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HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Environmental and Social Impact Assessment



70069878-ESIA
DECEMBER 2021

PUBLIC

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ECOLOGY

8 ECOLOGY

8.1 INTRODUCTION

8.1.1. This chapter reports the findings of the assessment of potential ecological effects of the Project during both the construction and operational phases. For both phases, the type, source and significance of potential effects are identified, and measures that should be employed to minimise those described.

8.2 LEGISLATIVE FRAMEWORK, POLICY AND GUIDANCE

8.2.1. This section outlines the legislation, policy and guidance considered as part of the assessment, which includes international guidance, EBRD performance requirements applicable EU legislation, and national standards.

8.2.2. The overall strategy with regards nature conservation in Turkey is documented within 'The National Biological Diversity Strategy and Action Plan', which was adopted in 2007 with the aim of meeting the country's obligations under the UN Convention on Biological Diversity. The strategy is underpinned by a large number of national laws and policies; those relevant to the Project and this assessment are listed below:

- Environmental Law (No. 2872) - which makes provision for the improvement of use of land and natural resources and preserving the country's vegetative and livestock assets and natural and historical richness;
- Regulation on the Protection of Wetlands (2014) - which defines the principles of protection, management and development of wetlands and their habitats in Turkey's land borders and the continental shelf;
- Draft Law on the Protection of Nature and Biological Diversity – which has not entered into force, but was intended to provide a framework law on the conservation of natural habitats and biodiversity;
- National Plan for In-Situ Conservation of Plant Genetic Diversity (1998) - which establishes legal, institutional and financial requirements for the in-situ conservation of species that are important for agriculture, food, economy and culture;
- National Plan on In-Situ Conservation of Plant Genetic Diversity in Turkey (1997);
- National Plan for In-situ Conservation of Plant Genetic Diversity in Turkey (1996);
- National Forestry Program (2004/2023) – which seeks to ensure sustainable forest management, biodiversity conservation, ecosystem preservation and efficient use of forest resources;
- The National Strategy and Action Plan for Biodiversity in Turkey (2001)
- National Biological Diversity Strategy and Action Plan (2007) – seeks to achieve the goals of conservation and sustainable use through a comprehensive and integrated approach to biological diversity;
- National Wetland Strategy (2003-2008) - is an important guidebook for the conservation, management, restoration, monitoring, and sustainable use of wetlands, though institutional co-operation;
- General Directorate of Forestry Strategic Plans (2010-2014 / 2013-2017 / 2017-2021) - the overall purposes of these Strategic Plans are protection of forests and forest resources, forestry development, ecosystem preservation, and multifaceted benefits to society;

8.2.3. In addition to the above, Turkey has ratified or signed the following relevant (to the Project) major environmental agreements related to natural resources, including:

- Convention on Biological Diversity (1992) – Ratified;
- Convention on Wetlands on International Importance as Waterfowl Habitat (Ramsar) – Ratified;
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern) – Ratified; and
- Convention on International Trade in Endangered Species (CITES) – Acceded, not Ratified.

8.2.4. Additional international and European legislation and agreements are also relevant to the Project due to the requirements of PR6: 'Biodiversity Conservation and Sustainable Management of Living Natural Resources'. These include, but are not limited to, the following:

- Directive 2009/147/EC of the European Parliament and of the Council on the Conservation of Wild Birds (herein referred to as the EU Birds Directive) – this gives provision for the protection of all wild birds, their nests, and eggs, within the European Community; and
- Council Directive 92/43/EEC of the European Parliament and of the Council on the Conservation of Natural Habitats and of Wild Fauna and Flora (herein referred to as the EU Habitats Directive) – this provides a framework for the strict protection of animal and plant species listed under Annex IV of the Directive.

8.2.5. Further detail on the application of PR6 is documented within the associated Guidance Note[56].

8.3 ASSESSMENT METHODOLOGY

8.3.1. This ecological impact assessment follows international guidance (as well as relevant documents referenced within **Chapter 5: Approach to ESIA**):

- EBRD (2014). Environment and Social Policy;
- EBRD (2014). Performance Requirement (PR) 1: Assessment and Management of Environmental and Social Impacts and Issues;
- PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources; and
- Hardner, K., Gullison, R. E., Anstee, S. & Meyer, M. 2015. Good practices for Biodiversity Inclusive Impact Assessment and Management Planning.

8.3.2. In the absence of suitable national guidance, the ecological assessment is broadly underpinned by the methodology outlined by the Chartered Institute of Ecology and Environmental Management (CIEEM)[57], which is aligned with the EU EIA Directive 2014.

SUPPORTING INFORMATION

8.3.3. This chapter should be read in conjunction with the following associated documents:

- Appendix L: Critical Habitat Assessment;
- Appendix M: Biodiversity Management Plan; and

[56] EBRD. (2014). EBRD Guidance Note. Biodiversity Conservation and Sustainable Management of Living Natural Resources.
[57] CIEEM. (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 3rd edition.

- Appendix N: Habitat Classification Figures

AREA OF STUDY

8.3.4. Two separate spatial extents are referenced throughout this assessment, reflecting both the extent of impacts associated with the Project, and also the consideration of a landscape/ecosystem-level area, within which a broadly uniform biodiversity assemblage could feasibly be present. This ecosystem level approach allows for biodiversity receptors to be assessed within the context of an appropriate biogeographical range and it also serves to inform those biodiversity receptors likely to be present within the Project Zone of Influence (ZoI), as part of an initial screening process. The two separate spatial extents are described below.

Ecologically Appropriate Area of Analysis (EAAA)

8.3.5. This assessment follows updated industry guidance (EBRD 2020[58]) and focusses upon impacts associated with the Project, within the context of an area that is appropriate to the receptors in question, i.e. one that is ecologically linked to the functioning of that receptor. This is defined as the ecologically appropriate area of analysis (EAAA) and in most cases will comprise a continuous habitat/ecosystem area, within which the ecology is functionally linked.

Zone of Influence

8.3.6. The ZoI is a widely used concept/term used to describe the maximum potential area over which impacts from the Project will be experienced. For the purposes of this assessment, this extends up to a precautionary maximum distance of 500m either side of the Project centreline (i.e. a corridor of 1km) within which a level of acoustic impact will be experienced during construction and operation of the Project. Where the ZoI markedly deviates from this (e.g. for plants), this is addressed accordingly. The ZoI has been used to inform the scope of receptors requiring consideration through the assessment process (i.e. those potentially impacted) as well as providing the basis for predicting likely impact magnitudes.

BASELINE DATA

8.3.7. The objective of the baseline data collection was to collect sufficient information to describe the ecological conditions across the Project's ZoI and across the wider study area as appropriate (e.g. such as the requirement to understand bird movements across the wider area).

8.3.8. It is accepted that hydrological connectivity extends beyond the ZoI; however, for watercourse crossings where there will be no in-channel/direct impacts, measures to mitigate potential hydrological effects are embedded within the Project and considered further within **Chapter 11: Surface Water Environment** and **Chapter 12: Geology and Hydrogeology**, such that surface water and groundwater will not be adversely affected and therefore biodiversity dependent upon

[58] EBRD. 2020. Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (v. January 1, 2020). Sept 10, 2020.

these regimes will be unaffected. For the seven watercourse crossings where in-channel work will be required, additional survey work was undertaken and is discussed further where relevant.

8.3.9. Baseline data collection has relied upon detailed desk study and targeted fieldwork. Specifically, this has comprised the following:

Desk Study

8.3.10. A number of desk study resources have been reviewed to inform this assessment. These are as follows:

Wintering Bird Survey Report[59]

8.3.11. A desk study and targeted field survey exercise was completed during February 2020, with a particular focus on the three Important Bird Areas (IBA) which are either crossed by, or in close proximity to, the project. Field work comprised vantage point (VP) flight activity surveys at six separate VP locations focussing on the two IBAs located to the east of the Project, where potentially significant risks to waterbirds had been identified due to the Project's immediate proximity to waterbodies at these locations.

Habitat / Vegetation Survey Report[60]

8.3.12. A targeted botanical survey was undertaken in March 2020, focussing on 16 representative sample sites at which detailed botanical information was collected and broad habitat types classified in line with the EUNIS system[61].

Faunal Surveys[62]

8.3.13. A survey to establish an inventory of fauna across the Project was undertaken in March 2020, focussing on 16 representative (and accessible) sample areas. Surveys considered all animals groups and subsequent reporting also made use of existing published information to provide an assessment of likely presence for those animal groups not, or less, active at the time of survey (e.g. amphibians and reptiles).

Halkali to Kapikule Railway National EIA for the Project (2017)

8.3.14. The National EIA for the Project (2017) was further reviewed following an initial review that informed a gap analysis for this Project at the start of the year.

Kanal Istanbul EIA

8.3.15. A brief review of the Kanal Istanbul EIA (published in 2020) was undertaken given the Project will pass under the Kanal Istanbul project in a 6km twin-bore tunnel (Tunnel 1). Further information on the Kanal Istanbul project is available in **Chapter 2: Description of the Project**.

59 Cogal., M. & Sozen., M. (2020). Survey of Potential Risks to Wintering Waterbirds from the Halkali-Kapikule High Speed Railway.

60 Unknown. 2020. Halkali-Cerkezköy High Speed Rail Project Flora and Vegetation.

61 European Nature Information System (accessed at: https://eunis.eea.europa.eu/index.jsp).

62 Prof. Sozen, M. 2020. Report of Fauna Studies Halkali – Kapikule Railway Project Küçükçekmece – Cerkezköy.

Pre-Classification of Remote Sensing Information

8.3.16. A remote sensing exercise was undertaken by the Project Team, and habitats across the Project ZoI were pre-classified based on the light frequency characteristics of different habitat types. This was then subject to retrospective 'ground-truthing' with information from the habitat/vegetation survey report, and further corroborated by a detailed review of higher-resolution aerial imagery (such as that provided by Google Earth). Final edits were made following biodiversity surveys undertaken in July 2020.

Review of Google Earth

8.3.17. Aside from the corroboration exercise undertaken above, Google Earth was also reviewed to inform the general appreciation of the habitat baseline and gain an understanding of the wider landscape context of the ZoI.

Review of Published Literature / Available Online Resources

8.3.18. A substantial array of published literature has been reviewed to inform this assessment. These papers / articles are referenced throughout where applicable. In addition to the review of those resources that are readily available (i.e. through online search engines), a detailed exercise of engagement with in-country ecologists has been undertaken to inform the assessment. This has involved seeking direct advice from national experts, as well as the identification and review of national papers / reports to provide a more informed interpretation of these resources (some of which are in Turkish).

8.3.19. A notable component of the desk study has been the review of eBird[63] records for the birds relevant to this study. This resource captures amateur ornithologist records from across the world and is a useful supplementary resource when undertaking baseline data collection. Similarly, data obtained from a review of the Global Biodiversity Information Facility[64] (GBIF) has also been used where considered appropriate.

8.3.20. A key aspect of this literature review and consultation exercise has been to supplement field survey for animals / species group where survey access has been disrupted by the developing Covid-19 situation (see **paragraph 8.3.50**).

Review of Information Received from Birdlife International Partner (Doga)

8.3.21. Doga (the Turkish Birdlife International Partner) were approached for information regarding the Project and provided some information to inform this assessment.

Integrated Biodiversity Assessment Tool (IBAT) Report[65]

8.3.22. A biodiversity screening reporting from the IBAT website provided a high-level appraisal of likely, key biodiversity sensitivities present across the Project site, and a 50km study area. This report is a

[63] Cornell Lab of Ornithology (2020). eBrid. Available at: https://ebird.org/home (Accessed 06/07/20).
[64] Available at: https://www.gbif.org/ (Accessed 06/07/20).
[65] As generated from: https://www.ibat-alliance.org (Accessed 06/07/20).

standard tool for flagging potential presence of Critical Habitat/Priority Biodiversity Features triggers and is an important component in the scoping process for additional study (e.g. field survey).

Surveys

8.3.23. Following (and concurrent with) the desk study exercise, the field survey scope was developed and implemented. In line with the requirements of PR6 an appropriate level of field survey was scoped and undertaken. This process is summarised in **Table 8-1** below, with subsequent text providing further detail around the studies undertaken.

Table 8-1 - Survey Scoping Rationale

Survey	Timing	Purpose
Flight activity surveys - birds	Breeding season (June) 2020 Autumn migration season (August/September) 2020	Ornithological sensitivities had been identified as one of the main risks to the Project. These included potentially important breeding bird interests (mainly imperial eagle) as well as more extensive migratory/wintering bird interests (in particular in relation to the two IBAs in the east of the Project. As per February/March surveys, flight activity surveys were undertaken to identify potential collision risk and gather data sufficient to inform an assessment of this impact.
Breeding bird surveys	June 2020	To qualify presence/potential presence of important breeding bird interest within the ZoI (most notably imperial eagle), surveys of suitable breeding bird habitat were completed during two visits in June 2020.
Ecological walkover surveys	July 2020	A series of transects were undertaken to build upon findings reported in March 2020 regarding terrestrial biodiversity sensitivities and further qualify presence/potential presence of key biodiversity receptors within the context of PR6)
Aquatic habitat surveys	February 2021	Following design updates (including confirmation regarding the requirement for in-channel works at seven separate watercourses), aquatic habitat surveys were completed to corroborate desk study findings regarding ecological conditions at the watercourse crossing points.

8.3.24. The IBAT report generated for the Project, was of particular importance to the scoping exercise, the biodiversity gap analysis and subsequent survey effort undertaken at the start of 2020. Information gathered from these exercises highlighted the key potential biodiversity sensitivities (in particular

potential Critical Habitat/Priority Biodiversity Features triggers[66], as per PR6), which then informed the survey effort subsequently undertaken for the assessment.

8.3.25. Information regarding this iterative process is included within the following sections.

Vantage Point Bird Surveys

8.3.26. Following the February / March bird surveys, a broadly similar vantage point (VP) survey plan was designed and implemented during June, August and September 2020. Work undertaken in early-2020 had identified key ornithological constraints, so further desk study research into the ecology of those species associated with relevant protected areas was then undertaken. This informed the June surveys that extended across six VPs and focussed mainly on the Büyükçekmece Lake and Küçükçekmece Basin, but they were also designed to capture a level of flight activity data around other perceived areas of high breeding bird interest within areas further to the west.

8.3.27. The surveys in August and September were designed to record key flight activity associated with returning wintering birds around Büyükçekmece Lake and Küçükçekmece Basin and so VPs were positioned around these sites only (i.e. with the two VPs used for recording breeding bird flight activity dropped accordingly). Two VPs were considered appropriate at each site (so four VPs in total) to gain a robust appreciation of bird flight behaviour across both sites.

8.3.28. As with surveys completed during February/March 2020, the additional survey effort in June, August and September was scoped with the aim of identifying important flight routes / regularly used airspace, at altitudes that would potentially represent a collision risk with the operational Project. As opposed to the application of flight activity surveys within different contexts (i.e. such as wind farms), the onus was not so much on quantifying the flight time spent at potential collision height, but more focused on qualifying the locations where birds were flying at 'at-risk' heights and which species were flying at these heights.

8.3.29. The location of the VPs used during the June, August and September surveys is shown in **Figure 8-1**.

8.3.30. VPs were undertaken broadly in line with methods described in SNH (2017)[67], which is the accepted resource for methods on ascertaining sufficient levels of flight activity information to inform assessments on potential bird collision risk. Surveys comprised completion of a minimum of 12 hours of survey at each VP during June. Surveyors scanned across a 180-degree arc and recorded Target Species[68] flight activity at 3 distinct height bands (0-15m, 15-50m and >50m).

8.3.31. Flight activity was recorded on a standard recording (mirroring that used during February and March surveys). As is standard practice, each individual survey lasted no longer than three hours without the surveyors taking a break.

[66] These are receptors which may trigger classification of an area/feature/habitat as Critical Habitat or Priority Biodiversity Feature as per PR6 criteria.
[67] Scottish Natural Heritage (2017). Bird survey methods for onshore wind farms.
[68] Species considered to be at particular risk of impacts from train collisions due to elevated conservation status and/or perceived susceptibility to collision impacts with trains by virtue of flight behaviour. For breeding bird walkovers this also includes those species of particular sensitivity to disturbance impacts.



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Legend

- Vantage Bird Survey Locations
- Proposed Railway Route



Note:

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 8-1 - Vantage Bird Survey Locations

Scale at A4: 1:350,000

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Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 8-1 - Vantage Bird Survey Locations.mxd

Breeding Bird Surveys

8.3.32. A series of walkover surveys were also completed to further inform of breeding bird interests across the ZoI during June 2020. These walkovers were focussed on areas of greatest perceived breeding bird interest and mainly comprised the areas of more natural and semi-natural habitats in the western half of the Project. The location of the surveys is shown in **Figure 8-2**.

8.3.33. The breeding bird surveys comprised a walkover of the ZoI searching for signs indicative of breeding bird behaviour (such as territorial singing, birds carrying food or nesting materials, alarm-calling, young birds, etc.). As above, surveys focussed on identifying Target Species and their nest sites / territories.

Ecological Walkover Transects

8.3.34. Targeted biodiversity transect walkovers were completed during July 2020 and comprised experienced local specialists completing surveys across the ZoI in seven separate locations, with a focus on species / animal groups identified from the desk study of sufficient conservation interest to require consideration under PR6 at this stage (i.e. such as those potentially triggering Critical Habitat status or Priority Biodiversity Features), but also those species on the IUCN Red List of Threated species[69], Annexes II/IV of the EU Habitats Directive and Annex II of the Bern Directive. Most notably, this included the following:

- Spur-thighed tortoise
- Marbled polecat
- European ground squirrel
- Bats (and long-fingered bat in particular)
- Rare plants (most notably regional endemics)
- Other biodiversity of potential interest (e.g. large assemblages of a single species, etc.)

8.3.35. Surveys were designed to identify (where possible) the presence / potential absence of the above species / animals, as well as the suitability of the habitat to support such animals. A range of techniques were employed and implemented by ecologists who had a detailed expert knowledge of the local biodiversity. Aside from active searches for important features / evidence, camera traps were also deployed to capture photographic evidence of animal species, particularly nocturnal animals.

8.3.36. Surveys were targeted at areas of greatest perceived biodiversity interest (e.g. in areas where urbanisation and agricultural land use were less prevalent), together with locations where the Project diverged the greatest distances from the existing railway, and therefore where the greatest potential impacts are likely to occur. In general surveys extended across a study area of up to 500m, although this was tailored on the ground depending on prevailing habitats and based upon survey experience.

8.3.37. These surveys were also designed to inform the remote sensing, and were used to, 'ground truth' the remote sensing work undertaken (as **paragraph 8.3.16**). Refinements and updates to the EUNIS habitat mapping were made on the basis of this additional field-based information.

[69] IUCN (2019). The IUCN Red List of Threatened Species. Available at: https://www.iucnredlist.org/ (Accessed 24/06/20).

8.3.38. The location of the surveys is shown in Figure 8-3 - Ecological Walkover Transect Locations.

Aquatic Habitat Surveys

8.3.39. The only sensitive aquatic ecology receptors identified as being potentially present within the Project ZoI were two sturgeon species (Russian sturgeon *Acipenser gueldenstaedti colchicus* and Beluga sturgeon *Huso huso*), both recorded from Kucukcekmece Lake. Information on these two species was obtained from desk-based resources[70].

8.3.40. Aquatic habitat surveys were undertaken in February 2021 in order to collect more detailed baseline information at locations where in-channel works will be required and therefore where more material direct impacts will be realised. These locations are illustrated on **Figure 8-4 – Aquatic Habitat Survey Locations**.

8.3.41. In total 7 watercourses were visited, and information was collected on the following environmental parameters:

- Watercourse measurements (depth, width, etc.);
- Flow type characteristics;
- Neighbouring land use/habitats;
- Water physio-chemical characteristics;
- Substrate characteristics;
- Notable flora/fauna; and
- Evidence of pollution/sedimentation.

8.3.42. Surveys were designed to corroborate desk study findings regarding the general aquatic ecology sensitivity across the Project and also to identify any particular features/habitat characteristics that would be at risk in light of the increased impact levels expected at the 7 locations, due to the in-channel works.

[70] Aksehirli, I. (2005). Landscape analysis of Kucukcekmece Lake and its vicinity for ecological planning. *Master's Thesis*. Istanbul University Institute of Sciences. Retrieved from http://nek.istanbul.edu.tr:4444/ekos/TEZ/40505.pdf.



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Legend

- Breeding Bird Locations
- Proposed Railway Route



Note:

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 8-2 - Breeding Bird Locations

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Legend

- Ecological Walkover Transect
- Proposed Railway Route



Note:

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 8-3 - Ecological Walkover Transects

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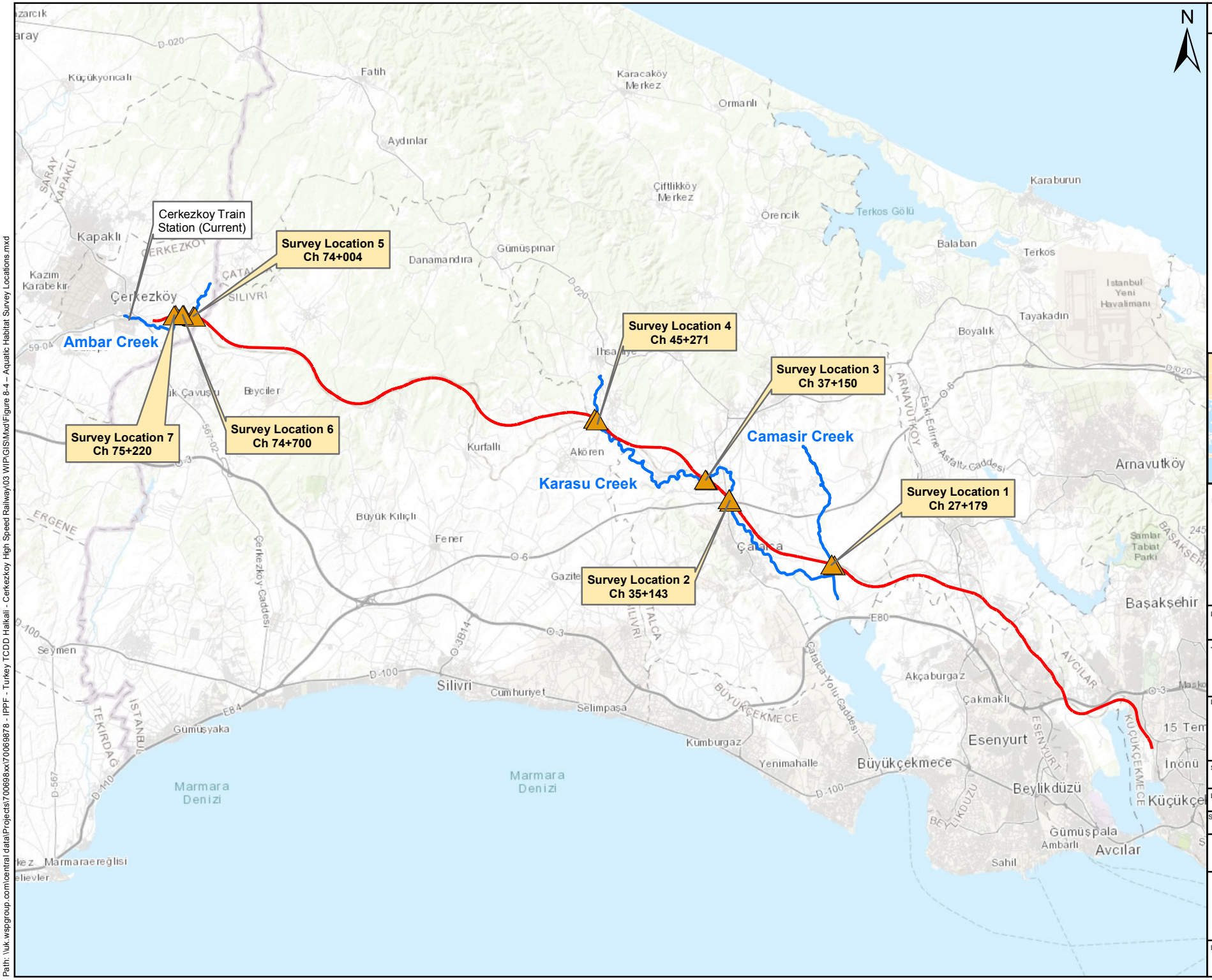
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Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 8-3 - Ecological Walkover Transects.mxd



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Legend

- Proposed Railway Route
- Waterway

Structure Type

- Bridge



Note:

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 8-4 - Aquatic Habitat Survey Locations

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RECEPTOR EVALUATION

8.3.43. The sensitivity of ecological resources has been valued by taking into account both resources that have been designated for their nature conservation interest, and the use of professional judgement to determine biodiversity values, including any social, community and economic values of ecological resources. The valuation has made use of available guidance and information and considered the distribution or status of the species or features. Where uncertainty exists, or where features cannot be valued with confidence due to the acknowledged limitations, an 'up to' valuation has been applied as a precautionary approach, using professional judgement based on available information. The conservation categories of value in **Table 8-2** have been used.

Table 8-2 - Evaluation Categories

Value / Sensitivity	Criteria	Examples
High	High importance and rarity, international, national or regional scale with limited potential for substitution.	▪ Internationally recognised designated site (e.g. Ramsar, Biosphere Reserves, National Nature Parks, etc.); ▪ Critical Habitats (as per PR6); ▪ Critically Endangered (CR) or Endangered (EN) Species (as per IUCN[69] and Red Data Book of Turkish Plants (RDB)[71] [72]) that trigger Critical Habitat; or ▪ Qualifying/trigger species for a relevant designated site.[73].
Medium	High or medium importance and rarity, local or regional scale, and limited potential for substitution.	▪ Priority Biodiversity Features (PBF) as per PR6 (including RDB species that trigger PBF); ▪ EU Habitats Directive Annex I, II and IV species and/or Bern[74] Convention Annex II species; ▪ Regionally protected areas with potential for substitution; ▪ Natural/semi-natural habitats that do not meet threshold for Critical Habitat; ▪ Nationally important populations of IUCN Vulnerable (VU) species, or locally important populations of CR / EN species; or ▪ Locally important endemic / restricted range species and/or migratory species.

[71] Ekim, T., Koyuncu, M., Vural, M., Duman, H., Aytac, Z. & Adiguzel, N. (2000). Red Data Book of Turkish Plants (Pterdophyta and Spermatophyta). Van: Turkiye Tabiatini Koruma Dernegi.
[72] The RDB is based upon the 1994 IUCN Red List assessment criteria.
[73] Such as Ramsar sites and global-level Key Biodiversity Areas and Important Bird Areas.
[74] Species under Resolution 6 of the Bern Convention requiring specific conservation measures.

Value / Sensitivity	Criteria	Examples
Low	Low or medium importance and rarity, local scale.	▪ Modified habitats of limited ecological value; ▪ Non-designated sites / areas of some local biodiversity; or ▪ Locally important VU or IUCN Near Threatened (NT) species populations
Negligible	Very low importance and rarity, local scale.	▪ Other sites with little or no local biodiversity – e.g. built-up areas; and ▪ Non-threatened species; common species with widespread distribution.

8.3.44. In order to focus the assessment on those receptors of greatest ecological value, only those of Low or above value have been considered through the assessment process. Hereafter these are referred to as Valued Ecological Receptors (VER).

ASSESSMENT OF SIGNIFICANCE

8.3.45. The assessment considers the effects of the Project with the application of embedded mitigation (i.e. that is an inherent component of the Project design). This gives an indication of the need for additional (secondary) mitigation to be implemented. The likely effectiveness of that additional mitigation has then been considered, and a residual effect stated.

8.3.46. The assessment of the significance of effects takes into account the following:

- The size, value and sensitivity of the receptor;
- The duration, magnitude and extent of the impacts;
- The timing and frequency of the impacts;
- The ability of the affected receptor to recover from temporary impacts and timescale of recovery;
- The potential for implementation of, and effectiveness of, additional mitigation or enhancement measures; and
- The level of confidence in these predictions.

8.3.47. The impact definitions in **Table 8-3** and **Table 8-4** describe the criteria used for assessing impact magnitude, confidence levels and the overall appraisal categories used in the assessment.

Table 8-3 - Magnitude of Impact

Magnitude	Criteria
Large	Major effect on the nature conservation status of the site, habitats or species, likely to threaten the long-term integrity of the system.
Moderate	Moderate effect on the nature conservation status of the site, habitats or species, but would not threaten the long-term integrity of the system.

Magnitude	Criteria
Slight	Noticeable effects, but either of sufficiently small scale or short duration to cause no harm to the conservation status of the site, habitats or species.
No Change	Not expected to affect the conservation status of the site, habitats or species under consideration in any way, therefore no noticeable effects on the ecological resource.

Table 8-4 - Confidence in Predictions

Confidence Level	Description
Certain	Probability estimated at 95% chance or higher.
Probable	Probability estimated above 50% and below 95%.
Unlikely	Probability estimated above 5% but less than 50%.
Extremely Unlikely	Probability estimated at less than 5%.

8.3.48. The final stage of the assessment uses the value as obtained with reference to **Table 8-3** and **Table 8-4** in order to provide a qualitative assessment of the resulting effects. The matrix for assessing significance of effects is shown in **Chapter 5: Approach to ESIA** and effects that are classified as moderate, large or very large are considered to be significant effects. Effects classified as minor or below are considered to be not significant (see **paragraph 8.3.49** below for exclusions).

CRITICAL HABITAT / PBF

8.3.49. Adherence to PR6 mandates that No Net Loss (NNL), and for Critical Habitat a Net Gain (NG), must be achieved for any Critical Habitat / PBF values identified as being adversely affected by the Project. With this in mind, any materially adverse impacts (i.e. those classified as minor and above) will be subject to mitigation, as if they were considered significant (in ESIA terms).

ASSUMPTIONS AND LIMITATIONS

8.3.50. In light of the restrictions imposed by measures to combat the COVID-19 pandemic, the biodiversity baseline collection for this Project has relied more heavily (than under normal circumstances) upon desk-based study and consultation. Site walkover and survey effort have then been applied to supplement and corroborate these findings. While this represents a variation from optimal practice for baseline data collection, given the extent and quality of the information that has been accessed, this is a limitation that is not considered to be significant in terms of the robustness of this assessment. Where considered appropriate, recommendations have been made to provide further confidence in these findings.

8.4 BASELINE CONDITIONS

SUMMARY

8.4.1. This section provides a brief overview of baseline conditions ascertained from the work described within paragraphs 8.3.10 to 8.3.35.

8.4.2. The Project is located within the Northern Marmara biogeographic region (as described within Güngöroğlu (ed), 2018[75]), further defined in ecological terms as the Dry Forest (*P. nigra – Quercus*) subregion within Marmara Transitional Region (as per Atalay,(2002) within Atalay *et al.* (2014)[76]). In broad terms, the Project can be split in to three sections based on the prevailing land uses:

- the greater Istanbul area, where an urban / land use prevails;
- as the Project extends to the west, a more agricultural landscape dominates; and finally,
- the west of the Project is generally characterised by semi-natural habitats such as woodlands and scrub.

8.4.3. The notable biodiversity hotspots within the ZoI are the three mainly-wetland Important Bird Areas (IBA), that are either crossed by, or situated adjacent to, the Project.

PROTECTED / DESIGNATED AREAS

8.4.4. The Project crosses two areas designated for their importance to biodiversity and is located in a tunnel beneath a third. Relevant designated areas are listed within **Table 8-5** below and illustrated on Figure 8-5.

[75] Güngöroğlu, C. (ed) (2018). Practicability of EU Natura 2000 Concept in the Forested Areas of Turkey. EU Nature Conservation in Turkey Forests Project.
[76] Atalay, I., Efe, R. & Ozturk, M. (2014). Ecology and classification of forests in Turkey. Procedia – Social and Behavioural Sciences: 120. pp788-805.



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Legend

- Proposed Railway Route
- Important Bird and Biodiversity Areas (IBAs)



Note:

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 8-5 - Protected Areas

Scale at A4: 1:350,000

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Table 8-5 - Protected Areas Summary

Site Name	Designation (and IUCN category)	Approximate Distance from Project (and direction)	Summary
Büyükçekmece Lake	Important Bird Area (IBA) (IUCN cat. IV)	A feeder channel (Camasir Creek and surrounding agricultural fields) to the north of the lake is crossed by the Project.	A freshwater lake situated west of Istanbul where the Karasu stream reaches the Marmara Sea. This site is important for wintering and passage waterbird species and also supports a range of breeding waterbirds.
Küçükçekmece Basin	IBA (IUCN cat. IV)	The Project passes under the site in a tunnel.	A natural brackish lagoon situated to the west of Istanbul on the Sea of Marmara that supports significant numbers of wintering waterbirds.
Terkos Basin	Key Biodiversity Area (KBA) and IBA The KBA also encompasses four nationally designated areas (not crossed by the Project): Kasatura Körfezi (Bay) – Natural Protection Area (IUCN cat. Ia) Istanbul-Catalca-Cilingoz – Wildlife Development Area (IUCN cat. IV) Cilingoz – Nature Park (IUCN cat. V) Camlikoy – Nature Park (IUCN cat. V)	Crossed by the Project. (approximately 5km)	A large area comprising a complex of habitats including coastal, aquatic, swamp, grassland, heath and coppice forests. These habitats support a wide range of flora and fauna including a number of IUCN Red List species.

8.4.5. The following section provides a description of the Project baseline (habitats in order of decreasing extent).

HABITATS

8.4.6. The habitats recorded are listed within **Table 8-6** below, along with their extents within the study area for the Project (i.e. including the expropriation corridor, where appropriate). These habitats are then discussed in greater detail within the subsequent paragraphs (habitat mapping is provided within **Appendix N**).

Table 8-6 - Habitats Recorded

Broad Habitat Type	EUNIS Habitat Type	Extent within Project Footprint (ha)
Dense Shrubland And Scrub	F4.2 Dry heaths	5.8
	F5.3 Pseudomaquis	151.3
	F5.4 Sparticum junceum fields	20.6
	F6.2 Eastern garrigues	1.3
Agricultural Fields	I1.1 Intensive unmixed crops	112.6
	I1.5 Bare tilled, fallow or recently abandoned arable land	50.3
Woodland	G1.3 Mediterranean woodland	5.9
	G1.A Meso- and eutrophic Quercus, Carpinus, Fraxinus, Acer, Tilia, Ulmus and related woodland	74.3
	G3.F Highly artificial coniferous plantations	13
Lowland Grassland	E2.2 Low and medium altitude hay meadows	82
Built-Up Area	J1 Buildings of cities, towns and villages	20
Aquatic Habitats / Wetlands	C3 Littoral zone of inland surface waterbodies	2.7
	C3.2 Water-fringing reedbeds and tall helophytes other than canes	1.1
	D5.1 Reedbeds normally without free-standing water	0.2

Broad Habitat Type	EUNIS Habitat Type	Extent within Project Footprint (ha)
	C1 Surface standing water	0.2

Dense Shrubland and Scrub

8.4.7. Shrub and scrub habitat extend across large parts of the ZoI and comprises EUNIS habitats: pseudomaquis (F5.3), *Spartium junceum* fields (F5.4); and eastern garrigues (F6.2). The habitat is broadly dominated by shrub and scrub / dwarf tree species and is indicative in most areas of degraded woodland habitat that has lost dominance of tree species through long-term deforestation/logging. The habitat extends across large areas in the west and central regions of the ZoI and forms a mosaic with woodland habitats, where degradation is less pronounced.

8.4.8. A varied flora is present within this habitat and the structure varies from densely vegetated scrub (as found within the pseudomaquis to the west of Gökçeali) to more sparsely vegetated areas more indicative of the *Spartium junceum* fields; these latter habitats being indicative of greater levels of disturbance and degradation and therefore more common around built-up areas.

8.4.9. A number of broadleaved tree species are represented within this habitat category including dominant oak (*Quercus petraea, Q. frainetto* and *Q. cerris*), willow *Salix alba* and pear *Pyrus elaeagnifolia*. Associated ground flora is varied and includes numerous herbs (commonly rock rose *Cistus* spp., but also daisy *Bellis perennis*, golden marquerite *Anthemis tinctorial* and wild carrot *Daucus carota*), dwarf heath shrubs (such as ericoids *Erica arborea, E. manipuliflora* and *Calluna vulgaris*) and ferns such as bracken *Pteridium aquilinum*.

8.4.10. Three of the threatened Turkish Red Data Book[71] (RDB) plant species are found within this habitat type: *Galanthus x valentinei, Crocus olivieri* and *C. pestalozzae*.

Agricultural Fields

8.4.11. Agricultural fields dominate the eastern half of the ZoI and appear indicative of intensively farmed arable fields, with very little evidence of retained field margins.

Woodland

8.4.12. The woodland habitat type is represented by three distinct communities: oak-dominated broadleaved woodland (EUNIS type G1.A – Meso- and eutropic *Quercus, Carpinus, Fraxinus, Acer, Tilia, Ulmus* and related woodland), ash and elm-dominated riparian woodland (G1.3 – Mediterranean riparian woodland) and pine-dominated plantation woodland (G3.F – Highly artificial coniferous plantations).

8.4.13. Oak woodlands are widespread across the west of the ZoI, often in mosaic with pseudomaquis and other scrub habitats, reflecting areas subject to less human interference. The habitat composition is similar to that of the pseudomaquis, but with greater coverage of mature trees and including hornbeams *Carpinus* spp. alongside the widespread oak species. A mature habitat structure is present with a rich understorey including dwarf shrubs and grasses and herbs such as cock's foot *Dactylis glomerata,* corky-fruited water-dropwort *Oenanthe pimpinelloides* and salad burnet

Sanguisorba minor. This habitat also supports the RDB species *Galanthus x valentinei, Centaurea hermannii* and *Cirsium polycephalum*.

8.4.14. The riparian woodland community is scattered across the western half of the ZoI, alongside watercourses and in valley plains. The habitat is typically elm and ash dominated, in particular field elm *Ulmus minor* and narrow-leaved *Fraxinus angustifolia.* Thicket scrub species such as holy bramble *Rubus sanctus* and blackthorn *Prunus spinosa* are also common, as are common riparian ground flora species such as pendulous sedge *Carex pendula* and hard rush *Juncus inflexus*.

8.4.15. The final woodland category comprises plantation forest, which consists of commercial pine species *Pinus* spp. as well as cedar of Lebanon *Cedrus libani* and Mediterranean cypress *Cupresses sempervirens*.

Lowland Grasslands

8.4.16. Lowland meadow habitats are scattered across the ZoI, including pockets situated among built-up areas on the outskirts of Istanbul. These habitats lack much floristic diversity, with a standard mix of meadow species recorded, including various buttercup species *Ranunculus* sp., legumes such as clover *Trifolium* sp. and scrub species such as *Rubus* spp.

8.4.17. This habitat type is represented by EUNIS type E2.2 – low and medium altitude hay meadows.

Built-up Areas

8.4.18. The east of the ZoI is dominated by built-up areas associated with the Greater Istanbul conurbation. Elsewhere, the Project passes through a number of urban / suburban areas with extensive hardstanding.

Aquatic Habitats

8.4.19. Aquatic habitats comprise: the wetland areas of the Küçükçekmece Basin and Büyükçekmece Lake; several eutrophic inland lakes; and a number of small to medium-sized watercourses. The habitats align with EUNIS habitat C1.3 – permanent eutrophic lakes, C3.2 – water-fringing reedbeds and tall helophytes other than canes and D5.1 – reedbeds normally without standing water.

8.4.20. The wetlands support a typical emergent flora consisting mainly of reeds, rushes and sedges (such common reed *Phragmites australis,* common bulrush *Typha latifolia* pendulous sedge and hard rush) and riparian tree species (similar to that recorded within the riparian woodland zone).

8.4.21. The watercourses surveyed generally exhibited signs of heavy modification, especially those within modified landscapes (e.g. around built-up areas and agricultural land). A summary of the watercourses surveyed is provided within Table 8-7 below (see Figure 8-4 for the survey locations referenced below).

Table 8-7 - Aquatic Survey Results

Survey Location	Summary description
1	**Camasir Creek** (chainage 27+179 to 27+340): The Project will cross the watercourse via a 161.2m span bridge. A new structure will be required adjacent to the existing structure, which will require 4 piers, 3 of which will be located within the Camasir Creek. Heavily modified watercourse. The watercourse was approximately 9.3m wide on average. Depth of water within the vicinity of the Project crossing varied, with a maximum depth of more than 81cm. The channel was characterised by deep pool and riffle features. The substrate was found to consist predominantly of silt, cobble, and high organic matter, which was silted, stable and compacted. Turbidity at this location was high. The general land use within 50m of the left-hand bank was meadowland, with rock and scree, moorland and tall herbs were also present. The general land use within 50m of the right-hand bank primarily comprised wetland, with moorland, improved pasture, and scrub also observed. The banks of the watercourse were steeply sloping and bare along much of the stretch. The bank tops comprised a simple vegetation structure, consisting primarily of *Phragmites* sp. and *Typha* sp. The surface area of the water shaded by vegetation at this location was minimal. Fish cover (mainly in the form of emergent/aquatic vegetation) throughout the stretch was good. The recorded pH of 8.00, was between 6 and 9, and is therefore suitable for a variety of fish species. Despite the presence of significant modifications, the watercourse at this location is likely to support a variety of aquatic macroinvertebrate and fish species.
2	**Karasu Stream** (chainage 35+143 to 35+304): The Project will cross the Karasu Stream via a bridge (161.2m span), immediately adjacent to the existing railway. A new structure will be required adjacent to the existing structure. The new structure will require 4 piers, 1 of which will be located within the Karasu Stream. Heavily modified watercourse. The watercourse was approximately 8.5m wide. Depth of water within the vicinity of the Project crossing varied, with a maximum depth of more than 81cm. Flow was constant, and the channel characterised by shallow glide areas. The substrate was comprised entirely of sand, which was stable and partly compacted. Turbidity at this location was high. The general land use within 50m of both the left-hand and right-hand banks was scrub. The banks of the watercourse were steeply sloping, close to vertical, with scrub cover. The bank tops consisted of a simple vegetation structure comprising scrub and riparian zone plants. The surface area of the water shaded by vegetation at this location was minimal. Fish cover throughout the stretch was poor due to the lack of in-channel features and vegetation cover. The recorded pH of 8.14, was between 6 and 9, and is therefore suitable for a variety of fish species. Despite heavy modifications to the watercourse and poor fish cover, the habitat at this location is likely to support aquatic macroinvertebrate and fish species.
3	**Karasu Stream** (chainage 37+150 to 37+245): The Project will cross the Karasu Stream again via a new bridge (95.6m span). The bridge structure at this location will require 2 piers, both of which will be located within the Karasu Stream. At this location the Project is approximately 30m to the south of the existing railway. Heavily modified watercourse. The watercourse was approximately 8.3m wide. Depth of water within the vicinity of the Project crossing varied, with a maximum depth of more than 81cm. Flow was constant, and the channel characterised by shallow glide areas. The substrate consisted of sand and gravel, which was stable and partly compacted. Turbidity at this location was high. The general land use within 50m of both the left-hand and right-hand banks was scrub and rock and scree. Fly-tipping was also noted close to the bank. The banks were steeply sloping, close to vertical, and bare. Some scrub bank cover was evident. The bank tops were dominated by cobbles and rocks with very little vegetation. Substantial bank modifications and man-made structures were also observed. The surface area of the water shaded by vegetation at this location was minimal. Fish cover throughout the stretch was poor due to the lack of in-channel features and vegetation cover. The recorded pH of 8.32, was between 6 and 9, and is therefore suitable for a variety of fish species. Despite the heavy modifications and poor fish cover, the watercourse at this location is likely to support aquatic macroinvertebrate and fish species.
4	**Karasu Stream** (chainage 45+271 to 45+432): The Project will cross the Karasu Stream again via a bridge (161.2m span) consisting of 4 piers, 2 of which will be located within the Karasu Stream. Semi-natural watercourse. The watercourse was approximately 4.0m wide on average. Depth of water within the vicinity of the Project crossing varied, with a maximum depth of more than 81cm. Water was standing and identified as still margin. The substrate was found to consist of silt and high levels of organic matter, which was, stable and compacted. Turbidity at this location was high.

Survey Location	Summary description
	The general land use within 50m of both the left-hand and right-hand banks was broadleaf woodland, scrub and moorland. The banks of the watercourse were steeply sloping, close to vertical, and covered in scrub vegetation. The bank tops were characterised by a simple vegetation structure (two to three vegetation types). The surface area of the water shaded by vegetation at this location was minimal. Fish cover throughout the stretch was good, mainly due to the abundant emergent and marginal vegetation. The recorded pH of 8.21, was between 6 and 9, and is therefore suitable for a variety of fish species. Assessment of the habitat at this location has shown it is likely to support a variety of aquatic macroinvertebrate and fish species.
5	Ambar Creek (chainage 74+005 to 74+100): The Project will cross the Ambar Creek via a bridge (95.6m span) which will require 2 piers, 1 of which will be located within the Ambar Creek. Semi-natural watercourse. Depth of water within the vicinity of the Project crossing varied, with a maximum depth of more than 81cm. The substrate consisted of sand and was high in organic matter, which was stable and compacted. Turbidity at this location was high. The general land use within 50m of both the left-hand and right-hand banks was broadleaf woodland, scrub, meadowland and moorland. The banks of the watercourse were approximately steeply sloping, incised, and partly covered by scrub vegetation. The bank tops were characterised by broadleaf woodland vegetation. The surface area of the water shaded by vegetation at this location was minimal. Fish cover throughout the stretch was moderate, with some in-channel features such as tree roots present. The recorded pH of 7.99 was between 6 and 9 and is therefore suitable for a variety of fish species. The habitat assessed at this location is likely to support a variety of aquatic macroinvertebrate and fish species.
6	Ambar Creek (chainage 74+700 to 74+763): The Project will cross the Ambar Creek via a bridge (62.8m span) which will require 1 pier which will be located within the Amber Creek. Semi-natural watercourse. Depth of water within the vicinity of the Project crossing varied, with a maximum depth of 80cm. The substrate consisted of sand, silt, and high organic matter, which was stable and compacted. Turbidity at this location was high. The general land use within 50m of both the left-hand and right-hand banks was broadleaf woodland, meadowland, and moorland. The banks of the watercourse were sloping and incised, with areas of scrub coverage. The bank tops were characterised by broadleaf woodland vegetation. The surface area of the water shaded by vegetation at this location was moderate. Fish cover throughout the stretch was moderate, with some in-channel features such as tree roots present. The recorded pH of 8.27 was between 6 and 9 and is therefore suitable for a variety of fish species. The assessment of aquatic habitat at this location has shown it is likely to support a variety of aquatic macroinvertebrate and fish species.
7	Ambar Creek (chainage 75+220 to 75+316): The Project will cross the Ambar Creek via a bridge (span 95.6m) which will require 2 piers, 1 of which will be located within the Amber Creek Heavily modified watercourse. Depth of water within the vicinity of the Project crossing varied, with a maximum depth of more than 81cm. Flow and channel characterised by run and riffle features. The substrate was found to consist of sand, gravel, and high levels of organic matter, which was stable and partly compacted. Turbidity at this location was high. The general land use within 50m of both the left- and right-hand banks was broadleaf woodland, moorland, scrub, as well as rocks and scree. The banks of the watercourse were steeply sloping and incised in areas, with some scrub coverage. The bank tops were characterised by a simple vegetation structure of broadleaf woodland and scrub vegetation. The surface area of the water shaded by vegetation at this location was minimal. Fish cover throughout the stretch was poor due to the lack of in-channel features and vegetation cover. The recorded pH of 7.81, was between 6 and 9, and is therefore suitable for a variety of fish species. Despite the presence of substantial modifications, the habitat at this location is likely to support aquatic macroinvertebrate and fish species.

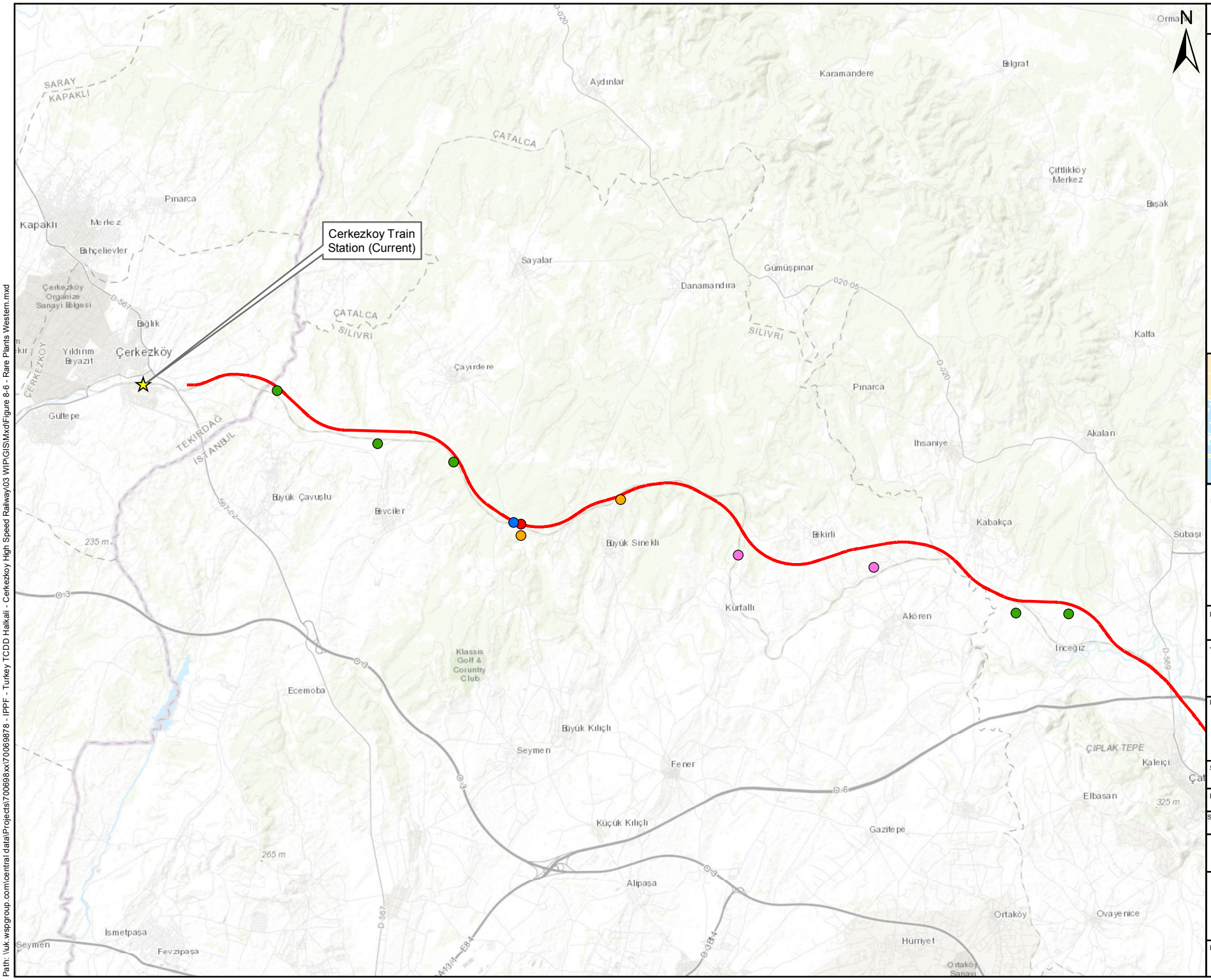
FLORA AND FAUNA

Flora

8.4.22. A wide range of plants have been recorded from across the ZoI (taken as the expropriation corridor for the Project); totalling 224 species. Many of these are those indicative of ongoing anthropogenic influence and are widespread and common species.

8.4.23. In total 6 species of elevated conservation concern were identified during vegetation surveys (including five endemics). These comprise the following (see **Figure 8-6** and **Figure 8-7** below):

- *Galanthus x valentinei* (endemic to the Thrace region of Turkey; Vulnerable on RDB);
- *Cirsium polycephalum* (endemic to Marmara region and Istanbul; Critically Endangered on on RDB);
- *Centaurea hermannii* (endemic to Marmara region and Istanbul; Endangered on RDB);
- *Crocus pestalozzae* (endemic to Marmara region and Istanbul; Vulnerable on RDB);
- *Crocus olivieri* subsp. *Istanbulensis* (endemic to Marmara region and Istanbul; Endangered on RDB); and
- *Ferulago confusa* (Vulnerable on RDB).



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Legend

- Cerkezkoy Train Station
- Proposed Railway Route

Rare Plants

- Centaurea hermannii
- Cirsium polycephalum
- Crocus pestalozzae
- Ferulago confusa
- Galanthus valentinei

Note:

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 8-6 - Rare Plants Western Half

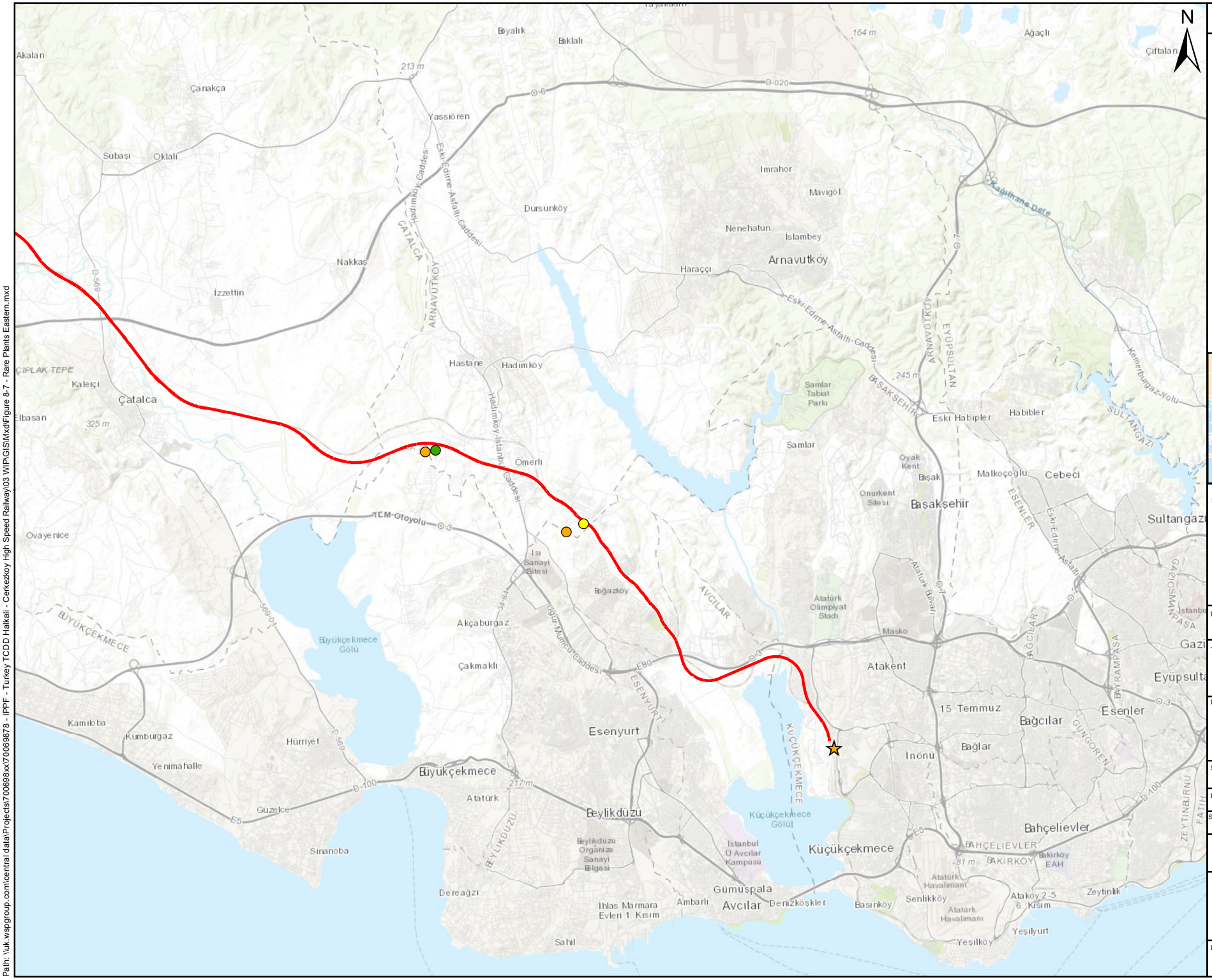
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Legend

- Halkali Train Station
- Proposed Railway Route

Rare Plants

- Cirsium polycephalum
- Crocus olivieri
- Crocus pestalozzae

Note:

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 8-7 - Rare Plants Eastern Half

Scale at A4: 1:175,000

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AD	JW	DG	23/02/2021

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Drawing Number: Figure 8-7

Path: \\uk.wspgroup.com\central data\Projects\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 8-7 - Rare Plants Eastern.mxd

8.4.24. The notable plant species listed above were found within the scrub and woodland habitats. The relative populations of each species recorded ranged from an estimated 0.5% to between 1-2% of the total population numbers for *Centaurea hermannii, Crocus pestalozzae* and *Galanthus x valentinei.*

Fauna (Excluding Birds)

Mammals

8.4.25. No species of mammals were observed during the February and March 2020 surveys; however, signs of presence were recorded for some species (such as potential European ground squirrel *Spermophilus citellus* mounds and golden jackal *Canis aureus* prints). Surveys undertaken during July 2020 confirmed the presence of golden jackal as well as fox *Vulpes Vulpes,* along with more common and widespread species. The desk study resulted in an estimated 68 species of mammal present across the ZoI, with only four of these considered threatened (as per the IUCN Red List[77]). These are European ground squirrel, marbled polecat *Vormela peregusna* long-fingered bat *Myotis capaccinni* and greater noctule bat *Nyctalus lasiopterus.* Further desk-based literature review suggested the greater noctule bat *Nyctalus lasiopterus* is unlikely presence across the ZoI.

8.4.26. The most important habitats across the ZoI for mammals are the more extensive natural / semi-natural scrub and woodland although pockets of suitable habitat appear to exist throughout the ZoI, including for species of increased conservation interest, such as the European ground squirrel which was suspected as present in agriculture habitats in the east of the ZoI.

8.4.27. A total of 32 of the mammals considered likely to be present are listed on Annex II of the Bern Convention. Two species (otter and European ground squirrel) are listed on Annex II of the EU Habitats Directive, with one (wild cat *Felis sylvestris*) listed on Annex IV.

Amphibians

8.4.28. No amphibians were observed during field surveys undertaken in February and March 2020, as would be expected given the inactivity of such animals at this time of year. However, a likely species list has been produced based upon prevailing habitat types and known ranges of amphibians in the region. Surveys in June 2020 revealed the presence of common and widespread amphibians such as marsh frog *Pelophylax ridibundus* and European green toad *Bufotes viridis.*

8.4.29. A total of ten amphibian species are considered likely to be present across the ZoI (and wider area). These comprise common and widespread species of frogs, toads and newts, none of which are threatened (as per the IUCN Red List). Amphibians will be present in proximity to waterbodies, so areas around the large wetlands in the east of the Project, are likely to be the most important areas for amphibians within the ZoI.

[77] On the IUCN Red List, a species is considered 'threatened' if it is categorised as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU).

8.4.30. Five of the amphibians considered likely to be present are listed on Annex II of the Bern Convention, with four listed on Annex IV of the EU Habitats Directive and one (fire-bellied toad) also listed upon Annex II of the EU Habitats Directive.

Reptiles

8.4.31. A single species of reptile, the snake-eyed skink *Ablepharus kitaibelli,* was observed incidentally during fauna surveys in early 2020. As above for amphibians, the timing of these surveys during February and March 2020 is sub-optimal with regards to reptiles due to most species being inactive at this time. During the June 2020 surveys additional reptile species were recorded such as Caspian whipsnake *Dolichophis caspius* and spur-thighed tortoise *Testudo graeca.* The desk results suggest that 29 species of reptile are potentially present across the ZoI.

8.4.32. Spur thighed tortoise is listed as Vulnerable by IUCN and is considered to be relatively common across parts of the ZoI (as indicated by the findings during June 2020 surveys) and also from anecdotal records obtained during the February and March surveys). Two further species identified from the desk study – Hermann's tortoise *Testudo hermanni* and European pond turtle *Emys orbicularis* – are listed as Near Threatened and are also listed on Annexes II and IV of the EU Habitats Directive, with a further 11 species listed on Annex IV only. Of the 29 reptile species that are potentially present across the ZOI, nineteen are listed on Annex II of the Bern Convention.

Aquatic Ecology

8.4.33. A detailed study of the fish present within rivers across Istanbul/Thrace (Özuluğ, & Saç 2019[78]) was referenced to inform this study and reported a common and widespread aquatic assemblage comprising 36 fish species, with only a single IUCN VU species identified (common carp *Cyprinus carpio*) although not from a catchment crossed by the Project. Additional studies from both Küçükçekmece Basin confirmed the presence (possibly historical) of IUCN CR Russian sturgeon *Acipenser gueldenstaedtii* and Beluga sturgeon *Huso huso.* No migratory fish (e.g. salmonids) have been recorded from the watercourses across the ZoI.

8.4.34. Aquatic surveys at 7 locations (see **paragraph 8.4.19** onwards) corroborate the above findings in relation to the suitability of these watercourse crossing locations for common/widespread fish and aquatic macroinvertebrates. Water chemistry records did not suggest anything that would preclude fish presence, and fish cover varied from poor to good across the 7 locations.

8.4.35. The water chemistry records also corroborate the lack of records of more sensitive fish species (such as salmonids) which require higher water quality standards. In particular, the presence of suspended sediment and the low dissolved oxygen levels, are parameters that will limit the presence of more sensitive aquatic macrofauna.

[78] Özuluğ, M. & Saç, G. (2019). Province of Istanbul (Turkey) freshwater fish fauna. Turkish Journal of Bioscience and Collections, 3(1), s. 19–36.

Birds

8.4.36. The desk study data identified 256 species of bird listed for the ZoI. These include a high number of migratory birds; the ZoI incorporates the southern edge of the Bosporus strait, an important migratory bottleneck for raptors and other large soaring species.

8.4.37. Additional data on birds has been collated from beyond the ZoI to provide context, in consideration of potential connectivity between bird populations within the ZoI and beyond. The main considerations for connectivity are mobile waterbird aggregations within the three Important Bird Areas (IBAs) which the Project crosses; as such, the study area in these instances has extended across these three sites.

Threatened Species Desk Study / or Field Data Summary

8.4.38. The following species of elevated conservation concern, those species within the three IUCN threatened categories, were identified as present from desk study data and / or recorded in the study area during field surveys (unless stated, all other species recorded and mentioned within this chapter are of lesser conservation concern within the IUCN Red List):

Table 8-8 - Desk Study / or Field Data Summary

Species	IUCN threatened status	Desk Study Results	Field Survey Results
Common pochard	Vulnerable.	The supplementary desk study data included survey counts from the three IBAs in the study area, namely: a three-year sample of the mid-winter waterbird counts (MWC) between 2018-2020, which recorded a peak of 12,385 at the Küçükçekmece Basin. The peak three-year MWC for common pochard from the other two sites (Büyükçekmece Lake and Terkos – Durusu Lake) along the Project were considerably smaller at 408 and 130 birds respectively and there may have been interchange between these sites and Küçükçekmece Basin. Peak counts from the MWC will have been derived from the total population of birds taking into consideration the total area of each of the IBA. Using eBird data, at Küçükçekmece Basin there were six records within the study area with a peak count of 48. At Küçükçekmece Basin there were six records within the study area with a peak count of 48. At Büyükçekmece Lake, eBird data showed there were 14 records just outwith the study area with a peak of 410. Although the Project passes through the Terkos Basin IBA, the habitat that is suitable for this species within the IBA (at Durusu Lake) is located at a considerable distance from the Project (approximately 22km).	A single flock of 10 birds was recorded during spring 2020 surveys, to the south of Halkali.
Red-breasted goose	Vulnerable	Historical data from the MWC shows a low number of records for the study area, and the wider area within the three IBAs. The most recent records comprise 1st February 2017 for Büyükçekmece Lake (two birds), and 1st February 2014 (one bird) for the Terkos Basin. Considering eBird records in terms of records within the study area, there were four historical records, all in 2006, peaking at 340 birds from the north end of Büyükçekmece Lake (the feeder channel and surrounding fields rather than the main lake). All other records listed within the eBird website for this site were beyond the study area with the closest at approximately 3.5km. Although the Project passes through the Terkos Basin IBA, the habitat that is suitable for this species within the IBA (at Durusu Lake) is located at a considerable distance from the Project (approximately 22km).	This species has not been recorded during field surveys.
White-headed duck	Endangered	Desk study data shows this species to be present at the three IBA's that the Project crosses, albeit erratic in occurrence. A review of the annual MWC undertaken between 1967-2018, indicated that this species was recorded in four of the count years at Büyükçekmece Lake (last record in 2013) and three of the count years at the Küçükçekmece Basin (last record in 2014). Additional data from the eBird website included records from more recent years, including a peak count of 42 birds at Büyükçekmece Lake in 2017, which is a notable count in the context of this species' small global population. In terms of records within the study area, the eBird website shows two records for Büyükçekmece Lake, with a peak count of two birds, the most recent record in 2010, and the next closest record at approximately 3.5km away. There were four records for Küçükçekmece Basin just outwith the study area, and then the next closest record at approximately 2km from the Project. The four records involved a peak count of seven birds, with the most recent record of five birds in 2014. No records were listed on the eBird website for the Terkos Basin.	Not recorded during field surveys.
Egyptian vulture	Endangered	Desk study data includes a small number of records (five), derived from the eBird website and all during the period August-October. None of these records were within the study area with the closest at approximately 3km from the Project.	Not recorded during field surveys.
Greater spotted eagle	Vulnerable	Three records were derived from the eBird website involving birds within the study area at Büyükçekmece Lake (January 2008 and September 2010, single birds) and one at Küçükçekmece Basin (January 2012, single bird). One of the records from Büyükçekmece Lake was on the boundary of the study area (January 2008), the other two records were outwith the study area. Additionally, there were 11 reports listed on the eBird website of single birds or number unspecified, from the Terkos Basin IBA. Although the Project extends through this IBA, the Terkos basin is an extensive area, and the nearest of these 11 records was approximately 22km from the Project.	Not recorded during field surveys.

Species	IUCN threatened status	Desk Study Results	Field Survey Results
Steppe eagle	Critically Endangered	This is a very rare breeding bird in Turkey with one to two pairs recorded for two IBAs in a different region of the country. This species is also a passage migrant through Turkey, when small number of birds could be encountered over a wider geographical area. However, only one record was derived from the eBird website, located just outwith the study area, at the northern extent of the Büyükçekmece Lake IBA.	No records during field surveys.
Imperial eagle	Vulnerable	Desk study data showed numerous records in the study area and up to 44 pairs across the Thrace region. The breeding population in Turkey has been estimated at between 70 and 120 pairs in 2003 (Mebs & Schmidt 2006[79]).	Recorded in the study area during field survey work in June 2020, with observations suggesting that a territorial pair may be present in the study area.
Turtle dove	Vulnerable	Desk study data derived from the eBird website included widespread records in the study area. Estimates for the Turkish population range from between 500,000- 5,000,000 pairs (Snow et al. 1998[80]) to between 300,000 to 900,00 pairs (Fisher et al. 2018[81]).	Recorded during breeding bird field survey work in June and August 2020.
Other birds	Up to Near Threatened.	A wide variety of additional bird species in the study area, including important aggregations of wildfowl and waders, are associated with the three IBAs. These include species that are Near Threatened under IUCN criteria e.g. ferruginous duck and important aggregations of species of least concern e.g. pygmy cormorant and great cormorant. The Küçükçekmece Basin was identified as an international IBA based on importance to great cormorant, the multi-species migratory waterbird congregations at this site and Büyükçekmece Lake are also listed as reasons for IBA selection. A further example of an important aggregation of a waterbird species is white stork, which can be present in large numbers at both Küçükçekmece Basin and Büyükçekmece Lake.	Large aggregations of waterbirds recorded during field surveys in February and March 2020 included lapwing

[79] Mebs, Theodor & Schmidt, Daniel (2006). Die Greifvögel Europas, Nordafrikas und Vorderasiens. Kosmos Verlag.
[80] Snow, D., Perrins, C. M., & Gillmor, R. (1998). The birds of the western Palearctic. Oxford: Oxford University Press.
[81] Fisher I, Ashpole J, Scallan D, Proud T and Carboneras C (compilers) (2018). International Single Species Action Plan for the conservation of the European Turtle-dove Streptopelia turtur (2018 to 2028).

Threatened Species Field Survey Summary

8.4.39. A summary of Target Species bird survey findings obtained from the various surveys in 2020 is provided within Table 8-8 below.

Table 8-9 - Ornithological Field Survey Summary

Species	Summary
Flight Activity Surveys February/March 2020	
Common pochard	A total of ten birds recorded from the six VP locations. Of the total number of birds, 10 were recorded flying at Potential Collision Height (PCH – 0-15m).
Great cormorant	A total of 2,882 birds recorded from the six VP locations. Of the total number of birds, 54 were recorded flying at PCH.
Pygmy cormorant	A total of 13 birds recorded from the six VP locations. Of this total, seven birds were recorded at PCH.
Lapwing	A total of 440 birds recorded all observations from one of the six VP locations. Of this total, 375 birds were recorded at PCH.
Black-headed gull	A total of 19,828 birds recorded from the six VP locations. Of this total 18,127 birds were recorded at PCH.
Bird Surveys June 2020	
Imperial eagle	Imperial eagle. Two birds, a sub-adult and an adult were observed together at breeding bird walkover location four, between Çatalca and the boundary of the Terkos Basin IBA. The record may be indicative of a territorial pair (aligned with the information received from Doga; see Figure 8-8).
Black stork	Black stork. A total of six flights with one of these flights at PCH for 15 seconds.
White stork	White stork. A total of ten flights. Six of these flights recorded time at PCH amounting to a total of 180 seconds.
Black-headed gull	A total of three flights, two of these flights recorded time at PCH amounting to 45 seconds.
Great cormorant	A total of 50 flights, 27 of these flights recorded time at PCH amounting to a total of 750 seconds.

Species	Summary
Pygmy cormorant	A total of nine flights, six of these flights recorded time at PCH amounting to a total of 90 seconds.
Turtle dove	A total of seven flights, all with time at PCH amounting to a total of 150 seconds
Flight Activity Surveys August/September 2020	
Black stork	A total of 17 flights involving 851 individuals, the majority of which were recorded from along the channel feeding in to Büyükçekmece Lake from the north at VP 4. Eight of these flights, containing 38 birds, recorded time at PCH. Most individuals recorded were derived from a single flock of 750 birds on active migration over VP4 on 15 August, this flock was above PCH in height band three (>50m).
White stork	A total of six flights involving 343 individuals. Of the total flights, two flights recorded time at PCH, containing two birds. The majority of individuals recorded were derived from a single flock of 280 birds on active migration over VP4 on 4 September, this flock was above PCH in height band three (>50m).
Black-headed gull	A total of 38 flights involving 984 individuals with 24 of these flights (455 individuals) recording time at PCH, all of which was north to south over the Küçükçekmece Basin.
Yellow-legged gull	A total of 108 flights, containing 662 birds; 36 of these flights were at PCH containing 80 birds.
Mediterranean gull	A total of seven flights containing 55 birds; five of the flights were at PCH containing 53 birds.
Great cormorant	A total of 17 flights, containing 28 birds, all but one of which were at PCH and all, but one was within the Küçükçekmece Basin.
Pygmy cormorant	A total of six flights with three flights recording time at PCH, containing three birds.
Turtle dove	A total of five flights with three flights recording time at PCH, containing four birds.
Lapwing	A total of one flight with time spent at PCH, containing 22 birds.

Species	Summary
Imperial eagle	A total of two flights, both from VP4, on 13 and 15 August, likely to have involved the same foraging individual. All the flight time was significantly above PCH.
Other birds	Wader and wildfowl assemblage. Several wader and wildfowl species were observed from VP2 and VP4, at the northern edge of Küçükçekmece Basin IBA and Büyükçekmece Lake IBA respectively. Species observed included grey heron, snipe, little egret, spoonbill, glossy ibis, wood sandpiper, green sandpiper, greenshank and garganey. The total combined count for these species was 225 individuals and the total number of flights for these species was 73, with 67 of these flights recording time at PCH.



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

Legend

- Proposed Railway Route
- Imperial eagle territory location



Note:

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 8-8 - Imperial Eagle Territory Location

Scale at A4: 1:350,000

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JS	JW	DG	23/02/2021

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Drawing Number: Figure 8-8

Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 8-8 - Imperial Eagle Territory Location.mxd

8.4.40. A total of 172 out of the 256 bird species considered likely to be present are listed on Annex II of the Bern Convention.

8.5 POTENTIAL IMPACTS AND EFFECTS

8.5.1. This section comprises a precautionary assessment of the impacts upon receptors of ecological importance in relation to the Project ('Valued Ecological Receptors' (VER)) that require consideration through the assessment process. The VER that were identified from desk study resources, as potentially present but were subsequently concluded as being absent based upon field data and additional literature review, are also included here.

8.5.2. The basis for receptor evaluation is derived from PR6, which requires receptors of increased value (Priority Biodiversity Features and Critical Habitats) to be identified and appropriately assessed in order that a project can demonstrate compliance. These classifications represent the most important biodiversity values (in the case of Critical Habitat, the very highest), which require particular conditions to be met before projects can proceed in areas where such values are present. A detailed assessment of Priority Biodiversity Features and Critical Habitat is presented in Appendix L.

8.5.3. The overall process to receptor evaluation for the Project is summarised within Table 8-10 below, along with the VER evaluation and associated reasoning:

Table 8-10 - Valued Ecological Receptors Summary

VER	Value / Sensitivity[82]	Justification
Büyükçekmece Lake IBA	High	Important Bird Area that meets global IBA selection criteria. This evaluation extends to those qualifying species not explicitly mentioned below as follows: Little tern *Hydrocoloeus minutus* and Mediterranean gull *Larus melanocephalus.* **PBF** due to the IBAs importance to congregatory / migratory species. **Critical Habitat** due to comprising part of the overall EAAA for white-headed duck.
Küçükçekmece Basin IBA	High	Important Bird Area that meets global IBA selection criteria. This evaluation extends to qualifying species not explicitly mentioned below, namely: Ferruginous duck *Aythya nyroca,* great cormorant*, Phalacrocorax carbo*, and pygmy cormorant *Microcarbo pygmaeus*. **Critical Habitat** due to the following: ▪ size of the regularly occurring waterbird assemblage (which meets threshold for designation as a Ramsar site under Criterion 5[83]). ▪ forming part of the overall EAAA for white-headed duck, Russian sturgeon and Beluga sturgeon.
Terkos Basin KBA	High	Key Biodiversity Area / Important Bird Area that meets global IBA selection criteria. **PBF** due to the following: ▪ comprising part of the overall EAAA for: common pochard, red-breasted goose, greater spotted eagle ▪ being a significant biodiversity features identified by a broad set of stakeholders or governments (such as Key Biodiversity Areas or Important Bird Areas)
Habitats (general)	Low	Much of the habitat assemblage across the ZoI has been modified through human influence and is subsequently of decreased conservation interest. Given the modified nature of habitats across the ZoI, a value of Low is considered appropriate.
Habitats – oak / hornbeam forests	Medium	The EUNIS type G1.A Meso- and eutrophic *Quercus, Carpinus, Fraxinus, Acer, Tilia, Ulmus* and related woodland aligns with EU Habitats Directive Annex I habitat types such as Galio-Carpinetum oak-hornbeam forests (Code: 9170). It is of sufficient value to be considered **a PBF** and of Medium value.
Centaurea hermannii	High	**Critical Habitat trigger** due to the relative proportion of the global population of this RDB Endangered plant species within its EAAA.
Rare Plants	Medium	The floral assemblage across the ZoI broadly comprises common and widespread species; however, there were six species identified of increased conservation interest due to their listing on the Turkey Red List (TRL) of plants: *Cirsium poycephalum* (TRL - CR)*, Centaurea hermannii* (EN)*, Crocus olivieri subsp. Istanbulensis* (EN), *Crocus pestalozzae* (VU)*, Galanthus x valentinei* VU) and *(Ferulago confusa)* (VU). The first five of these species are also regional endemics. Populations were recorded across a study area of 200m (for plants) which are thought to comprise up to 2% of the global population. These species are considered to be of regional importance and are all **PBF triggers. They are** therefore assigned a value of Medium.
European Ground Squirrel	Medium	IUCN Endangered. This species is found in locations across central and south-eastern Europe. The global population is unknown; however, data from in-country studies provides a precautionary (lower end) estimate of between 50,000-75,000 animals.

[82] Where an assemblage is being valued, the highest value receptor is considered.
[83] The Ramsar Sites Criteria (2014). Available at: https://www.ramsar.org/sites/default/files/documents/library/ramsarsites_criteria_eng.pdf (Accessed 20/07/20).

VER	Value / Sensitivity[82]	Justification
		Potential presence was confirmed from two VPs and the prevailing habitat appears suitable to support around 200 animals (when assuming a population density of approximately 40 animals/ha, a figure based upon published density ranges within varying habitat types[84]). This would represent approximately 0.4% of the global population (upper estimate). **PBF** trigger due to IUCN EN status.
Marbled Polecat	Medium	IUCN Vulnerable. The marbled polecat has a large range but appears naturally rare across this range. There is very little published information regarding the species' global population and the numbers in Turkey are unknown. It occurs across many open, dry habitats and there is evidence that this extends to cultivated habitats. No marbled polecats were observed during surveys; however, the habitat is considered suitable to support a population across much of the ZoI, where more open habitats prevail (excluding the built-up areas). **PBF** trigger due to potential population size of this IUCN VU species.
Bats	Medium	It is considered likely that the ZoI supports around 20 species of bats, all of which are listed on Annex II of the Bern Convention and six of which are listed on Annex II of the Habitats Directive. Outwith the two species of increased conservation concern, long-fingered bat (IUCN VU) and greater noctule bat (IUCN EN - listed below), there are also those that are IUCN Near Threatened. The long-fingered bat is present across the coastal regions (in the main) of southern Europe, north Africa and into Asia. The population is not well understood although a declining population trend is expected. Country estimates are available in places (e.g. Bulgaria – 20,000 individuals, France – 10,000 individuals) and on this basis a precautionary estimate of 75,000 individuals is assumed. There are no known roosts within the Project ZoI, although bats have been recorded from the cave system at Gökçeali located approximately 1km to the north of the Project (Karatas *et al.* 2003[85]). A count in 2000 recorded 60 bats at this location, with a subsequent count in 2001 revealing just two individuals. Roost sites across Turkey are sparsely distributed and estimated to number just 14[85] and it is therefore appropriate to assume that each one is of national importance. The species is known to forage around average distances of 10km (as per Almenar *et al.,* 2009[86]) and forages over wetland/aquatic habitats. It is therefore assumed to be present across the ZoI. **PBF** trigger due to species' Annex II status (together with potential population size of an IUCN VU species).
Greater Noctule Bat	Negligible	No known records from the ZoI. The closest known population is from the Erdine region (as per Paksuz & Ozkan, 2011[87]). This is species is not considered any further within this assessment.
Other fauna	Medium	A range of relatively common / widespread fauna are potentially present across the ZoI, including those listed on Annex II of the EU Habitats Directive and Annex II of the Bern Convention, but they are not considered to be represented by important populations across the ZoI. This includes species such as otter *Lutra lutra* and fire-bellied toad *Bombina bombina.* **PBF** trigger due to species' Annex II status.

[84] Nicolás Ramos-Lara, John L. Koprowski, Boris Kryštufek, Ilse E. Hoffmann. (2014). Spermophilus citellus (Rodentia: Sciuridae), Mammalian Species, Volume 46, Issue 913, 12 December 2014, Pages 71–87.
[85] Karatas, A., Benda, P., Toprak, F. & Karakaya, H. (2003). New and significant records of Myotis capaccinii (Chiroptera: Vespertilionidae) from Turkey, with some data on its biology. Lynx 34:39-46
[86] Almenar, D., Aihartza, J., Goiti, U., Salsamendi, E. & Garin, I. (2009). Foraging behaviour of the long-fingered bat Myotis capaccinii: implications for conservation and management. Endanered Species Research, Vol. 8: 69-78.
[87] Paksuz, S. & Özkan, B. (2011). New distributional records and some notes for Greater Noctule *Nyctalus lasiopterus* (Mammalia: Chiroptera) from Turkey. Acta Zoological Bulgarica, 63 (2). P217-220.

VER	Value / Sensitivity[82]	Justification
Spur-thighed Tortoise	Medium	The species has fairly extensive (albeit patchy) distribution across north Africa, southern Europe and into Asia. Population information for the species is unclear, most likely because of the relative confusion over the number sub-species and therefore difficulty in attributing numbers to a particular sub-species. However, given the Bulgarian population is considered to be in excess of 2 million individuals[88], it can be assumed that a comparable population size exists in Turkey. **PBF** trigger due to potential population size of this IUCN VU species.
Saker Falcon	Negligible	No known records from the ZoI since 1970s (as per Dixon *et al.* 2009[89]). It's possible that birds visit the ZoI as passage visitors; however, this is not considered to infer any particular value here. This species is not considered any further within this assessment.
Common Pochard	High	Common pochard is listed as Vulnerable within the three IUCN threatened categories. The peak three-year MWC for Küçükçekmece Basin potentially equates to 0.9% of the Central Europe, Mediterranean and Black Sea wintering population previously estimated at 1,250,000 birds (Snow *et al.* 1998[80]). The global population was estimated to number approximately 1,950,000-2,250,000 individuals. Given the species' IBA association, it is considered to be of High value and is assessed on the basis of this association (i.e. as opposed to as a standalone receptor). **PBF** trigger due IUCN VU species.
Red-Breasted Goose	High	Red-breasted goose is listed as Vulnerable within the three IUCN threatened categories. This is a qualifying species listed for two of the IBAs within the study area. Data collated in support of this assessment suggests a decline in the species in the study area (Cogal., M., Sozen, M, March 2020, Sozen., M, April 2020). Red-breasted goose was not recorded during the field surveys and historical data gives the last year of occurrence for records as 1st February 2017 for Büyükçekmece Lake (two birds) and 1st February 2014 (one bird) for the Terkos Basin. Given the species' IBA association, it is considered to be of High value and is assessed on the basis of this association (i.e. as opposed to as a standalone receptor). **PBF** trigger due IUCN VU species.
White-Headed Duck	High	Critical Habitat trigger species. This species was not recorded during surveys in support of this assessment and is not a qualifying species of any of the three IBAs relevant to the study area. Historical records for the study area were derived from official MWC made at Büyükçekmece Lake and Küçükçekmece Basin between 1967- 2018 with the following results: ▪ Büyükçekmece Lake. Recorded in four of the count years, peak annual count of eight in 1993 and the latest record of six in 2013. ▪ Küçükçekmece Basin. Recorded in three of the count years, peak annual count of 36 in 2006 and the latest record of five in 2014. Additional data was derived from the eBird website where records came from Büyükçekmece Lake (peak of 42 birds in 2017) and Küçükçekmece Basin (peak of 29 birds in 2006). This species has undergone a rapid decline across its range. Both Büyükçekmece Lake and Küçükçekmece Basin are known to support low numbers during the winter (Gursoy-Ergon, 2019[90]), which have peaked at 42 individual birds at Büyükçekmece Lake in 2017. This represents approximately 0.8% of the global population and as such means that the wetlands within the ZoI are Critical Habitat for the species.

[88] Modelled estimate from 'Preparation of Bulgarian NGOs for the Biogeographocal Seminars, a Cornerstone of the Naura 2000 Designation Process, taken from Denkstatt. (2014). Biodiversity Action Plan for the Hermann Tortoise (*Testudo hermanni*) and the spur-thighed tortoise (*Testudo graeca*) at Ada Tepe Project area.
[89] Dixon, A., Ragyov, D., Ayas, Z., Mehmet, D., Demerdzhiev, D., Angelov, I., Kmetova, E. & Nedylkov, N. (2009). Population status of breeding saker falcons (*Falco cherrug*) in Turkey. Avian Biology Research. 2 (4): 213-220.
[90] Gürsoy-Ergen, A. (2019). Hope for the White-headed Duck, *Oxyura leucocephala* (Aves: Anatidae) in Turkey despite a declining breeding population and abandonment of its traditional wintering area?. Zoology in the Middle East, DOI: 10.1080/09397140.2019.1580930.

VER	Value / Sensitivity[82]	Justification
		A value of High is therefore assigned.
Egyptian Vulture	Negligible	The Egyptian vulture is listed as Endangered within the three IUCN threatened categories. Data collated in support of this assessment[59] lists this as species potentially encountered in all parts of the study area. The potential for widespread records reflects that this species passes over the Bosphorus Strait incorporating the study area, a well-known bottleneck for migrant birds of prey. Furthermore, this species will forage in a variety of habitats including urban environments. However, with respect to breeding sites this species requires a sheltered cliff ledge or cave and only rarely uses trees (Snow *et al.* 1998[80]). Only five records were derived for the ZoI from the desk study process for this assessment and all came during the autumn migration period (August-October), indicative of birds on passage through the area. There have been no records in the breeding season during field survey work undertaken to date and the ZoI is judged to hold suboptimal breeding habitat. Given the low number of records in the ZoI area and absence of breeding records, a value of Negligible is considered appropriate for this species. This is species is not considered any further within this assessment.
Greater Spotted Eagle	Negligible	Greater spotted eagle is listed as Vulnerable within the three IUCN threatened categories. This species has not been recorded during field surveys to date. Only three records were noted within the ZoI from the eBird website. The species does not breed in Turkey and there is no indication that the ZoI plays any role in maintaining the very small passage/wintering population that has been recorded in the wider area. Esra *et al.* (2018) describe a small wintering population within the region and no important roost sites within the ZoI. Given the above, a value of Negligible is considered appropriate for this species. This species is not considered further within this assessment.
Steppe Eagle	Negligible	Steppe eagle is listed as Endangered within the three IUCN threatened categories. This species is recorded as breeding in Turkey (1-2 pairs at two IBA sites, year of population estimate 1998), but these sites are in an entirely different part of the country. This species is also a passage migrant through Turkey although only one record was noted on the eBird website for the ZoI. Given the low number of records in the ZoI area and absence of breeding records, a value of Negligible is considered appropriate for this species. This is species is not considered further within this assessment.
Imperial Eagle	Medium	Imperial eagle is listed as Vulnerable within the three IUCN threatened categories. Data derived from the eBird website shows numerous records in the study area including recent records (2019) and throughout the year. The main concentration of records in the study area was in the Büyükçekmece Lake area extending approximately 7km north-west from here to Çatalca. This cluster of records was distributed across a variety of habitats including agricultural land, wetlands and wooded hills, reflecting the species eclectic choice of habitats; it will breed in agricultural areas (Snow et al. 1998[80]). The breeding population in Turkey was estimated at between 70 and 120 pairs in 2003 (European Raptors: Biology and Conservation website[91]). A pair of birds comprising a sub-adult and an adult was recorded during surveys in June 2020, which suggests a breeding territory exists within the ZoI. Given this species low breeding population in Turkey and its IUCN threatened status, a value of Medium is therefore assigned. **PBF** trigger due IUCN VU species.

[91] European Raptors: Biology and Conservation (2020). New Publication About Hen Harrier Identification. Available at: www.europeanraptors.org (Accessed 21/06/20).

VER	Value / Sensitivity[82]	Justification
Turtle Dove	Negligible	Turtle dove is listed as Vulnerable within the three IUCN threatened categories. However, historically Turkey has had a large breeding population, estimated at 500,000- 5,000,000 pairs (Snow *et al.* 1998[80]). A search of more recent records on the eBird website shows the species to be still widespread and numerous within the ZoI and beyond. Given this species relatively widespread and common status, the ZoI does not appear to be of local or above value for the species and so a value of Negligible is considered appropriate for this species. This is species is not considered further within this assessment. **PBF** trigger due IUCN VU species.
Aquatic Ecology (fish)	High	Two IUCN CR sturgeon species (Russian sturgeon and beluga sturgeon) are present within Küçükçekmece Basin. **PBF** trigger due to relative population size of IUCN CR species.
Aquatic Ecology (general)	Low	No species of conservation concern were identified through the aquatic surveys; however, the potential exists for more sensitive aquatic invertebrate populations to be present in some of the more semi-natural watercourses identified (such as Karasu Stream (chainage 45+271 to 45+432), Ambar Creek (chainage 74+005 to 74+100) and Ambar Creek (chainage 74+700 to 74+763)). On this basis, a precautionary value of Low is considered appropriate for this receptor.

8.5.4. For each of the above VER, the assessment considers the nature and magnitude of the impact before considering the effect that will result. This is done separately for construction and operation of the Project. Mitigation is then applied where appropriate in order that effects are reduced to a level that is considered acceptable.

8.5.5. Given the limitations (recognised within **paragraph 8.3.50**) the following assessments are made with probable confidence unless otherwise stated (see **Table 8-4**).

CONSTRUCTION PHASE

8.5.6. Construction phase impacts will comprise the following:

- Land-take – including the track and all associated ancillary infrastructure;
- Disturbance – including noise / vibration and visual disturbance;
- Injury or killing of fauna as a result of construction activities; and
- Spread of alien/invasive species.

8.5.7. Potential hydrological impacts have been scoped out on the basis that embedded mitigation will reduce the risk of a pollution incident and other impacts to watercourses, or any groundwater impacts to an acceptable level (see **Chapter 11: Surface Water Environmental Hydrology** and **Chapter 12: Geology and Hydrogeology**).

8.5.8. Potential air quality impacts have been scoped out on the basis that preventative mitigation measures will be put in during construction (see **Chapter 6: Air Quality**).

8.5.9. With regards the disturbance impact from the construction activities, **Table 8-11** below provides predicted absolute noise levels at targeted locations for the various construction activities in isolation (i.e. excluding baseline levels). For comparison, baseline noise levels for comparative locations are provided in brackets within header cells. As illustrated here, the maximum predicted acoustic impacts will be realised around the Terkos Basin KBA (IBA points 2, 3 & 4[92]). (Noise modelling locations illustrated on **Figure 8-9** below), but even here, they only exceed baseline levels by a maximum of <15dB. Furthermore, the sensitive receptors at Terkos basin are located further from the Project than this point, so will experience a lower noise levels, as explained in **paragraph 8.5.46**.

[92] Other IBA locations: IBA 1 is at Küçükçekmece Basin; and IBA 5 is at Büyükçekmece Lake.

Table 8-11 - Noise Modelling Results

Construction Phase	Predicted Free field LAeq,1hr (dB)					
	Receptor Height (m)	IBA 1 (59.5)*	IBA 2 (55.9)*	IBA 3 (55.9)*	IBA 4 (55.9)*	IBA 5 (58.9)*
Phase 1 - Site Preparation	1.5	30	55	49	59	30
	15	30	55	49	59	30
Phase 2 - Earthworks	1.5	33	58	51	62	33
	15	33	58	51	62	33
Phase 3 - Piling Activities and Bridge/Viaduct Construction	1.5	40	65	59	69	40
	15	40	65	59	69	40
Phase 4 - Tunnel Boring Activities	1.5	40	65	59	69	40
	15	40	65	59	69	40
Phase 5 - Foundation / Rail	1.5	36	60	54	65	36
	15	36	60	54	65	36

*Baseline noise levels.



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

Legend

- Noise Modelling Locations
- Proposed Railway Route
- Important Bird and Biodiversity Areas (IBAs)



Note:

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 8-9 - Noise Modelling Locations

Scale at A4: 1:350,000

Drawn			
DG			
Stage 1 check	Stage 2 check	Originated	Date
JS	JW	DG	23/02/2021

0 1.25 2.5 5 7.5 10
Km

wsp

Drawing Number: Figure 8-9

Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 8-9 - Noise Modelling Locations.mxd

Protected Areas

8.5.10. As per the requirements of PR6, the assessment of protected areas will broadly align with the approach taken to assessing impacts upon Natura 2000 sites (in line with the EU Habitats Directive). Where appropriate (i.e. where effects exist), an assessment of impacts within the context of each site integrity has been made. This process also ensures compliance with Turkey's Draft Law on the Protection of Nature and Biological Diversity, which harmonises national legislation with the EU Habitats and Birds Directives.

8.5.11. Given the high value assigned to qualifying species of each IBA, those threatened species which contribute to the designation are assessed individually within the context of the IBA, before the overall impact to the IBA is concluded (non-threatened species also assessed on this basis, e.g. gulls and the waterbirds assemblage).

Büyükçekmece Lake IBA

8.5.12. Potential construction impacts to the Büyükçekmece Lake IBA comprise the following:

- Land-take – including the track and all associated ancillary infrastructure;
- Severance impact and alteration of hydrological regime; and
- Disturbance – including noise / vibration and visual disturbance.

8.5.13. The Project extends across the northernmost section of the Büyükçekmece Lake IBA, alongside the existing railway at this location. Assuming a uniform land-take width of 50m through the IBA, the total area lost to the Project will be in the region of 0.03km^2. The habitats lost to the Project within the IBA will be predominately agriculture, with small sections of plantation forest also. While these are habitat types sporadically used as foraging resources for birds associated with the IBA, in particular red-breasted goose, there is no indication that the area to be lost is of any particular importance in this regard.

8.5.14. The section of the Project within the IBA will be located adjacent to the existing railway for a sizeable proportion of the route, and within 250m of the existing railway at its greatest divergence, meaning that areas to be lost are already currently subject to varying levels of disturbance / degradation.

8.5.15. The habitat loss represents approximately 0.18% of the overall foraging resource potentially available to foraging IBA birds and therefore is considered to be an impact of negligible magnitude. Accordingly, the effect of land-take upon the integrity of the Büyükçekmece Lake IBA is considered to be **Neutral** (**Not Significant**).

8.5.16. The Project bisects the IBA as well as several feeder watercourses. A robust embedded mitigation strategy is in place to prevent adverse impacts from occurring to the surface and ground water environments (see **Chapter 11: Surface Water Environmental Hydrology** and **Chapter 12: Geology and Hydrogeology**). No severance impacts are therefore expected.

8.5.17. Disturbance impacts from the Project during construction will primarily be derived from acoustic / vibration disturbance as a result of construction activities. Additionally, visual impacts will also arise during this phase.

Common Pochard

8.5.18. Potential impacts to this species during the construction phase are as follows:

- Direct visual and noise disturbance to foraging flocks where the Project is near wetland habitats, which have been identified as supporting this species.

8.5.19. Construction impacts will elicit a disturbance response in the species. A waterbird disturbance toolkit (Cutts *et al.* 2013[93]) has been used to estimate the likely response from common pochard and other species, to disturbance impacts from the Project during the construction phase. The toolkit uses species representative of various bird species groups (ducks, waders, geese); common pochard is not one of the species included, therefore mallard *Anas platyrhynchos* was selected given the similar ecology of the two species. While mallard forages by dabbling at the surface and common pochard dives for food, they use similar open water habitat and their response is expected to be broadly similar.

8.5.20. Acoustic disturbance resulting from construction works around the IBA is predicted to result in up to 40dB of noise, which Cutts *et al.* (2013)[93] consider to be below the level at which mallards would be displaced from foraging and are less than baseline noise levels at this location. In terms of visual disturbance, for mallard the tool kit recommends that birds closer than 200m to activities (including plant and workers operating away from plant) are potentially at risk of high levels of visual disturbance.

8.5.21. Using a 200m study area around the Project as a guideline, the ZoI for disturbance during the construction phase results in a low amount of potential foraging area from where common pochard may be displaced, in comparison to the foraging area available in the wider area. Furthermore, this study area extends across an area that is not typically used by the species (with no records from this area on ebird).

8.5.22. At Büyükçekmece Lake the total area of the IBA is 5,118 ha and the total area of the IBA within disturbance ZoI for common pochard is estimated at 97.4ha, 2% of the total area.

8.5.23. In light of the above, the acoustic and visual disturbance impact is considered to be negligible, resulting in an effect that is **Neutral** (**Not Significant**).

8.5.24. This species is considered to trigger PBF. In light of the Project being situated within this PBF habitat, any impacts will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in **Section 8.6**.

Red-Breasted Goose

8.5.25. Potential impacts to this species during the construction phase are as follows:

- Direct visual and noise disturbance to foraging flocks on agricultural fields or roosting flocks on water bodies where the Project is near these habitats.

[93] Cutts, N., Hemingway, K. & Taylor, J. 2013. Waterbird Disturbance Toolkit Informing Estuarine Planning & Construction Projects Institute of Estuarine & Coastal Studies (IECS). University of Hull.

8.5.26. Using the disturbance tool kit referenced under common pochard, this species is predicted to have a visual disturbance ZoI of approximately 400m (well in excess of a distance at which acoustic disturbance would be a material impact), using the closest species available in the tool kit, brent goose *Branta bernicla*.

8.5.27. There are no historical records falling within the 400m disturbance ZoI (the closest being c. 450m). At Büyükçekmece Lake the total area of the IBA is 5,118ha and the total area of the IBA within disturbance ZoI for red-breasted goose is estimated at 184.4ha, 3% of the total area. Furthermore, given that the species is not tied to water for foraging and utilises farmland and grassland, there is extensive suitable foraging habitat widely available beyond the disturbance ZoI.

8.5.28. In consideration of the low (if any) number of birds potential at risk of experiencing disturbance impacts, and the lack of specialism in this species feeding requirements on grassland and arable fields (Snow *et al.* 1998[80]) which are widely available in the study area and beyond, the impact is negligible resulting in an effect from the Project to red-breasted goose that is considered **Neutral** (**Not Significant**).

8.5.29. This species is considered to trigger PBF. In light of the Project being situated within this PBF habitat, any impacts will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (Appendix L), with relevant mitigation included in Section 8.6.

Gulls

8.5.30. Three separate gull species are listed as qualifying species for this site: little gull, Mediterranean gull and yellow-legged gull. Disturbance during construction will likely result in temporary abandonment of areas close to the Project; however, this does not include roost sites, which are generally open water. The open water areas are approximately 4km from the Project and therefore will not be subject to disturbance impacts.

8.5.31. A number of studies exist which suggest gulls (in general) have tolerance to noise disturbance of up to c. 65dB (e.g. as per Wright *et al.* 2010[94]). Given the maximum expected construction noise impact will be c. 40dB, this impact is not considered to be greater than negligible, especially when considering the baseline levels and the abundance of habitat that gulls can temporarily relocate to (both terrestrial and aquatic). A similar consideration is given for visual disturbance (for which very little published literature exists). This displacement effect during construction, of gulls from arable fields where they will congregate and forage, is considered to be **Minor** (**Not Significant**) within the context of the abundant similar habitats across the wider ZoI.

Waterbirds Assemblage

8.5.32. Aside from the qualifying species, there are potential impacts to other relevant IBA species from the Project. Important aggregations of wildfowl and waders are associated with Büyükçekmece Lake as well as white stork, which can be present in large numbers at the site.

[94] Wright, M. D., Goodman, P. & Cameron, T. C. 2010. Exploring behavioural responses of shorebirds to impulsive noise. Wildfowl **60**: 150-167

8.5.33. Given the extent of suitable habitat for waterbirds in the study area, their distribution is anticipated to be extensive and not tied to specific areas. As an example, records derived from the eBird website for ferruginous duck and white stork shows wide a distribution at Büyükçekmece Lake.

8.5.34. The impact of disturbance during construction is considered to be of slight magnitude when considering the abundance of available habitat across the IBA (and further afield), together with the limited nature of disturbance levels (when considering a maximum potential noise level of 40dB) and a level of habituation to visual and noise disturbance from the existing railway here. This will result in an effect that is **Minor** (**Not Significant**).

8.5.35. Given the above assessments there are no predicted significant effects to the integrity of the Büyükçekmece Lake IBA as a result of Project construction activities.

8.5.36. The IBA is considered to be Critical Habitat due to it forming part of the EAAA for white-headed duck. As such, the construction impacts upon the Büyükçekmece Lake IBA will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in **Section 8.6**.

Küçükçekmece Basin IBA

8.5.37. Potential construction impacts to the Küçükçekmece Basin IBA comprise the following:

- Land-take – including the track and all associated ancillary infrastructure; and
- Disturbance – including noise, vibration and visual disturbance.

8.5.38. The Project extends beneath the Küçükçekmece Basin IBA via a tunnel of approximately 6km in length. As a result, there will not be any habitat loss associated with the Project here.

8.5.39. Disturbance impacts from the Project during construction will primarily be derived from acoustic and vibration disturbance as a result of construction activities at the tunnel entrances as well as during tunnel excavation. Additionally, visual impacts will also arise during this phase at these locations.

8.5.40. The tunnel entrances are located outside the IBA boundary and over 500m from the lake itself. Furthermore, on the eastern side of the IBA (where construction activities are at their closest, between 500-600m from the open water), there are buildings/built up areas between the proposed tunnel entrance location and the lake which will further reduce impacts associated with construction on the IBA. Taking into considering the thresholds detailed above for the assessment in relation to Büyükçekmece Lake, the acoustic and visual impacts are not considered to be any greater than negligible here, resulting in an effect that is **Neutral** (**Not Significant**).

8.5.41. Given the above assessments there are no predicted significant effects to the integrity of the Küçükçekmece Basin IBA.

8.5.42. The IBA is considered to be Critical Habitat. As the Project is located in a tunnel beneath this Critical Habitat, and based on the above assessment, the construction impacts upon Küçükçekmece Basin IBA do not require any further consideration under PR6 compliance terms.

Terkos Basin KBA

8.5.43. Potential construction impacts to the Terkos Basin KBA comprise the following:

- Land-take – including the track and all associated ancillary infrastructure; and
- Disturbance – including noise, vibration and visual disturbance.

8.5.44. The Project extends across a small section of the Terkos Basin KBA, to the immediate north-west of the settlement of Kurfalli. Most of the route of the Project through the KBA follows the existing railway; however, a section in the east of the KBA section will result in loss of woodland habitat. This habitat is likely to include communities described within the corresponding IBA factsheet, such as mature oak woodland (as per EUNIS habitat G1.A – see **Section 8.3**), but also includes disturbed habitats alongside the existing railway. The length of the Project through the KBA is approximately 4.7km (this accounts for a section of viaduct beneath which habitat loss will not occur).

8.5.45. The KBA is listed as a site 'in danger', with numerous existing threats having been identified which will have resulted in impaired resilience of the site to additional impacts from the Project.

8.5.46. When considering a uniform, permanent land-take width of 50m, the total habitat loss will be in the region of 24ha, which is not considered to represent a significant impact relative the size of the woodland resourced within the KBA here (approximately 1,300ha of connected woodland to the south of the existing railway). Furthermore, the Project runs parallel with the existing railway for much of the route through the KBA, meaning the quality of the habitat being lost here will not be typical for the less disturbed woodland outside the Project footprint. The impact of land-take upon the KBA is therefore considered to be slight, resulting in an effect that is **Minor** (**Not Significant**) (including within the context of the site's current status), not compromising the integrity of the site.

8.5.47. Disturbance impacts from the Project during construction will primarily be derived from acoustic and vibration disturbance as a result of construction activities. Additionally, visual impacts will also arise during this phase. None of the IBA trigger species are considered a disturbance risk, due to the distance of suitable wetland habitat within the Terkos Basin from the Project (approximately 22km). This impact is therefore negligible, resulting in an effect that is **Neutral** (**Not Significant**).

8.5.48. Given the above assessments there are no predicted significant effects to the integrity of the Terkos Basin KBA.

8.5.49. The KBA is considered to be a PBF. In light of the Project being situated within this PBF and following the above assessment, the construction impacts upon the Terkos Basin KBA will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in **Section 8.6.**

Habitats

8.5.50. Potential impacts to habitats during the construction phase are as follows:

- Loss/degradation of habitat; and
- Loss/degradation of plants due to increased competition from invasive alien species.

8.5.51. The habitats within the Project ZoI are generally indicative of ongoing disturbance, from settlements and urban sprawl and agricultural land-use. Indeed, the most widespread habitat type across the study area is agricultural fields. The main habitats of interest (outwith the protected areas considered above) are natural/semi-natural pockets of woodland and scrub, most notably pseudomaquis (EUNIS F5.3), eastern garrigues (F6.2), Mediterranean riparian woodlands (G1.3) and meso- and euthropic *Quercus, Carpinus, Fraxinus, Acer, Tilia, Ulmus* and related woodland (G1.A).

8.5.52. Habitat loss by broad habitat type is listed below in **Table 8-12**. Total loss figures are provided along with an estimated relative loss for the EAAAs[95]. Further details regarding the EAAA of those habitats of greatest sensitivity (i.e. the oak/hornbeam woodland PBF) is provided within **Appendix L – Critical Habitat Assessment**, which includes EAAA figures.

Table 8-12 - Broad Habitat Loss Summary

Habitat Type	Approximate Area within EAAA (ha)	Habitat Loss (total ha)	Indicative Relative Loss within EAAA - %
Dense Shrub / Scrubland	12,000	179	1.5% relative loss. Slight: Maquis (shrub) vegetation is a common component of the woodland/scrub mosaic that extends across the Terkos Basin KBA and elsewhere therefore losses expected here at not considered to represent a material impact to the habitat's conservation status across the study area.
Agricultural Fields	11,455	162.9	1.5% relative loss. Negligible: Agricultural fields are a common component of the landscape, especially across the east of the study area. Predicted losses to this habitat will not affect the conservation status.
Woodland	65,497	93.2	0.1% relative loss. Slight: Dry oak forests are common across the study area away from the coasts and form a large component of mosaic habitats across the Terkos Basin KBA. Many of these forests are degraded and so relative losses of oak-hornbeam forests within the ZoI are considered to be slight.
Lowland Grassland	4,775	82	1.7% relative loss. Slight: Lowland grassland is relatively common in the east of the study area (as illustrated by area recorded within the ZoI). The losses as expected during construction will not materially impact upon the habitat type's conservation status in the study area and are therefore Slight.

[95] Losses do not account for ancillary sites such as temporary camps, laydown areas, or new access roads. The locations and extents of these areas are unconfirmed at present.

Habitat Type	Approximate Area within EAAA (ha)	Habitat Loss (total ha)	Indicative Relative Loss within EAAA - %
Built-up Areas	884	20	N/A
Wetlands	76.3	0	Neutral: Wetland habitats impacts will be avoided through embedded mitigation designed to maintain the hydrological regime across the Project.
Aquatic Habitats	16.3	Not Applicable	N/A

8.5.53. None of these habitats will experience greater than 1.7% loss across their respective EAAAs, and this figure is likely a worst-case estimate as described above. Furthermore, given the presence of the existing railway across sections of the ZoI, it is likely that the losses as a result of the Project will affect habitat edges, which themselves will have been degraded through the presence of the existing railway. With this in mind, the overall effect upon habitats is considered to be **Minor** (**Not Significant**).

8.5.54. There are not currently considered to be any significant invasive plant outbreaks across the ZoI and no notable such communities were identified during baseline surveys. However, the risk remains that the Project may serve as a conduit to facilitate the establishment of new invasive species communities across the ZoI. Ozaslan *et al.* (2016[96]) concluded '*…that railways have notable contribution to plant invasion in Turkey.'*

8.5.55. Any new invasive species presence across the ZoI will affect disturbed or open areas preferentially due to the nature of such plants' colonisation strategy. With this in mind, areas that are already of limited ecological value will be most at risk, with impacts of the potential to be large upon these areas. Assuming this scenario, the effect is considered to be **Minor** (**Not Significant**).

Oak / Hornbeam Woodland

8.5.56. The most valued of the habitats within the ZoI is considered to be the natural oak and hornbeam woodland that appears to exhibit the fewest signs of human influence and aligns with EU Habitats Directive Annex I habitat Galio-Carpinetum oak-hornbeam forests (Code: 9170). When considered in isolation, the anticipated loss of this habitat will be 74.3ha.

[96] Ozaslan C., Farooq, S. & Onen, H. 2016. Do railways contribute to plant invasion in Turkey? Agriculture and Forestry, Vol 62. Issue 3. P.285-298.

8.5.57. The magnitude of this impact is considered to be slight given that the loss of 74.3ha represents 0.1% of the EAAA extent (see Figure A-1 within **Appendix A** for EAAA extent)[97]. This magnitude will be a worst-case estimate, as it is likely that habitat will be retained where more significant bridge/viaduct structures are planned (around chainages 53+000 and 54+000). An overall effect of **Minor** (**Not Significant**) is therefore concluded.

8.5.58. As described above, any invasive species colonisation will most likely affect more open and historically disturbed areas where ecosystem resilience is impaired. With this in mind established woodland habitat will unlikely be significantly affected and any invasive species impacts here will be slight (at worst). This would result in an effect that is considered to be **Minor** (**Not Significant**).

8.5.59. This habitat is considered to be a PBF. In light of the Project being situated within this PBF and following the above assessment, the construction impacts upon the oak/hornbeam woodland will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in **Section 8.6**.

Flora – Rare Plants

8.5.60. Potential impacts to this species during the construction phase are as follows:

- Loss of plants due to removal of habitat; and
- Loss of plants due to increased competition from invasive alien species.

8.5.61. The Project has the potential to result in the loss of individuals from six threatened plant species populations, one of which is a Critical Habitat trigger (*Centaurea hermannii*) and five of which are regional (to Thrace) endemics that trigger PBF. These populations were all found in woodland or scrub/shrub habitat immediately within, or in close proximity to, the Project footprint (see **Figure 8-6** and **Figure 8-7**).

8.5.62. While no further individuals of these plants were recorded, it's likely that the population extends across suitable habitat outwith the study area (albeit at a low level), especially in the case of those regional endemics. For the purposes of this assessment it is assumed that these species' relative occurrence outwith the 200m study area survey is equivalent to that recorded within this study area (see **Table 8-10**). The Project will result in losses of between approximately 25-50% of the specimens recorded based on the findings from the field survey effort and the locations of the individuals recorded. When considering these potential losses, out of a population that constitutes a maximum of 2% of the total population, this impact is moderate, resulting in an effect that is expected to be **Moderate** (**Significant**) for both *C. hermannii* and the other rare plants present.

8.5.63. As described within the habitat section above, the risk exists that the construction phase provides a conduit for the spread of invasive plant species across the ZoI and beyond. While there is very little certainty in this regard, it is feasible that such a scenario could result in threatened plant species being lost as invasive species colonise and out-compete other plants. Such an impact has the

[97] the EAAA for this habitat comprises oak-hornbeam dominated mosaic which extends across much of the Terkos Basin KBA). See Appendix A – Critical Habitat Assessment for more information.

potential to be large, which would result in an effect that is considered **Major** for *C. hermannii* and **Moderate** (**Significant**) for rare plants in general as it could ultimately lead to the permanent loss of some of these threatened plants from the ZoI which would materially affect the conservation status of the species as a whole.

8.5.64. The occurrence of *C. hermannii* is considered to trigger Critical Habitat, while the other rare plant species recorded trigger PBF. In light of the above assessment, the construction impact to rare plants will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment report (Appendix L), with relevant mitigation included in Section 8.6.

Fauna

European Ground Squirrel

8.5.65. Potential impacts to this species during the construction phase are as follows:

- Land-take – loss of important habitat/features;
- Disturbance – including noise, vibration and visual disturbance; and
- Injury or killing of fauna as a result of construction activities.

8.5.66. European ground squirrel was recorded from two sample points in the east of the Project during walkovers in early-2020, around the Küçükçekmece Lake; no further evidence was recorded during subsequent survey effort, although the species is known to be present from the Terkos Basin KBA[98]. The area around Küçükçekmece Lake is considered to represent the most likely extent of the species across the ZoI. The Project here is in relatively close proximity to the existing railway.

8.5.67. The areas around Küçükçekmece Lake will be largely avoided from direct disturbance due to the Project being tunnelled here and it is estimated that less than 1% of the open agricultural habitat where the species was recorded will be lost. Furthermore, it is considered likely that the population here is a relict population, given the fragmented nature of the habitat (i.e. surrounded by built-up areas of greater Istanbul). As such, impacts to this population (from land-take), disturbance and injury/mortality) will unlikely be more than slight within the context of the population across the study area (i.e. including within Terkos Basin), especially when considering the inherent mobility of the species and the linear nature of the Project.

8.5.68. The above impact is considered to result in an effect that is **Minor** (**Not Significant**).

8.5.69. This species is considered to trigger PBF. In light of the Project being situated within this PBF habitat, the construction impacts upon European ground squirrel will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in Section 8.6.

[98] As per http://datazone.birdlife.org/site/factsheet/terkos-basin-iba-turkey.

Marbled Polecat

8.5.70. Potential impacts to this species during the construction phase are as follows:

- Land-take – loss of important habitat/features;
- Disturbance – including noise, vibration and visual disturbance; and
- Injury/killing of fauna as a result of construction activities.

8.5.71. Impacts to marbled polecat comprise habitat loss, and disturbance and injury or mortality that may occur as a result of construction activities. The species is considered to be the most fossorial within the mustelid family and would therefore be particularly susceptible to the Project construction impacts.

8.5.72. Marbled polecats are most likely to be present across the east of the ZoI, due to the prevalence of their preferred habitat type of open steppe and potentially cultivated landscapes here, although no presence has been confirmed, including from camera-trapping undertaken in July 2020.

8.5.73. Given the assumed low density of animals across the ZoI, together with the species' inherent mobility, it's likely that animals will be able to disperse to suitable habitat outwith the Project and therefore impacts will be mainly limited to direct injury or mortality from construction activities. Again, this low density and mobility will restrict the magnitude of this impact to slight, resulting in an effect which is therefore likely to be **Minor** (**Not Significant**).

8.5.74. This species is considered to trigger PBF. In light of the Project being situated within this PBF habitat, any impacts will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in Section 8.6.

Bats

8.5.75. Potential impacts to this species group during the construction phase are as follows:

- Land-take – loss of important habitat/features;
- Disturbance – including noise/acoustic and visual disturbance; and
- Injury or killing of fauna as a result of construction activities.

8.5.76. The Project has the potential to result in direct losses to roosting bats (i.e. through destruction of roosting habitat/features) and also through disturbance associated with construction activities (most notably noise and vibration). The Project ZoI extends through habitat, which is considered likely to support bat roosts, most notably within the southern tip of the Terkos Basin KBA where mature woodland will be impacted; but also around urban and suburban areas where roosts within built structures will be at risk. In the absence of detailed population estimates for the bats across the EAAA (taken as mosaic scrub/woodland habitat), it is feasible that construction activities could result in the loss of a local population of bats. However, given the abundant similar habitat present across the study area, the magnitude of the impact is considered to be slight.

8.5.77. In particular, the Project will not directly impact any known long-fingered bat roosts, nor will it result in the loss or degradation of foraging resource for this species, which are assumed to be mainly the large wetland habitats in the east of the ZoI. There are risks that construction activities will result in disturbance impacts to roosting bats, which can lead to abandonment and/or increased mortality if bats are unable to find other suitable roost sites; however, given the nearest known roost is greater

than 500m from the Project, this impact is considered to be slight (which is precautionary on the basis that small, unknown roosts may become established).

8.5.78. Given the above, the effect is considered to be **Minor** (**Not Significant**).

Spur-Thighed Tortoise

8.5.79. Potential construction impacts to spur-thigh tortoise comprise the following:

- Land-take – loss of important habitat/features;
- Disturbance – including noise/acoustic and visual disturbance; and
- Injury/killing of fauna as a result of construction activities.

8.5.80. The Project has the potential to result in direct loss of this species during construction as well as the loss of important habitat features (e.g. those used for hibernation) and disturbance of animals while using such features. The impact is exacerbated by the animal's relative immobility and so it can be assumed that most animals within the Project ZoI would be affected.

8.5.81. The species was confirmed as being present around the Terkos Basin KBA, from ecology transects 4 and 5. In these locations, the Project runs close to/parallel with the existing railway and so it is assumed that tortoises are successfully negotiating the railway in maintaining a population here. With this in mind, it is considered that the Project will have a moderate impact mainly due to the slow rate at which the species may recolonise an area should animals be lost during construction, which will result in an effect in the absence of any mitigation which is **Minor** (**Not Significant**).

8.5.82. This species is considered to trigger PBF. In light of the Project being situated within this PBF habitat, any impacts will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in Section 8.6.

Other Fauna

8.5.83. Potential impacts to this other fauna during the construction phase are as follows:

- Land-take – loss of important habitat/features;
- Disturbance – including noise, vibration and visual disturbance; and
- Injury/killing of fauna as a result of construction activities.

8.5.84. The faunal assemblage across the ZoI includes a range of animals which will be at risk of experiencing the above impacts, in a similar manner to those described for the specific fauna above. With regards habitat loss, the overall Project footprint and linear nature of these losses will mean that such losses will result in limited losses in most cases. As described previously, the proximity of the Project to the existing railway together with other inherent degradation/disturbance impacts (such as agricultural practices, etc.) across large areas (particular in the east of ZoI) will mean that habitat suitability here is already relatively impaired so it is not considered to represent an area of particular importance to fauna. The main area of broad importance to general fauna (as derived from desk study and fieldwork results) is around the Terkos Basin and the surrounding woodland and scrub habitat in the west of the ZoI. This area also includes EU Habitats Directive Annex II species such as otter and fire-bellied toad, which may make use of riparian zones here to establish holts/resting areas. Otters are also considered potentially present around Küçükçekmece Basin and Büyükçekmece Lake.

8.5.85. Given the scale of habitat losses expected, the greatest impacts will be realised among small animals with small home ranges/territories where it is possible losses of complete ranges/territories will occur. This is particularly relevant to reptiles, which are considered to be numerous within the ZoI (a potential 29 species were identified during the desk study process) and which typically have small home ranges. With this in mind it is feasible that losses of populations of such animals may occur during construction activities. When considering the similar habitat composition across the study area and the availability of suitable replacement habitat, any losses are not considered to be greater than slight.

8.5.86. Disturbance impacts from construction will occur most notably to those animals in close proximity to Project and those with lifecycles that have periods of particular sensitivity (e.g. during breeding, roosting, etc.). As such, this impact represents an indirect extension of the habitat loss impact described above, albeit on a temporary and short-term basis. As such a slight impact magnitude is also expected here.

8.5.87. Direct mortality from construction activities may occur from a number of sources including vehicle movement, excavation and vegetation clearance. It is assumed that most animals will be displaced as a result of construction disturbance, which will reduce the mortality risk; however, there will be animals that will not be able to relocate. Given the inherent mobility of most animals potentially present, together with the short-term nature of this impact, the magnitude here is considered to be slight.

8.5.88. Given the above assessment, the impacts to fauna during construction are considered to result in an effect that is **Minor** (**Not Significant**).

8.5.89. These species include those which trigger PBF. In light of the Project being situated within this PBF habitat, any impacts will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in Section 8.6.

Birds (Non-IBA Qualifying Species)

White-Headed Duck

8.5.90. Potential impacts to this species from the Project during the construction phase are as follows:

- Direct visual and noise disturbance to foraging flocks where the Project is near wetland habitats identified as supporting this species.

8.5.91. Although there is a recent lack of records in the study area, taking consideration of the extremely low global population estimate of 5,300-8,700 individuals (BirdLife International, 2017[99]) and uncertainty about the possible large-scale inter-year movement of birds between wintering sites,

[99] BirdLife International. 2017. *Oxyura leucocephala*. *The IUCN Red List of Threatened Species* 2017: e.T22679814A119403602. https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22679814A119403602.en. Downloaded on 29 July 2020.

then peak counts reported on the eBird website and during MWC are indicative of significant aggregations in the study area in some years.

8.5.92. Using records from the eBird website to assess the distribution of white-headed ducks, at Büyükçekmece Lake there were 20 records from the northern end of the lake i.e. the closest area to the Project. However, the majority of these records (18 of the 20) were at approximately 4km distance from the project with two records much closer at approximately 450m from the Project. The records closest to the Project involved two birds in 2006 and a single bird in 2010. The peak count of 42 birds noted from the eBird website for 2017 was in the central section of the lake approximately 8km from the Project.

8.5.93. At Küçükçekmece Basin the eBird website shows four records from the north shore, approximately 1.5km from the nearest tunnel entrance, and nine records from the central part of the site at approximately 2km from the Project which included the peak count of 29 birds in 2006.

8.5.94. When adopting the disturbance tool kit described by Cutts *et al.* (2013)[93], the same predictions have been made for this species as common pochard, given its relatively similar ecology and usage for foraging at the two IBA sites:

- At Büyükçekmece Lake the total area of the IBA is 5,118ha and the total area of the IBA within disturbance ZoI for white-headed duck is estimated at 97ha, 2% of the total area.
- At Küçükçekmece Basin the total area of the IBA is 11,715ha and the total area of the IBA within disturbance ZoI for white-headed duck is estimated at 1ha, 0.009% of the total area.

8.5.95. Given the above and the abundance of (potentially more) suitable habitat outwith the zone of disturbance likely to be experienced by these birds; and when considering that no records exist of birds within disturbance distance of the Project, the overall impact is considered to be negligible. This will result in an effect that is **Neutral** (**Not Significant**).

8.5.96. This species is considered to be a Critical Habitat trigger. In light of the Project being situated within this Critical Habitat (by virtue of it bisecting the Büyükçekmece Lake, and following the above assessment, the construction impacts upon white-headed duck requires further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in **Section 8.6.**

Imperial Eagle

8.5.97. Potential impacts to this species during the construction phase are as follows:

- Loss of a breeding site or non-breeding foraging site due to removal of habitat; and
- Direct visual and noise disturbance to a breeding site or non-breeding foraging site.

8.5.98. The impacts of habitat loss are predicted to be negligible due to the relatively small land take for the Project and the eclectic choice of foraging habitat by the species (agricultural land, wetlands and wooded hills mainly) which is widely available throughout and beyond the ZoI. The Project largely follows an existing train line and is also located alongside other infrastructure, so it is considered unlikely that the Project footprint will result in the loss of a nest site; indeed, the only territory recorded during surveys (and desk study) has a nest site located approximately 3km from the Project. Direct losses from construction activities are therefore expected to result in an effect which is **Neutral** (**Not Significant**).

8.5.99. The disturbance impact magnitude is predicted to be negligible based upon the distance from the Project that the established territory is located. As an indication of this species' sensitivity to disturbance at a nest, disturbance distances quoted for Spanish imperial eagles (González *et al.* 2006[100]) suggested a minimal protection buffer of 500m (based on 95% prediction of flight probability) with a vulnerable zone extending to 800m (based on 99% prediction of flight probability) where some activities, such as vehicles, are allowed. Therefore, potential effect from the Project during the construction phase are expected to be **Neutral** (**Not Significant**).

8.5.100. This species is considered to trigger PBF. In light of the Project being situated within this PBF habitat, the construction impacts upon imperial eagle will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (Appendix L), with relevant mitigation included in **Section 8.6**.

Aquatic Habitats

Fish

8.5.101. Potential construction impacts to aquatic ecology comprise the following:

- Loss/degradation of habitat through in-channel works and pollution/sedimentation.
- Direct mortality/injury to fish.

8.5.102. At the watercourse crossings where no in-channel works are required, there will be mitigation measures in place to prevent adverse impacts from occurring to the surface and groundwater environments (see **Chapter 11: Surface Water Environmental Hydrology** and **Chapter 12: Geology and Hydrogeology**). On this basis there are not expected to be any impacts to aquatic ecology at these locations.

8.5.103. Furthermore, appropriate pollution mitigation measures will be applied to the Project at all watercourse crossing locations to prevent pollution/sedimentation impacts from occurring during construction, as detailed in **Chapter 11: Surface Water Environment** and **Chapter 12: Geology and Hydrogeology**. On this basis, pollution impacts are not considered any further in this assessment.

8.5.104. The presence of sturgeon has been confirmed in the Küçükçekmece Basin (although it is possible that this presence is historical, as no records from the last 15 years have been identified), however there will be no impacts to this waterbody as a result of the Project, due to it being located in a tunnel to the north of this waterbody. Sturgeon species are therefore not considered any further within this assessment.

8.5.105. Direct impacts to fish are expected as a result of the in-channel works planned at the seven watercourse crossing locations. These impacts will comprise loss of shelter and foraging habitat as well as potential loss of spawning gravels. There is also the risk that fish may become injured or trapped during construction activities.

100 González, L.M., Arroyo, B.E., Margalida, A., Sanchez, R. & Oria, J. (2006). Effect of human activities on the behaviour of breeding Spanish imperial eagles (Aquila adalberti): management implications for the conservation of a threatened species. Animal Conservation, 9. 85-93.

8.5.106. The impacts to fish where in-channel works are planned are predicted to be slight due to the inherently mobile nature of fish and the relatively small footprint of the construction activities (within the context of the wider aquatic habitat). There is nothing to suggest that any of the 7 in-channel works locations offer any features of increased relative value to aquatic ecology, with the features recorded being readily available outside the expropriation corridor (i.e. marginal/emergent vegetation, tree roots, etc.). On this basis, the construction activities are anticipated to result in an effect that is **Minor** (**Not Significant**).

8.5.107. Therefore, the potential effect from the Project on aquatic ecology during the construction phase is expected to be **Minor** (**Not Significant**).

8.5.108. Küçükçekmece Basin is considered to be Critical Habitat due the presence of two IUCN CR sturgeon species. As such, any impacts require consideration under PR6; this is done within the Critical Habitat Assessment (**Appendix L**).

General

8.5.109. Potential construction impacts to wider (non-fish) aquatic ecology comprise the following:

- Loss/degradation of habitat through in-channel works and pollution/sedimentation.
- Direct mortality/injury to aquatic fauna.

8.5.110. Direct impacts to general aquatic ecology are expected as a result of the in-channel works planned at the seven watercourse crossing locations. These impacts will comprise loss of shelter and foraging habitat as well as potential loss of spawning habitat. There is also the risk that aquatic fauna become injured or trapped during construction activities.

8.5.111. The impacts to aquatic fauna where in-channel works are planned are predicted to be slight due to the inherently mobile nature of aquatic fauna and the relatively small footprint of the construction activities (within the context of the wider aquatic habitat). There is also nothing to suggest that any of the 7 in-channel works locations offer any features of increased relative value to aquatic fauna, with habitat features recorded being common across the wider riparian environment. With this in mind, the construction activities will result in an effect that is **Minor** (**Not Significant**).

8.5.112. Mitigation measures will be in place to prevent adverse impacts from occurring to the surface and ground water environments, including from pollution/sedimentation during construction (see **Chapter 11: Surface Water Environmental Hydrology** and **Chapter 12: Geology and Hydrogeology**). On this basis there are not expected to be any impacts to wider aquatic ecology at these locations. Therefore, the potential effect from the Project on wider aquatic ecology during the construction phase is expected to be **Minor** (**Not Significant**).

OPERATIONAL PHASE

8.5.113. Operational phase impacts will comprise the following:

- Direct mortality – e.g. as a result of increased collision risk and electrocution; and
- Disturbance – including noise/vibration and visual disturbance.

8.5.114. No potential effect pathways exist in relation to habitats and flora as a result of the Project operation and so these receptors have been scoped out from this section of the assessment, Potential impacts associated with increased risk of spreading invasive plants has been discussed within the preceding section.

8.5.115. The mitigation described within **Chapter 11: Surface Water Environmental Hydrology** and **Chapter 12: Geology and Hydrogeology** will be sufficient to protect aquatic ecology during the operation of the Project. No further assessment is required in this regard.

8.5.116. With regards the disturbance impact from the operational Project, Table 8-9 below provides predicted noise levels at targeted locations. The current baseline levels have been included in brackets against each IBA location – as per Table 8-11). As illustrated here, the maximum predicted acoustic impacts will be realised at-height around the Terkos Basin IBA (IBA 4 - north of Kurfalli), although crucially, none of these modelled scenarios will exceed the current baseline.

Table 8-13 - Operational Noise Modelling Summary – IBA Locations

Receptor	Height (m)	LAeq_Day_ DSO[101] (dB)	LAeq_Night_ DSO (dB)	LAeq_Day_ DSD[102] (dB)	LAeq_Night_ DSD (dB)
IBA_1 (59.5)	1.5	Less than 20	Less than 20	Less than 20	Less than 20
IBA_1 (59.5)	15		Less than 20	Less than 20	Less than 20
IBA_2 (55.9)	1.5	32.2	26.6	35	29.8
IBA_2 (55.9)	15	35.2	29.6	38	32.8
IBA_3 (55.9)	1.5	35.5	29.9	38.3	33.1
IBA_3 (55.9)	15	39	33.4	41.8	36.6
IBA_4 (55.9)	1.5	38.4	32.8	41.2	36
IBA_4 (55.9)	15	48.3	42.7	51.1	45.9
IBA_5 (58.9)	1.5	Less than 20	Less than 20	Less than 20	Less than 20
IBA_5 (58.9)	15	Less than 20	Less than 20	Less than 20	Less than 20

[101] DSO = 'do something opening' year, i.e. the year of opening
[102] DSD = 'do something design' year, i.e. the year of maximum impact that has been designed for

Protected Areas

Büyükçekmece Lake IBA

8.5.117. Potential operational impacts to the Büyükçekmece Lake comprise the following:

- Direct mortality – e.g. as a result of increased collision and electrocution risk to the IBA populations; and
- Disturbance – including noise/acoustic and visual disturbance.

8.5.118. The potential collision risk associated with the operational phase of the Project focusses mainly on that associated with bird/train collisions given that this is recognised as the most frequent cause of bird mortality on railways[103]. It is acknowledged (e.g. in Santos *et al.* 2017[103]) that collisions with catenary (wires) are also possible bird mortality causes and so are discussed here where considered relevant. Train collision will comprise the combination of train frequency together with bird occupancy of the potential collision zone (i.e. the height band at which birds are at risk of collision with trains and ancillary railway structures). Information on train frequency is detailed in **Chapter 2: Description of the Project.**

8.5.119. There is no defined quantitative method for assessing bird/train collision risk (i.e. as has been published for wind farms) and so a combination of conservative quantitative estimates and qualitative assessment has been undertaken.

8.5.120. The projections for daily train movements, both passenger and freight, for the Project predict that upon opening (in 2026) there will be 13.4 trains daily each way (so a total of 26.8 train movements), rising to 15.7 (31.4) in 2030 and 21 (42) in 2041.

8.5.121. On the assumption that train movement will be spread evenly throughout the day (based largely on freight trains travelling through the night), this results in an average hourly instance of train movement at any single location within the Project being 1.1, 1.3 and 1.75 trains/hour for 2026, 2030 and 2041, respectively.

8.5.122. With regards likelihood of collision within a high-speed rail (HSR) setting, there is very little published information on this subject, largely because of the relatively low number of HSR projects. One study from an HSR in Spain (in Malo *et al.* 2017)[104] describes a relatively low collision rate of one bird strike every 406.1km, and also provides useful commentary around 'at risk' species and behavioural influences on collision risk (i.e. variation in how birds view a railway line/train and how this impacts flight behaviour around such a feature). A separate study of an operational railway in Portugal (Godinho *et al.* 2020)[105] described very few incidents of waterbird collisions in relation to

[103] Santos S.M., Carvalho F., Mira A. (2017) Current Knowledge on Wildlife Mortality in Railways. In: Borda-de-Água L., Barrientos R., Beja P., Pereira H. (eds) Railway Ecology. Springer, Cham.
[104] Malo J.E., García de la Morena E.L., Hervás I., Mata C., Herranz J. (2017) Cross-scale Changes in Bird Behavior Around a High Speed Railway: From Landscape Occupation to Infrastructure Use and Collision Risk. In: Borda-de-Água L., Barrientos R., Beja P., Pereira H. (eds) Railway Ecology. Springer, Cham.
[105] Godinho, C., Marques, J. T., Salgueiro, P., Catarino, L., Osorio de Castro, C, Mira, A. & Beja, P. 2017. Bird Collisions in a Railway Crossing a Wetland of International Importance (Sado Estuary, Portugal). Railway Ecology. Springer, Cham.

train movements through a wetland habitat (also an IBA and Ramsar site[106]). Similarly, a study into the potential collision risk to crested ibis from high-speed rail also concluded that impacts were considered to be low (Hu *et al.* 2020 [107]). It is acknowledged (e.g. in Malo *et al.* 2017[104]) that a species' flight behaviour is a key consideration and so generalised conclusions about collision risk to birds are not possible. Information from these studies is referenced where appropriate.

8.5.123. None of the qualifying species for this IBA were observed during flight activity surveys undertaken; however, an area of potential collision risk was identified, based upon overall level of non-Target Species flight activity, along the channel that feeds Büyükçekmece Lake from the north (see Figure 8-10 below). The following species-specific assessments have been completed on this basis:

- Red-breasted goose. As discussed within text for the construction phase, there have been no records of this species during field surveys in support of this assessment and a low number of historical records for the study area. Geese are typically high-flying species that adopt habitually used flight routes to/from foraging grounds and when migrating. A study of pink-footed geese in Scotland (Patterson, 2015)[108] also described flight behaviour in which birds descended steeply when landing, which suggests a lesser general risk of collision than if flying parallel with the ground. In the absence of regularly occurring populations, potentially commuting across the Project between established long-term roost sites and favoured foraging locations, and when considering that the potential collision for those birds which are present at times, the magnitude of impact is predicted to be negligible, resulting in an effect from the Project that is **Neutral** (**Not Significant**).
- Common pochard. Although there were no flights observed during surveys in relation to this site, there were ten birds at PCH observed at Küçükçekmece Basin (albeit to the south of Halkali, outwith the Project footprint), which has a significantly lower listed population (albeit far higher recent MWC and eBird counts). This number was extrapolated to 420 to reflect potential flights across a 24-week winter period. Given the lower MWC (and eBird) counts for common pochard at Büyükçekmece Lake when compared to Küçükçekmece Basin, it is reasonable to assume potential flights at PCH would be also be lower and potentially non-existent. Furthermore, evidence presented in Godinho *et al.* (2017) suggests that ducks are not at any significant collision risk from high speed trains that pass through wetland habitats (based on that study recording a single duck fatality across 12 months of bird fatality monitoring) and in general it has been demonstrated that birds alter their flight behaviour in response to high-speed railways, with all species flying up to 5m higher than normal (as per Malo *et al.* 2017[104]). No common pochard flights were observed during autumn 2020 surveys and in the absence of any evidence

[106] It is recognised that this study focused on a monitoring bird movement across a bridge over the wetland, which is not wholly representative of the Project situation. However, the vast majority of flights were above bridge level and so collision mortality monitoring results are still of relevance to this assessment. Furthermore, it does provide a closer comparison with a planned bridge located within the area of highest predicted collision risk to the north of Büyükçekmece Lake (between chainages 22+000 and 24+000).
[107] Hu, H., Tang, J., Wang, Y., Zhang, H., Lin, Y., Su, L., Liu, Y., Zhang, W., Wang, C., Wu, D. & Wu, X. (2020). Evaluating bird collision risk of a high-speed railway for the crested ibis. Transportation Research Part D Transport and Environment. 87. 10.1016/j.trd.2020.102533.
[108] Patterson, I.J. 2015. Goose flight activity in relation to distance from SPAs in Scotland, including an analysis of flight height distribution. Scottish Natural Heritage Commissioned Report No. 735.

suggesting that a significant number of birds (relative to the IBA population) fly across the Project to get to/from Büyükçekmece Lake, the impact magnitude is considered to be negligible. Collision effects to common pochard are therefore considered to be **Neutral** (**Not Significant**).

- Little gull. This species was not recorded at this site during winter or autumn flight activity surveys in support of this assessment and numbers recorded during MWC here in the last three years have been low (single birds in 2019-2020 only). Given the lack of records at the site, any potential impact from collision is considered to be of negligible magnitude, with effects from the Project therefore **Neutral** (**Not Significant**).
- Mediterranean gull. The only records of this species from flight activity surveys was two young birds recorded during August 2020 surveys. This species was not recorded at this site during winter flight activity surveys in support of this assessment and numbers recorded during MWC here in the last three years have been low (peak of 15 in 2018). Given the lack of records at the site, together with evidence presented in Godinho *et* al. (2017) that suggests gulls are not at any significant collision risk from high speed trains that pass through wetland habitats (based on that study recording a single gull fatality across 12 months of bird fatality monitoring); and Malo *et al.* (2017) which suggests any birds will increase their flight height to avoid a high-speed railway, any potential impact from collision is considered to be of negligible magnitude, with effects from the Project therefore **Neutral** (**Not Significant**).
- Yellow-legged gull. Most records during the winter flight activity surveys came from VPs associated with Küçükçekmece Basin rather than this site, where a total of 16 birds were recorded compared to 707 from the Küçükçekmece Basin. Similarly, during autumn surveys, the species was frequently recorded although mainly from VPs associated with Küçükçekmece Basin. A total of 17 birds were recorded flying at PCH around Büyükçekmece Lake. Large numbers of this species have been recorded at Büyükçekmece Lake during MWC in the last three years (peak of 4,201 in 2020). However, the Project at this point is at considerable distance (4km+) from the main lake where these large aggregations are most likely due to the more suitable habitat, including roost sites favoured by gulls on open water. Taking consideration of the lack of records in this part of the ZoI and the distance from significant aggregations of the species, together with low expected risk to gulls, the relative impact is not predicted to adversely affect the conservation status of this population and is therefore of negligible magnitude. Collision mortality effects from the Project are therefore predicted to be **Neutral** (**Not Significant**).
- A4iii Species group – waterbirds. The Project passes at distance (approximately 4km) from the lake side although winter and autumn flight activity surveys in 2020 highlighted collision risk for associated species such as lapwing (where an extrapolated 17,750 annual (winter) bird flights were predicted based on the flight activity recorded during February/March 2020), little egret and great white egret, as well as potential for other species of wader on migration in this area which comprises feeder channels to the main lake and associated wetland habitat – this information helped to inform the high risk level (level 4) here, as illustrated on Figure 8-10 below. This habitat is also suitable for foraging white stork, mainly on passage and as a summer visitor. Data from June 2020 breeding season surveys recorded small numbers of white stork in the study area. Godinho *et al.* (2017)[105] did not record any wader collisions around the Sado Estuary in Portugal, although the study did record five white stork fatalities, which aligns with a likely increased relative risk to such impacts within larger waterbirds. With this in mind, the magnitude of impact here is likely to be moderate in terms of the site's conservation status, resulting in an effect that is **Moderate** (**Significant**).

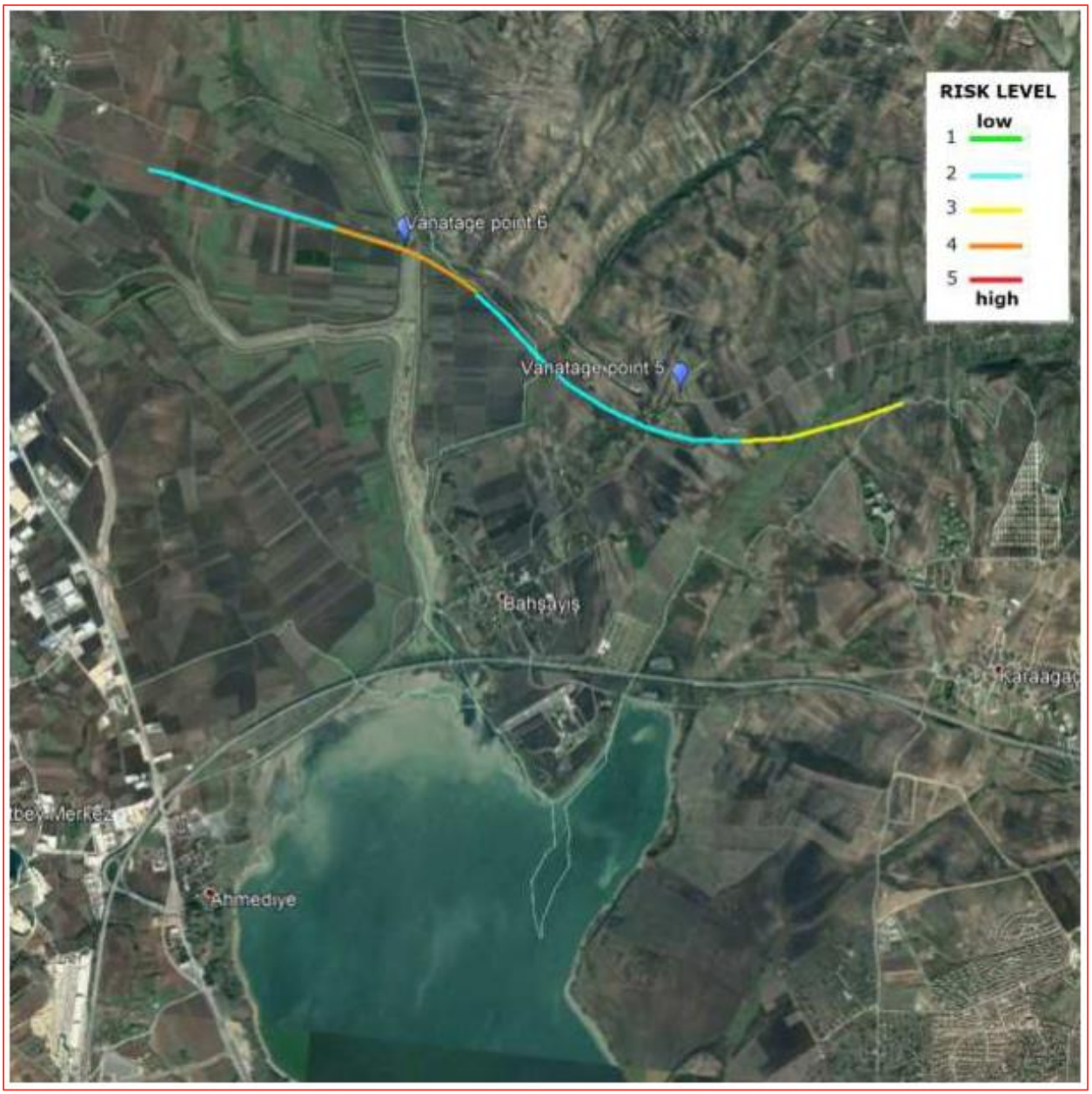


Figure 8-10 - Potential Collision Risk Zone to the North of Büyükçekmece Lake (taken from Cogal., M. & Sozen 2020[59])

8.5.124. An electrocution impact risk exists when large birds perch on electrified structures, touching two live components simultaneously. Small birds are unaffected as their size precludes them from creating a circuit between live components. It is an impact which affects raptors and other large perching birds (e.g. storks) disproportionately because of their perching habits.

8.5.125. There is nothing to indicate that this impact will be any greater than slight, with the most species associated with this protected area not being perching birds. Furthermore, no records of electrocution events from the existing railway have been obtained and there is also a network of transmission wires across the wider landscape that comprise a component of the current baseline.

However, in the absence of robust data to corroborate this conclusion a precautionary overall effect of **Minor** (**not significant**) is considered appropriate.

8.5.126. Disturbance impacts will affect those species which make use of the IBA areas closest to the Project. Based upon the habitat types and following a review of qualifying species ecology, this is considered likely to impact the following species:

- Red-breasted goose;
- Common pochard; and
- A4iii Species group – waterbirds.

8.5.127. Acoustic disturbance during operation is unlikely to exceed 50db at any point modelled in to inform this assessment, or 65dB at any point along the Project at ground level, so there is limited potential for any material disturbance to the above receptor (based upon evidence presented by Cutts *et al.* (2013)[93].

8.5.128. Further to the above, the same rationale can be applied to these species as previously discussed (e.g. within **paragraph 8.5.32**), including quantitative examples (detailed from **paragraph 8.4.38**). Given the extent of suitable habitat for waterbirds outwith the ZoI but across the study area, their distribution is anticipated to be extensive, and not tied to specific areas. Desk study data collated shows a generally wide distribution with peak counts as likely, if not more likely, at locations that are a considerable distance from the Project. Additionally, given the presence of the existing railway in close proximity to the Project at this location, disturbance effects are unlikely to elicit any material (ongoing) avoidance behaviour from birds of the IBA here for two reasons: firstly the IBA around the Project is not widely used by IBA birds (indeed the closest records are in excess of 650m) so it is a component of the IBA which does not appear important for birds; and secondly, those birds which do make use of the IBA (at >650m distance) do so despite the existing operational railway, suggesting habituation to any impacts associated with train movements here.

8.5.129. The magnitude of this impact will likely not exceed slight given the above and when also factoring a certain level of habituation to the lesser acoustic impacts from the existing railway. The overall effect is therefore not considered to exceed **Minor** (**Not Significant**).

8.5.130. Given the potential for significant effects from collision of IBA-qualifying bird species, there is the potential that this will also have a significant effect upon the integrity of the Büyükçekmece Lake IBA, in the absence of mitigation.

8.5.131. The IBA is considered to be a PBF. In light of the Project being situated within this PBF and following the above assessment, the operational impacts upon the Büyükçekmece Lake IBA will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in Section 8.6.

Küçükçekmece Basin IBA

8.5.132. Potential operational impacts to the Küçükçekmece Basin comprise the following:

- Direct mortality – e.g. as a result of increased collision and electrocution risk; and
- Disturbance – including noise/acoustic and visual disturbance.

8.5.133. Collision risk has been identified for the following IBA qualifying species:

- Pygmy cormorant;

- Great cormorant; and
- A4iii Species group – waterbirds.

8.5.134. The Project will extend beneath the IBA in the form of a tunnel for the majority of the risk areas provisionally identified from February and March 2020 surveys. An area of elevated flight activity identified to the immediate east of the IBA and approximately 900m from the eastern tunnel entrance is not considered to pose a material collision risk given the Project at this location is within a cutting, so bird flight activity will likely be elevated beyond collision height during operation. This location is also immediately outside Halkali Station at which point it is assumed the baseline train speed will not be notably different to that currently experienced and therefore will not pose any materially different collision risk. Taking consideration of this, collision impacts are considered to be of negligible magnitude, resulting in an effect that is **Neutral** (**Not Significant**).

8.5.135. A consideration of potential electrocution impacts as described within **paragraphs 8.5.114** and **8.5.115** is also applicable here.

8.5.136. Disturbance impacts have been identified for the following IBA qualifying species:

- Pygmy cormorant;
- Great cormorant; and
- A4iii Species group – waterbirds.

8.5.137. The same rational can be applied to these species as previously discussed above - see **paragraph 8.5.127** to **8.5.129**. Given the extent of suitable habitat for waterbirds in the study area, their distribution is anticipated to be extensive, and not tied to specific areas. Desk study data collated shows a generally wide distribution with peak counts as likely, if not more likely, at locations that are a considerable distance from the Project. Additionally, and as per reasoning provided within **paragraph 8.5.116**, there is not expected to be any material IBA avoidance by birds because of the Project.

8.5.138. The potential disturbance impact magnitude is therefore considered to be negligible due to the narrow, linear nature of the Project and the extent of the foraging areas available on the waterbodies identified as holding important concentrations of waterbirds. This will result in an effect that is **Neutral** (**Not Significant**).

8.5.139. Given the above assessments there are no predicted effects to the integrity of the Küçükçekmece Basin IBA.

8.5.140. The IBA is considered to be Critical Habitat. In light of the Project not being situated within this Critical Habitat and following the above assessment, the construction impacts upon Küçükçekmece Basin IBA do not require any further consideration under PR6 compliance terms.

Terkos Basin KBA

8.5.141. Potential operational impacts to the Terkos Basin KBA and IBA comprise the following:

- Direct mortality – e.g. as a result of increased collision and electrocution risk; and
- Disturbance – including noise/acoustic and visual disturbance.

8.5.142. None of the IBA trigger species are considered at collision or electrocution risk due to the distance of suitable wetland habitat within the Terkos Basin from the Project.

8.5.143. None of the IBA trigger species are considered at disturbance risk due to the distance of suitable wetland habitat within the Terkos Basin from the Project.

8.5.144. An overall impact magnitude of negligible is therefore concluded that will result in an effect that is **Neutral** (**Not Significant**).

8.5.145. No effect upon the integrity of the Terkos Basin KBA is therefore predicted.

8.5.146. The KBA is considered to be a PBF. In light of the Project being situated within this PBF and following the above assessment, the operational impacts upon the Terkos Basin KBA will require further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in Section 8.6.

Fauna

European Ground Squirrel

8.5.147. Potential operational impacts to European ground squirrel comprise the following:

- Direct mortality – e.g. as a result of increased collision risk; and
- Habitat/range fragmentation and severance.

8.5.148. Ground squirrels are considered to be at low risk from collision, mainly because of their inherent mobility. Studies of mammal deaths as a result of train collisions showed that only 4% of recorded deaths were attributable to small mammals, of which squirrels were a component (Santos *et al.* 2017[103]). The species was recorded from an area in the east of the Project where the existing railway is also located, suggesting a level of tolerance of such a feature. The impact from the Project operation is considered to be slight, resulting in an effect that is therefore **Minor** (**Not Significant**).

8.5.149. The Project has the potential to result in the fragmentation of ground squirrel home ranges, which may result in population decline. Concurrently, it is feasible that such an impact will be tempered by the species' known exploitation of linear structure embankments (including railways) and their use of these structures for crossing watercourses, enabling them to expand their range (Popova *et al.* 2019[109]). Across their range, the species is increasingly restricted to fragmented home ranges because of habitat loss and alteration; however, they can reach conspicuous densities in such instances (Turrini *et al.* 2008[110]). On this basis, although fragmentation may occur, it is anticipated that the impact will be short-term and may be offset by localised benefits derived from the Project that will result in range increases; a net impact that is therefore slight is considered appropriate. This will result in an effect that is **Minor** (**Not Significant**).

8.5.150. This species is considered to trigger PBF. In light of the Project being situated within this PBF habitat, the operational impacts upon European ground squirrel will require further consideration

[109] Popova, L. V., Maul, L. C., Zagorodniuk, V., Veklych, Yu. M., Skydlovskiy, N. V., Pogodina, N. V., Bondar, K. M., Strukova, T. V. & Parfitt, S. A. (2019). 'Good fences make good neighbours': Concepts and records of range dynamics in ground squirrels and geographical barriers in the Pleistocene of the Circum-Black Sea area.
[110] Turrini, T. A., Brenner, M., Millesi, E. & Hoffmann, I. E. (2008). Home ranges of European Ground Squirrels (Spermophilus citellus) in two habitats exposed to different degrees of human impact. Lynx 29(2): 323-332.

under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in **Section 8.6.**

Marbled Polecat

8.5.151. Potential operational impacts to marbled polecat comprise the following:

- Direct mortality – e.g. as a result of increased collision risk; and
- Habitat/range fragmentation and severance.

8.5.152. Marbled polecats are considered to be at low risk from collision, mainly because of their inherent mobility and also because of the broadly nocturnal behaviour, aligning with when high speed train frequency will be at its lowest. The low population densities typical of this species also means that the numbers of crossings are likely to be low, reducing the frequency of any potential collisions. The Project is unlikely to affect the conservation status of the species and is therefore an impact of slight magnitude resulting in an effect that is **Minor** (**Not Significant**).

8.5.153. Given the species' relatively low natural population densities it's unlikely that fragmentation impact caused by the Project will elicit any response in the population present across the ZoI. Polecats have a generalist and opportunistic character which enables them to adapt effectively to their environment (Baghli *et al.* 2004[111]). As such, any fragmentation impact will be short-term and therefore slight. This will result in an effect that is **Minor** (**Not Significant**).

Bats

8.5.154. Potential operational impacts to bats comprise the following:

- Direct mortality – e.g. as a result of increased collision risk; and
- Disturbance – including noise/acoustic and visual disturbance.

8.5.155. Very little information exists in terms of bat and train collision risks. There is likely a fairly complex relationship between bat activity and railway corridors, with new routes potentially being of use to bats in terms of commuting within their range, while also providing a foraging resource should there be new planting associated with the Project. This may result in increased flight activity here, which leaves bats susceptible to increased interaction with trains. However, it is assumed given the inherent mobility of the species, with bat movements largely occurring during the evening and night, that in most cases this interaction would not result in a collision; indeed Godinho *et al.* (2017)[105] recorded only a single bat fatality during a year of monitoring at an operational railway situated within comparably suitable bat habitat. The direct mortality impact to bats in general therefore considered to be slight.

8.5.156. The only know roost location for the long-fingered bat this species within foraging distance (i.e. broadly approximately 10km average as per Almenar *et al.* (2009)[112]) of the Project is at Gökçeali, approximately 1km to the north of the Project. Although other bat roosts will exist across the EAAA,

[111] Baghli, A, Walzberg, C. & Verhagen, R. (2004). Habitat use by the European polecat Mustela putorius at low density in a fragmented landscape. Wildlife Biology, 11(4): 331-339

[112] Almenar, D., Aihartza, J., Goiti, U., Salsamendi, E. & Garin, I. (2009). Foraging behaviour of the long-fingered bat Myotis capaccinii: implications for conservation and management. Endanered Species Research, Vol. 8: 69-78.

it's considered unlikely that they will be of sufficient size to increase levels of flight activity which may influence the assessment here. The effect overall on bats is therefore considered to be **Minor** (**Not Significant**) effect is anticipated.

8.5.157. Upon operation, the Project has the potential to introduce new levels of acoustic disturbance to existing bat roosts, which could lead to death of individuals if they're unable to find an alternative roost site, or abandonment/loss of the roost. There are no significant bat roosts known to be present within the ZoI, although areas of mature woodland habitat in particular will likely support a number of small roosting bats. On the basis that small, unrecorded roosts may be present within the Project ZoI, a precautionary impact that is slight is considered appropriate, which would result in an effect that is **Minor** (**Not Significant**).

Other Fauna

8.5.158. Potential impacts to other fauna during the operational phase are as follows:

- Direct mortality – e.g. as a result of increased collision risk; and
- Disturbance – including noise/acoustic and visual disturbance.

8.5.159. Collisions are the most common cause of railway (animal) mortality (Dorsey *et al.* 2015 in Santos *et al.* 2017[103]). All fauna considered likely to be present across the ZoI will be at risk of collision, albeit to varying extents. In multi-species studies, mammals make-up between 26-38% of all fatalities (as per Santos *et al.* 2017[103]), while other groups such as amphibians and reptiles are far lower but considered under-recorded. The animals most affected are considered to be those of particular rarity, those with large home-ranges and those with low recruitment rates. None of these traits are considered applicable to species likely to be present across the ZoI and as such, although fatalities will occur, this isn't considered to be an impact of any greater than slight magnitude.

8.5.160. Given the relatively low noise levels predicted during operation (see **Table 8-7**), together with the relative infrequency of train movements at the peak operation in 2041, the disturbance impact from the Project is considered to be slight and temporary. It's likely that a level of habituation will also occur amongst resident animal species.

8.5.161. Given the above assessment, the impacts to fauna during construction are considered to result in an effect that is **Minor** (**Not Significant**).

Spur-thighed Tortoise

8.5.162. Potential operational impacts to spur-thigh tortoise comprise the following:

- Direct mortality – e.g. as a result of increased collision risk
- Habitat/range fragmentation and severance

8.5.163. Tortoises are at risk of mortality due to their relative immobility, meaning that there is no material avoidance factor to consider when looking to quantify mortality rates for tortoises that will cross the Project to get from one part of their range to another. Indeed, during behavioural trials, 0 of 24 tortoises placed within the railways were capable of escaping from the rails (Rautsaw *et al.* 2018), which suggests an avoidance rate in the case of the Project of 0% would be a reasonable assumption. With this in mind, assuming the Project ZoI bisects the ranges of the tortoises present, then the magnitude of the collision mortality impact has the potential to be large. This would result in an effect that is **Minor** (**Not Significant**).

8.5.164. Habitat fragmentation has been identified as one of the main reasons for the continued decline of this species (as per Rouag *et al.* 2017[113]). The Project will likely result in the fragmentation of tortoise ranges at points, although given the species was most commonly recorded around the transect locations 4 and 5 where the Project runs close to/parallel with the existing railway, such impacts are considered to be limited. This has the potential to be an impact that is slight, resulting in an effect that is **Minor** (**Not Significant**) due to the permanence of the Project.

Birds

White-headed Duck

8.5.165. The white-headed duck is listed as Endangered within the three IUCN threatened categories. Potential impacts to this species from the Project during the operational phase are as follows:

- Direct visual and noise disturbance to foraging flocks from passing trains where the Project is near wetland habitats identified as supporting this species.
- Collison risk for birds making commuting flights between different water bodies.

8.5.166. As discussed in paragraph 8.4.36 onwards this species was regularly recorded in small numbers at Büyükçekmece Lake and Küçükçekmece Basin within the study area. At both sites most records were at considerable distance (4km at Büyükçekmece Lake and 2km at Küçükçekmece Basin) from the Project.

8.5.167. The potential effects of disturbance to foraging flocks are predicted to be minor due to the narrow, linear nature of the Project and the extent of the foraging areas available on the water bodies identified as holding important wintering concentrations of this species. Furthermore, predicted acoustic levels are not considered to be high enough to elicit a significant disturbance response from the species (as assumed from conclusions per Cutts *et al.* (2014)[93]). This impact is therefore considered to be negligible resulting in an effect that is **Neutral** (**Not Significant**).

8.5.168. No flights were recorded for this species during winter and autumn flight activity surveys undertaken in support of this assessment. Given that this species is relatively scarce in the study area and the field survey period was relatively narrow (13th February to 2nd March 2020; and September/August 2020), it's possible that flight activity for this species could be underrepresented. However, high amounts of flight activity across the Project are considered unlikely based on the distribution of records collated during the desk study process; the majority of records were at considerable distance from the Project and the Project does not bisect areas identified as having important aggregations of this species.

8.5.169. As with common pochard, it is possible there is interchange between white-headed duck aggregations on Büyükçekmece Lake and Küçükçekmece Basin given the relatively short distance between the two sites (11km). Commuting flights between the two sites are anticipated to occur at well above PCH as this species would need to traverse unsuitable habitat and most flights are likely

[113] Rouag, R., Ziane, N. & Benyacoub, S. 2017. Home Range of the Spur-Thighed Tortoise, Testudo graeca (Testudines, Testudinidae), in the National Park of El Kala, Algeria. Vestnik zoologii, 51(1): 45-52.

to avoid the Project completely as the route is largely located along the very northern edge of both sites.

8.5.170. Taking consideration of this, the potential collision risk impact is slight, resulting in an effect that is **Neutral** (**Not Significant**).

8.5.171. This species is considered to be a Critical Habitat trigger. In light of the Project being situated within this Critical Habitat (by virtue of it bisecting the Büyükçekmece Lake, and following the above assessment, the operational impacts upon white-headed duck requires further consideration under PR6 compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in **Section 8.6**.

Imperial Eagle

8.5.172. Imperial eagle is listed as Vulnerable within the three IUCN threatened categories. Potential impacts to this species during the operational phase are as follows:

- Direct visual and noise disturbance to a breeding site or non-breeding foraging site from passing trains.
- Collision and electrocution risk for birds making flights across the length of the Project.

8.5.173. As discussed within the construction phase text, desk study results show numerous records throughout the year in the study area with a concentration the Büyükçekmece Lake area extending 7km north-west from here to Çatalca, potentially indicating that the study area could incorporate a breeding territory. This has been substantiated through field survey results from June 2020 and consultation responses from Doga.

8.5.174. The known eagle nest site/territory centre is approximately 3km from the Project, which is sufficiently distant to result in a disturbance impact magnitude that is slight. Furthermore, a large proportion of the Project will follow the existing railway, which reduces the impacts of disturbance to any nesting eagles through their exposure to existing train infrastructure, resulting in nesting eagles already having tolerance to train activity or placing their nest sites at suitable distance from existing train infrastructure. Taking consideration of this, it is considered that the disturbance effects to the imperial eagle through during the operation phase will be **Minor** (**Not Significant**).

8.5.175. Imperial eagle prey items range from various ground dwelling mammals to reptiles and birds. The species hunting strategy employs both hunting from a perch and making low flights (Snow *et al.* 1998[80]). Records of flight activity were recorded incidentally during breeding bird walkovers in June 2020 and also more formally during flight activity surveys in August 2020; none of these records were at PCH or within the ZoI. However, the species hunts over a wide range of habitats, many of which are found in proximity to the Project and adopts a hunting strategy that includes low level flights. Therefore, there is potential collision risk for this species during commuting or hunting flights as well as electrocution risk when perching on catenary structures). Any such mortality would potentially result in the loss of a breeding pair and recruitment for at least a single year, which represents c. 2% of the regional population. Taking a precautionary approach given the relative lack of breeding season flight activity surveys completed, and in the absence of any mitigation, this impact is considered to be large, the effects to imperial eagle from the Project through collision risk are considered to be **Moderate** (**Significant**).

8.5.176. This species is considered to trigger PBF. In light of the Project being situated within this PBF habitat, the operational impacts upon imperial eagle will require further consideration under PR6

compliance terms. This has been done within the associated Critical Habitat Assessment Report (**Appendix L**), with relevant mitigation included in **Section 8.6**.

8.6 MITIGATION AND ENHANCEMENT MEASURES

8.6.1. Mitigation will be secured through delivery of a **Biodiversity Management Plan** (**BMP**). A **BMP** has been produced to supplement this assessment, which provides further details regarding the measures described within this section. Given the requirement to update some elements of baseline survey effort during 2021, it will be necessary for this **BMP** to be finalised as these surveys progressed/are completed. The finalising and approval of the **BMP** will be included as a specific requirement of the Project **ESAP**.

8.6.2. These below mitigation and enhancement measures are also reflected within the **ESMP**.

8.6.3. Mitigation measures are split in to two separate categories: those that are required to address specific effects identified for a particular receptor; and those which will reduce effects to multiple receptors, as well as ensuring biodiversity losses are reduced and animal welfare measures and general environmental good practice is adhered to. This latter category will also help to ensure the Project remains compliant with applicable international conventions to which Turkey must adhere to, such as the Bern Convention.

8.6.4. In order that the mitigation strategy is fully informed, additional pre-construction survey effort will be required, comprising a walkover of areas of greatest biodiversity interest as follows:

- Potential European ground squirrel habitat, in particular between chainages 6+000 and 8+000 and elsewhere as considered appropriate.
- At locations where the Project overlaps with Terkos Basin KBA between chainages 54+000 and 59+000 (and extended to chainage 70+000 given prevalence of similar semi-natural habitat across these areas). Particular focus here should be on endemic plant species, watercourse crossing locations for otter shelters, and bat roosts within mature woodland.
- Mature woodland such as that between chainages 40+000 and 42+000, but also including isolated trees/coupes[114]/treelines e.g. such as those located between chainages 38+000 and 39+000 and 20+000 and 21+000. A detailed scope of checks should be informed through review of the **Landscape Management Plan**. Particular focus here should be on endemic plant species, watercourse crossing locations for otter shelters, and bat roosts within mature woodland.

8.6.5. This should be undertaken by suitably qualified biodiversity specialist, with sufficient knowledge and experience of surveying for the species identified within this section.

8.6.6. Following the above and immediately in advance of clearance works, pre-works checks should be undertaken, with the aim of identifying the following:

- Nesting bird habitat/features;
- Presence of specific sensitive receptors (e.g. burrows of European ground squirrels or marbled polecat, otter holts, etc.);

[114] An isolated stand of trees.

- Bat roosts;
- Suitable reptile/amphibian hibernacula; and
- Invasive plants.

8.6.7. Findings from the above surveys will be used to update the **BMP**. The **BMP** will remain a 'live' document throughout its implementation.

8.6.8. Where possible, surveys should be undertaken as soon as possible (i.e. during appropriate seasons pre-construction) to ensure findings can be incorporated into ongoing designs as appropriate.

GENERAL BIODIVERSITY

8.6.9. An Ecological Clerk of Works (ECoW) will be employed to provide biodiversity support in advance of, and throughout project construction; given the scale of the Project, it may be necessary for an ECoW 'team' to be employed at certain points. This role will have a wide-ranging brief but ultimately will focus on ensuring required ecological mitigation is appropriately undertaken and measures are maintained throughout construction. In addition, this role will provide ad hoc support and guidance to help manage unforeseen ecological impacts. The ECoW will have the authority to stop works at any point should they consider that the potential ecological impacts associated with a particular activity are unacceptably high.

8.6.10. The ECoW will advise on micrositing of works. This will serve to avoid biodiversity sensitivities on the ground through minor tweaks in the location of works, where possible. This process will be informed by (and concurrent with) pre-works checks described within **paragraph 8.6.6**.

8.6.11. The ECoW will deliver a series of 'toolbox talks', including site inductions, to construction operatives to raise awareness of particular ecological issues. This will include, but is not limited to, the following:

- Ecological exclusion zones and working around features of increased ecological sensitivity (e.g. nesting birds, mammal burrows, reptile hibernacula, watercourses, etc.)
- Construction site good practice (e.g. keeping the construction site safe for wildlife when not in use; sensitive use of lighting, etc.)
- How to recognise particular animal or plant species or groups
- What to do if particular animal or plant species are encountered
- Awareness-raising in relation to hunting/poaching of sensitive fauna, and prohibition in the construction workers Code of Conduct, as required in the ESMP.

8.6.12. Throughout construction activities the ECoW will provide watching brief role for works with the potential to harm wildlife (most notably ground and vegetation clearance). During this time, the ECoW will oversee works and remove animals (such as reptiles and amphibians) which may not be able to disperse quickly enough and would therefore be at risk of mortality. Any such animals will be moved to nearby suitable habitat.

8.6.13. An important component of the pre-construction survey will be identification of any invasive plant species in the area. Should any such species be identified then an Invasive Species Management Plan should be produced which will detail measures to be adopted to stop the spread of such species along the construction corridor. This Plan will be delivered within the Biodiversity Management Plan as required.

8.6.14. In certain areas, construction activities will be timed to avoid the breeding bird season where possible. This will be informed by pre-construction walkovers and at present is considered most

applicable to areas of woodland and semi-natural habitat (e.g. within the Terkos Basin KBA and across the scrub habitat outwith the KBA here). Where this is not possible, the ECoW will undertake pre-works checks of suitable areas and advise on mitigation to protect any bird nests identified. Specifically, this will comprise avoidance of known nest sites or areas of suitable nesting habitat being excluded until such point that the young birds have fledged the nest (or the nest has failed for natural reasons). To help minimise the impact of this measure upon the overall construction programme where works cannot avoid this period, necessary vegetation clearance should take place in advance of works (and outwith the breeding bird season) so that habitat suitability is reduced, and birds are dissuaded from nesting in these areas during construction.

8.6.15. Complementing the above, timing of works in specific areas should avoid where possible disturbance during the overwintering period for sensitive bird species. In particular this should be targeted to the works in the vicinity of Büyükçekmece Lake and Küçükçekmece Basin for the main purpose of minimising disturbance to white-headed duck. The main months to be avoided in this regard comprise November to early-March (inclusive), which represents the months where this species has been recorded here (from eBird records).

8.6.16. Following on from the above, in areas of optimal ground-nesting habitat it may be necessary to deploy bird-scarers to dissuade ground-nesting birds from establishing nests in advance of construction activities in certain areas. This will be informed by findings from the pre-construction walkover.

8.6.17. Animal underpasses will be installed (outwith the current designs for larger-scale underpasses to facilitate cattle movement, etc.). These will be located at likely key crossing points where animals are particularly sensitive to becoming trapped within the tracks, or at risk of collision mortality (i.e. such as mammals, reptiles and amphibians). The locations of these features will be informed by the pre-construction walkovers and will be detailed within the **BMP** to maintain connectivity between habitat severed by the Project. Specific underpass locations are included within subsequent sections where appropriate.

8.6.18. Catenary wire supporting structures/tubes should be capped throughout the Project to prevent animals accessing these structures and becoming trapped.

8.6.19. Where bat roosts have been pre-identified (or where such features are identified immediately prior to construction activities) and where these roosts cannot be avoided through micrositing of works, the ECoW will advise on an appropriate course of action to be taken to prevent loss of these roosts. Such actions will comprise the following:

- If not in use during construction activities, and if adequate alternative natural roost sites are available in the wider area then no further action will be required.
- If not in use during construction activities, and if no other roost sites are available, then it will be necessary to provide artificial roost sites for use by bats when they return to the roost site. The artificial roost should be suitable for they species/number of bats that use the roost that will be lost; expert input should be provided to inform this. Artificial bat roosts are readily available online.
- If the roost is in use during construction works, and if these works cannot be delayed until the bats have vacated the roost, then a suitably experienced bat worker should be consulted to attend site and remove the bats prior to work. In advance of this an alternative roost site should be identified (whether natural or artificial). The bats should be oved to a suitable new roost site. It

is important than an experienced bat worker is engaged to undertake this work given the risk of rabies transmission when handling bats.

RECEPTOR-SPECIFIC MEASURES

Habitats

8.6.20. Although no significant impacts to habitats have been identified within this assessment, the loss of woodland aligned with EU Habitats Directive Annex I habitat: Galio-Carpinetum oak-hornbeam forests (Code: 9170) will need to be compensated for in line with the requirements of PR6. This habitat type is a Priority Biodiversity Feature and therefore must experience No Net Loss from the Project. The projected 74.3ha losses to the G1.A habitat will be compensated for within a **Habitat Restoration Plan** (HRP) to be produced for the Project in advance of construction, delivered as part of the **BMP** and as specified in the **ESAP**. This measure should be adopted in line with the requirements of the National Forestry Program, to ensure compliance at a national level also.

8.6.21. At present, it is proposed that replanting of oak/hornbeam woodland takes place within current areas of plantation forest (EUNIS code G3.F) – indicative areas are illustrated on **Figure 8-11** (and described in greater detail within the BMP). The **HRP** should be produced in consultation with a local expert in habitat restoration/botany; at this stage, it is recommended that individuals from Nezahat Gokyigit Botanical Gardens in Istanbul[115] are contacted to assist with this practical conservation initiative.

8.6.22. A key component of the **HRP** will be the requirement to ensure the success of restoration/replanting in perpetuity. This will comprise long-term management commitments and monitoring plans together with a commitment from the Project to contribute to the ongoing delivery of the **HRP**.

8.6.23. Both Büyükçekmece Lake and Küçükçekmece Basin have been identified as Critical Habitat for white-headed duck. Land within the Büyükçekmece Lake IBA boundary will be subject to direct habitat losses (of terrestrial habitat) due to the Project and it will be necessary for habitat restoration to occur to compensate for losses to the IBA. This compensation should take place away from the Project (so as not to improve conditions for IBA birds close to the railway thus increasing the potential for collision mortality here). Specific measures should be included within the **HRP** and at present are recommended to be implemented south of the feeder channel (Camasir Creek) for the Lake, which is located to the east of Catalca.

8.6.24. Further to the above and in order to achieve net gains for this Critical Habitat (in line with PR6), the Project should commit to making a material contribution sufficient to support production of a **White-headed Duck Management Plan** for ongoing conservation management at both Büyükçekmece Lake and Küçükçekmece Basin. This should be produced in collaboration with relevant organisations such as Doga and the Ministry of Environment and Urbanisation.

[115] http://www.ngbb.org.tr/en/index.html.



THIS DRAWING MAY BE USED ONLY FOR THE PURPOSE INTENDED AND ONLY WRITTEN DIMENSIONS SHALL BE USED

Legend

- Indicative Replanting Locations
- Proposed Railway Route



Note:

Drawing Status: FINAL

Job Title: HALKALI-ISPARTAKULE-CERKEZKOY RAILWAY LINE

Drawing Title: Figure 8-11 - Indicative Replanting Locations

Scale at A4: 1:350,000

Drawn			
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JS	JW	DG	23/02/2021

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Drawing Number: Figure 8-11

Path: \\uk.wspgroup.com\central data\Projects\70069878xx\70069878 - IPPF - Turkey TCDD Halkali - Cerkezkoy High Speed Railway\03 WIP\GIS\Mxd\Figure 8-11 - Indicative Replanting Locations.mxd

Rare Plants

8.6.25. In order to prevent significant impacts from occurring to the rare plants identified within the ZoI, a translocation programme will be undertaken whereby all rare plant specimens are removed from the Project construction footprint and replanted within a suitably secure/protected receptor site where possible. This will be done by a suitably experienced botanists, with access to facilities that will enable safe storage of plants where necessary (such as those from the Nezahat Gokyigit Botanical Gardens).

8.6.26. Further to the above, some of the translocated plants should also be propagated to help achieve a net gain in plant numbers for the rare plants identified. This should be supplemented by collection of seeds, tubers, etc. As a minimum this will apply to *Centaurea hermannii*, *Crocus pestalozzae* and *Galanthus* x *valentine* but where possible should also apply to the other five species recorded from the ZoI given their rare/endemic status. This propagation exercise should be undertaken by a suitably experienced botanist as above.

8.6.27. In order to ensure long-term viability of these measures, they will also be fully detailed within the Project **HRP** and developed in consultation with relevant specialists (such as those from Nezahat Gokyigit Botanical Gardens). The Project should commit to furthering the long-term conservation of these species through a contribution to the ongoing management of the receptor sites for translocated and propagated individuals of the above species. This will be a critical component of the **HRP** and will be the ultimate responsibility of AYGM. The **BMP** provides further detail in this regard.

Small Mammals

8.6.28. As discussed within **paragraph 8.5.3** the borrows of species such as European ground squirrel and marbled polecat will be identified and protected during construction wherever possible. The ECoW will mark an exclusion zone around these features/clusters within which construction activities should be avoided/limited (at the discretion of the ECoW). Where it is not possible to prevent damage to these features, construction activities should be timed so that this damage occurs when these features are not in use (i.e. outwith the breeding periods for these animals). The ECoW will advise in this regard as required.

8.6.29. Underpasses to help facilitate safe movement of such mammals across the operational Project will be installed at 100m intervals at the following locations as a minimum (to be confirmed within the **BMP**):

- Between chainages 7+000 and 8+000
- Between chainages 19+000 and 27+000
- Between chainages 34+000 and 38+000

8.6.30. As part of this measure, the underpasses will be flanked by fencing to act as a guiding structure, leading animals towards the underpasses, thus increasing their usage and effect. This could feasibly be achieved by the fencing already planned to minimise human/animal crossing (see **Chapter 2: Project Description)**.

8.6.31. Underpasses will also be installed beyond the areas listed above within woodland and scrub habitat between chainages 39+000 and 70+000 as a general good practice measure to minimise the potential for any small mammal collisions. In all cases, the underpasses will be designed/installed to ensure they are available for use all year round, avoiding any areas prone to flooding (see **Chapter**

11: Surface Water Environment); ideally the underpass should be located on an embankment to overcome such issues. Other design recommendations are as follows:

- Underpass diameter of around 1.5m to make it accessible for a variety of animals (and to aid ongoing maintenance)
- Rectangular tunnels are preferred, with prefabricated concrete structures suitable
- The bottom of the tunnel/structure should be filled with a natural substrate (e.g. sand, rocks) to provide a horizontal movement surface
- A minimum gradient of 1% should be achieved where any waterlogging risk exists
- The tunnel should be located within a recess in the fenceline to guide animals to them

8.6.32. As an additional measure to the above, culverts adapted with the dual purpose of allowing safe passage by small animals will be used. This is achieved by using a culvert design that has dry passage beneath the railway at all times (e.g. as achieved through ledges). Indicative designs for such a structure are included in Figure 8-12 below:

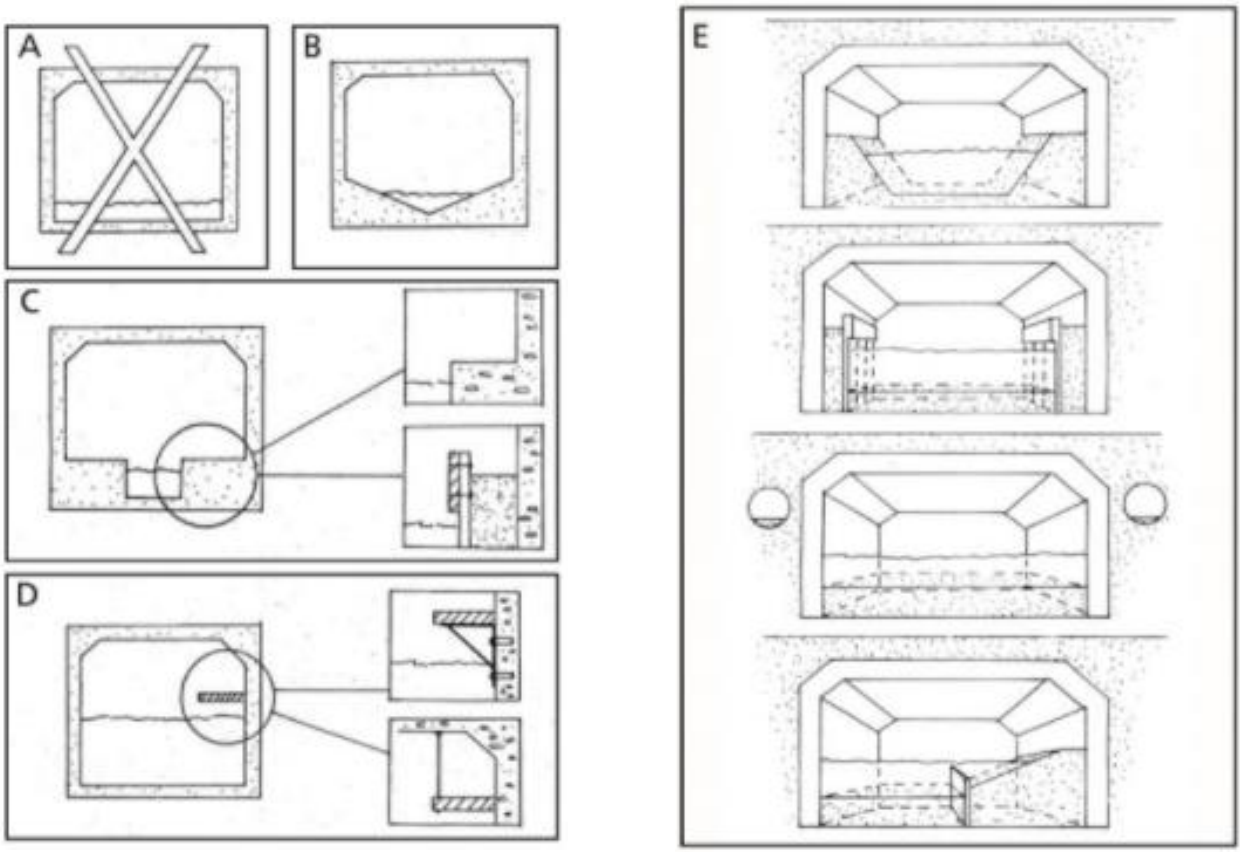


Figure 8-12 - Adapted Culvert Design Options[116]

116 Iuell. B. 2003. Wildlife and Traffic: A European Handbook for Identifying Conflicts and Designing Solutions.

8.6.33. Further to the above, where adapted culverts are not feasible, modifications will be made to the designs of watercourse crossings to incorporate mammal ledges to facilitate safe movement along watercourses at targeted locations (most notably where the potential exists for otter to be present). Specifically, these are between chainages: 0+000 to 1+000; 7+000 to 15+000; 22+000 to 24+000; 26+000 to 28+000; and 54+000 to 65+000. As above, the specifics of this measure should be updated through delivery of the **BMP** as part of the **ESMP**.

Spur-Thighed Tortoise

8.6.34. The key measure to reduce potential impacts to this species will be the animal underpasses/trenches described within paragraph 8.6.29. Trenches not only provide means of population connectivity across Project, but also an escape route for entrapped tortoises[117]. At present, the chainage locations described above will be targeted; however, the exact location of these features may be refined following the pre-construction walkovers and updated within the **BMP** accordingly.

Birds

8.6.35. Potentially significant impacts as a result of collision mortality have been identified for waterbirds and imperial eagle, while potential electrocution impacts have also been identified. There are two main options for minimising this risk: influencing bird flight activity so that they fly above potential collision height; and reducing train speeds (although this does not minimise risk of collision with ancillary railway structures). Given the nature of the Project (i.e. a high-speed railway), the mitigation is based on the former option.

8.6.36. Mitigation measures should be further informed by targeted bird surveys (of particular importance given the survey limitations experienced during the COVID-19 pandemic). Flight activity surveys for waterbirds should be undertaken during the spring migration period (broadly March to May inclusive) at the four VPs surveyed during August and September 2020, and for imperial eagle should be undertaken from March to June inclusive at a VP located within the confirmed imperial eagle territory.

8.6.37. Adapted fencing should be installed at locations where most significant collision risk has been identified or where, in the absence of more detailed baseline information, it is considered prudent to apply such measures on a precautionary basis. There are numerous studies that look into the efficacy of installing barrier-like structures to mitigate bird collisions (e.g. Jacobson 2005[118]; Bard *et*

[117] Rautsaw, R. M., Martin, S. A., Vincent, B. & Lanctot, K. S. (2018). Stopped dead in their tracks: the impact of railways on gopher tortoise (*Gopherus polyphemus*) movement and behaviour. Copeia 106(1): 135-143.
118 Jacobson, S. L. (2005). Mitigation measures for highway-caused impacts to birds. In In: Ralph, C. John; Rich, Terrell D., editors 2005. Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference. 2002 March 20-24; Asilomar, California, Volume 2 Gen. Tech. Rep. PSW-GTR-191. Albany, CA: US Dept. of Agriculture, Forest Service, Pacific Southwest Research Station: p. 1043-1050, volume 191.

al. 2002[119]; and Zuberogoitia *et al.* 2015[120]) and such measures are considered especially effective in diverting the flight of medium- or large-sized birds.

8.6.38. Specifically, this mitigation should be targeted around the east of Küçükçekmece Basin (chainages 0+000 to 1+000 and 7+000 to 8+000) and around the channel north of Büyükçekmece Lake (chainages 25+000 to 30+000). Mitigation should be installed as close to the tracks as practicable (i.e. as allowed by restrictions imposed by underground services, overhead lines, etc.) and it is recommended that these measures are delivered through adapting the planned fencing which will flank the Project for its entirety (see **Chapter 2: Project Description)**. This planned fencing will be 2m high; in the areas listed above additional pole sections should be installed to increase this height to 3m and these poles should be fitted with coloured ribbon/tape which will further influence bird flight behaviour (as per Carvalho *et al.* 2017[121]). Design considerations for the adapted fencing sections are as follows:

- Additional pole sections should increase the fence structure height to 3m;
- Poles should be sufficiently robust to withstand wind/weather impacts;
- Poles should be spaced 1m apart for the duration of the sections listed above; and
- Coloured (e.g. red) ribbons/tape should be fitted to each section and should be sufficiently robust to withstand wind/weather impacts.

8.6.39. In the case of imperial eagle, the final requirement (and location) for these measures will depend upon findings from the pre-construction surveys. At present, the flight activity recorded does not suggest any particular collision risk; however, this has been based on a truncated survey effort. Further survey will corroborate this.

8.6.40. If following the above exercise there remains areas of high potential collision risk then adaptive management will need to be deployed, which may include an increase in the height or density of the pole structures, use of more novel flight diversion techniques or potentially imposition of speed restrictions on the trains at certain times of the year. To reduce risks to waterbirds associated with the wetlands in the east of the Project these measures would extend across the winter and spring/autumn migration windows, whereas for imperial eagle these measures would be more applicable to the spring/summer breeding season. A key component of ensuring the continued success of this (and ongoing adaptive management) will be operational monitoring. This is described fully within the **BMP**. The requirements for the Project to commit making a material contribution sufficient to support production of a **White-headed Duck Management Plan** for ongoing conservation management at both Büyükçekmece Lake and Küçükçekmece Basin, is set out in **paragraph 8.6.24.**

[119] Bard, A. M., Smith, H. T., Egensteiner, E. D., Mulholland, R., Harber, T. V., Heath, G. W., et al. (2002). A simple structural method to reduce road-kills of royal terns at bridge sites. Wildlife Society Bulletin, 30, 603–605.
[120] Zuberogoitia, I., del Real, J., Torres, J. J., Rodr´ıguez, L., Alonso, M., de Alba, V., Azahara, C., and Zabala, J. (2015). Testing pole barriers as feasible mitigation measure to avoid bird vehicle collisions (BVC). Ecological Engineering, 83:144–151.
[121] Carvalho, F., Santos, S. S., Mira, A. & Lourenco, R. 2017. Methods to Monitor and Mitgate Wildlife Mortality in Railways. In: Borda-de-Água L., Barrientos R., Beja P., Pereira H. (eds) Railway Ecology. Springer, Cham.

8.6.41. The above mitigation is assumed to be sufficient to prevent/minimise electrocution impacts posed by catenary wiring; however, should electrocution impacts be identified through ongoing monitoring then appropriate mitigation should be implemented.

8.6.42. With regards potential electrocution risk, anti-perching measures should be installed upon catenary structures within chainage sections identified as posing a risk to imperial eagle following results of the pre-construction surveys. Additional measures for imperial eagle should be further informed by these surveys (as per **paragraph 8.6.39**).

Aquatic Ecology

8.6.43. The Project has the potential to affect aquatic fauna and flora through the degradation of aquatic habitats, pollution, disturbance and potential spread of invasive non-native species (INNS). The following mitigation will therefore be implemented to protect aquatic ecology (this is to be delivered through the **BMP** and **ESMP**).

8.6.44. Construction work should adhere to the best practice pollution prevention guidance outlined by the Construction Industry Research and Information Association guidance[122].

8.6.45. Specific measures are not limited to, but must include the following:

- Construction materials should be stored and maintained away from watercourses. Silt fences or similar should be placed around exposed ground and stockpiles, and early revegetation of the completed elements of the scheme should be undertaken to reduce further erosion.
- Surface water runoff from the construction sites into the watercourses should be avoided and a system of cut-off ditches, silt fencing and/or bunds should be installed if required.
- Chemicals and fuels should be stored in secure containers located away from watercourses or water bodies. No refuelling of plant of machinery should take place near the watercourse.
- Noise and vibration should be controlled and kept to the minimum necessary to prevent potential negative effects on fish.
- Lighting used for construction should be switched-off when not in use and, where possible, positioned so as not to spill on to watercourses.

8.6.46. Should any part of a watercourse need to be impounded during the works, then a fish translocation should be carried out to remove fish from the impoundment. Expert advice must be sought by the ECoW in advance of any translocation requirement.

8.6.47. Biosecurity measures will be implemented during the construction phase to prevent the spread of INNS. Biosecurity is defined as a set of precautions that aim to minimise the risk of moving non-native species, parasites and diseases. Measures must include:

- The briefing and training of workers on good biosecurity practices appropriate to their role.
- Equipping workers with the necessary equipment, Personal Protective Equipment (PPE) and materials to implement biosecurity control measures. This will most frequently comprise

[122] CIRIA (2015) Environmental good practice on site (fourth edition) (C741). Charles, P., Edwards, P. (eds). CIRIA, London.

disinfectant tablets, sprayers and brushes to clean and disinfect equipment and PPE prior to leaving site.

8.6.48. Should any dead or visibly injured fish be observed during construction the Contractor should stop works and notify the ECoW immediately. The Contractor will not continue works until the ECoW has confirmed that it is acceptable to do so.

ENHANCEMENT

8.6.49. Opportunities for enhancement should be explored, specifically increasing the biodiversity value along the expropriation corridor once construction is complete. This should be done in consultation with relevant stakeholders (such as representatives of the Nezahat Gokyigit Botanical Gardens in Istanbul). The aims of such enhancement should be to improve biodiversity through replanting with native plant species, especially those which provide a reliable food source for invertebrate species (in particular).

8.6.50. It is important that any enhancement measures chosen do not increase the overall impact associated with the Project to sensitive fauna (such as by increasing attractiveness to foraging bats and raptors), and this should be considered through the design of enhancement measures.

MONITORING

8.6.51. An appropriate monitoring programme will be a critical component in ensuring the ongoing success of mitigation described above. Monitoring has been referenced within the above sections and is detailed more specifically within **BMP** (**Appendix M**). Monitoring requirements and methods should be reviewed and updated periodically (e.g. on an annual basis) to ensure they are still fit for purpose. The overall monitoring commitment should be partnered with the Project's capacity building objective, with AYGM identifying individuals to be increasingly involved on the Project's biodiversity monitoring, through a training and mentoring programme overseen and managed by Project biodiversity specialists.

8.7 RESIDUAL EFFECTS

8.7.1. With the application of the above mitigation measures the residual impacts to biodiversity will all be reduced to Minor (Not Significant). In order to ensure this is realised, the monitoring programme included within the Biodiversity Management Plan will be adhered to and adaptive management implemented as required.

8.7.2. **Table 8-14** summarises the assessment; receptors have been grouped together for ease of reading.

8.8 SUMMARY

Table 8-14 - Summary of Potential Impacts, Effects and Mitigation (Ecology)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
Protected Areas	There are three IBAs crossed by the Project.	Construction	Habitat Loss Disturbance	Neutral to Minor (Not Significant)	Compensatory planting of oak-hornbeam woodland. ECoW Sympathetic timing of works	Neutral (Not Significant)
		Operation	Disturbance Collision Mortality	Neutral (Not Significant) to Moderate (Significant)	Adapted fencing to divert flying birds.	Minor (Not Significant)
Habitats	A mixture of agriculture, woodlands/scrub and built-up areas across the ZoI. Includes an area of higher sensitivity oak-hornbeam woodland. Aquatic habitats comprise a number of watercourses, together with wetland associated with large lakes in the east of the Project.	Construction	Habitat Loss	Minor (Not Significant)	Micrositing to avoid areas of greatest biodiversity interest. Compensatory planting of oak-hornbeam woodland to ensure no net loss for this habitat. Material contribution sufficient to support the production of a White-headed Duck Management Plan**.** Standard aquatic ecology mitigation measures including pollution prevention, minimising noise, vibration and lighting, and fish rescue as set out in the **BMP** and **ESMP**.	Neutral (Not Significant)
Rare Plants	Common and widespread floral assemblage across the ZoI. Six rare plant species (including five endemics) recorded from across the ZoI. One species *Centaurea hermannii* assessed as a Critical Habitat trigger species.	Construction	Loss of Plants Spread of Invasive Species	Moderate to Large (Significant)	Translocation of plants and propagation of individuals to increase overall numbers. Invasive Species Management Plan in **ESMP**. ECoW.	Minor Beneficial (Not Significant)
Notable Fauna	Notable species of increased conservation value include European ground squirrel, marbled polecat, bat species and spur-thighed tortoise.	Construction	Disturbance Injury/Mortality	Minor (Not Significant)	Micrositing to avoid areas of greatest biodiversity interest. ECoW	Minor (Not Significant)
		Operation	Disturbance Collision Mortality	Minor (Not Significant)	Maintaining habitat connectivity and reducing collision risk through animal underpass / trench installation.	Neutral (Not Significant)
General Fauna	Common and widespread faunal assemblage across the site but including some species of slightly elevated conservation such as fire-bellied toad.	Construction	Disturbance Injury/Mortality	Minor (Not Significant)	Micrositing to avoid areas of greatest biodiversity interest. ECoW	Minor (Not Significant)
		Operation	Disturbance Collision Mortality	Minor (Not Significant)	Maintaining habitat connectivity and reducing collision risk through animal underpass / trench installation.	Neutral (Not Significant)
Birds	Common and widespread bird assemblage across the study areas.	Construction	Disturbance Injury/Mortality	Moderate (Significant)	Targeted bird surveys. Flight activity surveys. Timing of works.	Minor (Not Significant)

Topic	Baseline Summary	Phase	Potential Impact(s)	Effect (without mitigation)	Mitigation Measures	Residual Effects (after mitigation)
	Notable/threatened species include white-headed duck, imperial eagle, common pochard and red-breasted goose.	Operation	Disturbance Collision Mortality/Electrocution	All species, excluding the imperial eagle – Minor (Not Significant) Imperial eagle – Large (Significant)	Adapted fencing to divert flying birds.	Minor (Not Significant)