# Natural and Critical Habitat Assessment for Amulsar, Armenia

Prepared for:

**Lydian International**

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# CONTENTS

## FIGURES



## TABLES

# 1 Introduction

This document explains the approach taken to identification of natural and critical habitat affected by Lydian International's Amulsar Project in Armenia, by reference to the requirements and criteria set out in International Finance Corporation (IFC) Performance Standard 6 (PS 6) (IFC, 2012a) and the European Bank for Reconstruction and Development (EBRD) Performance Requirement 6 (PR 6) (EBRD, 2008). Requirements of EBRD PR6 generally align with those of IFC PS 6.

IFC PS 6 emphasises the role of the environmental and social risks and impacts identification process, carried out through the Project Environmental and Social Impact Assessment (ESIA), in informing an adaptive approach to the implementation of mitigation and management measures which are responsive to changing conditions and the results of monitoring throughout the Project's lifecycle. There are specific requirements relating to development of mitigation strategies for impacts on modified, natural and critical habitats affected by a Project to ensure acceptable outcomes for biodiversity. Specifically, no net loss (NNL) of biodiversity should be achieved in natural habitats where feasible, while net gains of those biodiversity values for which an area of critical habitat was designated should be demonstrated if significant residual impacts are identified.

NNL is defined in PS 6 as "*the point at which Project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the Project's impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale (e.g., local, landscape-level, national, regional)*".

Where a project is located within a legally protected or internationally recognised area[1], PS 6 stipulates some requirements in addition to those relating to natural and critical

[1] Legally protected areas are the areas that meet the IUCN definition: "*A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values*." As specified in PS 6, they include areas proposed by governments for such designation.

Internationally recognised areas are exclusively defined by PS 6 as UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, and wetlands designated under the Convention on Wetlands of International Importance (the Ramsar Convention).

habitat. These are (i) to demonstrate that the development in these areas is legally permitted, (ii) to act in a manner consistent with government-recognised management plans, and (iii) to consult protected area sponsors and managers, affected communities and other stakeholders on the implications of the proposed project. The Project is not located within a legally protected or internationally recognised area, but is adjacent to two Key Biodiversity Areas. Implications of the Project for the integrity of these areas have therefore been considered.

The remainder of this document describes the approach and methods used to identify areas of natural (Section 2) and critical (Section 3) habitat affected by the Project, summarises likely significant effects on natural and critical habitat and describes proposed mitigation strategies.

# 2 Natural and Modified Habitat

## 2.1 Definitions of "Natural" and "Modified" Habitat

IFC PS 6 (IFC, 2012a) defines "natural habitat" (in paragraph 13) as habitat "composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition". Conversely, paragraph 11 defines "modified habitat" as "vegetation with a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition".

## 2.2 Identifying and Mapping Natural and Modified Habitat

Natural and modified habitats were identified and mapped following baseline surveys of plant communities within the Project-affected area and its surroundings. The species within different plant communities were identified and quantified using data gathered from quadrats along four transects carried out by GeoTeam staff in 2012.

Plant community composition in the Project-affected area reflects topography, altitude, soil-type and soil-wetness as well as management. Based on the results of the vegetation transects and habitat survey, the main vegetation types found in the Project-affected area have been classified as:

- Sub-alpine Meadows.
- Sub-alpine Meadows With Alpine Elements.
- Montane Meadow.
- Montane Meadow Steppe.
- Vegetation With Shrubs.
- Riparian Vegetation.
- Wetland.

There are also characteristic plant communities associated with rock and scree substrates, some of which occur in rocky gorges.

These vegetation types are largely determined by altitude but can also be sub-categorized based on slope and moisture. Following discussions with the NAS RA Institute of Botany it was concluded that true alpine vegetation, as defined within the Armenian classification, does not occur at Amulsar. However, plant species do occur which are typical of that vegetation zone. The presence of these plant species makes the vegetation important for biodiversity despite its non-typical nature, and a new description "Sub-alpine Meadow With Alpine Elements" was defined to describe the type of vegetation found on the highest areas on Amulsar mountain. Typically the alpine plants are found in rocky areas within a matrix of Sub-alpine vegetation.

Table 1 provides brief descriptions of these types and identifies constituent plant species which would be expected to occur in natural or relatively un-modified examples and which were used as indicators of natural habitat. The distribution of habitat types is indicated in Figure 1.

**Table 1 Typical Plant Species Constituents of the Natural Vegetation Types within the Project-affected area**

| **Sub-Alpine Meadow With Alpine Elements** |
|---|
| Sub-alpine Meadow With Alpine Elements occurs on the highest areas of Amulsar Mountain that are not rock outcrops. It is seldom grazed or used and can be considered entirely natural. The turf is kept short partly by the extreme conditions. The characteristic species are the same as Sub-alpine Meadows (see below) but with additional species from genera such as *Gentiana* and *Merendera. Potentilla porphyrantha* grows on rocky outcrops and boulders from the |

summit of the Amulsar Mountain down to 2450 metres above sea level (masl) within a matrix formed by this vegetation and by Sub-alpine Meadows. Other alpine species of note include: *Aetheopappus caucasicus*, *Arabis caucasica, Aster alpinus, Campanula bayerniana, Cystopteris fragilis, Erigeron venustus, Helichrysum plicatum, Huynhia pulchra* (endemic), *Jurinea moschus,* and *Potentilla crantzii.*

**Sub-alpine Meadow**

Sub-alpine Meadows are found on flat or sloping ground (sometimes very steep) above 2450masl. They are only grazed lightly (usually in mid-summer) due to late snow lie, or sometimes used for a late hay cut. The Project has chosen to take a conservative approach and define these as natural due to the fact that they consist entirely of native species, occurring in combinations that reflect management carried out in a traditional way throughout centuries. The characteristic species are *Festuca ovina, Astragalus aureus*, and *Pulsatilla albana*.

**Montane Meadows**

Montane Meadows are found at low to medium altitude. They are typically used as pastures and are found on dry steep slopes on the western side of the mountain and steep slopes and wet valley floors on the east side of the mountain. On slopes, the typical species are *Dactylis glomerata, Festuca spp., Thymus kotchyanus, Astragalus aureus*. On wet valley floors the typical species are *Dactylis glomerata, Festuca spp., Bromus spp. Ranunculs spp*. These meadows have been defined as natural in cases where they retain species-rich communities of native species that reflect traditional extensive management carried out for hundreds of years. They have been defined as modified in cases where characteristic species richness has declined, for example in local areas around herder camps where vegetation has been modified due to high stocking density and physical damage from trampling.

**Montane Meadow Steppe**

Montane Meadow Steppe is found at low altitude in the Project-affected area and surroundings, typically on average/dry flat or rolling land to the east of Amulsar Mountain, but also on small steep dry slopes on the western side. The large expanse of the Vorotan Valley is grazed pasture and forms this habitat characterized by grasses including *Stipa*. The dry slopes on the western side of the mountain have less grass and are characterized by herbs such as Origanum, Thymus, Tanecetum, Nepeta, Onobrychis, Acantholimion. This vegetation type has been defined as natural with the exception of locations surrounding herder camps in the Vorotan Valley or where there is a higher density of tracks, where it has been defined as

| |
|---|
| modified. |
| **Vegetation With Shrubs** |
| Vegetation With Shrubs occurs in both the Mountain Meadow and Mountain Meadow Steppe zones. The characteristic species are those of the two main vegetation zones but with rocks at high abundance. It is normally drier than average. The characteristic species of shrub are *Juniperus communis, J.polycarpus* and *Crataegus meyeri*. Juniper scrub is one of the characteristic vegetation types of the Caucasus Mixed Forest Ecoregion and is of conservation importance. Small fragmented examples of this vegetation type remain which would be classed as truly natural. Where the vegetation type is more affected by grazing and has sparse presence of charateristic shrub species, it has been defined as modified. |
| **Riparian** |
| Riparian communities are found along the Vorotan Valley. Species of wetland are common. Characteristic species include *Juncus spp, Ranununcules spp, Phragmites australis* and *Caltha palustris*. Some good, unmodified examples remain that have been defined as natural, but this vegetation type is increasingly damaged by poaching from livestock and by modification of the river, for example by hydro-schemes. In such locations it is defined as modified. |
| **Wetland** |
| Wetland areas tend to be small and are found around ponds and pools both on the west side of the mountain and in the valleys on the east side of the mountain where they are associated with hollows and springs. The vegetation is similar to the Riparian communities. Where poaching occurs, the habitat is defined as modified. |
| **Gorge** |
| Gorges occur where rivers cut through the soft rocks of the Mountain Meadow Steppe. The largest gorge by far is the famous Arpa River Gorge to the west of Amulsar but there are smaller gorges between Gndevaz and Amulsar and on the eastern side of Amulsar in the Vorotan. |

Areas defined as “Urban” or that are used relatively intensively for farming (arable land, cultivated orchards) have been defined as “modified”. As indicated in Table 1, some vegetation types are considered to be essentially natural in all cases of their

occurrence in the Project-affected area, notably vegetation associated with rocky crags and gorges, Sub-alpine Meadows and Sub-alpine Meadows with Alpine Elements. Others may be defined as natural or modified, depending on their management and use.

Pastures and hay meadows have been defined as "natural" if there has not been any significant modification due to addition of inorganic fertilisers or reseeding. This includes several habitats which would be termed "semi-natural" in European conservation programmes, where allowances have been made for some mechanisation and the influence of traditional grazing management. Prior to the Soviet Era, grasslands in the Project-affected area were managed for centuries (and possibly millennia) under a transhumant grazing and hay meadow system. Botanically diverse vegetation with a high proportion of characteristic native species developed under this traditional management. Such areas, which are managed traditionally and retain relatively high species richness have therefore been included in the definition of “natural”.

Areas immediately surrounding seasonal herder-camps, however, which are heavily grazed and have become dominated by agricultural weed species, are defined as “modified”. Areas of land used more intensively for grazing and for hay by local communities are also defined as modified, as are areas exposed to physical damage by vehicles.

Habitat types were mapped (Figure 1) and assigned to categories of natural or modified (Figure 2). The scale of modification remains low relative to an overall “matrix” that is largely defined as “natural” except in the Vorotan Valley and around villages. Some localised areas of modified habitat are too small to indicate clearly on the habitat map.

## 2.3 Impacts on Natural Habitat

The Project’s impacts on natural habitat were determined by considering the different types of impact that might be experienced in three different types of Project-affected area (see Section 4.1.6 of the ESIA):

a) The physical Project footprint within which vegetation will be either destroyed or fundamentally modified for the lifetime of the mine;

b) Areas of land surrounding the footprint, within which plant communities are predicted to become modified by dust deposition, deposition of pollutants or eutrophication, for example due to deposition of nitrogen and sulphur oxides. Section 4.1.3 of the Project ESIA defines two such buffer zones: the Ecologically Disturbed Area, which comprises 500m around access roads and 1km around haul roads; and a 50m buffer around all other infrastructure (which is a component, along with the footprint, of the Project Disturbed Area); and

c) Additional restricted areas, within which land use may alter due to the Project's restricted access arrangements, with possible longer term effects on vegetation. These include areas restricted by fencing; areas around the open pits that will not be fenced but will be restricted in access during blasting; and other non-fenced areas that are likely to be inaccessible to wildlife due to barrier effects of nearby infrastructure.

The extent of different natural vegetation types included in these zones is summarised in Table 2. A further column is included to show potential impacts on natural habitat along the Kechut-Gorayk road due to previous road expansion and "improvement" during the exploration phase and possible future use associated with access to the mine for some personnel and materials, and ongoing use by the public.

Based on these estimates, the Project could affect 1805.2 ha of natural habitat, which represents 13.8% of the extent of natural habitat that has been mapped around the Project area, as identified in Figures 1 and 2. This mapped area lies within a wider region of predominantly natural habitat; the mountains to the north, east and south of the area studied for the ESIA have extensive areas of Sub-alpine and true Alpine vegetation, and the land cover study undertaken by WAI showed that modified areas constituted 2.5% of the mapped area of 287 $km^2$.

Nevertheless, Sub-alpine Meadows and Sub-alpine Meadow with Alpine Elements of the type found on Amulsar Mountain and the associated rock habitat which supports *Potentilla porphyrantha* are less common in the wider area studied for the ESIA. These habitats are of high conservation priority and this is why the Project has chosen to develop and implement a comprehensive mitigation strategy for them. Progressive restoration is proposed, but until effective techniques can be proven through ongoing

field trials, the Project has chosen to take a precautionary approach and use conservative estimates of habitat loss in its mitigation strategy.

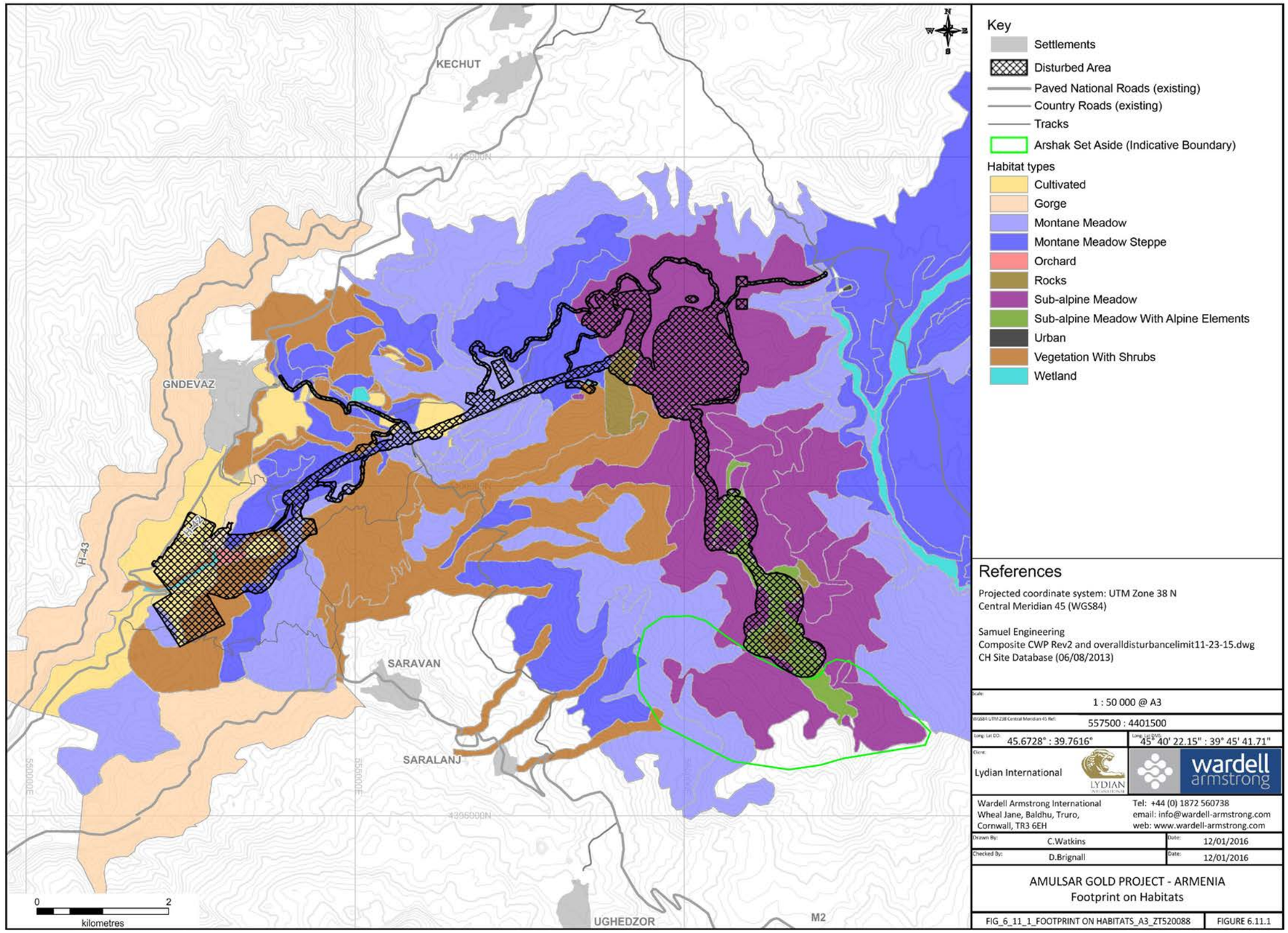


**Figure 1 Project footprint on habitats**

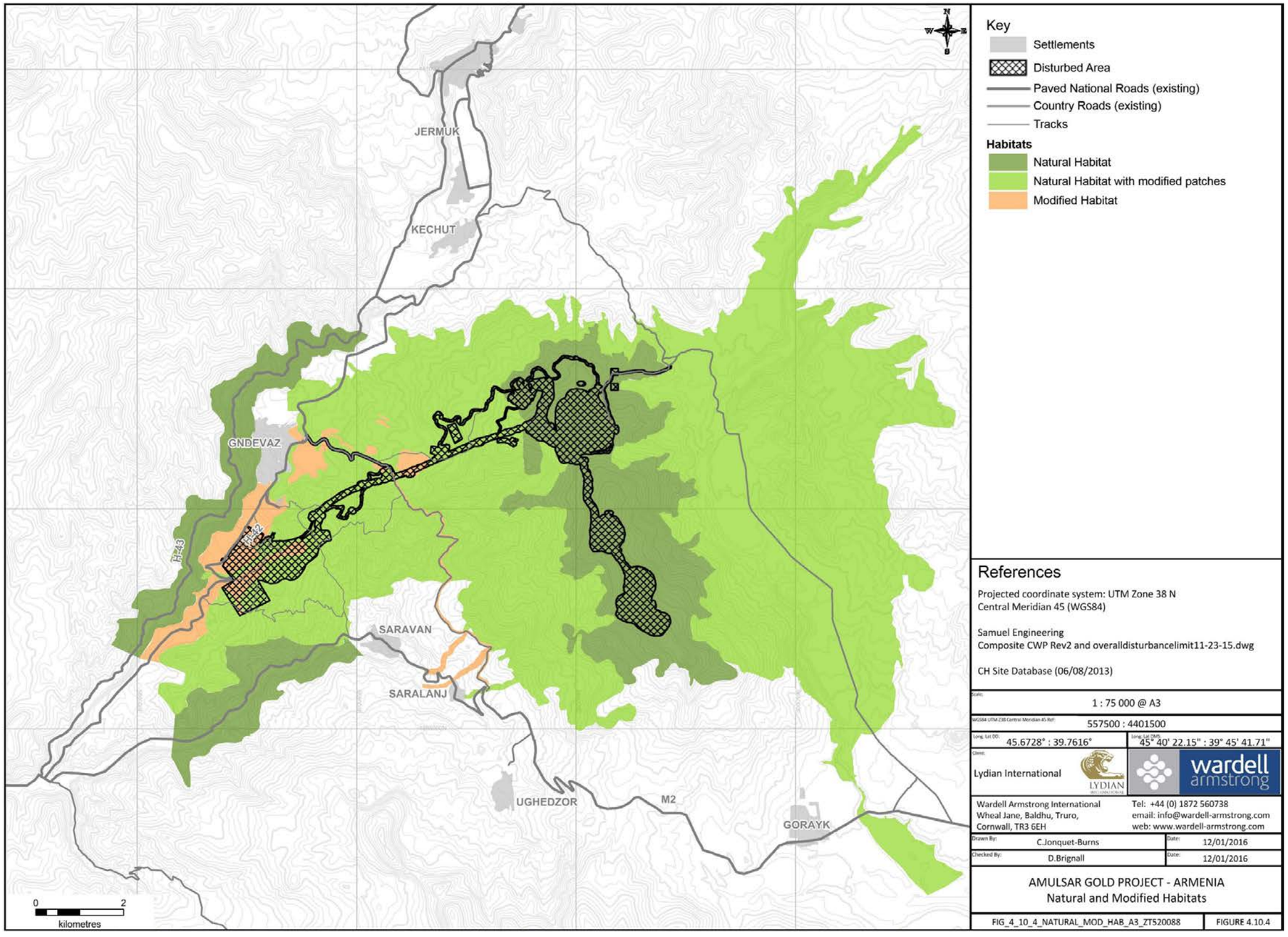


**Figure 2 Project footprint on natural and modified habitats**

| Natural Habitat Type | Disturbed Area* | | Restricted Area* | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Area in Project footprint (ha.) | Area in adjacent buffer zone (ha.) | Wildlife Restricted Area (ha.) | Restricted Area through fencing(ha.) | Operational Restricted Area (ha.) | Project Ecologically Disturbed Area (ha.) | Area adjacent to Kechut-Gorayk Road (ha.) | Total area potentially affected (ha.) |
| Gorge | 7.0 | 1.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | 8.1 |
| Montane Meadow | 38.7 | 32.8 | 11.4 | 0.6 | 11.6 | 28.5 | 16.5 | 140.1 |
| Montane Meadow Steppe | 36.9 | 54.2 | 65.4 | 0.5 | 0.0 | 111.9 | 147 | 415.8 |
| Rocks | 24.5 | 7.7 | 0.1 | 0.0 | 9.4 | 4.7 | 0 | 46.4 |
| Sub-alpine Meadow | 254.2 | 126.3 | 3.3 | 58.0 | 277.0 | 171.5 | 9.5 | 899.8 |
| Sub-alpine Meadow With Alpine Elements | 85.5 | 17.3 | 0.0 | 0.0 | 25.2 | 2.1 | 0 | 130.1 |
| Vegetation With Shrubs | 65.5 | 38.7 | 10.7 | 0.1 | 0.0 | 34.8 | 0 | 149.8 |
| Wetland | 5.2 | 1.2 | 0.3 | 0.1 | 0.0 | 1.3 | 7.1 | 15.2 |
| Total | 517.5 | 279.3 | 91.2 | 59.3 | 323.2 | 354.7 | 180.1 | **1805.3** |

*Note: for definitions of Disturbed, Restricted and other areas refer to Section 4.1.6 of the ESIA

**Table 2 Extent of Natural Habitats affected by the Project**

## 2.4 Mitigation Strategy for Impacts on Natural Habitat

The Project has developed a comprehensive mitigation strategy for its impacts on natural habitat that includes the following key components:

1. A set-aside of an area of relatively intact Sub-alpine Meadow with Alpine Elements and rocky habitat for *Potentilla porphyrantha* (the "Arshak set-aside").
2. A suite of measures designed to minimise and control the Project's impacts during construction, operation and decommissioning.
3. Progressive restoration, backed up by field trials and restoration trials in more controlled conditions.
4. An offset for residual impacts.

### 2.4.1 Set-aside

Although the relative proportion of natural habitat directly impacted by the Project footprint is relatively small with respect to the surrounding region, the Project is committed to adhering to the avoidance principle of the mitigation hierarchy and the set-aside of an area of relatively intact Sub-alpine Meadow. (This avoidance measure is in addition to efforts to minimise the footprint of major infrastructure in high value habitat, as described in Chapter 6 of the ESIA.) The precise boundary of the set-aside will be confirmed following consultation with local communities and the Ministry of Nature Protection; Figure 1 shows an indicative boundary. This will safeguard a proportion of species-rich Sub-alpine Meadow on Amulsar Mountain as well as habitat for *P. porphyrantha,* which occurs within this Sub-alpine Meadow matrix on suitable rock substrate, as well as preserving confirmed breeding dens for *Ursus arctos* (Brown Bear) and habitat for alpine bird species (see Section 3). However, recent evidence suggests that this indicative boundary is not necessarily optimal for safeguarding the affected population of Brown Bear, as discussed in Sections 3.3.1.8 and 4.2.1.

### 2.4.2 Minimisation and control of impacts

The Project's Environmental and Social Management Plan (ESMP), and specifically the component Biodiversity Management Plan (BMP), includes a suite of measures aimed at ensuring that unavoidable impacts on natural habitat are controlled and minimised. Many of these measures represent basic good international practice in mining, and serve to protect other important receptors such as air quality, surface water and landscape integrity. These measures, and arrangements for their implementation, are described in the BMP.

### 2.4.3 Progressive restoration

The Project's BMP includes a suite of measures aimed at progressive vegetation restoration on disturbed areas. This includes storage of topsoil and its associated soil seed bank, collection of seed from native species and growth of transplants in plant nurseries which have been established in local villages. Seed mixes used for re-seeding will reflect the composition of extant vegetation to the extent possible, given available stocks of seed and it may be possible to restore some natural vegetation types. A programme of field-testing is underway to test techniques for restoring specific target vegetation types.

### 2.4.4 Offset

PS6 requires that there should be NNL of natural habitat if feasible. Biodiversity offsets may be used as part of a suite of measures to achieve this. The Project has developed a matrix which combines biodiversity distinctiveness with habitat condition to give a set of scores (see Table 3, in which possible scores of 0 to 24 have been normalised to a range of 0 to 1). Areas of land affected by the Project are multiplied by the appropriate score, reflecting the vegetation types they support and their condition. This gives an adjusted number of "impact units". The offset must result in an equal or raised number of units and this can be achieved by enhancing biodiversity on a fixed area of land and/or increasing the area of land under conservation protection or management.

**Table 3 Proposed Framework for Biodiversity Offset Metrics**

| | | Biodiversity Distinctiveness | | | |
|---|---|---|---|---|---|
| | | Very Low (0) | Low (2) | Medium (4) | High (6) |
| Condition | Optimum (4) | 0 | 8 [0.33] | 16 [0.67] | 24 [1.00] |
| | Good (3) | 0 | 6 [0.25] | 12 [0.50] | 18 [0.75] |
| | Moderate (2) | 0 | 4 [0.17] | 8 [0.33] | 12 [0.50] |
| | Poor (1) | 0 | 2 [0.08] | 4 [0.17] | 6 [0.25] |

Each of the natural habitat types affected by the Project has been assigned to one of the distinctiveness categories in the matrix, based on their intrinsic species richness/ conservation priority (Table 5).

**Table 4 Distinctiveness of vegetation types affected by the Project**

| Distinctiveness Category | Vegetation or land use types |
|---|---|
| **Very Low** | Modified land, including arable fields |
| **Low** | Village grazing lands, gardens and orchards |
| **Medium** | • Montane Meadow<br>• Montane Meadow Steppe<br>• Wetlands<br>• Vegetation with shrubs |
| **High** | • Rocks with *Potentilla porphyrantha*<br>• Sub-alpine Meadow with Alpine Elements<br>• Sub-alpine Meadow |

A comprehensive assessment of the condition of natural habitats throughout the Project-affected area would be challenging, so the Project has chosen to take a conservative approach and assume that each vegetation type has the same condition throughout the Project-affected area (except in the case of a small area of Sub-alpine Meadow - see Table 6) and to use the category applicable to the majority of each type

occurring in the Project-affected area. For example, the majority of Sub-alpine Meadow with Alpine Elements was in optimal condition prior to the Project, whereas condition of Montane Meadows could generally be improved through modifications to management.

The impacts of the Project on natural habitat are illustrated in Table 6. It has been assumed that habitats in the Project's physical footprint will be lost, while those in the remaining part of the Project Disturbed Area, and those in the Ecologically Disturbed Area, restricted areas, and along the Kechut-Gorayk road, will persist, although probably in a degraded or modified condition, due to impacts such as dust contamination or altered grazing regimes. This approach makes it possible to distinguish between habitat loss and habitat degradation.

For example the 254.2 ha. of Sub-alpine Meadow lost in the footprint is multiplied by 0.75, reflecting the fact that it has high distinctiveness and is in good condition. This gives a sub-total of 190.7 units. The units are area (in ha) adjusted for their distinctiveness and condition: we have called them "habitat impact units" (HIU). For the areas of Sub-alpine Meadow in the remaining part of the Project Disturbed Area (i.e. the buffer adjacent to the footprint) and in the Operational Restricted Zone, which total 403.3 ha, the difference between the current and future forecast state of that habitat post-Project must be determined. In this case it is assumed that the Sub-alpine Meadow will take on a vegetation composition more similar to Montane Meadow (medium distinctiveness) and will be in poor condition, giving (403.3 x 0.75) less (403.3 x 0.17) = 233.9 HIUs. The third category of land affected by the Project includes the Ecologically Disturbed Area, the Wildlife Restriced Area, the Restricted Area (by fencing) and the area next to the Kechut to Gorayk road. These areas will not be as affected as the previous category and are assumed to drop by one condition category. The Sub-alpine Meadow will be poor instead of moderate condition and the calculation becomes (242.3 x 0.75) less (242.3 x 0.33). Adding this to the result for the Project's physical footprint (190.7 HIUs) gives a combined impact on on Sub-alpine Meadow of 424.6 HIUs.

For each of the natural habitat types affected by the Project, a residual number of HIUs has been determined as shown in Table 5. This can then be used to establish the offset requirement.

**Table 5 Calculation of residual impact on natural habitat**

| Natural Habitat Type | Baseline Distinctiveness | Baseline Condition | Score (from Table 4) | Area in Project footprint (ha.) | Forecast condition in footprint post project | Buffer zone adjacent to footprint and Operational Restricted Area (ha.) | Forecast habitat and condition in these zones post project | Score (from Table 4) | Wildlife and Fencing Restricted Areas, Ecological Disturbance Area and Area adjacent to Kechut Gorayk Road (ha.) | Forecast habitat and condition in these zones post project | Score (from Table 4) | Combined Impact (Habitat Impact Units) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gorge | Medium | Optimum | 0.67 | 6.985816 | Lost | 1.112049 | poor | 0.17 | 0 | Moderate | 0.33 | 5.236521 |
| Montane Meadow | Medium | Moderate | 0.33 | 38.72243 | Lost | 44.37338 | medium | 0.17 | 56.9865141 | Poor | 0.17 | 28.99598 |
| Montane Meadow Stepp | Medium | Moderate | 0.33 | 36.86121 | Lost | 54.16758 | poor | 0.17 | 324.780512 | Poor | 0.17 | 72.79589 |
| Rocks | High | Optimum | 1 | 24.52855 | Lost | 17.09099 | poor | 0.25 | 4.78417833 | Moderate | 0.5 | 39.73888 |
| Sub-alpine Meadow | High | Good | 0.75 | 254.2487 | Lost | 403.2993 | poor | 0.17 | 242.272231 | Moderate | 0.33 | 526.3544 |
| Sub-alpine Meadow* | High | Moderate | 0.5 | 0 | n/a | 0 | poor | 0.17 | 9.5 | Poor | 0.17 | 3.135 |
| Sub-alpine Meadow Wit | High | Optimum | 1 | 85.50257 | Lost | 42.4952 | poor | 0.17 | 2.09793668 | Moderate | 0.5 | 121.8226 |
| Vegetation With Shrubs | Medium | Moderate | 0.33 | 65.45379 | Lost | 38.73887 | poor | 0.17 | 45.5751248 | Poor | 0.17 | 35.08999 |
| Wetland | Medium | Moderate | 0.33 | 5.241163 | Lost | 1.187117 | poor | 0.17 | 8.77934988 | Poor | 0.17 | 3.324219 |
| Total | | | | 517.5442 | | 602.4645 | | | 685.275847 | | | 836.4934 |

#### 2.4.4.1 Offset Delivery Options

The Project proposes to achieve NNL of natural habitat through the establishment of a new Jermuk National Park (to afford some protection to Caucasian Montane Steppe, Sub-alpine Meadows and other natural habitats which currently have little protection within the region) and the implementation of specific conservation management measures within the Park to enhance the condition of degraded natural habitat. Development and implementation of a management plan is envisaged which will involve improving the condition of target vegetation types, possibly including management agreements and livelihood interventions with herders to reduce numbers of livestock in some areas.

The indicative boundary of the proposed Jermuk National Park is shown in Figure 3. The area is considered potentially suitable to offset residual impacts of the Project on natural habitat because it is adjacent to the Project-affected area and has a similar range of altitudes. Initial botanical surveys indicate that there are extensive areas of suitable habitat available, though some of it may show more xeric characteristics due to areas with drier conditions than those found on Amulsar Mountain.

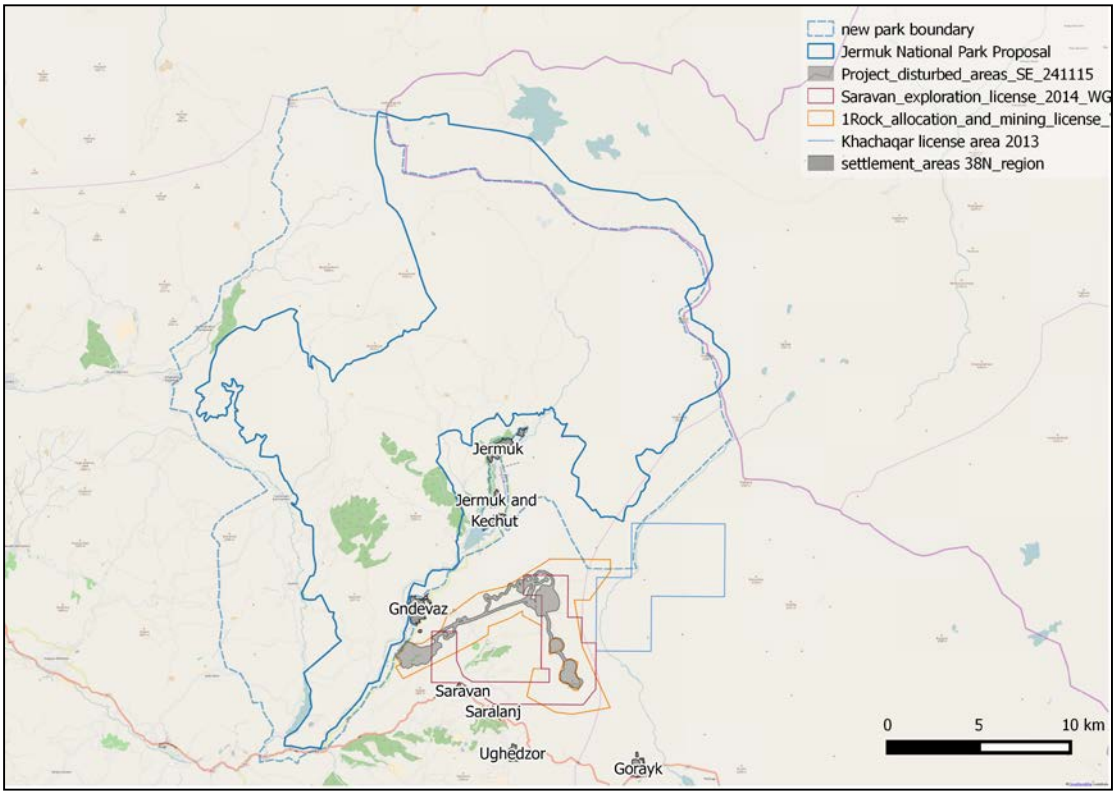


**Figure 3 Jermuk National Park proposal in relation to the Project area**

The extent of land potentially available is 38,867 hectares according to published data, which far exceeds the area that will be needed to achieve NNL (see Figure 3). Surveys conducted by WWF Armenia of the proposed National Park and those conducted by Lydian/Geoteam in 2015 confirm that there are extensive areas of pasture that are currently in poor condition through overgrazing which could be included in a conservation management programme as well as areas of woodland and “shrubland” that is also degraded.

Proposals to develop a new Jermuk National Park have been promoted by WWF Armenia and are part of Government plans, contingent on resources and funds. The Project proponent has conducted initial stakeholder engagement to establish likely attitudes to a new National Park and has also carried out initial stakeholder mapping in the proposed National Park Area. The results are reflected in the Biodiversity Offset Strategy, which includes a commitment to ongoing stakeholder engagement and to substantial financial support for the National Park’s establishment in partnership with national and local government and other partners. Subsequent support for ongoing

administration and implementation of conservation management would then be targeted on the Project's offset requirement. Accordingly Lydian/Geoteam conducted ecological surveys in the proposed National Park area in 2015 to gain a better understanding of the vegetation types currently represented and their condition in relation to current land use.

Target vegetation types would include Caucasian Montane and Sub-alpine Meadows that are afforded negligible protection in the region at present, as well as delivering benefits for other associated animal species of conservation concern that are affected by the Project.

#### 2.4.4.2 Calculation of offset gains

This section presents the proposed approach to calculation of gains required for the offset.

Firstly, an exchange rule is proposed whereby the offset provided will not be smaller than the area exposed to project impacts (in other words there will be a minimum ratio of impacted area to offset area of 1:1).

The Project's offset strategy is also based on an objective of "like for like" outcomes if possible, in which losses of one natural habitat type are substituted for by gains in the same different type. However, in certain circumstances "trading up" may be necessary, whereby losses in one type are offset through gains in a different habitat type of the same or higher levels of distinctiveness.

A survey of the proposed National Park was carried out in 2015 and the results are discussed in a summary report: "Preliminary Baseline Surveys of the proposed Jermuk National Park". The survey covered an area of 2086 ha. (approximately 5% of the total) identifying the habitats present. A condition assessment was carried out to give baseline distinctiveness and condition scores that relate to Table 3 above. The habitat types identified at Amulsar were further classified using the hierarchical BioHab system into sub-categories (Table 6; Figure 4).

**Table 6. Sub-categories of habitats identified during survey of proposed National Park**

| Habitat | Number of sub-categories |
|---|---|
| Mountain Meadow (includes vegetation with shrubs) | 13 |
| Wetland | 11 |
| Sub-alpine Meadow | 10 |
| Mountain Meadow-Steppe | 6 |
| Sub-Alpine Meadow with Alpine Elements | 2 |
| Woodland | 6 |
| Rocks/Scree | 1 |

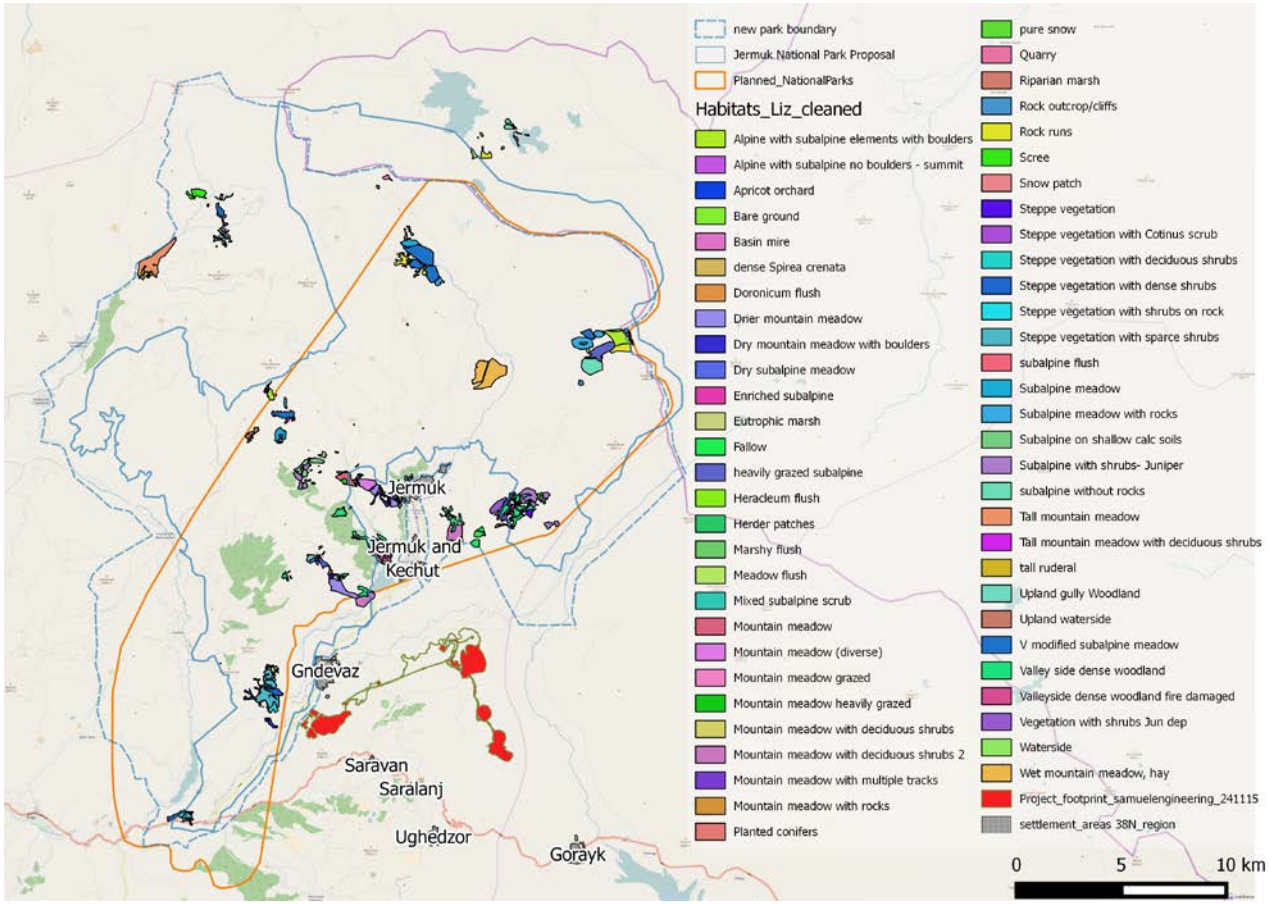


**Figure 4 Habitats and sub-types surveyed in the proposed Jermuk National Park in 2015, with indication of three different planned or proposed boundaries for this park.**

Condition assessments were carried out on examples of the sub-categories so that the baseline condition of each could be used to calculate the number of HIUs currently available in the surveyed area for use as an offset. The calculation required four steps:

1. The identification of the distinctiveness and condition relating to Table 3;
2. The calculation of the number of current HIUs by multiplying the area by the value from Table 3;
3. The calculation of the number of HIUs if the habitat was raised in quality by one condition category; and
4. The calculation of the difference between steps 3 and 4 to give the gain in HIUs per habitat.

The calculations show that 274 HIUs can be gained from the surveyed area of 2086 ha (Table 7). Most of the gain is predicted to come from improved management of Sub-alpine Meadow and Mountain Meadow habitats. If it is assumed that the survey was broadly representative, then the 274 HIU gain - even though it came from only approximately 5% of the new national park area - can be extrapolated to a potential gain of 5480 HIUs for the whole national park. This exceeds the 836.5 HIUs lost from the Project.

The exchange rule whereby the area offset should not be smaller than the area impacted will also be met as the area required to offset the 1805ha impacted by the Project will be exceeded even if only Sub-alpine Meadow and Mountain Meadow are targeted in the new national park. The area of these two habitats in the new national park is estimated at 25,800 ha.

**Table 7. Calculated difference in HIU for habitats from the current state to an improved future state**

| Habitat | Area (ha.) | Current Score | Improved Score | Difference in HIU |
|---|---|---|---|---|
| Mountain Meadow-Steppe | 189 | 188.7 | 189 | 0.26 |
| Mountain Meadow | 639 | 288.3 | 378.2 | 90 |
| Sub-alpine Meadow | 651 | 336.9 | 499.7 | 162.8 |
| Sub-alpine Meadow With Alpine Elements | 72.5 | 56.3 | 72.5 | 16.2 |
| Wetland | 33 | 14.3 | 19.3 | 5 |
| Woodland | 247 | 151.7 | 151.7 | 0 |
| Total | | | | 274.3 |

Unfortunately, implementing targeted management of just Sub-alpine Meadow and Mountain Meadow does not fulfill the requirement of the second principle of like-for-like outcomes. In Table 5 there is a requirement for an offset of 121.8 HIU of Sub-alpine Meadow With Alpine Elements. The surveyed area could produce 16.2 HIU and it is possible that the National Park could produce 324 HIU through enhancement.

A possible outline for the offset could be as follows:

- 162.4 ha of Sub-alpine Meadow With Alpine Elements (121.8/0.75);
- 72.8 ha of good condition Mountain Meadow-Steppe protected (see Table 5);
- 40 ha. of rocks protected (see Table 5);
- 19.8 ha. of Wetland under better management (33 x 3/5 see Table 7);
- 205.2 ha. of Mountain Meadow under better management (639 x 28.9/90 see Tables 5 and 7); and
- 2,243 ha. of Sub-alpine Meadow under better management (651 x 561/162.8; see Tables 5 and 7) (n.b. includes Vegetation with Shrubs from Table 5).

The total land requirement to offset the 1805 ha of the Project impact area would therefore be 2743.2 ha in the new National Park.

# 3 Critical Habitat

IFC PS6 and EBRD PR6 require identification of critical habitat that might be affected by a Project as well as identification of potential impacts on it and appropriate application of the mitigation hierarchy.

## 3.1 Definition of "Critical" Habitat

Critical habitat is a category of natural or modified habitat defined under paragraph 16 of IFC PS 6 (IFC, 2012a) as an area with high biodiversity value which meets the following criteria (as defined in paragraph GN55 of GN 6):

- Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species;
- Criterion 2: Endemic and/or restricted-range species;
- Criterion 3: Migratory and/or congregatory species;
- Criterion 4: Highly threatened and/or unique ecosystems;
- Criterion 5: Key evolutionary processes.

Paragraph GN56 of GN 6 (IFC, 2012b) specifies that the determination of critical habitat is not necessarily limited to these five criteria, and that the assessment should evaluate on a case-by-case basis other recognized high biodiversity values that might also support a critical habitat designation.

## 3.2 Critical Habitat Determination

Paragraph GN58 of GN 6 (IFC, 2012b) recognises gradients of critical habitat and defines numerical thresholds for Criteria 1 through 3 above. These thresholds are used to establish whether critical habitat is present and to assign areas potentially meeting the three criteria to a Tier 1 or a Tier 2 critical habitat designation (see Table 8).

**Table 8 Quantitative thresholds for Tier 1 and 2 Critical Habitat Criteria 1 to 3 (IFC, 2012b).**

| Criterion | Tier 1 | Tier 2 |
|---|---|---|
| 1. Critically Endangered (CR)/ Endangered (EN) Species | (a) Habitat required to sustain ≥ 10 percent of the global population of a CR or EN species/subspecies where there are known, regular occurrences of the species and where that habitat could be considered a discrete management unit for that species.<br>(b) Habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species. | (c) Habitat that supports the regular occurrence of a single individual of a CR species and/or habitat containing regionally important concentrations of a Red-Listed EN species where that habitat could be considered a discrete management unit for that species/ subspecies.<br>(d) Habitat of significant importance to CR or EN species that are wide-ranging and/or whose population distribution is not well understood and where the loss of such a habitat could potentially impact the long-term survivability of the species.<br>(e) As appropriate, habitat containing nationally/regionally important concentrations of an EN, CR or equivalent national/regional listing. |
| 2. Endemic/ Restricted Range Species | (a) Habitat known to sustain ≥ 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species (e.g., a single-site endemic). | (b) Habitat known to sustain ≥ 1 percent but < 95 percent of the global population of an endemic or restricted-range species where that habitat could be considered a discrete management unit for that species, where data are available and/or based on expert judgment. |
| 3. Migratory/ Congregatory Species | (a) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle where that habitat could be considered a discrete management unit for that | (b) Habitat known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent but < 95 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle and where that habitat could be considered a discrete management unit for that species, where adequate data are |

| Criterion | Tier 1 | Tier 2 |
|---|---|---|
| | species. | available and/or based on expert judgment.<br>(c) For birds, habitat that meets BirdLife International's Criterion A4 for congregations and/or Ramsar Criteria 5 or 6 for Identifying Wetlands of International Importance[2].<br>(d) For species with large but clumped distributions, a provisional threshold is set at ≥5 percent of the global population for both terrestrial and marine species.<br>(e) Source sites that contribute ≥ 1 percent of the global population of recruits. |

No numeric thresholds are defined for Criteria 4 and 5 in PS 6 and therefore expert judgement must be used to determine whether areas are of sufficient importance to qualify, based on review of available information.

### 3.2.1 Discrete Management Units

A Discrete Management Unit (DMU) is defined in paragraph GN65 of GN 6 (IFC; 2012b) as "an area with a definable boundary within which the biological communities and/or management issues have more in common with each other than they do with those in adjacent areas". The concept is central to the evaluation of critical habitat for Criteria 1 to 3, as the DMU is the geographical area within which a species population is assessed for significance against the thresholds and criteria used to determine if critical habitat is present.

[2] IBA global criteria in http://www.birdlife.org/datazone/info/ibacriteria, and Ramsar criteria http://www.ramsar.org/cda/en/ramsar-about-faqs-what-are-criteria/main/ramsar/1-36-37%5E7726_4000_0__

## 3.3 Critical Habitat Affected by the Project

A long list of species potentially triggering identification of critical habitat was produced. This included species:

- Listed as Endangered or Critically Endangered in the IUCN Red List;
- Included in the RA Red List with a status of Endangered or Critically Endangered (the RA Red Book was recently revised, using the IUCN methodology); or
- Considered by national or international specialists to be endemic, restricted range, migratory or congregatory based on available documented evidence.

Information about species meeting Criteria 1 to 3 was screened against the Tier 1 and Tier 2 quantitative thresholds (Table 7), drawing on evidence obtained through the Project's ESIA process. Species specialists were consulted in cases where relevant background data on species distributions and trends were limited.

These specialists included:

- For plants, Professor George Fayvush, RA Botanical Institute; Jalil Noroozi, Department of Conservation Biology, Vegetation and Landscape Ecology, University of Vienna; George Schatz of Missouri Botanical Garden; and Dr. Peter Carey, with informal input from Jamie Carr of the IUCN Red List team dealing with climate change impacts.
- For birds, Dr Phil Edwards and Ramaz Gokhelashvili, both specialists in migratory raptors, as well as specialists from the Armenian Society for the Protection of Birds, including Mamikon Ghasabian.
- For mammals and other taxonomic groups of fauna, specialists from the RA Institute of Zoology and for *Ursus arctos*, survey specialists from Alberta Innovates in Canada and genetic specialists from Wildlife Genetics International.

To determine whether any bird species population might be significant in terms of Criterion 3 ("*globally significant concentrations of migratory and/or congregatory species"*), raptor counts in the Project-affected area were commissioned through the 2013 spring and autumn migrations, and numbers of birds observed on migration were compared with global population estimates.

### 3.3.1 Assessment Against Criterion 1 for CR and EN species

Species potentially meeting Criterion 1 are listed in Table 8. Affected populations were then evaluated against the numerical thresholds for Tier 1 and Tier 2 critical habitat.

To determine whether populations of these species were nationally or regionally significant, national specialists and institutions in Armenia were consulted, including the Armenian Society for the Protection of Birds, the RA NAS Institute of Zoology and the RA NAS Institute of Botany. Best available information was used, taking into account existing data on range, distribution and likely proportion of populations in the areas affected, based on interpretations by species specialists. Results are summarized by species below.

**Table 9 Species occurring in areas affected by the Project which potentially meet critical habitat Criterion 1.**

| Species | Status on IUCN Red List | Status in RA Red Book |
|---|---|---|
| *Neophron percnopterus* (Egyptian vulture) | EN | EN |
| *Falco cherrug* (Saker falcon) | EN | EN |
| *Aegypius monachus* (Cinereous vulture) | NT | EN |
| *Circus macrourus* (Pallid harrier) | NT | EN |
| *Milvus milvus* (Red kite) | NT | EN |
| *Falco naumanni* (Lesser kestrel) | LC | VU |
| *Potentilla porphyrantha* | Not evaluated by IUCN | CE |
| *Ursus arctos* (Brown Bear) | LC | VU |

#### 3.3.1.1 *Neophron percnopterus* (Egyptian vulture)

Extensive ornithological surveys carried out as part of the ESIA for this Project showed that Egyptian Vulture breeds in the Arpa Gorge (one pair) to the west of the Project-affected area (see Appendix 4.10.5 for results of bird surveys in spring and autumn

2013 and spring 2014). The relevant management unit is considered to be the foraging range for the pair and the Project-affected area overlaps with this.

The global population of Egyptian Vulture is estimated at 21,000 to 30,000 individuals (Birdlife International, 2012), the species occurring widely across Asia, Europe and Africa. The Project-affected area therefore does not meet the criteria for Tier 1 Critical Habitat under criterion 1 for Egyptian Vulture, i.e. habitat sustaining >=10% of the global population or representing one of ten or fewer discrete management units for the species.

For assessment against Tier 2 criteria it is necessary to determine whether the habitat supports a nationally important concentration (1e) or a regionally important population (1c), or whether its loss would threaten the long term survivability of the species (1d).

Populations of Egyptian Vulture occur throughout the Caucasus region and the Armenian Society for the Protection of Birds estimates the population of Egyptian Vultures breeding in Armenia to be around 55-60 pairs, perhaps now 50-55 pairs after a recent population decline in southern Armenia. One breeding pair in the Arpa Gorge cannot be considered to be a regionally or nationally important population. Furthermore, loss of one breeding pair from a global population of at least 20,000 pairs cannot be considered as threatening the long term survivability of the species.

Because there has been a rapid decline in the number of breeding pairs in the Project-affected area, however, an assessment was carried out to establish the likely significance of the Project's effects on the viability of the breeding habitat for the pair nesting in the Arpa Gorge. Detailed surveys in 2013 indicated that the birds spent up to 20% of their time on the Amulsar Mountain, suggesting that other parts of the territory were much larger or favoured for feeding or both (see Figure 5). Surveys in the 2014 breeding season showed that the pair spent most of their time (71%) in Arpa Gorge, near their nest site. They only used the Project-affected area for approximately 10% of the time they were observed being active. It is concluded that the Arpa Gorge does not support a globally or nationally important concentration and that the affected pair should have access to sufficient alternative feeding area with the Project in place to support continued breeding in future.

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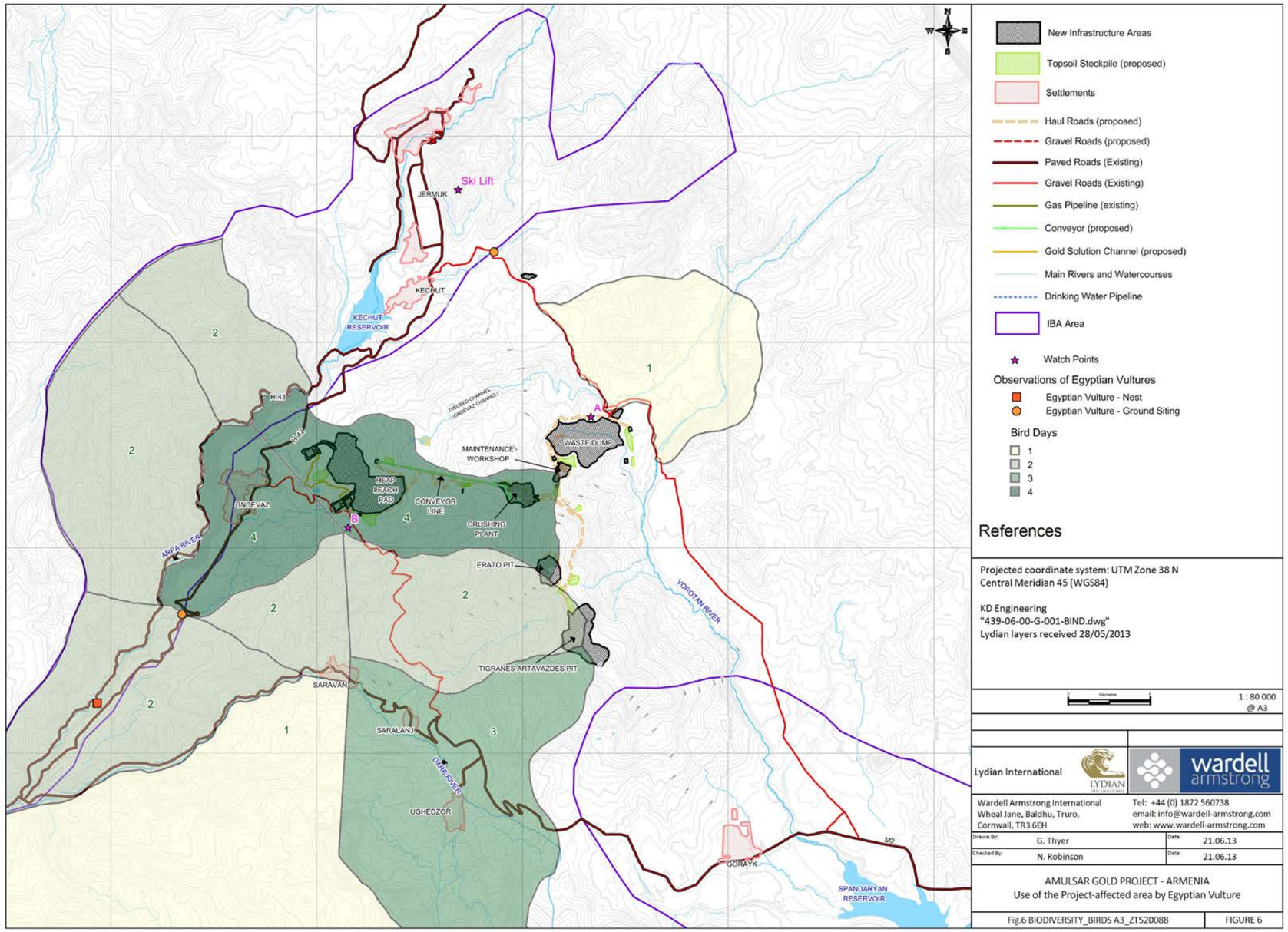



**Figure 5 Use of the Project-affected area by Egyptian Vulture**

#### 3.3.1.2 *Falco cherrug* (Saker falcon)

Saker Falcon has not been confirmed as breeding in Armenia since 1948 and had not been recorded in the Project-affected area before ornithological surveys were carried out for this Project. Several sightings were recorded during surveys, including a pair exhibiting hunting behaviour that could be consistent with a nearby nest site. However, no nest was found, and habitat suitability descriptions from its full range, indicating a strong preference for arid landscapes with an abundance of diurnal rodents as prey, suggest that the Project-affected area does not provide enough suitable habitat for breeding.

The global population of Saker Falcon is estimated at 12,800 to 30,800 mature individuals. In the context of lack of evidence for breeding, it is concluded that Saker Falcon does not meet the criteria for Critical Habitat under criterion 1 at Amulsar.

#### 3.3.1.3 *Aegypius monachus* (Cinereous vulture)

In the 2013 ornithological surveys (as reported in Chapter 4 of the ESIA), single birds were recorded within the Project-affected area on six days, suggesting that they might be from a pair breeding somewhere to the north of the Project-affected area. The available foraging area is believed to be extremely large for this species.

The global population of Cinereous Vulture is estimated at 7,200 to 10,000 pairs (Birdlife International, 2012 (2)). The number of breeding pairs in Armenia was estimated at 15-25 in the mid 1990s, occurring in Khosrov forest south of Yerevan and in the far south along the borders with Iran and Azerbaijan (Heredia, 1996).

As a species listed in the RA Red Book, only criterion 1e is potentially relevant. As there is no evidence of breeding, the habitat cannot be considered to support a nationally significant population. Therefore the assessment concludes that Cinereous Vulture does not meet the criteria for Critical Habitat under criterion 1 at Amulsar.

#### 3.3.1.4 *Circus macrourus* (Pallid harrier)

Pallid Harrier has been recorded on the Amulsar Mountain only passing through on migration: 19 individuals were recorded in the 2013 spring passage and 192 in the autumn. The Project-affected area therefore does not qualify as Critical Habitat under

criterion 1. Implications for this species were further assessed alongside other migrants against criterion 3 (see Section 3.3.3).

#### 3.3.1.5 *Milvus milvus* (Red kite)

Red Kite has been recorded on the Amulsar Mountain only passing through on migration; just one individual was recorded on the 2013 spring passage. It therefore does not qualify as Critical Habitat under criterion 1. It is assessed alongside other migrants against criterion 3 (see Section 3.3.3).

#### 3.3.1.6 *Falco naumanni* (Lesser kestrel)

Lesser Kestrel has an established breeding colony in the Gorayk area, its only breeding location in Armenia. It is one of the  species for which the Gorayk Important Bird Area was designated (Birdlife International, 2013). Lesser Kestrel's conservation status has improved and it is now listed as Least Concern on the IUCN Red List, though it remains listed as Vulnerable in the RA Red Book. The species does not meet criterion 1, but the colony is important within Armenia where it has a high public profile and is studied intensively by graduate students, as well as being used by the Armenian Society for the Protection of Birds as a resource for raising conservation awareness with school children. Baseline surveys established that much of the Project-affected area could provide important supporting habitat, in terms of spring and autumn feeding on invertebrates, to the colony and therefore to Gorayk IBA which has been treated as critical habitat. Section 6 discusses protected area considerations.

#### *3.3.1.7 Potentilla porphyrantha*

*Potentilla porphyrantha* (juz) is endemic to the southern Caucasus region and was recorded on the Amulsar Mountain during baseline surveys. It is included in the Armenian Red Book of plants (2010) and is classified as Critically Endangered by criteria D 1 ab(iii) + 2 ab(iii), reflecting the fact that the area occupied by the species in Armenia is less than 10 $km^2$ in total.

The species has not hitherto been evaluated against IUCN Red List criteria at global level, and nor was it included in the Red List of the Endemic Plants of the Caucasus (Solomon *et al*., 2014). Therefore, in accordance with IFC's Performance Standard 6 Guidance, a provisional assessment was made against the latest version 3.1 criteria,

by the Project's botanical experts in consultation with Armenian specialists, IUCN Red List specialists and the Missouri Botanical Garden (Appendix 1).

This assessment concluded that *Potentilla porphyrantha* meets two criteria for Endangered status (EN): for criterion A3a (as there is a threat of population size reduction of ≥50%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer, up to a maximum of 100 years), based on a decline in area of occupancy, extent of occurrence and/or quality of habitat; and also for criterion B2ab(ii,iii,v) as there is an Area of Occupancy estimated to be less than 500 $km^2$, and it is known to exist at no more than five locations and there is a projected decline in the area of occupancy, the area, extent and/or quality of habitat and the number of mature individuals.

The distribution of the plant is highly fragmented and the extent and quality of the habitat in which it occurs is generally considered to be declining. In addition to degradation of habitat, climate change is a possible additional threat.

The population discovered on Amulsar is important because it is one of only 5 known sub-populations globally (a 6th is known only from historic records). The population on Amulsar brings the number in Armenia to three (others are at Mets Ishkhanasar and Geghama mountains: Sevsar and Agusarka). Other sub-populations are in northern Iran.

The sub-population on Amulsar Mountain is therefore believed to meet the threshold for Tier 1 critical habitat under criterion 1b (habitat with known, regular occurrences of CR or EN species where that habitat is one of 10 or fewer discrete management sites globally for that species).

It is not known whether the DMU on Amulsar Mountain sustains ≥ 10 percent of the global population because it is the only population for which a detailed population census has been carried out. However, Amulsar represents approximately 60% of the known global Area of Occupancy for the species.

The Amulsar population is the strongest known in the country and therefore must be considered to be nationally important. The Armenian Red List was prepared on the basis of IUCN criteria, so Amulsar Mountain is also considered to be critical habitat under criterion 1e.

#### *3.3.1.8 Ursus arctos (*Brown Bear*)*

The Brown Bear *Ursus arctos* is a protected species in Armenia and is included in the national Red Data Book with a status of Vulnerable. Although classified as Least Concern by IUCN, it is listed in Annex IV of the EU Habitats Directive, which means that degradation of its habitat is prohibited under EU law. This is of significance to the Project because of its commitment to comply with the EBRD PR - which assume compliance with EU law.

Initial baseline ecological surveys in 2008 noted the presence of Brown Bear but concluded that individuals were passing through the Project-affected area occasionally. Further ecological surveys carried out as part of the ESIA for Amulsar since 2011 have confirmed that a breeding population of bear is present. Initial field surveys took place in autumn 2011 along 5-7 km long linear routes or transects designed to include all biotopes considered to form suitable habitat for both large and medium sized animals in the Project-affected area. Further surveys were undertaken by the Armenian Institute of Zoology during 2013.

The results of these surveys suggested that five or six adult bears might be present, based on scats and other signs and direct observations. Bears have been observed relatively frequently by workers at the mine camp and are known to hibernate in various dens on the mountain. In spring 2014 two different females with cubs were observed and video footage obtained (see Figure 6). Further, a more comprehensive survey in 2015 (for which final results of data analysis are not yet available) confirmed that the number of bears regularly associated with Amulsar Mountain is at least 10, including two breeding females, five associated young and three males. Key areas are the Arshak set-aside where confirmed breeding dens are located and the woodlands north of Saravan on the western flank of Amulsar Mountain.

Based on these findings, the Project-affected area is determined to be critical habitat for Brown Bear in relation to EBRD PR6 and its reference to the EU Habitats Directive.

As IFC's PS do not require adherence to the EU Habitats Directive, this species does not trigger critical habitat requirements under PS6.

**Figure 6 Mother with two cubs at Amulsar, 2014**

### 3.3.2 Assessment against Criterion 2 for Endemic and Restricted Range Species

The Project-affected area supports some species which are endemic to the Caucasus Region. An endemic species is defined for this purpose as one that has ≥ 95 percent of its global range inside the country or region of analysis (paragraph GN79, IFC 2012b).

The whole of Armenia falls within a Birdlife International Endemic Bird Area, reflecting the importance of the Caucasus as a centre of bird endemism (see ESIA Section 4.1.2). However the Caucasus region does not align with the regional concept in critical habitat criteria, and the restricted range species giving rise to the EBA status (*Tetrao mlokosiewiczi*, *Tetraogallus caucasicus*, *Phylloscopus lorenzii*) are not present in the Project-affected area.

In addition to *Potentilla porphyrantha*, there are a number of plant species within affected vegetation types which are regional endemics, either within the Trans-Caucasus (TC) or the Caucasus (C) including: *Astrantia maxima Pall*.,(C) *Huynhia*

*pulchra* (Willd. ex Roemer & Schultes) Greuter & Burdet (Syn.: *Macrotomia echioides* (L.)(C), *Noccaea tatianae* (Bordsz.) F.K. Mey. (= *Carpoceras tatianae* (Bordz.) Grossh.) (TC), *Cerastium szowitsii Boiss*. (Syn.: *C. araraticum Rupr*.)(TC), *Hylotelephium caucasicum* (Grossh.) *H. Ohba* (= *Sedum caucasisum* (Grossh.) Bor.)(C), *Sedum gracile* C.A. Mey (C)., *Sempervivum transcaucasicum* Muirhead (C), *Cephalaria gigantea* (Ledeb.) Bobrov (C), *Scabiosa caucasica* M. Bieb.(C), *Anthyllis lachnophora Juz*. (= *Anthyllis boissieri* (Sagorski) Grossh)(C), *Vicia alpestris Steven*(C), *Tulipa Julia* k. Koch (TC), *Iris demetrii* (TC), *Papaver orientale* L. (C), *Delphinium flexuosum* (C), *Delphinium freynii conrath* (TC), *Crataegus caucasica* C. Koch (C), *Saxifraga cartilaginea* Willd. ex Sternb. (C), *Linaria schelkownikowii* Schischk. (TC) and *Rhynchocorys orientalis* (L.) Benth. (C). *Fritillaria armena* Bois. var lucida Hausskn. et Bornm *(also called Fritillaria caucasica* Adam and *F.tulipifolia* M.Bieb.) is another Caucasus endemic species which occurs in just one location within the Project-affected area, under the proposed conveyor route. However, none of these species have more than 1% of their global range in Armenia, and therefore they do not have critical habitat within the Project-affected area under criterion 2.

The reptile *Montivipera raddei* (Armenian viper), recorded in baseline surveys, is present in parts of Eastern Turkey, Armenia, Nakhichevan (Azerbaijan), Iraq, and fragmented populations in the mountains of northwestern Iran (Göran Nilson *et al*, 2009). Its distribution has been assessed against criterion 2 through analysis of Extent of Occurrence (EOO). The EOO of Armenian Viper is approximately 360,000 km$^2$, well above the threshold of 50,000km$^2$ specified for criterion 2b. On this basis, the species does not have critical habitat in the Project-affected area.

### 3.3.3 Assessment against Criterion 3 for Migratory and Congregatory Species

Quantitative thresholds to establish whether an area of habitat meets Tier 1 or Tier 2 thresholds for criterion 3 are presented in Table 7. The total number of each species of migratory raptor passing Amular Mountain in spring 2013 is compared with global population estimates of the species in Table 9.

**Table 10 Assessment of migratory raptor numbers (base on data from spring 2013)**

| Species[3] | Total | % of global population estimate[4] |
|---|---|---|
| Common Buzzard | 1,554 | 0.03885 |
| European Honey-buzzard | 1,340 | 0.3350 |
| Montagu's Harrier | 222 | 0.1332 |
| Black Kite | 189 | 0.0071 |
| Western Marsh-harrier | 161 | 0.0161 |
| Eurasian Sparrowhawk | 155 | 0.0103 |
| Steppe Eagle | 112 | 0.2800 |
| Common/Lesser Kestrel | 89 | 0.0018 |
| Levant Sparrowhawk | 80 | 0.8000 |
| Long-legged Buzzard | 69 | 0.0690 |
| Booted Eagle | 59 | 0.1475 |
| Common Kestrel | 56 | 0.0011 |
| Lesser Spotted Eagle | 42 | 0.0894 |
| Eurasian Hobby | 38 | 0.0095 |
| Lesser Kestrel | 24 | 0.0288 |
| Eurasian Griffon Vulture | 21 | 0.0913 |
| Merlin | 20 | 0.0015 |
| Pallid Harrier | 19 | 0.1727 |
| Eastern Imperial Eagle | 5 | 0.1007 |
| Short-toed Eagle | 5 | 0.0057 |
| Egyptian Vulture | 3 | 0.0134 |

[3] From ornithological report, 2013, Table 3b, taxa not identified to species level omitted

[4] From Birdlife International Species Factsheets; where population estimates are given as ranges, the 33% point is used, e.g. range 10,000-100,000, then 40,000 is used.

| Species[3] | Total | % of global population estimate[4] |
|---|---|---|
| Peregrine Falcon | 3 | 0.0003 |
| Golden Eagle | 2 | 0.0012 |
| Northern Goshawk | 2 | 0.0004 |
| Red-footed Falcon | 2 | 0.0004 |
| Cinereous Vulture | 1 | 0.0063 |
| Oriental Honey Buzzard | 1 | 0.0003 |
| Red Kite | 1 | 0.0022 |
| Saker Falcon | 1 | 0.0053 |

No species reaches the 1% of global population threshold specified in PS6 criterion 3b. The total number of migratory raptors passing Amular Mountain in spring 2013 was 4536. This number is significantly below the 20,000 threshold for evaluation as a bottleneck site under criterion 3c[5]. Based on these assessments, no critical habitat has been identified in the Project-affected area under criterion 3. Results from further surveys carried out in Autumn 2013 did not alter this conclusion.

### 3.3.4 Assessment against Criterion 4 for Threatened Ecosystems

Evaluation against criterion 4 is challenging in the Armenian context because of its geographical position and sparse information on habitat extent in the region. The EUNIS (European Union Nature Information System) classification was found to be inapplicable here because many of the Caucasian habitats present have not been described as part of EUNIS. While some of the habitats present, in the groups Montane Meadows and Sub-alpine Meadows, appear to be local equivalents of types that are assessed as Annex 1 Priority Habitats from the EU Habitats Directive, and therefore

[5] The 20,000 threshold is part of Birdlife International's criterion A4, referenced in Critical Habitat criterion 3c, see Table 7

could be regarded as threatened ecosystems in the context of criterion 4, data on the extent and level of threat of these habitats in the region are currently lacking.

A large programme of work involving extensive surveys in the wider region would be required in order to evaluate these habitats robustly. It would be necessary to develop a more detailed habitat classification for the Caucasus than is currently available, to enable evaluation of habitats present in the Project-affected area and its immediate surroundings against emerging IUCN threatened ecosystems criteria. No critical habitat in the Project-affected area under criterion 4 has been identified.

### 3.3.5 Assessment against Criterion 5 for areas associated with key evolutionary processes

No critical habitat under criterion 5 is considered to be present on Amulsar Mountain, though this situation could change if a genetically distinct sub-population of Brown Bear was confirmed.

### 3.3.6 Assessment against additional criteria

PS6 guidance emphasises that the determination of critical habitat is not necessarily restricted to the five listed criteria. Examples of other considerations are given, including the presence of Key Biodiversity Areas (KBAs). Important Bird Areas (IBAs) are types of KBA selected using scientific criteria developed by Birdlife International.

Two IBAs are present in the Project vicinity although neither are directly affected by the Project footprint, Gorayk IBA to the south and Jermuk Gorge IBA to the north-west (Birdlife International, 2013). The trigger species for these IBAs do not trigger critical habitat in their own right and the IBAs are not considered to constitute critical habitat. However they have been treated as critical habitat in terms of applying the mitigation hierarchy to Project impacts, including avoidance of Project footprint (see Section6).

## 3.4 Summary of Critical Habitat Affected by the Project

Table 10 summarises the criticah habitat affected by the Project. One area of Tier 1 critical habitat is identified on the Amulsar Mountain, selected for the plant *Potentilla porphyrantha* under criterion 1b.

The Project-affected area is classified as critical habitat for Brown Bear in relation to EBRD's PR6 and its reference to the EU Habitats Directive, in relation to which Brown Bear is an Annex IV species. Brown Bear is also listed as VU in the RA Red Book.

It is possible that, with improved contextual information, some parts of Amulsar Mountain will also qualify as critical habitat under criterion 4, threatened ecosystems, but regional data deficiencies preclude this assessment at present.

Effects on supporting habitat for Gorayk IBA are possible. Although the Project will not encroach on these IBAs, the implications of the Project for adjacent habitat that may provide a supporting role has been considered and mitigation measures have been identified if necessary.

**Table 11 Summary of Critical Habitat Affected by the Project According to the Criteria in PS6**

| Feature assessed | Relevant Criteria | Conclusion | Tier |
|---|---|---|---|
| *Neophron percnopterus* (Egyptian Vulture) | 1(c,d,e) | X | |
| *Falco naumanni* (Lesser Kestrel) | Additional | X | |
| Migrant birds | 3 | X | |
| *Ursus arctos* (Brown bear) | 1b | **Present** | - |
| *Potentilla porphyrantha* | **1b** | **Present** | **1** |
| Sub-alpine meadows | 4 | X (?) | |
| IBAs | Additional | Treat as critical | |

The same conclusions are considered appropriate to comply with the requirements of EBRD's PR6.

# 4 Impacts on Critical Habitat for *Potentilla porphyrantha*

A suitable Discrete Management Unit (DMU) was identified for *P. porphyrantha* habitat as shown in Figure 7. Amulsar Mountain is not within a Protected Area. The appropriate DMU for critical habitat for *Potentilla porphyrantha* is considered to be defined by the extent of Sub-alpine Meadow with Alpine Elements habitat in which the species occurs on suitable rock substrate.

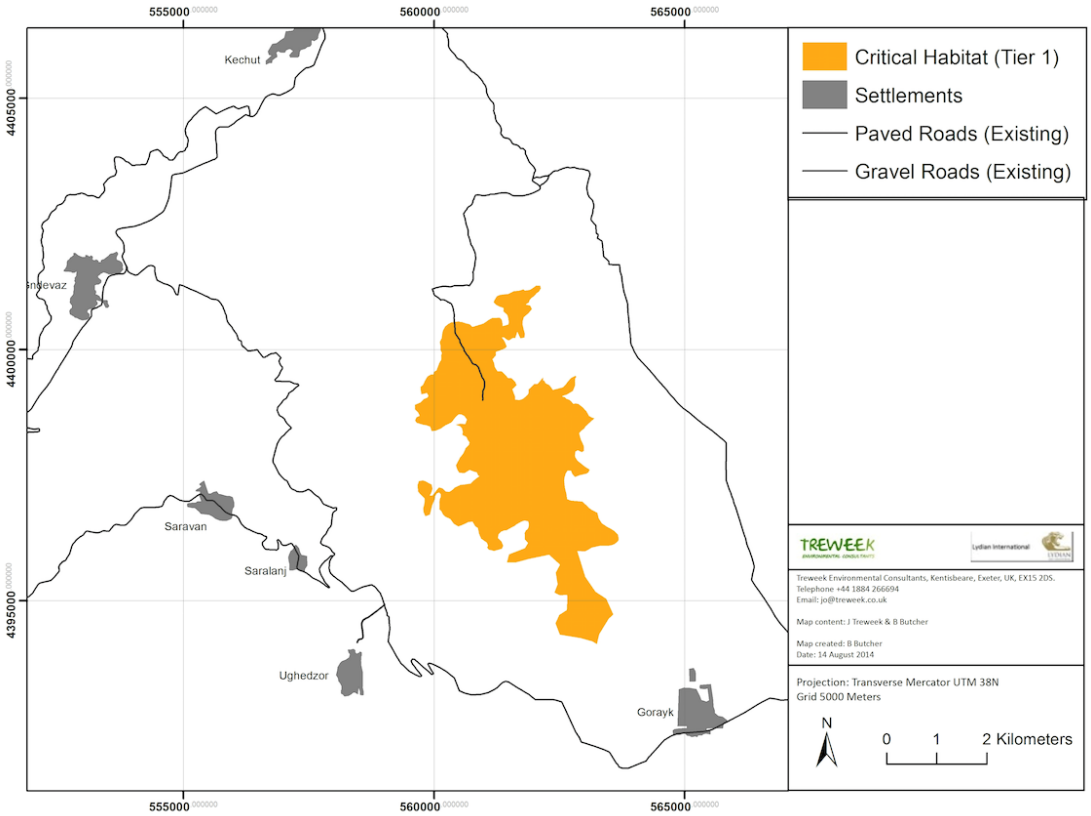



**Figure 7 *Potentilla porphyrantha* Critical Habitat**

All plants found have been found on rocky outcrops, boulders and scree within this habitat. GN6 for PS6 (IFC, 2012b) suggests that a single coherent area should be defined rather than a series of small areas tightly defined around individuals' locations. The DMU therefore comprises the rocky habitats on which the species is found and the Sub-alpine Meadows with Alpine Elements surrounding these habitats. On this basis the Tier 1 Critical Habitat for *P. porphyrantha* covers 1200 hectares.

## 4.1 Project Impacts

The Project's physical footprint on Tier 1 critical habitat, selected for the plant *P. porphyrantha*, is 150.5 hectares, representing 12.5% of the total area of critical habitat (Figure 8). The Project will remove the proportion of the population within the mine pit areas and further impacts may occur on remaining plants due to reduced habitat quality caused by fugitive dust and changes in microclimate around the rock outcrops supporting them.

There are 1560 plants within the footprint of the mine pits on Tigranes, Artavadzes and Erato, representing 33% of the recorded plants and 21% of the estimated sub-population on Amulsar. There are an additional 607 plants within the approximately 50m buffer zone around the working areas, and 1621 plants in the additional restricted area. It was not possible to count the entire population due to difficulties of access, many plants being located on steep cliff faces on the southern end of Amulsar Mountain. In terms of the global Area of Occupancy five of the 32 4km$^2$ grid cells are partly covered by the Project's physical footprint.

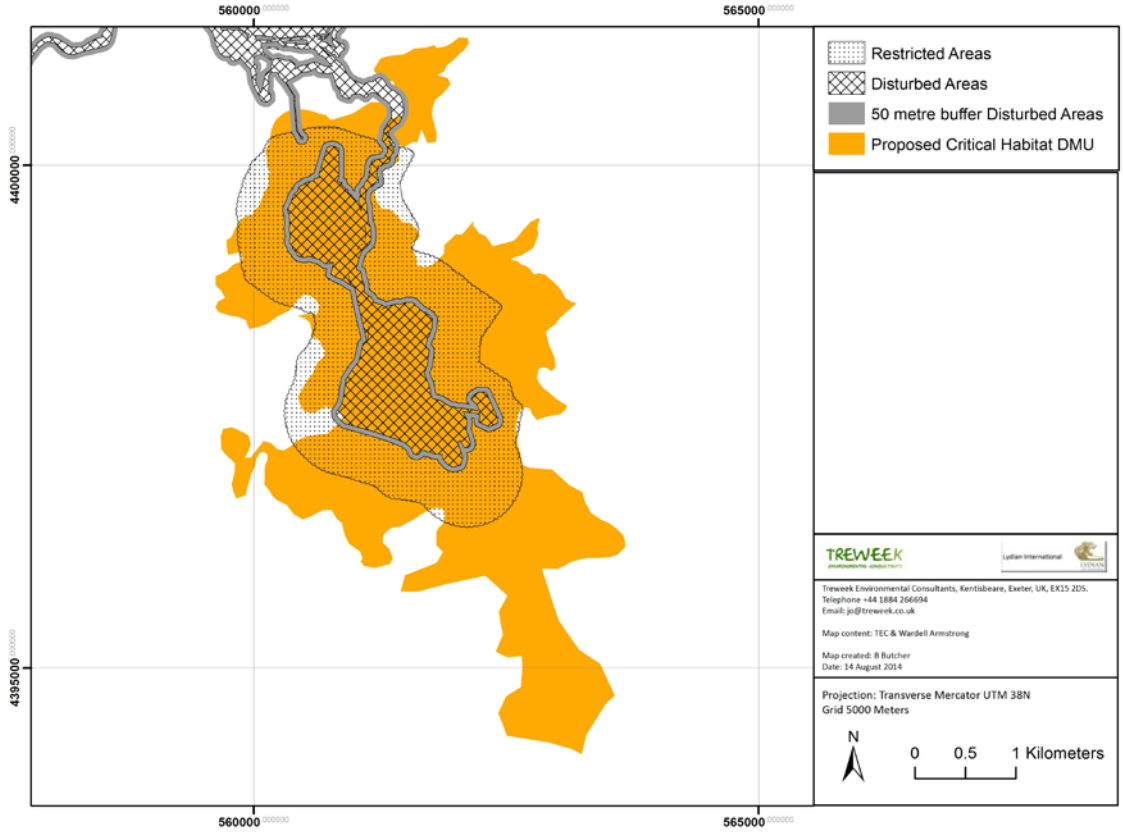



**Figure 8 Project Footprint on Critical Habitat for *Potentilla porphyrantha***

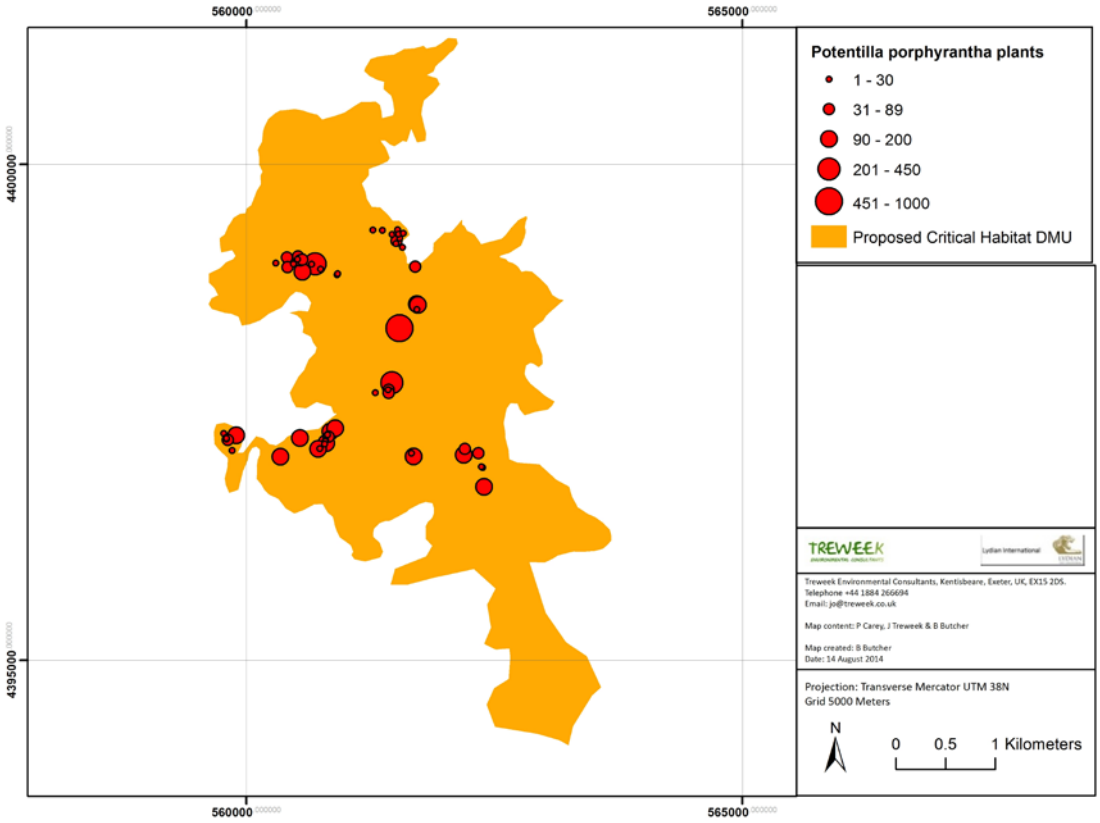



**Figure 9 Distribution of *Potentilla porphyrantha* plants**

## 4.2 Mitigation Strategy

The mitigation strategy for *P. porphyrantha* is described in detail in a Species Action Plan (SAP) that forms part of the Project's Biodiversity Action Plan (BAP). This includes a scientific research programme to determine the exact environmental requirements of the species and the optimum means of *ex-situ* conservation and re-introduction. The proposed strategy is summarized below.

### 4.2.1 Avoidance

Performance Standard 6 (IFC, 2012a) requires Projects potentially affecting critical habitat to demonstrate that it is not possible to avoid areas of critical habitat through viable alternative options in the region for Project development on habitats that are not critical. Complete avoidance of critical habitat was not possible as the gold-bearing strata are at the top of the mountain, coincident with the distribution of the plant. There

are no viable alternatives to the location of the mine but a large proportion of the sub-population will be avoided as it is outside the infrastructure footprint. Protection to a proportion of remaining plants has been afforded through a set-aside, within which no Project activities will take place. This incorporates the southern part of the critical habitat, and once the boundary has been finalised it will safeguard the remaining proportion of the *P. porphyrantha* population on Amulsar as well as other important biodiversity receptors. This was illustrated in Figure 1.

To the extent possible, the design of the mine footprint has been adapted based on survey results to avoid habitat with a high density of plants. For example, efforts have also been made to design mine access roads and other infrastructure so that they avoid concentrations of the plant. Figure 10 shows the mine pits: the design for the pit on Erato and the roads leading into it was altered partly to minimise removal of rocks with *P. porphyrantha* growing on them (red line is the boundary of the mine pit; brown lines are internal contours; green lines are roads; black dots represent locations of *P.porphyrantha* plants).

Destruction of plants within the mine pits has been avoided through a translocation process under a permit issued by the Ministry of Nature Protection. These plants will be used for collaborative research with the RA Institute of Botany as detailed in the Species Action Plan.

A small number of plants were collected on June 10th 2015 from the tracks at the top of Artavadzes where the plant had begun to grow in 2014 and 2015. These plants were in imminent danger of being destroyed by vehicles. The plants were dug out of the track by carefully prising apart the rocks and excavating with a small fork and transferred to a tray filled with soil from the top of the mountain, within seconds of being dug out.. A further nine plants were collected on June 11th 2015 and transferred to Sevan Botanic Garden where a purpose-built glass-house has been constructed, as well as an experimental rockery. On September 14th 2015 the collection of plants from Artavadzes and Tigranes began in earnest in difficult terrain. The plants were individually checked for seeds. If seeds were present they were transferred to a packet. Each plant had its own packet so that genetic analysis could be carried out at a later date. The packets were labelled as either Tigranes or Artavadzes. Once seed had been collected rocks were broken apart using hammers and chisels. Soil around the plants was cleared

away using 5mm wide laboratory spatulas, so that the roots could be better freed from the rock crevices. Collection was completed on 23rd September 2015. Plants were often removed as a clump from the rock and were only separated on planting into pots at the Sevan Botanical Garden The total number of plants collected was therefore unknown until plants were potted up.

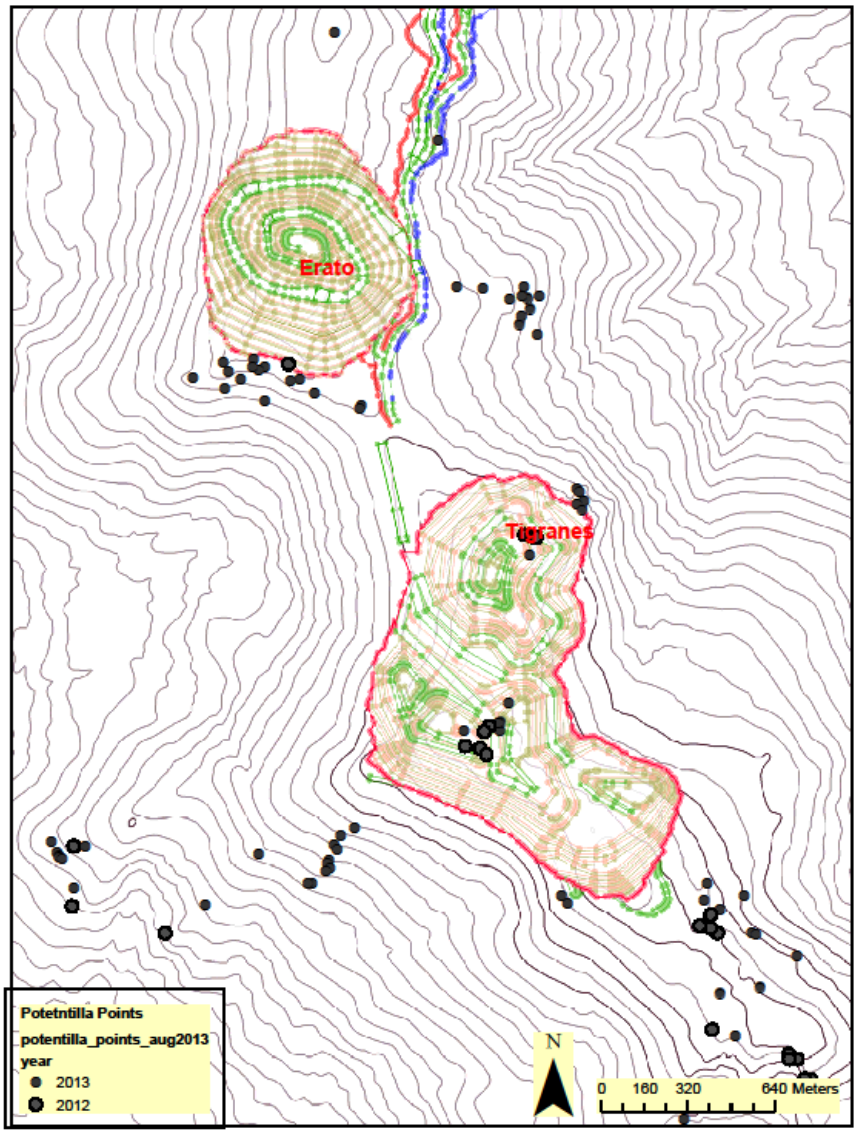



**Figure 10: Design of mine pits to avoid *P.porphyrantha***

The total number of plants collected was 1685. On 31st October 2015 there were 845 plants in pots in the glasshouse, two of which had died by December 2015. 172 plants collected from Artavadzes are on one rockery and 191 plants collected from Tigranes are on the other rockery at Sevan Botanical Garden (363 plants on rockeries in total). There are 477 plants being stored temporarily in boxes filled with soil and kept in the glasshouse for subsequent work on the North Erato rockeries in the spring of 2016 and as replacements for any plants that die in pots.

Surveys in 2013 and 2014 meant that the locations of most plants were known before collection started. However, to ensure no areas with *P.porphyrantha* were missed a search strategy was developed. The area at the top of Tigranes and Artavadzes was divided into sections on a map and each was searched systematically after collection had finished to count any plants that were either inaccessible or too difficult to remove from rocks. The smaller zones are where high concentrations of plants were known to exist whereas the larger areas are where it was almost certain no plants would be found. Georeferenced photos were taken of each zone. Survival rate of translocated plants will be monitored. As well as research, plants will be used to test different forms of propagation so that sufficient plants are available to achieve net gain when restoration takes place post-mining (see Section 4.4).

## 4.3 Minimisation

Preventing destruction of plants due to activities and impacts outside the direct mine footprint is essential and measures have already been taken in the pre-development phase to minimise incidental damage by protecting plants with fencing and signs. Boulders supporting plants which are outside areas of essential land clearance, such as the fringes of Erato Pit have been marked and regular inspection and monitoring by an on-site environmental officer and senior environmental & social manager will be undertaken to ensure compliance. These measures will be consolidated and maintained throughout construction and operation. A marking system has been devised to identify rocks supporting plants which are proposed to be translocated and also rocks close to the proposed edges of pits where remaining plants might be at risk of collateral damage. In August 2013 different faces of rocks which were known to support plants of *Potentilla porphyrantha* were sprayed with large green painted dots,

that are visible from over 200m, to ensure that they are clearly visible to workers (see Figure 11). The markings will be monitored and re-painted as necessary. All of these measures are covered in the Species Action Plan for *Potentilla porphyrantha.*

**Figure 11 Rocks marked with green paint to indicate *P. porphyrantha* plants**

## 4.4 Restoration

Options for creating suitable conditions post mine-closure will be defined based on results of research. A programme of research and study has been developed to improve knowledge of the ecological requirements of *P. porphyrantha* and to support development of an effective restoration programme. A population model is being developed which will provide estimates of likely recovery time for the population. This will draw on the results of monitoring of plants remaining *in situ* during construction and the early phases of operation. A precautionary approach will be used. Scope to re-introduce plants post-mining depends on the conditions that can be created in the back-filled mine pits, the suitability of new micro-climatic conditions and whether it is possible to create suitable large boulders on which the plants can grow. As indicated in the preliminary Mine Reclamation, Closure and Rehabilitation Plan (pMRCMP,

Appendix 8.19), the goal is to retain rocky cliffs at the lip of the mine pits which will be able to support *P. porphyrantha*, but these may interfere with ground hydrology and further research is required.

It may be also possible to leave boulders of a suitable size, orientation and moisture-holding capacity on the surface of the substrate filling the pits. Moss will be introduced to the new boulders and, once this has established, *P. porphyrantha* plants and/or seeds could be planted in the moss to start the colonisation process. Seed will be collected from Amulsar plants for experimental growing of plants *ex-situ*, for potential re-introduction to the mine sites on closure. Plants from seed and/or transplanted stock will be re-introduced. Suitable techniques will be confirmed during the research programme being undertaken between 2014 and 2018.

The current research programme for *P.porphyrantha* that includes a scientific programme to determine the exact environmental requirements of the species and the optimum means of ex-situ conservation and re-introduction is described in the Biodiversity Action Plan (BAP). The BAP includes a draft Species Action Plan for *P.porphyrantha* which will be enhanced and updated as the research programme progresses.

### 4.4.1 Offsets

The need for offsets will be reviewed following a phase of monitoring. Mine development is phased over time and allows for a period of monitoring and research to refine population models that are being developed to support estimates of the time needed for the population to recover post-mining, with or without re-introduction of plants. Current models predict that it should be possible to restore the number of *Potentilla porphyrantha* plants to above pre-mining levels if post-mining restoration can generate suitable rock-substrate. However this is contingent on effective translocation of plants, which is currently being tested. If offsets do prove necessary, the most likely option is to seek formal protection for a population of the species to avert future risks of damage. The Project undertook some expeditions during 2015 to search for other populations of the plant in Armenia, with a view to improving knowledge of its conservation status in the country (and therefore also at a global level) but no additional populations were discovered. Surveys will continue during 2016, to access areas that were inaccessible in 2015 due to poor weather.

## 4.5 Conclusions

Paragraph 17 of PS6 requires that, in cases where critical habitat is impacted,

1. "The Project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;" and
2. "The Project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time;" and
3. A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program.

The extensive and long-term research and reintroduction programme on the exact environmental requirements of the species should ensure that the Project will result in no measurable, long-term adverse effects on the species. Dependence on moisture, snow cover persistence and absence of airborne particle deposition are parameters that require particular investigation, in the context of potential local climate effects arising from the removal of the mountain tops by mining and risks of dust pollution from blasting and extraction vehicle movements. The set-aside should ensure that *P. porphyrantha* locations in the southern part of the critical habitat DMU in the Arshak area will remain unaffected. Monitoring required to confirm this is described in the Species Action Plan referred to above, as is an adaptive management plan to address any unforseen effects observed in the set-aside.

Under the Project design a large proportion of the habitat supporting *P.porphyrantha* will be maintained. With planned new rocky outcrops after mine closure the area of suitable habitat could be increased above current levels. The lifetime of the mine is anticipated to be around 14 years (including the closure period) but could be longer (see ESIA section 3.12). Although it is known that the plant is a long-lived perennial, the precise longevity of the species is unknown.

There will be a measurable negative impact on a proportion of the critical habitat in at least the short-term, although current theory would suggest that a viable sub-population will persist despite this. Large decreases in plant populations are not catastrophic if seed production and germination are not limited and there are suitable sites for plants to colonise. There can be issues if one part of a plant population acts as the source of

seed and the rest of the plant population persists because it receives seed from this source. Observations of *P. porphyrantha* plants in 2012 at Amulsar show that seed production can be high, although seed production was lower in 2013.There is no reason to believe that the part of the population that will be lost due to the mining operation is the only source of seed for the sub-population on Amulsar Mountain. There will be enough remaining rocky outcrops to provide habitat to maintain the sub-population while the mine operation takes place and there is the opportunity to create new habitat afterwards, allowing for a net gain in population size in the longer term.

A biodiversity monitoring and evaluation programme (BMEP) has been incorporated into the proponent's management systems. The science research programme for *P. porphyrantha* and the biodiversity monitoring and evaluation programme will be undertaken by collaboration between in-country teams, external experts (Treweek Environmental Consultants with Bodsey Ecology Ltd) and academic institutions including the University of Cambridge and RA NAS Institute of Botany.

In conclusion, no other viable alternatives within the region exist for development of the Project on modified or natural habitats that are not critical. The adverse effects arising from the Project on critical habitat will be measurable in the short-term but are theoretically reversible in the medium to long term. This should mean that the critical habitat's ability to support the identified biodiversity values and ecological processes will remain in the longer term and that a viable population of *Potentilla porphyrantha* could remain in Amulsar Mountain with net gain in numbers in the longer term.

# 5 Impacts on Brown Bear and Proposed Mitigation Strategy

Ecological surveys carried out as part of the ESIA have confirmed that a breeding population of Brown Bear is present in the area. The construction of the mine would introduce a major source of disturbance into the habitat of approximately ten bears. In addition to possible loss of hibernating dens, there would be some loss of foraging area. Haulage roads and the conveyor may act as a barrier, making it difficult for bears to range widely enough to find food, particularly cubs. The mine will operate day and night and there will be elevated levels of noise and lighting.

While the Arshak set-aside will protect some bear habitat (for up to two breeding females and associated young) the available foraging area may no longer be sufficient with the mine in place, assuming that the bears are not displaced anyway due to disturbance during construction. For purposes of safeguarding Brown Bear habitat on Amulsar Mountain itself, conservation of bears would also be necessary within the woodlands north of Saravan, on the western flank of Amulsar Mountain. Scope for incorporating this area into the set-aside or working with local communities to reduce disturbance in this area will be considered when the set-aside boundary is formalised.

The Project-affected area is considered critical habitat for Brown Bear according to PR6, because the species is listed in Annex IV of the EU Habitats Directive. This means that the Project must ensure (i) that the ecological functionality of breeding sites and resting places for Brown Bear are not damaged or destroyed; and (ii) that the Project will not result in disturbances that affect the species' survival or breeding success, or reduce its area of occupancy.

The formulation of necessary measures to ensure net gain with respect to the Brown Bear population will depend on the results of the forthcoming surveys. However, it is already known that fragmentation and isolation of sub-populations is a threat to bears in Armenia; thus the mitigation (and any offset) commitments will need to focus on provision of safe, suitable habitat (protected from hunting) and the establishment of safe movement corridors to link populations and allow inter-breeding. In particular, safe, suitable habitat can be set aside close to the Project-affected area since important bear numbers are already present there. Figure 12 shows the recommended area, which includes the Arshak set-aside but is extended to include the southern flank of Arshak as well as the woodland north of Saravan, both areas where bears were successfully rearing young in 2015. These are areas that would benefit from conservation, for example through management agreements with the local villages. Stakeholder Engagement is important to promote bear conservation but could also benefit communities concerned about health and safety risks from bears if they are displaced during construction or operation.

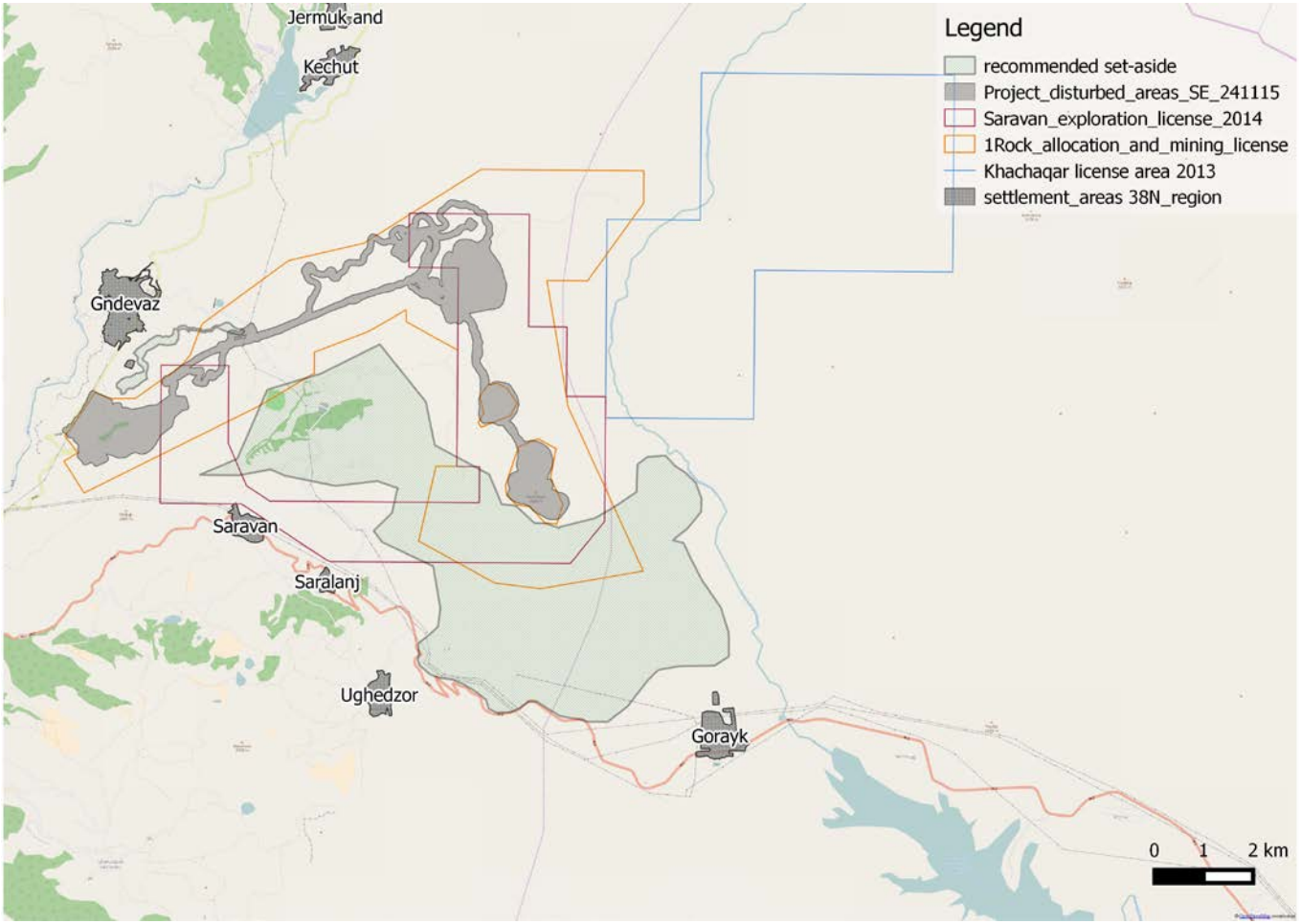



**Figure 12. Recommended Set-aside area for Brown Bear**

Organisations actively involved in bear research and conservation in Armenia include WWF and also the World Land Trust and FPWC with NACRES being actively involved in related research in Georgia. The World Land Trust and FPWC are currently involved in initiatives in Armenia to develop corridors for large carnivores including bears but there do not appear to be any definite proposals in place.

If biodiversity offsets prove necessary for residual impacts on Brown Bear, (as well as other species associated with natural habitat such as Eurasian Lynx, Grey Wolf and Bezoar Goat), preliminary results of baseline survey in the proposed Jermuk National Park / Natural Habitat Offset suggest that it will be possible to offset impacts on these species, as they all have suitable habitat present and are also adversely affected by hunting, over-grazing and road-construction. Through targeted interventions to control these threats and pressures within the proposed National Park, it should be possible to increase the potential of this area for these species and demonstrate a net positive impact. The required gain will be quantified and proposals for positive outcome finalised in summer 2016, when all survey data including the results of genetic testing are analysed.

The mitigation strategy for Brown Bear is developed in detail in a Species Action Plan (SAP) that is part of the Project BAP.

# 6 Impacts on Legally Protected and Internationally Recognised Areas

The Project is not located in a legally protected or internationally recognised area as defined by paragraph 20 of PS6 and associated guidance.

As noted in Section 3.3.6, two Important Bird Areas lie to the north-west and south of the Project area. A proposed Jermuk National Park, to the north-west of the Project area (see Figure 3), offers strong potential for the development of biodiversity offsets for the Project's significant residual impact on natural habitat. This area also has designations for the protection of water and forest resources under Armenian legislation which would be incorporated within the Park.

# 7 References Cited

BirdLife International 2012 (1). *Neophron percnopterus*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <http://www.iucnredlist.org/>. Downloaded on **14 February 2013**.

BirdLife International 2012 (2). *Aegypius monachus*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on **20 June 2013**.

BirdLife International (2013) Important Bird Areas factsheet: Gorayk. Downloaded from <http://www.birdlife.org> on 04/07/2013.

Calvignac, S., Hughes, S. and Hänni, C. (2009), Genetic diversity of endangered brown bear (*Ursus arctos*) populations at the crossroads of Europe, Asia and Africa. Diversity and Distributions, 15: 742–750.

EBRD, 2008. Performance requirements and guidance for clients, European Bank for Reconstruction and Development, http://www.ebrd.com/pages/about/principles/sustainability/requirements.shtml (Accessed 10 December 2012)

Göran Nilson, Claus Andrén, Aziz Avci, Ferdi Akarsu 2009. *Montivipera raddei*. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <http://www.iucnredlist.org/>. Downloaded on **29 April 2013**.

Heredia, B. 1996. Action plan for the Cinereous Vulture (*Aegypius monachus*) in Europe. In: Heredia, B.; Rose, L.; Painter, M. (ed.), *Globally threatened birds in Europe: action plans*, pp. 147-158. Council of Europe, and BirdLife International, Strasbourg.

IFC, 2012a. Performance Standard 6. Performance standards and guidance notes – 2012 edition, International Finance Corporation, http://www1.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/IFC+Sustainability/Sustainability+Framework/Sustainability+Framework+-+2012/Performance+Standards+and+Guidance+Notes+2012/ (Accessed 15 December 2012)

IUCN, 2001. IUCN Red List Categories and Criteria Version 3.1., International Union for Conservation of Nature, Gland, Switzerland.

Murtskhvaladze, M., Gavashelishvili, A. and Tarkhnishvili, D. (2010), Geographic and genetic boundaries of brown bear (*Ursus arctos*) population in the Caucasus. Molecular Ecology, 19: 1829–1841

Republic of Armenia Red Book, 2011.

## Appendix 1 – Proposed Global Assessment of *Potentilla porphyrantha* Juz. (information available November 2014)

This forms the basis of an IUCN Red List Assessment.

### A.1 Taxonomy

PLANTAE

TRACHEOPHYTA

MAGNOLIOPSIDA

ROSALES

ROSACEAE

*Potentilla porphyrantha* Juz.

A possible synonymous species has come to the attention of the assessors during the work for an ESIA. This species is *Potentilla cryptophila* Bomm.

### A.2 Assessment Information

Red List Category and Criteria: EN A3c, B2a,bii&biii ver 3.1

Assessor: P Carey (with advice from K.Batsatsashvili, G.Fayvush, J.Noroozi, G.Schatz)

Justification: *Potentilla porphyrantha* Juz. has only been recorded from six sub-populations in the Caucasus (three in Armenia, two in Iran, one in Azerbaijan (Nakhichevan). The Azeri population is only known from an historic record. The area of occupancy is 48 $km^2$ based on occupied 2x2 km grid cells. It is found growing on moss cushions on rocky outcrops/boulders and sub-nival screes at altitudes above 2700 m. The main threat is climate change, and because this threat is universal across the extent of occurrence the population should be considered as a single entity for criterion B. A new sub-population was discovered in 2012 during the ESIA for a mining

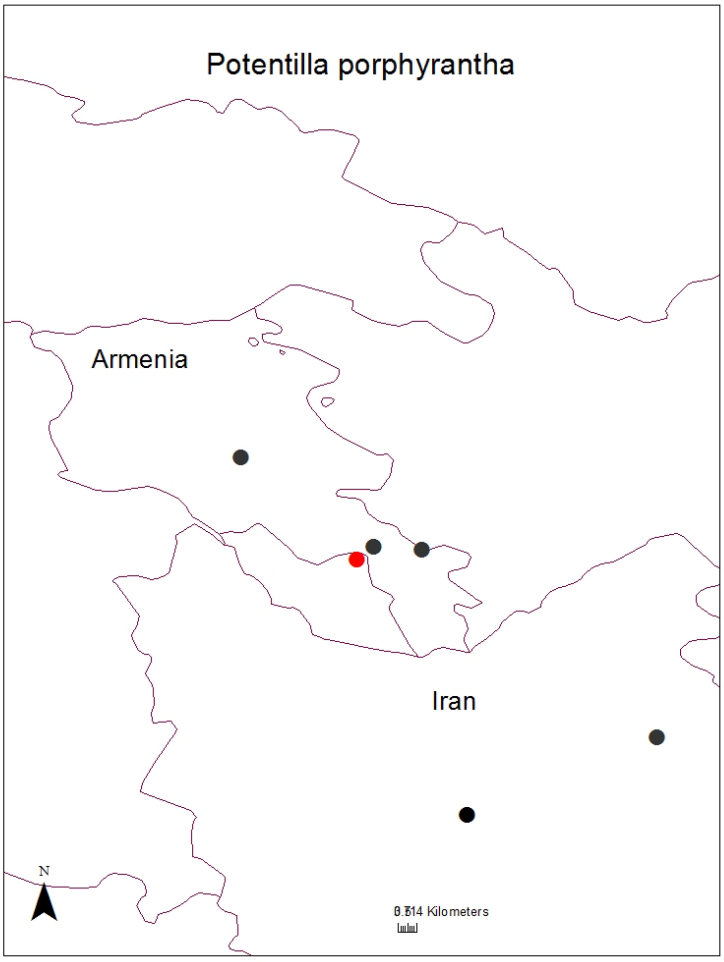
development and this accounts for 66% of the AOO. 50% of the global AOO of this species is now threatened by the mining development for which the ESIA was undertaken if there is no avoidance or mitigation strategy. In Armenia loss of habitat and plant collection could also be a threat. The species is grown as a garden plant, especially in the USA. The provenance of the garden plants is unknown. This species was not evaluated for the Red List of the Endemic Plants of the Caucasus (Solomon *et al* 2013).

### A.3 Geographic Range

Range description: The species was previously thought to have an Area of Occupancy of <10 $km^2$ (Armenia - Tamanyan *et al* 2010 and Iran - Noroozi *et al* 2011). Using the 2 x 2 km grid cell method the AOO would increase to 16$km^2$. Since the discovery of a new sub-population the AOO has increased to 48$km^2$ (Carey *personal observation* and publicly available EIA submitted to the government of the Republic of Armenia 17/10/14).

Countries: Armenia, Iran and Azerbaijan (Nakhichevan).

Range map:




Black dots represent extant populations, red dot is an historic record.

Site locations:

1) Recorded in 1988 at Sevsar and Agusarka in the Gegham Mountains, Armenia (40°14'04''E,44°56'23''N) (Tamanyan *et al* 2010).

2) Recorded in 1986 at Mets Ishkhanasar, Zangezur, Armenia (39°35'25''E, 46°12'31''N) (Tamanyan *et al* 2010).

3) Recorded at some time between 2003 and 2011, Sabalan, Iran (47°51'15.0''E, 38°16'24.6''N) (Noroozi *et al* 2013).

4) Recorded at some time between 2003 and 2011, Sahand, Iran (46°31'08.6''E, 37°43'58.6''N, and 46°29'58.5''E, 37°43'56.0''N) (Noroozi *et al* 2013).

5) The historic record (more than 60 years old) from Nakhichevan, Azerbaijan has an estimated location based on some village names.

6) Amulsar, Armenia (discovered in 2012, and recorded in 2013 and 2014) (45°43'02''E, 39°43'35''N).

There are further historic records from the Gegham mountain range in Armenia (close to the 1980s records – G.Fayvush *pers comm.* and including records for *P.cryptophila*) and one from Iran near the Caspian Sea although that population is thought to no longer exist (Noroozi pers comm.).

There are two further possible historic (recorded 1947 and held within the national herbarium of Armenia) Armenian sub-populations of *P.porphyrantha* (45°32'09''E,39°34'43''N and 46°09'53''E, 39°28'13''N) if *Potentilla cryptophila* Bomm. is confirmed as synonymous with *P.porphyrantha* (G.Fayvush *pers comm.*). However, as these are historic records the chances of finding the sites is small.

### A.4 Population

Population: The species has five extant sub-populations, two of these (Armenia) occupy less than 8 $km^2$ between them. The two populations are 130km apart and considered in the Armenian Red Book as severely fragmented (Tamanyan *et al* 2010). The new population discovered in 2012 is in between the two populations listed in Tamanyan *et* al (2010). The new population numbers in the region of 7,500 plants whereas previously the total in Armenia was considered to be in the '00s. In Iran the species was found during a survey in three 10 x 10m plots , two of these were close together (Noroozi *et al* 2013). The species is almost common in the two locations but is not expected to be found elsewhere in Iran (Jalil Noroozi pers comm.). The species should no longer be considered severely fragmented.

Population trend: unknown.

### A.5 Habitat

Habitat: It is found on sub-nival screes in Iran above 4000m and has been assigned to the community *Potentilletum porphyranthae* ass. nov.hoc loco and is associated with

*Alopecurus dasyanthus*,and *Potentilla argaea* (Noroozi *et al* 2013). In Armenia it was previously thought to be found in rocky slopes and screes at altitudes above 3300-3500m (Tamanyan *et al* 2010). The new population at Amulsar is found above altitudes of 2450m on boulders and a few plants are found on scree. Noroozi *et al et cit* (2013) summarise the geology of the Iranian sites thus: Sabalan is a Plio-Quaternary volcano, mainly composed of potassium-rich calc-alkaline andesitic rocks. Sahand volcano is a volcanic complex that has formed through two major episodes of volcanic activity: during Middle-Upper Miocene and Plio-Quaternary. The studied plots are localized over the Plio-Quaternary rocks mostly comprised of calc-alkaline dacitic and andesitic rocks. The soil of all these volcanic areas is constituted of lithosols (igneous rocks). This suggests *P.porpyrantha* is restricted to rocky areas high in mineral content and could be a metallophyte. The population discovered at Amulsar is also found in an area with the same geology. This might explain its restricted distribution.

At Amulsar the plants are strongly associated with cushions of a moss of the genus *Grimia*. This is especially true of young plants that appear to germinate on the moss and gain water and nutrients from the moss. As the plants mature their woody root systems penetrate cracks in the rocks which contain a certain amount of humus from decaying moss. *P.porphyrantha* plants are extreme stress tolerators and probably cannot compete with other species. *P.porphyrantha* has only once been seen growing intimately with any other higher plant species and on that occasion it looked as though the *Campanula* plant was overcrowding it.

Systems:Terrestrial.

### A.6 Threats

Major threats: Predicted climate change will remove the snow cover required for this species in the winter. Increased temperature through all seasons is likely to reduce all suitable habitat with little chance of migration to other sites (Noroozi *et al* 2011). In Armenia the main threat is indicated as global climate change and loss of habitats caused by “geological factors” (Tamanyan *et al.* 2010). Geological factors could mean either seismic events or more likely erosion of the screes. The threat of temperature rise from global climate change applies to the whole of the population in the same way. Following the Guidelines for Using the IUCN Red List Catergories and Criteria (Version

11) section 12.1.2 the whole population should be assessed as a single enitity when assessing criterion B (Ketevan Batsatsashvili *pers comm.*).

Global climate change is a direct threat but may also be an indirect threat in that the amelioration in the climate may allow species that currnetly inhabit lower altitudes to survive in the areas currently inhabited by *P.porphyrantha* in the future. Being an extreme stress-tolerator *P.porphyrantha* will be outcompeted by most other species.

The population at Amulsar discovered in 2012 is directly threatened by mining activities in the next 5 years. Without any mitigation 50% of the global AOO will be destroyed. Although this is not enough to shift the categorisation from EN to CR it is a major threat.

Threats: Seed is collected from at least one sub-population for the horticultural trade although this is currently sustainable. The plant is grown as an alpine rockery plant (mainly in the USA and Canada).

### A.7 Conservation Actions

Conservation Actions: The species is listed in the Armenian Red Data Book, Plants (Tamanyan *et al* 2010) but has no specific population recovery programmes within that country. The mining company has a written mitigation strategy but this assessment assumes there will not be one. In Iran there are no conservation measures in place.

## A.8 IUCN Criteria

| IUCN Criteria | | Description | Measurement | Category |
|---|---|---|---|---|
| A | | Population Size Declining | | |
| | 1 | Observed,estimated, inferred, suspected population decline over last 10 years or 3 generations where threat has ceased and decline can be reversed | there is no population trend information available | DD |
| | 2 | Observed,estimated, inferred, suspected population decline over last 10 years or 3 generations where threat has not ceased or is not understood or decline cannot be reversed | there is no population trend information available | DD |
| | 3 | A population size reduction of ≥50%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1. | 50% of the global AOO could be destroyed in the next 5 years by mining activity | EN |
| | 4 | An observed, estimated, inferred, projected or suspected population size reduction of ≥ 80% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible | there is no population trend information available | DD |
| B | | Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both | | |
| | 1 | Extent of occurrence | 24000 $km^2$ | LC |
| | 2 | Area of occupancy | The population has an AOO of less than 500$km^2$ The threat of climate change applies to the whole population as a single location. The AOO is predicted to decline as is the quality of the habitat due to increasing temperature and lack of snow. | EN(B2a,bii&iii) |

| | | | | |
|---|---|---|---|---|
| C | | Population Size for Small Populations | | |
| | 1 | Continuing decline in next generation | Population size is unknown but is assumed to be over 10,000 individuals. | LC |
| | 2 | Continuing decline in fragmented and/or fluctuating populations | Population size is unknown but believed to be in excess of 10,000 individuals and there is no evidence of current decline. | LC |
| D | | Population Size - total size | Ultimately will be threatened by climate change | LC |
| E | | Quantitative Analysis | | NE |

## A.9 References

Noroozi,J., Pauli, H., Grabherr, G. and Breckle, S. (2011). The subnival–nival vascular plant species of Iran:a unique high-mountain flora and its threat fromclimate warming. *Biodiversity and Conservation* **20**, 1319-1338.

Noroozi, J., Willner, W., Pauli, H.andGrabherr, G.(2013). Phytosociology and ecology of the high-alpine tosubnival scree vegetation of N and NWIran (Alborz andAzerbaijan Mts.).*Applied Vegetation Science.*Doi: 10.1111/avsc.12031.

Gabrielian, E. T. (1988). Red data book of Armenia: plants. *Yerevan*.

Solomon, J.,T. Shulkina, & G.E. Schatz (editors) (2013). Red List of the Endemic Plants of the Caucasus: Armenia, Azerbaijan, Georgia, Iran, Russia and Turkey. *Monographs in Systematic Botany from the Missouri Botanical Garden (MSB)* **125,** Missouri Botanical Garden Press, Saint Louis pp451.

Tamanyan K., Fayvush G., Nanagulyan S., Danielyan T. (eds.) Red Data Book of plants of the Republic of Armenia. Yerevan: Zangak, 2010, 598 pp.