ESIA Italy
Section 4 Project Description
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4 PROJECT DESCRIPTION

4.1 Introduction

The aim of this section is to describe the different components involved in the construction, operation and decommissioning of the TAP pipeline coming ashore in Italy, and to provide an overview of the project construction and operation management, use of resources, and environmental interferences.

The Project is a proposed gas pipeline that will bring gas from new sources in the Caspian region to Western and South Eastern Europe through the Southern Gas Corridor. The planned pipeline will start in Greece, cross Albania and the Adriatic Sea, and come ashore in Southern Italy, allowing gas to flow directly from the Caspian Region into Western and South Eastern European markets.

The proposed “Base Case” route, shown by the red line in Figure 4-1, has been selected following an extensive and thorough route alternative assessment process performed by TAP AG between 2008 and 2013 with the aim to select a technically feasible pipeline route with the least negative environmental, socioeconomic and cultural heritage impacts. The route refinement process was completed in the early months of 2013.

The pipeline system in Italy consists of an approximately 45 km long offshore pipeline, an approximately 8.2 km long onshore pipeline, and a Pipeline Receiving Terminal (also referred to as PRT) in the municipality of Melendugno, in the province of Lecce. The pipeline system has an initial capacity of 10 billion cubic metres (bcm) of natural gas per year (average around 1,190,000 standard cubic metres per hour, assuming 350 days of activity per year) which could be extended to 20 bcm per year (average around 2,380,000 standard cubic metres per hour, assuming 350 days of activity per year). The impact assessment in Section 8 refers conservatively to the 20 bcm scenario.

Figure 4-1 shows the onshore pipeline route and the main Project Components.
4.1.1 The Base Case Route

The pipeline landfall will be located at the coast between San Foca and Torre Specchia Ruggeri in the municipality of Melendugno. The landfall will be constructed using micro-tunnelling technology to minimise interference with the coastline. In line with international best practice and Italian regulations, a block valve station (BVS) will be installed close to the landfall approximately 100 m downstream of the entry (onshore) of the microtunnel to interrupt the gas flow in cases of emergency or maintenance.

After the shore approach area, the planned pipeline route diverts towards the south in order to avoid a large topographical depression consisting of wetlands named “Palude di Cassano” (Cassano Marsh), under environmental protection (Melendugno Municipality Plan).

From the first open-cut crossing with the “Strada Comunale S. Viceta” at Kp 0.6 (south-east of the wetland), the pipeline route runs parallel to a paved municipal road for approximately 3.5 km.
In order to minimise the impact on properties and landscape it crosses the road three times more, at Kp 1.1, Kp 2 and then again at Kp 4. The route continues its course mainly through olive groves running close to the side of the road wherever feasible, crossing another provincial road, the “Strada provinciale Lecce Melendugno” (SP2) at Kp 6.5. With a total onshore route length of approx. 8.2 kilometres, the pipeline reaches the PRT at a location to the west of the township of Melendugno. The PRT will be situated close to the border between Melendugno and Vernole municipalities, approximately 1.5 kilometres south of the provincial road connecting these towns.

The pipeline will connect with the Italian gas network (Snam Rete Gas) immediately after the PRT (Map 1 in Appendix 3 to Annex 7).

Box 4-1 The Kilometre Point

To allow an easy identification of the onshore pipeline components, their location is defined in this ESIA by their kilometre point (Kp), where Kp 0 is the tie-in between the onshore and the offshore pipeline at the starting point of the microtunnel. Therefore, Kp represents the pipeline length in kilometres from the microtunnel starting point.

4.1.2 Project Components

4.1.2.1 Overview

The pipeline system in Italy will be basically composed of the following main installations, listed from the Adriatic Sea median line to the PRT (Figure 2 in Appendix 3 to Annex 7):

- A sub-sea 36” pipeline from the Adriatic Sea median line to the Italian landfall, approximately 45 km long (145 bar-g design pressure, 75 bar-g normal operating pressure at the Pipeline Receiving Terminal);
- A landfall microtunnel, approximately 1,485 m long, including 600 m onshore;
- A buried cross-country 36” pipeline from the landfall to the Pipeline Receiving Terminal (PRT), approximately 8.2 km long (145 bar-g design pressure, 75 bar-g operating pressure at the Pipeline Receiving Terminal);
- A landfall block valve station (BVS) at Kp 0.1;
- The Pipeline Receiving Terminal (PRT) (Kp 8, 2 from landfall);
- Associated facilities required during construction (access roads, construction, pipe yards, etc.).
4.1.2.2 Offshore Pipeline

The offshore pipeline crosses the Adriatic Sea and travels from the Albanian coast to the shore approach in Italy (approximately 45 km from the Adriatic Sea median line to the landfall). It will have a diameter of 36” and a 145 barg design pressure.

The pipeline enters the Italian territorial waters in the middle of the Strait of Otranto at a water depth of about 820 metres.

At about 95 m water depth, the almost direct route is diverted slightly South-Westward with a radius of 3000 m, in order to approach the Italian coast following a straight line alignment perpendicular to the shoreline.

The section of the route closest to the shore, approximately 3,600 m long, runs on a gentle and regular upward slope to reach a narrow calcarenite beach located in an area North of San Foca village (Municipality of Melendugno).

The rectilinear section in the proximity of the coast allows the installation of the pipeline inside the microtunnel by means of a pull-in from barge method.

The offshore pipeline has been designed in accordance with the recognized offshore pipeline design code DNV OS-F101, and has the following preliminary design specification:

- Line pipe material: Steel Grade API 5L X65 or equivalent DNV grade 450;
- Internal diameter: 36” (871 mm constant);
- Steel thickness: 34 mm in microtunnel, and between 20.6 and 34 mm for the offshore section according to the water depth;
- Internal epoxy coating (flow coating);
- A 3 mm thick anti-corrosive coating, polyethylene-based coating if non-concrete coated, polyurethane or asphalt if concrete coated;
- Concrete coating range between 120 and 55 mm depending on water depths;
- Cathodic protection system from corrosion.
4.1.2.3 Landfall

As previously defined, the landfall will be on the coast between San Foca and Torre Specchia Ruggeri in the Municipality of Melendugno (Province of Lecce).

The landfall will be constructed using microtunneling technology to minimise interference with the coastline. Microtunneling is a process that uses a remotely controlled Tunnel Boring Machine (TBM) combined with a pipe jacking technique to directly install concrete jacking pipes. The TBM will be installed in a jacking shaft (also known as a launch shaft) and the concrete pipes jacked seawards until the tunnel reaches the surface of the sea bed, as shown on Figure 4-5.

The rectilinear section in the proximity of the coast is needed for the installation of the pipeline inside the landfall tunnel by means of a pull-in from an offshore lay barge.

Once the microtunnel is complete and the pipe pulling head reaches the launch shaft at its onshore end, offshore pipeline installation will continue up to the Albanian coast.

The microtunnel will be approximately 1.485 km long, with a circular section and an external diameter of 3 m.

The microtunnel also passes beneath one of the two important roads intersected by the planned pipeline route, the Provincial Road SP n. 366 and a secondary road.

4.1.2.4 Onshore Pipeline

The onshore pipeline (approximately 8.2 km long from the landfall to the Pipeline Receiving Terminal) runs in an E-W direction in the Province of Lecce to the southeast of the town of Lecce, entirely within the Municipality of Melendugno.

The pipeline will be designed in accordance with Decree 17/04/2008 and Standard EN 1594 (Pipelines for Maximum Operating Pressure over 16 bar) and has the following preliminary design specification:

- Line pipe material: Steel Grade API 5L X65 or equivalent DNV grade 450;
- Internal diameter: 871 mm;
- Steel thickness: 26.8 mm;
- Internal epoxy coating (flow coating);
- A polyethylene-based coating (minimum thickness 3 mm);
- Cathodic protection system.
As defined by Decree 17/04/2008 concerning the gas pipeline construction methods in Italy, the minimum required pipeline cover is 0.9 m from the top of the pipe, reducing to 0.4 m in rocky soil. In Italy however, pipelines are generally realized with a minimum cover of 1.5 m, in order to guarantee the maximum protection against interference with human activities (excavation, trenching for agricultural uses, etc.). TAP AG plans to follow this construction practice and to maintain a minimum cover thickness of 1.5 m.

The route will cross a Provincial Road (SP 02 from Lecce to Melendugno), at Kp 6.542.

Other secondary crossings are summarised in the following Table 4-1, which includes estimated distance from the landfall tunnel exit (Kp):

Table 4-1  Crossings

<table>
<thead>
<tr>
<th>Nr</th>
<th>Crossing Category</th>
<th>Kp</th>
<th>Municipality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SP 366</td>
<td>-</td>
<td>Melendugno</td>
</tr>
<tr>
<td>2</td>
<td>Secondary road</td>
<td>-</td>
<td>Melendugno</td>
</tr>
<tr>
<td>3</td>
<td>Seasonal road</td>
<td>0.6</td>
<td>Melendugno</td>
</tr>
<tr>
<td>4</td>
<td>Secondary road</td>
<td>1.1</td>
<td>Melendugno</td>
</tr>
<tr>
<td>5</td>
<td>Secondary road</td>
<td>2.0</td>
<td>Melendugno</td>
</tr>
<tr>
<td>6</td>
<td>Secondary road</td>
<td>4.0</td>
<td>Melendugno</td>
</tr>
<tr>
<td>7</td>
<td>Secondary road</td>
<td>4.6</td>
<td>Melendugno</td>
</tr>
<tr>
<td>8</td>
<td>Secondary road</td>
<td>5.6</td>
<td>Melendugno</td>
</tr>
<tr>
<td>9</td>
<td>Secondary road</td>
<td>5.9</td>
<td>Melendugno</td>
</tr>
<tr>
<td>10</td>
<td>SP 02</td>
<td>6.5</td>
<td>Melendugno</td>
</tr>
<tr>
<td>11</td>
<td>Secondary road</td>
<td>7.6</td>
<td>Melendugno</td>
</tr>
</tbody>
</table>

4.1.2.5 Block valve station

One block valve station (BVS) will be installed close to the pipeline landfall in order to enable the isolation of the offshore pipeline from the onshore part for maintenance and safety purposes.

The BVS will be unmanned and comprises as above ground features only a small cabinet for the power and control system and a fence to avoid any interference, covering a total surface area of approximately 13 x 24 m.

According to Italian regulation (DM 17/04/2008) BVS’s in high pressure natural gas pipelines are to be installed every 15 km. BVS’s are also required upstream and downstream of railway crossings, at a maximum distance of 2 km between them (DM 23/02/1971). Given the limited length of the onshore pipeline, no additional BVSs are needed.
Figure 4-2 provides a visual representation of a typical BVS.

**Figure 4-2  Block Valve Station – 3D Model**

The BVS will be usually operated remotely from a control centre in the PRT through a fibre-optic cable communication system and will be connected to the local power grid. Pipeline block valve, by-pass valves and connected piping will be buried below ground. Valve integrity will be also monitored in continuum by the pipeline Leak Detection System.

The selection of the pipework constituting the BVS is based on the same design standards and design specifications related to the selection of the onshore pipeline. The diameter of this pipework will be 12” for the by-pass line and 2” for branches to measuring instruments.
4.1.2.6 Pipeline Receiving Terminal

The Pipeline Receiving Terminal (PRT) will be the terminal point of the TAP pipeline and will constitute the connection with the Italian national grid owned and operated by Snam Rete Gas S.p.A (SRG). The main functions of the PRT will be to:

- Receive the gas and inline maintenance equipment (PIGs – Pipeline Inspection Gauges);
- Control the flow, pressure and temperature to meet the SRG requirements;
- Measure the flow for fiscal requirements;
- Deliver the gas to the SRG;
- Safe venting requirements during maintenance and emergencies;
- Control the operation of the entire pipeline, isolation valves, compressions stations (located in Albania and Greece) and the facilities at the PRT.

_Figure 4-3_ shows the location of the PRT, _Figure 4-4_ provides the 3D model of the terminal. The PRT will be located within the municipality of Melendugno at the boundary with the Municipality of Vernole, in an uncultivated area about 8.2 km inland from the seashore.

**Figure 4-3** PRT Area – South View

*Source: ERM (April 2013)*
The PRT area will also represent the laydown area during construction of the onshore pipeline.

The maximum gas flow design rate of TAP Terminal is 10 Bcm/year for initial installed equipment. The capacity increasing to 20 Bcm/year will be done by adding additional equipment (pumps, heaters, entire trains etc.). The purpose of the gas metering station is to perform fiscal measurement of the quantity and quality of gas to be delivered from TAP Terminal to SRG Network.

The purpose of the terminal inlet section is to receive the incoming gas feed and to act a point of isolation (and emergency shutdown by means of ESD valves) between the BVS close to the coast and the Terminal. The inlet facilities also contain a Pig Receiver.

For availability reasons the terminal will be provided in a block design for the different process units (filter, two electrical heaters and two gas fired boilers, heat exchangers, pressure/flow control and metering) with 3 identical gas processing units each fed from a single header immediately downstream of the terminal inlet facilities. Between each process unit, the gas will be again collected in a common header and then again split up to the next process unit.

The first process unit consist of filter separators that remove potential solids and liquids from the gas stream before the gas enters the conditioning facilities (heater, pressure/flow control unit). Liquids will be collected in this process unit and further fed into the closed drain system, which leads to a condensate tank.
The heating of the gas to be received shall be done to guarantee the minimum delivery gas temperature, downstream the pressure reducing system; this operation may be required only in transport transient condition (packing/de-packing operation, start-up etc.) and in case of quick fluctuation of the pressure in the downstream SRG network. The gas heating will be done by heat exchangers, based on hot water circulation. Hot water shall be supplied by a closed circuit production system using electrical heaters and gas fired boilers. The heating system is designed to provide in total 8.6 MW duty. The electrical heaters, designed to provide a duty of approximately 2 MW, will cover most of the operational heating requirements. The gas fired boilers, designed for the remaining duty, are intended to cover mainly start-up and abnormal operation conditions. Thus, local air emissions from heating will be sporadic.

In order to protect downstream equipment and systems against over-pressure (145 barg vs. 75 barg) a pressure/flow control unit controls the flow rate to the downstream network and simultaneous reduces the pressure to the downstream network pressure. Additionally a HIPPS (High Integrity Pressure Protection System) shall be installed between pressure/flow control unit and metering unit. This system consists of two serial mounted independent quick self-closing valves (one is purely mechanical, the second one is an instrumented safety system), which are maintained open as long as the downstream pressure is below the set point.

The quantity of the natural gas to Snam Rete network will have to be measured for custody purposes. This will be done by using ultrasonic flow meters (USM). To fulfil the strict requirements of custody transfer measurement two identical USM will be installed in serial, in each meter run to compare the accuracy of the individual meter. The quality of the natural gas to SRG network will be analysed for custody purpose by a Gas Analysing Unit.

A fuel gas unit will be provided for the conditioning of the fuel gas to the requirements of the heating medium. The fuel gas is taken from the outlet side of the pipeline receiving terminal as the lowest pressure level is expected there. As the fuel gas might be also taken during terminal shut down from Snam Rete Network the fuel gas stream will be measured with a flow meter suitable working a measurement required for invoicing. The closed drain system will be collected in a suitable condensate tank, 10 cubic metres in volume. The closed drain system will be sized for the final TAP Terminal flow rate (20 Bcm/year), considering the quantity of liquids discharged from Main Gas filters, and the hypothesis that a liquid slug can enter the Terminal. The collected fluid shall be removed by road tanker.

For surface/rain water two separate drainage systems are required for the TAP Terminal:
- Process areas
- Other areas (utilities, buildings etc.)

Their purpose is to collect and discharge the applicable waste water preferably to the public waste water network.

Surface water from potential polluted areas will be carried to an oil separator and then into the sewage system. This sewage system will also be used for the discharge of sanitary waste water.
4.1.2.6.1 Cold Vent

The depressurization of the PRT piping/equipment, both in emergency and in normal shutdown conditions, will occur through two dedicated cold vent stacks, to be installed within the terminal (being the gas lighter than the air it will dissipate easily without the need of combustion).

The design of the PRT underwent a number of changes and optimization since the ESIA submission in March 2012. Amongst them, the depressurization and venting philosophy has been revisited with the aim to provide the facility with the safest and most effective strategy to cope with operations and maintenance as well as emergencies. In particular, the following revised design elements were included:

- depressurization of the entire terminal at once (in 15 min.), rather than a staged release from different sections;
- depressurization down to 6.9 bar-g, rather than to 50% of the design pressure in order to assure a more rapid control of the situation in which the hazard source is the leakage of flammable materials from the equipment/system being depressurized;
- reconsideration of the total geometric volume of the PRT, including future capacity expansion;
- allowance for future increase of volume during detail design due to equipment design and piping layout finalization.

As noted above the vent system comprises two cold vent stacks. This solution contributes to mitigate the visual impact of the PRT, because the stack height is retained as 10 m; on the contrary, a single vent stack solution would have caused more significant consequences on the visual impact of the PRT due to the required minimum stack height of 40 m.

Gas dispersion as well as potential heat radiation levels due to an injection source have been evaluated as per requirements of EN 23251. For safety reasons, each vent stack will be surrounded by a sterile area with a radius of 86 m; in case of incident, the heat radiation is likely to overcome 5 kW/m² within this radiation area.

From an emission point of view, the PRT design is such that no venting in atmosphere is foreseen during normal operating conditions.
4.1.2.7 Construction Phase Associated Elements

Associated facilities and features required during construction will include the following:

- Work sites;
- Construction site (with pipe stockyard);
- Crossings;
- Access Roads.

Further details of these construction-related facilities and activities are provided in Section 4.2. Details concerning access roads are provided in Section 4.2.6 Access, Transportation and Traffic.

4.1.3 Design Philosophy

4.1.3.1 Philosophy

The onshore/offshore pipeline and the PRT will be designed for a lifetime of 50 years. Equipment and piping within the PRT will be designed for a lifetime of 25 years.

The design philosophy is to ensure that the gas transport system fulfils all safety requirements of the base National and European Codes and Standards, and that the impact to the environment is kept to a minimum.

The pipeline, the BVS and the PRT will be designed in accordance with requirements resulting from:

- National and local regulations;
- Safety of the public and personnel working near the pipeline;
- Protection of the environment;
- Protection of property and facilities;
- Geotechnical, corrosiveness and hydrographical conditions;
- Requirements for construction, operation and maintenance;
- Third party activities.

4.1.3.2 Applicable Codes and Standards

All project facilities will be designed in accordance with the European Codes (EN) and National Standards. For certain equipment, where other standards are more practical the respective equipment standard may be used. For the onshore pipeline, the main codes to be used are following:

- DM 17/04/2008 “Technical regulation for the design, construction testing, operation and supervision of works and facilities for transporting natural gas with a density not exceeding 0.8”;
DM 10/08/2004 “Modification to the “Technical standards for crossings and the parallelism of pipes and channels, transporting liquid and gas, with railways and other transportation infrastructures ”;

EN 1594:2009” Gas supply systems. Pipelines for maximum operating pressure over 16 bar. Functional requirements”.

The offshore pipeline will be designed according the following Det Norske Veritas standard:

- DNV OS F101 Submarine Pipeline Systems.

The list of others notable codes and standards to be applied to project design includes:


- DM 24/11/1984 “Fire Safety for the transport. The distribution. the accumulation and utilisation of natural gas with a density not exceeding 0.8”;

- DM 23/02/1971 n. 2445 “Technical standards for crossings and the parallelism of pipes and channels, transporting liquid and gas, with railways and other transportation infrastructures "and amendments;

- EN ISO 10208-2 Steel pipes lines for combustible fluids – Technical delivery conditions; Part 2;

- EN ISO 12327 Pressure Testing, Commissioning and decommissioning procedures for gas supply systems;

- EN ISO 12732 Gas Supply Systems – Welding Steel Pipework, Functional Requirements;

- EN ISO 14141 Valves for Natural Gas transportation in Pipelines;

- EN ISO 12954 Cathodic Protection;

- EN ISO 14780 Induction bends, fitting and flanges;

- EN ISO 21329 Mechanical Connectors;

- EN 12186 Gas Supply Systems – Gas Pressure regulation stations for transmission and distribution – functional requirements;

- EN 1776 Gas Supply Systems – Natural Gas Measuring Station – Functional Requirements;

- DNV RP E305 On-Bottom Stability Design of Submarine Pipelines;

- DNV RP F105 Free Spanning Pipelines.
4.1.3.3 Noise and Emissions (Guidelines and Directives)

- IFC EHS Guidelines for noise levels from World Bank Group;
- 2008/50/EC European Parliament Directive on ambient air quality;
- EU 2003-10/EC of the European Parliament and the Council. The minimum health requirements regarding the exposure of workers to the risks arising from physical agents (noise);
- EN ISO 4871 Declaration and verification of noise emission values of machinery;
- EN 21680 Noise levels for electrical rotating machines;
- IEC 225 Specification for Octave-Band and Fractional-Octave-Band-Analog and Digital Filters;
- IEC 651 Recommendations for Sound-Level Meters;
- EEMUA Pub.140 Noise Procedure Specification (formerly OCMA Spec. NWG1, Rev.2, 1980);

4.1.3.4 Safety (Guidelines and Directives)

- CEN/TS 15173 Frame of reference regarding Pipeline Integrity Management System;
- CEN/TS 15174 Guideline for Safety Management Systems for natural gas transmission pipelines;

The route selection was undertaken under the following overall considerations:

- The pipeline shall be designed in accordance with EU Norms and local standards (in some cases other international standards such as API, ASME may be used), whereby the more stringent rules apply.
- Avoidance routing was the primary approach to constraints that are identified and mapped inside an investigated corridor. For areas where avoidance of the identified geo-hazards and selected constraints is not entirely possible, the relevant sections of infringement must be "earmarked" for closer investigation during the subsequent site investigations and other studies.
- Parallel route with other infrastructures is preferred (so-called “infrastructure bundling”).
- Crossings with other existing and /or planned infrastructural installations shall be kept as short as possible (ideally at 90 degrees).
- The pipeline shall be installed in geologically stable areas with gentle topography – side slopes and landslide areas must be avoided.
4.1.4 System Capacity

The project is designed for an initial transportation capacity of 10 bcm/year with the potential to expand it from 10 to 20 bcm/year depending on gas availability. However, the timeframe for the capacity expansion beyond 10 bcm/year is not defined yet.

The pipeline will have a design pressure of 145 barg (bars above atmospheric pressure), which shall be sufficient for the TAP capacity base case of 10 bcm/year as well as for the potential future extension of the TAP System capacity to 20 bcm/year.

4.1.5 Gas Properties

The pipeline will transport natural gas which is a naturally occurring gas mixture consisting primarily of methane, typically with a range of 0–25% higher hydrocarbons, natural gas and accompanying substances (e.g. ethane, propane, butane, pentane, hexane, carbon dioxide, nitrogen, oxygen and sulphur (ref. Table 4-2). Just after natural gas extraction from gas-fields, it undergoes processing to remove most of the impurities in order to be transported.

TAP will therefore transport natural gas, which is similar in composition to that provided for domestic and industrial supply, for uses such as heating and power generation.

A likely composition of natural gas is shown, in the following table. The properties of the processed natural gas provided to TAP may vary slightly from those identified in the table; however, any changes will be very small deviations around the design natural gas parameters and will not result in changes to the size and design of the main project components in any meaningful way.

### Table 4-2 Gas components of the natural gas design

<table>
<thead>
<tr>
<th>Component</th>
<th>Mole-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>87.78</td>
</tr>
<tr>
<td>Ethane</td>
<td>2.72</td>
</tr>
<tr>
<td>Propane</td>
<td>1.54</td>
</tr>
<tr>
<td>i-Butane</td>
<td>0.50</td>
</tr>
<tr>
<td>n-Butane</td>
<td>0.51</td>
</tr>
<tr>
<td>i-Pentane</td>
<td>0.24</td>
</tr>
<tr>
<td>n-Pentane</td>
<td>0.24</td>
</tr>
<tr>
<td>Hexane</td>
<td>0.03</td>
</tr>
<tr>
<td>(N_2)</td>
<td>4.43</td>
</tr>
<tr>
<td>(CO_2)</td>
<td>2.01</td>
</tr>
<tr>
<td>(SUM)</td>
<td>100.00</td>
</tr>
</tbody>
</table>
4.2 Construction Phase

4.2.1 General

The project will be realized by qualified Contractors. The following sections provide details on the construction activities and construction methods.

Note: In this section, the landfall construction activity is described before the offshore pipeline construction activities because it is the first activity foreseen for the project.

4.2.1.1 Heavy Equipment

Although on a very large scale, onshore, the TAP Project will be a conventional civil engineering project, and will not require unusual or unfamiliar heavy equipment or construction techniques. The major plant items needed are bulldozers, heavy excavators, spoil removal trucks, large heavy-lift cranes, standby generators, tunnel boring machine (TBM), excavators, rock breakers, etc.

Details of the equipment that will be used for construction of the main project components are provided in the following sections. Pictures showing examples of some of this major construction equipment are shown in Figure 4 in Appendix 3 to Annex 7.

4.2.2 Support Port

For the offshore pipeline construction activities, a support port is needed as a stockyard for pipe and to sustain the marine spreads.

Taking into account the needs of the project, the port of Brindisi has been assumed suitable in terms of position and capacity.

It will be used as the base for the vessels, and will also be the yard for the pipe joints and all the materials and supplies needed for the offshore construction activities not related to the landfall. All the materials and crew for the vessels will be transported through this port and all the waste and wastewater will be unloaded at Brindisi port and transported onward to suitable treatment facilities.

4.2.3 Construction Site and Work Sites

A single storage and work site is foreseen mainly as a stock and bending yard for the line pipes. The anticipated location is in uncultivated land at the western end of the route at KP 8.2 within the footprint of the land take for the PRT.

The Construction Site will be easily accessible through the existing road network (SP 29 and connected asphalt roads) and two new access roads.

No accommodation for workers is planned at the aforementioned site. The whole extent of the land parcels affected amounts to:
33 hectares (0.33 km²) as land-easement along the pipeline, including 21 ha for temporary activities during the construction phase;

12 hectares (0.12 km²) as land acquisition that will be permanently occupied by the PRT (including 5 ha for fabrication and material storage).

A temporary worksite is foreseen specifically for the construction of the landfall microtunnel, which is part of the offshore pipeline; the area for this worksite is included in the 21-hectare area foreseen for temporary construction, as specified above. The microtunnel launch shaft will be also located here (Kp 0.000). The temporary worksite will be also be used for placing the pre-commissioning spread related to the offshore pipeline hydrotesting. It is foreseen to occupy an area of 26,000 m² and a total of approximately 8,000 m³ of soil will be temporarily set aside in order to prepare the working area. This material will be redistributed on the area after the works completion.

4.2.4 Landfall (Offshore Microtunnel)

4.2.4.1 Layout and Configuration

A temporary worksite is needed for the construction of the offshore microtunnel (Kp 0.000) (Map 3 in Appendix 2 of Annex 7) and it will have an area of 26,000 m². The launch shaft will be located here, and the temporary worksite will also be used for the pre-commissioning of the offshore pipeline.

4.2.4.2 Construction Method

Microtunnelling is a process that uses a remotely controlled Tunnel Boring Machine (TBM) combined with the pipe jacking technique to directly install concrete jacking pipes in order to install an underground microtunnel and in it the pipeline, as shown in Figure 4-5.
The microtunnel will be the first of the construction activities to be carried out. The microtunnelling activities will consist of the following phases:

- Launch shaft excavation;
- Microtunnel excavation and installation of concrete jacking pipes;
- Pre-dredging and TBM recovery.

4.2.4.2.1 Launch Shaft Excavation

The jacking shaft (or launch shaft), is needed in order to ensure the correct alignment of the Microtunnel (Figure 4-6), and is foreseen at the worksite at Kp 0. The provisional dimensions of the microtunnel launch shaft are:

- Depth: 11.0 m;
- Length: 10.0 m
- Width: 12.0 m
The launch shaft will be prepared by excavation, and the limited use of micro blasting, in accordance with the anticipated ground conditions, is foreseen. The estimated volume of soil to be excavated for the launch shaft construction is approximately 1,300 m³.

The heavy equipment to be used during the Launch Shaft excavation is listed in Table 4-3.

### Table 4-3  
**Equipment expected for use in the Launch Shaft Excavation**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavator</td>
<td>3</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Truck</td>
<td>1</td>
<td>200-300 hp</td>
</tr>
</tbody>
</table>

4.2.4.2.2  
**Microtunnel Excavation**

A typical microtunnel equipment spread consists of a Tunnel Boring Machine (TBM) matched to the expected subsurface conditions and the pipe diameter to be installed, a hydraulic jacking system to jack the pipe (Figure 4-6), a closed loop slurry system to remove the excavated tunnel spoil, a slurry cleaning system to remove the spoil from the slurry water, a lubrication system to lubricate the exterior of the pipe during installation, a guidance system to provide installation accuracy, a crane to load and unload the concrete casing, and an electrical supply and distribution system to power all of the above equipment.

**Figure 4-6  
Pipe Jacking Overview**

---

*Source: ERM (January 2012)*
The soil cuttings are removed by means of slurry water flow, the soil being mixed with slurry (water) in the TBM extraction chamber. Large slurry pumps in the tunnel section behind the TBM will transport the soil / mud mixture through slurry pipes to the departure site. The mud will be desanded in a recycling plant, and the cleaned slurry water returned to the front-face operation site.

For as long as the slurry remains in the hydraulic circuit, it will continuously undergo treatment through a de-sanding installation. This installation will exclusively separate the sandy fraction (i.e. particles bigger than 60 μm), and smaller particles that adhere to each other. In a second stage, the slurry will undergo treatment through the filter press unit to separate smaller particles.

The de-sanding installation is composed of the following parts:

- Feeding slurry line;
- Sieves:
  - First vibrating sieve;
  - Second vibrating sieve;
- Hydro cyclones;
- Slurry containers.

Once the slurry has been saturated with silt/clay, it will be replaced by water. The saturated slurry will be removed from the slurry containers and disposed into the storage pool for slurry.

While the tunnelling operations continue with water, the dewatering installation treats the saturated slurry. In the first phase, some polymers will be added to the slurry in order to make small particles bond together.

The slurry will then enter a band filter press.

The polymer injection will be fully controlled. Dosage, polymer adaptation and monitoring will be followed during the complete tunnelling operations.

The estimated excavated material for the landfall is approximately 11,800 m³ (1,300 m³ for the launch shaft and 10,500 m³ for the microtunnel).

The excavated material from the jacking shaft will be treated in accordance with the relevant legislation:

- if the material is suitable for reuse, the Project will reuse the material or transfer it to facilities capable of reuse;
- if the resulting material is contaminated and thus not suitable for reuse, it will be transported to disposal, according to the legislative framework.

The layout of the microtunnelling temporary worksite is shown on Figure 4-7.
Figure 4-7  Temporary Worksite for Microtunnelling

Source: TAP AG (June 2013)

Table 4-4  Equipment expected for use in Landfall Microtunneling

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine generator</td>
<td>2</td>
<td>1000 kW</td>
</tr>
<tr>
<td>Crane</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Excavator</td>
<td>3</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Truck</td>
<td>1</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>TBM</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

The pipeline and seabed profile related to the offshore microtunnel are shown in Figure 5 in Appendix 3 to Annex 7.
4.2.4.2.3 Pre-dredging, and TBM recovery

The recovery of the drilling head at the microtunnel exit point requires dredging works. For this purpose, the final jacking pipes (the first of which are following the drilling head at the beginning of the job) will be dimensioned to ensure the stability of the part of the tunnel without soil cover in the dredged trench.

Work on the pre-dredged trench shall be carried out by a backhoe dredger (Figure 4-8), in order to prepare the laying of the pipeline, and to recover the TBM in the proximity of the tunnel exit, seawards.

**Figure 4-8 Typical Backhoe Dredger**

Excavated material is temporary displaced to the side of the pipeline route, to be reused in subsequent sea bottom works.

The trench work will be carried out seawards from the microtunnel exit (approx. water depth range from 18 to 27 m), and will be approximately 110 m in length.

The trenched volume will be approximately 15,500 m³; all the material will be discharged to the side of the trench and will be used for backfilling after laying the pipeline. The sediment quantity calculation for the trench is conservative as it considers the presence of sandy material not very solid.

The sea bottom will be pre-trenched in front of the microtunnel and with a gently sloping vertical profile to achieve a smooth pipeline configuration and facilitate the pipeline laying and its insertion into the tunnel. These activities are performed just subsequent to and with the same vessel used to prepare the microtunnel exit point for TBM recovery. The water depth is approximately 20 m-25 m. The pipeline and associated fibre optic cable will be covered by excavated material from the exit point and for a certain length seawards.
With regard to recovery of the TBM, a barge with a crane will be positioned where the machinery will be lifted. The connection of the TBM with the crane will be made by divers (see Figure 4-9).

**Figure 4-9  TBM Recovery**

![TBM Recovery](image)

Source: ERM (March 2011)

Once recovered, the TBM will be transported to the support port.

**Table 4-5  Vessel expected for use in pre-dredging**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backhoe dredge</td>
<td>1</td>
<td>18 MW</td>
</tr>
<tr>
<td>Fall pipe vessel</td>
<td>1</td>
<td>6.5 MW</td>
</tr>
<tr>
<td>Dive support vessel</td>
<td>1</td>
<td>11.5 MW</td>
</tr>
</tbody>
</table>

**4.2.4.2.4  Post-trenching Works**

A post-trenching machine may be utilised to lower the pipe into the seabed to an assigned depth and provide a suitable depth of cover. The trenching system usually consists of adapted ROV (Remotely Operated Vehicle) equipment to perform trenching tasks. These machines utilize predominantly jetting based excavation systems, possibly in combination with trenching wheels.
4.2.4.2.5 Gravel Embankment

A gravel embankment will be constructed out of the excavated trench material to facilitate the operation of pulling-in the pipeline through the microtunnel.

The gravel embankment will be placed using the Fall Pipe Method (*Figure 4-10*), a method used for placing gravel heaps in deep water, with high precision, with the following purpose:

- to provide pre-lay or post lay support to the pipeline;
- to cover it for protection purposes or preventing in-service buckling; and
- to build crossings of existing pipelines and cables.

The vessels that perform gravel placement are usually multi-purpose, in particular equipped with a flexible fallpipe with an ROV at the lower end for better positioning. Gravel is dumped through the fallpipe at a controlled rate. The vessel moves along the route under dynamic positioning control. The ROV is controlled from the ship to ensure accurate positioning.

The embankment will be about 246 m long and maximum 2.7 m high. The volume will be approximately 7,500 m$^3$.

*Figure 4-10  Fall Pipe with ROV*

4.2.4.2.6 Fibre Optic Cable Installation and Burial

A fibre optic cable (FOC) will be laid along a route parallel to the pipeline at a distance of 50 m approx. The installation will be performed with a dedicated vessel. The FOC, where necessary, will be buried 1 m beneath the seabed to protect against trawl fishing, ships anchoring and other activities.
A volume of soil 0.5 m$^3$/m is expected to be moved and backfilled, where buried. In that case, in the Italian Exclusive Economic Zone (EEZ), a maximum volume of 22,500 m$^3$ of soil moved is estimated.

4.2.5 Offshore Pipeline

4.2.5.1 Layout and Configuration

Detailed surveys of the proposed route have been performed and involved a range of standard geophysical and geotechnical survey techniques, including a visual survey using an ROV.

The results of these surveys have been used to optimize the design route of the pipeline and to confirm the most appropriate construction methods.

The offshore pipeline will be installed using a pipelay vessel or a pipelay barge as described below.

4.2.5.2 Offshore Construction Method

The offshore pipelaying is a sequential pipe construction and installation process on the pipe laying vessel or barge. Pipe joints (approximately 12.2 m pipe sections) are typically transported by supply vessels from the support port to the pipelaying barge/vessel. Following alignment on the lay barge, the pipe joints are welded together to one long pipe string and then safely installed under tension to the seabed.

There are two main ways to install long large diameter subsea pipelines, S-lay, and J-lay. The choice of the method depends mainly on the water depth and/or cost of installation vessel.

In the S-lay installation, the pipe is assembled in a horizontal working plane, by welding together joints of steel pipe. As welding progresses, the pipeline is gradually lowered to the seabed behind the pipelaying vessel, supported by a ‘stinger’ (a steel structure protruding from the end of the firing line supporting the pipeline on rollers, to avoid pipe buckling). The name S-lay refers to the pipeline shape on its way to the seabed. This method, originally developed for shallow waters, now has evolved also for operation in deep waters, which can be achieved by larger installation vessels/barges and a longer and more curved stinger. Sufficient tension is required during the S-lay process to avoid overstressing the pipeline. This is maintained via tensioning rollers and a controlled forward thrust, keeping the pipe from buckling.

J-lay pipeline installation was developed for laying pipe in deep waters as it puts less stress on the pipeline by installing the pipeline in an almost vertical position. The pipe joints are on J-lay vessels/barges welded to the pipeline almost vertically via a tall tower on the boat, and then lowered into the sea under tension. Unlike the double curvature obtained in S-lay, the pipe only curves once in J-lay installation, taking on the shape of a "J" under the water. J-lay method becomes impractical for shallower waters where depth of less than 150 metres limit the shape of the pipe angle and impose sever bending stresses on the pipe.
At present it is foreseen that the TAP pipeline is installed using the S-lay method, or a combination or the S-lay and J-lay methods. Final choice will be based on competitive tendering from qualified vendors depending on proposed installation vessels or barges.

4.2.5.3 Pipeline Installation

The pipeline installation will be carried out after the completion of the landfall microtunnel. The pipeline installation in the microtunnel will be performed by means of a direct pull-in from an offshore pipelaying barge or vessel positioned outside the landfall microtunnel. A land-based winch, having a 300 tonnes pulling capacity as minimum, shall be placed in the working area, in the proximity of the tunnel shaft. A schematic profile of pipeline installation in nearshore section is shown in Figure 6 in Appendix 3 to Annex 7.

On the offshore pipelay barge/vessel a pipe string is prepared, and connected with the land-based winch, the winch then pulls the pipe string inside the microtunnel. The vessels continue the pipeline installation towards Albania as soon as the pipe pulling head reaches the launch shaft, and is ended with pipe laydown in a target box close to the Albanian coastline. The onshore pulling facilities will be demobilised after installation of a sufficiently long pipe string.

Figure 4-11 Typical S-lay vessel

![Typical S-lay vessel](Source: Internet (December 2011))
The pipelaying operation is typically carried out at a rate of 2 to 3 km of pipe laid per day. The pipe string, welded and coated in the barge, is paid out over the stern, the vessel moves forward by reeling in anchor chain at the bow while easing out over the stern. Once all the anchor chain is paid out, anchor handling tugs reset the anchors before the pipelaying vessel advances. If an anchored laybarge is selected, an anchor spread of typically 10-12 anchors is foreseen required to maintain the correct position and speed while laying pipe (Figure 4-12). A safety zone of about 2-3 km radius (depending on the anchor spread) will be adopted to avoid incident with marine traffic. The delivery of pipes, supplies and water and the crew change is carried out by specific vessels.

**Figure 4-12  Typical Anchor Spread for Anchored Lay Barges**

Source: Saipem (Project Basic Design 2013)
4.2.5.4 Vessels

The offshore construction activities will require a number of vessels. The main vessel will be the pipeline installation vessel, such as a Pipelaying Barge or a Dynamic Positioned Lay Vessel, (specialised vessels). In addition, other vessels will be needed in the construction activities, such as a supply vessel to provide the material needed, a crew vessel to ensure the crew shift, a pipe carrier barge, etc.

As a conservative assumption, the impact assessment in Section 8 refers to the use of a Pipelay Barge as a pipelay vessel.

Pictures showing examples of some of the typical vessels to be used are shown in Figure 7 in Appendix 3 to Annex 7.

Table 4-6 lists the type and number of vessels expected to be used for pipelaying.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipelay barge</td>
<td>1</td>
<td>20.5 MW</td>
</tr>
<tr>
<td>Anchor handling tug</td>
<td>3</td>
<td>12 MW</td>
</tr>
<tr>
<td>Supply Vessel</td>
<td>3</td>
<td>12 MW</td>
</tr>
<tr>
<td>Pipe carrier barge</td>
<td>3</td>
<td>7 MW</td>
</tr>
<tr>
<td>Crew boat</td>
<td>1</td>
<td>2 MW</td>
</tr>
</tbody>
</table>

4.2.6 Onshore Pipeline

4.2.6.1 Layout and Configuration

The trench digging operations and pipeline assembly require the opening of the Working Strip.

The overall width of the normal Working Strip will be 26 m, one side approx. 11 m wide for the stockpiling of trench excavated material and on the other side, a strip approx. 15 m wide to allow pipeline assembly and for transit of vehicles/machinery required for pipeline construction.

A reduced Working Strip, 22 m wide, will be applied where requested in the pipeline design due to technical reasons (i.e. connection to access roads).

Typical cross sections of the construction process are shown below for both the reduced Working Strip (Figure 4-13) and standard Working Strip (Figure 4-14).
4.2.6.2 Construction Method

Onshore pipeline construction is a sequential process and comprises a number of distinct operations, typically broken down into manageable lengths called “spreads,” and utilises highly specialised and qualified workgroups. Each spread is composed of various crews, each specialised in one activity. As one crew completes its activity in a position, the next crew moves in to complete its action.

Onshore pipeline construction activities foreseen for this project are described below, together with the techniques that will be used to cross features such as roads. Final construction techniques are determined during the detailed design.
4.2.6.2.1 Route surveying

A field survey has been performed in order to map the topography of the area and the land parcels. Environmental specialists and archaeologists supervised the topographic survey activities in order to identify and record environmental and archaeological aspects of interest. Prior to construction, the pipeline route will be surveyed and the centreline will be marked out. The centreline of the pipeline will generally be offset to one side of the Working Strip.

Other pre-construction site activities will include:

- assessment of construction materials quantities;
- assessment of specific construction methods; and
- installation of construction site and worksites.

4.2.6.2.2 Preparation of the Working Strip, Topsoil Stripping and Grading

Before starting any construction work, topographic and photographic records will be realized to characterize the existing condition of the pipeline route and the access roads. These records will be used as the reference against which the quality of the restoration work will be judged when construction work is completed.

The exact pipeline route will first be pegged out, while simultaneously staking out the width of the Working Strip on both sides of the route. Obstructions such as walls, fences and paths will be disturbed by the minimum amount necessary for safe working. Wall material will be carefully dismantled and stored for reuse.

Records of buried facilities such as drains and irrigation pipe locations will be prepared and verified with the landowner/user to prevent accidental damage during pipeline construction.

Existing third party services will be located, marked, and either safeguarded or diverted. Warning posts will be erected for overhead cables, and temporary crossing points clearly identified.

Although construction activities do not interfere with any tree included in the regional list of “monumental olive trees” (approved by the Regional Council with resolution n. 357 of 7 March 2013), there are olive trees of significant age and size along the working strip. TAP AG commits to restore the condition of the land to the ante-operam status through the reinstatement of the olive groves. Upon request of the landowner, and in agreement with the relevant authorities, alternative compensation measures could be applied (Figure 8 in Appendix 3 to Annex 7).

Olive trees will be suitably prepared for temporary removal and then transplanted.

In the case of olive trees located exactly on the centreline, these would be relocated a short distance from their original position in order to avoid the need for excavation on top of the pipeline.
Topsoil, which supports plant life and contains seed stock, will be removed from the Working Strip by suitable earth moving equipment and stockpiled in the form of a continuous ridge along the edge of the strip. The topsoil stockpile will be typically no higher than 2 m and will be stored in such a way that it is not mixed with other trenched materials or trafficked over by vehicles. If the topsoil requires long-term storage, then aeration and raking will be carried out regularly to avoid compaction.

The Working Strip will then be levelled, using typical construction site machinery to eliminate irregularities, large stones, tree stumps and other features.

**Table 4-7  Equipment expected for use in preparing the Working Strip**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavator</td>
<td>2</td>
<td>200-300 HP</td>
</tr>
<tr>
<td>Backhoe loader</td>
<td>1</td>
<td>200-300 HP</td>
</tr>
</tbody>
</table>

4.2.6.2.3  Pipe Stringing and Pipe Bending along the Working Strip

The pipeline will be constructed from approximately 12 to 18 m long sections of steel pipe. The individual sections will be transported to the Working Strip from the pipe storage yard in the Construction site.

This activity involves transporting the pipes from the storage areas and positioning them along the working strip. This operation will be carried out using side-booms and tracked vehicles suitable for pipe transportation.

The pipe will be unloaded with a mounted pipelayer crane, and side boom, and placed end-to-end alongside the future trench, taking special care of the bevelled pipe joint ends (*Figure 4-15*).
Before the pipe is prepared for welding, a bending crew will bend the pipe in place where necessary, to match terrain contours (Figure 4-16). The crew will use a hydraulic bending machine to put gradual bends in the pipe. This equipment bends individual joints of pipe to the desired angle at locations where there are significant changes in the natural ground contours, or where the pipeline route changes direction. The bending will be limited to making many small bends along the length of a pipe section until the desired bend angle has been reached.

Figure 4-16  Pipe Bending

Source: ERM (October 2011)
The pipeline centreline will be surveyed with bending limitations in mind. Where the bend cannot be made gradually enough to meet specific conditions, a prefabricated factory bend will be inserted into the pipeline. These conditions will be identified prior to construction.

### Table 4-8 Equipment expected for use in pipe stringing and bending

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane 25 t (pipelayer)</td>
<td>1</td>
<td>200-300 HP</td>
</tr>
<tr>
<td>Side boom</td>
<td>1</td>
<td>200-300 HP</td>
</tr>
<tr>
<td>Pay-welder</td>
<td>1</td>
<td>200-300 HP</td>
</tr>
<tr>
<td>Pipe bending machine</td>
<td>1</td>
<td>200-300 HP</td>
</tr>
</tbody>
</table>

#### 4.2.6.2.4 Pipe Welding

The individual sections of pipe will be welded together to form the pipeline (*Figure 4-17*).

**Figure 4-17 Pipe Welding**

![Pipe Welding](source: ERM (October 2011))

The weld will consist of several passes (layers) depending on the pipe wall thickness. The pipes will be joined together using a motor-driven welding machine by a continuous wire arc welding process.
Pipes will be joined by connecting and welding several pipes so that a pipe string is formed and placed on temporary supports along the edge of the trench.

The weld will be tested by Non-Destructive Testing (NDT) with radio graphic inspection, and any test results of questionable quality will be retaken. Any welds indicating defects will be remedied by repair or replacement. In this eventuality, the weld will be re-tested.

**Table 4-9  Equipment expected for use in pipe welding**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pay-welder</td>
<td>1</td>
<td>200-300 HP</td>
</tr>
<tr>
<td>Welding machine</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Side-boom</td>
<td>1</td>
<td>200-300 HP</td>
</tr>
<tr>
<td>Engine driver compressor</td>
<td>1</td>
<td>200-300 HP</td>
</tr>
</tbody>
</table>

4.2.6.2.5 Joint Coating

After the welds have been checked, tested and approved, the coating crew will clean the exposed steel section at the joint between the pipes, sand-blast the steel, and apply a protective coating to it. The coating will be heat-shrinkable polyethylene sleeves around the pipe.

The pipeline will be examined for coating damage after installation.

The entire pipeline coating will be electronically inspected, using Direct Current Voltage Gradient (DCVG) or any equivalent technique, to assess the condition of coating to locate and repair any coating faults or voids.

4.2.6.2.6 Trench Digging

The onshore pipeline will be laid in a trench generally around 2.6 m deep. The trench (see *Figure 9 in Appendix 3 to Annex 7*) will be approximately 1.4 m wide at the base and will be excavated to the requisite depth by an excavator or specialised trenching equipment suitable for the morphological and lithological characteristics of the ground to be crossed (i.e. excavators in loose ground, hydraulic hammers in rock) (*Figure 4-18*).
Figure 4-18  Pipe Trench Excavation

The excavated subsoil will be placed adjacent to the topsoil pile (separated to prevent mixing).

Table 4-10  Equipment expected for use in trench digging

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavators</td>
<td>2</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Trucks</td>
<td>2</td>
<td>200-300 hp</td>
</tr>
</tbody>
</table>

4.2.6.2.7  Pipe laying and Backfilling

The welded pipeline will be raised off the skids and lowered into the trench by a team of side boom operators (Figure 4-19). All rock will be removed from the trench prior to the lowering-in operation. It will be ensured that in any case only stone-free material will be used for bedding the pipe sections. In areas of rocky terrain, sand or sieved backfill material will be placed in the bottom of the trench and on both sides of the pipe for protection purposes.
Before the pipe section is laid in the bottom of the trench, the insulation will be re-tested. Following pipe laying the wooden skids or sand bags will be moved to the next trench section. All other debris will be removed from the site and the trench will be inspected to ensure that no debris has fallen in.

Backfill will normally be placed over the pipeline immediately after the pipe section has been lowered into the trench. Backfill material in the direct vicinity of the pipe will be compacted in layers. A backhoe loader will be used to replace the excavated material into the trench to cover the pipe. Extreme care will be taken with the initial fill to avoid damage to the coating. After the initial layer of screened material is placed into the trench, the remaining soil and rock mixture will be replaced to complete the backfill (Figure 4-20).
In order to avoid any damage to the pipeline coating and the bottom of the trench, the padding material will consist of well graded, sandy material.

The depth of material on top of the pipeline after construction will be 1,5 m. Trenching material not used for backfill will be removed and disposed according to legal requirements.

Table 4-11  Equipment expected for use in pipe laying

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side-boom</td>
<td>4</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Excavator</td>
<td>2</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Backhoe loader</td>
<td>1</td>
<td>200-300 hp</td>
</tr>
</tbody>
</table>

4.2.6.2.8  Reinstatement

After completion of backfill, the restoration operation will begin. The removed top soil will be placed back on the working corridor. The original contours of the land will be restored as closely as possible (Figure 4-21). As part of the restoration process, all equipment will be removed and access roads reinstated.
Particular care will be taken to ensure that land drainage infrastructure, access roads, other networks and facilities, and olive trees that were disturbed/moved during construction, will be reinstated to their former state. Photographic records will be made of the route, where necessary, before and after the works.

All posts and markers will be located to minimise interference with agricultural activities. Cathodic protection system test posts will be installed.

The final stage in the pipeline construction process, once reinstatement is established, is the removal of the temporary fencing where it has been installed.

### Table 4-12  Equipment expected for use in Reinstatement

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavator</td>
<td>2</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Backhoe loader</td>
<td>1</td>
<td>200-300 hp</td>
</tr>
</tbody>
</table>

Source: ERM (October 2011)
Morphological and Hydraulic Restoration Works

Based on desktop information there are no morphological or geological difficulties anticipated in the areas crossed by the route. The excavation work for pipeline construction will not result in significant alteration to or interference with the hydrogeological system of the area. For these reasons, no particular operations or works are necessary, as the good geological characteristics of the sites, especially with regard to excavation stability, will enable the pipeline to be laid in safe conditions.

Following the pipeline backfilling operation, prior to the completion of the above-mentioned restoration works, a preliminary phase involving general tidying up of the line will be carried out. This consists of the levelling of the area affected by the works and the reconfiguration of pre-existing slopes, restoring the original morphology of the ground, and proceeding to the re-activation of ditches and channels, as well as of pre-existing flow lines. During ground levelling, particular care will be taken in order not to leave holes or hollows that could create problems for subsequent farming activities.

The former topsoil layer will be reinstated on top of pipeline backfilling. Attention will be paid to the latter operation on route sections running through arable land and permanent cultivations, which are essentially flat with a good pedogenic substrate. Stone removal activities will also need to be carried out, where necessary.

To complete the construction works, the required environmental restoration work will be carried out. The purpose of this work is to reinstate the pre-existing natural balances in the area and, at the same time, prevent the development of situations of instability that could compromise the safety of the pipeline itself.

In consideration of the morphology of the territory crossed by the pipeline, the morphological restoration works will essentially consist, in the event of demolition, of the reconstruction of the structures affected by the planned works, returning them to their original condition.

**Dry stone wall reinstatement**

With regard to the existing structures, attention should be drawn to the numerous dry stone walls that are a typical feature of the Salento landscape. These border walls, which separate the various plots of land or delimit roads, were built using stone materials of a calcareous and/or calcarenitic nature, found in situ and often the result of the de-stoning of the adjacent fields.

During construction works, some of them will be dismantled along the Working Strip preparation. During reinstatement operations, these walls shall be rebuilt observing their original dimensions and using the original stone materials duly set aside before pipeline installation works.
The building technique can be briefly described as follows.

First the base is built with two parallel rows of large stones. Then, over this base, another two rows of smaller stones are positioned and so on until the desired height is reached. Larger stones are positioned on top of the wall in order to tie the stones below. Finally, the interstices among the stones are filled with very small stone materials, in order to stabilise the entire structure (Figure 10 in Appendix 3 to Annex 7).

**Olive Tree Reinstatement**

Although construction activities do not interfere with any tree included in the regional list of “monumental olive trees” (approved by the Regional Council with resolution n. 357 of 7 March 2013), there are olive trees of significant age and size along the working strip. TAP AG commits to restore the condition of the land to the ante-operam status through the reinstatement of the olive groves. Upon request of the landowner, and in agreement with the relevant authorities, alternative compensation measures could be applied.

In the case of olive trees located exactly on the centreline, these would be relocated a short distance from their original position in order to avoid the need for excavation on top of the pipeline.

Reinstatement activities (Figure 8 in Appendix 3 to Annex 7) will be the following:

- Restoration of the original site;
- Excavation, mulching and fertilisation of the new hole;
- Plant positioning with the wire net and without cloth;
- Sod sealing;
- Installation of 3 or 4 stakes around the plant, in order to strengthen it against the wind;
- First irrigation until sod filling is complete.

The best transplanting period is in autumn – winter (from October to February).

An agronomics plan will be prepared in order to ensure the successful reinstatement of the transplanted olive trees. This plan will be prepared by an agronomist and based on periodic examination of the olive trees to assess their condition and to identify water and fertiliser needed.

4.2.6.3 Fencing

The PRT and block valve station shall be permanently fenced.

Temporary fencing will also be installed along the pipeline route during the construction.
4.2.6.4 Crossings

4.2.6.4.1 Road Crossings

In addition to the one provincial road and one minor asphalt road crossing by microtunnel upstream of Kp 0 the route crosses the following roads:

- “Strada provinciale Lecce Melendugno”, crossed at Kp 6.5, that will be crossed through the trench-less method;
- “Strada Comunale S. Viceta”, crossed 4 times at Kp 0.6, Kp 1.1, Kp 2 and Kp 4, that will be crossed through the open cut method, with a protective casing pipe.

At locations where the pipeline crosses secondary roads, the crossing will be accomplished by the open cut method with or without protective casing. The choice of the installation method will depend on several factors, such as depth of the installation, presence of water or rock, traffic intensity, Authorities’ provisions, etc.

The casing pipe will be installed in the same way as the pipeline installation, by means of digging, laying and backfilling operations.

Traffic will be diverted around the crossing via detours or temporary roads. To minimise the duration of traffic disruption, the pipe will be prepared prior to commencement of roadway excavation.

Once the pipeline has been installed, the trench will be backfilled and compacted in layers in accordance with relevant agency specifications. The roadway will then be resurfaced over the compacted trench. Final selection of crossing methods will be coordinated with the appropriate road management authority.

A typical road crossing with casing pipe is shown in Figure 11 in Appendix 3 to Annex 7.

The pipe casing will have the characteristics shown in the following table.

**Table 4-13 Pipe Casing Characteristics**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal diameter</td>
<td>DN 1050 (42&quot;)</td>
</tr>
<tr>
<td>Thickness</td>
<td>14.3 mm</td>
</tr>
<tr>
<td>Material</td>
<td>EN L415NB or X60 grade steel</td>
</tr>
</tbody>
</table>

A typical road crossing by the open cut method is shown in Figure 13 in Appendix 3 to Annex 7.
4.2.7 Pipeline Receiving Terminal

4.2.7.1 Layout and Configuration

A visual representation of the Pipeline Receiving Terminal (PRT) is shown on Figure 4-4. More detailed layout plan is provided as Figure 3 in Appendix 3 to Annex 7 Construction Method.

The following construction steps are usually followed for such facilities:

- Surveying;
- Preparation of temporary facilities such as storage areas, office facilities;
- Preparation of the construction site;
- Earthworks;
- Preparation of foundations;
- Erection of equipment and buildings;
- Laying of cables and electrical works;
- Piping and mechanical works;
- Construction of internal roads;
- Installation of operational and instrumentation systems.

4.2.7.2 Construction Plant and Equipment

The equipment used for the construction of a PRT comprises mainly conventional construction equipment described in Section 4.2.1.1.

Table 4-14 Equipment expected for use in the construction of the PRT

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavator/Rock-breaker</td>
<td>4</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Backhoe loader</td>
<td>1</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Truck</td>
<td>12</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Crane/pipelayer</td>
<td>2</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Side-boom</td>
<td>1</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Pipe Bending Machine</td>
<td>1</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Drilling equipment</td>
<td>2</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Ram</td>
<td>2</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Chisel equipment</td>
<td>2</td>
<td>200-300 hp</td>
</tr>
</tbody>
</table>
4.2.8 Component: Block Valves

4.2.8.1 Layout and Configuration

An example of a typical fence and layout of a block valve station (BVS) is displayed in Figure 4-2.

4.2.8.2 Construction Method

The following construction steps are usually recognised in such facilities:

- Preparation of the construction site;
- Earthworks;
- Preparation of foundations;
- Erection of equipment and building;
- Laying of cables and electrical works;
- Piping and mechanical works;
- Installation of operational and instrumentation systems.

4.2.8.3 Construction Plant and Equipment

The following equipment is expected to be used for the construction of the BVS.

**Table 4-15 Equipment expected for use in the construction of BVS**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavator</td>
<td>1</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Crane 50 t / Side boom</td>
<td>1</td>
<td>200-300 hp</td>
</tr>
</tbody>
</table>

4.2.9 General Approach to Reduce the Impact on Olive Groves

This section describes the proposed TAP approach to be applied in Southern Italy when a pipeline crosses olive groves, in order to reduce the impact.

It is an unwritten practice to cross olive groves using a reduced Working Strip (22 m).

Although construction activities do not interfere with any tree included in the regional list of “monumental olive trees” (approved by the Regional Council with resolution n. 357 of 7 March 2013), there are olive trees of significant age and size along the working strip. TAP AG commits to restore the condition of the land to the ante-operam status through the reinstatement of the olive groves (*Figure 8, in Appendix 3 to Annex 7*). Upon request of the landowner, and in agreement with the relevant authorities, alternative compensation measures could apply.
4.2.10 Pre-commissioning Phase

4.2.10.1 Offshore Pipeline Testing and Pre-commissioning (Hydrotesting)

The purpose of offshore hydrostatic testing is to confirm the integrity of the offshore pipeline laid from Italy and Albania.

The pipeline will be flooded by injecting seawater (not chemically treated and filtered to 50 micron) into the pipeline via a temporary pipeline inspection gauge (PIG) launcher installed to the pipeline’s end at the worksite near the landfall. The water will be taken from the sea by a water winning spread (pumps).

First, the pipeline will be inspected and cleaned. Filtered seawater will be injected at a minimum rate of 1,000 m³/hr (equal to a velocity of 0.5 m/s in the 36”pipeline). An adequate vent will be open on the temporary PIG launcher during the flooding operation to avoid a vacuum in the temporary equipment, and to vent air once the pipeline is adequately water filled. Once water is seen discharging from this vent, the vent point on the temporary PIG launcher shall be closed.

Once the pipeline has been flooded and all air has been discharged from the system both in Italy and Albania, the flooding operation is complete.

Once the pipeline has been flooded, a cleaning and gauging PIG train will be launched into the system from the PIG launcher in the Italian side.

The PIG train will be propelled through the pipeline by a pumping spread located in the pull-in area at the Italian landfall.

The water ahead of the PIG train and the water slugs between the PIGs is planned to be discharged to the sea in Albania via the temporary discharge system. The discharge system shall allow for monitoring and regulating the flow in addition to having an actuated isolation valve to remotely stop the operation should it become necessary.

Once the pipeline has been cleaned and gauged, it shall be subjected to a hydrotesting operation as per Standard (DNV) OS-F101.

A pressurisation spread, located in the worksite at Kp 0.000, will be fed from the water winning spread and shall be used to raise the pressure in the pipeline to the specified test pressure. After stabilisation, the system shall undergo a 24 hrs hold period with acceptance criteria as detailed in DNV OS-F101.

Once the hydrotesting has been accepted, the system shall be depressurised to ambient pressure. Water bled from the system shall be discharged to the sea in Albania via the temporary discharge system.

Upon completion of hydrotesting operation, the pipeline shall be dewatered. A PIG dewatering train shall be launched from the temporary PIG launcher in Italy.
Once the PIG train has been launched into the pipeline, it shall be propelled towards the PIG receiver in Albania with dry air and with a dew point lower than -40 degree Celsius. Dew point of the air shall be monitored prior to injection into the pipeline in Italy.

Water ahead of the PIG train and the water slugs between the PIGs shall be discharged to the sea via the temporary discharge system in Albania.

When all PIGs of the dewatering train have been received into the temporary PIG receiver in Albania, the dewatering operation is complete. Prior to further drying operations, the pipeline shall be depressurised to ambient pressure. Depressurisation of the pipeline shall be done in Albania and a silencer shall be used to limit the noise during depressurisation.

Once the pipeline has been depressurised, pipeline drying operation will commence. Dry air shall be injected into the pipeline in Italy and dew point of the air being discharged in Albania shall be monitored. Once the dew point of the air discharged in Albania reaches an acceptable level (lower than criterion of acceptability), the pipeline shall be shut in for 24 hrs to perform a “soak” test.

Upon completion of the 24 hrs “soak” period, dry air, equal to minimum one line fill volume, shall be injected into the pipeline from Italy. The discharged air in Albania shall be monitored for dew point and if an acceptable level is obtained, then the drying operation is complete. Should the dew point prove to be unacceptable, then the drying operation shall be continued and “soak” test repeated until a satisfactory result has been obtained.

**Table 4-16   Equipment and vessels expected in the offshore pipeline hydrotsting**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine driven centrifugal pump</td>
<td>6</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Engine driven pressuring pump</td>
<td>6</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Primary compressor</td>
<td>28</td>
<td>1.2 MW</td>
</tr>
<tr>
<td>Booster compressor</td>
<td>14</td>
<td>1.2 MW</td>
</tr>
<tr>
<td>Desiccant driers</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Motoponton / Barge</td>
<td>1</td>
<td>8 MW</td>
</tr>
</tbody>
</table>
4.2.10.2  Onshore Pipeline Testing and Precommissioning (Hydrotesting)

The purpose of onshore hydrostatic testing is to confirm the integrity of the onshore pipeline.

The methodology is the same as that of the offshore Hydrotesting, but freshwater instead of seawater will be used.

Following pipeline construction, hydraulic testing shall be performed by filling the line with water at a minimum pressure of 1.3 times the pipeline design pressure for a period of 48 hours.

Only following the successful result of the hydraulic test and pipe dewatering, the onshore and offshore pipeline sections will be welded together. Each weld shall be checked using a non-destructive testing system.

Once hydraulic testing and pipeline backfill are completed, a further coating integrity test shall be performed. This test consists of an appropriate measure of the electric flux.

The estimated fresh water volume for the onshore hydraulic test is 4,900 m³. This water will be supplied by water tanks and will not be chemically treated. At the end of the test, the water will be disposed in conformity with legal requirements.

Immediately following successful completion of the pressure test, the tested section will be dewatered using Pipeline Inspection Gauges (PIGs).

**Table 4-17  Equipment expect for use in the onshore hydrotesting**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
<th>Engine Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine driven compressor</td>
<td>3</td>
<td>200-300 hp</td>
</tr>
<tr>
<td>Engine driven pump</td>
<td>3</td>
<td>200-300 hp</td>
</tr>
</tbody>
</table>
4.3 Operational Phase

4.3.1 Pipeline Operation

4.3.1.1 Operating Philosophy

The primary objective of the operating and control philosophy to be developed for the TAP system is to provide the basis for safe, reliable and efficient pipeline operation with an optimum of operations and maintenance personnel, consistent with current practices in the pipeline industry.

The scope of such philosophy covers:

- Common functionality of the entire TAP system;
  - Control modes;
  - Pipeline operation, based on station operation;
  - Leak detection, PIG tracking, simulation, scheduling, etc.;

- Compressor station functionality;
  - Compressor station operation;
  - Compressor station safety;

- PRT functionality;
  - PRT operation;
  - PRT safety;

At each Compressor station (in Greece and Albania) and the PRT, there shall be an Integrated Control and Safety System (ICSS) comprising a Station Control System (SCS) and an integrated Emergency Shutdown system (ESD). In addition, there is a separate Fire and Gas (F&G) detection system. Each of these systems shall communicate via a fibre optic-based telecommunication system running the entire length of the pipeline.
4.3.1.2 The Supervisory Control Centre

The PRT control system will permit full operational monitoring and control of the terminal. Moreover, inside the PRT the control and supervision centre of the entire pipeline will be located. Detailed operating procedures for the pipeline control system will be developed. These procedures will be in place ahead of pipeline operation. The operating procedures will typically address the following:

- An administrative system covering legal considerations, work control and safety;
- Clear and effective emergency procedures and operating instructions;
- Adequate and regular training of all personnel involved in operational and maintenance issues;
- A comprehensive system for monitoring, recording and continually evaluating the condition of the pipeline and associated equipment;
- A system to control all development or work in the vicinity of the pipeline;
- Effective corrosion control and monitoring;
- A system to collect and collate information on third party activities; and
- Monitoring of restoration, and the undertaking of remedial work as necessary.

The pipeline including the entire offshore part between Albania and Italy will be monitored and controlled 24 hours a day and 365 days a year from a central control room. The monitoring system is a SCADA System (System Control and Data Acquisition), during operation, leak detection will be by continuous measurements of pressure and flow rates at the inlet and outlet of the stations and pipeline. If a leak is detected, an alarm is triggered. To allow internal inspection, pigging facilities will be installed. The pipeline system has been designed to allow use of instrumented pigs.

4.3.1.3 SCADA and communication systems

4.3.1.3.1 SCADA System

The Supervisory Control and Data Acquisition System is a backend system that has overall control of the pipeline and station operation. It is one of the main instance regarding core business aspects. It comprises a series of control and acquisition functions that include, amongst others, the

- Transport operation (monitoring, process insight, alarms, thresholds, etc.)
- Overall pipeline security including all BVS and tie-in valves of each station
- Overall pipeline Ordered Shutdown triggering
- Logging
- Simulation
- Engineering
- Etc.
The SCADA system will be placed in the Supervisory Control Centre and be backed up with a Backup Supervisory Control Centre. The BSCC will take over in failed attempts of use the SCC.

SCADA heavily relies on the communication infrastructure alongside the pipeline, the so called Passive and Active Optical Network (PON/AON).

4.3.1.3.2 Leak Detection System

The Leak Detection System shall eliminate the threat of undetected and unwanted depressurization of parts or the entire pipeline. It monitors by technical means the status of the pipeline and warns or acts in case of imminent danger to the pipeline itself or the business (loss of gas). A mechanism will be implemented relying on sensors along the pipeline to detect malfunctions. A certain level of automation can be achieved to prevent losses and danger to human life. The LDS will report to the SCADA system.

4.3.1.3.3 Passive Optical Network

The Passive Optical Network is the physical transport layer of the communication backbone. It serves as the carrier for the numerous systems with communication needs. Infrastructure-wise optical distribution frames will offer the possibility to implement various systems for wide area network connections. It comprises a number of fibre optical cables, installed along the entire pipeline. Spare capacities for future expansions or third party business (like bright/dark fibre interconnections for telcos or data carriers) can be allocated.

4.3.1.3.4 Active Optical Network

The Active Optical Network is the actual communication backbone. It features a setup of different channels, protocols and capacities to allow flexible interconnection of all relevant systems. Distances of up to one hundred (100) kilometres per hop can be spanned. By making the AON available in all stations and block valve stations various services can be delivered to any point in the ring, like telephony, video conferencing, data access, remote control, etc. It is also able to deliver redundancy.

4.3.2 Alarm and Monitoring System

4.3.2.1 Gas Detection System

The Gas Detection System detects gas leakages on the station inside the fuel gas building as well as in the open range, e.g. gas heaters, metering piping and other above ground piping within the station limits. One warning and one alarm can be caused by the GDS, the detection of 20% and 40% lower explosion limit in the proximity of its sensors. The GDS reports to the station’s ESD system as well as to the station’s DCS and to the SCADA system.
4.3.2.2 Fire Detection System

The Fire Detection System detects smoke and fires within the station buildings, inside the fuel gas building and in the open range, e.g. gas heaters, metering piping and other above ground piping within the station limits. One warning and one alarm can be caused by the FDS, a fire warning and a fire alarm. The FDS reports to the station’s ESD system as well as to the station’s DCS and to the SCADA system.

4.3.2.3 Audio Visual Alerting System

The Audio Visual Alerting System generates an audible and visible alert notification, distributed across the entire station. It serves as evacuation alert to all personnel in hazardous or potentially hazardous areas. The AVAS is triggered by the FDS, GDS or manually in case of gas, fire or any other situation deemed hazardous. Among others it reports into the SCADA system.

4.3.3 Pipeline Maintenance

On a separate plot inside the PRT a receiver scraper station will be provided for inspection of the pipeline (determination of possible corrosion rate, wall thickness and inner surface diagnostics). PIG launching and receiving will be by manual operation, accompanied by a PIG tracking system.

Furthermore, a Pipeline Integrity Management System (PIMS) will be developed to control ongoing monitoring / maintenance during system operation, with special focus on corrosion control.

4.3.3.1 Access to Pipeline for Maintenance

The roads that will be used to access the pipeline for maintenance will be the same as those used in construction activities.

4.3.4 PRT, Metering Stations

4.3.4.1 Receiving facilities

A metering system will be installed in the PRT to measure the pipeline flow rate for the purpose of operational control and as a basis for the leak detection system of the main pipeline.

4.3.4.2 Electrical power supply

Power requirements of the pipeline receiving terminal (PRT) will be met by a medium Voltage electricity transmission line and substation, which will connect the installations with medium voltage network in the station area. For back-up power supply diesel engine driven power generators are provided.

The following electrical systems will be installed:

- Transformers
- Medium voltage switchgear;
- Low voltage switchgear;
Emergency power supply with diesel generators;
Uninterruptible power supply;
Grounding and lightning protection;
Building installations;
Outdoor lighting.

PRT station will contain electrical circuits with the following voltages:
- Medium voltage three phase AC system;
- 400V three phase AC system (main power system);
- 400 V three phase AC emergency power system;
- 230 V single phase AC UPS system;
- 110 V DC UPS system;
- 24 V DC UPS system.

SCC will contain electrical circuits with the following voltages:
- Line in medium voltage network or 400 V grid operator
- 400V three phase AC system with diesel emergency generator (main power system);
- 230 V single phase AC UPS system;
- 24 V DC UPS system.

The electricity furniture will be done via the public grid and supported by emergency power supply and backup provisions.
4.3.5 Inspection and Maintenance

The TAP system will be monitored and maintained to ensure that the system, as designed, constructed and tested, remains "fit for purpose" throughout the design life as well as minimising environmental and human risk. In general, pipeline surveillance, function checks and condition monitoring will be used to anticipate system problems and allow them to be rectified in a timely manner. Planned maintenance management will be implemented through a combination of modern management techniques, information technology and innovative technical engineering analysis with the aim of minimizing any risks associated with long-term plant and equipment operation. The incorporation of planned maintenance has been a fundamental element of project development to date and it will be implemented throughout the operation of the pipeline system.

Pipeline inspection and maintenance (including potential repair) activities during operation will include the following tasks:

- Pipeline monitoring (pigging and outside inspection);
- Onshore route surveillance, possibly with road vehicles;
- Offshore route surveillance, using ROV and/or Side Scan Sonar and other techniques;
- Monitoring of population and third-party activities in close proximity to the onshore pipeline;
- Corrosion protection system monitoring;
- Functional operational checks and verification of plant and equipment;
- Routine maintenance of plant and equipment at pre-defined interval; and
- Repair as necessary (it is worth noting that the need for repair works on the pipeline is highly unlikely, ref. Section 8.12).

Intelligent pigging of the pipeline will be undertaken on a regular basis to confirm the geometry of the pipeline, to check and monitor pipeline wall thickness and following suspected damage or a seismic event.
4.4 Use of Resources and Environmental Interferences

4.4.1 Introduction

The following sections describe the main interactions of the Project to the environment in terms of “use of resources” and “environmental interference”.

These interactions are assessed for both construction and operation phases.

4.4.2 Land Use

4.4.2.1 Construction Phase

During construction phase, land will be needed for:

- Access roads and site access;
- Construction sites including storage and parking;
- Temporary infrastructure (e.g. pipeline manufacturing plant, administration buildings, concrete plants).

After use for construction, most sites will be restored to their original condition. Exceptions may be accepted where, after consultation with the relevant authorities and stakeholders, a decision is made to hand over the facility (for example a building) to be used and maintained by the local population.

The Table 4-18 below summarises the land use required by the construction activities, at this stage.

### Table 4-18 Land Use – Construction Phase

<table>
<thead>
<tr>
<th>Component</th>
<th>Temporary Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline (8.2km)</td>
<td>Working strip: max 26m working strip → 213,200 m²</td>
</tr>
<tr>
<td>Access roads to PRT</td>
<td>New Road 1 to access to PRT: 5,993 m² (partially included in PRT area)</td>
</tr>
<tr>
<td>New Road 1: 922 m → 6.5m width</td>
<td>New Road 2 to access to PRT: 4,654 m² (partially included in PRT area)</td>
</tr>
<tr>
<td>New Road 2: 716 m → 6.5m width</td>
<td></td>
</tr>
<tr>
<td>Access roads to BVS</td>
<td>New Road to access to BVS: 637 m²</td>
</tr>
<tr>
<td>New Road: 98 m → 6.5m width</td>
<td>Upgrade road to access to BVS: 3,738 m²</td>
</tr>
<tr>
<td>Upgrade Road: 575 m → 6.5m width</td>
<td></td>
</tr>
<tr>
<td>Block valve station</td>
<td>13m x 14m = 182 m²</td>
</tr>
<tr>
<td>Construction site/ Pipeline receiving terminal</td>
<td>120,000 m² (12.0 Ha)</td>
</tr>
<tr>
<td>Worksite (1)</td>
<td>26,000 m²</td>
</tr>
<tr>
<td>Landfall</td>
<td>n/a</td>
</tr>
<tr>
<td>Road crossings</td>
<td>n. 9 Included in pipeline land use</td>
</tr>
</tbody>
</table>
4.4.2.2 Operation Phase

Land will be acquired for permanent project structures and to allow for operations, maintenance and emergency access throughout the operational life of the project.

A major criterion of the project design has been that, as far as is practical, permanent infrastructure should be sited on unused land of no particular ecological or cultural value. Where this has not been possible, effort has still been made to avoid land on which there are dwellings or public infrastructure, or which is of high value as a habitat or for agriculture.

A Right of Way (RoW) is foreseen along the pipeline route. Regarding permanent constraints, no construction activities will be allowed in the 20 metres of the RoW in both the side of the pipeline (40 m strip), no clusters of houses construction activities will be allowed in a strip of 100 metres on both sides of the pipeline (200 m strip).

The Table 4-19, below, summarises the land use required by the Operation activities.

**Table 4-19 Permanent Land Use in Operation Phase**

<table>
<thead>
<tr>
<th>Component</th>
<th>Permanent Land Take</th>
<th>Permanent Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline (8,200 km)</td>
<td>-</td>
<td>40 m → 328,000 m² (no single building allowed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200 m → 1,640,000 m² (no cluster building allowed)</td>
</tr>
<tr>
<td>Access roads to PRT</td>
<td>New Road 1 to access to PRT: 5,993 m² (partially included in PRT area)</td>
<td></td>
</tr>
<tr>
<td>New Road 1: 922 m → 6.5 m width</td>
<td>New Road 2 to access to PRT: 4,654 m² (partially included in PRT area)</td>
<td></td>
</tr>
<tr>
<td>New Road 2: 716 m → 6.5 m width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access roads to BVS</td>
<td>New Road to access to BVS: 637 m²</td>
<td></td>
</tr>
<tr>
<td>New Road: 98 m → 6.5 m width</td>
<td>Upgrade road to access to BVS: 3,738 m²</td>
<td></td>
</tr>
<tr>
<td>Upgrade Road: 575 m → 6.5 m width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Block valve station</td>
<td>13 m x 14 m = 182 m²</td>
<td>-</td>
</tr>
<tr>
<td>Pipeline receiving terminal</td>
<td>120,000 m² (12 Ha)</td>
<td>-</td>
</tr>
</tbody>
</table>
4.4.3 Materials and Fuels

4.4.3.1 Construction Phase

4.4.3.1.1 Materials

During the construction activities, various types of materials needed for the project execution will be used.

An estimation of the main materials consumption foreseen during the construction activities is shown in Table 4-20.

Table 4-20 Material Consumption

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Offshore</strong></td>
<td></td>
</tr>
<tr>
<td>Steel</td>
<td>30,000 t</td>
</tr>
<tr>
<td>Concrete</td>
<td>20,000 t</td>
</tr>
<tr>
<td>Coating</td>
<td>400 t</td>
</tr>
<tr>
<td><strong>Onshore</strong></td>
<td></td>
</tr>
<tr>
<td>Steel</td>
<td>4,000 t</td>
</tr>
<tr>
<td>Concrete</td>
<td>2,500 t</td>
</tr>
<tr>
<td>Polyethylene tape</td>
<td>80 t</td>
</tr>
<tr>
<td>Sand</td>
<td>20,000 t</td>
</tr>
</tbody>
</table>

4.4.3.1.2 Fuels

Vessels, heavy equipment and motor engine driven equipment will be fuelled with diesel and naval fuel oil.

Diesel fuel will be delivered via approved fuel road tankers to the support port or the Construction site.

For the vessels, the fuel will be pumped into the ships’ tanks via the tanker and all precautions taken to eliminate spills. Additionally there will be sufficient mops, pads and absorbents available during the fuelling process, whereby in the unlikely event of any occurring spill, it will be dealt with immediately.
The estimate of fuel consumption is reported in Table 4-21.

### Table 4-21 Fuel consumption for construction activities

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Use</th>
<th>Quantity (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel</td>
<td>Equipment and vehicles</td>
<td>15,000</td>
</tr>
<tr>
<td>Marine Diesel</td>
<td>Vessels</td>
<td>15,000</td>
</tr>
</tbody>
</table>

4.4.3.2 Operation Phase

4.4.3.2.1 Materials

During the operations phase, only a small quantity of materials will be used, mainly for maintenance of equipment at PRT.

4.4.3.2.2 Fuels

A fuel gas unit will be provided for the conditioning of the fuel gas in line with the defined requirements. The fuel gas is taken from the outlet side of the PRT as the lowest pressure level is expected there. As the gas could be taken also during the shutdown of the PRT by the SRG Network, the fuel gas flow will be measured through an appropriate flowmeter, provided with a measuring system for billing.

It should be noted that boilers will be in operation only for limited periods (e.g. due to fluctuations in SRG Network), or in transient conditions (e.g. pipeline restart after shutdown), only when the electrical heaters should not be able to meet the need for heating.

Diesel fuel will be used for the emergency generator and the firewater emergency pump.

4.4.4 Water Consumption:

4.4.4.1 Construction Phase

The foreseen water consumption during construction phase is related primarily to the watering of the construction sites to reduce dust emissions due to earthmoving activities and for domestic uses.

In the commissioning phase, water consumption is related to the hydrotesting activities, fresh water for the onshore pipeline, and seawater for the offshore pipeline.

The fresh/industrial water will be supplied from a tanker.
The following Table 4-22 shows the estimated water consumption foreseen during the construction activities.

### Table 4-22 Water Consumption

<table>
<thead>
<tr>
<th>Typology</th>
<th>Quantity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Offshore</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seawater</td>
<td>65,000 m³</td>
<td>For hydrotesting</td>
</tr>
<tr>
<td>Domestic water</td>
<td>Max 24 m³/day</td>
<td>60 l/person per day</td>
</tr>
<tr>
<td>Industrial water</td>
<td>10 m³/day</td>
<td>Other use</td>
</tr>
<tr>
<td>Industrial water</td>
<td>10,000 m³</td>
<td>Slurry microtunneling</td>
</tr>
<tr>
<td><strong>Onshore</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic Water</td>
<td>Max 12 m³/day</td>
<td>60 l/person per day</td>
</tr>
<tr>
<td>Industrial water</td>
<td>5/10 m³/day</td>
<td>Working strip humidification</td>
</tr>
<tr>
<td>Industrial water</td>
<td>4,900 m³</td>
<td>Hydrotesting</td>
</tr>
<tr>
<td>Industrial water</td>
<td>3,000 m³</td>
<td>Slurry microtunneling</td>
</tr>
</tbody>
</table>

#### 4.4.4.2 Operation Phase

During the operation phase, the water consumption will be related to the PRT operation. This consumption will be very low and connected to domestic use, maintenance and irrigation. Water for fire fighting purposes will be stored in a tank.

#### 4.4.5 Transportation and Traffic

#### 4.4.5.1 Construction Phase

#### 4.4.5.1.1 Offshore

The project results in an increase of vessel traffic on local routes connecting with the mainland, and in particular from the Brindisi Port, for the following aspects:

- Traffic increase related to the pipelaying activities;
- Traffic increase related to pipelaying barge supply (diesel, material, pipe, crew on site, etc.);
- Traffic increase due to construction waste handling and waste water transportation.
An estimation of the vessels likely to be used during the offshore construction activities is shown in the following Table 4-23.

### Table 4-23 Vessels expected to be used during construction activities

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backhoe dredge</td>
<td>1</td>
</tr>
<tr>
<td>Motopontoon</td>
<td>4</td>
</tr>
<tr>
<td>Pipelay barge</td>
<td>1</td>
</tr>
<tr>
<td>Anchor handling Tug</td>
<td>3</td>
</tr>
<tr>
<td>Pipe carrier barge</td>
<td>3</td>
</tr>
<tr>
<td>Supply vessel</td>
<td>1</td>
</tr>
<tr>
<td>Survey vessel</td>
<td>1</td>
</tr>
<tr>
<td>Crew boat</td>
<td>2</td>
</tr>
<tr>
<td>Dive support vessel</td>
<td>1</td>
</tr>
<tr>
<td>Fall pipe vessel</td>
<td>1</td>
</tr>
<tr>
<td>Backhoe dredge</td>
<td>1</td>
</tr>
<tr>
<td>FOC Cable Laying Vessel</td>
<td>1</td>
</tr>
<tr>
<td>Post trenching vessel</td>
<td>1</td>
</tr>
<tr>
<td>Gravel Dumping vessel</td>
<td>1</td>
</tr>
</tbody>
</table>

Besides, the offshore project will increase onshore traffic, via road, and offshore to the support port.

An estimation of number of trips during the pipelaying activities is presented in Table 4-24.

### Table 4-24 Offshore Trips Estimation

<table>
<thead>
<tr>
<th>Traffic Type</th>
<th>Number of trips</th>
<th>Average per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road – trucks or minivan</td>
<td>90</td>
<td>3</td>
</tr>
<tr>
<td>Marine - supply vessels</td>
<td>40</td>
<td>1.5</td>
</tr>
<tr>
<td>Marine - crew vessels</td>
<td>4</td>
<td>0.2</td>
</tr>
<tr>
<td>Marine - pipe supply vessels</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>Marine - other vessels</td>
<td>30</td>
<td>1</td>
</tr>
</tbody>
</table>

### 4.4.5.1.2 Onshore

There will be considerable transportation of labour, heavy equipment and materials along the pipe route and the related Working Strip, in order that movement of vehicles on the public roads will be minimised.

In order to facilitate the movement of plant and equipment and the construction workforce two new access roads will be constructed to provide access to the PRT.

A new permanent road 98 m long will be built to access the BVS and it is also foreseen the enlargement of an existing road for a length of 575 m.
Traffic will then mainly travel up and down the construction strip. Construction materials such as pre-fabricated pipe joints will be stored in the Construction Site. Materials will then be transported on heavy goods vehicles from this location to the Working Strip.

During construction activities described in the previous sections, many vehicles will be used; the maximum number of each type of heavy equipment foreseen in the different construction phases is shown in the following Table 4-25. In addition, a number of minivans and cars will be used for the transportation of crew and light materials.

**Table 4-25**  Maximum numbers of vehicles to be expected for use in construction activities

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavator</td>
<td>2</td>
</tr>
<tr>
<td>Backhoe loader</td>
<td>1</td>
</tr>
<tr>
<td>Crane</td>
<td>1</td>
</tr>
<tr>
<td>Pipelayer</td>
<td>1</td>
</tr>
<tr>
<td>Pipe bending machine</td>
<td>1</td>
</tr>
<tr>
<td>Pay-welder</td>
<td>1</td>
</tr>
<tr>
<td>Side-boom</td>
<td>4</td>
</tr>
<tr>
<td>Excavator</td>
<td>2</td>
</tr>
<tr>
<td>Backhoe loader</td>
<td>1</td>
</tr>
<tr>
<td>Excavator</td>
<td>3</td>
</tr>
<tr>
<td>Truck</td>
<td>2</td>
</tr>
</tbody>
</table>

An average number of 40 vehicle movements per day are estimated through the Working Strip during the pipeline construction activities, with a peak of 60 movements per day during the excavation and pipe-laying activities, due to the transfer of excavated soil to be disposed of and sand used to protect the pipeline.

During the construction activities discontinuous movements are foreseen through the public roads, involving mainly transport of materials, sand, excavated soil, waste and water to and from the Construction site.

An estimation of number of trips during the onshore construction activities is presented in Table 4-26.
Table 4-26  Onshore Trips Estimation

<table>
<thead>
<tr>
<th>Traffic Type</th>
<th>Number of trips</th>
<th>Average per day</th>
<th>Maximum per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public road to the Construction site</td>
<td>6,100</td>
<td>15</td>
<td>40</td>
</tr>
<tr>
<td>Public road to the worksites and working strip</td>
<td>3,200</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Right of Way – truck, minivan and heavy equipment</td>
<td>5,200</td>
<td>40</td>
<td>60</td>
</tr>
</tbody>
</table>

4.4.5.2  Operation Phase

During operation, the traffic is essentially related to the movement of workers, by minivans or cars, for the PRT operation, planned maintenance and inspection of the line.

4.4.6  Air Emissions

4.4.6.1  Construction Phase

During the construction activities, the air emission will be earth dust particles from soil movement, and pollutants from the exhausts of heavy equipment and vessels.

The earth dust will be produced during the excavation and backfilling activities and the earthworks related to the worksites, PRT and BVS construction activities. Other sources of dust emission will be the traffic movements on the Working Strip of trucks, minivans and heavy equipment to be used.

Pollutants will be produced by heavy equipment and vessels due to the fuel combustion in their engines, and released in the exhausted gas. The main pollutants produced will be NO_x, CO, dust and SO_x.

A detailed analysis on Air emission is reported in Section 8.
4.4.6.2 Operation Phase

The Pipeline Receiving Terminal (PRT) is the end point of the TAP natural gas transportation system and is directly connected to the Snam Rete Gas (SRG) network. Natural gas entering the PRT is filtered, flow-controlled, measured and delivered into the SRG network. The gas is not stored in the PRT nor undergoes any chemical reactions.

The minimum supply temperature to SRG network shall be 3°C. Due to the temperature-balancing effect between the soil / sea water and the natural gas flowing in the pipeline, the temperature of the natural gas entering the PRT is estimated to be on average 10°C. The pressure drop through the PRT causes cooling of the natural gas due to expansion (known as Joule-Thomson (J-T) effect). If the natural gas temperature after control valves remains above 3°C, no heating of the gas will be required. If the natural gas temperature after control valves drops below 3°C, heating of the gas will be required and electrical heaters will be put in operation. In case of high heating load, also gas fired boilers will be put in operation with subsequent emissions into atmosphere.

In normal operating conditions, which include also minor fluctuations of flow rate and network pressure, the PRT can operate without emissions into the atmosphere. At specific times, in case of large and rapid fluctuations of pressure in SRG network or during start-up/restart after PRT shutdown, there could be emissions associated with boiler operation. It is assumed that the duration of such occurrence will not exceed 2% of the time on a yearly basis.

The boiler characteristics are shown in the following Table 4-27:

<table>
<thead>
<tr>
<th>Information</th>
<th>Value</th>
<th>Units of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stack height (each)</td>
<td>10 m (3 m above roof)</td>
<td>m</td>
</tr>
<tr>
<td>Stack diameter (each)</td>
<td>1</td>
<td>m</td>
</tr>
<tr>
<td>NOx emission concentration</td>
<td>100 mg/m³ @3% O₂</td>
<td></td>
</tr>
<tr>
<td>Exhausted temperature</td>
<td>200 °C</td>
<td>°C</td>
</tr>
<tr>
<td>Max flue gas mass flow for each boiler</td>
<td>5,800 kg per hour</td>
<td></td>
</tr>
</tbody>
</table>

4.4.7 Noise Emission

4.4.7.1 Construction Phase

Noise emissions are anticipated to be generated in the construction phase by heavy equipment/construction activities along the Working Strip, in various worksites and in PRT.
In addition during the pre-commissioning phase there will be noise emission associated with the compressors and pumps required for hydrotesting activities near the landfall.

A detailed analysis of noise emissions is reported in Section 8.

4.4.7.2 Operation Phase

The main noise sources will be present in the Pipeline Receiving Terminal (PRT) and include operation valves, filters, air compressors for the gas pressure pipeline and piping. All the equipment will be in compliance with the applicable limit values and, where necessary, noise attenuation packages will be foreseen. More details are provided in Section 8.

4.4.8 Waste Handling and Disposal

4.4.8.1 Construction Phase

Waste management will be kept closely in line with the legal framework and under consideration of the best practice principles.

All waste materials will be collected, stored and transported separately in appropriate and approved bins and containers.

Only approved companies will be charged with the transportation, recycling and disposal of waste. This process will be closely aligned with the responsible authorities.

The overall objective is to minimise the impacts of waste generated during the construction phase through the following:

- Minimise the amount of waste that is generated;
- Maximise the amount of waste that is recovered for recycling, including segregation of recyclable wastes at source;
- Minimise the amount of waste that is deposited at landfill;
- Ensure any hazardous wastes (e.g. used oils, lead-acid batteries) are securely stored and transferred to appropriate facilities to appropriate disposal sites;
- Avoid dust impacts from handling of construction wastes;
- Ensure all wastes are properly contained, labelled and disposed of in accordance with local regulations;
- Dispose of waste in accordance with the waste management plan.

The construction waste management strategy will incorporate the following ‘good site practices’ which will reduce the risk of impacts arising from waste management activities. The construction waste management plan will cover the following key aspects:

- Develop an inventory and schedule of likely wastes;
- Assessment of local waste management facilities;
• Waste minimisation principles;
• Maximise reuse/recycling opportunities;
• Waste segregation (liquid and solid/reusable and recyclable);
• Waste collection, storage and transfer;
• Auditing and reporting procedures;
• Closure process, which will include appropriate monitoring and recording.

Most of the excavated spoil will be used to backfill the trenches. Wastewater and solid waste from the work and construction sites will also be generated.

Waste generated during construction and operation is likely to be classified into four categories for disposal as described below.

4.4.8.1.1 Inert Construction waste

These include earth (not including excavated material, which is destined to be backfilled when the area is restored), building rubble, unused construction material, etc., generated during preparation and restoration of worksites. These wastes pose no risk of pollution, but may be unsightly and need to be disposed of at a controlled disposal site. Detailed soil management and soil quantities are included in Annex 5 “Soil management Plan” (“Terre e rocce di scavo”).

4.4.8.1.2 Domestic waste

The offices and administration buildings associated with the Construction site and the worksites, and with the PRT for the operation, will generate amounts of ‘domestic’ type waste (i.e., food waste, paper and packaging etc.). This will be transported to a controlled municipal waste disposal site.

4.4.8.1.3 Oily and hazardous wastes

There will inevitably be waste generated during construction that needs special handling and treatment. These will include the oily waste associated with vehicle and heavy equipment maintenance (waste oil, material collected from waste water interceptors etc.); unused or waste chemicals, paints and solvents; and, any other waste, sludge or debris that are unsuitable for disposal in a municipal type landfills. Such wastes will be segregated for collection and disposal by specialist contractors at sites that are equipped and approved for them.
The following table describes the hazardous/special wastes generated during construction.

### Table 4-28 Hazardous/special waste generated during construction

<table>
<thead>
<tr>
<th>Category</th>
<th>Description / examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oils and solvents</td>
<td>Empty containers, oily rags, thinners, solvents, degreasers, hydraulic fluids, lube oils, used oil spill clean-up/absorbent materials and associated contaminated soil.</td>
</tr>
<tr>
<td>Paint</td>
<td>Primers, paints and empty cans.</td>
</tr>
<tr>
<td>Coatings</td>
<td>Used for coating pipe joints or repairing damaged factory applied coatings.</td>
</tr>
<tr>
<td>Contaminated ground</td>
<td>Waste sites, old mineral workings.</td>
</tr>
<tr>
<td>Batteries</td>
<td>Lead acid.</td>
</tr>
<tr>
<td>Welding rods</td>
<td>Depending on composition of the material.</td>
</tr>
<tr>
<td>Shot blast</td>
<td>Depending on composition of the material.</td>
</tr>
</tbody>
</table>

4.4.8.1.4 Liquid waste

Liquid waste will be generated during both construction and operation and will include the following:

- Hydrotesting water from the onshore pipeline;
- “Black” and “grey” water from construction site;
- Hazardous liquid waste (e.g. oils, solvents etc.).

4.4.8.2 Operation Phase

During the operation phase only limited amounts of waste, due mainly to maintenance activities, are foreseen.

4.4.9 Waste Water

4.4.9.1 Construction Phase

During the construction phase only limited amounts of waste, due mainly to maintenance activities, are foreseen.
4.4.9.2 Operation Phase

General effluent management considerations are described below. The specific drainage and effluent treatment philosophy at the PRT is outlined here.

The following types of wastewater will be produced during the operation phase:

- Rain water: water from non-polluted areas such as building and shelter roofs, areas beside roads and traffic areas;
- Sanitary sewage (Waste water): water coming from the sanitary installations within the buildings such as Administration Building, Workshop/Stores Building and Control Building;
- Oily water: the catchment areas at the metering, reducing pressure trains and scraper traps, roads and traffic areas, etc.

For the waste water, two separate drainage systems are required for the PRT:

- Process areas;
- Other areas (utilities, buildings etc.).

The drainage systems will discharge the applicable waste water to the public sewage system.

Surface water from potential polluted areas will be discharged via an oil separator into the sewage system. This sewage system will also be used for the discharge of sanitary waste water of buildings. The surface run off from potential polluted areas and the sanitary waste waters will be treated in a small waste sewage works and will be discharged into the public waste water network.

Effluents will comply with EU and Italian legislation and requirements. Wastewater treatment and disposal is designed to meet those requirements.
4.5 Pipeline Design Safety and Risk Assessment

A series of risk studies have been performed in accordance with international standards and good practice to evaluate potential risks, their mitigation and to check against the project risk acceptability. The assessment determined that the project was feasible with regard to safety of the foreseen facilities and the nearby population.

Additional or more detailed studies will be carried out during detailed design of the project.

The principle design and selection principles for PRT and the pipelines are the following:

- Safety of the public and personnel working near the pipeline and the PRT;
- Protection of the environment;
- Protection of property and facilities;
- Third party activities;
- Geotechnical, corrosiveness and hydrographical conditions;
- Requirements for construction, operation and maintenance;
- National and local requirements.

More specific details for each of the system components follow.

The pipeline will be designed according to Standard EN 1594 (Pipelines for Maximum Operating Pressure over 16 bar – Functions Requirement) and the following Italian legal framework:

- DM 17/04/2008 “Technical regulation for the design, construction, testing, operation and supervision of works and facilities for transporting natural gas with a density not exceeding 0.8”;
- DM 24/11/1984 “Fire safety for the transport, the distribution, the accumulation and utilisation of natural gas with a density not exceeding 0.8”;
- DM 23/02/1971 2445 “Technical standards for crossings and the parallels pipes and channels in liquid and gas service for, railways and other transportation infrastructures” and subsequent amendments;
- DM 10/08/2004 “Changes to the technical standards for the crossings and the parallels of pipes and channels in liquid and gas service for, railways and other transportation infrastructures ”.
4.6 Employment and Labour

4.6.1 Construction Phase

Prior to the completion of the detailed design, it is not possible to state precisely the number of personnel that will be employed in the construction of the TAP project.

An independent economic impact assessment (Nomisma Energia 2013) suggests that during the three years construction phase in Apulia TAP will directly support 150 jobs per year (part-time and full-time) as well as 640 indirect jobs (part-time and full-time) via local companies working for TAP. Worker hiring and materials sourcing will be managed by primary contractors but required to meet EBRD standards, EU requirements and TAP policies (e.g. on CSR).

4.6.1.1 Local Preferences in Hiring

Criteria for hiring should include the local and national origin of workers. Where practical, it may be desirable to give preference to employees from the local area.

4.6.1.2 Worker Health and Safety Standards

Internationally recognised procedures to assure the health and safety of the workforce will be adopted along with the necessary equipment and training to make these effective.

4.6.1.3 Workers’ Accommodation

The work force will be lodged in the nearby towns and villages. No accommodation is foreseen in the Construction site or worksites.

4.6.2 Operation Phase

During the 50 year operation phase, TAP will support directly 30 and indirectly 150 jobs per year (part-time and full-time). In the operation phase, approximately 32 permanent workers are the expected employment needs.
4.7 Overall Duration and Timing

The following Table 4-29 provides a summary of the expected timescales for the construction of the major project components.

Table 4-29 Duration of Construction of Project Components

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Duration of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction site and work sites</td>
<td>1 month</td>
</tr>
<tr>
<td>Micro-tunnel</td>
<td>9 months</td>
</tr>
<tr>
<td>Offshore pipeline</td>
<td>2 months</td>
</tr>
<tr>
<td>Pre-trench excavation</td>
<td>2 months</td>
</tr>
<tr>
<td>Pre-trench backfilling</td>
<td>1 month</td>
</tr>
<tr>
<td>Post-laying Gravel dumping</td>
<td>1 month</td>
</tr>
<tr>
<td>Pipeline Receiving Terminal</td>
<td>18 months</td>
</tr>
<tr>
<td>Onshore pipeline and Block valve station</td>
<td>6 months</td>
</tr>
<tr>
<td>Pre commissioning</td>
<td>5 months</td>
</tr>
<tr>
<td>Landscaping/Reinstatement and Road</td>
<td>6 - 12 months</td>
</tr>
<tr>
<td>Construction</td>
<td></td>
</tr>
</tbody>
</table>

The whole project will be constructed within approximately three years, although construction activities near the coastline will be suspended during the summer period in order to avoid interference with tourism related activities. The first activity to begin with will be the pipeline receiving terminal, Work on pipeline installation is anticipated to start 10-12 months later.

4.8 Decommissioning

At the end of its useful life (at least 50 years), the pipeline and associated facilities will be decommissioned safely and with due regard to the environment, with the aim of creating the conditions to allow, within a reasonable time, the restoration of conditions prior to the installation work.

At this stage it is thought that all buildings will be taken down and the sites reinstated. Materials as steel will be recycled where possible.

The pipeline – both onshore and offshore – will be pigged, purged and filled with a suitable substance and be left in situ (to avoid its future collapse).

The decommissioning operation will be made with equipment similar to the ones foreseen for the construction activities. All the waste will be properly treated in compliance with the Italian law.
4.9 Preliminary Identification of the Potential Environmental/Social Interferences

The proposed pipeline project has the potential to affect the environment in several different ways during both construction and operation activities.

The first step in impact identification is to identify the various types of activity associated with the pipeline and PRT construction activities, together with their associated emissions and discharges where appropriate. At a high level, the main sources of impact of the project are:

- Land take;
- Emissions, discharges and wastes;
- Worker Presence (that affect livelihoods framework of individuals, households, communities or societies).

By analysing the project, different aspects having potential interferences on the environment and socioeconomic have been identified for:

- Offshore construction activities (pipeline and landfall construction activities and pre-commissioning);
- Onshore construction activities (pipeline and PRT construction activities and pre-commissioning);
- Offshore Operation;
- Onshore Operation;
- Decommissioning (Pipeline and PRT decommissioning).

In order to summarise the potential interferences, a series of tables with the main potential impacts and a preliminary assessment of their potential impact are presented in the following Sections.

These are carried forward into a detailed description and analysis of the potential impacts in Section 8.
Environmental aspects analysed in this study are reported below:

- Air;
- Water;
- Seabed / Sediments / Subsurface;
- Soil and subsoil;
- Vegetation, flora, fauna and ecosystems;
- Noise;
- Public health;
- Socioeconomic framework;
- Landscape;
- Traffic;
- Cultural Heritage;
- Electromagnetism

4.9.1 Air

Air Emission due the project activities are mainly related to the following sources:

- Soil movement from the earthworks in construction activities;
- Exhausted gas from equipment and vessels to be used;
- Exhausted gas from equipment foreseen in the PRT.
### Table 4-30 Air Potential Interference

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction activities</td>
<td>Air pollution emission from vessels</td>
<td>Local sea route between the offshore route and the port</td>
<td>ST/L</td>
<td>Optimisation of the naval routes</td>
</tr>
<tr>
<td>Offshore construction activities</td>
<td>Air pollution emission from equipment to be used in the landfall microtunnel construction activities</td>
<td>Area close to the landfall</td>
<td>ST/L</td>
<td>All the equipment to be maintained and operated under manufacturers’ standards to ensure working as efficiently as possible.</td>
</tr>
<tr>
<td>Offshore construction activities</td>
<td>Dust from soil movement</td>
<td>Area close to the landfall</td>
<td>ST/L</td>
<td>Humidification of the offshore microtunnel worksite</td>
</tr>
<tr>
<td>Offshore construction activities</td>
<td>Air pollution emission from equipment to be used during pre-commissioning activities</td>
<td>Area close to the landfall</td>
<td>ST/L</td>
<td>All the equipment to be maintained and operated under manufacturers’ standards to ensure working as efficiently as possible.</td>
</tr>
<tr>
<td>Onshore construction activities</td>
<td>Dust from soil movement</td>
<td>Area close to the pipeline onshore route and PRT</td>
<td>ST/L</td>
<td>Humidification of the working strip and involved worksites</td>
</tr>
<tr>
<td>Onshore construction activities</td>
<td>Air pollution emission from heavy equipment</td>
<td>Area close to the pipeline onshore route and PRT</td>
<td>T/L</td>
<td>All the equipment to be maintained and operated under manufacturers’ standards to ensure working as efficiently as possible.</td>
</tr>
<tr>
<td>Offshore operation</td>
<td>No air pollution foreseen</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Onshore operation</td>
<td>Air pollution from PRT operation and safety/emergency procedures</td>
<td>Area close to the PRT</td>
<td>LT/L</td>
<td>All the equipment to be maintained and operated under manufacturer standards to ensure working as efficiently as possible.</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>As construction activities for “above ground” facilities. For underwater marine decommissioning, no potential interferences are foreseen</td>
<td>Pipeline route, and area close to the PRT</td>
<td>LT/L</td>
<td>As construction activities</td>
</tr>
</tbody>
</table>

**Note:**

* D/I: Duration, Interference Area

ST = Short Term; LT = Long Term; P = Permanent; L = Local; R = Regional
4.9.2 Water

Water discharges due to the project activities are mainly related to the following sources:

- Civil water from construction activities;
- Discharge of industrial water from construction and pre-commissioning activities;
- Water to be used for civil use, humidification of the working strip, in slurry for the microtunneling operation, etc.;
- Waste water from PRT;
- Turbidity from pre-trenching activities offshore and FOC installation.

Additional, vessel movements could potentially interfere with water quality.
### Table 4-31  Water Potential Interference

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction activities</td>
<td>Naval traffic</td>
<td>Local sea route between the offshore route and the port</td>
<td>ST/L</td>
<td>Optimisation of the naval routes</td>
</tr>
<tr>
<td></td>
<td>Increase of seawater</td>
<td>Sea close to the landfall</td>
<td>ST/L</td>
<td>The trenched length is optimised to minimise the soil movement. Utilisation of best practice</td>
</tr>
<tr>
<td></td>
<td>turbidity due the pre-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>trenching related to the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>landfall construction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Waste water</td>
<td>Local sea route between the offshore route and the port</td>
<td>ST/L</td>
<td>Waste water collected and treated as waste</td>
</tr>
<tr>
<td>Onshore construction activities</td>
<td>Waste water</td>
<td>Pipeline onshore route</td>
<td>LT/L</td>
<td>Waste water collected and treated as waste</td>
</tr>
<tr>
<td>Offshore operation</td>
<td>No water pollution</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Onshore operation</td>
<td>Water discharge from</td>
<td>Area close to the PRT</td>
<td>LT/L</td>
<td>Water treatment before discharge</td>
</tr>
<tr>
<td></td>
<td>PRT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td>As construction</td>
<td>Pipeline route, and area close to the PRT</td>
<td>ST/L</td>
<td>As construction activities.</td>
</tr>
<tr>
<td></td>
<td>activities for “above ground” facilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For underground</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>decommissioning, no</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>potential interferences</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>are foreseen</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

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4.9.3 Seabed/Sediments/Subsurface

The impacts on the seabed (and sediment) are strictly connected to the impacts on the water quality column and to the offshore construction activities. Furthermore, the seabed is potentially and temporarily affected by the anchor spread related to the pipelaying barge.

**Table 4-32 Seabed/Sediments/Subsurface Potential Interference**

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction activities</td>
<td>Anchor spread</td>
<td>Local sea route between the offshore route and the port</td>
<td>ST/L</td>
<td>Utilisation of best practice</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offshore construction activities</td>
<td>Physical smothering of seabed habitat due to</td>
<td>Local sea route between the offshore route and the port</td>
<td>ST/L</td>
<td>The trenching length is optimised to minimise the soil movement.</td>
</tr>
<tr>
<td></td>
<td>the backfilling</td>
<td></td>
<td></td>
<td>Utilisation of best practice</td>
</tr>
<tr>
<td>Onshore construction activities</td>
<td>not foreseen</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Offshore operation</td>
<td>not foreseen</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Onshore operation</td>
<td>not foreseen</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>not foreseen</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note:

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4.9.4 Soil and Subsoil

The impacts on the soil are mainly due to:

- Excavation and backfilling operation;
- Earthwork for worksites preparation and PRT construction.

Table 4-33 Soil and Subsoil Potential Interference

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction</td>
<td>Soil excavation and occupation</td>
<td>Landfall worksite</td>
<td>ST/L</td>
<td>Reinstatement of the worksite</td>
</tr>
<tr>
<td>activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onshore construction</td>
<td>Soil excavation and occupation</td>
<td>Pipeline onshore route</td>
<td>ST/L</td>
<td>Reinstatement of the worksite and Working Strip</td>
</tr>
<tr>
<td>activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offshore operation</td>
<td>No interferences on soil and subsoil are foreseen</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Onshore operation</td>
<td>Soil occupation for PRT</td>
<td>PRT area</td>
<td>LT/L</td>
<td>PRT layout optimised</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>As construction activities</td>
<td>Pipeline route, and area close to the PRT</td>
<td>ST/L</td>
<td>As construction activities</td>
</tr>
</tbody>
</table>

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4.9.5 Vegetation, Flora, Fauna and Ecosystems

Potential impacts on vegetation, flora, fauna and ecosystems resulting from project activities might be impacts due to vessel and heavy equipment activities, as:

- Soil excavation;
- Removing of olive trees;
- Air and Noise Emission.

**Table 4-34 Potential Interference Vegetation, Flora, Fauna and Ecosystems**

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction activities</td>
<td>Disturbance to fish and cetaceans may be associated to:</td>
<td>Local offshore sea route</td>
<td>ST/L</td>
<td>Utilisation of best practice. See also prevention methods for Seabed/Sediments/Subsurface, Air and Noise.</td>
</tr>
<tr>
<td></td>
<td>- noise during pipelaying operations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- vessel traffic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- air emission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Second impacts on the biodiversity could potentially derive from the impacts on the seabed</td>
<td></td>
<td></td>
<td>Microtunnel length optimised to reduce the impact on Posidonia</td>
</tr>
<tr>
<td>Onshore construction activities</td>
<td>Disturbance to flora and fauna may be associated to:</td>
<td>Pipeline onshore route</td>
<td>ST/L</td>
<td>Utilisation of best practice. See also prevention methods for Soil/Subsoil, Air and Noise</td>
</tr>
<tr>
<td></td>
<td>- noise during construction operations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- heavy equipment and trucks traffic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- air emission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- soil occupation and excavation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offshore operation</td>
<td>No interference to vegetation, flora, fauna and ecosystems are foreseen</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Onshore operation</td>
<td>Disturbance to flora and fauna may be associated to:</td>
<td>PRT area</td>
<td>-</td>
<td>Utilisation of best practice. See also prevention methods for Soil, Air and Noise</td>
</tr>
<tr>
<td></td>
<td>- noise during operation activities in PRT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- air emission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- soil occupation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Phase</td>
<td>Potential Interference</td>
<td>Area of Influence</td>
<td>D/I *</td>
<td>Prevention Methods</td>
</tr>
<tr>
<td>---------------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>-------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Disturbance to flora and fauna may be associated to:</td>
<td>Pipeline route, and route close to the PRT area</td>
<td>ST/L</td>
<td>As construction activities</td>
</tr>
<tr>
<td></td>
<td>- noise during construction activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- heavy equipment and trucks traffic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- air emission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- soil occupation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
* D/I: Duration, Interference Area

ST = Short Term; LT = Long Term; P = Permanent;
L = Local; R = Regional
4.9.6 Noise

The noise associated to the proposed project can be divided as follows:

- Underwater noise: trenching operation, pipelaying operation, vessel engines; anchoring operation;
- Aerial noise: vessel and heavy equipment diesel engines, equipment.

**Table 4-35 Noise Potential Interferences**

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction activities</td>
<td>Noise from vessels and associated with construction and pre-commissioning activities</td>
<td>Local offshore sea route and local route between the offshore route and the port</td>
<td>ST/L</td>
<td>Utilisation of best practice and prescriptions to contractors related to noise performances of vessels.</td>
</tr>
<tr>
<td>Offshore operation</td>
<td>No noise interferences are foreseen</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Onshore construction activities</td>
<td>Noise from heavy equipment and associated with construction and pre-commissioning activities</td>
<td>Pipeline onshore route</td>
<td>ST/L</td>
<td>Utilisation of best practice. All facilities to be maintained and operated under manufacturers’ standards to ensure working as efficiently as possible. Installation of noise abatement walls</td>
</tr>
<tr>
<td>Onshore operation</td>
<td>Noise from equipment installed in the PRT</td>
<td>PRT area</td>
<td>LT/L</td>
<td>some noisy equipment will be enclosed</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>As construction activities for “above ground” facilities.</td>
<td>Pipeline route and area close to the PRT</td>
<td>ST/L</td>
<td>As construction activities</td>
</tr>
</tbody>
</table>

**Note:**
- * D/I: Duration, Interference Area

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4.9.7 Public Health

The potential impacts on public health are indirect and in particular related to:

- Noise generated by equipment and transport;
- Air emissions;
- Potential contamination of seawater and soil.

### Table 4-36 Public Health Potential Interferences

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction activities</td>
<td>Noise and air emissions</td>
<td>The closest coastal area</td>
<td>ST/R</td>
<td>HSE National/International Standard Procedures related to naval traffic</td>
</tr>
<tr>
<td>Onshore construction activities</td>
<td>Noise and air emissions</td>
<td>Pipeline onshore route</td>
<td>ST/L</td>
<td>Use of HSE Integrated Management System for aspects related to health, safety and environment</td>
</tr>
<tr>
<td>Offshore operation</td>
<td>No potential public health interferences are foreseen</td>
<td>Local offshore sea route and local route between the offshore route and the port</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Onshore operation</td>
<td>Noise and air emissions</td>
<td>PRT area</td>
<td>LT/L</td>
<td>Use of HSE Integrated Management System for aspects related to health, safety and environment</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>As construction activities for “above ground” facilities. For underwater marine decommissioning, no potential interferences are foreseen</td>
<td>Pipeline route and area close to the PRT</td>
<td>ST/L</td>
<td>As construction activities</td>
</tr>
</tbody>
</table>

**Note:**

*D/I: Duration, Interference Area*

ST = Short Term; LT = Long Term; P = Permanent;
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4.9.8 Socioeconomic Framework

The main sources of potential impact on socioeconomic context will be:

- Physical presence of facilities/vessels during the project activities;
- Disturbance/emission during project activities (e.g. noise, discharges, traffic);
- Workers presence.

### Table 4-37 Socioeconomic Context Potential Interferences

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction</td>
<td>Potential disturbance on fish stock. Visual impacts, increasing in vessels number, worker presence</td>
<td>The closest coastal area ST/R</td>
<td>Optimisation of naval route.</td>
<td></td>
</tr>
<tr>
<td>activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onshore construction</td>
<td>Visual impacts, increasing, traffic, worker presence</td>
<td>Pipeline onshore route ST/L</td>
<td>Construction activities on coast not foreseen in touristic season</td>
<td></td>
</tr>
<tr>
<td>activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offshore operation</td>
<td>No potential Socioeconomic interferences are foreseen,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onshore operation</td>
<td>Visual impacts BSV and PRT</td>
<td>LT/L</td>
<td>See landscape</td>
<td></td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Visual impacts, increasing, traffic, worker presence</td>
<td>Pipeline route and area close to the PRT ST/L</td>
<td>As construction activities</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

* D/I: Duration, Interference Area

ST = Short Term; LT = Long Term; P = Permanent; L = Local; R = Regional
4.9.9 Landscape

The visual impact caused by the project is related to construction activities, the lighting and the presence of points of view in the nearby landscape from which the temporary facilities and vessels can be perceived. In addition, the PRT as a permanent structure will cause potential interference to the landscape.

Table 4-38 Landscape Potential Interferences

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction activities</td>
<td>Vessels and facilities presence</td>
<td>The closest coastal area</td>
<td>ST/R</td>
<td>-</td>
</tr>
<tr>
<td>Onshore construction activities</td>
<td>Facilities presence</td>
<td>Pipeline onshore route</td>
<td>ST/L</td>
<td>-</td>
</tr>
<tr>
<td>Offshore operation</td>
<td>No potential landscape interferences are foreseen</td>
<td>Local offshore sea route and local route between the offshore route and the port</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Onshore operation</td>
<td>Facilities presence</td>
<td>BVS and PRT</td>
<td>LT/L</td>
<td>Mitigation measures: Plants screen layout optimised Architectural Concept optimized</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>As construction activities for “above ground” facilities. For underwater marine decommissioning, no potential interferences are foreseen</td>
<td>Pipeline route and area close to the PRT</td>
<td>ST/L</td>
<td>As construction activities</td>
</tr>
</tbody>
</table>

Note:
* D/I: Significance, Duration, Interference Area

ST = Short Term; LT = Long Term; P = Permanent; L = Local; R = Regional
4.9.10 Traffic

The impact on traffic for this project will be caused by:

- Marine traffic including fishing vessels traffic due to construction vessel movements;
- Traffic due vehicle movements on public roads and Working Strip.

### Table 4-39 Traffic Potential Interferences

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction activities</td>
<td>Increasing offshore traffic</td>
<td>Local offshore sea route and local route between the offshore route and the port</td>
<td>ST/L</td>
<td>Optimisation of naval route.</td>
</tr>
<tr>
<td>Onshore construction activities</td>
<td>Increasing onshore traffic</td>
<td>Pipeline onshore route</td>
<td>ST/L</td>
<td>Traffic on public road minimised</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Road on Working Strip</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Traffic Management Plan</td>
</tr>
<tr>
<td>Offshore operation</td>
<td>Increasing offshore traffic for maintenance</td>
<td>Local offshore sea route and local route between the offshore route and the port</td>
<td>LT/L</td>
<td>Traffic negligible due only to maintenance and survey activities</td>
</tr>
<tr>
<td>Onshore operation</td>
<td>Increasing onshore traffic</td>
<td>Pipeline onshore route</td>
<td>LT/L</td>
<td>Traffic negligible due only the PRT operation and to maintenance and survey activities</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Increasing onshore traffic</td>
<td>Pipeline route and area close to the PRT</td>
<td>ST/L</td>
<td>As construction activities</td>
</tr>
</tbody>
</table>

**Note:**

* D/I: Duration, Interference Area

ST = Short Term; LT = Long Term; P = Permanent; L = Local; R = Regional
4.9.11 Cultural Heritage

The impact on Cultural Heritage for this project will be caused by:

- Disturbance and potential physical damage to archaeological items due the offshore construction activities;
- Disturbance and potential physical damage to archaeological items due the onshore construction activities;

### Table 4-40 Cultural Heritage Potential Interferences

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Potential Interference</th>
<th>Area of Influence</th>
<th>D/I *</th>
<th>Prevention Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore construction activities</td>
<td>Loss of scientific, cultural and historical value due direct disturbance or damage</td>
<td>Pipeline offshore route</td>
<td>ST/L</td>
<td>Removal of potential findings, archaeological monitoring</td>
</tr>
<tr>
<td>Onshore construction activities</td>
<td>Loss of scientific, cultural and historical value due direct disturbance or damage</td>
<td>Pipeline onshore route</td>
<td>ST/L</td>
<td>Route already optimized, use of reduced working strip were needed, archaeological monitoring</td>
</tr>
<tr>
<td>Offshore operation</td>
<td>Maintenance and inspection activities</td>
<td>Pipeline offshore route</td>
<td>LT/L</td>
<td>Archaeological monitoring</td>
</tr>
<tr>
<td>Onshore operation</td>
<td>Maintenance and inspection activities</td>
<td>Pipeline onshore route</td>
<td>LT/L</td>
<td>Archaeological monitoring</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>Loss of scientific, cultural and historical value due direct disturbance or damage</td>
<td>area close to the PRT</td>
<td>ST/L</td>
<td>Archaeological monitoring</td>
</tr>
</tbody>
</table>

* D/I: Duration, Interference Area

ST = Short Term; LT = Long Term; P = Permanent; L = Local; R = Regional
4.9.12 Electromagnetism

The production of ionizing or non-ionizing radiation is not foreseen for this type of project.

Only during the welding testing operation, x-ray radiation will be locally used in compliance with the Italian legislation and International standards for the workers protection.

The PRT will be connected to the power grid with a 20 kV power line and associated non-ionizing radiation will be not significant.

Considering that the potential impact due to electromagnetism will be negligible, no further investigations are included in this Environmental Impact Assessment Study.