

**Annex B
Protection and Mitigation Measures Against
Adverse Environmental Impacts**

1. Introduction

This Annex ascertains the nature of different mine action environmental impacts and their mitigation measures that should be taken into account to reduce adverse impacts of mine action activities and operations on the environment. Mine action organizations should assess each situation, using an EIA where appropriate, before determining appropriate mitigation and appropriate response measures.

One of the primary methods by which direct impacts upon soil and vegetation are mitigated is through the effective implementation of land release principles; to reduce the number of square meters processed.

2. Erosion and Soil Degradation

Natural processes can also cause soil erosion that can move or deposit especially the upper sediment of the soil. The sediment on the surface of ground can be dislodged by wind, water or slope instability; however, the erosion can be initiated by human activities in terms of destabilizing the surface, one of human activities of such nature can be demining operations, if not properly managed.

Soil degradation includes loss of the nutrient-rich topsoil through erosion, loss of organic matter and loss of structural stability, and it occurs when the changes in the depth of soil or its physical or chemical properties reduce its quality.

Environmental management and protection, as part of demining activities requires that the mitigation measures shall assure that survey and clearance operations do not lead to further erosion or soil degradation. If the area is already exposed to erosion, measures should aim to mitigate this effect. These measures may include:

- a) Minimizing the area subject to direct intrusive technical investigation using manual or mechanical methods through well targeted survey and clearance operations;
- b) Re-seeding and re-planting (grass, trees, ground cover) after mine action operations or when appropriate, if mine action contract permits that, otherwise, mine action organizations should seek the support of other related agencies to support environmental protection;
- c) Construction of terracing as part of the site handover process, after consultation with local beneficiaries, especially after the clearance of areas with slopping profile;
- d) Preparation of drainage systems where appropriate, to avoid erosion;
- e) 3 to 4 meter wide strips of vegetative cover across the site horizontal to the likely route of erosion, if mine action contract permits that;
- f) A schedule for land release operations that allows cultivating the site as soon as possible after such operations are completed;
- g) Land release takes place at a time when the climate does not contribute further to erosion and when the soil and vegetation is less vulnerable;

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- h) Deep tracks or detonation craters are filled out, to reduce erosion or left unfilled to be used as habitat for local wildlife, if deemed necessary, but this should be communicated with NMAC and UNMAS;
- i) Return of processed soil to the affected sites;
- j) Soil is stored in areas where it is not subject to erosion, while it is processed;
- k) Topsoil structures are not broken over large areas;
- l) Local communities are involved in the process of implementing mitigation measures;
- m) The natural flow of watercourses is not permanently obstructed or diverted by mine action operations;
- n) If it is necessary to divert or dam a watercourse, the landowner, communities and local authorities are consulted and their agreement obtained;
- o) Regular community liaison and consultation regarding mechanical operations, including advice to property owners, communities and local authorities about any possible damage to the environment, should be considered. If necessary, advice to minimize damage should be given to property owners of the land adjacent to mine action worksites.
- p) The land right issues shall also be considered, mine action operations should not destroy the natural boundaries of the land that may cause conflict between communities on land ownership.

3. Pollution of Air, Water and Soil by Toxics and Hazardous Chemicals

Mine action organizations shall consider and take care of the possible contamination of the surrounding area including vegetation and wildlife by fragmentation, toxic or hazardous substances. Provision shall be made for eliminating or minimizing any contamination and disturbance of humans, wildlife and vegetation.

Different chemical components from mines and ERW could dissolve and enter watercourses and crystallize into new components in the soil or be incorporated into existing soils and minerals. Being planted on the surface or just below the surface of land, the most direct impact of landmines is on soil quality and composition. Soil can be affected by the casing, explosions or leaking of toxic substances as a consequence of corrosion or decomposition.

Consequences of the corrosion of fragments and leakages may include the release of various chemical elements to the soil. A number of toxic and hazardous elements may appear as a pollutant after utilization of high explosive weapons. In agricultural regions, toxic elements can penetrate the human food chain. Therefore, as toxic elements penetrate the soil, processes of bioaccumulation can start and affect human health. To mitigate these processes the following should be considered:

- a) Land release operations do not contribute to an increase of toxic components in soil, watercourses or air;
- b) If degradation and corrosion have already taken place, investigate the composition of explosives in order to assess potential adverse impacts on watercourses, soils and vegetation and identify possible mitigation measures to limit such impacts.

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4. Pollution from Disposal of Mines, ERW and Hazardous Waste

Mines and ERW shall be disposed off in a way that minimizes adverse environmental impacts. If mines or ERW must be destroyed in situ and there is a risk to the environment including noise, ground shock and damage to infrastructure, protective works shall be undertaken in accordance with SNMAS 06.03 EOD Operations and Demolition of Mines and ERW. If there is still a risk of adverse impacts to the environment, the NMAC sub office, local authorities, property owners and communities shall be consulted. As minimum the followings shall be considered by mine action organizations:

- a) Conduct mine and ERW demolition at a Central Disposal Site (CDS) with due care and consideration of environmental protection around CDS.
- b) Highly consider the possibility of contamination of surrounding areas with toxic and hazardous substances such as spread of white phosphorus and others, and required mitigation measures are planned and applied.
- c) Restore EOD task area upon the completion of EOD operations, in accordance with requirements of the local communities. Refurbishment of the EOD task area can include recovering and filling of pits and craters made as a result of demolitions.
- d) All parts of heavy metals and explosives should be removed after demolition, so that they will not dissolve and end up in watercourses.
- e) Ensure that previously safe areas are not contaminated during transportation of safe to move landmine and ERW.

Toxic waste products of mine action operations shall not be buried at the work site but collected and removed to a government approved disposal area.

5. Pollution from Transportation of Hazardous Materials

During the transportation of any hazardous, toxic or flammable materials with the potential to damage the environment, precautions shall be taken to ensure that risk is minimized. These should include:

- a) All materials to be transported in containers that will minimize or prevent spills or leakage;
- b) Materials to be securely loaded in the transport;
- c) Fire precautions to be taken relevant to the materials being transported;
- d) Vehicles carrying hazardous material to be driven in a safe and careful manner; and

6. Degradation of Air Quality

Mitigation measures shall be put in place when conducting technical survey and clearance operations that can have an adverse impact on air quality. In this case, mine action organizations should remain aware of the location of communities, the prevailing wind conditions in the area and the ability of prevailing winds to carry smoke, dust and toxic fumes to local communities. Mine action organizations should ensure that the adverse impact on local communities of any degradation of air quality is minimized.

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When degradation of air quality is likely to affect local communities, Mine action organizations should liaise with local communities and authorities to explain the scope, scale, duration of any likely air degradation and any evacuation requirements.

When ground shock or noise is likely to affect local communities, measures should be taken to minimize these affects. These measures may include:

- a) Sitting disposal areas well away from inhabited areas;
- b) Limiting the size of individual disposal serials;
- c) Using pits to suppress noise;
- d) Using protective works to limit the effects of ground shock and noise; and
- e) Restricting the conduct of disposal activities when certain meteorological conditions, for example low cloud, may increase the effects of noise.

7. Impact on Wildlife and Vegetation

7.1. Wildlife

Wildlife should not, as reasonably practicable, be impacted by mine action operations. Exceptions may be made towards invasive species.

Mine action organizations shall enquire how protected nature may be influenced by the survey and clearance operations and consider:

- a) Scare off actions should take place before demolition.
- b) Whether demolition pits should be filled in or left open after clearance/destruction, considering their potential value as habitats for some species, as well as any increased erosion risk they may present;
- c) Limiting mine action operations to specific hours of the day during breeding/nesting periods in order to not disturb wildlife; and
- d) Limiting the timing of detonations to influence wildlife the least.

7.2. Vegetation

Removal of vegetation and deforestation may be necessary to allow detectors/locators to get close enough to the soil so that detection and removal of mines and ERW can take place. This process may also be linked to erosion. Clearing of vegetation may have a beneficial impact, since it can remove invasive species and improve the conditions for natural occurring plants and trees. In contrast, it can remove trees, which create shade or act as wind barriers for crops or it can remove slow growing vegetation used by the local population. Mine action organizations should consider the following:

- a) Slow growing vegetation used by the local communities should not be removed/cut during clearance, as appropriate and possible;
- b) Vegetation that stabilizes the soil and prevents erosion should be left alone especially on steep slopes and along streams and irrigation channels;

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- c) For the removal of vegetation it should be considered that for what purpose the site will be used, after release (housing, grazing, agriculture or industry);
- d) The area may be subdivided into fields, leaving trees on boundaries. This will give shade and lead to decreased wind erosion;
- e) Clearing of vegetation may remove invasive species and improve the condition for natural occurring plants;
- f) If possible, turn over the wood to communities; and
- g) Introducing new crops that would grow better or adapt towards climate change.

7.3. Impacts from Burning of Vegetation

Burning of vegetation should generally be avoided. However, the condition of some vegetation is improved when burned. This should be identified before burning. When Mine action organizations and relevant stakeholders agree that vegetation burning is to be carried out, the following procedures and control measures should be applied:

- a) Plans for burning vegetation should be discussed with and approved by the landowners/users, local authorities and local communities;
- b) Burning of vegetation should take place after wildlife scare off actions and not during breeding periods;
- c) Ensure that the landowners/users and local authorities are aware of the type of mines/ERW and their likely hazards including fragments, shocks, toxic and smoke, in the event of burning vegetation;
- d) Burning should not to be carried out at night or continue into the night;
- e) No burning should be started unless there are sufficient personnel and firefighting equipment on site to control, and if necessary, stop the burning;
- f) Wind and moisture conditions should be considered before any burning operations;
- g) All personnel involved in the burn should be briefed on the burning plan, including any safety procedures;
- h) Consideration of the direction of the prevailing wind should be made when determining the direction of the burn; both as a means of controlling the burn and of minimizing the effect of smoke and ash on local communities;
- i) Access areas should be available around the complete perimeter of the burn area for control purposes; and
- j) Burning should only be carried out towards natural firebreaks such as roads and tracks etc. However, if this is not possible and the perimeter of an area to be burned is vegetated, the vegetation should be dampened before the burn is started and personnel should be positioned there with firefighting equipment to control the burn.

8. Pollution from Waste in Worksite Facilities

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Protection of the environment should be considered during site selection and when planning the layout of worksites and temporary accommodation facilities.

The establishment and operation of worksites and temporary accommodation facilities should be carried out in a manner that minimizes any contamination of the land or water systems (including ground water systems) and has minimal effect on flora and the natural habitats of wildlife.

Where applicable, the location of temporary accommodation facilities should be selected in consultation with men and women in the local communities to ensure that the demining teams do not adversely affect local conditions, economic activities or social and cultural values.

Temporary accommodation facilities should comply with all national or local regulations.

8.1. Toilets

Human waste should never be discharged into watercourses or onto the soil surface.

Where possible, temporary toilets should be established and used in all mine action worksites and temporary accommodation facilities. Temporary toilets should be equipped with holding tanks that can be pumped to sewage trucks for disposal or connected to septic tanks and safe drainage. Sex-segregated facilities should be made available taking into consideration the needs of both men and women.

Where latrines are used, there should be at least one for every 15 persons. They should be located at least at 30 meters distance from any accommodation or food preparation area and from any watercourses or wells.

8.2. Domestic Rubbish

Rubbish removed from the site should be disposed off at approved rubbish dumping sites. Any rubbish spilled during the removal process shall be cleaned up.

Rubbish should only be buried with the approval of the local communities/authorities and in the locations agreed to by them.

Rubbish pits should be located away from watercourses and wells and be located and constructed so as not to contaminate groundwater. Pit bottoms should be at least 2m above the water table. Rubbish pits should be deep enough to allow 1m of earth cover over the rubbish when they are filled in.

Consideration should be given that no hazardous wastes like petroleum products, hazardous metals are buried.

8.3. Wastewater

Wastewater from washing, bathing or kitchen areas should be drained into soak pits large enough to take the amount of wastewater generated. Soak-away pits should be at least 75cm x 75cm and 1m deep.

8.4. Domestic Water Supply

The supply of domestic water should be carried out in a manner that does not affect the supply of water to the local communities; unless the local communities have been consulted on this matter and have agreed to any arrangements made.

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8.5. Fuel, Oil and Lubricant (FOL) Areas

The operation, repair, maintenance and servicing of mine action equipment should be carried out in a manner that minimizes the adverse impact on the environment and in accordance with the requirements of the EIA.

Mine action organization should ensure that procedures are in place to contain and quickly clean up any spills of FOL. Contaminated materials containing spilled FOL should be collected and disposed off at controlled landfill. Where it is necessary to establish fuel storage facilities, precautions should be taken to ensure that FOL is stored safely and does not contaminate the soil or groundwater. These precautions should include:

- a) No fuel storage facilities are positioned closer than 30m to a watercourse;
- b) All storage tanks, containers and fuel dispensing equipment are regularly maintained to ensure that there are no leaks; and
- c) Vehicle and equipment fueling are undertaken on a hard surface or over drip pans to ensure that any spilled FOL is contained and disposed off in an environmentally acceptable manner.

8.6. Maintenance Areas

When maintenance, repair or washing of vehicles, machines and equipment is required on worksites, specific areas should be designated for this activity. The environmental precautions to be taken include:

- a) Wastewater shall not be released so that it will enter watercourses;
- b) Drained oil shall be contained using a drip pan or other suitable receptacle and disposed off in an environmentally acceptable manner; and
- c) Used parts, by-products of maintenance or other rubbish shall be disposed off as for domestic rubbish.

9. Completion of Mine Action Operations

On completion of mine action operations, all buildings, equipment, surplus materials, fencing other than hazardous area marking, and other such items should be removed. The toilets and soak pits and rubbish pits should be filled in, covered with soil and the surface stabilised to prevent erosion and to allow natural regeneration of vegetation.

Site office and clearance areas should be cleaned up including removal of all material and equipment lying at the surface after clearance including the recovering and disposal of all large items of scrap. All disturbed areas should be restored to their original condition.

10. Risk to Heritage

When mine action operations take place in locations where there are areas of cultural or historical significance, the organizations should take all practicable steps to prevent damage to these sites.

Such action may dictate that any mines or ERW found at the worksite are removed to another area for destruction. If these items are unsafe to move and in situ demolitions are necessary, protective works should be used.

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If any article is located and identified during mine action operations and is deemed to be of cultural or historical significance, work in that area should be ceased and the matter be reported to NMAC sub-office and related government entities.