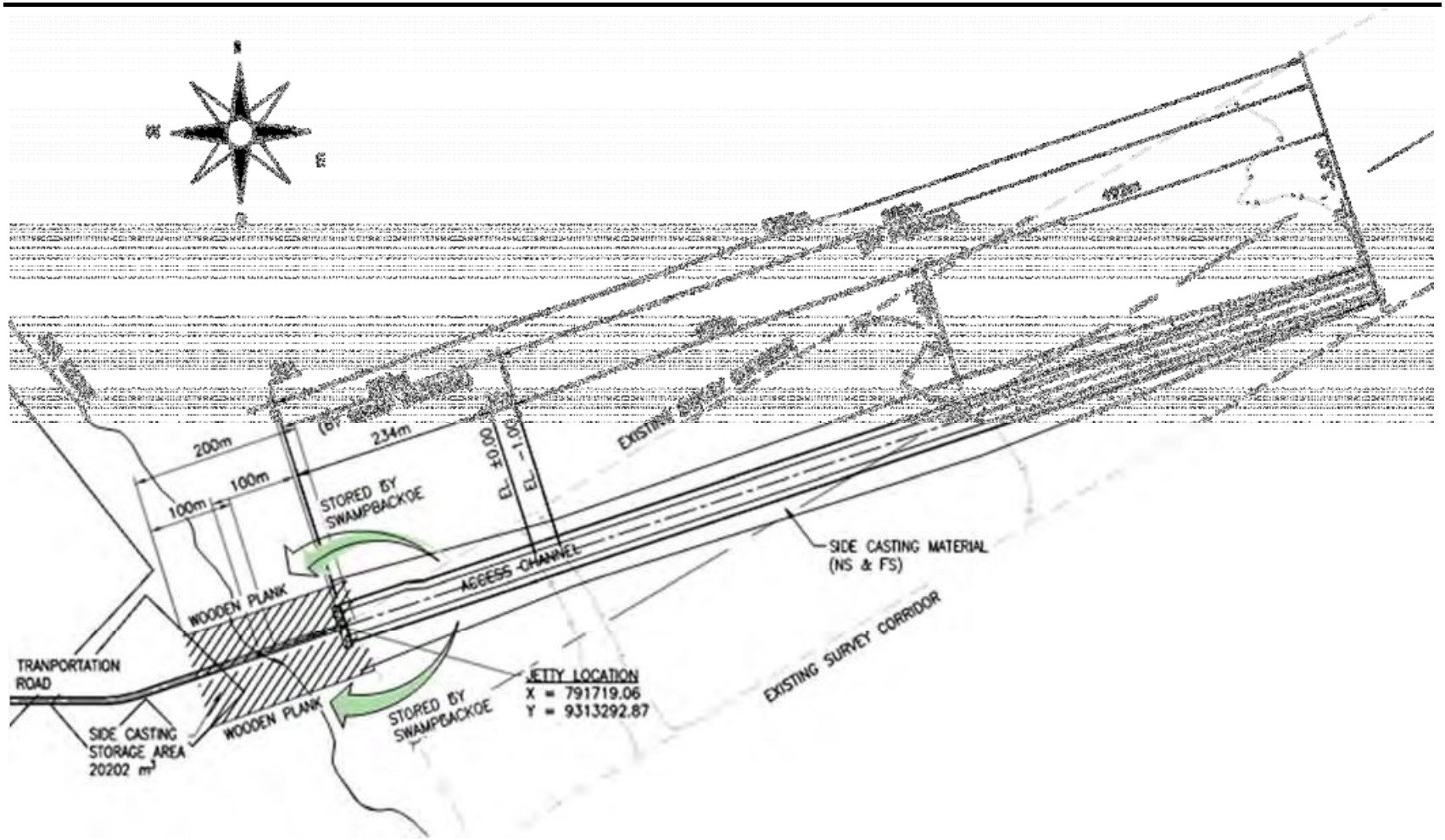
The total volume of the dredging material is approximately 45,981 m^3, as shown in **Figure 4-16**. Material from the location of the jetty to a water depth of -1.0m (20,202 m^3) will be transported by Swamp Back Hoe to the nearshore jetty area. The remainder of dredged material from -1.00 to -3.00 m water depth (i.e. 989 m total length and 25,778 m^3 of material), will be side cast with a maximum height of 0.5 m, which will be maintained below sea level with a minimum of 1.50 m LAT. Material relocation by side casting involves the discharge of dredged material alongside the area of dredging by direct discharge of the dredger's grab. The dredging activities will be completed within 26 days (nearshore and offshore).

Once the jetty is built, a barge will dock in every two (2) to five (5) days per month, depending on the weather conditions. This will decrease to one (1) barge every two (2) weeks during the final 10 months of construction activity. The jetty will be used to supply large equipment, which cannot be readily transported via road.

In general, workforces required for permanent mooring and offshore unloading platform require specific expertise workforces designated for working on the sea. Approximate maximum manpower is around 500. This can be changed as per Project progress (*Meindo, 2018*).

The EPC Consortium has yet to agree and determine the location of centralised basecamp and its design layout in meeting the requirements of IFC Performance Standard 2 – Labour and Working Conditions (*IFC, 2012*).

Figure 4-16 Jetty and Access Channel Trenching Plan

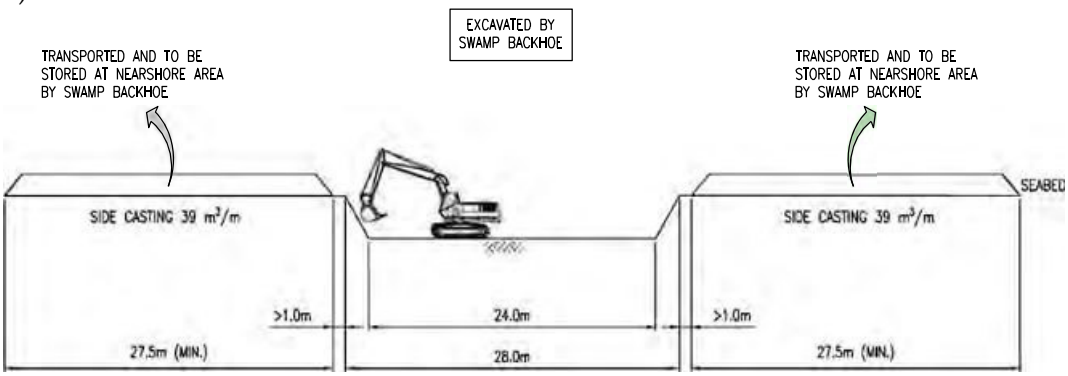


Abbreviations:

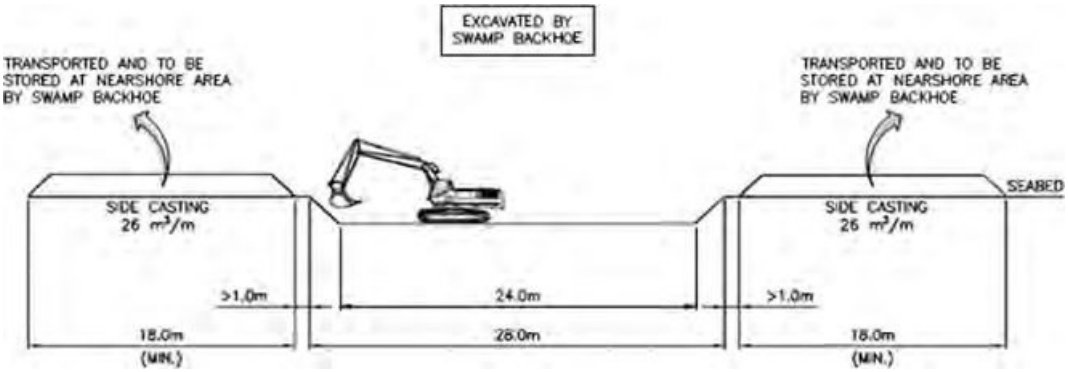
- FS: Far Side
- HAT: Highest Astronomical Tide
- LAT: Lowest Astronomical Tide
- MSL: Mean Sea Level
- NS: Near Side

Figure 4-17 Dredging Plan

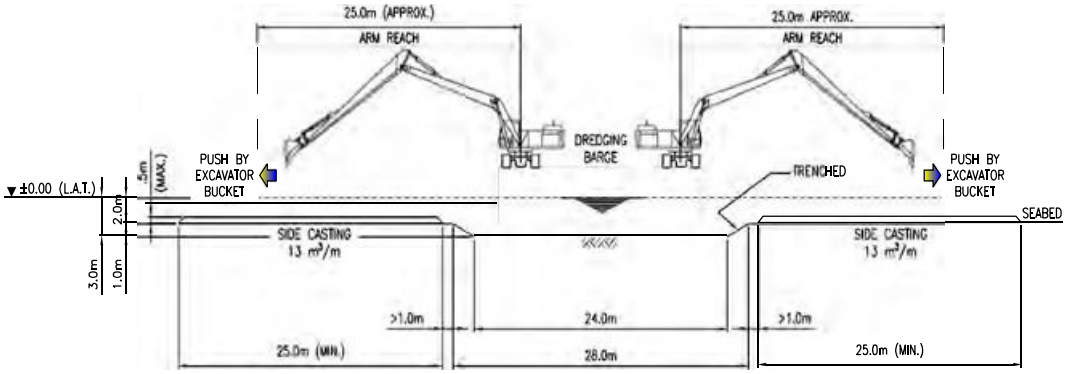
a) ***Elevation on EL. ±0.00***



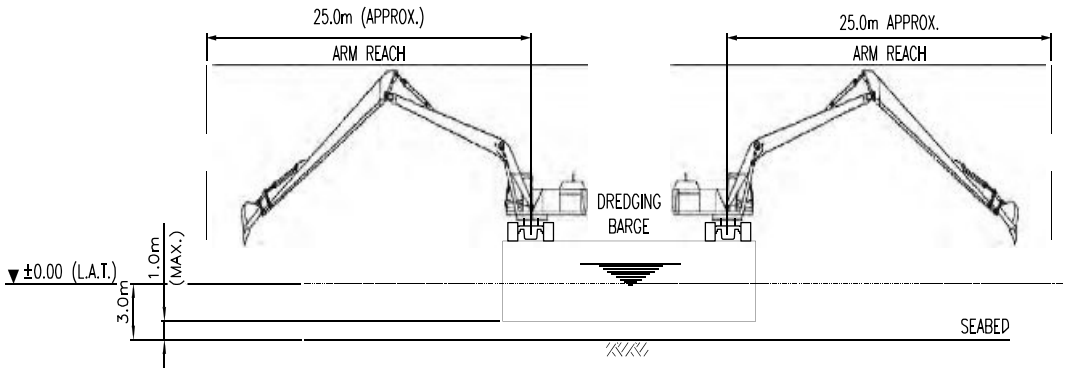
b) Elevation on EL. -1.00



c) Elevation on EL. -2.00



d) Elevation on EL. -3.00



4.5 ACCESS ROAD

4.5.1 Project Location

A private access road will be constructed along the pipeline ROW to transport equipment from the Jetty to the CCGT Power Plant during construction phase. This will be used as a maintenance road during the plant operation. The roads will be design to withstand heavy vehicles (expected to transport equipment up to 550 MT).

4.5.2 Construction

Prior to any road work, the Sponsor Group and EPC will record all data required in order to determine the boundary of the ROW, existing pipeline and the approved transportation road route.

The earthwork activities will be conducted to form the road level. This includes activities such as land clearing, grubbing, soil filling, cutting, grading and compaction. Following the formation level activities, access roads will be constructed as follows:

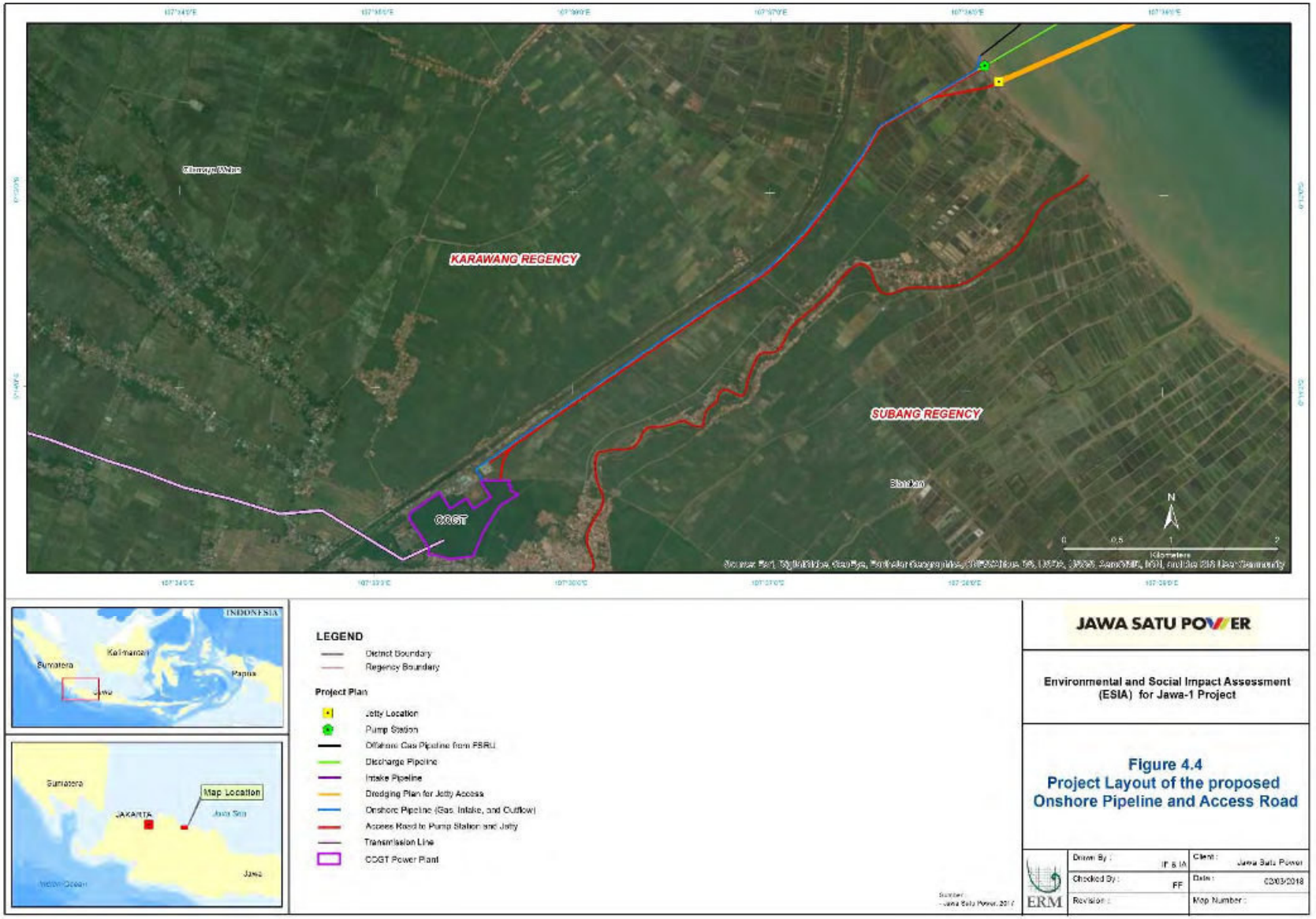
- Sub basecourse: After the formation level of the road, a sub base will be constructed. This will protect the sub grade from any damages during the construction;
- Basecourse: The basecourse will provide a uniform traffic load on the soil; and
- Upper Layer: Surfacing of the access road will be layered by bitumen concrete or stone chips which will be then compacted by water.

The total volume of source material is estimated at around 40,000 m^3 however the source of the material has not been finalised but will be confirmed during the execution stage. Drainage and water flow will be managed by the installation of a drain pipe if required.

During construction, workers will be housed locally in the vicinity and will be managed via the sub contractor.

The roads will be design to withstand heavy vehicles (expected to transport equipment up to 550 MT). The road will be constructed at six (6) m of width with one (1) m of road shoulder at both sides. Once the equipment transportation is completed, the road will used a private maintenance road.

Figure 4-18 Project Layout of the Proposed Onshore Pipeline and Access Road



4.6 CCGT POWER PLANT

4.6.1 Project Location

Administratively, the CCGT Power Plant is located in administration area of Cilamaya Village, Cilamaya Wetan District, Karawang Regency. **Figure 4-20** provides a Project layout of the proposed power plant and its boundaries; the green line illustrates the boundary of the existing Pertagas facility.

The total area of the site boundary is 33.3 has composed of the power plant (21.6 ha) and laydown area (11.7ha). The EPC will likely utilise the northern area of the site as a temporary site office with approximately 2.0ha. However, this plan is preliminary and will be revised in the project execution stage.

Figure 4-19 Project Layout of the Proposed Jetty

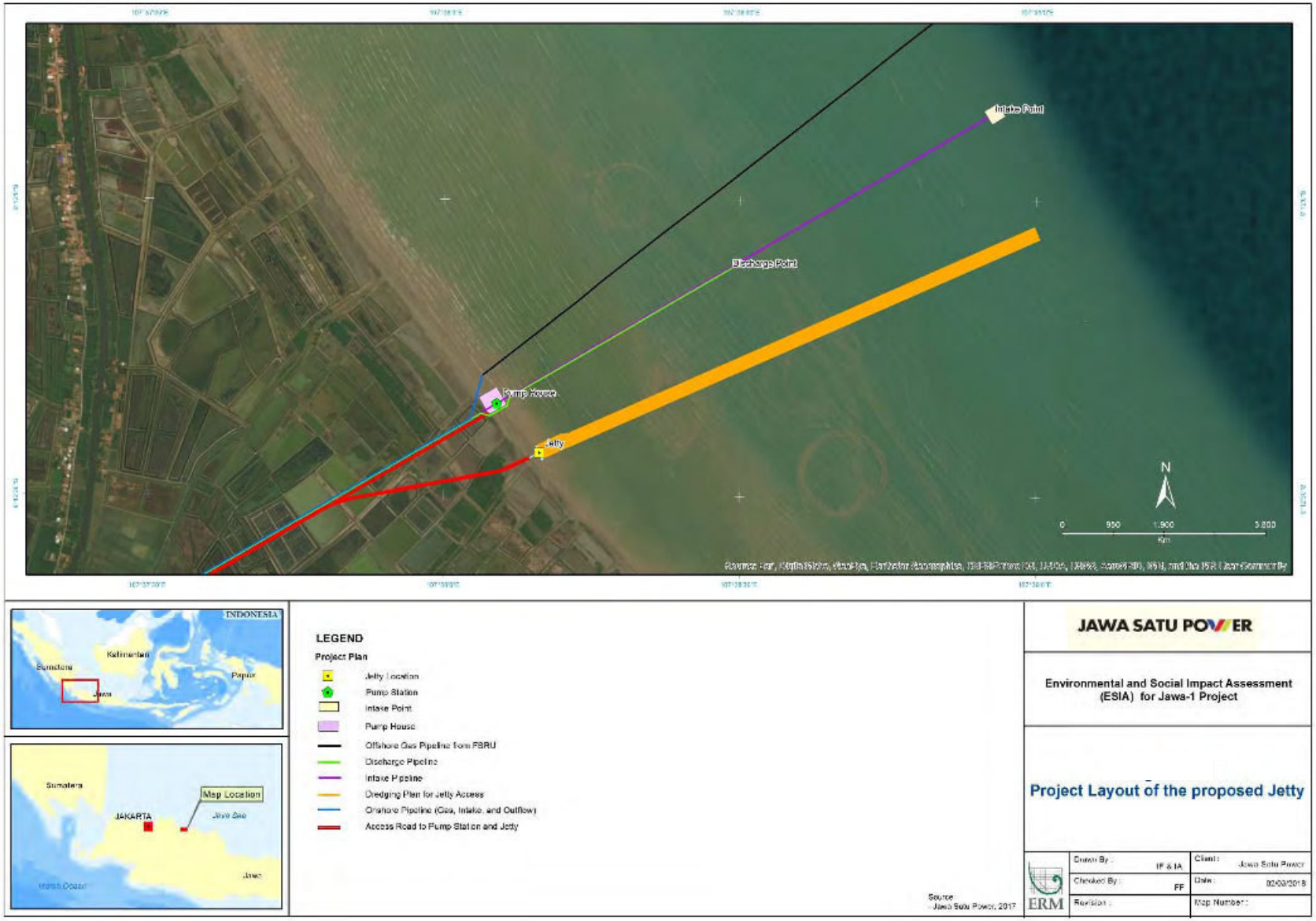
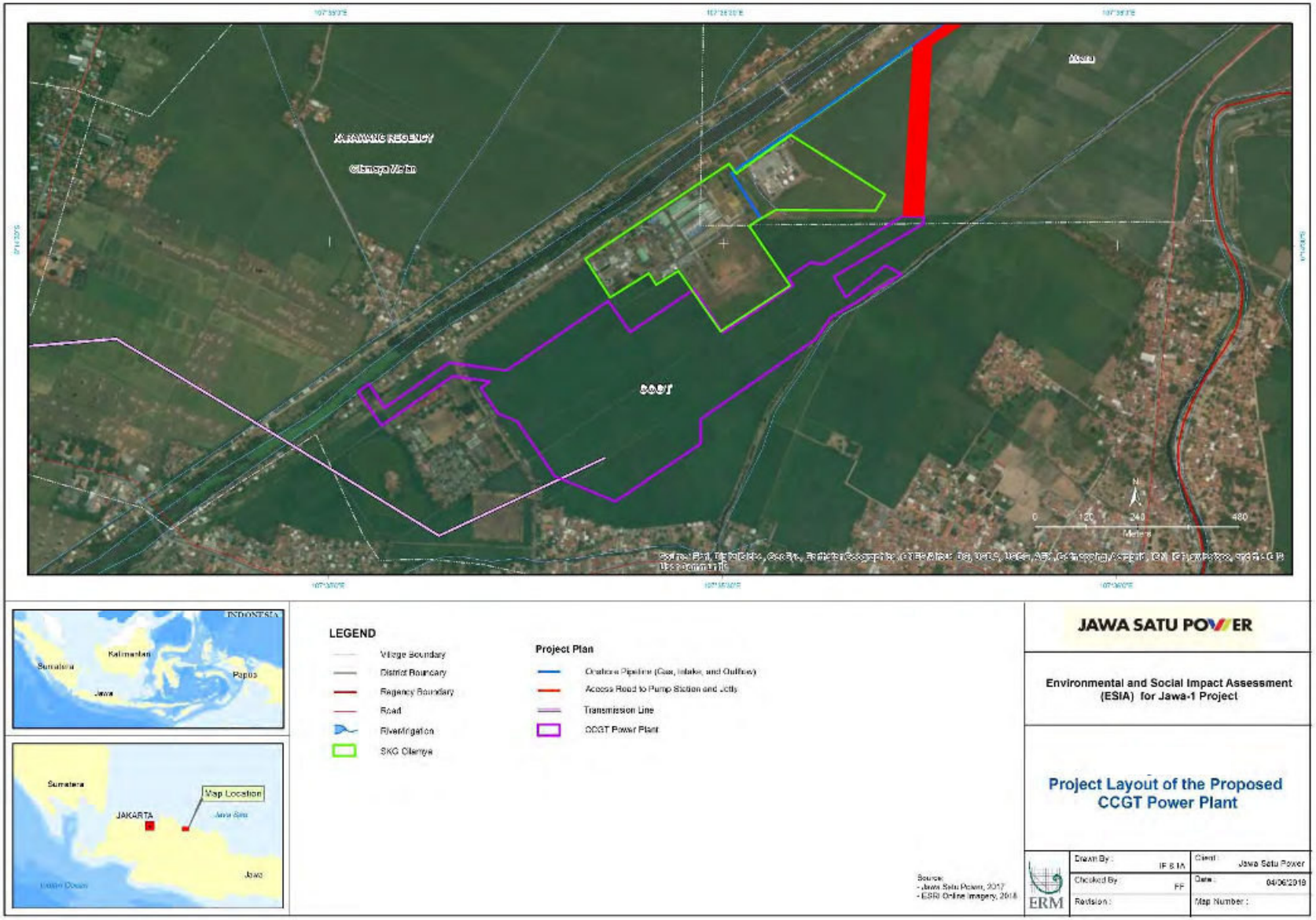


Figure 4-20 Project Layout of the Proposed CCGT Power Plant



4.6.2 Construction

The 1,760 MW Combine Cycle Gas Turbine (CCGT) Power Plant will be developed on a 36.7 ha or 0.367 km^2 parcel of land located in Cilamaya Village, Cilamaya Wetan District, Karawang Regency. The land was originally owned by Pertamina (Persero) and such land title will transfer to PT JSP. Cilamaya Village is located next to the site with roughly 50 residences sharing a direct boundary with the site with more located in close proximity to the boundary. These sensitive receptors and the potential impacts to them are further discussed in *Chapters 8* and *9* of this ESIA.

The power plant complex will consist of five (5) main buildings supported by other facilities. The main buildings include two (2) Turbine Building, the Control and Electrical Building (CEB), an Administration Building and the Workshop/Warehouse Building.

Other associated process facilities within the building complex includes the gas turbine, the steam turbine and a generator. In addition, equipment installed outside of the main buildings includes the Heat Recovery Steam Generator (HRSG), Onshore Receiving Facilities (ORF), Cooling Towers, Black Start Facility, Seawater Supply System, Service and Fire Water Storage Tank, a Fire Water Pump Shelter and a Chemicals and Lube Oil Storage Shelter. In addition, Water Treatment Plant and Wastewater Treatment Plant will also be located at the proposed Project area.

The physical construction work will start with land clearance. It is anticipated that the soils from land clearing including topsoil, roots and plants will be disposed off-site. The unsuitable materials including the cut soil will be spread out at laydown area, located in the southern corridor of Project area i.e. approximately 20,000 m^2.

A temporary storm drainage and collecting pit will be considered for disposal of stormwater by pumping (**Figure 4-21**). Groundwater levels will not be affected by this activity.

Earthworks will be then carried out to raise the power plant platform to +4.0 m above mean sea level i.e. +1.5 m from the existing ground level. This requires approximately 300,000 of soil for backfilling purposes by the licensed land excavation company in Purwakarta or Subang region. The backfilling and consolidation activity will be conducted by excavator, bulldozer, backhoe etc. and is predicted to last for 210 working days. The fill material will be deposited in layers and will not exceed a 230 mm loose depth. This will then be thoroughly compacted by rolling to a dry density not less than 90% of the maximum dry density as per the modified proctor test (ASTM D 1557) (*Samsung, 2018).* The first half of the backfilling soil i.e. 150,000 will be compacted for the duration of three (3) months and the remaining soil will be backfilled following the civil works phase (*Samsung, 2018*). Backhoes will be used to trench the area of which wastewater and associated pipelines

are placed. Compaction for site preparation will be performed by 10 ton vibration roller.

Any displacement of ground water due to compaction will return to the compacted soil and re-saturate it as such the water table will not be affected by these activities. The soil backfill material is permeable hence the water table under its hydraulic pressure from the surrounding area would soon return it to its natural level. In order to validate this a geohydrological assessment is being conducted and as such appropriate mitigations will be implemented if required to manage potential for contamination of groundwater or impact on ground water levels.

During the construction activities, the proposed Project area will be secured with a temporary fence. Prior to the operation, a permanent fence will surround the power plant. The three (3) metre welded and meshed type boundary fence and a 2.4-metre inner fence made of galvanised steel. At the southern part of site boundary, the EPC will construct fences to minimise visual impact to the nearby communities and to prevent non-authorised access. **Figure 4-23** illustrates the indicative temporary fences during construction activities surrounding CCGT Power Plant.

Access roads will be constructed which consists of a one (1) - way lane of 4.0m in width and a two (2)-way total with a width of eight (8) m and six (6) m for the main access road and within the plant area respectively. **Figure 4-23** illustrates the proposed access road within the CCGT Power Plant.

Figure 4-22 illustrates the indicative laydown area. Upon completion of construction phase, the laydown area will be reinstated to the existing conditions.

During the construction activities, the proposed Project area will be secured with a temporary fence. Prior to the operation, a permanent fence will surround the power plant. The three (3) metre welded and meshed type boundary fence and a 2.4-metre inner fence made of galvanised steel. At the southern part of site boundary, the EPC will construct fences to minimise visual impact to the nearby communities and to prevent non-authorised access. **Figure 4-23** illustrates the indicative temporary fences during construction activities surrounding CCGT Power Plant.

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Figure 4-21 Temporary Storm Drainage Plan

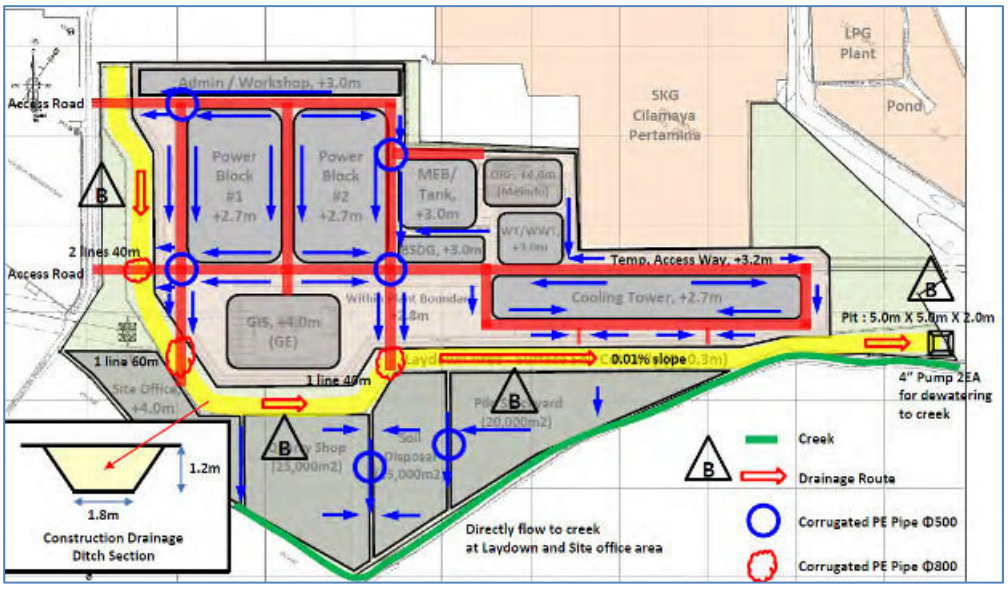

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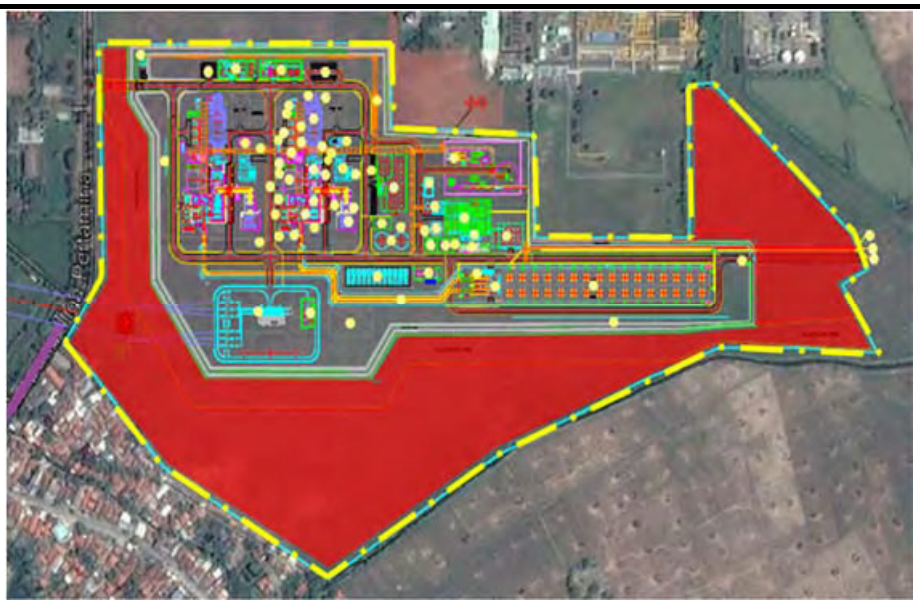
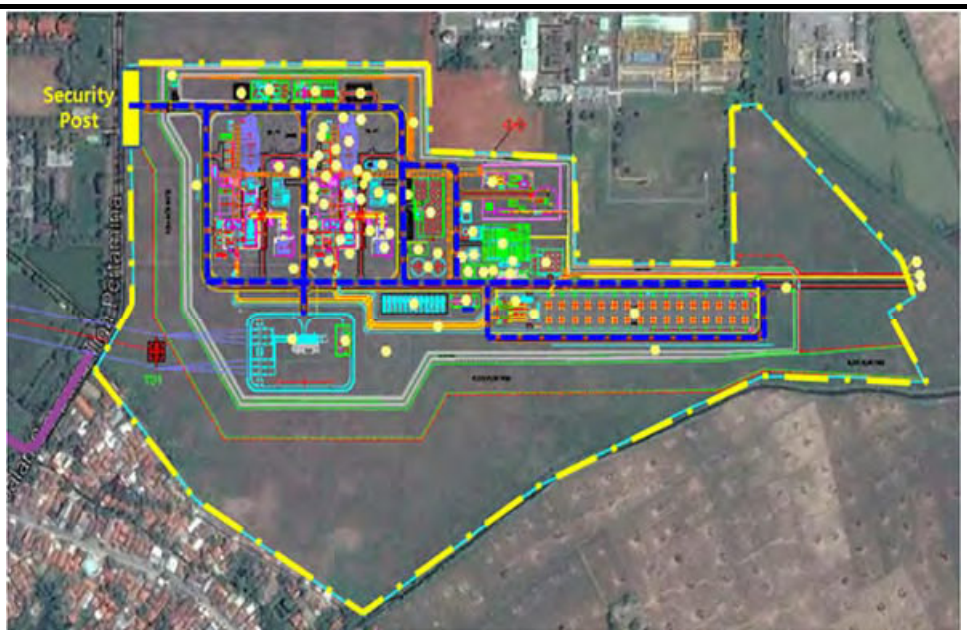
Figure 4-22 Indicative Lay-Down area during the Construction of CCGT Power Plant



Source: GE, 2017
Note: The red-zone will be utilised as the laydown area.

Figure 4-23 Indicative Layout of the Temporary Fences and Access Road during the construction of CCGT Power Plant



Source: GE, 2017
Note: The yellow-line represents the proposed fences and the blue-line represents the proposed access roads.

In addition, a new stormwater drainage line will also be constructed. Rainwater collected on the roads will be discharged by gravity to the nearby Ciherang River. The drainage line will cross under the existing gas pipelines. For installation of drainage pipes, manual excavation will be conducted. The existing pipeline will be attached using sling-belts, which will be supported by a framed H-Beam. Further excavation will be conducted to create a one (1) m

width of slope benching. Pipeline will be laid and backfilling will be conducted using jump/plate compactor (*Samsung, 2017*).

The entire power plant site will also be surrounded by a peripheral flood defence embankment with the crest level varying from MSL+ 4.2 m to MSL +5.5 m MSL to avoid the site area becoming inundated. The flood embankment will be constructed in a circle within the Project footprint with the height of the embankment varying from 0.2 m – 1.5 m from the ground surface of the power plant.

A 25 m trapezoidal drainage canal/swale system around the flood dike is also planned to compensate for any increased water level in the vicinity of the site due to Project. Such drainage system will compensate for blocked flow paths due to the dike. The effect of the proposed swale is to intercept floodwaters along the flood dike and convey them downstream. Further four 2 m x 2 m concrete box culverts will be constructed under the access road.

This flood defence embankment has been designed to protect the power plant against a 1 in 100-year return period flood level.

The current storm water design plans are in progress by the EPC. The current design entails discharge clear onsite runoff to the Cilamaya irrigation canal. Only treated waste water will be routed back to sea with a back up emergency drain near the cooling tower area. The site drainage plan is still being discussed with the EPC.

A 500kV substation will be located within the power plant area occupies i.e. a total area of 1.1 ha. A substation control building will be provided which will consist of an office room, communications room, control room, and protection room (*Pöyry, 2016*) which includes the following circuits:

- Two (2) outgoing lines to the 500kV Transmission Line; and
- Two (2) incoming lines from Jawa-1 CCGT Power Plant to Step-up Transformer output.

It is anticipated that an approximate of 7,000 piles within seven (7) months or 40 piles/day will be conducted using the circular driven concrete pilings. In addition, 11 rigs will also be installed on-site. Following the completion of pilings, the foundation will be laid and mechanical, electrical and piping installation will be conducted. Construction lighting will be installed and to be used during construction, if required. The construction of CCGT Power Plant is predicted to be completed within 36 months, which consist of material and heavy equipment mobilisations/ demobilisation, installation of main building, supporting facilities and onshore gas pipes and commissioning test.

Figure 4-24 illustrates the associated buildings and facilities at the CCGT Power Plant and **Figure 4-25** illustrates the temporary boundary areas.

Figure 4-24 CCGT Power Plant and Associated Facilities

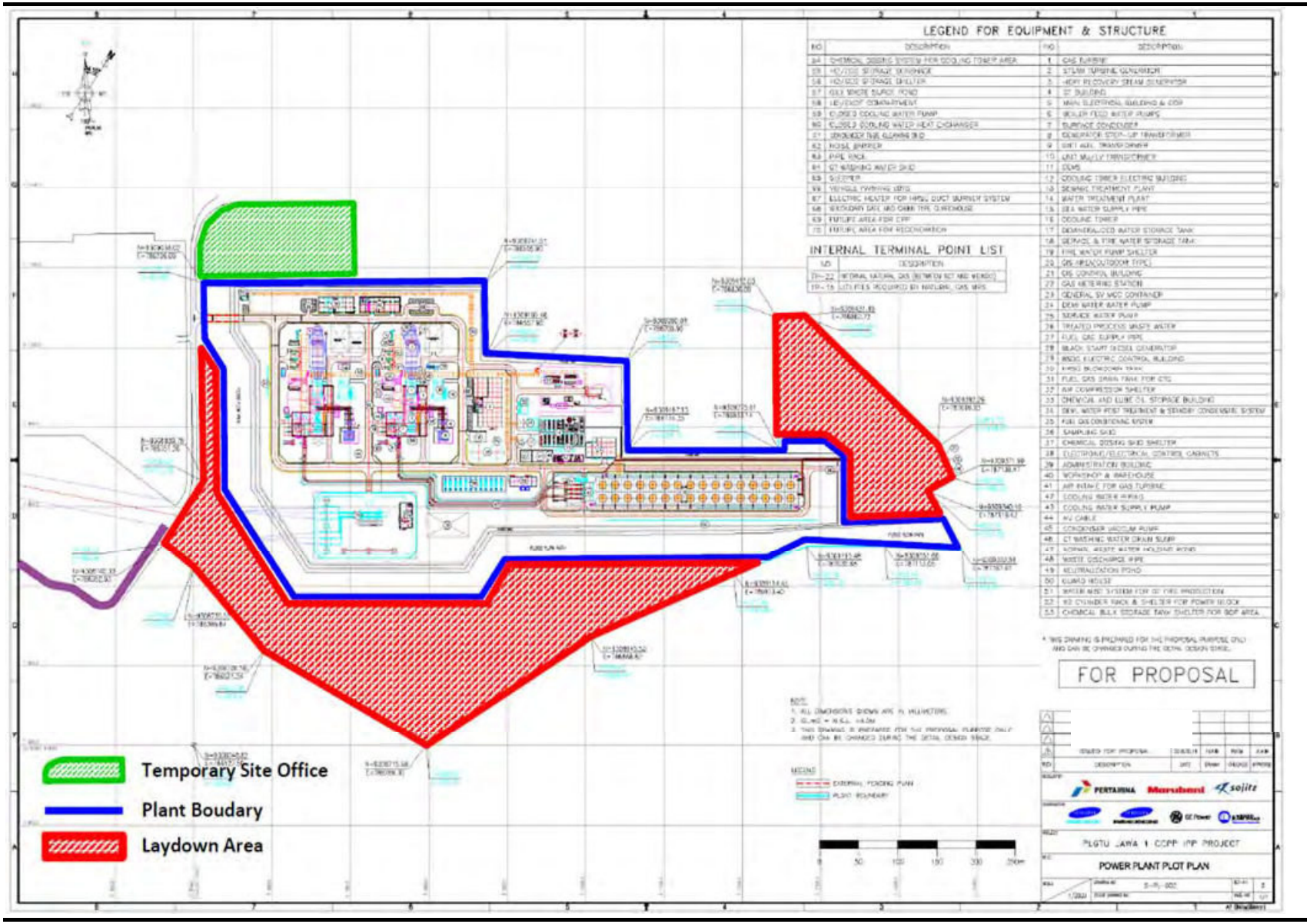
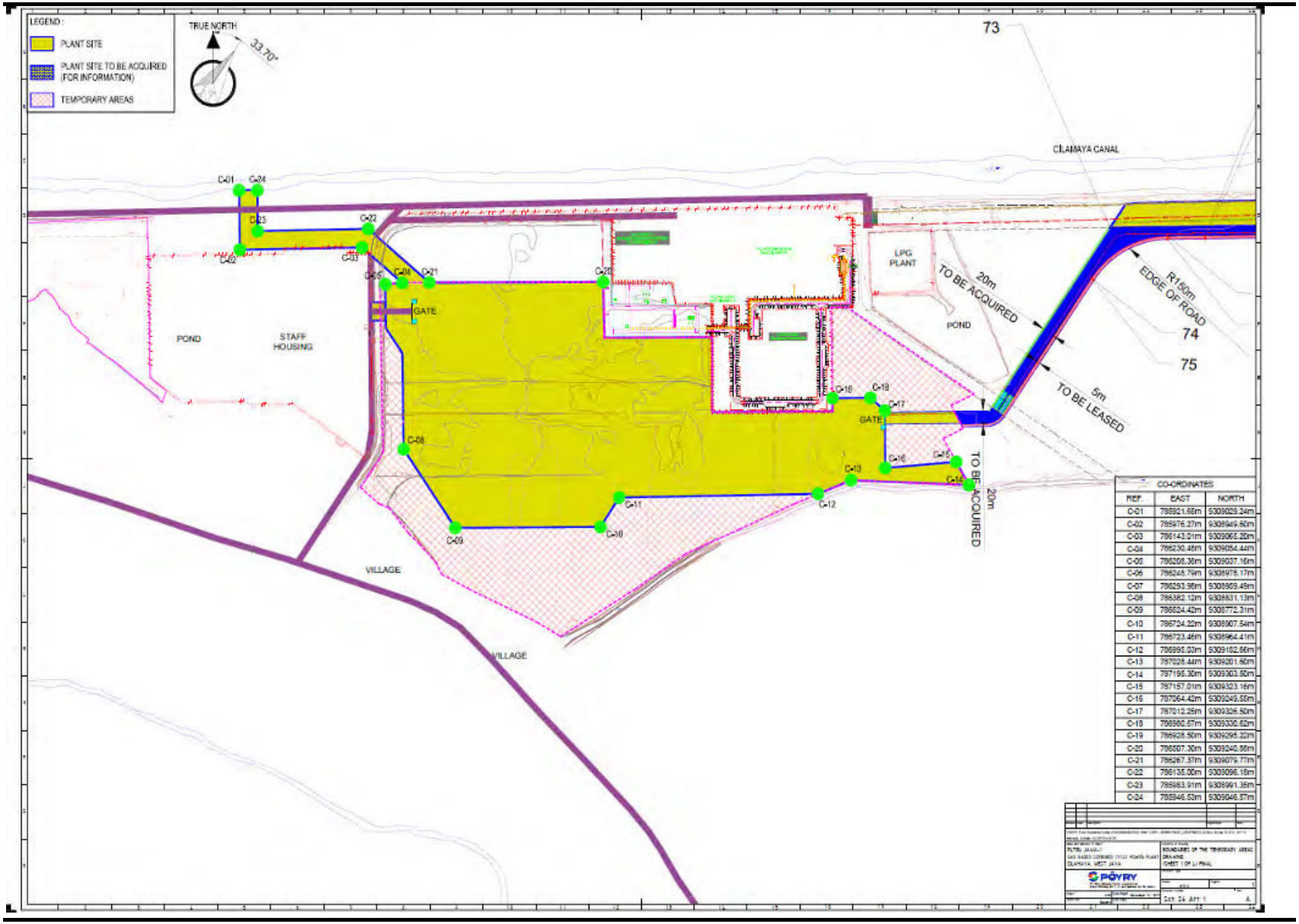


Figure 4-25 CCGT Power Plant Temporary Boundary Areas



4.6.2.1 *Main Buildings*

There will be two (2) turbine buildings, one (1) for each of the two (2) single shaft CCGT units. Each building has an area of 2,448 m^2 and will be 25.5 meters in height.

The Control and Electrical Building will house the central control room, document room, kitchen/mess facilities, toilets, electronic and computer rooms, telecommunication room, MV and LV switchgear rooms and battery rooms. The Power Plant will be operated from this location with all instrumentation housed here.

An administration building will be constructed to include facilities such as a reception area, offices, meeting rooms and prayer room.

This building will be a combined workshop and warehouse. The workshop will contain machine tools and equipment required for essential routine maintenance. The warehouse facility is for the storage of all spares and materials needed for operation and maintenance of the plant.

4.6.2.2 *Gas Turbines*

Two (2) units of the General Electric (GE) 9HA.02 gas turbines will be fitted with the DLN 2.6e combustion system. The gas turbine has a single shaft and bolted rotor with the generator connected to the gas turbine at the compressor. The turbine section consists of a four (4) stage turbine. The 9HA.02 has: two (2) radial bearings to support the turbine rotor and one (1) dual direction thrust bearing to maintain the rotor-to-stator axial position. The bearings are located in two (2) housings: one (1) at the compressor inlet and one (1) at the centre of the exhaust frame. The compressor design consists of 14 3D aero stages with a variable Inlet Guide Vane, and three (3) variable stator vane stages, to provide enhanced operability.

The gas turbine is contained within its own separate acoustic enclosure within the turbine building. The enclosure covers both the gas turbine itself and the gas fuel module. In addition, the acoustic enclosure includes the following functions:

- As a protection to the personnel from heat radiation;
- As a fire protection with a fire extinguishing media containment;
- As a ventilation system to remove the heat; and
- As a heating system to maintain the required internal temperature and/or avoid condensation phenomena when the gas turbine is stopped.

4.6.2.3 *Steam Turbines*

The steam turbines will be manufactured by General Electric (GE). The three-cylinder steam turbine consists of standardised inlet and exhaust modules. The main features of the proposed steam turbine concept are as follows:

- Base mounted turbine with lateral exhaust;
- Double shell design for all cylinders;
- Reaction type blading;
- Precision forged last stage rotating blades;
- Monobloc HP rotor and welded (built-up) IP and LP rotor;
- Integral expansion sleeve coupling; and
- Synchronous Self Shifting clutch (SSS clutch).

The steam turbine is designed for a steam mass flow taken from the exhaust heat of a single 9HA gas turbine. A single shaft arrangement is provided which requires only a single generator. The single shaft power train comprises of the gas turbine driving the turbo generator via a permanent coupling. The steam turbine is coupled via an SSS clutch to the opposite side of the generator. This arrangement allows starting and stopping the steam turbine independently from the gas turbine.

4.6.2.4 *Generator*

The generator, manufactured by General Electric, will be equipped with a water-cooled generator.

4.6.2.5 *Other Facilities*

Other facilities that will be installed within the main building complex includes:

- Boiler Feed Water Pump;
- Surface Condenser;
- General SV MCC Container;
- Fuel Gas Drain Tank for GTG;
- Electronic/Electrical Control Cabinets;

- Air Intake for Gas Turbine;
- Condenser Vacuum Pump;
- Water Mist System for GT Fire Protection;
- Nitrogen Cylinder Rack & Shelter for Power Block;
- Hydrogen/Carbon Dioxide Storage Sunshade;
- LCI/Exciter Compartment;
- Closed Cooling Water Pump;
- Closed Cooling Water Heat Exchanger;
- Condenser Tube Cleaning Skid;
- Pipe Rack;
- GT Washing Water Skid; and
- Maintain Lay down area Hard Paving (*JSP, 2016*).

4.6.2.6 Heat Recovery Steam Generator (HRSG)

There will be two (2) HRSGs, one (1) for each single shaft CCGT unit. Each HRSG will be around 40 m in height. At one end of each HSRG will be a chimney stack with height of 60 m and diameter size of nine (9) m. Each will be equipped with a Continuous Emission Monitoring System (CEMS).

The stack emissions specifications comply with the emissions standards established in the *WB IFC EHS Guidelines for Thermal Power Plants* as well as the national Indonesian regulations.

4.6.2.7 Onshore Receiving Facilities

The Onshore Receiving Facilities (ORF) will be located within a fenced compound of the proposed CCGT Power Plant site. The ORF will be equipped with a control room and a metering room, as well as a vent stack that will be used under the emergency and upset conditions only. The vent design on stack conforms to international standards including reference to the *EPA Good Engineering Practice Stack Height Guidelines*.

4.6.2.8 Cooling Towers

The plant will be cooled by indirect wet cooling system via seawater cooling

towers. The cooling water will be recirculating through the condenser in an open loop. The heat removed by the cooling water from the condenser will be rejected to atmosphere using mechanical draft cooling towers.

There will be two (2) cooling tower blocks, one for each single shaft CCGT unit. The cooling towers will be of the wet induced draft counter flow type.

The preliminary design also foresees 16 cells per unit, with each cell having dimensions 16 m x 14 m x 18 m high (from finished ground level). The exact number of cells and their dimensions will be finalised at the detailed design stage.

4.6.2.9 Black Start Facility

The black start facility will consist of a total of 12 containerised diesel generator sets and one BSDG electric control building. The generators and black start activities are discussed in more detail in **Chapter 10**.

4.6.2.10 Seawater Supply System

The seawater intake pumping station will be installed in a separate fences area at the Java Sea shoreline. A total of two (2) x 100% (plant capacity) seawater supply pumps will be provided. Additionally, an electrical building would be constructed adjacent to the seawater pumping station to house the switchgear for the seawater supply pumps and the electro-chlorination plant.

The pumps will be supplied with electricity from the CCGT Power Plant. The site of the seawater pumping station (including electro-chlorination plant, electrical building, etc.) will be elevated on the ground level of +2.6 m MSL. This is two (2) m above the highest astronomical tides (+0.59m MSL) in order to protect the pumping station against highest astronomical tide, freeboard and additional sea level rise due to climate change.

Screening equipment will be provided upstream of each seawater supply pumps. The screening equipment will comprise both coarse and fine screens. The coarse screens will comprise bar screens. The fine screens will comprise travelling band screens fitted with an automatic backwashing system. Debris removed from the coarse and fine screens will be collected in a trash basket for off-site disposal.

An access road will be constructed beside the SKG Cilamaya ROW to connect the CCGT Power Plant to the Seawater Pumping Station area.

4.6.2.11 Service and Fire Water Storage Tank

Service water storage system consists of two (2) service/fire water storage tanks (occupying an area of 628 m^2). Service/fire storage tank is sized to store

12 hours of normal service water consumption plus two (2) hours of fire water storage based on the maximum fire water demand (as per National Fire Protection Association (NFPA) requirements).

From the service/fire water storage tanks, the respective service consumers will be supplied with water via two (2) x 100% service water transfer pumps. The main consumers of service water are the GT Evaporative Cooler and general service water hose reels.

4.6.2.12 Fire Water Pump Shelter

The Fire Water Pump Shelter (occupying an area of 338 m^2) houses one (1) diesel engine driven fire pump, one electrical motor driven fire pump and one fire water jockey pump.

4.6.2.13 Chemical and Lube Oil Storage Shelter

The Chemical and Lube Oil Storage Shelter (200 m^2) will be used for the storage of chemicals and lube oil which are required for the normal operation and maintenance of the power plant.

The storage and handling of chemicals and regenerants at the power plant will meet all relevant codes and legal requirements and will be designed such that:

- The manual handling of chemicals during unloading and transfer to storage shall be kept to a minimum;
- Solid chemicals shall be delivered and stored in dry, covered conditions. Solid and liquid chemical storage tanks and silos shall have moisture and CO^2 traps fitted, as required;
- Liquid chemicals shall be stored in tanks constructed from or lined with corrosion resistant material; there shall be double isolation valves on the outlet from each bulk storage tank;
- Each tank shall be separately bunded to retain 110% of the whole tank volume in the event of spillage or leakage. Bunds shall have no direct drainage, will incorporate a sump and shall be lined with chemical resistant coatings;
- Tank or silo filling connections shall be separated from each other, each within an individual locked enclosure and clearly marked with the chemical type;
- Chemical delivery/unloading areas shall, where appropriate, have suitable bunds and drains to divert any spillage and wash down to a suitable containment sump or chemical drains system.
- Chemicals releasing volatile or harmful vapours shall have a suitable traps and scrubbers fitted to the tank vents;
- Automatic safety showers, operated by foot treadle shall be installed adjacent to chemical unloading facilities, within the water treatment plant. Sprays or equipment for eye wash shall also be provided;

- Transfer of concentrated liquid chemicals from bulk storage to regeneration systems and other tanks shall provide the minimum risk of spillage or leakage commensurate with reliable operation; vacuum transfer is preferred: alternatively gravity transfer or water ejector may be used; a pressurised, pumped system is not a preferred option; and
- Transfer of diluted regenerant from measuring/dilution tanks shall provide minimum risk of spillage and leakage; transfer by water ejector is preferred.

4.6.2.14 Wastewater Treatment Plant

The wastewater treatment system consists of one (1) x 100% wastewater holding pond with a capacity of 600 m^3 and a 70 m^3 neutralisation pond. Additionally, a 105 m^3oily wastewater equalisation basin and an eight (8) m^3/h oily waster separator will also be installed (*JSP, 2018b*). **Figure 4-26** provides a schematic overview of the WW discharge at the power plant.

The CCGT Power Plant construction is predicted to be implemented in 36 months, which consist of material and heavy equipment mobilisations, building and supporting facilities. **Table 4-4** the breakdown of required workers that will be present during the Project construction of CCGT Power Plant and the associated facilities.

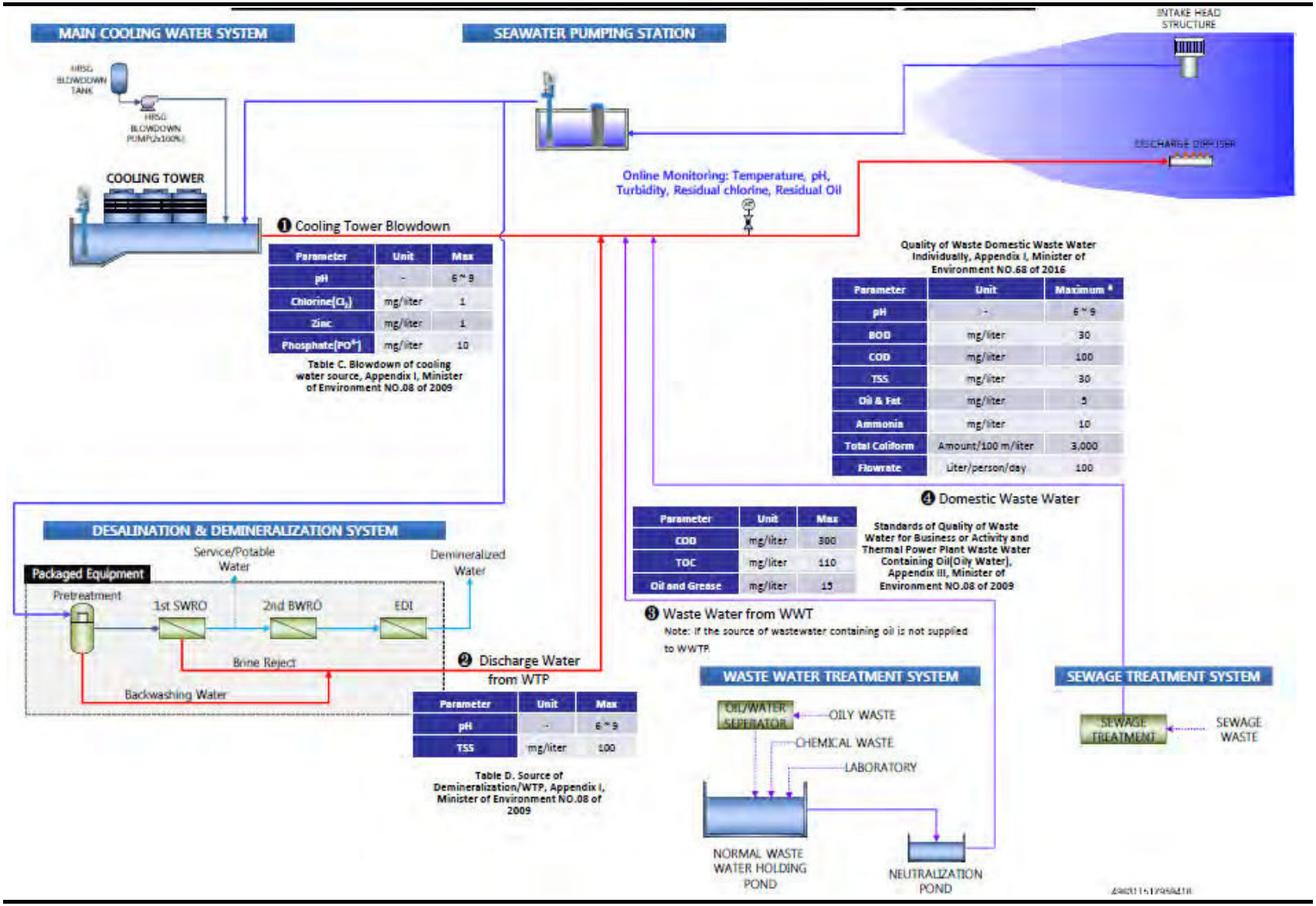
Table 4-4 Indicative Workforce during Project Construction of CCGT Power Plant and Associated Facilities

Facilities	Level	Number of Workforce
CCGT Power Plant and associate facilities	Skilled	1,400 (peak)
	Semi-skilled	2,100 (peak)
TOTAL		**3,500**

Source: Samsung, 2018c
Note: including 60 – 70 skilled expatriates.

The EPC Consortium has yet to agree and determine the location of centralised basecamp and its design layout in meeting the requirements of IFC Performance Standard 2 – Labour and Working Conditions (*IFC, 2012*).

Figure 4-26 Power Plant Waste Water Discharge



Parameter	Unit	Max
pH	-	6 ~ 9
Chlorine(Cl_2)	mg/liter	1
Zinc	mg/liter	1
Phosphate(PO^{4-})	mg/liter	10

Parameter	Unit	Maximum *
pH	-	6 ~ 9
BOD	mg/liter	30
COD	mg/liter	100
TSS	mg/liter	30
Oil & Fat	mg/liter	5
Ammonia	mg/liter	10
Total Coliform	Amount/100 m/liter	3,000
Flowrate	Liter/person/day	100

Parameter	Unit	Max
COD	mg/liter	300
TOC	mg/liter	110
Oil and Grease	mg/liter	15

Parameter	Unit	Max
pH	-	6 ~ 9
TSS	mg/liter	100

4.6.3 Operations

The Project will be based on CCGT technology. In a CCGT Block, natural gas is combusted to drive an alternator to produce electrical power. The power plant will burn natural gas as its only fuel. There will no back –up alternative use of fuel firing (e.g. using distillate fuel oil).

The hot exhaust gases from the gas turbine are used to raise high pressure steam in a Heat Recovery Steam Generator (HRSG). This high-pressure steam is expanded through a steam turbine, which drives an alternator (the same generator which be driven by the turbine) to produce further electrical power. The low-pressure steam leaving the steam turbine is condensed in the water-cooled condenser and pumped back to the heat recovery steam generator.

The following section summarises the operations of associated facilities at the Power Plant.

4.6.3.1 Onshore Receiving Facilities

Following regasification at the FSRU, the gas will be channelled through a 14 km subsea pipeline and a seven (7) km onshore pipeline to the ORF. The ORF is the receiving and measuring station for gas to be used by the CCGT Power Plant. The process of receiving LNG and dispatching gas to the pipeline and ORF is shown in **Figure 4-27**.

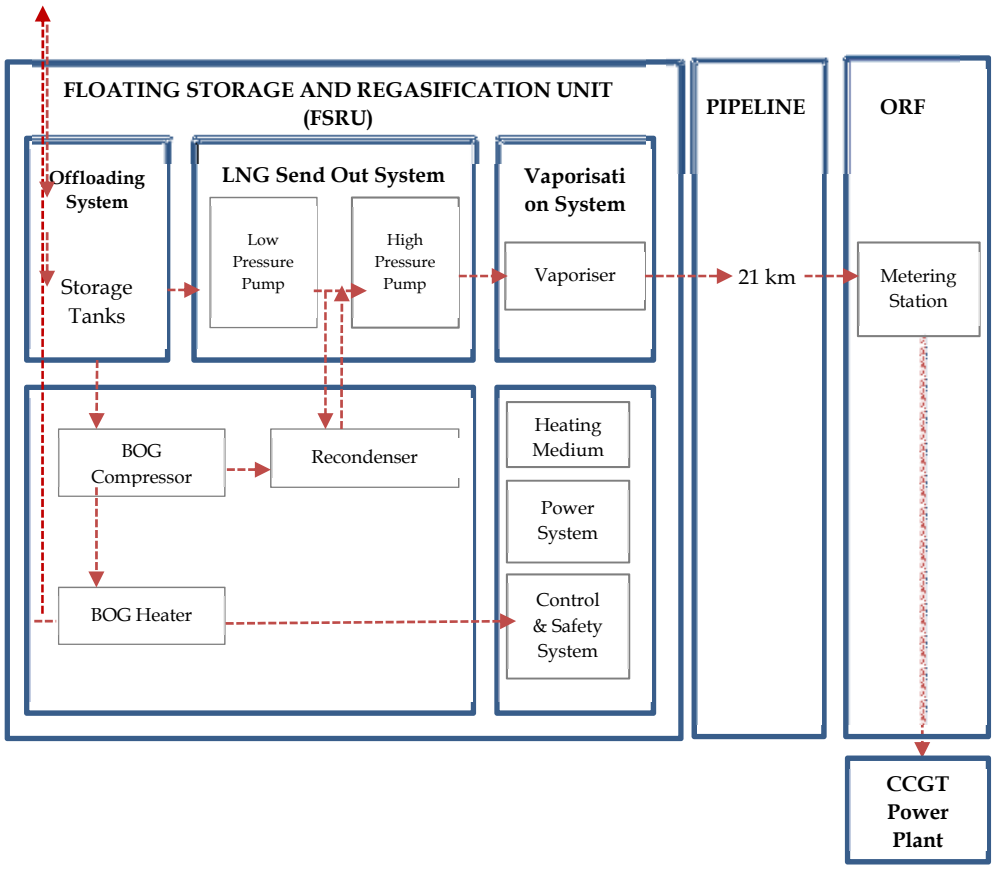
The ORF will be located within a fenced compound within the CCGT Power Plant area. It houses the pig receiver, gas filters, pressure let-down skid, metering packages, indirect fired water bath heater, vent stack and flow computer building.

The vent stack will vent the natural gas during emergency conditions only. This includes sweet gas containing mostly methane (97%) and a small quantities of other hydrocarbons.

The amount of gas in energy units (MMBTU) will be calculated by measuring the gas volume and its composition. The gas volume rate is measured using mechanical and/or electronic system and the measurement of gas composition will be measured using Gas Chromatography.

A sample of natural gas (in small quantities) will be taken from the piping then injected into Gas Chromatography (GC) with the help of a carrier agent i.e. Helium gas. The sample gas and the carrier agent will then be vented.

Figure 4-27 Gas Delivery Flow Chart



Source: ERM, 2018b

4.6.3.2 *Gas Turbine*

Two (2) units of the General Electric (GE) 9HA.02 gas turbines will be fitted with the DLN2.6e combustion system. The starting and cool down system consists of a Static Frequency Converter (SFC). This includes a power thyristor frequency converter to bring the turbine to self-sustaining speed during the starting cycle. The SFC is fed from the starting transformer which is connected to the switchgear.

During the starting operation, first rotations of shaft line with Electric turning gear up to 12rpm. Above this speed, SFC drives the rotor faster. During the cool down process, once the GT reduces speed at 12rpm, the electric turning gear starts for the barring operation.

The lube oil and control oil supplies for the gas turbine are combined in a single common supply unit with the supplies for steam turbines and the generator.

4.6.3.3 *Steam Turbine Condenser*

The low pressure steam leaving the steam turbine will be condensed to form condensate in the water cooled condenser. The cooling water will then be

recirculated in a closed-loop system. The heat gained by the cooling water as it passes through the condenser will be removed by passing it through a set of mechanical draft cooling towers.

4.6.3.4 Condensate System

The condensate system delivers the condensate from the condenser to the HRSG. Three (3) x 50% capacity condensate pumps will supply the condensate through the gland seal condenser and the low pressure economiser circuit to the HRSG low pressure drum. Additionally, the condensate will also be used for the following purposes:

- Condenser expansion tank/drain manifolds cooling sprays;
- Steam turbine exhaust hood spray;
- Condensate pump seals;
- Steam by-pass system desuperheaters i.e. Low Pressure (LP) bypass attemperation, HRH bypass attemperation;
- Gland seal emergency spray; and
- High Pressure (HP) evacuation line attemperation.

4.6.3.5 Condenser Air Removal System

The condenser air removal system creates and helps maintain a vacuum in the steam side of condenser by removing air and non-condensable gases. The system consists of two (2) skid-mounted condenser vacuum pump packages and the connecting piping to the surface condenser.

The non-condensable gases flow from the condenser to one of the condenser vacuum pump packages during normal operation (holding mode). However, during start-up, both condenser vacuum pumps are operated in parallel (hogging mode). After the start-up mode, one of the condenser vacuum pumps will be used as a standby pump; operating only if the pressure begins to rise above the pressure set point which starts the pump.

4.6.3.6 Feedwater System

Three (3) x 50% boiler feed pumps will supply feedwater to the HRSG intermediate and high pressure circuits. The pumps are the multi-stage, combined high pressure (HP) and intermediate pressure (IP) with variable frequency drive. The pumps are supplied with feedwater from the HRSG low pressure drum.

Intermediate pressure feedwater will also be channelled from the intermediate pressure outlet to the performance fuel gas heater located near the gas turbine.

The fuel gas-cooled feedwater then returns to the cycle through piping connected to condensate pump discharge header.

The required minimum flow through each boiler feed pump is provided an auto recirculating check valve that automatically modulates a flow control valve to recirculate feedwater back to the low pressure drum condensate system upstream of the LP preheating coil.

The feedwater system also provides water for the HRSG HP superheater attemperation, and HP bypass attemperators at the appropriate flow and pressure conditions.

4.6.3.7 Steam Systems

The main function of the steam system is to transport steam produced in the HRSG to the steam turbine generator. The steam system consists of high pressure steam, reheat steam, intermediate pressure steam and low pressure steam.

High pressure steam is piped from the HRSG high pressure superheater outlet to the throttle/stop valves of the steam turbine. The line is equipped with flow, pressure, and temperature measuring devices along with safety relief valves, automatic drains, and a shut-off valve.

A high pressure steam turbine by-pass line with pressure reducing and steam de-superheating will be provided to allow steam to be bypassed to the cold reheat steam system during start-up, shutdown and emergency operation.

The intermediate pressure steam, cold reheat steam and high pressure bypass discharge system will be combined into a common system. A cold reheat steam is channelled from the high pressure turbine exhaust to the HRSG where it mixes with steam from the intermediate superheater outlet.

This steam mixture then travels to the reheater section of the HRSG where it becomes hot reheat steam. This hot reheat steam will then be channelled from the HRSG reheater outlet to the intermediate pressure turbine section inlet. The HRSG reheater will also be equipped with safety valves and automatic drain valves. The intermediate pressure superheater outlet is provided with similar valving, instrumentation and controls as the high pressure steam system.

A hot reheat steam turbine bypass line, with pressure reducing and steam desuperheating will be installed to allow steam to be by-passed to the condenser surface during start-up, shutdown and emergency operation.

A low pressure steam from the HRSG will then be channelled to the low pressure section inlet of the steam turbine. The low pressure steam will be exhausted from the turbine into the surface condenser where it condenses. The

low pressure steam line contains similar valving, instrumentation and controls as the high pressure steam lines.

A low pressure steam turbine by-pass line, with pressure reducing and steam desuperheating, will be installed to allow steam to be bypassed to surface condenser during start-up, shutdown, and emergency operation. An attemperator will be provided in this bypass line if required by the condenser manufacturer.

4.6.3.8 HRSG Blowdown

One (1) blowdown tank, including piping and valves, is provided with the HRSG to receive blowdown and water/steam drains.

During blowdown operation, water is discharged into the blowdown tank. This water is then pumped to the cooling tower basin for re-use by a motorised valve controlled by the conductivity.

In addition to the blowdowns, the blowdown tank receives water/steam drains from the high pressure, intermediate pressure, and low pressure economisers, superheaters, drum gauge glasses, water column blowdowns and steam line drains in the HRSG area.

4.6.3.9 Compressed Air System

The compressed air system consists of an air compressor package and an instrument air distribution system. An instrument air will be used for air operated valves and power plant instrumentation. The instrument air for normal on line (routine) repairs and maintenance activities provides a limited service air capacity. It is not designed to support heavy air use which is normally associated with major outage activities.

The air compressor package is skid mounted on a heavy duty structural steel base and consists of:

- Two (2) x 100% capacity oil free rotary screw type air compressors;
- Two (2) x 100% capacity coalescing type pre-filter;
- Two (2) x 100% capacity dual tower heatless desiccant dryer;
- Two (2) x 100% capacity particulate after filter;
- Two (2) x 100% capacity particulate fine filter for service air;
- One (1) x 100% compressed air receiver tank;
- One (1) x 100% instrument air receiver tank; and

- Instrumentation and controls to allow automatic unattended operation and remote monitoring.

The instrument air distribution system distributes clean dry air to the various plant users.

4.6.3.10 Compressed Gas Systems

A nitrogen blanketing system will be used during the short unit shutdowns to protect the internal surfaces of the heat recovery steam generators. When extended unit shutdowns are anticipated, the HRSG should be drained and dried.

The nitrogen blanketing system consists of standard pressurised nitrogen cylinders connected to a station manifold. The system is designed to maintain nitrogen pressure of 0.34 bar gauge (or 5 psig) in each HRSG drum.
A hydrogen storage system is provided to maintain the hydrogen pressure in the generators. The hydrogen system consists of standard pressurised hydrogen storage cylinders connected to a generator manifold supplied with the generator. An emergency shutoff valve shall be located downstream of the gas cylinders designed to shutoff hydrogen supply in the event of a supply pipe rupture

A carbon dioxide system is provided to purge the hydrogen from the generators which is usually done before starting generators maintenance. The carbon dioxide system consists of standard pressurised carbon dioxide storage cylinders connected to a manifold supplied with the generator. The cylinders are housed in a heated enclosure that is sized and designed to prevent walk-in possibility.

4.6.3.11 Black Start Facility

The Black Start Diesel Generators (BSDG) will supply black power in case of a station black out and emergency power for the safe shutdown of the power plant in the event of the loss of main supply.

The black start operation of the gas turbine requires the power output of 12 diesel generators each rated for 2 MWe electrical outputs.

The BSDGs are connected to the medium voltage AC system and will start automatically if the voltage at the diesel emergency bus fails. A manual initiation of starting and synchronising for test purposes will be also possible.

A separated emergency diesel generator is not provided as one black start diesel generator will be engaged for emergency safety shutdown i.e. one (1) sub-black start diesel generator will provide electrical AC supply to station auxiliaries to ensure the safe shut-down of the gas or/and steam turbines to turning gear operation.

Each diesel generator set with auxiliaries will be installed in a steel container. The black start facilities shall be provided with a sufficient independent fuel storage capacity for 24-hours continuous full-load operation without replenishment of fuel supplies. This is discussed in more detail in **Chapter 10**.

4.6.3.12 Generator

The generator, manufactured by General Electric, will be equipped with a water-cooled generator. It is cooled with a pressurised hydrogen gas in a closed circuit to remove heat from the rotor and stator. The heat is removed via hydrogen/water heat exchangers within the casing. The stator casing is fully sealed to minimise hydrogen consumption. The water-cooling system in the stator winding is designed to provide optimum reliability. The deionised water flows through the stainless-steel cooling tubes to remove the heat dissipated by the stator winding. The rated voltage at generator terminals is 24,000 V.

4.6.3.13 Cooling Tower

The plant will be cooled by an indirect wet cooling system using seawater cooling towers. Two (2) x 50% Main Cooling Water (MCW) Pumps supply cooling water from MCW Pump suction pit to the Surface Condenser, the Closed Cooling Water Coolers and the Heat Exchangers for the Condenser Vacuum Pumps. The discharge pipe of each MCW Pump is connected to a common cooling water supply line. This common cooling water supply line is branched-off other lines i.e. one (1) water boxes of Condenser, the other line is for Closed Cooling Water Coolers and Heat Exchanger for Condenser Vacuum Pump.

The return pipe of each Condenser water box with motorised inching butterfly valve is connected to return header with return line from Closed Cooling Water Cooler and Heat Exchanger for Condenser Vacuum Pump. This common return line is branched-off for each cell of Cooling Tower.

Cooling towers are heat exchangers that are used to dissipate large heat loads to the atmosphere. Given wet cooling towers provide direct contact between the cooling water and the air passing through the tower, some of the liquid water can enter the air stream and be carried out of the tower as "drift" droplets. To reduce the drift from the cooling towers, drift eliminators will be incorporated into the tower design to remove as many droplets as practical from the air stream before exiting the tower.

Hypochlorite solution is injected at the cooling tower basin to inhibit the growth of biological organism and for disinfection. Scale inhibitor and Sulphuric acid are also injected at the cooling tower basin to inhibit scale formation.

The cooling towers require a supply of make-up water to replace the water that is lost from the circuit. As the water circulates through the system,

evaporated water exits the system as pure vapour leaving dissolved solids behind, which begin to concentrate over time.

To control solids build-up a portion of the cooling water is bled from the cooling tower basin ("blowdown"). The make-up water for the cooling towers will be seawater extracted from the Java Sea.

The cooling tower blowdown will constitute the largest volume of the wastewater discharged from the Project. The cooling tower blowdown water will essentially be seawater, but with slightly increased temperature and salinity.

To further mitigate the temperature effect of the cooling tower blowdown on the environment, the blowdown will be taken from the cold side of the cooling towers. The cold side temperature will vary with ambient conditions and the plant load. When the CCGT Power Plant is operating at a full load under ambient conditions of 31°C and 75% RH, the cold side temperature will be around 32.4°C.

The seawater has a nominal salinity of 35,000 ppm and the cooling tower blowdown will have a salinity of 49,000 ppm. In addition to temperature and salinity effects the cooling tower blowdown will also contain any inherent concentrations of the chemicals that are used to control scaling and marine growth within the cooling water circuit.

According to *Minister of Environment Regulation No. 8 of 2009*, maximum value for temperature from thermal wastewater is 40 °C, while the IFC EHS Guidelines establish an expectation that the temperature of wastewater prior to discharge does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone.

Cooling tower is controlled by plant DCS at the control room and the cooling water temperature set point is input by operator or programmed by graph for ambient web bulb temperature. The set point will be dependent on ambient web bulb temperature. The annual operation of cooling towers is 8,760 hours with 897,924 lpm of circulating rate, design drift of 449 L/min and 44,100 mg/l of the average Total Dissolved Solids (TDS) (*Pöyry, 2018*).

4.6.3.14 Auxiliary Cooling Water

Auxiliary cooling water is supplied from the main cooling water supply header upstream of the condenser. The auxiliary cooling water is used the Closed Cooling Water heat exchanger and the condenser vacuum pump heat exchanger. Then it is returned into the cooling water system return header downstream of the condenser.

4.6.3.15 Closed Cycle Cooling Water

The Closed Cycle Cooling Water (CCCW) System is a closed-loop system. One (1) of two (2) x 100% capacity cooling water pumps takes suction from the CCCW return header and pumps the water through the CCCW heat exchangers. Two (2) x 100% Closed Cooling Water Heat Exchangers are provided which are of the shell & tube type.

Closed cooling water heat exchanger will require to be periodically cleaned by either chemical or mechanical method. The method selected will be the choice of the Operator of the plant and will depend on the type of deposit and the facilities available in the plant.

4.6.3.16 Water Treatment Plant

The primary source of operating water for the Project will be seawater from the Java Sea. This seawater will be used, after varying levels of treatment, for the following purposes:

- Cooling tower make up water;
- Evaporative cooler make up water;
- Process water (boiler make up, chemical dosing system dilution water, closed circuit cooling water make up etc.);
- Service water (for cleaning and maintenance purposes);
- Fire water; and
- Potable water.

The water in the seawater supply system will be dosed with sodium hypochlorite solution in order to prevent slime and marine growth in the system. Marine growth can increase the pressure losses in the seawater piping. The normal point of dosing will be at the mouth of the offshore intake pipe located in the Java Sea.

The sodium hypochlorite will be produced locally to the seawater pumping station by a dedicated electro-chlorination plant. Filtered seawater will be passed through trains of electrolytic cells where it will subject to a low voltage, high amperage direct current (DC). The electrical current passing through the seawater causes the disassociation of salt (i.e. NaCl) and water. These reactions then allow the formation of a weak Sodium Hypochlorite (NaOCl) solution with hydrogen gas (H2) as a by-product.

The electro-chlorination plant shall comprise two (2) x 100 % sea water filters, two (2) x 100 % electrolysers, one (1) sodium hypochlorite storage and degassing tank, two (2) x 100 % air blowers, two (2) x 100 % Sodium

Hypochlorite continuous dosing and shock dosing pumps and one (1) x 100% acid and neutralisation washing tank, two (2) x 100% acid and neutralisation washing pump.

The raw seawater from the intake pumping station will be used as the source of raw water for the seawater pre-treatment plant. The seawater pre-treatment plant will provide clarified and filtered seawater to the Seawater Reverse Osmosis (SWRO) plant. Either Dissolved Air Flotation (DAF) or multi-media filter, which configuration or selection of pre-treatment system can be proposed depended upon sea water analysis as alternative design, will accomplish the removal of suspended solids from the seawater.

The SWRO system will treat the filtered and clarified seawater for use in the service water/fire water system and by the demineralisation water plant. The SWRO system will comprise Reverse Osmosis (RO) feed pumps, cartridge filters and reverse osmosis membrane vessel arrays. The reject water from the first stage RO plant will be discharged to the Java Sea. This reject water will be concentrated brine; containing ions extracted from the seawater that are separated from permeate during the RO. Seawater is highly saline due to the concentration of dissolved ions, predominantly sodium and chloride ions.

In addition, the SWRO system reject stream will also contain ions from the chemicals that are used in the process, anti-scalent is dosed during desalination to protect fouling of the RO membranes. The concentration of anti-scalent in the discharge will be extremely low.

Chlorine may also be dosed into the seawater as sodium hypochlorite upstream of the reverse osmosis equipment to prevent marine growth in the seawater supply system. This chlorine has the potential to damage sensitive membranes, and so will be removed prior to the SWRO membranes via a reaction with sodium bisulphite.

The brine reject stream from the SWRO plant will typically have twice the ion content of the natural seawater. However, in the quantities proposed, this discharge stream will have a negligible effect on the salinity of the Java Sea.

Overall the installation of a desalination plant to provide high quality process water for the new plant will be beneficial for the management of water resources in the local area.

Desalinated water from the SWRO plant will be used as the source of raw water for the demineralised water plant. The plant will comprise two (2) x 100% duty Brackish Water Reverse Osmosis (BWRO) stages and two (2) x 100% duty polishing stages (based on EDI). Each 100% demineraliser train (RO/EDI) will be capable of meeting the normal demineralised water demands of the power plant.

One (1) demineralised water tank shall be provided; sized to store twenty-four

(24) hours of demineralised water consumption. Two (2) x 100% demineralised water transfer pumps are provided to supply demineralised water to the water wash skid and makeup to standby condensate system for ultrapure water and other services as closed cooling water make-up and condensate pump sealing during start-up.

A Demineralised Water Post Treatment and Standby Condensate System will be provided to further purify the demineralised water before it is used as make-up water to the water-steam cycle of the power units. The purification sub-system consists of the following main equipment:

- One (1) x 100% ultraviolet light treatment stage;
- One (1) x 100% membrane deaeration system including internal nitrogen generation unit and vacuum generation unit (water ring pump);
- Two (2) x100% mixed bed cartridge ion-exchangers; and
- Two (2) x100% cartridge micro-filtration trains.

4.6.3.17 Wastewater Treatment Plant

As illustrated in the power plant process waste water will be discharged using one (1) offshore discharge pipe connected to a submerged discharge diffuser located at -2.5 m Mean Sea Level (MSL). The offshore wastewater discharge pipe is preliminary sized at 0.9 m and made of HDPE. The approximate length of the outfall pipe is 1,000 m**.**

The cooling tower blowdown will constitute the largest volume of the wastewater discharged from the Project. The cooling tower blowdown water will essentially be seawater, but with slightly increased temperature and salinity.

According to *Minister of Environment Regulation No. 8 of 2009*, maximum value for temperature from thermal wastewater is 40 °C, while the IFC EHS Guidelines establish an expectation that the temperature of wastewater prior to discharge does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone.

The seawater has a nominal salinity of 35,000 ppm and the cooling tower blowdown will have a salinity of 49,000 ppm. To mitigate the temperature effect of the cooling tower blowdown on the environment, the blowdown will be taken from the cold side of the cooling towers. In addition to temperature and salinity effects the cooling tower blowdown will also contain any inherent concentrations of the chemicals that are used to control scaling and marine growth within the cooling water circuit.

The collected chemical wastewater with treated oily waste water is transferred to a neutralisation pond via waste water delivery pumps and neutralised to pH 6 ~ 9. After the neutralisation, wastewater is discharged to the Java Sea in compliance with the pH requirement along with cooling tower blow down, back-washing water from the pre-treatment facility in the water treatment system and brine reject water stream from the SWRO.

All wastewater from oil separator, laboratory, and condensation system (with an exception of the boiler blowdown) will be channelled via a normal wastewater holding pond then to a neutralisation pond prior to being discharged to the Java Sea via a submerged offshore discharge head. The discharge head will always be submerged under at least two (2) m depth of water (i.e. two (2) m below the lowest astronomical tide).

The discharged wastewater quantity, assuming the plant is operating at a full load, is summarised in **Table 4-5**.

Table 4-5 Wastewater Discharge Volumes

Type	Discharges (ton/hour)
Cooling Water Blowdown	3,681.4
SWRO Reject	75
Neutralisation Pond	21.0
Oil Separator	15.0
Miscellaneous Demineralisation Water	6.0
Laboratory	0.01
Sewage Treatment Plant	1.0

Source: *PT Jawa Satu Power, 2017*

Treated wastewater (comprising domestic wastewater and on-site run-off from specific areas) will be discharged to the Java Sea in accordance with Indonesian regulation i.e. *Minister of Environment No.08 of 2009*.

The oily wastewater in the oily waste water surge pond is transferred to CPI oil/water separator constant flow rate and oil is removed to 10 mg/l in the separator. Collected oil/sludge in the CPI oil/water separator is drained to the oil sludge tank and will be collected by the licensed local hauler.

Sanitary wastewater will be treated separately from the normal plant process waste water. An on-site sewage treatment system will be provided, consisting of several treatment chambers, including screening devices, aeration, sludge treatment, sedimentation, clarification and separation/ recirculation of sewage sludge. The configuration would be subject on the supplier packaged type. The sewage treatment includes hypochlorite dosing into the discharge stream for disinfection.

The treated water will be chlorinated in an effluent tank and discharged to the Java Sea along with the treated wastewater. The sludge will be stored in a packaged sludge holding chamber, dried and then removed by a licensed

third-party contractor via trucking.

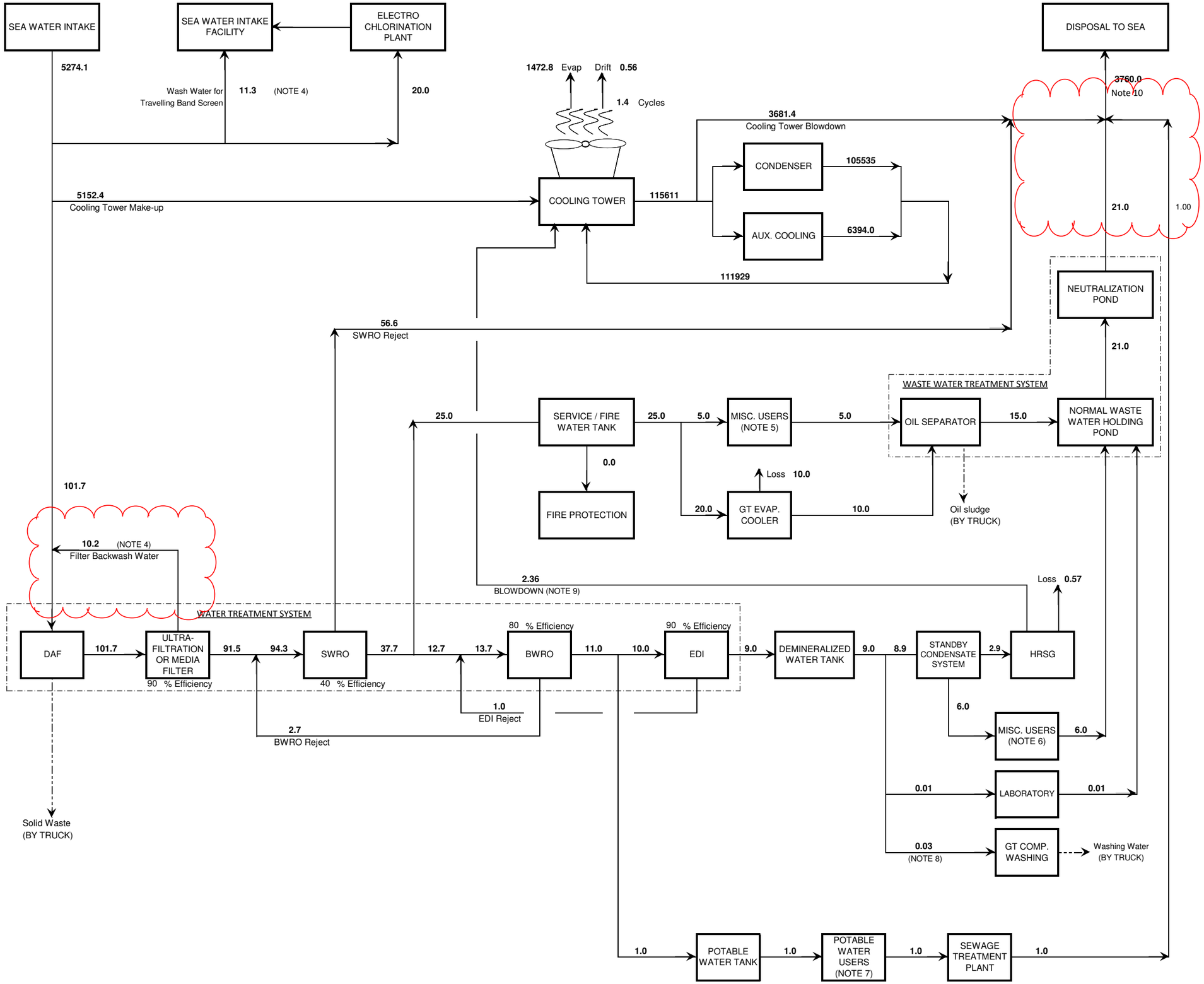
The amount of workforce during the construction phase of transmission line and the substation includes their presence during the tower Project land preparation activity, ROW clearing, installation of the tower foundation and tower construction, material and equipment transportation from the nearest road to tower site, cable withdrawal and commissioning test. The local construction workforce with the right technical skills and expertise will be prioritised. The EPC Contractor will manage the recruitment process.

Additionally, a total of 95 workers (i.e. 76 workers on-site and 18 at the Jakarta office) will be employed to operate the CCGT Power Plant. The on-site workers will be accommodated at the 30 units of houses located on a 12,100 m^2 of land located at 720 m to the west of the Power Plant.

The domestic wastewater from this housing complex will be transferred to Sewage Treatment Plant (STP) with a capacity of 2.5 m^3 /day. The estimated wastewater is expected to be 3.4 m^3/day, assuming the use of water is 50 litres/person /day and 80% of water usage will become wastewater. The wastewater effluent from the housing complex CCGT Power Plant staff will be discharged by the outfall pipe to sea. The remaining mud will be sent to the sludge thickener and will handed over to a licensed third party.

The generation of solid waste is estimated at 0.2125 m^3/day (assuming based on SNI 19-3964-1994: The Sampling Method and Measurement Examples of the Composition and Urban Waste). The domestic solid waste will be handed over to suitably licensed third parties to be transported periodically.

The water balance diagram for the power plant during operations is illustrated overleaf.



NOTES

1. All units in t/h
2. Design Ambient Conditions: 31 °C, 75% RH
3. Water Balance is valid for two (2) units
4. Consumptions are prorated to 24 h. Average flows if consumptions are not continuous
5. Miscellaneous Service Water Users :
   - Utility Station
   - Others
6. Miscellaneous Demi. Water Users :
   - Sampling
   - CCW Make-Up
   - Generator Stator Water Cooler Make-up
   - Others

   Allowance for misc. demi users is 0.5% of condensate flow.
7. Potable Water Users :
   - Emergency showers
   - Sinks, toilets, showers in buildings
8. Frequency of GT compressor washing is considered as below;
   - On-line washing : once a week (870 liters)
   - Off-line washing : once in two months (1240 liters)
9. 1.5% blowdown rate has been considered.
10. On-line monitoring requirement for final waste water discharge
    - Temperature
    - pH
    - Turbidity
    - Residual chlorine
    - Residual oil

Reference

1. Heat Balance Diagram

* THIS DRAWING IS PREPARED FOR THE PROPOSAL PURPOSE ONLY AND CAN BE CHANGED DURING THE DETAIL DESIGN STAGE.

PROPOSAL

REV.	DESCRIPTION	DATE	DRAWN	CHECKED	APPROVED
0	FOR PROPOSAL	05-Sep-17	H.SEO	M.KIM	H.KIM

DEVELOPER: PERTAMINA, Marubeni, sojitz

CONTRACTOR: SAMSUNG C&T, SAMSUNG ENGINEERING, GE Power, MEINDO

PROJECT: PLGTU JAWA 1 CCPP IPP PROJECT

TITLE: WATER BALANCE DIAGRAM
100% MCR, GE 9HA.02

SCALE | DRAWING NO | REV-NO

CLIENT DRAWING NO | PAGE-NO

4.7 500 KV TRANSMISSION LINE AND CIBATU II/SUKATANI SUBSTATION

4.7.1 Project Location

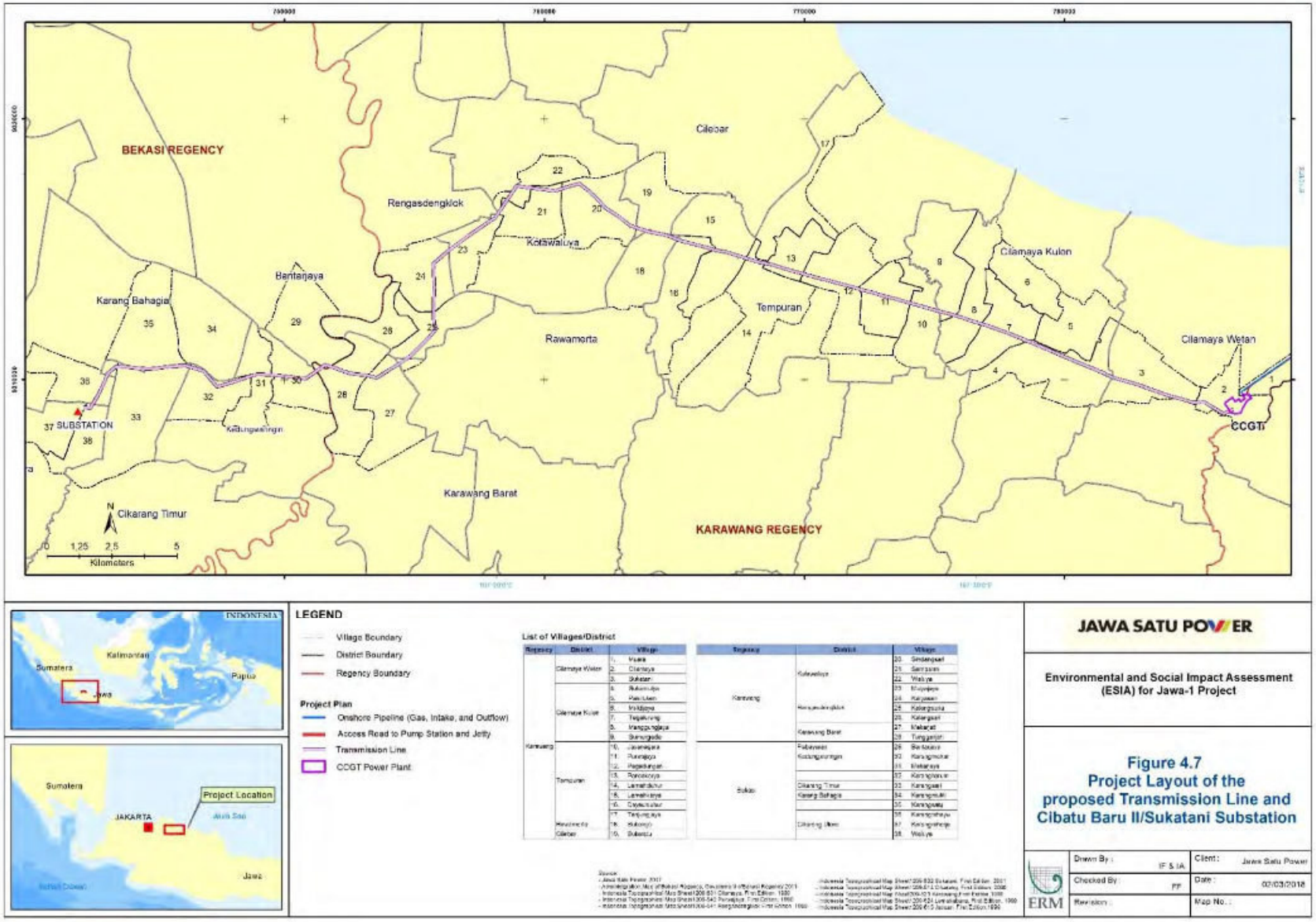
The proposed 52 km-transmission line will be routed from the proposed CCGT Power Plant to the 500kV Cibatu Baru II/Sukatani substation. The line will comprise approximately 118 transmission towers with a transmission corridor of around 17 m each side of the transmission lines as required by local regulation (total Right of Way (RoW) of 34 m).

The line will run through two (2) regencies, being Karawang and Bekasi, West Jawa Province. The route planning will affect 12 districts in Karawang and Bekasi Regencies. The districts impacted by the transmission line and tower footings include Cilamaya Wetan, Cilamaya Kulon, Tempuran, Cilebar, Rawamerta, Kutawaluya, Rengasdengklok, Karawang Barat, Kedung Waringin, Cikarang Timur, Cikarang Utama and Karang Bahagia. A total of 37 villages affected; 27 villages in Karawang Regency and 10 villages in Bekasi Regency.

The proposed transmission line route crosses mainly areas of land used as agricultural paddy fields. Some residential areas are also in close proximity.

Figure 4-29 provides the location of proposed transmission line and the substation.

Figure 4-29 Project Layout of the Proposed Transmission Line and Cibatu Baru II/Sukatani Substation



4.7.2 Construction

A 52 km long 500kV Transmission Line will be established from the CCGT Power Plant in Cilamaya to Cibatu Baru II/Sukatani Extra High Voltage (EHV) Substation in Sukatani. The construction of the Transmission Line is predicted to be completed within 22 months.

The line will comprise around 118 transmission towers will run through two (2) regencies: Karawang and Bekasi and will affect 37 villages. The proposed transmission line route crosses mainly areas of land used for agricultural purposes (rice paddy fields) (*Spatial Planning, 2011*).

The tower type and land area required for the development of 500 kV Transmission Line will comply with the requirement of PT. Perusahaan Listrik Negara (PLN). The transmission tower to be constructed are consisted of the types AA, BB, CC, DD, EE, and FF Types (refer **Table 4-6**).

Table 4-6 Tower Type and Land Area for 500 KV Transmission Line Standards

Tower Type	Angle (°)	Height (m)	Minimum Area (m)	Area (m^2)
AA	0 – 5	65 -72	28 x 28	784
BB	0 – 10	65 -72	34 x 34	1,156
CC	10 – 30	65 -72	34 x 34	1,156
DD	30 – 60	72 - 81	39 x 39	1,521
EE	60 – 90	72 - 81	39 x 39	1,521
FF	Dead End Tower	72 - 81	42 x 42	1,764

Source: PT. Perusahaan Listrik Negara, 2010

The above tower types are presented **in Figure 4-29**.

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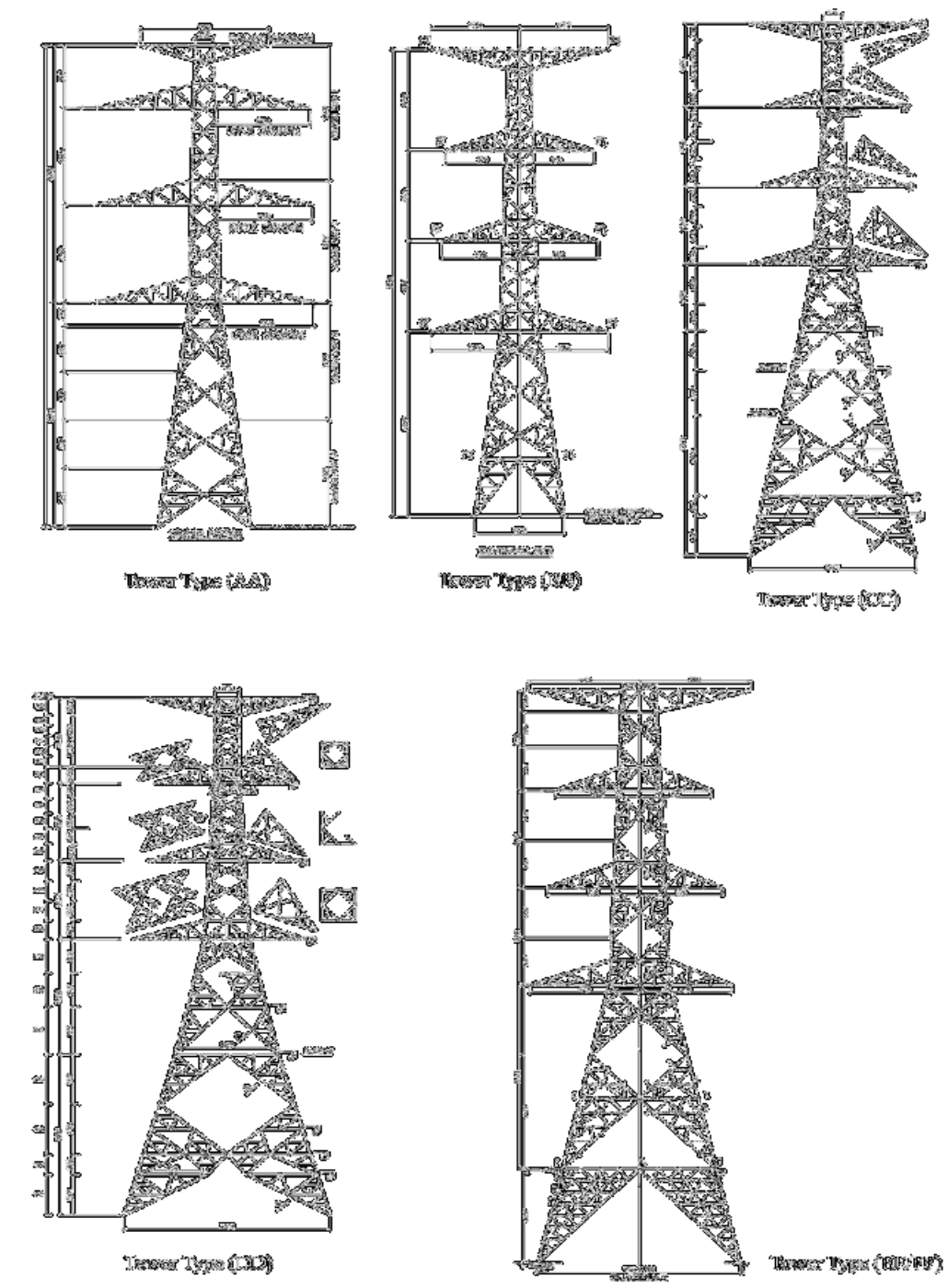
The minimum horizontal free space of the proposed Transmission Line Tower is 17 m as per the requirement of Indonesian Standard i.e. *SNI 04.6918-2002, regarding Free Space and Minimum Free Distance of High-voltage Transmission Line and Extra High-voltage Transmission Line*. In addition, the minimum vertical free space is 9m above any building in order to address potential community impacts.

Based on this and Project requirements, it is estimated that a total acquisition of 116,212 m^2 of land is required for the tower footings. This is based on 118 towers and typical footing area of 1,150 m^2 per tower. The actual land area required will depend on the nature of the tower (the area required or suspension tower, dead end tower and tension tower are different and range from 784 m^2 to 1,764 m^2) (*ERM, 2018b*; *Pöyry, 2016c*).

Figure 4-30 Transmission Tower Types



The access road to the construction area will be via existing main and village roads. A total of 45 km route will be required to reach the all areas where the towers will be constructed, hence several area will be acquired in order to minimise the disturbance to the local communities' daily activities. A compensation scheme will be implemented to the landowners and the status of the road will be reverted to them once the construction of the Transmission Line reaches its completion (*ERM, 2018b*)**.** The laydown area is proposed to be located within the vicinity of tower footing's area.

The physical construction work will start with land clearing and soil compaction. Following to this, tower foundations will be constructed involving land excavation, piling, setting, working floor making, stub shoes making, stub setting, crooked cut and supporting, formwork installation, cast preparation, earthing angle installation and grounding, cast foundation concrete, formwork disposal, filling and equipment demobilisation, and PLN boundary stacks installation.

An excavation of the land as deep as 3.5 m according to tower engineering design will be conducted for the tower that located within the paddy field. The excavated soil will be placed on the left and right side of holes which will be utilised to close the holes after foundation making is finished. Excavator will be used during land excavation and the clearing biomass will be distributed surrounding the footings area. The amount of these biomass is currently being assessed (*Samsung, 2018c*).

During the construction activities, where necessary, the immediate construction area will have a temporary perimeter erected. Preparation work also includes the construction of temporary worker shelters including food stalls at the laydown area.

The foundation of flooring will be conducted by drilling several points with the diameter size and depth mentioned in tower engineering design. A casing will be mounted to prevent the destruction of ground wall. In total, the material needed for foundation construction will require ± 14,150 cement sacks, ± 1,179 m^3 sand and ± 1,769 m^3 gravels. Construction of foundations can be conducted at 20 sites at one time (*Samsung, 2018c*).

Land coverage will also be conducted after the foundation is dry and ready for tower establishment, then the excavated soil can be levelled at one (1) meter height above the ground level. The tower height will be measured from the foundation soil and it ranges between three (3) to eight (8) meters, depending on the type of tower.

Construction materials will be transported using truck with capacity of ± 5 tons or smaller weight, take into consideration the road class that will be used. This complies with *Minister of Transportation Decree No. KM 69 Year 1993*. If five (5) tons load transports to be used, it is expected that the total vehicles movement during the construction of Transmission Line will be over 1,000 to transport materials such as steel piece, cement, sand and gravel. The laydown area will be located within the vicinity of the transmission line area. This has yet to be determined and agreed with the local communities and landowners (*Samsung, 2018a*).

The amount of steel material to construct the entire towers will be approximately 5,550 tonnes. Other materials to be used during the construction of these towers will be iron, rocks, sand, cement, woods, and bricks for tower and other structure foundations. This includes 30,000 sacks of

cement, 10 m^3 of sand, and 15 m^3 of gravel. Steel will be transported from Cilegong, Indonesia and cement will be sourced from Jakarta, Indonesia. Tower steel will be galvanised at the factory, hence no hazardous materials will be anticipated to be used on-site.

Local community will be hired by the EPC to manually transport the construction materials from the laydown to the footings area. The EPC will select the workforce and provide on-the-job trainings to specify Occupational H&S and Job Hazards related information

The installation of conductor/cables will include erection of scaffold, insulation, conductor and ground wire withdrawal, setting the hitch, clamping and other accessories installation and finishing.

The type of conductor to be used is an ACSR/AS 429 m^3 - Zebra. The installation of these cables will be conducted using a compound pulley or with a corkscrew (winch, chain jack) on a pole, or with a Lear on the ground. After the conductor is pulled until it reaches the specified tension, the end of the conductor is then anchored at the foot of the pole. The final pole would be reinforced with a pull support.

The conductor will be then let loose for ½ - 4 hours in order to distribute the tension (*Samsung, 2018c*). A method of tension stringing which shall not cause damage to the conductors and shall not be dropped on the ground at all times or any obstacles such as fences or buildings, except when the conductors are at rest. Suitable scaffolding will be installed to protect the obstructions and conductor.

The lightning protector will also be installed. In order to limit lightning back voltage that might cause an electrical jump on the conductor, tower feet resistance will be constructed and installed at a maximum of 20 ohm.

Other activities include the installations of stub tower, cross arm (travers) installation, tower shoots, number and danger plat and stringing the tower using bolt, nut and washer. These parts will be transported and assembled separately. Additionally, equipment used for the tower construction and stretching conductor wire will include winches, pulling machine and pile machine and other equipment according to field conditions.

The isolation test will be performed to determine the condition of the isolation of transmission line. The load test will be performed to determine the performance of the transmission line during the normal loading and overloading.

A short circuit test and open circuit will be undertaken to identify the performance of the transmission line and protection system.

4.7.2.1 *Cibatu Baru II/Sukatani Substation*

The 500kV Cibatu Baru II substation is located in Sukatani, a sub-district in Bekasi regency and occupies a total area of 7.8 ha. The lands around the substation are largely paddy fields however the area is developing rapidly with residential and business retail given its proximity to Jakarta.

The substation that will be constructed is a Gas Insulated Switchgear (GIS). The substation will be of the double bus one and a half circuit-breaker design comprising four (4) diameters and 10 circuit breakers and the following number of circuits:

- Two (2) outgoing lines to the 500kV Muara Tawar substation;
- Two (2) outgoing lines to the 500kV Cibatu substation; and
- Two (2) incoming lines from the CCGT Power Plant (*Pöyry, 2016c*).

The substation site is predicted to be constructed within 24 months (*ERM, 2018b*). The earthwork activities include removal of the existing top soil, backfilling and soil compaction, of which the purpose to rise the existing ground level to+ 2.25 m above mean ground level to protect the site against flooding (*GE, 2017*). Soil will be transported from a quarry located in surrounding Bekasi Regency, Indonesia (*GE, 2018*).

During construction, Safety Management will be implemented including:

- Installation of barrier surrounding the Project area; and
- Installation of Warning & Safety Signage, presence of site Security Forces and also Traffic Controller along construction/access road (*GE, 2018*).

To accommodate the transportation load of construction materials, eight (8) transit points will be set-up along the construction/access road. It is also anticipated that a 20 m x four (4) m temporary bridge will be constructed at Jalan Pandawa near Lemah Abang floodgate. The proposed bridge will be dismantle upon the completion of construction phase (*GE, 2018*).

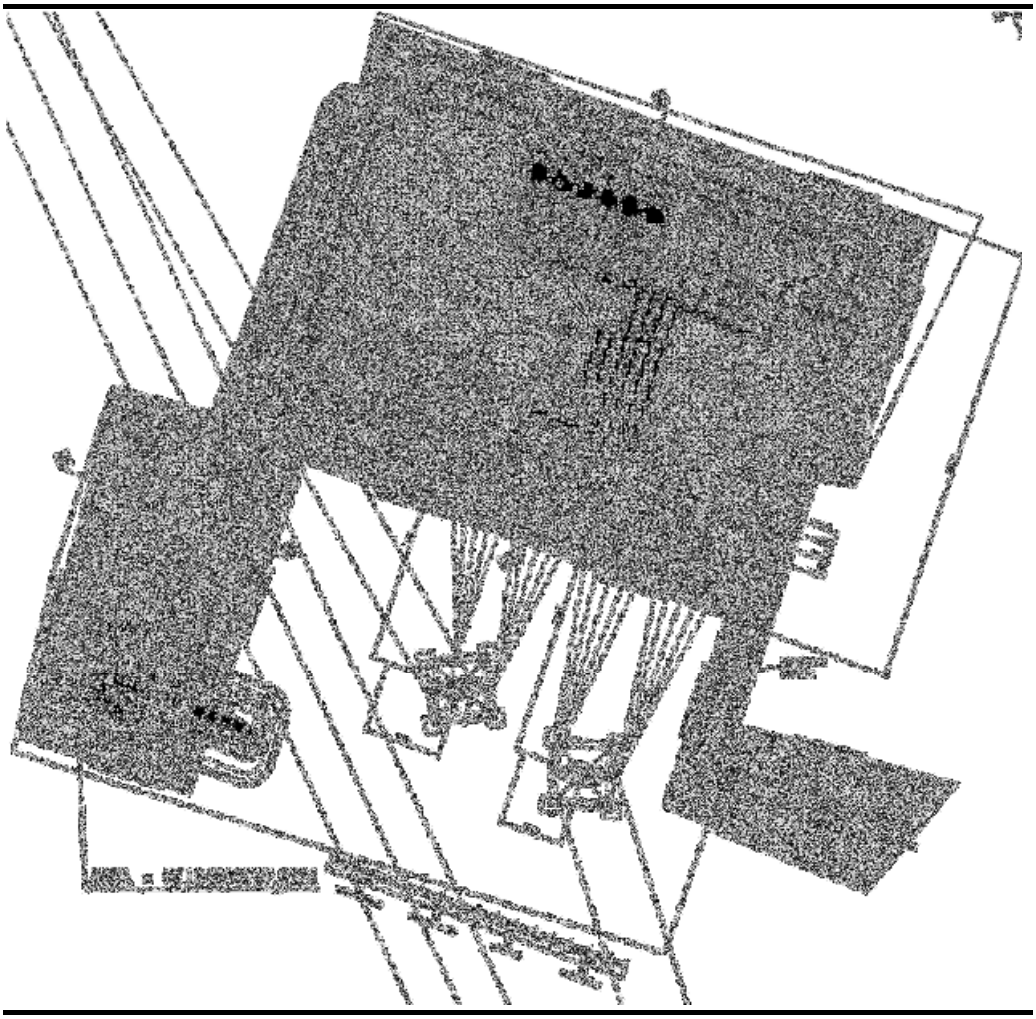
The existing inspection road to be utilised as temporary laydown area. A formal application will be submitted to the relevant authorities. Upon completion of construction phase, this leased land will be reinstate to the government (*GE, 2018*).

A substation control building will also be constructed where an office room, telecommunication room, control room and protection room will be located. In addition, the substation construction also consists of control and switchyard building.

The substation will be enclosed by a security fence, which shall also encompass the substation control building. The substation control building will contain all protection relays, control facilities, A.C. and D.C. electrical supplies, etc. (*Pöyry, 2016c*). **Figure 4-31** illustrates the layout of the substation.

The substation will be handed-over to PLN and it is anticipated that PLN will responsible for the Landscaping & Rehabilitation of the substation area (*GE, 2018*).

Figure 4-31 Layout of Cibatu Baru Substation



Substation equipment commissioning tests will be conducted together with the transmission line equipment commissioning tests. Similar to the transmission line commissioning test, the substation testing includes an isolation test, load test, short circuit test and open circuit test. These are intended to identify the performance of the protection and control systems used in the distribution of electrical power.

Table 4-7 summarises the breakdown of required workers that will be present during the Project construction of Transmission Line and the substation.

Table 4-7 Indicative Workforce during Project Construction of Transmission Line and the Substations

Facilities	Level	Number of Workforce
Transmission Line	Skilled	400 (peak)
	Semi-skilled	100 (peak)
Construction of Cibatu II/Sukatani Substation	Skilled	75
	Semi-skilled	115
Construction of CCGT Power Plant Substation	Skilled	56
	Semi-skilled	80
TOTAL		**826**

Source: Samsung, 2018c; GE, 2018b

During the towers and substation construction, number of workforces ranges from eight (8) to a maximum of 500 workers monthly. The construction teams are likely to rent temporary accommodation at the local villages - depending on the tower locations. However, the EPC Consortium has yet to agree and determine the location of centralised basecamp and its design layout in meeting the requirements of IFC Performance Standard 2 – Labour and Working Conditions (*IFC, 2012*).

4.7.3 Operations

PLN as the operator is responsible to supervise the meter (measuring instrument) for current, voltage, active power and reactive power, so that the power supply capacity is not exceeded. In carrying out its duties, PLN will coordinate with the load control centre.

The measuring instruments used in the operation phase include volt-meters, ampere-meters, kWh-meters, frequency-meters, cosφ-meters, meggers, and AVO-meters. Safety equipment for workers will include locks, ladders, gloves, safety helmets, eye protection, mouth and nose masks; and the field strength will weaken the further away the distance is from the transmission line.

However the field strength under the network is already below the safe limit value determined by the International Non-Ionising Radiation Committee (INIRC), in cooperation with the Environmental Health Division of the World Health Organisation (WHO) i.e. 10kV/m (500μT) and 5kV/m (100μT) for occupational and general public exposures respectively (*NRL, 2008*).

The substation serves as the control centre for the distribution of the electrical power through the transmission line. Centrally, the transmission network operations are governed by PLN's Load Control Centre. The communication between substations will be conducted via using fibre optics. The substation will be in line with the operating voltage level of the equipment i.e. 500 kV. In the event of excessive sag or snapping of conductor, the electricity will be cut-back.

The measuring device will record data over a specified time interval, usually

hourly. Along with technological advances, recording can be done automatically using a computer protection equipment, where the role of the computer is very helpful to obtain precision and speed.

4.7.3.1 GIS Outdoor Switchyard

The 500 kV switchyard with Gas Insulated System (GIS) type operates at 500 kV for each installed equipment, i.e. switchyard metering and protection, and switchyard surge arrester.

4.8 PROJECT DECOMMISSIONING AND CLOSURE

Decommissioning refers to the process of dismantling the operating assets after completion of the operating life cycle of the Project. Due to the long-term operation i.e. 25 years, the Project will review and update the decommissioning plan as it nears the end of its lifespan.

Typical decommissioning of the subsea system would encompass flushing the pipelines, which will likely to be capped and abandoned in place. For the nearshore and onshore infrastructures and facilities, decommissioning entails the safe demolition of buildings, removal of infrastructure and rehabilitation. A decommissioning and closure plan will be developed by the Project during the operations phase to prepare for closure.

4.9 PROJECT TRAFFIC MANAGEMENT

The EPC Consortium is currently developing a Traffic Management Plan during Construction Phase. This Plan will outline the traffic management philosophies, framework and inventory for how the Project will manage traffic and transportation of construction materials associated with the various phases of the Project.

The following summarises the anticipated amount of vehicles/vessels required during construction phase and a qualitative description of transportation during operations. **Figure 4-32** illustrates the existing road networks within the vicinity of Project area.

4.9.1 Construction Phase

The CCGT Power Plant is located in Cilamaya Wetan District, which can be reached through Jakarta – Cikampek Highway. The distance of CCGT Power Plant from the highway via Kotabaru, Jatisari, and Banyusari District is approximately 27 km.
The distance between the CCGT Power Plant to the fishermen jetty in Muara Village is approximately three (3) km. Additionally, the FSRU location can be reached by motorboats from the jetty in Muara Village. Vessels will be temporarily present within the nearshore area during pipe laying, dredging

and establishment of the FSRU mooring.

The material mobilisation is a huge amount of volume using large and heavy vehicles, which will disrupt traffic smoothness potentially resulting in traffic congestion and road disruptions especially local roads around the Cilamaya Wetan District for CCGT Power Plant and LNG-FSRU construction activities.

For the construction of the 500 kV Transmission Line and the substation, the material mobilisation using heavy and large vehicles is predicted to disrupt the traffic smoothness of road traffic. This includes the road networks in Cilamaya Wetan Village, Cilamaya Kulon Village, Tempuran Village, Kutawaluya Village, Rengasdengklok Village, and Karawang Barat Village along 75.11 km. The distance from the transmission line to the main road ranges from 200 to 1,400 m.

The remaining material in the Project footprint is very small, that is, in accordance with the calculation of the material needed in the construction process. The implementation of heavy equipment demobilisation will be conducted in accordance with the procedure of mobilisation of materials and equipment.

With the possibility of traffic congestion, the Sponsors shall co-ordinate with the Department of Transportation and Traffic Unit of Karawang and Bekasi Regencies Police, and aim to manage heavy mobilisation only during the night time where possible.

Table 4-8 summarises the indicative number of vehicles and vessels that will be required during the construction phase.

Table 4-8 Indicative Vessels/Vehicles required during Project Construction

Facilities	Number of Vehicles
Mooring Facilities, Offshore Unloading Platform, Pipelines and Jetty	
Transportation of heavy load construction material via jetty and using the trucks for bringing infill material to site, small equipment and construction materials	• Approximately 2,500 truck movements, depending on the construction progress
Seawater supply and waste water discharge pipeline and gas pipeline deployment	• Mobilisation of ± 1650 joint pipes, pulleys and welding equipment, approximately 400 truck trips
Subsea Pipelines	• The subsea gas pipeline deployment includes the 20" pipeline and approximately ± 1,200 pipeline joints. The material will be mobilised three (3) times per day during construction phase; • Transportation will start from a pipeline laydown area to the Project area by two (2) pontoon logistic barge, alternately in every three (3) days to one (1) pontoon lay barge used for pipe welding and • In addition, the pipe installation process requires two (2) unit of Tugs. Other heavy equipment i.e. two (2) unit Cranes will be placed on the pontoon and two (2) other units are on land and four (4) units of sideboom dozers.
Other Supporting Vessels	The vessel types during the construction of the offshore facilities includes: • Accommodation barge; and • Crew Boat;
Transportation of Workforce	N/A
CCGT Power Plant and associated facilities	
Transportation of Workforce	N/A
Transportation of the 300,000 m^3 soil piles using eight (8) tons capacity of dump truck	• ± 37,500 trips total or approximately 200 trips/day (during 180 working days)
Transportation of the 57,000 m^3 construction materials using five (5) tons trucks	• ± 27,360 trips or 76 trips/day or 10 trips/hour (during 360 working days)
500kV Transmission Line and the substations	
Transportation of Workforce	• N/A
Transportation of backfilling soils and construction materials for the substation	• Approximately 15,058 trucks during 24 months construction period or approximately two (2) trucks/hour
Construction Materials for the overall Transmission Line ROW i.e. 5,550 tons steel, iron framework casted with casted concrete consist of sand and coral, ± 30,000 cement sacks, ± 1,179 m^3 of sand and ± 1,769 m^3 gravel, woods and bricks.	• Approximately 1100 trips for steel pieces; • Approximately 300 trips for cement transportation; • Approximately 565 trips for sand transportation, and • Approximately 849 trips for gravel, wood and bricks transportation.

Note:

- One (1) m^3 = 2.4 metric ton
- Based on conservative estimations i.e. 30 working days and eight (8)-hrs/day.
- Material transportation using truck with capacity of ± five (5) to eight (8) tons or smaller weight, considering road class which complies with *Minister of Transportation Decree No. KM 69 Year 1993*.

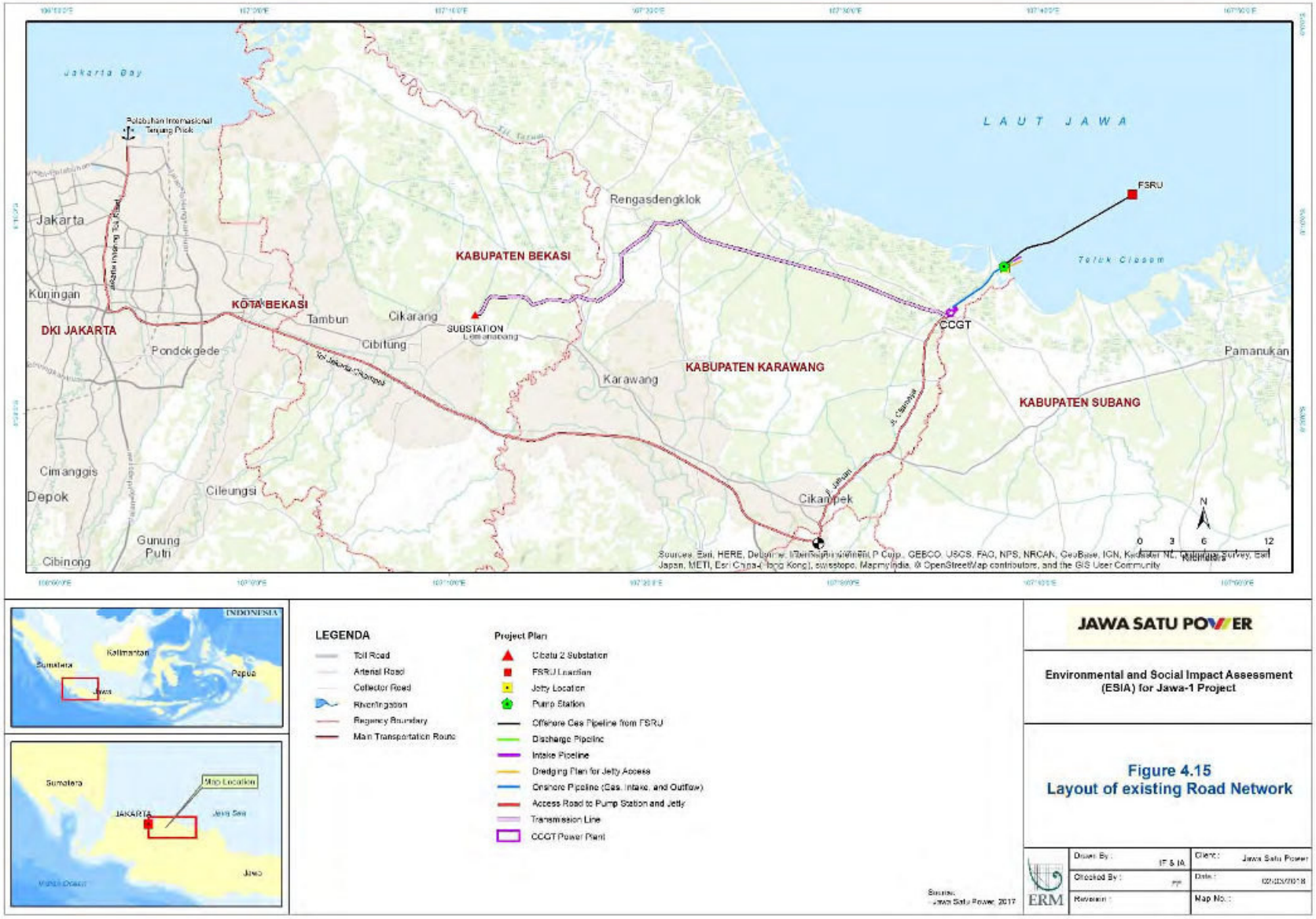
Source: ERM, 2018b; GE, 2018; Marubeni, 2018; Meindo, 2018; Samsung, 2018c.

Other types of equipment required are heavy equipment for land clearing and road construction such as bulldozer, loader, excavator, mobile crane, pile machine, molen, fibro rather, grader, scrapper, batching plant, asphalt mixing plant, and pile driver and gas turbine equipment transportation.

4.9.2 Operations Phase

During operation, Offshore Support Vessels (OSVs) will be required to transport crews i.e. two (2) to three (3) trips weekly, a tug boat to manoeuvre the LNG carrier, and service and maintenance vessels including annual under water inspection/maintenance. The location of supply base has yet to be determined. Additionally, the proposed jetty will serve as the point of the imported maintenance equipment and materials and will be transported to the CCGT Power Plant.

Figure 4-32 Layout of Existing Road Network



4.10 PROJECT WASTE MANAGEMENT

During the construction phase, waste materials, if not stored and disposed of appropriately, have the potential to have negative impacts on the environment and social receptors.

The majority of the generated wastes from the Project during the construction phase will be non-hazardous. General construction waste will comprise of surplus or off-specification materials such as concrete, steel cuttings/filings, wooden planks, packaging paper or plastic, wood, plastic pipes, metals, etc. Domestic wastes i.e. from the proposed workforce basecamp will consist of food waste, plastic, glass, aluminium cans, waste packages and sewage will also be generated. A small proportion of the waste generated during construction will be hazardous, including used paint, engine oils, hydraulic fluids and waste fuel, spent solvents from equipment cleaning activities, e-waste and spent batteries or spent acid/alkali from the maintenance of machinery on site and medical waste.

The EPC Consortium is currently developing a Waste Management Plan during Construction Phase. This Plan will outline the waste management philosophies, framework and inventory for how the Project will manage wastes associated with the various phases of the Project. It is anticipated that authorised third party disposal contractor will be appointed to handle, store and dispose of all waste in accordance with applicable international and local guidelines.

There will also be some wastes generated by the operations of CCGT Power Plant and various offices associated with the Project will generate relatively small amounts of a limited range of domestic wastes. These will include non-hazardous materials, such as paper and cardboard, as well as wood/metal furniture, which can be recycled if suitable facilities are available, and very small quantities of more hazardous wastes such as printer cartridges, e-waste and fluorescent lamps (containing mercury).

Accommodation facilities will also give rise to wastes from food preparation and consumption, maintenance and recreational activities. These wastes will include food, plastic bottles, paper and cardboard, and sewage.

There will also be some hazardous waste such as e-waste i.e. fluorescent bulbs, used batteries and medical waste.

During the operational phase of the Project, the proposed jetty will serve as the point of the imported maintenance equipment and materials. There will be small amounts of waste generated by the OSVs such as lubricating oils.

4.11 PROJECT CONSIDERATION OF ALTERNATIVES

Analysis of alternatives in environmental and social assessment is designed to bring environmental and social considerations into the upstream stages of development planning as well as the later stages of site selection, design and implementation.

During the earlier stages of the Project preparation, the environmental and social aspects were taken into consideration by the Engineering Team while selecting the Project's location, technology, fuel sources and technology. The alternatives analysis was documented based on the following technical documents:

- Policy and Planning Level Investigations undertaken by PT PLN Persero (PLN) as part of PLN's Power Development Plan Electric Power Supply Business Plan (RUPTL);
- Technical Feasibility Study of 1,6000 MW Combined Cycle Gas Turbine Power Plant, Cilamaya West Java, Indonesia in 2015; and
- Alternate Site Study Report of PLTGU Kawa 1 IPP Project, 1,600 MW CCGT Power Plant, West Java, Indonesia in 2015.

4.11.1 *Objectives of Project Alternatives*

The objectives of Project alternative analysis are:

- To describe the basis of selection of preferred alternatives including location, technology and design; and
- To provide the information that reviewers of the analysis will need if they wish to check its conclusions or apply their own methods to compare alternatives.

4.11.2 *Identification of Project Alternatives*

The initial proposal of the proposed Project to establish a new Power Plant in West Java was based on the Policy and Planning Level Investigations undertaken by PLN. It was formed as part of PLN's Power Development Plan Electric Power Supply Business Plan (RUPTL).

The proposed Project also indicates that 1,760 MW of additional electricity power generating capacity by 2019 to meet the demand of Indonesia's growing middle class population and the local manufacturing sector as well to support national economic growth.

Based on these needs, an alternatives analysis is conducted to identify the preferred Project Location, Fuel Sources and Technology as follows:

- ***Alternative 1*** is the CCGT Power Plant in Marunda Centre and to extend PLN's Muara Tawar 500 kV substation;

- ***Alternative 2*** is the CCGT Power Plant in Marunda Centre and a new substation located at a point along the existing Muara Tawar- Cibatu 500kV Transmission Line; and

- ***Alternative 3*** is the CCGT Power Plant located at Cilamaya and connected to the Muara Tawar 500kv Substation via 79.8-km Transmission Line; and

- ***Alternative 4*** is the CCGT Power Plant located in Cilamaya and connected to Cibatu II/Sukatani Substation via 52-km Transmission Line (Base Case).

The following sections summarises the information of Project Alternatives.

4.11.3 Alternative Locations

4.11.3.1 CCGT Power Plant

The alternative location of proposed CCGT Power Plant comes out of policy and planning level investigations, undertaken by PLN. The Request for Proposal (RfP) issued by PLN for the Project stated that the plant must be located on a site in the West Java Province.

The main objective in selecting the proposed Project area is to provide the lowest cost of electricity to PLN whilst satisfying environmental and social requirements. Site specific factors which impact the cost of electricity included:

- Site available to be purchased as reasonable cost – impacting acquisition costs;

- Site level relative to flood levels – impacting cost of protecting site against flooding;

- Site ground conditions – impacting foundation costs;

- Site proximity to Jawa Sea – impacting cost of cooling water and gas supply infrastructure; and

- Site proximity to PLN grid connection points – impacting cost of transmission line infrastructure.

With the above factors in mind, a number of areas were investigated.

The original RFP stated that the plant must be connected to PLN's grid system. This included an option (***Alternative 1***) which to construct a new power plant and a substation of which the power will be fed to PLN's Muara

Tawar 500 kV substation, located in the northern part of the Bekasi district or approximately 35 km from Central Jakarta.

The second option (***Alternative 2***) was to construct a power plant and a new substation located at a point along the existing Muara Tawar-Cibatu 500kV Transmission Line.

The proposed for these options is located within Marunda Center and along the coastal line of the Tanjung Priok Harbor in Bekasi Regency.

These options offered advantages in terms of the proximity to the PLN grid connection point. However, they suffered from disadvantages in terms of land purchase cost and uncertainties in acquisition (being close to Jakarta and owned by third parties), likely enhanced social issues caused by relocation of settlement, flood protection costs (due to the need to protect coastal sites from tidal storm surge), foundation costs (due to poor soil conditions at shoreline with Java Sea) and additional cooling water infrastructure costs (due to the shallow bathymetry of the offshore area and existing heat loads on offshore water from the existing Muara Tawar CCGT Power Plant).

Referring to the geotechnical site investigation at the Muara Tawar CCGT in 2004, the top soil layer in the area is of a soft condition, hence, a careful staged reclamation must be performed to avoid failure to this layer. Additionally, the settlement process over the reclaimed area should be finished before the plant construction, whilst the estimated average total settlement likely to occur within the years.

Backfilling is not allowed since it will significantly reduce the strength of the existing soil. As well as having cost disadvantages, the requirement for backfilling and consolidation of the available coastal sites meant that the construction schedule would be significantly impacted, exposing the ability to construct the Project according to the timetable set out by PLN.

The area is also on a reclaimed island and is therefore at risk of flooding by wave action, freeboard from high water level, storm surge and sea level rise due to global warming. Basic estimates of the amount of sea level rise is shown from 1990 to 2100 which accompanied the estimated upper limit and lower limit. The sea level rise (SLR) will be increase to approximately 70 centimeters.

Based on the bathymetry study, the elevation is assessed to be between 0.0 m to -2.5 m below mean sea level, hence the ground level setting of the Project area to be +3.36 m above mean sea level. This implies that a layer of at least three (3) to six (6) meters of sand will need to be deposited on the original terrain.

The proximity of the existing Muara Tawar CCGT Power Plant to these areas also meant that stack height would most likely need to be higher in comparison to the more rural locations.

As such the location for the proposed CCGT Power Plant was selected as Cilamaya given its history of industrial use i.e. Cilamaya Gas Compressor station. Additionally, as the proposed Project area in Cilamaya was essentially owned by one of the project proponents, it imposes a lesser impact avoiding any physical or economic resettlement.

Additionally, a considerable cost would be required to acquire and purchase additional land that would be utilised as construction laydown for ***Alternatives 1*** and **2**.

This CCGT Power Plant will then be connected to either Muara Tawar substation via 79.8-km Transmission Line (***Alternative 3***) or the proposed 500kV Cibatu II/Sukatani substation via 52-km Transmission Line (***Alternative 4***).

Although the proposed area in Cilamaya has a disadvantage in terms of the proximity to the PLN grid connection point, this was offset by the advantages it offered in terms of land purchase cost and more certainty for its acquisition. The Project land was already owned by one of the project proponents and so available on reasonable terms, lesser social impact as the site did not involve significant resettlement issues, flood protection costs (as the site was inland and only at risk of fluvial flooding) and foundation costs (as the inland location meant existing soil conditions were already suitable for heavy construction).

A topographic survey was undertaken and showed the proposed area has a generally flat topography with average elevation in range +3.00 to +3.50 Mean Sea Level (MSL) with some minor topography elevation minimum +2.50 MSL and maximum of +3.75 MSL. The floor ground level (FGL) of the area will be raised to +4.00 m MSL, to match that of the existing SKG Cilamaya and provide good drainage.

A hydrology survey has been undertaken for the Cilamaya area as part of the feasibility study and indicated that the water depth for return period of 100 years is +4.57 meters MSL. As the floor ground level (FGL) of the site average site elevation is proposed to be around +4.0 m MSL which implies the flood protection measures will be required.

The bathymetry of the Java Sea was reasonably steep for the Cilamaya area which kept the cooling water infrastructure costs at reasonable level.

The total estimated Project investment costs for the Project Alternatives are summarised in **Table 4-9**. These estimations are based on the 2015 price levels.

Table 4-9 Breakdown of Project Investment Costs (in MMUSD)

Items	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Land Cost	88.8	88.8	40.0	40.0
Site Enabling Work	27.9	27.9	3.0	3.0
EPC Cost	970.0	970.0	959.5	959.5
Two (2) years of Operating Spares	9.7	9.70	9.6	9.6
LTSA Mobilisation Cost	20.0	20.0	20.0	20.0
New Transmission Facilities	19.6	21.6	107.5	84.0
New gas supply infrastructure	0	0	0	0
LNG Contingency Reserve	0	0	0	0
Pre-Operating Costs	76.0	76.0	75.8	75.8
Financing Fees	15.0	15.0	15.0	14.8
Interest during Construction	112.5	112.6	112.8	110.7
Contingency	62.20	62.3	63.6	62.4
Initial Working Capital for Operation	59.9	60.1	60.2	59.1
VAT	37.5	37.6	37.6	36.9
Initial Fill of Light Fuel Oil Tanks	0	0	0	0
TOTAL	1,499.10	1,501.60	1,504.60	1,475.80

Source: Pöyry, 2015

The Commercial Operational Date (COD) for ***Alternative 1*** and **2** was October 1st, 2020 and ***Alternative 3*** and ***4*** was October 1st, 2019.

For the above reasons, it was found that Cilamaya offered the lowest cost of electricity in comparison to the alternative sites in Maruda Centre and also offered a construction schedule which was consistent with the proposed Project schedule.

Table 4-16 compares the alternatives location of the proposed CCGT Power Plant using the physical and biological environmental, social and community health receptors.

4.11.3.2 Transmission Line

The Project transmission line has currently planned for 118 tower footings across the 52 km. As such it has undertaken a number of steps (and will continue to) in order to design out and manage potential community impacts as a result of the construction and operation of the transmission line and substation acknowledging that PLN will be responsible for the operation of the transmission line.

A total of 24 towers have been relocated to minimize resettlement impacts (physical and economic), address refusal to sell, impacts to the community resulting from the construction and operation of the transmission line, and also to avoid transactions with land owners with incomplete administrative documents.

A summary of the tower locations, based on the consultations on the 31st July 2018 in Karawang, is provided below:

- **Towers 63, 64, 65, 66, 67 and 68:** The land for towers 64 and 65 was not able to be purchased as the owner refused to sell. The rerouting area for all six towers is now only just paddy land.
- **Towers 112, 113 and 114;** Tower 113 was relocated because the transmission line right of way crossed over a residential house (constructed after the original right of way was identified). As such all three towers were relocated.
- **Towers 102 and 103:** The original route crossed over an Islamic School as such the towers were relocated but the right of way now passes over three houses.
- **Towers 115, 116, 117 and 118** (near the sub-station): These towers were re-routed because the previous land was identified as an area for the government's residential houses programme. The towers were relocated to paddy land.
- **Towers 94 and 95:** These towers were re-routed because they could not purchase the land and the land owner documents were incomplete. T The towers were moved to cultivated crop land and paddy.
- **Towers 75, 76, 78 and 79:** These towers were relocated **as the** owner wanted a very high price for the land as such the towers were moved to another land owner's land.
- **Towers 57, 58 and 59:** The landowners were not willing to sell as such the towers were relocated 100 m to alternative paddy land.

The Project was unable to avoid the right of way passing over 6 locations. These locations are summarised below:

Tower 4-5: The cable passes over a number of shops that were constructed after the land was purchased in October 2017. The land owners were informed in January 2018 of the right of way and were happy because of the compensation received. Community health impacts from the transmission line and the design mitigations in place were also discussed.

Figure 4-33 Transmission Line Crossing over Shops

Towers 44 and 45: The right of way passes over a number of illegal houses on government land (should the government decide to use this land they will be asked to move). However at present they have an agreement with the government landowner to be there. Neither tower could be moved because the adjacent landowner was not willing to sell.

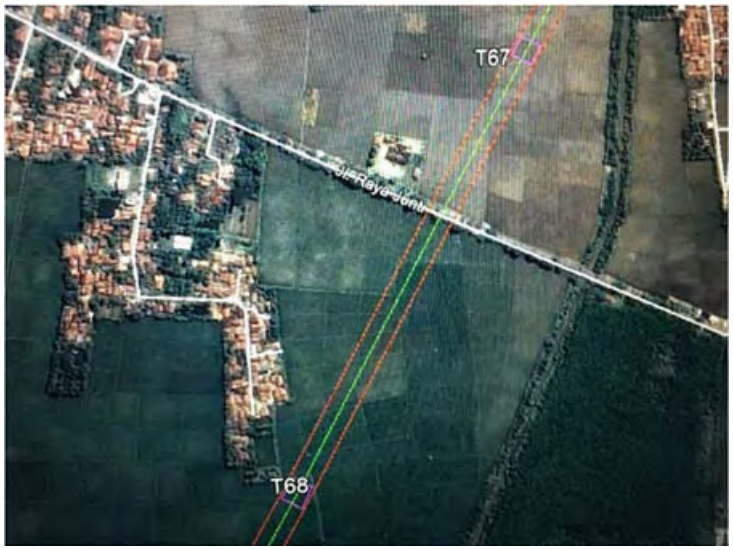
Figure 4-34 Transmission Line Crossing over Illegal Housing

Towers 80 and 81: Similar to Towers 44 and 45 the land is government owned; three houses are below this part of the transmission line next to the river. They have an agreement with the PJT irrigation company to live there. The landowner next to Tower 80 has no documentation so the land could not be purchased and on the left side the land is in dispute between two owners. For Tower 81 on the left side is the same disputed land and on the right it is the same owner as Towers 75 to 79 who requested too high a selling price.

Figure 4-35 Transmission Line Crossing over Housing by River

Towers 67 and 68: The transmission line passes indirectly above a shop due to re-routing of Towers 63 to 68. Rerouting was not possible as the land owners were not willing to sell. The house is in the ROW but not directly under the lines.

Figure 4-36 Transmission Line Crossing over Shop (Towers 67 and 68)



Towers 102 and 103: The original route crossed above an Islamic School, when rerouted it passes over three houses with non metal roofing.

Figure 4-37 Transmission Line Crossing over Three Houses

All four households have been engaged with to discuss the compensation process and Project H&S impacts and mitigations.

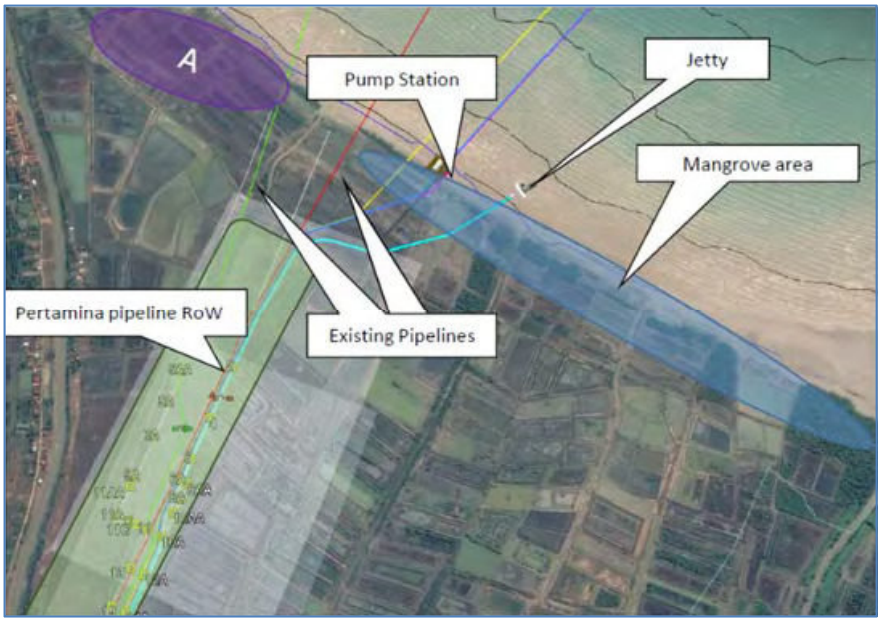
Section 9.5.5 and Annex 4 of the Resettlement Plan (**Annex I**) provides further details.

Location of Jetty and Pump House

The jetty location has been moved a further 100m seaward from the original location. The equipment jetty design will involve heavy load transportation (approximately 550 MT excluding the multi axle weight) however if the equipment jetty is moved out further to the sea, a significant size of structure would be required to withstand the load especially considering the soil condition at nearshore which relatively soft. As such moving the jetty out further is not economical given the usage during operations (emergency only).

It was also noted there is an area of 0.33 ha of mangrove around the pump house and jetty area that will be utilized by the Project during construction and operations (see **Figure 4-38**). This area was selected to minimize the further need for land acquisition but optimizing use of the right of way land owned by Pertagas.

Figure 4-38 Location of Mangrove Area in Relation to Project Facilities



Specifically the construction activities at the nearshore will require the land to:

- Build the pump house and electrical building to serve the pump house including the chlorination unit which will involve trenching, backfilling, piling, concreting, erection of structure, erection of equipment etc.
- Installation of the gas pipeline including shore pull activities (installation of the temporary foundation for the winch, hold back system and its hydraulic unit) which will involve trenching, backfilling and welding of gas pipeline.
- Installation of the seawater intake and discharge pipelines which will involve trenching, backfilling and fusion welding of the intake pipeline.
- Transportation road construction which will involve backfilling and compaction.
- Equipment jetty construction that will involve piling work, concreting and dredging.

As such at the construction area, it is not possible to avoid the impact on the mangroves as most of the work involves earthwork as specified above.

The EPC considered various options when locating the pump house and jetty however relocation to avoid or reduce impact to the mangrove areas was not possible. The area is required during construction as the EPC will perform concurrent activities at equipment jetty (dredging) and installation of offshore intake and discharge pipe and therefore requires the land to minimize the impact of dredging at the jetty to be transferred to the intake and discharge pipe. The area is also required for anchoring of the dredging barge and pipe installation vessel.

Area A highlighted in **Figure 4-38** cannot be utilized due to the restrictions in crossing over the existing pipelines and the minimum distance for the pipelines to the shoreline facilities of +/- 500 m required.

During operations the jetty is planned for emergency events and as such the area will need to be dredged for the transportation barge to approach the jetty and to allow space for the anchoring of the dredging barge as well as to avoid the potential damage to the seawater intake and discharge pipe during the anchoring of the dredging barge.

During construction, the EPC will also minimise mangrove removal where feasible through restricting clearance, vegetation protection fencing and steepening of road batters. These measures are further discussed in the ESMP in *Chapter 12*.

However, during operations the area utilized for the fabrication of the offshore intake and discharge pipe will not be required and as such can be compensated.

Length of Outfall Pipeline

The EPC also considered a number of criteria when selecting the length of the pipeline outfall and its design. The basis of the EPC design and code is based on the length of pipeline determined by the location of the Power Plant in Cilamaya and the FSRU. It also considers the required water depth for the FSRU and safety factors. The following criterion were considered for optimizing the offshore pipeline route:

- Compliance with government regulations;
- Shortest length between the landfall point, while avoiding sea bed obstructions and hazards;
- Minimum straight section calculated towards the landfall and opposite curve direction to avoid possible pipeline shifting during pipe laying and or start-up;
- Avoid or minimize the number of pipeline or cable crossings (if possible);
- Avoid pipeline route through unsupported span (depletion) on sea bottom;

- Regulatory constraints and authority permits; and
- Design constraints (minimum radius of curvature etc.).

Based on the above the current pipeline design and route has been selected by the project as the optimal design based on technical, environmental and economic factors.

Alternatives Analysis

For ***Alternative 1 - 3***, it has been assumed that the grid connection point will be at Muara Tawar 500kV substation. Two (2) conceptual routes have been considered for this purposes. The general topography of these routes is flat and the maximum elevation is approximately six (6) m within the route skirts perimeter of an industrial area.

The first route (***Alternative 1***) was designed to run in an easterly direction from the north-east corner of the proposed area and crosses an existing CW intake and discharge channels of the Muara Tawar CCGT Plant. The route length is 1.9 km.

The second route (***Alternative 2***) was designed to run in a southerly direction from the proposed area, crossing over the industrial estate land, before turning westwards and then northwards towards Muara Tawar substation. This route involves crossing several residential areas, a waterway and two (2) existing 500kV Transmission Line.

Based on available information, the route does not traverse any area subject to local, national or international terrestrial biodiversity designation or protected area.

For ***Alternative 3***, a 79.8 km transmission line was designed to run from the proposed CCGT Power Plant in Cilamaya and heads to the Muara Tawar substation. On the final approach to the substation, the route will run alongside the existing Muara Tawar – Cibatu Transmission Line. This proposed Transmission Line will cross a staff housing complex, Pertamina gas pipeline corridor, Cilamaya irrigation canal, Citarum River and multiple residential and commercial areas.

Alternative 4 will require the proposed 52 km Transmission Line from CGGT Power Plant in Cilamaya to Cibatu II/Sukatani Substation. The line will run through two (2) regencies, being Karawang and Bekasi, West Jawa Province and crosses mainly areas of land used as agricultural paddy fields. Some residential areas are also in close proximity.

The Project is committed to avoid where possible and/ or reduce the impacts resulting from the land acquisition activities. This is reflected in several alterations to the Project design during the initial project planning phase:

- The CCGT power plant has optimised Pertagas' land to avoid resettlement impacts to private owners. As such, the land acquisition for the power plant will only impact those who currently use the land informally for grazing purposes. This will be discussed subsequently.

- Tower footing locations for the transmission line have been rerouted 45 times (detailed are presented in **Annex I**) to minimise resettlement impacts (physical and economic) as well as impacts to the community resulting from the construction and operation of the transmission line.

- Land acquisition in the coastal area for the onshore pipeline, jetty, and access road has been minimised by optimising the use of the existing Pertagas RoW. Where requested, the Project has acquired additional unviable land to support the livelihoods of the land owners.

4.11.4 Alternative Fuel Sources

According to the BP Statistical Review, at the end of 2013 Indonesia possessed 2.9 trillion cubic metres (TCM) or 103 trillion cubic feet (TCF) of proven natural gas reserves at the of 2013 and ranked as the 13th largest holder of proven natural gas reserves in the world, and the second-largest in the Asia-Pacific.

Hence, the choice of fuel for this Project comes out of policy and planning level investigations undertaken by PLN. The RfP issued by PLN for this Project stated that PLN shall procure the natural gas for the Project which is planned to be supplied by BP Tangguh.

Additionally, natural gas is also an extremely important source of energy in terms of reducing environmental pollution. Natural gas also burns cleaner than other fossil fuels, such as oil and coal, and produces less carbon dioxide per unit energy released. For an equivalent amount of heat, burning natural gas produces about 30% less carbon dioxide than burning petroleum and about 45% less than burning coal. The combined cycle power generation based on natural gas is thus the cleanest source of power available using fossil fuels.

Table 4-10 summarises the qualitative comparisons of fuel sources options available including coal, hydropower, nuclear and renewable energy such as solar and wind energy.

Table 4-10 Comparisons of Alternatives Fuel Sources

Fuel Alternatives	Description
Natural Gas	The abundant natural gas in Indonesia would not require the source to be imported and it provides greater reliability, proven technology, well suited to meeting the required energy demand.

Fuel Alternatives	Description
Coal	Coal supply is relatively expensive and contributes to a significant fuel delivery and by-product production implications. Coal consumption also causes serious environment issues such as Greenhouse Gas (GHG) emissions, which contribute to global warming, acid rain, and localised air pollution, along with social impacts such as increased respiratory ailments (ADB, 2015).
Hydropower	The energy source would likely require large hydropower sources at multiple sites in West Java in order to achieve the required power generation, which can contribute to negative environmental and social impacts (e.g., changes in river ecosystem, disruptions in wildlife, and social displacement).
Nuclear	Nuclear cannot be permitted and constructed within the required time limit.
Renewable Energy i.e. Wind or Solar	Renewable energy cannot provide the sufficient supply needed for the Project's requirement in West Java.

As discussed in *Chapter 8*, the Project is responding to additional power demands for the region. Therefore, it needs to be queried as to whether there are alternative, lower GHG intensive power generation options available. Given the scale of the Project (1,760MW), and the requirement for baseload power generation, it is appropriate to compare the Project with other thermal (fossil fuel) power generation alternatives.

A comparison of conventional (thermal) baseload electricity generation operations is provided in **Table 4-16**.

Table 4-11 Electricity Generation Greenhouse Gas Intensities (tCO_2-e/MWh)

Operation	Natural Gas		Black Coal		
	OCGT	CCGT	Sub-critical	Super critical	Ultra super critical
Assumed average efficiency (%)	39	53	33	41	43
Extraction and processing	0.14	0.1	0.03	0.02	0.02
Transport	0.02	0.01	0.03	0.03	0.03
Processing and Power Generation	0.59	0.43	0.97	0.78	0.74
Total	**0.75**	**0.55**	**1.03**	**0.83**	**0.79**
Min estimate	0.64	0.49	0.75	0.61	0.58
Max estimate	0.84	0.64	1.56	1.26	1.2

Source: Worley Parsons, 2011

Table 4-16 shows that, compared with other conventional fossil fuel baseload power generation, CCGT Power Plant is the least GHG-intensive option. Table 4 within the *IFC Thermal Power Plant Guidelines 2008* provides typical CO_2 emissions performance of new thermal power plants. IFC, 2008 further supports that CCGT is the least GHG-intensive of all fossil fuel baseload power generation options.

4.11.5 Alternative Technology/Design

4.11.5.1 CCGT Power Plant

The gas turbine technology selected for this project is manufacturerd by General Electric (GE) and is designated as a 9HA.02 machine and has the largest power ouput of any single gas turbine currently available. This model of gas turbine uses the latest materials and combustion technology that make it the most efficient gas turbine currently available in the power generation market. As such it has the lowest green house gas emissions compared to other gas turbines on the market. This model has also been designed to reduce emissions of nitrous oxides and carbon monoxide at lower loads; a significant environmental benefit for the project which will include part load operation.

The choice of Combined Cycle Gas Turbine (CCGT) for this Project comes out of policy and planning level investigations undertaken by PLN. The Request for Proposal issued by PLN for this Project stated that the Project must be based on CCGT technology, designed for continuous load following operation. The Plant operating profile is anticipated to be minimum generation overnight, 60% output during the day (non-peak), and 100% output during afternoon/evening peak.

As the GE 9HA.02 model has the highest power output available in the market for a single gas turbine unit and with the addition of some supplemental gas firing in the heat recovery steam generator, the plant can satisfy the load demands of PLN with two gas turbines and two heat recovery steam generators with two steam turbines. Any alternative gas turbines currently available in the market to produce the same power output level as the GE 9HA.02 machine would require three gas turbine and three heat recovery steam generators/steam turbines which would be less efficient than the two unit 9HA.02 combined cycle configuration, have a higher capital cost and hence cost of power to PLN and also require a larger footprint.

Additionally, combined cycles are characterised by flexibility, quick part-load starting, suitability for both base-load and cyclic operation, and high efficiency over a wide range of loads. The construction programme for a CCGT is relatively short, when compared to other large scale generation plant.

The proposed CCGT Power Plant will use a combination of gas and steam turbines to supply power. A gas turbine generator generates electricity and the waste heat is used to produce steam to generate additional electricity through a steam turbine, which enhances the efficiency of electricity generation and reduces environmental emissions.

Alternative gas turbines technology currently available in the market to produce the same power output level as the designated turbine machine would require three (3) gas turbines and three (3) heat recovery steam generators/steam turbines.

The other power generation technology options available include Coal Fired Boilers, Integrated Gasification Combined Cycle (IGCC), nuclear, hydropower, and renewable energy such as solar and wind.

A Coal Fired Power station are relatively expensive, requires a longer construction programmes and also have lower efficiencies when compared to the Combined Cycle Gas Turbine technologies. Hence, a Coal Fired Power Plant is more suitable for base load applications and offers a lesser load following duty and cyclic operation.

IGCC is a technology in which coal is gasified and the resulting gas is fed into a CCGT plant. The technology is complex and essentially unproven, and therefore has been discounted at this stage for these reasons.

Following the factors for the fuel sources of hydropower, nuclear and renewable energy (refer to **Table 4-10**), such technologies have been discounted for this Project.

Cooling System

The main surface water resources in the area of the Project Site are:

- the Citarum River;
- the East Tarum Canal;
- the Cilamaya Irrigation Canal;
- the Cilamaya River; and
- the Java Sea.

Based on the assessment, the supply of water from Jawa Sea is the best option. It provides an advantage due to the practically in terms of the supply and cost.

The following summarised the considerable cycle cooling alternatives for the Project:

- *Once Through Cooling*: This type of cooling system the cooling water is extracted from the water resource, pumped through the power plant condensers and returned to the water resource. The heat removed by the cooling water from the condenser will be rejected to the water resource. The main environmental impact during operation of a direct once through cooling water system relates to the thermal discharge. This type of cooling system requires a suitable sized and reliable source of cooling water and is only really feasible for a plant located next to the sea (for a coastal plant) or next to a large river (for an inland plant).

- *Wet Evaporative Cooling*: This type of cooling system the cooling water will be recirculating through the condenser in a closed loop. The heat removed by the cooling water from the condenser will be rejected to atmosphere using mechanical draft cooling towers. As the water circulates through the

system, evaporated water exits the cooling towers as pure vapour leaving dissolved solids behind, which begin to concentrate over time. To control solids build-up a portion of the cooling water is bled from the cooling tower basin. Called blowdown, this is usually controlled using a conductivity monitor and is accomplished on a continuous or on a controlled bleed cycle basis. This type of cooling system therefore requires a supply of make-up water to replace the cooling water lost through the evaporation process and due to blowdown. The make-up water can be either seawater or freshwater.

- *Dry Cooling*: In this type of cooling system the fluid to be cooled is circulated through coils, tubes or conduits, which are cooled by an air stream that flows past the tubes thus cooling the medium by conduction and convection. The air stream is normally created by fans. Because the heat capacity of air is low and the coefficient of conduction and convection is low, a lot of air is needed and a larger heat exchanging surface is required than with water cooling. For the same capacity, dry air-cooling needs a larger surface than a wet evaporative cooling system and dry systems are generally considered to be more expensive. The use of fans means that air-cooled condensers have a high electrical power consumption. A dry cooling system decreases the net efficiency of the power plant, thereby increasing the cost of electricity produced by the plant and the amount of carbon dioxide emitted by the plant per kWh of electricity produced. Other disadvantages of the air cooled condenser include larger visual impact and increased noise levels from the fans.

There is already an existing Muara Tawar CCGT Power Plant next to the proposed Project ***Alternative 1*** and **2** which uses a direct once through cooling system. The power plant has a total installed generating capacity of over 2100 MW. The first block entered operation in 1996 and the site was expanded again in 2005 and again in 2010.

Cooling water for the Muara Tawar CCGT is extracted from the Jawa Sea via an open intake channel that extends some 2.8 km offshore and four (4) m depth contour. The heated cooling water is then returned to the Jawa Sea by another open discharge channel that extends approximately 800 m offshore.

The cooling water intake must be taken from a water depth of at least seven (7) m to provide sufficient distance to the existing system to tolerate a certain degree of warming up increment and recirculation from the new and existing plume dispersion effects. Hence, an open intake was considered noting that the simplest solution to provide a breakwater parallel to the existing channel (a new breakwater forming one side wall and the existing channel the other side wall). However, as it is necessary to extend further into the open sea, the constructability of an open channel of such a length would be difficult to operate from hydraulically point of view.

The modelling at proposed area of Project ***Alternative 1*** and **2** indicated that the temperature at the inlet end of the intake channel for Muara Tawar CCGT reaches a maximum of 30.75 °C. Accordingly, there is already a substantial temperature increment of 1.75 °C at the inlet location of the existing channel.

In addition to the plume dispersion aspects, the distribution of hot water has socioeconomic impacts on the local communities caused by the direct contact with the water plume in the area.

Based on above, a submerged offshore intake structures was recommended which to connect the intake to the shore via twin or triple piping or conduit design embedded in trench below sea bed level. For the cooling water return, a submerged offshore discharge is also proposed. This method is to comply with the anticipated environmental limits.

Additionally, the intake and discharge locations will need to take into consideration entrainment of sediments, recirculation and dispersion of hot water, sea bed gradient, sea bed material, wave action, navigational constraints, environmental constraints and other factors.

The cooling system for ***Alternative 3*** will be as per recommended for ***Alternative 1*** and **2**.

For ***Alternative 4***, as the Project area is located seven (7) km inland, once through cooling was not considered technically feasible. Additionally, a dry cooling systems are generally only utilised where a make-up water supply for a wet evaporative system cannot be made available at reasonable cost. As this was not the case for the proposed are in Cilamaya, a dry cooling system was not considered for the Project. Hence, the power plant will be cooled by an indirect wet evaporative cooling system using seawater cooling towers. Additionally, it was considered feasible to establish a pumping station on the shoreline of the Jawa Sea to meet the make-up water demands of wet evaporative cooling system.

Stack Height Scenarios

A base case modelling scenario was initially considered to include a stack height of 60m and a NO_x emission rate based on the IFC NO_x emission limit value and the turbine manufacturer guaranteed NO_x emission level of 51mg/Nm^3. The resulting NO_2 1-hour maximum PC was found to exceed 25% of the NO_2 1-hour Indonesian air quality standard and considered not compliant with the criteria outlined previously. In order to facilitate the decision making process, the air quality impact assessment presented in **Annex D** details the methodology and findings from a number of additional modelling scenarios based on varying stack heights (60 to 82 m) and a reduced NO_x concentration (40 to 51 mg/ Nm^3).

The Project considered a range of scenarios for stack heights at the 100%ile at 51mg/Nm^3 (**Table 4-12** and **Figure 4-39**).

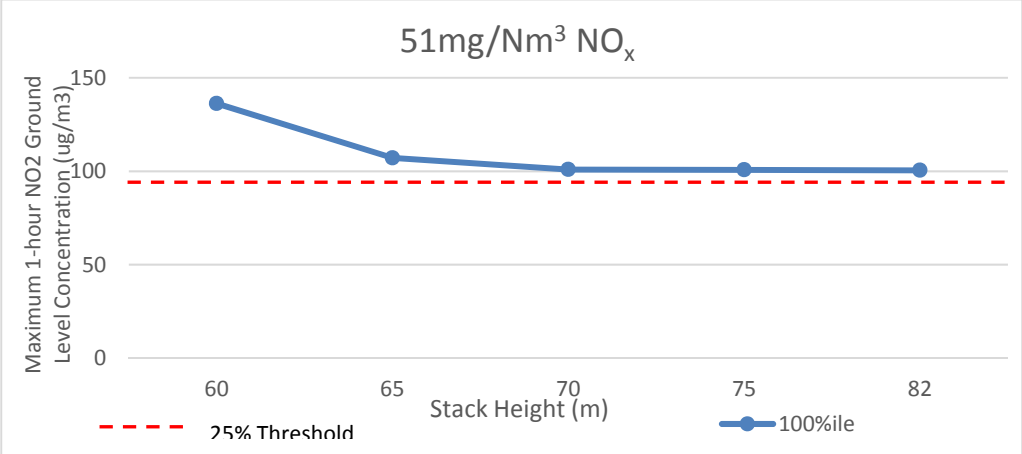
Table 4-12 Stack Height at 51mg/Nm^3 Concentration Scenarios (100%ile)

The model results indicate that a stack height of 70m is required to meet the 25% threshold to allow for future sustainable development in the same airshed (*IFC, 2008*). However the estimated cost of increasing one stack by one meter is approximately US$100,000. On this basis, the Project cost for increasing two stacks to 70m is approximately US$2,000,000. Per year the cost of increasing both stacks to 70m is approximately US$80,000 based on a 25 year design criteria. As such there is no cost-benefit to the Project for increasing stack height based on the outcome of this assessment.

A Stack height increase to 82m (GIIP) would cost approximately US$4,400,000 or US$176,000 per annum based on 25 year design criteria. The model results indicate that there is a negligible environmental benefit of increasing stack height to 82m with only a 0.4µg/m^3 maximum ground level concentration decrease relative to 70m design.

The maximum 1-hour average model results at the 100%ile should be treated with caution as evidence suggests findings can be greatly sensitive to modelling uncertainty as a result of extreme, rare and transient meteorological conditions (refer to Annex D).

Figure 4-39 Stack Height at 51mg/Nm^3 Concentration (100%ile)



The Project also considered a range of scenarios for stack heights and the 51mg/Nm^3 concentration at the 99%ile (**Table 4-13** and **Figure 4-40**).

Table 4-13 Stack Height at 51 mg/Nm³ Concentration Scenarios (99%ile)

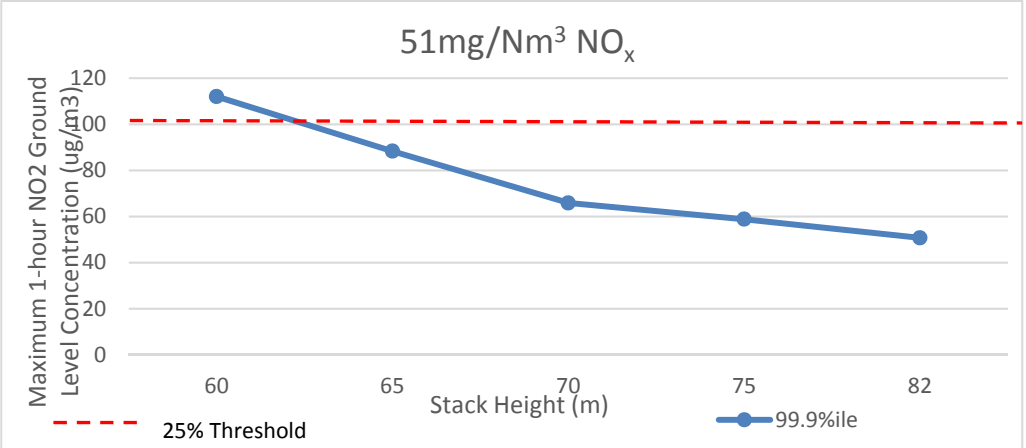
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The model results indicate that a stack height of 65m is required to meet the 25% threshold to allow for future sustainable development in the same airshed (*IFC, 2008*). The estimated cost of increasing one stack by one meter is approximately US$100,000. On this basis the Project cost for increasing two stacks to 65m is approximately US$1,000,000. Per year the cost of increasing both stacks to 65m is US$40,000 based on a 25 year design criteria. The cost benefit to the Project relative to the findings at the 100%ile is approximately US$1,000,000 or US$40,000 per annum.

Justification for the use of the 99.9%ile is provided in technical dispersion modelling guidelines in Australia, New Zealand and Canada and the modelling approach is used to remove modelling uncertainty which is found at the 100%ile (refer to Annex D).

Stack height increase to 82m (GIIP) would cost approximately US$4,400,000 or US$176,000 per annum based on 25 year design criteria. However, the dispersion modelling demonstrates that the Project is compliant with the air quality standards and guidelines relevant to the Project based on a 65m stack height.

Figure 4-40 Stack Height and 51mg/Nm³ Concentration (99%ile)



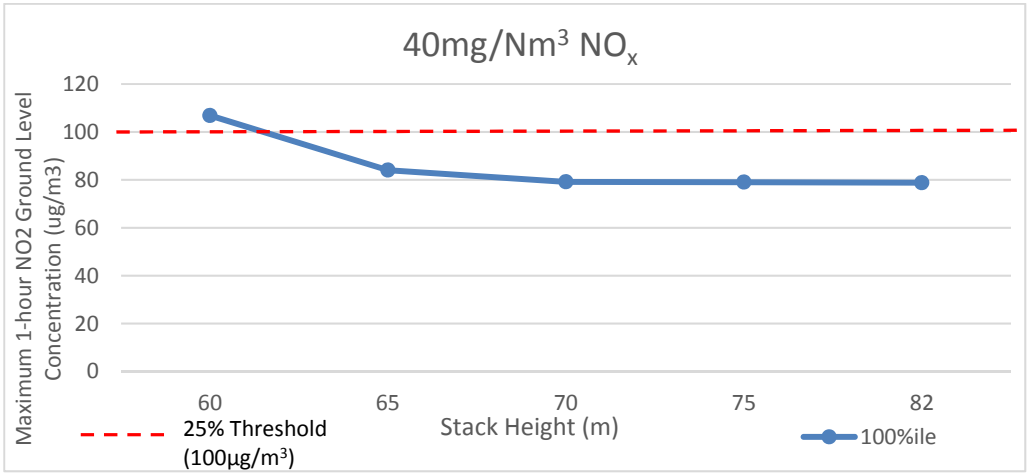
In addition the Project also considered a range of scenarios for stack heights and the 40mg/Nm³ concentrations at the 100%ile (**Table 4-14** and **Figure 4-41**).

Table 4-14 Stack Height Scenarios and 40mg/Nm³ (100%ile)

Scenario	Stack height (m)	In-stack NOx concentration (mg/Nm3)	Max NO2 Ground Level Concentration (µg/m3)	% of Air Quality Standard
1b	60	40	107	27%
2b	65	40	84.0	21%
3b	70	40	79.2	20%
4b	75	40	79.0	20%
5b	82	40	78.8	20%

The model results indicate that a stack height of 65m is required to meet the 25% threshold to allow for future sustainable development in the same airshed (*IFC, 2008*). The estimated cost of increasing one stack by one meter is approximately US$100,000. On this basis the Project cost for increasing two stacks to 65m is approximately US$1,000,000. Per year the cost of increasing both stacks to 65m is US$40,000 based on a 25 year design criteria. The cost benefit to the Project relative to the findings based on a NO_x emission concentration of 51mg/Nm³ is approximately US$1,000,000 or US$40,000 per annum. Stack height increase to 82m (GIIP) would cost approximately US$4,400,000 or US$176,000 per annum based on 25 year design criteria. The model results indicate that there is a negligible environmental benefit of increasing stack height to 82m with a 5.2µg/m³ maximum ground level concentration decrease relative to 65m design. The maximum 1-hour average model results at the 100%ile should be treated with caution as evidence suggests findings can be greatly sensitive to modelling uncertainty as a result of extreme, rare and transient meteorological conditions (refer to Annex D).

Figure 4-41 Stack Height and 40mg/Nm³ Concentration (100%ile)



The Project scenarios for stack heights and the 40mg/Nm³ concentrations at the 99%ile (**Table 4-15** and **Figure 4-42**) were undertaken and considered the optimal outputs.

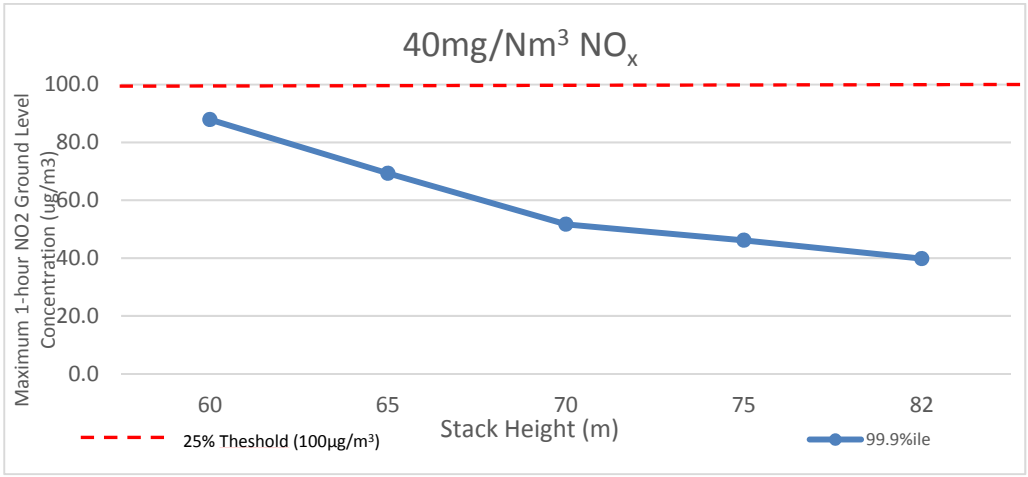
Table 4-15 Stack Height Scenarios and 40mg/Nm³ (99%ile)

Scenario	Stack height (m)	In-stack NOx concentration (mg/Nm3)	Max NO2 Ground Level Concentration (µg/m3)	% of Air Quality Standard
1b	60	40	87.9	22%
2b	65	40	69.3	17%
3b	70	40	51.7	13%
4b	75	40	46.2	12%
5b	82	40	39.8	10%

The model results indicate that a stack height of 60m is required to meet the 25% threshold to allow for future sustainable development in the same airshed (*IFC, 2008*).

No stack height increase is required therefore there is no associated Project cost. The cost benefit to the Project would be approximately US$1,000,000 as a minimum relative to other mitigation options. Per year this equates to US$40,000 based on a 25 year design criteria. Stack height increase to 82m (GIIP) would cost approximately US$4,400,000 or US$176,000 per annum based on 25 year design criteria. However, the dispersion modelling demonstrates that the Project is compliant with the air quality standards and guidelines relevant to the Project based on a 60m stack height.

Figure 4-42 Stack Height and 40mg/Nm³ Concentration (99%ile)



There is clear justification for the use of the 99.9%ile is provided in technical dispersion modelling guidelines in Australia, New Zealand and Canada and the modelling approach is used to remove modelling uncertainty which is found at the 100%ile (refer to **Annex D**). Reducing and guaranteeing the NO_x emission from the turbines is considered the most cost-beneficial mitigation measure to the Project. The Project will confirm the guaranteed height and emission concentration based on the 99%ile by the end of August 2018 to ensure it will comply with the Applicable Standards.

Table 4-16 Summary of Preferential NOX Scenarios

%ile used	Stack Height (m)	In stack concentration (mg/Nm^3)	Maximum NO2 ground level (ug/mg^3)	% Air quality Standard	Estimated Cost (USD)
100	70	51	100.9	25	~ US$22M
100	65	40	84.0	21	~USD 1M
99	60	40	69.3	22	unknown
99	65	51	88.4	22	~ US$1M.

Sedimentation Considerations

The original dredging plan was to achieve a 4 m water depth for the vessel draft. This resulted in an estimation of 80,000 m^3 of dredge material. The equipment mobilisation plan has been revised to reduce the amount of dredging required for the access channel by selecting a vessel with operating draft of 2.0-4.0 m and reducing the channel depth from the original plan of 4.0 m to 3.0 m at Lowest Astronomical Tide (LAT) conditions. Equipment offloading at the jetty is planned for Highest Astronomical Tide (HAT).
In addition, the original position of the jetty was adjacent to the shoreline. The jetty location has been moved 100 m seaward from this original location, further from the drainage channel and reducing the amount of dredging required around the structure. The amount of dredging required as a result of these changes is reduced to 45,981m^3 (57%). This is further discussed in **Annex N**.

4.11.6 Evaluation Criteria

The alternatives selected for comparative assessment are the four (4) alternatives. **Table 4-17** compares the alternatives using the initial information of the proposed Project locations, available fuel sources and viable technology in relations to the environmental and social receptors. It can be concluded that ***Alternative 4*** (Base Case) offers the best environmental, social and economic option in comparison with the Project Alternatives considered and also offers consistency with the Project requirement and schedule outlined by PLN.

Table 4-16 Evaluation Criteria of Project Alternatives

Alternative / Receptors	*Alternative 1*		*Alternative 2*		*Alternative 3*		*Alternative 4*	
Physical and Biological Environment								
Protection from Coastal Flooding and Sea Level Rise	• The proposed area is on a reclaimed island and at risk of flooding by wave action, freeboard from high water level, storm surge and sea level rise due to global warming. • Basic estimate of the amount of sea level rise is shown from 1990 to 2100 which accompanied the estimated upper limit and lower limit. The sea level rise (SLR) will be increasing of 2100 that approximately of 70 centimeters.	**M**	• The proposed area is on a reclaimed island and at risk of flooding by wave action, freeboard from high water level, storm surge and sea level rise due to global warming. • Basic estimate of the amount of sea level rise is shown from 1990 to 2100 which accompanied the estimated upper limit and lower limit. The sea level rise (SLR) will be increasing of 2100 that approximately of 70 centimeters.	**M**	• Project area is located seven (7) km inland from the Java Sea. • Water depth for return period of 100 years is +4.57 meters MSL. As the floor ground level (FGL) of the site average site elevation is proposed to be around +4.0 m MSL which implies the flood protection measures will be required.	**L**	• Project area is located seven (7) km inland from the Java Sea. • Water depth for return period of 100 years is +4.57 meters MSL. As the floor ground level (FGL) of the site average site elevation is proposed to be around +4.0 m MSL which implies the flood protection measures will be required.	**L**

Alternative / Receptors	*Alternative 1*		*Alternative 2*		*Alternative 3*		*Alternative 4*	
Geotechnical Suitability	• Top soil layer in the proposed area is in a very soft condition. • Backfilling is not allowed since it will significantly reduce the strength of the existing soil. • Besides the cost disadvantages, the requirement for backfilling and consolidation of the available coastal sites will impact the construction schedule.	**M**	• Top soil layer in the proposed area is in a very soft condition. • Backfilling is not allowed since it will significantly reduce the strength of the existing soil. • Besides the cost disadvantages, the requirement for backfilling and consolidation of the available coastal sites will impact the construction schedule.	**M**	• This topographic survey showed the proposed areas has a generally flat topography with average elevation in range +3.00 to +3.50 Mean Sea Level (MSL) with some minor topography elevation minimum +2.50 MSL and maximum +3.75 MSL. • The floor ground level (FGL) of the Site be raised to +4.00 m MSL, to match that of the existing SKG Cilamaya and provide good drainage. This will require soil filling and compaction.	**L**	• This topographic survey showed the proposed areas has a generally flat topography with average elevation in range +3.00 to +3.50 Mean Sea Level (MSL) with some minor topography elevation minimum +2.50 MSL and maximum +3.75 MSL. • The floor ground level (FGL) of the Site be raised to +4.00 m MSL, to match that of the existing SKG Cilamaya and provide good drainage. This will require soil filling and compaction.	**L**
Access to Cooling Water Source	• Seawater from the Java Sea will be used as the primary source of raw water.	**L**	• Seawater from the Java Sea will be used as the primary source of raw water.	**L**	• Seawater from the Java Sea will be used as the primary source of raw water.	**L**	• Seawater from the Java Sea will be used as the primary source of raw water.	**L**

Alternative / Receptors	*Alternative 1*		*Alternative 2*		*Alternative 3*		*Alternative 4*	
Cooling Water and Marine Water Quality	• Once Through Cooling Water System • A 2.8 km open intake offshore channel and seven (7) m depth. The heated cooling water is then returned to the Java Sea by another open discharge channel that extends approximately 800 m offshore. The constructability of an open channel of such a length would be difficult to operate from hydraulically point of view. • A submerged offshore intake structures was recommended which to connect the intake to the shore via twin or triple piping or conduit design embedded in trench below sea bed level.	**M**	• Once Through Cooling Water System • A 2.8 km open intake offshore channel and seven (7) m depth. The heated cooling water is then returned to the Java Sea by another open discharge channel that extends approximately 800 m offshore. The constructability of an open channel of such a length would be difficult to operate from hydraulically point of view. • A submerged offshore intake structures was recommended which to connect the intake to the shore via twin or triple piping or conduit design embedded in trench below sea bed level.	**M**	• Cooling System will be based on Wet Evaporative System. • The bathymetry of the Jawa Sea was reasonably steep for the Cilamaya area which kept the cooling water infrastructure costs at reasonable level.	**L**	• Cooling System will be based on Wet Evaporative System. • The bathymetry of the Jawa Sea was reasonably steep for the Cilamaya area which kept the cooling water infrastructure costs at reasonable level.	**L**

Alternative / Receptors	*Alternative 1*		*Alternative 2*		*Alternative 3*		*Alternative 4*	
Natural Habitat	• No protected fauna identified.	L	• No protected fauna identified.	L	• No protected fauna identified.	L	• No protected fauna identified during feasibility study. • Terrestrial and Marine Biodiversity Surveys was conducted to further identify species that may be impacted throughout Project lifecycle (see **Chapter 7**).	L
Social and Community Health								
Land Requirement	• Located within Marunda Center Industrial Area and along the coastal line of the Tanjung Priok Harbor. • Available land area is 35 hectare.	M	• Located within Marunda Center Industrial Area and along the coastal line of the Tanjung Priok Harbor. • Available land area is 20 hectare.	M	• Available land area for CCGT power Plant is approximately 40 hectare • A 79.8 km transmission line to run from the proposed CCGT Power Plant in Cilamaya and heads to the Muara Tawar substation.	H	• Available land area for CCGT power Plant is approximately 40 hectare • A 52 km transmission line to run from the proposed CCGT Power Plant in Cilamaya and heads to the Cibatu II/Sukatani substation. An advantage of this route is that it does not need to pass through the land areas designated for industrial and commercial development in the vicinity of Karawang city, where the land will generally command a higher purchase price. • Lesser social impact as the site does not involve any significant resettlement issues.	L

Alternative / Receptors	*Alternative 1*		*Alternative 2*		*Alternative 3*		*Alternative 4*	
Traffic and Accessibility	• The area is accessible from Jalan Akses Marunda, approximately 10 km by road from the Tanjung Priok Harbor and about five (5) km from Cakung – Cilincing outer ring road. This road leads into the Marunda Center onto an industrial area main gate and leads to the proposed Alternative Project areas. • A bridge will be required to cross over the river that runs around the south side of the proposed area.	**M**	• The area is accessible from Jalan Akses Marunda, approximately 10 km by road from the Tanjung Priok Harbor and about five (5) km from Cakung – Cilincing outer ring road. This road leads into the Marunda Center onto an industrial area main gate and leads to the proposed Alternative Project areas. • A bridge will be required to cross over the river that runs around the south side of the proposed area.	**M**	• The initial part of the route involves travelling along the four-lane Jakarta–Cikampek Toll Road and emerges along local roads, mainly along the two (2) lane Jalan Cikampek-Cilamaya towards the Project area of CCGT Power Plant in Cilamaya.	**L**	• The initial part of the route involves travelling along the four-lane Jakarta–Cikampek Toll Road and emerges along local roads, mainly along the two (2) lane Jalan Cikampek-Cilamaya towards the Project area of CCGT Power Plant in Cilamaya.	**L**

Alternative / Receptors	*Alternative 1*		*Alternative 2*		*Alternative 3*		*Alternative 4*	
Community Health & Safety	• The proposed 1.9 km Transmission Line will crosses an existing CW intake and discharge channels of the Muara Tawar CCGT Plant. • In addition to the plume dispersion aspects of cooling water, the distribution of hot water has socioeconomic impacts on the local communities caused by the direct contact with the water plume in the area.	**H**	• The proposed 3.4 km Transmission Line will crosses over the industrial estate land, before turning towards Muara Tawar substation, and is also crossing several residential areas, a waterway and two (2) existing 500kV Transmission Line. • In addition to the plume dispersion aspects of cooling water, the distribution of hot water has socioeconomic impacts on the local communities caused by the direct contact with the water plume in the area.	**H**	• The proposed Transmission Line will cross a staff housing complex, Pertamina gas pipeline corridor, Cilamaya irrigation canal, Citarum River and multiple residential and commercial areas.	**M**	• The land use along the Transmission Line route is paddy field. There are numerous small residential settlements along the route, however the population density is generally low providing the possibility for a practically straight routing.	**L**
Note: Assessment Criteria								
H	**High**							
M	**Moderate**							
L	**Low**							