2 PROJECT DESCRIPTION

2.1 Introduction

2.1.1 Project Description Contents

This section describes the components of the Tilenga feeder pipeline associated with the Tilenga Project (Figure 2.1-1) and includes information on the:

- project design
  - project design overview
  - typical pipeline section
  - international standards
  - pre-front-end engineering and design (FEED) and FEED studies
- project components
  - pipeline
  - aboveground installations (AGI) including electric substations and mainline block valves (MLBV)
  - construction facilities
  - access roads
  - land requirements
- project activities
  - feasibility studies
  - construction
  - soil management, erosion control and reinstatement
  - pre-commissioning, commissioning and start-up
  - operations
  - decommissioning
- associated[1] facilities
- schedule.

This project description, including FEED and subsequent design optimisation information, has been used in the development of an environmental and social impact assessment (ESIA) of the Tilenga feeder pipeline. It is recognised that some design refinements may be made during the detailed engineering influenced by site-specific conditions.

If design changes are made and the effects of these changes require assessment by NEMA then an ESIA addendum will be submitted to NEMA.

[1] Associated facilities are those that are not funded as part of the project (funding may be provided separately by the client or third parties including the Government), but depend exclusively on the project for their viability and existence, or have goods or services that are essential for the successful operation of the project (IFC Performance Standard 1, Social and Environmental Assessment and Management Systems).

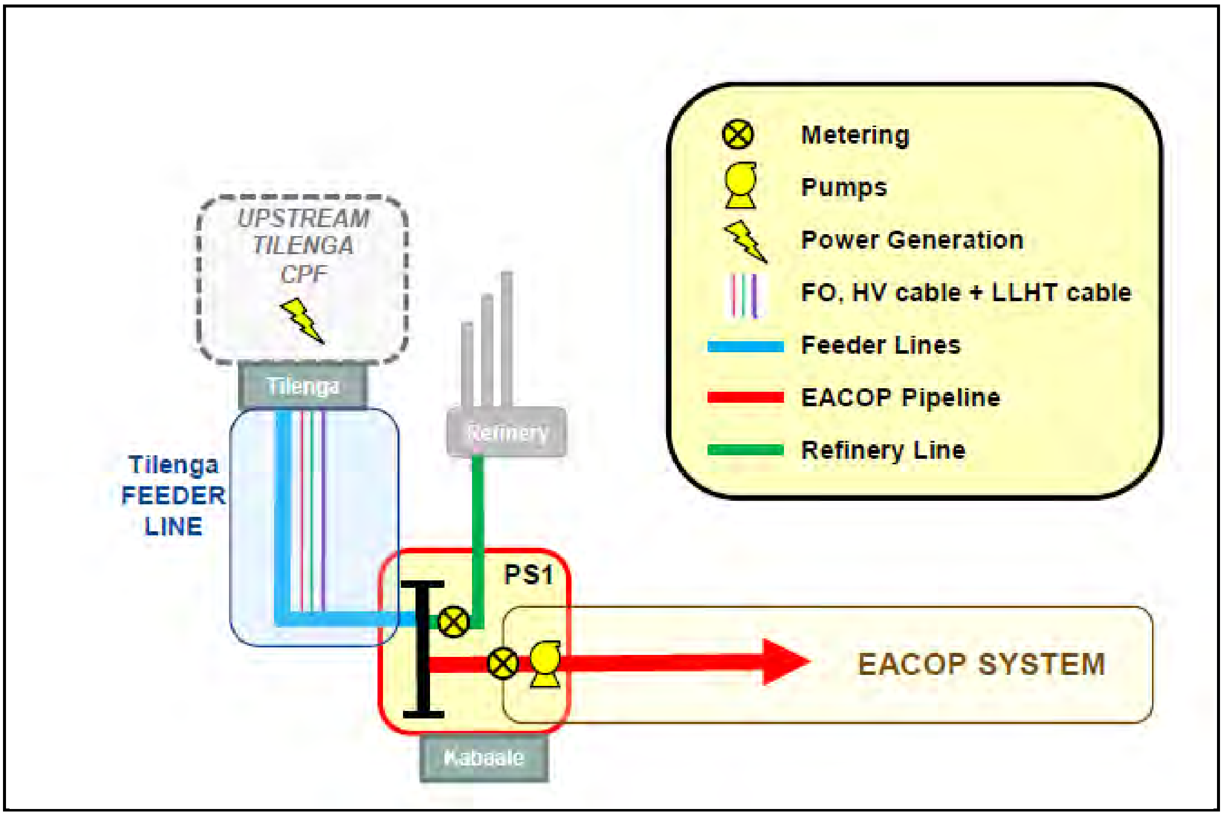

Figure 2.1-1 Tilenga Feeder Pipeline Components

2.2 Project Design

2.2.1 Project Design Overview

The characteristics of Albertine Graben oil, particularly the pour point and wax appearance temperature, require a fit-for-purpose feeder pipeline. Table 2.2-1 includes some of the key design basis parameters.

Table 2.2-1 Project Design Basis

Parameter	Value
Design flow rate	216,000 barrels per day
Pipeline diameter	24-in. nominal
Pipeline minimum operating temperature	50°C

The pipeline will be buried, thermally insulated with polyurethane foam (PUF) and electrical heat tracing (EHT) will be installed for the entire pipeline length.

The Tilenga feeder pipeline consists of a 95-km long, carbon steel pipeline of 24-in. outside diameter designed to American Society of Mechanical Engineers (ASME) standards with design pressures varying between 9.46 MPa, 14.97 MPa and 16.7 MPa. The pipeline will traverse from the outlet flange at the Tilenga Project central processing facility (CPF) to pumping station (PS) 1 at Kabaale Industrial Park.

A key design element is to maintain the crude oil above its pour point and, as much as possible, above its wax appearance temperature. The project components responsible for this task are a minimum fluid export temperature as it leaves the CPF and pipeline EHT.

At plateau production, pipeline insulation will maintain crude oil temperature above 50°C without additional heat supply. During pipeline commissioning, the EHT will continuously heat the crude oil to keep it above 50°C.

As production begins to decline, the transit time of the oil through the pipeline will increase and thus the oil will have more time to cool. Then, crude oil temperature will be maintained above 50°C by EHT and, potentially later in the project life, any additional heat required will be from bulk heaters at the Tilenga Project CPF.

Figure 2.2-1 provides an overview of the thermal, hydraulic and power design principles.

There will be no requirement for PSs on the Tilenga feeder pipeline as pumping and heating will be performed at the Tilenga Project CPF. All operations will be managed remotely from the central control room (CCR) at the Tilenga Project CPF.

The Tilenga Project and Kingfisher crude oil volumes will be aggregated at the Kabaale Industrial Park and allocated to the refinery and the East African Crude Oil Pipeline (EACOP) System. The interface between the feeder lines and PS1 of the EACOP System will be the fiscal meter at the Kabaale manifold outlet.

2.2.2 International Standards

The pipeline technical design has been primarily based on the following industry standards:

- ASME B31.4 – 2016 “Pipeline Transportation Systems for Liquids and Slurries”

2.2.3 Pre-Front-End Engineering and Design, and Front-End Engineering and Design Studies

The completed early stage studies (feasibility and concept) and pre-FEED study scopes of work included:

- a study to identify potential corridors for a feeder pipeline that would terminate at the Kabaale Industrial Park
- a high-level evaluation and identification of potential 50-km-wide corridors
- several helicopter flights (2016) to support final route selection
- using the above, geographical information system (GIS) and statistical analysis, to identify two potential routes for the feeder pipeline (see Figure 3.5-1);
- an initial ground truthing site visit (2016) to identify a 2-km-wide corridor that would be suitable for a light detection and ranging (LIDAR) survey and collection of aerial imagery
- an assessment of oil transportation technology, including flow assurance and thermal management.

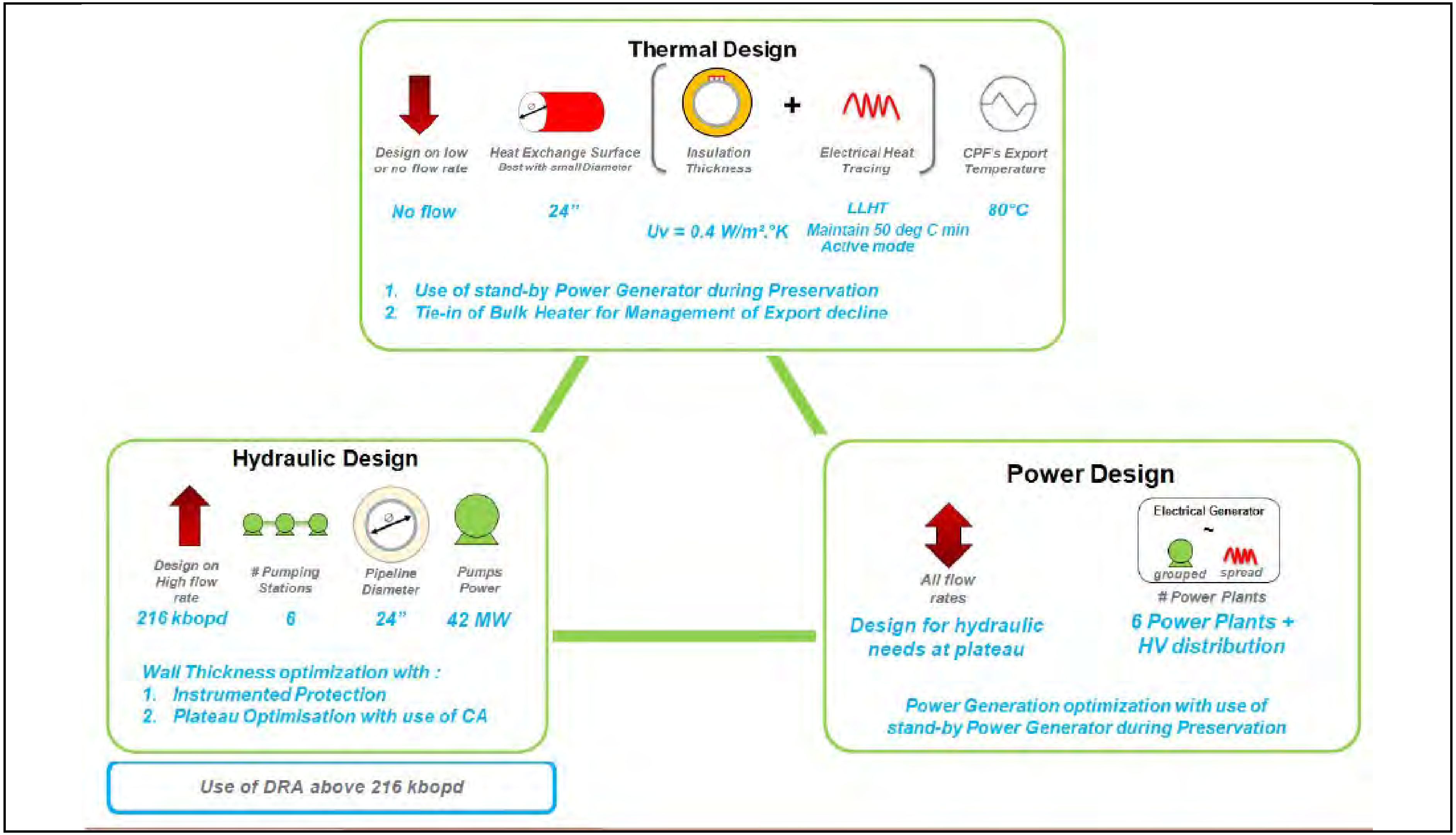

Figure 2.2-1 Design Principle Overview

NOTES: EHT – electric heat tracing, HV – high voltage, CA – corrosion allowance, Uv – ultraviolet

Section 3, Alternatives, describes the Tilenga feeder pipeline route selection and optimisation process, AGI siting, and fixed-facility and construction technologies.

FEED was undertaken during 2017 with input from disciplines including environment, social, health and safety, and engineering specialists. It consisted of:

- project optimisation with the Tilenga Project facilities in Uganda
- finalisation of the Tilenga feeder pipeline route
- finalisation of AGI locations and concepts
- civil works design
- development of a project logistics philosophy plan.

FEED optimisation was undertaken for:

- centralised power generation for pressure and thermal operation of the feeder pipeline from the Tilenga Project CPF
- crude oil storage facilities at the Tilenga Project CPF
- block valves and electrical substations AGIs along the Tilenga feeder pipeline route.

2.3 Project Components

2.3.1 Pipeline

Route identification began in 2012 with the participation of the Government of Uganda. The proposed route was developed through the use of route selection criteria which balanced economics and constructability with environmental and social constraints. The routing included technical, environmental, social and security considerations. The initial technical considerations used to evaluate the constructability of the route were:

- pipeline hydraulics (topography, friction related to oil flow and pipe size)
- remoteness from infrastructure
- topography
- road and watercourse crossings
- flooding and landslide hazards
- seismic activity
- shallowness of bedrock
- geohazards.

The initial environmental and social considerations used to evaluate the proposed route were:

- populations
- environmental
- cultural
- security
- tourism
- infrastructure
- crossings

- land use such as urban centres, protected areas and intensive agriculture.

The initial security considerations used to evaluate the proposed route were:

- potential risk associated with criminality, including organised crime, and separatist groups and radical groups operating in eastern Africa
- risks for host communities.

The Tilenga feeder pipeline route is shown in Figure 2.3-1. Secondary information, including remote sensing, was used to assess the corridors. Using GIS, quantitative and qualitative considerations were identified and weighted.

In April 2017, a site visit was undertaken by project representatives including engineers, and environmental and social teams to identify constraint areas along the 2-km corridor from the Tilenga Project CPF to PS1 at Kabaale Industrial Park. In parallel, updated LIDAR data and aerial imagery were obtained and, with the results from the site visit, used to define the centreline of a 100-m corridor. The route has been refined to a 30-m wide corridor as part of the FEED and this route has been used as the basis for the ESIA.

The Tilenga feeder pipeline corridor is approximately 95 km long and originates at the Tilenga Project CPF, about 8 km northeast of the town of Buliisa in Buliisa District and 5 km south of the Albert Nile. The feeder corridor crosses predominantly flat to gently sloping terrain. The route then crosses the steep rift escarpment toward the Kabaale hub. The route crosses several watercourses, including the Sambiye River at KP7, Waiga River at KP21–25, Waisoke River at KP28–29, Sonso River at KP34.3, Bubwe River at KP39, Waki River at KP46.9, Hoimo River at KP77, Rwamutonga River at KP87 and Wambabya River at KP89.5.

The northern section of the corridor lies between the Murchison Falls Protected Area and the eastern shore of Lake Albert at the floor of the western arm of the East African Rift Valley system. At the top of the rift escarpment, the route runs through Kizirafumbi subcounty which is a mixture of settlements and cropland. On its approach to the Kabaale hub, the route crosses substantial areas of agricultural land and traverses the edges of both Bujaawe and Wambaya Forest Reserves. The feeder corridor ends at PS1 at the Kabaale Industrial Park, in Hoima district.

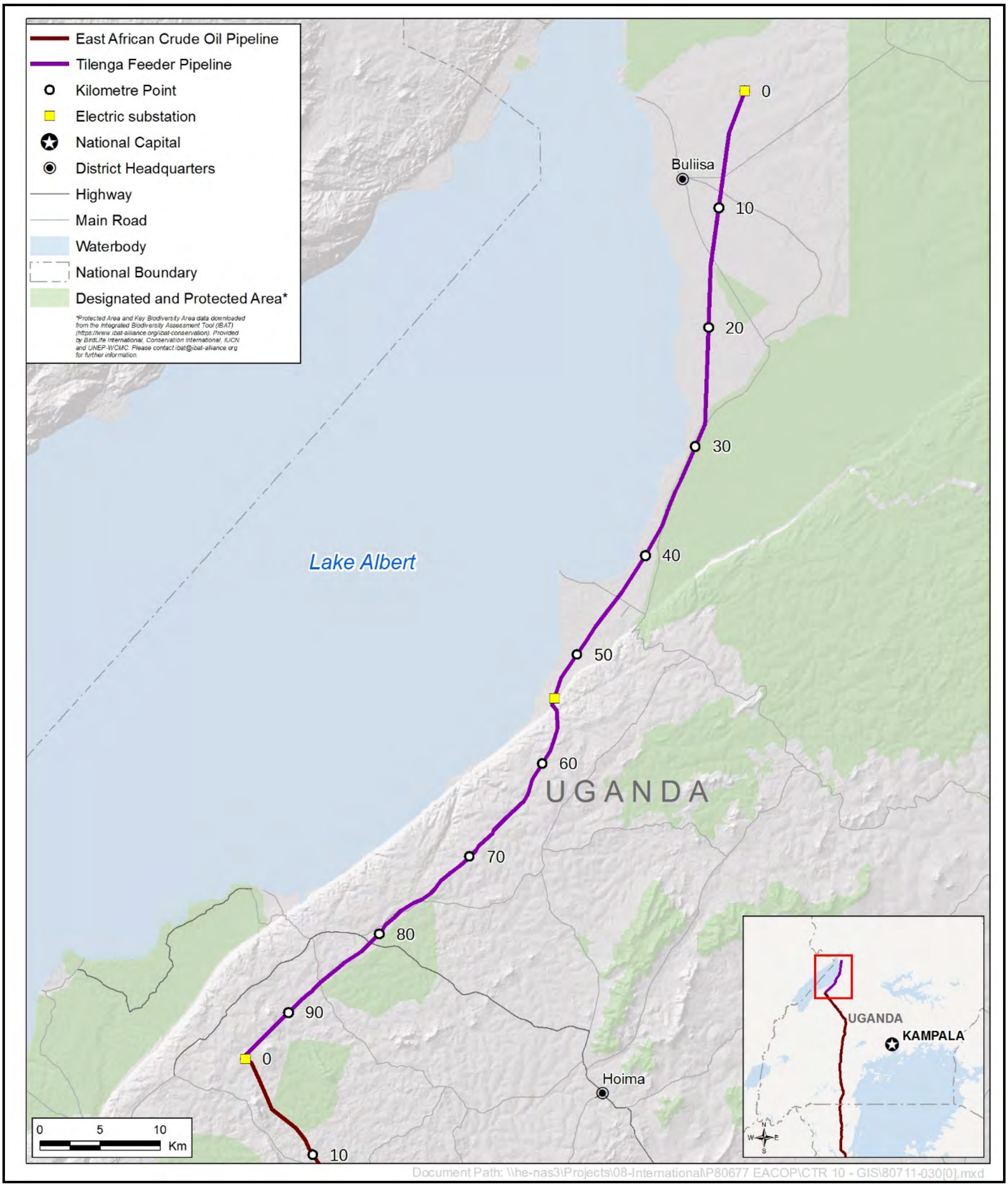

Figure 2.3-1 Tilenga Feeder Pipeline Corridor

2.3.2 Typical Feeder Pipeline Section

For precautionary purposes, the pipeline is specified with a fusion-bonded epoxy coating to protect the pipe over the course of its operational life against external corrosion. This coating will act as a second barrier in case of water ingress below the bonded thermal insulation system. To provide additional corrosion control, cathodic protection measures may be implemented.

As described in Section 2.2.1, temperatures will be maintained at all times by a combination of PUF insulation and the EHT system. The EHT system consists of three heat tracing electric cables inserted through three dedicated aluminium channels within the typically 70–80 mm thick PUF material insulating the pipe. The PUF insulation is protected by a high-density polyethylene extruded covering. The EHT system will only need to operate for flow conditions lower than the design capacity and, as required, during start-up, maintenance or when there may be no flow.

The EHT system will receive power from three high-voltage electrical power cables buried in a dedicated trench, parallel to the pipeline trench. Power will be supplied from the Tilenga Project CPF. One electric substation will be installed at approximately KP54 to transform electricity from the high-voltage power cable to the voltage required by the EHT system. The electrical generation and distribution system is described in Section 2.3.3.3.

A main fibre optic cable will be laid above the pipeline, in the same trench, over the full distance (see Figure 2.3-2). This cable is designed for communications and transmitting control data between AGIs. The fibre optic cable will also be used for pipeline leak detection and, as an option, intrusion detection. In areas prone to faulting or landslide risks, a second fibre optic cable will be installed for strain detection.

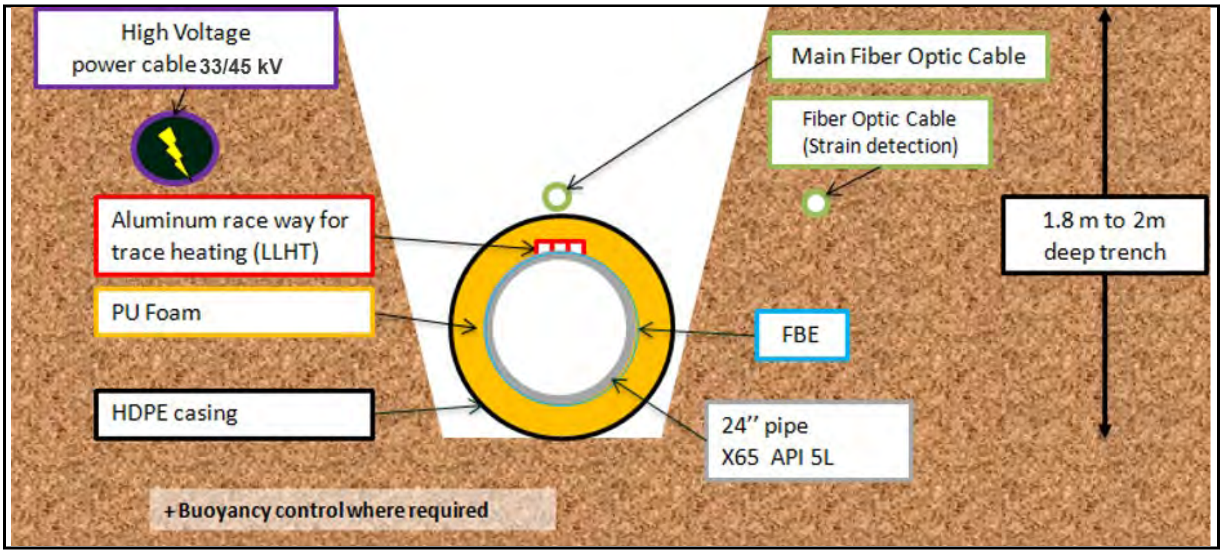

Figure 2.3-2 Typical Feeder Pipeline Cross-Section

NOTES: Material X65 as per API5L (65000 PSI specified minimum yield strength); EHT - electric heat tracing

2.3.3 Aboveground Installations

2.3.3.1 Introduction

Table 2.3-1 lists the aboveground components of the Tilenga feeder pipeline.

Table 2.3-1 Components of the Tilenga Feeder Pipeline

Component	Aspect
Pigging facilities	At Tilenga Project CPF
Main line block valve stations	4 in the operational RoW
Electric substation combined with main line block valve station	1 in the operational RoW
New or upgraded construction facility access roads	3.7 km
Main camp and pipe yard (MCPY)	MCPY Feeder – KP45

2.3.3.2 Power Generation

Power required for pumping and EHT operation will be supplied by the Tilenga Project CPF which includes a centralised and integrated power and heat generation system. The impacts associated with power generation at the Tilenga Project CPF are the subject of a separate ESIA (refer to Section 2.5 Associated Facilities).

2.3.3.3 Electric Substation

Function

The electric substation houses transformers and switchgears for power transmission through the high voltage cable and step-down transformers to provide the required voltage for the EHT.

The high-voltage cable is installed underground next to the pipeline.

Figure 2.3-3 depicts the power generation and EHT supply architecture.

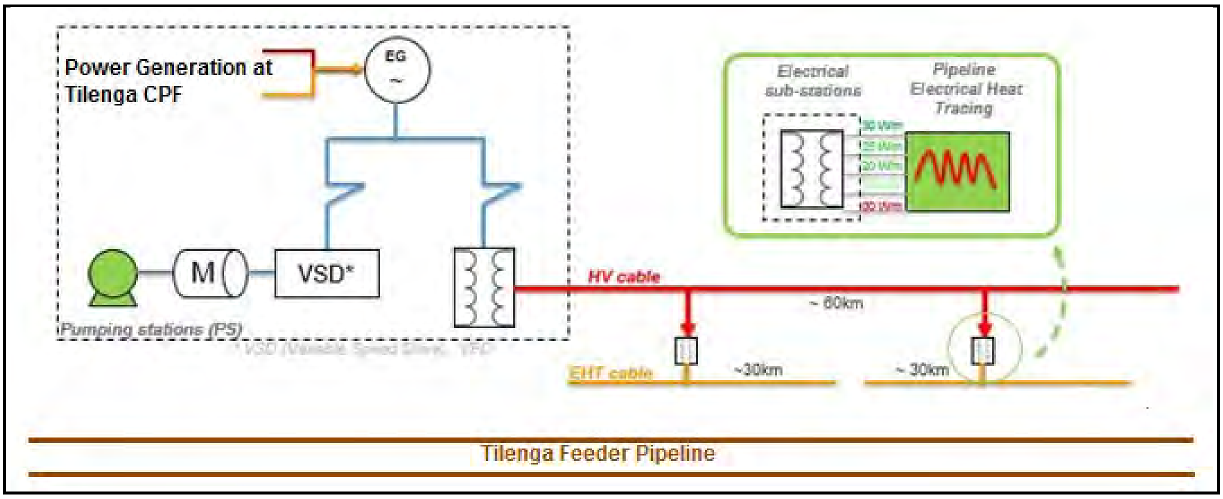

Figure 2.3-3 Power Generation Architecture

NOTES: M – motor; VSD – variable speed drive; EG – electrical-driven generator

Locations and Size

Figure 2.3-4 shows the electrical distribution system, with power provided by the Tilenga Project CPF. To ensure EHT operation along the Tilenga feeder pipeline, electric substations will be 50–60 km apart. One electric substation will be integrated with the Tilenga Project CPF and one will be co-located with main line block valve station (MLBV) 04 and occupy an area of approximately 24 m x 18 m. There will be no standalone electric substations associated with the pipeline.

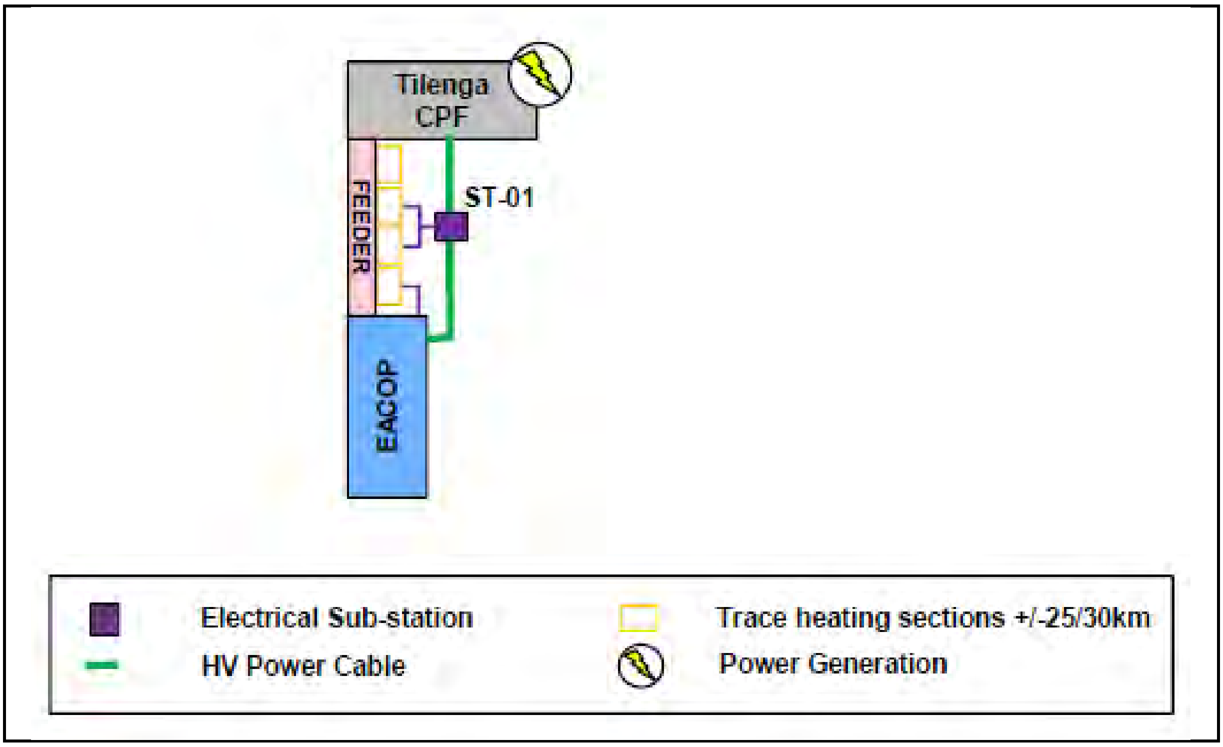

Figure 2.3-4 Electrical Distribution System

Layout and Components

The layout of the electric substation, depicted in Figure 2.3-5, consists of:

- a building that houses the electrical and instrument technical rooms with associated heating ventilation and air conditioning (HVAC)
- a voltage regulating transformer that reduces the voltage provided by the high voltage cable to the voltage required to power the EHT
- transformers that power the EHT
- a fibre-optic system for intrusion and leak detection.

The substation will be fenced. A workstation desk will be available for personnel during maintenance visits.

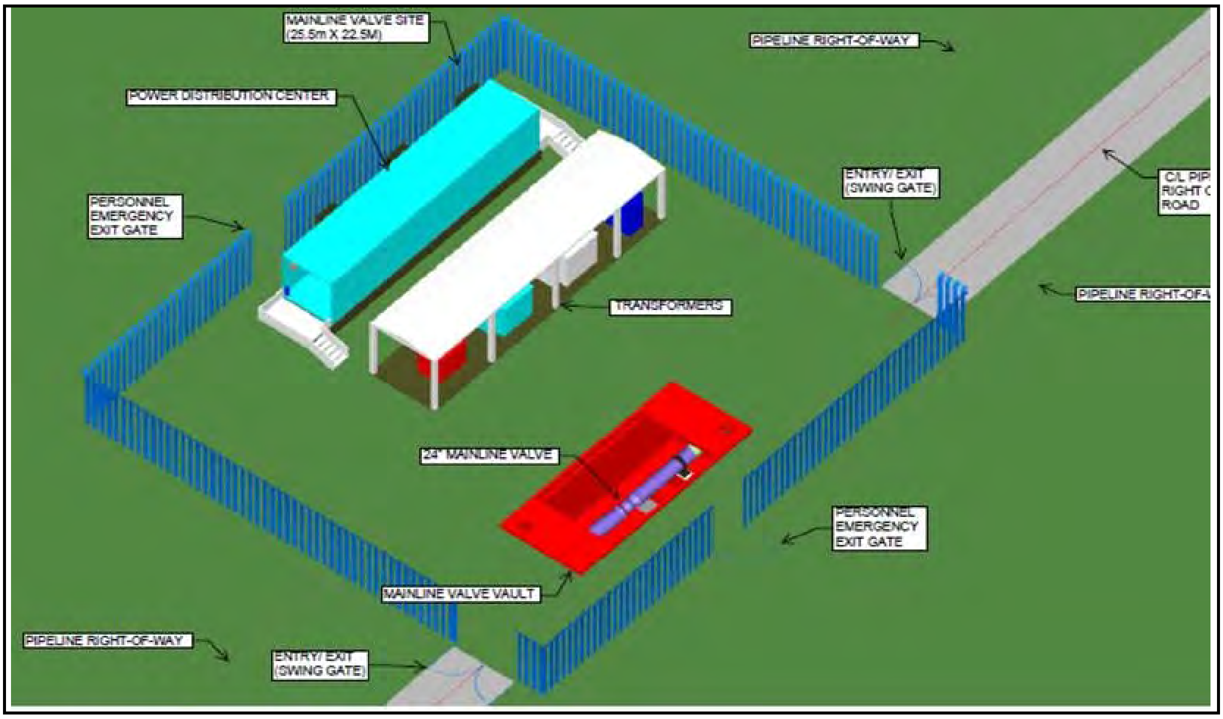

Figure 2.3-5 Typical Electric Substation with Main Line Block Valve Station

2.3.3.4 Block Valves

Function

MLBV stations are installed along the Tilenga feeder pipeline route to isolate any damaged pipeline section and prevent oil from flowing into it . In addition to the MLBVs, the pipeline design includes a fibre-optic-cable leak detection system for the entire pipeline.

Locations and Size

The number and locations of MLBVs was determined by the need to access for repair and regular maintenance, and environmental considerations. The locations are also based on a combination of standard spacing arrangement and for critical areas such as major rivers, roads crossings and active geological fault zones. MLBVs are installed:

- along continuously ascending or descending elevation profiles
- on each side of wetlands
- at each watercourse that is more than 30 m wide, and at each watercourse that is less than 30 m wide if it meets one or more of the following criteria, having direct or downstream flow to:
  - a populated area
  - a reservoir holding water intended for human consumption
  - a navigable waterway
  - an environmentally sensitive area.

There will be four MLBVs within the permanent RoW, one of which will be combined with an electric substation.

Layout and Components

The pipeline enters the MLBV station, as shown in Figure 2.3-6. The block valve will be installed inside an underground reinforced concrete vault or directly buried and supported by a slab in a pit. A leak detection system and emergency flow restriction device reduce the probability and quantity of spills. Emergency flow restriction devices are either check or ball valves that are activated remotely from the control room (see Section 2.4.5.2).

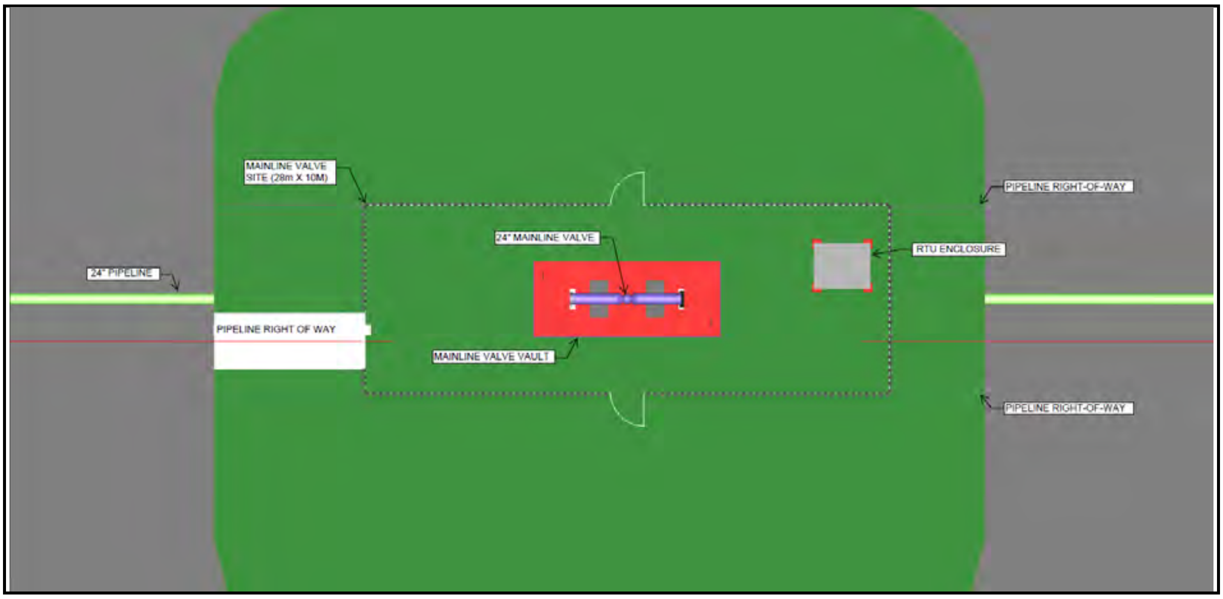

Figure 2.3-6 Typical Main Line Block Valve

NOTE: RTU = remote terminal unit

A series of photovoltaic solar panel arrays, depicted in Figure 2.3-7, and batteries with six days autonomy, will provide the low power supply required at the MLBV, with a 1.1 kV total power consumption estimated (ICSS, telecom and electro-hydraulic actuated valves).

Leak detection is part of the operational monitoring system described in Section 2.4.5.6. Each MLBV will be fitted with a remote terminal unit controller for block valve protection. All MLBV station process and safety signals will be directly connected to the remote terminal unit via a telecommunication system. Synchronisation of these terminal units is required for accurate leak detection and location. The remote terminal unit is within the MLBV footprint (see Figure 2.3-6) and is in direct communication with the CCR. In the event of abnormal pipeline operation, block valves can be closed from the CCR.

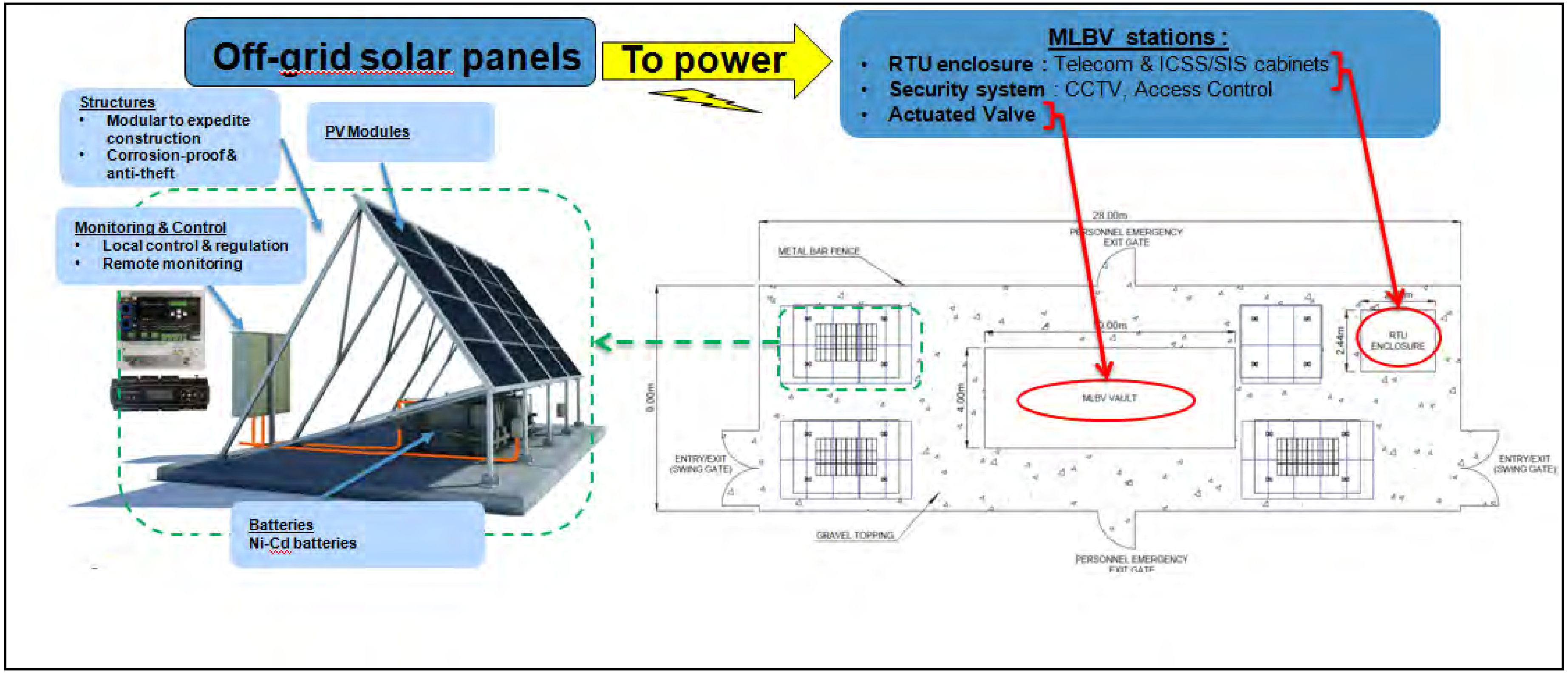

Figure 2.3-7 Typical Solar Panel Array at Main Line Block Valve Stations

2.3.4 Construction Facilities

Facilities will be required to support pipeline construction and will include one main camp with a pipe yard facility (Figure 2.3-8).

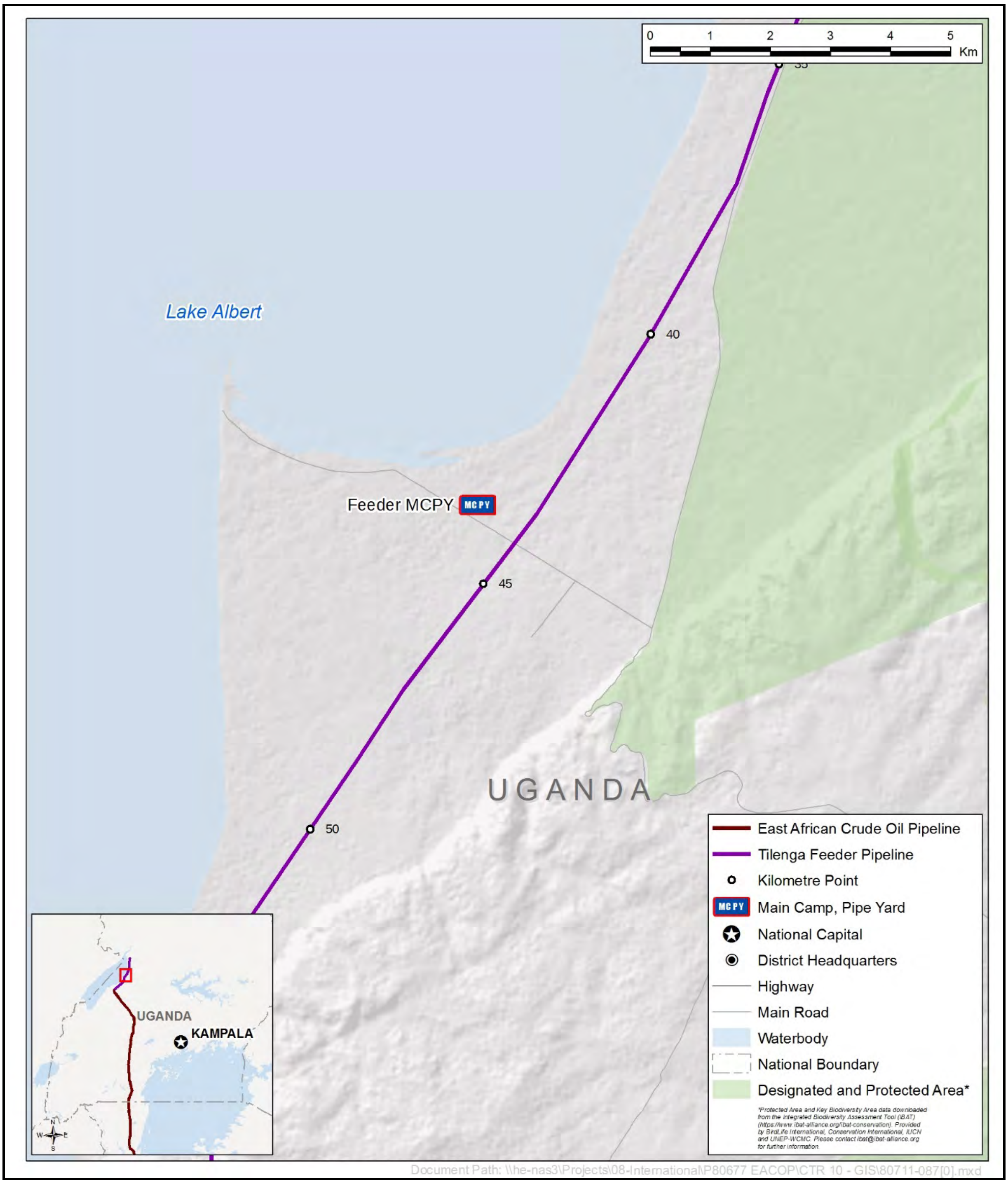

Figure 2.3-8 Main Camp and Pipe Yard Location

2.3.4.1 Camp

Function

One MCPY will be established along the pipeline corridor to accommodate workers and store line pipe before distribution along the RoW.

The camp has been designed to accommodate 800–1000 people. Among the criteria to identify the camp location was the requirement to minimise the daily commute from the camp to work site. Depending on where the work will be conducted, it may be possible for local workers to commute from their homes. The construction of the camp will require a temporary workforce, which will be accommodated where possible using local infrastructure and where infrastructure is not available, small fly camps at the MCPY and AGI locations will be established. (The scale and duration of fly camps is such that the impacts are not substantive enough to require assessment; however, the same level of mitigation will be applied to the operations of these camps as the rest of the project).

Locations and Size

The MCPY location is based on site selection criteria (see Section 3) that include being sited within approximately 50 km of the most remote work site, minimising the land required and the distance from existing road networks, and avoiding populated and protected areas. The MCPY is at KP45 as shown in Figure 2.3-8.

A footprint of approximately 350 x 500 m will be required for the MCPY. The camp section will be approximately 350 x 220 m and the pipe yard 350 x 280 m.

Camp Layout and Components

The shape and extent of the camp footprint will vary with consideration of local, environmental, social and cultural features, and will contain the following components:

- accommodation and sanitary facilities
- recreation facilities
- a kitchen and canteen
- offices
- workshops
- a first aid post
- water supply and treatment
- a sewage treatment system
- waste storage and processing
- power generators
- fuel storage
- an emergency evacuation area.

The MCPY will have a non-electrical wire perimeter fence with entrance control gates and a security post. A typical MCPY layout is depicted in Figure 2.3-9.

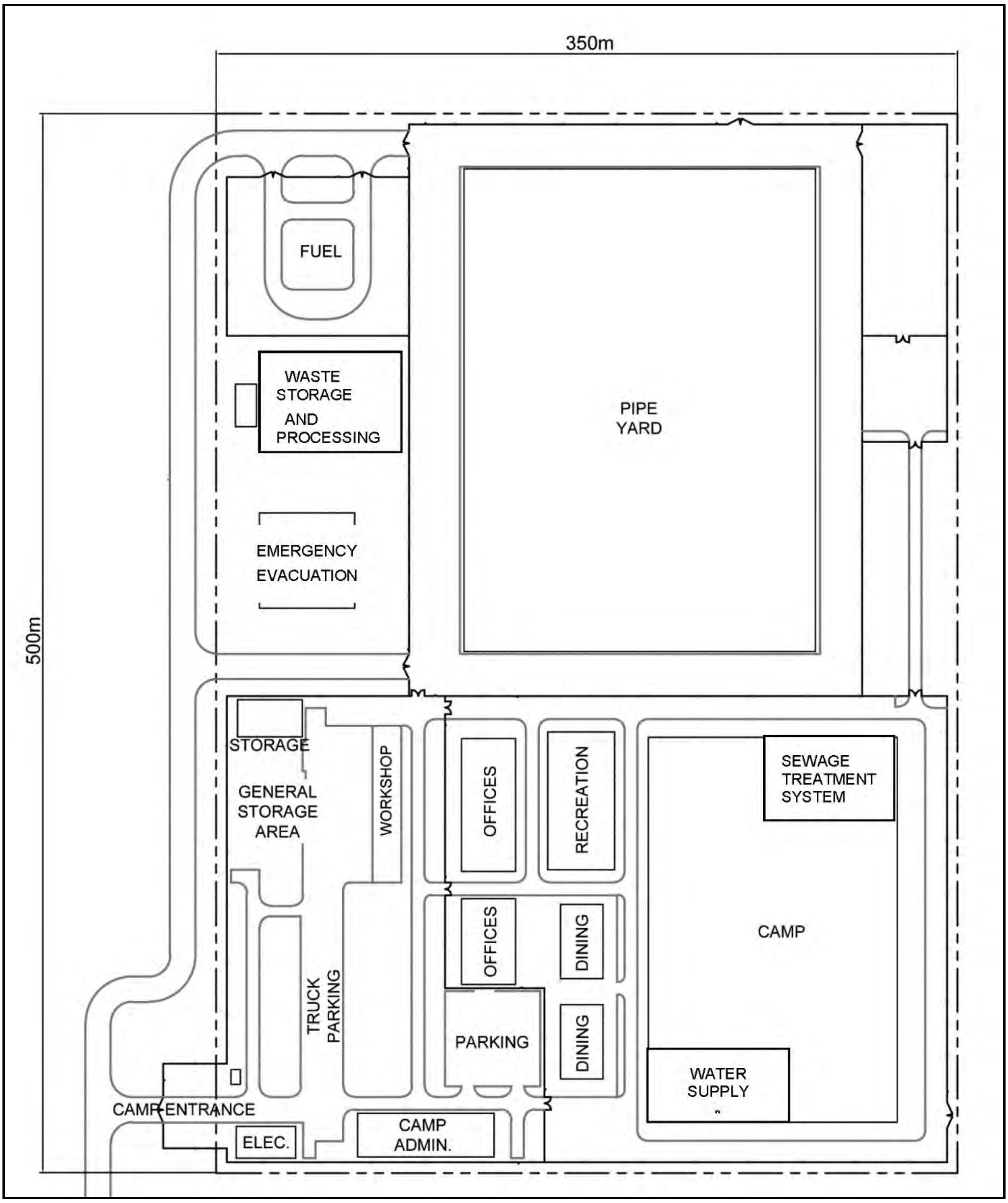

Figure 2.3-9 Typical Main Camp and Pipe Yard

2.3.4.2 Pipe Yard

Pipe yards can store up to 7000 sections of 18-m-long coated pipe. Other material and equipment will be stored in the pipe yard storage area before being dispatched to the RoW, including high-voltage, EHT and fibre-optic cable drums, MLBVs, and electrical and instrumentation shelters. Coated pipe will be transported to the MCPY by truck from the coating facility in Tanzania.

2.3.5 Access Roads

The RoW was routed along existing roads to minimise the requirement for new access roads. During the construction phase, the RoW will be used as the main access road as much as possible. In sections where there is no existing access, including where permanent access will be required, the access roads will be defined during detailed engineering. It is estimated that the new access roads will be less than 1 km long, as the RoW is close to existing roads, and 5 m wide (13 m wide during construction to allow for ditching and spoil storage). Unless otherwise specified, the roads will have a design speed of 40 km/h. All access roads to construction facilities will have a murram (laterite) surface. During the construction phase, when the roads will be used extensively, graders will be used for regular maintenance. After completion of the construction phase, road maintenance will be supplied by the Government as part of its regular road maintenance programme.

During FEED, the pipeline routing and AGI location selection process aimed to optimise the use of existing roads that could be upgraded to meet project requirements, taking into consideration affected communities. The siting of AGIs along the feeder pipeline route has been limited to four MLBV stations, one of which will be integrated with an electric substation. Access to the stand-alone MLBVs and electric substation co-located with MLBV-05 will be via the permanent RoW as a base case. Access to these AGIs will be reviewed during the detailed design to ensure practical access from the nearest existing infrastructure. When the locations are identified, environmental and social evaluation will be undertaken.

All roads will be surveyed, designed, constructed and maintained using Uganda National Road Authority standards.

2.3.6 Land Requirements

2.3.6.1 Area Requirements

There are two categories of project land requirements:

- construction phase only for the MCPY and potentially hydrotest water storage
- for construction and operation of pipeline and AGIs.

All land required for the project in Uganda will be acquired on a permanent basis, even for construction facilities (Table 2.3-2). For the MCPY, the lifespan will be three years, after which it will be decommissioned and the land returned to the Government unless otherwise negotiated and agreed between the project and third parties or the Government.

During the construction phase, the pipeline RoW will mostly be kept within a width of 30 m (except for crossings where wider areas will be required for operations). On completion, in agricultural areas, the corridor will be reinstated with suitable and available seed of local species, potentially supplemented by locally collected seeds, and maintained as grassland. In areas such as the Murchison Falls Conservation Area and open areas of mixed habitat, the project will restore the land cover and manage the land use to achieve equivalent capability.

Table 2.3-2 Land Requirements

Project Component	Estimated Affected Area
Construction Facilities	
MCPY	18.4 ha
Hydrotest water storage	To be confirmed
Construction and operation	
New access roads to construction facilities, pipeline corridor and AGIs	Estimate: 1.75 ha
Operational Facilities	
Feeder Pipeline	
30 m wide construction corridor	95 km corridor: 285 ha
Additional temporary construction workspace along the corridor (estimate)	82.5 ha
Permanent AGI	
MLBV stations and electrical substations	Constructed within pipeline corridor, no additional land required
Total areal requirement	388 ha

During operations, the RoW for the pipeline will continue to be 30 m and crossing of the corridor by pedestrians and livestock will be allowed, with provision for vehicle crossings at existing roads.

Land will be required for the AGIs that will also remain operational over the lifespan of the project, after which these facilities will be decommissioned and the land returned to the Government unless otherwise negotiated and agreed between the project and third parties or the Government.

2.3.6.2 Land Acquisition

A Land Acquisition and Resettlement Framework (LARF) has been developed for the Upstream project in Uganda that sets out principles and methodology for land acquisition consistent with national and IFC requirements (see Section 8.4.3). Project and land acquisition contractor teams provide oversight of the land acquisition process to ensure that a fair and transparent process is implemented for the project facilities.

Land additional to that required for operations and construction facilities, such as borrow pits, will be assessed through Management of Change procedure and in compliance with national and international standards, as included in the LARF. Wherever possible, material for the Project will be sourced from existing borrow pits, to minimise the need for land acquisition.

Contractors will be required to assess and mitigate potential environmental and social impacts consistent with regulatory and IFC requirements and manage associated land access in compliance with national and international standards, as included in the LARF.

2.4 Project Activities

2.4.1 Feasibility Surveys

Pre-construction feasibility surveys were undertaken to confirm the feasibility of the pipeline corridor. The results of these studies will inform the detailed engineering phase.

2.4.1.1 Geological, Geotechnical and Geophysical Surveys

Geological, geotechnical and geophysical surveys were undertaken to:

- identify potential geological hazards in the pipeline route corridor
- determine the need for rock blasting, fault-line crossing, engineered retaining structures and unrestrained pipe sections
- develop site-specific mitigation strategies to be implemented during construction.

Geological and Geophysical Surveys

Geological and geophysical surveys are being undertaken to evaluate soil conditions and to assess potential geohazards (e.g., faulting) on the pipeline route.

The geological survey team walked the pipeline route to record the geology and conduct geological mapping. Based on the maps, the most suitable construction methodology for each geological section will be established.

For sections of the pipeline route where there is uncertainty on the soil and ground conditions, geophysical seismic data is acquired. The data provides information on subsurface conditions, which supports identification of potential constraints for the construction of the pipeline and other installations.

Geotechnical Survey

The physical (geotechnical) properties of subsurface soils have been established by geotechnical surveys. These surveys require drilling of boreholes to sample and test subsurface geological layers.

The geotechnical study scope included:

- boreholes drilled to extract cores of soils, rocks and water for sampling
- trial pits (few metres) dug to expose the soil layers for easy visual examination.

The soils, rocks and water samples were analysed in a laboratory to determine structure and characteristics.

Piezometers have been installed in some of the geotechnical boreholes to measure groundwater levels and fluctuations.

2.4.1.2 Water Supply Study

A study to identify and evaluate potential water sources to support construction, commissioning and operations was undertaken in stages:

- Stage 1 consisted of a study of potential existing and additional new water supply sources for construction facilities, AGIs and hydrostatic testing. In addition, Uganda and international potable water standards, effluent discharge standards, and Uganda abstraction and discharge permitting requirements were evaluated.

- Stage 2 consisted of field investigations to evaluate the availability, quality and local community use of the potential water sources identified in Stage 1. It was also conducted to provide data on:
  - water resource availability for engineering studies and discharge requirements
  - water resources to support permit applications
  - community water source baseline conditions.

New project water supply sources will be required as existing water sources are considered inadequate. A third stage, to be implemented before construction starts, will include aquifer testing, borehole siting and borehole drilling for future abstraction. Water for the MCPY will be obtained from underground sources.

Preliminary water needs are defined in Section 2.4.2.1. For the management of hydrotesting requirements, described in Section 2.4.4.2, a hydrotest management plan will be prepared that will identify water sources and disposal options. This plan will serve as the basis for a surface water abstraction and discharge permit applications to the Uganda Department of Water Resources Management.

2.4.2 Construction

2.4.2.1 Strategy and Logistics

Overview

Tilenga feeder pipeline construction will be primarily influenced by logistics, the mobilisation of materials and labour to portions of the pipeline corridor and AGI sites, rather than by construction processes.

Early Works

For construction work to begin, some preparatory activities, commonly referred to as early works, are required. Early works provide the required facilities needed for construction to start in locations where there is no existing infrastructure.

For the project, early works will include necessary road upgrades and erection of the camp facility (see Sections 2.3.4 and 2.3.5 for a description).

Spread Strategy

The feeder pipeline is expected to be constructed using one spread as shown in Figure 2.4-1. The spread’s location, length and major components are described below. The strategy will be progressed once the pipeline laying contractor is confirmed.

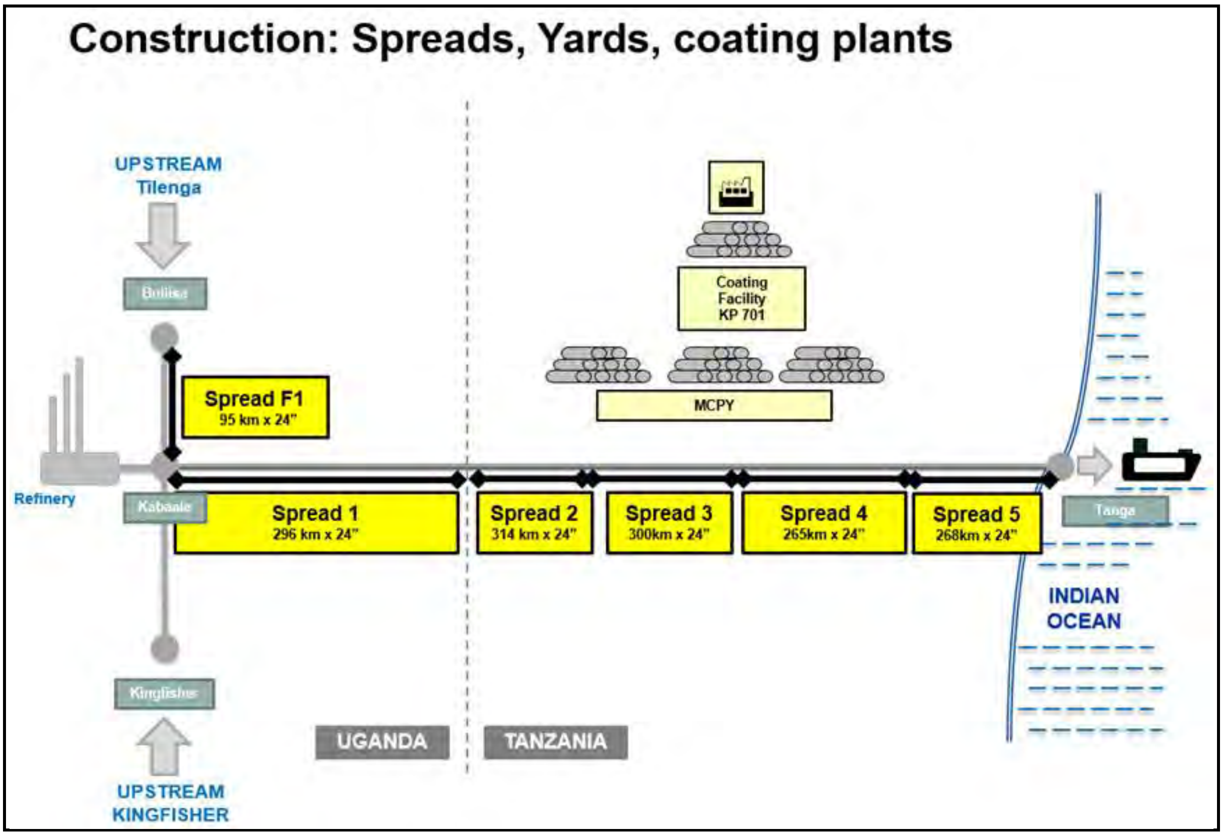

Figure 2.4-1 Construction Spreads

Construction from the Tilenga Project CPF (KP0) to PS1 in the Kabaale Industrial Park (KP95) will be supported by Spread Feeder F1 activities which includes the following components:

- 95 km of 24-in. pipeline
- four MLBV sites
- one EHT substation co-located with MLBV-05.

Pipe and Material Transportation

The project has undertaken an evaluation of logistics options and developed a strategy for the delivery of supplies and construction materials to predetermined locations on schedule.

Transportation requirements for approximately 5700 x 18-m-long pipe sections, and associated infrastructure constraints and opportunities were considered to identify the optimum logistics strategy. Section 3, Alternatives, addresses the logistics strategy selection process.

Imported construction materials will enter Tanzania via the ports of Dar es Salaam and Tanga. From there, pipe (only via Dar es Salaam), will be transported to a coating plant in Nzega district, Tabora region Tanzania and then to the feeder pipeline site. AGI components and construction materials will be transported to Uganda and between storage facilities and construction sites.

Construction materials sourced domestically will be delivered through a combination of local and project suppliers.

Ports

The project will receive the following cargo through Dar es Salaam and Tanga ports, based on their infrastructure:

- containers
- break bulk (goods not in shipping containers)
- construction components.

The following cargo will be received through Dar es Salaam:

- pipe
- heavy load or overload.

Road

Insulated and coated pipe will be transported by road from the pipe coating facility to the Tilenga feeder pipeline MCPY and in some cases, directly to the work site.

The road network used by the trucks transporting pipe and construction materials is mostly in good enough condition to permit trucks to travel 320 km per day at an average speed of 40 km/h.

Trucking requirements are summarised as:

- one driver per truck
- driving between 06:30 and 18:30
- 2 hours maximum continuous driving
- 10 hours maximum driving per day.

Movement of construction materials to the main camp and pipe yard will require, on average, 20 heavy goods vehicles (HGVs) daily for over three months. Traffic movements during pipeline construction are as follows:

- number of cars/motorcycles: 72
- number of buses (30 seater): 28
- number of HGVs: 60
- total: 160.

Detailed project traffic information is included in Section 8.16.2.1, Tables 8.16-1 and 8.16-2.

Maintenance and Upgrades of National Roads

The Government of Uganda through the UNRA has an ongoing road maintenance and upgrade programme. The project will continue to work with the UNRA to have planned road maintenance and upgrades sequenced to facilitate project logistics.

Permanent and construction access roads constructed by the project are addressed in Sections 2.3.4 and 2.4.2.1.

Rest Stops

Drivers will be required to have a break during their journeys (every 2 hours for light vehicles, and every 4 hours 30 minutes for heavy vehicles). A survey of suitable overnight rest stops along the proposed routes has concluded that existing facilities are sufficient.

Labour Transportation

Buses and four-wheel-drive vehicles will transport personnel from the MCPY to the different construction locations. Local hires from the surrounding areas who live outside the camps will travel to work by shuttle bus service.

Construction Facilities

The fundamental aspects of the construction philosophy for MCPY and access roads include:

- the sequential use of construction crews contributing to a smaller construction footprint, as fewer construction personnel require less camp facilities
- modularisation and commonality leading to assembly instead of “stick-building” on site, which reduces construction time and construction waste generated at the sites
- the close coordination of construction, and the supply and delivery of pre-purchased equipment to reduce construction time.

An associated advantage of this construction philosophy is that the facilities will be constructed with a high degree of safety and reliability.

Aboveground Installations

The fundamental aspects of the AGI construction philosophy are similar to those for construction facilities and include:

- the sequential use of construction crews, starting near major AGI equipment and material supply laydown areas, contributing to a smaller construction footprint, as fewer construction personnel require less camp facilities
- modularisation and commonality leading to assembly instead of “stick-building” on site, which reduces construction time and construction waste generated at the sites
- the close coordination of construction and the supply and delivery of pre-purchased equipment reduces construction time.

An associated advantage of this construction philosophy is that facilities will be constructed with a high degree of safety and reliability.

Crossings

One of the pipeline route selection considerations was that the route should have a minimal number of crossings (see Section 2.3.1). The feeder pipeline will require 55 crossings of various types described in Section 2.4.2.5.

When the pipeline corridor crosses large infrastructure or watercourses, special construction methods (see Section 2.4.2.5) will need to be employed to reduce effects on road and rail use, resource users and biodiversity. These crossings will be managed as separate construction activities, which can be completed independently to the main pipeline construction sequence.

Roads

Access Roads Philosophy

The creation of new access roads may be required in some areas. However, because the feeder pipeline has been routed, as much as possible, close to existing infrastructure, the need for new access roads has been reduced.

AGI and construction facility selection criteria included minimisation of their distance to the national road network and optimisation of existing road use, either used directly or upgraded to accommodate project traffic volumes.

National and District Road Upgrades

The Government of Uganda through the UNRA is currently upgrading key road networks required for oil activities. Planned upgrades shown in Table 2.4-1 and Figure 2.4-2 will support the project logistics.

Table 2.4-1 National and District Road Upgrades

Road Section	Length (km)	Status
Kyenjojo–Kabwoya	69	Ongoing
Kabwoya–Hoima–Bulima	66	Ongoing
Bulima–Masindi–Kiguma	107	Ongoing
Mubendi–Kakumiro–Kabaale–Kagadi	159	Ongoing
Hoima–Butiaba–Wanseko	111	Ongoing – under construction at time of writing
Buhimba–Nalweyo-Bulamagi and Bulamagi–Igayaza–Kaumiro	93	Ongoing
Lusalire–Nkonge–Lumegere–Ssembabule	97	Planned
Masindi–Biiso, Kabaale–Kizirafumbi and Hohwa–Nyairongo–Kyaruseha	106	Ongoing
Kabwoya–Buhuka and Ntoroko–Karugutu	98	Ongoing

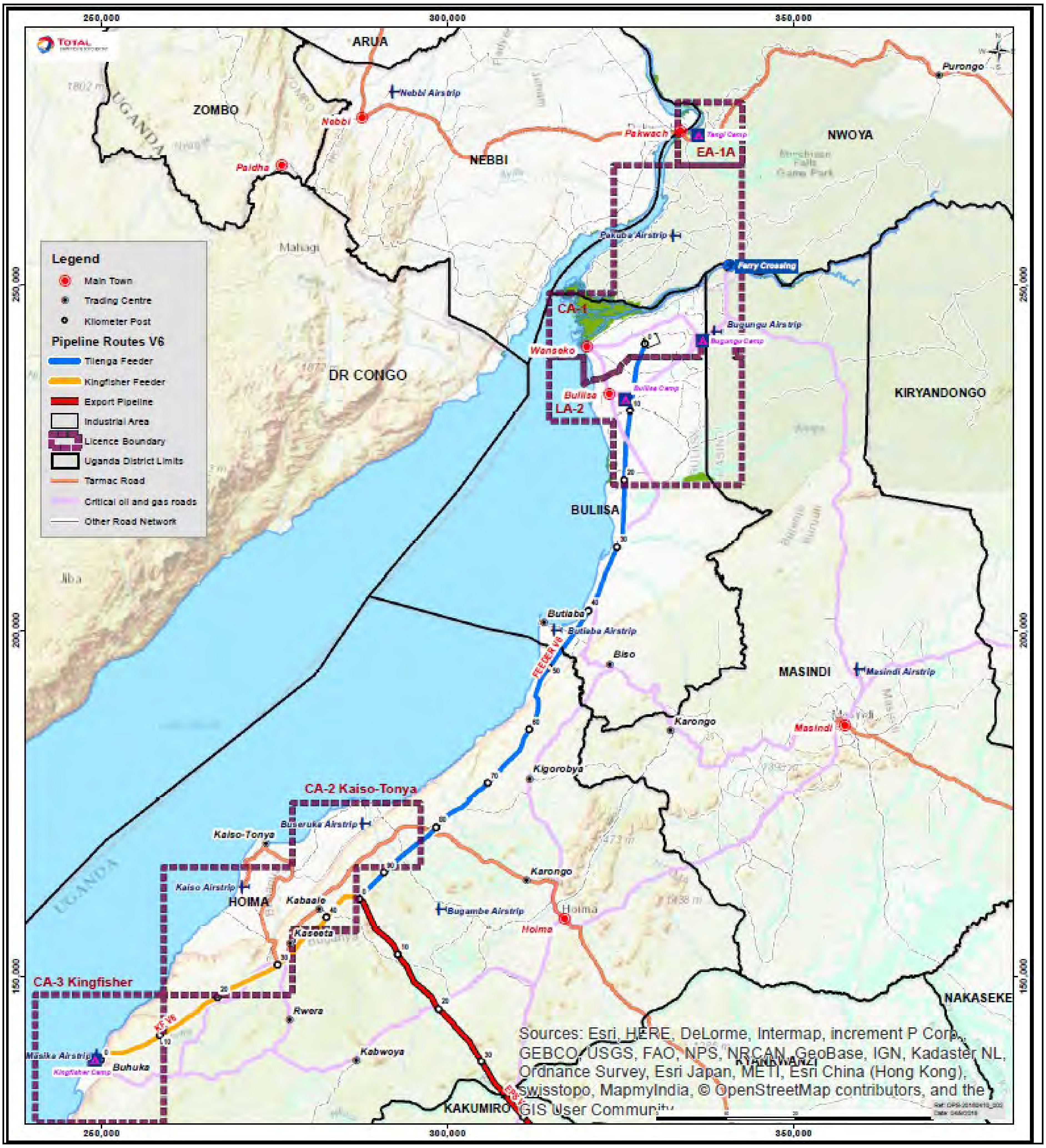

Figure 2.4-2 Road Upgrades

Resources and Local Resourcing

Construction Materials

Construction materials will be sourced from inside and outside the country.

The project has undertaken preliminary resource abstraction studies that require the following guiding principles to be implemented by contractors:

- local resources will be sourced in a way that reduces impacts on local use
- sourcing will be as close as possible to the locations requiring the resource
- sourcing from resource locations should be minimised and sustainable.

The sources of material from Uganda will be identified during detailed project phases. One of the project objectives is to optimise the use of locally available materials.

Estimated quantities for the primary construction materials (for the camp, pipe yard and access road construction) required are:

- gravel – 14,000 m^3
- sand – 17,000 m^3
- cement – 1400 m^3
- murram – quantities will be identified during construction.

In addition, the following materials will be sourced locally:

- concrete blocks
- engineered backfill soils
- fencing
- rebars
- geotextile materials
- lumber
- tarmac asphalt.

Materials Sourced Abroad

Materials sourced outside Uganda and that will be assembled or installed at site include, but are not limited to:

- pipe
- high-voltage cable for power distribution
- heating equipment, including heat tracing cables
- fibre-optic cables
- valves and metering equipment.

Water Requirements

The estimated project water requirements are, for the:

- construction camp – 200 m^3/day of potable water at maximum occupancy (up to 1000 people)
- construction activities – 100–200 m^3/day

- hydrostatic testing – 16,000 m^3 for each of the 2–3 test sections required, see Section 2.4.4.2.

A water study has been undertaken and is described in Section 2.4.1.2.

Construction Equipment

Construction will require equipment including, but not limited to:

- trucks to transport pipe
- bulldozers and graders for site preparations
- tippers for materials
- backhoes for excavation
- trenching machines
- cold bending machines
- welding and weld testing equipment
- side boom cranes to lift pipe string
- cranes, forklifts and cement mixers.

Labour

A labour management plan will be prepared that will set forth the policies, objectives and procedures to maximise local content employment for the project, including relevant training and job-readiness support for host communities. Direct recruitment for suitable positions to support the development, and indirect recruitment of Ugandan nationals by contractors and suppliers supporting the development will be targeted.

As well as technical and commercial criteria, contractors will be evaluated based on their commitment to local content, and on their training and capacity building plan. The contractors will be assessed for the number of positions, and nature of the roles and associated training, and their commitment to local content optimisation.

There will be no construction works along the RoW during night hours.

Project Requirements

The approximate size of the construction labour force for the different project components is as follows, for the:

- MCPY and access roads – 200–250 skilled and 20–40 unskilled workers
- pipeline spread – 900–1700 skilled and 100–150 unskilled workers depending on the stage of construction
- EHT and MLBVs – 20–40 skilled and 5–10 unskilled workers.

Local Content Management

A local content plan for the project will be established. This will identify:

- areas and disciplines where Ugandan companies can gain valuable capacity in partnership with international contractors
- ways to maximise Ugandan manpower
- opportunities for capacity building and technology transfer

- local communities' development initiatives.

The pipeline project has already taken some initiatives to proactively work with Ugandan companies and encourage their participation in the project and field development activities. The objective is to focus on identifying and promoting the use of local resources and working collaboratively to develop the resources on a long-term basis by:

- maintaining communication between the project and potential Ugandan suppliers by initiating a regular and supervised dialogue
- providing assistance to Ugandan companies by offering support to specific sectors
- supporting the educational system by reinforcing the best academic institutions already in place to focus on certification programmes to develop qualified technicians.

The feeder pipeline will be constructed near villages and towns in the Buliisa and Hoima districts in Uganda. Inhabitants from these communities will have the opportunity to provide labour and the supply of goods and services.

Supply Chain Management

Supply Chain Management Philosophy

The project will follow a competitive tendering process to select contractors to complete construction activities.

Local content will be a criterion, among others, for contractor selection.

Contractors and subcontractors will be required to implement and optimise local content by adhering to local content principles set out in the local content plan and be encouraged to propose "enhanced" local content initiatives that go beyond such requirements.

2.4.2.2 Pipeline

When the land acquisition process is completed as described in Section 2.3.6.2, construction activities will be sequenced as follows.

Pipe Storage

For pipe storage in the RoW where soil (sand, loam or similar) berms are used, the following minimum measures will be applied:

- lay-down areas will be covered with polyethylene sheets or similar
- the soil or sand used for lay-down areas will be sifted and free from rocks and gravel.

Right-of-Way Clearing and Grading

Before clearing, a risk management process will be conducted for land mine potential, primarily for the pipeline, which will include four steps:

- explosive remnants of war risk assessment
- nontechnical survey depending on risk assessment findings

- technical survey depending on nontechnical survey results and impact on the project
- clearance programme depending on technical survey results and impact on the project.

After clearance the 30-m-wide RoW will be grubbed to remove all organic material and cleared of debris to permit the movement of work crews, pipe and equipment. Topsoil and subsoil will be stockpiled and silt fences will be installed to control erosion. Figure 2.4-3 is a photo of typical topsoil removal. Drainage and sediment mitigation measures will be implemented in areas prone to run-off and near surface water, see Section 2.4.3.3.

Figure 2.4-3 Typical Topsoil Removal

Where required, existing services such as water lines, sewage lines and electric cables will be temporarily removed or permanently relocated.

Where the pipeline is routed along a side slope, benching of the RoW may be required to create a safe work area. On steep gradients or narrow ridges where successful reinstatement is difficult to establish, benching may become permanent.

Stringing

Pipe will be delivered to its pre-determined location, unloaded and positioned in a way that avoids damage to pipe and coating. Pipe will be supported by skids to avoid contact with the ground. Figure 2.4-4 shows typical pipe stringing.

Figure 2.4-4 Typical Stringing

Bending

Bending accommodates elevation and directional changes and can be executed in two ways:

- Hot bending will be done during the pipe manufacturing process for tight-radius directional bends. This process allows for precise control of the specific bend angles.
- Cold bending, mostly done in the field and outside the insulated pipe, is used to bend steel pipe up to a maximum cold bending angle (approximately 10° per joint). The maximum allowable angle for the pipeline route will have to be taken into consideration and if this angle is exceeded hot bends are required. Figure 2.4-5 shows a typical cold-pipe bending machine.

Figure 2.4-5 Typical Cold Bending Machine

Welding

Pipe sections will be prepared and welded together. For mainline welding the pipe sections are assembled in long strings that are placed in the RoW beside the trench. Tie-in welds, usually performed in the trench, connect pipeline sections. Figure 2.4-6 shows typical pipe welding.

Figure 2.4-6 Typical Pipeline Welding

Nondestructive Testing

Nondestructive testing is performed to identify joint weld flaws. The linear welds undergo testing at the place of manufacture.

Two nondestructive testing methods can be used:

- Industrial radiography tests for hidden flaws and defects in the weld with X-ray or gamma radiation. Film or specific sensor may be used.
- Manual or automatic ultrasonic testing are used for defect detection in steel components or welds. Figure 2.4-7 is a photo of automatic ultrasonic testing. Ultrasonic testing makes use of high frequency (ultrasonic) sound waves. When the ultrasonic waves travel through a material, they will reflect or diffract (scatter in all directions) at inconsistencies and travel back to a transducer. The transducer records an electric signature that allows for the identification of inconsistencies.

The radiographic test and manual or automatic ultrasonic testing methods will be evaluated by the pipeline construction contractor, who will also be responsible for the selection of the most suitable method.

Figure 2.4-7 Automatic Ultrasonic Testing

Field Joint Coating

Joints will be protected with a coating that is compatible with the pipe anti-corrosion coating and thermal insulation system and that is applied in the field. Figure 2.4-8 is a photo of an anti-corrosion field joint coating.

The weld surface will be cleaned and grit blasted in preparation for coating. A two-part liquid epoxy resin will be sprayed around the entire circumference of the pipe. A high-density polyethylene extruded sleeve will be made for the joint and fuse welded to the pipe's high-density polyethylene extruded outer jacket, ensuring water tightness and protection before injection of thermal insulation into the sleeve.

On completion of the process, inspections will be conducted of the coated field joints.

Figure 2.4-8 Anti-Corrosion Field Joint Coating

Trenching

Trench Location

The trench centre line will be as identified and marked by the pre-construction survey team, taking into consideration the location indicated on approved pipeline alignment drawing and local topography (drains, rock and outcrops) restrictions. Local deviations may be required to facilitate construction.

Location of Services, Pipelines and Cables

Before any excavation, the owner and/or operator of any facility or utility expected to be crossed or encountered closely by the pipeline will be informed.

Services, pipelines and cables that will be crossed will be located as accurately as possible by:

- assessing available drawings
- electronic sounding
- hand digging.

Excavation

A trench will be excavated, approximately 1.8–2 m deep, in which the pipe will be installed. The trench bottom and walls are prepared to a condition that allows for the coated pipeline to be lowered in without damage.

Topsoil Segregation

In agricultural land, the topsoil and subsoil will be stripped and stored along the RoW on the side opposite to the working side. Topsoil will be stored separately from subsoil. Additional description of topsoil stripping is included in Section 2.4.3.2.

Excavation in Normal Soils

For excavation through normal soils, the trench will be advanced using a tracked excavator or a continuous trenching machine (Figure 2.4-9). The depth of the trench will be excavated to provide pipeline cover in accordance with the approved alignment drawing. The depth and width of the trench will be checked as excavation progresses by using gauge canes or templates, held by a worker in front of the operator.

Figure 2.4-9 Typical Trenching Machine

In areas where the safety of personnel or the integrity of adjacent facilities is a concern, the trench will be sloped back to an appropriate angle to prevent material from collapsing into the trench. Material excavated from the trench will be piled on the side of the trench opposite to the work side and sufficiently far back from the edge of the trench to prevent overloading of the trench walls.

The approximately 1-m-wide trench bottom will be smooth with no rocks exceeding 25 mm in diameter and will match the pipeline profile.

Consistent with pipeline construction best practices, the trench will be excavated completely with escape ramps, or side cuts into the trench wall, to allow a safe exit from within the trench. The slope of the escape ramps should not exceed 45°. The ramps should be excavated every 500–1000 m (terrain dependent) to provide an escape route for any personnel working or animals that may become trapped in the trench.

Excavation in Rock

In areas of rock, when the grading is completed, a large machine that can rip rocks and a backhoe will be used to assess if the trench can be dug, ripped or requires blasting.

When the trench is to be excavated through areas of rock that can be ripped, the rock will be ripped using large construction equipment pulling a single shank ripper.

If blasting is required, it will be conducted by licensed contractors who will develop site-specific plans that include:

- notification requirements for workers and the surrounding population
- controls to prevent rock projectiles
- procedures that limit environmental impacts (e.g., noise and vibrations).

On completion and implementation of the blasting plan, tests will be undertaken and geologists will:

- inspect the rock to determine blast effectiveness
- evaluate microblasting criteria for potential implementation.

Microblasting avoids rock projectiles and creates less noise and vibrations, but can only be used under certain conditions. Sections suitable for microblasting will be identified during construction based on geology, and proximity to infrastructure and environmentally sensitive features. If blasting is required, the excess blasted rock, which is unsuitable for use as backfill will be disposed of in approved rock disposal areas.

Excavation through Wetlands

Topsoil is not normally segregated in wetland areas. Dry wetland areas will be excavated using normal methods (as described above; excavation in normal soils) to the extent possible.

For saturated wetlands, the trench will be excavated using tracked excavators fitted with swamp mats, board roads, timber riprap or similar devices. Excavated spoil will be stockpiled on the nonworking side of the RoW for seasonal wetlands.

The extent of disturbance will be restricted to that which is required for the excavation of the trench. Traffic through the wetland is to be restricted to only those vehicles necessary to install the pipe, to the extent practical.

Flooded wetlands will be excavated using either tracked excavators or draglines from barges or similar equipment, or using marsh equipment excavators. Spoil will be piled adjacent to the pipe ditch.

Padding, Lowering and Laying

Before pipeline installation, the trench bottom will be cleared of hard and sharp elements and unstable soil encountered at the trench bottom removed. Figure 2.4-10 is a photo of a pipe being lowered and laid.

Figure 2.4-10 Lower and Lay

The trench bottom, where necessary, will be covered with a continuous layer of soft padding, using approved material. Padding material, free from rocks, stones and debris, will be placed to provide uniform bearing and support for each pipe section.

When the pipeline padding coating has been inspected and approved, side booms will lift the welded string, and lower and lay it into the trench.

Pipe sections will be lifted in a way that reduces the risk of damage to the coating. Booms will be fitted with padding and when lifting the pipe, the booms will be evenly spaced along the section for an even load.

When the pipe section has been placed in the trench, the ends will be welded to the adjacent sections, or sealed with caps to prevent the entry of dirt or animals until welded.

Backfilling

Initial backfill, free from large rocks and stones, will be placed from the padding material to approximately 0.3 m over the top of the pipe and will be placed as soon as possible to maintain pipe alignment and provide protection.

A high visibility polyethylene pipeline warning net, with a width equal to the pipeline diameter, will be placed 0.3 m above the pipeline over the entire route.

Final backfill will extend from the initial backfill to the top of the trench. Final backfill will be placed in layers of 0.3 m. No rocks or stones will be allowed within 1 m of the pipe. A front-end loader or a bulldozer will be used to push the spoil bank into the trench at an angle so that impact on the pipe is avoided. Surplus material will be spread over the trench.

High-Voltage Cables

The high-voltage power cables will be installed approximately 4.5 m from the pipeline centre or as far away from the pipe as possible, in a separate trench within the RoW, as shown in Figure 2.3-2. The required depth of burial will be approximately 1.25 m to top of the cable. In addition to the separation distance, the high-voltage line will be in an armoured cable, protecting the pipe from the induced electromagnetic field.

The high-voltage cables are installed using the same methods as the pipeline installation. The trenching and laying of the cable, as shown in Figure 2.4-11, will be done concurrently using a trencher and cable laying equipment. Backfilling of the trench will use the same methods as used for the pipeline.

Figure 2.4-11 High Voltage Power Cable Installation

2.4.2.3 Construction Facilities

Civil Construction/Site Preparation

Site preparation will include:

- cut and fill
- building of foundations
- laying drainage and underground services
- compacting soils for the stability of the site
- site surfacing.

Main Camp and Pipe Yard

The MCPY construction process will include:

- installation of fencing, a generator set, water wells and sewage treatment
- installation of camp materials and equipment that can be portacabins, containers or flat pack units. At MCPY, buildings will be erected using concrete blocks.
- installation of offices and accommodation on wooden skids and connected to distribution networks
- building of concrete-block facilities, such as bunded fuel storage and workshops, by local subcontractors.
- maintenance of access roads during construction activities.

2.4.2.4 Aboveground Installations

The remoteness of some of the AGIs may require the installation of construction infrastructure such as concrete batch plants. When possible, pre-fabricated construction will be employed to reduce field construction requirements.

AGI construction will begin with site preparation, and establishment of drainage and erosion mitigation measures to ensure that the site remains ready for further construction under all weather conditions. Once the site preparation crew executing civil construction is finished, they will begin preparation at another AGI site.

After the site is ready, foundations will be poured for major equipment, buildings and pipe supports. Concurrently, process equipment such as valves will be delivered to the construction site for setting. The lifting crews and equipment will move from site to site.

When the major equipment has been installed, piping and cables will be laid out and connected. When piping, electrical and instrumentation connections are completed, testing of each portion of the AGI facility will begin.

On completion of the primary AGI construction activities, fencing, guard houses and entry gates will be constructed.

2.4.2.5 Crossings

Overview

Most crossings along the pipeline are relatively small and the pipeline will be installed using an open-cut method, where a trench is excavated to a minimum depth of 1.8 m. This may require the crossing to be temporarily blocked or diverted during construction.

There is only one tarmac road crossing where the pipeline will be installed underneath by auger boring with a 36-in. casing.

The construction for all crossings will require a temporary workspace area of approximately 1.5 ha that may extend beyond the 30-m wide construction RoW.

Where possible, the pipeline will intersect crossings at an angle as close to 90° as possible to reduce addition to pipeline length. External casing will be installed for the auger bored crossing and where specifically requested by regulatory agencies and utility owners.

Pipe with a larger wall thickness will be used for waterbody and wetland crossings. For anti-buoyancy, pipe will be coated with concrete. Geotextile bag weights, concrete set-on weights, screw anchors or concrete coating could also be applied at wetland crossings.

Types and numbers of crossings are provided in Table 2.4-2 and described in more detail below.

Table 2.4-2 Crossings

Type of Crossing	Number	Length (m)
Murram roads	30	300
Sealed tarmac roads	1	36
Railway	0	0
Power line	0	N/A
Perennial rivers	2	535
Perennial river (by horizontal directional drill)	0	0
Perennial streams	6	339
Ephemeral streams	16	1104
Fault lines	TBD[2]	TBD
TOTAL	55	2314

Watercourse Crossings

Strategies for crossing watercourses depend on several site-specific factors, most importantly, the size and nature of the watercourse and the nearby environmental and social features. Open-cut construction methods will be used for all watercourse crossings for the Tilenga feeder pipeline, as it is the most appropriate and efficient

[2] To be determined

(cost and time) option, inclusive of environmental mitigations, for crossing the watercourses along the pipeline route.

Wet Open Cut

A wet open-cut crossing does not require a diversion of stream flow and includes the following steps:

- surveying the crossing location
- preparing the pipeline string that will be installed
- digging a 1.8-m-deep trench, starting and ending at approximately 50 m either side of the watercourse
- pulling the prepared pipeline string into the trench and fitting it with concrete weights where required
- natural backfilling in turbid streams and engineered backfilling in the trench for clear-water streams.

Open-cut watercourse crossing methods will include the following mitigation measures:

- a reduced working width will be used
- a wider RoW will be used on either side of the crossing to accommodate the temporary storage of bed and bank material
- seasonal watercourses will be crossed during the dry season where practical
- sediment control will be installed
- fuel will not be stored within 30 m of the crossing.

Figure 2.4-12 depicts a typical open-cut crossing.

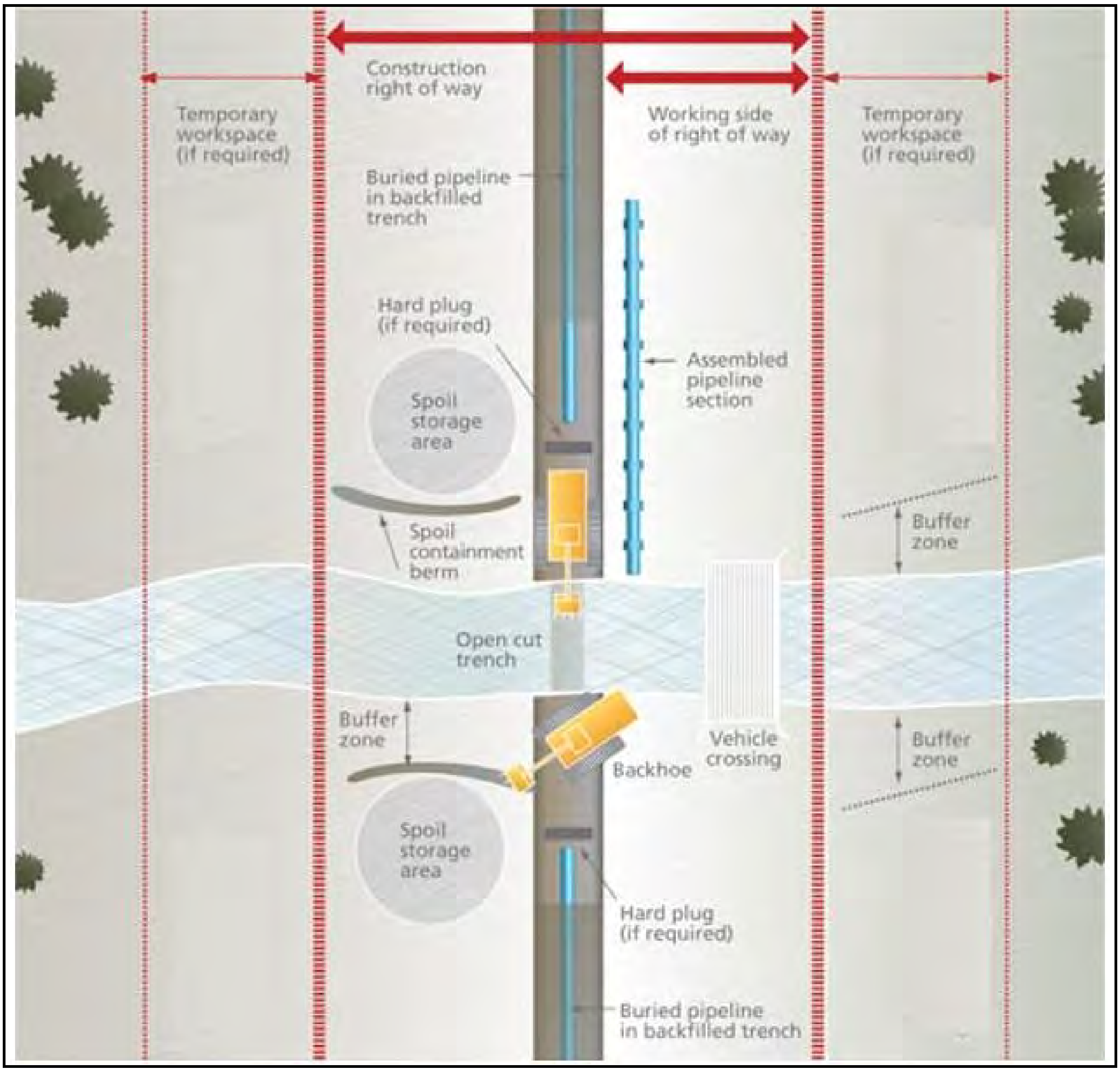

Figure 2.4-12 Open Cut Crossing

Wetland Crossings

Wetland crossings have been identified from LIDAR data and verified through field surveys.

Crossings of annual wetlands (standing water or saturated soil for most of the year) will be open-cut with a wider trench to reduce erosion. Construction equipment will use prefabricated equipment mats to reduce soil erosion. Sediment control measures will be installed to avoid impacts on adjacent wetland, and fuel will not be stored within 30 m of the wetland. Figure 2.4-13 is a cross-section of an annual wetland crossing.

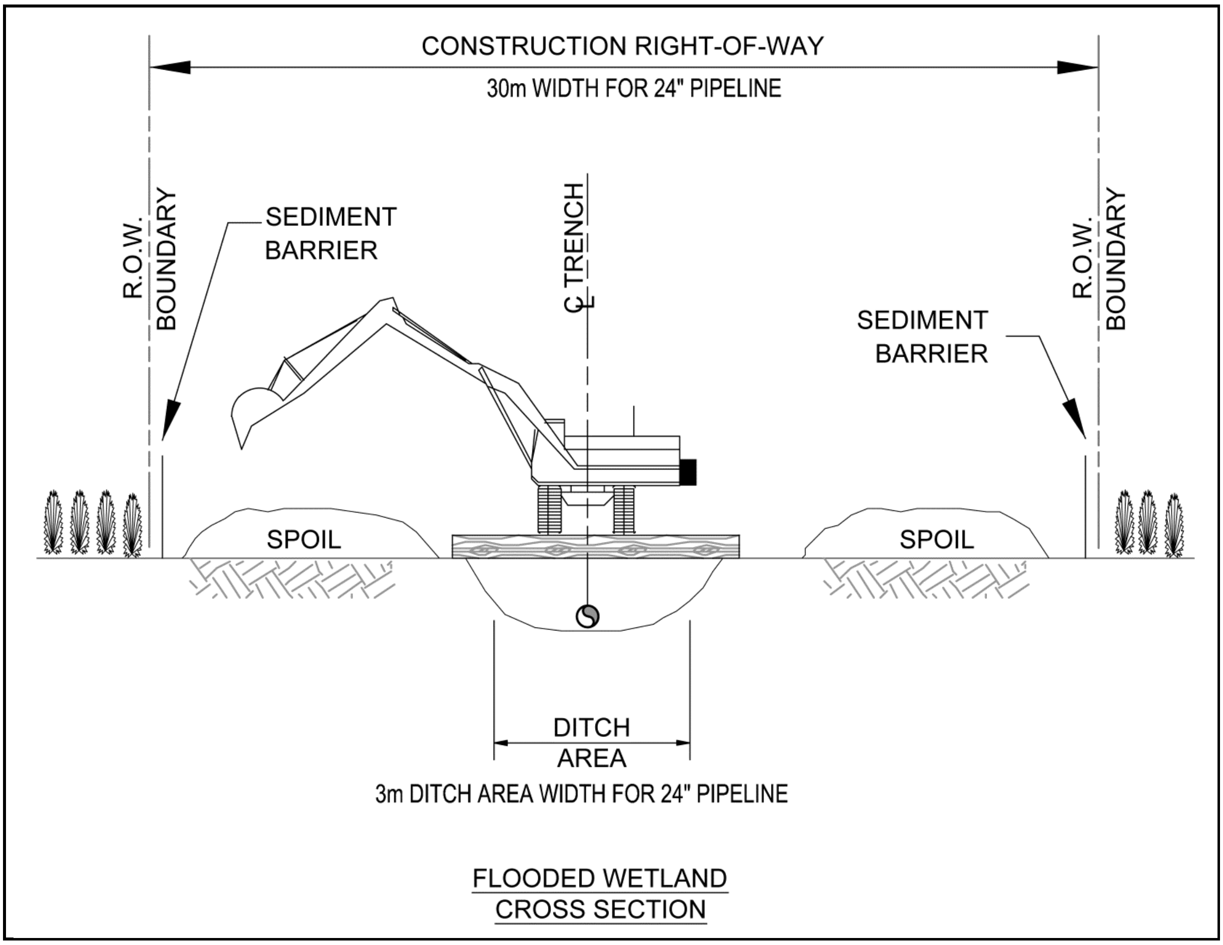

Figure 2.4-13 Crossing of Annual Wetlands

Seasonal wetlands (no standing water or saturated soil for most of the year) will be open cut with a narrower trench, as erosion is not as great a concern. Construction equipment will use prefabricated equipment mats to reduce soil erosion. Sediment control measures will be installed to avoid impacting on adjacent wetland, and fuel will not be stored within 30 m of the wetland. Figure 2.4-14 is a cross-section of a seasonal wetland crossing.

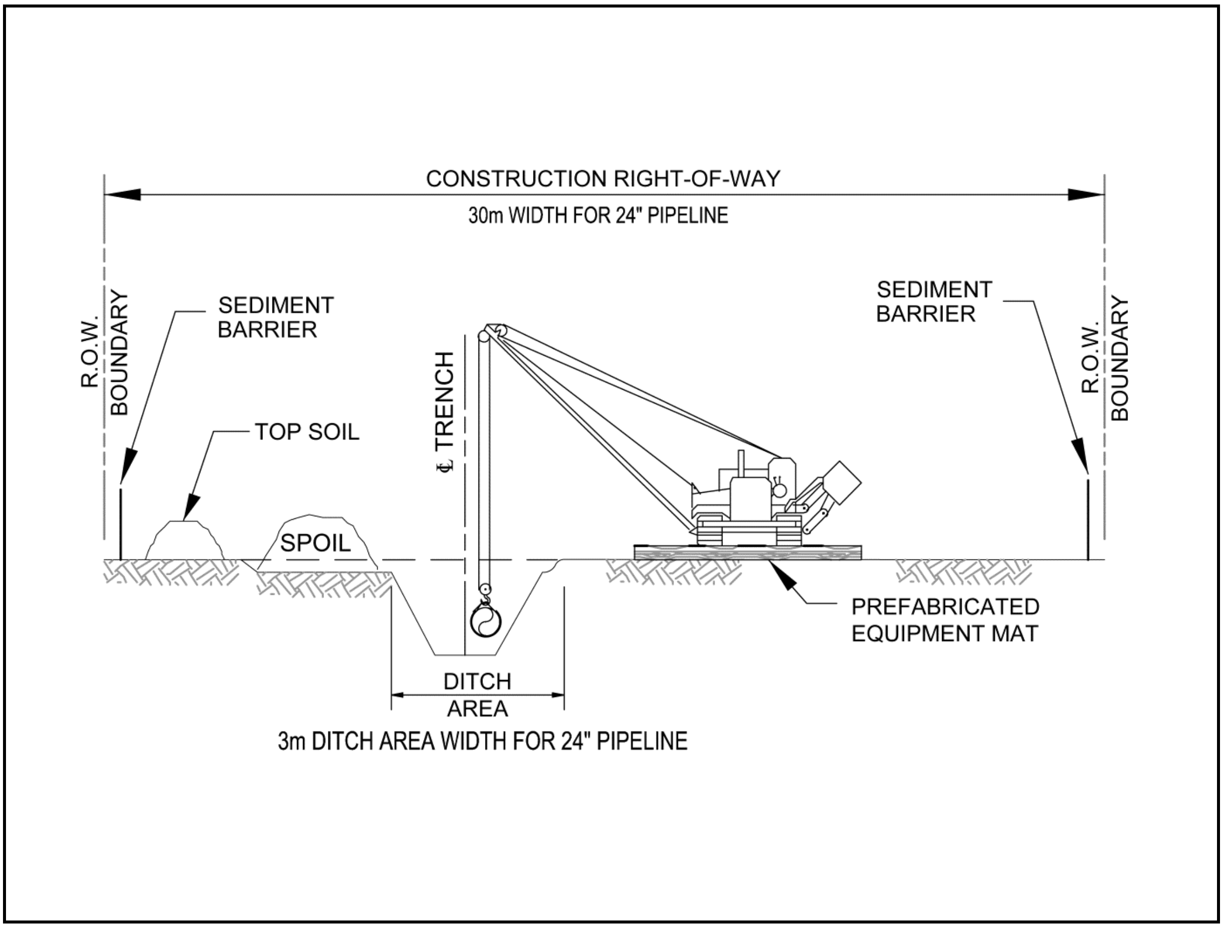

Figure 2.4-14 Crossing of Seasonal Wetland

Major Road Crossings

Auger boring requires the excavation of access pits on either side of a crossing so that boring equipment can be lowered to the depth of the bore. Figure 2.4-15 is a photo of an auger bore. The auger will bore horizontally under the crossing emerging in the access pit on the other side.

Figure 2.4-15 Auger Bore

Fault Line Crossings

Locations of fault lines are identified by the geological, geophysical and geotechnical field surveys. For fault lines, a crossing angle will be calculated depending on type of fault and activity, and the pipeline will be constructed with a straight alignment for 100–200 m on each side. The trench will be backfilled with granular material and not machine compacted. Figure 2.4-16 depicts a typical fault crossing plan.

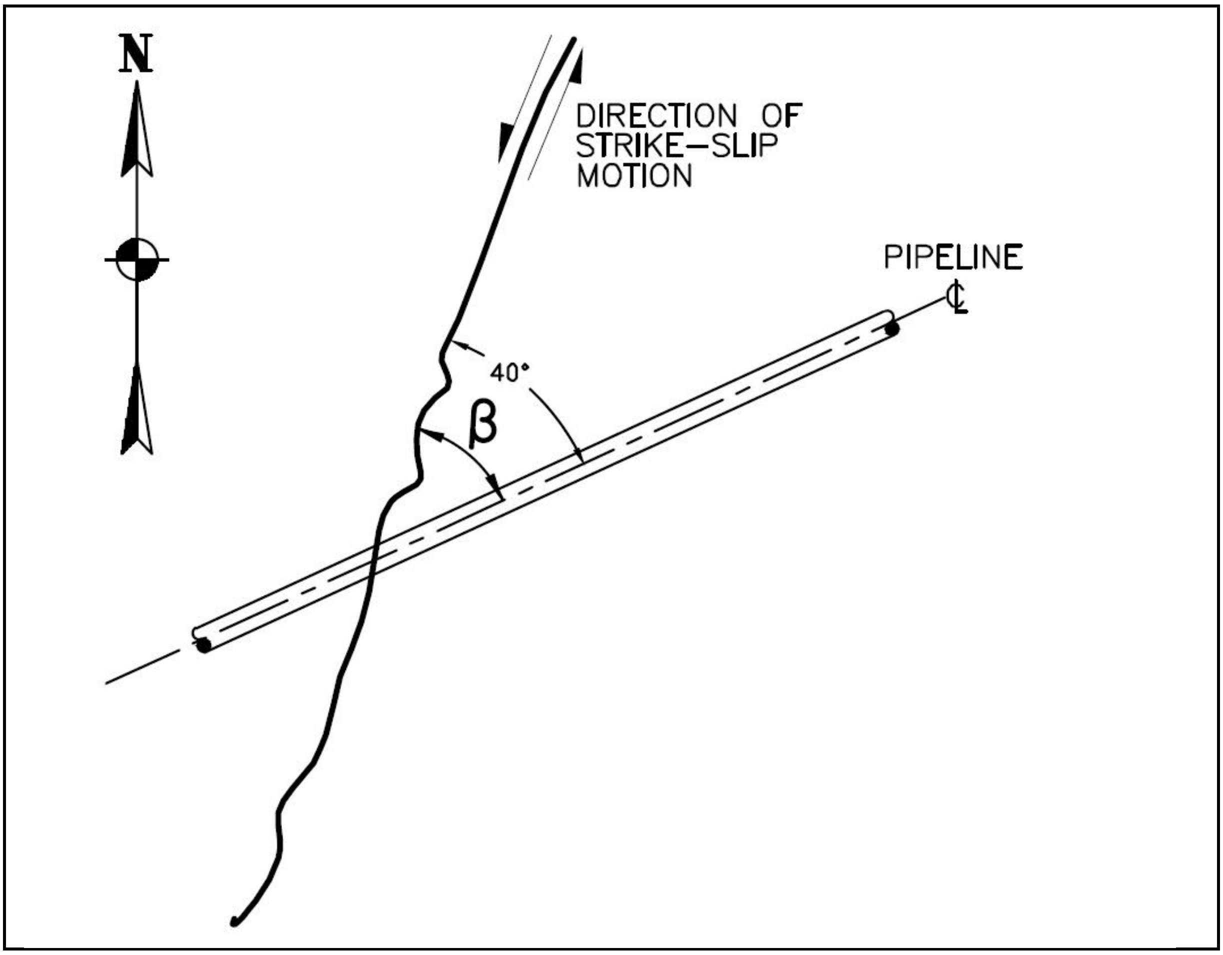

Figure 2.4-16 Typical Fault Crossing Plan

Underground Line Crossings

Underground lines to be crossed potentially include water, sewer and storm water lines, and fibre-optic, electrical and communications cables. The pipeline will cross a minimum of 0.3 m below underground lines.

2.4.2.6 Roads

Permanent and construction access roads can be:

- upgrades of existing murram roads
- newly constructed murram roads.

Access road construction will require equipment, including, but not limited to:

- bulldozers and graders for route preparation
- compactors for surface compression
- excavators for trenching
- pavers for surface preparation.

All new access roads will be graded to prepare the road base that will be compacted. Excavated materials approved for use as fill or backfill will be stored in the road RoW, i.e., the road width and area required for road construction.

Excavated materials which are not needed or are unsuitable for use as fill or backfill will be removed from the RoW and stored at district-approved locations. Where additional material is required, locally available murram will be used.

The roads will be crowned with 2.5% slope for drainage and drainage diversion ditches will be constructed. Corrugated metal pipe culverts will be installed where the road crosses watercourses.

The extent of existing road upgrades will be identified during detailed engineering. Construction methods for upgrades will be the same as for new access roads.

The road RoW will be kept free from waste material. Waste and surplus materials will be removed from work areas and disposed of in accordance with the waste management plan (see Section 2.4.2.8).

Road Maintenance

Access roads will be maintained until project completion. Road safety measures will be implemented and where work will be undertaken close to an existing road, the safety of vehicular and pedestrian traffic will be maintained at all times.

Dust reduction measures will be implemented for traffic and sprinkling or other dust-control measures will be implemented as necessary.

2.4.2.7 Emissions and Discharges

During construction, the following sources of air emissions are expected:

- power generation using diesel-fired engines
- construction equipment and vehicle exhausts
- dust from vehicle movement and construction activities
- welding.

Section 8.22.2 discusses and quantifies the greenhouse gas emissions from the construction phase. Appendix G3 provides more detail and also quantifies air pollutant emissions from construction.

During construction, the only expected water discharge from construction facilities is rainwater surface runoff and treated sewage water. Additional information on water discharges is included in Section 8, Potential Impact Identification and Evaluation – Normal Construction and Operation.

2.4.2.8 Construction Waste Management

Construction waste management will be based on the following elements:

- **avoidance** – establishing contracts to allow the return of excess product and packaging
- **reduction** – construction processes to reduce waste generation (e.g., accurate calculation of concrete mixes) and waste reduction techniques (e.g., volume reduction of waste materials).
- **reuse and recycling** – all categories of waste will be segregated to facilitate recycling and reuse. Waste materials which cannot be recycled either locally or shipped to recycling facilities (e.g., plastics) will be treated at site.

- **disposal** – where wastes cannot be treated onsite, residual waste will be transported offsite to a project- and regulatory-approved waste disposal facility where it may undergo additional treatment.

A construction waste management plan will be developed which identifies waste types and volumes, and locations where these may be generated. Expected waste types will include:

- solid waste:
  - metal
  - concrete
  - combustible materials
- liquid waste:
  - surface run-off collected at AGIs
  - other waste waters collected in the site drainage system
- hazardous waste:
  - lubricants
  - organic solvents
  - chemical additives
  - waste containing heavy metals
  - hazardous chemicals used in the coating facility to create PUF
- sanitary waste, generated at all construction camps:
  - sewage
  - grey water generation from sinks and wash-downs

Sanitary waste will be treated to discharge quality standards. Dedicated bio-oxidation treatment facilities that treat sewage and grey water will be installed at the MCPY.

There will be periodic removal of sewage sludge from the units for treatment at an approved waste management facility. If there is no treatment facility or where effluent discharge is not permitted, raw sewage or effluent will be transferred by tanker to the closest available project facility for processing.

Food waste will be shredded, dewatered and composted into a soil enhancer using an in-vessel composter.

Waste Reduction

Strategies will be employed to reduce the volume and hazardousness of waste, including a:

- **purchasing strategy** – procurement personnel will routinely employ strategies to identify and acquire environmentally ‘favourable’ products and to identify waste generation avoidance or minimisation opportunities
- **material reuse and recycling strategy** – materials will be identified and used that have a potential beneficial post-project use for local contractors working on the project.

Where it has been assessed safe to do so, waste that will not be reused by the project or contractors will be made available to local communities (e.g., containers and wood).

Storage

All waste (hazardous and nonhazardous) generated, collected, segregated, stored in temporary stockpiles and removed from site will be managed in compliance with environmental laws and regulations.

Collection Points

During construction, waste will be collected at worksite waste collection points. Segregation will be promoted via the provision of multiple waste containers. Waste will be transported from the waste collection points to a waste storage area for further segregation, treatment and compaction.

Storage Area

The MCPY will include a waste storage area. The size of this area will be based on a factor of at least 1.5 above maximum capacity to account for unforeseen circumstances (e.g., inclement weather) and additional guests and workers. The waste storage area will be placed downwind of the construction camp.

The waste storage area will have dedicated storage areas for hazardous and nonhazardous wastes. Segregation and physical treatment of wastes will be undertaken to increase reuse and recycling opportunities.

Disposal

Waste treatment will be implemented to render waste less hazardous and reduce its volume before final disposal. Hazardous waste from the MCPY and the RoW will be collected and transported to licenced waste disposal sites for appropriate disposal, e.g., incineration and landfilling. Nonhazardous waste will either be recycled, reused, incinerated on-site (e.g., food-contaminated waste and packaging) or transported for landfilling to NEMA-approved disposal sites. A waste management plan that identifies all the waste streams and appropriate disposal options will be developed before project construction begins.

General Waste Transport Requirements

All collected loads will be properly labelled in compliance with national waste management regulations, and all wastes will be accompanied by relevant Material safety data sheets (MSDS) and waste transfer notes.

Waste Collection and Transfer at Facilities

Wastes will be stored at the dedicated locations and collected by a licensed waste contractor.

Hazardous Waste

Hazardous waste will be collected, stored and transported by an authorised third party. MSDS will be available for all products and substances used.

Tracking System

A waste tracking system will ensure appropriate management of wastes produced.

Waste transfer notes will be used to ensure that wastes are transferred from the producer, through the transportation chain to the final disposal point and will provide a record of due diligence across the system. Each waste transfer note will track the consignment of waste from the point of origin to the final location.

2.4.3 Soil Management, Erosion Control and Reinstatement

2.4.3.1 Philosophy

Good soil management practices reduce the potential for erosion and will be the basis for reinstatement.

2.4.3.2 Soil Management

Topsoil Stripping

Topsoil and subsoil will be stripped and stored separately to avoid co-mingling.

In areas with thin topsoil, constant supervision during topsoil stripping will be implemented to preserve topsoil for reinstatement.

Topsoil and Subsoil Storage

Topsoil and subsoil will be stored away from project activities and protected from wind and water erosion.

If sufficient storage space exists, topsoil and subsoil may be stored on the same site. Signs will be erected on the topsoil and subsoil stockpiles to avoid mixing during removal and reinstatement.

Topsoil Maintenance

If topsoil is stored for more than six months, stockpiles will be monitored for anaerobic conditions that may affect soil fertility and subsequent success of reinstatement. Manual aeration will be undertaken if necessary.

2.4.3.3 Erosion and Sediment Control

Erosion and sediment control during construction is required to prevent sediment from entering watercourses and to reduce areas requiring erosion-associated reinstatement.

Erosion Control

On pipeline construction sites erosion is mostly caused by heavy rain, which creates sediment laden run-off.

To prevent erosion and damage to soil structure, movement along the RoW by vehicles will be discouraged, especially in wet conditions. Erosion control measures will be installed on steep gradients and high-risk areas to reduce sediment laden run-off.

Erosion control measures may include, but not be limited to, French drains. Detailed erosion control measures will be defined during detailed engineering work. Figure 2.4-17 shows a typical French drain. They may be installed across the RoW to restrict the movement of surface run-off. The collected run-off is discharged to the side of the RoW.

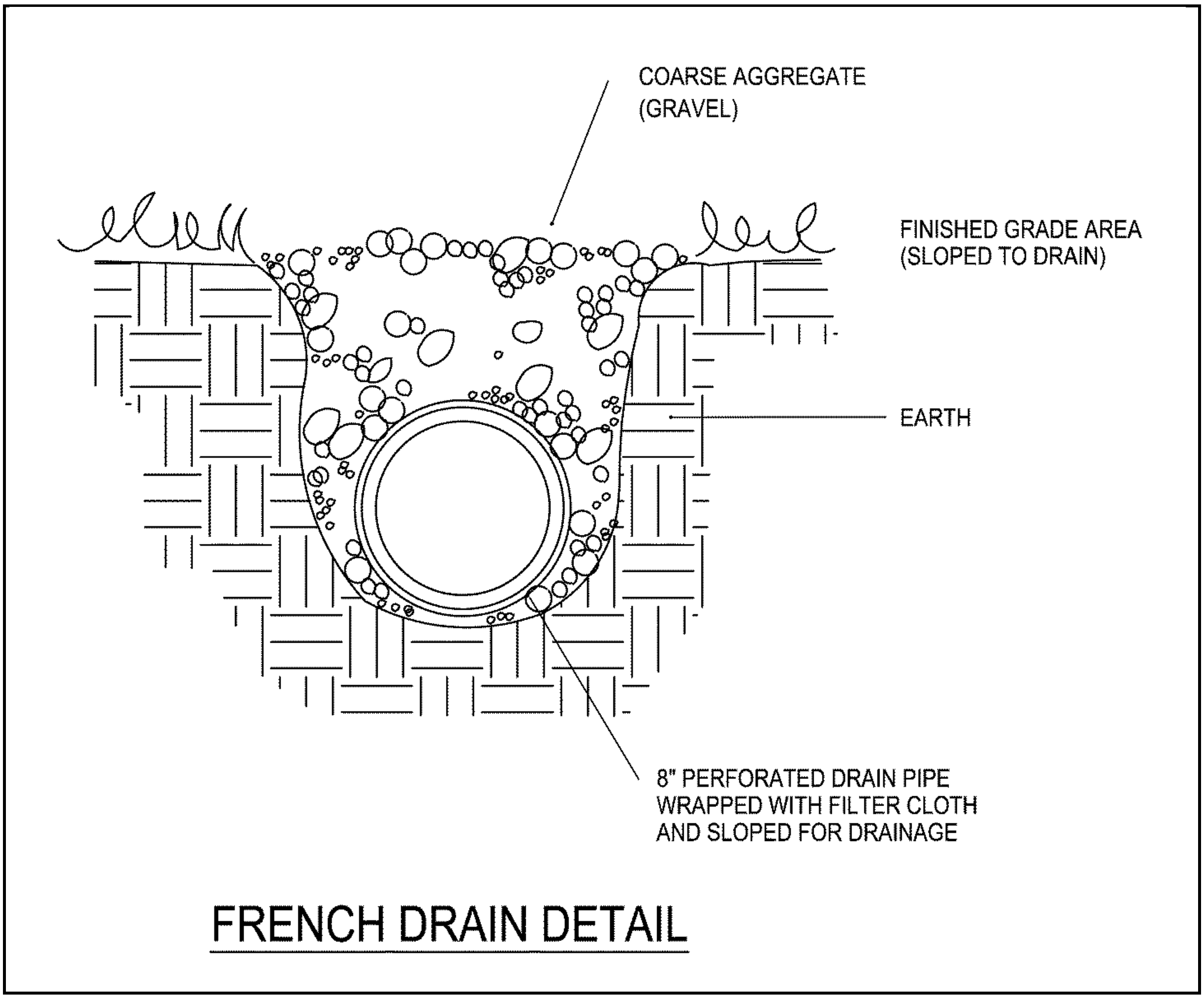

Figure 2.4-17 Typical French Drain

Sediment Control

Sediment control measures will be installed to remove sediment from run-off and may include, but not be limited to, straw-bale filters, silt fences, sediment traps and sediment basins.

Straw-bale filters could be installed at the bottom of slopes or across drainage ditches during road construction and at the time of ditch cleaning. Figure 2.4-18 depicts a typical straw-bale filter. The bales must be inspected often and replaced as required.

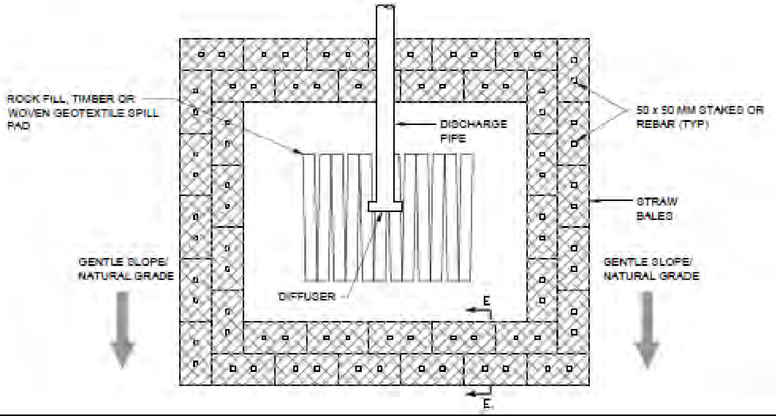

Figure 2.4-18 Straw Bale Filter

Silt fences could be installed at the side of the RoW and function as a run-off sediment filter. Figure 2.4-19 shows a typical silt fence. Routine maintenance must be undertaken on the silt fences to remove sediments.

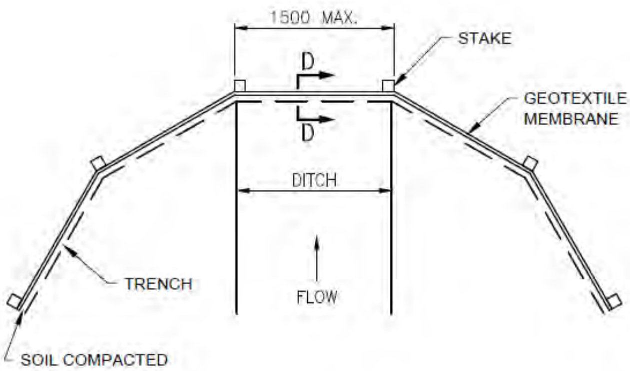

Figure 2.4-19 Typical Silt Fence

Sediment traps could be dug within the RoW to slow run-off and trap sediment. Figure 2.4-20 depicts a typical sediment trap. The number and spacing of sediment traps depends on the slope of the terrain.

When the sediment trap is half full, trapped sediment must be removed and filter material cleaned or replaced.

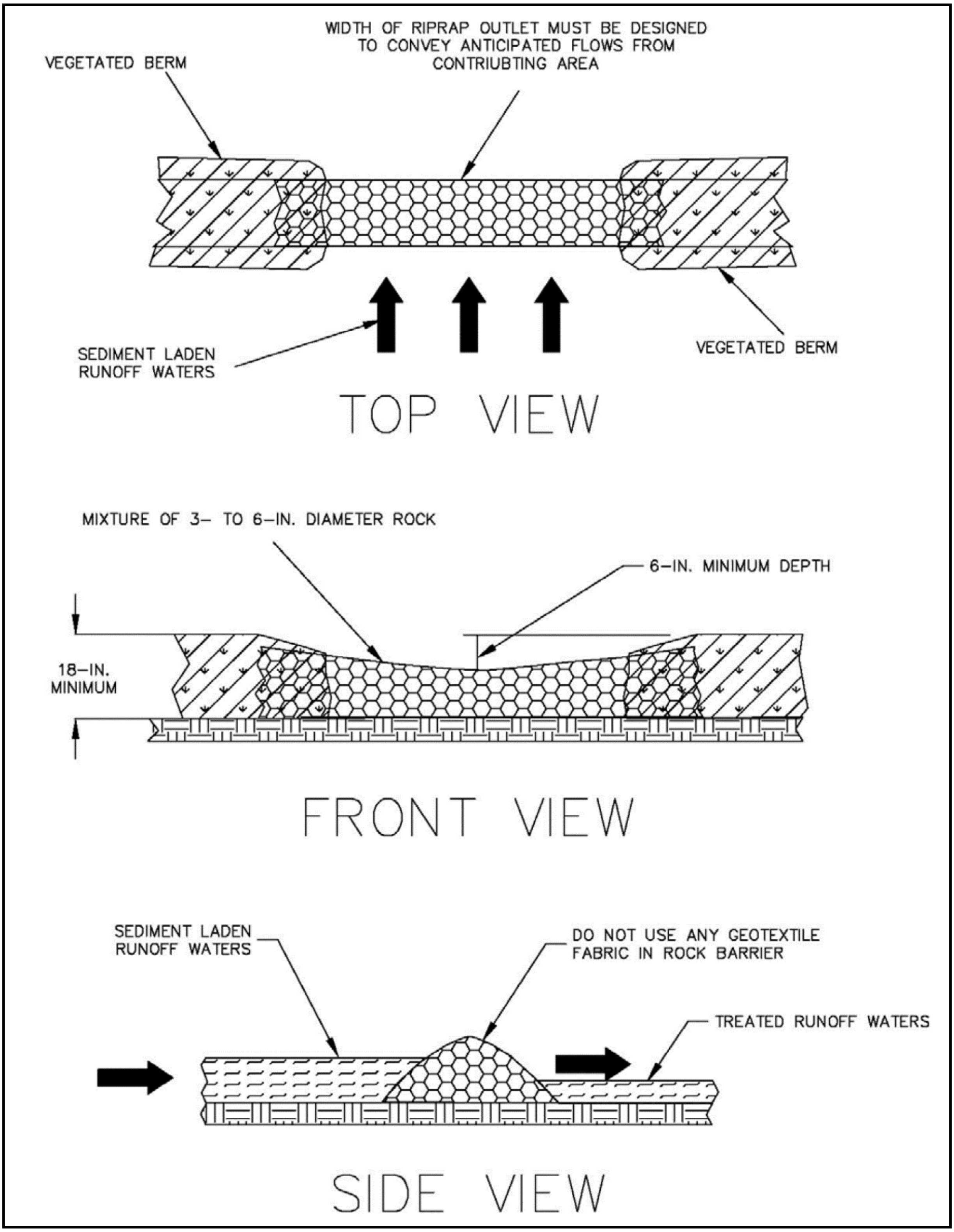

Figure 2.4-20 Typical Sediment Trap

Sediment basins are similar to sediment traps and can be used to collect sediment laden water and for settling of the sediment. Figure 2.4-21 depicts a typical sediment trap.

When the basin is half full, the sediments will be removed, and, if necessary, the filter material must be cleaned or replaced.

The sediment will be collected and stored. At the end of the construction period during backfilling, the sediment will be added to the subsoil and put back into the trench. Before mixing with the subsoil, the sediment will be sampled and tested for contamination. If found to be contaminated, the sediment will be handled and disposed of as waste.

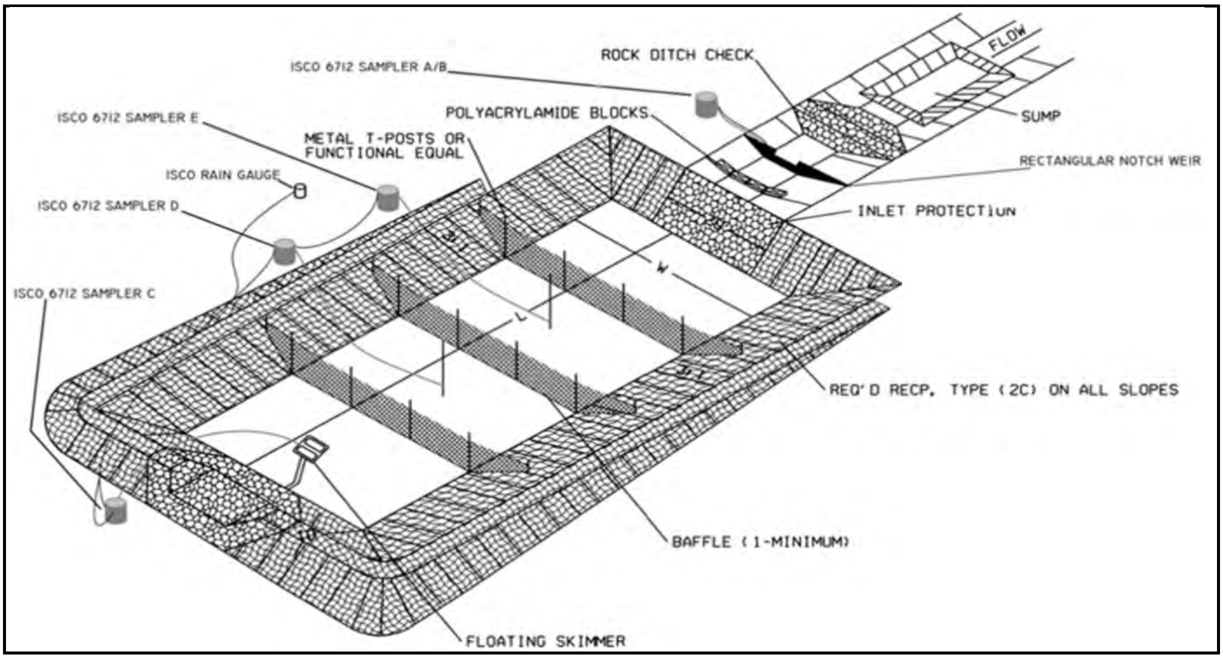

Figure 2.4-21 Sediment Basin

2.4.3.4 Reinstatement

On completion of construction activities, the following reinstatement activities will be undertaken:

- all debris, equipment and excess materials will be removed from construction areas
- construction areas will be reinstated to their original profile
- the stored topsoil will be placed on construction areas
- stones lying on the surface from construction activities that may interfere with tilling of the land will be removed
- soil compacted by traffic in construction areas will be tilled
- temporary access paths that may be damaged by project traffic will be restored to their original condition
- fences (around the MCPY), embankments, irrigation systems and ditches will be restored to a working condition
- in the steeply sloping areas of the RoW, drainage and erosion control measures will be provided
- construction in non-agricultural areas will be reinstated using natural revegetation to avoid the introduction of invasive species

- construction in agricultural areas will be reinstated as grassland
- in areas prone to erosion, native plant seeds will be used to expedite revegetation.

2.4.4 Pre-commissioning, Commissioning and Start-up

2.4.4.1 Overview

On completion of the construction phase, there will be pre-commissioning and then commissioning phases, followed by the introduction of oil into the feeder line through the outlet flange at the Tilenga Project CPF.

Start-up sequences will drive the priorities for pre-commissioning activities. Start-up optimisation includes the timely and sequential completion of operational systems. For example, fuel distribution, power generation, EHT and pumping are required for start-up. The Tilenga feeder pipeline will be subject to commissioning of facilities at the Tilenga Project CPF.

As part of the overall commissioning philosophy, the pipeline is divided into systems and subsystems. The basic commissioning unit is the subsystem and there will be several hundred subsystems on the Tilenga feeder pipeline. Each of these subsystems must reach a completion status during pre-commissioning, which includes three main types of activities:

- conformity checks
- static or de-energised tests
- piping tests.

When the tests are completed, a ‘Ready for Commissioning’ certificate will be issued for each subsystem. A subsystem is ‘Ready for Commissioning’ when all pre-commissioning operations on that subsystem are completed and there are no outstanding items.

Commissioning is the final quality check before transfer to the start-up team and includes:

- dynamic verification
- testing with substitute fluids
- preparing the pipeline system for start-up.

Commissioning Execution

A commissioning execution plan will be developed during detailed engineering. It will govern and describe all aspects of pre-commissioning and commissioning for all components. The plan will interface with the Tilenga Project commissioning programme to ensure synergies, and define the entire internal commissioning organisation and the corresponding organisation required for all the phases of commissioning activities.

2.4.4.2 Pipeline

Before commissioning can begin, the following core pre-commissioning activities will be completed:

  - controls and instrumentation system check and verification
  - flushing with water and initial cleaning of the pipeline and then baseline gauging of pipeline wall thickness
  - hydrostatic testing consisting of a strength and leak test
  - final cleaning and dewatering, pipeline inertion with nitrogen or drying to a specified dew point, after completion of hydrostatic testing
- communications systems check and verification.

Flushing, Initial Cleaning and Gauging

The water used to flush and subsequently clean the pipeline will be filtered. Corrosion inhibitors may be needed, pending water quality and duration of residence in the pipeline.

Cleaning will use a pig fitted with water jetting, brushes and magnets to collect debris. Reuse of pre-commissioning water will be optimised. Used water will also be analysed to assess substance presence and concentration, and solid content, and will be released consistent with regulations and industry best practice.

Gauging will include the deployment of gauging plates on pigs that monitor pipeline diameter. Deviations will be analysed and repairs made to maintain structural integrity.

Hydrotesting

The pipeline will be hydrostatically tested to confirm pipeline integrity and strength. Pipeline sections of approximately 35–50 km will be cleaned and gauged using several large batches of approximately 16,000 m^3 of water separated by pigs. The water used for cleaning will be reused in the next pipeline section or released to environment after it has gone through a suitable filtration process. The water will be released to the environment when analysis indicates that the water parameters comply with water discharge regulations. When satisfactorily cleaned and gauged, the pipeline section will be filled with water to remove all air from the test section and will be pressurised, over a minimum of 8 hours at 1.25 times the design pressure, as a combined strength test and leak test. The strength tests will confirm the integrity of the pipe and welds, and establish the operating pressure limit of the pipeline section.

All MLBV assemblies will be tested separately from the mainline hydrostatic testing.

Final Cleaning and Gauging

The final cleaning process will follow the same steps as those described for initial cleaning.

The pipeline will be dewatered and filled with nitrogen or dried to a specified due point for corrosion prevention.

Commissioning Completion

When these commissioning activities are completed, and the EACOP System has been commissioned and is ready, oil will be introduced in a controlled way until it arrives at the EACOP Pump Station 1. Commissioning will be considered complete once all the above testing activities have been performed successfully.

Markers and Signs

Markers will identify the pipeline and high-voltage cable locations and direction every 500 m. Warning signs will identify the pipeline and high-voltage cable at road, stream and river crossings. Warning signs will be on both banks of every waterbody crossed by the pipeline. Additional warning signs will be installed in areas with greater risk of excavation and construction activities. These signs will identify the presence of the pipeline and high-voltage cables, and provide pipeline operator telephone numbers.

2.4.4.3 Aboveground Installations

Electric Substations

The EHT electric substations will be checked for proper operation. The following fundamental checks of major items will be conducted:

- transformer operates properly
- switch isolates and connects properly
- heating cables checked for shorts or opens
- remote operation of switch checked.

The electric substations will all be set at maximum power for commissioning so that the EHT system can be powered to prevent flow stoppage. Operators will control the substations manually during early operating stages.

2.4.5 Operations

2.4.5.1 Operating Philosophy

The operating philosophy establishes the facility design requirements to ensure safe, efficient and cost-effective operations. This philosophy will guide the principles for field operation organisation and implementation.

2.4.5.2 Operations and Maintenance

The Tilenga feeder pipeline, including all MLBVs and the electric substation, will be managed from the Tilenga Project CPF CCR with a duplicate CCR in Tanzania at the marine storage terminal. Automation capabilities with special focus on a remote start–stop control will ensure emergency response in the event of unplanned incidents.

Operations will follow work permit procedures. Maintenance and inspection activities will be executed to complete the scheduled interventions required to retain the integrity and reliability of the installations.

An EPRS (Emergency Pipeline Repair System) will be established for the feeder pipeline, and equipment and procedures to manage abnormal operation and incidents.

Security measures are described in Section 2.4.5.6.

Wax deposition during start up and when the pipeline starts to operate below design capacity is expected to be low with EHT active. However, some wax deposits may still form requiring pigging.

The Tilenga feeder pipeline will be equipped with a pig launching facility at the Tilenga Project CPF and a pig receiver in PS1. Residue collected from pig trap receivers will normally be heated and reinjected into the pipeline. However, the waste storage system will accommodate residuals not suitable for reinjection which will then be transported to a suitable licensed facility for treatment and or disposal.

The Tilenga feeder pipeline pig receiver is in the EACOP Uganda pumping station PS1 in the Kabaale industrial area (see Figure 2.4-22).

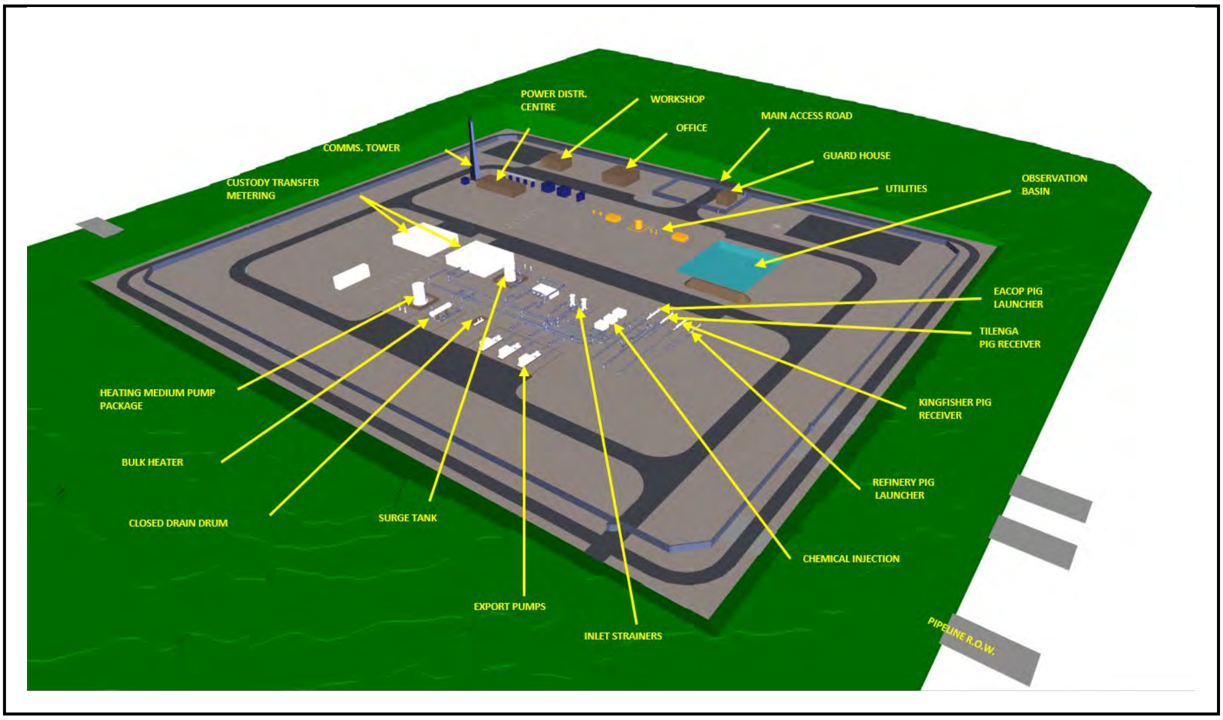

Figure 2.4-22: Layout of EACOP Uganda Pumping Station PS1

A maintenance team will be dedicated and trained to execute repairs that may be required due to:

- corrosion (internal or external)
- seismic events
- landslides
- erosion or scouring
- external causes (vandalism and accidental digging).

Complex repairs will be conducted by specialists for:

- pipeline section replacement
- thermal insulation (PUF) repair
- fibre optic cable repair

- high-voltage power cable repair
- electric heat tracing repair.

In areas where the pipeline traverses natural habitat, manual vegetation management along the operational RoW will be undertaken to ensure that a width of 10 m is kept free of deep-rooted plants to maintain pipeline integrity and facilitate access. In other areas, vegetation management to support grassland will be undertaken across the full width of the operational RoW.

Teams at the Tilenga Project CPF and PS1 will be responsible for sections of pipeline including the electric substation and MLBVs.

2.4.5.3 Resources and Local Resourcing

Services and Supplies

During the operation phase, services and supplies for the project will be sourced in accordance with applicable national legislation and project commitments. Services and supplies include:

- maintenance and inspection activities
- catering and camp operation services
- supporting services (e.g., logistics, medical services and civil works).

Labour

Production, maintenance and inspection personnel will be locally recruited and trained during the construction phase to ensure that there is a trained resource pool that can be used for pre-commissioning, commissioning and operations.

Approximately 10 personnel are planned to be needed and these people be positioned at the Tilenga Project CPF. The team will have responsibility for the management of the MLBVs and EHT for specific sections of the pipeline.

Local Content Management

An operations local content strategy and plan will be established for the project. This will:

- aim to maximise Ugandan manpower
- identify areas and disciplines where Ugandan companies can gain valuable capacity in partnership with the project.

The objective will be to focus on identifying and promoting the use of local resources, and working collaboratively to develop these resources on a long-term basis by:

- maintaining communication between the project and Ugandan suppliers through regular and supervised dialogue
- supporting the educational system by reinforcing the best academic institutions already in place to focus on certification programmes to develop qualified technicians.

Supply Chain Management

The project will follow a competitive tendering process to select contractors for operations activities.

Local content, as defined above, is a core criterion for selection of these contractors.

For operations the project will:

- use Ugandan companies, when possible, for the provision of goods and services
- prioritise when possible the purchase and use of goods produced or manufactured in Uganda
- invest in training and technology transfer with the objective of enhancing the performance or capacity of local suppliers.

2.4.5.4 Emissions and Discharges

During operations, the following sources of air emissions are expected:

- occasional operation (including regular testing) of standby generators
- vehicle movement, and operation and maintenance activities.

Note that the emissions associated with power generation at the Tilenga Project CPF and the associated air quality impact assessment have been included in the Tilenga Project ESIA.

During operations, the only expected discharge from project facilities is rainwater surface runoff and treated sewage water. Additional information on water discharges is included in Section 8, Impact Identification and Evaluation – Normal Construction and Operation.

2.4.5.5 Operations Waste Management

An operational waste management plan will be developed which identifies waste types and volumes, and locations where these may be generated. The plan will be based on the same elements as the construction waste management described in Section 2.4.2.8, waste avoidance, reduction, reuse and recycling, and disposal. Expected waste types will include:

Solid

Wax deposited in the pipeline will be cleared from the pipeline by pigging operations. Most of the wax will be reinjected into the pipeline. Disposal space will be provided for residual wax not deemed suitable for reinjection and will be managed under the Tilenga Project CPF waste management arrangements.

Liquid

There will be no planned discharges of effluent from the MLBVs or the electrical substation situated along the Tilenga feeder pipeline. Only clean surface water is expected and will drain naturally to the environment in accordance with regulatory discharge standards for water quality.

Hazardous

Other than trace amounts of biocide, anti-corrosive oxygen scavenger and maintenance wastes, no hazardous wastes are expected from typical pipeline operations.

The preferred and alternative waste management methods used will be waste specific. When methods are not available the waste will be safely stored while a method is developed.

Sanitary

There will be minimal sanitary waste requirements as the AGIs for the Tilenga feeder pipeline as the AGIs will be unmanned. There is a possibility that security personnel may be present, but this is subject to a detailed security plan for the project.

Segregation

The objective of waste segregation will be to achieve a high recovery of recyclables, particularly all wood, paper, plastic, packaging materials, glass and scrap metal.

The waste bins or skips for segregation of waste will be colour coded with appropriate signage and labels to facilitate segregation.

Waste Storage

Wastes will be stored to prevent:

- accidental spillage or leakage
- contamination of soils and groundwater
- corrosion or wear of containers
- loss of integrity from accidental collisions or weathering
- scavenging and infestation of vermin and disease-bearing insects.

Disposal

Waste treatment will be implemented to render waste less hazardous and reduce its volume before final disposal.

General waste transport requirements, waste collection and transfer at facilities and hazardous waste management will be similar to those detailed under Section 2.4.2.8.

Tracking System

A tracking system will be in place, similar to the one detailed under Section 2.4.2.8.

2.4.5.6 Monitoring

Pipeline Operational Monitoring

Pipeline monitoring along the RoW may be assisted by a ‘community watch’ system and or unmanned aerial vehicles. These people and equipment will monitor for intrusions or other activities on the RoW.

Pipeline Integrity

The supervisory control and data acquisition system, described in Section 2.4.5.2, will be operated from the CCR for centralised monitoring and control of process and safety systems for the pipeline and AGIs. A pipeline acoustic intrusion system may be installed along the pipeline and connected to the fibre optic cable. The pipeline acoustic intrusion system will identify disturbances (e.g., unauthorised digging or blasting) in the pipeline RoW and communicate these disturbances via the fibre-optic cable to the security control room.

An EPRS will form part of the pipeline system’s contingency plan. The contingency plan will be designed to facilitate rapid and safe repair of pipeline damage. The EPRS will integrate leak detection with operations and emergency response and repair. Additional information on contingency planning is included in Section 9.2.4.

Corrosion Management

For precautionary purposes, the pipeline is specified with a fusion-bonded epoxy anticorrosion coating applied to protect the pipe against external corrosion over the course of its operational life. This coating will act as a second barrier in case of water ingress below the bounded thermal insulation system. To provide additional corrosion control, cathodic protection measures may be implemented.

Cathodic protection measures will be provided on AGIs. For the pipeline, internal corrosion will be monitored by intelligent pigging, see footnote in Section 2.3.2, and for microbiologically induced corrosion.

The intelligent pigs that will be used travel through the pipeline to monitor its integrity and diagnose matters such as metal defects. Intelligent pigging will be conducted as follows:

- during commissioning to establish a baseline
- initial in-service inspection in year five or earlier
- subsequent in-service inspections every five years (or more often depending on legal requirements and monitoring results).

Biocide injection will be required if microbiologically induced corrosion is confirmed.

Security

The project will abide by the national laws of the country and will develop its security based on international standards and best practices. A security risk assessment has identified a set of security measures for each phase of the project.

Physical Security

Physical security includes passive and active measures to protect personnel and facilities against potential threats. Passive measures include the use of architecture, landscaping and lighting to achieve improved security by deterring, disrupting or mitigating potential threats. Active measures include the use of systems and technologies designed to deter, detect, report and react against potential threats.

During the operations phase, closed-circuit television and intrusion detection systems will be in place and will be monitored from a security control room at the Tilenga CPF.

Operational Security

Operational security is the process of creating policies and procedures, and establishing controls to protect the facilities and assets of the project. It includes:

- policies and procedures to establish controls to prevent unauthorised access to a facility or assets, whether through carelessness, criminal intent or an outside threat
- controls that are performed on a regular basis to ensure that the requirements are met by all security stakeholders.

The project's facilities will be secured by local security providers who have been trained by professionals with expertise in voluntary principles on security and human rights.

Other Monitoring

Environmental and social monitoring is described in Section 10.

2.4.6 Decommissioning

2.4.6.1 Construction Facilities

A decommissioning plan for the construction facilities will be developed, which includes a social management component that addresses associated impacts (e.g., loss of jobs and economic activity). In addition, the plan will ensure that all the project components that were required for constructing the pipeline, but that will no longer be required during the operational phase, are removed and the land returned to the Government. This will be based on the following principles:

- engagement with stakeholders at local, regional and district levels to determine potential use of all redundant equipment and structures
- project structures to be removed from land that is no longer required for operations
- before decommissioning, site environmental due diligence will be undertaken based on historical site data and monitoring data done throughout the life of the field
- land to be reinstated to a capability similar to that which existed before construction activities.

As described in Section 2.3.6, the land required for facilities will be leased from the Government. When the operational phase has been completed, and after decommissioning, the leases will be surrendered. Some of the facilities, such as the camps, after the construction phase, may be transferred to the Government with some structures left in place.

2.4.6.2 Pipeline

When pipeline oil shipping volumes diminish to the point that it becomes inefficient to transport oil via the pipeline, the pipeline will be decommissioned based on applicable regulations and standards, and international standards and protocols. This will be based on similar principles to those listed above for the construction facilities.

2.5 Associated Facilities and Third-Party Developments

2.5.1 Associated Facilities

Associated facilities are those belonging to projects that would not normally be developed independently without the development of the Tilenga feeder pipeline.

The project will include associated facilities, as defined by the IFC Performance Standards, which states that ‘associated facilities’ are: *facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable*.

Associated facilities comprise:

- the EACOP System, a 24-in.-diameter export pipeline which is insulated, trace heated and buried. The pipeline in Uganda traverses from the Kabaale Industrial Park to the Uganda–Tanzania border.
- the Hoima–Butiaba–Wanseko road upgrade. The upgrade of this road was requested by the Tilenga Project. It is proposed to widen the road to a 6-m-wide two-lane carriageway with 1–2 m shoulders. Construction was underway at the time of writing and the road upgrade will be completed before construction of the Tilenga feeder pipeline. It has therefore been considered in the Tilenga feeder pipeline baseline and project impact assessments rather than the cumulative impact assessment.

There will be a need to source aggregate from borrow pits. The current plan is that either existing borrow pits will be sourced or borrow pits will be developed by the project construction contractor after acquiring requisite land rights as described in Section 2.3.6.2, and regulatory approvals. If the supply from either of those options is not adequate and existing borrow pits need to be expanded, or new ones need to be developed by external developers, those pits will be considered associated facilities. The external developers are expected to conduct requisite environmental evaluations, develop mitigation and reinstatement measures, and acquire approvals.

As mentioned in Section 2.4.2.4, due to the remoteness of some AGIs, construction infrastructure (concrete batch plants) may be required and would be developed in the early stages of construction. If it is decided that some of the concrete batch plants are best developed by external contractors, the plants will be considered associated facilities. The contractors would be expected to conduct requisite environmental evaluations, develop mitigation and reinstatement measures, and acquire approvals.

The construction waste management plan described in Section 2.4.2.8 refers to the potential use of existing waste management facilities and the operations waste management plan described in Section 2.4.5.5 refers to the potential use of a waste management service provider. If the existing waste management facilities and service providers are not adequate to receive construction and operation wastes, and the facilities and services needed to be expanded, they will be considered associated facilities. Synergies for waste management optimisation in the area with the rest of the Tilenga Project will be a priority. Similar to the borrow pits and concrete batch plants mentioned previously, contractors would be expected to conduct requisite environmental evaluations, develop mitigation and reinstatement measures, and acquire approvals.

Since the need for development of new facilities or expansion of existing facilities is uncertain and potential locations and design of such facilities are not known, they have been screened out of the cumulative impact analysis of associated facilities (see Appendix H).

Where new facilities are required, TEPU will ensure that the requisite regulatory, legal and industry best practice requirements are met and complied with. Where existing facilities are used, due diligence of the operator will be conducted to ensure that all legal and regulatory requirements are met. Where required, independent environmental and social impact assessments will be conducted in consultation with the relevant authorities.

2.5.2 Third-Party Developments

Third-party developments that were reasonably defined, reasonably predictable or foreseeable at the time the impact assessment was undertaken have been identified to assess cumulative impacts within the spatial and temporal boundaries of the project. These are described below.

- The Kingfisher Oil Project, on the southeast shoreline of Lake Albert, includes a MCPY near to PS1. The project will comprise field development, a CPF, water abstraction station, flow lines and a feeder pipeline to PS1.
- A 132-kV transmission line from the upstream Tilenga Project development to the Kabaale Industrial Park. The line will evacuate excess power generated at the Tilenga Project CPF and import power to the Tilenga Project CPF when excess gas is reduced or depleted. The line will also be used to provide power to the Kabaale Industrial Park and surrounding areas. A preliminary route is available.
- The Bugungu airstrip will be upgraded with an extension to the existing airstrip as part of Tilenga upstream project development.
- Kabaale International Airport will be expanded to facilitate the delivery of equipment and transportation of personnel during oil-field exploration and development phases.
- Two 33-kV transmission lines to Kabaale Airport will be installed, associated with the Kabaale Airport development.
- A 60,000-barrel-per-stream-day hydrocracker and coker refinery will be constructed at Kabaale within the 29 km^2 area of land already acquired for the Kabaale Industrial Park.
- A 210-km-long Hoima–Buloba pipeline will be built for transporting refined petroleum products from the refinery in Hoima (see UG07) to a distribution terminal in Buloba, Kampala.
- Road improvements will be developed under the jurisdiction of UNRA to supporting the oil industry. These include the following roads:
  - Buliisa–Paraa
  - Wanseko–Kasenyi–Kirango–Bugungu camp
  - Kisanja Park junction
  - Sambiya–Murchison Falls

- o Paraa–Pakwach
- o Kabaale–Kiziranfumbi
- o Kaseeta Lwera via Bugoma Forest
- o Hohwa–Kyarushesha–Karokarungi.
- A mini hydroelectric power station on the Waki River and associated concrete batching plant will be built.

2.6 Schedule

A schedule for the project is shown in Table 2.6-1. Project activities are progressing with construction being planned after the conclusion of the Uganda ESIA regulatory process and the RAP implementation.

Table 2.6-1 Feeder Pipeline Project Schedule

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Regulatory approval			■	■								
Land acquisitions	■	■	■	■								
Detailed engineering	■	■	■	■	■	■	■					
Logistics (transportation of equipment and materials)				■	■	■	■	■	■			
Construction facilities (construction of camp and access roads)				■	■	■	■					
Pipeline construction					■	■	■	■	■	■	■	■
AGIs construction (electrical substations and block valves)					■	■	■	■	■	■	■	■
Stakeholder engagement	■	■	■	■	■	■	■	■	■	■	■	■