Trans Adriatic Pipeline


# Watercourse Crossing Management Plan

**CONTENTS**

**CONTENTS ..... 2**
**1 INTRODUCTION AND BACKGROUND ..... 4**
1.1 Greece ..... 5
1.2 Albania ..... 5
**2 PURPOSE AND RESPONSABILITIES ..... 6**
2.1 Purpose ..... 6
2.1.1 Scope of the Watercourse Crossing Management Plan ..... 6
2.1.2 Interfaces with Other Management Plans ..... 6
2.1.3 Interfaces with engineering specification ..... 7
2.2 Roles and Responsibilities ..... 8
**3 DESIGN ..... 12**
3.1 Basis of Design ..... 12
3.2 Watercourse Classifications ..... 13
3.3 Design considerations ..... 14
3.4 Detailed Design Activities ..... 15
3.4.1 General ..... 15
3.4.2 Desktop Review ..... 15
3.4.3 Site Review ..... 15
3.4.4 Assessment and Analysis ..... 16
3.5 Detailed Designs ..... 16
3.5.1 Mechanical Protection and Buoyancy Control ..... 19
3.5.2 Civil Protection Works ..... 20
3.6 Engineering Watercourse Crossing Schedule ..... 20
**4 INSTALLATION ..... 22**
4.1 General ..... 22
4.2 Reinstatement ..... 24
4.3 As Built Records ..... 26
4.4 Photographic Records ..... 26
**5 MANAGEMENT OF BIODIVERSITY UPDATES ..... 28**
5.1 Route Environmental Impact Register (REIR) ..... 28
5.2 Level 3 site files ..... 28
**6 ECOLOGICAL REQUIREMENTS ..... 30**
6.1 ESIA Ecological Surveys ..... 30
6.2 ESIA Preliminary Crossing Methodologies ..... 30
6.2.1 Greece ESIA Crossing Methodology vs. Detailed Design ..... 31
6.2.2 Albania ESIA Crossing Methodology vs. Detailed Design ..... 33
6.3 Post ESIA Company Surveys ..... 34
6.3.1 Fish Surveys Greece ..... 34
6.3.2 Aquatic Habitat and Fish Surveys: Albania, 2015 ..... 34
6.4 Critical Habitat Assessment – Watercourses ..... 35
6.4.1 Greece Critical Habitat Watercourses ..... 35
6.4.2 Albania Critical Habitat Watercourses ..... 38
6.5 Protected areas ..... 40

6.5.1 Protected areas Greece ..... 40
6.5.2 Protected areas Albania ..... 40
6.6 Contractor Watercourse Ecological Survey and Assessment ..... 46
6.6.1 Rank A (high aquatic ecological importance) ..... 46
6.6.2 Rank B (medium aquatic ecological importance) ..... 47
6.6.3 Rank C (low aquatic ecological importance) ..... 47
6.7 Contractor ESMS Watercourse Crossing Method Statements ..... 47
6.8 ROW crossing Methodology ..... 48
6.9 Pipe lay Methodology ..... 49
6.9.1 Dry bed open cut / Isolated open cut ..... 50
6.9.2 HDD – Trenchless ..... 51
6.9.3 Thrust bore – Trenchless ..... 51
6.10 Fauna-related Requirements ..... 56
6.10.1 Aquatic Vertebrates ..... 56
6.10.2 Fish Translocation ..... 56
6.10.3 Eurasian Otter ..... 58
6.10.4 Reptiles and Amphibians ..... 58
6.10.5 Riparian Non-aquatic Fauna ..... 58
6.11 Flora-related Requirements ..... 59
6.12 Water Quality Monitoring ..... 59
6.13 Sediment Control ..... 61
**7 MONITORING AND MAINTENACNE ..... 62**
7.1 Monitoring philosophy ..... 63
7.2 Biodiversity monitoring ..... 63
**APPENDIX 1 – BLANK ESMS WATERCOURSE CROSSING METHOD STATEMENT ..... 65**
**APPENDIX 2 – EXAMPLE ESMS WATERCOURSE CROSSING METHOD STATEMENT ..... 71**

# 1 INTRODUCTION AND BACKGROUND

The TAP project is a greenfield development comprising the design, construction and operation of an 878 km natural gas pipeline. The pipeline route starts near Kipoi in Greece at the Greek–Turkish border and terminates near San Foca in Italy, crossing Greece, Albania and the Adriatic Sea. The pipeline connects at its entry point to the Trans Anatolian Pipeline and downstream of the Italian SRG natural gas network. The pipeline follows a carefully selected route that is designed to minimise risk in terms of deliverability by trying to avoid densely populated and environmentally sensitive areas, and by ensuring that it runs through the shortest and shallowest offshore route.


**Figure 1 TAP route overview**

The pipeline's initial design capacity of 10 billion cubic metres per annum (bcma) can rise to about 20 bcma by increasing the system's compression capacity. The pipeline will span 773 km onshore (550 km in Greece, 215 km in Albania and 8 km in Italy) and 105 km offshore.

Main construction activities begin in 2016 and the project is expected to be commissioned at the end of 2019.

Watercourses crossed by TAP have varying ecological value ranging from man made irrigation channels to large rivers within internationally designated protected areas and watercourses that support critically endangered fish species. Several watercourses are banked by EU priority habitat and may also provide important foraging, resting, breeding and commuting corridors for terrestrial animals of conservation interest.

Erosion risk is equally variable; the largest rivers crossed by TAP exhibit multi-thread and braided characteristics with multiple channels and bars that can change radically in a single

flood event. The smaller rivers are more likely to form a single channel but are often deeply incised and with widespread evidence of both lateral movement and of vertical instability, whereas the ditches and canals are generally confined within a stable channel and are sometimes formed with concrete.

Flow rates fluctuate significantly throughout the year, with human activities often influencing flows regimes particularly through the irrigation season. Many watercourses will be dry for the majority of the year and only flow following snow melt or prolonged periods of rain.

The variation in watercourse characteristics and ecological sensitivities requires a varied and dynamic approach to watercourses crossing management.

### 1.1 Greece

There are a total of 823 watercourses to be crossed by the TAP pipeline in Greece. The main watercourses that are crossed by the pipeline route are Evros, Provatonas, Fytemata, Apokrimno (Ireni), Filioiuris River, Chionorema Stream, Aspropotamos stream, Xiropotamos, Xanthi, Nestos, Aggitis Ditch, Aggitis, Strymonas, Gallikos, Axios, Loudias, Aliakmonas.

### 1.2 Albania

There are a total of 616 watercourses to be crossed by the TAP pipeline in Albania. The main watercourses that are crossed by the pipeline route are the Devolli, Osumi, Vokopala and Semani rivers, and Dunaveci, Stermort streams.

### 1.3 Italy

No watercourses are crossed in Italy.

# 2 PURPOSE AND RESPONSABILITIES

## 2.1 Purpose

The Watercourse Crossing Plan (WCP) outlines the philosophy and general requirements of all watercourse crossing activities including (but not limited to) watercourse crossing characterisation, preconstruction ecological and design considerations, watercourse crossing documentation and schedules, construction techniques, reinstatement, monitoring and verification.

The crossing works shall achieve the Basis of Design whilst satisfying both environmental and regulatory requirements as set out within the ESIA and applicable legislation.

### 2.1.1 Scope of the Watercourse Crossing Management Plan

The WCMP outlines the philosophy and general requirements of all watercourse crossing activities including (but not limited to) watercourse crossing characterisation, preconstruction ecological and design considerations, watercourse crossing documentation and schedules, construction techniques, reinstatement, monitoring and verification.

The WCMP introduces the process for selection of the methods to be used for pipe lay and access road construction.

It is applicable to the all watercourse crossing activities within the ROW and all other project areas that are used to support construction, including (but not limited to) construction camps, pipe lay down areas, maintenance areas, roads and other transport facilities.

This plan is limited to aquatic and semi aquatic fauna and flora which directly relate to specific watercourse crossings. Other fauna and flora which have been identified within areas that include, but are not directly related to the to a watercourse biodiversity at a given crossing point are included in the Ecological Management Plan.

This WCMP is presented in three general phases:

- Technical specifications to ensure the basis of design is achieved through engineering design
- Installation
- Ecological requirements and constraints

### 2.1.2 Interfaces with Other Management Plans

The Watercourse Crossing Management Plan is part of TAP's over-arching ESMS and as such has interfaces with several other management plans, and should be read in conjunction with:

- Environmental and Social Management Plan;
- Ecological Management Plan
- Supplementary Ecological Assessment
- Erosion Control and Reinstatement Management Plan;
- Biorestroation Management Plan;
- Watercourse Crossing CCPs;
- Erosion Control and Reinstatement CCPs;
- Pollution Prevention CCPs;

- Ecological Management CCPs;
- Onshore Compliance Monitoring CCPs;
- Additional Land Take CCPs;
- Resource Management CCPs.

This WCMP forms part of the TAP E&S and biodiversity management system which is described in:

- Environmental and Social Management Plan CAL00-PMT-601-Y-TTM-0006

This WCMP forms part of the ecological management system which is described in:

- Ecological Management Plan CAL00-C5577-640-Y-TTM-0001

### 2.1.3 Interfaces with engineering specification

Table 1 TAP Design documentation

| Document Number | Document Title |
|---|---|
| CAL00-PGC-125-F-TSD-5000 | Watercourse Crossing Philosophy |
| CAL00-PGC-125-F-TSX-5001 | Horizontal Directional Drilling (HDD) Specification |
| CAL00-PGC-125-F-TSX-5000 | Watercourse Civil Protection Works Specification |
| CPL00-CME-120-F-TSX-0005 | Specification for Concrete Weight Coating |
| CAL00-PGC-125-F-DFT-5000 | Typical - Open Cut Major River/ Channel RV1, RV2 |
| CAL00-PGC-125-F-DFT-5001 | Typical - Open Cut Smaller River/ Major Stream RV3 |
| CAL00-PGC-125-F-DFT-5002 | Typical - Open Cut Minor Stream RV4 Upland |
| CAL00-PGC-125-F-DFT-5003 | Typical - Open Cut Minor Stream RV4 Lowland |
| CAL00-PGC-125-F-DFT-5004 | Typical - Open Cut Ditch RV5 |
| CAL00-PGC-125-F-DFT-5005 | Typical - Open Cut Concrete Ditch RV6 |
| CAL00-PGC-125-F-DFT-5006 | Typical - Thrust Bore Concrete Ditch RV6 |
| CAL00-PGC-125-F-DFT-5007 | Typical - Open Cut Canal RV7 |
| CAL00-PGC-125-F-DFT-5008 | Typical - Rip Rap Revetment |
| CAL00-PGC-125-F-DFT-5009 | Typical - Gabion Revetment |
| CAL00-PGC-125-F-DFT-5010 | Typical - Rip Rap Lined Channel |

| | |
|---|---|
| CAL00-PGC-125-F-DFT-5011 | Typical - Gabion Lined Channel |
| CAL00-PGC-125-F-DFT-5012 | Typical - Rip Rap Sill |
| CAL00-PGC-125-F-DFT-5013 | Typical - River Bank Restoration (Riparian Areas) |
| CAL00-PGC-125-F-DFT-5014 | Typical - Concrete Coating |
| CAL00-PGC-125-F-DFT-5015 | Typical - Concrete Mechanical Protection Slabs |

## 2.2 Roles and Responsibilities

During Front-End Engineering Design (FEED) Company completed a Watercourse Crossing Schedule and establish Baseline Ecological Conditions for the main watercourses.

During detailed design Contractor is responsible for developing the Watercourse Crossing schedule, complete topographical, hydrological and ecological surveys and produce watercourse crossing method statements that are subject to approval by Company.

Contractor shall undertake watercourse crossing works in accordance with the Watercourse crossing CCP, this Watercourse crossing management Plan, Company specifications, ESIA and host country legislation.

This Plan shall take precedent over the watercourse crossing CCPs.

Company verifies and monitors the watercourse crossing works, including the successful rehabilitation and ongoing monitoring.

The contents of this Plan shall be rolled out through in country training sessions to both Company and Contractor personnel.

Table 2 Key COMPANY ESCH staff and associated responsibilities

| Role | Responsibility |
|---|---|
| Commercial and External Affairs Director | Implementation of this WCMP.<br>Provision of adequate and appropriate resources to E&S teams for the implementation of this WCMP. |
| TAP E&S Manager | Review of the Project ESMS, including this WCMP, on a regular basis or after any significant change to the Project.<br>Managing the E&S resources across the TAP Project for the implementation of the Project ESMS, including this WCMP.<br>Responsible for implementation of TAP's Watercourse crossing philosophy and methodology and for communicating any changes to Project E&S standards to the in-country teams. |

| | |
|---|---|
| | Supplying and managing technical support from third party specialists as required assisting the implementation of this plan.<br>Providing functional support to the in-country E&S teams for the implementation of this plan.<br>Sharing monitoring/audit findings and lessons-learnt between in-country E&S Managers and ESCH Experts. |
| TAP environmental advisor | Review of the Project ESMS, including this WCMP, on a regular basis or after any significant change to the Project.<br>Managing the ecological and biodiversity aspects related to watercourse crossings.<br>Maintaining of an ecological and biodiversity tracking register and schedule in relation to watercourse crossings.<br>Ensuring watercourse crossings are conducted in accordance with relevant ecological and biodiversity requirements.<br>Scoping and planning of COMPANY ecological and biodiversity surveys in relation to watercourses.<br>Supplying and managing technical support from third party specialists as required assisting the implementation of this plan.<br>Report and regularly update ecological and biodiversity performance to TAP E&S Manager and in country E&S managers.<br>Sharing monitoring/audit findings and lessons-learnt between in-country E&S Managers and ESCH Experts. |
| TAP biodiversity advisor | Provide ecological and biodiversity advice to TAP environmental advisor<br>Coordination of biodiversity specialists. |
| TAP Freshwater biodiversity specialist. | Freshwater ecological surveys<br>Provide freshwater ecological and biodiversity advice to TAP environmental advisor. |
| In-country Project Manager (IPMT) | Implementation of this WCMP at country level as related to TAP IPMT and providing the resources to do so.<br>Providing resources to promptly react to environmental, social and cultural heritage incidents arising from Project activities.<br>Notifying the CONTRACTORS of any amendments to the WCMP<br>Communicating the WCMP, specifying the Project's watercourse crossing commitments and requirements, to the CONTRACTORS. |

| | |
|---|---|
| In-country E&S Manager | Communicating the contents of this WCMP and any changes to the in-country COMPANY E&S team and CONTRACTOR and ensuring that they meet their responsibilities with respect to this plan.<br>Management of the resources provided for the implementation of this WCMP at country level, as related to in-country TAP E&S function.<br>Managing the review and acceptance of CONTRACTOR ESIPs and associated sub-plans, and monitoring of their implementation.<br>Managing effective Contractor oversight in accordance with this plan across all Project activities.<br>Ensuring that all E&S related incidents are reported and dealt with effectively and that lessons learned are shared in accordance with the COMPANY incident reporting procedure.<br>Managing in-country COMPANY resources to promptly react to E&S related incidents arising from Project activities when required. |
| TAP Senior Site Representatives | Implementation of this plan at site (pipeline; compressor stations etc.) level as related to TAP IPMT and providing the resources to do so.<br>Providing resources to promptly react to E&S related incidents arising from Project activities.<br>Support the E&S Field Monitors to discharge their duties in relation to this plan. |
| In-country Environmental and Social Experts | Support E&S Site Leads and field staff through provision of technical advice, training, audits and planning including assistance with pre-construction surveys, document review, management of change documentation, trend analysis, incident investigation, and technical advice.<br>Review and approval of CONTRACTOR ESIPs and associated sub-plans.<br>Organising and participating in COMPANY in-country inspections, reviews and audits of the CONTRACTORS' performance with respect to the requirements of this WCMP<br>Reporting on CONTRACTOR Watercourse crossing performance, compliance and corrective actions` implementation to the in-country E&S Manager as required.<br>Liaising with the CONTRACTORS' Environmental and Social Manager(s) in conjunction with the E&S Site Leads (Greece) on Watercourse crossing corrective actions` implementation issues.<br>Ensure Management of Change conform to TAP requirements.<br>Undertake Quarterly performance review activities and maintain Watercourse crossing schedules / REIRs across the Project to capture compliance evidence. |
| Environmental and | Responsible for oversight of site based E&S monitoring, inspections, meetings |

| | |
|---|---|
| Social Site Leads (Greece) | and functional reporting to the In-country E&S Manager.<br>Manages and coaches the site based environmental and social field monitors.<br>Manages the site based interface between COMPANY and CONTRACTOR on E&S issues in conjunction with the TAP Senior Site Representatives.<br>Ensures implementation by CONTRACTOR of the ESIA through monitoring CONTRACTOR implementation of CCP's, ESIP's and other relevant environmental and social requirements.<br>Supervision and monitoring of construction activities as they relate to E&S performance and reporting of monitoring activities to TAP Senior Site Representatives and In-country E&S Manager.<br>Provision of on-site day-to-day advice and assistance to TAP Senior Site Representatives and their teams.<br>Participate in E&S verification, compliance auditing and raising corrective actions as necessary. |
| Environmental and Social Field Monitors | Oversight of implementation by CONTRACTOR of ESIPs, associated sub-plans and of the requirements of this plan.<br>Undertaking daily assurance monitoring and inspections.<br>Providing feedback on inspections findings to the Environmental and Social Site Leads (Greece) or the in-country Environmental, Social, Cultural Heritage Experts and the In-country E&S Manager, as appropriate.<br>Reporting non-conformances to the Environmental and Social Site Leads (Greece) or the in-country Environmental, Social, Cultural Heritage Experts (as appropriate) and communicating these and required action to address them to CONTRACTOR.<br>Recording environmental and social incidents and following up formal reporting by CONTRACTORS.<br>Participating in internal (i.e. assuring COMPANY compliance) and external (i.e. assuring CONTRACTOR compliance) audits.<br>Documenting monthly oversight checklists based upon joint site inspections (where possible) and observations made during monitoring<br>Supporting In-country Environmental, Social, Cultural Heritage Experts to maintain watercourse crossing trackers trackers and REIR by facilitating production of evidence of compliance as appropriate. |

# 3 DESIGN

## 3.1 Basis of Design

The following basis is adopted for the purpose of the watercourse crossing design:

**Design Life**

- 50 years

**Design Philosophy**

- Pipeline to remain fully buried outside predicted active zone for design life

**Design Event**

- 1:200yr return period flood

**Vertical and lateral Design Factor of Safety**

- In accordance with TAP Watercourse Crossing Philosophy (CAL00-PGC-125-F-TSD-5000) and TAP Watercourse Crossing Specification (CAL00-PGC-125-F-TSX-5002)

**Vertical Design Factor of Safety**

For Unprotected crossings the Minimum Burial Depth below TCB to the end of the set backs to be the GREATER of:

- Cumulative Vertical Scour/ Erosion Components, PLUS 1.5m

Or

- 1.25 x (Maximum Single Event Scour + Climate Change Allowance), PLUS 1.0m

Or

- 3.0m for RV1, RV2, RV3 with Medium to High Erosion Potential
- 2.5m for RV3 with Low Erosion Potential
- 2m for RV4
- 1.2m for RV5&6
- 2.0m for RV7

For Protected crossings the Minimum Burial Depth below TCB to the end of the set backs to be:

- 2.5m for RV1, RV2, RV3 with Medium to High Erosion Potential
- 2.0m for RV3 with Low Erosion Potential
- 2m for RV4
- 1.2m for RV5&6
- 2.0m for RV7

**Lateral Design Factors of Safety**

Major Crossings RV1 & RV2:

- Bury outside site specific potential active width, Min. 10m - Unprotected
- 5m beyond standardised active width - Protected

Major RV3 Crossing, RV3 Medium to High Erosion Potential:

- Bury outside site specific potential active width, Min. 10m - Unprotected
- 5m beyond standardised active width - Protected

Minor RV3 Crossing, RV3 Low Erosion Potential:

- 7.5m beyond standardised active width - Unprotected
- 5m beyond standardised active width - Protected

Natural Minor Crossings RV4:

- 5m beyond standardised active width - Unprotected lowland
- 3m beyond standardised active width - Unprotected upland
- 3m beyond standardised active width - Protected

Man-made Minor Crossings RV5 &6:

- 3m beyond standardised active

Man-made Canal Crossings RV 7:

- 5m beyond standardised active width - canal width <10m
- 10m beyond standardised active width - canal width >10m

## 3.2 Watercourse Classifications

TAP watercourses are classified in accordance with table 1.

**Table 3 TAP watercourse crossing classification**

| Type | Class | Description | Sub class | Type |
|---|---|---|---|---|
| Natural Watercourses | RV1 | Large River (width > 30m) | N/A | Major Crossings |
| | RV2 | River (width 10m to 30m) | N/A | |
| | RV3 | Small River/Large Stream (width 5m to 10m) | RV3 Medium to High Erosion Potential | |
| | | | RV3 Low Erosion Potential | Minor Crossings |
| | RV4 | Small Stream/Gully (width < 5m) | RV4 Upland Stream with Medium to High Erosion Potential | |
| | | | RV4 Upland Stream with Low Erosion Potential | |
| | | | RV4 Lowland Stream | |
| Man made Watercourses | RV5 | Ditch (width < 5m) | N/A | |
| | RV6 | Concrete Channel | RV6 (>5m) | |
| | | | RV6 (<5m) | |
| | RV7 | Canal (width > 5m) | RV7 Canal (>=10m) | |
| | | | RV7 Canal (<10m) | |

### 3.3 Design considerations

The TAP watercourse crossings shall be designed to remain fully buried outside the predicted zone of river movement for the full 50 year design life of the pipeline.

For the pipeline to remain fully buried throughout the 50 year design life a large number of considerations need to be taken into account, including but not limited to:

- Hydrology;
- Geology;
- Topography;
- Environmental impact and sensitivities;
- Safety;
- Man-made change;
- Constructability;
- Operational monitoring and maintenance;
- Parallel pipelines;
- Pipeline protection works;
- Other infrastructure (bridges, weirs, dams, hydro-schemes, irrigation etc.);
- Cost.

Assessment and analysis of the above factors determines the overriding crossing philosophy to be adopted at each crossing

In addition to the overriding crossing philosophy the crossing methodology is selected as part of design i.e. to:

- Open cut;
- Horizontal Directional Drill (HDD);
- Micro-tunnel;
- Auger-bore.

Between the overriding crossing philosophy and overriding crossing technique there are a number of iterations that need to be considered by the pipeline engineering teams as part of the design activities.

Selection of the crossing philosophy for each of the major crossings (RV1, RV2 and specific RV3 sites) is made on a case-by-case basis.

Minor unlined crossings (RV3 with Low Erosion Potential sites, RV4, RV5, & RV7) will generally be installed by open cut techniques. Minor concrete lined crossings (RV6) shall be constructed as required by the third-party operator (either open cut or trenchless). Minor crossings should be designed and constructed in accordance with standard or typical drawings for pipeline installation and reinstatement/ pipeline protection.

For major crossings Company has carried out preliminary assessments and, for the largest sites, outline designs have been developed for detailed design by Contractor. The set backs and burial depths as assigned on Company drawings are minimum technical requirements. The minimum set backs and burial depths shall not be reduced without the prior written approval of Company.

For minor crossings Company has developed Typical or Standard designs for each classification of watercourse. These typical designs represent minimum technical requirements which shall be achieved by Contractor. During detailed design Contractor verifies the applicability of each typical design and where required either increase the burial depth and/ or setback or, where appropriate, assign civil protection works to protect the pipeline.

## 3.4 Detailed Design Activities

### 3.4.1 General

Design activities are undertaken by Contractor in a number of phases with specialist inputs being provided at each key stage of the process. Where the pipeline is parallel to any of the existing pipelines, engagement with the operators is required to agree the solution to be adopted for TAP. The following sub-sections include a high level summary of design activities.

### 3.4.2 Desktop Review

The first stage in the design process is to gather available information and execute a desk top review of the proposed crossings. The desktop review should include review and assessment of:

- FEED Designs;
- Environmental impact and sensitives.
- Satellite imagery (historic to present);
- Hydrological data (records and analysis);
- Geotechnical data (Site investigations, reports and soils maps);
- Topographic mapping and Digital Elevation Models (DEMs);
- Associated infrastructure and protection works;
- Existing and planned works.

Desktop study outputs:

- Identification of sites for detailed field inspection;
- Identification of data requirements;
- Scope for site reviews.

### 3.4.3 Site Review

Upon completion of the desktop review, major watercourse crossings shall be visited on site by river crossing specialists. The purpose of the site review will be to:

- Validate the findings of the desktop review;
- Obtain additional site information;
- Validate and review environmental impact and sensitivities.
- Assess crossing requirements;
- Determine any additional data needs;

- Develop scopes for additional data requirements;
- Confirm detailed design activities.

Site review outputs:

- Classification of watercourse crossings;
- Identification of preferred crossing methodology and protection requirement;
- Scope for additional data requirements;
- Scope for site specific analysis and detailed design activities

### 3.4.4 Assessment and Analysis

Based on the results of the desktop study and site reviews the scope for assessment and analysis is determined. Assessment and analysis will be necessary at specific sites and this will include, but not be limited to the following activities:

- Hydrological assessment;
- Hydraulic analysis;
- Fluvial assessment;
- Engineering inspection, assessment and analysis of:
    - Site constraints;
    - Topographical survey;
    - Geotechnical survey;
    - Existing and planned works;
    - Impacts of third party activities;
    - Potential impacts of TAP.

The site specific analysis and assessment will be utilised to confirm the:

- Active zone;
- Burial depth requirements;
- Set back requirements;
- Requirements for pipeline protection measures;
- Selected crossing technique;
- Crossing requirements.

## 3.5 Detailed Designs

During detailed design TAP Contractors conduct desktop studies and site surveys to verify or where necessary reclassify FEED watercourse classifications in accordance with Table 1.

Contractor develops Detailed Designs for each watercourse crossing. This shall include the review, assessment and analysis of each crossing as applicable to the watercourse crossing type.

For Major Crossings, site specific design documentation shall be developed for Company review and approval via project document control system. As a minimum this shall include the following for each crossing location:

- Pre-construction records;

- Hydrological assessment for unprotected watercourse;
- Hydrological assessment for protected watercourse (i.e. where Civil Protection Works are assigned);
- Geological X-section;
- Constructability Assessment;
- Detailed Pipeline crossing designs and method statements;
- Civil Protection Works Calculations (where applicable);
- Civil Protection Works Drawings (where applicable).

For Minor Crossings standard or Typical designs can generally be applied. These crossings shall be individually assessed in order to confirm the applicability of each Typical design. Where necessary to ensure the integrity of the watercourse Civil Protection Works shall be applied. For each Minor crossing the following, as a minimum, shall be developed for Company review and approval:

- Pre-construction records;
- Crossing Drawing(s), applying the typical design to the pre-construction survey;
- Typical Designs and method statements;
- Civil Protection Works Drawing(s), applying the typical design to the pre-construction survey.

It shall be noted that some minor crossings, particularly those with higher energy, may require a site specific detailed design in order to ensure pipeline integrity and satisfy the Basis of Design. Contractor shall therefore identify any such crossings during development of the Watercourse Crossing Schedule and develop site specific designs for any minor crossing locations which fall outside the envelope of the Typical design requirements.

Table 4 summarises the detailed design requirements and technical key aspects for each watercourse class.

**Table 4 Detailed design requirements and technical key aspects**

| Class | Crossed Object | Detailed Design Requirements and Technical Key Aspect |
|---|---|---|
| RV1 | Large River (width > 30m) | Detailed site specific assessment and definition of active width.<br><br>Site specific assessment of flows and river characteristics.<br><br>Detailed site specific crossing and constructability assessment defining burial depth, set-back and protection requirements (if any).<br><br>Detailed site specific construction design including burial depth, set back, pipeline protection and reinstatement requirements. |
| RV2 | River (width 10m to 30m) | Base case open-cut method with continuous concrete coating for buoyancy control and mechanical protection. Constructability assessment to consider trenchless options where appropriate. |

| Class | Crossed Object | Detailed Design Requirements and Technical Key Aspect |
|---|---|---|
| | | Where trenchless crossings offer e.g. environmental/ cost/ technical benefits to the project these shall be considered. Trenchless crossings shall be implemented where approved by TAP.<br><br>Construct crossings in line with environmental constraints as per the REIR |
| RV3 | Small River / Large Stream (width 5m to 10m) | Site specific assessment and definition of active width.<br><br>Site specific assessment of flows and stream characteristics.<br><br>Where the watercourse has the potential for erosion a site specific design (RV3 with Medium to High Erosion Potential) shall be implemented, unless the site specific assessment can have demonstrated that application of a standard design (RV3 with Low Erosion Potential) is robust.<br><br>Open-cut method or thrust/ auger-bore as defined through constructability assessment or as required by authorities.<br><br>Open-cut method to be applied with continuous concrete coating for buoyancy control and mechanical protection.<br><br>Site specific designs for stream bank/ river bed protection/ restoration unless standard designs can be applied based on calculated flows and stream characteristics.<br><br>Construct crossings in line with environmental constraints as per the REIR |
| RV4 | Small Stream / Gully (width < 5m) | Standard design.<br><br>Open-cut method with continuous concrete coating or pipeline protection slabs for mechanical protection.<br><br>For lowland areas, standard design of stream bank/ river bed protection/ restoration based on estimated flows and stream characteristics.<br><br>For upland channels site specific assessment of flows and design of stream bank/ river bed protection/ restoration works required.<br><br>Construct crossings in line with environmental constraints as per the REIR |
| RV5 | Ditch (width < 5m) | Standard design.<br><br>Open-cut method with concrete coating for mechanical protection.<br><br>Standard design of stream bank/ river bed protection/ |

| Class | Crossed Object | Detailed Design Requirements and Technical Key Aspect |
|---|---|---|
| | | restoration.<br>Construct crossings in line with environmental constraints as per the REIR |
| RV6 | Concrete Channel | Standard design.<br>Open-cut method or thrust/ auger-bore as defined through constructability assessment or as required by authorities.<br>Reinstatement to pre-construction details/ condition.<br>Construct crossings in line with environmental constraints as per the REIR |
| RV7 | Canal (width > 5m ) | Standard design.<br>Open-cut method with concrete coating for buoyancy control and mechanical protection at Major Canals (>10m wide).<br>Open-cut method with concrete coating where required for buoyancy control or pipeline protection slabs for mechanical protection at Minor Canals (≤10m wide).<br>Standard design of stream bank/ river bed protection/ restoration as required.<br>Construct crossings in line with environmental constraints as per the REIR |

Crossing method are indicative for class of watercourse and shall be confirmed during detailed design. The selection of trenchless methodology depends upon the many technical factors including length of trenchless section and ground conditions.

As described in section 5 and 6, all proposed crossing methodologies and timings will be cross referenced with known ecological sensitivities identified within the ESIA, post ESIA ecological data and REIR register. All crossing method and timings are approved by Company. Any change to Contractor proposed crossing methodology will be communicated by Company via the project document control system.

### 3.5.1 Mechanical Protection and Buoyancy Control

Contractor shall design and provide continuous mechanical protection between set-backs at all watercourse crossings. The type of protection provided at each classification of watercourse shall be in accordance with TAP Watercourse Crossing Philosophy (CAL00-PGC-125-F-TSD-5000).

Where concrete coating is designated this shall be negatively buoyant, with a minimum safety factor of 1.2, without taking account of any overburden. Contractor shall perform buoyancy assessments and calculations for Company review and approval. Contractor shall refer to Typical – Concrete Coating, CAL00-PGC-125-F-DFT-5014 and Typical -

Concrete Mechanical Protection Slabs, CAL00-PGC-125-F-DFT-5015 for minimum dimensional requirements. For additional design requirements refer to CPL00-CME-120-F-TSX-0005, Specification for Concrete Weight Coating.

### 3.5.2 Civil Protection Works

Where required to control the active zone of the watercourse Civil Protection Works shall be utilised. Company has assigned minimum Civil Protection Works at specific Major crossings where identified during preliminary assessments. The Civil Works assigned by Company on a site specific basis are minimum requirements. Company preliminary designs shall be developed by Contractor during Detailed Design. The minimum requirements shall not be reduced without prior written approval from Company.

Company has developed a suite of Typical or Standard designs for bed and bank protection works. Typical shall be assigned to watercourses as applicable and site specific designs developed. The Typical designs represent minimum technical requirements which shall be achieved by Contractor.

Contractor shall develop a detailed Civil Protection Works Schedule and submit this for Company review and approval. The Civil Protection Works Schedule shall include details of the protection to be assigned at each site.

Contractor shall submit both site specific and generic technical and logistics method statements covering all Civil Protection Work activities. Site-specific method statements shall be provided for all RV1, RV2 and RV3 major sites where Civil Protection Works are assigned. For all other sites, generic Riprap and gabion method statements shall be developed. Method statements shall be submitted for Client review and approval prior to planned Civil Protection Works construction at any site. Method Statements shall be approved by Client prior to commencement of construction.

The method statements shall include a detailed description of the Civil Protection Works, where applicable, the method statements shall form part of the overall Watercourse Crossing method statements applicable to specific sites.

Civil protection works shall be in accordance with Watercourse Civil Protection Works Specification (CAL00-PGC-125-F-TSX-5000).

## 3.6 Engineering Watercourse Crossing Schedule

During Detailed Design standalone engineer Watercourse Crossing Schedules are developed by contractors and include the following as a minimum:

- KP;
- Classification;
- Unique crossing reference;
- Co-ordinates of crossing;
- Owner;
- Width of feature along pipeline chain age;
- Width of feature (perpendicular to flow);
- Pipeline wall thickness and design factor;
- Pipeline protection and buoyancy requirements/ length/ type;

- Hot bends where assigned;
- Referenced crossing drawing(s) (Site specific or typical detail as applicable to each crossing);
- Crossing method;
- Pre-construction Photographic Record Reference;
- Notes.

The schedule details rhw technical information required to achieve the basis of design.

The Watercourse Schedule shall be validated by suitably experienced pipeline engineers.

The Watercourse Crossing Schedules prepared by contractors are provided in Appendix 3.

# 4 INSTALLATION

## 4.1 General

Table 5 below summarises TAP watercourse crossings following Contractor detailed design activities, classified in accordance with Table 3.

**Table 5 Detailed design watercourse crossings by class**

| Class | Number of watercourse crossings | |
|---|---|---|
| | Greece | Albania |
| RV1 | 20 | 13 |
| RV2 | 21 | 2 |
| RV3 | 41 | 15 |
| RV4 | 226 | 84 |
| RV5 | 290 | 401 |
| RV6 | 86 | 44 |
| RV7 | 139 | 49 |
| **Total** | **823** | **608** |

Tables 4, 5 and 6 summarise proposed crossing methods following detailed design. The tables include trenchless crossings where the watercourse is the primary feature to be crossed and also watercourses that are secondary crossings within limits of the trenchless crossing of a primary feature.

**Table 6 Crossing method Greece**

| Class | Pipe lay method | | | | | |
|---|---|---|---|---|---|---|
| | Trenchless | | | | | Open cut |
| | HDD | Micro Tunnel | Thrust bore | Within limits of other trenchless* | Total Trenchless | |
| RV 1 | 9 | - | - | - | 9 | 11 |
| RV 2 | 3 | - | - | 3 | 6 | 15 |
| RV 3 | - | - | - | 2 | 2 | 39 |
| RV 4 | - | - | - | 4 | 4 | 222 |
| RV 5 | - | - | - | 19 | 19 | 271 |
| RV 6 | - | - | 5 | 14 | 19 | 67 |
| RV 7 | 1 | - | 1 | 19 | 21 | 118 |
| **All** | **13** | **-** | **6** | **61** | **80** | **743** |

*An example of a secondary trenchless crossing, or a crossing within limits of another trenchless crossings would be a watercourse or ditch within the trenchless crossing length of a larger watercourse, road or rail crossing.

**Table 7 Crossing methods Albania**

| Class | Pipe lay method | | | | | |
|---|---|---|---|---|---|---|
| | Trenchless | | | | | Open cut |
| | HDD | Micro Tunnel | Thrust bore | Within limits of other trenchless | Total Trenchless | |
| RV 1 | 2 | 6 | - | - | 6 | 5 |
| RV 2 | - | - | - | - | - | 2 |
| RV 3 | - | - | - | - | - | 15 |
| RV 4 | - | - | - | - | - | 81 |
| RV 5 | 6 | - | 13 | - | 19 | 382 |
| RV 6 | - | - | 2 | - | 2 | 42 |
| RV 7 | 1 | - | 4 | - | 5 | 44 |
| **All** | **9** | **6** | **19** | **-** | **35** | **577** |

Crossings of watercourses shall be executed in line with Company approved drawings and the requirements of Company specifications (referenced earlier), whilst satisfying the site specific requirements of the ESIA and post ESIA ecological data which is summarised within the REIR and included within the level 3 site files. When developing installation designs Contractor shall perform a pre-construction topographic survey, including river bed survey and issue construction drawings reflecting the actual and up–to–date status of the watercourse.

Construction of the pipeline across rivers and streams shall be performed in such a manner that causes minimum disturbance to the watercourse banks, bed, water quality, third party users, irrigation, drainage, riparian areas and fish / wildlife habitats.

Working widths at river crossings will be reduced as far as practicable to ensure safe construction conditions. Crossing working widths will be reduced as far as possible to a maximum width of 28m in Critical habitats and PBFs. Working width will be reduced further to 18m at a number of crossings with EU priority habitat in Greece. These requirements will be detailed and verified within the level 3 site files (discussed in section 5). It is recognised that this is not always possible to achieve reduced working widths due to technical or safety constraints these instances will be recorded by Company.

Prior to commencement of work at major crossings Contractor shall submit to Company, for review and approval, site specific Construction Method Statements as part of the detailed design requirements in section 4.1. These shall include full details of the proposed methods of installation/ construction from mobilisation through to reinstatement, temporary works including diversion channels, sediment and erosion control, temporary areas, equipment requirements, materials, personnel, procedures, inspection and test plans etc. to be employed plus task specific risk assessments. Contractor shall also provide individual construction drawings for each major watercourse showing the method of crossing, special conditions, temporary works and the areas required for construction activities such as diversion channels, lay down areas, etc.

Contractor shall execute any additional survey, hydrology, geotechnical work required to support Contractor's construction methods.

Contractor shall be required to incorporate any additional special conditions required by third parties or Company within the Construction Method Statements, including the measures to satisfy requirements of the REIR and level 3 site files.

Any requests for modification of an approved crossing design must be pre-approved in writing by Company.

During the construction of the river crossings, Contractor shall ensure that flow will be diverted properly to protect both personnel and downstream users. All open cut watercourse crossings will be isolated, using Dam and Pump, Flumes or Diversion methods unless the channel bed in dry to bottom, or overriding technical constraints prevent it, in which case the Contractor shall provide a full technical justification along with detailed mitigation measures to reduce impact as far as reasonably practicable.

When crossing irrigation canals, Contractor shall ensure that the water supply will not be interrupted without third party users` agreement. The excavation works shall be done with extreme care to avoid adverse impact on the water qualities and in compliance with ESIA and permit requirements.

Trenchless crossings shall be executed where required by Company. If Contractor proposes to change crossing technique either to or from trenchless then Contractor shall provide a fully substantiated request for change for Company consideration and approval.

All watercourse crossing techniques and timings shall be in agreement with Company. Documentation shall be submitted for review and approved via Company document control system prior to crossing activities.

The EPC contractor environmental coordinators and ecological experts will complete daily inspections during the execution of all CH watercourse crossings.

TAP environmental monitors will oversee the execution of CH watercourse crossings to measure compliance with the associated level 3 site files and approved ESMS Watercourse crossing method statements.

TAP and the EPC contractor shall ensure that temporary works and temporary sediment control is regularly inspected at watercourses during routine daily inspections at all active work fronts.

Temporary erosion and sediment control will be monitored during routine ROW inspections and targeted inspections during and after rain events.

Any noted non-compliance or required improvements from the inspections and monitoring noted above will be documented and provided to the contractor site engineer.

## 4.2 Reinstatement

Where no protection of the river bed is planned, the stratum of the river bed shall be reinstated according to the natural conditions found in the river bed. Contractor shall restore the disturbed areas to their natural pre-construction condition including but not limited to the bank slope, bed structure, upland drainages and vegetation cover, and provide erosion protection measures as required so that erosion will not accelerate and/or increase as a result of construction activities. Deep rooted woody vegetation will not be replanted over the 8m PPS.

Changes to width-depth ratio of watercourses at crossings shall be avoided. Changes to natural substrate material in watercourses shall be prevented.

River banks shall be reinstated and re-vegetated to their original shape and alignment. Contractor shall be responsible for implementing erosion and sediment control measures on disturbed areas until re-vegetation coverage and/or other reinstatements are fully established and functioning correctly, and meet the ESIA, permit conditions and project specification prerequisites. Contractor shall determine original precondition by comparing detailed preconstruction surveys and photographs as described in section 4.4.

Contractor shall be responsible for removing temporary works, material and debris that are not intended to be part of the permanent installations.

Should the Civil Protection Works Schedule not show a protection measure at any specific site, but these are later deemed necessary during installation, then, the protection shall be proposed by Contractor prior to reinstatement for Company review and approval.

Contractor shall be responsible for implementing and maintaining all erosion and sediment control measures until final acceptance by Company. Further details on erosion monitoring can be found in section 7.

The stability of the channel at the crossings shall be monitored regularly and remedial actions implemented if signs of instability such as erosion, sedimentation or other indicators of channel instability are observed.

Riparian vegetation (Plant habitats and communities along the river margins and banks) is of high importance to the long term stability of the river. Contractor shall minimise riparian disturbance wherever removal is not required to enable safe construction conditions. Contractor shall replant of the same species mix shall be planted. Nursery trees of minimum 2 years old up to 5 year old shall be planted in order to restore the riparian environment, subject to the restrictions of the 8m PPS detailed in CAL00-PGC-125-F-DFT-5013, Typical - River Bank Restoration (Riparian Areas)

Contractor shall plant sufficient density of vegetation to achieve the original plant densities subject to the restrictions of the 8m PPS detailed in CAL00-PGC-125-F-DFT-5013, Typical - River Bank Restoration (Riparian Areas)The planting density shall take consideration of dieback rates of each plant.

Where originally present, native shrubs shall be re-planted above the pipeline and within the riparian zone subject to the restrictions of the 8m PPS detailed in CAL00-PGC-125-F-DFT-5013, Typical - River Bank Restoration (Riparian Areas). If no shrubs are originally present, Contractor shall introduce shrubs native to the region to provide vegetative stabilisation and erosion protection across the cleared ROW to a minimum of 10m beyond the watercourse bank, or the edge of an active agricultural field.

Biorestoration of river banks shall be undertaken to re-establish vegetation to the equivalence of the adjacent untouched areas. This may include juvenile trees and shrubs the selection of, placement and planting shall be supervised by a competent ecologist and approved by Company. River banks shall generally be restored to their original condition and contours. Where this is not practicable, Contractor shall propose site specific solutions with engineering justification; this shall be included within Contractor Method Statements. Biorestoration shall be in accordance with the Biorestoration Management Plan.

Where engineered solutions are required the design of riverbed and riverbank protection shall be in accordance with CAL00-PGC-125-F-TSX-5000, Watercourse Civil Protection Works Specification and the Reinstatement and Soil Erosion and Reinstatement Plan.

Watercourse reinstatement shall be monitored following completion of works, in accordance with the Soil Erosion and Reinstatement Plan, The Biorestoration Management Plan and Section 7 of this WCMP.

The above reinstatement and biorestoration requirements apply to all works at watercourses, including ROW access tracks.

The EPC contractor environmental coordinators and ecological experts will complete daily inspections during the removal of temporary works and reinstatement at all CH watercourses.

TAP environmental monitors will oversee the reinstatement of CH watercourse crossings to measure compliance with the associated level 3 site files and approved ESMS Watercourse crossing method statements.

Reinstated watercourses will be monitored during routine ROW inspections and targeted inspections during and after rain events.

TAPs longer term reinstatement and erosion monitoring is discussed in section 7.

TAPs longer term biodiversity monitoring is introduced in the Ecological Management Plan.

Any noted non-compliance or required improvements from the inspections and monitoring noted above will be documented and provided to the contractor site engineer.

## 4.3 As Built Records

As-built records of the works shall be provided to Company as the works progress. As-builts shall be provided for all watercourse crossings including details of the pipeline installation up to standard cover, any civil works deployed and the final, reinstated, plan and profile of the watercourse.

As-builts shall be developed as the works progress and shall be handed over no later than two weeks after completing reinstatement activities at a specific site.

## 4.4 Photographic Records

CONTRACTOR shall make digital photographic records of all watercourse crossing sites using high quality compact digital cameras with GPS functionality. Each photograph shall be “geo-tagged”, with the location of each photograph being embedded within the native file.

Full preconstruction photographic records shall be complied for all watercourses.

At each stage of the construction a set of GPS referenced photographs shall be taken viewing:

- +ve along pipeline alignment;
- -ve along pipeline alignment;

- Upstream along river alignment from pipeline alignment;
- Downstream along river alignment from pipeline alignment;
- Upstream along river alignment from downstream edge of ROW;
- Downstream along river alignment from upstream edge of ROW.

All photographs shall be taken with a digital GPS camera. Minimum photographic resolution and size shall be fine 3264 x 2448 (F3264 (8m)).

Photographic records shall be handed over to Company, along with the as-built records of the site, in both JPEG and PDF file formats.

# 5 MANAGEMENT OF BIODIVERSITY UPDATES

## 5.1 Route Environmental Impact Register (REIR)

As described in the ecological management plan, TAP has developed the Route Environmental Impact Register (REIR) to manage georeferenced data on environmental sensitivities and the associated management actions.

Preparation of the REIR includes a review of the ESIA, post-ESIA survey reports, SEA, CHA, CCPs, EPC Contractor ESIPs, and any sub-plans, which relate to the relevant pipeline sections as a whole, or individual features.

The REIR database and associated impact assessment and mitigation tools ensure that all information on sensitive sites and recommended mitigations is centralised in a single location that is available to TAP and its EPC Contractors. The Register format is applied across all countries and contractors to ensure consistency in the ecological management approach.

Every watercourse with a Critical Habitat (CH) or Priority Biodiversity Feature (PBF) rating will be included within the REIR, this will include:

- Fresh water fish
- Fresh water invertebrates
- EU priority habitat, EU habitat and Greek habitat.
- Watercourses and riparian zones important to CH and PBF semi aquatic, terrestrial and avifauna.

The REIR ensures that every sensitive watercourse identified in the ESIA and Supplementary Ecological Assessment is highlighted to TAP and the EPC Contractors.

The REIR is described in more detailed in the ecological management plan.

## 5.2 Level 3 site files

A Level 3 site file shall be developed for every watercourse with a CH or PBF rating.

The Site Files will:

- Set out roles and responsibilities for implementation of control measures
- Rationalize ESIA and post ESIA ecological constraints and mitigation.
- Identify any conflicts with detailed design and biodiversity requirements.
- Communicate the rationalized ecological constraints and mitigation to the EPC Contractors for implementation.
- Monitor the implementation and success of ecological mitigation
- Identify ecological rehabilitation, monitoring and potential intervention requirements

The site files will be developed by TAP ecological subcontractors and ensure that all environmental and biodiversity ecological requirements are identified and communicated to the EPC.

This process is described in more detail in the Ecological management plan.

# 6 ECOLOGICAL REQUIREMENTS

## 6.1 ESIA Ecological Surveys

During the ESIA 39 watercourses (26 in Greece, 13 in Albania) watercourses were selected for analysis of ecological sensitivity.

In line with the Water Framework Directive (WFD), the following elements were analysed:

- Hydro-morphology;
- Water quality;
- Sediments;
- Aquatic Ecology.

These elements, together with the condition of the riparian vegetation and landscape contributed to establish the quality status of the rivers in the area based on ecological parameters. It also provides detailed data on several ecological features of the stream and riparian environment at the crossing points in order to provide a full picture of the river ecological status at the pipeline crossing points.

The analysis of watercourse sensitivity value, along with geotechnical restrictions was considered during FEED to develop appropriate crossing methodologies and mitigations in accordance with the mitigation hierarchy in figure 1.

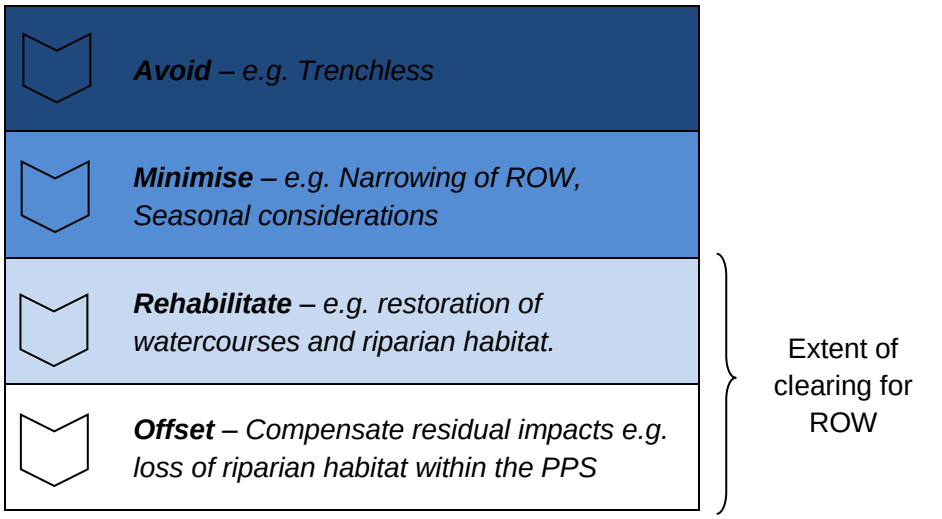



**Figure 2**

**Watercourse Crossing Hierarchy of Mitigation**

## 6.2 ESIA Preliminary Crossing Methodologies

TAP assigned preliminary crossing methodologies to the 39 water watercourses surveyed within the ESIAs. The preliminary crossing methodologies considered ecological value, geotechnical and constructability constraints.

Where detailed design differs from ESIA recommendations, Contractors shall submit, to Company for approval, a detailed technical justification for the change in construction methodologies along with alternative mitigation measures in order to reduce impact as far as reasonably practicable.

Construction and residual impact of any changes in methodology shall be assessed in the Level 3 site files as discussed in section 7.

### 6.2.1 Greece ESIA Crossing Methodology vs. Detailed Design

The ESIA evaluated the potential impacts to the aquatic ecosystems studied during the field surveys. The evaluation was based on the information compiled during the desktop and field investigations of the 26 watercourses. The assessment focused on a selection of 22 that were considered as having the highest ecological potential (i.e. permanent waters) and also because in those construction operations the impacts would be expected to be more significant.

It has been considered that from the 22 rivers considered to have high ecological potential a total of 6 are actually in poor condition (i.e. as shown by having very poor fish population/species or by the combination of indicators for fishes, macroinvertebrates and diatoms). These include: Fytemata (Mega Rema), Chionorrema (Bosbos), Tafros Belitsa (Mitrousi), Strymonas, Vrardarovasi, Grammatiko Creek. In all these rivers the potential to generate a relevant impact due to an increased turbidity during construction is rather scarce and considered as not significant.

The remaining 16 river crossings are considered to be in good/very good condition or at least to include some fish species of interest or abundant fish populations (that could be the key source to animals such as otters or some species of birds mainly). Among these 16 a total of 8 rivers are considered to be especially relevant thanks to the presence of valuable fish species and populations often in combination with good communities of macroinvertebrates and diatoms.

These rivers are: Filiouris (Vathoulorema), Nestos, Tafros Aggitis (Filippoi), Aggitis, Axios, Aliakmonas (crossing AL1), Aliakmonas (crossing AL2), Aliakmonas (crossing AL3).

Of remarkable interest are the three Aliakmonas crossings as they proved to retain very good populations of fishes, the absence of non indigenous fish species and also a healthy population of macroinvertebrates and diatoms, thus demonstrating that the river maintains a good water quality when compared with many of the remaining middle-to large sized rivers located along the entire pipeline corridor.

The potential to create relevant negative impacts in these 16 rivers would be high in the case of a wet open cut technique. However, in all 16 river crossings the project design has defined that only dry open cut or trenchless (e.g. HDD) techniques would be used. With both these latter two techniques the potential for generating relevant pulses of high turbidity are significantly reduced and therefore there is also a reduced risk for a significant impact on the river ecosystem. This is specially the case for those specific rivers in which a

trenchless technique is being proposed, which include 10 out of 16 crossings (including the 3 Aliakmonas crossings). Based on this, the impact significance for the crossing of the 16 above-mentioned rivers is moderate and basically it is associated to the risks inherent from any construction operation (e.g. failure of machinery being used in the river, unexpected river conditions, etc.) which are standard and managed through the management plans of the construction site.

It should be noted that the number of watercourses surveyed during ESIA is directly related to the presence of permanent or seasonal flow at these 20 crossings.

Of the 26 watercourses surveyed, the ESIA recommended 14 Trenchless crossings in order to reduce impact on the watercourses. Table 6 below compares the ESIA preliminary trenchless crossings versus Contractors proposed detailed design methodology.

**Table 8 Greece ESIA Trenchless recommendations vs. Detailed Design**

| CROSSING ID | NAME | KP | ESIA recommendation | Detailed design |
|---|---|---|---|---|
| C0001-N | Evros | 0 | Trenchless | Trenchless |
| C0223 | Filiouris River | 78 | Trenchless | Trenchless |
| C0343 | Xiropotamos River | 113 | Trenchless | Trenchless |
| C0530 | Nestos | 153 | Trenchless | Trenchless |
| C0886 | Aggitis | 226 | Trenchless | Trenchless |
| C1256 | Strymonas | 294 | Trenchless | Trenchless |
| C2053 | Axios | 374 | Trenchless | Trenchless |
| C2065 | Vardarovasi | 376 | Trenchless | Trenchless |
| C2258<br>C2259<br>C2260 | Tributaries of the Loudias | 399 | Trenchless | Trenchless |
| C2403 | Channel 66 | 420 | Trenchless | Trenchless |
| C2500-1-1 | Grammatiko Creek | 453 | Trenchless | Dry bed open cut / Isolated Open Cut |
| C2796 | Aliakmonas I | 527 | Trenchless | Trenchless |
| C2825 | Aliakmonas II | 535 | Trenchless | Trenchless |
| C2843 | Aliakmonas III | 539 | Trenchless | Dry bed open cut* /Isolated Open Cut |

*TAP and its contractor are currently investigating reversion to trenchless crossing technique at watercourse C2843.

There are a total of 80 trenchless watercourse crossings in total. All other watercourses crossings will be isolated, using Dam and Pump, Flumes or Diversion methods unless the channel bed is dry to bottom, or overriding technical constraints prevent it, in which case the Contractor shall provide, for Company approval, a full technical justification along with detailed mitigation measures to reduce impact as far as reasonably practicable.

In all circumstances, Company shall review Contractor crossing methodology at all watercourses for approval via the Project document control system.

### 6.2.2 Albania ESIA Crossing Methodology vs. Detailed Design

Of the 13 watercourses surveyed, the ESIA recommended 10 Trenchless crossings in order to reduce impact on the watercourses. Table 7 below compares the ESIA preliminary trenchless crossings versus Contractors proposed detailed design methodology.

**Table 9 Albania ESIA Trenchless recommendations vs. Detailed Design**

| CROSSING ID | NAME | KP | ESIA Recommendation | Detailed design |
|---|---|---|---|---|
| RV-282 | Osumi (Qender) | 105 | Trenchless | Dry bed open cut /Isolated Open Cut |
| RV-287 | Osumi | 109 | Trenchless | Trenchless |
| RV-294 | Osumi | 114 | Trenchless | Trenchless |
| RV-297 | Vokopola | 124 | Trenchless | Dry bed open cut /Isolated Open Cut |
| RV-298 | Osumi | 134 | Trenchless | Trenchless |
| RV-301 | Vurtopi | 135 | Trenchless | Dry bed open cut /Isolated Open Cut |
| RV-302 | Osumi (Vertop1) | 138 | Trenchless | Trenchless |
| RV-304 | Osumi | 139 | Trenchless | Trenchless |
| RV-405 | Osumi River flood plain (no longer cross Zagoria River) | 146 | Trenchless | Watercourse not directly crossed |
| RV-430 | Osumi (Otllak) | 161 | Trenchless | Trenchless |

There are a total of 35 trenchless watercourse crossings in total. All other watercourses crossings will be isolated, using Dam and Pump, Flumes or Diversion methods unless the channel bed is dry to bottom, or overriding technical constraints prevent it, in which case the Contractor shall provide, for Company approval, a full technical justification along with detailed mitigation measures to reduce impact as far as reasonably practicable.

In all circumstances, Company shall review Contractor crossing methodology at all watercourses for approval via the Project document control system.

## 6.3 Post ESIA Company Surveys

### 6.3.1 Fish Surveys Greece

Post ESIA freshwater fish surveys were completed at 3 crossings in the Phillipoi region, Phillippoi 3, 5 and 9 specifically for the Greek brook lamprey (*Eudontomyzon hellenicus*) and Aggitis spined-loach (*Cobitis punctilineata*) species.

The IUCN Red List and Greek Red Data Book cite the Greek brook lamprey as critically endangered. The species is also listed under Annex II of the European Union Habitats Directive and Annex III of the Bern Convention.

The IUCN Red List considers the Aggitis spined loach vulnerable. It is listed as a Greek Red Data Book species and in Annex II of EC Directive 92/43/EEC.

The Greek Brook Lamprey was confirmed present in 1 watercourse, while the Aggitis Spined loach was confirmed present in all 3, as shown in table 8.

**Table 10 Fish survey of Phillippoi 3, 5 and 9**

| Watercourse Name | Crossing ID | Lamprey presence | | Loach presence | |
|---|---|---|---|---|---|
| | | 2014 | 2015 | 2014 | 2015 |
| Philippoi 3 | C0791-N | Yes | Yes | Yes | Yes |
| Philippoi 5 | C0797-N-9-1 | No | No | Yes | Yes |
| Philippoi 9 | C0797-N-23 | No | No | Yes | Yes |

In accordance with the Hierarchy of mitigation presented in the fish survey report GAL00-C5577-642-Y-TRS-0004 based on the habitat suitability of the watercourses, the following construction methods have been confirmed during detailed design.

**Table 11 Phillippoi 3, 5 and 9 crossing methodology**

| Watercourse Name | Crossing ID | Detailed design crossing method |
|---|---|---|
| Philippoi 3 | C0791-N | Trenchless |
| Philippoi 5 | C0797-N-9-1 | Trenchless |
| Philippoi 9 | C0797-N-23 | Isolated open cut outside sensitive period for Aggitis spined loach (April-June) |

Site Specific ESMS watercourse crossing method statements shall be developed for each watercourse.

### 6.3.2 Aquatic Habitat and Fish Surveys: Albania, 2015

The surveys were carried out to fulfil commitments in the ESIA and to provide additional baseline biodiversity data at 18 watercourses. The overall aim of the habitat and fish surveys at RC and PC locations was to provide TAP with information regarding the potential sensitivity of sites, which can be used to guide construction activities.

The survey report did not make any design change recommendations; however, TAP is investigating mitigating options on a site by site basis. Mitigation for European Eel was recommended at some locations, which have been captured in the project Critical Habitat Assessment and discussed below.

## 6.4 Critical Habitat Assessment – Watercourses

A Critical Habitat Assessment (CHA) was completed for the TAP project, tables 12 and 13 identify the relevant species DMUs.

All ditches from KP195 to the coast in Albania have been classified as DMUs for the Albanian pool frog. Management controls are discussed within the EMP.

For Eel and Otter mitigation see section 6.11.1 and 6.11.2.

### 6.4.1 Greece Critical Habitat Watercourses

Table 10 below identifies watercourses identified as Critical Habitat DMUs for aquatic and semi-aquatic fauna in Greece. Detailed design construction methodologies and mitigation is provided for each crossing.

Contractor shall prepare a Site Specific ESMS Watercourse Crossing Method Statement for crossings listed in table 12.

TAP has identified the key sensitive periods for the fish species during which isolated open cut crossings will be avoided:

Greek Brook Lamprey – Metamorphosis – Oct – Jan

Aggitis Spined loach – Spawning – Apr – Jun

Cobitis puncticulata - – Spawning – Apr – Jun

Alburnoid Sp.Volvi – Spawning – Mid April – Mid May.

Pelagos Trout – Spawning – Sept – Jan

Alburnus vistonicus – Spawning – May – July

**Table 12 Greece Critical Habitat Watercourses**

| KP | Crossing ID | Name | Species | CH Tier | Crossing method |
|---|---|---|---|---|---|
| 0 | C0001-N | Evros | Otter<br>Cobitis Puncticulata | 2 | HDD |
| 1 | C0007-N | Provantos Canal | Otter | 2 | Dry bed open cut / isolated open cut or with Otter mitigation |
| 13 | C0041 | Fytemata stream (Mega) | European Eel<br>Otter | 2 | Dry bed open cut / isolated open cut or dry bed open cut with Eel and Otter mitigation |
| 27 | C0074 | Tsai Stream | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 42 | C0127-N | Apokrimno | European Eel | 2 | Dry bed open cut / isolated open cut |

| KP | Crossing ID | Name | Species | CH Tier | Crossing method |
|---|---|---|---|---|---|
| | | stream (Irini) | Otter | | with Eel and Otter mitigation |
| 78 | C0223 | Lissos River Filiouris River | *Alburnus vistonicus*<br>European Eel<br>U.crassus | 1<br>2 | HDD |
| 82 | C0240 | Mavropotamos | *Alburnus vistonicus*<br>European Eel<br>Otter<br>U.crassus | 1<br>2 | Dry bed open cut / isolated open cut outside critical period for Alburnus Vistonicus with Eel, Otter mitigation and invertebrate mitigation |
| 100 | C0302-N | Chionorema stream / Bospos | *Alburnus vistonicus*<br>European Eel<br>Otter<br>U.crassus | 1<br>2 | Dry bed open cut / isolated open cut outside critical period for Alburnus Vistonicus with Eel mitigation and Otter mitigation |
| 106 | C0319-N | Aspropotamos stream | European Eel<br>Otter | 2 | Dry bed open cut / isolated open cut with Eel and Otter mitigation |
| 107 | C0330-N | Meleti Stream | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 113 | C0343 | Xiropotamos | *Alburnus vistonicus*<br>European Eel<br>Otter | 1<br>2 | HDD |
| 117 | C0376 | Filalos River (Iasmos) | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 126 | C0411 | Amaxades Stream | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 136 | C0458 | Xanthis River | *Alburnus vistonicus*<br>European Eel<br>Otter | 1<br>2 | Dry bed open cut / isolated open cut outside critical period for Alburnus Vistonicus with Eel and Otter mitigation |
| 154 | C0530 | Nestos River | European Eel<br>Otter<br>*T. hohenackeri* | 2 | HDD |
| 165 | C0570 | Channel | European Eel<br>*T. hohenackeri* | 2 | Thrust bore |
| 175 | C0689-N | Pontolivado Stream | European Eel | 2 | Thrust Bore |
| 179 | C0711-N-1 | Kotsas stream | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 205 | C0791-N | Philippoi 3 | Aggitis spined loach<br>Greek Brook Lamprey<br>European Eel<br>*T. hohenackeri*<br>Otter | 1<br>2 | Thrust bore |
| 208 | C0797-N-9-1 | Philippoi 5 | Aggitis spined loach<br>European Eel<br>*T. hohenackeri* | 1<br>2 | Thrust bore |
| 211 | C0797-N-23 | Philippoi 9 | Aggitis spined loach<br>European Eel<br>*T. hohenackeri* | 1<br>2 | Dry bed open cut / isolated open cut outside critical period for loach with eel and invertebrate mitigation |

| KP | Crossing ID | Name | Species | CH Tier | Crossing method |
|---|---|---|---|---|---|
| 216 | C0848A-N-6 | | Aggitis spined loach<br>European Eel<br>*T. hohenackeri* | 1<br>2 | Dry bed open cut / isolated open cut outside critical period for loach with eel and invertebrate mitigation |
| 222 | C0865 | Agios Ioannis River | Aggitis spined loach<br>European Eel<br>Otter<br>*T. hohenackeri* | 1<br>2 | Dry bed open cut / isolated open cut outside critical period for loach with eel Otter and invertebrate mitigation |
| 226 | C0886 | Aggitis | Aggitis spined loach<br>European Eel<br>Otter<br>*T. hohenackeri* | 1<br>2 | HDD |
| 269 | C1030 | Agios Ioannis River | European eel<br>*T. hohenackeri* | 2 | Dry bed open cut / isolated open cut with Eel mitigation and invertebrate mitigation. |
| 284 | C1103 | Belista Ditch | European eel<br>Pelagos trout | 2 | Dry bed open cut / isolated open cut outside critical period for Pelagos trout with Eel mitigation |
| 294 | C1256 | Strymonas River | European eel<br>Otter<br>Pelagos trout<br>Alburnoide Sp. Volvi<br>Barbus Macedonis | 2 | HDD |
| 359 | C1458 | Gallikos River | European eel | 2 | Dry bed open cut / isolated open cut with outside critical period with eel mitigation |
| 375 | C2053 | Axios River | Pelagos trout<br>European eel<br>Otter<br>Barbus Macedonis | 2 | HDD |
| 377 | C2065 | Vardarovasi | Pelagos trout<br>European eel | 2 | HDD |
| 400 | C2258 | Loudias River | European eel<br>Otter<br>Barbus Macedonis | 2 | HDD |
| 420 | C2403 | Canal 66 | Otter<br>European eel | 2 | HDD |
| 450 | C2500-1-1 | Grammatiko stream | Otter | 2 | Dry bed open cut / isolated open cut with Otter mitigation |
| 466 | C2541 | Kastro Stream | Otter | 2 | Dry bed open cut / isolated open cut with Otter mitigation |
| 475 | C2577 | | European Eel | 2 | Dry bed open cut / isolated open cut with eel mitigation |
| 486 | C2632 | | Otter | 2 | Dry bed open cut / isolated open cut with otter mitigation |
| 505 | C2700 | | *U.crassus* | 2 | Dry bed open cut / isolated open cut with invertebrate mitigation. |
| 510 | C2732 | | *U.crassus* | 2 | Dry bed open cut / isolated open cut with invertebrate mitigation. |

| KP | Crossing ID | Name | Species | CH Tier | Crossing method |
|---|---|---|---|---|---|
| 520 | C2772-1 | Gioli Canal | European Eel<br>Otter<br>*U.crassus* | 2 | Dry bed open cut / isolated open cut with eel, otter and invertebrate mitigation. |
| 528 | C2796 | Aliakmonas 1 | Pelagos trout<br>European Eel<br>Otter<br>Barbus Macedonis | 2 | HDD |
| 534 | C2825 | Aliakmonas 2 | Pelagos trout<br>European Eel<br>Otter<br>Barbus Macedonis | 2 | HDD |
| 539 | C2843 | Aliakmonas 3 | Pelagos trout<br>European Eel<br>Otter<br>Barbus Macedonis | 2 | Dry bed open cut / isolated open cut outside critical period for Pelagos trout and Barbus Macedonis with eel, otter and invertebrate mitigation. |

### 6.4.2 Albania Critical Habitat Watercourses

Table 11 below identifies watercourses identified as Critical Habitat DMUs for aquatic and semi-aquatic fauna in Albania. Detailed design construction methodologies and mitigation is provided for each crossing.

Contractor shall prepare a Site Specific ESMS Watercourse Crossing Method Statements for crossings listed in table 13.

TAP has identified the key sensitive periods for the fish species during which isolated open cut crossings will be avoided:

Osum Riffle Minnow – Spawning - Mid-April to Mid-May

Devoll Riffle Minnow – Spawning - Mid-April to Mid-May

P.Prespensis – Spawning - Mid-April to June -

Oxynoemacheilus pindus - Spawning – Apr – Jun

**Table 13 Albania Critical Habitat Watercourses**

| KP | Crossing ID | Name | Species | CH Tier | Crossing method |
|---|---|---|---|---|---|
| 0 | RV-1 | Llabanica Stream | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 1 | RV-7 | Ampraku Stream | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 2 | RV-8 | Kalivere (Kaline) Stream | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 9 | RV-27 | Devolli River | European Eel<br>Otter<br>Devoll riffle minnow | 1<br>2 | Trenchless |
| 13 | RV-47 | Stropani Stream | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |

| KP | Crossing ID | Name | Species | CH Tier | Crossing method |
|---|---|---|---|---|---|
| 52 | RV-240 | Dunaveci (Stermort Stream) | Pelasgus prespensis<br>Osum riffle minnow<br>European Eel | 1<br>2 | Dry bed open cut / isolated open cut outside critical period for Pelasgus prespensis and osum riffle minnow minnow, with Eel mitigation |
| 58 | RV-254 | Karavidhja Stream | European Eel | 2 | Dry bed open cut / isolated open cut with eel mitigation |
| 59 | RV-256 | Osumi River | Osum riffle minnow<br>European Eel<br>Otter | 1<br>2 | Dry bed open cut / isolated open cut outside critical period for Minnow, with Eel and Otter mitigation |
| 61 | RV-260 | Ndrenja Stream | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 68 | RV-267 | Rrungaja Stream | European Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 105 | RV-282 | Osumi (Qender) | Osum riffle minnow<br>Otter | 1<br>2 | Dry bed open cut / isolated open cut outside sensitive period for Osum Minnow with Otter mitigation |
| 109 | RV-287 | Seman Water Basin | Osum riffle minnow | 1 | Trenchless |
| 114 | RV-294 | Osumi River | Osum riffle minnow | 1 | Trenchless |
| 122 | RV-297 | Vokopala River | Otter | 2 | Dry bed open cut / isolated open cut with Otter mitigation |
| 134 | RV-298 | Osumi | Osum riffle minnow<br>European Eel<br>Otter | 1<br>2 | Trenchless |
| 135 | RV-301 | Vertopi | European Eel<br>Otter | 1<br>2 | Dry bed open cut / isolated open cut with Eel and Otter mitigation |
| 138 | RV-302 | Osumi (Vertop1) | Osum Riffle minnow<br>Otter | 1<br>2 | Trenchless |
| 139 | RV-304 | Vodica | Osum Riffle minnow<br>Otter | 1 | Trenchless |
| 143 | RV-400 | | Eel | 2 | Dry bed open cut / isolated open cut with Eel mitigation |
| 144 | RV-401 | Osumi | Osum Riffle minnow<br>European Eel<br>Otter | 1<br>2 | Trenchless |
| 146 | RV-405 | Osumi River (flood plain) | Osum Riffle minnow<br>European Eel | 1<br>2 | Watercourse not crossed directly. |
| 161 | RV-430 | Osumi (Otllak) | Osum Riffle minnow<br>Otter | 1<br>2 | Trenchless |
| 186 | RV-490 | Semani River (Roskovec) | Osum Riffle minnow<br>Oxynoemacheilus pindus<br>European Eel | 1<br>2 | Trenchless |
| 198 | RV-540 | Semani River (Mbrostar) | Osum Riffle minnow<br>Oxynoemacheilus pindus<br>European Eel | 1<br>2 | Trenchless |

## 6.5 Protected areas

The qualifying features of protected areas are underpinned by existing commitments and mitigations. However, level 3 site files will be developed for all protected areas.

### 6.5.1 Protected areas Greece

Table 14 below identifies the watercourses within protected and designated areas. There are a total of 134 watercourses within protected and designated areas within Greece. These include National Parks (NP), Natura 2000 (SPA/SAC) and Wildlife Refuge Areas (WRA). All protected areas are identified within the REIR.

The qualifying features of the protected areas will be considered during the screening process for candidate watercourses for site specific ESMS method statements as described in section 6.6, 6.7 and 6.8.

TAP and its contractors will also screen in watercourses that maybe connected to but not directly located within protected areas

### 6.5.2 Protected areas Albania

There are no watercourses within protected or designated areas within Albania

**Table 14 Watercourses within protected areas**

| Protected area | Designation | Area KP | RVX KP | RVX code | RVX type | Provisional crossing method | Area KP | Designation | Protected area |
|---|---|---|---|---|---|---|---|---|---|
| GR1110009<br><br>South Forest Complex Of Evros | SPA | 21-33 | 23 | C0068 | RV3 | Open Cut | | | |
| | | | 24 | C0068-N | RV4 | Open Cut | | | |
| | | | 26 | C0072-N | RV4 | Open Cut | | | |
| | | | 26 | C0072B | RV5 | Open Cut | | | |
| | | | 26 | C0073A | RV4 | Open Cut | | | |
| | | | 27 | C0074 | RV1 | Open Cut | | | |
| | | | 30 | C0074A-1 | RV4 | Open Cut | | | |
| | | | 31 | C0084A | RV4 | Open Cut | | | |
| | | | 31 | C0084B | RV4 | Open Cut | | | |
| GR1130006<br><br>Potamos Filiouris<br><br>Filiouris River | SAC | 77-78 | 77 | C0220 | RV4 | HDD | | | |
| | | | 77 | C0220A | RV5 | HDD | | | |
| | | | 78 | C0223 | RV1 | HDD | | | |
| Hatoisio | WRA | 98-100 | 99 | C0298_N | RV5 | Open Cut | | | |
| | | | 100 | C0302-N | RV1 | Open Cut | | | |
| The National Park of East Macedonia-Thrace | NP | 111-129 | 112 | C0343 | RV1 | HDD | 112-113 | SAC | GR1130009 Lakes And Lagoons Of Thrace - Broader Area And Coastal Zone |
| | | | 113 | C0350 | RV6 | Open Cut | | | |
| | | | 114 | C0355-N | RV5 | Open Cut | 114-115 | WRA | Periochi Kompsatou<br><br>kompsato's area |
| | | | 114 | C0358-N | RV5 | Open Cut | | | |
| | | | 114 | C0358-N-1 | RV5 | Open Cut | | | |
| | | | 115 | C0360-N | RV5 | Open Cut | | | |
| | | | 115 | C0362-N | RV5 | Open Cut | | | |
| | | | 115 | C0364-N1 | RV7 | Open Cut | | | |
| | | | 115 | C0366-N | RV5 | Open Cut | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 116 | C0368-N | RV5 | Open Cut | | | |
| | | | 116 | C0370-N | RV5 | Open Cut | | | |
| | | | 117 | C0372-N | RV5 | Open Cut | | | |
| | | | 117 | C0374-N | RV5 | Open Cut | | | |
| | | | 117 | C0376 | RV1 | Open Cut | | | |
| | | | 117 | C0378 | RV5 | Open Cut | | | |
| | | | 118 | C0379 | RV5 | Open Cut | | | |
| | | | 118 | C0381 | RV5 | Open Cut | | | |
| | | | 119 | C0383 | RV5 | Open Cut | 119-123 | SAC | GR1130009<br><br>Lakes And Lagoons Of Thrace - Broader Area And Coastal Zone |
| | | | 119 | C0384 | RV5 | Open Cut | | | |
| | | | 119 | C0385 | RV5 | Open Cut | | | |
| | | | 119 | C0387 | RV5 | Open Cut | | | |
| | | | 120 | C0391 | RV2 | Open Cut | | | |
| | | | 121 | C0394A | RV5 | Open Cut | | | |
| | | | 121 | C0396 | RV5 | Open Cut | | | |
| | | | 122 | C0396A | RV5 | Open Cut | | | |
| | | | 122 | C0397 | RV4 | Open Cut | | | |
| | | | 123 | C0399 | RV5 | Open Cut | | | |
| | | | 123 | C0401 | RV5 | Thrust Boring | | | |
| | | | 123 | C0401-N | RV7 | Open Cut | | | |
| | | | 124 | C0404 | RV5 | Open Cut | | | |
| | | | 125 | C0407 | RV3 | Open Cut | | | |
| | | | 125 | C0409-N | RV7 | Open Cut | | | |
| | | | 125 | C0411 | RV2 | Open Cut | | | |
| | | | 126 | C0414 | RV4 | Open Cut | | | |
| | | | 127 | C0418 | RV2 | Open Cut | | | |
| | | | 127 | C0421-N | RV5 | Open Cut | | | |
| | | | 127 | C0421-NA | RV4 | Open Cut | | | |
| | | | 127 | C0422-N | RV4 | Open Cut | | | |
| | | | 128 | C0424-N-1 | RV3 | Open Cut | | | |
| | | | 128 | C0430-N | RV4 | Open Cut | | | |
| | | | 129 | C0431A | RV5 | Thrust Boring | | | |
| | | | 129 | C0433-N | RV3 | Open Cut | | | |
| | | | 152 | C0518 | RV5 | Open Cut | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| GR1150010<br><br>Delta of Nestos and Lagoons of Keramoti - Broader Area and Coastal Zone | SAC | 152-158 | 152 | C0524 | RV5 | Thrust | | | |
| | | | 153 | C0527 | RV6 | HDD | 153-156 | WRA | Kotza Orman Nestou |
| | | | 153 | C0530 | RV1 | HDD | | | |
| | | | 153 | C0530A | RV3 | HDD | | | |
| | | | 154 | C0532 | RV5 | Open Cut | | | |
| | | | 154 | C0533 | RV5 | Open Cut | | | |
| | | | 154 | C0536 | RV5 | Open Cut | | | |
| | | | 154 | C0536A | RV5 | Open Cut | | | |
| | | | 154 | C0537 | RV6 | Open Cut | | | |
| | | | 154 | C0540 | RV5 | Open Cut | | | |
| | | | 154 | C0541 | RV5 | Open Cut | | | |
| | | | 155 | C0542 | RV5 | Open Cut | | | |
| | | | 155 | C0546 | RV5 | Open Cut | | | |
| | | | 156 | C0549 | RV5 | Open Cut | | | |
| | | | 156 | C0550 | RV5 | Open Cut | | | |
| GR1150001<br><br>Delta Of Nestos And Lagoons Of Keramoti And Thasopoula Island | SPA | 157-161 | 157 | C0556 | RV7 | Open Cut | | | |
| | | | 157 | C0558 | RV5 | Open Cut | | | |
| | | | 158 | C0561 | RV5 | Open Cut | | | |
| | | | 158 | C0562 | RV5 | Open Cut | | | |
| | | | 159 | C0569 | RV5 | Open Cut | | | |
| | | | 159 | C0570 | RV6 | Thrust Boring | | | |
| | | | 160 | C0575 | RV6 | Open Cut | | | |
| | | | 160 | C0577-N | RV5 | Open Cut | | | |
| | | | 160 | C0579-N | RV5 | Open Cut | | | |
| | | | 160 | C0581-N | RV5 | Open Cut | | | |
| | | | 161 | C0583-N | RV5 | Open Cut | | | |
| | | | 161 | C0586-N | RV5 | Open Cut | | | |
| Agios timotheos-kioupia | WRA | 187-191 | 187 | C0732 | RV4 | Open Cut | | | |
| | | | 190 | C0733-1 | RV4 | Open Cut | | | |
| | | | 191 | C0735 | RV4 | Open Cut | | | |
| Petroto-faraggi-almyra | WRA | 225-228 | 225 | C0872-1 | RV7 | Open Cut | | | |
| | | | 225 | C0873 | RV7 | Open Cut | | | |
| | | | 226 | C0875 | RV7 | Open Cut | | | |
| | | | 226 | C0877 | RV7 | Open Cut | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 226 | C0879-1 | RV5 | Open Cut |
| | | | 227 | C0886 | RV2 | HDD |
| | | | 227 | C0886A-N | RV4 | HDD |
| | | | 227 | C0887B | RV5 | Thrust Boring |
| | | | 227 | C0888-1 | RV5 | Thrust Boring |
| National Park Of Lakes Koronia - Volvi | NP | 312-322 | 312 | C1319 | RV4 | Open Cut |
| | | | 312 | C1320 | RV4 | Open Cut |
| | | | 312 | C1322 | RV4 | Open Cut |
| | | | 313 | C1324-1 | RV4 | Open Cut |
| | | | 313 | C1324A-2 | RV4 | Open Cut |
| | | | 314 | C1329 | RV4 | Thrust Boring |
| | | | 315 | C1332-3 | RV4 | Open Cut |
| | | | 315 | C1332-4 | RV4 | Open Cut |
| | | | 315 | C1332-5 | RV4 | Open Cut |
| | | | 315 | C1334 | RV4 | Open Cut |
| | | | 316 | C1335-1 | RV4 | Open Cut |
| | | | 316 | C1336A-1 | RV4 | Open Cut |
| | | | 317 | C1339-N-1 | RV4 | Open Cut |
| | | | 318 | C1340-1 | RV4 | Open Cut |
| | | | 319 | C1343A | RV4 | Open Cut |
| | | | 319 | C1344A | RV4 | Open Cut |
| | | | 320 | C1346-1 | RV4 | Open Cut |
| | | | 320 | C1346B | RV4 | Open Cut |
| | | | 320 | C1347-N | RV4 | Open Cut |
| | | | 321 | C1347A-1 | RV4 | Open Cut |
| | | | 321 | C1348 | RV4 | Open Cut |
| | | | 321 | C1348-1 | RV4 | Open Cut |
| | | | 322 | C1349-1 | RV4 | Open Cut |
| | | | 329 | C1361 | RV4 | Open Cut |
| | NP | 328-329 | 329 | C1363 | RV4 | Open Cut |
| | NP | 332-344 | 332 | C1366A | RV4 | Open Cut |
| | | | 332 | C1366A-1 | RV4 | Open Cut |
| | | | 335 | C1373-N | RV4 | Open Cut |
| | | | 339 | C1380 | RV4 | Open Cut |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | 341 | C1388 | RV4 | Open Cut |
| | | | 343 | C1392A | RV5 | Open Cut |
| | | | 344 | C1396-N-1 | RV4 | Open Cut |
| GR1220010<br><br>Delta Axiou Loudia Aliakmona Alyki Kitrous<br><br>Delta of Axios, Loudias, | 369-371 | SPA | 369 | C2021 | RV4 | Open Cut |
| | | | 369 | C2021-1 | RV4 | Open Cut |
| | | | 370 | C2024-1 | RV4 | Open Cut |
| Kouri – Ptolemaida | | | 471 | C2555 | RV4 | Open Cut |
| | | | 471 | C2560 | RV4 | Open Cut |
| | | | 475 | C2577 | RV4 | Open Cut |

## 6.6 Contractor Watercourse Ecological Survey and Assessment

Contractor shall complete ecological preconstruction surveys (PCS) and assessments for all watercourses identified during detailed design, including crossings included within ESIA and post ESIA Company surveys.

A suitably qualified ecologist shall conduct all PCS, with specialists present where species of conservation interest are deemed possible.

At a minimum, Contractor PCS shall include assessment of the following:

- Baseline literature review;
- REIR review;
- Riparian habitat;
- Watercourse bank and bed characteristics;
- Fauna;
- Flora;
- Connectivity with sensitive habitats;
- Erosion risk;
- ROW crossing method and requirements;
- Reinstatement considerations.

Contractor PCS data shall be compiled within an ESMS Watercourse Crossing schedule, standalone from the Construction Water Crossing Schedules described in section 3.

Each watercourse shall be risk assessed for ecological impact and sediment pollution. Construction methodologies and mitigation shall be prescribed for all watercourses with ecological or sediment pollution risk. This shall define watercourse sensitivity.

PCS results and risk ratings shall be reviewed with Company. A Site Specific ESMS Watercourse Crossing Method Statement shall be developed for company approval for all high sensitivity watercourses Ranked A. If any new sensitivities above the SEA are identified, TAP will work with the EPC contractor to ensure that methods and mitigations proposed within the ESMS method statements are in line with the principles of other identified important species within this plan.

### 6.6.1 Rank A (high aquatic ecological importance)

Rank A is for sites with a diverse array of habitat types. These include different flow types and substrates and the presence of functional habitat such as gravel substrate that may be used by lithophilic (gravel spawning) fish species; macrophyte stands that may be used as spawning, refuge or foraging habitat; and the presence of backwaters or shallow marginal bays that serve as refuge areas, particularly for juvenile fishes. The fish community would comprise populations that demonstrate recruitment over several generations, including young of the year (0+) individuals, and may include species of conservation interest. Water clarity may also be very good.

Watercourses contain, or have the possibility to contain protected species or other species with high conservation value. Includes all watercourses with Critical habitat trigger species and specific commitments.

### 6.6.2 Rank B (medium aquatic ecological importance)

Rank B is for sites with moderate habitat diversity and may include some features that would serve as functional habitat. Water clarity is likely to be poor but may allow for observations of the substrate in very shallow water. The observed fish community may include several species and some evidence of recruitment but key age classes may be absent. Species of conservation interest may be present at very low abundances. There may be evidence of some anthropogenic activities.

Typically, watercourses which have medium ecological value. Watercourse is fish bearing, or contains other sensitive fauna species within its water or on its banks.

### 6.6.3 Rank C (low aquatic ecological importance)

This includes site with homogenous flow and substrate types throughout the majority of the survey reach. Functional habitat would be sparse and there may be evidence of high levels of pollution including high turbidity from overland runoff or direct disturbance of the channel substrate and banks. There are likely to be obvious signs of human activity including physical modifications to the channel such as dredging and straightening of the channel or the presence of man-made structures including dams or bank-retaining walls. The fish community is likely to be poor with regards to abundance and species diversity, and there would be no species of conservation interest.

Typically, Watercourses which have little or no ecological value. No Fauna or sensitive flora has been identified within the watercourse or on its banks

## 6.7 Contractor ESMS Watercourse Crossing Method Statements

Stand alone from Construction Method Statements described in section 3, Contractor shall develop ESMS Watercourse Crossing Method Statements for all RV1 and RV2 crossings and any crossing deemed sensitive following Contractor PCS and ESMS watercourse crossing schedule review.

Contractor ESMS Watercourse crossing method statements shall include ROW access and / or running track installation.

In addition, the Contractor shall develop ESMS Watercourse Crossing Method Statements for all ESIA surveyed and Critical Habitat watercourses.

Contractor ESMS Watercourse Crossing Method Statements shall supplement Construction method statements and focus on site specific environmental controls and mitigations deemed necessary to mitigate impact to baseline conditions and shall include at a minimum:

- Baseline literature review;
- ESIA commitments and mitigations;
- Post ESIA recommended mitigations;
- Preconstruction photographs;

- Flow;
- Construction period predicted flows;
- Bed characteristics;
- Identified Fauna and Flora during PCS;
- Water quality monitoring requirements;
- ROW crossing method and design;
- Pipe lay method and design;
- Step by Step Mitigations specific to method and individual crossing;
- Reinstatement considerations.

Where watercourses are to be trenchless crossings, ESMS Watercourse Method Statements shall include site specific layout drawings that include all settlement ponds and water treatment facilities and discharges, site specific emergency response procedures, drilling mud specification and surplus material disposal.

An example blank ESMS Watercourse Method Statement is provided in Appendix 1.

An example completed ESMS Watercourse Method Statement is provided in Appendix 2.

ESMS Watercourse Method Statements shall be provided to Company for review and approval prior to any construction activities, including ROW access and / or running track installation via the project document control system.

EPC Contractor ESMS watercourse crossing plans shall include details of all works at those watercourses, including ROW access tracks.

All ROW crossing designs and pipe lay construction methods shall be included within the contractor ESMS method statement and approved by company to ensure that ecological commitments and sensitivities are adequately managed and to prevent adverse impact on the ecological sensitivities.

## 6.8 ROW crossing Methodology

ROW crossings will be avoided where possible, for example at trenchless crossings or where suitable exiting crossings are available in the immediate vicinity.

Ecological sensitivities identified in the REIR and EPC contractor assessments shall be considered during ROW crossing design and installation.

Crossings will be designed so as to ensure:

- The free passage of aquatic, semi aquatic and terrestrial fauna at all times
- The free flow of water
- Vegetation removal is minimised and limited to that required for the crossing.

The preference is for no ROW crossing such as at the sensitive watercourses that will be crossed via trenchless methods.

Single span bridges will be considered at sensitive watercourses where the topography allows safe installation and vehicle passage. Bridges will be avoided where the

topography requires significant manipulation of levels with bank removal in order to make the crossing safe. This will retain avoid bank instability and retain riparian seed banks.

Flume crossings shall be installed with clean stone and geotextile. Flume pipes will be of sufficient size to maintain level of flow and allow for high flow conditions throughout the lifetime of the crossing installation. Flume pipes shall be checked periodically to ensure they are kept free of debris that may restrict the flow of water.

**Table 15 ROW Crossing hierarchy**

| Sensitivity | ROW Crossing Design |
|---|---|
| Highest | No ROW crossing |
| | Single Span Bridge |
| Lowest | Flume Crossing |

ROW access crossings shall be predetermined based on the above hierarchy and included within the ESMS watercourse crossing schedule and where required within the ESMS watercourse crossing method statements.

ROW crossings shall be the minimum size necessary to allow safe access and shall be microsited to avoid mature trees where possible.

ROW crossings shall be left in situ until completion of works and shall be designed with consideration of all seasonal river flows expected. However, ROW access crossings shall be installed for the minimum time necessary for the safe completion of works.

Erosion and sediment control shall be installed at all watercourses where silt water runoff risk exists.

Vehicles and machinery shall not drive directly through watercourses.

All ROW crossings shall be removed following completion of works in accordance with the Reinstatement Erosion Control and management plan.

Seasonal restrictions detailed in 6.4.1 and 6.4.2 shall be adhered to during ROW crossing installation and removal.

## 6.9 Pipe lay Methodology

Company shall approve Pipe lay methods for all watercourses.

General pipe lay methodology shall be defined during detailed design and included within Contractors watercourse crossing schedule. Where Open Cut is the preferred methodology, detailed open cut methodology shall be defined at least 30 days before construction, to allow for assessment of flows and site conditions at the time of crossing.

Generally all open cut crossings shall be performed during dry bed conditions or with isolation.

Contractor shall prepare standard method statements for all pipe lay methods, with site specific method statements for watercourses triggered by above mentioned criteria in Table 2.

Table 13 identifies the key attributes and mitigations for each type of Pipe laying methodology.

Typically, in stream pipe lay activities at open cut crossings will be completed within 2-3 days, where this is not possible and for larger crossings, works shall be provided with measures implemented to ensure continual flow of water. At the end of each day, crossings shall be civilised to ensure free flow of water. Duration of in stream pip lay activities shall be agreed with Company.

Weather forecasts shall be reviewed prior to open cut crossings, crossing shall not be attempted if an increase in flow is expected unless crossing methodology has been changed and approved by Company so that any additional flow is adequately considered.

The pipe lay methods and associated requirements are summarised in Table 13 below.

### 6.9.1 Dry bed open cut / Isolated open cut

Dry bed open cut refers to conditions where the river is naturally dry.

In isolated open cut methods water flow is maintained by damming and over pumping or using temporary “flume” pipes installed in the bed of the watercourse.

For isolated open cut methods the site is first prepared by stripping the topsoil from the banks and areas adjacent to the river/stream crossing and storing it separately within the working area. When using the temporary “flume” pipes in the bed of the watercourse method, a suitably sized flume pipe is installed over the point of the proposed crossing, ensuring that it extends on each side of the watercourse to a distance at least equivalent to the depth of the proposed excavation. The flume pipe is then bedded and packed or surrounded with soil filled sandbags to create a seal or dam across the watercourse. A flume pipe bridge will have been installed, during the preparation of the working width, adjacent to the trench line flume in order to enable passage of plant and materials along the pipeline route.

Excavation of the riverbed then proceeds beneath the trench line flume pipe. The excavated riverbed material is stored within the working area separately from the bank material. De-watering and/or trench supports may be used to facilitate safe excavation.

If damming and over pumping methodology is adopted then soil filled sandbags are still used to create a seal or dam across the watercourse. However, flume pumps are not installed in the riverbed but adjacent to the river instead. The discharge hose will be directed through a filtering medium, if necessary to limit silt carry over, before the pumped water is allowed to percolate back into the watercourse.

Within both methodologies the prefabricated pipeline section is then installed in the trench and checked to ensure that a minimum cover as stated in section 3 exists below the clean hard bed of the watercourse and the top of the pipe. Initial backfilling will take place using excavated subsoil free of large stones or other deleterious material. Final reinstatement

will use the stored riverbed materials. The riverbanks are then reformed to their original profile to the satisfaction of both the TAP and the landowner.

The flume pipe and packing or bags are removed once the bed materials and bank profile is reinstated. Final bank reinstatement may require further measures to stabilise the banks and prevent erosion. Geotextiles such as geojute may be used in conjunction with seeding of an appropriate grass mix. Heavier solutions such as the importation of locally sourced large stones or rocks may also be used. Bank stabilisation works will be discussed with the Environment Agency to ensure that suitable materials are being used.

### 6.9.2 HDD – Trenchless

HDD is a trenchless crossing method which begins with boring a small diameter, horizontal hole (pilot hole) under the river with a continuous string of steel drill rod (refer to Section 4.4.5 Project Description for further details). When the bore head and rod emerge on the opposite side of the crossing, a special cutter, called a back reamer, is attached and pulled back through the pilot hole. The reamer bores out the pilot hole so that the pipe can be pulled through.

The pipe is usually pulled through from the side of the crossing opposite the drill rig. Usually a drilling mud, such as fluid bentonite clay (an inert, non-toxic substance), is forced down the hole to stabilize the hole and remove soil cuttings. Bentonite reduces drilling torque, gives lubrication to the pipe, provides annular flushing of the freshly cut borehole soil debris, and affords stability and support for the bored hole. There have been very rare instances during HDD construction when bentonite clay has leaked from the horizontal bores and filtered into the watercourse. Although bentonite is inert and nontoxic, the accidental release of a significant quantity could impair water quality and thus have an effect on freshwater ecology. In such unlikely cases the standard construction procedure would be to stop the HDD operations, recover as much bentonite as possible from the bore and leave the filtered bentonite to naturally stabilize. In order to continue, the bore hole would be deviated to a new location, close by but with no unstable terrain, so as to ensure that the water course remains unaffected. In addition, and as a standard prevention measure during the operations, the HDD process is monitored continuously (i.e. GPS device installed on the head of the cutter head) to ensure an early identification of any potential filtrations of bentonite and therefore diminish the likelihood of any significant release. Based on the non-toxic nature of the bentonite and the unlikely event of an accidental release occurring then the significance of the impact is considered to be not significant.

Minimum distance for entry and receive pits are outside the active zone as stated in section 3, or dependent on site-specific ecological constraints.

### 6.9.3 Thrust bore – Trenchless

Auger bore, pipe-ram and pipe jack are collectively referred to as ‘thrust bore’. They all require the excavation of pits on either side of the crossing to aid the installation of the pipeline. The depth of the pits depends on the nature of the crossing and the local ground conditions. De-watering, sheet piling and other techniques are generally used to enable excavations and construction techniques to be carried out in accordance with Health and Safety requirements. A 'thrust' or 'sending' pit is excavated on one side of the crossing to a length slightly greater than that of the crossing. A smaller receiving or ‘reception’ pit is excavated on the opposite side of the crossing large enough for the pipeline crossing to be 'tied in' (i.e. welded onto) the rest of the pipeline. Additional land is required on both sides of the crossing to accommodate the additional excavated material from the pits and the pipe, and the construction plant associated with the crossing. Significance of the impact is considered to be not significant.

Minimum distance for entry and receive pits are outside the active zone as stated in section 3, or dependent on-site specific ecological constraints and agreed with Company in approved drawings.

Typically a thrust bores provides stable and virtually maintenance-free crossing methods with minimal to no disturbance of the stream or river bed. Geotechnical investigations are needed to confirm if a thrust bore method is possible be applied as river crossing method. Send and receive pits will be situated outside of sensitive riparian habitats. Sheet piles are required to form the send and receive pits. Sheet pile will be installed using vibro piling techniques or outside of the critical period of important fish species, if this is unachievable TAPs aquatic specialists shall be consulted to assess the potential impacts. Seasonal restrictions for terrestrial and avifauna shall apply to thrust bore operations. All cuttings and pit water will be managed in a way to avoid impact to the watercourses. As a result, under normal thrust bore execution the magnitude of impacts is considered negligible and therefore no significant impacts are anticipated to result.

**Table 16 Pipe lay methods**

| Pipe lay Method | | | Final Decision | | Environmental Requirements | |
|---|---|---|---|---|---|---|
| Open-cut | Naturally Dry Bed | Trench excavated and back-filled without isolation of flow. | FEED / Detailed design | Up to 30 days Prior to works | Preconstruction ecological surveys. Fauna translocation & exclusion, Microsite around sensitive flora as required.<br><br>Minimise working width at crossing point to reduce impact on riparian habitat.<br><br>Watercourse crossing environmental risk assessment to assign generic or site specific method statement.<br><br>Bed and bank material removed and stored separately for reinstatement.<br><br>3-day weather forecast look ahead prior to works to identify any potential increase in flow. Crossing not attempted if high flows expected.<br><br>Turbid trench water pumped to over land settlement area, if required.<br><br>Water quality monitoring in | Dry watercourses only<br><br>Typically 2-3 days in stream for all activities. |
| | Isolated - Flumed | Dams isolate the in-stream work area and bypass flumes maintain downstream flow. | | Up to 30 days Prior to works | | See section 6.9.1<br><br>Flume pipes adequately sized to carry expected flow for duration of works.<br><br>Typically 2-3 days in stream for all activities. |
| | Isolated - Dam and pump | Dams isolate the in-stream work area and bypass pumps maintain downstream stream flu | | Up to 30 days Prior to works. | | See section 6.9.1<br><br>Pumps adequately sized to carry expected flow for duration of works.<br><br>100% standby pump capacity.<br><br>Fauna screens on pump heads.<br><br>Typically 2-3 days in stream for |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | accordance with regime stipulated in any applicable site-specific watercourse crossing method statement.<br><br>Sheet piles used where ground conditions are unstable. Species sensitivities shall be assessed prior to any sheet piling.<br><br>Monitoring as per 6.14 | pipe laid activities. |
| | Isolated - Diversion | Temporary diversion berms or channels installed to maintain downstream flow but divert away from work area. | | Up to 30 days Prior to works. | | Low flow only<br>Berm or channel placement and construction methods to be agreed with company prior to works.<br><br>Typically 2-3 days in stream for all activities. |
| Trenchless | Thrust bore | A trenchless crossing method | FEED / Detailed design Up to 30 days methodology change request | | Preconstruction ecological surveys and fauna translocation / exclusion as required.<br><br>Sheet piles used where appropriate to minimise trench excavation. Species sensitivities shall be assessed prior to any sheet piling.<br><br>Citing of send and receive pits always from sensitive flora & Fauna.<br><br>Design of settlement ponds and dewatering discharges to avoid impact to surface waters or other sensitive habitats and species. .<br><br>Additional land to be agreed with Company as per Additional Land take procedure. | See section 6.9.3 |
| | HDD | A trenchless crossing method | | | | See section 6.9.2<br><br>Site specific bentonite disposal plan approved prior to works.<br><br>Bentonite breakout procedure approved prior to works., to include:<br>• Drilling mud and frackout monitroing<br>• Response<br>• Reporting |

| | | | | | |
|---|---|---|---|---|---|
| | | | | Noise assessments and mitigation to ensure no noise impact on sensitive receptors. Noise assessments shall be completed by Contractor and verified by Company.<br><br>In the event of night time working during critical stages of HHD operations, site lighting shall be inverted away from sensitive receptors such as fish, mammals and avifauna which use the watercourse and riparian corridors,<br><br>Monitoring as per 6.14 | |

## 6.10 Fauna-related Requirements

Fauna presence shall have been identified during Company surveys, Contractor PCS and during final preconstruction walkovers.

The REIR shall be reviewed in advance of any crossing selection process or activity.

Where appropriate, fauna related seasonal restrictions should be considered and adhered to during works scheduling.

Watercourses requiring fauna translocation shall be identified within the ESMS watercourse-crossing schedule.

Fauna shall be translocated and excluded from the work area prior to any works.

Trained personnel under the supervision of appropriately qualified ecologists shall conduct fauna translocation and exclusion.

All fauna salvages and translocations shall be recorded.

All Fauna translocation and exclusion shall be in accordance with Company approved methods.

All species critical periods and locations are identified within the REIR. These are reviewed weekly and incorporated into construction work schedules.

### 6.10.1 Aquatic Vertebrates

All watercourses shall be surveyed for aquatic vertebrates. Contractor shall include site translocation and exclusion requirements within site specific ESMS watercourse crossing plans for all watercourse that contain aquatic vertebrates.

Contractor shall develop a site specific ESMS watercourse crossing method for all critical Habitat watercourses, where detailed species-specific mitigations will be identified.

Species critical periods shall be avoided, unless alternative mitigation is agreed with Company and its ecological consultant.

All critical habitat watercourses shall be included within the REIR.

Where works cannot be schedule outside of the European Eel migration period for a particularly watercourse, Ensure Eel surveys shall completed to ensure works do not coincide with the Eel migration run. If surveys deem inconclusive, free passage of water shall be maintain at all times, using either flume or diversion methods.

### 6.10.2 Fish Translocation

Prior to construction site dewatering fish will be captured and relocated to avoid direct mortality.
Fish relocation activities will only be performed by project ecologists who have experience with fish capture and handling and trained personnel under the supervision of the Ecologist. The ecologist will remain onsite during the entire process of dewatering.

If the site is exposed to warm air temperatures at the time of fish relocation then all capture activities will occur during morning periods.

Methods to be used for capturing fish will include seining and dip netting, depending on the size of the watercourse. Electrofishing is not permissible for fish rescue because the site could contain species of fish that may be harmed by that method. Considering the small areas required for fish rescue, limited to the trench dig zone, seining and dip netting should be effective.

The ecologist and translocation team will begin to capture fish before dewatering begins, if the site conditions allow. If the site is too deep to seine, the ecologist will begin capturing fish with a dip-net as the water level is reduced. If pumping is required to reduce water depths for the removal of fish, the ecologist will ensure a fish guard is placed on the pump rose so that fish are not entrained into the pump.

The ecologist will minimize handling of fish, and when handling is necessary the ecologist and translocation team will always wet hands or nets prior to touching fish. Captured fish will be held in a container with a lid that contains cool, shaded Water.

Fish will not be subjected to jostling or excess noise, will not be overcrowded in the containers, and water temperature will be monitored.

Two holding containers will be available to segregate young-of-the-year fish from larger fish to avoid predation.

Fish are not expected to be abundant, but if they are the ecologist will periodically cease capture and relocate fish to the pre-selected release location.

Fish will not be removed from the container until the time of release.

An appropriate release location will be selected in advance for different captured species, and the ecologist will release fish only in those pre-determined locations.

These release locations will be selected on the basis of having ample habitat similar to that of the capture location.

Fish will be unable to enter the work area because of the temporary cofferdams.

Adult and larger fish will be placed upstream of the construction site; juvenile fish will be released downstream of the construction site. For all captured individuals the ecologist will identify species, estimate size, age and record estimated numbers at the time of release.

The fish will not be anesthetized or measured. A report summarizing the fish relocation activities will be submitted to Company soon after the relocation effort.

### 6.10.3 Eurasian Otter

ESIA and post ESIA Company surveys have identified suitable otter habitat. These shall be identified within the REIR.

During PCS, Otter surveys shall be completed within ROW limits 50m either side for all watercourses.

Surveys shall be recorded for all watercourses that have been identified as suitable habitat during Company surveys.

Where Holts are confirmed or suspected within 30m of ROW, passive infrared motion sensor (PIR) camera traps shall be deployed to verify otter activity for a period of at least 1 month prior to construction.

Where a Holt is deemed active, a site specific otter mitigation plan including artificial holt creation shall be developed and agreed with Company.

The following general mitigation measures will be applied to all Otter DMUs:

- Further checks for otter holts and resting sites will be completed immediately before works begin.
- Work to be supervised by EPC Ecological advisors and monitored by TAP.
- Removal of riparian vegetation will be minimised and a vegetated strip left at the crossing point for as long as possible i.e. restrict initial clearance to running track for equipment access.
- Long-term (> 3 days) impediment of water flow or construction of long-term barriers (> 3 days) along the river banks will be prohibited.
- Means of escape will be provided in the pipeline trench if left open overnight and/or the excavation profiled/sloped to allow otters and other animals to escape if they become trapped

### 6.10.4 Reptiles and Amphibians

Reptile and amphibian mitigation and translocation is described within the EMP. CH and PBFs are identified within the REIR.

### 6.10.5 Riparian Non-aquatic Fauna

Riparian corridors identified as important for non-aquatic fauna shall be identified within the REIR; these include but are not limited to:

- Brown Bears;
- Grey Wolf;
- Golden Jackal;
- Birds.

Site specific mitigation shall be developed and identified within the REIR for all riparian corridors and watercourses that are important breeding or commuting corridors for non-aquatic fauna. Details are not included within the scope of this Plan.

Species-specific mitigations including seasonal restrictions and working width reductions are included within the REIR and the following ecological reports.

AAL00-C5577-641-Y-TRS-0005 Albania Large Carnivore Surveys
AAL00-C5577-641-Y-TRS-0004 Albania Migrating And Breeding Bird Surveys
GAL00-RSK-642-Y-TRS-0002 Large carnivore Greece
GAL00-RSK-642-Y-TRS-0005 Jackal report Greece
GAL00-RSK-601-Y-TRS-0002 Ornithological Survey Report Greece

## 6.11 Flora-related Requirements

Sensitive Flora presence, including aquatic flora, shall been identified during Company surveys and Contractor PCS.

High sensitivity flora shall be included within the REIR to ensure appropriate mitigation measures have been designed into work plans and procedures.

Where micro siting cannot avoid sensitive flora, reduced working widths will be enforced to reduce impact, while translocation of terrestrial and aquatic flora shall be completed if deemed appropriate for the species. Working widths shall be a minimum of 28m at watercourses, reducing to 18m at Greek and EU priority habitat where possible.

Specific locations of EU priority habitat shall be included within the Environmental REIR

Where technically feasible, reduced working widths shall be applied at all watercourse crossings. Additional width reductions shall be applied to EU priority habitat, as per the REIR.

Contractor shall submit a technical justification to Company for approval where reduced working width is not possible.

The location of invasive species shall be highlighted within the Environmental REIR. Contractor shall develop site specific invasive species management plans at these locations.

## 6.12 Water Quality Monitoring

Before, during and after Water Quality Monitoring (WQM) shall be conducted at sensitive watercourses.

Water quality monitoring requirements shall be agreed with Company and identified within ESMS Site Specific Watercourse crossing method statements.

The following parameters shall be monitored for open cut crossings

- TSS;
- Conductivity;
- pH;
- Temperature.
- Oil in water

Additional parameters may be added on a case by case basis to be determined by TAP. .

WQM requirements shall be included within the ESMS Watercourse Crossing Method Statements, to be agreed with company.

Water quality monitoring shall be conducted with site monitors, calibrated and maintained in accordance with manufactures recommendations.

Water quality standards are defined with Project standards

AAL00-ENT-601-Y-TSP-0001 ESMS Project Standards Albania
GAL00-RSK-601-Y-TSP-0002 ENVIRONMENTAL PROJECT STANDARDS GREECE

Both Contractor and Company environmental staff have the authority to stop works in the event of any pollution incident.

The following tables identify water quality and reinstatement during crossing works.

Hydro test discharges into different watersheds shall be avoided where possible. In the event that a cross-watershed discharge is required, a full suite of chemical and biological analysis of both source and receiving watercourses shall contribute to a biosecurity risk assessment. Company shall be provided analytical results risk assessment prior to discharge.

**Table 17 Water Quality monitoring**

| **Parameter/Aspect** | **Responsibility** | **Location** | **Frequency/Timing** | **Threshold level*** (if applicable) |
|---|---|---|---|---|
| TSS | CONTRACTOR & TAP | 50m upstream of ROW crossing<br>50 m downstream of ROW crossing | Before watercourse crossing works initiation<br>During watercourse crossing works initiation:<br>Post watercourse crossing works | Table 6.5 project standards |
| pH | | | | Table 6.5 project standards |
| Temperature | | | | S Table 6.5 project standards |
| Oil in water | | | | |
| Other site-specific parameters as specified in the Watercourse Crossing Method Statement | | | | Table 6.5 project standards |

*Where applicable, unless not specified otherwise in available permits, whichever of EU, IFC EHS Guidelines and national threshold levels is most stringent, applies.

Table 18 Watercourse characteristics

| **Parameter/Aspect** | **Responsibility** | **Location** | **Frequency/Timing** | **Threshold level*** (if applicable) |
|---|---|---|---|---|
| Channel habitat distribution and coverage of river/channel (photo- | CONTRACTOR & TAP | At selected watercourse crossings | Prior to construction<br>Following restoration/reinsta | Reinstate to preconstruction QBR or better |

| Parameter/Aspect | Responsibility | Location | Frequency/Timing | Threshold level* (if applicable) |
|---|---|---|---|---|
| documented) | | | tement works | |
| Flow | CONTRACTOR | At selected watercourse crossings | Prior to construction | N/A |

*Where applicable, unless not specified in available permits, whichever of EU, IFC EHS Guidelines and national threshold levels is most stringent, applies.

All watercourses will be monitored for signs of fauna distress and mortality.

TAPs will request immediate remedial actions and stop work if necessary if project standards are exceeded or signs of fauna distress are identified.

### 6.13 Sediment Control

All watercourses shall be risk assessed for sediment pollution from approaching slopes. Appropriate mitigation measures shall be installed in accordance with the Erosion Control and Reinstatement Management Plan.

Erosion and sediment control acceptance criteria is provided within the Erosion and reinstatement management plan.

Sediment pollution risk shall be identified within the ESMS Watercourse Crossing Method Statements.

TAP and the EPC contractor shall ensure that temporary erosion and sediment control is inspected regularly and during routine daily inspections at all active work fronts.

Temporary erosion and sediment control will be monitored during routine ROW inspections and targeted inspections during and after rain events.

Temporary erosion and sediment control will maintained or improved immediately after identification of corrective actions.

Long term erosion control monitoring and maintenance is discussed in section 7.

# 7 MONITORING AND MAINTENACNE

Minor maintenance to be executed in line with ROW maintenance guidelines. Major maintenance to be executed as defined by expert assessments and site-specific design.

Monitoring and maintenance forms an essential component of pipeline integrity management.
Monitoring and Maintenance Procedures for Watercourse crossings should be developed as applicable to TAP watercourse crossings.

The monitoring and maintenance requirements will need to take consideration of various factors including, but not limited to:

- River type
- Crossing technique
- As-built burial depth
- As-built set back
- Pipeline protection measures (existing and proposed)
- Third party activities (e.g. gravel winning, new infrastructure etc.)
- Environmental change (e.g. water transfer schemes, de-forestation, climate
- change etc.)

It is acknowledged that pipeline protection works will require maintenance during the operational life of the pipeline. Protection works shall be sufficiently robust and sympathetic to the natural river processes such that major maintenance is not required any more frequently than every 10years or after the 200yr design event. Major maintenance is considered to address elements of the works which could potentially risk the integrity of the pipeline and would therefore require upgrade or enhancement of the installed works.

Minor maintenance, as required to address repair and replacement of distressed works should not be required any more frequently than every 5years or after a 10year event. Minor maintenance includes activities such as addressing erosion at the edges of bed sills or revetments, repairs to distressed rip rap revetments or bed protection, repairs to distressed individual gabion boxes.

During design and construction (and prior to operations) monitoring and maintenance guidelines will be adopted as part of the design and as-built verification. The guidelines will include both generic and site specific requirements.

Contractor shall inspect and maintain works for the full duration of the Warranty period.

Unless stated otherwise within the Contract the Warranty period shall be Two (2) years after completing reinstatement at a specific site. Contractor shall monitor all sites at least monthly during the Warranty period and after heavy rain events. Any damages to installed works shall be notified to Company and repaired by Contractor in a timely manner.

At the end of the Warranty period Contractor and Company shall perform a joint walkthrough to inspect the installed works. Unless stated otherwise within the Contract, a final acceptance certificate will be provided if the site is stable and no corrective actions/

maintenance are required at the end of the Warranty period.

Erosion and sediment control acceptance criteria is provided within the Erosion and reinstatement management plan.

## 7.1 Monitoring philosophy

- **Set Back Monitoring Philosophy**

Regular ROW patrols plus Expert assessment of set backs annually and after floods exceeding 1:10yr return period

- **Burial Depth Monitoring Philosophy**

Regular ROW patrols plus Expert assessment of burial depths annually and after floods exceeding 1:10yr return period

- **Pipeline Protection Works Monitoring Philosophy**

Regular ROW patrols plus Expert assessment of protection works annually and after floods exceeding 1:10yr return period

## 7.2 Biodiversity monitoring

TAPs post construction monitoring program is described in the EMP. The individual site files for all CH and PBF watercourses will include detailed post construction monitoring programs.

TAPs Biodiversity Offset Strategy demonstrates how any unavoidable significant residual impacts to biodiversity values including critical habitat, priority biodiversity features and natural habitat from the project will be compensated though the establishment of biodiversity offsets in a manner that achieves an overall net gain in biodiversity.

A Biodiversity Offset Management Plan (BOMP) will provide more details on the offset design, intended conservation outcomes, specific management actions and details on the legal mechanisms of establishing the prospective site(s), as well as any indirect initiatives to be supported.

Predicted significant residual impacts will be verified in the Site Files for each CH, PBF and NH.

New residual impacts may be identified following assessments in the Site File of all Level 3 sites.

Individual Biodiversity Action Plans (BAPs) will be developed for each Offset or enhancement. They will provide a detailed roadmap for the long-term implementation,

management and monitoring of each of the Offsets where significant residual impacts exist or enhancement programs proposed. Development of the BAPs will involve national and local-level stakeholder engagement and the cultivation of long-term partnerships with appropriately experienced in-country organisations that would implement specific BAP activities.

## APPENDIX 1 – BLANK ESMS WATERCOURSE CROSSING METHOD STATEMENT

**DRAFT: INDICATIVE FOR EXAMPLE ONLY**

| **ESMS Site Specific Watercourse Crossing Method Statement** | |
|---|---|

| Colour key: | Complete 30 days prior to any works at crossing | Complete during crossing |
|---|---|---|

| **Crossing information** | | | |
|---|---|---|---|
| Pipeline section | | Route subsection | |
| KP chainage (km) | | Related IP and distance | |
| Crossing type | | Common name | |
| **Satellite image** | | **HMGS 1:50000** | |
| | | | |
| **Preconstruction Upstream** | | **Preconstruction Downstream** | |
| | | | |

**Preconstruction Baseline**

**Crossing point**

**Site assessment**

| Assessment date | | Weather | | Assessed by | |
|---|---|---|---|---|---|
| | | Previous 3 day rainfall | | | |

**Physical description**

| River | Stream | Ditch | Irrigation channel / canal | Concrete Channel | Ravine |
|---|---|---|---|---|---|
| | | | | | |

| Crossing width | | Water depth | | Flow rate | | | | |
|---|---|---|---|---|---|---|---|---|
| Bed material | | Bank material | | Bank height | + | | - | |
| Vegetation (cover/ species) | | | | Trees (Number / size/ species) | | | | |
| Adjacent Slopes | + | | - | Runoff risk | | | | |
| Watercourse Description: | | | | | | | | |
| Adjacent area description: | | | | | | | | |

| Manmade structures: | Bridge | Sluice gate | Discharge | Abstraction | Dumping | Quarry | Livery |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Distance from crossing | | | | | | | |

**Profile Sketch**

*Expand to fit*

**Ecological observations (50m survey upstream and downstream)**

| Assessment date | | Assessed by | |
|---|---|---|---|
| | | | |

| | Yes | No | Species / comments |
|---|---|---|---|
| Fish | | | |
| Amphibians | | | |
| Reptiles | | | |
| Otter | | | |
| Birds | | | |
| Sensitive bed | | | |
| Trees / Flora | | | |
| EU priority habitat | | | |
| Invasive flora | | | |
| Other | | | |
| **Preconstruction baseline literature review** | | | |
| Review date | | Reviewed by | |
| Special mention | Yes | No | Reference |
| Species / constraint | | | |
| Critical Habitat | Yes | No | Details: |
| Specific commitment | Yes | No | Commitments: |
| | | | |
| Reference mitigation | Yes | No | Source: |
| **KP register review: Additional constraints or conflicts?** | Yes | No | Details: |
| **Baseline review summary:** | | | |
| *Expand to fit* | | | |
| Ecological risk | | | |

**ROW preparation**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **ESMS Objective** | | | | | | | | | | |
| Schedule | | Schedule compliant with restrictions? | | | No | | N/A | | | |
| ROW crossing method | No crossing | Existing Access | Bridge | Flume | Flume details (if applicable) | Size | | | | |
| | | | | | | No. | | | | |
| | | | | | | Fill | | | | |

| **Mitigation in Sequence:** | **Confirm and sign (ESMS)** |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**ROW sketch**

| **Water Quality Monitoring** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sample time** | Sample 1 | - 24hrs | Sample 2 | - 1hr | Sample 3 | During | Sample 4 | + 1hr |
| Conductivity | | | | | | | | |
| pH | | | | | | | | |
| Temp | | | | | | | | |
| TSS | | | | | | | | |
| Sampled by: | | | | | | | | |
| Ad-hoc sampling details and results: | | | | | | | | |

| **Pipe lay** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **ESMS Objective** | | | | | | | | | | | |
| **Schedule** | | **Schedule compliant with restrictions?** | | | | | | No | | N/A | |
| **Pipe lay method** | HDD | Auger | Dam & Pump | Flume | Low flow OC | Diversion | **Flume pipe details (if applicable)** | | | Size | |
| | | | | | | | | | | No. | |
| **Mitigation in Sequence:** | | | | | | | **Confirm and sign (ESMS)** | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Pipe lay sketch | | | | | | | | | | | |

| **Reinstatement and Erosion control** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Reinstatement considerations: | | | | | | | | | | | |
| | | | | | | | | | | | |
| Planting required? | Yes | | No | | If yes, planting plan in place? | Yes | | No | | Plan Ref: | |
| Erosion considerations: | | | | | | | | | | | |
| | | | | | | | | | | | |
| Erosion Risk | Yes | | No | | If yes, Erosion control designed? | Yes | | No | | Plan Ref: | |
| Erosion control method | | | | | | | | | | | |
| N/A | Jute | | Hydroseed | | Riprap | Gabian | | Temporary | | Other (explain) | |
| | | | | | | | | | | | |

| **Engineering documentation** | | | | |
|---|---|---|---|---|
| Do any detailed designs exist for this crossing? | Yes | | No | |
| List documents: | | | | |

| **Approval** | | | | | | |
|---|---|---|---|---|---|---|
| CTR Environmental Manager | Name | | Signed | | Date | |
| CTR Construction Manager | Name | | Signed | | Date | |
| TAP ESMS | Name | | Signed | | Date | |

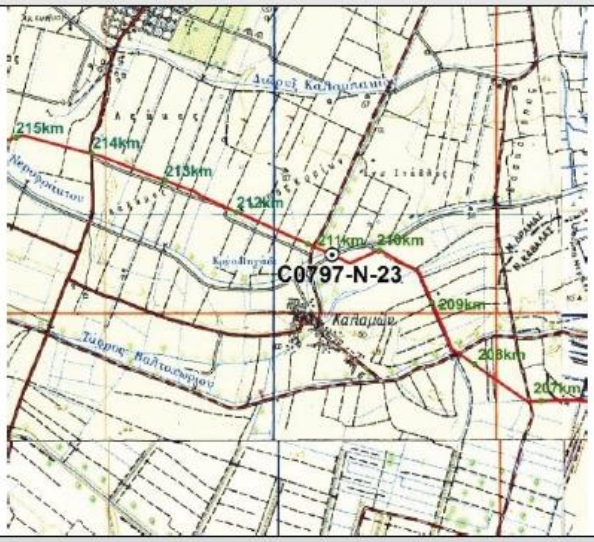
## APPENDIX 2 – EXAMPLE ESMS WATERCOURSE CROSSING METHOD STATEMENT

**DRAFT: INDICATIVE FOR EXAMPLE ONLY**

| **ESMS Site Specific Watercourse Crossing Method Statement** | **C0797-N-23** |
|---|---|

| Colour key: | Complete 30 days prior to any works at crossing | Complete during crossing |
|---|---|---|

| **Crossing information** | | | |
|---|---|---|---|
| Pipeline section | GSE20 | Route subsection | GPL-1000 |
| KP chainage (km) | 210.66 | Related IP and distance | IP0450 -19+51.57 |
| Crossing type | RV7 | Common name | Philippoi 9 |
| **Satellite image** | | **HMGS 1:50000** | |


| **Preconstruction Upstream** | **Preconstruction Downstream** |
|---|---|

**Preconstruction Baseline**

**Crossing point**

**Site assessment**

| | | | | | |
|---|---|---|---|---|---|
| Assessment date | 01/09/2016 | Weather | Fine | Assessed by | A N Other |
| | | Previous 3 day rainfall | 0 mm | | |

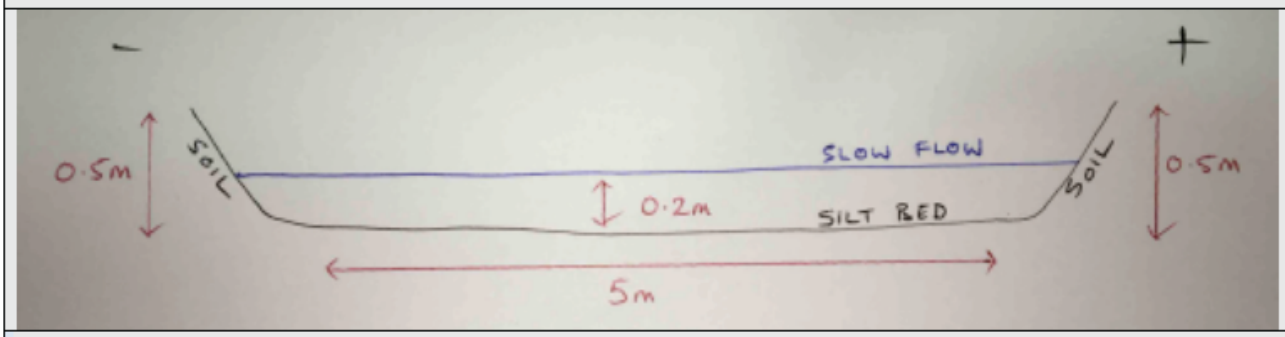
**Physical description**

| River | Stream | Ditch | Irrigation channel / canal | Concrete Channel | Ravine |
|---|---|---|---|---|---|
| | | | X | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Crossing width | 5 | Water depth | 0.20 | Flow rate | Very slow (estimate rate) | | | |
| Bed material | Silt | Bank material | Compacted soil | Bank height | + | 0.5 | - | 0.5 |
| Vegetation (cover/ species) | Sparse (add vegetation type) | | | Trees (Number / size/ species) | None | | | |
| Adjacent Slopes | + | Slight away | - | no | Runoff risk | (1) Low | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Watercourse Description: | 5m wide irrigation canal. Slow to no flow. Shallow water depth 0.2m. Shallow banks up to 0.5m from compacted soil following many years of dredging. 100% silt cover on bed, appearing very thick in places. Sparse vegetation on both banks. Low runoff risk. | | | | | | |
| Adjacent area description: | Extensive cultivated fields. | | | | | | |
| Manmade structures: | Bridge | Sluice gate | Discharge | Abstraction | Dumping | Quarry | Livery |
| | x | | | | | | |
| Distance from crossing | 300m upstream | | | | | | |

**Profile Sketch**




**Ecological observations (50m survey upstream and downstream)**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Assessment date | 01/09/16 | | Assessed by | | A N Other | | |
| | Yes | | No | | Species / comments | | |
| Fish | x | | | | Several fish (common species) noted (add species) | | |
| Amphibians | | | x | | | | |
| Reptiles | x | | | | Green lizards present on banks | | |
| Otter | | | x | | | | |
| Birds | | | x | | | | |
| Sensitive bed | | | x | | 100% silt | | |
| Trees / Flora | | | x | | | | |
| Invasive flora | | | x | | | | |
| Other | | | x | | | | |

**Preconstruction baseline literature review**

| | | | | | | |
|---|---|---|---|---|---|---|
| Review date | 10/08/16 | | Reviewed by | | A N Other | |
| Special mention | Yes | x | No | | Reference | • ESIA, RSK fish survey (GAL00-RSK-601-Y-TRS-0003)<br>• RSK Critical habitat Assessment report. CAL00-C5577-640-Y-TRB-0001 |
| Species / constraint | • Watercourse has confirmed presence of **Aggitis spined loach.** Red listed. Vulnerable<br>• Watercourse considered suitable habitat for **European Eel.** Red listed. Critically endangered. | | | | | |
| Critical Habitat | Yes | x | No | | Details: | **Tier 1 - Aggitis spined loach**<br>**Tier 2 - European Eel** |
| Specific commitment | Yes | x | No | | Commitments: | GR0627, GR0628 |

**GR0627:** Watercourse Crossing Plans will be developed and implemented for the Philippoi_5 and Philippoi_9 streams with the aim of reducing the impacts of sediment release on E. hellenicus and C. punctilineata species

**GR0628**: A fish survey for E. hellenicus and C. Punctilineata will be conducted immediately after construction

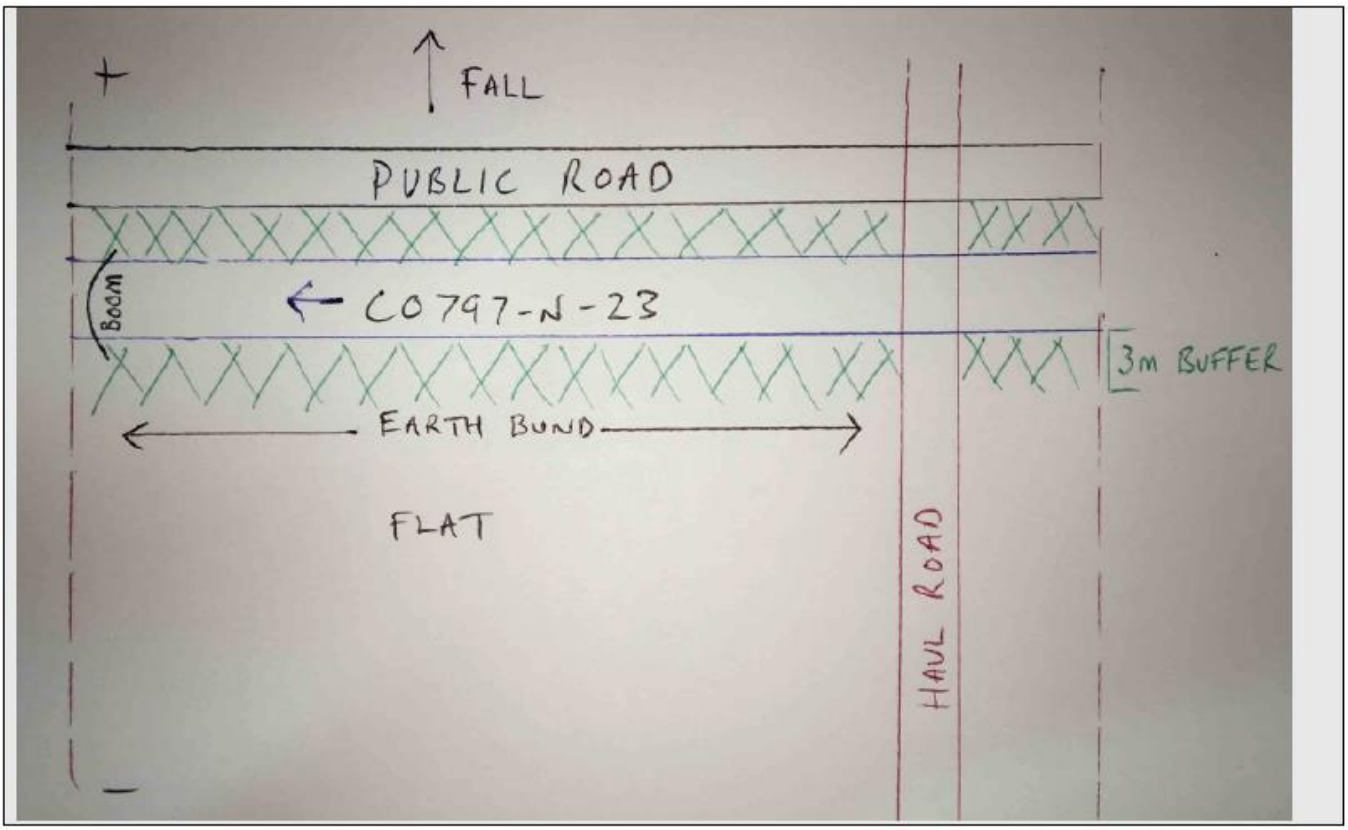
| | | | | | | |
|---|---|---|---|---|---|---|
| Reference mitigation | Yes | x | No | | Source: | • RSK fish survey (GAL00-RSK-601-Y-TRS-0003)<br>• Commitments register (GAL00-PMT-601-Y-TLX-0001) |
| **KP register review: Additional constraints or conflicts?** | Yes | | No | x | Details: | Aggitis spined loach and Eel European eel already identified. |

- Specific Watercourse Crossing Plan for this crossing, as required by GR0627, which should be submitted to TAP for approval.
- Construction during the spawning period (early April to late June) should be avoided and a dry open-cut crossing method should be used.
- Mitigation hierarchy for European Eel implemented.
- It is recommended that a suitably qualified aquatic ecologist be appointed to be present on site during construction to monitor any sediment release, document any changes in habitat at the site (by undertaking a habitat assessment immediately before and after construction) and ensure that work stops if any distressed fish are seen, until the fish can be caught and relocated upstream of the construction site.
- The aquatic ecologist should document the construction process through taking photographs and regular water quality testing.
- Post construction monitoring

| | |
|---|---|
| Ecological risk | High (3). Risk of sediment impact on Aggitis spined loach during construction activities. |

**ROW preparation**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ESMS Objective** | **Minimise sedimentation of watercourse and prevent direct mortality of Aggitis spined loach during ROW preparation activities.** | | | | | | | | | | | |
| Schedule | 8/10/16 | Schedule compliant with restrictions? | | | | yes | x | No | | N/A | | |
| ROW crossing method | No crossing | Existing Access | Bridge | Flume | Flume details ( if applicable) | | Size | | 30” | | | |
| | | | | x | | | No. | | 5 | | | |
| | | | | | | | Fill | | Sand bag head wall / | | | |




| **Water Quality Monitoring** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sample time** | Sample 1 | - 24hrs | Sample 2 | - 1hr | Sample 3 | During | Sample 4 | + 1hr |
| **Parameter** | | | | | | | | |
| Conductivity | | | | | | | | |
| pH | | | | | | | | |
| Temp | | | | | | | | |
| TSS | | | | | | | | |
| Sampled by: | | | | | | | | |
| Ad-hoc sampling details and results: | | | | | | | | |

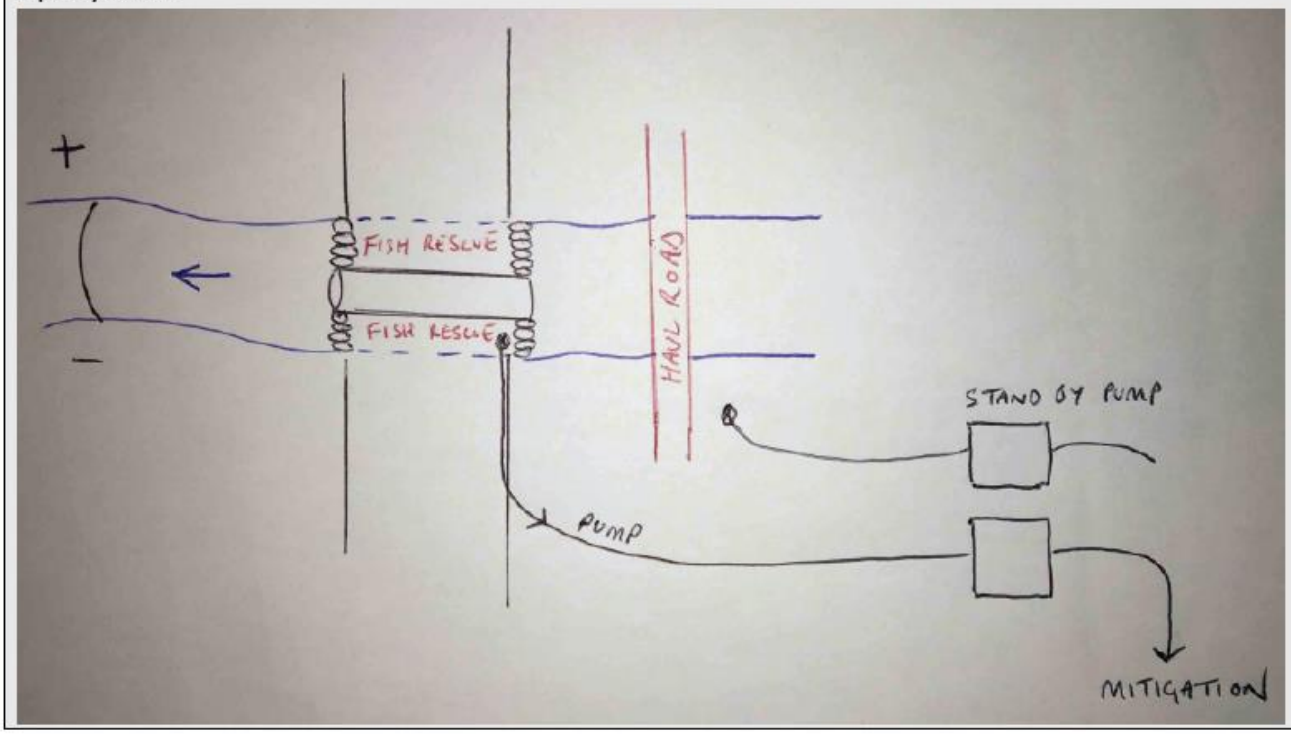
| **Pipe lay** |
|---|

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **ESMS Objective** | **Minimise sedimentation of watercourse and prevent direct mortality of Aggitis spined loach during pipelaying activities.** | | | | | | | | | | |
| **Schedule** | 11/11/16 | **Schedule compliant with restrictions?** | | | | yes | x | No | | N/A | |
| **Pipe lay method** | HDD | Auger | Dam & Pump | Flume | Low flow OC | Diversion | **Flume pipe details (if applicable)** | | | Size | 48" |
| | | | | x | | | | | | No. | 2 |

| **Mitigation in Sequence:** | **Confirm and sign (ESMS)** |
|---|---|
| All mitigation and construction materials available prestart | |
| 3-day weather look ahead. Works shall not be attempted during flood waters | |
| Environmental coordinator and ecologist to supervise pipelay activities | |
| All activities documented with photographs | |
| Complete subscribed water quality monitoring | |
| Any activity causing significant sediment disturbance shall be ceased immediately and suspended until in stream sediment mitigation is installed, or a new method agreed. Ad-hoc water quality monitoring to be conducted following any adverse event. | |
| Flumes pipes to be slowly lowered into position to allow any fauna to disperse and to minimise sediment disturbance | |
| Sand bag headwall to be constructed upstream end of flume pipes | |
| Fauna rescue performed for any animals trapped in the drained area behind flume pipes (if free draining). All fauna rescues to be recorded | |
| Sand bag head wall to be constructed at downstream end of flume pipes | |
| Final fauna rescue to be performed between headwalls, area to be slowly dewatered if necessary. All fauna rescues to be recorded. | |
| 4" pump installed within dig zone to dewater any residual / ingress water. 100% standby pump capacity to be available | |
| Suitable location for pumping outfall to be identified to ensure no pollution risk. Pumping outfall location to be agreed with landowner if required. | |
| Reptile rescue completed if necessary on watercourse banks. All fauna rescues to be recorded. | |

| | |
|---|---|
| Bank material to be carefully removed and protected for reinstatement | |
| After pipe lay and backfill, the isolation area will be slowly rewatered and allowed to settle prior to the removal of flume pipes. | |
| If pump is used in river, fish screens shall be used to cover the pump head | |
| After suspended solids have sufficiently settled within the flooded isolation area, the downstream sandbags shall be slowly removed, followed by the upstream headwall | |
| Flumes pipes removed and banks reformed back to original profile | |

Pipe lay sketch




**Reinstatement and Erosion control**

Reinstatement considerations:

No special reinstatement considerations. Reform banks to original profile. No planting or reseeding required.

| Planting required? | Yes | | No | x | If yes, planting plan in place? | Yes | | No | | Plan Ref: | |
|---|---|---|---|---|---|---|---|---|---|---|---|

Erosion considerations:

| No special erosion considerations. Reform banks to original profile. No stabilisation required. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Erosion Risk | Yes | | No | x | If yes, Erosion control designed? | Yes | | No | | Plan Ref: | |

| Erosion control method | | | | | | |
|---|---|---|---|---|---|---|
| N/A | Jute | Hydroseed | Riprap | Gabian | Temporary | Other (explain) |
| X | | | | | | |

| **Engineering documentation** | | | | |
|---|---|---|---|---|
| Do any detailed designs exist for this crossing? | Yes | | No | X |
| List documents: | | | | |

| **Approval** | | | | | | |
|---|---|---|---|---|---|---|
| CTR Environmental Manager | Name | | Signed | | Date | |
| CTR Construction Manager | Name | | Signed | | Date | |
| TAP ESMS | Name | | Signed | | Date | |