Trans Adriatic Pipeline

TAP Routing Report

TABLE OF CONTENTS

LIST OF FIGURES

1. Introduction

The Trans Adriatic Pipeline (TAP) is a natural gas pipeline in the so-called Southern Gas Corridor (see Figure 1-1) that will bring gas from new reserves in the Caspian region to Southern and Central Europe.

TAP will contribute to the security and diversity of Europe's energy supply by providing part of the necessary infrastructure to transport gas from the Shah Deniz (SD) II field in the Azerbaijan sector of the Caspian Sea via the most direct route to Southern Europe. TAP is designed to be operational in early 2020 with an initial capacity of 10 billion cubic metres per annum (bcma). The capacity of TAP can be increased to 20 bcma as additional gas becomes available.

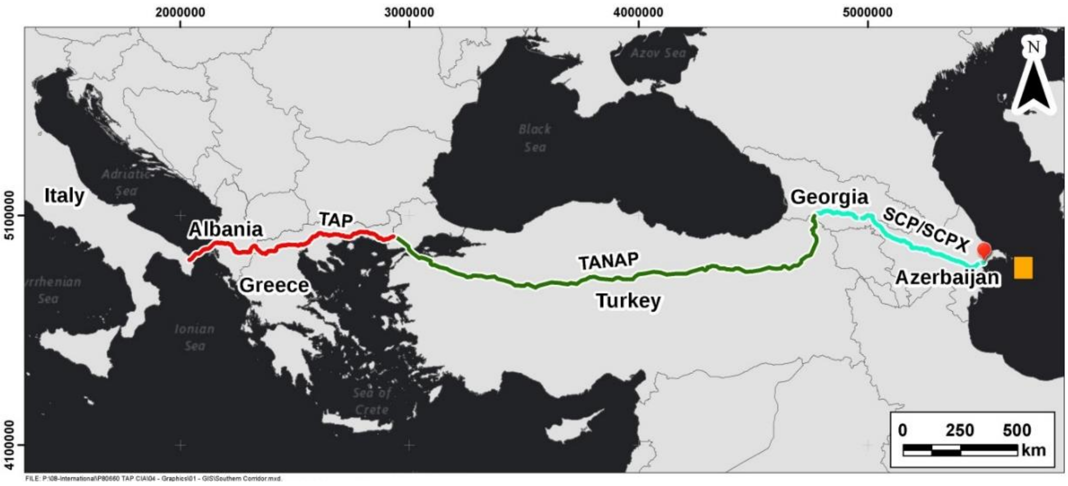


Figure 1-1: Southern Gas Corridor

TAP AG (the operator) performed a thorough route alternatives appraisal, and as a result of this process, selected the preferred pipeline route that represented the most viable corridor with respect to technical, environmental, socioeconomic and cultural heritage (ESCH) factors. The preferred route starts near Kipoi in eastern Greece, at the Greek–Turkish border, and terminates near San Foca in Italy, crossing Greece, Albania and the Adriatic Sea. The pipeline will connect at its entry point to the Trans Anatolian Pipeline and downstream to the Italian SRG natural gas network. The preferred route is illustrated in Figure 1-2.

Upon selection of the preferred route (also referred to as the base case), a route verification process was undertaken, which aimed to assess any local level pipeline re-routings to avoid more constrained areas. This was an iterative process, with an increasing focus on detail as the route corridor was narrowed and refined.

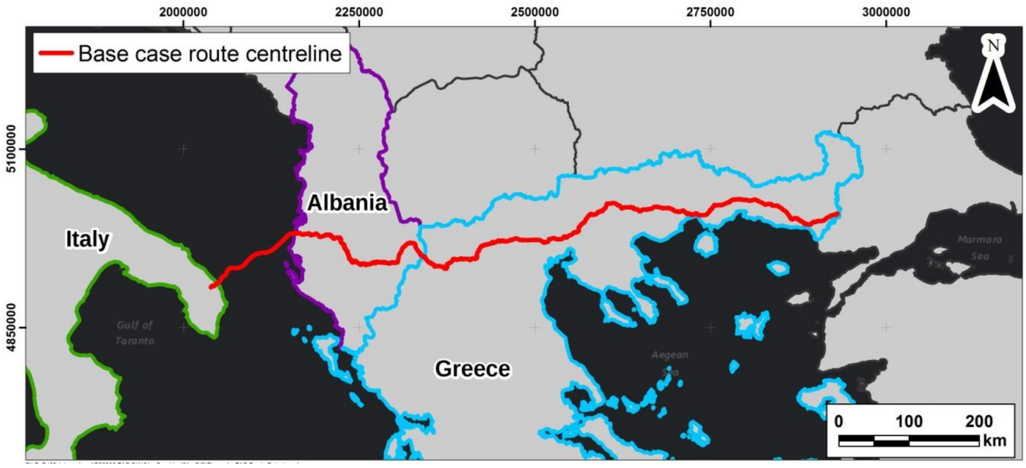


Figure 1-2: TAP base-case route centreline

2. Route Selection History and Approach

Figure 2-1 provides an overview of the project engineering timeline for route selection followed by TAP AG. The process began with pre-feasibility and feasibility studies, which included an assessment of the practicality, cost and value of the proposed pipeline. The stages that followed included the basic conceptual design engineering, Pre-Front-End Engineering Design (FEED) and FEED. These stages included various studies to identify technical issues and to estimate approximate investment cost. The completion of these stages allowed the engineering; procurement and construction (EPC) tendering phase to then be undertaken.

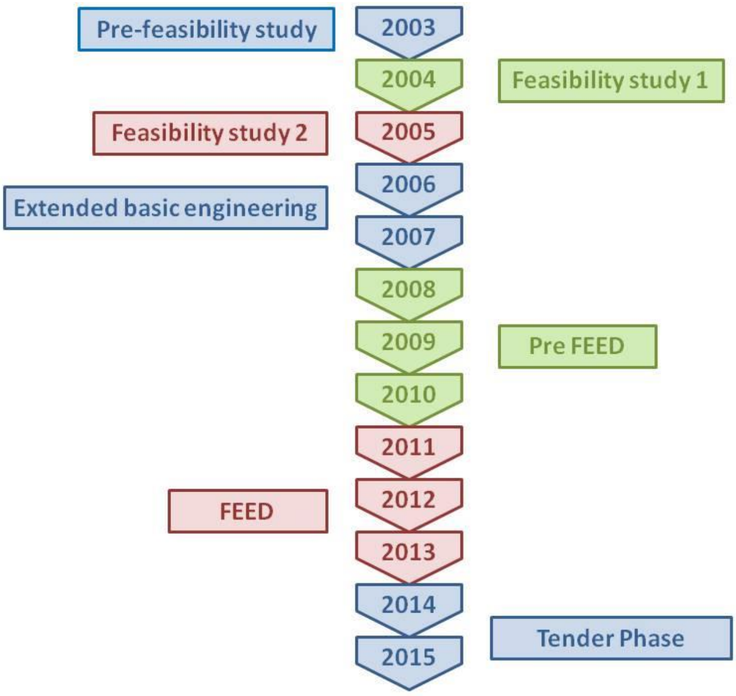


Figure 2-1: Project Engineering Timeline

2.1 European Pipeline Feasibility Study

Considering the geographical location of the Caspian Sea, the possibility of transporting its natural gas resources to the energy rich regions in the north or south seems unsustainable from a business perspective. Comparing the gas markets of Europe, to the west, and China, to the east, the former emerges as the shortest and, consequently, the more economically viable option.

A high-level feasibility study completed between 2003 and 2005 concluded that the SD II field in the Azerbaijan sector of the Caspian Sea, was the most suitable future source of gas for Europe.

There were two broad alternatives for delivery of SD II gas to Europe via the Southern Gas Corridor, each with two sub-alternatives:

- Southern Italy:
  - extension of the existing Turkey–Greece gas interconnector into Italy, or
  - TAP
- Baumgarten, Austria:
  - Nabucco West pipeline, traversing Bulgaria, Romania and Hungary, or
  - South East Europe Pipeline, traversing Bulgaria, Romania, Hungary and Croatia.

In 2012, the Shah Deniz consortium selected TAP as the priority pipeline route to Italy and Nabucco West for the route to Baumgarten as part of a competitive tender process. Thereafter, in June 2013 the Shah Deniz consortium selected TAP to complete the first phase of the Southern Gas Corridor. This selection was based on eight criteria: commerciality, project deliverability, financial deliverability, engineering design, alignment and transparency, safe and efficient operability, and scalability and public policy considerations. TAP was chosen the preferred route based on the eight criteria, as well as being the shortest option and, therefore, the most economical way for Caspian gas to reach Europe. Selecting TAP also meant less environmental and social impact compared to the alternative (TAP is approximately 450km shorter than its former competitor).

While TAP will initially transport 10 bcm/a from the Shah Deniz II field in Azerbaijan, the pipeline can double its capacity and can transport 10 more bcm/a once additional gas resources come on stream. The Southern Gas Corridor can therefore in the future link European markets with sources in the wider Caspian region.

2.2 Approach to TAP Route Selection

The proposed route corridor for TAP was identified by using a systematic route selection process comprising the following four stages:

- identification of an area of search
- identification of potential route corridors macro within the area of search
- selection of preferred routes within the macro corridors
- identification of the final route during the conceptual design stage, FEED stage, and also the detailed design stage. In Albania and Greece this process is still ongoing at a micro level.

The prospective alternatives were evaluated against a set of criteria to determine their suitability. These criteria included technical and ESCH considerations, such as:

- population centres and proposed future developments
- engineering considerations such as roads, overhead cables, rivers, railways and other major pipelines

- construction issues such as steep slopes and difficult ground conditions arising from geology, hydrology and soils of the area
- mineral extraction and known areas of landfill or contamination
- landscape and topography
- nature conservation, including designated areas and protected species
- archaeology and cultural heritage
- the shortest distance, bearing in mind the above considerations and bundling of infrastructure (see below).

The overall length of each alternatives was also considered, as longer pipelines are generally less desirable because they represent greater risk in terms of:

- environmental impacts, including
  - risk of leaks
  - greater area of temporary construction-related disturbance to natural habitat (e.g., wetlands, forests)
  - permanent habitat fragmentation.
- construction and operational costs, which generally increase in proportion to overall pipeline length.

The infrastructure bundling principle was also considered where relevant. This principle refers to the grouping of infrastructure projects, far as possible, so that the overall impacts to environment, society and cultural heritage from the projects are minimised. The bundling of infrastructure is commonly applied to infrastructure like high voltage overhead lines or roads to reduce negative effects like fragmentation of habitats and landscapes, avoid an increase in traffic noise, avoid increasing the existing number of affected communities, minimise impacts on livelihoods, and a reduced potential for further archaeological finds. In cases where a new route would open a new construction corridor in a previously unaffected area it is good international practice to bundle linear infrastructure. This is particularly true for pipelines where the impacts are mainly during the construction phase. However, the benefits of a bundling approach diminish with distance from the existing corridor. Further, as discussed within the following chapter on Greece east routing, bundling is not always an optimal solution.

2.3 General Route Selection and Refinement Process

The route selection and refinement process started during the European Pipeline Feasibility Study. The study was performed between 2003 and 2005 with the objective of identifying a suitable corridor from south-eastern Europe to Italy. The feasibility study identified the initial area of search, which ranged from 50 km to 100 km depending on country specific characteristics.

Following the identification of the initial area of search, an assessment of the possible route alternatives was performed in each TAP host country (namely Greece, Albania and Italy). This assessment aimed to identify macro corridors within the area of search following a thorough alternative route assessment based on the following criteria:

  - Minimise social and economic impacts and respond to stakeholder concerns.
  - Ease of returning areas to pre-existing condition and land use.
  - Air quality and noise disturbance.
  - Minimise environmental impacts by avoiding:

  - Protected environmental areas, national parks, etc., where possible.
  - Watercourse crossings in areas affected by urban and/or industrial development plans (i.e. preference for agricultural land).
  - Areas susceptible to landslides, floods and coastal erosion.
  - Marshlands and peat soil.
  - Geohazard areas (prone to phenomena such as landslides and earthquakes).
  - Areas at risk of permanent habitat fragmentation.
- Minimise impacts to cultural heritage.
- Wherever possible use corridors already constructed by other pre-existing infrastructure (natural gas pipelines, channels and roads).

Similarly, for the offshore section of the pipeline, the process of identification of the possible route alternatives was based on the following criteria:

- Identification of areas that present engineering or construction challenges to allow for further investigation of safety and integrity factors.
- Avoid protected seagrass areas.
- Minimise interference with navigation channels.
- Minimise pipeline installation and construction constraints, i.e. obstacles, fishing areas, dumping areas, unexploded munitions areas and archaeological sites.
- Minimise the need for engineering and construction challenges to mitigate seabed hazards associated with offshore fishing, dumping, crossings of existing seabed pipelines and communication lines, and geohazards.

This process resulted in the selection of a preferred 2 km wide corridor for each of the host countries and several alternatives, which were assessed as part of the route refinement process described in section 3 of this report. These preferred corridors were then subjected to further a more detailed assessment as part of the initial stages of the Environmental and Social Impact Assessment (ESIA) process.

The objective of the process was threefold:

- Identify the optimal route;
- Identify options and measures to avoid and/or minimise residual ESCH impacts; and
- Further engagement with national, regional and local authorities and the population at large on the route selection.

This process is explained in greater detail in the Project ESIA.

The 2 km corridors were considered sufficient to characterise the ESCH baseline as part of the initial ESIA stages. However, this was extended where necessary to incorporate sites/areas of interest outside of these corridors. The information gathered during the desktop and field phase to inform the route selection indicators was managed using a geographic information system (GIS). Once the ESCH aspects and constraints were established, 'impact indicators' were used to highlight and appraise features of route alternatives that could be related to key potential impacts of standard gas pipeline projects.

These impact indicators included technical indicators (e.g. length of pipeline, number of road crossings, accessibility, and cost), environmental indicators (e.g. area of sensitive / important habitat crossed, river crossings), socioeconomic indicators (e.g. population / settlements within corridor, industries present) and cultural heritage indicators (e.g. monuments, archaeological potential). The output of all the indicators was presented as a table or indicator matrix for comparison and use for the selection of the base case route. An 'impact indicators' matrix example employed at this stage of assessment is provided in Annex 1. This semi-quantitative / quantitative analysis allowed for the comparison of different route alternatives.

The outcome of this analysis resulted in the selection of a base case route, which was then subject to a detailed ESIA in each host country. The route refinement process continued in parallel to the ESIAs, with information exchanged iteratively between the studies.

The area of influence (the area where a direct or indirect impact might occur) varied between the ESIAs depending on each host country requirements. It was however a minimum 500 m corridor along the centre line (i.e. 250 m either side) for environmental impacts, a minimum 2 km corridor[1] (i.e. 1 km either side of the base case centre line) for the social impacts and a minimum 50 m corridor for cultural heritage impacts (to accommodate for physical disturbance within the working strip).

The detailed ESIA process resulted in further adjustments to the base case route as the result of the requests of local stakeholders or statutory authorities.

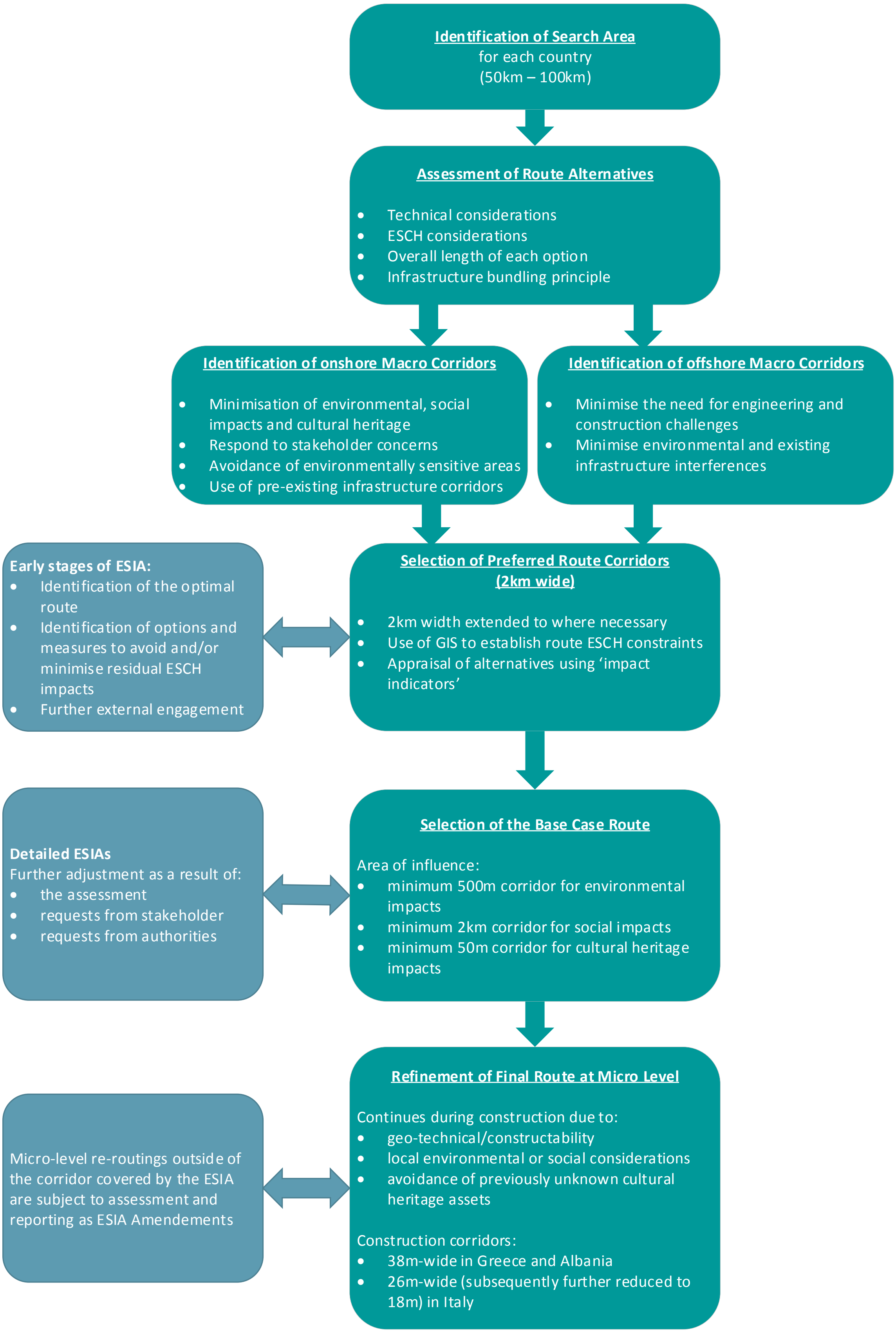
The final route identified a 38m-wide construction corridor in Greece and Albania and a 26m-wide (subsequently reduced to 18m) corridor in Italy. The base case route refinement process will continue post-ESIA during the construction phase as micro-rerouting becomes necessary at certain locations due to geo-technical/constructability, local environmental or social considerations or to avoid cultural heritage assets unknown at the previous stages of project development. Should local micro adjustments be required, rerouting the pipeline outside of the corridor assessed in the ESIA would be subject to further environmental and social assessment to be reported in ESIA Amendments.

This general route selection approach was followed in all TAP host countries but with some differences, particularly in the case of eastern Greece, Italy and the offshore pipeline sections. This is detailed further in the following sections of this report. Figure 2-2 illustrates the general route selection and refinement process.

As of August 2017, TAP has obtained approval for five ESIA amendments in Greece and four in Albania since the main Environmental and Social Impact Assessments (ESIAs) were approved and continues to make micro-adjustments within a formally agreed governance process. Where a route adjustment was outside the ESIA study corridor the reroute was considered a major change which involved an ESCH assessment and stakeholder engagement. Whilst route adjustments within the ESIA study corridor were considered minor changes they were still presented within ESIA amendments.

[1] For Greece East section, an area of influence of 1 km (i.e. 500 m each side of the base case centre line) was chosen for the route running parallel to existing Greek natural gas pipeline network.

Figure 2-2: General Route Selection and Refinement Process



2.4 Stakeholder Engagement during the Route Selection and Refinement Process

From its early stages of potential corridor identification to route refinement (including micro adjustments) during the construction stage, stakeholder engagement was integral to the route selection process.

This included consultation with local communities, authorities and institutional stakeholders starting at the feasibility study stage, then continuing during ESIA pre-scoping, route refinement, ESIA scoping, ESIA engagement, route optimisation and disclosure as well in the context of the micro-adjustments of the route during execution. These public consultation and stakeholder engagement activities have shaped the route selection process, and have been used as a vehicle for stakeholders to influence project design, planning and decisions on the routing of the pipeline.

Details on the stakeholder engagement undertaken at each of these stages are provided in the publicly available ESIA documentation.

3. Route Selection Process: Greece

Initially the starting location of TAP in Greece was at Nea Mesimvria (near Thessaloniki), where a tie in was planned with an existing pipeline operated by the Natural Gas Transmission System Operator (DESFA) before heading west towards Albania. The route selection process was therefore initially performed only for the pipeline section between Nea Mesimvria and the Greek-Albanian border. This is referred to as the Greece West pipeline section. However, due to capacity issues with the existing DESFA pipeline, the decision was made to extend TAP further east to the Greek–Turkish border to connect with the planned Trans Anatolian Pipeline (TANAP). This section of TAP is referred to as the Greece East pipeline section.

The limited distance of the overland border between Greece and Turkey and adoption of the bundling principle so as to have a parallel connection point to DESFA- BOTAŞ, determined TAP’s connection point with TANAP at Kipoi. Please refer to Figure 3-1. Thereafter, the Kipoi area was considered a fixed point in the routing process. There were no formal constraints in terms of the location of the Greek-Albanian border crossing.

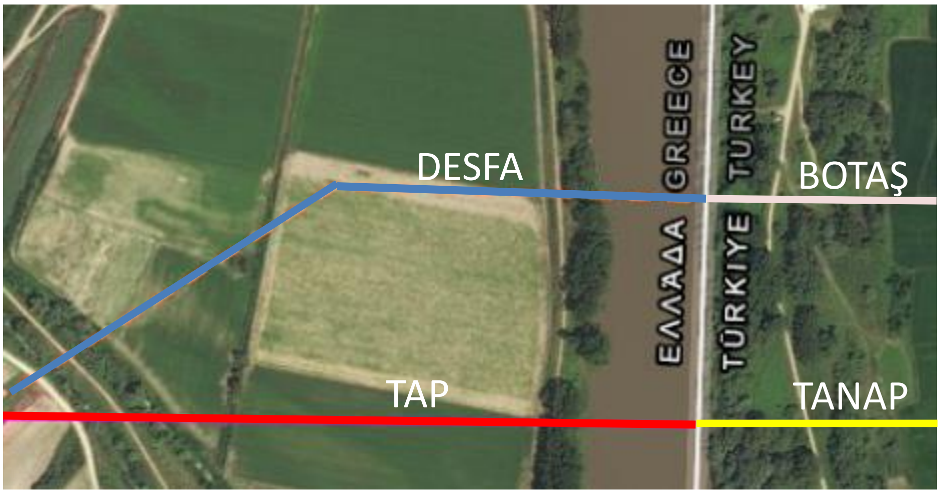


Figure 3-1: TAP connection point with TANAP

The route selection of the Greece East and Greece West sections of TAP is presented in sections 3.1 respectively 3.2.

Complete information on the route selection and assessment performed in the frame of the stages indicated above is available in Section 2.3.2 – Project Justification of the Integrated ESIA Greece (GPL00-ASP-642-Y-TAE-0050 Rev.: 00)

3.1 Greece East Route Selection

The base case for the Greece East pipeline section was for it to run parallel and in close proximity to the existing DESFA pipeline applying the bundling principle. This decision streamlined the route selection and refinement process as being adjacent to an existing high pressure natural gas pipeline minimised potential ESCH impacts. The initial stages of the route selection process (i.e. the identification of potential 2 km corridor alternatives within a 50 km-wide search area) were therefore not performed for the Greece East section given that a base case 2 km corridor could already be identified for the entire length of the pipeline.

Upon identification of this route as the base case, an iterative process of route verification and refinement commenced whereby possible improvements aimed at avoiding local constraints and at minimising impacts (i.e. where bundling would cause additional impacts) were considered. The process identified five local alternative route corridor areas that are illustrated in Figure 3-2:

- Kirki area
- Kavala Mountains area
- Turf area (hereafter referred to as the Peat area)
- Kamilokorfes area
- Provatas area

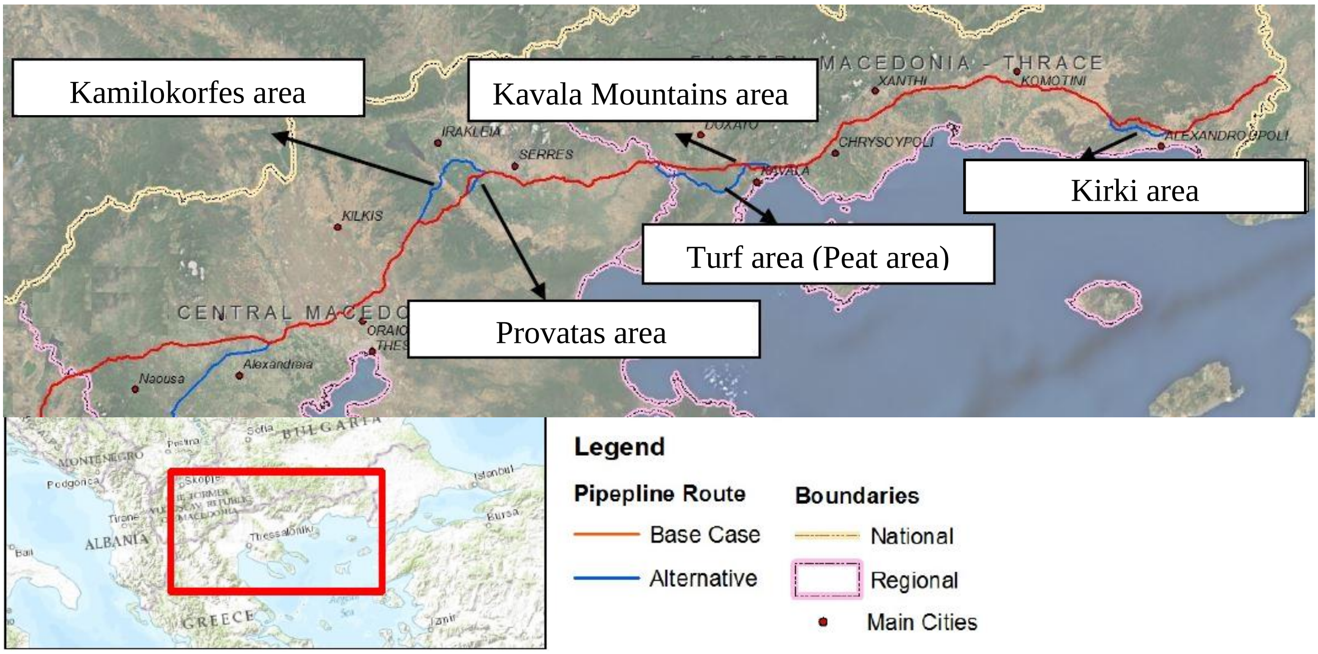


Figure 3-2: Routing Alternatives Greece East

Following disclosure of the ESIA public consultation resulted in 7 major re-routings and 238 minor re-routings to the ESIA base case. The major re-routings were as follows:

- Amfitriti
- Kosmio
- Nestos
- Nea Karvali
- Drymos
- Pyrgoi (in Greece west)
- Foufas – Eordea (in Greece west)

The minor re-routings were the result of route optimisation and made to minimise the impact on affected land. These changes were small and within the pipeline route corridor that was assessed in the ESIA.

The re-routing required a number of block valve stations and temporary installations (e.g. pipe yards and camp sites) to be relocated. Certain reroutes and a change of facility locations were made in Greece West. Further information can be found in the ESIA Amendment 1 (GPL00-EXG-642-Y-TAE-1004 Rev.: 00) and supplement (GPL00-EXG-642-Y-TAE-5000 Rev.: 00) and ESIA Amendment 3 (GAL00-EXG-TAE-5101 Re.: 02)

Subsequent technical studies investigating the geotechnical conditions and constructability on terrain along the base case route identified additional alternatives in the area of Ano Grammatiko, in Edessa municipality, and Pentalofos, in Oraiokastro municipality.

The following sections discuss the routing alternatives starting with those considered in the ESIA and then the amendments, to the direction of gas flow (i.e. from east to west). These routing alternatives, considered as part of the route refining process, are discussed in further detail in the ESIA and the ESIA Amendments.

When considered that the DESFA pipeline runs approximately 16m parallel to the TAP route and the scale of the maps in Figure 3-3, Figure 3-5 and Figure 3-7 the line illustrating the DESFA route is not always visible.

3.1.1 Route Refinement – Kirki Area

Two options were considered along this section of pipeline:
- the GRE Base Case
- the Southern GRE Alt_1S.

The GRE Base Case route in the Kirki area runs parallel to the existing DESFA pipeline. The route alternative GRE Alt_1S is located approximately 2.5 km south of the base case. The routing options are illustrated in Figure 3-3. Both routes are similar in length and pass through mountainous areas.

The main advantage of the alternative route is that it crosses fewer protected areas. It also allows more working space during construction. The base case crosses IBA GR005 “South Forest Complex of Evros Prefecture, Natura 2000 site GR110009 “Notio Dasiko Symplegma Enrou” and the wildlife refuge area “Periochi Kirkis”. The alternative route only crosses the IBA. In addition, there are fewer known cultural heritage sites located in the corridor of the alternative route although it is considered to have a higher potential for further finds.

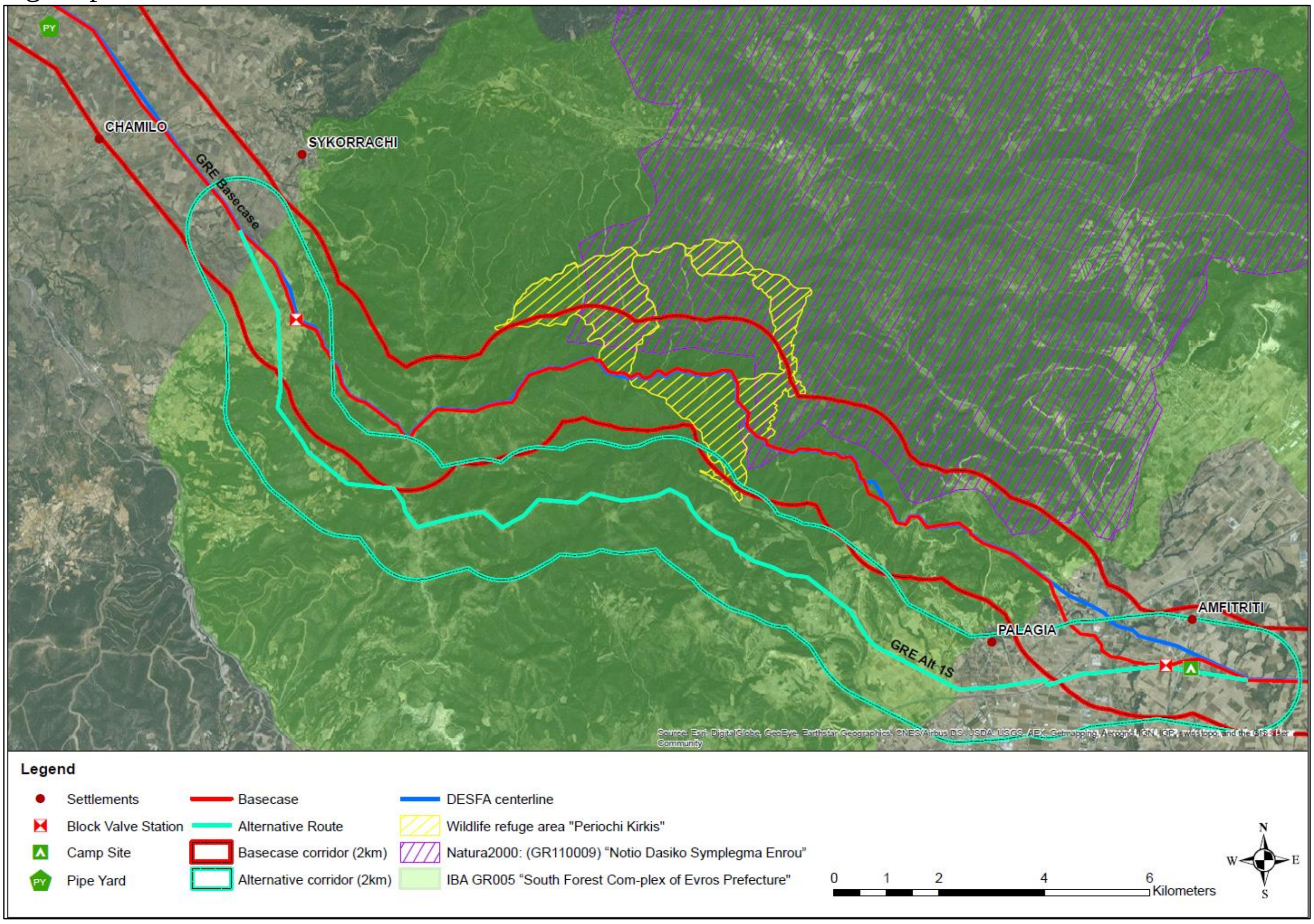


Figure 3-3: Greece East Route Refining - Kirki Area

Despite the base case crossing several protected areas however, the ESCH impacts are thought to be minimised by paralleling the existing DESFA corridor. The alternative route would require extensive logging to create a new corridor, and military restrictions exist in some of the areas. Additionally, the base case has a lower potential for archaeological finds given that the area was disturbed during the construction of DESFA. The GRE Base Case was selected as the preferred route in the Kirki area.

Further details on the route alternatives considered for the Kirki area can be found in Section 2 – Project Justification of the Integrated ESIA Greece (GPL00-ASP-642-Y-TAE-0050 Rev.: 00) with impact indicators of the two routes in ESIA Annex 1.1 (GPL00-ASP-642-Y-TAE-0050 Rev.:01/at02) on the TAP website.

3.1.2 Route Refinement – Kavala Mountains

Two options were considered along this section of pipeline during the ESIA process:

- the GRE Base Case
- the Northern GRE Alt_2N

The GRE Base Case in the Kavala Mountains runs parallel to the existing DESFA pipeline through the municipality of Kavala. Route alternative GRE Alt_2N runs approximately 1.1 km north of the base case. The Northern Alternative route is more direct and approximately 1.5 km shorter than the GRE Base Case. These routes are illustrated on Figure 3-4.

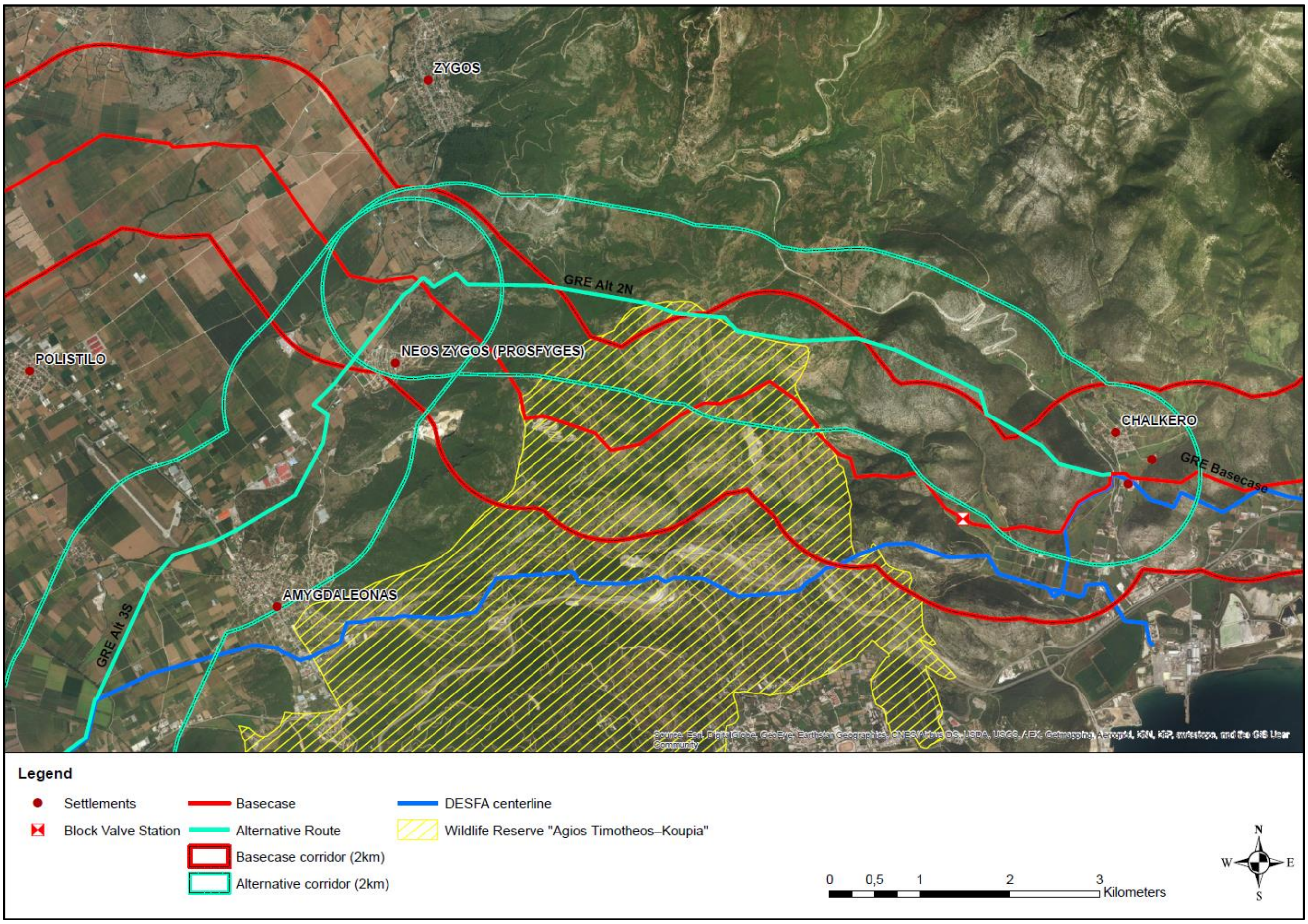


Figure 3-4: Greece East Route Refining - Kavala Mountains

The presence of an additional archaeological site within the Northern Alternative and a rehabilitation centre at a distance of 50m from the route centreline, contravening the required safety distance to such public buildings were the primary reasons for selecting the base case. Environmental sensitive habitats within both route options were considered similar albeit the Northern Alternative did not cross a designated wildlife reserve.

Further details on the route alternatives considered for the Kavala Mountains area can be found in Section 2 – Project Justification of the Integrated ESIA Greece (GPL00-ASP-642-Y-TAE-0050 Rev.: 00) with impact indicators of the two routes in ESIA Annex 1.1 (GPL00-ASP-642-Y-TAE-0050 Rev.:01/at02) on the TAP website.

3.1.3 Route Refinement – Peat Area

Two options were considered along this section of pipeline:

- the GRE Base Case
- the Southern GRE Alt_3S.

The alternatives for the Peat area are illustrated in Figure 3-5.

The alternative GRE Alt_3S runs mostly parallel to the existing DESFA pipeline at approximately 5.5km. However, it passes through the Natura 2000 protected area of Pageo Mountain GR 1150011 and close to the designated archaeological site of Pageo Mountain. The alternative route also crosses an area included in the Amygdaleonas Town Plan, which features a hospital under construction and passes near to the settlement boundary of Prosfyges. Four other settlements are located within the 2km corridor.

For these reasons the ESIA base case route was confirmed as the preferred case as it avoids the Natura 2000 site of Pageo Mountain at a distance of approximately 6 km and presents a lower overall archaeological potential.

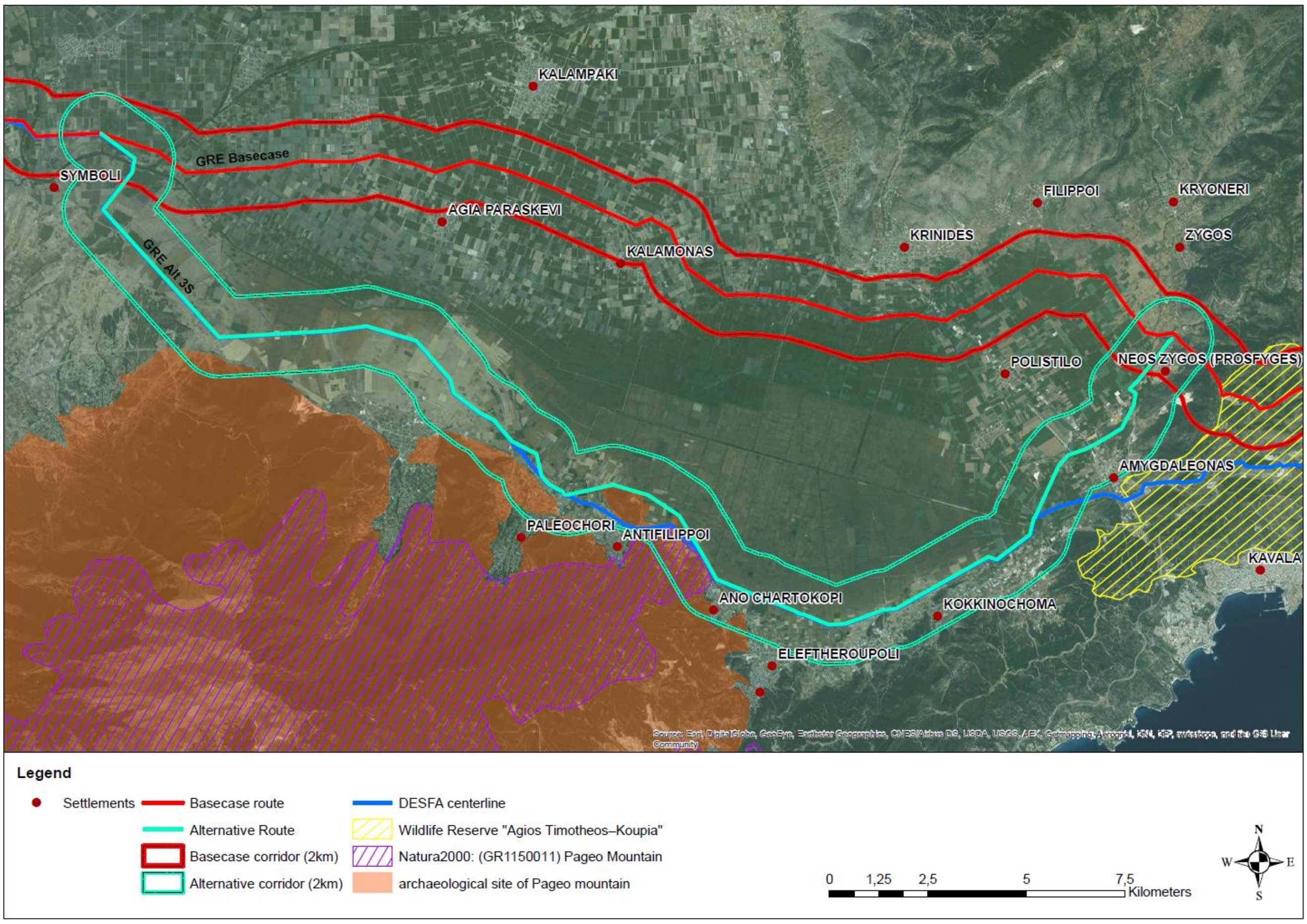


Figure 3-5: Greece East route refining – Peat Area

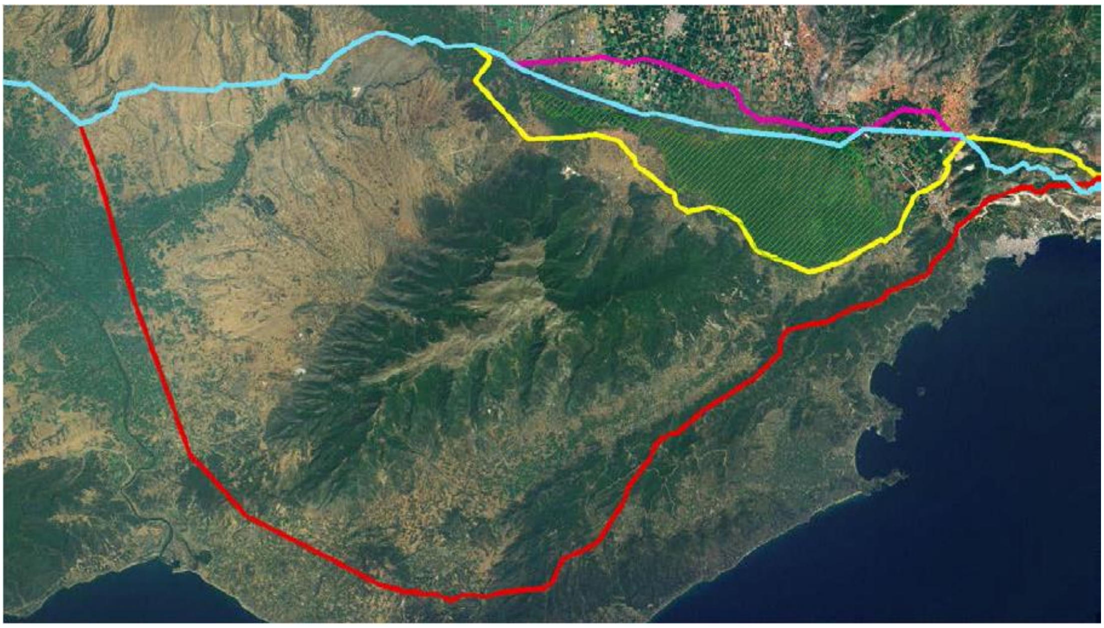
However, as part of the ongoing consultation process, several re-routings for crossing the Peat area were investigated at the request of stakeholders. In addition to concerns over perceived risks to operational safety and pipeline integrity if the original base case route was chosen, stakeholders were worried that local farmers would face significant socio-economic impacts associated with the loss of agricultural productivity.

Taking into consideration the stakeholders concerns, additional to the route options assessed during the ESIA stage (see Figure 3-5) TAP identified another three alternatives as follows:

- an alternative parallel to the existing DESFA route

- a southern alternative, suggested by TEE-AM (Technical Chamber of Greece, Division of East Macedonia)
- a northern alternative.

To select a new base case, these alternatives were each compared against the ESIA base case and evaluated on their technical feasibility, ESCH constraints, and in terms of conflicts with other infrastructure and projects in the area. The ESIA base case and the three alternatives identified following consultation are illustrated in Figure 3-6.



Light blue line:	ESIA basecase
Yellow line:	Alternative parallel to DESFA route
Red line:	South alternative
Purple line:	North alternative
Green dashed area:	Tenagi area (Peat)

Figure 3-6: Greece East Route Refining - Plain of Philippi and Peat Area route options

The evaluation of options was subject to an ESIA addendum which demonstrated that the south alternative and the alternative parallel to the DESFA route presented major technical problems particularly in regard to land stability that would make their construction extremely challenging. Both routes would require complex mitigation measures which would further increase environmental impacts. For these reasons, these alternatives were rejected.

The north alternative maintains all the advantages of the ESIA base case whilst avoiding crossing areas with possible ground stability issues. Additionally, the route mainly follows existing roads and channels minimising the impact on cultivated land. Recent, intrusive soil samples in this area has also demonstrated the absence of peat soil.

The north alternative was considered to effectively address local concerns and at the same time provided a technically feasible and environmentally advantageous route for this sensitive area. The north alternative crosses the peripheral zone of the archaeological area of Philippi, and additional work and investigations were required to ensure that pipeline construction would not affect cultural heritage.

Based on the above, the north alternative was selected as the new base case route for Plain of Philippi / Peat area.

Additional consultation on the north alternative took place during mid February – early September 2014 including five meetings with representatives from TEE, GeoTEE and farmers representatives. Additional consultation with the public in communities affected by this rerouting took place in late September – early October 2014 as part of the Greece ESIA addendum public disclosure and consultation process. Seven meetings were held including with the communities and/or representatives in Doxato Kalamonas, Kalampaki Krinides, Kryoneri, Nerofraxtis Philippoi, Prosotsani,and Zygos.

Further details on the route alternatives considered for the Plain of Philippi area can be found in Section 2 – Project Justification of the Integrated ESIA Greece (GPL00-ASP-642-Y-TAE-0050 Rev.: 00) and the ESIA Addendum – Alternatives in Tenagi Area (GPL00-EXG-642-Y-TAE-0002 Rev: 02) on the TAP website. The consultation meetings on the north alternative are included in the ESIA Addendum Appendix 4.1 and ESIA Amendment Annex 7.

TAP also investigated an additional route through the mountainous area, known as the super-north route. While the north alternative does not impact any natural habitat, the 'super-north route' traverses 15 km of natural habitat. Further, as this mountainous route crosses rocky ground and is in closer proximity to established settlements and villages (namely Kryoneri and Zygos), this route option was determined to have greater impact on the environment and local communities than the north alternative. As the north alternative is on flat rural land it is also safer and avoids complexities in construction.

3.1.4 Route Refinement – Kamilokorfes Area

Two options were considered along this section of pipeline:

- the GRE Base case
- the Northern GRE Alt_5N.

These alternatives are illustrated in Figure 3-7. The alternative GRE Alt_5N runs north of Serres, traversing the municipality of Serres, and approximately parallels the existing DESFA pipeline.

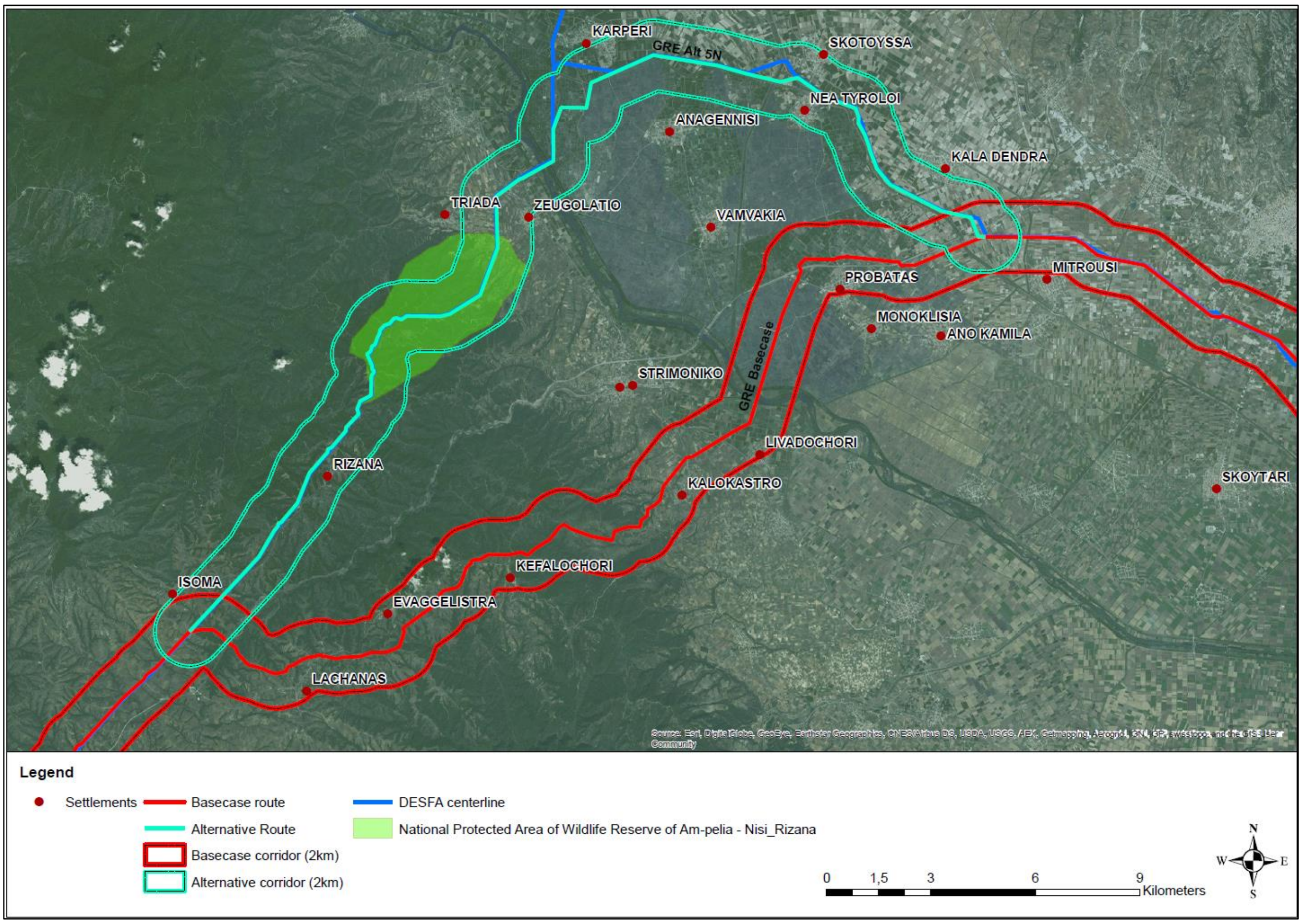


Figure 3-7: Greece East route refining – Kamilokorfes Area

The Alternative GRE Alt_5N passes through the National Protected Area of Wildlife Reserve of Ampelia - Nisi_Rizana. The selected base case route passes mainly through agricultural areas and does not traverse any protected areas. Therefore, from an environmental perspective the base case is the preferred option.

Specific technical difficulties (construction space, slope instabilities etc.) close to the DESFA pipeline within this area were further reasons for the confirmation of this base case.

Further details on the route alternatives considered for the Kamilokorfes area can be found in Section 2 – Project Justification of the Integrated ESIA Greece (GPL00-ASP-642-Y-TAE-0050 Rev.: 00) with impact indicators of the two routes in ESIA Annex 1.1 (GPL00-ASP-642-Y-TAE-0050 Rev.:01/at02) on the TAP website.

3.1.5 Route Refinement – Provatas Area

Two options were considered along this section of pipeline, which is within the base case route mentioned for the Kamilokorfes area:

- the GRE Base case
- the Southern GRE Alt_4S.

These alternatives are illustrated in Figure 3-8. The alternative route is more direct and approximately 1.3 km shorter in length.

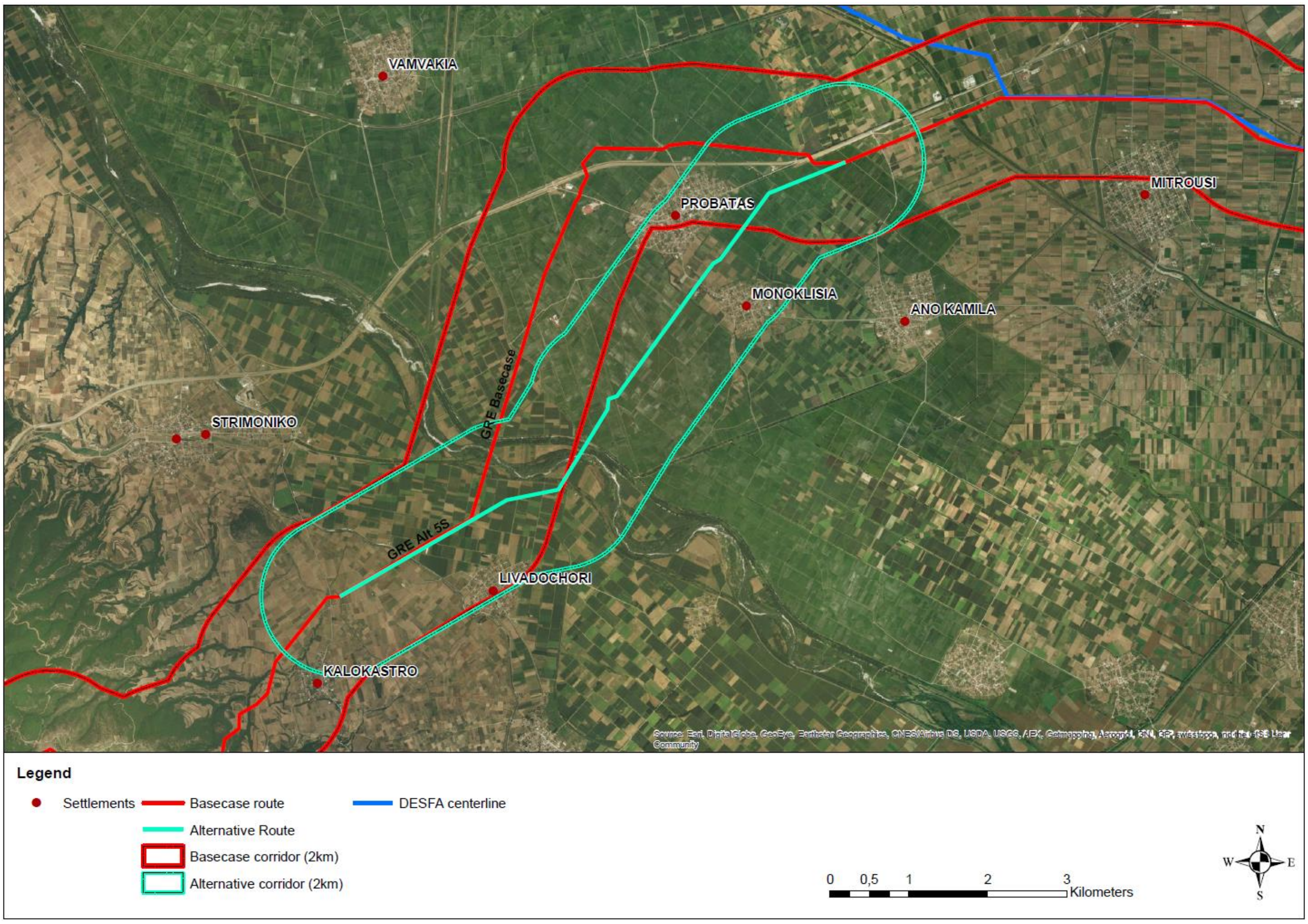


Figure 3-8: Greece East route refining – Provatas Area

The GRE Base Case route runs north of Provatas while route alternative GRE Alt_4S is located between the Provatas and Monoklisia. The analysis performed indicated that both routing options are expected to result in similar ESCH impacts. Based on consultation with local stakeholders and their concerns regarding Southern GRE Alt_4S, the GRE Base Case route passing to the north of Provatas was confirmed as the preferred base case.

Further details on the route alternatives considered for the Provatas area can be found in Section 2 – Project Justification of the Integrated ESIA Greece (GPL00-ASP-642-Y-TAE-0050 Rev.: 00) with impact indicators of the two routes in ESIA Annex 1.1 (GPL00-ASP-642-Y-TAE-0050 Rev.:01/at02) on the TAP website.

3.1.6 Route Refinement – Amfitriti Rerouting

This rerouting was designed to take into consideration the plans for the construction of a new hospital to the north of the ESIA base case and to keep a greater safety distance (see Figure 3-9). The planned hospital is now over 650 m away from the proposed new route. The overall length of the rerouting is 3,730 m, slightly longer (374m) than the ESIA base case.

Figure 3-9: Amfitriti Rerouting

3.1.7 Route Refinement – Kosmio Rerouting

The Kosmio rerouting was put forward by the local administration and concerned individuals who argued that TAP would further hinder the development of the area, considering the impact already from the existing DESFA pipeline and the road infrastructure. The overall length of the proposed rerouting is 17,324 m, 900 m shorter than the ESIA base case. The rerouting is illustrated in Figure 3-10.

Figure 3-10: Kosmio Rerouting

3.1.8 Route Refinement – Nestos Rerouting

The Nestos rerouting lies to the south-southeast of the ESIA base case (Figure 3-11). The rerouting runs in parallel to an existing channel and gravel road in an area of non-private land. It was put forward by the Mayor of Nestos and the Municipality's technical department of irrigation to minimise crossing of private land and damage of the sensitive irrigation system installed there. The overall length of the rerouting is 14,878m, slightly longer (700m) than the ESIA base case.

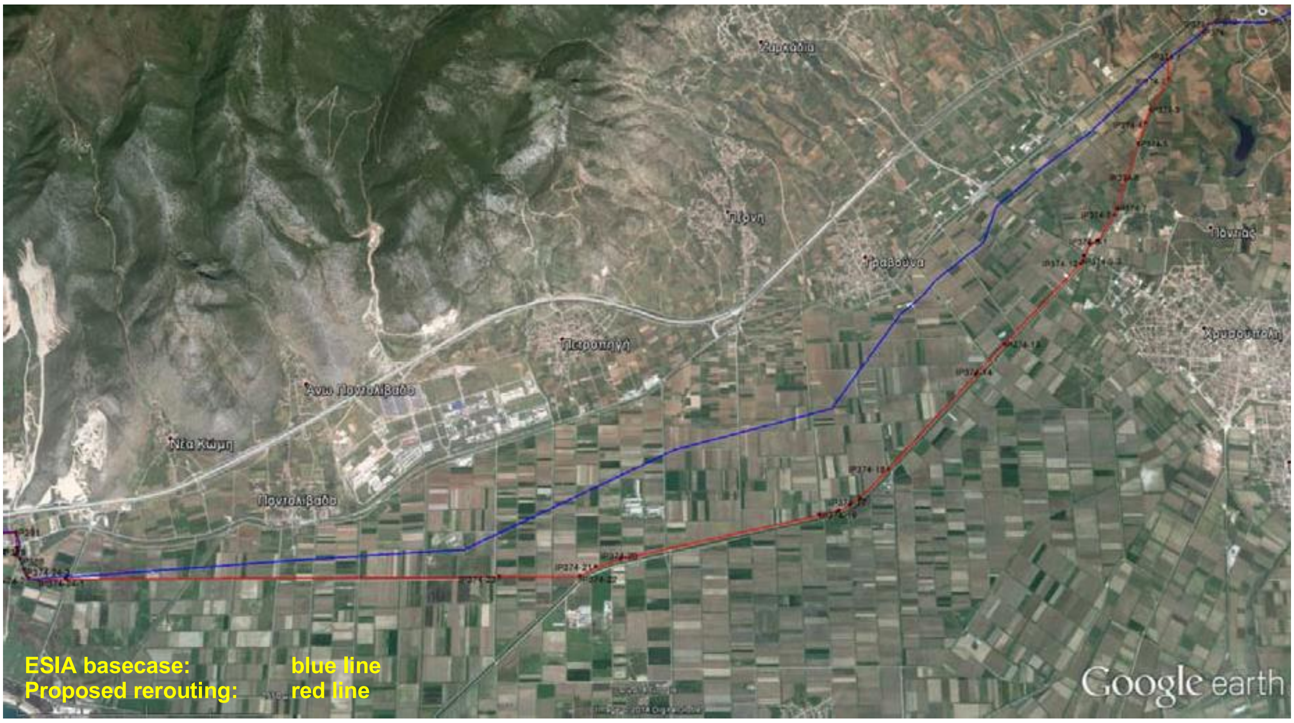


Figure 3-11: Nestos Rerouting

3.1.9 Route Refinement – Nea Karvali Rerouting

The Nea Karvali rerouting was proposed by the local Community (based upon a rerouting suggestion of the Technical Chamber of Greece – Branch of East Macedonia and Thrace) with the aim to shift pipeline further away from the community of Nea Karvali which is heavily affected by the existing infrastructure projects (gas pipeline, tank farms, Highway etc.). The overall length of the rerouting is 4,960m, approx. 1,160 m longer than the ESIA base case. The rerouting is illustrated in Figure 3-12.

Figure 3-12: Nea Karvali Rerouting

3.1.10 Route Refinement – Drymos Rerouting

Drymos rerouting was designed to avoid proximity to sports installations and to allow more area for future town expansion, following a relevant request by the Municipality of Oreokastro. The overall length of the rerouting is 3,300m, slightly longer (271m) than the ESIA base case. The rerouting is illustrated in Figure 3-13.

Figure 3-13: Drymos Rerouting

3.1.11 Route Refinement – Pentalofos Rerouting

The proposed rerouting around Pentalofos (illustrated in Figure 3-14) is in Oraiokastro municipality, approximately 1.2 km in length and deviates a maximum 520 m from the initial base case route. The reroute was made because of a request from the Ministry of Defence, which required a larger distance between the pipeline route and the Mitrousis army camp.

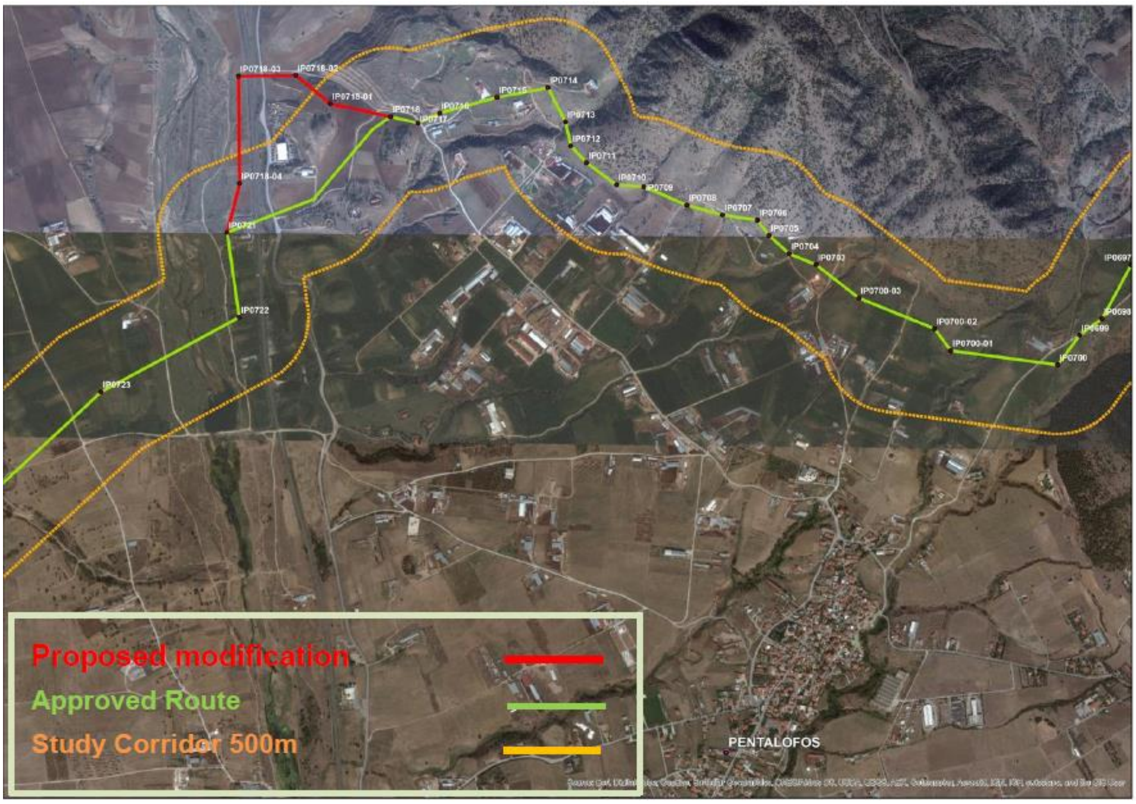


Figure 3-14: Greece East route refining – Pentalofos re-route

The analysis performed in an ESIA Amendment indicated that both routing options are associated with similar ESCH impacts. The alternative was selected as the new base case route for the Pentalofos area to accommodate the extended distance from the military base.

Further details on the route alternatives considered for the Pentalofos area can be found in the Fourth Amendment to the ESIA Greece (GAL00-EXG-642-Y-TAE-5004 Rev.: 00) on the TAP website.

3.2 Greece West Route Selection

The TAP route in this section does not follow any existing pipelines. However, the bundling principle was applied along existing or planned linear infrastructure where possible (notably the Egnatia motorway).

As a result of the route selection process (described in section 2.3), two main corridors were identified for the Greek West pipeline section between Nea Mesimvria and the Greek-Albanian border, namely the Northern Corridor and Southern Corridor.

A detailed assessment of the possible route alternatives across the Greece West pipeline section commenced in mid-2010 with the aim of selecting a technically feasible pipeline route whilst minimising interactions with the main ESCH constraints such as: protected areas, settlements with land use planning constraints and known cultural heritage sites. As result of this process, three alternatives were identified within the Northern Corridor (Alternatives N1, N2 and N3) and two within the Southern Corridor (Alternatives S0 and S1) as represented in Figure 3-15.

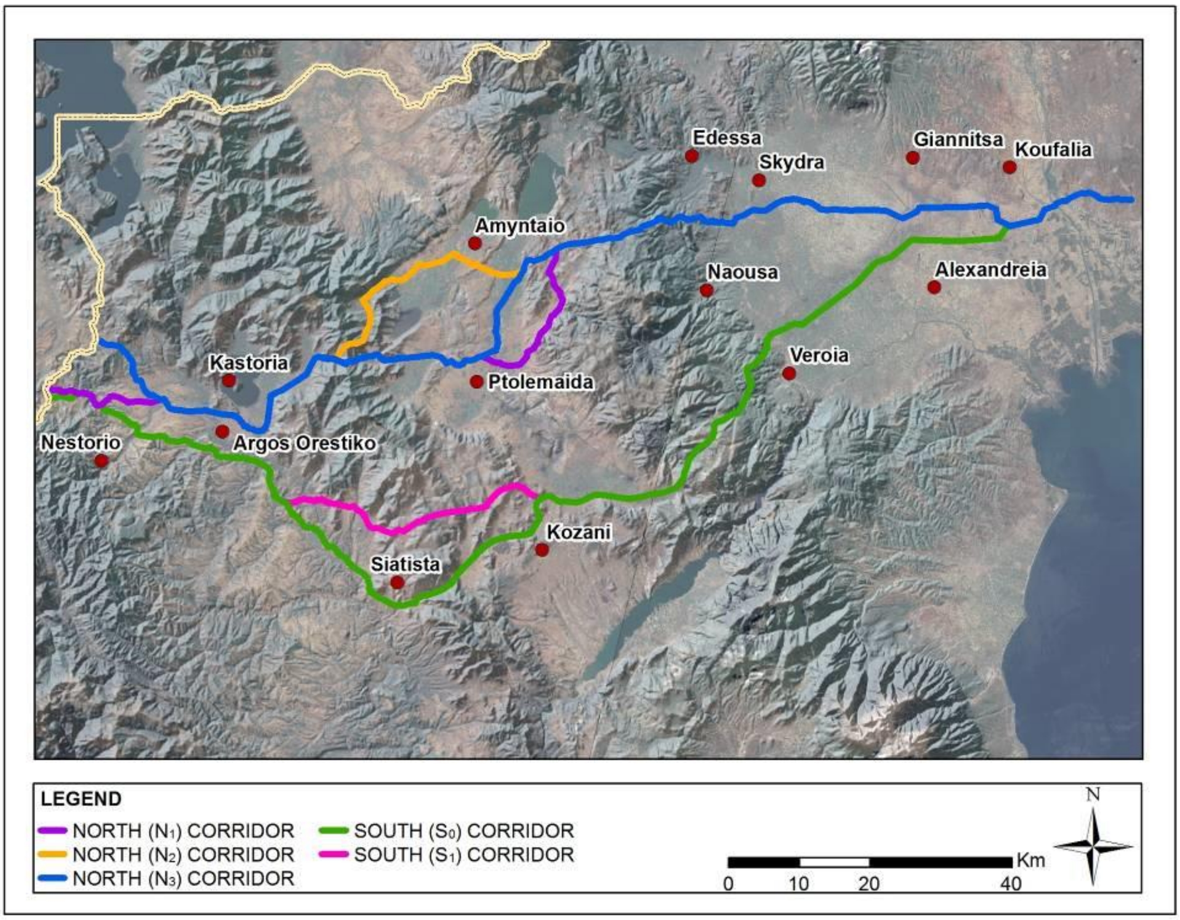


Figure 3-15: Routing alternatives Greece West

A technical and ESCH baseline characterisation and appraisal of these alternatives was then conducted through a combination of desk top studies and field studies. For each alternative, a 2-km wide corridor (1 km both sides of the centreline) was investigated. Impact indicators of the ESCH characteristics of each alternative were established to highlight the key potentially critical features.

The comparative evaluation of the routing options performed resulted in the selection of two routes as the main alternatives (see Figure 3-15):

- The Northern Route (Alternative N1); and
- The Southern Route (Alternative S0).

The consideration of the above alternatives during the route refining process is described in the sections below and discussed in further detail in the Greece West ESIA on the TAP website.

3.2.1 Route Refinement – Northern Route vs. Southern Route

The Northern Route Alternative N starts from Nea Mesimvria, at the existing DESFA compressor station, and follows a western direction through the municipalities of Chalkidona, Pella, Skydra, Naousa and Edessa. The route then turns to the south through the municipality of Eordea and then again to the west crossing the municipalities of Aminteo, Kastoria, Orestidos and Nestorio before reaching the border.

The Southern Alternative S0 has the same starting point as the Northern Alternative, but it heads towards the southwest, following the Egnatia Highway for some distance. It crosses the municipalities of Chalkidona, Pella, Alexandria, Veroia, Kozani and Voio. South of Siatista. The route then turns towards the northwest to cross the municipalities of Orestida, Kastoria and Nestorio before reaching the Albanian border crossing.

The two alternatives assessed are illustrated in Figure 3-16.

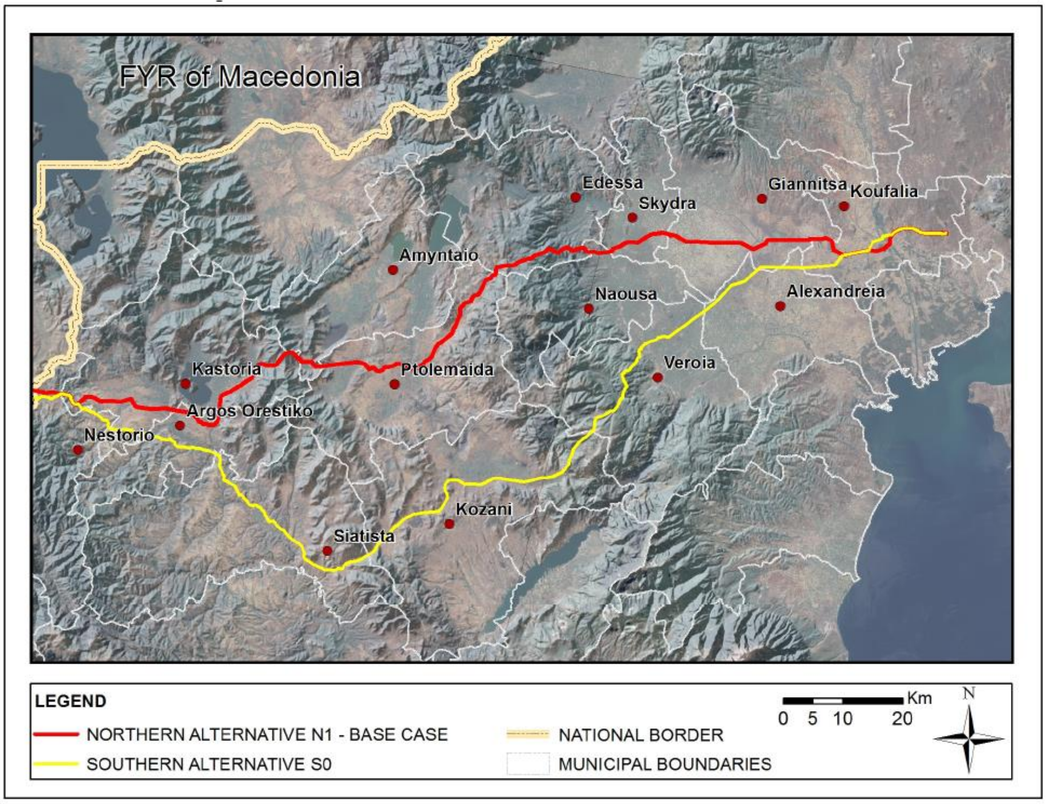


Figure 3-16: Greece West route refining – Northern Route vs. Southern Route

The main ESCH characteristics of the two alternative routes were assessed through a semi-quantitative review based on impact indicators, in line with the methodology described in section 2.3 of the report.

In summary, the Northern route faces higher challenges with regards to official planning zones, namely potential interactions with mining concession areas but potentially fewer challenges in terms of cultural heritage impacts, as there are fewer known cultural heritage sites. This route will cross the Axios River Natura 2000 site, which is unavoidable because the river runs in a north–south direction. The impacts due to the crossing will be minimised by adopting trenchless crossing techniques (micro tunnelling or horizontal directional drilling underneath the protected area).

The Southern Alternative S0 faces fewer challenges with regards to official planning zones but potentially higher challenges with regards to cultural heritage owing to a higher density of currently known archaeological sites within the corridor. Alternative S0 will also cross the Axios Natura 2000 site, which is unavoidable, and will further cross a second Natura 2000 site (North Vourinos Mountains and Mellia). The impacts due to the crossing of the Axios Natura 2000 site will be minimised by adopting trenchless crossing techniques (micro tunnelling or horizontal directional drilling underneath the protected area).

Based on the above assessment, the Northern route, Alternative N1 was selected as the preferred base case.

3.2.2 Route Refinement – Mining Concession Areas

The route refinement process continued for the favoured route corridor N1. This follow-up route refinement stage initially focused on the mining concession areas that the base case route crosses in Eordea municipality, for which mineral exploration rights are held by the Public Power Corporation (PPC).

TAP AG consulted with PPC to find a consensus about the most sustainable routing across this area. At the end of the consultation exercise a new base case was identified (illustrated in Figure 3-17) in agreement with PPC. This rerouting was implemented with a shift of the route corridor to the valley adjacent to the mountains.

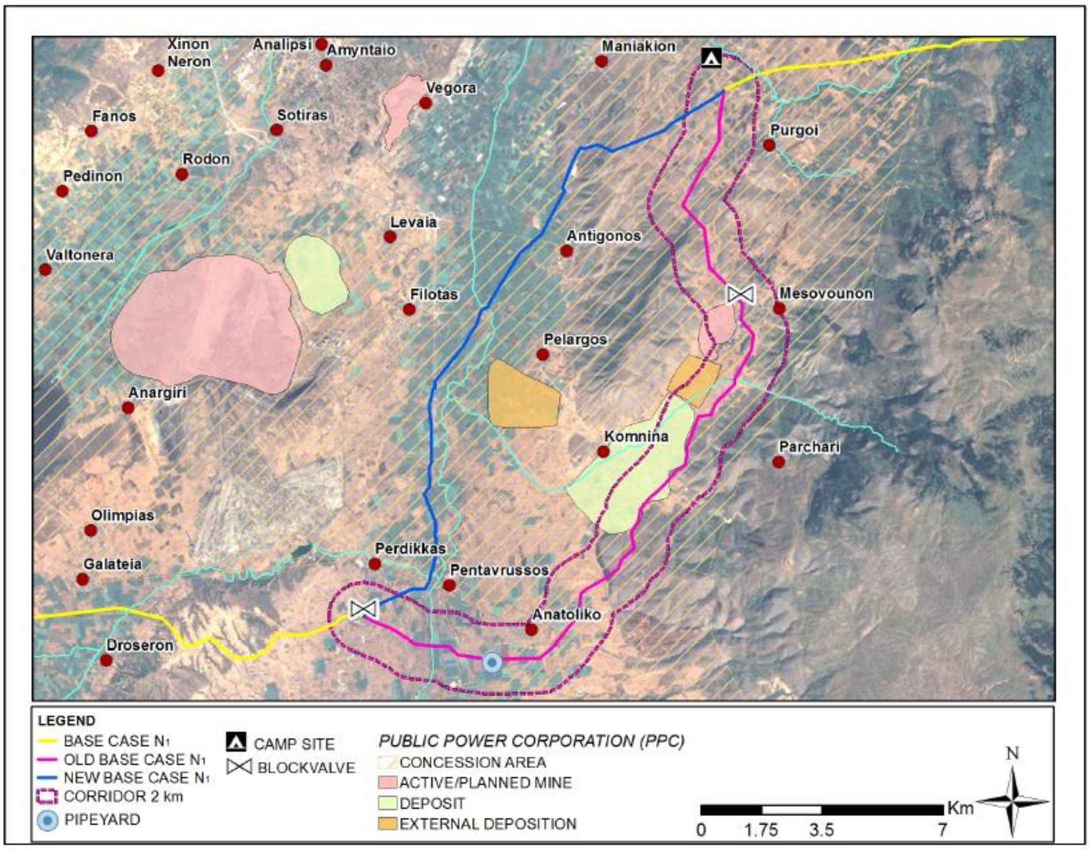


Figure 3-17: Greece West route refining – Mining Concession Areas

3.2.3 Route Refinement – Adjustment due to Albania Route Change

At the same time as Greece route refinement, a similar process was ongoing on the Albanian section of the pipeline and this process resulted in a route change close to the Greek border (refer to section 4.2). This route change in Albania was optimised for the entire TAP project by adapting the western end of the Greek route corridor. As result of this route refinement, the new base case considered the westernmost part of route option N3 identified as potential alternative at an earlier stage in the project. This adjustment is illustrated in Figure 3-18.

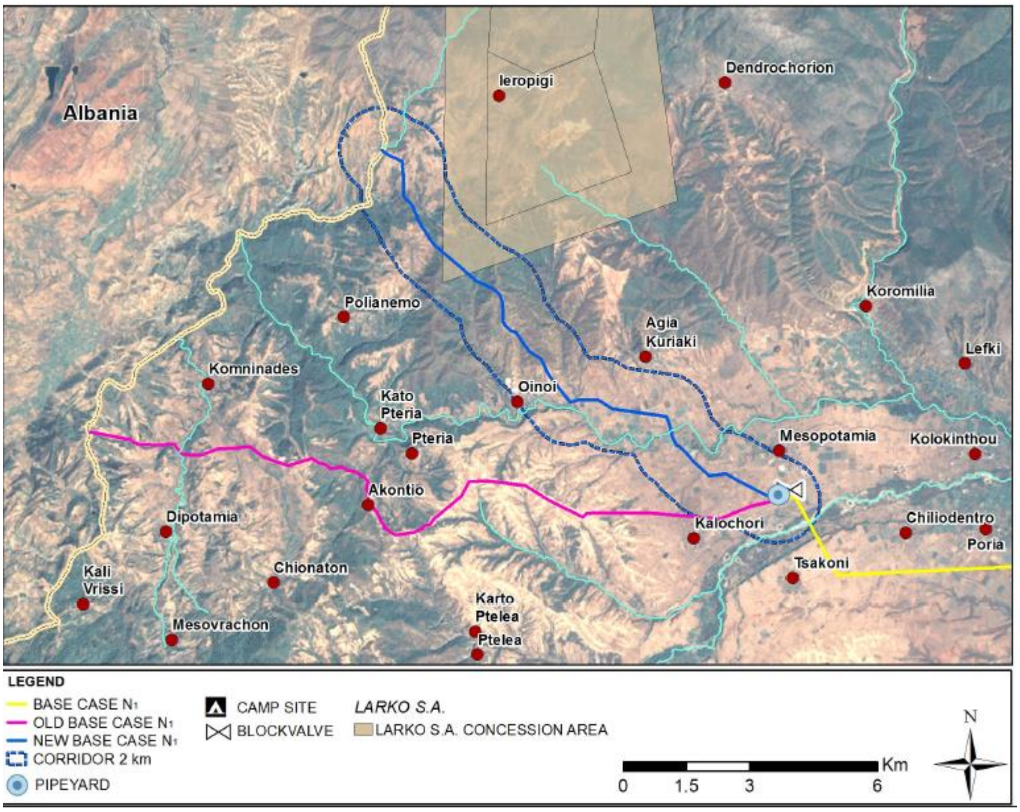


Figure 3-18: Greece West route refining – Adjustment due to Albania Route Refinement

A minor rerouting was subsequently undertaken to avoid the LARCO nickel mining concession area close to the border (inner polygon represented in Figure 3-18 above). This rerouting was within the 2 km-wide N3 option corridor originally assessed.

Further details on the route alternatives for Greece west discussed above can be found in Section 2 – Project Justification of the Integrated ESIA Greece (GPL00-ASP-642-Y-TAE-0050 Rev.: 00) on the TAP website.

The following three subsections detail further major reroutes undertaken in Greece west and detailed within ESIA amendments.

3.2.4 Route Refinement – Pyrgoi Rerouting

Pyrgoi rerouting designed to optimise crossing the apple plantations of the area and minimise damage to agricultural installations, i.e. trees support, irrigation networks, crop protection netting, and so on. The overall length of the rerouting is 4,710m, slightly longer (80m) than the ESIA base case. The re-routing is illustrated in Figure 3-19.

Figure 3-19: Pyrgoi Rerouting

3.2.5 Route Refinement – Foufas - Eordea Rerouting

Foufas – Eordea rerouting addresses requests by the Municipality of Eordea to avoid crossing an area currently under development for construction, it allows community plans for small hydropower development in the area and it accommodates individual requests through route optimisation. The overall length of the rerouting is 10,755m, slightly (25m) shorter than the ESIA base case. The rerouting is illustrated in Figure 3-20.

Figure 3-20: Foufas - Eordea Rerouting

3.2.6 Route Refinement – Ano Grammatiko Rerouting

The proposed rerouting in the Ano Grammatiko area (illustrated in Figure 3-21) is in Edessa municipality, and is approximately 4 km in length. The reroute was made as the result of geotechnical investigations and a request made by the Ephorate of Archaeology of Pella, to avoid sites of archaeological interest in the area.

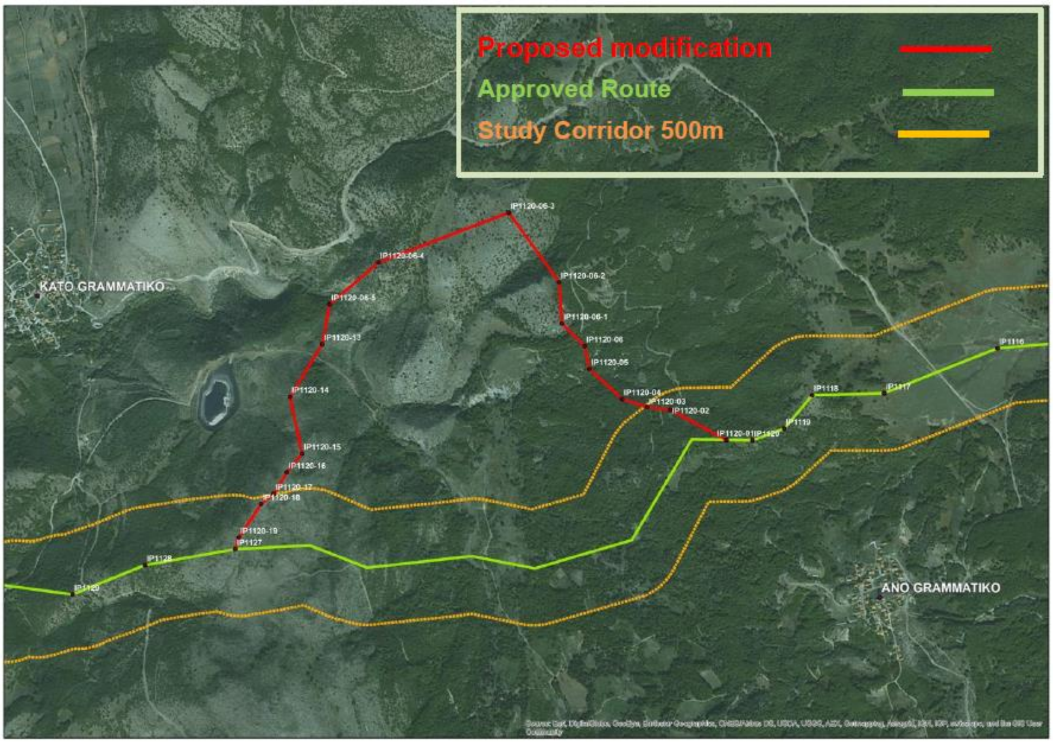


Figure 3-21: Greece East route refining – Ano Grammatiko re-route

The analysis performed in an ESIA Amendment indicated that the alternative routing option did not cause any additional ESCH impacts and avoided the sites of archaeological interest in the area. The reroute alternative was therefore selected as the new base case route for Ano Grammatiko to avoid the area of cultural heritage interest. TAP is investigating further route refinement.

Further details on the route alternatives considered for the Ano Grammatiko area can be found in the Fourth Amendment to the ESIA Greece (GAL00-EXG-642-Y-TAE-5004 Rev.: 00) on the TAP website.

3.3 Compressor Station Locations

For the initial capacity of 10 bcma, one compressor station near Kipoi (GCS00) is foreseen in Greece. For the 20 bcma phase, an additional compressor station (GCS01) will be located near Serres.

For both compressor stations, three local alternatives have been investigated. For each location, the main ESCH aspects were identified and compared in a 1000-m buffer zone.

3.3.1 Compressor Station GCS00

This section briefly describes the selection of the location for the GCS00 compressor station and the refinement of that location. Further information on the relocation of GCS00 can be found in the ESIA Amendment 2 (GAL00-EXG-642-Y-TAE-5002 Rev.: 02) on the TAP website.

Location selection

The alternative locations for GCS00 near Kipoi were selected based on the availability of space and the distance from sensitive receptors (as far as possible).

The three alternative sites initially investigated are in an agricultural area (see Figure 3-22). No significant environmental, cultural or socioeconomic constraints were identified for any of the alternatives other than potential flooding risks on the locations of GCS00-A and GCS00-C. GCS00-B1 is located closer to the existing DESFA installations and therefore it presents more operational advantages. Based on this initial assessment, although all compressor station alternative locations were deemed feasible, GCS00-B1 was chosen as the selected GCS00 location due to the operational advantages.

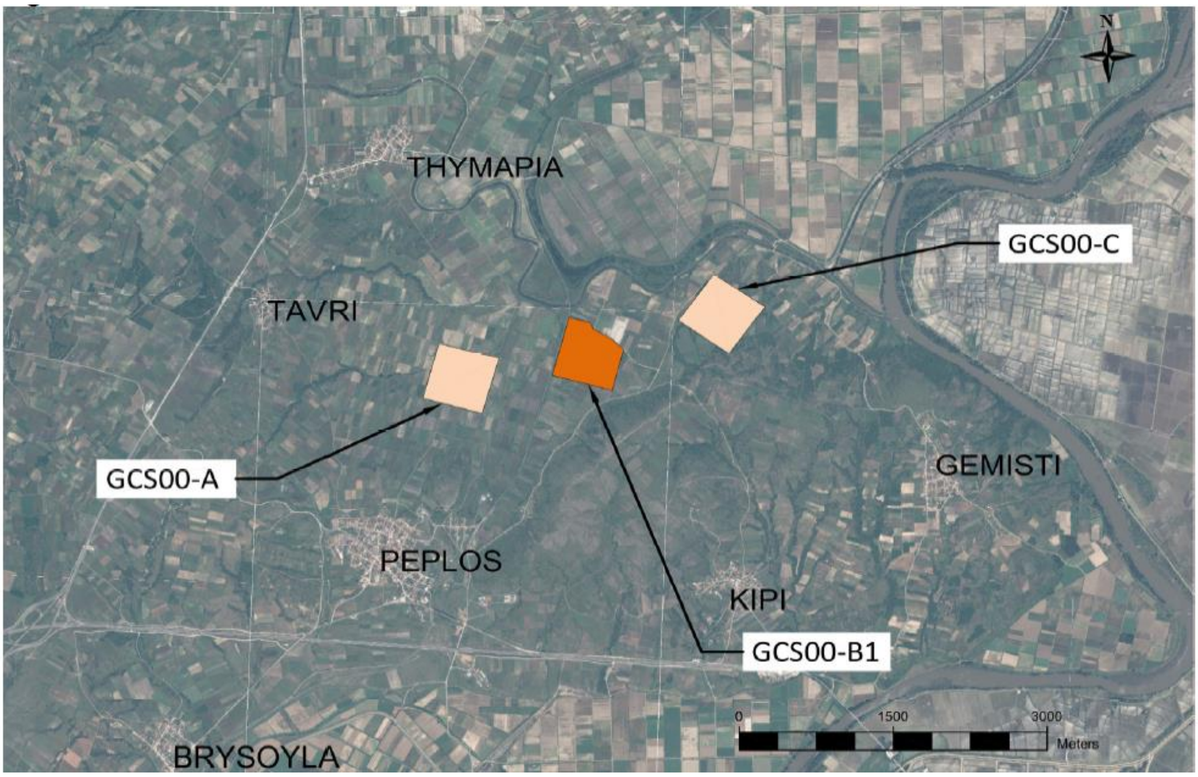


Figure 3-22: GCS00 Location Options

Location Refinement

Further assessment of the proposed GCS00 location was performed at a later stage and was subject to an ESIA amendment.

Owing to the presence of designated streams (temporary watercourse) crossing the initially approved site as well as afore mentioned alternatives, the GCS00 location required further refinement. The main constraints associated with the stream included risk of damage and erosion to the banks, which could flood the land plot. The necessary works to mitigate these risks would introduce changes to the local hydrological regime of the area, which belongs to the extended floodplains of the River Evros. As this was not desirable, TAP sought an alternative location.

The new GCS00 location is in a more elevated area in the municipality of Alexandroupolis; approximately 1200 m east-southeast of the approved GCS00 location (see Figure 3-23).

The new GCS00 site is in an area with low, undulating hills and comprises pastures, abandoned fields and a few cultivated areas. The compressor site itself comprises pastureland. The nearest settlements are Kipoi (1.9 km to the south), Peplos (2.8 km to the southwest) and Gemisti (1.9 km to the east). Moving the compressor station to an elevated area reduces the flooding risk and benefits from better air dispersion. Moving the compressor site required a minor reroute of the pipeline and access roads to the facility to be built, as illustrated in Figure 3-23.

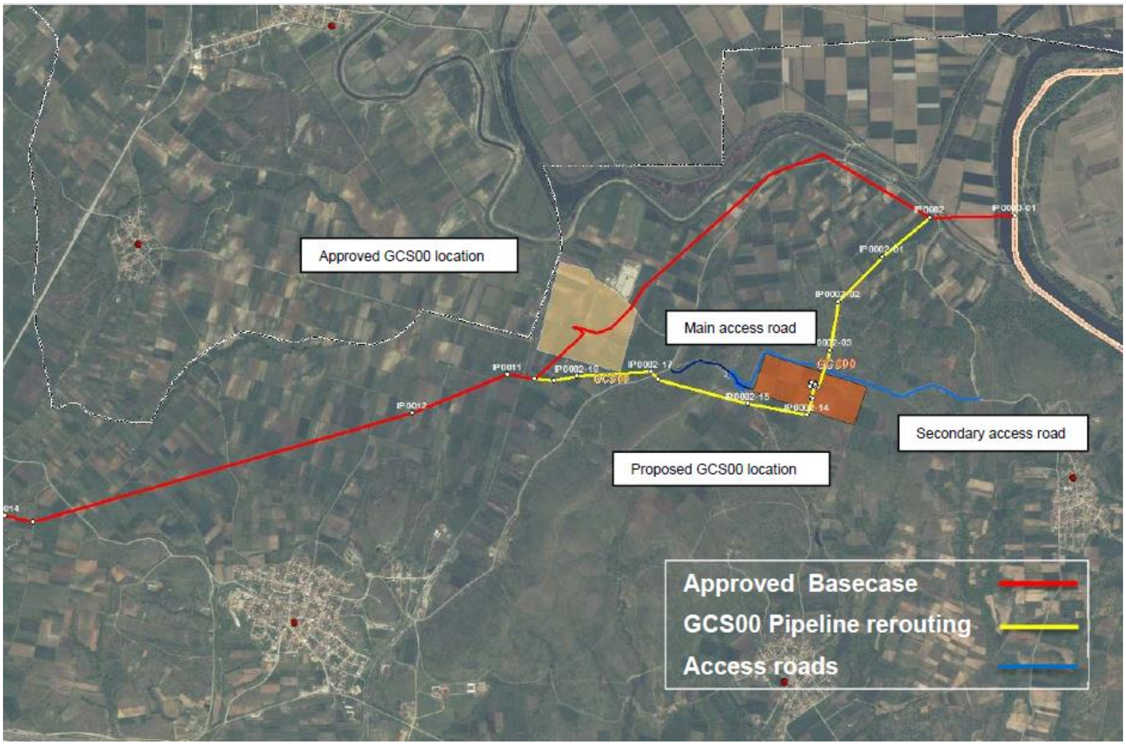


Figure 3-23: GCS00 Location

3.3.2 Compressor Station GCS01

Three alternative locations for GCS01 near Serres were assessed, all in agricultural areas close industrial (mainly commercial) areas (see Figure 3-24). No significant environmental, cultural or socioeconomic constraints were identified for any of the alternatives. During the stakeholder engagement process, Krinos residents and various other local stakeholders suggested GCS01-D as the most appropriate location for the compressor station. Based on the above assessment, although all compressor site alternative locations are feasible, it is considered that GCS01-D presents advantages over the other alternatives and therefore GCS01-D was selected as the proposed GCS01 location.

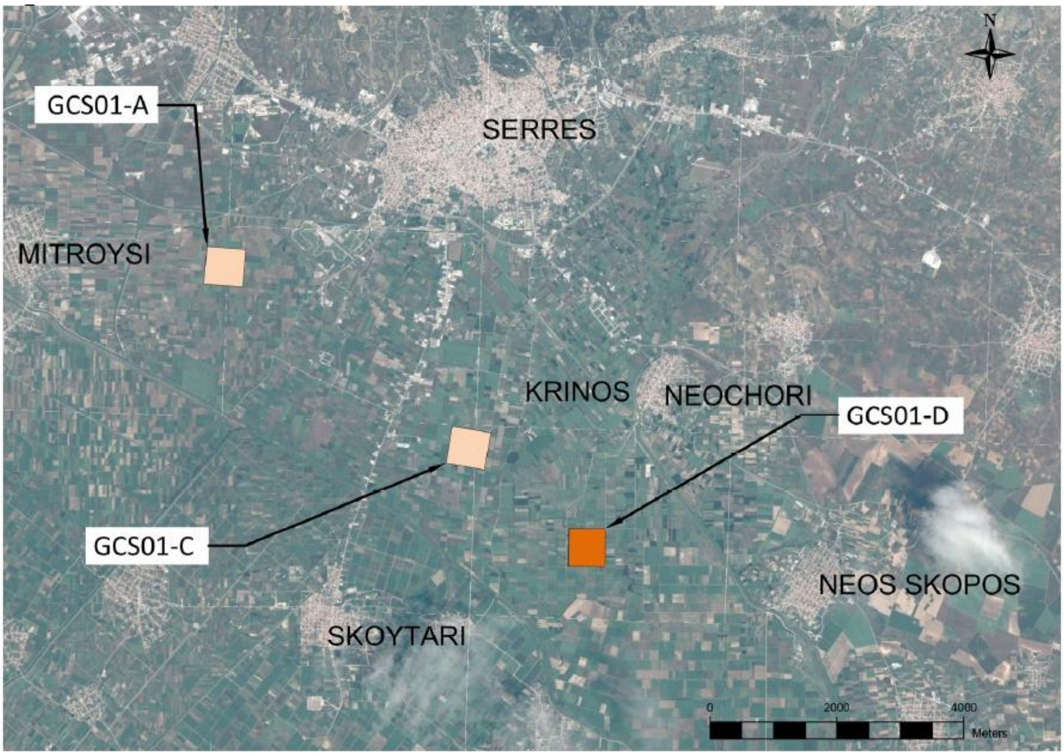


Figure 3-24: GCS01 Location Options

Following a further stakeholder request, four alternative locations for GCS01 were investigated. All four locations are within the boundaries of the Koronia-Volvi National Park, which issued a negative opinion regarding the proposed location of GCS01 within the national park.

TAP investigated two further locations (near Kalokastro and Sfelinos), however from an air dispersion perspective the approved location of CS01 was better than these two alternatives. All these activities were also communicated to the relevant stakeholders.

3.4 Greece Base Case

Following the process outlined above, Figure 3-25 presents the current TAP base case for the Greece onshore pipeline route as of January 2016.

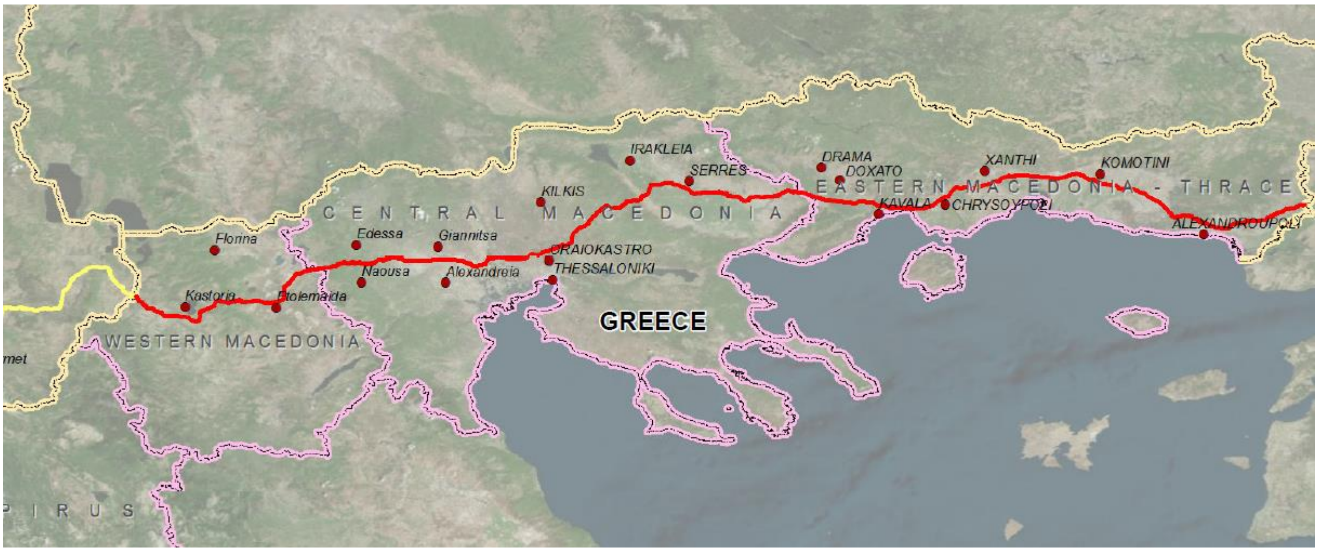


Figure 3-25: Greece pipeline base case

4. Route Selection Process: Albania

The technical feasibility of both the onshore and offshore pipeline sections and the shortest and shallowest crossing point of the Adriatic Sea between Albania and Italy drove the route selection process in Albania. During the Basic Engineering Phase (July 2006–April 2007), the landfall on the Albanian Adriatic coast initially foreseen to be north of the city of Vlore was shifted further northwards to the Hoxhara plain, west of the city Fier. The reason for doing so was the presence of protected areas to the north and south of Vlore and the urbanised bay in-between, as visible in Figure 4-1.

The route corridor branched off from the initially identified corridor near Kalivac/Shkoza towards the northwest mainly following the Vjosa River. Following this change, six corridor alternatives were identified in a 50-km search area (as indicated in Figure 4-1).

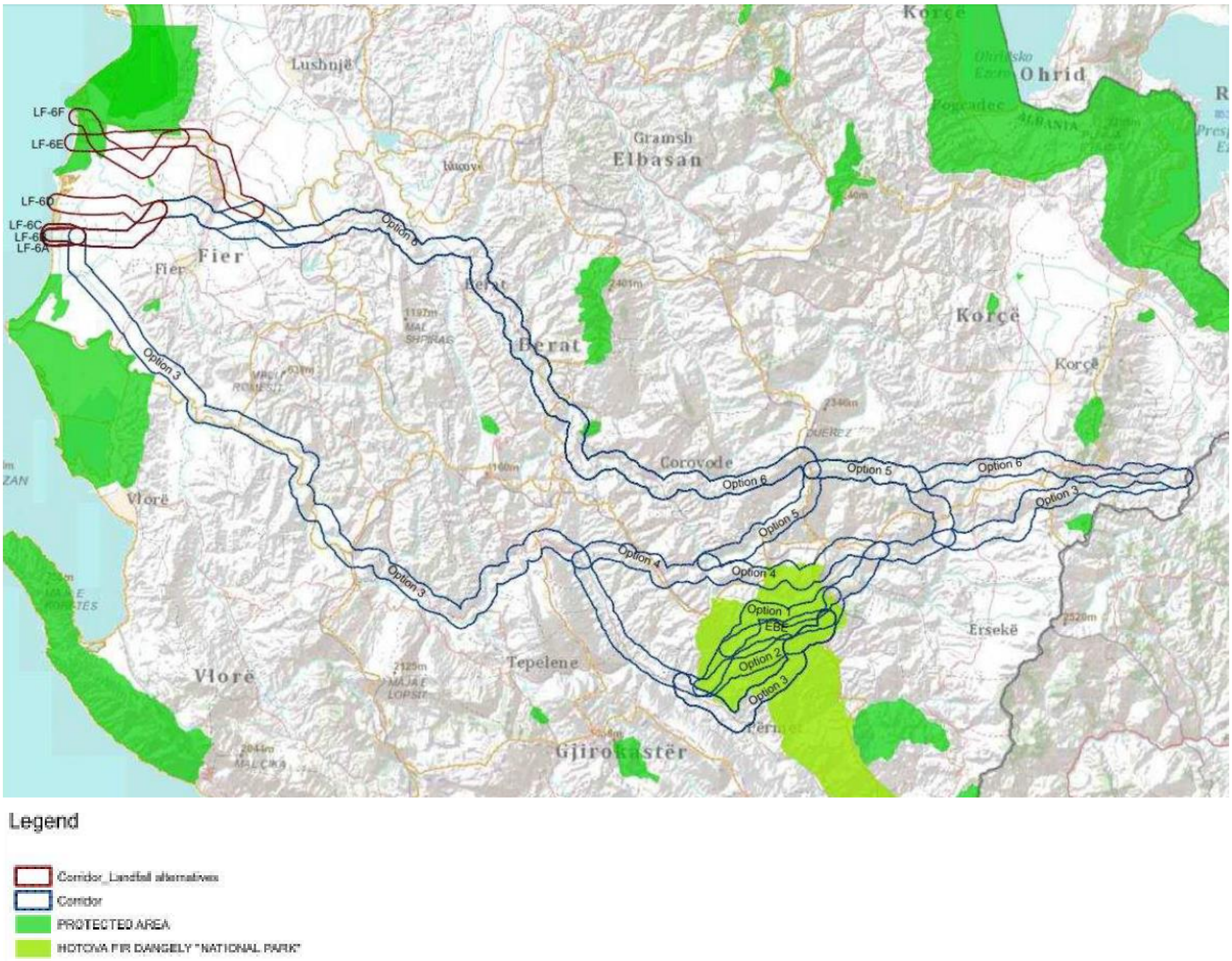


Figure 4-1: Identified routing alternatives Albania

A further route refinement process addressed the eastern, central and western parts of the Albanian pipeline sections as reflected in Figure 4-2. The central part of the Albanian corridors proved to be one of the most challenging parts of the route selection process due to the presence of the Hotova Fir-Dangelli National Park, a legally protected area and international Emerald Area[2]. The area is also characterised by steep slopes and geohazards including faulting and susceptibility to landslides. Hydrological hazards are also present in the region such as soil liquefaction and conditions that could cause pipeline buoyancy issues in floodplains.

Complete information on the route selection and assessment performed in the frame of the stages indicated above is available in Section 2.3.2 and 2.3.3 – Project Justification of the ESIA Albania (AAL00-ERM-641-Y-TAE-1004_Rev.: 03)

[2] The Emerald Network is an ecology network made up of Areas of Special Conservation Interest. The objective of the network is the long-term survival of the species and habitats of the Bern Convention requiring specific protection measures,

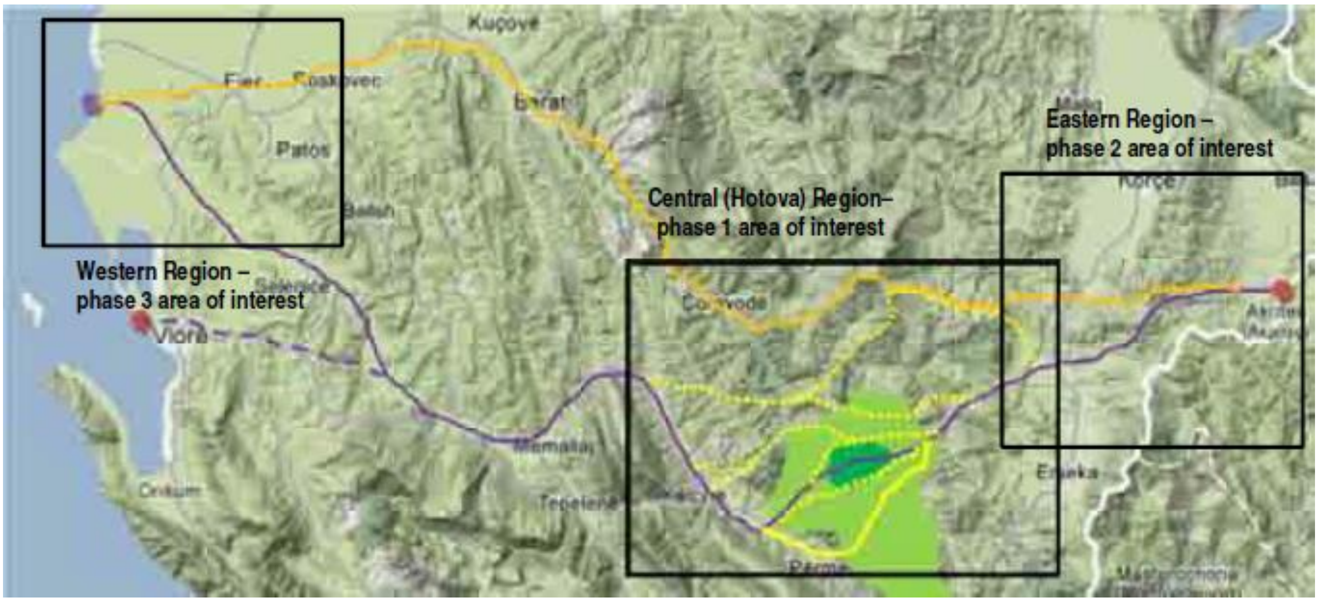


Figure 4-2: Albania routing alternatives and main areas of route refinement

4.1 Eastern Region

The alternatives assessment carried out during early 2011, considered the Eastern Region, between the Greek border and the mountainous Central Region. An assessment of the approximately 30 km-long alternative identified at an earlier Project stage (Alternative 6) was made in detail, including another round of consultation with national and regional authorities. These activities highlighted several important issues regarding this section, which had already been identified in earlier phases, (mainly between 2009 and 2011). This included crossing of a protected area with several high-value ecosystems, crossing of an area with high touristic potential and constructability constraints along very narrow mountain ridges.

These characteristics of Alternative 6 deemed it necessary to identify and appraise an alternative route for this section of the pipeline. After the identification of a potential alternative, named Alternative 6A (see Figure 4-3 below) a comparative appraisal of both alternatives using the route indicators and the methodology outlined in Section 2, was performed. A summary of the appraisal is presented in Table 4-1.

Based on the assessment Alternative 6A has a significantly better environmental profile than Alternative 6, due to lower impact to protected areas and natural habitat. From a cultural heritage perspective Alternative 6A has a higher potential for undiscovered cultural heritage sites than Alternative 6, because it has higher potential for open air sites buried under flood plain alluvium, which are harder to detect from above-ground reconnaissance. On the other hand, as re-routes due to chance finds during construction are common, flexibility for these reroutes is also an important factor. If constructability constraints are greater due to rougher topography along Alternative 6, which is the case, then the flatter topography of Alternative 6A would offer more opportunity to create minor route variants during construction and therefore more flexibility to respond to archaeological chance finds. As a result, Alternative 6A was selected the base case option.

This reroute resulted in changing the location of the Greece - Albania border crossing, and determined the Greece West section route change presented in section 3.2.3.

Impact Indicator	Units	Relevance to the Appraisal	Alternative 6	Alternative 6A
Environment				
Total length and surface clearance (pipeline construction) within CORINE Biotopes	Km/ha	Second level of designation, constitute areas of high environmental interest (ecological, landscape, flora and fauna species, etc.).	16.8/67.7	4.8/19.3
Total area of natural habitats crossed (pipeline construction)	Ha	Natural Habitats (as identified in the CORINE Land Cover database) are an indicator of natural value	63.5	6.9
Total forest clearance (pipeline construction)	Ha	Important as habitat itself and as indicator of fauna	49.2	0
Number of Natural Monuments within 2 km corridor	No.	Proposed protected points by statutory designation	4	2
Ridge modification	km	Highly visible and landscape modification (permanent impact). Indicative of relevant earthworks and potential landfills and restoration difficulties	7	0
Cultural heritage				
Important Archaeological Sites		Important in this context means physically substantial that would require considerable time to investigate and/or rescue	2 Sites	1
Overall Archaeological Potential of Corridor	%	Percentage of "cultivated land" (Code 211 and 223) within the 500km corridor from CORINE land cover maps.	10%	90%
Archaeological Flexibility	Qualitative (High, Medium, Low)	Re-route options due to chance finds during construction are common. If constructability constraints are great due to rough topography and flatter topography offers more opportunity to create minor route variants during construction and therefore more flexibility to respond to archaeological chance finds	Low	High
Social				
Settlements within the corridor routes	Number of settlements	Population potentially affected by the project	6	18

Table 4-1: Route comparison table

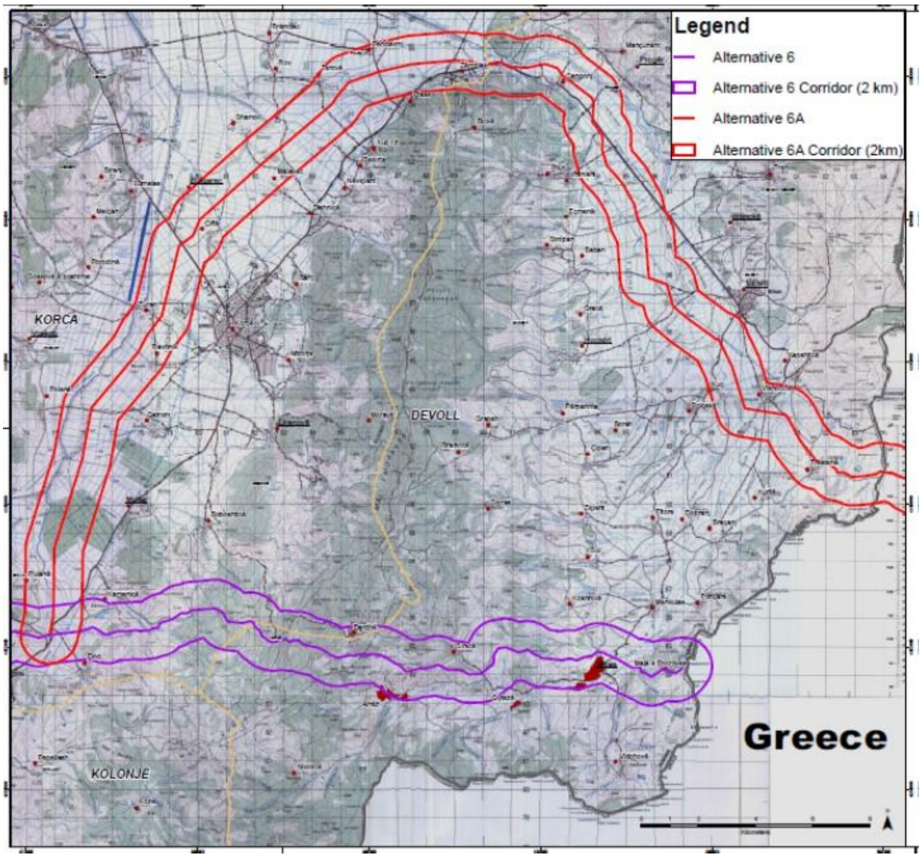


Figure 4-3: Albania eastern region route options

Technical requirements dictated the metering station ACS02 (which would be converted to a compressor station for the 20 bcma phase) be located in proximity to the Greek/Albanian border on Albanian territory. As such Bilisht was selected as the location for ACS02.

4.2 Route Refinement - Central Albania region

By the end of 2009, six alternative crossings of the central mountainous region of Albania had been identified. Figure 4-4 details the location of these six alternatives in the Hotova region, the most challenging part of this terrain.

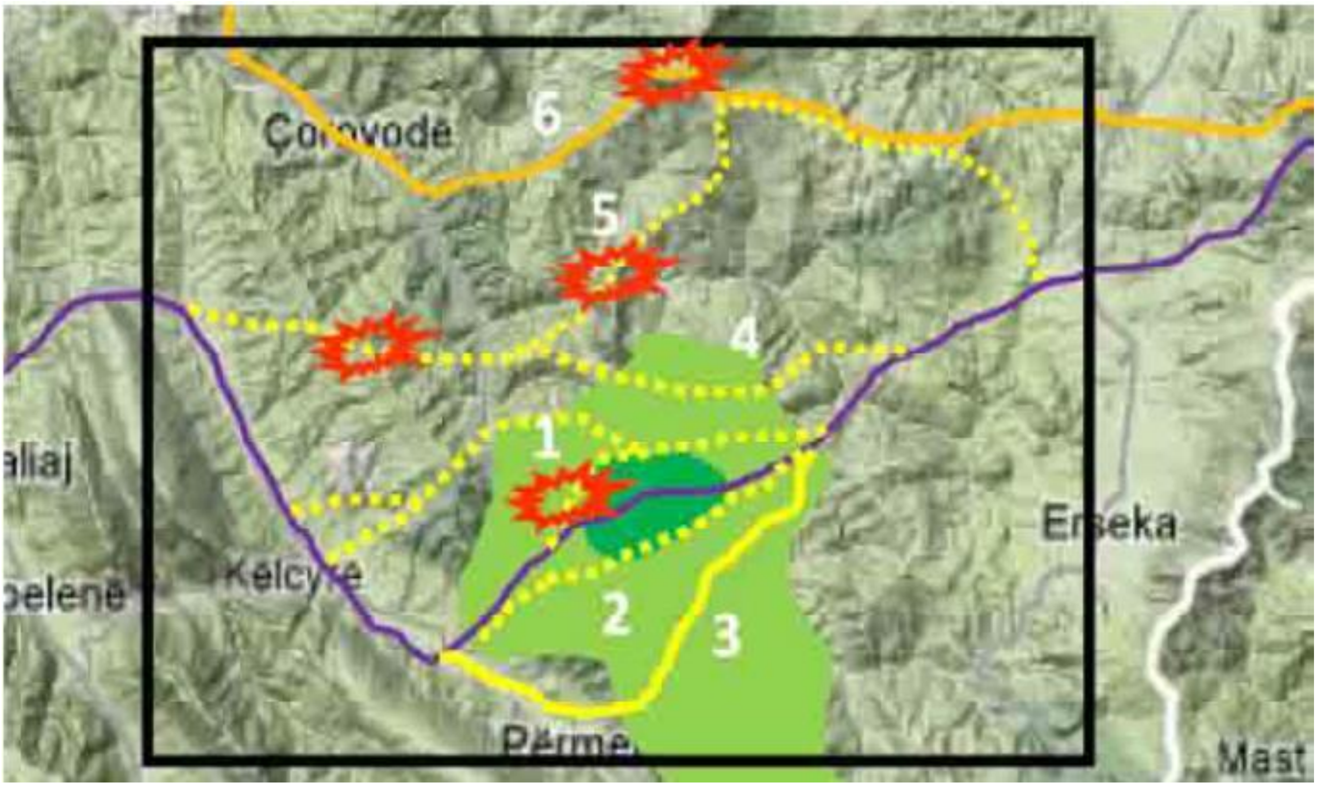


Figure 4-4: Hotova Region, Assessed Route Corridors and Challenging Sections

The six alternatives were studied following the methodology described in Section 2.3, using the Route Selection Indicators. As a result of this analysis, two of the alternative routes were selected for further study and comparison.

The other four were discarded because:

- Alternative 1 was found to be unfeasible from a construction perspective, as it crosses several active landslides.
- Alternative 2 could not avoid impacts on the core zone of the National Park; it would need to be built partly along the borders of the core zone where construction and new access roads would cause irreversible changes to the protected and sensitive landscape and forest habitats.
- Alternative 4 aimed to avoid the core zone and reduce the overall impacts on the National Park while using the most direct connection between the Albanian highlands and the Vjosa Valley. The assessment concluded that this routing was not technically feasible as it crosses some active landslides and follows the bed of the Osumi river for 8 km.
- Alternative 5 proposed a route completely outside the National Park. However, field investigations concluded that this route was not technically feasible due to a large number of active landslides and the need to follow the bed of the Osumi river for 8 km.

The two technically feasible routes identified by the interdisciplinary alternatives (northern route Alternative 6; and southern route Alternative 3) are shown in Figure 4-5.

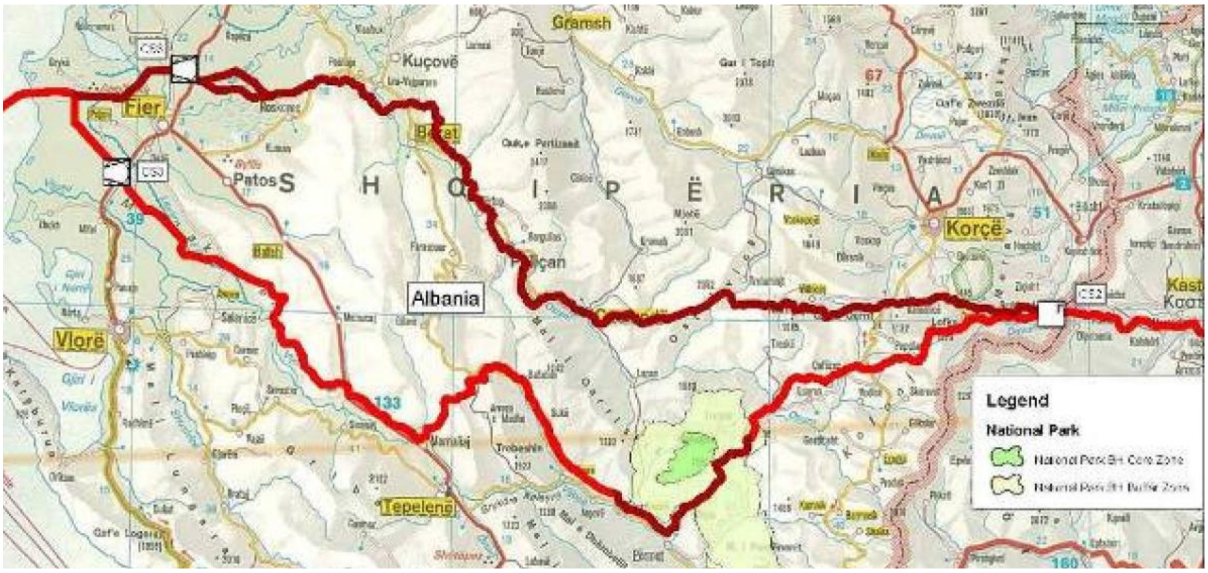


Figure 4-5: Albania – Central Region Route Alternatives selected for Further Assessment

Appraisals of each alternative demonstrated that both were technically feasible, facing similar overall construction challenges. Further assessment of their ESCH aspects found no significant differences in terms of safety, socio-economic and cultural heritage impacts.

The Northern Alternative faced fewer constraints in terms of environmental impacts and interference with official planning zones. The Southern Alternative crosses the Hotova National Park's sustainable/traditional use zones for 18 km.

TAP adopted the Northern Alternative as the base case routing for its further route refinement, planning and approval process in Albania.

Further details on impact indicators of the two routes can be found in Albania ESIA Annex 1 (AAL00-ERM-641-Y-TAE-1004 Rev.: 03/at01) on the TAP website.

4.2.1 Route Refinement – Central Albania, Potom area

Further technical studies were conducted on the base case after November 2011, including more detailed research on geotechnical conditions and constructability on slopes and mountain ridges. Following these studies, TAP investigated the feasibility of alternatives to a proposed tunnel section of the route, with suitable options for road access.

The proposed tunnel, which would be approximately 2.5 km long, lies at the highest point of the November 2011 base case route, 18 km east of Corovode in the Ostrovice Mountains (2,350 m above sea level). However, the tunnel option did not fully resolve the technical challenges of the pipeline section. In addition, there were issues associated with access to the remote highland area for tunnel construction and residual challenges of constructability on steep gradient slopes.

As a technically feasible alternative to the tunnel section, a route directly along the ridge was selected. Further details on this route selection can be found in Section 2 – Project Justification of the ESIA Albania (AAL00-ERM-641-Y-TAE-1004 Rev.: 03) on the TAP website.

Engineering and construction challenges, however, led to the identification of a re-route in the Potom area (blue line in Figure 4-6). This became the base case in January 2016.

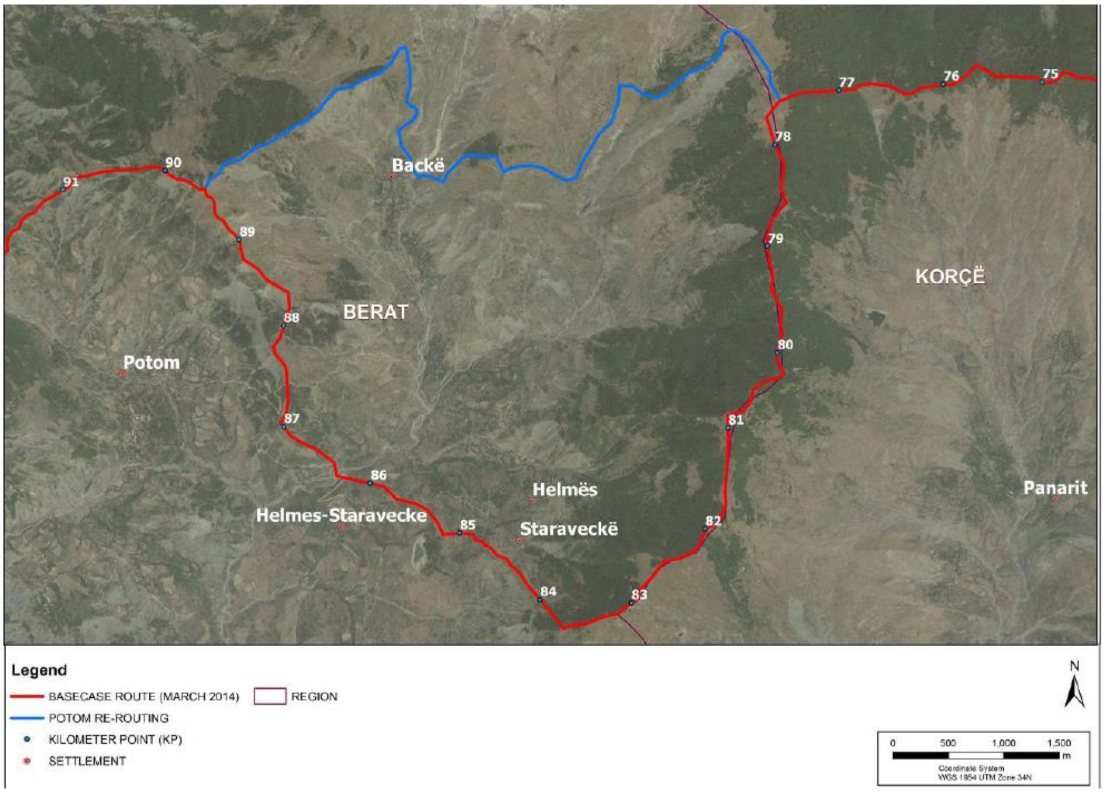


Figure 4-6: Albania – Potom Re-Route

Further information on the Potom re-route can be found in the Albania ESIA Amendment 2 (AAL00-ERM-641-Y-TAE-5000 Rev.: 00) on the TAP website.

Following further geotechnical investigation, the Potom re-route was found to be unsuitable because of a high potential for geohazards, in particular landslides in the Terpollar Valley. An additional route alternative was therefore proposed: the Terpollar re-route, shown on Figure 4-7. This is located a few kilometres north of the villages of Terpollar and Potom. The pipeline route is approximately 6,300m long section and traverses the head of the Terpollar valley by passing over the lower slopes and saddle area between Mounts Faqekuqit and Frengut. The second section of ridge crest is approximately 4,900m long and maintains the ridge alignment along the head of the Terpollar and Potom valleys avoiding sidelong ground above Potom village. The Terpollar re-route is the current base case.

While the new route is challenging from a constructability point of view, it is feasible and avoids a major landslide feature. Geotechnical investigations will identify any residual geohazards that will require mitigation.

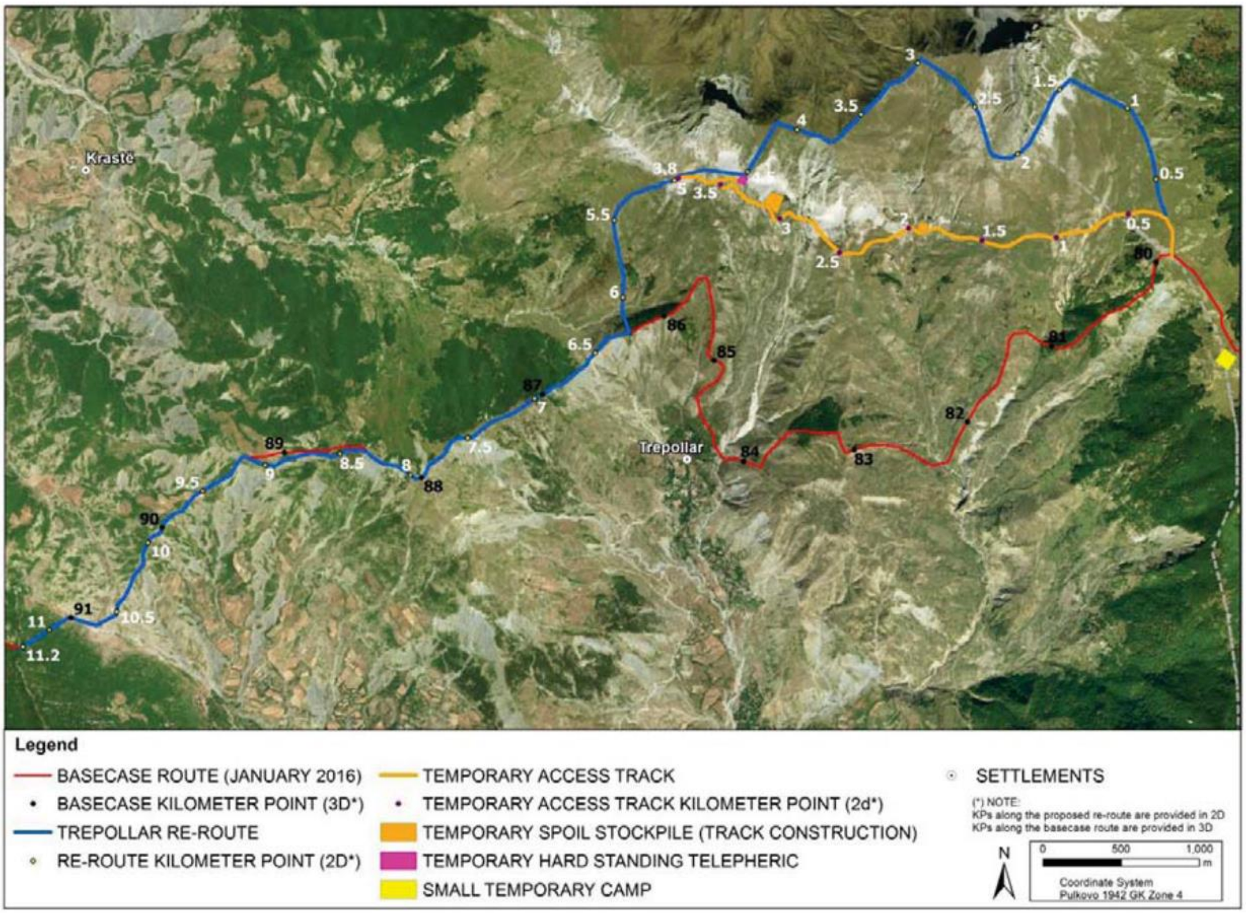


Figure 4-7: Albania – Terpollar Re-Route

Further information on the Terpollar re-route can be found in Albania ESIA Amendment 4 (AAL00-C10766-641-X-TAP-0004) on the TAP website.

4.2.2 Route Refinement – Central Albania, Corovode Microtunnel

The pipeline corridor along the Osumi River valley, near the city of Çorovodë, is susceptible to both geohazards and flooding; route alternatives were therefore assessed during the detailed design for this section. The assessments and technical investigations included multiple alternatives and potential local re-routes. Overall, three main route alternatives were considered (see Figure 4-8):

- Placement of the pipeline in the Osumi River channel protected by a piled wall.
- Two micro-tunnel segments through the Çorovodë rocky outcrop.
- Re-routing to avoid the Çorovodë section altogether (Çorovodë – Spathare re-route).

The option of placing the pipe in the Osumi river was dismissed as unconventional and high risk. Similarly, the re-routing option was considered unfeasible as the risk of landslides could not easily be mitigated.

The assessment concluded that a microtunnel option was the best solution from both, a technical, and risk reduction point of view. This was subsequently integrated into the current January 2016 base case route.

Further information can be found in Albania ESIA Amendment 3 (AAL00-ERM-641-Y-TAE-5007 Rev.: 00) on the TAP website.

Figure 4-8: Corovode Re-route Alternatives

4.2.3 Route Refinement – Central Albania, Osumi Valley Re-Routes

In 2015 two re-routes were made to avoid the mining concession areas L1437 (see Figure 4-9) and L1577 (see Figure 4-10), which are located in the central western section of the pipeline route in the Osumi Valley. The re-routes were made to ensure that the project does not conflict with the licensed quarry and mining areas. The re-routes enable the pipeline to bypass the concession areas.

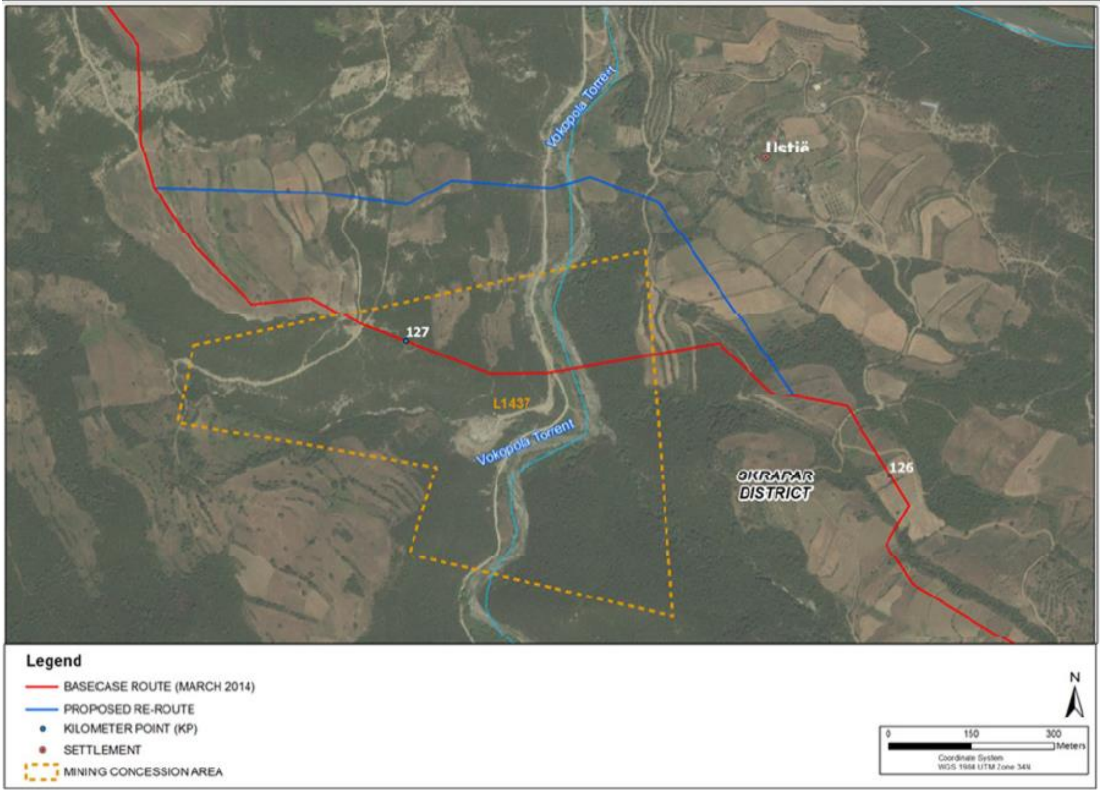


Figure 4-9: Osumi Valley L1437 Re-route

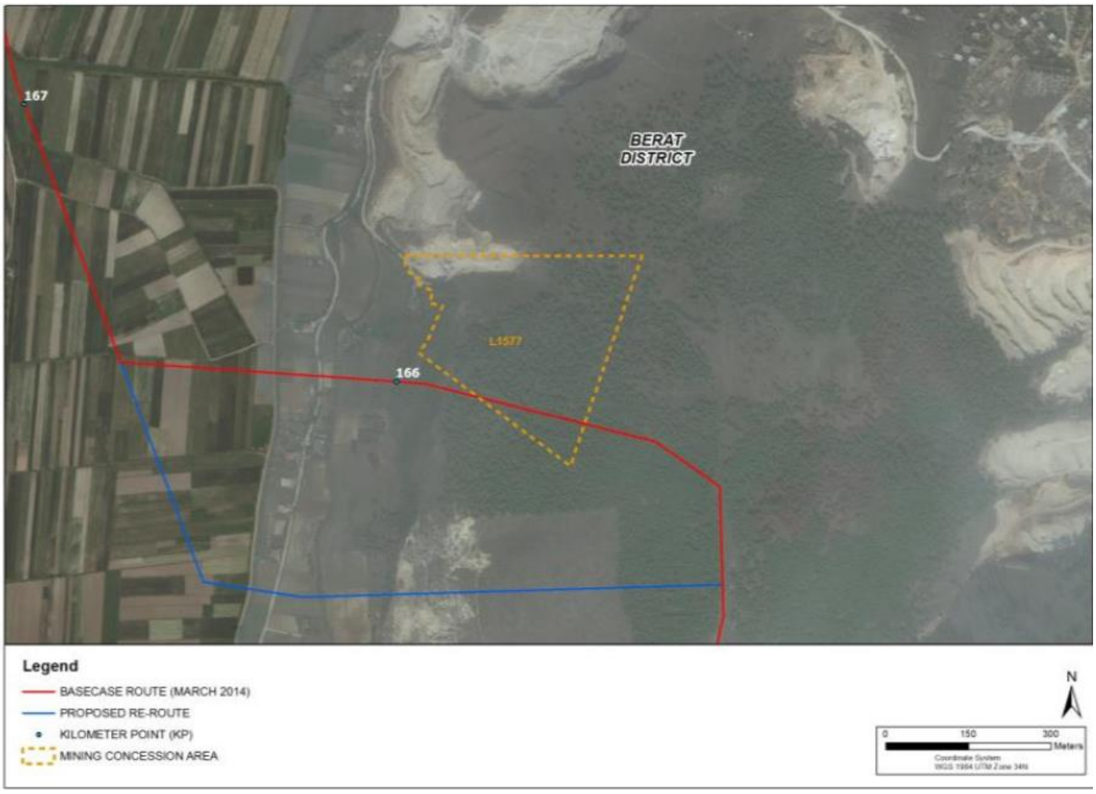


Figure 4-10: Osumi Valley L1577 Re-route

Analysis undertaken in the ESIA Amendment 1 indicated that both routing options are associated with similar ESCH impacts namely:

- In terms of environmental impacts, the habitat loss for this area even with mitigation measures implemented is expected to be of moderate to major significance due to the high quality and sensitivity of the area, and will require the implementation of biodiversity offsets.
- The most relevant socioeconomic impacts at local level are related to loss of livelihood due to land take for pipeline construction, including an area of cropland. Positive impacts include improved infrastructure, local employment and income from worker expenditure.
- Several cultural heritage resources and two areas of high archaeological potential that could be impacted by the project were assessed and measures identified to avoid, minimise, or mitigate those impacts identified.

Given the similar ESCH impacts, the reroute alternatives were initially selected as the new base case since they avoid the mining concession area.

However, following submission of the ESIA Amendment 1 the reroute for L1437 was withdrawn. A new alternative was included as part of ESIA Amendment 3 to avoid the mining concession area (see the blue line in Figure 4-11) as well as areas prone to landslides along this part of the route.

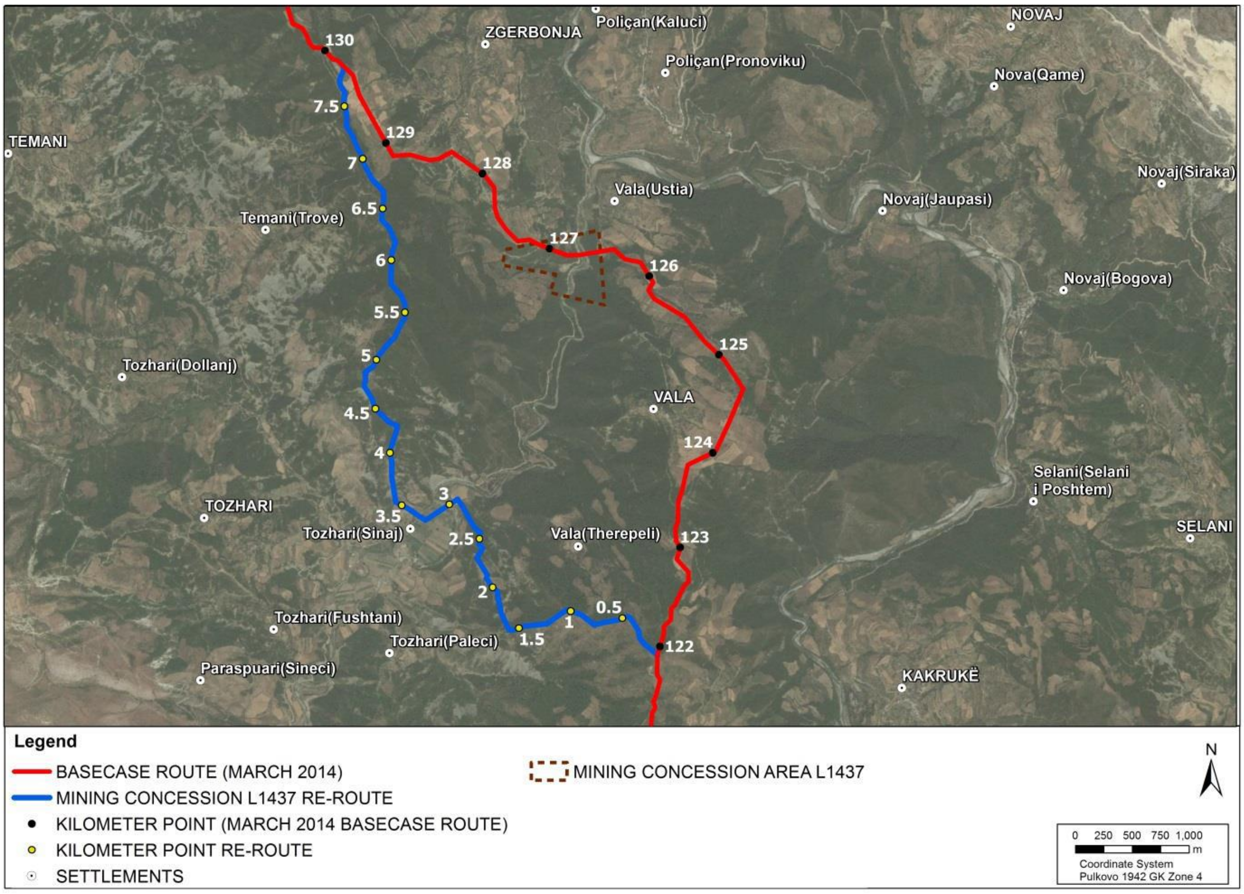


Figure 4-11: Osumi Valley L1437 revised Re-route

Further information on the reroutes for L1437 and L1577 can be found in ESIA Amendment 3 (AAL00-ERM-641-Y-TAE-5004 Rev.: 01)) and ESIA Amendment 1 (AAL00-ERM-641-Y-TAE-1024 Rev.: 00) respectively, on the TAP website.

4.2.4 Route Refinement – Central Albania, Polenë Area Re-route

Two field surveys were conducted in October and November 2015 to investigate and establish base-line conditions for several proposed pipeline re-routes and access roads between the settlements of Qafë and Poliçan (Berat region). The re-route was considered necessary to avoid an area at risk of landslides. Based on these field surveys, a pipeline re-route was proposed near the area of Polenë (see Figure 4-12).

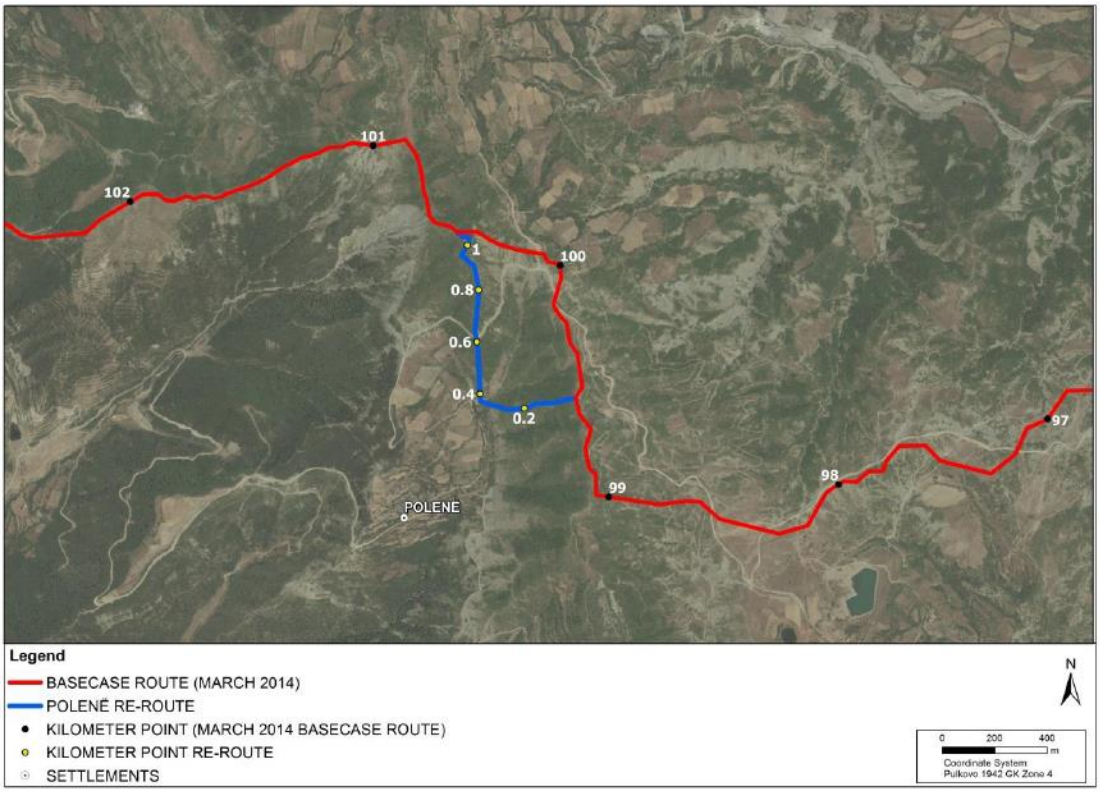


Figure 4-12: Polenë Area Re-route

However, the Polenë re-route was also found to be prone to landslide risk. TAP therefore reverted to the original route. This is referred to as the Osoja re-route (AAL00-C10766-641-X-TAP-0002Rev.: 00) and further information can be found on the TAP website.

4.2.5 Route Refinement – Central Albania, Mbrakulla and Verzezha Re-routes

In 2016 a further two re-routes were made to avoid areas at risk of potential hydraulic hazards and landslides at Mbrakulla (see Figure 4-13) and Verzezha (see Figure 4-14), which are located in the central western section of the pipeline route. The reroutes are approximately 2 km and 2.7 km in length, respectively.

Further information can be found in the ESIA Amendment 3 for the Mbrakulla (AAL00-ERM-641-Y-TAE-5003 Rev.: 00) and Verzezha (AAL00-ERM-641-Y-TAE-5005 Rev.: 00) re-routes on the TAP website.

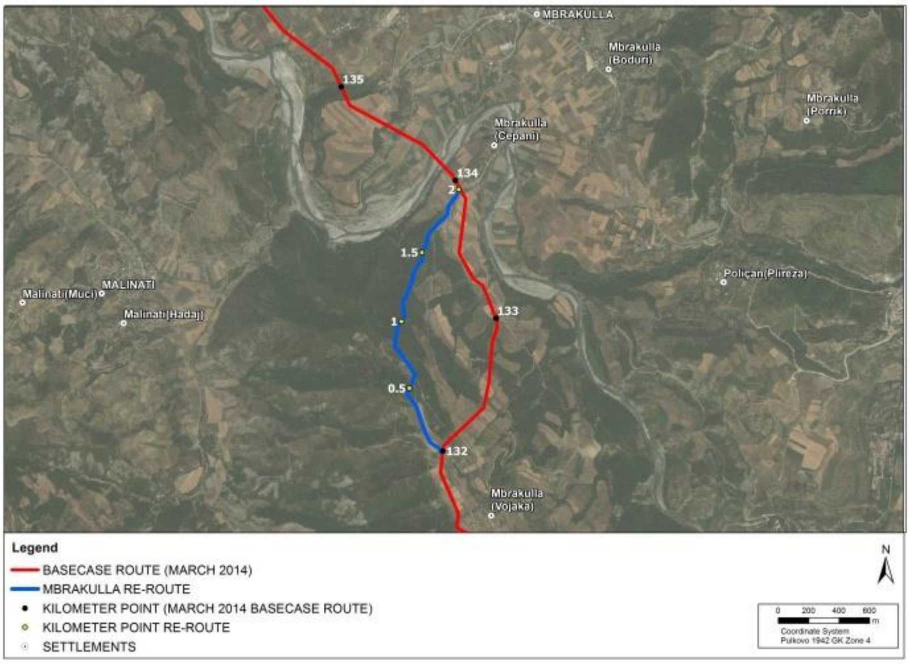


Figure 4-13: Mbrakulla Re-route

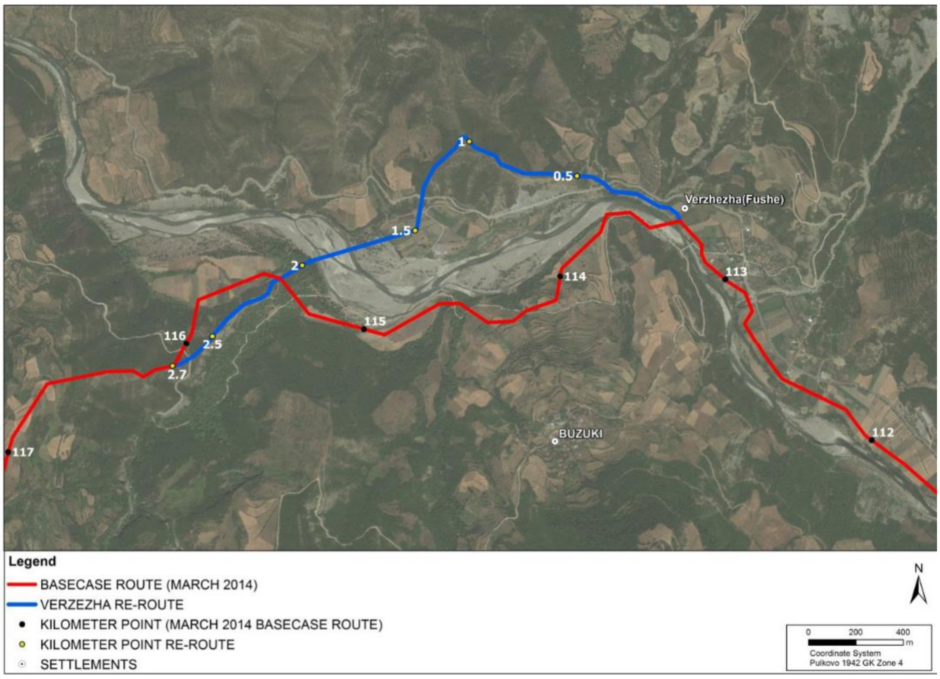


Figure 4-14: Verzezha Re-Route

The Verzezha reroute was subsequently modified to avoid a potential landslide hazard close to the main road around KP 114 and two very difficult road crossings. The road is currently the only link to Corovode and beyond. Constructing the pipeline as originally routed would require closure of the road for several days.

The reroute takes the pipeline onto the flood plain. A combination of deep burial and a riprap revetment will protect the pipeline from any lateral movement of the river. The Orizaj re-route is presented in Figure 4-15 in a blue line. Further information can be found within the Albania ESIA Amendment 4 (AAL00-C10766-641-X-TAP-0001 Rev.:0).

Figure 4-15: Orizaj Re-route

4.2.6 Route Refinement – Central Albania, Sqepuri Re-route

Avoiding landslide hazards the Sqepuri re-route is located on the hills between Poshnje (East) and Drenovicë (west), 4 km to the west of Ura Vajgurore. The new route is approximately 1.3 km long and located just south of Sqepuri village. Further information can be found in the ESIA Amendment 4 for the Sqepuri reroute (AAL00-C10766-641-X-TAP-0003 Rev. 0).

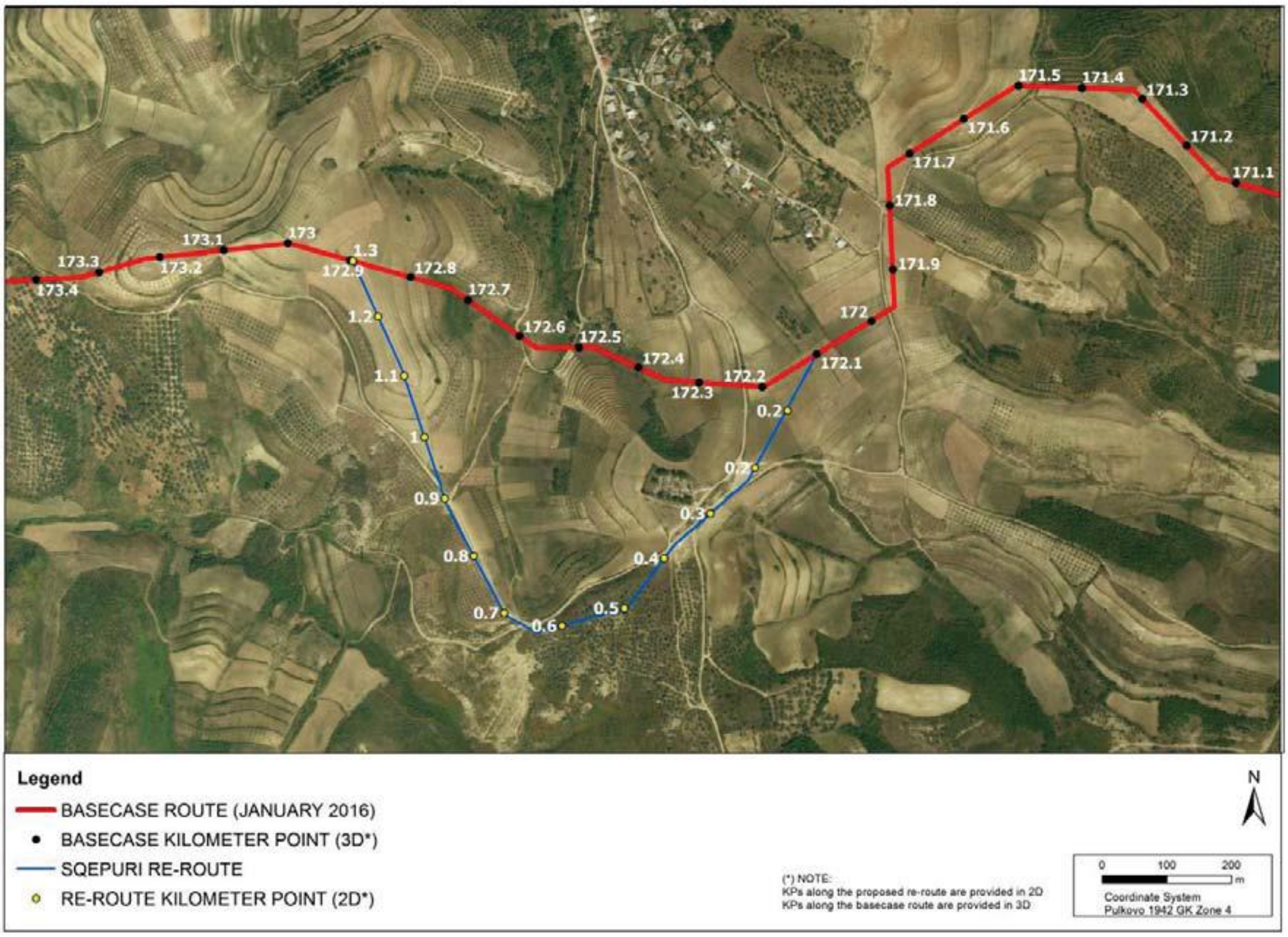


Figure 4-16: Sqepuri Re-route

4.3 Western Region and Landfall

A key feature of this western region was the location of the landfall and its link with offshore route selection. The onshore route selection process in Albania was the main driver for the location of the landfall (since the onshore routeing was more complex and had greater constraints than offshore) and consequently, of the starting point for the offshore corridor.

During late 2010 and 2011 an alternatives appraisal took place, using the general methodology outlined in Section 2.

Six pipeline route alternatives and six compressor station locations were identified based on technical and logistical considerations (see Figure 4-17 and Figure 4-18).

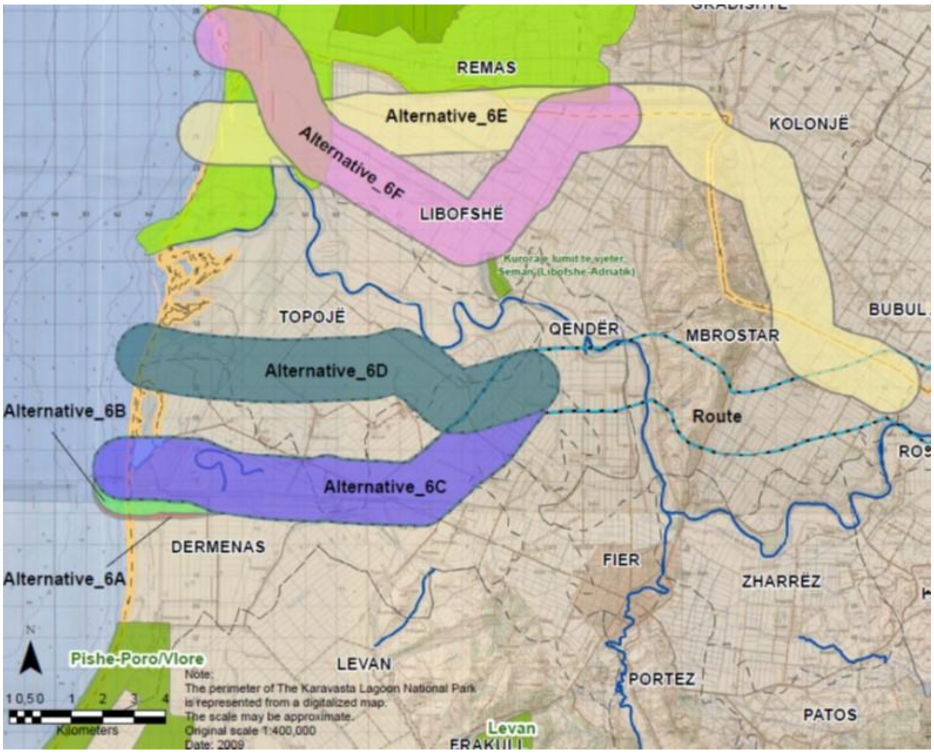


Figure 4-17: Albania Landfall and Onshore Route Corridor Options

Figure 4-18: Compressor Station Options

Of the six preliminarily identified routes, alternatives 6F and 6E fall within the extended boundaries of the Karavasta Lagoon protected area (Ramsar site) and, as such, were rejected. Therefore, the ESCH appraisal focused on the remaining four landfall location alternatives, 6A to 6D.

The four landfall alternatives can be considered very similar in ESCH terms. The only significant difference is that the southern landfall options are near the Roskovec–Hoxhara channel. During the field survey, it was observed that the Roskovec–Hoxhara channel is heavily polluted with crude oil. The crude oil pollution originates from the Marinez oil field approximately 25 km inland. For this reason, the northern Landfall Route Alternative 6D and associated Compressor Station Option 6 were selected as the base case.

Additional information for the landfall location can be found in Section 2 of the ESIA for Albania (AAL00-ERM-641-Y-TAE-1004 Rev.: 03) on the TAP website.

4.4 Albania Base Case

Following the process outlined above, Figure 4-19 presents the current TAP base case for the Albania onshore pipeline route.

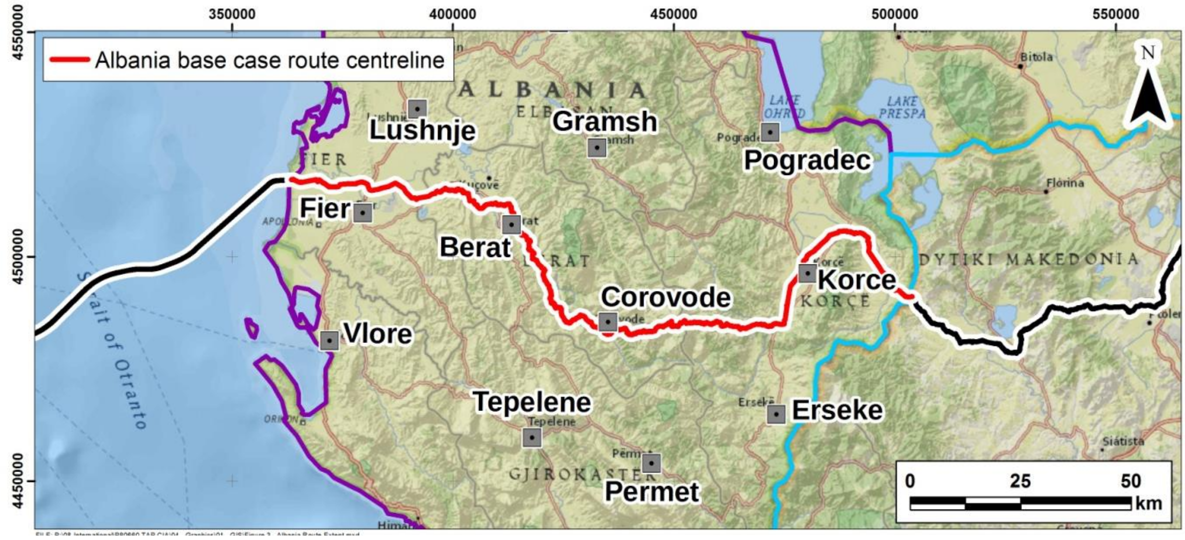


Figure 4-19: Albania Base Case

5. Route Selection Process: Italy

In Italy the route selection process was subject to an iterative assessment starting in 2003 as follows:

- at the stage of the initial Feasibility Study conducted between 2003 and 2005
- at the Conceptual Engineering Phase conducted between 2006 and 2007
- at the Basic Engineering Phase conducted between 2008 and 2011
- at the ESIA stage in 2012
- at the ESIA 2013 Update and ESIA Integration 2014 stage.

The search area is located between Brindisi and Otranto. The selection of this area within the Region of Apulia is naturally defined by the technical development of the pipeline route starting in Greece, passing through Albania and crossing the Adriatic Sea. In fact, the need to reduce the length of the pipeline crossing the Adriatic Sea from Albania identified a landfall on the Southern coast of Apulia as the only realistic option from a technical and commercial perspective.

The area of search is illustrated in Figure 5-1.

Figure 5-1: Pipeline route area of search (East Coast only)- Italy

In the following sections, for reasons of clarity, the route selection process performed until the original 2012 ESIA is presented separately as the initial route selection and assessment. The outcomes of the route selection undertaken at later stages, starting in 2013 are summarised in section 5.2.

Complete information on the route selection and assessment performed in the frame of the stages indicated above is available on the TAP website. Please refer to Section 2.2 of the ESIA Italy (IAL00-ERM-643-Y-TAE-1002 Rev.: 00) , Annex 2 Alternative Assessment (IAL00-ERM-643-Y-TAE-1000 Rev.: 00) and an analysis of restrictions (IAL00-ERM-643-Y-TAE-1022 Rev.: 01)

5.1 Initial route selection and assessment (pre-March 2012)

In the period leading up to the original ESIA submission in March 2012, five alternative route options (see Figure 5-2) were investigated during the basic engineering phase of the project:

- Alternative 0, landfall north of San Foca
- Alternative 1, landfall north of Lindinuso village
- Alternative 2, landfall at the Cerano power plant
- Alternative 3, landfall at the petrochemical plant in Brindisi
- Alternative 4, landfall north of Casale Airport (Brindisi).

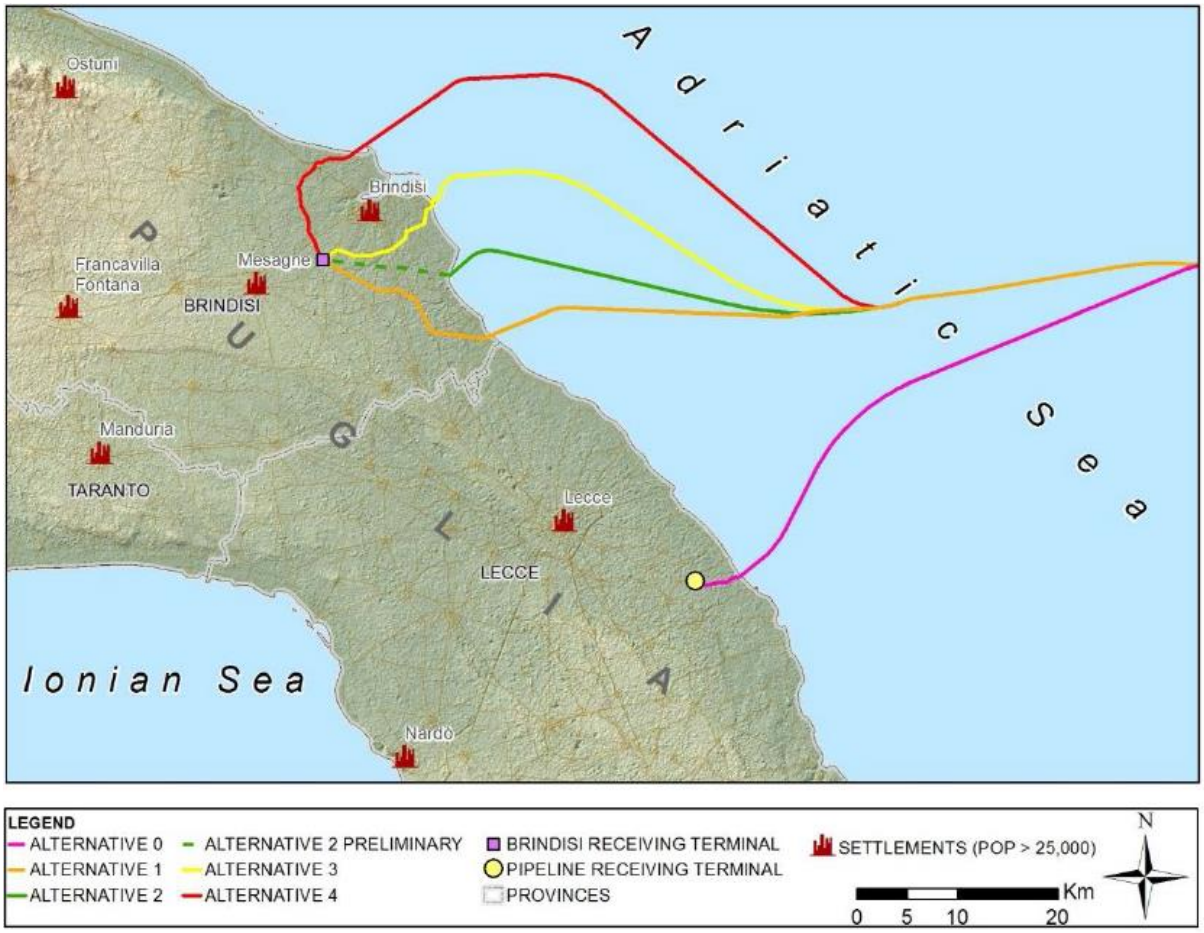


Figure 5-2: Initial routing alternatives

Detailed assessments of these alternatives were conducted from a technical, environmental and socio-economic perspective.

As a result of this assessment Alternatives 1 to 4 were rejected for the following reasons:

- Alternative 1 was rejected as it crosses a Natura 2000 protected area (Posidonia oceanica).
- Alternative 2 was rejected as it crosses a Natura 2000 protected area (Posidonia oceanica) and due to the high, rugged cliffs at the landfall.
- Alternative 3. For this option, 8 sub-alternatives were analysed (3A to 3H), all were found to be impracticable for constructability and safety reasons since they would cross an area with extensive industrial infrastructure and buildings associated with the Brindisi industrial district (Polimeri Europa and Basell chemical plants). This alternative might also interfere with a protected area (Posidonia oceanica formations/Natura 2000 area) and passes through areas of heavy soil contamination.
- Alternative 4 interacts with future land-use plans of the Municipality of Brindisi and is therefore no longer a viable alternative. There are also numerous clusters of houses near this route alternative.

For the reasons above, Alternative 0 was found to be the most suitable solution in terms of technical viability, safety, land use and ESCH impacts for the following reasons:

- it did not interfere with offshore and onshore protected areas
- the onshore route lies within non-urbanised agricultural areas

- the route does not cross any protected (Natura 2000) areas.

Alternative 0 was therefore selected as the project base case route and was taken further into the ESIA stage which was concluded in 2012. The outcome of this analysis and the subsequent process undertaken is explained in the following section.

5.2 Route selection and assessment post-March 2012

During consultations that took place after the submission of the ESIA in March 2012, two main issues arose with respect to Alternative 0:

- The landfall of Alternative 0 was located within a zone identified as being of very high geomorphological risk due to the potential instability of the sea cliffs.
- The proposed pipeline receiving terminal (PRT) location was found to fall within a landscape protection area.

For this reason, for the Italian section of the pipeline TAP AG reconsidered the entire route selection process conducted up to the point of the original ESIA submission (in March 2012), based on a systematic analysis and evaluation process which included both the onshore pipeline route and the PRT location. This process is summarised in the following sections.

This analysis followed a logical process: as a first step land uses along the Adriatic Sea coast and nearshore areas within the provinces of Brindisi and Lecce were assessed to identify preferred zones (referred to as “macro-corridors”). Within the identified macro-corridors an environmental/social/cultural heritage constraints/key indicators analysis was undertaken to identify the most-suitable micro-corridor. Then, the selected micro-corridors were analysed in detail and compared using a series of key indicators as well as cultural heritage, social and environmental constraints.

5.2.1 Macro–Corridors and Micro-Corridors Identification

The identification of the macro-corridors was performed based on an analysis of the land use in the area of search. The analysis considered both residential and commercial/industrial land uses. For each, the analysis was based on a coverage index (on a scale from 0 to 1) using a grid with cells of 1 km^2 in size. The result was a land use map which allowed identification of areas of dense urban and commercial/industrial development. This allowed identification of 5 possible macro-corridors for the pipeline route.

The macro corridors were further assessed in detail considering:

- National legislation constraints (onshore and offshore)
- Regional planning legislation (Thematic Territorial Urban Planning - PUTT/p, Regional Landscape and Territorial Plan - PPTR, Hydrogeological Plan - PAI)
- Safety distances from industrial/urban areas
- Technical feasibility.

The next step was to identify, evaluate and compare micro corridors within the macro corridors and to select a preferred option based on additional studies, conducted to:

- Identify the optimal pipeline route and landfall location

- Minimise residual ESCH impacts
- Further engagement with national, regional and local authorities.

Twelve micro corridors were identified. The location of the macro and micro corridors is illustrated in Figure 5-3.

Micro corridors were not identified in macro corridor A, due to the presence of dense urban and industrial areas, which did not allow respect of the safety distances required by the legislation in force.

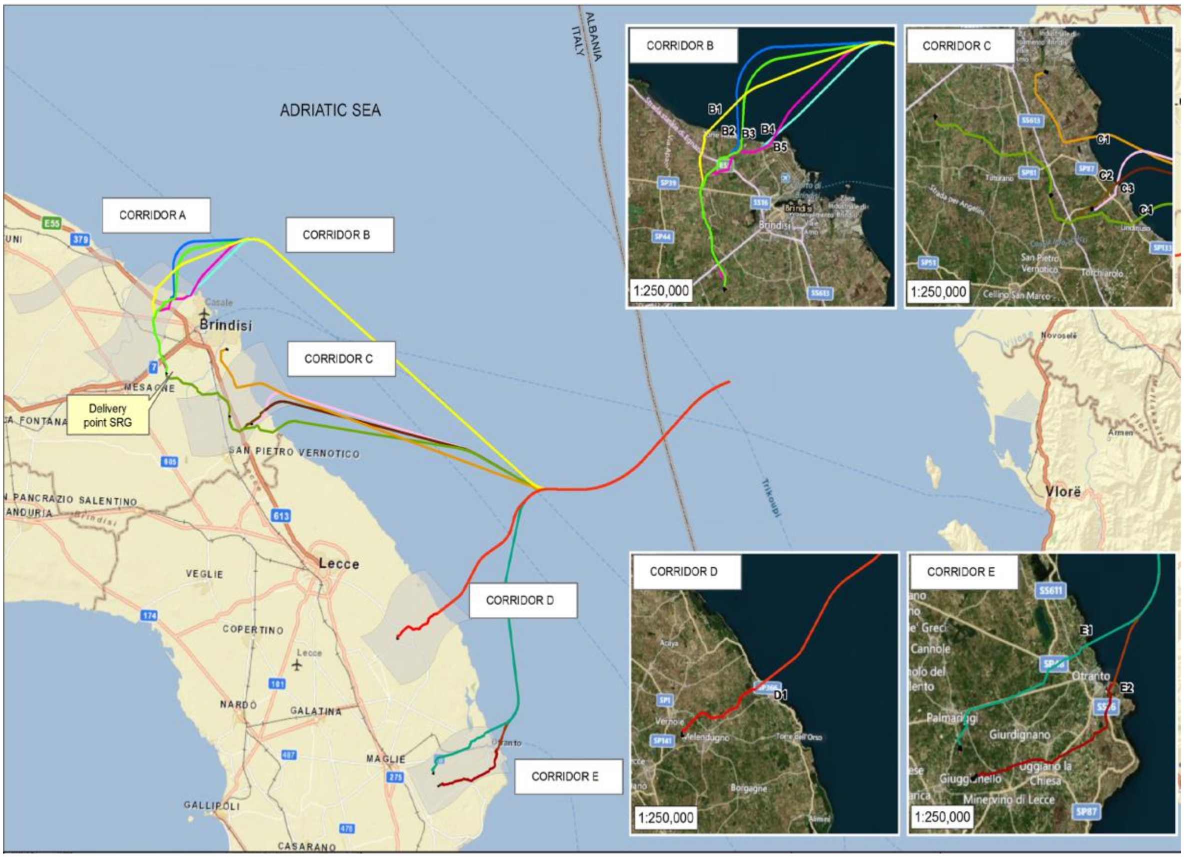


Figure 5-3: Macro-corridors overview

5.2.2 Base Case Micro–Corridor Selection

The next stage of the analysis consisted of an expert-based evaluation of the ESCH constraints within the micro-corridors to discard those deemed unsuitable and to identify the best micro - corridor.

A score was assigned to each kind of constraint and technical characteristic of the route; the final score of the alternatives is given by the sum of the scores attributed to each parameter (the alternative with the lowest score is the best from a technical/environmental/landscape point of view).
The constraints and technical aspects were divided according to the national/regional planning issue or topic concerned and the scores were assigned to the constraints as follows.

Protected areas: *SCI and SPA areas (Natura 2000), IBA and Regional nature reserve buffer zones*. In these areas, the potential impacts of digging and earth moving operations, movement of marine sediments and temporary noise/light emissions on vegetation, biodiversity and ecosystems could be high.

- Score 0 – the route does not interfere with the constraint
- Score 1 – some indirect interaction of the route with the constraint has been found. A buffer area of 1 km is considered for offshore protected areas and 100m for national and regional onshore protected areas
- Score 2 – some direct interference of the route with the protected areas has been found.

Hydrogeological Plan (PAI) constraints: *Flood risk and landslide risk areas*. These areas require further geological and hydraulic/hydrogeological compatibility studies to demonstrate the feasibility of the project. In particular, for areas with a high landslide risk (P.G.3), the PAI technical regulations (NTA) prohibit digging and earth moving. Operations in these areas would only be possible after a redefinition of the areas mapped by the Basin Authority, based on a technical assessment.

- Score 0 - the route does not interfere with the constraint
- Score 1- the route interferes directly with areas with a flood and landslide risk classified as low and/or medium
- Score 2 – the route interferes directly with areas with a flood and landslide risk classified as high.

Thematic Territorial Urban Planning (PPTR) constraints: Wooded areas, hydrogeological constraints, natural pasture, shrubby areas, dunes, woodland and natural park buffer zones. In these areas, the potential impacts on vegetation, flora and fauna could be high. In addition, in such areas it could be necessary to remove the vegetation (woods, Mediterranean shrub) thus modifying the landscape and local hydrology. Project activities could only be authorised based on detailed reinstatement plans, developed in collaboration with the competent authorities. Any removal of vegetation and/or morphological changes in these areas could also modify the symbolic and perceived value of the coastal landscape.

- Score 0 – the route does not interact with the existing constraints
- Score 1 – the route interacts directly with areas subjected to hydrogeological constraints, natural pasture, shrubby areas, woodland and natural park buffer zones. In these areas, the presence of vegetation should be further investigated to demonstrate the actual degree of interference of the project. Score "1" also applies to crossings of woodland areas or sand dunes providing the use of trenchless technology (microtunneling, HDD) which allows to avoidance of direct interaction with these constraints
- Score 2 – the route interacts directly with constrained areas where it would not be technically feasible to use trenchless technology (microtunneling, HDD) or its use would not, in any case, avoid interfering directly with the areas subject to the constraints.

Site of National Interest (SNI): this classification refers to large contaminated areas identified by the Italian government as requiring decontamination operations on the soil, subsoil and/or surface or ground water to prevent damage to the environment and public health. In these areas, digging and earth moving operations could spread contaminants in the environment.

- Score 0 – the pipeline route and PRT does not interfere with the constraint
- Score 1 – the pipeline route interferes directly with the SNI
- Score 2 – the pipeline route and PRT interfere directly with the SNI.

Length of the onshore pipeline: the length of the onshore route up to the SRG delivery plant in Mesagne was also used as assessment criterion, because it has a relatively direct relationship with the environmental and social impacts.

- Score 0 – the length of the onshore route is less than 25 km
- Score 1 – the length of the onshore route is between 25 km and 50 km
- Score 2 – the length of the onshore route is more than 50 km.

Technical Aspects: the length of the pipeline between the compressor station in Albania and the PRT in Italy, if more than 150km, could, during the winter months, entail heating the gas before feeding it into the Italian national network. This would significantly increase the operational hours of the gas boilers, with a consequent increase of impacts on air quality during the project's operations phase.

- Score 0 – length < 150km
- Score 1 – length > 150km.

The quantitative alternative assessment (summarised in the following Table 5-1) confirmed that the micro-corridor D1 (San Foca) is the best alternative from a technical, environmental and landscape point of view.

In particular, for this alternative, microtunnel technology would allow interference with the coastal area (potential impacts on tourism, landscape and environment) to be reduced to a minimum.
It is also underlined that the second-best alternative after D1 is alternative C3. This interferes with the SCI area "*Bosco Tramazzone*" for about 8.4 km and crosses 3.6 km of Posidonia oceanica seagrass, as mapped by the" Posidonia *oceanica meadow Inventory of Manfredonia, Molfetta, Bari, Brindisi, Gallipoli and Taranto*" project, financed by the Puglia Region.

Topic analysed	***B1***	***B2***	***B3***	***B4***	***B5***	***C1***	***C2***	***C3***	***C4***	***D1***	***E1***	***E2***
Protected areas	2	2	2	1	1	2	2	2	2	0	2	2
PAI	2	2	0	2	2	2	0	0	0	0	0	0
PPTR	1	1	1	2	2	1	2	1	2	1	1	2
Landscape restrictions	1	1	1	2	2	0	1	1	1	1	1	2
SNI	0	0	0	0	0	2	0	0	0	0	0	0
Distance from SRG	0	0	0	0	0	1	1	1	0	2	2	2
Technical aspects	1	1	1	1	1	0	0	0	1	0	0	0
TOTAL	**7**	**7**	**5**	**8**	**8**	**8**	**6**	**5**	**6**	**4**	**6**	**8**

Table 5-1: Micro-corridor comparison table

Based on this assessment, micro corridor D1 was selected as the base case and was subject to further stages of detailed analysis, as described in the following section.

5.3 Landfall and Near-Shore Route Selection

The next step in the route selection process was the selection of the most suitable landfall and near-shore route within micro-corridor D1.

This was based on an analysis of specific ESCH and technical constraints that affect the feasibility of the pipeline, namely:

- Areas of very high landslide hazard

- Presence of *Posidonia oceanica*
- Location of tourism facilities
- Microtunnel length
- Safety distance from constructions
- Mediterranean maquis
- Woodlands
- Wetlands
- Archaeology
- Local constraints

Presence of very high landslide hazard (P.G.3) was considered a no-go condition and was therefore analysed at an early stage in the process. The results are represented in Figure 5-4:

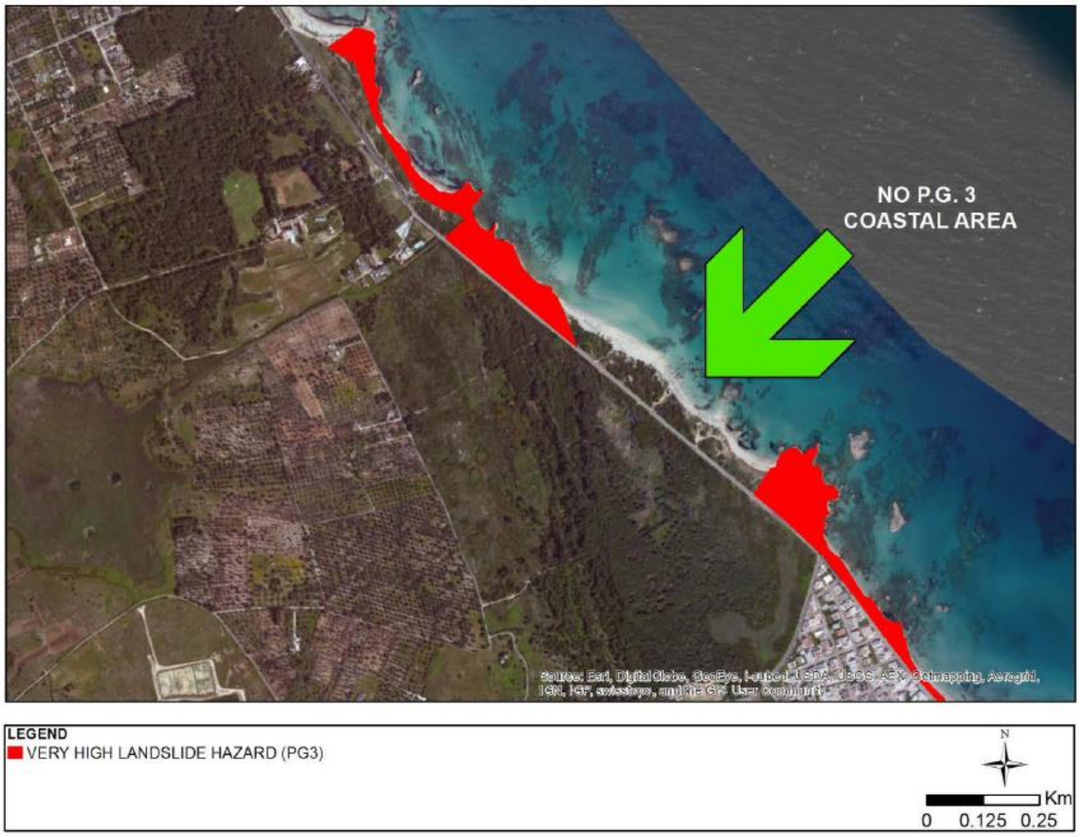


Figure 5-4: Areas of very high Landslide Hazard

The presence of very high landslide hazard areas limited the suitable landfall location to the area indicated by the green arrow in Figure 5-4 above.

The next step was the identification of possible landfall locations based on an analysis of the above listed constraints both onshore and near-shore.

Within this area, considering the required 20 m safety distance from existing isolated buildings and facilities, two possible options for landfall location were identified (Figure 5-5): The North Micro - Corridor and the South Micro - Corridor.

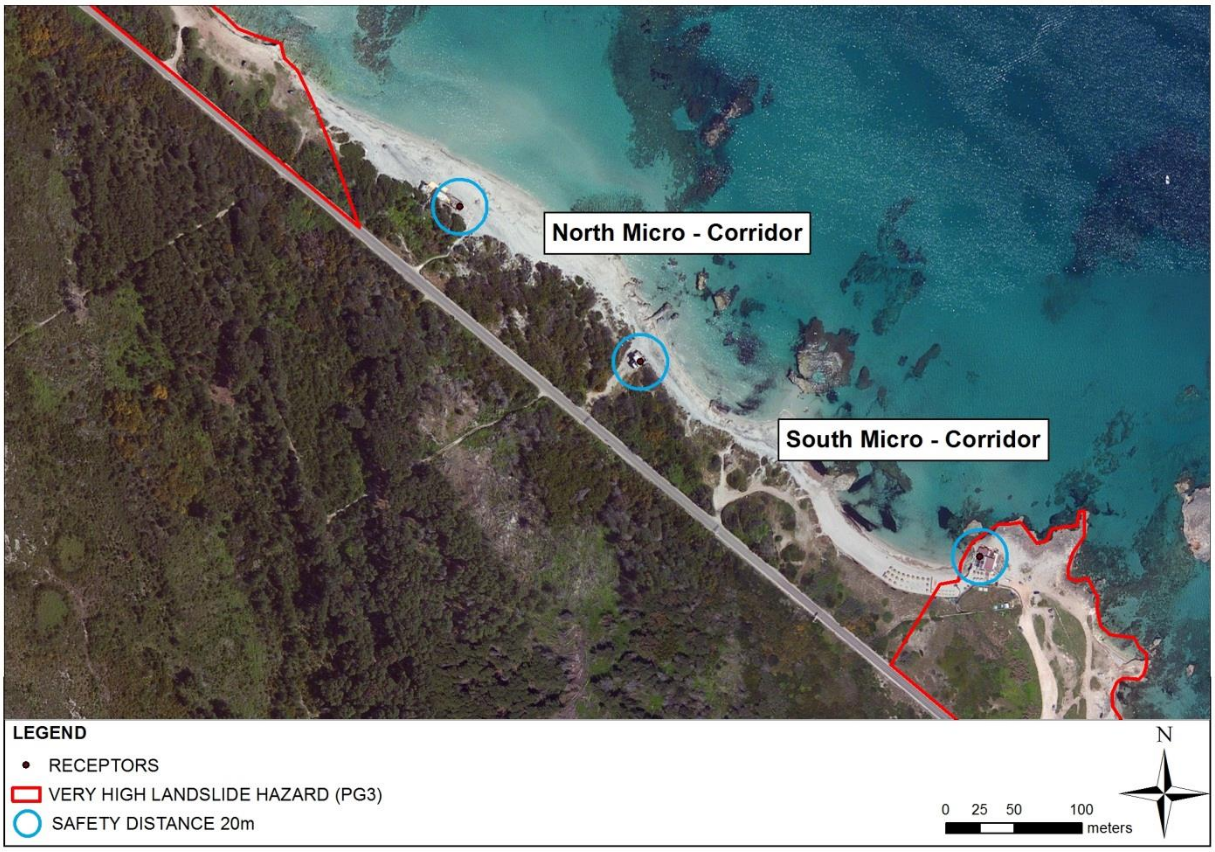


Figure 5-5: Possible Landfall Micro - Corridors

For both Micro - corridors, the nearshore section would be built with a microtunnel, therefore the elements evaluated for the selection of the landfall location are the following:

- Presence of *Posidonia oceanica* (based on TAP offshore surveys): as it should be avoided, the microtunnel exit point (offshore) will depend on the location of areas of Posidonia oceanica ;
- Length of the microtunnel and offshore impact: 1,500 m is considered to be a reasonable length for the microtunnel. Increasing the length of the microtunnel increases the complexity of construction.

Other constraints considered for the microtunnel entry point are: the presence of tourism facilities on the shore, environmental constraints such as Mediterranean Maquis, woodlands and wetlands and related protection zones and local constraints (including the Municipal Urban Plan (PRG) of Melendugno).

This resulted in the identification of 4 landfall alternatives (identified as Alternative F to I), represented in Figure 5-6.

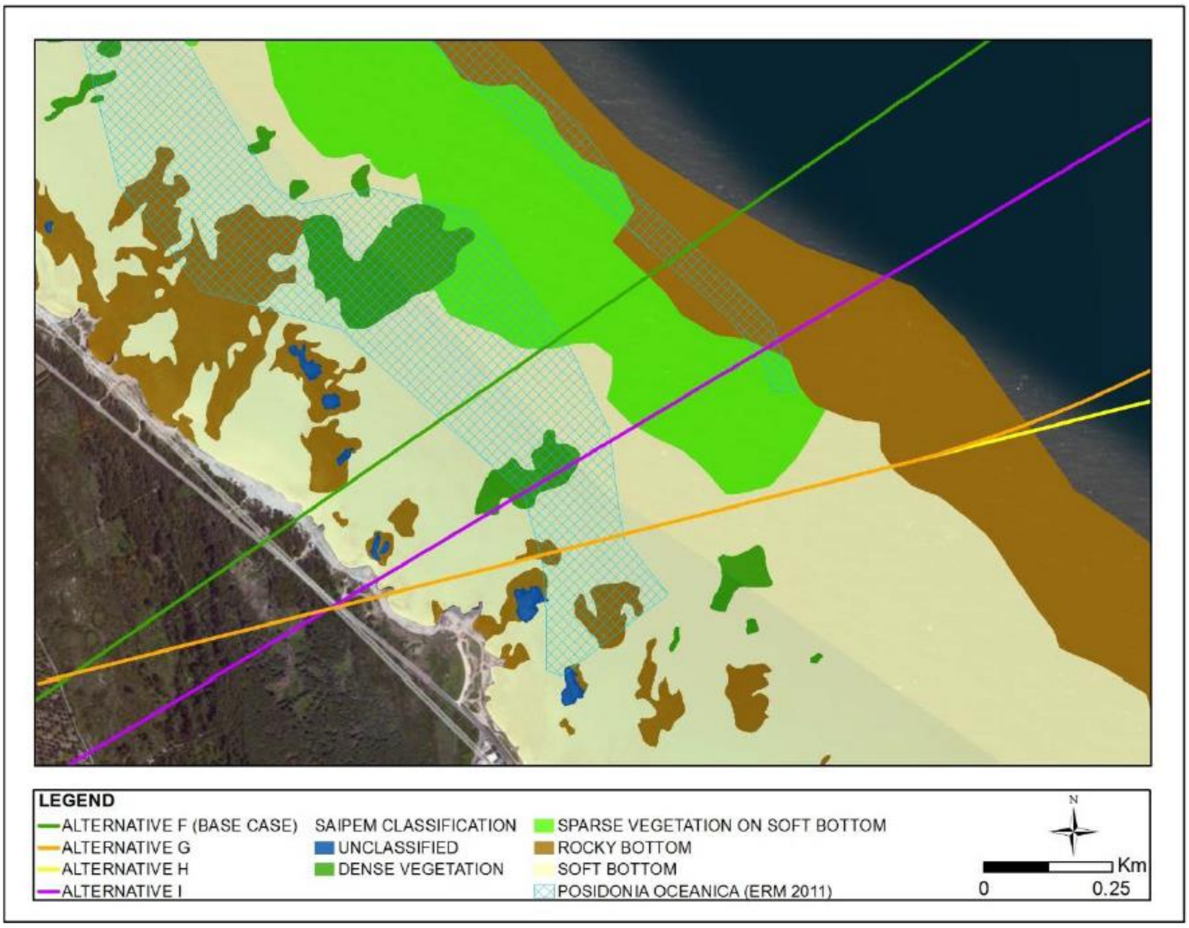


Figure 5-6: Landfall Alternatives

Within the four alternative landfall locations a ranking was made to select a solution which minimizes interactions with environmental, cultural heritage and social constraints. The ranking comparison between the landfall alternatives, based on the above reported analysis, is shown in Table 5-2.

	Alternative F	*Alternative G*	*Alternative H*	*Alternative I*
PG3	No PG3			
Presence of *Posidonia oceanica*	*Posidonia oceanica* can be avoided with a microtunnel			
Touristic facilities on the shore	No interaction with the touristic facilities			
Microtunnel Length and offshore impact for areas not crossed with the microtunnel	< 1,500 m and minor impact on offshore route not crossed with the microtunnel	> 1,500 m and major impact on offshore route not crossed with the microtunnel		
Safety Distance	Safety Distance Respected			
Mediterranean Maquis	No interaction thanks to microtunnel			
Woodland	No interaction tanks to microtunnel			Microtunnel entry point in "Woodland" area (PUTT/p)
Wetland	No interaction	Potential interaction		No interaction
Archaeology	No interaction			
Municipal Local constraints	Microtunnel entry point in an agricultural area)			Microtunnel entry point in "Woodland" area (PRG of Melendugno and PUTT/p)

Legend
Green: alternative minimizing the interactions with the considered constraints
Yellow: there are no substantial and relevant differences between the analysed alternatives
Orange: alternative which interferes with the considered constraint

Table 5-2: Ranking comparison between the landfall alternatives

As shown in Table 5-2, the preferred landfall and microtunnel route is Landfall Alternative F. This landfall alternative is characterized by:

- an overall tunnel length which ensures:
  - avoidance of any interaction with Mediterranean Maquis and Woodland onshore and Posidonia oceanica offshore
  - avoidance of any interaction with tourist facilities
- compliance with safety distances from buildings.

5.4 PRT Location and Onshore Route Selection

As mentioned in Section 5.2, the PRT should be located outside the designated landscape protection area (*coastal and territorial areas of Melendugno and Vernole*) and where no local constraints (such as protected olive trees, archaeological sites and other local environmental and social constraints) are present. The alternative assessment process identified two options for the location of the PRT, as shown on Figure 5-7.

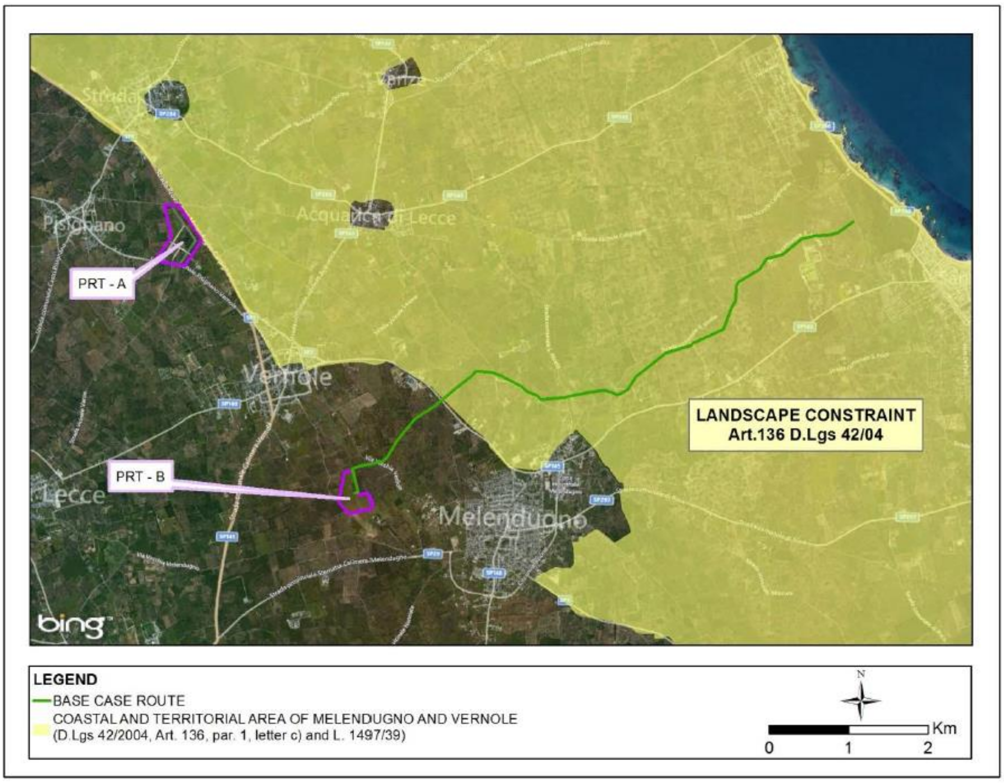


Figure 5-7: PRT Location Alternatives

Both PRT alternatives met the above criteria. The preferred PRT location was not identified at this stage but was based on further analysis in combination with the potential impacts associated with the pipeline route leading to each location.

The onshore base case route development started from the base case landfall and was selected based on the consideration of the following constraints:

- Wetland locations
- Agricultural areas
- Known cultural heritage areas
- Distance to residential areas
- Other local constraints.

The presence of a wetland and of agricultural areas of landscape interest represented constraints that had to be considered at the eastern section of the onshore route. To minimise impacts on these areas, a base case route running parallel with existing roads and along the southern border of the wetland was selected as represented in Figure 5-8.

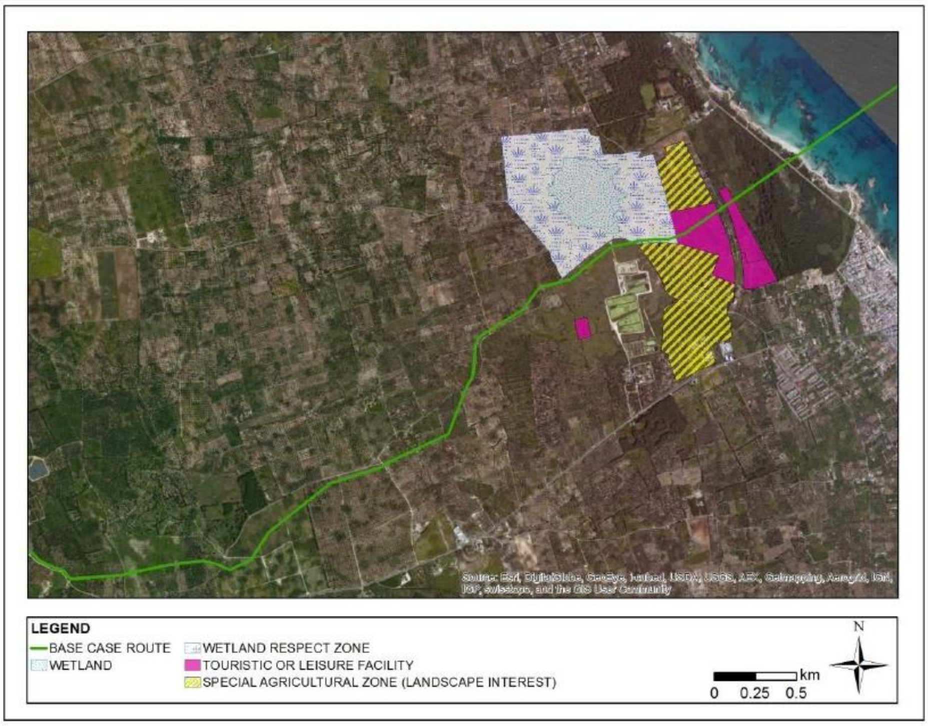


Figure 5-8: Eastern onshore base case route

At the next stage, once the eastern route section was defined, the analysis focused on identifying the most suitable western route alternatives connecting the two PRT sites. Taking into consideration the above indicated constraints, two route alternatives were identified:

- Northern Alternative connecting PRT-Option A (red line in Figure 5-9);
- Southern Alternative connecting PRT-Option B (green line in Figure 5-9);

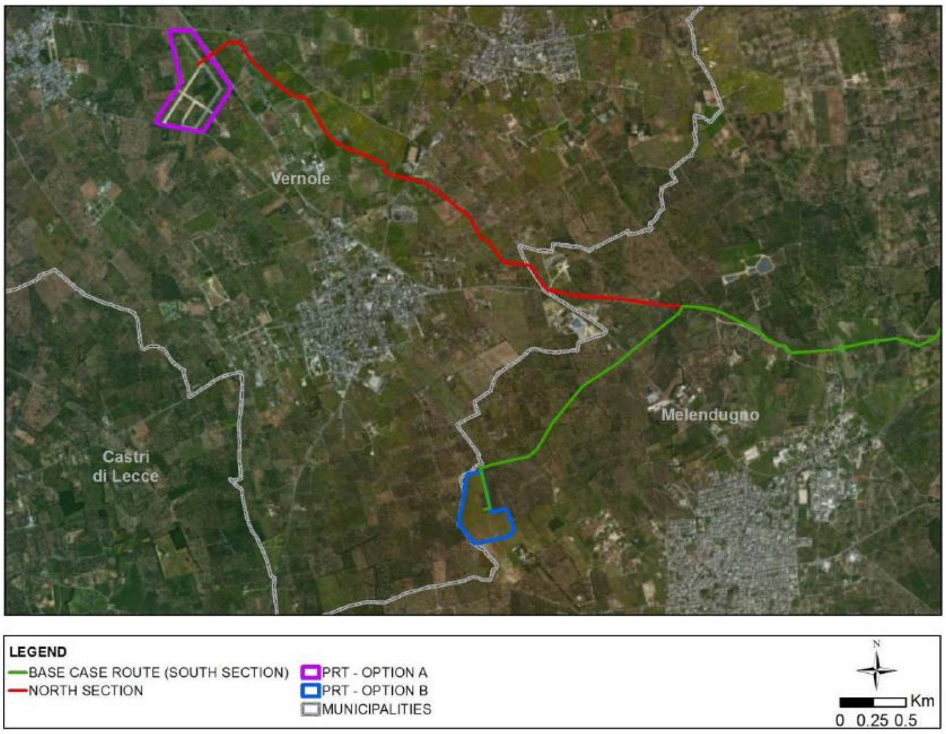


Figure 5-9: Route alternatives connecting PRT sites

Neither of the investigated routes to the newly proposed PRT sites had any particular technical constraints.

The comparative analysis indicated that the northern route may potentially interfere with archaeological constraints as it passes in close to an area characterized by a large number of *Pagghiare* (dry stone buildings) and close to the Archaeological Park of Acquarica (which includes two archaeological sites). Other constraints along the northern route are associated with potential conflicts with the urban plan of Vernole.

The proposed south route falls completely in the municipality of Melendugno. It showed less significant constraints than the northern one, because it crosses mainly agricultural land and avoids natural and cultural heritage protected areas, while respecting the required distance from urban areas.

Therefore, the south route and the PRT Option B were together selected as the base case for the Italian onshore pipeline section.

The comparison between PRT (Option A and option B) and Route (Northern and Southern Route) is summarised in Table 5-3.

Constraint	***North Route – PRT Option A***	***South Route – PRT Option B***
	North Route	*South Route*
Wetland	No interaction	
Agricultural Area	Mainly along existing roads	
Archaeological findings	Close to an area characterized by a large numbers of Pagghiare and the future Archaeological Park of Acquarica (as defined in the PUG of Vernole), which includes two archaeological sites.	No interaction
Distance from urban area	Respected	
Other local constraints	Interaction with local constraints reported in the PUG of Vernole and listed above, which limit the construction activities	Interaction with local constraints which are compatible with the construction activities
	PRT Option A	*PRT Option B*
Landscape Constraint (Coastal and Territorial area of Melendugno and Vernole)	Outside	
Monumental Olive Tree	No Olive Trees and in particular Monumental ones	
Archaeological findings	No archaeological findings	
Other local constraints	No constraints in the identified area	
Distance from urban area	Respected	
Land use	Commercial/ light industrial Area	Agricultural Area (without particular interest/ protection)
Legend		
Green: alternative minimizing the interactions with the considered constraints		
Yellow: there are no substantial and relevant differences between the analysed alternatives		
Orange: alternative which interferes with the considered constraint		

Table 5-3: Ranking Comparison between PRT and Onshore Route Alternatives

5.5 Italy Base Case

Following the process outlined above, Figure 5-10 presents the current TAP base case for the Italy onshore pipeline route.

Figure 5-10: Italy Base Case Onshore Pipeline

6. Offshore Route Alternatives

The landfall locations in both Italy and Albania had the greatest influence on the offshore corridor, as these determined the start and end points. At an early stage in the Project, the offshore route selection process initially led to the identification of three potential macro- corridors for connection between Albania and Italy (see Figure 6-1).

Figure 6-1: Macro Corridors Offshore Route Alternatives

The location of the Albanian and Italian landfalls, as well as the associated water depth and route length, initially resulted in the selection of the northern corridor. Later developments, mainly the selection of a landfall location in Italy, resulted in a base case route that combines the red corridor in Albania, but crosses towards the black central corridor.

In parallel to the landfall location selection process, marine route selection was performed primarily through the evaluation of constraints, such as protected areas; marine habitats of high ecological value (e.g. seagrass); archaeological sites; military areas; fishing areas; anchorage areas; geohazards (e.g. subsea landslides); landfall constraints; tourism areas; existing offshore installations (e.g. subsea cables); water depth; and route length.

During this process, each alternative corridor was reviewed in a series of desktop and site investigations, during which the constraints along the routes were identified and evaluated, with the information available at the time, using an iterative process. The routes were also evaluated against the appropriateness of design and necessary construction methods.

One main constraint to offshore routing was the large amount of UXO disposed of on the seabed at the end of the Second World War, primarily concentrated on the Albanian side of the Adriatic. Another key constraint was slope stability on the Albanian slope between the continental shelf and the abyssal plain.

With all these variables, several potentially feasible alternatives were generated, linking the various Albanian and Italian landfall options and examining the existing corridors between the UXO dumping areas and the geophysical characteristics of the continental slopes. Figure 6-2 shows an array of potential offshore routes considered and investigated to different levels of detail.

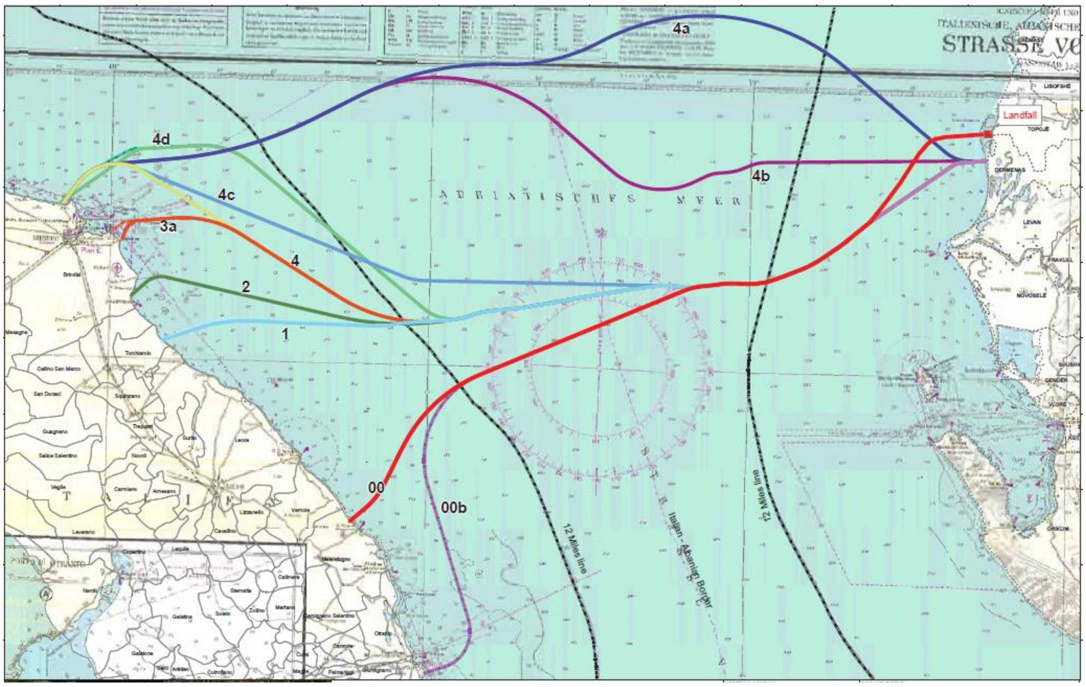


Figure 6-2: Offshore Route Micro corridors

Following extensive offshore survey work, the alternatives assessment determined that the red route (00) is the best, primarily due to the location of landfall sites but also from a technical, environmental and landscape point of view. The red route was incorporated into the base case and was refined reflecting the existing constraints as represented in Figure 6-3.

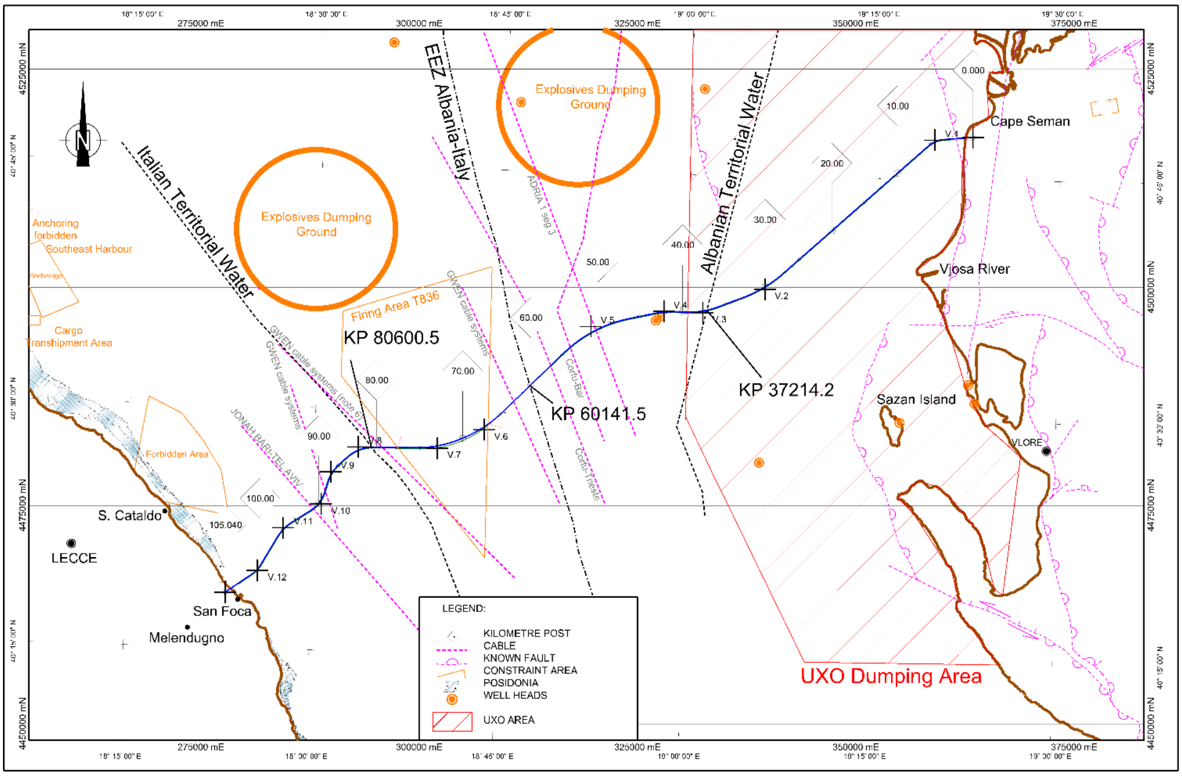


Figure 6-3: Offshore Base Case Route.

6.1 Offshore Base Case

Following the process outlined above, Figure 6-4 presents the current TAP base case for the offshore pipeline route.

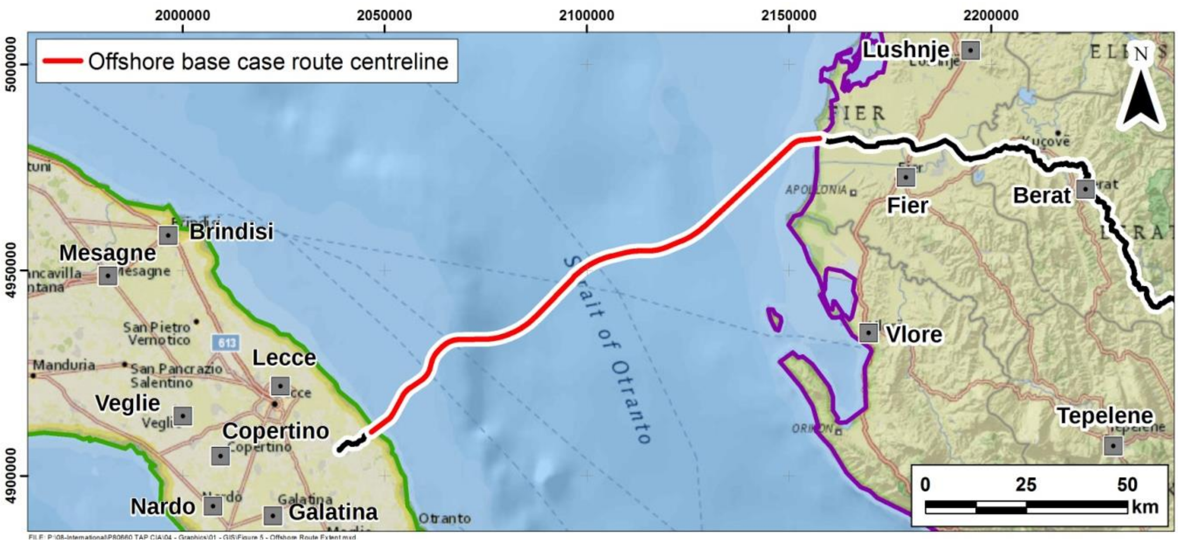


Figure 6-4: TAP Offshore Pipeline Base Case

During construction, micro-rerouting may become necessary at certain locations due to technical/constructability, local environmental or social reasons or to avoid cultural heritage assets unknown at the previous stages of project development. Whenever such local micro adjustments are required rerouting the pipeline outside of the 500-m wide environmental ESIA corridor (250 m each side of the base case centre line), these will be subject to environmental and social impact assessment in the frame of Amendments to the ESIA.

7. TAP Base Case Route

Following the process outlined in previous chapters, Figure 7-1 presents the current TAP base case for the entire route.

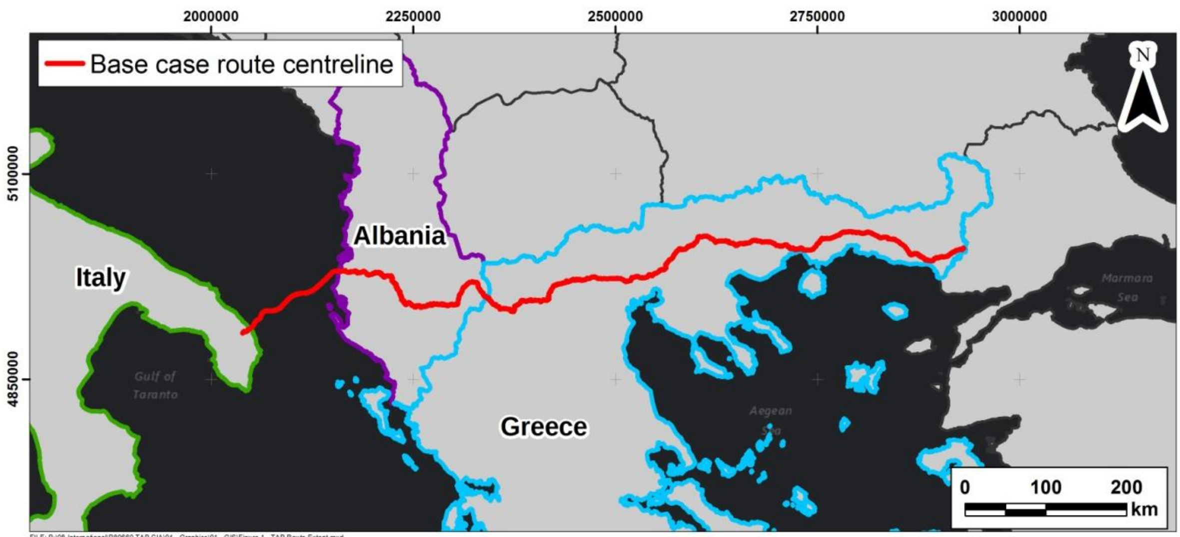


Figure 7-1: TAP pipeline route base case

Annex 1

Route Selection Impact Indicators (SAMPLE)

Route Selection Impact Indicators - Sample

Indicator	***Definition***	***Relevance to the Appraisal***
Technical Indicators		
Length of the pipeline onshore	Length Kipoi to GR/AL border	Construction time and cost related
Pipeline characteristics in mountainous areas	Hilly and mountainous areas	Increased construction effort; cost related
	Highest elevation to be crossed	
Block valves	Number of required block values	Influence on permanent land use
Number of river crossings	RV - 1: large river / channel > 30m	Increased construction effort depending mainly on the site conditions, geometry of riverbed, geology and discharge of the river section and cost related
	RV - 2: river / wide channel > 5m ≤ 30m	
	RV - 3: creek / channel ≤ 5m	
Number of road crossings	RD – 1: highway, national road	Influence on temporary land use close by the crossing and cost related.
	RD – 2: main road	
	RD – 3: secondary road	
	RD – 4: carriage way/ track	
Number of railway crossings	Single / double track	Influence on temporary land use close by the crossing and cost related.
Site accessibility	In general (qualitative description)	Influence on permanent land use and potential for further development of the affected region.
	Upgraded carriage ways/ tracks	
Investment costs	Cost comparison in relation to S_0	Investment
Soil and rock classification	Cl. I: soil, loose rock or stones	Cost related (excavation possible with excavator)
	Cl. II: weak rock	Cost related (heavy excavation required; ripping)
	Cl. III: hard rock	Cost related (drill and blast)
Expected high groundwater level	Percentage of the entire route length	Cost and additional HSE related (additional technical effort required)
Overall technical route characteristics	Route classification factor	Construction time and cost related
	Route length classified as ‘Uncritical’	Routine pipeline construction
	Route length classified as ‘Minor’	Minor construction compensation measure required

Indicator	***Definition***	***Relevance to the Appraisal***
	Route length classified as 'Major'	Major influence on construction; cost and additional HSE related
	Route length classified as 'Severe'	Severe influence on construction; cost and additional HSE related
	Route length classified as 'Extreme'	Areas to be avoided by route alignment
Longitudinal slopes	Cl. I: 0 – 8 degree	Cost related (flat terrain)
	Cl. II: 8 – 18 degree	Cost related (hilly; appropriate for trucks)
	Cl. III: > 18 degree	Cost and additional HSE related (mountainous; accessible for tracked vehicles, rope ways)
Transversal slopes	Cl. I: 0 – 7 degree	Cost related (flat terrain)
	Cl. II: 7 – 18 degree	Cost related (moderately inclined; side cuts required)
	Cl. III: > 18 degree	Cost and additional HSE related (steep special construction measure required)
Quaternary faults	Number of potential crossing points	Potential impact on design, construction, availability and costs
	Length of parallelism with fault, where the pipeline runs in close vicinity of the route	
Potential liquefaction areas	Length of sections which have might be vulnerable for liquefaction in case of an earthquake	Cost related (impact on design and construction)
Qualitative risk assessment	Societal risk	Additional risk for population close by the pipeline (Dense populated areas)
	Location class 2 (BS 8010-1)	
Environmental Indicators		
Total length of the Alternative	Total length of each Alternative within the Study Area	The longer the distance the higher the potential for impacts as the overall magnitude of works is increased (bigger Project footprint, longer construction time required more access requirements, etc.)
Total length and surface clearance (pipeline construction) within Protected Areas (excluding Natura 2000 sites)	Total length and clearance area along the 40 m Working Strip within National Parks, Ramsar sites and National Woodland parks (Natura 2000 sites not considered).	Existing protected areas by statutory designation affected constitute areas of high environmental interest (ecological, landscape, flora and fauna species, etc.)
Length within Important Bird Areas (IBA)	Total length within important bird areas	IBAs constitute areas of conservation interest for birds which, in Greece, are considered as a standard requirement within ESIA process
Total length and surface clearance (pipeline construction) within Natura 2000 Network	Total length and clearance area along the 40 m Working Strip within sites of conservation interest under Directive 92/43 EEC	EU protected areas by statutory designation affected constitute areas of high environmental interest (ecological, landscape, flora and fauna species, etc.)
Total area of non-urbanised and non-	Total clearance area along the 40 m wide Working Strip	Non-urban and non-agricultural areas in general have a higher

Indicator	***Definition***	***Relevance to the Appraisal***
agricultural land crossed (pipeline construction)	classified neither urban nor agricultural by the official Forestry Maps classification	biodiversity and sensitivity to impacts than those less affected by anthropogenic activities
Total area of non-urbanised and non- agricultural land crossed within Pipeline Protection Strip (PPS)[1] (pipeline operation)	Total clearance area along the 10 m wide PPS in areas classified neither urban nor agricultural by the official Forestry Maps classification	Non-urban and non agricultural areas in general have a lower biodiversity and sensitivity to impacts than those less affected by anthropogenic activities
Total forest clearance (pipeline construction)	Total clearance area along the 40 m wide Working Strip classified as forests by the official Forestry Maps classification To-	Forest clearance, in opposition to herbaceous and agricultural areas, will be generally a long term effect
Total forest clearance within the PPS (pipeline operation)	tal clearance area along the 10 m wide PPS in areas classified as forests by the official Forestry Maps classification Total	Forested areas (including shrublands) will be permanently cleared during pipeline operation
Total broadleaved forest dominated by *Fagus, Quercus ,Castanea and platanus sp* species to be cleared (pipeline construction)	clearance area along the 40 m wide Working Strip within areas classified as broadleaved forest by the official Forestry Maps classification	Broadleaved forests count among the most valuable forest types. These areas to be cleared during construction count among the most valuable habitats in the region and will constitute a long term effect
Total broadleaved forest dominated by *Fagus, Quercus ,Castanea and platanus sp* species to be cleared within the PPS (pipeline operation)	Total surface to be cleared within the 10 m wide PPS classified as broadleaved forest by the official Forestry Maps classification	Broadleaved forests count among the most valuable forest types. Areas within the PPS will be permanently cleared during pipeline operation
Beech dominated forests (*Fagus sp*) clearance (pipeline construction)	*Fagus sp* dominated areas, according to the official Forestry Maps classification, to be cleared within the 40 m wide Working Strip	*Fagus sp* forests count among the most valuable forest in the region. Its clearance constitutes a long term effect.
Beech dominated forests (*Fagus sp*) to be cleared within the PPS (pipeline operation)	*Fagus sp* dominated areas, according to the official Forestry Maps classification, to be cleared within the 10 m wide PPS	*Fagus sp* forests count among the most valuable forest type. Clearance within the PPS will be permanent during pipeline operation
Oak dominated forests (*Quercus sp.*) clearance (pipeline construction)	*Quercus sp.* dominated areas, according to the official Forestry Maps classification, to be cleared within the 40 m wide Working Strip	*Quercus sp.* forests count among the most valuable forest in the region. Its clearance constitutes a long term effect
Oak dominated forests (*Quercus sp.*) to be cleared within the PPS (pipeline operation)	*Quercus sp.* dominated areas, according to the official Forestry Maps classification, to be cleared within the 10 m wide PPS	*Quercus sp.* forests count among the most valuable forest type. Clearance within the PPS will be permanent during pipeline operation *Casta-*
Chestnut dominated forests (*Castanea sp.*) clearance (pipeline construction)	*Castanea sp* dominated areas, according to the official Forestry Maps classification, to be cleared within the 40 m wide Working Strip	*nea sp* forests are very rare in Greece. Its clearance constitutes a long term effect
Chestnut dominated forests (*Castanea sp*) to be cleared within the PPS (pipeline operation)	*Castanea sp* dominated areas, according to the official Forestry Maps classification, to be cleared within the 10 m wide PPS	*Castanea sp* forests are very rare in Greece. Its clearance within the PPS constitutes a permanent effect
Area of coniferous forests[2] to be cleared	Total area to be cleared within the Working Strip (40 m width)	Clearance of this natural habitat during construction works will constitute

[1] The Alternatives Appraisal exercise considered that Project operation will require a 10 metre wide permanent corridor is maintained free of deep rooting plants to protect the integrity of the pipeline – the Pipeline Protection Strip (PPS) or Safety Protection Strip (SPS). Since the appraisal was completed the design of the PPS/SPS has been reduced to an 8 metre width.

[2] *Pinus nigra* and / or *Pinus sylvestris* pure or mixed forest. It does not involve conifer afforestations.

Indicator	***Definition***	***Relevance to the Appraisal***
(pipeline construction)	supporting coniferous forests (mainly *Pinus sp.*), according to the official Forestry Maps classification	a long term effect
Area of coniferous forests to be cleared within the PPS (pipeline operation)	Total area to be cleared within the PPS (10 m width) supporting coniferous forests (mainly *Pinus sp.*), according to the official Forestry Maps classification	Clearance of this natural habitat during operation of the pipeline will constitute a permanent effect
Area of montane and subalpine grasslands, meadows and pastures to be cleared (pipeline construction)	Total area of grasslands and montane meadows according to the official Forestry Maps classification to be cleared within the Working Strip (40 m width) at an altitude > 800 m a.s.l.	This habitat counts among the most valuable environments in the region as it commonly hosts several endemic or protected species
Total area of agricultural lands and plantations to be cleared (pipeline construction)	Total area to be cleared within the Working Strip (40 m width) in areas classified as agricultural land (including permanent and yearly crops) in the official Forestry Maps classification	Agricultural land and plantations have a higher degree of anthropogenic disturbance and are less sensitive to impacts than natural habitats
Area covered by brown bear range[3] crossed (pipeline construction)	Total area within the 2 km corridor suitable for bear habitat identified during field survey and based on brown bear distribution maps ('bear spread')	Brown bears are a protected species and an apex predator and keystone species within Greece which rely on large habitat ranges largely free from human disturbance. Their habitat is sensitive to disturbance and fragmentation
Area covered by brown bear range [4] crossed (pipeline construction)	Total area within the 2 km corridor suitable for bear habitat identified during field survey and based on brown bear distribution maps ('bear reappearance areas')	Brown bears are a protected species and an apex predator and keystone species within Greece which rely on large habitat ranges largely free from human disturbance. Their habitat is sensitive to disturbance and fragmentation
Total area of 'wetland' type habitats [5] (standing water, lagoons, running waters incl. river crossings, saltmarshes…) (pipeline construction)	Area of the Working Strip (40 m width) supporting all wetland habitats including running and standing water.	Lagoons, saltmarshes and river habitats are scarce environmental features which support a range of specialist species, particularly water birds. These areas provide a crucial resource for a range of vertebrate species such as freshwater fishes, amphibians and mammals (some of which, like Otter (*Lutra lutra*) are protected).
Total number of river crossings[6] in rivers of perennial flow	Number of expected river crossings, considering only those rivers with a permanent flow (rivers of ephemeral – rivers of permanent flow).	Rivers are habitats sensitive to construction impacts, which also support a range of vulnerable and protected species.
Area with slope degree <33^{o} (slope lower 2V:3H)	Area of the 40 m wide Working Strip of each Alternative on slopes >33^{o}	Areas with slopes < 33^{o} are less susceptible to erosion and likely to be quicker to re-colonise. After restoration and maintenance a high degree of naturality should be achieved.

[3] Sites with regular bear appearance.
[4] Sites recently colonized by bears.
[5] The calculation on the wetlands has to be taken with a precautionary approach as there is a relatively high degree of uncertainty due to the scale of the cartography (GIS layers) and the variable and constantly changing nature of the particular landscape feature. Nevertheless it is presented here as a rough estimate to assess potential differences between corridors.
[6] The number of river crossings includes all those rivers and streams that have running water throughout the year. Data on the hydrological status of the rivers are according to the Hellenic Military Geographical Service (HMGS).

Indicator	***Definition***	***Relevance to the Appraisal***
Area of serpentine soils to be cleared (pipeline construction)	Total area within the Working Strip (40 m width) potentially supporting critical areas for endemic plant species identified during field survey and based on geological features.	Serpentine soils comprise spots where several rare or endemic species are found.
Socio-Economic Indicators		
Regional government stakeholders	Total number of regions crossed by each alternative	Regional authorities are key stakeholders in the development of the Project and should play an important enabling role.
Local government stakeholders	Total number of communes/municipalities crossed by each alternative	Commune level stakeholders are also key stakeholders in the development of the Project. For example Heads of Commune are responsible for future land use and planning and development initiatives.
Population in settlements within the corridor routes.	Total number of residents within the 2 km corridor of each alternative.	The number of people living within the corridors in each alternative is relevant in assessing the magnitude of potential impacts on local communities.
Settlements within the corridor routes	Total number of settlements within the 2 km corridor of each alternative.	Settlements are key receptors for both positive and negative socio-economic impacts. It will also be necessary to engage with all settlements along the route.
Area of agricultural lands along corridor alternative	Area of the 2 km corridor for each alternative classified as agricultural land.	Agricultural land constitutes one of the main sources of livelihoods for population within the study area.
Area of agricultural lands within working strip	Area of the 40 m working strip for each alternative classified as agricultural land.	Agricultural land constitutes one of the main sources of livelihoods for population within the study area.
Area of grazing lands along corridor	Area of the 2 km corridor for each alternative classified as grazing land.	Grazing is the main livelihood in mountainous communes in the study area.
Area of grazing lands affected during construction works (working strip)	Overall weight of grazing lands along working strip (40 m) (pipeline construction)	Land use potentially disturbed during construction (short term).
Area of permanent crops along the 2 km corridor	Area of the 2 km corridor for each alternative classified as area of cultivation of permanent crops by the CORINE Land Cover database.	Fruit trees, vineyards and olive tree plantations are permanent crops found in the study area that cannot be easily replaced should they be removed. These represent an important source of income for communities in the study area.
Area of active mineral extraction within the 2 km corridor	Area of the 2 km corridor for each alternative classified as having active mineral activities.	Mineral extraction, including queries, represents a significant land use in some areas crossed by the corridors.
Area of active mineral extraction affected during construction works (working strip)	Area of the 40 m working strip classified as having active mineral activities	Mineral extraction, including queries, represents a significant land use in some areas crossed by the corridors.
Area occupied by industrial and commercial units within the 2 km corridor	Area of the 2 km corridor for each alternative classified as industrial and commercial area by the CORINE Land Cover database	Industrial areas are often the result of strategic investments and key to the economic development of an area.

Indicator	***Definition***	***Relevance to the Appraisal***
Area occupied by industrial and commercial units working strip Settlements reliant	Area of the 40 m working strip classified as industrial and commercial area by the CORINE Land Cover database Num-	Industrial areas are often the result of strategic investments and key to the economic development of an area.
on agriculture as their main economic activity	ber of villages within the 2 km corridor for each alternative that rely on crops, livestock, forestry, or hunting as their main source of livelihoods and income (2001 census data).	Reliance on agricultural production as the main or only source of income evidences high dependence on land in agricultural use as a means for economic development. Any alterations to agricultural land as a result of Project activities might have a high impact on the local economy. Disaggregated data on settlements relying on crop cultivation are not available, but primary data collected in the field suggest that this is the most common activity.
Settlements reliant on industry as their main economic activity	Number of villages within the 2 km corridor for each alternative whose livelihood and main source of income is a work in industry or manufacturing (2001 census data)	Reliance on industry suggests a community that is less vulnerable then those who rely solely on the land, but more vulnerable then those with diversified economies
Settlements reliant on mineral extraction as their main economic activity	Number of villages within the 2 km corridor for each alternative for which the primary source of income is work in mines or quarries (2001 census data)	Reliance on Mineral Extraction suggests a community that is less vulnerable than those who rely solely on the land, but more vulnerable then those with diversified economies
Settlements with a diversified economy	Number of settlements within the 2 km corridor whose livelihood is based on a mixture of economic activities (agriculture, light industry, services, government jobs, etc.)	Communities that have a diversified economy have more capacity to deal with negative impacts and capitalise on Project benefits.
Cultural Heritage Indicators		
Archaeological Site	Number of known or suspected archaeological sites within the corridor	Time (high) and cost related of excavation or avoidance
Monument (old above ground structure)	Number of known monuments with the corridor	Time and cost related of rerouting
Intangible Heritage (ICH)	Heritage site with current, usually, local use	Time (modest) and cost related of consultation and / or rerouting
Archaeological Potential	Potential of corridor to contain undiscovered archaeological sites	Time (high) and cost related of chance finds during construction