October 2017

TRANS-ANATOLIAN NATURAL GAS PIPELINE (TANAP) PROJECT

Biodiversity Offset Strategy

REPORT

Report **Number** 1786851/9059

Golder Associates

Executive Summary

The Trans-Anatolian Natural Gas Pipeline (TANAP) Project is part of the Southern Gas Corridor, which aims to transport the Azeri Natural Gas from Shaz Deniz 2 Gas Field and other fields in the South Caspian Sea to Turkey and Europe. The TANAP Project crosses all of Turkey, from the Georgian border in the east to the Greek border in the west.

TANAP is committed to managing the potential effects of the Project on biodiversity by implementing the biodiversity mitigation hierarchy (i.e. avoiding, minimizing, rehabilitating and offsetting). The first three steps of the mitigation hierarchy have been considered by TANAP through the project design, Environmental and Social Impact Assessment (ESIA), and Biodiversity Action Planning (BAP) processes. However, the calculation of net habitat losses, net gain and the identification of offset measures to compensate the residual impacts were not conducted.

This report constitutes the Biodiversity Offset Strategy for the TANAP Project, with the purpose of providing a practical and achievable offset scheme for TANAP and creating a framework to direct actions undertaken to offset the residual effects of the Project after the first three steps of the mitigation hierarchy have been implemented. The Biodiversity Offset Strategy for the TANAP Project was developed in accordance to the requirements of the European Bank of Reconstruction and Development (EBRD) Performance Requirement 6 (PR6) and the International Finance Corporation (IFC) Performance Standard 6 (PS6) "Biodiversity Conservation and Sustainable Management of Living Natural Resources".

As the TANAP Project covers such a large geographic area and as biodiversity varies greatly across this extent, an ecoregion approach (Olson et al. 2001) was used to ensure that losses caused by the TANAP Project and gains resulting from offset actions were calculated within the same geographically distinct assemblage of species, natural communities and environmental conditions (i.e., like-for-like concept). Each of the nine ecoregions crossed by the TANAP project therefore represents an important spatial unit for the application of the Biodiversity Offset Strategy.

An offset accounting methodology to calculate residual losses for biodiversity caused by the TANAP Project was developed in the present document. This accounting method has been defined to permit demonstration of No Net Loss or Net Gain for biodiversity taking into account the pre-existing disturbance of each habitat type within the ecoregions, the suitability of each habitat to host the species of conservation concern, the level of conservation significance of certain areas across the Project and finally the benefits of rehabilitation activities identified in the BAP.

The TANAP Project footprint covers 7222 ha in total, of which 72% of modified habitats and the remaining 28% of natural habitats. The footprints of "pipeline Right of Way (ROW)", "permanent associated facilities" and "temporary associated facilities" were considered in the quantification. Residual losses for biodiversity have been expressed as Biodiversity Value (Vh) and net loss of habitat in hectares (*Ha*), the latter to give additional spatial context to the biodiversity value score.

Critical Habitats (CH) and Priority Biodiversity Features (PBF)/ Natural habitats (NH) were calculated separately since they have different offset requirements. In fact, the offset planned for CH need to ensure a Net Gain, while for PBF and Natural Habitats (NH) only a No Net Loss is required. In case of an overlap of CH, PBF or NH criteria, the areas was categorized CH since it is the one with the highest offset requirements.

The results of the calculation indicates that residual effects of the TANAP Project are identified in both modified (43% of the total net loss in hectares) and natural habitats (57% of the total net loss in hectares) in all ecoregions affected by the Project. In particular, the largest residual impacts were identified in the Caucasus Mixed Forests and North Anatolian Conifer and Deciduous Forests, and within these ecoregions the Irano-Anatolian steppes and Calciphilous alpine and subalpine grasslands are among the natural habitats with the greatest adverse residual effects to biodiversity value. Comparatively few residual effects to biodiversity value were identified in the Balkan Mixed Forests, Central Anatolian Steppe, and the Aegean and Western Turkey Sclerophyllous and Mixed Forests.

Following the quantification of the residual effects, offset concepts and tactics that can be applied to achieving No Net Loss or Net Gain are addressed in the report, describing the approaches that will be taken to identify and evaluate offset opportunities, and outlining the process for developing a Biodiversity Offset Management and Monitoring Plan for the TANAP Project. Within the tactics, a preliminary quantification of offset benefits in the Local Study Area is also provided, as part of demonstrating the suitability of offset actions selected for implementation as part of the Biodiversity Offset Management Plan.

The Biodiversity Offset Strategy also acknowledges the primary importance of the involvement of stakeholders, including governments, lenders (e.g. EBRD), and other potentially affected and interested parties as part of the process. A preliminary list of stakeholders and relevant issues is therefore proposed.

Finally, the implementation schedule for the Biodiversity Offset Strategy is presented, aiming to finalize the Biodiversity Offset Management Plan by the end of 2019 and commit to implement the entire offsetting program by 2040.The TANAP biodiversity offset strategy is a living strategy that will need to be updated over time as new technical data becomes available through ground truthing studies.

Glossary

Term	*Description*
Baseline	A description of existing conditions to provide a starting point (e.g. pre-project condition of biodiversity) against which comparisons can be made (e.g. post-impact condition of biodiversity), allowing the change to be quantified.
Critical Habitat (CH)	Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes (IFC Performance Standards 6, 2012)
Habitat suitability	This term defines the probability that a certain SCC species occurs in a given EUNIS habitat.
Like-for-like	Conservation (through the biodiversity offset) of the same type of biodiversity as that affected by the project. This is sometimes modified to ‘like-for-like or better’, in which the offset conserves components of biodiversity that are a higher conservation priority (for example because they are more irreplaceable and vulnerable) than those affected by the development project for which the offset is envisaged.
Local Study Area (LSA)	The area coinciding with 500 m corridor around the pipeline centreline already used in the ESIA study and the entire footprint of the temporary and permanent associated facilities, plus a 100 m buffer. This is also considered as the primary spatial boundary for offset.
Mitigation hierarchy	Measures which aim to reduce impacts to the point where they have no adverse effects. The mitigation hierarchy is defined as a scale including the avoidance, the minimization, the rehabilitation/restoration and the offset.
Modified habitat	According to IFC Performance Standard 6, modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area’s primary ecological functions and species composition.
Natural habitat	According to IFC Performance Standard 6, natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area’s primary ecological functions and species composition.
No Net Loss (NNL) / Net Gain (NG)	A target for a development project in which the impacts on biodiversity caused by the project are balanced or outweighed by measures taken to avoid and minimise the project’s impacts, to undertake on-site restoration and finally to offset the residual impacts, so that no loss remains. Where the gain exceeds the loss, the term ‘net gain’ may be used instead of no net loss.

Term	*Description*
Offset	Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure and ecosystem function and people's use and cultural values associated with biodiversity (BBOP, 2012).
Priority Biodiversity Features (PBF)	Priority biodiversity features include: (i) threatened habitats; (ii) vulnerable species; (iii) significant biodiversity features identified by a broad set of stakeholders or governments (such as Key Biodiversity Areas or Important Bird Areas); and (iv) ecological structure and functions needed to maintain the viability of priority biodiversity features described. Priority biodiversity features are a subset of biodiversity that is particularly irreplaceable or vulnerable, but at a lower priority level than critical habitats (EBRD Performance Requirement 6, 2014)
Rehabilitation/restoration	Measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/ or minimised (BBOP, 2012)
Regional Study Area (RSA)	This is the broader study a rea encompassing the nine ecoregions crossed by the TANAP project that represents an important spatial unit for the application of the Biodiversity Offset Strategy.
Residual impact	The remaining adverse impact on biodiversity after appropriate avoidance, minimisation and rehabilitation measures have been taken according to the mitigation hierarchy.
Resilience	The ability of an ecosystem to recover and maintain diversity, integrity and ecological processes following disturbance.
Right Of Way (ROW)	The 36 m pipeline construction corridor of the onshore natural gas pipeline from the Turkey/Georgia border to the Turkey/Greece border.
Significant Conservation Areas (SCA)	In this report, the term SCA refers to internationally and/or nationally recognized areas of high biodiversity value, including threatened habitats, Key Biodiversity Areas (KBA), Important Plant Areas (IPA) or Important Bird Areas (IBA), protected areas, areas associated with key evolutionary processes.
Species of Conservation Concern (SCC)	Species identified as the most sensitive from both a protection and a threat point of view along the TANAP ROW.
Target species	Species in the group of the SCCs chosen as more sensitive than others because of their higher threat status, restricted distribution and low mobility

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1.0 INTRODUCTION

Trans-Anatolian Natural Gas Pipeline (TANAP) Project is part of the Southern Gas Corridor, which aims to transport the Azeri Natural Gas from Shah Deniz 2 Gas Field and other fields in the South Caspian Sea to Turkey and Europe.

The Southern Gas Corridor comprises the South Caucasus Pipeline (SCP) that crosses Azerbaijan and Georgia, the TANAP across Turkey and the Trans-Adriatic Pipeline (TAP) across Greece and Albania and Italy (Figure 1). The TANAP gas corridor starts from the Georgia/Turkey border at Türkgözü/Posof/Ardahan where it connects to SCP and ends at the Turkey/Greece border in Ipsala/Edirne, where it feeds into the TAP Pipeline.

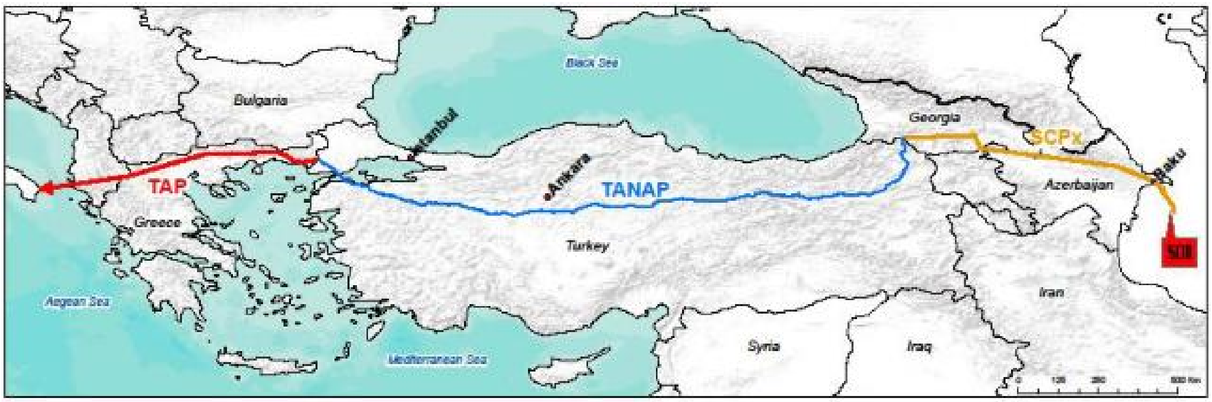

Figure 1: Southern Gas Corridor including the South Caucasus Pipeline (SCP), TANAP and the Trans-Adriatic Pipeline (TAP).

TANAP is committed to managing the potential effects of the Project on biodiversity by implementing the biodiversity mitigation hierarchy, which consists of four steps that should be followed in order:

- **Avoid** – To the extent practicable, development projects should avoid impacts to biodiversity by modifying the design of the project to spatially avoid areas with high biodiversity value or achieve temporal avoidance by conducting activities outside of periods when biodiversity features are most vulnerable to development activities (e.g., fish spawning, bird nesting).
- **Minimize** – Development projects should limit impacts that cannot be avoided through best available design technology and best management practices (e.g., minimizing soils disturbance or right-of-way width).
- **Rehabilitate** – If development projects cannot avoid or minimize adverse effects on biodiversity, affected ecosystems or species should be rehabilitated in situ, so that affected biodiversity is re-established in the same place where it was adversely affected.
- **Offset** – If opportunities to implement the first three steps of the mitigation hierarchy have been exhausted and residual impacts are still present, development projects should implement offsets to achieve desired outcomes for biodiversity (e.g., no net loss or net gain).

The first three steps of the mitigation hierarchy have been considered by TANAP through the project design, Environmental and Social Impact Assessment (ESIA), and Biodiversity Action Planning (BAP) processes. This document focuses exclusively on offsetting and presents TANAP's Biodiversity Offset Strategy. The Biodiversity Offset Strategy for the TANAP Project was developed in accordance with the requirements of the European Bank of Reconstruction and Development (EBRD) Performance Requirement 6 (PR6) and the International Finance Corporation (IFC) Performance Standard 6 (PS6) *"Biodiversity Conservation and Sustainable Management of Living Natural Resources"*.

The Biodiversity Offset Strategy is based on relevant study results, mitigation, reclamation and monitoring measures presented by TANAP in previous related documents, specifically including:

- Environmental and Social Impact Assessment (ESIA) Report and Non-Technical Summary (Document n. TNP-REP-ENV-GEN-002);
- Stakeholder Engagement Plan (Document n. TNP-PLN-SOC-GEN-001-Rev-P3-2);
- Resettlement Action Plan (RAP) (Document n. GLD-PLN-LAC-GEN-003 Rev-P3-1) and its Addendum for TANAP Pipeline Route (Document n. TNP-PLN-SOC-GEN-006);
- Addendum to RAP for TANAP Pipeline Route (Document n. TNP-PLN-SOC- GEN-006);
- Resettlement Action Plan for AGIs. (Document n. TNP-PLN-SOC-GEN-008)
- Environmental and Social Management Plan (ESMP) (Document n. TNP-PLN-ENV-GEN-001-Rev-P3-3);
- Biodiversity Action Plan (BAP) (Document n. CIN-REP-ENV-GEN-017-Rev-P3-11);
- BAP Executive Summary (Document n. CIN-REP-ENV-GEN-022-Rev-P3-0);
- Commitment Register (Document n. TNP-REG-ENV-GEN-003-Rev-P3-3).

1.1 Objectives

The purpose of the Biodiversity Offset Strategy for the TANAP Project is to create a framework to direct actions undertaken to offset the residual effects of the Project after the first three steps of the mitigation hierarchy have been implemented. The Biodiversity Offset Strategy was created to accomplish the following specific aims:

- Provide a practical and achievable offset scheme for TANAP, in accordance with the biodiversity offsetting requirements of the Lenders (e.g., EBRD).
- Provide TANAP with a roadmap for identifying, evaluating, and undertaking offset actions.

TANAP's Biodiversity Offset Strategy builds upon substantial existing information available for the Project. Baseline studies and an ESIA were completed for the Project in 2013. This work provided information about the biodiversity present in the vicinity of the Project, proposed mitigation to reduce impacts from the Project on biodiversity, predicted residual impacts of the Project, evaluated uncertainty, and identified requirements for further studies and monitoring.

Following submission of the ESIA, TANAP initiated development of a BAP, which was completed in June, 2017. The BAP included the following:

- A summary of the baseline work undertaken for the ESIA.
- The results of additional fieldwork conducted to fill information gaps and reduce uncertainty identified in the ESIA.
- A refined assessment of critical habitat.
- Recommended actions to avoid or minimize impacts.
- Information about how rehabilitation should proceed (e.g., soils placement, species of flora that will be planted).

This Biodiversity Offset Strategy is a further refinement and involves in part a revision of some previous work in order to better prepare for the offset stage. For example, the BAP provided a first estimate of the extension of Critical Habitat based on a species-specific approach (largely guided by expert judgement), which is about 366 ha, whereas the BOS is providing an estimate of residual loss of Critical Habitat and Priority Biodiversity Features of about 893 ha. This last figure is a more useful basis for estimating the offset needs as in addition to the IFC Performance Standard 6, it considers the EBRD Performance Requirement 6 by including the vulnerable species and the threatened habitats in the loss calculation, which makes the basis of the difference with BAP.

Consequently, a wealth of information is already available to support implementation of the first three steps of the mitigation hierarchy. However, other than to identify their importance as the fourth and final step of the biodiversity mitigation hierarchy, neither the BAP nor the ESIA addressed biodiversity offsets. This Biodiversity Offset Strategy fills this gap by providing a framework for the definition and implementation of offsets to mitigate residual adverse effects of the Project after the actions defined in the ESIA and BAP have been implemented. Specific objectives of the Biodiversity Offset Strategy are as follows:

- Develop an accounting method, based on established approaches and criteria, to calculate biodiversity losses (i.e., residual effects of the TANAP Project) and gains (i.e., offsets) for natural habitats, priority biodiversity features, and critical habitats.
- Identify residual impacts to natural habitats, priority biodiversity features, and critical habitats, taking into account the mitigation and conservation measures outlined in the BAP.
- Identify potential offsets and additional conservation actions in accordance with good international practice to achieve No Net Loss or Net Gain outcomes relative to the residual effects identified for natural habitats, priority biodiversity features, and critical habitats.
- Define approaches to stakeholder engagement, monitoring, and adaptive management, including feedback loops that permit re-calculation of loss-gain values and facilitate adjustments to the offset strategy to achieve No Net Loss or Net Gain.

At this early stage of the creation of a Biodiversity Offset Strategy for the TANAP Project, some portions of the framework that will guide the actions that must be undertaken to meet the objectives presented above are more advanced than others. In the case of residual effects calculations, for example, both loss-gain accounting methods and initial residual effects assessment based on these methods are presented. In other cases, such as stakeholder engagement and offset identification, this document provides a roadmap that will direct TANAP's activities to identify and implement effective offsets. The TANAP Biodiversity Offset Strategy is therefore a living strategy that will need to be updated over time as new technical data becomes available through ground truthing studies.

The Biodiversity Offset Strategy provides the conceptual framework and direction that will guide the development of a Biodiversity Offset Management Plan that will be implemented as part of TANAP's Environmental & Social Management System. The Biodiversity Offset Management Plan will define the specific actions that TANAP will undertake to offset residual effects of the Project. Implementation of this strategy will be ongoing until the Biodiversity Offset Management Plan is implemented, and offsets addressing all residual effects have been demonstrated.

1.2 Document Structure

After these introductory materials, the TANAP Biodiversity Offset Strategy is structured as follows:

- Section 2 – presents the **spatial boundaries** used for calculating residual effects and defining the focus areas within which opportunities to implement offsets will be sought.
- Section 3 – identifies the specific **standards and commitments** to biodiversity conservation and management that have been made for the TANAP Project.
- Section 4 – defines the **roles and responsibilities** of the various actors (e.g., TANAP, contractors, or specialists) required to implement the Biodiversity Offset Strategy.
- Section 5 – outlines the **offset accounting methodology** used to calculate residual adverse effects of the TANAP Project and gains associated with conservation actions. The offset accounting methodology will be used as the tool to demonstrate whether No Net Loss or Net Gain has been achieved as a result of implementing this Biodiversity Offset Strategy.

- Section 6 – presents the results of the **residual effects quantification** for the TANAP Project, taking into account all actions described in the BAP to avoid, minimize, or rehabilitate biodiversity.
- Section 7 – presents some additional considerations regarding the specie of highest conservation concern, identified as the species that are either Critically Endangered, local endemics or with very low mobility.
- Section 8 – outlines offset **concepts and tactics** that can be applied to achieving No Net Loss or Net Gain for the residual effects identified in Section 6, including defining offset principles, describing the approaches that will be taken to identify and evaluate offset opportunities, and outlining the process for developing a Biodiversity Offset Management Plan for the TANAP Project. This section also outlines the information necessary to apply the same tools and calculations used to account for residual adverse effects to **quantify offset benefits** as part of demonstrating the suitability of offset actions selected for implementation as part of the Biodiversity Offset Management Plan. This section also describes how **monitoring and adaptive management** should be used as an integral part of pursuing No Net Loss and Net Gain through implementation of the Biodiversity Offset Strategy.
- Section 9 – identifies appropriate **stakeholder engagement**, including engagement with government agencies and non-government organizations (NGOs) that will be undertaken during the implementation of the offset strategy.
- Section 10 – presents the **implementation schedule** for the Biodiversity Offset Strategy.
- Section 11 – states the **financial commitment** for implementing the TANAP Biodiversity Offset Strategy.
- Section 11 – provides the **bibliography** consulted for the preparation of the present report.

2.0 SPATIAL BOUNDARIES

Two levels of analysis have been considered in the present study: a Local Study Area coinciding with 500 m corridor around the pipeline centreline already used in the ESIA study (Section 2.1) and a Regional Study Area including the ecoregions crossed by the pipeline (Section 2.2).

2.1 Local Study Area

The spatial boundary used for calculating the residual adverse effects to biodiversity is the TANAP Project footprint. A 500 m corridor around the TANAP Project footprint and the entire footprint of the temporary and permanent associated facilities, plus a 100 m buffer is considered as the primary spatial boundary for offset, because offsets should be achieved in as close proximity as possible to the impacted site (Kiesecker et al. 2009). However, to ensure enough sites for the offset implementation, the spatial boundary can extend away from the footprint in broader areas that remain ecologically relevant (Kiesecker et al. 2009).

The TANAP Project footprint crosses the entire country of Turkey, from Georgia in the east to Greece in the west. The Project crosses 20 Turkish provinces, namely, Ardahan, Kars, Erzurum, Erzincan, Bayburt, Gümüşhane, Giresun, Sivas, Yozgat, Kırşehir, Kırıkkale, Ankara, Eskişehir, Bilecik, Kütahya, Bursa, Balıkesir, Çanakkale, Tekirdağ and Edirne, and ends at İpsala district of Edirne at Turkey/Greek border (Figure 2).

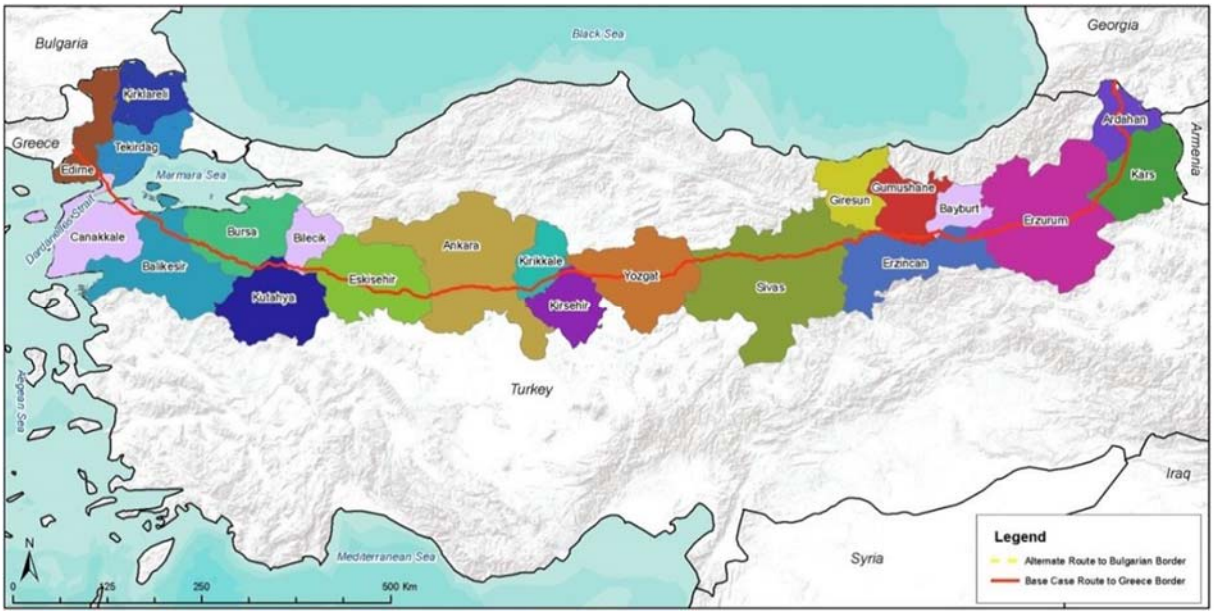

Figure 2: TANAP Project footprint and Turkish provinces crossed

The TANAP Project is comprised of an 1805 km long natural gas pipeline system, which includes 1787 km of underground terrestrial pipeline and 18 km of Marmara subsea pipeline. The TANAP system will be fully automated with main and back-up control centers to meet the requirements of gas transmission and associated environmental, social and safety considerations. The pipeline Right of Way (ROW) and the associated temporary and permanent facilities considered in the present Biodiversity Offset Strategy include the following spatially defined elements of the TANAP Project, totalling 7222 ha[1]:

- Pipeline ROW: the 36 m construction corridor of the onshore natural gas pipeline from the Turkey/Georgia border to the Turkey/Greece border. Onshore length = 1,787 km.
- Temporary associated facilities:
  - Pipe Stockyards: 17 during the construction phase of the Project.
  - Camp Sites: 20 during the construction phase of the Project, two of which were situated in the construction boundaries of two compressor stations.
- Permanent associated facilities:
  - Access Roads: built for Block Valve Stations, Compressor Stations, Metering Stations and Pig Launcher and Receiver facilities.
  - Block Valve Stations (BVSs): 49 stations planned along the pipeline route.
  - Compressor Stations: 4 compressor stations at intermediate points for fulfilling pressure requirements including pigging stations.

[1] The Project footprint incorporated into this version of the Biodiversity Offset strategy refer to Revision J of the Project design.

- Metering Stations: four stations are planned, of which one is included in the Compressor Station 5 in Eskişehir Province.
- Pig Launcher and Receiver facilities: two standalone facilities, one at either side of the shore approaches of the Dardanelles Strait Crossing.
- Other pigging stations: additional three pigging stations installed to allow cleaning of the pipeline and prevent corrosion.
- Main Control Centre, located in Ankara Province near Karaoglan village.

The TANAP Biodiversity Offset Strategy focuses on identifying offsets for the residual impacts of the TANAP Project on terrestrial and freshwater aquatic biodiversity. The ESIA did not identify any qualifying features, species or habitats that would trigger critical habitats or priority biodiversity features and thus require offsets for the marine environment.

2.2 Regional Study Area

Because the TANAP Project covers such a large spatial extent and because biodiversity varies greatly across this extent, an ecoregion approach (Olson et al. 2001) was used to ensure that losses caused by the TANAP Project and gains resulting from offset actions were calculated within the same geographically distinct assemblage of species, natural communities and environmental conditions (i.e., like-for-like concept). Each of the nine ecoregions crossed by the TANAP project therefore represents an important spatial unit for the application of the Biodiversity Offset Strategy.

Ecoregions are broad ecological units containing a geographically distinct assemblage of species, natural communities, and environmental conditions. For the purposes of this Biodiversity Offset Strategy, ecoregions were defined using the terrestrial ecosystems of the world maps developed by Olson et al. (2001). These ecoregions were specifically designed to be used as tools for biodiversity conservation planning (Olson et al. 2001).

The nine ecoregions intersected by the TANAP Project (Figure 3) are considered distinct Regional Study Areas (RSAs) for the purposes of calculating residual losses and seeking appropriate biodiversity gains to achieve No Net Loss or Net Gain through offsets at sites targeted for fine scale conservation action (Eken et al. 2004). The nine ecoregions are identified below according to the biome in which they are found:

- Mediterranean Forests, Woodlands and Scrub Biome:
  - Aegean And Western Turkey Sclerophyllous And Mixed Forest Ecoregion (PA1201);
  - Anatolian Conifer And Deciduous Mixed Forest Ecoregion (PA1202);
- Temperate Grasslands, Savannas and Shrublands Biome:
  - Central Anatolian Steppe Ecoregion (PA0803);
  - Eastern Anatolian Montane Steppe Ecoregion (PA0805);
- Temperate Conifer Forests Biome:
  - Northern Anatolian Conifer And Deciduous Forests Ecoregion (PA0515);
- Temperate Broadleaf and Mixed Forests Biome:
  - Balkan Mixed Forests Ecoregion (PA0404);
  - Caucasus Mixed Forests Ecoregion (PA0408);

- Central Anatolian Steppe And Woodlands Ecoregion (PA0410)
- Eastern Anatolian Deciduous Forests Ecoregion (PA0420)

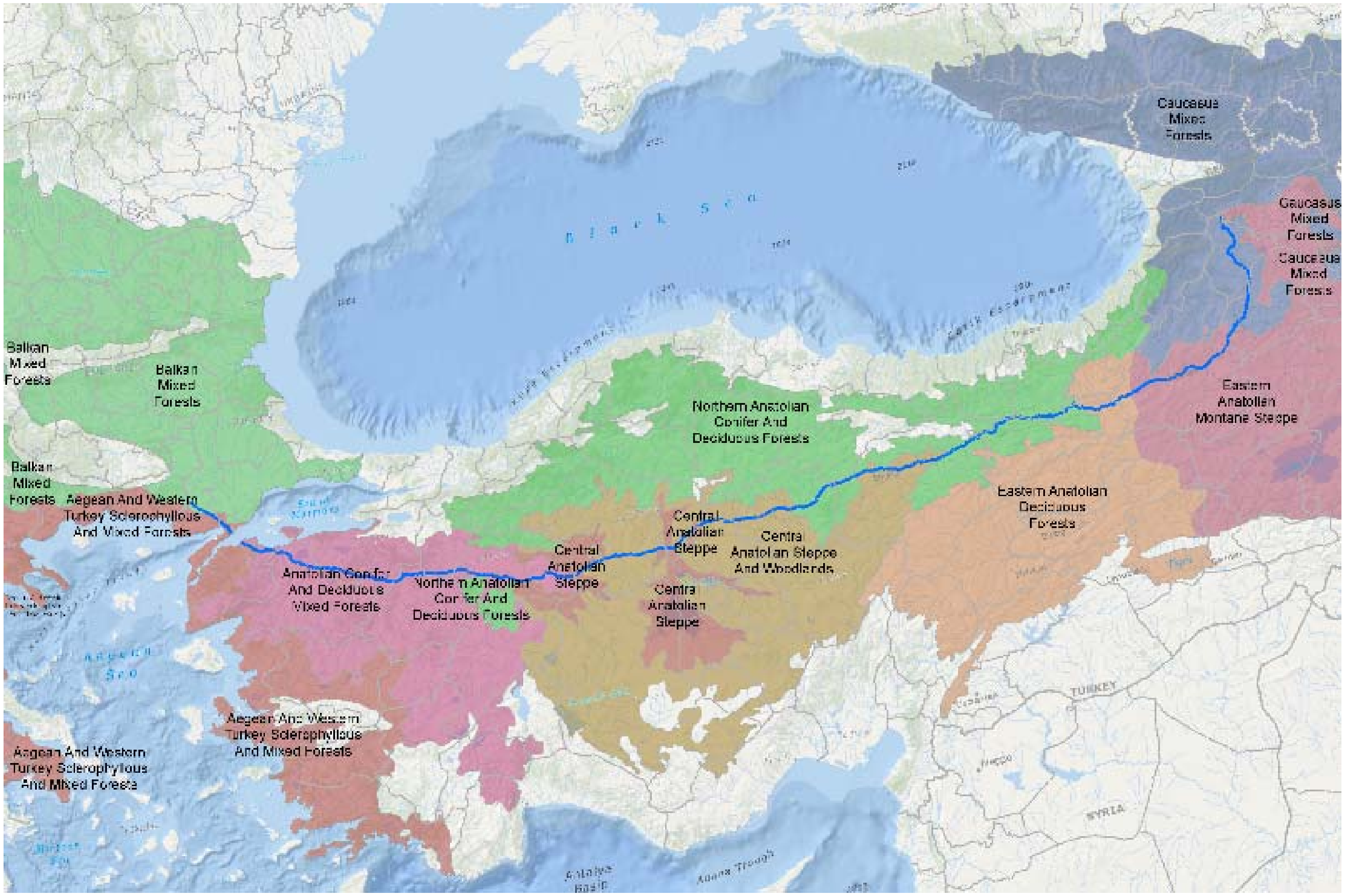

Figure 3: Ecoregions intersected by the Project

3.0 PROJECT STANDARDS AND COMMITMENTS

The Biodiversity Offset Strategy for the TANAP Project was prepared in accordance with international legislation and conventions (Section 3.1), lender requirements and standards (Section 3.2), and specific commitments to biodiversity conservation and management identified in the ESIA for the Project (Section 3.3).

3.1 International Legislation and Conventions

- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) - Published in the Official Gazette no. 18318 on February 20, 1984 and entered into force on September 1, 1984;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1975) - Published in the Official Gazette no. 22672 on June 20, and entered into force on December 22, 1996
- Natura 2000 (Habitats and Birds Directives) – the implementation programme for Strengthening the National Nature Protection System is in progress;
- Convention on Wetlands of International Importance (RAMSAR Convention) - Published in Official Gazette No. 21937 dated May 17, 1994;
- Convention on Biological Diversity (Rio Conference, 1992) - Turkey became a Party in 1992.

3.2 Lender Requirements and Standards

- International Finance Corporation (IFC) Performance Standard (PS) 6 and Guidance Note (GN) 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- European Bank for Reconstruction and Development (EBRD) Performance Requirements (PR) 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Business and Biodiversity Offsets Programme (BBOP): Standard on Biodiversity Offsets (2012).

3.3 ESIA Commitments

These commitments derive from the Environmental and Social Impact Assessment (ESIA) and Biodiversity Action Plan (BAP) developed for the TANAP Project. The main specific commitments on biodiversity (habitats, flora, terrestrial and freshwater fauna) include (reference to Commitment Register No. 136÷184 and No. 299÷672) the following categories:

- General commitments for ecological sensitive areas during construction phase (e.g. constant monitoring of construction works, prevention of explosions, increase awareness among employees and contractor working on site about the protected species potentially present in the areas and sensitive habitats; operational procedures to avoid pollution to wetlands and rivers by trucks; minimization of disturbance of natural habitats within cultivated areas).
- General commitments for ecological sensitive areas during operational phase (e.g. periodic monitoring of the bio-restoration works and compliance with the principles indicated in the Erosion, Reinstatement and Landscaping Plan).
- Specific mitigation actions to be applied during construction (e.g. facilitate wildlife crossing of ROW during construction by providing trenches and passages);
- Regulatory Authority requirements (e.g. Works should be terminated between 22:00–06:00 hours and the first 3 hours after sun rise and the last 3 hours before sunset);
- Monitoring actions during construction (e.g. pre-construction inspections);
- Pre-construction and post-construction mitigation measures for each Species of Conservation Concern (SCC) to put in place in the Critical Habitats identified within the BAP;

- Monitoring actions to evaluate the rehabilitation success of the SCC in the Critical Habitats above mentioned (i.e. methodology, achievement criteria, and frequency).

4.0 ROLES AND RESPONSIBILITIES

Principal roles and responsibilities for the implementation of this strategy and for the future elaboration and implementation of the Biodiversity Offset Management Plan are outlined in Table 1.

Table 1: TANAP roles and responsibilities

Entity	General Role & Responsibility
General Manager	• Ensure that this Strategy is implemented • Approval of this Strategy and resources required for implementation.
QHSSE Director	• Ensure that environmental and social management framework outlined in this Strategy is properly implemented and continuously improved according to Project's policies, applicable local and international standards, and ESIA commitments • Ensure, through regular evaluation, compliance with TANAP policies, applicable laws and regulations during the implementation of this Strategy • Provide necessary resources for proper implementation of this Strategy
Environmental Manager of TANAP	• Support HSSE Group Manager to implement this Strategy. • Coordinate & communicate with all TANAP departments for proper implementation of this Strategy • Fully responsible for meeting applicable environmental Project requirements, goals and objectives and operating in accordance with the Project ESMS • Fully responsible for organizing, managing and monitoring the environmental activities in the scope of the Project • Determine necessary resources for proper implementation of this Strategy and submit these for review and approval of HSSE Group Manager
Social Manager of TANAP	• Fully responsible for meeting applicable social Project requirements, goals and objectives and operating in accordance with the Project ESMS • Fully responsible for organizing, managing and monitoring the social activities which are an important component of the Biodiversity Offset Strategy
Biodiversity Consultant	• Prepare a Biodiversity Offset Management Plan in compliance with the Project standards, commitments and IFIs requirements. • Support TANAP Environmental Manager in the strategic decisions related to the ESMS with particular regard for the BAP and Biodiversity Offset Strategy and related Biodiversity Offset Management Plan
Biodiversity Single Point of Contact	• Support the Environmental Manager to implement this Strategy. • Coordinate & communicate with Biodiversity Consultant for proper implementation of this Strategy • Determine necessary resources for proper implementation of this Strategy and submit these for review and approval of Environmental Manager
Third party auditor	• Periodically audit the TANAP organization for the Biodiversity Offset Strategy and related Biodiversity Offset Management Plan implementation • Periodically reports to Lenders on the level of compliance with established concepts, principles, standards and requirements of this Strategy and Biodiversity Offset Management Plan

5.0 OFFSET ACCOUNTING METHODOLOGY

An offset accounting methodology is required to calculate residual losses for biodiversity caused by the TANAP Project and also account for the gains generated by offsets implemented by TANAP. This accounting process will permit demonstration of No Net Loss or Net Gain for biodiversity. Given the length of the TANAP Project and the number of different ecosystems and key biodiversity features that interact with the pipeline, the accounting methodology was developed to achieve "a balance between applying scientific rigour and transparent accounting, and finding pragmatic solutions given certain technical and socio-economic constraints" (BBOP 2012 pg. 16).

5.1 Biodiversity value

This section presents the equations used to generate a **biodiversity value** that will be used for offset accounting. Biodiversity value is a measure of the importance of any specific habitat from a biodiversity conservation point of view and ensures all relevant biodiversity features are accounted for. The importance can be related to the presence of one or more biodiversity features that are considered important, including the suitability of the habitat for globally threatened or endemic species, and the inclusion of the habitat into protected or internationally recognized areas. The Biodiversity value increases with the number of biodiversity features the habitat includes and considers the level of degradation of the habitat and the effectiveness of the rehabilitation activities conducted after construction. This measure allows to prioritize the sites and helps decision making in the implementation of offsetting actions,

The specific methods used to generate each component of the equation are described in Section 6.1, which describes the application of the accounting methodology for calculating residual effects of the TANAP Project.

A biodiversity value was assigned to each habitat patch by considering the following:

- The type of habitat (European Nature Information System habitat classification).
- The size of the patch (calculated in hectares). For the residual effects quantification, the size of each habitat patch is the area affected by the Project Footprint. When quantifying offset benefits, the size of the each habitat patch is the area of each patch overlapping with the area where offset actions are undertaken.
- The number of species of conservation concern (SCC) that occur in the patch (patches with more SCC have greater value than patches with less SCC).
- The relative importance of the habitat type for each of the SCC that occurs there (patches of higher habitat suitability for SCC have greater value than patches of lower habitat suitability).
- The value of significant conservation areas (SCA), such as areas associated with significant biodiversity features, key evolutionary processes, and threatened and/or unique ecosystems (patches overlapping one or more of these significant conservation areas will have greater value than those that do not).
- The level of degradation of the patch (patches that have been altered from a benchmark state receive less value than those that have not been altered, recognizing that natural habitats occur on a continuum).
- For ecosystems affected by TANAP, the offset accounting approach also considers the benefits of rehabilitation identified in the BAP.

These variables were combined spatially in a geographic information system (GIS) for each patch of habitat. The biodiversity value of each habitat type affected by the TANAP Project was calculated by summing the area of all the habitat patches of the same type and then identifying higher biodiversity value if the habitats also supported SCC or overlapped with SCA. The biodiversity value for each habitat were discounted by the extent to which they were degraded. Where rehabilitation will be applied, as defined in the BAP, the biodiversity value that would need to be offset was reduced according to the benefit provided by rehabilitation. The benefit was accounted as the rehabilitation effectiveness for a habitat to reach its pre-disturbance ecological functioning and species composition. A 20 years temporal scale was set as the most realistic timeframe for most of the habitats considered to recover from disturbance, although the process is likely to continue beyond this timeframe (e.g. forest habitats). Rehabilitation values have been assigned from 0 (no rehabilitation) to 1 (full rehabilitation) taking into account the experience of previous projects and the likelihood that the rehabilitation activities as described in the ESIA and the BAP will achieve the results desired. The equation used to calculate biodiversity value lost or gained for a group of patches of a given habitat type either affected by the TANAP Project or at an offset location is as follows:

$$V_h = \left(\sum_{i=1}^{n} \left((a_i * d_i) + \left(\sum_{j=1}^{n} (a_{ij} * s_j * d_{ij}) \right) + \left(\sum_{k=1}^{n} (a_{ik} * p_k * d_{ik}) \right) \right) \right) * (1 - R_h)$$

Where:

V_h = The biodiversity value of a group of patches of a given habitat type.

a_i = The area of the i^{th} habitat patch.

a_{ij} = The area of the i^{th} habitat patch which also contains the j^{th} species of conservation concern.

a_{ik} = The area of the i^{th} habitat patch which overlaps with the k^{th} significant conservation area.

d_i = The degradation coefficient of the i^{th} habitat patch (coefficient ranging from 0-1).

d_{ij} = The degradation coefficient of the i^{th} habitat patch which also contains the j^{th} SCC.

d_{ik} = The degradation coefficient of the i^{th} habitat patch which overlaps with the k^{th} significant conservation area.

s_j = The habitat suitability score assigned to the habitat patch for the j^{th} SCC (score from 0-1)

p_k = The score assigned to the i^{th} habitat patch for the k^{th} significant conservation area (score from 0-1)

R_h = The estimated rehabilitation success of each habitat type in 20 years (ranging from 0-1)

5.2 Net loss of habitat in hectares

In order to give additional spatial context to the biodiversity value score, the spatial extent of the residual effects of the TANAP Project were also calculated. This calculation is similar to the calculation presented for the Biodiversity Value but excludes consideration of habitat degradation, species of conservation concern (SCC) and significant conservation areas (SCA). This equation should not be used for loss-gain calculations, but contextualizes the output from the biodiversity value equation by providing the absolute spatial extent of residual effects after rehabilitation.

The equation used to calculate **net loss of habitat in hectares (*Ha*)** is as follows:

$$Ha = \left(\sum_{i=1}^{n} a_i \right) * (1 - R_h)$$

Where:

Ha = The net loss of habitat hectares.

a_i = The area of the i^{th} habitat patch.

R_h = The estimated rehabilitation success of each habitat type type in 20 years (ranging from 0-1)

6.0 RESIDUAL EFFECTS QUANTIFICATION

6.1 Application of the Offset accounting methodology

The offset accounting methodology described in the Section 5 was applied to the TANAP Project Footprint in order to calculate the residual effect after the first three steps of the mitigation hierarchy described in the BAP are taken into account (i.e., avoidance, minimization, rehabilitation).

6.1.1 Terrestrial and freshwater Habitats (*a*)

Habitat mapping was conducted and made available by CINAR according to the European Nature Information System (EUNIS) classification. The EUNIS classification is a comprehensive pan-European system that facilitate the harmonized description and collection of data across Europe, including Turkey. The EUNIS habitat map covers a 500 m wide strip along the pipeline ROW and the entire footprint of the temporary and permanent associated facilities, plus a 100 m buffer. This area included in the described buffer is identified as the LSA within the present Biodiversity Offset Strategy.

The procedure for defining and mapping habitats was carried out as follows:

1) A general land cover map was created from the CORINE Land Cover (Coordination of Information on the Environment Land Cover) database, which in its latest version (no. 16) includes the entire territory of the Republic of Turkey (www.eea.europa.eu/).

2) In order to identify natural and modified habitats, the map was refined to a EUNIS level 2 Habitat type map by analysing appropriate satellite imagery and aerial photos. Most of the territory of the Republic of Turkey is covered by high resolution satellite imagery available through Google Earth. The process used the correlation framework described in Moss et al. (2002).

3) A level 3 EUNIS Habitat type map was further prepared (i) by using Desktop Study available data with the cooperation of GIS and Ecology teams to delineate satellite imagery or aerial photos into polygons of different habitat fragments, (ii) by assigning a potential (or tentative) EUNIS level 3 habitat type for each of the polygons and finally (iii) ground truthing the tentatively assigned level 3 EUNIS habitat type by field studies.

The EUNIS habitat map derived from this analysis was used as a base for the quantification of the residual effect for the Biodiversity Offset Strategy.

The terrestrial and freshwater habitats identified within the habitat map are listed in Table 2. The complete set of information showing the hectares of habitat included in each ecoregion is provided in Appendix A.

In total, 93.339 ha of terrestrial and freshwater habitat were mapped according to EUNIS classification. Natural and modified terrestrial habitats were also identified based on the EUNIS habitat type (Table 2). The distinction between natural and modified habitats was made according to the IFC PS6 definition (IFC, 2012): natural habitats retain their primary ecological functions and species composition, although they can be impacted by some anthropogenic or natural disturbances, whereas modified habitats have lost their natural ecological attributes and include urban areas, agriculture, and commercial facilities (Table 2).

Due to mapping scale only permanent rivers with a river bed larger than 3 m were considered and mapped as freshwater habitat, corresponding to river crossing classified as RVX1, RVX2 and RVX3 in the Project design. Small temporary streams, channels and ditches, corresponding to river crossing classified as RVX4 to RVX7, were not considered. Also, RVX4 were excluded from the analysis because they were found dry at the time of the field work performed by the company CINAR. However, specific monitoring activities on RVX4 water bodies, within the distribution area of the target species (see Section 7) will be recommended within the Biodiversity Offset Strategy. The classification criterion, the respective *a* value, based on the river width category and number of crossings present in the LSA for each class are given in Table 3.

Table 2: EUNIS terrestrial and freshwater habitats identified

EUNIS Code	EUNIS Name	Terrestrial/ Freshwater	Natural/ Modified
B1.8	Moist and wet dune slacks	Terrestrial	Natural
B2.2	Unvegetated mobile shingle beaches above the driftline	Terrestrial	Natural
B3.3	Rock cliffs, ledges and shores, with halophytic angiosperms	Terrestrial	Natural
C1.2	Permanent mesotrophic lakes, ponds and pools	Freshwater	Natural
C1.6	Temporary lakes, ponds and pools (wet phase)	Freshwater	Natural
C2.2	Permanent non-tidal, fast, turbulent watercourses	Freshwater	Natural
C2.3	Permanent non-tidal, slow, smooth-flowing watercourses	Freshwater	Natural
C2.5	Temporary running waters	Freshwater	Natural
C3.6	Unvegetated or sparsely vegetated shores with soft or mobile sediments	Freshwater	Natural
E1.00	Anatolian Gypsum Steppes	Terrestrial	Natural
E1.01	Anatolian Marl Steppes	Terrestrial	Natural
E1.22	Arid subcontinental steppic grassland ([Festucion valesiacae])	Terrestrial	Natural
E1.2B	Serpentine steppes	Terrestrial	Natural
E1.2E	Irano-Anatolian steppes	Terrestrial	Natural
E2.1	Permanent mesotrophic pastures and aftermath-grazed meadows	Terrestrial	Modified
E2.5	Meadows of the steppe zone	Terrestrial	Natural
E3.4	Moist or wet eutrophic and mesotrophic grassland	Terrestrial	Natural
E4.4	Calciphilous alpine and subalpine grassland	Terrestrial	Natural
E6.2	Continental inland saline grass and herb-dominated habitats	Terrestrial	Natural
F2.2	Evergreen alpine and subalpine heath and scrub	Terrestrial	Natural
F5.3	Pseudomaquis	Terrestrial	Natural
G1.1	Riparian [Salix], [Alnus] and [Betula] woodland	Terrestrial	Natural
G1.3	Mediterranean [Populus], [Fraxinus], [Ulmus] and related riparian woodland	Terrestrial	Natural
G1.7	Thermophilous deciduous woodland	Terrestrial	Natural
G1.9	Non-riverine woodland with [Betula], [Populus tremula], [Sorbus aucuparia] or [Corylus avellana]	Terrestrial	Natural
G1.A	Meso- and eutrophic [Quercus], [Carpinus], [Fraxinus], [Acer], [Tilia], [Ulmus] and related woodland	Terrestrial	Natural
G1.C	Highly artificial broadleaved deciduous forestry plantations	Terrestrial	Modified
G2.1	Mediterranean evergreen [Quercus] woodland	Terrestrial	Natural

EUNIS Code	EUNIS Name	Terrestrial/ Freshwater	Natural/ Modified
G3.4	[Pinus sylvestris] woodland south of the taiga	Terrestrial	Natural
G3.5	[Pinus nigra] woodland	Terrestrial	Natural
G3.75	[Pinus brutia] forests	Terrestrial	Natural
G3.9	Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]	Terrestrial	Natural
G3.F	Highly artificial coniferous plantations	Terrestrial	Modified
G4.B	Mixed mediterranean [Pinus] - thermophilous [Quercus] woodland	Terrestrial	Natural
G5.1	Lines of trees	Terrestrial	Modified
I1.1	Intensive unmixed crops	Terrestrial	Modified
I1.2	Mixed crops of market gardens and horticulture	Terrestrial	Modified
I1.4	Inundated or inundatable croplands, including rice fields	Terrestrial	Modified
J1.2	Residential buildings of villages and urban peripheries	Terrestrial	Modified
J1.4	Urban and suburban industrial and commercial sites still in active use	Terrestrial	Modified
J2.3	Rural industrial and commercial sites still in active use	Terrestrial	Modified
J2.43	Greenhouses	Terrestrial	Modified
J2.6	Disused rural constructions	Terrestrial	Modified
J3	Extractive industrial sites	Terrestrial	Modified
J4.2	Road networks	Terrestrial	Modified
J4.6	Pavements and recreation areas	Terrestrial	Modified
J4.7	Constructed parts of cemeteries	Terrestrial	Modified
J5.4	Highly artificial non-saline running waters	Freshwater	Modified
J5.5	Highly artificial non-saline fountains and cascades	Freshwater	Modified
X18	Wooded steppe	Terrestrial	Natural

Table 3: River classification criteria and *a* value for the crossings

Class Code	Dimentional class
RVX1	Large River, width > 30m
RVX2	River, 10m < width < 30m
RVX3	Stream, 3m < width < 10m
RVX4	Small Stream, width < 3m
RVX5	Ditch, width > 5m
RVX6	Concrete Channel
RVX7	Ditch, width < 5m

6.1.2 Habitat degradation (*d*)

Natural habitats present in the LSA and at potential offset sites are characterized by different levels of anthropogenic and/or natural disturbance. In order to take pre-existing disturbance into account, a habitat degradation variable, *d,* was incorporated into the biodiversity value equation.

The *d* value represents the average degradation level of a natural habitat type within an ecoregion. This coefficient varies from 1, representing undisturbed habitat in its natural state, to 0.2, representing very high anthropogenic and/or natural disturbance (Table 4).

The *d* score was assigned to each natural ecosystem type in each ecoregion based on the evaluation of the qualitative information on disturbance level and types presented within the BAP. In addition, the data of the ecological Monitoring Reports of the Baku-Tbilisi-Ceyhan Pipeline (BTC) Project[2] were also reviewed: no quantitative information for *d* was available in BTC reports, but the qualitative information of the ongoing degradation processes (e.g. high pressure from grazing, erosion) was used as a guide to address the *d* value (see Section 6.1.5 for better description).

In order to apply a precautionary approach, whenever for a specific habitat only limited information were available the *d* value was set at 1.

Finally, a single average score was proposed for each EUNIS habitat type in each ecoregion. The complete set of values used is provided in APPENDIX B.

Further monitoring along the pipeline route is suggested to confirm or adjust the estimated average degradation level for each habitat and ecoregion.

Table 4: Natural habitats degradation levels and relative *d* score

Degradation level	*d* score
Very high anthropogenic and/or natural disturbance	0.2
High anthropogenic and/or natural disturbance	0.4
Medium anthropogenic and/or natural disturbance	0.6
Low anthropogenic and/or natural disturbance	0.8
Undisturbed natural habitat	1

6.1.3 Species of Conservation Concern and Habitat Suitability (*s*)

Within the TANAP ESIA, lists of fauna and flora species observed or potentially present in the Project area were created and Species of Conservation Concern (referred to as SCC) were preliminary identified. The SCCs were further reviewed according to additional studies performed within the Biodiversity Action Plan (BAP, 2017) and improved for the purpose of the Biodiversity Offset Strategy.

SCCs are defined as the most sensitive species from both a protection and a threat point of view observed or potentially present in the TANAP Project area. They have been selected according to the following criteria:

- threatened species according to IUCN Red Lists (CR, EN, VU status);
- threatened species according to Turkish Red Lists (CR, EN, VU status);
- species listed in the Bern Convention;

[2] BTC Project - Annual Ecological Monitoring Reports (from 2006 to 2016). The data provided in BTC reports are confidential and used for the solely purposes of this BOS.

- species listed in the CITES;
- species listed in the Bonn Convention;
- endemic and restricted-range species;
- species rare and decreasing in the Project area according to local expert evaluation.

The sources of information used to finalize the SCCs lists are:

- global IUCN Red List of Threatened species (version 2017-1);
- Red Data Book of Turkish Plants (Ekim et al., 2000);
- Red Data Book for butterflies in Turkey (Karaçetin, 2011);
- BAP data;
- TANAP ESIA (Document n. TNP-REP-ENV-GEN-002);
- local experts (botanists and zoologists) judgement.

A total of 101 SCC species were identified, including 54 species of terrestrial flora, 39 species of terrestrial fauna (7 mammal, 6 bird, 5 reptile, 1 amphibian and 20 arthropod species) and 8 species of freshwater fauna. All the species identified as SCC are considered threatened, endemic or restricted range.

The lists of terrestrial and freshwater SCC species identified are available in Appendix C.

To assess the distribution areas of each SCC within the LSA, data provided in the BAP were used. Additional data were collected through species specific desktop review and consultations with local experts in order to identify with a higher level of definition the potential distribution ranges of the SCC. Disjointed and patchy distribution ranges were also considered.

Since within a distribution area more habitats occur, each species does not use the entire distribution area in the same way. This is because each habitat presents different levels of suitability for each species.

Based on this, a suitability value has been assigned to each EUNIS habitat, defining the likelihood of a species to occur in each habitat within its distribution range. The value ranges between 0 and 1 and it is assigned to each habitat type according to the criteria described in Table 5. The lists of SCC species identified and the associated suitability values are available in APPENDIX D.

Table 5: Habitat suitability for SCCs and relative *s* score

Suitability level	Description	*s* score
Null	The species in unlikely to occur in the habitat.	0
Low suitability	The species occurs in the habitat only irregularly or infrequently, or only a small proportion of individuals is found in the habitat.	0.33
Medium suitability	The species occurs in the habitat regularly or frequently.	0.66
High suitability	The habitat is suitable and important for the survival of the species, either because it has an absolute requirement for the habitat at some point in its life cycle (e.g. for breeding or as a critical food source), or it is the primary habitat (or one of two primary habitats) within which the species usually occurs or within which most individuals occurs.	1

6.1.4 Significant Conservation Area (*p*)

For the identification of Significant Conservation Areas (SCA), both IFC Performance Standard 6 (IFC, 2013) and EBRD Performance Requirements 6 (EBRD 2014) were applied.

SCAs are defined by the following criteria:

- threatened habitats: these habitats are identified by presence of habitat considered threatened by the "European Red List of Habitats". These areas are considered as PBF (Criterion I, EBRD 2014):
  - E2.1 Permanent mesotrophic pastures and aftermath-grazed meadows : vulnerable (VU)
  - E3.4 Moist or wet eutrophic and mesotrophic grassland : endangered (EN)
  - E6.2 Continental inland saline grass and herb-dominated habitats: vulnerable (VU)
  - G1.3 Mediterranean [Populus], [Fraxinus], [Ulmus] and related riparian woodland: vulnerable (VU)
- significant biodiversity features identified by a broad set of stakeholders or governments: areas identified as Key Biodiversity Areas (KBA), Important Plant Areas (IPA) or Important Bird Areas (IBA) were considered under this criterion. These areas are considered as PBF (Criterion III, EBRD 2014)
- habitat supporting globally significant concentrations of migratory species and/or congregatory species: areas identified as or Important Bird Areas (IBA) were identified under this criterion. These areas are considered as Critical Habitats (Criterion III, IFC 2012; Criterion IV, EBRD 2014);
- highly threatened and/or unique ecosystems: the presence of protected areas was identified under this criterion. These areas are considered as Critical Habitats (Criterion IV, IFC 2012; Criterion I, EBRD 2014);
- areas associated with key evolutionary processes: the following habitats were identified since they are characterized by plant communities with an high percentage of rare and endemic species. These areas are considered as Critical Habitat (Criterion V, IFC 2012; Criterion V, EBRD 2014):
  - E1.00 Anatolian Gypsum Steppes
  - E1.2B Serpentine steppes

A score (*p*) is assigned to each SCA according to the criteria under which the area is considered in order to reflect its conservation significance. The scope ranges between 0 and 1. If an area correspond to multiple criteria (e.g. a patch correspond to a KBA, an IBA and also E1.00 Anatolian Gypsum Steppes habitat) the biodiversity value equation counts the area multiple times applying different *p* scores.

Table 6: Significant Conservation Areas (SCA) types and relative *p* score

SCA type	IFC Criteria	EBRD Criteria	PBF/CH	*p* score
Threatened habitat	-	Criterion I	PBF	0.2
Significant biodiversity features	-	Criterion III	PBF	0.4
Areas associated with key evolutionary processes	Criterion V	Criterion V	CH	0.6
Globally significant concentrations of migratory species and/or congregatory species	Criterion III	Criterion IV	CH	0.8
Highly threatened and/or unique ecosystems	Criterion IV	Criterion I	CH	1

6.1.5 Estimated rehabilitation success (*R*)

The residual effect quantification considers the benefits of rehabilitation activities identified in the BAP. The estimated rehabilitation success (*R*) is considered at 20 years from the beginning of rehabilitation activities. This temporal scale was set as the most realistic timeframe for most of the habitats considered to recover from disturbance (e.g. steppe habitats), although restoration is likely to continue beyond this timeframe (e.g. forest habitats). A study conducted by Wilson et al. (2011) in four native dominant habitat types occurring in California which has comparable climatic conditions to Turkey (coastal sage scrub, grasslands, chaparral and oak-sycamore woodland), showed that after 20 years over a half of the sites requiring restoration are likely to be successfully restored.

R is defined as recovery of habitat functionality and species composition compared to pre-disturbance levels at 20 years from the beginning of rehabilitation activities. *R* can vary from 1 (full rehabilitation) to 0 (complete habitat loss).

Different *R* values were estimated for each habitat type and Project footprint type using the approach and the available information described below. The Project footprint types and associated R are listed below:

- permanent associated facilities: R_0
- temporary associated facilities: R_t
- pipeline ROW: R_f

The EUNIS habitats present under the footprint of "permanent associated facilities" will not be rehabilitated, therefore R_0 is considered equal to 0 for all EUNIS habitat types.

The EUNIS habitats present under "temporary associated facilities" are expected to be completely or partially rehabilitated at 20 years depending on their habitat type. This is rehabilitation value is expressed as R_t.

The identification of the R_t value is based on a revision of rehabilitation activities identified in the BAP, and in particular in Annex 6.1 "Specification of Reinstatement" (WRP-SPC-EGG-PLG-001), on literature review and local expert opinion.

The results of BTC monitoring reports[3] from 2006 to 2016 were also reviewed and analysed. The BTC pipeline runs approximately in parallel to the TANAP Project for about 685 km from the Georgian border to approximately the city of Ekinli, then BTC pipelines runs southward to Ceyhan city. BTC construction was completed in 2005 and vegetation monitoring activities started in 2006 using 119 transects, to determine the success of the trend in vegetation re-growth on the pipeline ROW. For this purpose, along each transect, 1x1 m sampling quadrats were located "on-ROW" (i.e. representing the disturbed habitats), and 1x1 m quadrats were located "off-ROW" (i.e. representing the "pre-disturbance" status of the same habitat type). Based on these data, for years between 2006 and 2016, it was possible to calculate, for each habitat type, the average vegetation cover in each quadrat and the species commonality between the on-RoW and the off-RoW quadrats.

In particular, to incorporate BTC data within the *R*t determination, vegetation cover trend within the on-ROW quadrats for each habitat type were compared to the vegetation cover trend of the same habitat type in the same years within the off-ROW quadrats. This comparison allowed to infer the rehabilitation degree in the vegetation cover over 10 years (from 2006 to 2016) and to connect the trend with the EUNIS habitat types identified for the TANAP Project. Also, the information regarding the species commonality between the on-ROW and off-ROW quadrats were considered. Vegetation cover and species commonality data do not allow to directly quantify the rehabilitation success of a habitat but they can be used as an indication of rehabilitation success.

In order to apply a precautionary approach, whenever for a specific habitat multiple information sources or discording judgements from experts were available, the lowest R_t value was used.

The R_f values of the EUNIS habitats affected by the "pipeline ROW" of 36 m are similar to those calculated for R_t. The only difference is expected to be in forested areas (EUNIS habitat starting with G). In these areas, the pipeline ROW to be cleared of vegetation was reduced at 30 m wide. During rehabilitation the first 6 m on each side of the pipeline will only be seeded and no tree will be allowed to grow due to H&S reason. The next remaining 18 m on each side will be reforested using tree species appropriate for the ecoregion and habitat

[3] BTC Project - Annual Ecological Monitoring Reports (from 2006 to 2016). The data provided in BTC reports are confidential and used for the solely purposes of this BOS.

type to be rehabilitated. The remaining 6 m of the 36m ROW will remain untouched. Therefore, in forest habitat the R_f value was adjusted using the following formula.

$$R_f = (R_0) * \frac{12}{36} + (R_t) * \frac{18}{36} + 1 * \frac{6}{36}$$

The R values estimated for each habitat type according to the methodology described above are showed in

Table 7. Further studies on existing pipelines are suggested during the next two years to confirm or modify the estimated rehabilitation success at 20 years. A detailed methodology for this studied will be elaborated within the scope of the Biodiversity Offset Management Plan.

Table 7: Estimated rehabilitation success score at 20 years (R) for each EUNIS habitat type

EUNIS Code	EUNIS description	R_t	R_f	R_0
B1.8	Moist and wet dune slacks	1	1	0
B2.2	Unvegetated mobile shingle beaches above the driftline	1	1	0
B3.3	Rock cliffs, ledges and shores, with halophytic angiosperms	1	1	0
C1.2	Permanent mesotrophic lakes, ponds and pools	1	1	0
C1.6	Temporary lakes, ponds and pools (wet phase)	1	1	0
C2.2	Permanent non-tidal, fast, turbulent watercourses	1	1	0
C2.3	Permanent non-tidal, slow, smooth-flowing watercourses	1	1	0
C2.5	Temporary running waters	1	1	0
C3.6	Unvegetated or sparsely vegetated shores with soft or mobile sediments	1	1	0
E1.00	Anatolian Gypsum Steppes	0.8	0.8	0
E1.01	Anatolian Marl Steppes	0.8	0.8	0
E1.22	Arid subcontinental steppic grassland ([Festucion valesiacae])	0.8	0.8	0
E1.2B	Serpentine steppes	0.8	0.8	0
E1.2E	Irano-Anatolian steppes	0.8	0.8	0
E2.1	Permanent mesotrophic pastures and aftermath-grazed meadows	1	1	0
E2.5	Meadows of the steppe zone	1	1	0
E3.4	Moist or wet eutrophic and mesotrophic grassland	1	1	0
E4.4	Calciphilous alpine and subalpine grassland	0.8	0.8	0
E6.2	Continental inland saline grass and herb-dominated habitats	0.7	0.7	0
F2.2	Evergreen alpine and subalpine heath and scrub	0.7	0.7	0
F5.3	Pseudomaquis	1	1	0
G1.1	Riparian [Salix], [Alnus] and [Betula] woodland	0.8	0.6	0
G1.3	Mediterranean [Populus], [Fraxinus], [Ulmus] and related riparian woodland	0.7	0.5	0
G1.7	Thermophilous deciduous woodland	0.7	0.5	0
G1.9	Non-riverine woodland with [Betula], [Populus tremula], [Sorbus aucuparia] or [Corylus avellana]	0.7	0.5	0
G1.A	Meso- and eutrophic [Quercus], [Carpinus], [Fraxinus], [Acer], [Tilia], [Ulmus] and related woodland	0.7	0.5	0
G1.C	Highly artificial broadleaved deciduous forestry plantations	1	0.7	0

EUNIS Code	EUNIS description	R_t	R_f	R_0
G2.1	Mediterranean evergreen [Quercus] woodland	0.7	0.5	0
G3.4	[Pinus sylvestris] woodland south of the taiga	0.7	0.5	0
G3.5	[Pinus nigra] woodland	0.7	0.5	0
G3.75	[Pinus brutia] forests	0.7	0.5	0
G3.9	Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]	0.6	0.5	0
G3.F	Highly artificial coniferous plantations	1	0.7	0
G4.B	Mixed mediterranean [Pinus] - thermophilous [Quercus] woodland	0.7	0.5	0
G5.1	Lines of trees	1	0.7	0
I1.1	Intensive unmixed crops	1	1	0
I1.2	Mixed crops of market gardens and horticulture	1	1	0
I1.4	Inundated or inundatable croplands, including rice fields	1	1	0
J1.2	Residential buildings of villages and urban peripheries	1	1	0
J1.4	Urban and suburban industrial and commercial sites still in active use	1	1	0
J2.3	Rural industrial and commercial sites still in active use	1	1	0
J2.43	Greenhouses	1	1	0
J2.6	Disused rural constructions	1	1	0
J3	Extractive industrial sites	1	1	0
J4.2	Road networks	1	1	0
J4.6	Pavements and recreation areas	1	1	0
J4.7	Constructed parts of cemeteries	1	1	0
J5.4	Highly artificial non-saline running waters	1	1	0
J5.5	Highly artificial non-saline fountains and cascades	1	1	0
X18	Wooded steppe	0.8	0.8	0

6.2 Results of residual effect calculation

The footprints of “pipeline ROW”, “permanent associated facilities” and “temporary associated facilities” were considered in the quantification.

In the following sections both the net loss of habitat in hectares (*Ha*) and the net loss of biodiversity values (V_h) are presented for each EUNIS habitat type and for each ecoregion.

Critical Habitats (CH) and Priority Biodiversity Features (PBF)/ Natural habitats (NH) were calculated separately since they have different offset requirements. In fact, the offset planned for CH need to ensure a Net Gain, while for PBF and Natural Habitats (NH) only a No Net Loss is required. In case of an overlap of CH, PBF or NH criteria, the areas was categorized CH since it is the one with the highest offset requirements.

6.2.1 Net loss of habitat in hectares (*Ha*)

The net loss of habitat in hectares (*Ha*) was calculated after mitigation measures (avoidance, minimization, rehabilitation) at 20 years using the equation in section 5.2.

The results of the net loss calculation for CH and for PBF/NH are displayed in Table 8 for each EUNIS habitat type and ecoregion.

6.2.2 Net loss of Biodiversity Value (V_h)

The net loss of biodiversity value (V_h) was calculated after mitigation measures (avoidance, minimization, rehabilitation) at 20 years using the equation in section 5.1.

The results of the net loss calculation for CH and for PBF/NH are displayed in Table 9 for each EUNIS habitat type and ecoregion.

Table 8: Net loss of habitat in hectares (*Ha*) for Critical Habitat (CH) and for Natural Habitat and Priority Biodiversity Features (PBF/NH)

EUNIS Code*	Natural (N) Modified (M)	Ecoregions**																				Overall Total
		PA0404		PA0408		PA0410		PA0420		PA0515		PA0803		PA0805		PA1201		PA1202		**Total**		
		CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	
C2.5	N	-	-	-	0,12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*0,12*	***0,12***
E1.00	N	-	-	-	-	8,53	-	0,06	-	10,29	-	0,49	-	-	-	-	-	0,56	-	*19,92*	-	***19,92***
E1.01	N	-	-	-	-	0,65	-	-	-	-	-	2,33	-	-	-	-	-	0,86	1,29	*3,84*	*1,29*	***5,13***
E1.22	N	-	0,45	-	-	-	-	-	-	-	-	-	-	-	-	0,33	0,89	0,03	12,51	*0,35*	*13,84*	***14,20***
E1.2B	N	-	-	-	-	-	-	-	-	11,61	-	-	-	-	-	-	-	-	-	*11,61*	-	***11,61***
E1.2E	N	-	-	5,99	-	7,93	15,48	41,74	-	84,10	5,02	-	0,69	13,39	-	-	-	0,04	17,49	*153,19*	*38,68*	***191,86***
E2.1	M	-	-	66,75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*66,75*	-	***66,75***
E4.4	N	-	-	54,05	-	-	-	-	-	-	-	-	-	7,10	-	-	-	-	-	*61,16*	-	***61,16***
E6.2	N	-	-	-	-	-	-	-	-	-	-	-	-	2,17	-	-	-	-	-	*2,17*	-	***2,17***
F2.2	N	-	-	-	-	-	-	-	-	0,21	-	-	-	-	-	-	-	-	-	*0,21*	-	***0,21***
G1.1	N	-	-	0,49	-	-	-	-	-	-	-	-	-	0,45	-	-	-	-	-	*0,93*	-	***0,93***
G1.3	N	-	0,68	-	-	0,64	1,26	4,01	-	2,98	0,90	-	0,38	1,63	-	0,07	0,61	0,05	3,23	*9,39*	*7,06*	***16,45***
G1.7	N	-	-	-	-	-	0,17	3,71	-	9,76	0,37	-	-	-	-	-	2,91	11,13	50,61	*24,60*	*54,06*	***78,65***
G1.9	M	-	-	4,13	-	-	-	-	-	0,38	-	-	-	-	-	-	-	-	-	*4,52*	-	***4,52***
G1.A	N	-	-	5,45	-	-	-	-	-	-	-	-	-	5,31	-	-	-	-	-	*10,76*	-	***10,76***
G1.C	M	-	-	-	-	0,04	-	-	-	0,04	-	-	-	-	-	-	-	-	-	*0,08*	-	***0,08***
G2.1	N	0,19	0,56	-	-	-	-	-	-	-	-	-	-	-	-	0,12	4,50	-	0,15	*0,30*	*5,20*	***5,50***
G3.4	N	-	-	7,91	-	-	-	-	-	8,61	10,72	-	-	-	-	-	-	-	-	*16,51*	*10,72*	***27,24***
G3.5	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,27	26,31	*2,27*	*26,31*	***28,58***
G3.75	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,97	2,27	0,08	*2,27*	*5,05*	***7,32***
G3.9	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,15	-	*0,15*	***0,15***
G3.F	M	-	-	5,58	-	-	-	-	-	7,80	-	-	-	1,14	-	0,57	5,85	2,53	6,91	*17,61*	*12,75*	***30,37***
G4.B	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,50	11,14	*5,50*	*11,14*	***16,65***
G5.1	M	-	-	-	-	-	-	-	-	-	-	-	-	2,08	-	-	-	0,14	0,74	*2,21*	*0,74*	***2,96***
I1.1	M	16,19	-	-	0,72	14,48	-	1,24	-	50,22	-	1,73	-	39,64	-	8,06	-	145,35	-	*276,91*	*0,72*	***277,63***
I1.4	M	3,04	-	-	-	-	-	-	-	-	-	-	-	-	-	0,65	-	-	-	*3,69*	-	***3,69***
J5.4	M	-	0,02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*0,02*	***0,02***
X18	N	-	-	-	-	-	-	0,21	-	3,26	0,63	-	0,14	0,27	-	-	-	0,30	5,27	*4,05*	*6,04*	***10,08***
Total		*19,42*	*1,70*	*150,35*	*0,83*	*32,26*	*16,91*	*50,97*	*0,00*	*189,27*	*17,64*	*4,55*	*1,21*	*73,18*	*0,00*	*9,79*	*19,72*	*171,03*	*135,88*	***700,82***	***193,90***	***894,72***
Overall total			***21,13***		***151,18***		***49,17***		***50,97***		***206,91***		***5,76***		***73,18***		***29,51***		***306,90***			

Table 9: Net loss of biodiversity value (Vh) for Critical Habitat (CH) and for Natural Habitat and Priority Biodiversity Features (PBF/NH)

EUNIS Code*	Natural/ Modified	Ecoregions**																				Overall Total
		PA0404		PA0408		PA0410		PA0420		PA0515		PA0803		PA0805		PA1201		PA1202		**Total**		
		CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	CH	PBF/NH	
C2.5	N	-	-	-	0,12	-	-	-	-	0,01	-	-	-	-	-	-	-	-	-	*0,01*	*0,12*	***0,13***
E1.00	N	-	-	-	-	67,03	-	0,17	-	98,28	-	2,13	-	-	-	-	-	1,77	-	*169,36*	-	***169,36***
E1.01	N	-	-	-	-	2,35	-	-	-	-	-	9,85	-	-	-	-	-	4,67	3,76	*16,87*	*3,76*	***20,62***
E1.22	N	-	0,89	-	-	-	-	-	-	-	-	-	-	-	-	0,92	1,95	0,07	27,45	*0,99*	*30,29*	***31,28***
E1.2B	N	-	-	-	-	-	-	-	-	59,30	-	-	-	-	-	-	-	-	-	*59,30*	-	***59,30***
E1.2E	N	-	-	11,37	-	26,83	48,76	118,77	-	370,85	14,99	-	2,20	46,24	-	-	-	0,11	44,17	*574,16*	*110,12*	***684,28***
E2.1	M	-	-	148,77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*148,77*	-	***148,77***
E4.4	N	-	-	217,81	-	-	-	-	-	-	-	-	-	25,19	-	-	-	-	-	*243,00*	-	***243,00***
E6.2	N	-	-	-	-	-	-	-	-	-	-	-	-	5,12	-	-	-	-	-	*5,12*	-	***5,12***
F2.2	N	-	-	-	-	-	-	-	-	0,82	-	-	-	-	-	-	-	-	-	*0,82*	-	***0,82***
G1.1	N	-	-	1,79	-	-	-	-	-	-	-	-	-	1,78	-	-	-	-	-	*3,57*	-	***3,57***
G1.3	N	-	2,11	-	-	2,69	4,00	14,08	-	12,60	2,82	-	1,20	5,74	-	0,35	2,60	0,28	14,25	*35,74*	*26,98*	***62,72***
G1.7	N	-	-	-	-	-	0,36	9,10	-	32,76	0,78	-	-	-	-	-	9,23	41,56	157,02	*83,42*	*167,39*	***250,82***
G1.9	N	-	-	22,50	-	-	-	-	-	1,02	-	-	-	-	-	-	-	-	-	*23,52*	-	***23,52***
G1.A	N	-	-	14,33	-	-	-	-	-	-	-	-	-	21,47	-	-	-	-	-	*35,80*	-	***35,81***
G1.C	M	-	-	-	-	0,11	-	-	-	0,10	-	-	-	-	-	-	-	-	-	*0,21*	-	***0,21***
G2.1	N	0,59	1,42	-	-	-	-	-	-	-	-	-	-	-	-	0,34	12,55	-	0,44	*0,93*	*14,41*	***15,35***
G3.4	N	-	-	44,74	-	-	-	-	-	49,23	36,32	-	-	-	-	-	-	-	-	*93,97*	*36,32*	***130,29***
G3.5	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10,31	76,77	*10,31*	*76,77*	***87,07***
G3.75	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14,81	10,52	0,24	*10,52*	*15,04*	***25,57***
G3.9	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,26	-	*0,26*	***0,26***
G3.F	M	-	-	27,56	-	-	-	-	-	31,46	-	-	-	2,87	-	1,69	15,49	6,77	18,30	*70,35*	*33,79*	***104,15***
G4.B	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28,31	40,56	*28,31*	*40,56*	***68,87***
G5.1	M	-	-	-	-	-	-	-	-	-	-	-	-	4,84	-	-	-	0,46	1,80	*5,30*	*1,80*	***7,09***
I1.1	M	42,91	-	-	1,00	38,64	-	2,67	-	116,91	-	4,87	-	100,64	-	28,88	-	403,94	-	*739,45*	*1,00*	***740,46***
I1.4	M	7,06	-	-	-	-	-	-	-	-	-	-	-	-	-	1,51	-	-	-	*8,57*	-	***8,57***
J5.4	M	-	0,04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*0,04*	***0,04***
X18	N	-	-	-	-	-	-	0,56	-	13,84	1,85	-	0,48	0,72	-	-	-	1,27	15,25	*16,39*	*17,58*	***33,97***
	Total	*50,56*	*4,47*	*488,87*	*1,12*	*137,65*	*53,12*	*145,35*	*0,00*	*787,18*	*56,76*	*16,85*	*3,88*	*214,59*	*0,00*	*33,69*	*56,64*	*510,03*	*400,25*	***2384,76***	***576,24***	***2961,00***
	Overall total		***55,03***		***489,99***		***190,77***		***145,35***		***843,94***		***20,73***		***214,60***		***90,33***		***910,27***			

EUNIS Code*:

Freshwater Natural Habitat:

C2.5 Temporary running waters

Freshwater Modified Habitat:

J5.4 Highly artificial non-saline running waters

Terrestrial Modified Habitat:

E2.1 Permanent mesotrophic pastures and aftermath-grazed meadows
G1.C Highly artificial broadleaved deciduous forestry plantations
G3.F Highly artificial coniferous plantations
G5.1 Lines of trees
I1.1 Intensive unmixed crops
I1.4 Inundated or inundatable croplands, including rice fields

Terrestrial Natural Habitat:

E1.00 Anatolian Gypsum Steppes
E1.01 Anatolian Marl Steppes
E1.22 Arid subcontinental steppic grassland ([Festucion valesiacae])
E1.2B Serpentine steppes
E1.2E Irano-Anatolian steppes
E4.4 Calciphilous alpine and subalpine grassland
E6.2 Continental inland saline grass and herb-dominated habitats
F2.2 Evergreen alpine and subalpine heath and scrub
G1.1 Riparian [Salix], [Alnus] and [Betula] woodland
G1.3 Mediterranean [Populus], [Fraxinus], [Ulmus] and related riparian woodland
G1.7 Thermophilous deciduous woodland
G1.9 Non-riverine woodland with [Betula], [Populus tremula], [Sorbus aucuparia] or [Corylus avellana]
G1.A Meso- and eutrophic [Quercus], [Carpinus], [Fraxinus], [Acer], [Tilia], [Ulmus] and related woodland
G2.1 Mediterranean evergreen [Quercus] woodland
G3.4 [Pinus sylvestris] woodland south of the taiga
G3.5 [Pinus nigra] woodland
G3.75 [Pinus brutia] forests
G3.9 Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]
G4.B Mixed mediterranean [Pinus] - thermophilous [Quercus] woodland
X18 Wooded steppe

Ecoregions:**

PA0404 Balkan Mixed Forests
PA0408 Caucasus Mixed Forests
PA0410 Central Anatolian Steppe And Woodlands
PA0420 Eastern Anatolian Deciduous Forests
PA0515 Northern Anatolian Conifer And Deciduous Forests
PA0803 Central Anatolian Steppe
PA0805 Eastern Anatolian Montane Steppe
PA1201 Aegean And Western Turkey Sclerophyllous And Mixed Forests
PA1202 Anatolian Conifer And Deciduous Mixed Forests

6.3 Limitations of the residual effects quantification

The residual effects quantification presented in the previous sections are a surrogate measure for residual effects quantification using ecosystems to cover biodiversity in a broad sense.

As already mentioned in the methodological chapter there are some limitations to the calculation of the residual effects. These uncertainties can be reduced by further field studies to be carried out during the preparation of the Biodiversity Offset Management Plan. The main limitations are discussed below:

- habitat degradation (d): degradation levels of habitats within each ecoregion were defined using a precautionary approach from the available information present in literature review, BTC ecological monitoring reports and in the BAP.
- estimated rehabilitation success (R): the identification of the rehabilitation coefficients at 20 years was based on a revision of available information in literature review, BTC ecological monitoring reports and in the ESIA and BAP reinstatement activities.

These data presented the following uncertainties:

- limited general information about rehabilitation and degradation on these habitats was present in literature;
- to retrieve additional information, an attempt was done to use data from BTC Project ecological monitoring reports. As a result of the assessment, those data were used in the present Strategy only as a qualitative comparison because BTC available information was not directly comparable with the TANAP framework, namely for the following reasons:
  - BTC Project has a different geographical extent than TANAP Project, in fact the two ROWs run in parallel for the first 680 km of the TANAP route (about 1/3 of the entire TANAP length);
  - the habitat definition in BTC Project in not based on EUNIS classification or other standardized systems, therefore the habitat association between the two projects could be subject to different interpretation,
  - the assessment of degradation in the BTC and in the BAP was not performed in a systematic way and only few qualitative descriptions or general statements are reported for some of the habitats;
  - regarding the definition of rehabilitation success, BTC ecological monitoring was based on the assessment of vegetation cover and species commonality. These data do not allow to directly quantify the rehabilitation success of a habitat but they can be used as a broad indication.

Given the above uncertainties the *d* and *R* values were identified based on expert judgement and then discussed and confirmed by the biodiversity local experts who conducted the ESIA baseline studies.

To overcome the above limitations, it is recommended to perform further field studies in order to refine the parameters of the model set out in Section 5. A detailed methodology for these studies (e.g. locations, methods, timing) will be elaborated and data to be collected include:

- **baseline values for degradation (*d*)**. These field studies will aim at verifying the degradation values estimated in the present model by collecting relevant data in a selected sample of habitat patches for key EUNIS habitat types adjacent to the TANAP ROW. A set of criteria for assigning these scores precisely in the field will be developed.

- **rehabilitation success values (*R*).** These field studies will aim at verifying the rehabilitation success values estimated in the present model by collecting relevant data on the rehabilitation success in a selected sample of rehabilitated habitats along the BTC ROW (or other similar projects present in the vicinity of the TANAP project) and based on the result of TANAP ongoing monitoring. A set of criteria for assigning these scores precisely in the field will be developed.
- **Watercourses classified as RVX**4. Small watercourses can have significant ecological value for certain species of fish particularly during the spawning season. The importance of smaller and seasonal watercourses for the freshwater SCCs will be further assessed through dedicated studies.

Once refined *R* and *d* values are available, the offset accounting calculation will be run again in 2018/2019. This will assist TANAP in reassessing the residual effects and help to refine the selection of appropriate offset activities and locations (within and outside of the LSA). Since a precautionary approach was used in the calculations described in the present report, the results of new runs of calculation will likely help TANAP to decrease the residual effects and possibly reduce the offset requirements.

7.0 ADDITIONAL CONSIDERATIONS ON THE SPECIES OF HIGHEST CONSERVATION CONCERN

The rationale of the Offset Accounting Methodology (Section 5.0) is based on a habitat approach. However, a certain number of SCCs present a higher conservation risk and might face a concrete risk of extinction during the 20 year habitat rehabilitation framework considered in the present strategy.

Therefore for these species, hereinafter referred to as “target species”, a separate assessment has been conducted considering the loss of suitable habitat without taking into account the effects of the rehabilitation activities. This theoretical worst case scenario considers both the potential ineffectiveness of the rehabilitation activities for target species or the fact that they could become effective at a time when the species have declined below a critical threshold.

This target species were selected based on three main criteria:

1) greatest conservation concern: within this criterion, species assessed as Critically Endangered (CR) by the IUCN Red List of Threatened species were considered;
2) restricted distribution: this criterion considers species with a geographically restricted area of distribution and thought to be at higher risk of extinction due to habitat loss or change;
3) low mobility: this criterion takes into account slow species that often cannot reach all available habitats despite the presence of continuous paths to them. Slow-moving species might face a higher risk of extinction due to cumulative effects of habitat patch destruction and the failure to colonize newly created habitat.

In addition to the above criteria, the expert judgement and consideration of some life traits were used to guide the final selection of target species.

A list of the target species is given in the following Table 10. A total of 15 target species were identified, of which 8 belonging to terrestrial flora, 4 to terrestrial fauna (2 reptile 1 amphibian and 1 arthropod) and 3 freshwater fauna species.

Table 10: Target species

SCC Type	Species Code	Species Name	IUCN status	Endemic
Terrestrial flora	TFL_007	*Alyssum dudleyi*	CR	Endemic / Restricted range
Terrestrial flora	TFL_011	*Astragalus aytatchii*	CR	Endemic / Restricted range
Terrestrial flora	TFL_020	*Cephalaria aytachii*	CR	Endemic / Restricted range

SCC Type	Species Code	Species Name	IUCN status	Endemic
Terrestrial flora	TFL_028	*Dianthus goekayi*	CR	Endemic / Restricted range
Terrestrial flora	TFL_031	*Gypsophila heteropoda subsp. minutiflora*	CR	Endemic / Restricted range
Terrestrial flora	TFL_032	*Gypsophila osmangaziensis*	CR	Endemic / Restricted range
Terrestrial flora	TFL_033	*Hieracium sarykamyschense*	CR	Endemic / Restricted range
Terrestrial flora	TFL_051	*Scutellaria yildirimli*	CR	Endemic / Restricted range
Terrestrial fauna	TFR_001	*Montivipera wagneri*	CR	Endemic / Restricted range
Terrestrial fauna	TFR_002	*Darevskia uzzelli*	EN	Endemic / Restricted range
Terrestrial fauna	TAM_002	*Mertensiella caucasica*	VU	Restricted range
Terrestrial fauna	TFA_009	*Polyommatus merhaba*	EN	Endemic
Freshwater fauna	FFF_004	*Anguilla anguilla*	CR	-
Freshwater fauna	FFF_008	*Cobitis puncticulata*	EN	Endemic
Freshwater fauna	FFF_019	*Oxynoemacheilus simavica*	CR	Endemic

For each target species the following calculation has been applied :

$$Sj = \sum_{i=1}^{n} (a_i * s_{ij} * d_i)$$

Sj = Direct loss of suitable habitat for a target species

a_i = The area of the i^{th} habitat patch.

d_i = The degradation coefficient of the i^{th} habitat patch (coefficient ranging from 0-1).

s_j = The habitat suitability score assigned to the i^{th} habitat patch for the j^{th} species of conservation concern (suitability score ranging from 0-1)

The results of the direct loss calculation are displayed in Table 11 for each target species and ecoregion.

Based on the magnitude of the potential direct loss of habitat suitability for each species, compared to their distribution range, the habitat approach proposed for the generality of the biodiversity values at stake, could not be sufficient to guarantee the target species conservation. In these cases, the identification of species specific offsets should be undertaken to achieve No Net Loss or Net Gain

The need to pursue species specific offsets and their identification will be discussed within the Biodiversity Offset Management Plan based on the monitoring results.

Table 11: Direct loss of suitable habitat (S) for target species

SCC Type	Species Code	Species	Ecoregions*									
			PA0404	PA0408	PA0410	PA0420	PA0515	PA0803	PA0805	PA1201	PA1202	Total
Terrestrial flora	TFL_007	*Alyssum dudleyi*	-	-	-	-	-	-	-	-	4,99	**4,99**
Terrestrial flora	TFL_011	*Astragalus aytatchii*	-	-	25	-	-	-	-	-	-	**25**
Terrestrial flora	TFL_020	*Cephalaria aytachii*	-	-	-	-	-	-	-	-	9,99	**9,99**
Terrestrial flora	TFL_028	*Dianthus goekayi*	-	-	-	-	-	-	-	-	2,32	**2,32**
Terrestrial flora	TFL_031	*Gypsophila heteropoda subsp. minutiflora*	-	-	45	-	29	-	-	-	-	**74**
Terrestrial flora	TFL_032	*Gypsophila osmangaziensis*	-	-	-	-	-	-	-	-	9,99	**9,99**
Terrestrial flora	TFL_033	*Hieracium sarykamyschense*	-	6	-	-	-	-	-	-	-	**6**
Terrestrial flora	TFL_051	*Scutellaria yildirimli*	-	-	-	-	-	5	-	-	1	**6**
Terrestrial fauna	TFR_001	*Montivipera wagneri*	-	-	-	-	-	-	1,99	-	-	**1,99**
Terrestrial fauna	TFR_002	*Darevskia uzzelli*	-	3,33	-	-	-	-	-	-	-	**3,33**
Terrestrial fauna	TAM_002	*Mertensiella caucasica*	-	-	-	-	-	-	10,32	-	-	**10,32**
Terrestrial fauna	TFA_009	*Polyommatus merhaba*	-	-	-	-	-	-	1	-	-	**1**
Freshwater fauna	FFF_004	*Anguilla anguilla*	-	-	-	-	-	-	-	0,99	1,98	**2,97**
Freshwater fauna	FFF_008	*Cobitis puncticulata*	-	-	-	-	-	-	-	-	5,94	**5,94**
Freshwater fauna	FFF_019	*Oxynoemacheilus simavica*	-	-	-	-	-	-	-	-	9,9	**9,9**

Ecoregions*:

PA0404 Balkan Mixed Forests
PA0408 Caucasus Mixed Forests
PA0410 Central Anatolian Steppe And Woodlands
PA0420 Eastern Anatolian Deciduous Forests
PA0515 Northern Anatolian Conifer And Deciduous Forests
PA0803 Central Anatolian Steppe
PA0805 Eastern Anatolian Montane Steppe
PA1201 Aegean And Western Turkey Sclerophyllous And Mixed Forests
PA1202 Anatolian Conifer And Deciduous Mixed Forests

8.0 OFFSET CONCEPTS AND TACTICS

Biodiversity offsets are measurable conservation outcomes that compensate for residual impacts of a development project after the first three steps of the mitigation hierarchy have been applied (BBOP 2013). Consequently, biodiversity offsets only need to be undertaken if avoidance, minimization, and rehabilitation cannot fully address adverse effects of a Project. In the case of the TANAP Project, the vast majority of footprint effects are expected to be adequately addressed by mitigation identified in the ESIA and BAP (e.g., through rehabilitation). However, this mitigation will not be sufficient to prevent residual adverse effects to biodiversity. Residual effects are predicted in both critical and natural habitats/priority biodiversity features (Section 6), and the biodiversity values associated with these residual impacts have been defined (Table 9). Consequently, offsets will be required to address these impacts.

This section of TANAP's Biodiversity Offset Strategy outlines some of the foundational principles, derived from international good practice, that guide offset identification and implementation (Section 7.1). Next the tactics that will be employed to achieve measureable conservation outcomes that will result in No Net Loss for natural habitats and priority biodiversity features and Net Gain or critical habitats are described, as follows:

- Identify and evaluate offset opportunities (Section 8.2).
- Prepare a Biodiversity Offset Management Plan (Section 8.3).

These tactics provide the technical foundation for identifying and implementing appropriate offsets from an ecological standpoint; they do not consider the social and political aspects of biodiversity offsets, which are equally important (BBOP 2009). Defining technically appropriate offset actions that will result in measurable conservation outcomes is critical so that No Net Loss or Net Gain can be clearly demonstrated with respect to the residual adverse effects of the TANAP Project. However, technically appropriate offsets may not be achievable without support from local stakeholders, other businesses, and politicians. Stakeholder engagement with the public, policy makers, and other interested parties is therefore a critical component of successful implementation of each of the tactics defined for the identification, evaluation, and implementation of biodiversity offsets. Stakeholder engagement is addressed in Section 8.

8.1 Principles

Offsets can be achieved through any action that creates a measureable conservation gain. The following concepts and principles provide the foundation for identifying and implementing offsets for the TANAP Project:

- **Offset requirements should be based on a reliable and transparent assessment of losses and gains.** Section 5.0 presents a method for calculating both losses and gains for the TANAP Project. The loss-gain accounting system for the TANAP Project has been set up in a GIS, and, provided necessary spatial information is available, this tool permits relatively easy iteration of the calculation to refine estimated residual effects of the Project as new information becomes available (e.g., the results of additional studies defined in Section 6.3.1) and to identify biodiversity gains associated with offsets.
- **Biodiversity gains should be measurable based on averting otherwise likely losses to biodiversity from other sources or by creating gains through action.** Gains can take the form of creating protected areas where biodiversity might otherwise be at risk, strengthening policy and management capacity within protected areas for which a conservation objective is not being met, arresting ongoing degradation caused by sources other than the Project, and improving the biodiversity value of degraded habitats through rehabilitation.
- **Offset should be commensurate to the magnitude of the impacts and should adhere to the "Like-for-like or better" principle**. Biodiversity offsets must be designed to conserve the same biodiversity values that are being impacted by the TANAP Project (i.e., an "in-kind" offset). For this reason, offsets will be targeted within the same ecoregion in which residual impacts occur (see Tables 10 and 11). Although a like-for-like approach is preferred, "out-of-kind" offset that involve "trading up" to benefit biodiversity that is of greater conservation concern relative to the biodiversity affected by the Project will also be considered (IFC PS6).

- **Offsets should be secured over the long-term and should be auditable**. The design and implementation of the biodiversity offsets developed for the TANAP Project should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that demonstrate No Net Loss or Net Gain and last at least as long as the TANAP Project's impacts, and preferably in perpetuity. To ensure that offsetting programmes will be appropriate and managed properly, the offset should be structured to be endurable and verifiable by an independent third party (ref to Section 4.0).

8.2 Identify and evaluate offset opportunities

The BAP already presents seven actions to reach the net gain. These actions have been incorporated in the offset mechanisms described in the following. Where necessary, the relevant references to the BAP are provided.

The first action that must be undertaken when executing this Biodiversity Offset Strategy is to identify opportunities to undertake actions that will result in measureable conservation gains to compensate for residual impacts of the TANAP Project.

The kinds of actions that should be considered include the following:

- ***Create protected areas where biodiversity might otherwise be at risk.*** This should be accomplished for instance working with regulators to achieve higher levels of protection of areas with currently no formal protection (e.g. KBAs).

- ***Strengthen policy and management capacity within protected areas for which a conservation objective is not being met under current conditions.*** TANAP should engage with the relevant authorities to support biodiversity programmes to achieve wider conservation goals, including e.g. connectivity of protected areas, measures aiming at achieving favourable conservation status of species threatened or protected, and continued ecological functionality measures.

- ***Arrest ongoing degradation of biodiversity caused by sources other than the Project.*** This is an action already identified in the BAP. TANAP should put in place voluntary agreements with landholders to protect or enhance biodiversity by regulating the use of the land in order to protect its biodiversity value. A consultation with the Ministry of Food, Agriculture and Livestock and Branch Offices should also be started.

- ***Improve the biodiversity value of degraded habitats through rehabilitation, invasive species management, livestock management, fire regime management, sustainable agricultural rotations, re-introductions/plantings of SCC and sustainable use of the habitats.*** This is a covenant to agree with the Authority planners for the creation of a long term management plan to avoid habitat degradation, SCC perturbation and enhance the effectiveness of rehabilitation actions. This is an action specifically identified in the BAP, where the need to raise public awareness on negative impacts of agricultural and livestock activities and on illegal fishing observed in Kura river has been highlighted.

Avoided loss (averted risk) can also be used as a means of generating a measureable conservation gain. Averted loss means compensation for ecological damage by preventing otherwise likely impacts by removing or arresting threatening processes and activities (Gibbons & Lindenmayer, 2007; Maron *et al.* 2010, 2012). BBOP (2012) defines averting risk as "protecting areas of biodiversity where there is imminent or projected loss of that biodiversity; entering into agreements such as contracts or covenants with individuals in which they give up the right to convert habitat in the future in return for payment or other benefits now". To achieve an averted loss offset, TANAP could pursue actions such as the purchase and formal protection of areas where a landowner or leaseholder consents to setting aside and managing land as biodiversity conservation to conserve habitats that would otherwise have been adversely affected.

Biodiversity gains associated with averted loss offsets are measured using a counterfactual or crediting baseline (Maron et al. 2015a), which predicts the amount of loss that would have occurred if the offset action was not undertaken. This counterfactual could be calculated, for example, by assuming that the degradation coefficient (*d*) of the biodiversity value equation (Section 5.1) would decline without the offset, such that biodiversity value would be reduced under a counterfactual scenario. The amount of loss prevented is assigned as a gain for the Project, even though a net loss to biodiversity may still occur relative to existing conditions (Maron et al 2015b). Uncertainty about the counterfactual can also result in overestimated gains (Maron et al. 2015a). For these reasons, averted loss offsets are less desirable than other actions that produce measurable gains against existing conditions.

A final offset option is for TANAP to provide financial credits to local and international organizations to advance biodiversity conservation in Turkey. This option should be evaluated with great care, however, because the gains associated with financial transactions are often difficult to measure, and measurable gains are critical for demonstrating No Net Loss and Net Gain (McKenny and Kiesecker 2010). Financial offset options should be used by TANAP only as a last resort, and only after other preferred offset opportunities, such as improving biodiversity value in degraded habitats, have been clearly demonstrated to be unachievable.

Through investigation of the types of actions listed above and ongoing consultation with stakeholders (Section 9), other conservation actions may also be identified as opportunities to create measurable conservation gains that could serve as offsets for the residual effects of the TANAP Project identified in Section 6. These may include species specific actions to address residual impact to particular SCC, such as targeted habitat improvement and reintroductions.

To achieve like-for-like offsets to the extent possible, conservation actions to offset residual effects of the TANAP Project should be undertaken within the same ecoregion as that in which residual effects were identified. Residual effects of the TANAP Project were identified in both modified and natural habitats in all ecoregions affected by the Project (Table 8 and Table 9). However, the largest residual impacts were identified in the Caucasus Mixed Forests and North Anatolian Conifer and Deciduous Forests, and within these ecoregions the Irano-Anatolian steppes and Calciphilous alpine and subalpine grasslands are among the natural habitats with the greatest adverse residual effects to biodiversity value (Table 9). Comparatively few residual effects to biodiversity value were identified in the Balkan Mixed Forests, Central Anatolian Steppe, and the Aegean and Western Turkey Sclerophyllous and Mixed Forests (Table 9).

A large number of potential offset opportunities should be identified within each ecoregion, especially in those ecoregions where the largest residual effects were identified (). Many more offset opportunities should be identified than will eventually be required because some of the initially identified opportunities will likely prove unsuitable. For example, upon further evaluation, some offset opportunities may not generate the initially expected level of biodiversity gain or they may prove to be prohibitively expensive and will need to be discarded. In other cases, offset opportunities may prove unsuitable because they are not supported by stakeholders (Section 8). Identifying many opportunities at the outset will permit some to be discarded while retaining a sufficient number to achieve gains required to offset the

The following actions will achieve a preliminary evaluation of offset potential:

- ***Prioritize target species*****:** sites where target species are known to occur should be regarded as a priority. Spatial factors such as the size of the habitat patch and its functional connectivity to other habitat patches (e.g. to allow foraging, dispersal, and breeding) is another element of fundamental importance in terms of supporting the species survival.
- ***Look for similarity***: a preliminary identification of potential sites with similar biodiversity values (V_h) within the same ecoregion should be carried out (desktop). Potential sites should be assessed and ranked based on presence of similar SCCs species through similarity indices comparisons, connectivity with other habitats, size, shape, current land ownership.
- ***Seek proximity***: the location and proximity of existing protected areas which may be expanded or consolidated plays an important driver for offsetting. The most suitable closest areas should be selected with respect to the TANAP footprint. Where rehabilitation of previously degraded habitats is an option, rehabilitating degraded areas adjacent to the TANAP Project footprint, and in the same habitats as those affected by the Project, should be considered before looking for more distant restoration opportunities.

- ***Prioritize high biodiversity potential***: Not all offset sites are likely to yield the same biodiversity value. Without the advantage of the full set of data required to calculate biodiversity value at each potential offset location, potential offset sites should be selected giving priority to previously identified KBAs, IBAs and IPAs, especially where these areas are not currently afforded legal protection, and substantial opportunities exist to enhance protected status.

Based on the offset strategies outlined in this section, a preliminary review undertaken by Golder suggests that a number of offset opportunities exist for the TANAP Project. For example, offset activities could be undertaken to restore or rehabilitate areas adjacent to the pipeline ROW. Because many habitats are degraded under existing conditions (Section 6.1.2), these opportunities may be extensive. Action also could be undertaken to help preserve biodiversity under threat or improve conditions in high biodiversity areas that currently have little protection. For instance, KBAs are areas identified with a high biodiversity value (Doga Dernegi, KBA Programme), but at present they do not have any formal protection or management practice in place in Turkey. TANAP has a wide range of potential opportunities to protect biodiversity in these areas, such as delimiting grazing areas, working with regulators to achieve higher levels of protection, and setting up and implementing specific management and monitoring plans for important species. A preliminary list of high biodiversity sites intersected or adjacent to the TANAP Project footprint that may yield offset opportunities is presented in Table 12.

Table 12: Preliminary identification of sites that could yield offset opportunities

Site name	Status	Flora and fauna species present	Threat factors	Provinces	Ecoregion	Main habitat types
Acıkır Steppes	IPA, KBA	This is a suitable area for the bird species *Neophron percnopterus* (EN).	Important part of the area is military territory. The western mountain steppes are used for grazing by the local people.	Eskişehir, Ankara	PA0803- Central Anatolian Steppe; PA1202 Anatolian Conifer And Deciduous Mixed Forests	Mountain steppes, agricultural areas
Allahuekber Mountains	KBA	Plenty of endemic flora species and presence of the reptile species *Darevskia uzzelli*	Animal grazing and intense agriculture.	Erzurum, Kars	PA0408 - Caucasus Mixed Forests	Calciphilous alpine and subalpine grassland, [Pinus sylvestris] woodland south of the taiga
Ardahan Forest	KBA, IBA	Presence of flora SCC species *Delphinium iris*. Presence of the following SCC fauna species *Prometheomys schaposchnikowi*, *Aegypius monachus, Aquila pomarina, Circus aeruginosus, Grus grus, Hieraaetus pennatus, Lullula arborea, Glaucopsyche arion, Glaucopsyche nausithous, Melitaea aurelia, Pyrgus cirsii.*	No information available.	Ardahan	PA0408 - Caucasus Mixed Forests	Wet mountain meadows, pine forests
Erzurum Marshes	KBA	Important wetland for bird species. Presence of *Vanellus gregarious.*	Pasture	Erzurum	PA0805 - Eastern Anatolian Montane Steppe	Temporary and permanent marshes, seasonal wet grass, agricultural area, moors.
Gölova Lakes	KBA	No information available.	No information available.	Sivas	PA0515 - Northern Anatolian Conifer And Deciduous Forests	Marshes and standing waters
Hafik Zara Hills	IPA, KBA, IBA	Important wetland for reproduction of coots and cranes.	No information available.	Sivas	PA0410 - Central Anatolian Steppe And Woodlands	Temporary and permanent marshes, seasonal wet grass

Site name	Status	Flora and fauna species present	Threat factors	Provinces	Ecoregion	Main habitat types
Manyas Lake	KBA	Important wetland for bird, amphibian and reptile species.	Industrial waste, water reduction for the ongoing construction of the Manyas Dam, sewage discharges, grazing.	Balıkesir	PA1202 Anatolian Conifer And Deciduous Mixed Forests	Shallow standing waters
Posof Forests	KBA, PBA	Presence of flora SCC species as *Chaerophyllum posofiannum,, Seseli grandivittatum, Cirsium frickii and fauna species as Prometheomys schaposchnikowi Mertensiella caucasica.*	Planned hydroelectric power plants, uncontrolled cutting of the birch trees with the purpose of making besom, potential unplanned grazing, illegal individual hunting, pesticide / chemical pollution, overgrowing of meadows, firewood and charcoal production.	Ardahan	PA1202 Anatolian Conifer And Deciduous Mixed Forests; PA0805 - Eastern Anatolian Montane Steppe; PA0408 - Caucasus Mixed Forests	Mixed forests of *Picea orientalis*, *Abies nordmanniana* and *Fagus* sp. Species, oak forests
Refahiye Forests	KBA	Suitable areas for raptors species. No other information available.	No information available.	Erzincan, Sivas	PA0515 Northern Anatolian Conifer And Deciduous Forests	oak forest with juniper, grasslands, agricultural areas

After identifying a large number of potential offset opportunities, the various opportunities should be evaluated to determine the most suitable and cost-effective means for achieving No Net Loss for natural habitats and priority biodiversity features, and Net Gain for critical habitats. The details of the evaluation process will be determined during the course of the implementation of Biodiversity Offset Strategy (see Section 10), but will need to consider the biodiversity benefit generated by implementing the offset (i.e., consider expected outcomes of applying the biodiversity value equation), the alignment of the offset opportunity with the offsetting principles defined in Section 7.1, the financial costs to TANAP of implementing the offset, and the social and political considerations associated with implementing the offset (Section 8). The subset of opportunities that are identified as most likely to provide the biodiversity benefit required to offset the residual effects of the TANAP Project at the lowest cost and with the most stakeholder support should be advanced to be actioned through implementation of a Biodiversity Offset Management Plan that will be developed for the TANAP Project.

8.3 Prepare a Biodiversity Offset Management Plan

The offset actions determined to be most suitable for addressing the residual effects of the TANAP Project to biodiversity will be elaborated in a Biodiversity Offset Management Plan that will outline the steps TANAP will take to implement each offset. The Biodiversity Offset Management Plan will include the following:

- Quantification of the residual losses based on the new findings of further studies (Section 6.3.1).
- Assessment of the biodiversity gains that could be achieved at each selected offset location to ensure No Net Loss or Net Gain are likely outcomes of implementing offsets.
- Assessment of the offset sufficiency and identification of the shortfalls.
- Identification of the key performance indicators (KPIs) for each offset, including describing costs, setting up a detailed implementation timeline, and defining roles and responsibilities for implementation.
- Identification of uncertainties and necessary monitoring and maintenance activities and verification processes to ensure the success and long-term viability of the offset.

Quantification of the expected benefits of each offset (2nd bullet above) that will be implemented is a key first step in demonstrating No Net Loss or Net Gain. Offset gains will be calculated as the difference between the future biodiversity value assessed (VF_h) and the net loss of biodiversity value (V_h).The future biodiversity value (VF_h) will be calculated with the same equation for getting the biodiversity value (V_h) (Section 5.1).

The equation used to calculate the offset gains for a group of patches of given habitat type in the various ecoregions is as follows:

$$Ob_h = VF_h - V_h$$

Where:

Ob_h = The offset value gained to achieve the NNL/NG

VF_h = The future biodiversity value of a group of patches of a given habitat type in a given ecoregion

V_h = The biodiversity value of a group of patches of a given habitat type in a given ecoregion (net loss)

To achieve a successful offset, the OG_h value must be equal or higher than zero (e.g. 0 for No Net Loss requirement; > 0 for Net Gain requirements).

Finally, the result must be also expressed in terms of confidence in the offset prevision, which indicates the level of certainty about the success of the proposed offset areas in the long-term. This includes e.g. the degree to which the proposed offset actions can be achieved and the strength and effectiveness of risk-mitigation measures.

Monitoring will be performed to assess the efficacy of the conservation actions undertaken by TANAP.

Monitoring will applied as a minimum to:

- **Requirements already included in the Biorestoration Monitoring Plan** (Document n. CIN-PLN-ENV-GEN-014-Rev-P3-2), which is Annex 8 of the Biodiversity Action Plan. The Biorestoration Monitoring Plan indicates monitoring activities for habitats, flora and fauna SCCs within the Critical Habitats identified in the BAP. Monitoring methodologies, achievement criteria, monitoring period, frequency and reporting are detailed. Monitoring activities includes among others:
  - control erosion at sloping areas where seeds are planted;
  - monitoring of terrestrial flora and fauna species (e.g. *Corydalis wendelboi subsp. congesta, Prometheomys schaposchnikowi*, *Phengaris nausithous*), also considering the methodology provided in the BAP (Chapter 5: Terrestrial Species Actions Plan);
  - monitoring fish species.
- **Habitat rehabilitation progress and effectiveness.** These monitoring activities will be conducted in the offset sites identified. Habitat rehabilitation progress and effectiveness activities will be addressed to look at the evidence base for successful outcomes in habitat rehabilitation throughout the years. Monitoring information already provided in the BAP (Chapter 4: Terrestrial Critical Habitats Action Plan) will be also considered to set a prescribed protocol, including the key performance indicators to monitor and the success criteria. Key performance indicators will be identified as measurable value to demonstrate how effectively the ongoing activities meets the monitoring objective (for instance the percentage of the habitats surveyed within an ecoregion).
- **Target species** identified for flora and fauna. Those species selected among SCCs as at higher risk, will be precautionary monitored to assure a high level of protection as a 20 year rehabilitation framework could not be appropriate for this species. In case monitoring programs will reveal a potential for this species loss, offset should be designed and pursued immediately. The monitoring programs will be species-specific and will consist on the following steps:
  - defining the optimal monitoring protocols for each target species (if not available from the BAP Annex 8), the key performance indicators and the success criteria;
  - designate the areas where monitoring activities have to be carried out.
- **Watercourses < 3 m width (RVX4).** Smaller streams, not considered in the present strategy, could be seasonally important and support the presence of species of conservation concern. These streams will be monitored to confirm or exclude the presence of SCCs. In case the monitoring results will indicate their presence, the BOS and BOMP will be revised as necessary.

8.4 Potential offset scenario

The scenario presented in this section was elaborated in order to demonstrate if the offset potential present in the immediate vicinity of the TANAP Project, given by the implementation of the offset measures discussed above, is sufficient to compensate the offset need of the Project calculated as biodiversity value (V_h) estimated in Section 6.

This scenario considers only the offset potential on the LSA and it is based on the assumption that the proposed offset measures will affect positively the baseline habitat degradation value (*d*). A precautionary overall offset need was calculated in order to guarantee Net Gain for CH and No Net Loss /Net Gain for PBF/NH based on the Project net loss of biodiversity value. The offset potential calculated on the LSA was than compared to the Project offset need.

The methodology used for these calculations is explained in detail in the following paragraphs.

- The **net loss of biodiversity value** (V_h) was calculated after mitigation measures (avoidance, minimization, rehabilitation) at 20 years using the equation in section 5.1. The results of the net loss calculation for CH and for PBF/NH are displayed in Table 9 for each EUNIS habitat type and ecoregion.

- The **offset need** was calculated based on the net loss of biodiversity value presented in Table 9. To take into account uncertainties and need to provide a safety buffer, offset need was calculated as the 150% of net loss biodiversity values for CH and the 120% of net loss biodiversity values for PBF/NH was considered (BBOP, 2012)[4]. The two terms were then summed in order to obtain a precautionary "*Overall offset need"* for the Project as indicated in the equation below:

  *Overall offset need = (PBF/NH*1.2)+(CH*1.5)*

  The results of this calculation are displayed in Table 13 for each EUNIS habitat type and ecoregion.

- The **offset potential** of the LSA was calculated based on the assumption that the proposed offset measures will affect positively the habitat degradation (d) value of 20% compared to the baseline level[5]. Habitat degradation values (d) were therefore increased of 0.2. When the baseline value, in absence of further information, was already precautionary set as 1 (Undisturbed natural habitat) this value was not modified.

  The offset potential was calculated comparing the biodiversity value of the entire LSA after the effect of offset measures and comparing it with the baseline biodiversity value as indicated in the equation below:

  Offset potential = post-offset biodiversity value (V_h) *- baseline biodiversity value* (V_h)

  The resulting LSA offset potential is showed in (Table 14) for each EUNIS habitat type and ecoregion.

- The **offset balance** was calculated by comparing the offset potential, calculated on the LSA, to overall offset need of the project in order to verify if the offset potential of the LSA could match the calculated Project offset need, as indicated in the equation below:

  Offset balance = Offset potential - Offset need

  The resulting offset balance is showed in (Table 15) for each EUNIS habitat type and ecoregion.

Although this scenario is extremely conservative, its results demonstrate that the offset potential present along the TANAP Project is more than sufficient to compensate the offset need of the Project calculated as biodiversity value. In fact, considering only the LSA, the calculated total offset potential given by the implementation of the Biodiversity Offset Strategy (Table 14) is seven times higher than the total Project offset needs (Table 15).

In the comparison between the LSA offset potential and the Project offset needs negative values result for some of the EUNIS habitat types (Table 15). However, once considering the total biodiversity value, the results is clearly positive (Total *offset balance* 25848,59 V_h).

Negative values resulting for some natural habitats are due to the fact that for these habitats the baseline degradation value was already precautionary set as 1 (Undisturbed natural habitat) in absence of additional information, and therefore it was not possible to further increase the value within the present scenario. However, the proposed further studies will likely allow to set more realistic degradation values (d) for these

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[4] 4 The 150% and 120% figures was chosen as multipliers grounded in the precautionary principle to increase the basic size of the offset need, thereby helping to account for concerns that the 1:1 ratio offset may not be sufficient to deliver a successful outcome. These multipliers where used referencing to the guideline "Business and Biodiversity Offsets Programme (BBOP). 2012. Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets", section "3.2 Insuring against uncertainty and risk in biodiversity offsets".

[5] 5 The reason for designating a precautionary 20% value is that it represents a reasonable increase to appreciate the effects of a change.

habitat, which will in turn result in a higher offset potential and ultimately in a more positive offset balance within the LSA or a reduced area that needs to be offset in the first place. Natural habitat negative values could in any case be compensated “in-kind” by identifying and targeting specific degraded areas of the same habitat outside the LSA where to implement specific offsets or restoring new areas of modified habitats.

For modified habitats the habitat degradation concept was not applicable and the negative values are due to the presence of permanent facilities for which the rehabilitation potential was set as 0. The loss of biodiversity value in modified habitats will be compensated “out-of-kind” by implementing offset measures that will be affecting positively the habitat degradation (*d*) of natural habitats that have a greater conservation concern in order to obtain an equivalent or higher gain of biodiversity value.

In conclusion, the availability of sufficient offset opportunities along the TANAP Project is confirmed by the present scenario, even if based on extremely conservative assumptions.

Table 13: Offset need of biodiversity value (V_h) calculated for Critical Habitat (CH), Natural Habitat and Priority Biodiversity Features (PBF/NH)

EUNIS Code*	Natural/ Modified	Ecoregions**									
		PA0404	PA0408	PA0410	PA0420	PA0515	PA0803	PA0805	PA1201	PA1202	**Total**
C2.5	N	-	0,14	-	-	0,02	-	-	-	-	*0,16*
E1.00	N	-	-	100,54	0,25	147,42	3,19	-	-	2,65	*254,05*
E1.01	N	-	-	3,52	-	-	14,78	-	-	11,51	*29,81*
E1.22	N	1,07	-	-	-	-	-	-	3,72	33,04	*37,83*
E1.2B	N	-	-	-	-	88,95	-	-	-	-	*88,95*
E1.2E	N	-	17,06	98,76	178,15	574,26	2,64	69,36	-	53,16	*993,39*
E2.1	M	-	223,16	-	-	-	-	-	-	-	*223,16*
E4.4	N	-	326,71	-	-	-	-	37,79	-	-	*364,49*
E6.2	N	-	-	-	-	-	-	7,67	-	-	*7,67*
F2.2	N	-	-	-	-	1,23	-	-	-	-	*1,23*
F5.3	N	-	-	-	-	-	-	-	-	-	*0,00*
G1.1	N	-	2,68	-	-	-	-	2,67	-	-	*5,36*
G1.3	N	2,53	-	8,83	21,12	22,29	1,44	8,61	3,65	17,51	*85,98*
G1.7	N	-	-	0,44	13,65	50,08	-	-	11,08	250,76	*326,01*
G1.9	N	-	33,75	-	-	1,52	-	-	-	-	*35,27*
G1.A	N	-	21,50	-	-	-	-	32,21	-	-	*53,71*
G1.C	M	-	-	0,17	-	0,15	-	-	-	-	*0,32*
G2.1	N	2,59	-	-	-	-	-	-	15,58	0,53	*18,70*
G3.4	N	-	67,11	-	-	117,43	-	-	-	-	*184,54*
G3.5	N	-	-	-	-	-	-	-	-	107,58	*107,58*
G3.75	N	-	-	-	-	-	-	-	17,77	16,07	*33,84*
G3.9	N	-	-	-	-	-	-	-	-	0,31	*0,31*
G3.F	M	-	41,34	-	-	47,18	-	4,31	21,13	32,12	*146,08*
G4.B	N	-	-	-	-	-	-	-	-	91,14	*91,14*
G5.1	M	-	-	-	-	-	-	7,25	-	2,85	*10,10*
I1.1	M	64,37	1,20	57,96	4,00	175,37	7,31	150,95	43,32	605,91	*1110,38*
I1.4	M	10,59	-	-	-	-	-	-	2,26	-	*12,85*
J5.4	M	0,05	-	-	-	-	-	-	-	-	*0,05*
X18	N	-	-	-	0,85	22,98	0,57	1,07	-	20,20	*45,68*
	Total	*81,20*	*734,65*	*270,22*	*218,02*	*1248,89*	*29,93*	*321,89*	*118,50*	*1245,34*	***4268,63***

Table 14: Offset potential of biodiversity value (Vh) calculated in the LSA

EUNIS Code*	Natural/ Modified	Ecoregions**									
		PA0404	PA0408	PA0410	PA0420	PA0515	PA0803	PA0805	PA1201	PA1202	**Total**
C3.6	N	-	4,08	0,78	0,97	0,29	0,02	3,15	-	3,87	*13,16*
E1.00	N	-	-	1842,10	7,28	2358,79	47,49	-	-	37,47	*4293,13*
E1.01	N	-	-	70,94	-	-	242,81	-	-	201,64	*515,39*
E1.22	N	16,17	-	-	-	-	-	-	56,02	391,40	*463,59*
E1.2B	N	-	-	-	-	1296,79	-	-	-	1296,79	*1296,79*
E1.2E	N	-	244,62	2113,91	2516,10	8634,18	112,18	1135,33	-	967,91	*15724,25*
E2.5	N	-		67,15	7,43	34,75	1,00	16,50	3,08	23,90	*153,80*
E3.4	N	2,72	72,45	2,06	11,92	9,88	-	66,39	21,75	150,04	*337,22*
E4.4	N		3397,39	-	-	-	-	402,14	-	-	*3799,53*
E6.2	N	-	-	-	-	-	-	80,21	-	-	*80,21*
F5.3	N	-	-	-	-	-	-	-	5,41	53,43	*58,84*
G1.7	N	-	-	8,36	125,78	464,80	0,59	-	64,87	1920,64	*2585,05*
G2.1	N	60,82	-	-	-	-	-	-	119,42	19,50	*199,75*
X18	N	-	-	0,00	11,81	269,98	5,46	12,29	-	296,98	*596,53*
	Total	*79,71*	*3718,55*	*4105,30*	*2681,30*	*13069,45*	*409,56*	*1716,00*	*270,56*	*4066,80*	***30117,22***

Table 15: Offset balance of biodiversity value (Vh) calculated in the LSA

EUNIS Code*	Natural/ Modified	Ecoregions**									
		PA0404	PA0408	PA0410	PA0420	PA0515	PA0803	PA0805	PA1201	PA1202	**Total**
C2.5	N	-	-0,14	-	-	-0,02	-	-	-	-	*-0,16*
C3.6	N	-	4,08	0,78	0,97	0,29	0,02	3,15	-	3,87	*13,16*
E1.00	N	-	-	1741,57	7,03	2211,37	44,30	-	-	34,82	*4039,09*
E1.01	N	-	-	67,41	-	-	228,04	-	-	190,13	*485,58*
E1.22	N	15,09	-	-	-	-	-	-	52,30	358,36	*425,76*
E1.2B	N	-	-	-	-	1207,83	-	-	-	-	*1207,83*
E1.2E	N	-	227,57	2015,15	2337,95	8059,92	109,54	1065,98	-	914,75	*14730,86*
E2.1	M	-	-223,16	-	-	-	-	-	-	-	*-223,16*
E2.5	N	-	-	67,15	7,43	34,75	1,00	16,50	3,08	23,90	*153,80*

EUNIS Code*	Natural/ Modified	Ecoregions**									
		PA0404	PA0408	PA0410	PA0420	PA0515	PA0803	PA0805	PA1201	PA1202	Total
E3.4	N	2,72	72,45	2,06	11,92	9,88	-	66,39	21,75	150,04	*337,22*
E4.4	N	-	3070,68	-	-	-	-	364,36	-	-	*3435,04*
E6.2	N	-	-	-	-	-	-	72,53	-	-	*72,53*
F2.2	N	-	-	-	-	-1,23	-	-	-	-	*-1,23*
F5.3	N	-	-	-	-	-	-	-	5,41	53,43	*58,84*
G1.1	N	-	-2,68	-	-	-	-	-2,67	-	-	*-5,36*
G1.3	N	-2,53	-	-8,83	-21,12	-22,29	-1,44	-8,61	-3,65	-17,51	*-85,98*
G1.7	N	-	-	7,93	112,13	414,72	0,59	-	53,79	1669,88	*2259,04*
G1.9	N	-	-33,75	-	-	-1,52	-	-	-	-	*-35,27*
G1.A	N	-	-21,50	-	-	-	-	-32,21	-	-	*-53,71*
G1.C	M	-	-	-0,17	-	-0,15	-	-	-	-	*-0,32*
G2.1	N	58,24	-	-	-	-	-	-	103,84	18,97	*181,05*
G3.4	N	-	-67,11	-	-	-117,43	-	-	-	-	*-184,54*
G3.5	N	-	-	-	-	-	-	-	-	-107,58	*-107,58*
G3.75	N	-	-	-	-	-	-	-	-17,77	-16,07	*-33,84*
G3.9	N	-	-	-	-	-	-	-	-	-0,31	*-0,31*
G3.F	M	-	-41,34	-	-	-47,18	-	-4,31	-21,13	-32,12	*-146,08*
G4.B	N	-	-	-	-	-	-	-	-	-91,14	*-91,14*
G5.1	M	-	-	-	-	-	-	-7,25	-	-2,85	*-10,10*
I1.1	M	-64,37	-1,20	-57,96	-4,00	-175,37	-7,31	-150,95	-43,32	-605,91	*-1110,38*
I1.4	M	-10,59	-	-	-	-	-	-	-2,26	-	*-12,85*
J5.4	M	-0,05	-	-	-	-	-	-	-	-	*-0,05*
X18	N	-	-	-	10,97	247,00	4,89	11,22	-	276,78	*550,85*
	Total	*-1,49*	*2983,90*	*3835,08*	*2463,28*	*11820,56*	*379,63*	*1394,11*	*152,06*	*2821,46*	***25848,59***

EUNIS Code*:

Freshwater Natural Habitat:
C2.5 Temporary running waters
C3.6 Unvegetated or sparsely vegetated shores with soft or mobile sediments

Freshwater Modified Habitat:
J5.4 Highly artificial non-saline running waters

Terrestrial Modified Habitat:
E2.1 Permanent mesotrophic pastures and aftermath-grazed meadows
G1.C Highly artificial broadleaved deciduous forestry plantations
G3.F Highly artificial coniferous plantations
G5.1 Lines of trees
I1.1 Intensive unmixed crops
I1.4 Inundated or inundatable croplands, including rice fields

Terrestrial Natural Habitat:
E1.00 Anatolian Gypsum Steppes
E1.01 Anatolian Marl Steppes
E1.22 Arid subcontinental steppic grassland ([Festucion valesiacae])
E1.2B Serpentine steppes
E1.2E Irano-Anatolian steppes
E2.5 Meadows of the steppe zone
E3.4 Moist or wet eutrophic and mesotrophic grassland
E4.4 Calciphilous alpine and subalpine grassland
E6.2 Continental inland saline grass and herb-dominated habitats
F2.2 Evergreen alpine and subalpine heath and scrub
F5.3 Pseudomaquis
G1.1 Riparian [Salix], [Alnus] and [Betula] woodland
G1.3 Mediterranean [Populus], [Fraxinus], [Ulmus] and related riparian woodland
G1.7 Thermophilous deciduous woodland
G1.9 Non-riverine woodland with [Betula], [Populus tremula], [Sorbus aucuparia] or [Corylus avellana]
G1.A Meso- and eutrophic [Quercus], [Carpinus], [Fraxinus], [Acer], [Tilia], [Ulmus] and related woodland
G2.1 Mediterranean evergreen [Quercus] woodland
G3.4 [Pinus sylvestris] woodland south of the taiga
G3.5 [Pinus nigra] woodland
G3.75 [Pinus brutia] forests
G3.9 Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]
G4.B Mixed mediterranean [Pinus] - thermophilous [Quercus] woodland
X18 Wooded steppe

Ecoregions:**

PA0404 Balkan Mixed Forests
PA0408 Caucasus Mixed Forests
PA0410 Central Anatolian Steppe And Woodlands
PA0420 Eastern Anatolian Deciduous Forests
PA0515 Northern Anatolian Conifer And Deciduous Forests
PA0803 Central Anatolian Steppe
PA0805 Eastern Anatolian Montane Steppe
PA1201 Aegean And Western Turkey Sclerophyllous And Mixed Forests
PA1202 Anatolian Conifer And Deciduous Mixed Forests

9.0 STAKEHOLDER ENGAGEMENT

Identifying offset opportunities to ensure further contributions to conservation outcomes is another action that TANAP could undertake for the biodiversity offsetting of the Project. To this end, TANAP needs to support initiatives devoted to biodiversity conservation (e.g. local NGOs, programmes for the implementation of Natura 2000 requirements).

The implementation of the measures included in the Biodiversity Offset Strategy will require the involvement of several stakeholders, including National and Local governments, lenders (e.g. EBRD), and other potentially affected and interested parties.

The stakeholder engagement activities listed in this strategy will align with the broader Stakeholder Engagement Plan (SEP) for the TANAP Project (TNP-PLN-SOC-GEN-001-Rev P3-2), governed by the general principles of capacity building and participation of vulnerable stakeholder groups to the process.

In accordance with the SEP, throughout the BOS implementation, TANAP will maintain communication channels with relevant stakeholders as identified. Any additional stakeholders identified will also be added to the stakeholder Database and communication with them will be initiated. In case of significant changes or updates regarding the project, environmental and social issues will continue to be addressed and reported to the stakeholders. Improvements, upgrades and all environmental and social issues will be timely communicated via the methods identified in the SEP (e.g. written information with visual illustrations, technical workshops).

The SEP will be updated upon major changes. Results of grievances will be summarised on an annual basis to demonstrate the types of issues managed in the process, as well as the number of grievances received, closed and number remaining open. Results will also include the number of grievances that were not solved through internal procedures and that may have included third party or legal resolution.

A preliminary list of stakeholders is provided below. This list and the related issues will likely change and be refined as TANAP's stakeholder engagement activities progress and as implementation of the Biodiversity Offset Strategy results in the identification of specific offset opportunities.

Preliminary stakeholder list

A preliminary list of stakeholders that TANAP could consider engaging with as the Biodiversity Offset Strategy is implemented and specific Biodiversity Offset Management Plan is developed is as follows:

- Government Authorities:
  - Central Government Authorities;
  - Regional Government Authorities;
  - Local Government Authorities ;
  - Forestry Authorities;
  - Protected Areas Authorities;
- Project Affected People (PAPs):
  - Directly affected landowners;
  - Project affected communities/persons;
  - Project workers;
- Non- Commercial, Non-governmental and Public Organisations
- Interest groups:
  - Business Associations;

- Chambers of Commerce;
- Cooperatives;
- Universities;
- SMEs;

- Multinational and International Organizations:
  - International Union for Conservation of Nature (IUCN);
  - World Bank Group.
- Media:
  - International Media;
  - National Media;
  - Local Media Interest Groups;
- General public.

The specific stakeholders engaged will likely vary for different offset opportunities. As offset opportunities are identified following the approaches outlined in Section 7, the list of potential stakeholders defined above should be evaluated to determine which individuals and organizations will be consulted for the particular opportunity in question.

Stakeholder potential issues

Issues that will need to be discussed with the various Stakeholder will include:

- **Land Use Policy:** Careful evaluation of land-use policy can reveal situations where technically feasible offsets cannot be implemented or properly secured because of policy is inconsistent with those objectives (Robichaud and Knopff 2015). Engaging with government authorities can help identify situations where policy may prevent effective offset implementation.
- **Agricultural Areas Management**: the support nature-friendly agriculture practices such as conservation and plantation of hedges, shrubs and linear forests and set aside need be discussed with the land owners and local authorities;
- **Forestry Management**: the eventual reforestation of degraded areas with tree species typical of the ecoregion and habitat type to be restored will need to be performed in accordance with local authorities, and other relevant stakeholders;
- **Management of protected area and internationally recognized areas:** support in the management of Protected Area and internationally recognized areas (KBA, IBA, IPA) will be discussed with government authorities and local stakeholders. Offset activities that could be supported by TANAP include:
  - limitations to grazing: the protection of areas form excessive degradation due to overgrazing could require some restrictions to grazing. Compensation mechanisms will need to be discussed with stakeholders;
  - limitation of hunting activities: the protection of areas could require some restriction for the legal hunting activity. A compensation mechanisms will need to be discussed with stakeholders and also the possible growth of illegal activities should be carefully assessed.

- development of ecotourism: the creation of protected areas could become a driver for the increase of tourism. Challenges and needs will need to be discussed with stakeholder to evaluate obstacles and opportunities.

- **Land acquisition:** land properties of potential offsetting sites could be one of the major issues to afford. An early engagement mechanism of landowners and local governments should be clearly put in place and compensation measures implemented.

Engagement mechanisms

Consistently with the SEP, the methodologies for stakeholder engagement specific to the Biodiversity Offset Strategy will include, depending on the stakeholder involved:

- Consultation meeting;
- Presentations;
- Press Releases;
- Corporate website (www.tanap.com);
- Grievance mechanism;
- Technical workshop.

10.0 IMPLEMENTATION SCHEDULE

Given the scale of TANAP Project and the number of different Natural Habitats, Priority Biodiversity Features and Critical Habitats found along the route, the implementation of the Biodiversity Offset Strategy, including stakeholder engagement, offset identification, offset implementation, monitoring and adaptive management and ultimate verification of offset benefits is a process that will require years.

However an initial proposed implementation schedule is defined in Table 16.

Table 16: Proposed initial schedule for implementation of the Biodiversity Offset Strategy

Components	**Timeline**
Further studies - Refining the baseline value for degradation (*d*) and confirmation of the rehabilitation hypotheses (*R*)	Completed by the end of 2018
Offset opportunities Identification	Complete by the end of 2018
Offset Management and Monitoring Plan	Complete by the end of 2019
Stakeholder engagement	Beginning in 2018 and ongoing
Implement offsets	2019-2040
Verification of Offset Benefits	2022-2040
Monitoring and Adaptive Management	2022-2040

11.0 FINANCIAL COMMITTMENT

TANAP is committed to the implementation of the measures described in this Biodiversity Offset Strategy.

TANAP will put in place a mechanism to ensure that TANAP has sufficient funds and management resources to complete the actions required by the Biodiversity Offset Management Plan.

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APPENDIX A

Terrestrial and Freshwater Habitats (*a*)

Freshwater and terrestrial EUNIS habitats (km^2) mapped within the different ecoregions within the LSA

EUNIS Code	EUNIS Name	Ecoregions									Total
		PA0404	PA0408	PA0410	PA0420	PA0515	PA0803	PA0805	PA1201	PA1202	
B1.8	Moist and wet dune slacks	0	0	0	0	0	0	0	533	0	*533*
B2.2	Unvegetated mobile shingle beaches above the driftline	0	0	0	0	0	0	0	0	17	*17*
B3.3	Rock cliffs, ledges and shores, with halophytic angiosperms	0	0	0	0	0	0	0	0	291	*291*
C1.2	Permanent mesotrophic lakes, ponds and pools	0	83	157	35	0	0	452	0	0	*727*
C1.6	Temporary lakes, ponds and pools (wet phase)	0	6	636	0	21	0	104	67	0	*834*
C2.2	Permanent non-tidal, fast, turbulent watercourses	552	320	0	0	143	211	0	0	871	*2.098*
C2.3	Permanent non-tidal, slow, smooth-flowing watercourses	343	1.957	1.803	713	6.150	217	1.361	1.861	6.791	*21.197*
C2.5	Temporary running waters	143	1.186	5.670	1.395	7.921	898	10.318	299	5.656	*33.485*
C3.6	Unvegetated or sparsely vegetated shores with soft or mobile sediments	0	976	143	323	62	7	964	0	1.166	*3.641*
E1.00	Anatolian Gypsum Steppes	0	0	75.492	825	80.664	3.532	0	0	3.842	*164.355*
E1.01	Anatolian Marl Steppes	0	0	6.184	0	0	20.538	0	0	16.911	*43.633*
E1.22	Arid subcontinental steppic grassland ([Festucion valesiacae])	2.642	0	0	0	0	0	0	7.826	59.006	*69.474*
E1.2B	Serpentine steppes	0	0	0	0	80.669	0	0	0	0	*80.669*
E1.2E	Irano-Anatolian steppes	0	41.098	208.048	285.748	649.712	10.692	103.488	0	121.846	*1.420.631*
E2.1	Permanent mesotrophic pastures and aftermath-grazed meadows	0	231.175	0	0	0	0	170	0	0	*231.345*
E2.5	Meadows of the steppe zone	0	0	8.791	970	4.427	137	2.761	458	3.615	*21.159*
E3.4	Moist or wet eutrophic and mesotrophic grassland	341	11.156	174	1.381	1.021	0	8.511	2.712	18.809	*44.106*
E4.4	Calciphilous alpine and subalpine grassland	0	362.441	0	0	0	0	44.573	0	0	*407.014*
E6.2	Continental inland saline grass and herb-dominated habitats	0	0	0	0	0	0	10.308	0	0	*10.308*
F2.2	Evergreen alpine and subalpine heath and scrub	0	0	0	0	2.433	0	0	0	0	*2.433*
F5.3	Pseudomaquis	0	0	0	0	0	0	0	592	7.255	*7.847*
G1.1	Riparian [Salix], [Alnus] and [Betula] woodland	0	1.697	0	0	0	0	2.736	0	0	*4.433*
G1.3	Mediterranean [Populus], [Fraxinus], [Ulmus] and related riparian woodland	1.919	0	9.322	10.010	12.163	1.106	3.463	3.230	17.944	*59.158*

EUNIS Code	EUNIS Name	Ecoregions									Total
		PA0404	PA0408	PA0410	PA0420	PA0515	PA0803	PA0805	PA1201	PA1202	
G1.7	Thermophilous deciduous woodland	0	0	1.613	20.471	61.448	89	0	8.772	252.262	*344.655*
G1.9	Non-riverine woodland with [Betula], [Populus tremula], [Sorbus aucuparia] or [Corylus avellana]	0	16.229	0	0	3.881	0	0	0	0	*20.110*
G1.A	Meso- and eutrophic [Quercus], [Carpinus], [Fraxinus], [Acer], [Tilia], [Ulmus] and related woodland	0	12.028	0	0	0	0	10.428	0	0	*22.456*
G1.C	Highly artificial broadleaved deciduous forestry plantations	9	0	1.495	63	1.453	35	32	16	823	*3.926*
G2.1	Mediterranean evergreen [Quercus] woodland	6.584	0	0	0	0	0	0	13.993	1.997	*22.574*
G3.4	[Pinus sylvestris] woodland south of the taiga	0	31.404	0	0	76.937	0	0	0	0	*108.341*
G3.5	[Pinus nigra] woodland	0	0	0	0	0	0	0	0	109.164	*109.164*
G3.75	[Pinus brutia] forests	0	0	0	0	0	0	0	16.831	9.979	*26.810*
G3.9	Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]	0	0	0	0	0	0	0	0	1.843	*1.843*
G3.F	Highly artificial coniferous plantations	0	28.456	165	15.727	55.214	0	2.354	60.971	52.057	*214.945*
G4.B	Mixed mediterranean [Pinus] - thermophilous [Quercus] woodland	0	0	0	0	0	0	0	0	67.023	*67.023*
G5.1	Lines of trees	54	38	729	188	2.204	0	1.087	266	6.702	*11.266*
I1.1	Intensive unmixed crops	117.669	264.947	1.524.180	123.290	781.933	267.320	719.279	170.608	1.482.497	*5.451.723*
I1.2	Mixed crops of market gardens and horticulture	150	6.223	2.849	48	14.415	996	2.023	1.942	30.558	*59.205*
I1.4	Inundated or inundatable croplands, including rice fields	40.489	0	0	0	0	0	0	46.950	26.873	*114.311*
J1.2	Residential buildings of villages and urban peripheries	27	2.401	1.376	477	2.226	1.264	2.742	1.017	6.238	*17.770*
J1.4	Urban and suburban industrial and commercial sites still in active use	0	0	0	0	1.695	487	1.022	0	1.049	*4.253*
J2.3	Rural industrial and commercial sites still in active use	294	804	1.204	0	984	32	739	195	602	*4.853*
J2.43	Greenhouses	0	0	12	0	0	0	0	113	110	*235*
J2.6	Disused rural constructions	0	790	0	180	0	0	1.291	0	0	*2.261*
J3	Extractive industrial sites	690	0	0	0	281	0	0	0	79	*1.050*
J4.2	Road networks	0	307	425	0	304	0	456	0	441	*1.933*
J4.6	Pavements and recreation areas	0	0	0	0	0	0	0	0	153	*153*
J4.7	Constructed parts of cemeteries	0	27	346	7	34	95	113	0	48	*670*

EUNIS Code	EUNIS Name	Ecoregions									Total
		PA0404	PA0408	PA0410	PA0420	PA0515	PA0803	PA0805	PA1201	PA1202	
J5.4	Highly artificial non-saline running waters	5.107	0	3.567	844	121	137	5.187	970	645	*16.576*
J5.5	Highly artificial non-saline fountains and cascades	0	0	6	0	0	0	0	0	0	*6*
X18	Wooded steppe	0	0	0	1.891	28.879	704	1.992	0	42.993	*76.459*
Total		***177.013***	***1.015.749***	***1.854.388***	***464.586***	***1.877.396***	***308.498***	***937.952***	***340.221***	***2.358.155***	***9.333.958***

APPENDIX B

Habitat degradation (*d*)

Habitat degradation (d) value for natural habitats within the different ecoregions within the LSA

EUNIS Code	EUNIS Name	Ecoregions								
		PA0404	PA0408	PA0410	PA0420	PA0515	PA0803	PA0805	PA1201	PA1202
B1.8	Moist and wet dune slacks								1,0	
B2.2	Unvegetated mobile shingle beaches above the driftline									1,0
B3.3	Rock cliffs, ledges and shores, with halophytic angiosperms									1,0
C1.2	Permanent mesotrophic lakes, ponds and pools		1,0	1,0	1,0			1,0		
C1.6	Temporary lakes, ponds and pools (wet phase)		1,0	1,0		1,0		1,0	1,0	
C2.2	Permanent non-tidal, fast, turbulent watercourses	1,0	1,0			1,0	1,0			1,0
C2.3	Permanent non-tidal, slow, smooth-flowing watercourses	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
C2.5	Temporary running waters	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
C3.6	Unvegetated or sparsely vegetated shores with soft or mobile sediments		0,8	0,8	0,8	0,8	0,8	0,8		0,8
E1.00	Anatolian Gypsum Steppes			0,6	0,6	0,6	0,6			0,6
E1.01	Anatolian Marl Steppes			0,6			0,6			0,6
E1.22	Arid subcontinental steppic grassland ([Festucion valesiacae])	0,6							0,6	0,6
E1.2B	Serpentine steppes					0,6				
E1.2E	Irano-Anatolian steppes		0,6	0,6	0,6	0,6	0,6	0,6		0,6
E2.5	Meadows of the steppe zone			0,8	0,8	0,8	0,8	0,8	0,8	0,8
E3.4	Moist or wet eutrophic and mesotrophic grassland	0,8	0,8	0,8	0,8	0,8		0,8	0,8	0,8
E4.4	Calciphilous alpine and subalpine grassland		0,8					0,8		
E6.2	Continental inland saline grass and herb-dominated habitats							0,6		
F2.2	Evergreen alpine and subalpine heath and scrub					1,0				
F5.3	Pseudomaquis								0,6	0,6
G1.1	Riparian [Salix], [Alnus] and [Betula] woodland		1,0					1,0		
G1.3	Mediterranean [Populus], [Fraxinus], [Ulmus] and related riparian woodland	1,0		1,0	1,0	1,0	1,0	1,0	1,0	1,0
G1.7	Thermophilous deciduous woodland			0,8	0,8	0,8	0,8		0,8	0,8

EUNIS Code	EUNIS Name	Ecoregions								
		PA0404	PA0408	PA0410	PA0420	PA0515	PA0803	PA0805	PA1201	PA1202
G1.9	Non-riverine woodland with [Betula], [Populus tremula], [Sorbus aucuparia] or [Corylus avellana]		1,0			1,0				
G1.A	Meso- and eutrophic [Quercus], [Carpinus], [Fraxinus], [Acer], [Tilia], [Ulmus] and related woodland		1,0					1,0		
G2.1	Mediterranean evergreen [Quercus] woodland	0,6							0,6	0,6
G3.4	[Pinus sylvestris] woodland south of the taiga		1,0			1,0				
G3.5	[Pinus nigra] woodland									1,0
G3.75	[Pinus brutia] forests								1,0	1,0
G3.9	Coniferous woodland dominated by [Cupressaceae] or [Taxaceae]									1,0
G4.B	Mixed mediterranean [Pinus] - thermophilous [Quercus] woodland									1,0
X18	Wooded steppe			0,8	0,8	0,8	0,8	0,8		0,8

APPENDIX C

Species of Conservation Concern (SCC)

Terrestrial Flora: Species of Conservation Concern (SCC) and target species

Species Code	Species Name	IUCN status	Target species	Endemic
TFL_003	*Achillea ketenoglui*	EN	-	Restricted Endemic
TFL_004	*Achillea sintenisii*	VU	-	Restricted Endemic
TFL_005	*Achillea sipikorensis*	VU	-	Restricted Endemic
TFL_007	*Alyssum dudleyi*	CR	yes	Restricted Endemic
TFL_008	*Alyssum niveum*	EN	-	Restricted Endemic
TFL_010	*Asperula capitellata*	VU	-	Restricted Endemic
TFL_011	*Astragalus aytatchii*	CR	yes	Restricted Endemic
TFL_012	*Astragalus densifolius subsp. ayashensis*	VU	-	Restricted Endemic
TFL_014	*Astragalus kochakii*	VU	-	Restricted Endemic
TFL_015	*Astragalus physodes subsp. acikirensis*	EN	-	Restricted Endemic
TFL_016	*Astragalus zaraensis*	EN	-	Restricted Endemic
TFL_017	*Bellevalia crassa*	EN	-	Restricted Endemic
TFL_019	*Centaurea sivasica*	VU	-	Restricted Endemic
TFL_020	*Cephalaria aytachii*	CR	yes	Restricted Endemic
TFL_021	*Cephalaria sparsipilosa*	VU	-	Restricted Endemic
TFL_022	*Chrysocamela noeana*	EN	-	Restricted Endemic
TFL_023	*Cochlearia sintenisii*	VU	-	Restricted Endemic
TFL_024	*Cousinia bicolor*	EN	-	Restricted Endemic
TFL_025	*Cousinia halysensis*	VU	-	Widespread Endemic
TFL_026	*Cousinia sivasica*	VU	-	Restricted Endemic
TFL_027	*Cyathobasis fruticulosa*	VU	-	Restricted Endemic
TFL_028	*Dianthus goekayi*	CR	yes	Restricted Endemic
TFL_029	*Erodium sibthorpianum subsp. sibthorpianum*	EN	-	Restricted Endemic
TFL_030	*Gypsophila aucheri*	VU	-	Restricted Endemic
TFL_031	*Gypsophila heteropoda subsp. minutiflora*	CR	yes	Restricted Endemic
TFL_032	*Gypsophila osmangaziensis*	CR	yes	Restricted Endemic
TFL_033	*Hieracium sarykamyschense*	CR	yes	Restricted Endemic
TFL_034	*Isatis glauca subsp. sivasica*	VU	-	Restricted Endemic
TFL_035	*Isatis undulata*	EN	-	Restricted Endemic
TFL_036	*Lathyrus karsianus*	VU	-	Restricted Endemic
TFL_037	*Lepidium caespitosum*	VU	-	Restricted Endemic
TFL_038	*Onobrychis paucijuga*	VU	-	Restricted Endemic
TFL_039	*Onobrychis stenostachya subsp. krausei*	EN	-	Restricted Endemic
TFL_040	*Onosma briquetii*	VU	-	Restricted Endemic
TFL_041	*Onosma sintenisii*	VU	-	Restricted Endemic
TFL_043	*Reseda armena var. armena*	VU	-	Restricted Endemic
TFL_045	*Salvia huberi*	VU	-	Restricted Endemic
TFL_046	*Salvia tchihatcheffii*	VU	-	Restricted Endemic
TFL_047	*Scabiosa hololeuca*	EN	-	Restricted Endemic
TFL_048	*Scorzonera aucherana*	VU	-	Restricted Endemic
TFL_049	*Scrophularia lepidota*	VU	-	Restricted Endemic
TFL_051	*Scutellaria yildirimli*	CR	yes	Restricted Endemic
TFL_052	*Tanacetum albipannosum*	VU	-	Restricted Endemic
TFL_053	*Tanacetum densum subsp. sivasicum*	VU	-	Restricted Endemic
TFL_054	*Thesium stelleroides*	VU	-	Restricted Endemic
TFL_055	*Thymus canoviridis*	EN	-	Restricted Endemic
TFL_056	*Thymus cappadocicus var. pruinosus*	VU	-	Restricted Endemic
TFL_057	*Thymus leucostomus*	VU	-	Widespread Endemic
TFL_069	*Corydalis wendelboi subsp. congesta*	EN	-	Restricted Endemic
TFL_083	*Minuartia corymbulosa var. gypsophiloides*	EN	-	Widespread Endemic
TFL_084	*Eryngium wanaturi*	VU	-	Restricted Endemic
TFL_085	*Centaurea macrocephala*	VU	-	Restricted Endemic
TFL_086	*Tanacetum coccineum ssp. chamaemelifolium*	VU	-	Restricted Endemic
TFL_087	*Lilium kesselringianum*	VU	-	Restricted Endemic

Terrestrial Fauna: Species of Conservation Concern (SCC) and target species

Species Code	Class	Species Name	IUCN status	Target species	Endemic	Restricted range	PBF/CH
TFM_001	Mammals	*Capra aegagrus*	VU				PBF
TFM_002	Mammals	*Myomimus roachi*	VU		X	X	CH
TFM_003	Mammals	*Prometheomys schaposchnikowi*	NT			X	CH
TFM_005	Mammals	*Spermophilus citellus*	VU		X		CH
TFM_006	Mammals	*Myotis capaccinii*	VU				PBF
TFM_007	Mammals	*Rhinolophus mehelyi*	VU				PBF
TFM_008	Mammals	*Vormela peregusna*	VU				PBF
TFB_009	Birds	*Otis tarda*	VU				CH
TFB_015	Birds	*Vanellus gregarius*	CR				CH
TFB_016	Birds	*Aquila heliaca*	VU				PBF
TFB_017	Birds	*Anser erythropus*	VU				PBF
TFB_018	Birds	*Marmaronetta angustirostris*	VU				PBF
TFB_019	Birds	*Streptopelia turtur*	VU				CH
TFR_001	Reptiles	*Montivipera wagneri*	CR	yes	X	X	CH
TFR_002	Reptiles	*Darevskia uzzelli*	EN	yes	X	X	CH
TFR_003	Reptiles	*Darevskia unisexualis*	NT			X	PBF
TFR_004	Reptiles	*Testudo graeca*	VU				PBF
TFR_005	Reptiles	*Vipera eriwanensis*	VU				CH
TAM_002	Amphibians	*Mertensiella caucasica*	VU	yes		X	CH
TFA_002	Arthropods	*Phengaris nausithous*	EN			X	CH
TFA_003	Arthropods	*Polyommatus actis*	DD		X	X	CH
TFA_009	Arthropods	*Polyommatus merhaba*	EN	yes	X		CH
TFA_015	Arthropods	*Eulasia chrysopyga*				X	CH
TFA_017	Arthropods	*Muzimes caucasicus*				X	CH
TFA_018	Arthropods	*Zonitis nigriventris*				X	CH
TFA_019	Arthropods	*Dysmachus safranboluticus*			X		CH
TFA_020	Arthropods	*Zygaena armena*	-		X		CH
TFA_023	Arthropods	*Dorcadion ardahense*	-		X		CH
TFA_024	Arthropods	*Hilara truva*	-		X		CH
TFA_029	Arthropods	*Dioctria n. sp. 1*	-		X		CH
TFA_030	Arthropods	*Dioctria n. sp. 2*	-		X		CH
TFA_033	Arthropods	*Hilara n. sp. 3*	-		X		CH
TFA_034	Arthropods	*Hexatoma n. sp.*	-		X		CH
TFA_035	Arthropods	*Tipula n. sp.*	-		X		CH
TFA_036	Arthropods	*Erebia ottomana*	NT		X	X	CH
TFA_037	Arthropods	*Polyommatus antidolus*	DD		X	X	CH
TFA_038	Arthropods	*Brachythemis fuscopalliata*	VU				PBF
TFA_039	Arthropods	*Lycaena ottomana*	VU				PBF
TFA_040	Arthropods	*Somatochlora borisi*	VU				PBF

Freshwater Fauna: Species of Conservation Concern (SCC) and target species

Species Code	Class	Species Name	IUCN status	Target species	Endemic	Restricted range	PBF/CH
FFF_004	Fish	*Anguilla anguilla*	CR	yes	-	-	CH
FFF_008	Fish	*Cobitis puncticulata*	EN	yes	X	-	CH
FFF_013	Fish	*Chondrostoma angorense*	LC	yes	X	X	CH
FFF_014	Fish	*Cobitis fahireae*	LC	yes	X	-	CH
FFF_019	Fish	*Oxynoemacheilus simavica*	CR	yes	X	-	CH
FFF_020	Fish	*Cobitis simplicispina*	LC		X	-	CH
FFF_101	Fish	*Oxynoemacheilus kosswigi*	LC		X	-	CH
FFF_103	Fish	*Gobio sakaryaensis*	LC	yes	X	-	CH

APPENDIX D

Habitat suitability for SCC

Terrestrial Flora: SCC habitat suitability (*s*)

Species Code	E1.00	E1.01	E1.22	E1.2B	E1.2E	E2.1	E2.5	E3.4	E4.4	E6.2	F2.2	F5.3	G1.1	G1.3	G1.7	G1.9	G1.A	G1.C	G2.1	G3.4	G3.5	G3.75	G3.9	G3.F	G4.B	X18
TFL_003	0,66	1	0,33	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_004	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0,33	0,33	0,66
TFL_005	1	0,33	0,33	0,66	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_007	0	0	0	0,33	0	0	0	1	0	0	0	0,33	0	0,33	0,33	0	0	0	0,33	0	1	1	0,66	1	0,66	0
TFL_008	0,66	1	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,66	0,66	0,66	0,33	0,33
TFL_010	0	0	0,66	1	0,66	0	0	0	0	0	0	0	0	0	0,66	0	0	0	0	1	0	0	0	0,33	0	0,33
TFL_011	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_012	0,33	0,66	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0,33	0	0	1	0,66	0,33	0,33	0,33	0
TFL_014	0,66	1	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_015	0,66	1	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_016	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_017	0,33	0,33	0,66	1	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_019	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_020	0,66	1	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,66	0,33	0,33	0,33	0,66
TFL_021	0	0	0	0,33	0,33	0,33	0	0	1	0	0	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFL_022	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_023	0,33	0,33	0,66	1	1	0	0	0	0,33	0	1	0	0	0	1	0	0,33	0	0	0,33	0,33	0,33	0,33	1	0,33	0,33
TFL_024	0,33	0,33	0,66	0,66	1	0,33	0	0	1	0	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_025	1	1	0,66	0,66	1	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_026	1	0,66	0,33	0,66	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_027	0,66	1	0,33	0,33	0,33	0	0	0	0	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_028	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33	0	0	0	0,33	0	0,33	0,66	0,33	0	1	0
TFL_029	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0,33	0
TFL_030	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_031	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_032	0,66	1	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,33	0,33	0,33	0,33	0,66
TFL_033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,66	0,66	0,33	1	0,33	0
TFL_034	1	0,66	0,66	0,66	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_035	0,33	0,33	0,66	0,66	1	0	0	0	0	0	0	0	0	1	0,33	0	0	0	0	0	0	0	0	0	0	1
TFL_036	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0,33	0,33	0,33	0,33	0	0
TFL_037	0	0	0	0	0	0,33	0,33	1	0,33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFL_038	0,66	1	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_039	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33	0	0	0	0,33	0	0,33	0,33	0	0,33	1	0
TFL_041	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_043	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0,66	0	0	0	0	0	0	0	0	0
TFL_045	0	0	0,33	0,33	1	0,66	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0,66	0	0	0	0	0	0,33
TFL_046	0,66	1	0,66	0,66	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0,66	0	0,33	0,33	0,66
TFL_047	0,66	1	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,66	0	0,33	0,33	0,66
TFL_048	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_049	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_051	1	1	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_052	0,33	0,33	0,66	0,66	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_053	0,66	0,66	0,66	0,66	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_054	1	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_055	1	0,66	0,66	0,66	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFL_056	0,33	0,33	0,66	1	0,66	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0,33	0,66
TFL_057	1	1	0,66	0,66	1	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0	0,33	0,33	0,33	0,33	0,33	0	0,33	0,33
TFL_069	0	0	0	0	0	0	0	0	0,66	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFL_083	1	1	0,33	0,33	0,33	0	0	0	0,66	0	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33

Species Code	E1.00	E1.01	E1.22	E1.2B	E1.2E	E2.1	E2.5	E3.4	E4.4	E6.2	F2.2	F5.3	G1.1	G1.3	G1.7	G1.9	G1.A	G1.C	G2.1	G3.4	G3.5	G3.75	G3.9	G3.F	G4.B	X18
TFL_084	0	0	0	0	0	0	0	0	1	0	0,33	0	0		0	0	0	0	0	0	0	0	0	0	0	0
TFL_085	0	0	0	0	0,66	1	0,33	0	0,66	0	0	0	0	0	0	1	0,33	0,33	0	0	0	0	0	0	0	0
TFL_086	0	0	0	0	0	0	0	0	1	0	0,33	0	0	0	0	1	0,33	0,33	0	0	0	0	0	0,33	0	0
TFL_087	0	0	0	0	0	0,33	0	0	1	0	0,33	0	0	0	0	1	0,33	0,33	0	1	0	0	0,33	0,33	0	0

Note: habitat columns were suitability value (s) was 0 for all SCC species were deleted

Terrestrial Fauna: SCC habitat suitability (*s*)

Table 1 of 2

Species Code	B1.8	B2.2	B3.3	C1	C1.2	C1.6	C2.2	C2.3	C2.5	C3.6	E1.00	E1.01	E1.22	E1.2B	E1.2E	E2.1	E2.5	E3.4	E4.4	E6.2	F2.2	F5.3
TFM_001	0	0	0	0	0	0	0	0	0	0	0,33	0,33	1	0,66	0,66	0,33	1	0,66	1	0	1	1
TFM_002	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	1	1
TFM_003	0	0	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0	0,66	0,33	1	0	0	0
TFM_005	0	0	0	0	0	0	0	0	0	0	0,66	0,66	1	0	0,66	1	1	1	1	0,66	1	1
TFM_006	0	0	0	0,66	0,66	0,66	0,66	0,66	0,66	0	0	0	0	0	0	0	0,33	0,66	0	0	0,33	0,66
TFM_007	0	0	0	0,66	0,66	0,66	0,66	0,66	0,66	0	0	0	0,66	0	0	0	0,33	0,66	0	0	0,33	1
TFM_008	0	0	0	0	0	0	0	0	0	0	1	1	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,33	0	0,33
TFB_009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0
TFB_015	0	0	0,66	0,66	1	1	0,33	0,66	0,66	0	1	1	1	1	1	0,66	1	0,66	0,66	0,66	0,66	0
TFB_016	0	0	0	0	0	0	0	0	0	0	0	0	0,33	0,33	0,33	0,66	0,66	0,66	0,66	0	0	0,33
TFB_017	0	0	0	1	1	1	0,33	0	0	0,33	0	0	0	0	0	0	0	0	0	0	0	0
TFB_018	0,33	0,33	0,33	1	1	0,66	0	0,33	0	0,33	0	0	0	0	0	0	0	0	0	0	0	0
TFB_019	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0	0,66	0,66	0,66	0,66	0,33	0,33	0	0,66
TFR_001	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	1	0,33	0,33	0,33	0,66	0,66	1	0
TFR_002	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	1	0,33	0,33	0,33	0,33	0,33	1	0
TFR_003	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	1	0,33	0,66	0,33	0,66	0,33	1	0
TFR_004	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0,33	0,66	0,33	0,33	0,33	0	0,33
TFR_005	0	0	0	0	0	0	0	0	0	0	0,33	1	1	1	1	0,66	0,66	0,66	0,66	0	0,66	0,66
TAM_002	0	0	0	1	1	1	0,66	0,66	0,33	0,33	0,33	0,33	0,33	0,33	0,33	1	0,33	0,33	1	0	0,66	0,66
TFA_002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0,66	0
TFA_003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0,66	0,66	0
TFA_009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0,66
TFA_015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,66	0	0
TFA_017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0,66	0
TFA_018	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	1	0	0	1	1	0	0,66	0
TFA_019	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
TFA_020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0,66	1	1	0	0,66	0
TFA_024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_029	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66
TFA_030	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66
TFA_033	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	1	0,66	0,66	0,66	0,66	0,66	0,66	0,66
TFA_034	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66
TFA_035	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66
TFA_036	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	0,66	1	0,66	0,66	1	0,66	0,66	0,66
TFA_037	0	0	0	0	0	0	0	0	0	0	0,66	0,66	0,66	0,66	1	0,66	0,66	0,66	0,66	0,66	0,66	0,66
TFA_038	0	0	0	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0	0	0	0	0	0	0	0	0	0	0	0
TFA_039	0	0	0	0,66	0,66	0,66	0,66	0,66	0,66	0	0	0,33	0,33	0,33	0,33	0	0	0,33	0	0	0,66	0,66
TFA_040	0	0	0	0,66	0,66	0,66	0,66	0,66	0,66	0,66	0	0	0	0	0	0	0	0	0	0	0	0

Note: habitat columns were suitability value (s) was 0 for all SCC species were deleted

Table 2 of 2

Species Code	G1.1	G1.3	G1.7	G1.9	G1.A	G1.C	G2.1	G3.4	G3.5	G3.75	G3.9	G3.F	G4.B	G5.1	I1.1	I1.2	I1.4	J1.2	J1.4	J2.3	J2.6	J3	J4.2	J4.7	J5.4	J5.5	X18
TFM_001	0,66	0,66	1	1	1	0,33	0,33	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFM_002	0	0	0	0	0	0	1	0	0	0	0	0,66	0	0,66	0,66	0,66	0,66	0	0	0	0	0	0	0	0	0	0,66
TFM_003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,66
TFM_005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFM_006	0,33	0,66	0,66	0	1	0,33	0,66	0	0,33	0,33	0	0	0,33	0,33	0,33	0,33	0,33	0,33	0	0,33	0,33	1	0	0,33	0,66	0,66	0,33
TFM_007	0	0,66	0,66	0	1	0,33	0,66	0	0,33	0,33	0	0	0,33	0,33	0,33	0,33	0,33	0,33	0	0,33	0,66	1	0	0,66	0,66	0,66	0,66
TFM_008	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0,33	0,33	0	0	0	0	0,33	0,33	0	0	0	0	0,33	0,66
TFB_009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0,66	0	0	0	0	0	0	0	0	0	0
TFB_015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFB_016	1	0,66	0,66	0,66	0,33	0	0,66	0,66	0,66	0,66	0,33	0,33	0,66	0	0,33	0	0	0	0	0	0	0	0	0	0	0	0,66
TFB_017	0	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFB_018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFB_019	0,66	0,66	0,66	0,33	0,33	0,66	0,66	0,33	0,33	0,33	0	0,33	0,66	0,33	0,66	0,33	0,66	0,33	0,33	0	0	0	0	0,33	0	0	0,66
TFR_001	0,66	0	0	0,33	0,33	0	0	0,33	0,33	0	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFR_002	0,66	0	0,33	0,66	0,66	0	0	0,66	0,66	0	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFR_003	0,33	0	0	0	0	0	0	0,33	0,33	0	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFR_004	0,66	0,33	0,33	0,33	0,33	0,33	0,66	0,33	0,33	0,33	0,33	0,33	0,66	0,33	0,33	0,33	0	0	0	0	0	0	0,33	0	0	0	0,33
TFR_005	0,33	0	0,66	0	0	0	0	0	0	0	0	0	0	0	0,33	0,33	0	0	0	0	0,33	0	0	0	0	0	0,66
TAM_002	1	0,33	1	0,33	1	0	0	0,33	0,33	0	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,33
TFA_002	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_009	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_015	0	0	0	0	0	0	0	1	0,66	0,66	0,33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_019	0	0	1	1	1	1	1	0	0	0	0	0	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_020	0	0	0,66	1	1	0,33	0,66	0,33	0,33	0,33	0,33	0,66	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_023	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_024	0	0	0,66	0,66	1	0,33	0,66	0,33	0,33	0,33	0,33	0,66	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_029	0,66	0,66	0,66	0,66	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,66
TFA_030	0,66	0,66	1	0,66	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,66
TFA_033	0,66	0,66	0,66	0,66	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,66
TFA_034	0,66	1	0,66	0,66	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,66
TFA_035	0,66	0,66	0,66	0,66	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,66
TFA_036	0,66	0,66	0,66	0,66	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,66
TFA_037	0,66	0,66	1	0,66	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0,66
TFA_038	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_039	0,66	0,66	0,66	0,33	0,66	0,66	0,66	0	0,66	0,66	0,66	0,66	0,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TFA_040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: habitat columns were suitability value (s) was 0 for all SCC species were deleted

Freshwater Fauna: SCC habitat suitability (*s*)

Species Code	C1.2	C1.6	C2.2	C2.3	C2.5
FFF_004	0	0	0,66	0,33	0
FFF_013	0	0	0,66	1	0,33
FFF_014	1	1	0,33	0,66	0,66
FFF_008	1	0	0,33	0,66	0,66
FFF_020	0,66	0,66	0,33	0,66	0,66
FFF_103	0	0	0,66	1	0,33
FFF_101	0	0	0,33	0,66	0,66
FFF_019	0	0	0,33	0,66	0,66

*Note: habitat columns were suitability value (*s*) was 0 for all SCC species were deleted*

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