



Alien Invasive Species Management Plan

HSE-PLN-007-01-UZ-S-KHE01-EN

Khorzem Solar 100MW | Uzbekistan



INVASIVE ALIEN SPECIES MANAGEMENT PLAN

KHORAZM SOLAR PROJECT

Invasive alien species (IAS) are animals, plants or other organisms that are introduced into places outside their natural range, negatively impacting native biodiversity, ecosystem services or human well-being.

IAS pose a threat to biodiversity and related ecosystem services by heavily impacting native species as well as the structure and function of ecosystems through alteration of habitats, predation, competition, the transmission of diseases, the replacement of native species throughout a significant proportion of range and through genetic effects by hybridisation. Invasive alien species tend to have an advantage in disturbed ecosystems, and if they penetrate into a habitat, they can potentially change its functionality and species composition, including species of conservation concern.

Preventing and controlling the spreading flora IAS is crucial for the preservation of biodiversity, the stability of ecosystems, the protection of human livelihoods, and the restoration of native habitats. It requires proactive management to prevent the spread and effectively eliminate them where they have established. However, the potential IAS expected to be present in the area are only two (*Amaranthus viridis* and *Tribulus terrestris*). Moreover, the Project Area is a water-scarce area which makes washing truck wheels and footwear difficult. Therefore, IAS management will focus on monitoring the introduction of IAS in the site and their mechanical removal.

Baseline studies were conducted to assess the presence of IAS within the Local Study Area (LSA). The LSA includes all the Project components and its permanent and temporary associated facilities. The LSA is defined as the area beyond which no detectable effects on biodiversity are expected and it was designed as a 500 m buffer around the Project Area and its related associated facilities.

During the baseline studies conducted in April and June 2023 and in September 2023, no IAS have been found within the LSA. However, the region is known to host IAS that could accidentally be introduced in the LSA by cars, trucks, and other heavy machinery used during construction and even transported by employees' clothes. Two of these species are:

- *Amaranthus viridis* (Slender Amaranth);
- *Tribulus terrestris* (Puncturevine).

Construction activities have not yet started on the Khorazm Solar Project site (the Project site). For this reason, there has not been any invasive species entry or spread into the LSA as a result of soil and vegetation being disturbed or material being transported.

The main objectives of this Invasive Alien Species Management Plan shall be to:

- prevent the spread of flora IAS in the Project LSA;
- monitor the presence and diffusion of flora IAS in the Project LSA;
- control and eradicate IAS in the Project LSA.



The following document provides general information on the prevention, monitoring and control methods for flora IAS (Table 1) as well as detailed information on the IAS identified as potentially present in the LSA (Table 2). Monitoring for the potential presence of flora IAS is crucial to ensure an early detection and rapid eradication.

Table 1: General Measures for prevention and control of Invasive Alien Species.

Phase	Measures
<p>Prevention</p>	<p>Construction equipment, vehicles and footwear may provide a vector for the spread of invasive non-native species. Therefore, preventative measures must be taken. Maintaining site hygiene at all times in an area where invasive non-native species are present is essential. It is also necessary on sites where invasive non-native species are not present but where there is risk of contaminated material (material that could potentially carry IAS plant material or seeds) being brought to site, for example, site machinery being used on multiple sites, construction staff travelling between infested and not infested sites, etc.</p> <p>Prevention measures are described as follow:</p> <ul style="list-style-type: none"> ■ Clearly identify and mark out infested areas, when present. Erect signs to inform contractors of the risk. ■ Fence off infested area in order to avoid unvoluntary contamination. ■ Clearly identify and mark out areas where contaminated soil is to be stockpiled on site, if present. ■ Vehicles used in the transport of contaminated material will need to be visually checked and washed down in the dedicated vehicular wash facility before accessing the site. ■ Ensure all site users are aware of measures to be taken and alert them to the presence of the IAS Management Plan (IASMP). ■ No IAS will be cultivated on site and non-invasive native species will be preferred for landscaping.
<p>Monitoring actions</p>	<p>Monitoring is a crucial part of controlling IAS since it leads to identification of new populations while they are still small. It also allows to monitor the rate of success of control methods employed against already established IAS.</p> <p>Monitoring must include a strategy for identifying potential new problematic plant species within the site. Should the IAS clearing team may not have the botanical knowledge to detect new IAS, yearly monitoring surveys shall be conducted.</p> <p>The monitoring strategy will include the following steps:</p> <ul style="list-style-type: none"> ■ IAS monitoring surveys annually during the vegetative season (March to October) by an expert botanist to document and record the establishment of any new IAS in the LSA and the spreading of the species. The observed new plants should be flagged, photographed and the information shared with the Biodiversity Specialist(s). ■ The Biodiversity Specialist(s) will monitor the spreading of known IAS every three months within the LSA and they will document control methods implemented in infested area and the rate of success achieved.



Phase	Measures
<p>Control methods</p>	<p>Once an IAS has been identified and documented, it is crucial put in place extirpation campaigns which ensure a rapid eradication of the target IAS in order to avoid or contain further spread.</p> <p>The ideal time to remove and dispose of IAS is before they flower and produce seeds. This helps minimize seed dispersal. The method used for eradication as well as the time will strongly depend on the species involved. The Biodiversity Specialist(s) will help to select the most appropriate technique and will update the present Invasive Alien Species Management Plan.</p> <p>There are several methods for control of IAS, and they are usually employed in a combined approach. However, in this case, mechanical removal shall be utilized. <u>Biological control will be avoided and only used as last resort to avoid impact on the ecology of the area and the species that forage the area.</u> Chemical control and the use of herbicides is banned during construction and operation.</p> <ul style="list-style-type: none"> ■ Physical/mechanical control: it includes the direct removal of species by hand or with appropriate tools instruments and machines. Examples of control methods are hand pulling, hoeing, mowing/cutting, grazing, prescribed fire. This control option shall be prioritized is preferred in natural habitats due to the reduced impacts on other non-target flora and fauna species, however it is effective only for sparse infestations and only for species that do not coppice after cutting. ■ Biological control: it consists in the use of natural enemies to reduce the vigour or reproductive potential of an invasive alien plant. Biological control agents include insects, mites, and micro-organisms such as fungi or bacteria. The continuous attack by these agents may kill a plant or it may impact the reproductive capacity of the target IAS. However, it should be used as a last resort as the effects of the introduction of control agents is not extensively understood.
<p>Disposal of biomass</p>	<p>The removed IAS plant material will be disposed of properly. Plant material will be put in thick, durable, black or clear plastic bags and it will be tightly sealed in order to avoid seed dispersal and limit the risk of infestations.</p> <p>The bagged material will be placed in a sunny location for several days or weeks (depending on the temperature) to kill and decompose the plants. After this process the material can be composted on site or send to the local land field.</p>





Monitoring surveys will be conducted, according to what already stated in Table 1, in order to assess the rate of success of the control methods employed as well as the further expansion of the species in the LSA.

Further and specific measures for the control of these IAS are described in the table below (Table 2). In the table, information on the pathway of introduction is provided as well since it is crucial for prevention and early detection of IAS.

Table 2: Eradication measures for IAS potentially present in the region.

Species	Main pathways of introduction	Eradication	Disposal
<p><i>Amaranthus viridis</i></p>  	<ul style="list-style-type: none"> ■ Escape from confinement; ■ Debris and waste associated with human activities; ■ From contaminated land vehicles, machinery and equipment; ■ Horticulture, through seed contaminants in soil. 	<ul style="list-style-type: none"> ■ Mechanical control. In small infestations, slender amaranth can be eradicated with hand pulling or removed below the soil line with a dandelion fork. Mowing could be used in larger infestations; however, it needs to be maintained since the plant will bounce back. Similarly, rotational grazing can be employed to keep the population under control, making sure to avoid overgrazing that can instead make the infestation worse. 	<ul style="list-style-type: none"> ■ Use heavy-duty plastic bags to collect the material, sealing them tightly to prevent any seeds or plant fragments from escaping. ■ Leave the bagged plant material in a sunny, dry area for a few weeks to allow it to dry out completely. This will help to kill any remaining seeds or plant parts. ■ It is crucial to prevent the spread of seeds or plant fragments, as they can potentially germinate and lead to new infestations. ■ If burning is planned of the plant material is planned, make

Species	Main pathways of introduction	Eradication	Disposal
			<p>sure there are no seeds present as they could be spread by the hot air.</p>
<p><i>Tribulus terrestris</i></p> 	<p>The spiked seeds easily attach to animals, clothing and tires of vehicles.</p> <p>Other pathways of introduction include:</p> <ul style="list-style-type: none"> ■ Transportation of habitat material (soil, vegetation, etc.); ■ Contaminated vehicles and means of transport; ■ Natural dispersal of the seeds with the wind; ■ Debris and waste associated with human activities; ■ Seed contaminants in soil and water. 	<p>Puncturevine forms burs with spikes which readily adhere to animals, humans and vehicles. Therefore, when working in puncture vine infestations, it is crucial to clean shoes, clothing and tires to prevent spreading seeds to other areas.</p> <ul style="list-style-type: none"> ■ Mechanical control. In small infestation, Puncturevine can be hand-pulled or controlled by hoeing or digging up, prior to seed formation. Make sure to wear gloves when removing the plant to avoid its sharp spines. Shallow tilling (25 cm or less) can be used as a mechanical control for small plants prior to flower and seed development. Avoid deeper tilling in the soil as it may bury viable seeds that will then germinate. Mowing and burning are ineffective due to the plant's low growth form. Grazing is not advised since the species is toxic for livestock. Mechanical control methods will need to be repeated as new seeds germinate during the year and for at least four years due to seed viability. 	<ul style="list-style-type: none"> ■ Use heavy-duty plastic bags to collect the material, sealing them tightly to prevent any seeds or plant fragments from escaping. Leave the bagged plant material in a sunny, dry area for a few weeks to allow it to dry out completely. This will help to kill any remaining seeds or plant parts. ■ It is crucial to prevent the spread of seeds or plant fragments, as they can potentially

Species	Main pathways of introduction	Eradication	Disposal
			<p>germinate and lead to new infestations.</p>

BIBLIOGRAPHY

Beuret, E. (1988). Peculiar feature of resistance to atrazine and linuron in *Amaranthus lividus* L. and *Erigeron canadensis* L. In VIIIe Colloque International sur la Biologie, l'Écologie et la Systématique des Mauvaises Herbes. (Vol. 1, pp. 277-286). ANPP.

CABI Digital Library (2023): <https://www.cabidigitallibrary.org>

Center for Biodiversity Restoration (CBR) “The Bird Nest Program”. Available at: https://c4br.org/?page_id=465

DiTomaso, J. M., Kyser, G. B., Oneto, S. R., Wilson, R. G., Orloff, S. B., Anderson, L. W., ... & Mann, J. J. (2013). Weed control in natural areas in the western United States. *Weed Research and Information Center, University of California*, 544 pp.

Esanov, H. K. (2017). *Amaranthus viridis* L. (*Amaranthaceae*)—a new invasive species for the flora of Uzbekistan. *Stapfia*, 107, 127.

Euro+Med PlantBase - The information resource for Euro-Mediterranean plant diversity: <http://www.europlusmed.org>

GBIF.org (2023), GBIF Home Page: <https://www.gbif.org>

Goeden, R. D., & Kirkland, R. L. (1981). Interactions of field populations of indigenous egg predators, imported *Microlarinus* weevils and puncturevine in southern California. Proceedings of the 5th International Symposium on Biological Control of Weeds. (pp. 515-527). *Commonwealth Scientific and Industrial Research Organization*

Bat Conservation Trust (BCT) “A guide to making bat boxes”. Available at: <https://www.bats.org.uk/>

International Union for Conservation of Nature and Natural Resources. Invasive Species Specialist Group. (2000). IUCN guidelines for the prevention of biodiversity loss caused by alien invasive species. *Species Survival Commission*.

Invasive Species Specialist Group ISSG 2015. The Global Invasive Species Database. Version 2015.1 Available at: <http://www.iucngisd.org/gisd>

Johnson, D. H., & Talbert, R. E. (1993). Imazethapyr and imazaquin control puncturevine (*Tribulus terrestris*) but carry over to spinach (*Spinacia oleracea*). *Weed Technology*, 7(1), 79-83.

Parsons, W. T., & Cuthbertson, E. G. (2001). Noxious weeds of Australia. *CSIRO publishing*.

Saul, W. C., Roy, H. E., Booy, O., Carnevali, L., Chen, H. J., Genovesi, P., ... & Jeschke, J. M. (2017). Assessing patterns in introduction pathways of alien species by linking major invasion data bases. *Journal of applied ecology*, 54(2), 657-669.

Sennikov, A. N., Sh, T. K., Beshko, N. Y., Esanov, H. K., Jenna Wong, L., & Pagad, S. (2018). Global Register of Introduced and Invasive Species—Uzbekistan. Version, 1, 10-18.