Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia

Contract № ARM/01/2013

Phase 3 Selection & pre-design of long term technical solutions

Final, 16 December 2013

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Responsibility

Title	Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia *Phase 3 – Selection & pre-design of long term technical solutions*
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Executive Summary

The Nubarashen pesticide burial site (herein referred to as the Nubarashen landfill) was used mid-1970 as a disposal site for obsolete and banned pesticides (OPs) including Persistent Organic Pollutants (POPs) pesticides. It is located on the south east edge of Yerevan in a valley subject to severe erosion processes. Additionally, over the years since the site has been subject to vandalism and illegal mining of pesticides. The Government of Armenia has set up the Emergency Working Group led by the Ministry of Emergency Situations in July 2010 after a major incident of illegal mining. Around USD 100,000 has been allocated from a special fund for an intermediate containment and repair measures until a permanent solution could be developed, recognizing that human health and environmental risks still exist. In 2012, The Government of Armenia through the Ministry of Emergency Situations and with the funds provided by the Organization for Security and Co-operation in Europe (OSCE) decided to initiate the detailed work on a more permanent solution. This involved investigations and a feasibility study supporting the selection of a long term sustainable solution to the problem and specifically the minimization of any human health and environmental site risks. This project is directly supporting development of a follow on and now approved GEF/UNDP co-financed investment project obtained by the Government which is now in the detailed preparation stage and is scheduled to begin in 2014.
The Request For Proposal for this OSCE investigations and a feasibility study was published in June 2012. The contract for this assignment was signed between the OSCE and Tauw on January 2013. To reach the objective, the assessment and feasibility study is split in three project phases. Phase 1 is the initial site assessment. Phase 2 is the detailed site assessment and Phase 3 concerns the pre-design of two possible site remediation scenarios, mitigating the environmental and human site risks.

The landfill site at Nubarashen, comprising of a landfill body and surrounding land, is situated to the south east of Yerevan on a steep mountain slope, neighbouring Erebuni State Natural Reserve on the north. The surrounding land is used for extensive cattle farming. The site with the landfill body is fenced and the landfill body, a hillock, is enclosed on three sides by concrete runoff drains. Two 1.5 meter deep trenches, collecting some of the run-off water with sediments are situated 10 m down slope from the landfill body. The landfill body, has a surface area of approximately 0.2 hectares with a height of around 1-1.5 m above the surroundings, it is covered with a 40-70 cm top cover of clay, lying on top of a 2 mm ruberoid liner. The in-situ volume of this top cover is 890 m^3. The soil of the top cover is slightly contaminated with DDT. Traces of pesticides, remains of packaging materials and erosion features are observed in the top cover. Below the ruberoid liner is a layer of 5-10 cm coarse sand (100 m^3) on contaminated clay layers with or without pure pesticides. In total 605 m^3 of pure pesticide is present in one constructed cell and four different excavated pits.

The clay bottom and sides of the pits are very highly contaminated and would be considered equivalent to pure pesticides. The expected volume is 69 m^3. In additional, approximately 1,127 m^3 of highly contaminated soil (DDT above 1,500 mg/kg dry matter) with traces of pure pesticides is present in the hillock. Surrounding the landfill, within the fence, is a barren area of around 0.6 hectares. The top soil has areas of relatively high levels of POPs pesticides contamination to a depth of 0.5 m although these are less than 1,500 mg/kg dry matter. The in-situ volume of this surrounding contaminated top soil is estimated at around 3,000 m^3. The soil at the landfill site is split up in the following categories:

- Category 1: 674 m^3 pure pesticides or associated material with more than 30 % pure pesticides
- Category 2: 4,127 m^3 heavily contaminated soil above the human health risk threshold for direct exposure (> 1,500 ppm DDT) or visual presence of pure pesticides
- Category 3: 4,477 m^3 soil contamination (including the 100 m^3 coarse sand) less than determined as human health risk threshold but above the agricultural (grazing) risk threshold (0.7 ppm-1,500 ppm DDT)
- Category 4: 20 m^3 contaminated building materials

The total quantity of pure POPs pesticide waste found inside the landfill body exceeds the quantities that have been disposed at the area according to historical documents, likely as a result of latter unreported deposits being made on an informal basis. In addition the illegal waste mining activities in 2010 have significantly increased the total amount and distribution of POPs wastes creating a significantly larger volume of highly contaminated soil that require the treatment.

The perched groundwater table upstream the landfill is influencing the geo-stability of the land above, around and ultimately down slope of the landfill site. The poor geo-stability of the area is the force behind the observed mass movement of the slopes. In the absence of this remedial work being undertaken, continued mass spreading of POPs pesticides along with the erosion of the top cover and the top soil of the surrounding landfill site will be an ongoing process and if nothing is done this will enhance the threat of off-site migration of contaminants.

An environmental site assessment followed by a tier 2 risk assessment concluded that at present there are no significant health- or environmental risks off-site. The landfill site cannot be accessed and as such direct risks due to contact with the high contaminated soil is avoided and the pure pesticides are still contained in the landfill. There is evidence of a possible cumulative downstream impact that while not yet of major concern. Potential risks associated because of current land-use (extensive cattle farming) of the surrounding area however are present.

In the remediation scenario review, for all relevant components of the landfill site (low contaminated soil, high contaminated soil, pure pesticides and contaminated construction materials) the possible remediation techniques have been reviewed using a Multi Criteria Decision Analysis.

For the highly contaminated soil and the pure pesticides ex-situ destruction/aggressive and soil remediation/ cleaning are considered the most appropriate options. Options covered extend from pure destruction such as high temperature incineration (HTI) through to remediation/destruction options such as thermal desorption (with residual destruction by HTI) and ball milling.
For the low contaminated soil, containment and phytoremediation are considered the most appropriate techniques. The contaminated construction materials can be manually or mechanically decontaminated and the cleaned rubble can be brought to a controlled landfill. The removed POPs pesticides contaminated material will be treated as pure pesticides.

Using the previously mentioned preferred techniques, three scenarios for addressing the landfill site have been drafted. In distinguishing between these scenarios, the availability of funding for the work in the upcoming UNDP/GEF POPs pesticides project is taken as the main variable. The scenarios are:
1. Merely minimal funding is directly available in the first years. After a period of three to four years the GEF funding and associated co-funding for the full clean-up be at hand
2. Within a short timeframe (coming year) significant funds are available but not sufficient to fully remediate the site. To completely remediate the site a second tranche of funding becomes available after a period of around three to four years
3. Funding for the complete site remediation is available within the first year

The main conclusion of the scenario review is that the steps required for the final clean-up of the landfill site can be done in accordance with availability of the funding. For example, even if in the short term this funding is limited, steps can be taken to improve the landfill site and partially mitigate the current risks. Based on the review it becomes clear that the technical measures needed for the landfill remediation are quite similar for all scenarios. The timing of the funding will determine when, which steps can be taken. Therefore the pre-designs of scenario 2 and 3 contain nearly all elements that make up any scenario and should give a good insight in the cost and the feasibility for purposed on future work.

For scenario 2 and 3 the preparation works and measures required to ensure the geo-stability of the site are included. These measures are improvement of site accessibility, drainage of the upstream pond with standing water and repair the water main next to this pond and subsurface partition to redirect all surface run-off from the area above the landfill. These measures also concern the installation of proper site drainage with a discharge pond, just downstream the landfill site that also serves as sediment trap and phytoremediation pond. All these measures should increase the slope stability upslope of the landfill site and reduce site erosion significant, as well as effectively reduce to the point of elimination any downstream risks associated with water use.

Scenario 2 starts when part of the funding is available in the first year of the project. The above mentioned preparation and measures required to increase the slope stability upslope the landfill site and contribute to the geo-stability of the site are implemented first. These measures are followed by the first phase of the excavation, packaging and directly transport of pure pesticides to a destruction facility if possible. If the repacked pesticides cannot be transported directly to the facility it will be preferably temporary stored in a purposely designed hazardous waste storage/ treatment facility. This facility can also serve as storage for the POPs pesticides from other POPs pesticides contaminated sites of the upcoming GEF/UNDP project. For the period funds are not yet available the high and low contaminated soils are contained at landfill site. After 3 – 4 years when funding becomes available to take care of the high and low contaminated soil, the landfill will be reopened. The highly contaminated soil will be excavated, repacked and transported to the storage/treatment facility for destruction/treatment which might be preferentially developed in-country subject to economic viability.
After all pure pesticides and high contaminated soil are removed an investigation of surrounding area for low contaminated soil will be carried out. The low contaminated soil found, will be transferred to the open landfill for backfilling. After closure of landfill, site drainage as described above will be installed, erosion resistant bushes and shrubs will planted to sustainably contain the low contaminated soil at the site. The project is completed after a period of monitoring, aftercare and maintenance carried out by the contractor. The estimated costs, based on the pre-design of this scenario, are around 9 million US dollar, 80 % of the costs are for the transport and destruction of the pesticides and highly contaminated soil.

Scenario 3 starts when all funding needed for the removal and destruction/treatment of the pure POPs pesticides and high contaminated soil is available. The landfill will be backfilled with low contaminated soil after the low contaminated soil is mapped. After closure of the new landfill site the same measures as for scenario 2, required increasing the slope stability upslope the landfill site, are taken. The project is completed after a period of monitoring, aftercare and maintenance carried out by the contractor.
The estimated costs, based on the pre-design of this scenario, are also around 9 million US dollar and of course for this scenario 80 % of the costs are also for the transport and destruction of the pesticides and high contaminated soil.

The Nubarashen landfill site is located next to the Erebuni State Natural Reserve on the north. The Bio-recourses Management Agency of the Ministry of Environmental Protection has the responsibility of the Erebuni State Natural Reserve. Its goal is to protect the wild species of wheat and other cereals growing in their natural environment. This State Reserve is invaluable for Armenia and therefore needs infinite monitoring, aftercare and maintenance. If the area of the this Reserve could be extended with the Nubarashen landfill site, a sustainable solution concerning the monitoring, aftercare and maintenance of the Nubarashen landfill is at hand.

Hence it can be concluded that, in addition to the availability of the required funding, the deciding factor in the improvement of the Nubarashen landfill site is mainly the commitment of the various stakeholders. The purpose for stakeholder involvement in the Nubarashen project is the explorations of fresh ideas, networking to share ideas and best practices, awareness raising to reach decision makers and vulnerable groups, advocacy to support efficient political decision making and creation of commitment and project ownership among stakeholders. All these activities are targeted to support the overall project aim to minimize the potential health and environmental risks of Nubarashen landfill site in a sustainable manner.

With the finalization of the selection and pre-design of two best remedial scenarios providing a sustainable solution for the remediation of the Nubarashen landfill site the OSCE site assessment and feasibility study of the Nubarashen landfill site is finalized. It is to be made available to the GEF/UNDP project as a key input into that project's preparation work and specifically to the defining Project Document and GEF CEO Endorsement Document that are scheduled for submission and funding confirmation in Quarter 1 2014.

Contents

Appendices

1 Introduction

1.1 General

The Nubarashen landfill was used mid-1970's as a disposal site for Persistent Organic Pollutants (referred to as POPs), Obsolete Pesticides (referred to as OPs), and other chemicals and is located in a valley subject to severe erosion processes (gully, sheet and landslides).

The Government of Armenia (GoA) has set up the Emergency Working Group led by the Ministry of Emergency Situations (MoES) in July 2010. Around USD 100,000 has been allocated from a special fund for an intermediate containment and repair measures until a permanent solution could be developed. However, the risks still exist and the GoA through the MoES therefore decided with the funds of the Organization for Security and Co-operation in Europe (OSCE) to perform investigations and a feasibility study supporting the selection of a long term sustainable solution for the elimination of human and environmental site risks for the OPs and POPs waste at this landfill. This OSCE project is supporting development of a follow on and now approved GEF co-financed investment project and potentially other bilateral and national initiatives on this site (http://www.thegef.org/gef/project_detail?projID=4737). This is noted because these initiatives are relevant in the discussion of remediation scenarios selection and recommendation in chapter 5 of this phase 3 report of the feasibility study.

The Request For Proposal (RFP) for this investigations and a feasibility study was published in June 2012. The contract for this assignment (**Contract no ARM/01/2013**) was signed between the OSCE and Tauw on January 2013.

1.2 Objectives

1.2.1 Introduction

The overall objective of the assessment and feasibility study is to provide a structured framework for a comprehensive site remediation plan mitigating the environmental and human site risks. The result of the investigation is an overview of the horizontal and vertical extent of the landfill, the environmental soil and groundwater quality and the identification of migration pathways and potential receptors.

To reach this objective the assessment and feasibility study is split in three project phases. Phase 1 is the initial site assessment: Phase 2 is the detailed site assessment and phase 3 concerns two comprehensive site remediation plan (pre-designs) describing mitigation measures reducing and eliminating the environmental and human site risks.

This report deals with phase 3, the selection and pre-design of the two long-term technical solutions. Phases 1 and 2 have been reported separately in the Tauw report with the reference R003-1210169BFF-beb-V03-NL dated 10 October 2013. For the reader's convenience phase 1 and phase 2 are summarized in the following two sub-sections.

1.2.2 Phase 1 initial site assessment

Phase 1 contains the following three main tasks:

- Health and safety planning
- Start-up stakeholder involvement
- Verification design of landfill location and construction

The phase 1 verification of the layout of the landfill was carried out with a desktop study of available literature, interviews of staff that was involved in the construction of the landfill in the old days and fieldwork such as a Ground Penetrating Radar (GPR) campaign, a surface three dimensional (3D) laser scanning of topography of the landfill and its surroundings, Dynamic Cone Penetration Tests (DCPTs) to establish the soil structure and a soil boring campaign to verify the site layout. This information is used to make a Digital Terrain Model (DTM). With the DTM the volume of the different elements of the site including the landfill body are assessed.

The fieldwork of a soil boring campaign was executed in August of 2013; around 60 manual gauge drillings were constructed to establish the exact location, depth of the wastes present in the landfill body. The waste characterization was carried out by evaluation of data already presented in the annex 1 of the project's Terms of Reference (TOR), available data from the interviews, archive studies and the gathered fieldwork data during the various missions.

1.2.3 Phase 2 Detailed site assessment

Phase 2 is the soil and ground investigations and risk assessment of the catchment area of the landfill. This phase comprised:

- An environmental baseline assessment of the catchment area of the landfill
- A geophysical assessment of the catchment area of the landfill
- A risk assessment of the catchment area of the landfill

1.2.4 Phase 3 Selection and pre-design two best remediation scenarios

The current report deals with phase 3, a stepwise process leading to the selection and pre-design of the best two remediation scenarios. This phase starts by outlining the various techniques available to remediate the different landfill site components. A set of selected remediation techniques for the different landfill components makes-up a remediation scenario. This process is illustrated in figure 1.1 and pictures a toolbox full of remediation techniques and from this toolbox only the relevant techniques are taken to assemble a remediation scenario.

For each of the techniques available for the remediation of the landfill components a Multi-Criteria Decision Analysis (MCDA) is done to determine the most suitable technique. This information is then used to establish three viable remediation scenarios of the landfill. These scenarios are focussed on the availability of funding over a timeframe of max 5 years. But for each scenario the removal and disposal of the pure POPs pesticides is the ultimate goal. The last step of phase 3 is the pre-design of the best two scenarios.

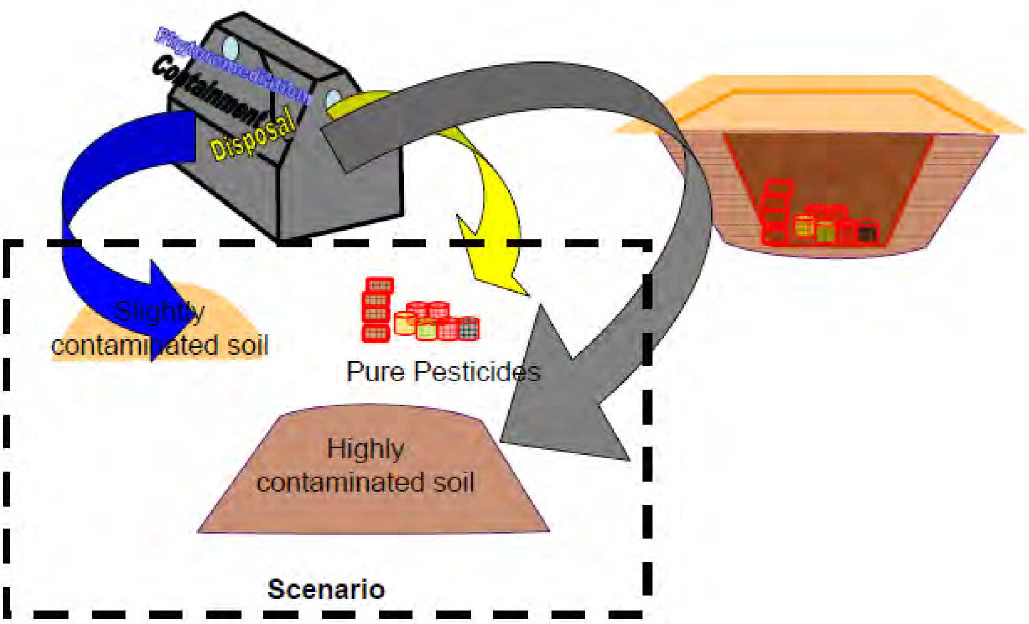

Figure 1.1 A set of selected remediation techniques for the different landfill components makes-up a remediation scenario

1.3 Contents of the report

This report is a continuation of the phase 1 and 2 report, for readability and to allow for the phase 3 report to be reviewed as a standalone document, a short summary of the outcomes of phase 1 and 2 is given in chapter 2. Following this chapter, the various components that make-up the remediation scenarios will be elaborated in chapter 3. Using MCDA, the selected remediation techniques (from the toolbox in figure 1.1) for the various landfill components are weighed in chapter 4. The information from the MCDA is then used in chapter 5 to draft three scenarios for the remediation of the landfill site. In chapter 6 the report concludes with a preliminary design of two best scenarios including an assessment of the remaining environmental risks. Chapter 7 presents the stakeholder involvement planning concerning the implementation of the remediation. The very last chapter, chapter 8, recapitulates this feasibility study.

An executive summary is added as the introductory section to this report.

2 Phase 1 and 2

2.1 Background information on the landfill site

The guarded Nubarashen landfill site can be reached from Yerevan by the highway M 15.
Uphill the landfill site is a dirt road passing the landfill site 300 - 400 m east. A culvert installed under this dirt road drains the runoff water from a large uphill separate catchment area.
This culvert is nearly filled up with sediments hindering the runoff drainage from uphill catchment area. Parallel on the north side of this road, runs a leaking water main which is also blocking the natural drainage pathway of the uphill catchment area. Because the drainage way is blocked, a pond is formed. Water from this pond infiltrates in the soil and drains into the valley of the landfill.

The landfill site itself, is a fenced area of 0.8 hectares. Within this fenced area contaminated soil, POPs and OPs are present in a clay covered hillock. The hillock is surrounded by a flat barren area of several meters wide (see figure 2.1). On the outside of this area three concrete runoff drains are present. West, 10 m down slope from the hillock but still within the fenced area, are two 1.5 m deep trenches trapping some of the runoff sediments from the entire landfill site.

Figure 2.1 Pictures of the landfill and barren soil

The fenced area has a grass/herbs cover and there are a few small trees and bushes. During the fieldwork bare patches of land were observed. The vegetation of the surrounding is also grass with few trees and bushes in the gullies. Reed is growing at flat areas which are pools with standing water during wet periods. The landfill body is located on landslide debris and is part of an active landslide. Figure 2.2 gives a bird eye view of the landfill site and surroundings.
The surrounding land is used as very extensive animal husbandry (pasture land).

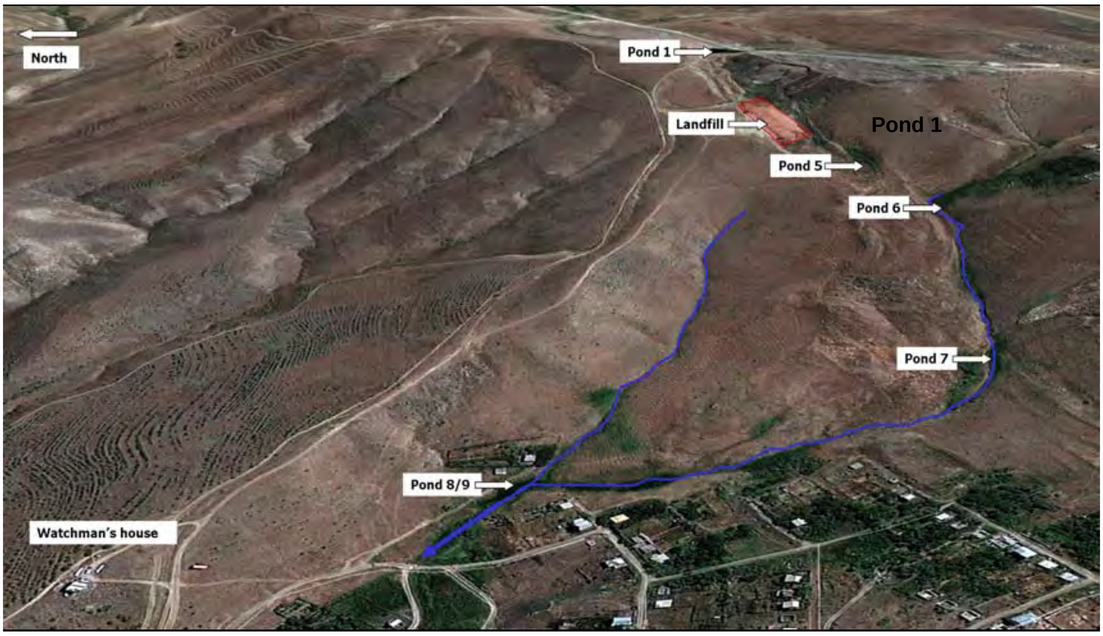

Figure 2.2 Birds eye view landfill site and surroundings

2.2 Geophysical assessment of the landfill site

The Nubarashen landfill site is situated on the debris of various landslides from the surrounding steep mountain slopes. The landfill site is situated on the debris that have filled up the valley. These debris have a thickness of several meters. This debris body and the landfill site on top of it are slowly but continuously moving towards the valley. Slope movements upstream of the landfill site are the mechanism behind the observed mass movement in the landfill site and its surrounding area. In a situation where the soil is saturated with water, slope failure can occur in the area directly above the landfill site. This in turn can decrease the stability of the landfill body. In dry conditions no slope failure is anticipated in the area directly above the landfill. Figure 2.3 gives the geotechnical interpretation of the section of the valley above the landfill site.

The debris comprises of silty (Montmorillonite) clays with volcanic tuff stones, boulders and blocks at various depths. The soil texture in the top soil (0.0 - 0.5 m bgl) varies from clayey loam to loam. The soil texture of the deeper soil horizons varies from clay to sandy clay loam. The stiffness of the top layer and landfill body is soft to firm. Generally from 2 to 4 m bgl and deeper the soil stiffness becomes very stiff to hard.

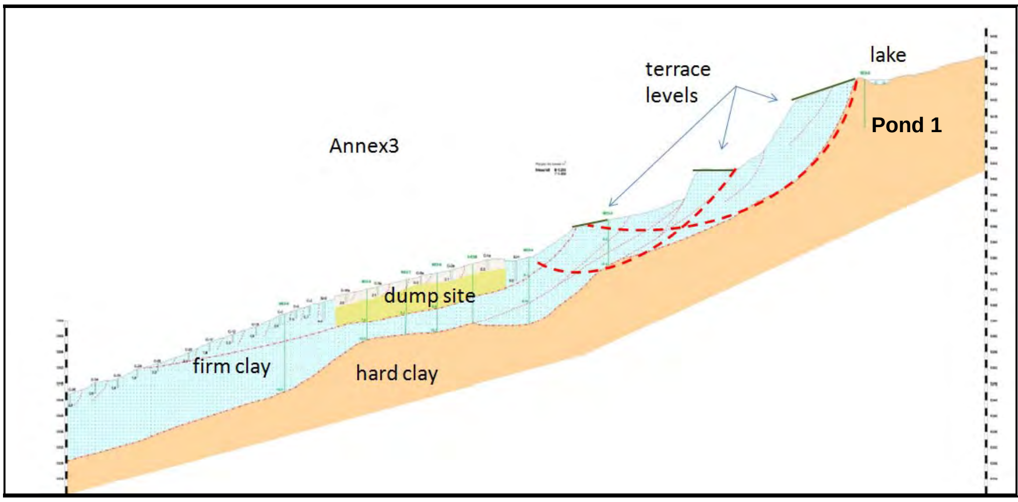

Figure 2.3 Geotechnical interpretation of section of the valley above the landfill site

2.3 Contamination situation

The landfill body, the hillock, has a total area of around 0.2 ha. The top soil of this hillock is covering the dumped pesticides with a 0.4 – 0.7 m thick clay layer with traces of pesticides and remains of packaging. This top cover of the landfill body is getting eroded. The top cover is overlaying a 2 mm ruberoid liner. Which in turn is overlaying a coarse sand layer of 5 cm (the support and/or drainage layer for the ruberoid) followed by disturbed clay layers with and without pesticides covering five different cells (one build and four excavated pits) partly filled with pure pesticides and soil mixed with pesticides. It is not clear if the ruberoid layer is sealed at the joints. Table 2.1 gives the eight different soil layers present at the landfill site and figure 2.4 gives a schematic impression of the build-up of the landfill site.

Table 2.1 Classification of soil layers landfill site

Class	Description of classes	Colour code
1	0.4 – 0.7 m top cover of clay covering the hillock	
2	2 mm ruberoid liner (barrier) directly under covering clay layer	
3	5 cm coarse sand support / drainage layer of the ruberoid	
4	Contaminated clay soil without pure pesticides	
5	Contaminated clay soil with pure pesticides	
6	Pure pesticides	
7	Clay soil under and around pesticides in the pits	
8	Bricks / stones / concrete of constructed cell 1	

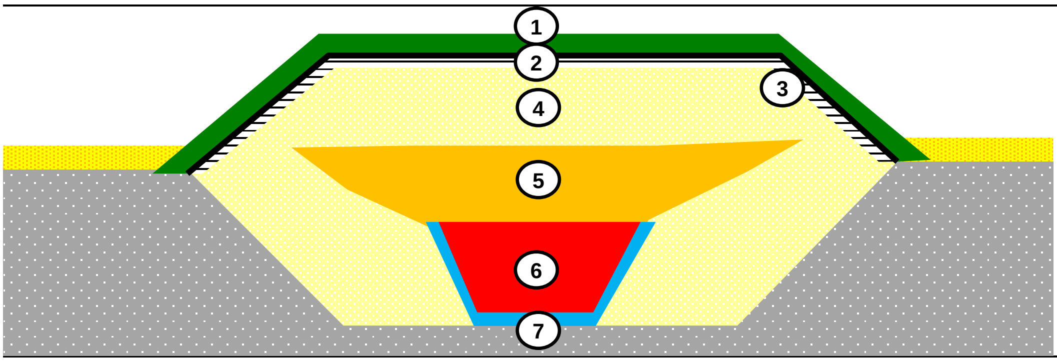

Figure 2.4 Idealized schematic impression of the build-up of the landfill site

Historic records mention the disposal of a total of 512 tons of POPs and OPs pesticides (powders and liquids in original packaging) at the site. The updated list is presented in the phase 2 report, but for convenience also attached as Appendix 5 to this report. However based on the site investigation, the total quantity of pure OPs and POPs pesticides at the site appears to exceed the quantities mentioned in the historical records. The waste at the landfill site has been disposed in a total of five cells with varying characteristics. Figure 2.5 presents the location of the five different cells within the landfill body.

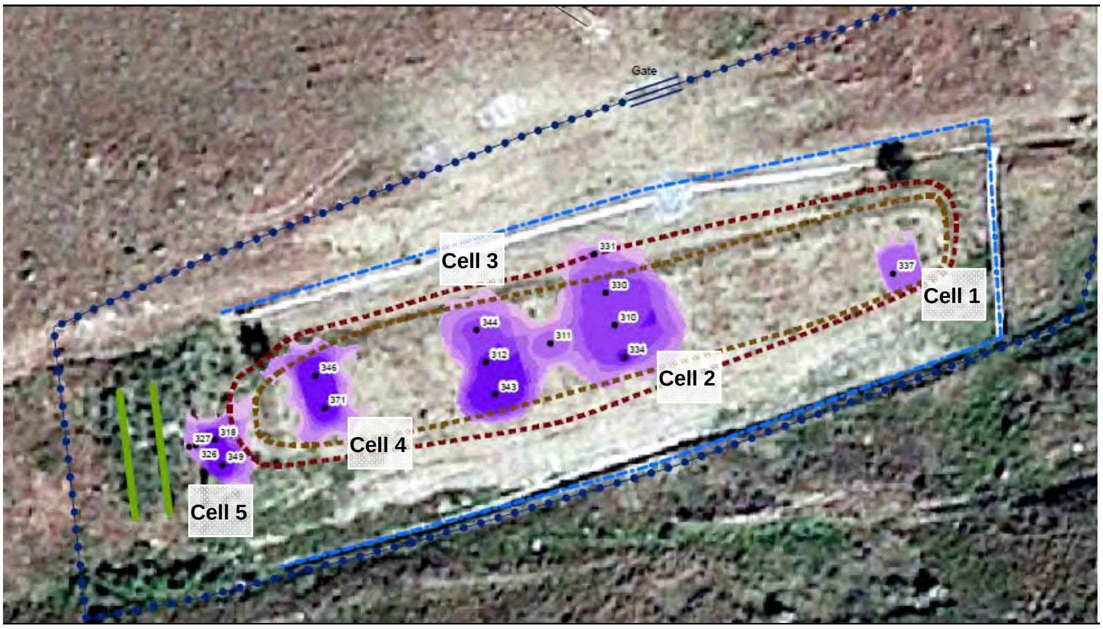

Figure 2.5 Location of the five cells and the landfill body

Cell 1 is build (600 x 600 cm) and contains an estimated 27 m^3 of pure pesticides and is located at the very eastern part of the hillock. This cell is covered by a coarse sand drainage layer of 10 cm, a ruberoid liner and a clay cover of 50 cm. The drainage layer is on top of a contaminated clay layer of 70 cm on a clay layer with around 50 % of pure pesticides of 75 cm followed by a 75 cm thick wet layer of 100 % pesticides. The bottom of this cell is at 280 cm below the top of the hillock. The top of the cell is at 160 cm minus the top of the hillock.

Cell 2 is a pit excavated in the original soil containing an estimated 186 m^3 of pure pesticides. This cell is located under the centre of the hillock except for northern part. This part is outside the area with the clay cover and ruberoid liner.

Cell 3 is located 3 meters west of cell 2 and is also a pit but with an estimated volume 178 m^3 of pure pesticides. Between cell 2 and 3, an estimated 40 m^3 of pure pesticides have been encountered. These pure pesticides are deposited here most likely during the illegal waste mining.

Cell 4 is located 18 meters west of cell 3 and is also an excavated pit in the original soil and contains an estimated 109 m^3 of pure pesticides. This cell is completely covered by the hillock and seems not to be disturbed by waste miners. The dimensions of this cell are 750 x 1,200 cm and the bottom of the cell is around 420 - 460 cm below the top of the hillock.

Cell 5 is located on the west side of the hillock and is also a pit with an estimated 65 m^3 of pure pesticides. This cell is not covered by the hillock and seems intact. The dimensions of this cell are 750 x 1,200 cm and the bottom of the cell is around 285 cm below the surface.

Outside the landfill body contaminated soil has been found randomly. Pollution outside the hillock within the fenced area is most likely associated with the illegal waste mining in 2010, either through movement of equipment that was in contact with the pure pesticides or spreading during the waste mining operation.

The fact that the (semi-permanent) groundwater table is present at relatively deep depth along with what appears to be a good natural hydro-geological barrier has prevented any off-site spreading of contamination in the groundwater. In addition no impacts on the surface water around the landfill were detected. Therefore in our remediation assessment we do not include any measures for the containment and/or clean-up of the groundwater although continued monitoring should be provided for.

Table 2.2 gives an overview of the estimated quantities of contaminated soil and pure pesticides in the landfill body and landfill site. The estimates given in this table can be considered conservative.

For the sake of contingency planning the degree of confidence is estimated to be around plus or minus 10 %. It should be noted that the difference between the three components in the landfill body is not always easy to establish in the field. This implies that the quantities given below can change due to mixing in the excavation phase of the project. Careful excavation of the landfill body will limit the mix-up of the various components and consequently avoids cross contamination of other soil.

Table 2.2 Estimated quantities of the landfill site, the Cells and landfill body

Component of general landfill site and landfill body	Estimated Quantities m^3 or ton		
	In situ	Excavated	Weight
Category 1: Pure pesticides or associated material > 30 % pure pesticides			
Pesticides in cell 1, 2, 3, 4, 5 and between cell 3 and 4	605	605	605
Contaminated clay at the bottom of four excavated pits (cell 2, 3, 4 and 5) and between cell 3 and 4	69	83	117
Total	**674**	**688**	**722**
Category 2: Overall volumes with significant potential for heavily contaminated soil above the human health risk threshold for direct exposure (>1,500 ppm DDT) or visual presence of pure pesticides in it			
Contaminated top soil with traces of pure pesticides in landfill body	1,127	1,352	1,916
Contaminated top soil with traces of pure pesticides in fenced area land	3,000	3,600	5,100
Total	**4,127**	**4,852**	**7,016**
Category 3: Overall volumes with potential for levels of soil contamination less than determined as human health risk threshold but above the agricultural (grazing) risk threshold (0.7 ppm-1,500 ppm DDT)			
Contaminated top soil without pure traces of pesticides in landfill body	2,387	2,864	4,058
Slightly contaminated top cover landfill body	890	1,068	1,513
Low contaminated soil outside the landfill site	4,000	4,800	6,800
Nominally clean white/purple coarse sandy liner support / drainage layer	100	120	170
Total	**4,377**	**8,852**	**12,541**
Category 4: Building materials with surface contamination			
Synthetic cover (2mm)	4	20	5
Contaminated bricks/concrete/rubble (cell 1)	16	19	36
Total	**20**	**39**	**41**

* Quantities are calculated by using the Digital Terrain Modeling
** Volume of excavated soil is set as 120 % of in-situ soil
1 m^3 of soil is set at 1.7 ton (factual weight varies with moisture and gravel content)
1 m^3 of rubber is set at 1.2 ton
1 m^3 of crushed concrete/rubble is set at 2.2 ton
Specific weight wet pesticide 1 ton for 1 m^3

3 Remediation components

3.1 Introduction

Based on the results of the first two phases of this study it is concluded that the contamination in the landfill site is present in the following landfill components:

- Pure pesticides (total quantity estimated at 605 m^3 indicated as category 1)
- High contaminated soil, soil with DDT concentration higher than 1,500 mg/kg dry matter (total quantity estimated at 4,196 m^3 indicated as category 2) to be divided, in a later phase of the project, in:
  - Soil with DDT concentration higher than 1,500 mg/kg dry matter with pure pesticides
  - Soil with DDT concentration higher than 1,500 mg/kg dry matter without pure pesticides
- Low contaminated soil, soil with DDT concentration lower than 1,500 mg/kg dry matter (total quantity estimated at 7,277 m^3 and 100 m^3 of coarse sand indicated as category 3)
- Contaminated construction materials (total quantity estimated at 16.2 m^3 indicated as category 4)

The above is further visualized in figure 3.1 and 3.2. The first figure depicts the factual size of the medium in which the pesticides are present. The second figure shows the total quantity of pesticides (in kg) in each medium. As becomes clear from figure 3.2 over 94 % of the on-site pesticides are present in the pure form. To eliminate the most POPs molecules all remedial scenarios will ultimately remove and destruct the pure pesticides.

In this chapter we review first for all landfill components what techniques are available to address the contamination. To have a transparent selection process we also describe, very briefly, techniques that are not logical and will never be realized. Using Multi-Criteria Decision Analysis (MCDA) we will then try and select for each component the Best Available Technique Not Entailing Excessive Cost (BATNEEC) in chapter 4. In chapter 5 we will put the selected techniques in three remedial scenarios in relation to the timing of the funding available.

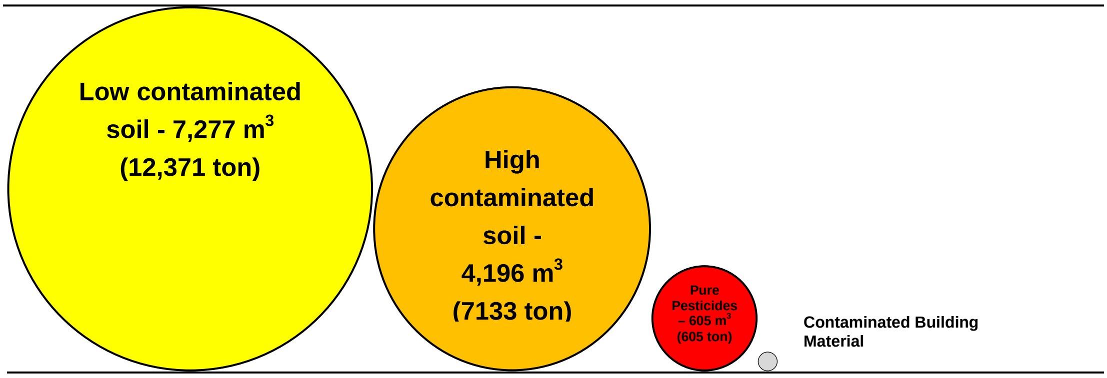

Figure 3.1 Visual representation of the respective qunatities of contaminated landfill components

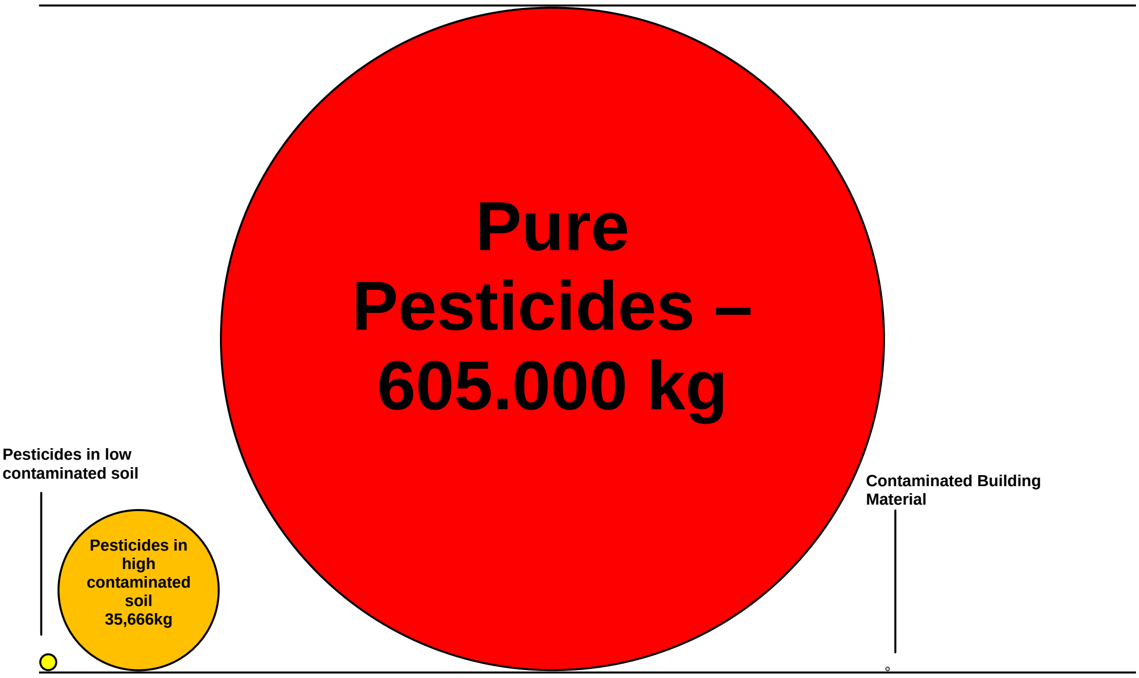

Figure 3.2 Visual representation of absolute quantities of pesticides present in the same lanfill components

3.2 Low contaminated soil

In this report, low contaminated soil is soil that has pesticide concentrations that can pose a risk if the land is used for agricultural purposes (cattle feeding), but it does not pose a direct risk for the human health.

One of the main problems with the low contaminated soil is that the presence of the contamination in the soil is very heterogeneous.

There are areas with relatively uncontaminated top soil and areas with very high levels as well as small spots with pure pesticides present in the top soil. To make a clear definition of what is low contaminated soil we use DDT as a proxy for all pesticides. DDT will be used as it is the most common pesticide in the dumpsite and it has quite stringent health risk values. Hence in this report low contaminated soil is defined as:

Low contaminated soil; is soil containing concentrations of DDT above 0.7 mg/kg dry matter but below 1,500 mg/kg dry matter and have no direct risk for human.

Within the Nubarashen area, low contaminated soil is present at the following places:
- Top soil (0 - 0,4 m) above the ruberoid on the landfill hillock (890 m^3)
- Soil inside the landfill body that has no visual presence of pesticides (2,387 m^3)
- Top 10 cm of the soil in an area surrounding the landfill site, where contaminated dust has impacted the soil (assumption based on information in FAO, GCP/ARM/003/GRE, November 5th 2010). Using an average distance of 100 m from the fenced area, approximately 40,000 m^2 is impacted (4,000 m^3)

The total quantity of low contaminated soil associated with the landfill area is estimated at 7,277 m^3. This is equivalent to around 12,371 tons. To give an impression of the total quantity of pesticides present in the low contaminated soil we assume the low contaminated soil contains on average of 30 mg/kg dry matter of pesticides which is basically below the low POPs content. This would set the total quantity of pesticides present in the low contaminated soil at 371.13 kg.

There are several techniques to eliminate the risks of the low contaminated soil such as:
- Remove and clean in an ex-situ controlled environment
- Remove and clean in an on-site controlled environment
- In-situ vitrification of the contaminated soil
- Remove and remediate on-site such as bioremediation using Daramend
- Phytoremediation in-situ using local vegetation

There are also techniques to contain the risks of the low contaminated soil such as:
- Remove and disposal at a controlled landfill to be used as intermediate cover
- Isolate on- or off-site and restrict site use

The destruction/cleaning of the low contaminated soil in an ex-situ controlled environment, such as a co-processing in suitable cement kiln or soil treatment plant are the most straightforward methods for dealing with the contaminated soil. Low contaminated soil will be excavated and transported by truck to the final destination, depending on the logistical process temporary storage at a centralized facility might be needed before shipment to the final destination. The removed soils will be resupplied with clean soil from the surroundings.

The removed low contaminated soil can also be contained ex-situ for example used as intermediate cover layers at a sanitary landfill.

For on-site cleaning of the POPs pesticides contaminated soil, several techniques are available on the market such as: Thermal Desorption, BCD, Super Critical Water Oxidation (SWO), Gas Phase Chemical Reduction (GPCR) and Mechanical Dehalogenation in a ball mill and In-situ vitrification or glassification are just some of them, but they are designed for high strength wastes and high contaminated soils. They are much too expensive for these kinds of soils and therefore not considered for the remediation of low contaminated soil.

The on-site remediation of the low contaminated soil is a possibility. Bio-remediation and phytoremediation are two technologies that have experience with remediation of contaminated soil.

The bio-remediation involves enhanced bio-degradation using additives (some of them are patented) such as Daramend that produces anoxic-conditions that favours decomposition of the Halogen compounds. The treated soil is then tilled in a land farm to promote oxic-conditions. These oxic-anoxic cycles are repeated till the desired clean-up targets are met.

Phytoremediation uses vegetation, enzymes derived from the vegetation, and other complex processes, to isolate, destroy, transport, and remove organic pollutants from contaminated soils. For a number of soil contaminations phytoremediation is accepted as a proven technique. Experiences with phytoremediation of POPs pesticides contaminated soil are so far limited. In the context of this project phytoremediation should therefore be seen more as a containment technique (the plant cover will prevent access to and erosion of the contaminated soil) with the added benefit that the concentrations of contamination in the soil can decrease over time.

3.3 High contaminated soil

In this report, high contaminated soil is soil that has POPs pesticides concentrations above 1,500 mg/kg dry matter as with low contaminated soil, DDT is used as a proxy. Hence in this report high contaminated soil is defined as:

Soil containing concentrations of DDT above 1,500 mg/kg dry matter that has:
1. *Visual presence of pesticides but less than 30 % of the volume*
2. *No visual presence of pesticides.*

The two different sort of contaminations (visual ad no visual presence of pesticides) should be separated in the during excavation works. The soil with visual presence of pesticides should be seen and treated as pure POPS pesticides. The soil with no visual presence of pesticides should be seen and treated as highly contaminated soil.

Within the Nubarashen area, high contaminated soil is present at the following places:
- Soil below the ruberoid within the hillock but above the pure pesticides (1,127 m^3)
- Soil (5 cm) directly underneath and next to the pure pesticides (69 m^3)
- The soil that is directly surrounding the hillock but is within the fenced area (3,000 m^3)

The total quantity of high contaminated soil (visual presence of pesticides and no visual presence of pesticides) within the fenced area is estimated at 4,196 m^3. This is equivalent to around 7,133 tons. When calculating with an average concentration of 5,000 mg/kg dry matter DDT, the total quantity of pesticides present in the high contaminated soil is around 35,666 kg.
This number is worst case and if the two different contaminations are segregated during excavation the real number will be probably be lower.

For the high contaminated soil there are three techniques to eliminate the related risks:
1. Remove and clean in a controlled environment ex-situ
2. Remove and clean in a controlled environment on-site, the purified soil can then be re-used on-site
3. In-situ vitrification of the contaminated soil

To clean the high contaminated soil in a controlled environment ex-situ, the soil should be exported/transported to a destruction / cleaning facility using one of more of the techniques such Thermal Desorption, BCD, Super Critical Water Oxidation (SWO), Gas Phase Chemical Reduction (GPCR) and Mechanical Dehalogenation and High Temperature Incineration (HTI). These techniques are realistic for the high contaminated soil. The co-processing of the pure pesticides and the high contaminated soil in cement kilns is never done in Armenia. If the request for destruction of the pesticides waste is put on the market and cement companies in the country are interested to extend their activities into this sector, they have to demonstrate that hey have the capability to co-process these POPs pesticides waste in a sound environmentally manner.
The high contaminated soil can also be treated ex-situ in the country when a company is prepared to import/build a (small) plant using one of the mentioned techniques. The amount to be treated has to be sufficient justify the investment.

On-site, in-situ treatments of the high contaminated soil using vitrification / glassification or In-Situ Thermal Desorption (ISTD) are possibilities. In case of vitrification the soil will be heated using electronic rods. An electric current flows then between the electrodes generating heat, melting first a starter path and then the surrounding soil. Gasses that escape the soil will need to be collected and purified. This technology is indistinct of the type of soil and as such will only be useful in case the pure pesticides and part of the low contaminated soil will also be addressed.
It is mentioned that the suitability of these technologies will be determined by the contractors themselves when they are intending to submit a proposal as this remediation project is on the public market.

There are also techniques to contain the risks of the high contaminated soil. The containment techniques are for instance:

- Excavate, repack and transport the high contaminated soil to a safe off-site storage facility
- Isolate and contain, the high contaminated soil in the current upgrade landfill and restrict site, monitor and maintain
- Excavate, repack and transport the high contaminated soil for final disposal to a controlled landfill site

Because of the high concentrations of pesticides in the high contaminated soil bio-remediation such as land farming and phytoremediation are not considered viable.

As an alternative to the remediation of the high contaminated soil, containment measures are a possibility. As the concentrations of pesticides (using DDT as a proxy) exceed the 1,500 mg/kg threshold value for human risks the prevention of contact with the high contaminated soil is the main goal. The most suitable technique is to repackage the high contaminated soil and store it in a dry above ground warehouse either on the current site or in a centralized location in Armenia. The last option gives the possibility to use this warehouse as Intermediate Collection Centre in the upcoming UNDP, GEF POPs pesticides project. The engineering requirements for such a more permanent Intermediate Collection Centre are given in a separate report presented in Appendix 4. Alternatively when the required funds are not yet available, the high contaminated soil can, with some adaptations, be encapsulated in the existing landfill.

3.4 Pure pesticides

In this report, pure pesticides are given as a body that contains > 30 % pesticides (volume). In addition to the pure pesticides, soil and packaging materials may be present in the cell and four pits. Because the separation of the POPs pesticides from the other severely contaminated materials is not desirable (the POPs pesticides are all mixed with the other waste due to the way it was dumped and the waste mining) and practically impossible, the entire body of the cell and four pits will be considered as pure POPs pesticides.

Hence in this report pure POPs pesticides are defined as:

A body that contains a minimum of 30 % (volume) of pure pesticides

In the Nubarashen landfill site a total of 605 m^3 of pure pesticides has been located. On-site the POPs pesticides have become mixed and compacted by the overlying clay layers. The weight of the (wet) POPs pesticides is there for estimated at 1 ton/m^3.

Although costly, the final destruction of the pure POPS pesticides is the ultimate goal of the Stockholm Convention. Hence the final destruction of the pesticides is always part of all the scenarios proposed.
The following options exist for the destruction of the POPs pesticides:

- Excavate, (re)pack and direct transport to a destruction facility in the country, avoiding expensive temporary storage awaiting final destruction
- Excavate, (re)pack and transport to a temporary storage awaiting final destruction and finally transportation to a destruction facility in the country
- Excavate, repack and transport to a destruction facility outside the country avoiding expensive temporary storage awaiting final destruction
- Excavate, repack and transport to a temporary storage awaiting final destruction and finally transportation to a destruction facility outside the country
- In-situ vitrification of the POPS pesticides

In-situ vitrification is only a viable option if also (a large part of) the high contaminated soil will be addressed using this technique. High and low contaminated soil can be included as vitrification material, as material with silicates is needed for the process. As early mentioned the amount to be treated has to be sufficient to justify the investment.

If currently sufficient funds are lacking for the destruction it is possible to:

- Excavate, (re)pack and store in an off-site centralized storage awaiting final destruction
- Contain on-site awaiting final destruction in an upgraded landfill fully covering the pure pesticides, controlling erosion, preventing site access and infiltration of the pesticides, excavate, (re)pack, and finally destruct

To destruct the pesticides, packed in UN approved repackaging material, the pesticides can be:

1. Exported to a destruction facility using techniques as mentioned earlier for the high contaminated soil. The most viable techniques for the pesticides are Thermal Desorption, BCD, Super Critical Water Oxidation (SWO), Gas Phase Chemical Reduction (GPCR), Mechanical Dehalogenation and High Temperature Incineration (HTI)
2. Transported to a destruction facility using on of the techniques in the country

3.5 Contaminated construction materials

In this report, contaminated construction materials are those materials that have been in direct contact with pure (liquefied) pesticides for a prolonged period of time but can be excavated separately from the pure pesticides. Based on the site investigation, only one cell was a constructed basin. A total of 16.2 m^3 (round 20 m^3) of contaminated construction material will be released when cell 1 demolished.

The quantity of contaminated construction material is, compared to the pure pesticides or contaminated soil, limited. Therefore the treatment of the construction materials will not be a major consideration in the selection of the remediation scenario.
Depending on the degree of contamination the following two techniques exist for dealing with the contaminated construction materials:

- The building material that is not only contaminated at the outside:
  - Clean from waste at the outside
  - Demolish
  - Excavate
  - Clean manually excavated rubble from contaminates soil
  - Pack and transported to a cleaning facility
  - Clean mechanically and vacuum clean manually in an enclosure
  - Recover particulate/soil and treat as pure pesticides
  - Dispose clean rubble in a controlled landfill
- The building material that is only contaminated at the surface:
  - Clean from waste at the outside
  - Demolish
  - Excavate and clean manually excavated rubble from contaminates soil
  - Pack and transport for containment at a controlled landfill

4 Multi Criteria Decision Analysis (MDCA)

4.1 Introduction

To select the best two scenarios for the remediation of the landfill a step wise process will be followed. Figure 4.1 visualizes this step wise process. The aim is to select the Best Available Technique Not Entailing Excessive Cost (BATNEEC) for the two best scenarios and will be carried out by using a Multi-Criteria Decision Analysis (MCDA). With this evaluation tool the different remediation techniques are compared. This report does not prescribe or assess the individual techniques that are on the market for the destruction of the pure pesticides and techniques that clean the soil, but rather gives an overall assessment of the suitability of a group of techniques for the remediation of the components of the landfill site. This allows for a certain amount of flexibility in the future when the factual works will be tendered and carried out.

The mentioned MDCA criteria in table 4.1 are used to assess the suitability of the various techniques for the landfill components as prescribed in chapter 3. The used score for the MCDA consists of the following five levels:

1. Aspects that have strong negative deviation from goals get one point
2. Aspects that are not in compliance get two points
3. Aspects that are almost in compliance are given a score of three points
4. Aspects that are in compliance have a score of four points
5. Aspects that are in compliance and have additional benefits get five points

Table 4.1 MCDA criteria

No	MCDA criteria	Scenario objectives at best score 5 in the MCDA
1	Planning	• The scenario finalizes within one season (May - October)
2	Technical feasibility	• The in-situ, ex-situ on- or off-site proposed techniques are feasible in Armenia
3	Future land-use	• The scenario allows transfer of people and cattle along the remediated landfill site when completed
4	Environmental impact	• Scenario mitigates direct risks associated with pesticides with the least environmental impact • Scenario destructs the most POPs pesticides molecules
5	Monitoring and aftercare	• Scenario has a minimum of monitoring and aftercare
6	Risk factors	• Scenario has a minimum of project risk factors

No	MCDA criteria	Scenario objectives at best score 5 in the MCDA
7	Social impact	• Scenario improves fostering national capacity / infrastructure related to Hazardous Waste and soil remediation • Scenario has the best short and long-term job creation possibilities
8	Cost	• Scenario has the lowest cost

Planning

Planning implementation is made up of the following two sub-assessments:

1. The ability to execute the implementation of the on-site works and off-site works at a permitted and controlled environment within one season (May-October)
2. The time needed to finalize / complete the remediation destruction works

The implementation of the on-site works within one season was chosen as the climatic conditions and accessibility of the site make the execution of work in the winter season very challenging. Techniques that require multiple seasons for the treatment of the contamination are considered less favourable. The time limit for the site remediation was set at 1 – 5 years max as this timeframe is fairly manageable for governmental agencies. The shorter the remediation / destruction works are completed the better.

Technique

Regarding the technical feasibility, only techniques that can, within reason, be executed in the Armenian environment are considered technically feasible. This implies that technologies where for instance specialized technical support is needed on-site for prolonged periods of time, or techniques that are vulnerable to the climate at the site are not deemed technically feasible.
The various techniques are scored for the:

1. Robustness of the technology
2. Availability of the technology in Armenia
3. Availability of the required skills sets and materials in Armenia
4. Previous experience with the proven track record
5. Health and safety during the execution of the works
6. Availability of suitable utilities and infrastructure

Land-use

The assessment of the land-use of the site is closely related to the environmental impact. Based on the risk assessment as performed in phase 2, there are two risk types distinguished. Direct risks for staff working in the contaminated area, set at 1,500 mg/kg dry matter of DDT in top soil and latent risk for cattle feeding in the area, set at 0.7 mg/kg dry matter of DDT in the top soil. The goal of the remediation is restrict land-use to undisturbed / monitored grasslands.

In case direct risks remain there is a strong negative deviation from the original goals.
The sub-aspects considered are the risks related to site accessibility and the risk using the direct site surroundings.

Environmental impact
Environmental merits and benefits locally and global are used to measure the positive aspects of the various techniques. For the local environmental impact the techniques are scored according to future impacts on soil, groundwater and air quality as well as the environmental impacts during the construction phase, the amount of CO_2 used for the technology and the amount of base material needed. For the global environmental benefit of each technique the number of pesticides molecules destructed is taken for this analysis.

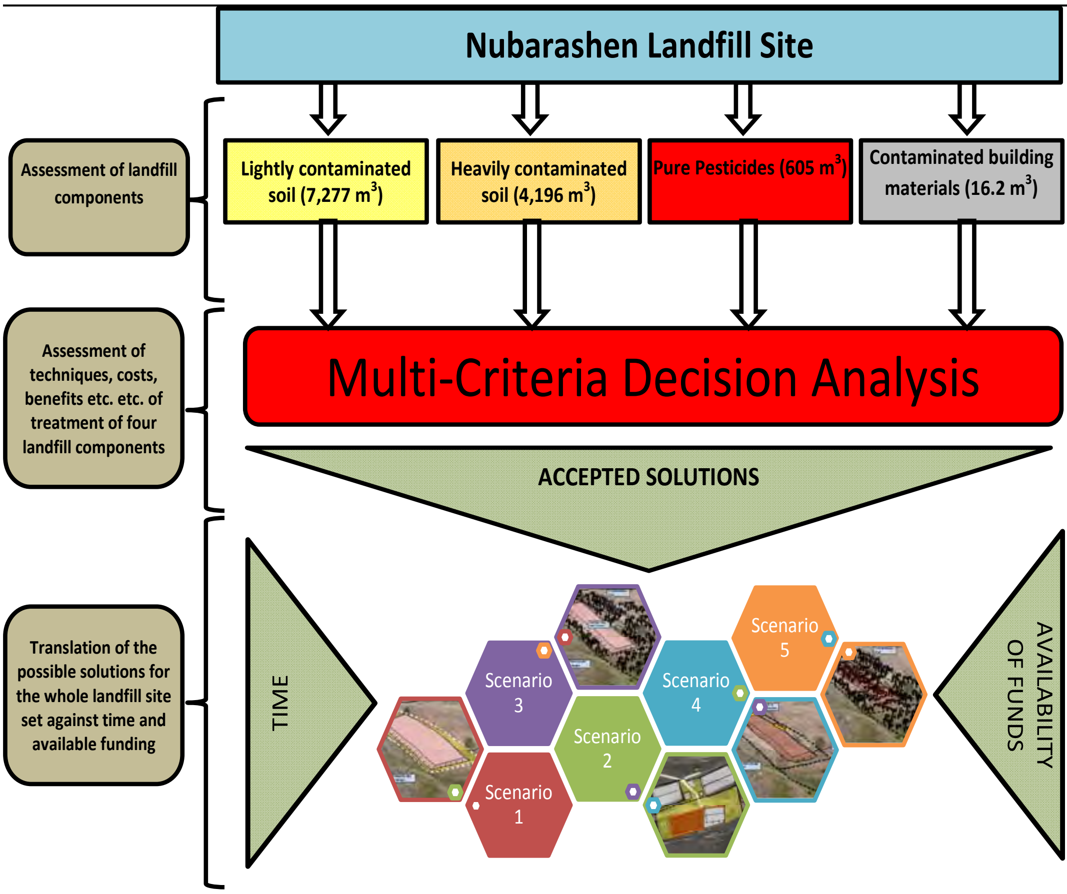

Figure 4.1 Step wise process of selection of the five remediation scenarios

Monitoring and aftercare
Monitoring and aftercare after the remediation should be kept to an absolute minimum. The more intense and complex the monitoring and aftercare requirement generally, the less sustainable will be the solution given on going funding demands.

Risk factors
Project risk factors are related to the implementation of the remedial measures. Based on the proposed techniques the risks for failure of the technique, either in time, money, sustainability or from a health and safety perspective and the dependence of climate conditions will be assessed.

Social impacts
Social impacts are viewed as the benefits of a technique in fostering national capacity / infrastructure related to Hazardous Waste and soil remediation as well as the short and long-term job creation from the deployment of the technique. The improvement of the livelihood of those using the site is also seen as positive although it has to be mentioned that the surrounding site use will be only very extensive animal husbandry. The risk that the solution proposed is not accepted by population and/or other stakeholders is also taken into account in the scoring of this aspect.

Cost
Last but not least the costs of the technique should be as low as possible both for the remediation itself as for the future monitoring and aftercare costs.

4.2 Low contaminated soil

Table 4.2 gives the subjective results of the MCDA for the following remediation techniques for the 7,277 m^3 (12,371 tons) low contaminated soil (earlier indicated as category 3):

- Ex-situ remediation of the low contaminated soil
- In-situ remediation of the low contaminated soil
- Bioremediation of the low contaminated soil
- Phytoremediation of the low contaminated soil
- Containment of the low contaminated soil

The reasoning behind the assessment is given in this section. The five levels explained in the previous section are used to carry out the MCDA. Appendix 1 has the detailed scoring for mentioned techniques for the low contaminated soil.

Planning
For the assessment on planning the above mentioned two criteria (implementation within one season and time needed to complete) are used.

In-situ remediation and bio-remediation of the low contaminated soil score is the same on planning because the on-site implementation will take more than one season and the in-situ remediation will take several years, but will also be completed within 5 years.
The bio-remediation needs more than one season on-site work, it will most likely be remediated within 5 years and during this whole period the equipment and staff will be active on-site. Although completely different in timing, the total score for planning is the same as the previous.

The phytoremediation and containment of the low contaminated soil have the same score, but these two scores are lower than the previous. The implementation of the measure can be completed in one season but the duration of the phytoremediation and containment will take very long (containment is everlasting).

Technique
For the technical assessment the above mentioned six criteria (complexity, availability, execution, experiences, safety and needed infrastructure) are used. Based on the assessment it is concluded that the remediation techniques for the 7,277 m^3 low contaminated soil such as bio-remediation and phytoremediation would be technically feasible but do not have any additional benefits compared to containment of the low contaminated soil. Therefore the overall technical score for containment is the highest.

Land-use
For the assessment on land-use the above mentioned two criteria (site accessibility and land-use restrictions of the surrounding) are used. Land-use is restricted when the bio-remediation, phytoremediation and/or containment are applied for the low contaminated soil. The given land-use score is the lowest for phytoremediation and containment.

Environmental impact
For the assessment of the environmental impact the above mentioned six criteria (no further deterioration of the soil, no impact on groundwater, no formation and spreading of contaminated dust, environmental impact limited during construction, CO_2 emission, the used base material and the destruction of POPs molecules) are used. With bioremediation a reduction of 60-90 % in the pesticide content of soil can be achieved. This implies that when using bioremediation the final concentrations of pesticides will remain above the 0.7 mg/kg d.m. level for unrestricted use of the area. Therefore this technique does not have any major environmental benefits compared to either phytoremediation or containment and additional containment measures are even necessary. Because of this the containment of low contaminated soil has the highest score on the environmental merits/impact and risk reduction.

Monitoring aftercare and maintenance

For the assessment on monitoring aftercare and maintenance no sub-aspects are used. Bio-remediation will require significant monitoring and after care because the risk for residues of soil contamination will remain. The monitoring, aftercare and maintenance is forever when the low contaminated soil is phytoremediated and/or contained the score for this aspect is therefore low.

Risk factors

For the assessment of the risk factors the technical and financial risks are used. Both risks (financial and technical) are significant when using bio-remediation. The technical and financial risks are acceptable when the low contaminated soil is bio-remediated. The technical and financial risks when phytoremediation and/or containment are applied are very limited.

Social Impact

For the assessment on the social impact job creation on the short term, job creation on the long term, improvement of national infrastructure for hazardous wastes and the improvement of local condition for extensive cattle farming are used.
When bioremediation is applied there are chances for new jobs. It provides limited experience to the Armenian hazardous wastes community but the area around the landfill cannot be used for herding but has no access restrictions.
Phytoremediation and containment create jobs, do not contribute to the Armenian hazardous wastes infrastructure development and the soil quality does not allow cattle farming.

Cost

For the assessment on cost the implementation cost and the cost for aftercare are considered. Because the implementation cost is a crucial aspect is weighs 4 times more than the cost for aftercare. The implementation costs for bioremediation, phytoremediation or containment are comparable implementation is not expensive therefore they score all high for this aspect. The costs for aftercare differ but not significant. The highest score is given to the bio-remediation.

From the MCDA it is concluded that the most suitable technique for the low contaminated soil is phytoremediation and containment. These two techniques can be combined to achieve greater benefits.

Table 4.2 MCDA remediation techniques for the 7,277 m^3 low contaminated soil

Technique	Planning	Technical Feasibility	Land use	Environmental merits	Monitoring aftercare	Risk factors	Social Impact	Cost / Benefit	Total
Daramend-bioremediation	3.5	3.3	3.0	3.6	3.0	2.5	3.0	3.0	**24.9**
Phytoremediation	3.0	4.0	2.0	4.0	2.0	5.0	3.3	4.4	**27.7**
Containment	3.0	4.8	2.0	4.0	2.0	5.0	3.3	4.4	**28.5**

4.3 High contaminated soil

Table 4.3 gives the subjective results of the MCDA for the following remediation techniques for the 4,196 m^3 high contaminated soil (earlier indicated as category 2):

- Ex-situ remediation of the high contaminated soil
- On-site remediation of the high contaminated soil
- In-situ vitrification of the contaminated soil
- Containment in new landfill or storage of the high contaminated soil
- Containment in current landfill of the high contaminated soil

The reasoning behind the assessment is given in text below. The identical five levels as the levels of the low contaminated soil are used to carry out the MCDA for the remediation techniques for the high contaminated soil. The detailed scoring is given in appendix 1.

Planning

For the assessment on planning the same criteria (implementation within one season and time needed to complete) are used. The on-site activities (excavation, repackaging and removal) for the ex-situ and off-site remediation of the 4,196 m^3 high contaminated soil can probably not be completed within one or two seasons. The ex-situ and off-site soil remediation/cleaning of the 4,196 m^3 high contaminated soil will be completed within 5 years. Therefore the ex-situ remediation is given an average score (3.5) for planning. In-situ remediation of the high contaminated soil scores on planning high because the on-site implementation will take not more than one season and the in-situ remediation will probably be completed within 1 year.
In-situ vitrification can be implemented within one season if multiple installations are applied at the same time. This will increase costs.
The implementation of containment in the current landfill, a new landfill or storage can be completed within one season and therefore the score for this sub-aspect is high. But, because it is containment, these techniques score low on time of completion (containment is everlasting).

Technical Feasibility
For the technical assessment the same mentioned six criteria are used. Based on the assessment it is concluded that the ex-situ techniques for the 4,196 m^3 high contaminated soil such as incineration are considered viable techniques. Application of on-site or in-situ techniques and vitrification can only be carried by highly specialized contractors, but seem feasible.
Off-site or on-site containment is technically feasible; the related works can be carried out by local contractors.

Land-use
For the assessment on land-use, site accessibility and land-use restrictions of the surrounding are used. The land-use restrictions after the high contaminated soil is ex-situ or in-situ remediated or off-site contained are very limited. The given scores for this criterion are for these three techniques the highest. In case of in-situ vitrification the land-use restrictions are very limited. The area with the treated soil will have poor soil and therefore some limitation on for instance cattle grazing. Site accessibility and surrounding land-use when the high contaminated soil is contained on-site are limited.

Environmental merits
For the assessment of the environmental impact the above mentioned six criteria are used. The ex-situ, in-situ techniques and off-site containment score high concerning the positive effect on the soil and groundwater quality. They score very low on all environmental aspects during construction. In-situ vitrification scores high on all criteria with the exception of the improvement of soil quality where vitrification scorer lower than the other techniques as is will significantly alter the soil, not only of the pesticide containing soil but also the soil directly around it. Only the destruction techniques score very high on the destruction of POPs molecules. Containment score low on the elimination of POPs molecules.

Monitoring aftercare
The site monitoring and aftercare is very limited for the first three techniques. But if contained elsewhere monitoring and aftercare is of course needed at the new containment site. The score for this aspect is the lowest for the on-site containment.

Risk factors
For the assessment of the risk factors the technical and financial risks are used. For the ex-situ, off-site remediation the technical risks are limited. The financial risks are higher because the cost can easily deviate from the original estimates because of various factors.
Both risks (financial and technical) are significant when using in-site remediation. The techniques can fail easily and this will have enormous financial consequences. Therefore both aspects have the lowest score.

The financial and technical risks for in-situ vitrification are also assessed as moderate because technique is proven and the location of the high contaminated soil is known. The technical and financial risks are very limited when the high contaminated soil is contained.

Social Impact

For the assessment on the social impact job creation on the short term, job creation on the long term, improvement of national infrastructure for hazardous wastes and the improvement of local condition for extensive cattle farming are used.

Ex-situ and off-site remediation do not create jobs, the current employed site staff will be also not needed in the near future. The in-site remediation scores on these aspects a bit better. Both these techniques do not contribute to the Armenian hazardous wastes infrastructure development but improves the soil quality and make extensive cattle farming possible. In-situ vitrification can only be executed by experienced foreign contractors. Job creation in Armenia during the implementation will be limited at most. In addition long term benefits for, for instance cattle grazing, are not expected as the soil in the area will be changed significantly but t. For the containment techniques the chance for new job creation is a bit better. It provides limited experience to the Armenian hazardous wastes community. When contained on-site the area around the landfill cannot be used for herding and the site itself has access restrictions.

Cost

For the assessment on cost the implementation cost and the cost for aftercare are considered. Because the implementation cost is a crucial aspect it has a weight of 4 times more than the cost for aftercare. The costs for ex-situ, off-site or on-site techniques (including in-situ vitrification) of the 4,196 m^3 high contaminated soil are significantly higher than the containment techniques.

Table 4.3 MCDA remediation techniques for the 4,196 m^3 high contaminated soil

Technique	Planning	Technical Feasibility	Land use	Environmental merits	Monitoring aftercare	Risk factors	Social Impact	Cost / Benefit	Total
Ex-situ destruction	4.5	2.7	5.0	4.0	5.0	3.0	3.3	2.6	30.0
On-site destruction	5.0	1.5	4.5	4.1	5.0	3.0	2.8	2.6	28.5
In-situ vitrification	4.5	2.2	4.5	3.4	5.0	3.0	2.8	3.4	28.7
Containment in new to be constructed landfill	3.0	5.0	5.0	3.6	3.0	4.5	4.5	3.8	32.4
Containment in current landfill	3.0	5.0	2.0	3.0	1.0	5.0	3.8	4.4	27.2

From the MCDA it is concluded that despite the high costs, the final destruction of this high contaminated soil in an ex-situ controlled environment is the preferred technique. On-site destruction of the soil is in theory possible but the financial benefits from the reduced transportation do not outweigh the extra costs associated with the installation of the treatment plant. In addition on-site destruction processes are mostly patented technologies that require expert technical input and hence have a lower mark for technical feasibility noting that this can be mitigated by establishment of suitable infrastructure at more practical location.
In-situ vitrification is not considered an option as the environmental benefits do not outweigh the risks and costs associated with applying the technique at this location.
Containment in a new to be constructed secure landfill has the preference for as long as the funding is not available for the destruction of the pesticides. A new landfill or designated warehouse reduces the risks of further spreading of the contamination in the surrounding area and secures the contaminated material under appropriate care and custody. The final choice in this nevertheless depends on the estimated time it will take before funding for destruction becomes available. If funding for the final destruction is available within a short time frame, the additional costs for the construction of a new landfill or designated warehouse do not compensate the risk reduction achieved.

4.4 Pure pesticides

Table 4.4 gives the subjective results of the MCDA for the 605 m^3 pure pesticides (earlier indicated as category 1). The reasoning behind the assessment is given in text below. The MCDA levels used are identical to the used before used levels. The detailed scoring is also given in appendix 1.

Planning

The on-site works (excavation and repackaging 605 m^3) for the ex-situ treatment, the off-site containment in a new landfill or storage and the on-site containment of the pure pesticides can be carried out within one season. The time needed to export and to destruct the repacked pesticides depends on the country and the planning of the contractor. But this will probably take 1 to two years. On-site destruction and in-situ vitrification can be carried out in one season but needs probably extra investments.

Technical Feasibility

For the technical assessment the same mentioned six criteria are used. Based on the assessment it is concluded that the ex-situ techniques for the 605 m^3 of pure pesticides such as incineration are considered viable techniques. Application of on-site / in-situ techniques such as vitrification can only be carried by highly specialized contractors, but seems feasible. If an on-site destruction technology is selected is should also be feasible to be applied for the high contaminated soil.

Off-site and on-site containment are technically feasible, the related works can be carried out by local contractors.

Land-use
The land-use for the landfill site and surrounding have no restrictions concerning the pure pesticides when it is off-site destructed or off-site contained. Depending on the in-situ technique there is always a certain very limited restriction on the site. Vitrification has actually no restriction on land use. The surrounding land-use will have some restrictions when the 605 m^3 is on-site contained.

Environmental merits
For the assessment of the environmental impact the above mentioned six criteria are used. The ex-situ, in-situ techniques and off-site containment score high concerning the positive effect on the soil and groundwater quality. They score very low on all environmental aspects during implementation. Only the off-site and on-site destruction techniques score very high on the destruction of POPs molecules. Containment score of course low on the elimination of POPs molecules. In-situ vitrification scores high on all aspects except for CO_2 emissions. Contrary to the application in the high contaminated soil, in-situ vitrification has no or only limited impact on the quality of the soil as the focus is in this case on the pure pesticides.

Monitoring aftercare
The site monitoring and aftercare for the techniques that removed the pesticides from the site is not needed (in relation to the pure pesticides). Monitoring and aftercare for the on-site destruction depends on the on-site residues, but should be minimal. The monitoring and aftercare is extensive when the 605 m^3 are contained on-site.

Risk factors
All techniques are technically feasible and the only financial risks associated with the techniques lie in changes in the total quantity of the pure pesticides. This aspect will depend strongly on the excavation skills of the staff at the site. The financial and technical risks for in-situ vitrification are also low because technique is proven and the location of the pure pesticides is known.

Social Impact
For the assessment on the social impact the ex-situ and off-site remediation as well as the in-situ vitrification do not create jobs, the current employed site staff will be also not needed in the near future. The in-situ remediation scores on these aspects a bit better. Both these techniques do not contribute to the Armenian hazardous wastes infrastructure development but improves the soil quality and make extensive cattle farming possible. For the containment techniques the chance for new job creation is a bit better.

It provides limited experience to the Armenian hazardous wastes community. When contained on-site the area around the landfill cannot be used for herding and the site has access restrictions.

Cost

Because the implementation cost is a crucial aspect it has a weight of 4 times more than the cost for aftercare. The costs for ex-situ, off-site or on-site techniques of the 605 m^3 soil are significantly higher than the containment off-site and on-site. Costs for the in-situ vitrification are lower than for ex-situ or on-site treatment. It should be noted however that in-situ vitrification is only a viable option when also applied to the highly contaminated soil.

Table 4.4 MCDA remediation techniques for pure pesticides

Technique	Planning	Technical Feasibility	Land use	Environmental merits	Monitoring aftercare	Risk factors	Social Impact	Cost / Benefit	Total
Ex-situ destruction	5.0	2.8	5.0	4.1	5.0	5.0	3.0	2.6	32.6
On-site destruction	4.5	1.5	4.5	4.1	5.0	3.0	2.8	3.4	28.8
In-situ vitrification	5.0	2.2	5.0	4.3	5.0	3.0	3.0	3.4	30.9
Containment in new landfill or storage	3.0	5.0	5.0	3.6	1.0	4.5	4.3	3.4	29.7
Containment in current landfill	3.0	4.8	2.0	3.0	1.0	5.0	3.3	4.2	26.3

Scoring for the pure pesticides in the MDCA analysis is nearly identical to the MCDA scores of the high contaminated soil. Main difference is that the total score for the ex-situ destruction is higher in case of the pure pesticides and the environmental merits for the containment techniques are estimated as far lower. In addition the score for in-situ vitrification is quite high it should however be noted that the use of in-situ vitrification is only viable when also used for the high contaminated soil. Therefore this technique is not considered further for the treatment of the pure pesticides.

4.5 Contaminated construction materials

No MDCA analysis was made for the 20 m^3 contaminated construction materials (earlier indicated as category 4) present at the site. The quantity of the contaminated construction materials is limited in comparison to the high contaminated soil and pure pesticides. It is proposed to address the contaminated construction materials as described in section 3.5.

5 Remediation scenarios

5.1 Introduction

The MCDA in chapter 4 has given insight in the most suitable techniques for the remediation of the four components of the landfill site. Based on the MCDA the final solution for the landfill site is given as:

- The excavation and ex-situ destruction of the pure pesticides of cell 1 and the four pits
- The excavation of ex-situ of the high contaminated soil and if possible separation in:
  - Ex-situ treatment of the soil with visual presence of but less than 30 % of pesticides
  - Ex situ treatment of the soil with no visual presence of pesticides
- The phytoremediation and containment of the low contaminated soil
- The on-site or off site decontamination of the construction materials and land filling of the cleaned material and destruction of the removed waste as pure pesticides

The now approved GEF co-financed investment project and potentially other bilateral and national initiatives on this site are relevant for the possible remediation scenarios selection and recommendation. Funds required for the final solution are significant and at present these GEF funds through the UNDP and the co-finance commitment of the GoA will become available. In this chapter we evaluate the following scenarios taking the above as one of the basic assumptions. These scenarios are:

1. Merely minimal funding is directly available. Only after a period of three to four years the GEF funding and associated co-funding for the full clean-up be at hand
2. Within a short timeframe (coming year) significant funds are available but not sufficient to fully remediate the site. To completely remediate the site a second tranche of funding becomes available after a period of around three to four years
3. Funding for the complete site remediation is available within the next year

These three scenarios are illustrated in the below figure 5.1. The availability of project funding is given on the Y axis of the graph and is presented in the graph with uninterrupted lines. The dashed lines in the graph of figure 5.1 are periods when no new funding is available and works at the site is limited to maintenance, monitoring and after care. The total funding is 100 %. This does not imply that the total costs for all three scenarios are the same.

It should be noted that doing nothing is **not** considered as a scenario because if nothing is done, the erosion of the top cover of the waste body and of the surrounding high contaminated top soil will continue. The surface drains will clog and malfunction. Consequently the landfill body will erode within a number of years exposing the pure products and cause further spreading into the surrounding environment increasing direct risks for human health and the risks for the environment. Hence we assume for all scenarios a minimal funding is available to address the most pressing issues within the coming year and that additional funds will become available within the coming 5 years to remove and destruct all the pure pesticides and clean the high contaminated soil and contain on-site the low contaminated soil.

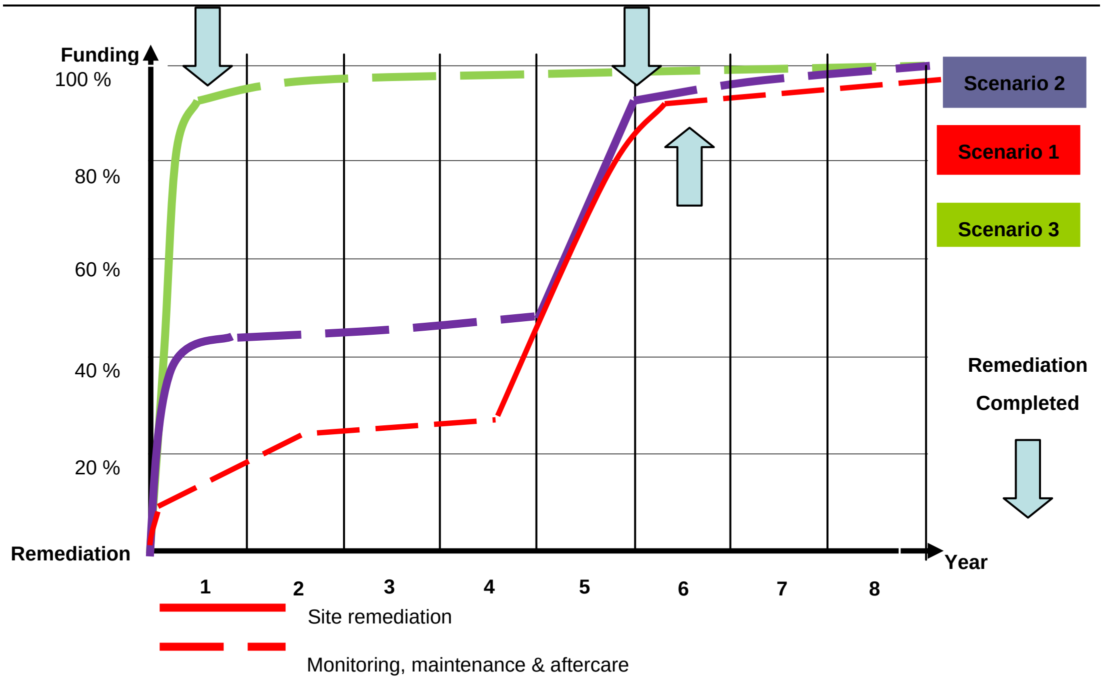

Figure 5.1 The funds availability plot against the time of the three remediation scenarios

The illustrations presented in the next sections are artist impressions and should give the reader idea of the works related to the scenarios. The pre-design of the features of the scenarios should not be seen as the proposed end solution. The next phase towards the final site clean up is the detailed design. Based on the selected scenario a gap analyses to assess the required additional information for a detailed design of the selected scenario should be made. The detailed design will for instance need more additional data on the topography of the catchment area to be able to reduce the size of catchment area and implement the erosion control measures to reduce the risk for erosion of the on-site contained low contaminated soil. The Digital Terrain Model of the landfill area, made by Tauw and its partners in the scope of this OSCE feasibility study, is available to be used in the next phase.

5.2 Scenario 1: Improve current site conditions

In the first scenario all funding needed for the removal and destruction of the pure pesticides and the treatment of high contaminated soil with and without pure pesticides and the containment/ phytoremediation of low contaminated soil will become available within a five years time span. In this scenario the measures that are taken in the short term are all about the prevention of risks and further deterioration of the site but at a minimal effort and cost. This scenario therefore entails the following short term works:

- Installation of temporary cover for pure pesticides that are not covered by the hillock
- Installation of vegetation to prevent the high contaminated soil situated outside the hillock to spread in the surrounding areas
- Maintain and upgrade the fence
- Implement erosion prevention measures that will increase the slope stability of the upstream part of landslide:
  - Installation of culvert under the water main to drain the pond uphill
  - Repair and upgrade water main next to the pond to prevent future leakage
  - Clean and upgrade the culvert under the road
  - Repair and upgrade drainage system on the landfill site
  - Install a phytoremediation pond and sediments trap at end of site drainage system just downstream the landfill site
  - Redirection of run-off from to circumvent the landfill site and implement slope stabilization measures
- Monitor and maintain the short term measures for the next three - four years

The above mentioned short term measures take away the most immediate threats and are easy and low-cost to implement. These measures are only designed as a short term solution. When the funds become available the hillock can be opened and the:

- Pure pesticides and high contaminated soil can be excavated, packaged and send directly to an ex-situ destruction facility
- High contaminated soil with and without pure pesticides can be excavated, packed and transported preferably to an in country (off-site) storage annex soil treatment facility
- Treat/clean the high contaminated soil without and with pesticides preferably at the storage annex soil treatment facility
- Removal and decontaminate the contaminated building materials and land filling the cleaned building materials

After the removal of the pure pesticides and high contaminated soil any low contaminated soil present (also from outside the fenced area) will be relocated within the fenced area and a phytoremediation and containment system will be installed on top of it. Because the high contaminated soils and pure pesticides are gone there will hardly be a hillock left on the site.

The legacy of the pesticides can then only be seen as a slightly higher tomb planted with thick vegetation.

The period between the completion of the first measures and the removal of the pesticides and high contaminated soil should be used to prepare this next phase. The preparation could be identification of a proper storage facility annex soil treatment centre and start up all necessary procedures for permitting the planned activities. If the preparation is started early, time can be saved for the implementation of the last phase of the project.

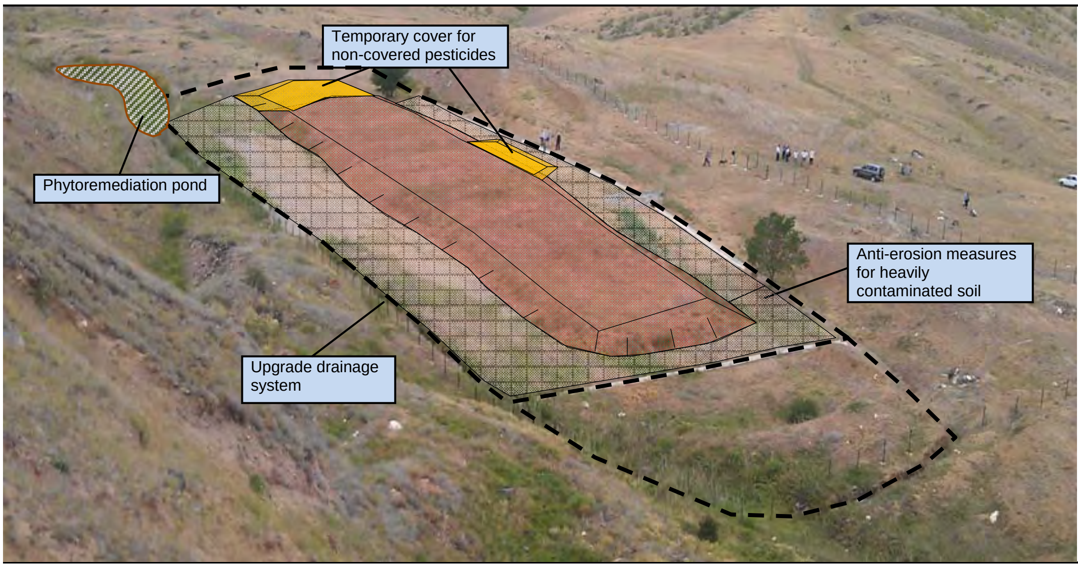

Figure 5.2 Short term measures of scenario 1 (artist impression)

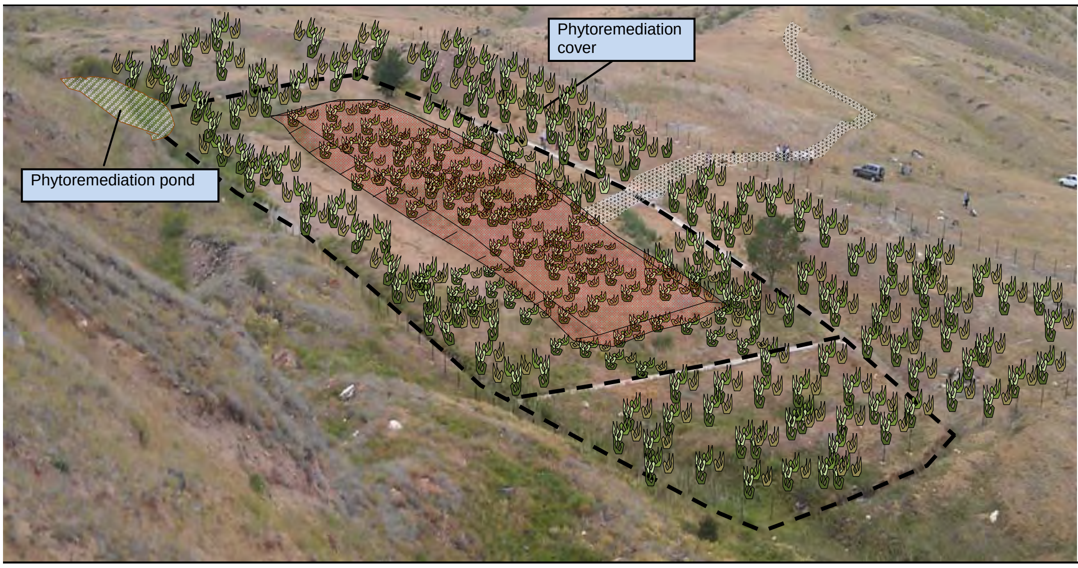

Figure 5.3 Long term measures of scenario 1 (artist impression)

5.3 Scenario 2: Removal of pesticides

In the second scenario a significant part of the funding becomes available immediately. However this funding is insufficient for full site rehabilitation and the finalization of this will take more funds and time. In this scenario the main measures should be focused on removing the biggest risk from the site first (i.e. the pure pesticides). The high contaminated soil and low contaminated soil pose less of a risk as they do not represent any value to waste miners. This scenario entails the following short term works:

- Upgrade outer fence
- Removal and storage in a temporary depot next to the storage site of the clay cover
- Excavation, packaging and temporary storage in an in country off-site storage annex soil treatment facility awaiting final destruction of the pure pesticides
- Disposal of pure pesticides via destruction at the in country (off-site) storage annex soil treatment facility or elsewhere (depending on the proposed techniques by the bidders)
- Removal and decontamination of the contaminated building materials of cell 1 and land filling of the cleaned building materials
- Relocation of the high contaminated soil in the hillock and recording the quantities, the type and the locations (GPS coordinates)
- Closure of the hillock by re-installing the ruberoid liner and application of a new 1 m thick clean clay cover
- Installation of phytoremediation system on low contaminated soils outside of hillock area
- Installation of terraces on hillock clay cover and surrounding areas

- Implementation of erosion prevention measures that will increase the slope stability of the upstream part of landslide:
  - Installation of culvert under the water main to drain the pond uphill
  - Repair and upgrade water main at the pond to prevent future leakage
  - Clean and upgrade the culvert under the road
  - Repair and upgrade drainage system on the landfill site
- Installation of phytoremediation pond and sediment trap at end of site drainage system
- Redirection of run-off from to circumvent the landfill site and slope stabilization works
- Monitor and maintain the short term measures for the next three - four years

The above mentioned short term measures take away the most immediate threats and also the risk of renewed illegal waste mining. When new funds become available the following activities have to be carried out:

- Re-open the hillock
- Localize the high contaminated soil
- Divide the high contaminated soil in soil with pesticides and soil without pesticides
- Pack and transport preferably to an in country (off-site) storage annex soil treatment facility
- Treat/clean the high contaminated soil with pesticides preferably at the storage annex soil treatment facility
- Treat/clean the high contaminated soil without pesticides preferably at the storage annex soil treatment facility

After the removal of the high contaminated soils, the hillock will be closed again and planted with vegetation that limits erosion. After the last pure pesticides have been removed the site guarding can be minimized. No further guarding is needed after the final removal of the high contaminated soil. Site maintenance with regard to the phytoremediation of the low contaminated soil as well as upkeep of the erosion prevention measures should remain in place indefinitely.

The period between the completion of the first measures and the removal of the high contaminated soil should be used to prepare this next phase.

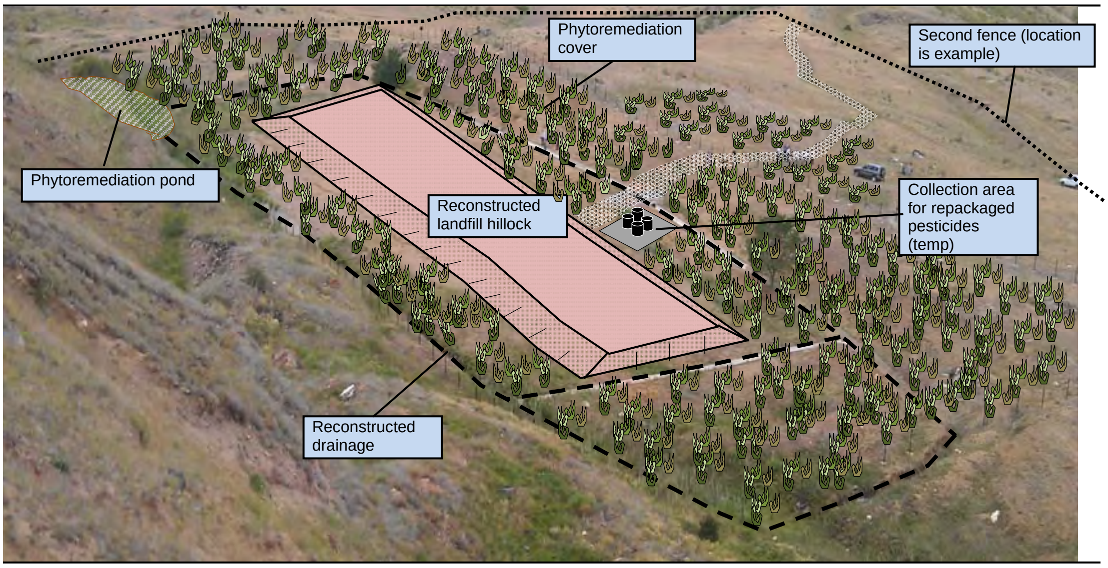

Figure 5.4 Measures of scenario 2 (artist impression)

5.4 Scenario 3: Immediate full clean-up

In the third scenario all funding needed for the removal and destruction of the pure pesticides and the cleaning of high contaminated soil will become available within the coming year. This implies that any measures taken till the final removal of the pesticides should be about prevention of the main risks at the lowest costs possible. This scenario therefore entails the following works prior to the removal of the pesticides and high contaminated soil:

- Identifying as soon as possible proper temporary storage facility and start up all necessary procedures for permitting the planned activities
- Installation of erosion controlling measures at those areas where pure pesticides are not covered by the hillock
- Upgrade outer fence
- Upgrade site guarding to prevent access to the area

As soon as the full funding is available works can start on the removal of the pure pesticides and high contaminated soil. This entails the following works:

- Removal of the cover (clay layer, ruberoid and coarse sand layer) of the hillock and storage in a temporary depot next to the landfill site
- Excavation of the low contaminated soil from the hillock and storage in a temporary depot next to the landfill site
- Excavation and packaging of the pure pesticides from the hillock and transport to an in country (off-site) storage annex soil treatment facility awaiting destruction

- Removal and decontamination of the contaminated building materials and land filling of the cleaned building materials
- Excavate and separate the high contaminated soil in soil with pesticides and soil without pesticides
- Pack and transport preferably to an in country (off-site) storage annex soil treatment facility
- Treat/clean the high contaminated soil with pesticides preferably at the storage annex soil treatment facility
- Treat/clean the high contaminated soil without pesticides preferably at the storage annex soil treatment facility
- Backfilling of the excavated area with low contaminated soil from the temporary depot and the surroundings
- Closure of the terraced hillock with low contaminated soil by re-installing the ruberoid liner and application of a new 1 m thick clean clay layer

After closure of the new landfill site additional measures should be implemented to ensure the long term safety of the area. This entails the following works:

- Implementation of erosion prevention measures that will increase the slope stability of the upstream part of landslide such as:
  - Installation of culvert under the water main to drain Pond 1
  - Repair and upgrade water main at Pond 1 to prevent future leakage
  - Clean and upgrade the culvert under the road
  - Redirection of the upstream run-off from to circumvent the landfill site
  - Repair and upgrade drainage system on the landfill site
  - Redirection of run-off from to circumvent the landfill site
  - Installation of phytoremediation pond with sediment trap at end of the site drainage system

  The measures as presented in drawing 5.3 are nearly identical and therefore no separate drawing of the measures has been made. The same applies for the long term measures. These are identical to scenario 1.

5.5 Conclusions and recommendations for preliminary design

The MCDA analysis in chapter 4 already highlighted that the technical measures needed to address the landfill site are very straight forward. The site location makes in-situ techniques more difficult to implement and the instability of the slopes do not allow for long term storage to continue at this site. Therefore in all scenarios the ex-situ treatment of the pure pesticides and highly contaminated soil is the suggested method. Describing the exact method of final destruction of the pure pesticides and the treatment of high contaminated soil with and without pure pesticides is in this stage irrelevant and will depend on the available options in the market at the time the project is put on the market for contractors to tender.

Main differences between the scenarios can be found in the timing of the availability of funding. The timing of the funding will determine when, which steps can be taken. Therefore we recommend detailing scenario 2 and 3. These scenarios contain nearly all elements that make up any scenario and should give a good insight in the cost and the feasibility as well as the additional costs that occur when part of the remediation is postponed.

6 Preliminairy design scenarios 2 and 3

This chapter gives in greater detail the various steps and costs associated with the second scenario called 'Removal of pesticides' and third scenario called 'Immediate full clean-up' as described in chapter 5. For the cost calculations that are behind these scenarios please refer to appendices 2 and 3.

6.1 Scenario 2: Removal of pesticides

6.1.1 Narrative description

In the second scenario a significant part of the funding to remediate the landfill becomes available immediately. However this funding is insufficient for full site rehabilitation and the finalization of this will take more money and time. In this scenario the first steps are focused on removing the biggest risk from the site first (i.e. the pure pesticides). The high contaminated soil and low contaminated soil pose less of a risk as they do not represent any value to waste miners.
As we do not prefer storage of packaged pesticides on the Nubarashen site, we propose to store these packed materials preferably in an existing, licensed centralized intermediate storage annex soil treatment facility (near industrial area of Yerevan for example). If the permits needed for storage/potential treatment facility site are not or partly in place they should be arranged with the Government. It is advised to initiate things like a possible required Environmental Impact Assessment for this facility as soon as a site for this storage annex soil treatment facility is selected. If the selected centralized storage annex soil treatment facility has to be reconstructed/constructed references is made to the engineering requirements of an Intermediate Collection Centre as given in a separate report presented in Appendix 4. Selection and reconstruction of such storage annex soil treatment facility should be developed within the larger scope of the implementation of the GEF/UNDP project and not only within the scope of the Nubarashen site remediation.
The next steps in this scenario are focused on removing high contaminated soil and containing the low contaminated soil by backfilling of the excavated area with low contaminated soil from the temporary depot and the surroundings.

From an execution point of view this scenario comprises of the following steps:

- Within the coming year:
  - Step 0: Improve road access to the site and implement measures to ensure geo-stability of the site including construction of a temporary mat to prevent further erosion and cover of exposed pesticides

- In the first season (May – October):
  - Step 1: Install working area around site. Construction of depot for top cover from hillock and removal of top cover comprising of the clay layer, the ruberoid liner and (if possible to separate) the coarse sand layer and store in depot. If it is not possible to excavate the coarse sand layer apart from the under laying contaminated soil, this coarse sand layer should be excavated together with the low contaminated soil in step 2
  - Step 2a: Excavation of low contaminated soil and high contaminated soil (divide in soil with and without pure pesticides) from dumpsite. Excavation and packaging of pure pesticides
  - Step 2b: Transport packed pesticides direct to a destruction facility or to the above storage annex soil treatment facility. The construction of a storage annex soil treatment facility is seen part of this project and a lump sum amount is taken in the cost estimate for the construction. Excavate and decontaminate the building material of constructed cell and bring cleaned building materials to a controlled landfill
  - Step 3: Installation of secure landfill. Relocation of low and high contaminated soil in landfill
  - Step 4: Temporary closure of landfill with new top cover and erosion resistant bushes planted
- When additional funding becomes available:
  - Step 5: Re-opening of landfill, excavation and packaging of high contaminated soil with pure pesticides and soil without pesticides
  - Transport packed high contaminated soil with pesticides direct to a destruction/treatment facility or to the storage annex soil treatment facility awaiting final treatment
  - Transport packed high contaminated soil without pesticides direct to destruction/ treatment facility or to the storage annex soil treatment facility awaiting final treatment
  - Step 6: Relocation of low contaminated soil to landfill. Closure of landfill and reconfiguration of the area including site drainage system
  - Step 7: Monitoring and aftercare

6.1.2 Future site use

After the removal of the pure pesticides the site will remain inaccessible. In addition the infrastructure will likely remain (partially) in place so a greater land area is occupied until the high contaminated soil is also removed. Following the finalization of the works the current landfill site will remain inaccessible by a fence and the authorities will institute appropriate long tern restricted land-use controls. The area will be planted with vegetation that limits erosion and possible improve the quality and the biological activity of the subsoil (phytoremediation). As only low contaminated soil will remain on the site, no further risks for illegal waste mining remain. Site security as such can be minimized but the containment and erosion control measures need monitoring, aftercare and maintenance forever. The area outside of the fence will be in principle suitable for extensive cattle farming and is fully accessible to all.

This landfill site is located next to the Erebuni State Natural Reserve on the north. The Bio-recourses Management Agency of the Ministry of Environmental Protection and Natural Reserve has the responsibility of the Erebuni State Natural Reserve. This State Reserve was established in 1981. Its goal is to protect the wild species of wheat and other cereals growing in their natural (original) environment. The flora and fauna of the State Reserve is very rich and variegated. It includes about 300 species of higher flowering plants, which is more than 9 % of the Armenian flora. This State Reserve is invaluable for Armenia and therefore needs infinite monitoring, aftercare and maintenance.
If the area of the Erebuni State Natural Reserve could be extended with the catchment area of the remediated and contained Nubarashen landfill site a sustainable solution concerning the monitoring, aftercare and maintenance of the Nubarashen landfill site can be established. The contained area with the implemented erosion control measures could at the same time serves as demonstration site of the effective erosion control.

6.1.3 Technical description

In this paragraph a short technical description of the works for scenario 2 is given, appendix 2 contains an overview of the foreseen works.

Step 0

Step 0 is the preparation of this scenario. The preparation includes all the measures required to increase the slope stability upslope the landfill site, contributing to the geo-stability of the site. The preparation works comprises:

- Improvement of the road from the current guard house till the landfill site. The road will be upgraded to a gravel road to allow for heavy trucks to reach the site. It should be noted that no measures are envisaged for the stretch of road from the main road till the guard house. The suitability of this road for heavy trucks is currently questionable
- Install new or improve the culvert at the eastern side (uphill) of the landfill. This allows permanent drainage of pond to the east rather than into the valley of the landfill site
- Repair the water main parallel to the road east to stop leakage
- Construct a concrete subsurface partition at the north-east entrance to the valley to redirect all surface run-off towards the culvert

Step 1 till 4

Step 1 till 4 are the first phase of the site remediation and address the pure pesticides. The following works are included in this phase:

- Step 1
  - Installation of a working-zone by construction of a second fence
  - Construction of depot areas

- Step 2
  - Excavation of clay cover of hillock including the ruberoid and coarse sand layer
  - Excavation of low contaminated soil, the high contaminated with pesticides and high contaminated soil without pesticides and placement in different depots
- Step 3
  - Excavation and packaging of pure pesticides form the constructed cell and the four excavated pits
  - Transport of packed pesticides to destruction facility or storage annex soil treatment facility
  - Clean the constructed cell from the inside, demolish the cell, clean rubble from soil, pack and if needed transport to enclosed cleaning facility for future decontamination. Pack removed contaminated soil and treat as pure pesticides, landfill decontaminated rubble
- Step 4
  - Installation of bottom liner in landfill area
  - Relocation of all low and high with and without pure pesticides contaminated soil to landfill area
  - Installation of new drainage layer, ruberoid and top cover
  - Temporary closure of landfill site

Step 5 and 6

After funding becomes available to take care of the high contaminated soil, the landfill will be reopened. In the next phase for step 5 and 6 the following works are envisaged:

- Step 5
  - Removal of top cover and placement in depot
  - Removal of ruberoid and drainage layer and placement in depot
  - Excavation of high contaminated soil with and without pesticides, packaging and transport respectively to destruction facility or storage annex soil treatment facility awaiting treatment
- Step 6
  - Investigation of surrounding area for low contaminated soil
  - Excavation of any low contaminated soil found and transfer to open landfill for backfilling
  - Closure of landfill by reinstalling drainage layer, ruberoid and top cover
  - Installation of erosion resistant bushes and shrubs
  - Redirection of run-off from to circumvent the landfill site
  - Install slope stabilization erosion control measures in catchment area of the landfill
  - Installation of phytoremediation pond and sediments trap at end of the newly installed site drainage system
  - Removal of all remaining infrastructure

- Step 7
  - The monitoring, aftercare and maintenance will be for a certain period after the completion of the on-site works the task of the contractor and is therefore explicitly mentioned in this list. Monitoring, aftercare and maintenance, at least for half a year after on-site works, should be part of the TOR of the upcoming GEF/UNDP project for remediation of the Nubarashen landfill site. The project is completed after the period of monitoring, aftercare and maintenance, mentioned TOR and when the contractor has submitted a monitoring, aftercare and maintenance report including an as build drawing

6.1.4 Planning and relation to required funding

Table 6.1 gives and overview of the required funding for the various steps. In addition a general planning of the works is presented. The estimated costs, based on the pre-design of this scenario as presented in appendix 2, are around 9 million US dollar and 80 % of the costs are for the transport and destruction of the pesticides and high contaminated soil.

The presented costs are worst case; no distinction in the ex-situ destruction and treatment in EU or in Armenia is made. The Scenario 2 calculation has been made for export to EU of the pure pesticides and all the high contaminated soil. There is no cost indication given for a treatment facility preferably at the storage annex soil treatment facility in Armenia. But it is estimated that if for instance MCD or any thermal desorption facility can brought to Armenia for the same or lower budget.

Table 6.1 General work schedule for scenario 2

	Month																					
Remediation works	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**20 year**
Step 0																						
General project preparation (off-season)	■																					
Improve Acces road		■																				
Install culvert		■																				
Repair water main		■																				
Installation of subsurface partition		■																				
Step 1+2+3+4																						
Installation of a working-zone by construction of a second fence			■																			
Construction of depot areas			■																			
Excavation of top of hillock			■																			
Excavation of low contaminated soil and high contaminated soil and placement in depots			■																			
Excavation and repackaging of pesticides				■	■																	
Transport of pesticides to destruction facility					■	■																
Installation of bottom liner in landfill area						■	■															
Redistribution of low and high contaminated soil to landfill area							■	■														
Installation of new drainage layer, ruberoid and topcover								■														
Temporary closure of landfill site								■	■													
Step 5+6																						
Removal of ruberoid and drainage layer and placement in depot										■	■											
Excavation of high contaminated soil, repackaging and transport to treatment facility											■	■	■	■	■							
Investigation of surrounding area for low contaminated soil																■						
Excavation of any low contaminated soil found and transfer to open landfill																	■	■				
Closure of landfill by reinstalling drainage layer, ruberoid and topcover																			■			
Reconfiguration of the area including site drainage system and erosion control measures catchment area																			■			
Installation of erosion resistant bushes and shrubs																			■	■	■	
Removal of all remaining infrastructure																					■	
Step 7 Running costs																						
Monitoring and aftercare																						■
(monitoring, maintenance and aftercare)																						
Required financing (USD)	**$70,000**		**$2,150,000**							**$6,500,000**												**$275,000**
Total estimated cost scenario 2	**$8,995,000**																					

6.2 Scenario 3: Immediate clean up

6.2.1 Narrative description

In this scenario all the pure pesticides and high contaminated soil are excavated, packaged and stored off-site for a short period awaiting further transport to the destruction and treatment facilities. If intermediate storage is needed reference is made to section 6.1.1 for the description of the storage annex soil treatment facility. From an execution point of view this scenario has two big differences with scenario 2.

- The first is that the dumpsite is excavated in two phases allowing for reduction in the space required for the works
- The second difference is that the investigation of surrounding area for low contaminated soil, the transfer to the open landfill for backfilling with low contaminated soil from the temporary depot will be done in two parts but directly after the pure pesticides and high contaminated soil is removed

In addition the new to be constructed landfill will not be reopened as both the pure pesticides and high contaminated soil will be removed instantly from the site and the open landfill will be directly filled with low contaminated soil. This scenario as such comprises of the following steps:

- Step 0: Preparation including improvement of the road from the current guard house till the landfill site as described in section 61.1. Also for this scenario the suitability of the road from the bituminous road to the guard for heavy trucks is currently questionable. Step 0 also concerns the installation of a temporary cover for exposed pesticides (jute mats), the installation of a working-zone by construction of a second fence, the construction of depot areas and the excavation of top of the hillock
- Steps 1 till 3 are the first phase of the site remediation and concern the eastern part of the landfill. The following works included in these steps are:
  - Step 1: Excavation of eastern part of the hillock and packaging of the pure pesticides and high contaminated soil with and without pesticides. Clean the constructed cell from the inside, demolish the cell, clean rubble from soil, pack and if needed transport to enclosed cleaning facility for future decontamination. Pack removed contaminated soil and treats as pure pesticides, landfill decontaminated rubble. The pure pesticides is directly transported to a destruction facility or to the earlier discussed storage annex soil treatment facility, awaiting destruction and treatment
  - Step 2: Construction of a secure landfill with bottom liner at eastern part of landfill site
  - Step 3: Deposition of low contaminated soil in newly constructed landfill

- The above mentioned steps 1 to 3 are nearly identical to the following first steps 4-6, except that these steps deal with the western part of the landfill site. The total works in this phase include:
  - Step 4: Excavation of western part of the hillock and packaging of the pure pesticides and high contaminated soil with and without pesticides and excavation and packaging of all remaining high contaminated soil. Also these materials are directly transported to a destruction/treatment facility or to the storage annex soil treatment facility awaiting destruction/treatment
  - Step 5: Construction of a secure landfill with bottom liner at western part of landfill site
  - Step 6: Deposition of all residual low contaminated soil in newly constructed landfill on western part of landfill site. Ensures long term safety and stability of the site. In scenario 2 most of these works will be executed prior to the excavation and packaging of the pesticides but as all funding is available immediately scenario 3 chooses to postpone these works till after the site remediation is finished. This will limit impact from the remediation works on the newly build structures
  - Step 7: Monitoring and aftercare

6.2.2 Future site use

After the finalization of the scenario 3, the landfill site will remain inaccessible by a fence and the authorities will institute appropriate long term restricted land-use controls on the land-use restriction. The area will be planted with vegetation that limits erosion and possible improve the quality of the subsoil for possible biodegradation (phytoremediation). As only low contaminated soil will remain on-site, no further risks for illegal waste mining remain. Site security and maintenance and aftercare as such can be minimized. The area inside the fence will be restricted for extensive cattle grazing and will be not accessible. Also for this scenario a sustainable solution by combining the future site monitoring, maintenance and aftercare with the site management of the Erebuni State Reserve is strongly advised.

6.2.3 Technical description

In this paragraph a short technical description of the works is given, appendix 3 contains a full overview of scenario 3. In the preparation phase (Step 0); the works that are required to successfully implement the remediation are executed. This step does not include the measures required to ensure the geo-stability of the site. These measures are taken in the last step of this scenario.

Step 0

- Improvement of the road from the current guard house till the landfill site

Step 1, 2 and 3

- Step 1
  - Installation of a working-zone by construction of a second fence
  - Construction of depot areas
  - Excavation of top of hillock
- Step 2
  - Excavation of eastern part of the hillock and packaging of the pure pesticides and high contaminated soil with and without pure pesticides
  - Transport directly to a destruction/treatment facility or store in the centralized storage annex soil treatment facility awaiting destruction/treatment
  - Demolish and decontaminated the constructed cell and landfill the cleaned material in a controlled landfill
- Step 3
  - Construction of a secure landfill with bottom liner at eastern part of landfill site
  - Deposition of low contaminated soil in newly constructed landfill

Step 4, 5 and 6

- Step 4
  - Excavation of western part of the hillock and packaging of the pure pesticides and high contaminated soil with and without pesticides
  - Transport directly to a destruction/treatment facility or store in the centralized storage annex soil treatment facility awaiting destruction/treatment
- Step 5
  - Excavation and packaging of all remaining high contaminated soil with and without pesticides
  - Transport directly to a treatment facility or store in the centralized storage annex soil treatment facility awaiting treatment
- Step 6
  - Deposition of all residual low contaminated soil in newly constructed landfill on western part of landfill site
  - Install slope stabilization erosion control measures in catchment area of the landfill
  - Installation of phytoremediation pond and sediments trap at end of the newly installed site drainage system
  - Installation or repair culvert at the eastern side, uphill, of the landfill allowing permanent drainage of the pond
  - Repair the water main parallel to the road east of the landfill
  - Install a concrete subsurface partition at the north-east entrance to the valley to redirect all surface run-off towards the culvert
  - Transport repackaged pesticides and high contaminated soil from the intermediate storage to a destruction/treatment facility

  - Redirection of run-off from to circumvent the landfill site
  - Planting of site with vegetation that prevents soil erosion and possibly enhances the bio-degradation of the remaining pesticides in the subsoil
  - Removal of all remaining infrastructure
  - Planting of the new landfill site
  - At the eastern side of the landfill a new culvert will be made to allow for the drainage of Pond 1 to drain the east rather than into the valley of the landfill site
  - The water main parallel to the road east of the landfill will be repaired to limit the leakage in the area
  - A concrete subsurface partition will be constructed at the north-east entrance to the valley to redirect all surface run-off towards the culvert

Step 7

- Step 7
  - The monitoring, aftercare and maintenance as described in section 6.1.3

Table 6.2 General work schedule for scenario 3

	Month																
Remediation works	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	20 years
Step 0																	
General project preparation (off-season)	■																
Improve Acces road		■															
Install culvert		■															
Repair water main		■															
Installation of subsurface partition		■															
Anti-erosion mat installation		■															
Covering of exposed pesticides		■															
Step 1+2+3																	
Installation of second fence			■														
Construction of depot areas			■														
Various facilities around the site			■														
Excavation of top cover, drainage layer and rubberoid				■													
Excavation of Eastern part of landfill site					■												
Transport of pure pesticides and heavily contaminated soil to ex-situ destruction site					■												
Construction of new landfill on Eastern part of the landfill					■	■											
Re-distribution of lightly contaminated soil to Eastern part of the landfill							■										
Step 4 + 5																	
Excavation of Western part of hillock								■									
Transport of pure pesticides and heavily contaminated soil to ex-situ destruction site								■									
Transport of lightly contaminated soil to new landfill on Eastern part									■								
Excavation and repackaging of heavily contaminated soil outside former hillock										■							
Transport of pure pesticides and heavily contaminated soil to ex-situ destruction site										■							
Construction of new landfill on Western part of former hillock											■	■					
Transfer of lightly contaminated soil to new landfill													■	■			
Step 6																	
Planting of landfill site with vegetation															■	■	
Reconfiguration of the area including site drainage system and erosion control measures catchment area															■	■	
Step 7																	
Running and monitoring, maintenance and aftercare																	■
Required financing (USD)	$80,000		$2,800,000					$5,550,000							$260,000		$160,000
Total estimated cost scenario 3	$8,850,000																

6.2.4 Planning and relation to required funding

Figure 6.2 gives the general planning and illustrates also the required timing for the availability of the funds. Funding has to be secured after the detailed design of each set of step(s).

It becomes clear from the planning that not all steps can be completed within one season (May-October). A logical breaking point is after step 3. In table 6.2 the bulk of the costs are present in step 7. If funding becomes available earlier during the project then the pure pesticides and high contaminated soil can be transported to the ex-situ destruction/treatment facility parallel to the earlier phases and the costs will be spread more evenly. The estimated costs, based on the pre-design of this scenario as presented in appendix 3, are also around 9 million US dollar and of course also for this scenario 80 % of the costs are for the transport and destruction of the pesticides and high contaminated soil.

The presented costs for this scenario are also worst case. No distinction is made in the ex-situ destruction and treatment in EU or in Armenia. The Scenario 3 calculation has been made for export to EU of the pure pesticides and all the high contaminated soil. There is no cost indication given for a treatment facility preferably at the Intermediate Collection Centre in Armenia. But it is estimated that if for instance MCD or any thermal desorption facility can brought to Armenia for the same or lower budget.

7 Stakeholder involvement planning and evaluation

7.1 Introduction

Next to the site assessment and feasibility study that the Tauw Consortium provides, stakeholder involvement is an important cross cutting issue of the OSCE Nubarashen project. The stakeholder involvement activities were initiated with a Quick Scan Stakeholder Analysis made during Phase 1 of this project in February 2013. This Quick Scan was used during the stakeholder workshop on 22 March 2013 to gather further information for the stakeholder involvement plan to be made in Phase 3 of this project.

The most important stakeholders of the Nubarashen site are taking part in the steering group of OSCE and UNDP obsolete pesticides projects. It was suggested that the Steering Group meetings of the OSCE and UNDP Nubarashen projects would be used as an active inter-agency coordination and working group for carrying out stakeholder engagement activities. This chapter is designed as a back ground document for the planning and implementation of the stakeholder involvement activities of the OSCE Nubarashen project.

Note: Most of the sections of this chapter (sections 7.1 to 7.8) were written before the final stakeholder workshop of 29 October 2013. Sections 7.8 and 7.9 were written after this workshop to report on the workshop itself and to reflect on the stakeholder involvement activities of the Project.

7.2 Quick Scan Stakeholder Analysis

In the frame of different international POPs and hazardous waste projects the Tauw - Milieukontakt consortium developed the Quick Scan Stakeholder Analysis - a tool to analyse the capacity and commitment of stakeholder groups to solve a technical and social problem like the problem of POPs and OPs pesticides.

Stakeholder involvement is becoming increasingly important in the implementation of environmental remediation projects. Engagement and involvement activities help to achieve better project results and especially avoid misunderstanding about project goals among the people that live close to an environmental hazard. Through sincere engagement with stakeholders and fully in line with article 10 of the Stockholm Convention sustainable results can be reached. This Stakeholder Involvement Plan for Nubarashen landfill site for POPs and OPs is one of the Phase 3 OSCE project deliverables and is intended to enhance the sustainability of the project results. The different project stages of stakeholder engagement and involvement are described in figure 7.1.

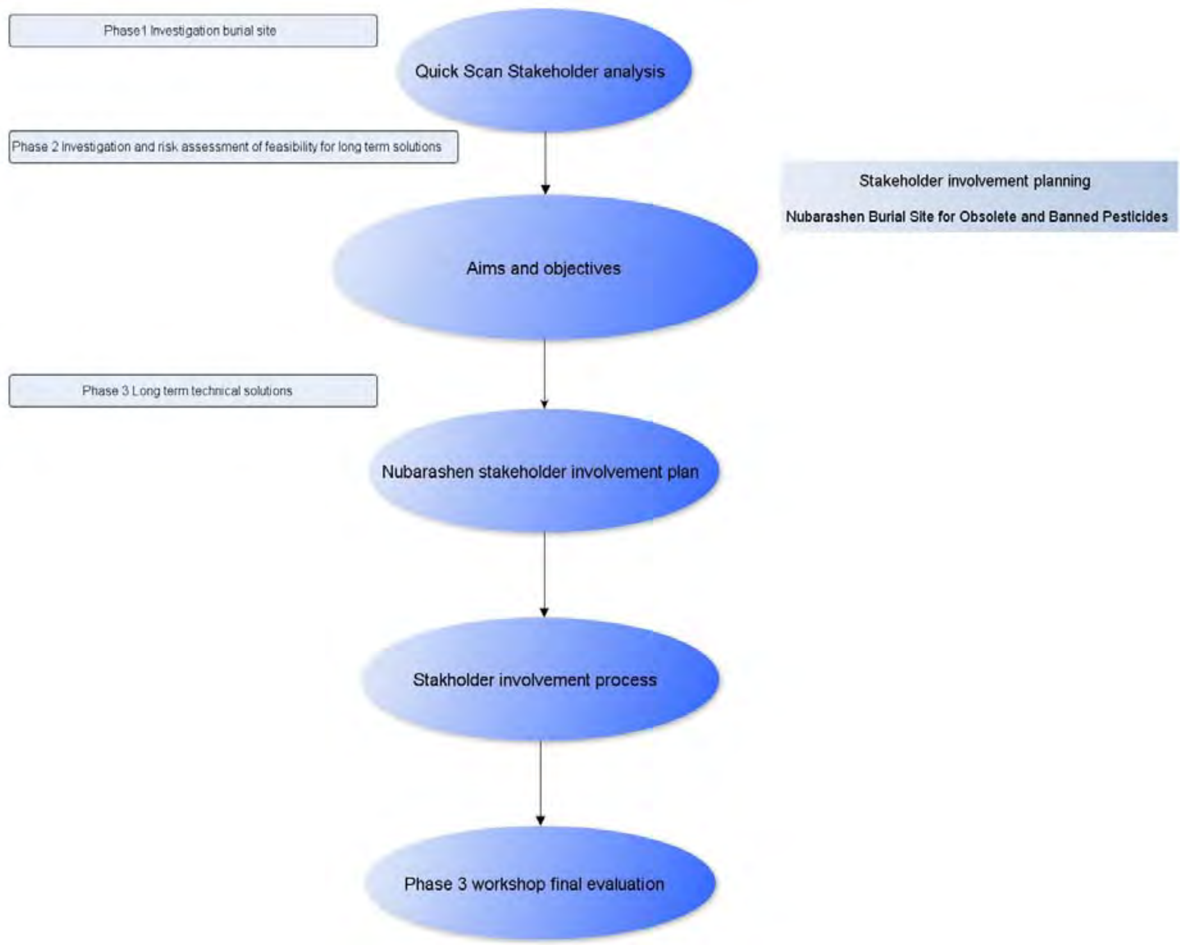

Figure 7.1 Different project stages of stakeholder engagement and involvement

7.3 Aims and objectives

In order to define the purpose of stakeholder involvement for Nubarashen landfill site it is important to distinguish between aims and objectives.

7.3.1 Aims for Nubarashen stakeholder involvement

This section of the stakeholder involvement plan describes the desired outcomes that ultimately have to be achieved. (What do we want to have achieved at the end of the involvements process? i.e. overall outcomes.). In short the aims for Nubarashen stakeholder involvement are:

1. Improved awareness of the health and environmental risks of the landfill site of all stakeholders

2. Improved awareness of the urgency to solve the problems of the burial site among relevant stakeholders in Armenian society
3. Achieve adequate technical capacity among relevant Armenian stakeholders to solve the problems of the landfill site
4. Achieve adequate policy and legislation in place and enforced to solve the problems of the landfill site
5. Have financial means available in Armenia to solve the problems of the landfill site

7.3.2 Objectives for Nubarashen stakeholder involvement

This section of the plan describes how the objectives for stakeholder involvement will be achieved through activities of the Steering Group. i.e. the outputs that will ultimately lead to achieving the aims for Nubarashen stakeholder involvement. The Steering Group should:

1. Assess their possibilities to raise awareness of the health and environmental risks of the landfill site. Plan and implement awareness raising activities
2. Use their professional and political networks to advocate sound political decision making that will prioritize reduction and finally elimination of health and environmental risks of the landfill site. Plan and implement advocacy activities
3. Elaborate a needs assessment for capacity building of relevant stakeholders for reduction and finally elimination of health and environmental risks of Nubarashen landfill site. Make an inventory of possible ways to build this capacity. Plan and implement capacity building activities
4. Analyse in how far Armenian policy and legislation enables the reduction and finally elimination of health and environmental risks of Nubarashen Burial Site. Make an inventory of existing and needed activities / projects that would bridge possible gaps in policy and legislation. Plan and implement advocacy activities to bridge these gaps
5. Analyse problems that hinder effective law enforcement for reduction and finally elimination of health and environmental risks of Nubarashen landfill site. Plan and implement advocacy activities to facilitate better enforcement of existing laws
6. Make an inventory of national and international projects that currently are being developed for reduction and finally elimination of health and environmental risks of Nubarashen landfill site. Answer the question whether it is likely that these projects will enable a final solution. Plan and implement advocacy activities when more projects will be needed to reach a sustainable solution for Nubarashen Burial site

To help define an accurate purpose of stakeholder involvement within the project the following questions are important:

- What do we want to have achieved overall at the end of the stakeholder involvement process (i.e. overall outcomes)?
- What tangible products do we want to have produced from the stakeholder involvement process (i.e. key outputs)?

In short the purpose for stakeholder involvement in the Nubarashen project could be defined as follows:

Exploration of fresh ideas, networking to share ideas and best practices, awareness raising to reach decision makers and vulnerable groups, advocacy to support efficient political decision making and creation of commitment and project ownership among stakeholders. All these activities are targeted to support the overall project aim to reduce and finally eliminate the health and environmental risks of Nubarashen landfill site.

7.4 Scope

It is important to clarify exactly what the boundaries of stakeholder involvement within the project are. With other words: what can be really achieved in practice?

Looking at the aims for Nubarashen stakeholder involvement, it is clear that the OSCE project by facilitating activities of the Nubarashen Steering Group can really contribute to these aims. Looking at the objectives of Nubarashen stakeholder involvement, it seems those two meetings of the Nubarashen Steering Group and one final workshop (Final workshop project Phase 3) listed below, would help to facilitate modest, but very important stakeholder involvement and advocacy activities under the Project:

- One meeting to facilitate formulation and planning of needed activities
- A second meeting to brief each-other on the implementation process of agreed activities
- One final workshop to evaluate the implemented agreed activities

Bearing the scope and time frame of the OSCE project in mind, it is important to realise that stakeholder involvement activities can only be modest in character. It will be possible for the Steering Group to draft the outputs outlined above under objectives for Nubarashen stakeholder involvement during the workshop itself for instance in the form of a short memo or minutes of the meetings. Any planned activities are expected to be carried out by the Steering Group members in the frame of their subsequent jobs and capacity as a Nubarashen Stakeholder.

7.5 Context

It is important to take into account what other initiatives, in the field of POPs and OPs remediation, are being developed in Armenia. The context of the issue will to a large extent influence the results to the stakeholder involvement process. If the proposed approach for stakeholder involvement works well, it can be used in the Steering Committees of future POPs and OPs remediation projects.

At the moment there seems to be a momentum for solving problems caused by obsolete and POPs pesticides in Armenia. Originally AWHHE has put the need to deal with the acute risks of Nubarashen landfill site on the political agenda in the country and the organization has implemented a lot of small and medium size projects to raise awareness for the issue. Currently the Armenian Government, OSCE, FAO, EU, UNDP and GEF are implementing or developing future projects for awareness raising, inventory, safeguarding and final disposal of obsolete and POPs pesticides in Armenia.

7.6 General approach to stakeholder involvement planning

The International Association of Public Participation has developed the so called Public Participation Spectrum to demonstrate possible types of engagement with stakeholders and communities. The spectrum also shows the increasing level of public impact as you progress from 'inform' through to 'empower'. The spectrum is presented here to show how further stakeholder involvement can be planned.

Table 7.1 Public Participation Spectrum as designed by the International Association of Public Participation

Public Participation Spectrum				
Increasing level of public participation → → → →→ →→ →→ →→ →→ →→ →→ →→ →→ →→ →→ →→ →				
INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
Public Participation Goal				
To provide the public with balanced and objective information to assist them in understanding the problems alternatives and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered	To partner with the public in each aspect of the decision, including the development of alternatives and the identification of the preferred solution	To place final decision-making in the hands of the public.

Public Participation Spectrum				
Increasing level of public participation → → → →→ →→ →→ →→ →→ →→ →→ →→ →→ →→ →→ →→ →				
INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
Promise to the public				
We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and provide feedback on how public input influenced the decision	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for direct advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.
Example Tools				
Factsheets Websites Open houses	Public comment Focus groups Surveys Public meetings	Workshops Deliberate polling	Citizen advisory comities Consensus building Participatory decision making	Citizen juries Ballots Delegated decisions

7.7 Specific approach to Stakeholder involvement planning

Based on the Quick Scan Stakeholder Analysis aims, objectives, scope and context of, involvement planning have been formulated. As described above it is proposed to invite the Nubarashen Steering Group to meet three times to facilitate modest, but very important stakeholder involvement activities under the project:

- One meeting to facilitate formulation and planning of needed activities
- A second meeting to brief each-other on the implementation process of agreed activities
- One final workshop to evaluate the implemented agreed activities

The above formulated Objectives for Nubarashen Stakeholder involvement give very concrete tasks and responsibilities that can be divided between the different members of the Steering Group.

For further stakeholder involvement a Stakeholder involvement planning file for the first proposed meeting of the Nubarashen Steering Group has been formulated to agree on the level of further participation needed for the project. This file is annexed to this document as Appendix 6 Nubarashen stakeholder involvement planning file.

The Tauw Consortium it is not in a position to decide on the level of participation needed for the project, without direct consultation of the Nubarashen stakeholders. It is clear that all identified stakeholders have to be informed (level one 'INFORM' from the public participation spectrum). It is clear as well that Armenian decision makers will consult with stakeholders. The Steering Group can promise the public that they will keep them informed, listen to and acknowledge concerns and provide feedback on how public input influenced the decisions on how to solve the problems of Nubarashen landfill site (level two 'CONSULT' from the public participation spectrum). The need for further levels of public participation (INVOLVE, COLLABORATE and EMPOWER) has to be discussed by the Nubarashen Steering Group. As a consequence the Nubarashen stakeholder involvement planning file has to be finalized after consultation with the members of the Nubarashen Steering Group during the proposed first meeting.

7.8 Summary of the final stakeholder workshop

The final stakeholder workshop of the 'Site Assessment and Feasibility Study of the Obsolete Pesticides and Persistent Organic Pollutants Burial Site in Nubarashen' project, implemented by the OSCE office in Yerevan in collaboration with the Ministry of Emergency Situations of the Republic of Armenia was organized on 29 October 2013. The Final Workshop focused on presentation of the project outcomes and achievements, as well as on potential scenarios for the burial site remediation.

The meeting opened with welcoming address by Ambassador Andrey Sorokin, Head of the OSCE Office in Yerevan, and Mr Armen Yeritsyan, Minister of Emergency Situations of the Republic of Armenia.

Edward Safaryan, ENVSEC National Project Officer, OSCE office in Yerevan, introduced the participants to the project background. Boudewijn Fokke, Project Manager, Tauw bv, presented an overview of the project implementation and potential scenarios for the site remediation.
Ms. Gohar Khojayan, Assistant to President, Armenian Women for Health and Healthy Environment NGO presented the outcomes of the stakeholders' involvement activities.
Then the participants were introduced to the UNDP/GEF 'Elimination of Obsolete Pesticide Stockpiles and Addressing POPs Contaminated Sites within a Sound Chemicals Management Framework' project (presentation by Georgi Arzumanyan, Programme Policy Adviser, Environmental Governance Portfolio, UNDP Armenia and Richard Cooke, UNDP International Consultant).

After the presentations, a discussion on the outcomes of the project and interconnection with upcoming projects was facilitated by Dr. Elena Manvelyan, President and Armenian Women for Health and Healthy Environment NGO. The discussion showed that the participants were satisfied with the level of stakeholder involvement. Generally, the stakeholders did not show notable interest in discussing stakeholder involvement activities and their outcomes.

Instead, preference was given to the discussion on the technical issues related to the site, with particular concern expressed by the Ministry of Emergency Situations in relation to the issue of monitoring the situation with the landslide. When asked to give opinions on best scenarios for the site remediation, the participants explained that the framework of the meeting was not appropriate for voicing official opinions. The informal discussions though showed that the audience agreed with the conclusions by the Tauw expert on the best option. Summarizing the discussion, Dr. Manvelyan thanked all the stakeholders for the open and construction discussion and cooperation throughout the project. She also expressed regret over the fact that some of the main actors, namely the Ministry of Health and Yerevan Municipality, did not participate at the stakeholder meetings thus demonstrating low interest to the solution of the issue. She concluded that cooperation among the stakeholders should strengthen to ensure better outcomes in the future activities on the site remediation.

Edward Safaryan / OSCE summarized the meeting noting the overall success of the project and its link with the planned UNDP project.

7.9 Conclusions

The Quick Scan Stakeholder Analysis was carried out quite successfully. By formal request and informal discussions with relevant stakeholders it indicated areas where capacity building, awareness raising, coordination, funding and advocacy were needed. Bearing the scope and time frame of the OSCE project in mind, it was important to realize that stakeholder involvement activities could only be modest in character. The needs for capacity building were not further defined as a result of the decision of the Steering Group not to meet when there was no new technical information from Tauw available. The stakeholder involvement activities, however, were designed as interactive and especially the input from stakeholders was lacking.

Looking back Tauw and partners realize that the fact that key stakeholders do not see the need to meet for stakeholder involvement only is a reality one cannot criticize or deny. As a recommendation the experience and lessons related for future stakeholder involvement and awareness raising activities in the frame of obsolete and POPs pesticides project in Armenia should be shared with the UNDP/GEF project team. It may be useful in the context of how stakeholder involvement might be applied as the work actually, cleaning up the Nubarashen site, proceeds under the UNDP/GEF project. The project partners concluded the following:

- Stakeholder involvement and awareness raising activities should not be addressed as a separate issue. These project activities have to be better incorporated with the technical issues at hand. It is expected that with such an approach stakeholders will have less reserves to work in a non-traditional way on issues such as awareness raising, disclosure and advocacy
- The characteristics and dynamics of the group of key stakeholders should be better taken into account

- The project aims for stakeholder involvement and awareness raising should be in balance with the technical aims of the project and these aims should not be over ambitious
- It is advisable to communicate in an early stage with the Client about the stakeholder involvement aims of the project
- It will be helpful to achieve positive experience with stakeholder involvement early in the project
- True intersectoral cooperation is difficult to achieve in Armenia, but very important when solving legacy problems like the problems of obsolete and POPs pesticides
- In all project communication it is important not to oversell the problems of obsolete pesticides, but put them into the real perspective of the country
- It is very important to realize that stakeholder involvement is key for successful project implementation but cannot be organized as a kind of extra ingredient without serious time investment

8 Recapitulation feasibility study

With the finalization of the selection and pre-design of long term technical solutions (phase 3) the OSCE project, the site assessment and feasibility study of the Nubarashen landfill site is finalized. The gathered data has provided a comprehensive overview of the status of the landfill site and the impacts on the surrounding soil and groundwater. The total quantity of pure pesticide waste found inside the landfill body exceeds the quantities that have been disposed at the area according to historical documents. In addition the illegal waste mining activities in 2010 have significantly increased the total amount of POPs wastes that require the same treatment as the pure pesticides.
The study also assessed the geo-stability of the area and the forces behind the observed mass movement of the slopes. The main conclusion is that the perched groundwater table upstream is influencing the stability of the landslide. By preventing soil saturation of the upstream soil, the slope stability increases and slope failure is unlikely.
A Tier 2 risk assessment concluded that at present the risks associated with the landfill site are moderate. The landfill site cannot be accessed and as such direct contact with the high contaminated soil are avoided. Latent risks associated with agriculture and animal husbandry around the site however, are present.
In the remediation scenario review, for all relevant components of the landfill site (low contaminated soil, high contaminated soil, pure pesticides and contaminated building materials) the possible remediation techniques have been reviewed using a Multi Criteria Decision Analysis (MCDA). For the pure pesticides ex-situ destruction and for the high contaminated soil ex-situ treatment are considered the most appropriate options. For the low contaminated soil, containment and phytoremediation are considered the most appropriate techniques. The contaminated building materials have to be decontaminated and the cleaned rubbles can be land filled.
Using these mentioned preferred techniques, three scenarios are drafted that took into account the availability of funding for the remediation of the site. The main conclusion of the scenario review is that the steps required for the final clean-up of the site can be done in accordance with availability of the funding of the upcoming GEF/UNDP project. Even if in the short term only very limited funding is available steps can be made to improve the site and mitigate the partly current direct risks. Hence it can be concluded that, this OSCE feasibility study is a good stepping stone for the final site remediation in the upcoming GEF/UNDP POPs pesticides project. In addition to the availability of the required funding, the deciding factor in the remediation of the Nubarashen landfill site is mainly the commitment of the various stakeholders such as the Ministry of Emergency Situations, the Ministry of Environment protection, the Ministry of Health, the Ministry of Finance, the local authorities, the group at risk, NGOs, the UNDP Armenia, Armenian Government, OSCE, FAO, EU, and GEF and other members of the existing donor community.

Appendix 1

MCDA scoring for all landfill components

Score	Explanation
1	Strong negative deviation from original goals
2	Non-compliant
3	Near compliant
4	Compliant
5	Additional benefit other than compliancy

1	Aspect	Planning							
Option	Sub-aspect	Implementation time	Duration						Total score
	Required	Implementation within one season (May-Oct)	Time to complete						
3	Bioremediation	3	4						3.5
5	Phytoremediation	5	1						3.0
6	Containment	5	1						3.0

	Aspect	Technical Feasibility							
2	Sub-aspects	Complexity	Technology availability	Execution aspects	Experiences	Safety	Infrastructure		Total score
Option	Required	Can be executed by Armenian contractor	Technology available in Armenia	Locally available skills and materials	Previous experience with similar projects	Safe working environment during execution	Limited upgrading required		
3	Bioremediation	3	3	3	3	4	4		3.3
5	Phytoremediation	4	4	4	3	5	4		4.0
6	Containment	5	5	5	5	5	4		4.8

3	Aspect	Land-use							
	Sub-aspects	Site	Surrounding						Total score
Option	Required	Accessible	No restrictions						
3	Bioremediation	3	3						3.0
5	Phytoremediation	2	2						2.0
6	Containment	2	2						2.0

4	Aspect	Environmental merits/impact and risk reduction							
	Sub-aspects	Soil	Groundwater	Air	Construction phase	CO2	Use base material	POPs destruction	Total score
Option	Required	No further deterioration of soil quality	No impact on GW	No contaminated dust	Environmental impact limited	Minimum	Minimum	Maximum destruction	
3	Bioremediation	4	4	3	4	4	3	3	3.6
5	Phytoremediation	4	4	3	5	5	5	2	4.0
6	Containment	4	4	3	5	5	5	2	4.0

Score	Explanation
1	Strong negative deviation from original goals
2	Non-compliant
3	Near compliant
4	Compliant
5	Additional benefit other than compliancy

5	Aspect	Monitoring aftercare and maintenance							
	Sub-aspects	Monitoring aftercare and maintenance							Total score
Option	Required	Minimal							
3	Bioremediation	3							3.0
5	Phytoremediation	2							2.0
6	Containment	2							2.0

6	Aspect	Risk factors							
	Sub-aspects	Technical	Financial						Total score
Option	Required	Feasible	Minimum						
3	Bioremediation	2	3						2.5
5	Phytoremediation	5	5						5.0
6	Containment	5	5						5.0

6	Aspect	Social Impact							
	Sub-aspects	Job creation short term	Job creation long term	National infrastructure for hazardous wastes	Improvement of local population				Total score
Option	Required	Maximum	Maximum	Improve	cattle-farmer				
3	Bioremediation	3	4	2	3				3.0
5	Phytoremediation	5	5	2	1				3.3
6	Containment	5	5	2	1				3.3

3	Aspect	Cost / Benefit							
	Sub-aspects	Implementation	Implementation	Implementation	Implementation	Aftercare			Total score
Option	Required	Lowest cost possible	Lowest cost possible	Lowest cost possible	Lowest cost possible	Minimum			
3	Bioremediation	3	3	3	3	3			3.0
5	Phytoremediation	5	5	5	5	2			4.4
6	Containment	5	5	5	5	2			4.4

Score	Explanation
1	Strong negative deviation from original goals
2	Non-compliant
3	Near compliant
4	Compliant
5	Additional benefit other than compliancy

1	Aspect	Planning							
Option	Sub-aspect	Implementation time	Duration						Overall score
	Required	Implementation within one season (May-Oct)	Time to complete						
1	Ex-situ destruction	4	5						4.5
2	On-site destruction	5	5						5.0
3	In-situ vitrification	4	5						4.5
4	Containment in new to be constructed landfill	5	1						3.0
5	Containment in current landfill	5	1						3.0

	Aspect	Technical Feasibility							
2	Sub-aspects	Complexity	Technology	Execution aspects	Previous performance	Safety	Infrastructure		Overall score
Option	Required	Can be executed by Armenian contractor	Technology available in Armenia	Locally available skills and materials	Previous experience with similar projects	Safe working environment during execution	Limited upgrading required		
1	Ex-situ destruction	1	1	1	5	5	3		2.7
2	On-site destruction	1	1	1	1	3	2		1.5
3	In-situ vitrification	1	1	1	3	4	3		2.2
4	Containment in new to be constructed landfill	5	5	5	5	5	5		5.0
5	Containment in current landfill	5	5	5	5	5	5		5.0

3	Aspect	Land use							
	Sub-aspects	Site	Surrounding						Overall score
Option	Required	Accessible	No restrictions						
1	Ex-situ destruction	5	5						5.0
2	On-site destruction	4	5						4.5
3	In-situ vitrification	4	5						4.5
4	Containment in new to be constructed landfill	5	5						5.0
5	Containment in current landfill	2	2						2.0

4	Aspect	Environmental merits/impact and risk reduction							
	Sub-aspects	Soil	Groundwater	Air	Construction phase	CO2	Use base material	POPs destruction	Overall score
Option	Required	No further deterioration of soil quality	No impact on GW	No contaminated dust	Environmental impact limited	Minimum	Minimum	maximum	
1	Ex-situ destruction	5	5	5	3	3	2	5	4.0
2	On-site destruction	5	5	5	3	3	3	5	4.1
3	In-situ vitrification	2	4	4	3	3	4	4	3.4
4	Containment in new to be constructed landfill	5	5	4	3	3	4	1	3.6
5	Containment in current landfill	2	2	4	4	4	4	1	3.0

5	Aspect	Monitoring aftercare and maintenance							
	Sub-aspects	Monitoring aftercare and maintenance							Overall score
Option	Required	Minimal							
1	Ex-situ destruction	5							5.0
2	On-site destruction	5							5.0
3	In-situ vitrification	5							5.0
4	Containment in new to be constructed landfill	3							3.0
5	Containment in current landfill	1							1.0

Score	Explanation
1	Strong negative deviation from original goals
2	Non-compliant
3	Near compliant
4	Compliant
5	Additional benefit other than compliancy

6	Aspect	Risk factors							
	Sub-aspects	Technical	Financial						Overall score
Option	Required	Feasible	Minimum						
1	Ex-situ destruction	3	3						3.0
2	On-site destruction	3	3						3.0
3	In-situ vitrification	3	3						3.0
4	Containment in new to be constructed landfill	5	4						4.5
5	Containment in current landfill	5	5						5.0

6	Aspect	Social Impact							
	Sub-aspects	Job creation short term	Job creation long term	National infrastructure for hazardous wastes	Improvement of local population				Overall score
Option	Required	Maximum	Maximum	Improve	cattle-farmer				
1	Ex-situ destruction	3	1	4	5				3.3
2	On-site destruction	2	1	3	5				2.8
3	In-situ vitrification	3	1	3	4				2.8
4	Containment in new to be constructed landfill	5	5	3	5				4.5
5	Containment in current landfill	5	5	2	3				3.8

3	Aspect	Cost / Benefit							
	Sub-aspects	Implementation	Implementation	Implementation	Implementation	Aftercare			Overall score
Option	Required	Lowest cost possible	Lowest cost possible	Lowest cost possible	Lowest cost possible	Minimum			
1	Ex-situ destruction	2	2	2	2	5			2.6
2	On-site destruction	2	2	2	2	5			2.6
3	In-situ vitrification	3	3	3	3	5			3.4
4	Containment in new to be constructed landfill	4	4	4	4	3			3.8
5	Containment in current landfill	5	5	5	5	2			4.4

Score	Explanation
1	Strong negative deviation from original goals
2	Non-compliant
3	Near compliant
4	Compliant
5	Additional benefit other than compliancy

1	Aspect	Planning							
Option	Sub-aspect	Implementation time							Overall score
	Required	Implementation within one season (May-Oct)	Time to complete						
1	Ex-situ destruction	5	5						5.0
2	On-site destruction	5	4						4.5
3	In-situ vitrification	5	5						5.0
4	Containment in new constructed landfill	5	1						3.0
5	Containment in current landfill	5	1						3.0

	Aspect	Technical Feasibility							
2	Sub-aspects	Complexity	Technology	Execution aspects	Previous performance	Safety	Infrastructure		Overall score
Option	Required	Can be executed by Armenian contractor	Technology available in Armenia	Locally available skills and materials	Previous experience with similar projects	Safe working environment during execution	Limited upgrading required		
1	Ex-situ destruction	1	1	1	5	5	4		2.8
2	On-site destruction	1	1	1	1	3	2		1.5
3	In-situ vitrification	1	1	1	3	4	3		2.2
4	Containment in new constructed landfill	5	5	5	5	5	5		5.0
5	Containment in current landfill	5	5	5	5	5	4		4.8

3	Aspect	Land use							
	Sub-aspects	Site	Surrounding						Overall score
Option	Required	Accessible	No restrictions						
1	Ex-situ destruction	5	5						5.0
2	On-site destruction	4	5						4.5
3	In-situ vitrification	5	5						5.0
4	Containment in new constructed landfill	5	5						5.0
5	Containment in current landfill	2	2						2.0

4	Aspect	Environmental merits/impact and risk reduction							
	Sub-aspects	Soil	Groundwater	Air	Construction phase	CO2	Use base material	POP Destruction	Overall score
Option	Required	No further deterioration of soil quality	No impact on GW	No contaminated dust	Environmental impact limited	Minimum	Minimum	Maximum	
1	Ex-situ destruction	5	5	4	3	4	3	5	4.1
2	On-site destruction	5	5	5	3	3	3	5	4.1
3	In-situ vitrification	5	5	5	3	3	4	5	4.3
4	Containment in new constructed landfill	5	5	4	3	3	4	1	3.6
5	Containment in current landfill	2	2	4	4	4	4	1	3.0

Score	Explanation
1	Strong negative deviation from original goals
2	Non-compliant
3	Near compliant
4	Compliant
5	Additional benefit other than compliancy

5	Aspect	Monitoring aftercare and maintenance							
	Sub-aspects	Monitoring aftercare and maintenance							Overall score
Option	Required	Minimal							
1	Ex-situ destruction	5							5.0
2	On-site destruction	5							5.0
3	In-situ vitrification	5							5.0
4	Containment in new constructed landfill	1							1.0
5	Containment in current landfill	1							1.0

6	Aspect	Risk factors							
	Sub-aspects	Technical	Financial						Overall score
Option	Required	Feasible	Minimum						
1	Ex-situ destruction	5	5						5.0
2	On-site destruction	4	2						3.0
3	In-situ vitrification	3	3						3.0
4	Containment in new constructed landfill	5	4						4.5
5	Containment in current landfill	5	5						5.0

6	Aspect	Social Impact							
	Sub-aspects	Job creation short term	Job creation long term	National infrastructure for hazardous wastes	Improvement of local population				Overall score
Option	Required	Maximum	Maximum	Improve	cattle-farmer				
1	Ex-situ destruction	3	1	3	5				3.0
2	On-site destruction	2	1	3	5				2.8
3	In-situ vitrification	3	1	3	5				3.0
4	Containment in new constructed landfill	4	5	3	5				4.3
5	Containment in current landfill	4	5	2	2				3.3

3	Aspect	Cost / Benefit							
	Sub-aspects	Implementation	Implementation	Implementation	Implementation	Aftercare			Overall score
Option	Required	Lowest cost possible	Lowest cost possible	Lowest cost possible	Lowest cost possible	Minimum			
1	Ex-situ destruction	2	2	2	2	5			2.6
2	On-site destruction	3	3	3	3	5			3.4
3	In-situ vitrification	3	3	3	3	5			3.4
4	Containment in new constructed landfill	4	4	4	4	1			3.4
5	Containment in current landfill	5	5	5	5	1			4.2

Options	Low contaminated soil	Planning	Technical Feasibility	Land-use	Environmental merits/impact and risk reduction	Monitoring aftercare and maintenance	Risk factors	Social Impact	Cost / Benefit	Overall score
1	Bioremediation	3.5	3.3	3.0	3.6	3.0	2.5	3.0	3.0	**24.9**
2	Phytoremediation	3.0	4.0	2.0	4.0	2.0	5.0	3.3	4.4	**27.7**
3	Containment	3.0	4.8	2.0	4.0	2.0	5.0	3.3	4.4	**28.5**

Options	High contaminated soil	Planning	Technical Feasibility	Land use	Environmental merits/impact and risk reduction	Monitoring aftercare and maintenance	Risk factors	Social Impact	Cost / Benefit	Overall score
1	Ex-situ destruction	4.5	2.7	5.0	4.0	5.0	3.0	3.3	2.6	**30.0**
2	On-site destruction	5.0	1.5	4.5	4.1	5.0	3.0	2.8	2.6	**28.5**
3	In-situ vitrification	4.5	2.2	4.5	3.4	5.0	3.0	2.8	3.4	**28.7**
4	Containment in new to be constructed landfill	3.0	5.0	5.0	3.6	3.0	4.5	4.5	3.8	**32.4**
5	Containment in current landfill	3.0	5.0	2.0	3.0	1.0	5.0	3.8	4.4	**27.2**

Options	Pesticides	Planning	Technical Feasibility	Land use	Environmental merits/impact and risk reduction	Monitoring aftercare and maintenance	Risk factors	Social Impact	Cost / Benefit	Overall score
1	Ex-situ destruction	5.0	2.8	5.0	4.1	5.0	5.0	3.0	2.6	**32.6**
2	On-site destruction	4.5	1.5	4.5	4.1	5.0	3.0	2.8	3.4	**28.8**
3	In-situ vitrification	5.0	2.2	5.0	4.3	5.0	3.0	3.0	3.4	**30.9**
4	Containment in new constructed landfill	3.0	5.0	5.0	3.6	1.0	4.5	4.3	3.4	**29.7**
5	Containment in current landfill	3.0	4.8	2.0	3.0	1.0	5.0	3.3	4.2	**26.3**

Planning	
Implementation time	
1	On-site works cannot be implemented within two seasons
2	On-site works cannot be implemented within one season, but probably two seasons, partitioning of works is difficult, costly and increases risks
3	On-site works cannot be implemented within one season, but can be executed over several seasons without significant additional costs or risks
4	On-site works can be implemented within one season but needs extra investments
5	On-site works can be easily implemented within one season
Finalization	
1	The contamination on the site will not be eliminated and not contained within 10 years
2	The contamination on the site will not be eliminated but contained within 10 years
3	The contamination will be eliminated within 5 - 10 years
4	The contamination will be eliminated within 5 years
5	The contamination will be eliminated within 1 year

Technical feasibility	
Can be executed by an Armenian contractor	
1	Work can only be executed by a very few experienced international companies
2	Work can only be executed by quite some experienced international companies
3	Work can be executed by Armenian contractor with in-put from experienced international companies
4	Work can be executed by large Armenian contractor
5	Work can be executed by small local contractor
Technology available in Armenia	
1	Technology is patented by single company and still under development
2	Technology is patented by single company
3	Technology is available in the region and can be used by Armenian companies
4	Technology is not patented and available on Armenian market
5	Technology is not patented and applied extensively on Armenian market
Locally available skills and materials	
1	Highly specialized materials and staff required, near 100% of materials, staff and equipment needs to be brought in
2	Highly specialized materials and staff required, international supervision required on Armenian contractor
3	Most works can be made with local staff, materials and equipment, for specialized parts materials, equipment or staff have to be brought in
4	Works can be done with local staff, materials and equipment with limited assistance of international expertise
5	Works can be done with local staff, materials and equipment, no international expertise is needed
Previous experience with similar projects	
1	No experience with technique, technique is still in test phase
2	Limited experience with technique, mostly in pilots
3	Experience with technique, however not in this region
4	Technique is well established and applied in this region
5	Technique is well established and applied in Armenia
Safe working environment during execution	
1	Safe working environment cannot be guaranteed during execution of the works
2	The location of the site makes a safe working environment difficult to achieve
3	During certain aspects of the work, safe working conditions are difficult to implement
4	Safe working environment can be implemented during the works
5	Risks for execution of the works are negligible

Availability of suitable utilities and infrastructure	
1	Required infrastructure upgrading is > 50% of total project costs
2	Investment in infrastructure to execute the works is significant and expensive and reaches up to 50% of project costs
3	Upgrading of the current infrastructure is needed to execute the works and reaches up to 20% of project costs
4	Limited upgrading of the current infrastructure is needed to execute the works reaches up tot 5% of project costs
5	No upgrade of current infrastructure is needed to execute the works
Land use	
Site use	
1	Site cannot be used or entered, deterioration from current situation
2	Site cannot be used or entered, status quo with current situation
3	Site cannot be used or entered, improvement from current situation but insufficient to change risks associated with the site
4	Site cannot be used but main risks associated with the site have been removed and site can be entered
5	No restrictions for the site remain, site can be used for all purposes
Surroundings	
1	Site surroundings are off-limits, deterioration from current situation
2	Site surroundings are off-limits, status quo with current situation
3	Improvement of site-surroundings, however insufficient to change the usage of the area
4	Site surroundings can be accessed and used for cattle grazing
5	No restrictions for the site surroundings remain, area can be used for all purposes

Environmental merits/impact and risk reduction	
Soil quality	
1	Significant further deterioration of soil quality
2	Limited deterioration of soil quality
3	No improvement of soil quality
4	Improvement of soil quality
5	Significant improvement of soil quality
Groundwater quality	
1	Significant deterioration of groundwater quality at the site and downstream of the site
2	Deterioration of groundwater quality at the site and limited deterioration of groundwater quality downstream of the site
3	Limited impact on groundwater quality at the site
4	No impact on groundwater quality at the site
5	Improvement of groundwater quality at the site
Air quality	
1	Formation of dust during and after works
2	Formation of dust during the works
3	Limited dust formation during and after the works (status quo)
4	No dust formation after the works, limited dust formation during the works
5	No dust formation during and after the works
Environmental impact during works phase	
1	Irreversible impact on the environment during works
2	Significant impact on the environment during the works (reversible)
3	Limited impact on the environment during the works (reversible)
4	No or very limited impact on the environment during the works
5	No impact on the environment during the works
CO_2 emissions during works	
1	CO_2 emissions are excessive in relation to the environmental benefits of the works
2	CO_2 emissions are significant in relation to the environmental benefits of the works
3	CO_2 emissions are acceptable in relation to the environmental benefits of the works
4	CO_2 emissions are limited in relation to the environmental benefits of the works
5	CO2 emissions are neutral or positive balance in relation to the environmental benefits of the works
Use of base materials	
1	Significant base materials are required for the works, including base materials that are rare or cause environmental impact where they are obtained
2	Significant base materials are required for the works including base materials that are in limited supply in Armenia
3	Base materials are required for the works, materials have to be brought in from outside the direct vicinity of the site
4	Limited base materials are required for the works, required base materials can be obtained from the direct surroundings
5	No base materials are required for the works
POP destruction	
1	No POP pesticides are destructed, they are contained in such a way that they are vulnerable to re-enter environment
2	No POP pesticides are destructed they are contained in such a way that re-entering the environment is not likely
3	Part of POP pesticides are destructed remain is contained in such a way that they are vulnerable to re-enter environment
4	Part of POP pesticides are destructed remain is contained in such a way that re-entering the environment is not likely
5	All POP pesticides are destructed

Monitoring aftercare and maintenance	
Minimal monitoring aftercare and maintenance	
1	Active, intense monitoring, aftercare and maintenance required. In case monitoring aftercare and maintenance is stopped site will deteriorate quickly
2	Active monitoring, aftercare and maintenance required
3	Mostly passive monitoring aftercare and maintenance with minimal active work required
4	Minimal and only passive monitoring, aftercare and maintenance required
5	No monitoring, aftercare or maintenance required

Risk Factors	
Technical risks	
1	Several factors have been identified that can cause the technology to fail
2	Chance that the chosen technology does not effectively address the problem is present
3	Chance that the chosen technology does not effectively address the problem is limited
4	Technical risks are acceptable
5	Limited technical risks
Financial risks	
1	Large deviations (> 100%) from the original budget are likely
2	Large deviations (50% - 100%) from the original budget are possible
3	Deviations (10 - 50%) from the original budget are possible
4	Deviations (<10%) from the original budget are possible but within normal means
5	Deviations from the original budget are not likely or very limited

Social Impact	
Job creation short term	
1	No local jobs are created, all works done by international staff and works lead to the loss of jobs
2	No local jobs are created, all works done by international staff but no loss of jobs the coming few years
3	Limited local jobs are created, most works done by international staff no loss of jobs the coming few years
4	No loss of jobs the for quite some years and additional local jobs are created
5	Current employed personnel is permanent jobs and additional local jobs are created Significant local jobs are created including jobs for people from direct vicinity of the landfill site
Job creation long term	
1	No long term jobs are created, works will lead to the destruction of jobs
2	No long term jobs are created
3	Limited long term jobs are created
4	Long term jobs are created for people in the region
5	Long term jobs are created, local community can provide workforce
Armenia Hazardous waste infrastructure	
1	Does not contribute to the Armenian hazardous wastes infrastructure
2	Provides limited extra experience to the Armenian hazardous wastes community
3	Adds specialized experience to the Armenian hazardous wastes community, no other benefits
4	Adds knowledge and handling facilities to the Armenian hazardous waste infrastructure
5	Significantly improves the hazardous waste handling capacity in Armenia, Armenia will become regional player
Improvement of local population	
1	Restrictions for the area are increased, no improvement for local population
2	Status quo
3	Area around the landfill cannot be used for herding, no access restrictions
4	Area around the landfill site can be used for herding, no access restrictions
5	All restrictions for the area are lifted

Cost / Benefit	
Implementation	
1	High costs (> $2,000,000) limited environmental benefits
2	High costs (> $2,000,000) significant environmental benefits
3	Medium or low costs (till $2,000,000) limited environmental benefits
4	Medium or low costs (till $2,000,000) significant environmental benefits
5	Low costs (till $500,000) significant environmental benefits
Monitoring and aftercare	
1	High costs (> $50,000/yr) with possibility of high failure costs
2	High costs (> $50,000/yr) failure costs not likely
3	Medium costs (till $10,000-50,000) failure costs not likely
4	Low costs (till $10,000)
5	No costs

Appendix

2

Preliminary design scenario 2

Date adjusted	4-dec-13
Projectnumber:	1210169

Prelimairy design

Scenario 2 - Removal of pesticides

Site	Nubarashen
Location	Nubarashen, Armenia
Site number	01
Client	OSCE

Author(s):	Guido van de Coterlet
Projectmanager:	Guido van de Coterlet
Reference:	K001-1210169GMC
Date drafted:	25-sep-13
Number of pages:	4 (excl front page)

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Project:	**Scenario 2 - Removal of pesticides**	Projectnr.:	1210169
Location :	**Nubarashen, Armenia**	Reference:	K001-1210169GMC
Client:	**OSCE**	Drafted by:	Guido van de Coterlet
Name of site:	**Nubarashen**	Date:	4-dec-13
Site number	**01**	Second reader	Boudewijn Fokke

GENERAL

Project parameters

Date of prices

Last adjustment 4-dec-13

Subject

Scenario 2 - Removal of pesticides

Base documents

- Phase 1 and 2 site investigation report Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia (Tauw report, R003-1210169BFF-beb-V04, d.d. 14nd November 2013)
- Inception report Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia (Tauw report, R002-1210169BFF-los-V04, d.d. April 15th 2013)
- H&S plan Site Assessment and Feasibility Study of the Persistent Organic Pollutants (POP) and Obsolete Pesticides (OP) Burial Site in Nubarashen, Armenia (Tauw report R001-1210169BFF-beb-V03-NL, 25th February 2013)
- BIDDING DOCUMENTS FOR SITE ASSESSMENT AND FEASIBILITY STUDY OF THE PERSISTENT ORGANIC POLLUTANTS (POP) AND OBSOLETE PESTICIDES (OP) BURIAL SITE IN NUBARASHEN, ARMENIA (OSCE, RFP NO. ARM/01/2012, June 2012)

Disclaimer

This document serves as a detailled insight in the required works for the secnond scenario for the Nubarashen landfill site in Armenia. This document should be seen in light of required accuracy for this stage of the process and is by no means a full bid book.

Assumptions

- One m^3 soil weighs 1.7 tonnes
- One m^3 of in-situ soil equals 1.2 m^3 of excavated soil
- One m^3 building waste weighs 2.3 tonnes (Crushed)
- One m^3 pure pesticides weighs 1.0 tonnes
- Clean soil contains < 0.7 mg/kg DDT and no other pesticides in any concentration that cause latent risks
- low contaminated soil contains 0.7 - 1,500 mg/kg d.m. DDT (or equivalent concentrations of other pesticides)
- high contaminated soil contains > 1,500 mg/kg d.m. of DDT (or equivalent concentrations of other pesticides)
- Pure pesticides are layers that contain > 30% (volume) of pure pesticides
- The total quantity of low contaminated soil at the landfill site is 7277 m3
- The total quantity of high contaminated soil at the landfill site is 4,196 m3
- The total quantity of pure pestcidies at the landfill site is 605 m^3
- The total quanitity of contaminated construction material is 16,2 m^3
- Size of fenced landfill is 0,8 hectares
- Size of the hillock is 0,2 hectares
- Average height of the hillock is 1.25 m above surrounding area
- Working season is May - October
- Temporary roads will have a surface layer of granulated rocks for stabilisation
- Warehouse will be semi-open building with concrete flooring and corrugated roof
- New guardhouse will be placed next to warehouse - one floor brick building with two rooms and corrugated roof. Total size 30 m^2
- Pesticides and high contaminated soil will be stored in 200 l plastic drums or big bags
- Plastic drums and big bags will be destructed together with pesticides and high contaminated soil


Improve access road
(600 m)
BB 0.01-0.04
Misc. Erosion works
BB 0.5
Repair water main
BB 0.3
Installation of culvert
(20 m)
BB 0.20
Upgrade embankment
prevention of erosion and
water inflow to valley.
BB 0.4
100 m
200 ft
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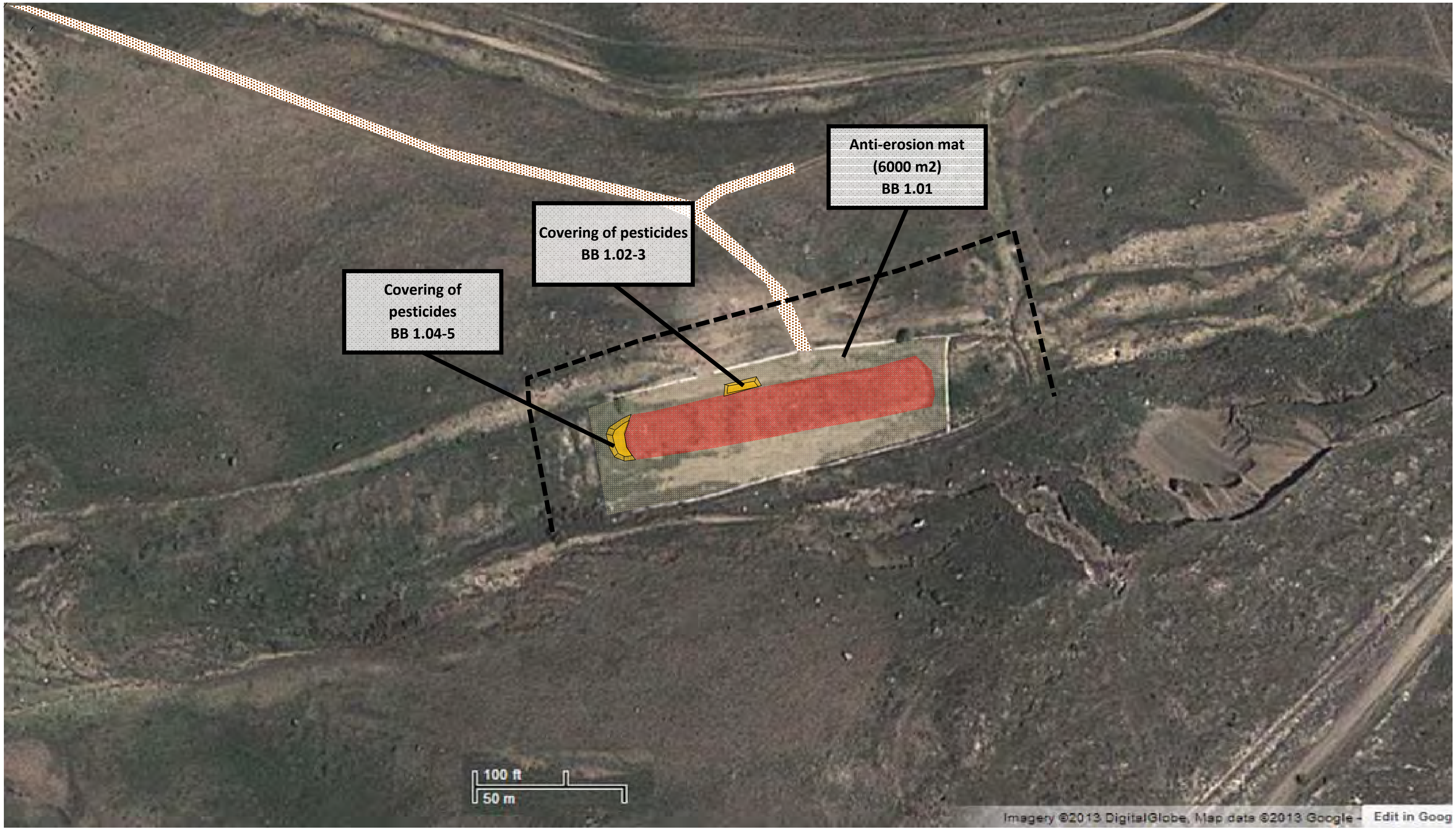
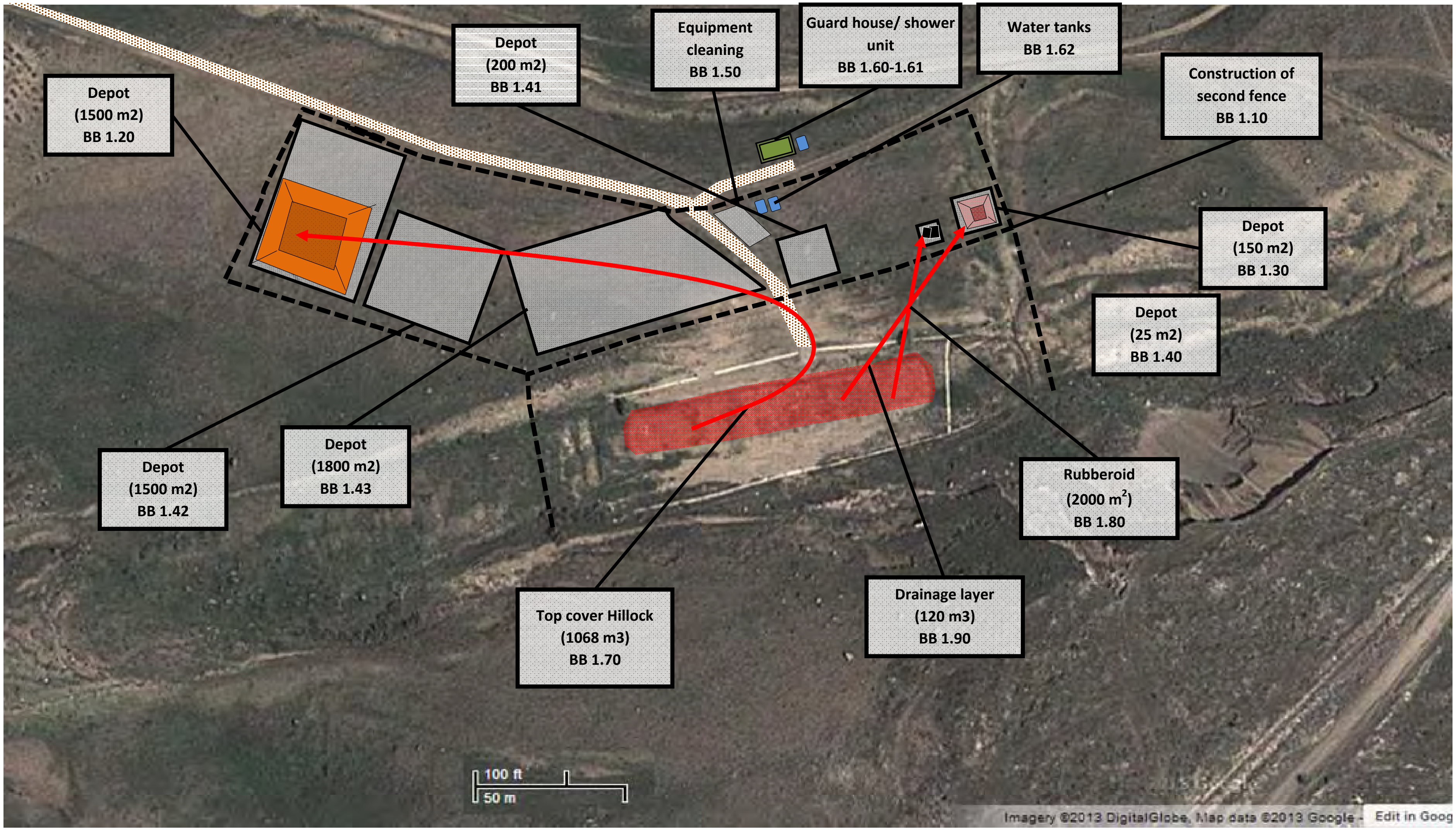
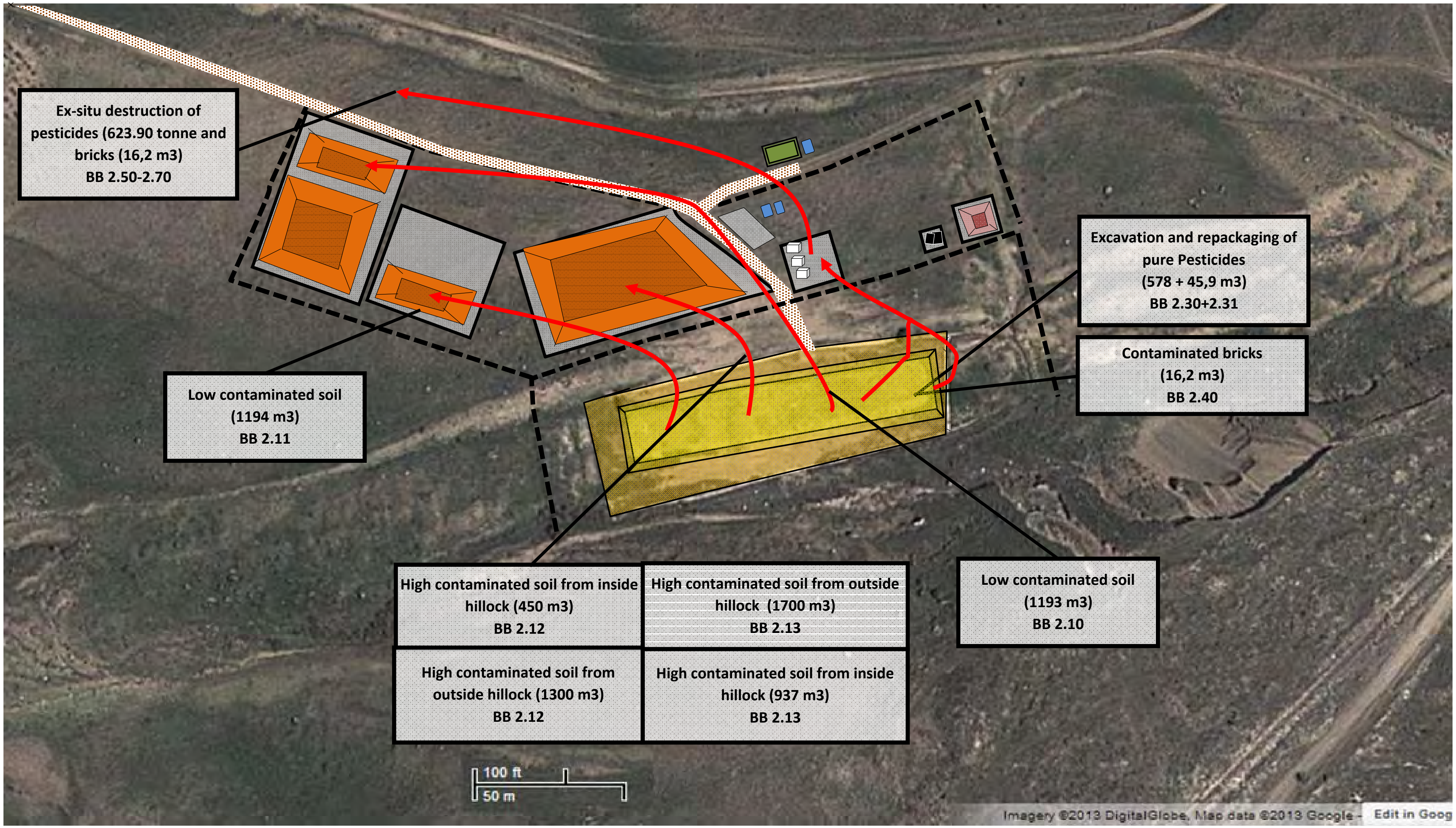
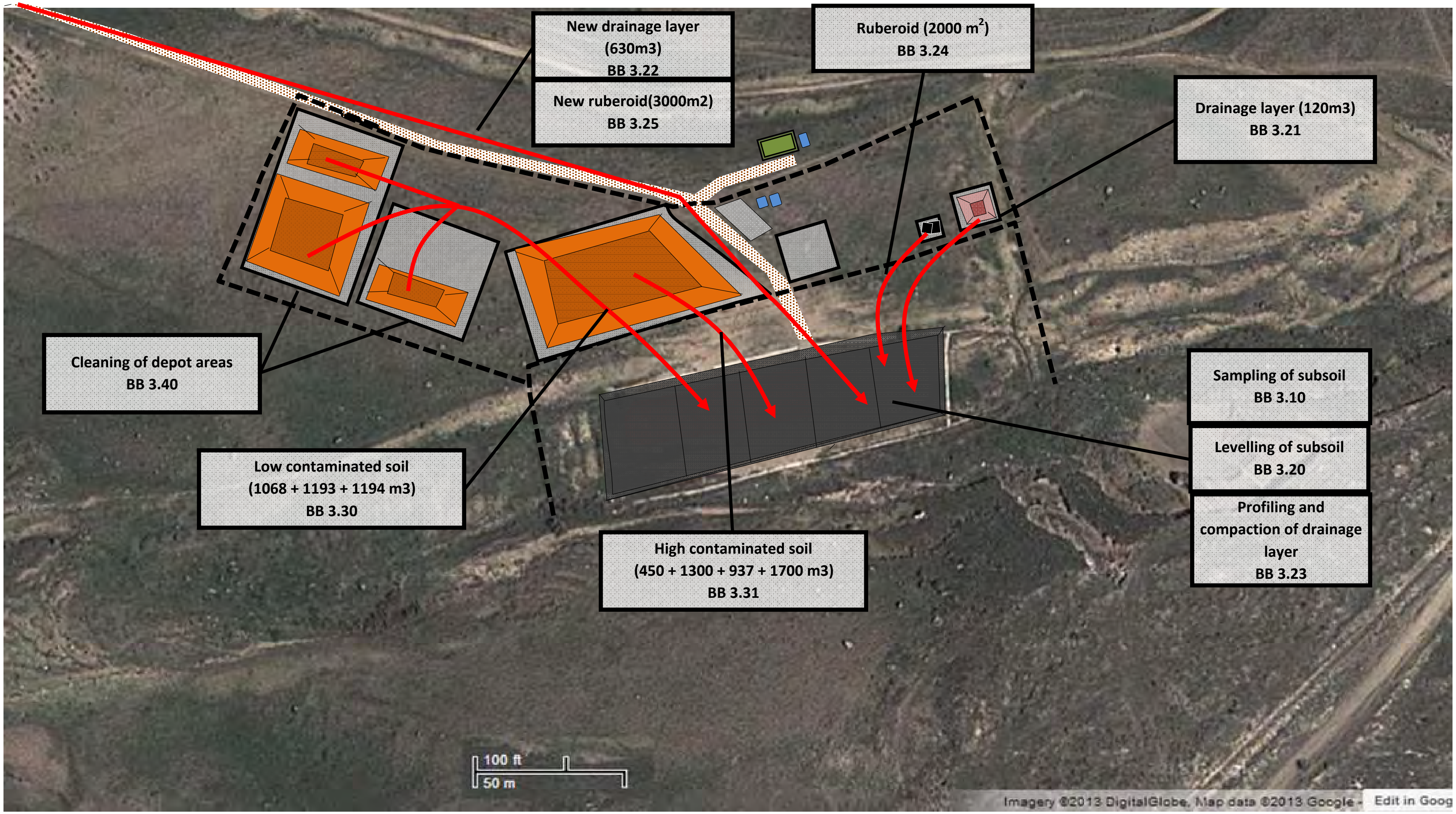
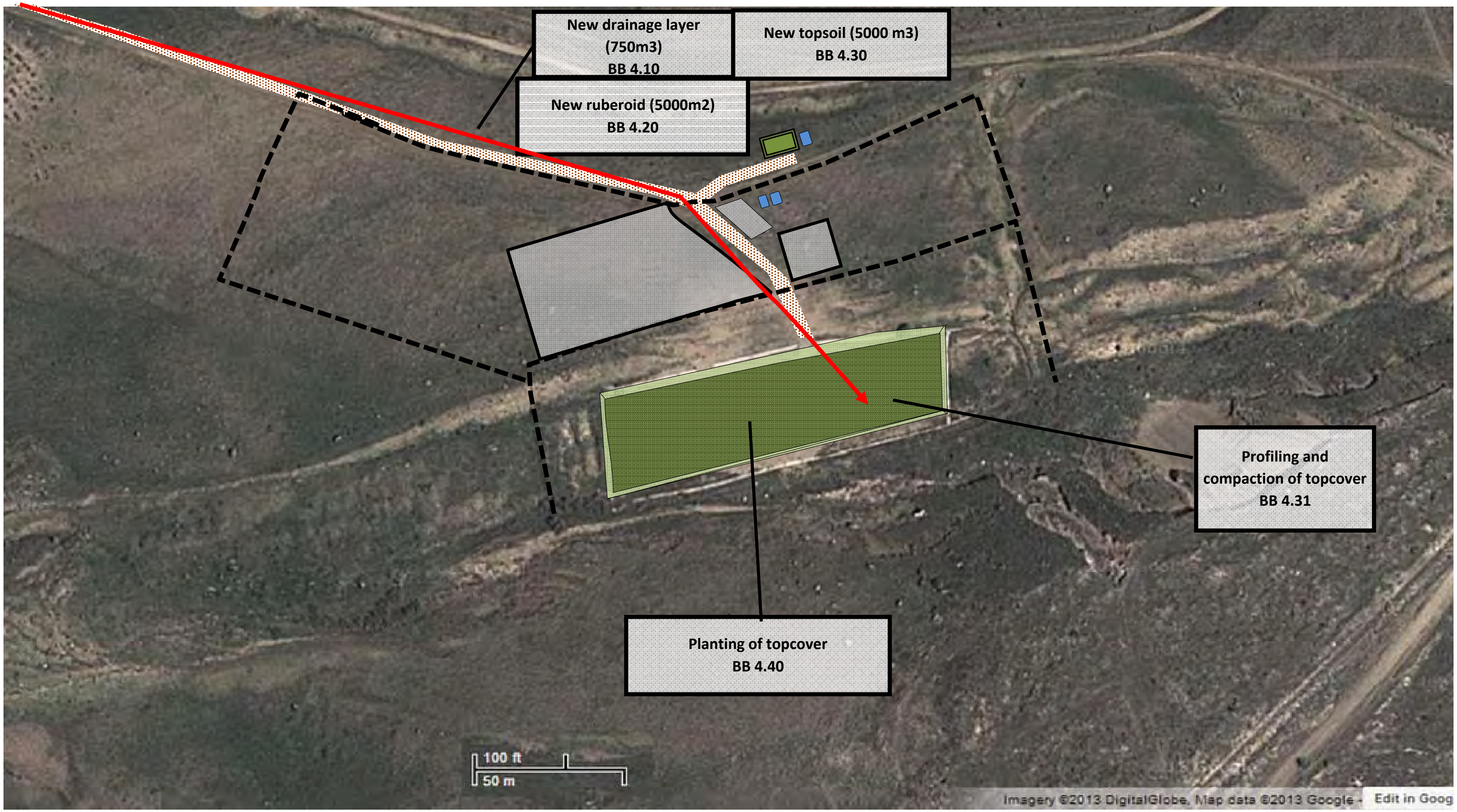
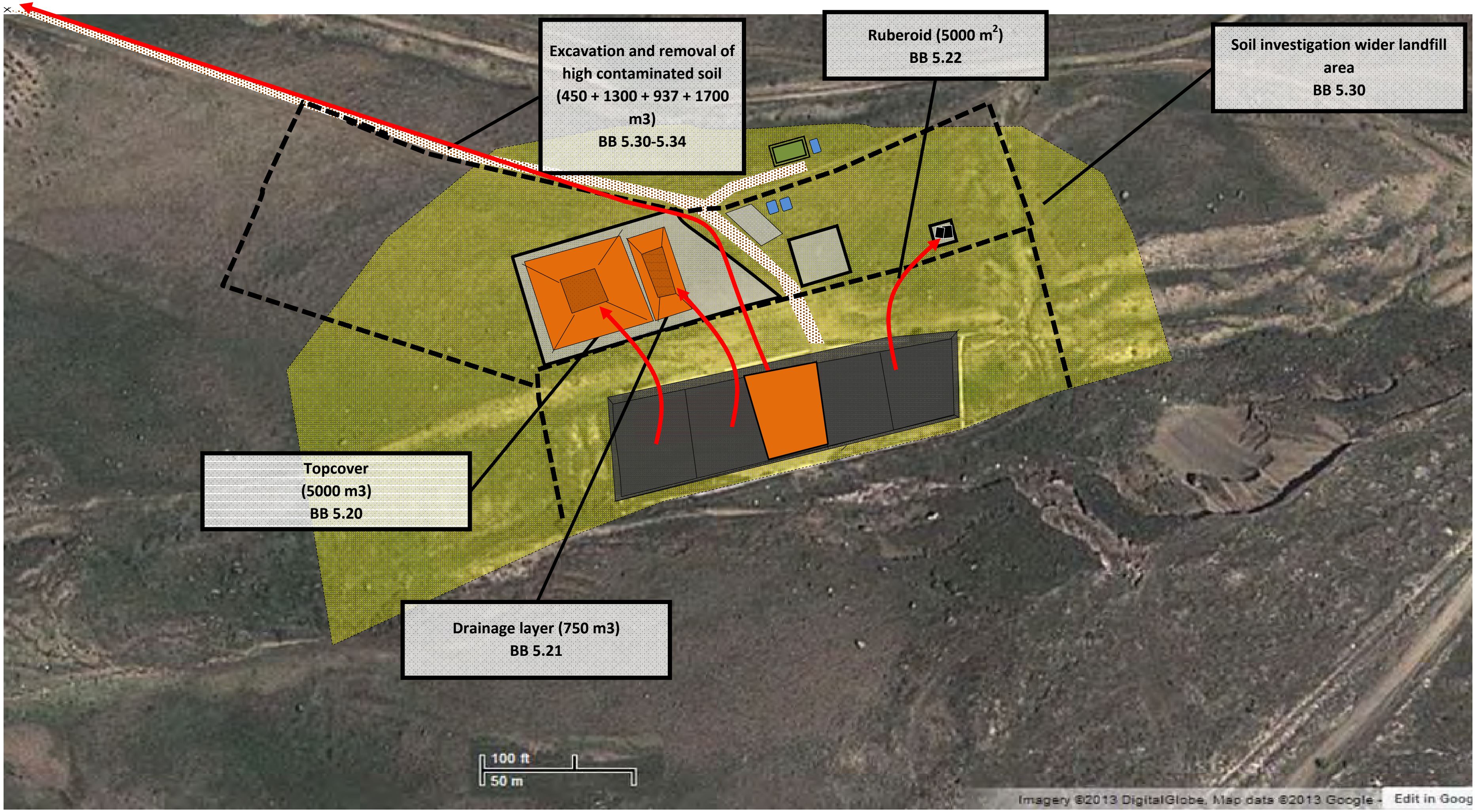

Anti-erosion mat
(6000 m2)
BB 1.01
Covering of pesticides
BB 1.02-3
Covering of
pesticides
BB 1.04-5
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google -
Edit in Goog

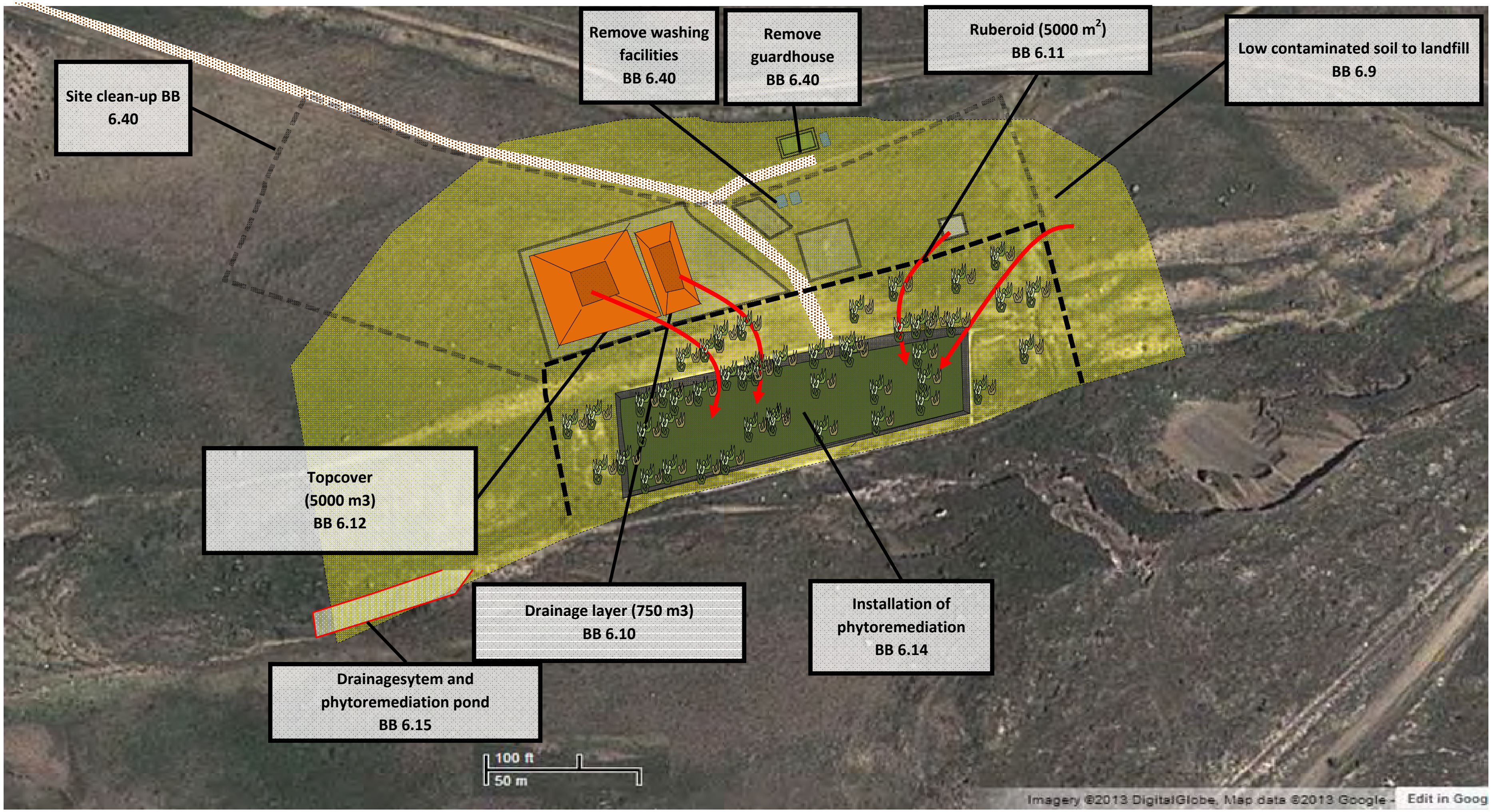

Depot
(200 m2)
BB 1.41
Equipment cleaning
BB 1.50
Guard house/ shower unit
BB 1.60-1.61
Water tanks
BB 1.62
Depot
(1500 m2)
BB 1.20
Construction of second fence
BB 1.10
Depot
(150 m2)
BB 1.30
Depot
(25 m2)
BB 1.40
Depot
(1500 m2)
BB 1.42
Depot
(1800 m2)
BB 1.43
Rubberoid
(2000 m2)
BB 1.80
Top cover Hillock
(1068 m3)
BB 1.70
Drainage layer
(120 m3)
BB 1.90
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google - Edit in Goog


Ex-situ destruction of pesticides (623.90 tonne and bricks (16,2 m3) BB 2.50-2.70
Excavation and repackaging of pure Pesticides (578 + 45,9 m3) BB 2.30+2.31
Contaminated bricks (16,2 m3) BB 2.40
Low contaminated soil (1194 m3) BB 2.11
High contaminated soil from inside hillock (450 m3) BB 2.12
High contaminated soil from outside hillock (1700 m3) BB 2.13
Low contaminated soil (1193 m3) BB 2.10
High contaminated soil from outside hillock (1300 m3) BB 2.12
High contaminated soil from inside hillock (937 m3) BB 2.13
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google


New drainage layer
(630m3)
BB 3.22
New ruberoid(3000m2)
BB 3.25
Ruberoid (2000 m2)
BB 3.24
Drainage layer (120m3)
BB 3.21
Cleaning of depot areas
BB 3.40
Sampling of subsoil
BB 3.10
Levelling of subsoil
BB 3.20
Low contaminated soil
(1068 + 1193 + 1194 m3)
BB 3.30
Profiling and
compaction of drainage
layer
BB 3.23
High contaminated soil
(450 + 1300 + 937 + 1700 m3)
BB 3.31
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google


New drainage layer
(750m3)
BB 4.10
New topsoil (5000 m3)
BB 4.30
New ruberoid (5000m2)
BB 4.20
Profiling and
compaction of topcover
BB 4.31
Planting of topcover
BB 4.40
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google -
Edit in Goog


Excavation and removal of high contaminated soil (450 + 1300 + 937 + 1700 m3)
BB 5.30-5.34
Ruberoid (5000 m^2)
BB 5.22
Soil investigation wider landfill area
BB 5.30
Topcover (5000 m3)
BB 5.20
Drainage layer (750 m3)
BB 5.21
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google - Edit in Goog


Site clean-up BB 6.40
Remove washing facilities BB 6.40
Remove guardhouse BB 6.40
Ruberoid (5000 m2) BB 6.11
Low contaminated soil to landfill BB 6.9
Topcover (5000 m3) BB 6.12
Drainage layer (750 m3) BB 6.10
Installation of phytoremediation BB 6.14
Drainagesytem and phytoremediation pond BB 6.15
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google - Edit in Goog

Tauw bv Soil Consultants and Engi

Project:	**Scenario 2 - Removal of pesticides**	Projectnr.:	1210169
Location :	**Nubarashen, Armenia**	Reference:	K001-1210169GMC
Client:	**OSCE**	Drafted by:	Guido van de Coterlet
Name of site:	**Nubarashen**	Date:	4-12-2013
Site number	**01**	Second reader	Boudewijn Fokke

GENERAL

Project parameters

BASE MAP CODE:

Last update: 4-dec-13

Post	PP-Code	WORKS	UNIT	QUANTITY	C.P.U.	SUBTOTAL	TOTAL
		SHORT TERM - ACUTE RISKS					
0.0		**Project preparation** **Location: Landfill site and uphill area**					
0.01		Improve access road from guard house till dump site - resurfacing	m	600.00	USD 3.33	USD 2,000.00	
0.02		Improve access road - stablization mat (3,5 m wide)	m	600.00	USD 11.39	USD 6,835.00	
0.03		Improve access road - gravel (15 cm - 3,5 m wide)	m^3	315.00	USD 39.05	USD 12,300.00	
0.04		Improve access road - levelling and finalization	m	600.00	USD 1.63	USD 975.00	
0.20		Installation of culvert (20 m - 525 mm diameter) including labor and transport to site	pc	1.00	USD 3,190.00	USD 3,190.00	
0.30		Repair water main	pc	1.00	USD 2,425.00	USD 2,425.00	
0.40		Excavation of trench (200 m x 0,3 x 0,9)	m^3	54.00	USD 9.17	USD 495.00	
0.41		Installation of concrete piles (200 x 0,3 x 1,0 m)	m	200.00	USD 32.13	USD 6,425.00	
0.50		Misc. works for rerouting surface run-off (to be decided at a later stage)	pc	1.00	USD 34,750.00	USD 34,750.00	
		Total preparation					**USD 69,395.00**
1.0		**STEP 0: COVERING OF PESTICIDES AND HEAVILY CONTAMINATED SOIL** **Location: Hillock**					
1.00		Removal of vegetation	m^2	6,000.00	USD 0.10	USD 570.00	
1.01		Anti erosion mat (jute)	m^2	6,000.00	USD 0.42	USD 2,515.00	
1.02		New rubberoid (2mm) transport to site and application on northern part of landfill	m^2	50.00	USD 9.70	USD 485.00	
1.03		New top cover (1 m) for northern part of landfill 50 m^2	m^3	50.00	USD 30.00	USD 1,500.00	
1.04		New rubberoid (2mm) transport to site and application on western part of landfill	m^2	100.00	USD 7.58	USD 757.50	
1.05		New top cover for western part of landfill (1 m) for 100 m^2	m^3	100.00	USD 25.00	USD 2,500.00	
		Total step 0					**USD 8,327.50**
1.0		**STEP 1: EXCAVATION OF TOP COVER** **Location: Hillock**					
1.10		Installation of second fence (2 m high hexagonal wire mesh)	m	700.00	USD 7.29	USD 5,100.00	
1.20		Depot area (levelling, removal of shrubs and drainage layer below plastic foil)	m^2	1,500.00	USD 3.33	USD 5,000.00	
1.30		Depot area (levelling, removal of shrubs and drainage layer below plastic foil)	m^2	150.00	USD 3.75	USD 562.50	
1.40		Depot area (levelling, removal of shrubs and drainage layer below plastic foil)	m^2	25.00	USD 5.21	USD 130.21	
1.41		Depot area (levelling, removal of shrubs and drainage layer concrete slabs)	m^2	200.00	USD 3.55	USD 710.00	
1.42		Depot area (levelling, removal of shrubs and drainage layer below plastic foil)	m^2	1,000.00	USD 3.49	USD 3,487.00	
1.43		Depot area (levelling, removal of shrubs and drainage layer below plastic foil)	m^2	1,800.00	USD 3.24	USD 5,837.50	
1.50		Equipment washing facility (removal of shrubs, levelling, stabilization layer, concrete slabs)	m^3	50.00	USD 50.00	USD 2,500.00	
1.60		Guard house (mobile construction, 30 m2)	pc	1.00	USD 5,220.00	USD 5,220.00	
1.61		Shower and changing unit	pc	1.00	USD 5,220.00	USD 5,220.00	
1.62		Water tanks (500 L)	pc	3.00	USD 136.67	USD 410.00	
1.70		Excavation of top cover and placement in depot	tonne	1,815.60	USD 2.25	USD 4,080.00	
1.80		Removal of rubberoid and placement in depot	m^2	2,000.00	USD 0.40	USD 790.00	
1.90		Excavation of drainage layer and placement in depot	tonne	204.00	USD 4.85	USD 990.00	
		Total step 1					**USD 40,037.21**

Tauw bv Soil Consultants and Engi

Project:	**Scenario 2 - Removal of pesticides**	Projectnr.:	1210169
Location :	**Nubarashen, Armenia**	Reference:	K001-1210169GMC
Client:	**OSCE**	Drafted by:	Guido van de Coterlet
Name of site:	**Nubarashen**	Date:	4-12-2013
Site number	**01**	Second reader	Boudewijn Fokke

GENERAL

Project parameters

BASE MAP CODE:

Last update: 4-dec-13

Post	PP-Code	WORKS	UNIT	QUANTITY	C.P.U.	SUBTOTAL	TOTAL
2.0		**STEP 2a: EXCAVATION OF HILLOCK**					
		Location: Hillock					
2.10		Excavation of low contaminated soil from eastern part of hillock and placement in depot	tonne	2,028.10	USD 3.91	USD 7,940.00	
2.11		Excavation of low contaminated soil from western part of landfill and placement in depot	tonne	2,029.80	USD 3.91	USD 7,940.00	
2.12		Excavation of high contaminated soil from eastern part of landfill and placement in depot	tonne	2,975.00	USD 5.07	USD 15,080.00	
2.13		Excavation of high contaminated soil from western part of landfill and placement in depot	tonne	4,482.90	USD 4.96	USD 22,220.00	
2.20		HDPE drums for storage of wet pesticides from cell 1 (200 L)	pc	135.00	USD 30.00	USD 4,050.00	
2.21		Big bags with liner for pesticides (1 m^3)	pc	578.00	USD 20.00	USD 11,560.00	
2.22		Drum filling equipment	pc	3.00	USD 500.00	USD 1,500.00	
2.30		Excavation of pure pesticides, transfer to bags and transport to depot (including labor, cranes and PPE)	tonne	578.00	USD 12.77	USD 7,381.06	
2.31		Excavation of pure pesticides from wet cell 1 and transfer to barrels (including labor, cranes and PPE)	tonne	45.90	USD 65.36	USD 3,000.00	
2.40		Demolition of underground structure, loading of materials into big bags and shipment to temporary storage	m^3	16.20	USD 33.95	USD 550.00	
		STEP 2b: EXCAVATION OF PESTICIDES AND DESTRUCTION IN EX-SITU FACILITY					
		Location: Hillock					
2.50		Transport of pesticides to facility in Europe	tonne	623.90	USD 239.35	USD 149,330.47	
2.51		Additional costs for hazardous materials (2% of total weight)	tonne	12.48	USD 239.35	USD 2,986.61	
2.61		Additional costs for hazardous packaging materials (2% of total weight)	tonne	12.48	USD 239.35	USD 2,986.61	
2.62		Destruction of pure pesticides	tonne	623.90	USD 2,500.00	USD 1,559,750.00	
2.62B		Additional costs for hazardous materials (2% of total weight)	tonne	12.48	USD 2,500.00	USD 31,195.00	
2.63		Decontamination and transport of decontaminated building materials to landfill	tonne	37.26	USD 50.00	USD 1,863.00	
2.64		Additional costs for hazardous of waste from rubbble	tonne	0.75	USD 2,500.00	USD 1,875.00	
2.65		Landfilling decontaminated building material	tonne	37.26	USD 20.00	USD 745.20	
2.70		Permitting for hazardous waste transport	pc	1.00	USD 50,000.00	USD 50,000.00	
		Total Step 2					**USD 1,881,952.94**
3.0		**STEP 3: REDISTRIBUTION OF LOW CONTAMINATED SOIL AND HIGH CONTAMINATED SOIL TO LANDFILL**					
		Location: Hillock					
3.10		Sampling of subsoil for residual pesticides	pc	1.00	USD 4,000.00	USD 4,000.00	
3.20		Levelling of subsoil of excavated landfill site	m^2	5,000.00	USD 0.85	USD 4,250.00	
3.21		Excavation of drainage layer from depot and distribution at bottom part of landfill	tonne	204.00	USD 4.29	USD 875.00	
3.22		New drainage layer sand, including transport to site and distribution at landfill	tonne	1,071.00	USD 20.34	USD 21,780.00	
3.23		Profiling and compaction of drainage layer	m^2	5,000.00	USD 0.39	USD 1,962.50	
3.24		Unloading of rubberoid and re-application on landfill	m^2	2,000.00	USD 0.47	USD 940.00	
3.25		New rubberoid (2mm) transport to site and application on bottom part of landfill	m^2	3,000.00	USD 4.44	USD 13,325.00	
3.30		Excavation of low contaminated soil from depot and distribution at new landfill	tonne	5,873.50	USD 2.63	USD 15,445.00	
3.31		Excavation of high contaminated soil from depot and distribution at new landfill	tonne	7,457.90	USD 3.47	USD 25,875.00	
3.40		Cleaning of depot area, removal and disposal of HDPE foil	m^2	1,875.00	USD 0.63	USD 1,177.50	
		Total Step 3					**USD 89,630.00**
4.0		**STEP 4: TEMPORARY CLOSURE OF LANDFILL AWAITING FUNDS FOR CLEANUP OF HIGH CONTAMINATED SOIL**					
		Location: Hillock					
4.10		New drainage layer sand, including transport to site and distribution at landfill	tonne	1,275.00	USD 20.34	USD 25,928.57	
4.20		New rubberoid (2mm) transport to site and application on top part of landfill	m^2	5,000.00	USD 4.44	USD 22,208.33	
4.30		Covering of landfill with one meter of topsoil including transport to site and application on landfill	tonne	8,500.00	USD 6.63	USD 56,325.00	
4.31		Profiling of topcover	m^2	5,000.00	USD 0.39	USD 1,962.50	
4.40		Planting of topcover with erosion resistant bushes and shrubs	m^2	5,000.00	USD 1.50	USD 7,500.00	
		Total Step 4					**USD 113,924.40**

Tauw bv Soil Consultants and Engi

Project:	**Scenario 2 - Removal of pesticides**	Projectnr.:	1210169
Location :	**Nubarashen, Armenia**	Reference:	K001-1210169GMC
Client:	**OSCE**	Drafted by:	Guido van de Coterlet
Name of site:	**Nubarashen**	Date:	4-12-2013
Site number	**01**	Second reader	Boudewijn Fokke

GENERAL

Project parameters

BASE MAP CODE:

Last update: 4-dec-13

Post	PP-Code	WORKS	UNIT	QUANTITY	C.P.U.	SUBTOTAL	TOTAL
5.0		**STEP 5: REOPENING LANDFILL SITE AND EXCAVATION AND REMOVAL OF HIGH CONTAMINATED SOIL**					
		Location: Whole landfill					
5.20		Excavation of top cover and placement in depot	tonne	8,500.00	USD 2.25	USD 19,101.12	
5.21		Excavation of drainage layer and placement in depot	tonne	1,275.00	USD 4.85	USD 6,187.50	
5.22		Removal of rubberoid and placement in depot	m^2	5,000.00	USD 0.40	USD 1,975.00	
5.23		Big bags and liner for heavily contaminated soil (1 $m^{3)}$	pc	4,387.00	USD 20.00	USD 87,740.00	
5.30		Excavation of heavily contaminated soil, transfer to bags and transport to storage on-site (including labor, cranes and PPE)	tonne	7,457.90	USD 12.77	USD 95,237.38	
5.31		Transport of high contaminated soil to facility in Europe / contruct storage annex soil cleaning facility and transport to this facility	tonne	7,457.90	USD 239.35	USD 1,785,048.37	
5.32		Destruction/treatment of higly contaminated soil in Europe or in storage annnex soil cleaning facility	tonne	7,457.90	USD 500.00	USD 3,728,950.00	
5.33		Additional costs for destruction of hazardous packaging materials (2% of total weight)	tonne	149.16	USD 2,500.00	USD 372,895.00	
5.34		Permitting for hazardous waste transport	pc	1.00	USD 50,000.00	USD 50,000.00	
5.40		Soil investigation wider area	pc	1.00	USD 20,000.00	USD 20,000.00	
		Total Step 5					**USD 6,167,134.37**
6.0		**STEP 6: FINAL CLOSURE OF LANDFILL - RECONFIGURING THE AREA**					
		Location: Whole landfill					
6.09		Transfer low contaminated soil from wider area to landfill	tonne	3,400.00	USD 4.29	USD 14,583.33	
6.10		Excavation of drainage layer and reapplication on landfill	tonne	1,275.00	USD 4.29	USD 5,468.75	
6.11		Unloading of rubberoid and re-application on landfill	m2	5,000.00	USD 0.47	USD 2,350.00	
6.12		Excavation of topcover from depot and re-application on landfill	tonne	8,500.00	USD 2.63	USD 22,351.66	
6.13		Profiling of topcover	m2	5,000.00	USD 0.39	USD 1,962.50	
6.14		Planting of topcover with erosion resistant bushes	m^2	5,000.00	USD 1.50	USD 7,500.00	
6.15		Installation site drainage including phytoremediation pond and erosion control measures catchment area	pc	1.00	USD 249,500.00	USD 249,500.00	
6.16		Clearance of storage areas including disposal of concrete	m^2	200.00	USD 15.40	USD 3,080.00	
6.40		Site clean-up	pc	1.00	USD 5,000.00	USD 5,000.00	
		Total Step 6					**USD 311,796.25**
7.00		**STEP 7: RUNNING COSTS**					
		Location: Whole dumpsite					
7.10		Installation of monitoring well for monitoring	pc	2.00	USD 6,000.00	USD 12,000.00	
7.11		Site monitoring	5yr	4.00	USD 10,000.00	USD 40,000.00	
7.20		Guarding	yr	5.00	USD 28,815.00	USD 144,075.00	
7.30		Maintenance of vegetation	yr	20.00	USD 3,000.00	USD 60,000.00	
7.40		Water costs	yr	20.00	USD 500.00	USD 10,000.00	
		Total running costs					**USD 266,075.00**
		TOTAL COSTS WORKS				**$**	**944,572.43**
		TOTAL COSTS TRANSPORT AND DESTRUCTION				**$**	**7,737,625.25**
		TOTAL COSTS LONG TERM				**$**	**266,075.00**
		TOTAL COSTS					**USD 8,948,272.68**
		Insurance	%	5.00	USD 447,413.63	USD 447,413.63	USD 447,413.63
		Uncontemplated	%	10.00	USD 939,568.63	USD 939,568.63	USD 939,568.63
		TOTAL COSTS					**USD 10,335,254.94**
		TOTAL COSTS + 20%					**USD 12,402,305.93**
		TOTAL COSTS - 20%					**USD 8,268,203.95**

Appendix

3

Preliminary design scenario 3

Date adjusted 4-dec-13
Projectnumber: 1210169

Prelimairy design

Scenario 3 - Immediate Clean up

Site	Nubarashen
Location	Nubarashen, Armenia
Site number	01
Client	OSCE

Author(s):	Guido van de Coterlet
Projectmanager:	Boudewijn Fokke
Reference:	K001-1210169GMC
Date drafted:	25-sep-13
Number of pages:	4 (excl front page)

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Tauw BV Soil Consultants and Engineers			
Project:	**Scenario 3 - Immediate Clean up**	Project nr.:	1210169
Location :	**Nubarashen, Armenia**	Reference:	K001-1210169GMC
Client:	**OSCE**	Drafted by:	Guido van de Coterlet
Name of site:	**Nubarashen**	Date:	4-dec-13
Site number	**01**	Second reader	Boudewijn Fokke
GENERAL			
Project parameters			
Date of prices			
Last adjustment	4-dec-13		
	Subject		

Scenario 3 - Immediate Clean up

Base documents

- Phase 1 and 2 site investigation report Site Assessment and Feasibility Study of the Unabashed Burial Site of Obsolete and Banned Pesticides in Unabashed, Armenia (Tauw report, R003-1210169BFF-los-V02, did. 22nd September 2013)
- Inception report Site Assessment and Feasibility Study of the Unabashed Burial Site of Obsolete and Banned Pesticides in Unabashed, Armenia (Tauw report, R002-1210169BFF-los-V04, did. April 15th 2013)
- HAS plan Site Assessment and Feasibility Study of the Persistent Organic Pollutants (POP) and Obsolete Pesticides (OP) Burial Site in Unabashed, Armenia (Tauw report R001-1210169BFF-beb-V03-NL, 25th February 2013)
- BIDDING DOCUMENTS FOR SITE ASSESSMENT AND FEASIBILITY STUDY OF THE PERSISTENT ORGANIC POLLUTANTS (POP) AND OBSOLETE PESTICIDES (OP) BURIAL SITE IN UNABASHED, ARMENIA (OSCO, RFP NO. ARM/01/2012, June 2012)

Disclaimer

This document serves as a insight in the works presented in the redesign of the second scenario for the Unabashed landfill site in Armenia. This document should be seen in light of required accuracy for this stage of the process and is by no means a full bid book.

Assumptions

- One m^3 soil weighs 1.7 tonnes
- One m^3 of in-situ soil equals 1.2 m^3 of excavated soil
- One m^3 building waste weighs 2.3 tonnes (Crushed)
- One m^3 pure pesticides weighs 1.0 tonnes
- Clean soil contains < 0.7 mg/kg DDT and no other pesticides in any concentration that cause latent risks
- Low contaminated soil contains 0.7 - 1,500 mg/kg d.m. DDT (or equivalent concentrations of other pesticides)
- High contaminated soil contains > 1,500 mg/kg d.m. of DDT (or equivalent concentrations of other pesticides)
- Pure pesticides are layers that contain > 30% (volume) of pure pesticides
- The total quantity of low contaminated soil at the landfill site is 7277 m3
- The total quantity of high contaminated soil at the landfill site is 4,196 m3
- The total quantity of pure pesticides at the landfill site is 605 m^3
- The total quantity of contaminated construction material is 16,2 m^3
- Size of fenced landfill is 0,8 hectares
- Size of the hillock is 0,2 hectares
- Average height of the hillock is 1.25 m above surrounding area
- Working season is May - October
- Temporary roads will have a surface layer of granulated rocks for stabilization
- New guardhouse will be build outside the fenced area of the landfill and working area - one floor brick building with two rooms and corrugated roof. Total size 30 m^1
- Pesticides and high contaminated soil will be stored in 200 l plastic drums or big bags
- Plastic drums and big bags will be destructed together with pesticides and high contaminated soil


Improve access road
(600 m)
BB 0.01-0.04
Misc. work erosion
control
BB 0.5
Repair water main
BB 0.3
Installation of culvert
(20 m)
BB 0.20
Upgrade embankment
prevention of erosion and
water inflow to valley.
BB 0.4
100 m
200 ft
Contributed
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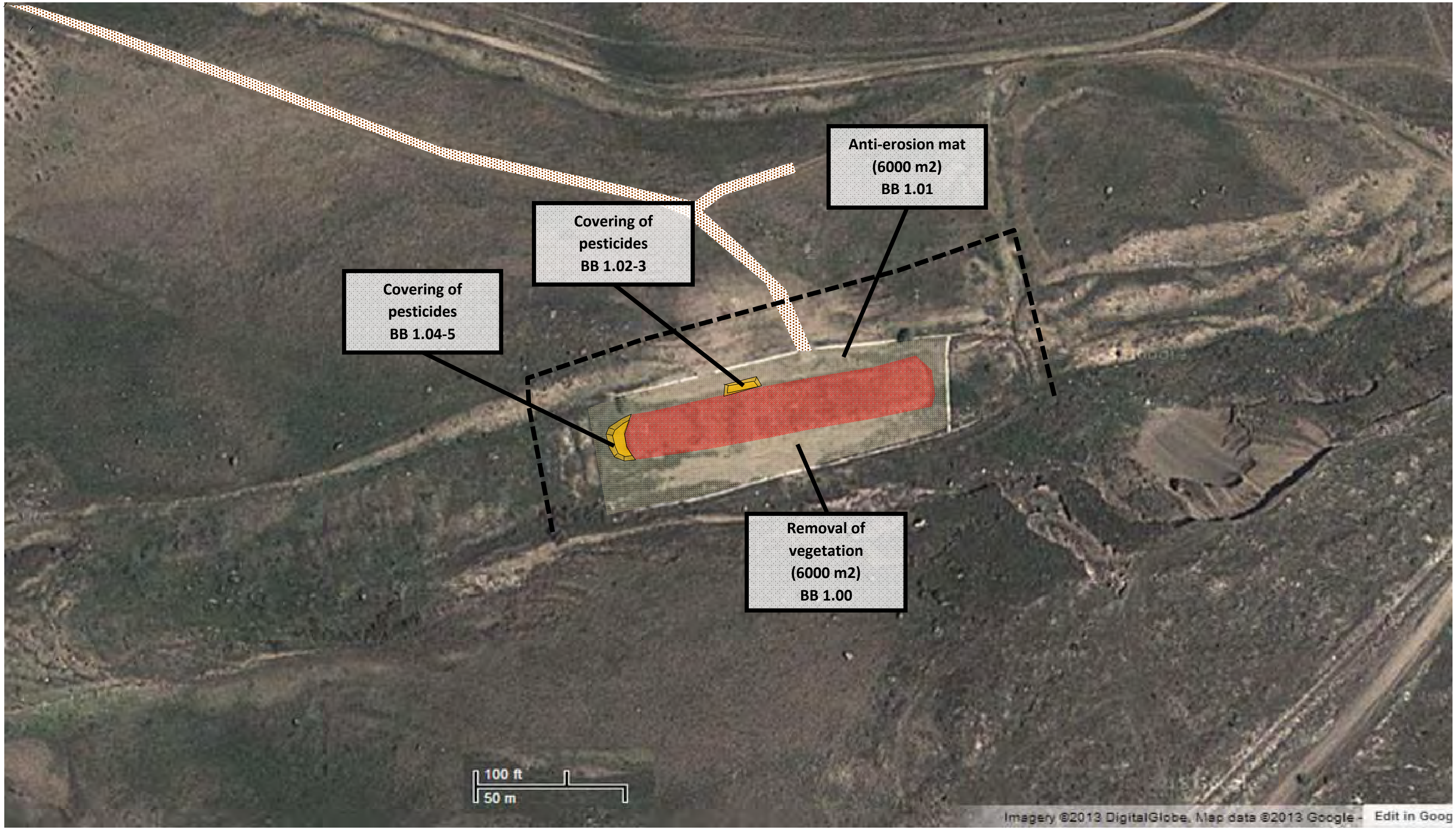
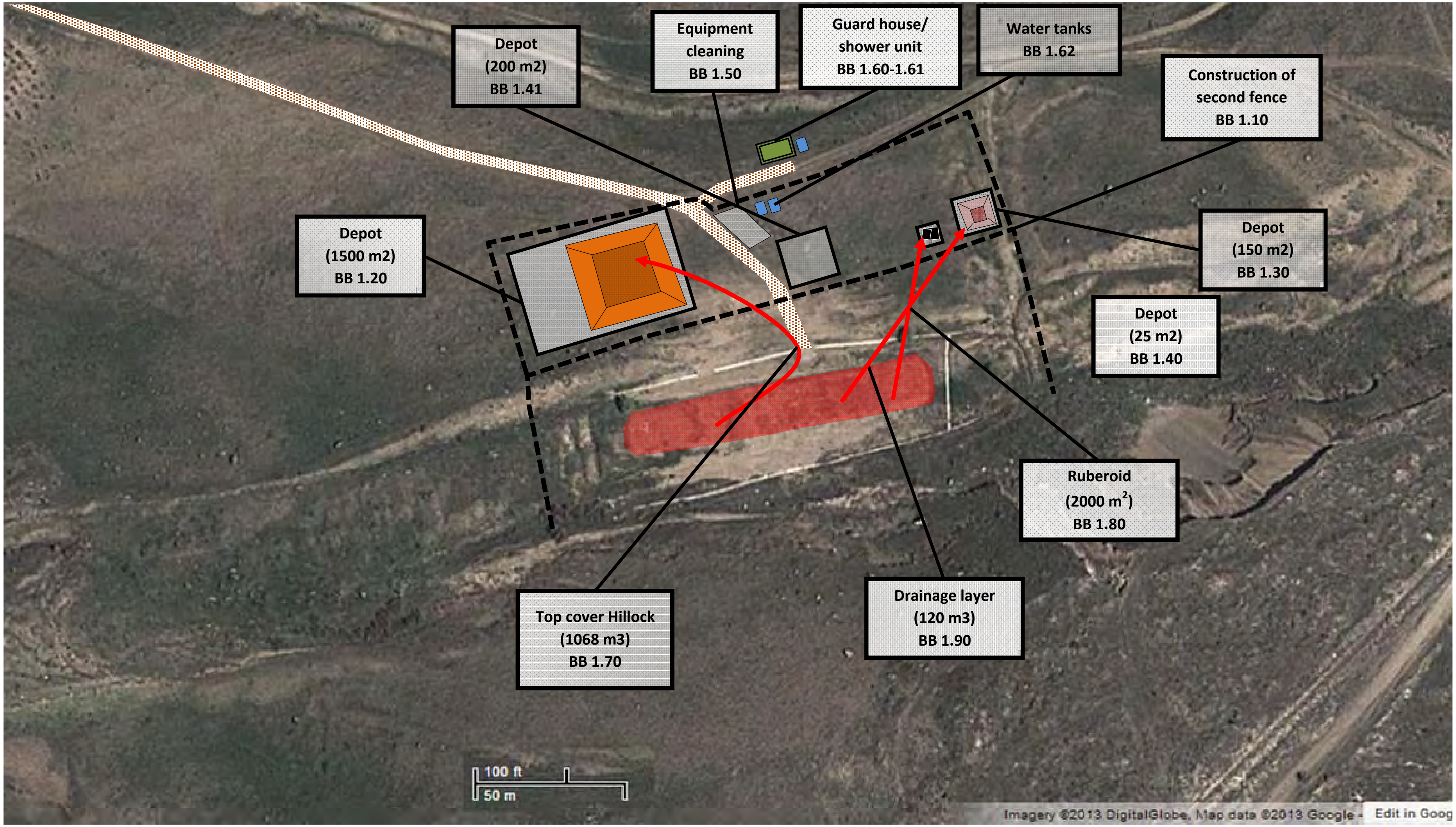
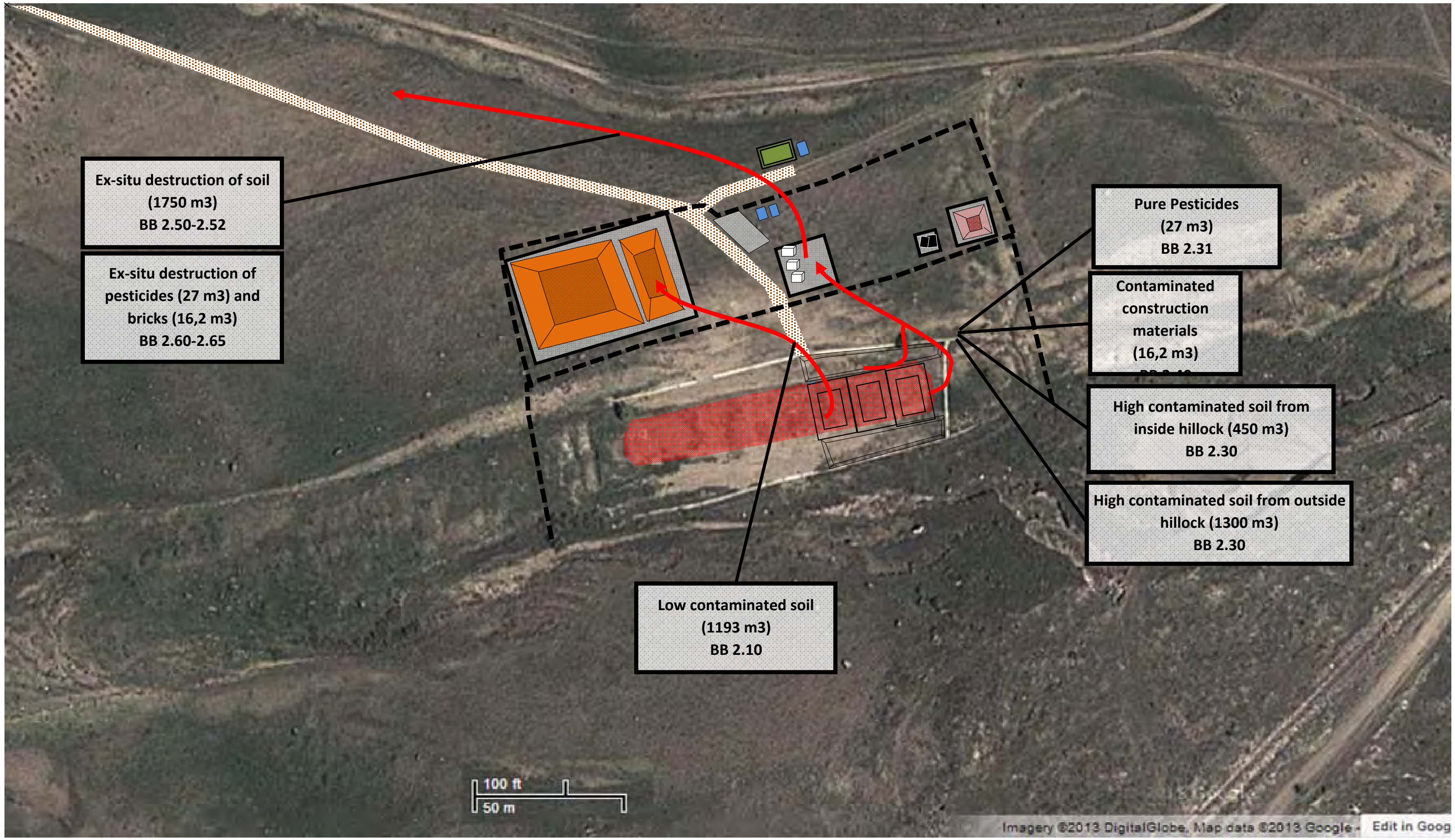
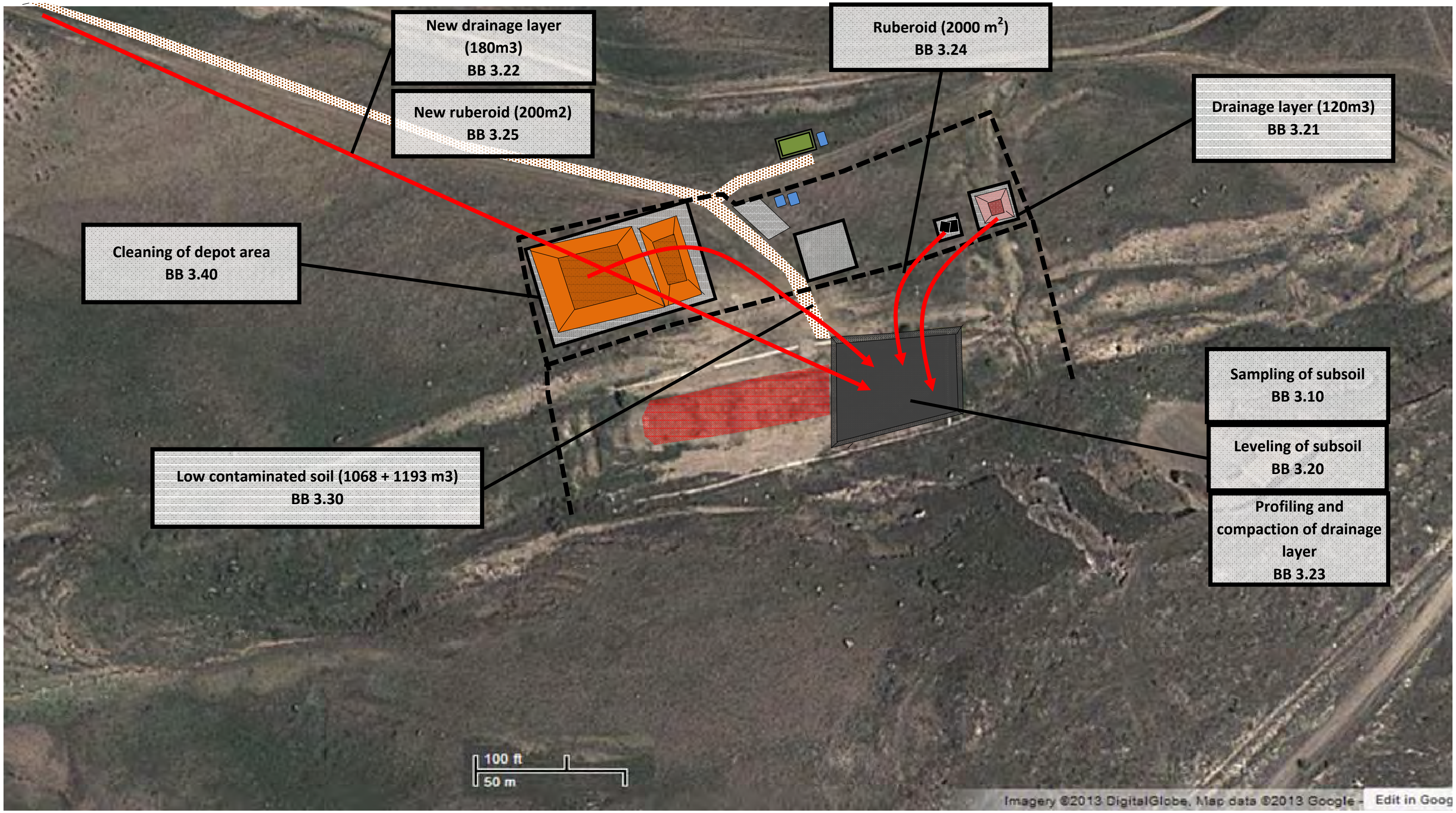
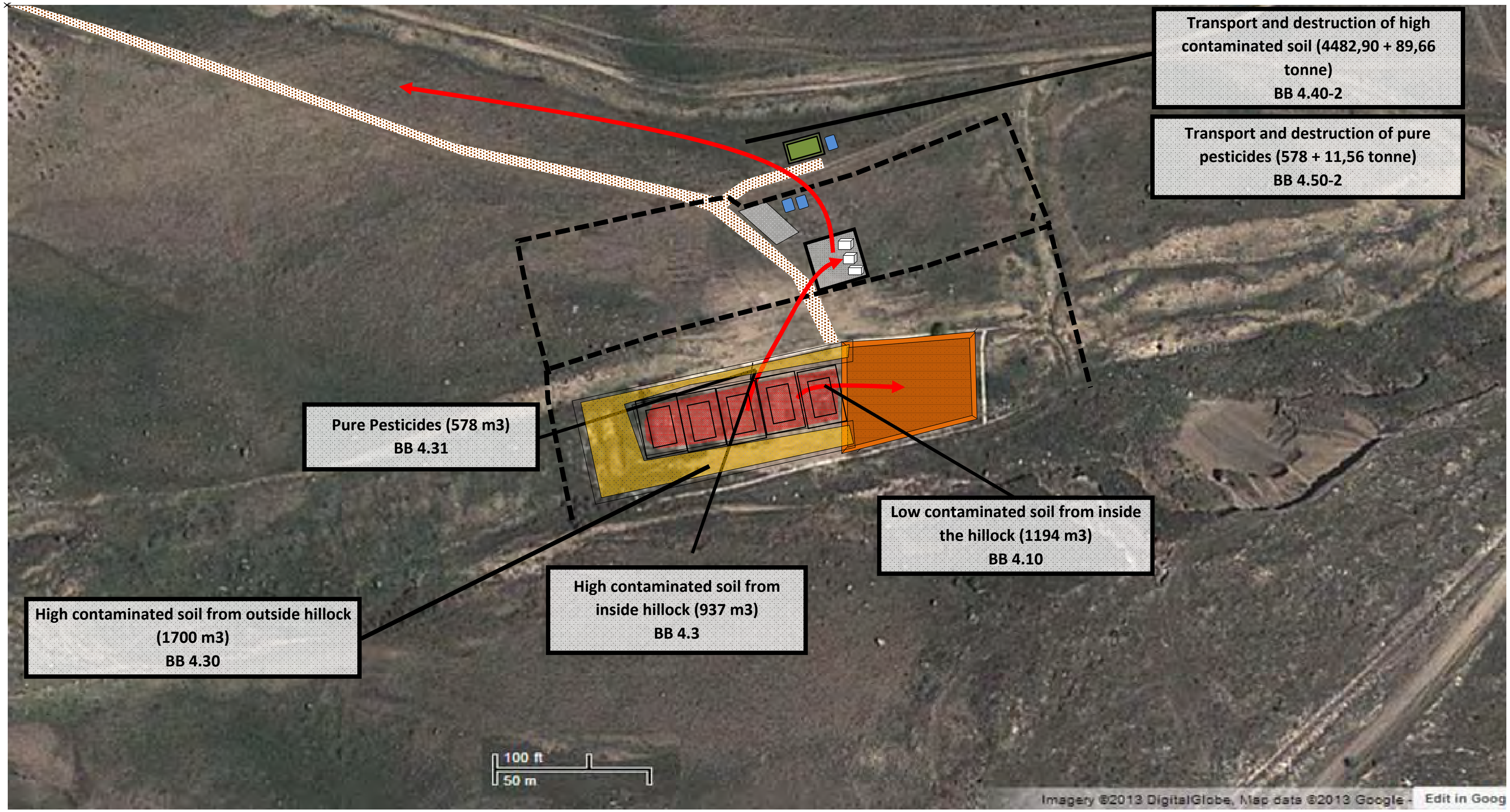
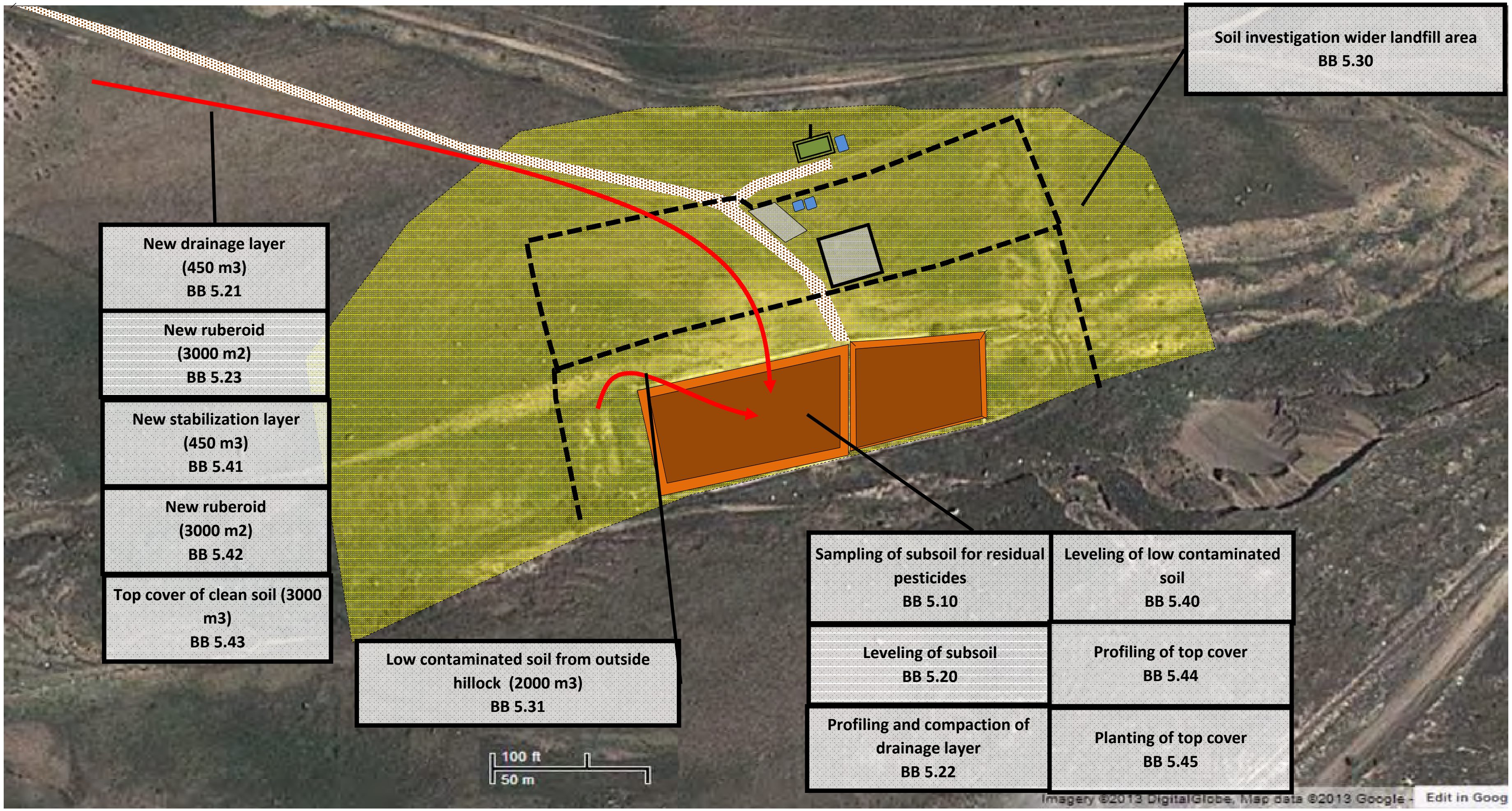

Anti-erosion mat
(6000 m2)
BB 1.01
Covering of
pesticides
BB 1.02-3
Covering of
pesticides
BB 1.04-5
Removal of
vegetation
(6000 m2)
BB 1.00
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google -
Edit in Goog


Depot
(200 m2)
BB 1.41
Equipment
cleaning
BB 1.50
Guard house/
shower unit
BB 1.60-1.61
Water tanks
BB 1.62
Construction of
second fence
BB 1.10
Depot
(1500 m2)
BB 1.20
Depot
(150 m2)
BB 1.30
Depot
(25 m2)
BB 1.40
Ruberoid
(2000 m²)
BB 1.80
Top cover Hillock
(1068 m3)
BB 1.70
Drainage layer
(120 m3)
BB 1.90
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google
Edit in Goog

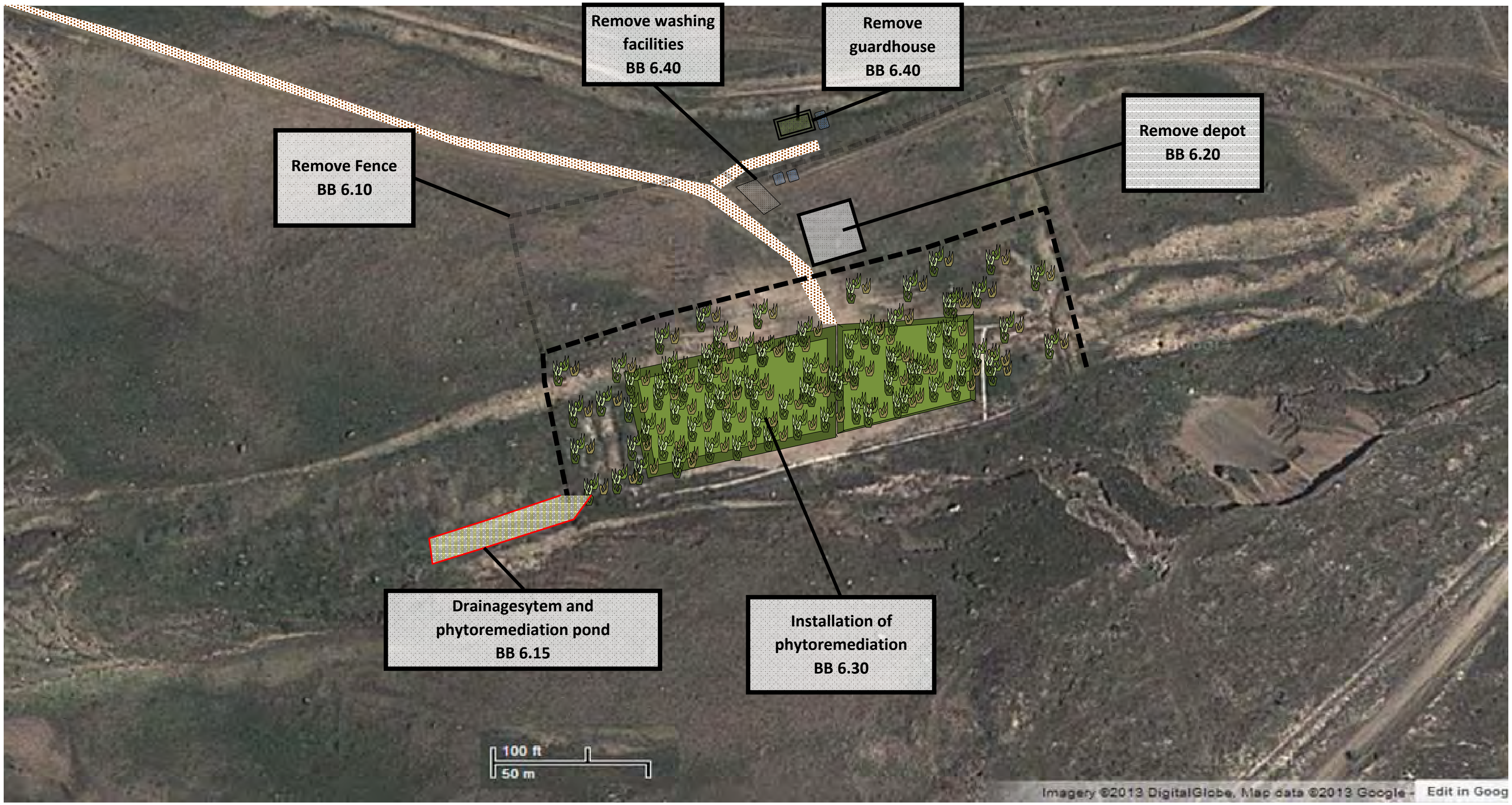

Ex-situ destruction of soil
(1750 m3)
BB 2.50-2.52
Ex-situ destruction of pesticides (27 m3) and bricks (16,2 m3)
BB 2.60-2.65
Pure Pesticides
(27 m3)
BB 2.31
Contaminated construction materials
(16,2 m3)
High contaminated soil from inside hillock (450 m3)
BB 2.30
High contaminated soil from outside hillock (1300 m3)
BB 2.30
Low contaminated soil
(1193 m3)
BB 2.10
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google -
Edit in Goog


New drainage layer
(180m3)
BB 3.22
New ruberoid (200m2)
BB 3.25
Ruberoid (2000 m2)
BB 3.24
Drainage layer (120m3)
BB 3.21
Cleaning of depot area
BB 3.40
Sampling of subsoil
BB 3.10
Leveling of subsoil
BB 3.20
Profiling and compaction of drainage layer
BB 3.23
Low contaminated soil (1068 + 1193 m3)
BB 3.30
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google -
Edit in Goog


Transport and destruction of high contaminated soil (4482,90 + 89,66 tonne)
BB 4.40-2
Transport and destruction of pure pesticides (578 + 11,56 tonne)
BB 4.50-2
Pure Pesticides (578 m3)
BB 4.31
Low contaminated soil from inside the hillock (1194 m3)
BB 4.10
High contaminated soil from inside hillock (937 m3)
BB 4.3
High contaminated soil from outside hillock (1700 m3)
BB 4.30
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google - Edit in Goog



Soil investigation wider landfill area
BB 5.30
New drainage layer
(450 m3)
BB 5.21
New ruberoid
(3000 m2)
BB 5.23
New stabilization layer
(450 m3)
BB 5.41
New ruberoid
(3000 m2)
BB 5.42
Top cover of clean soil (3000 m3)
BB 5.43
Low contaminated soil from outside hillock (2000 m3)
BB 5.31
Sampling of subsoil for residual pesticides
BB 5.10
Leveling of low contaminated soil
BB 5.40
Leveling of subsoil
BB 5.20
Profiling of top cover
BB 5.44
Profiling and compaction of drainage layer
BB 5.22
Planting of top cover
BB 5.45
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google
Edit in Goog


Remove washing facilities BB 6.40
Remove guardhouse BB 6.40
Remove depot BB 6.20
Remove Fence BB 6.10
Drainagesytem and phytoremediation pond BB 6.15
Installation of phytoremediation BB 6.30
100 ft
50 m
Imagery ©2013 DigitalGlobe, Map data ©2013 Google - Edit in Goog

Tauw BV Soil Consultants and Engi

Project:	**Scenario 3 - Immediate Clean up**	Project nr.:	1210169
Location :	**Nubarashen, Armenia**	Reference:	K001-1210169GMC
Client:	**OSCE**	Drafted by:	Guido van de Coterlet
Name of site:	**Nubarashen**	Date:	4-12-2013
Site number	**01**	Second reader	Boudewijn Fokke

GENERAL

Project parameters

BASE MAP CODE:

Last update: 4-dec-13

Post	PP-Code	WORKS	UNIT	QUANTITY	C.P.U.	SUBTOTAL	TOTAL
		SHORT TERM - ACUTE RISKS					
0.0		**STEP 0: PROJRCT PREPARATION, COVERING OF PESTICIDES AND HIGH CONTAMINATED SOIL**					
		Location: Landfill site and uphill area					
0.01		Improve access road from guard house till dump site - resurfacing	m	600.00	USD 3.33	USD 2,000.00	
0.02		Improve access road - stabilization mat (3,5 m wide)	m	600.00	USD 11.39	USD 6,835.00	
0.03		Improve access road - gravel (15 cm - 3,5 m wide)	m^3	315.00	USD 39.05	USD 12,300.00	
0.04		Improve access road - leveling and finalization	m	600.00	USD 1.63	USD 975.00	
0.20		Installation of culvert (20 m - 525 mm diameter) including labor and transport to site	pc	1.00	USD 3,190.00	USD 3,190.00	
0.30		Repair water main	pc	1.00	USD 2,425.00	USD 2,425.00	
0.40		Excavation of trench (200 m x 0,3 x 0,9)	m^3	54.00	USD 9.17	USD 495.00	
0.41		Installation of concrete piles (200 x 0,3 x 1,0 m)	m	200.00	USD 32.13	USD 6,425.00	
0.5		Misc. works for rerouting surface run-off (to be decided at a later stage)	pc	1.00	USD 34,750.00	USD 34,750.00	
		Total preparation					**USD 69,395.00**
1.0		**COVERING OF PESTICIDES AND HIGH CONTAMINATED SOIL**					
		Location: Hillock					
1.00		Removal of vegetation	m^2	6,000.00	USD 0.10	USD 570.00	
1.01		Anti erosion mat (jute)	m^2	6,000.00	USD 0.42	USD 2,515.00	
1.02		New ruberoid (2mm) transport to site and application on Northern part of landfill	m^2	50.00	USD 9.70	USD 485.00	
1.03		New top cover (1 m) for Northern part of landfill 50 m^2	m^3	50.00	USD 30.00	USD 1,500.00	
1.04		New ruberoid (2mm) transport to site and application on Western part of landfill	m^2	100.00	USD 7.58	USD 757.50	
1.05		New top cover for Western part of landfill (1 m) for 100 m^2	m^3	100.00	USD 25.00	USD 2,500.00	
		Total step 0					**USD 8,327.50**
1.0		**STEP 1: EXCAVATION OF TOP COVER**					
		Location: Hillock					
1.10		Installation of second fence (2 m high hexagonal wire mesh)	m	300.00	USD 8.00	USD 2,400.00	
1.20		Depot area (leveling, removal of shrubs and drainage layer below plastic liner)	m^2	1,500.00	USD 3.33	USD 5,000.00	
1.30		Depot area (leveling, removal of shrubs and drainage layer below plastic liner)	m^2	150.00	USD 3.75	USD 562.50	
1.40		Depot area (leveling, removal of shrubs and drainage layer below plastic liner)	m^2	25.00	USD 5.21	USD 130.21	
1.41		Depot area (leveling, removal of shrubs and drainage layer concrete slabs)	m^2	200.00	USD 3.55	USD 710.00	
1.50		Equipment washing facility (removal of shrubs, leveling, stabilization layer, concrete slabs)	m^3	50.00	USD 50.00	USD 2,500.00	
1.60		Guard house (mobile construction, 30 m^2)	pc	1.00	USD 5,220.00	USD 5,220.00	
1.61		Shower and changing unit	pc	1.00	USD 5,220.00	USD 5,220.00	
1.62		Water tanks (500 Liters)	pc	3.00	USD 136.67	USD 410.00	
1.70		Excavation of top cover and placement in depot	tonne	1,815.60	USD 2.25	USD 4,080.00	
1.80		Removal of ruberoid and placement in depot	m^2	2,000.00	USD 0.40	USD 790.00	
1.90		Excavation of drainage layer and placement in depot	tonne	204.00	USD 4.85	USD 990.00	
		Total step 1					**USD 28,012.71**

Tauw BV Soil Consultants and Engi

Project:	**Scenario 3 - Immediate Clean up**	Project nr.:	1210169
Location :	**Nubarashen, Armenia**	Reference:	K001-1210169GMC
Client:	**OSCE**	Drafted by:	Guido van de Coterlet
Name of site:	**Nubarashen**	Date:	4-12-2013
Site number	**01**	Second reader	Boudewijn Fokke

GENERAL

Project parameters

BASE MAP CODE:

Last update: 4-dec-13

Post	PP-Code	WORKS	UNIT	QUANTITY	C.P.U.	SUBTOTAL	TOTAL
2.0		**STEP 2a: EXCAVATION EASTERN PART OF HILLOCK**					
		Location: Hillock Eastern part					
2.10		Excavation of low contaminated soil and placement in depot	tonne	2,028.10	USD 2.89	USD 5,860.00	
2.20		HDPE drums for storage of wet pesticides from cell 1 (200 L)	pc	135.00	USD 30.00	USD 4,050.00	
2.21		Big bags for pesticides and high contaminated soil (1 m^3)	pc	1,750.00	USD 20.00	USD 35,000.00	
2.22		Drum filling equipment	pc	3.00	USD 500.00	USD 1,500.00	
2.30		Excavation of high contaminated soil and transfer to bags (including labor, cranes and PPE)	tonne	2,975.00	USD 12.77	USD 37,980.00	
2.31		Excavation of pure pesticides from wet cell 1 and transfer to barrels (including labor, cranes and PPE)	tonne	45.90	USD 65.36	USD 3,000.00	
2.40		Demolition of underground structure, loading of materials into big bags and shipment to temporary storage	m^3	16.20	USD 33.95	USD 550.00	
		STEP 2b: DESTRUCTION OF HIGH CONTAMINATED SOIL AND PURE PESTICIDES IN EX-SITU FACILITY					
		Location: Hillock Eastern part					
2.50		Transport of high contaminated soil to facility in Europe / contruct storage annex soil cleaning facility and transport to this facility	tonne	2,975.00	USD 239.35	USD 712,055.00	
2.51		Additional costs for hazardous materials (2% of total weight)	tonne	59.50	USD 239.35	USD 14,241.10	
2.52		Destruction/treatment of higly contaminated soil in Europe or in storage annnex soil cleaning facility	tonne	2,975.00	USD 500.00	USD 1,487,500.00	
2.53		Destruction of hazardous packaging material	tonne	59.50	USD 2,500.00	USD 148,750.00	
2.60		Transport of pure pesticides to facility in Europe	tonne	45.90	USD 239.35	USD 10,985.99	
2.61		Additional costs for hazardous packaging materials (2% of total weight)	tonne	0.92	USD 239.35	USD 219.72	
2.62		Destruction of pure pesticides	tonne	46.82	USD 2,500.00	USD 117,045.00	
2.63		Decontamination and transport of decontaminated building materials to landfill	tonne	37.26	USD 50.00	USD 1,863.00	
2.64		Additional costs for hazardous of waste from rubbble	tonne	0.75	USD 2,500.00	USD 1,863.00	
2.65		Landfilling decontaminated building material	tonne	38.01	USD 20.00	USD 760.10	
2.70		Permitting for hazardous waste transport	pc	1.00	USD 50,000.00	USD 50,000.00	
		Total Step 2					**USD 2,633,222.92**
3.0		**STEP 3: REDISTRIBUTION OF LOW CONTAMINATED TOP COVER TO EASTERN PART OF HILLOCK**					
		Location: Hillock Eastern part					
3.10		Sampling of subsoil for residual pesticides	pc	1.00	USD 4,000.00	USD 4,000.00	
3.20		Leveling of subsoil of Eastern part of landfill site	m^2	2,000.00	USD 0.85	USD 1,700.00	
3.21		Excavation of drainage layer from depot and distribution at Eastern part of landfill	tonne	204.00	USD 4.29	USD 875.00	
3.22		New drainage layer sand, including transport to site and distribution at Eastern part of landfill	tonne	306.00	USD 19.35	USD 5,920.00	
3.23		Profiling and compaction of drainage layer	m^2	2,000.00	USD 0.39	USD 780.00	
3.24		Unloading of ruberoid and re-application on Eastern part of landfill	m^2	2,000.00	USD 0.47	USD 940.00	
3.25		New ruberoid (2mm) transport to site and application on Eastern part of landfill	m^2	200.00	USD 7.48	USD 1,495.00	
3.30		Excavation of low contaminated soil from depot and distribution at Eastern part of landfill	tonne	3,843.70	USD 2.73	USD 10,500.00	
3.40		Cleaning of depot area, removal and disposal of HDPE liner	m^2	1,675.00	USD 0.60	USD 1,000.00	
		Total Step 3					**USD 27,210.00**

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Project:	**Scenario 3 - Immediate Clean up**	Project nr.:	1210169
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Client:	**OSCE**	Drafted by:	Guido van de Coterlet
Name of site:	**Nubarashen**	Date:	4-12-2013
Site number	**01**	Second reader	Boudewijn Fokke

GENERAL

Project parameters

BASE MAP CODE:

Last update: 4-dec-13

Post	PP-Code	WORKS	UNIT	QUANTITY	C.P.U.	SUBTOTAL	TOTAL
4.0		**STEP 4a: EXCAVATION OF WESTERN PART OF HILLOCK**					
		Location: Hillock Western part					
4.10		Excavation of low contaminated soil and placement in Eastern part of landfill area	tonne	2,029.80	USD 2.89	USD 5,864.91	
4.20		Big bags for storage of high contaminated soil and (dry) pure pesticides and soil (1 m^3)	pc	2,637.00	USD 20.00	USD 52,740.00	
4.30		Excavation of high contaminated soil, transfer to big bags and transport to depot on-situ for onward transport (including labor, cranes and PPE)	tonne	4,482.90	USD 12.77	USD 57,230.43	
4.31		Excavation of pure pesticides, transfer to big bags and transport to depot on site for onward transport (including labor, cranes and PPE)	tonne	578.00	USD 12.77	USD 7,378.97	
		STEP 4b: TRANSPORT AND DESTRUCTION OF PESTICIDES AND HIGH CONTAMINATED SOIL					
		Location: Hillock Western part					
4.40		Transport of high contaminated soil to facility in Europe / contruct storage annex soil cleaning facility and transport to this facility	tonne	4,482.90	USD 239.35	USD 1,072,965.16	
4.41		Additional costs for hazardous materials (2% of total weight)	tonne	89.66	USD 239.35	USD 21,459.30	
4.42		Destruction/treatment of higly contaminated soil in Europe or in storage annnex soil cleaning facility	tonne	4,482.90	USD 500.00	USD 2,241,450.00	
4.43		Destruction of hazardous packaging material	tonne	89.66	USD 2,500.00	USD 224,145.00	
4.50		Transport of pure pesticides to facility in Europe	tonne	578.00	USD 239.35	USD 138,342.11	
4.51		Additional costs for hazardous packaging materials (2% of total weight)	tonne	11.56	USD 239.35	USD 2,766.84	
4.52		Destruction of pure pesticides	tonne	589.56	USD 2,500.00	USD 1,473,900.00	
4.53		Additional costs for hazardous packaging materials (2% of total weight)	tonne	11.79	USD 2,500.00	USD 29,478.00	
4.60		Permitting for hazardous waste transport	pc	1.00	USD 30,000.00	USD 30,000.00	
		Total Step 4					**USD 5,357,720.74**
5.0		**STEP 5: RELOCATION OF LOW CONTAMINATED SOIL INTO FORMER HILLOCK**					
		Location: Whole landfill					
5.10		Sampling of subsoil for residual pesticides	pc	1.00	USD 4,000.00	USD 4,000.00	
5.20		Leveling of subsoil of Western part of landfill site	m^2	3,000.00	USD 0.85	USD 2,550.00	
5.21		New drainage layer sand, including transport to site and distribution at Western part of landfill	tonne	765.00	USD 13.43	USD 10,275.00	
5.22		Profiling and compaction of drainage layer	m^2	3,000.00	USD 0.39	USD 1,170.00	
5.23		New ruberoid (2mm) transport to site and application on Eastern part of landfill	m^2	3,000.00	USD 7.48	USD 22,425.00	
5.30		Soil investigation of wider landfill area	pc	1.00	USD 20,000.00	USD 20,000.00	
5.31		Excavation of low contaminated soil from outside former hillock and relocate in new landfill area	tonne	3,400.00	USD 2.89	USD 9,823.97	
5.40		Leveling of Western part of landfill with low contaminated soil	m^2	2,000.00	USD 0.85	USD 1,700.00	
5.41		New stabilization layer sand, including transport to site and distribution at Western part of landfill	tonne	765.00	USD 13.43	USD 10,275.00	
5.42		New ruberoid layer	m^2	3,000.00	USD 7.48	USD 22,425.00	
5.43		Top cover of clean soil (1 m) including transport to site	tonne	5,100.00	USD 12.24	USD 62,400.00	
5.44		Profiling of top cover	m^2	3,000.00	USD 0.39	USD 1,170.00	
5.45		Planting of top cover with erosion resistant bushes and shrubs	m^2	3,000.00	USD 2.32	USD 6,950.00	
		Total Step 5					**USD 175,163.97**

Tauw BV Soil Consultants and Engi

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Name of site:	**Nubarashen**	Date:	4-12-2013
Site number	**01**	Second reader	Boudewijn Fokke

GENERAL

Project parameters

BASE MAP CODE:

Last update: 4-dec-13

Post	PP-Code	WORKS	UNIT	QUANTITY	C.P.U.	SUBTOTAL	TOTAL
6.0		**STEP 6: REMOVAL OF LAST DEPOTS AND OUTER FENCE AND INSTALLATION OF PLANT COVER**					
		Location: Whole landfill					
6.10		Installation site drainage including phytoremediation pond and erosion control measures catchment area	pc	1.00	USD 249,500.00	USD 249,500.00	
6.20		Clearance of storage areas including disposal of concrete	m^2	200.00	USD 12.68	USD 2,535.00	
6.30		Planting of top cover with erosion resistant bushes and shrubs of eastern part of landfill	m^2	2,000.00	USD 2.32	USD 4,633.33	
6.40		Site clean-up	pc	1.00	USD 5,000.00	USD 5,000.00	
		Total Step 7					**USD 261,668.33**
7.0		**RUNNING COSTS**					
		Location: Whole dumpsite					
7.10		Installation of monitoring well for monitoring	pc	2.00	USD 6,000.00	USD 12,000.00	
7.11		Site monitoring	yr	5.00	USD 10,000.00	USD 50,000.00	
7.20		Guarding	yr	1.00	USD 28,815.00	USD 28,815.00	
7.40		Maintenance of vegetation	yr	20.00	USD 3,000.00	USD 60,000.00	
7.50		Water costs	yr	20.00	USD 500.00	USD 10,000.00	
		Total running costs					**USD 160,815.00**
		TOTAL COSTS WORKS				**$**	**780,931.83**
		TOTAL COSTS TRANSPORT AND DESTRUCTION				**$**	**7,779,789.34**
		TOTAL COSTS LONG TERM				**$**	**160,815.00**
		TOTAL COSTS					**USD 8,721,536.17**
		Insurance	%	5.00	USD 436,076.81	USD 436,076.81	USD 436,076.81
		Uncontemplated	%	10.00	USD 915,761.30	USD 915,761.30	USD 915,761.30
		TOTAL COSTS					**USD 10,073,374.28**
		TOTAL COSTS + 20%					**USD 12,088,049.13**
		TOTAL COSTS - 20%					**USD 8,058,699.42**

Appendix

4

Engineering Requirements Intermediate Collection Centre repacked POPs and obsolete pesticides

Engineering Requirements Intermediate Collection Centre for repacked POPs and obsolete pesticides

Site Assessment and Feasibility Study, Nubarashen POP and OPs burial site, ARM/01/2013

8 October 2013

Responsibility

Title	Engineering Requirements Intermediate Collection Centre for repacked POPs and obsolete pesticides
Client	Organisation for Security and Cooperation in Europe (OSCE)
Project Leader	Boudewijn Fokke
Author(s)	Boudewijn Fokke
Project number	1210169
Number of pages	14 (excluding appendices)
Date	8 October 2013
Signature	Is missing due to digital processing. This report is demonstrably released.

Colophon

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Contents

1 Introduction

1.1 Cause of objectives

The Organisation for Security and Cooperation in Europe (OSCE) has commenced implementation of the Project entitled 'Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen, Armenia' (Contract number ARM/01/2013).
In the framework of this project Tauw recommend to repack pure pesticides and heavily contaminated soil in adequate and approved UN repackaging and store these repacked POPs OPs pesticides in a proper storage facility awaiting final destruction. This proper storage could also be used in the upcoming UNDP POPs pesticides project. The repacked POPs pesticides will finally be destructed in an approved installation. The POPs and OPs pesticides should be stored safely waiting for shipment to this approved installation. Therefore this report gives an outline of this specific set of engineering requirements for the construction of an Intermediate Collection Centre (hereafter ICC) for the repacked POPs and OPs. This report is attached to the Phase 3 report of the 'Site Assessment and Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides in Nubarashen.

This report does not give the exact information for the construction of such an ICC. The company designing and building such an ICC has to visit the allocated site for the ICC, design the building, calculate the costs and report a building plan of the ICC. Based on the cost calculation and the building plan the project management can decide to build and adequately manage the operation.

1.2 Content

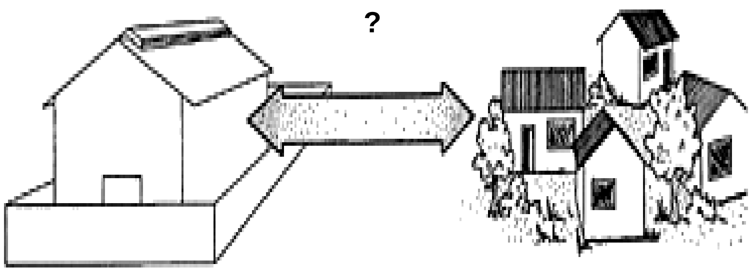
This report gives the cause and objectives of this report in chapter 1. Chapter 2 summarizes the requirement for the site where the ICC can be located. The minimal technical requirements are given in chapter 3. In the appendix 1 till 4 you will find a floor plan and some technical details concerning the standard construction.

2 Location ICC

The ICC should be located on a site:

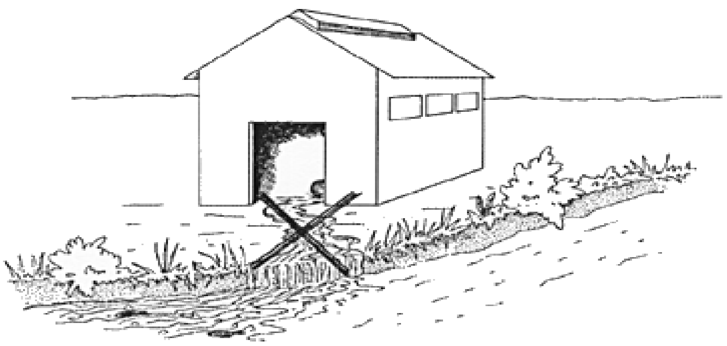
- Far from human dwellings

Each country has its own regulations and the minimal distance of the ICC should be in accordance with these regulations. The location however should preferably be on the windward side of the nearby settlement.



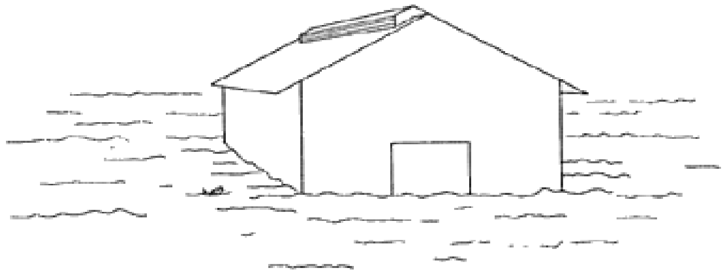
- Far from rivers, lakes, reservoirs, wells and other water bodies

To reduce the chance of polluting the surface water due to spillage in or around the ICC the ICC should be located in such a way that the water bodies are protected.



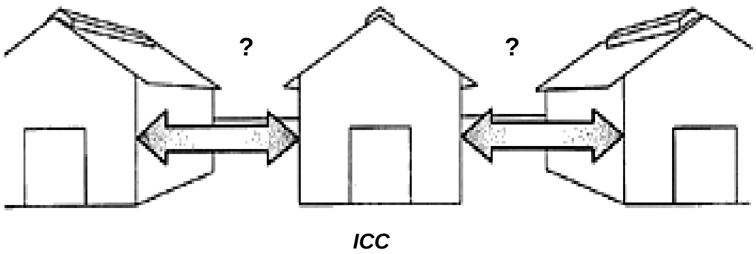
- Above floodplains and high water tables

To reduce the chance of polluting the surface and groundwater the ICC should be located above floodplains and the highest (ground) water table. The data concerning the highest levels of (ground) water table should be collected and reviewed before the final decision using a site/building to build/use as an ICC.



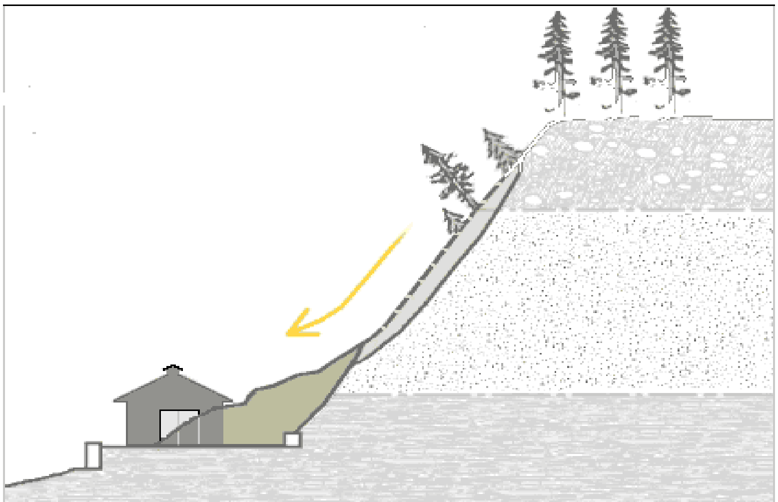
- Reasonable distance from other hazardous establishments carrying a risk of major hazard accident (explosion, fire…)

Each country has its own regulations and the minimal distance of the ICC should be in accordance with the regulations.



- Far from landslides zones

The location of the ICC should not be vulnerable for erosion. The location and its surroundings should be accessed for the erodibility. If a selected location is vulnerable and erosion control measures (planting trees, terracing and improving surface drainage) can protect the ICC, than the erosion control measures should be part of the area lay-out and building plan.



- The ICC should be accessible

The ICC should have good access for emergency services and the truck transporting the repacked POPs and OPs during the whole year. The ICC should also have easy access to the country highway network.

3 ICC and Guardhouse

3.1 Introduction

The ICC should be located on a fenced area. An off and on loading platform has to be constructed in front of the ICC. This platform is paved (e.g. reinforced concrete) and provides enough space for a forklift for off and on-loading trucks. Each ICC should have a Guardhouse for the watchman and the staff managing the ICC. The Guardhouse should be located inside the fenced area and in the direct vicinity of the ICC but always wind wards of the ICC.
The Guardhouse consists of:

- A main entrance with hall and toilet
- An office
- A decontamination unit

The ICC itself is in principle a modular construction. The modular construction allows easy extension of the ICC when more storage space is needed. The ICC can have one or more compartments by constructing left and or right of the first compartment additional compartments.

To illustrate the needed lay out of the site with the ICC and Guardhouse we present the following drawings in the appendices:

1. Site location plan with ICC, off and on-loading platform and Guardhouse
2. Floor plan Guardhouse (office, decontamination unit and toilet) with profiles (front, rear, left and right)
3. Cross-section A - A ICC and details (foundation, roof construction, ventilation)
4. Profiles ICC (front, rear and left/right)

The drawings give a minimum set of information for constructing an ICC for the repacked POPs and OPs. The drawings have not many details because the complete construction should be adapted to the local situation and the materials locally available. The construction should also comply with the local rules for construction. The intension of this document is to inform the designer about the minimum preconditions. Based on the content of this document a local contractor and/or a designer/architect can design the ICC and than make a calculation based on their design. The design presented in this report has no relevant design details for the ICC and the Guardhouse such as the:

- The type of foundation
- The sort of reinforced concrete
- The type pavement of the off and on-loading platform
- The sort of material for the rafters
- The sort of material for the (prefab)walls

- The type of isolation materials
- The layout of the electrical installation
- The layout of sanitary and the piping
- The type of lightning rods
- The type of widows and door frames
- The layout of the ventilation
- Et cetera

3.2 ICC

The ICC presented in appendix 1 has three compartments. Each compartment has a floor area of 400 square meters. This store has a total floor area of 1,200 square meters. The total floor area needed should be estimated during the POP pesticides inventory phase. The first (middle) compartment has a sump in the middle of the floor. The first, second and third compartment are sloping towards this sump. If an ICC has more than three compartments, an extra sump should be made for each three compartments.
Each compartment has an entrance door, large and high enough, to allow forklifts loaded with a pallet with repacked POPs and OPs entering the ICC. Each compartment has an emergency exit at the back. The (prefab) walls have ventilation openings a few decimeters above the floor level and they have ventilation windows a few decimeters under the roof (see appendix 3 and 4).
The ridge of each compartment has also ventilation. All ventilations have insect screens, preventing births, rodents and insects entering the ICC.

The ICC has lighting installation and each compartment has two fire extinguishers, one near the entrance door and one near each emergency door. The ICC is equipped with lightning rods preventing damage by thunderbolts.

3.3 Guardhouse

The Guardhouse should have sufficient space to realize the given elements of the layout. These elements are:

- Hall with:
  - Main entrance
  - Entrance to an office
  - Entrance to the clean part
  - Meter cupboard
  - Toilet
- Office for at least two persons
- Decontamination unit
  - Clean part with lockers
  - Separation
  - Contaminated part with cupboard for Personal Protective Equipment (PPE)

– Hand basin
– Permanent emergency shower
– Exit to ICC

The main entrance of the Guardhouse (see appendix 2) gives access to the hall and from the hall you can enter the office on the left hand side. A toilet and a separate meter cupboard where the facilities such as electricity and water needed in the Guardhouse are situated in the hall.

The office in the Guardhouse needs to give enough space for two desks, one for the watchman and one for a staff member. In the office the following documents are at hand:

1. The safety report
This report is on the Routines Measures to be taken, to avoid major accidents and incidents. This report is established by the Operator.

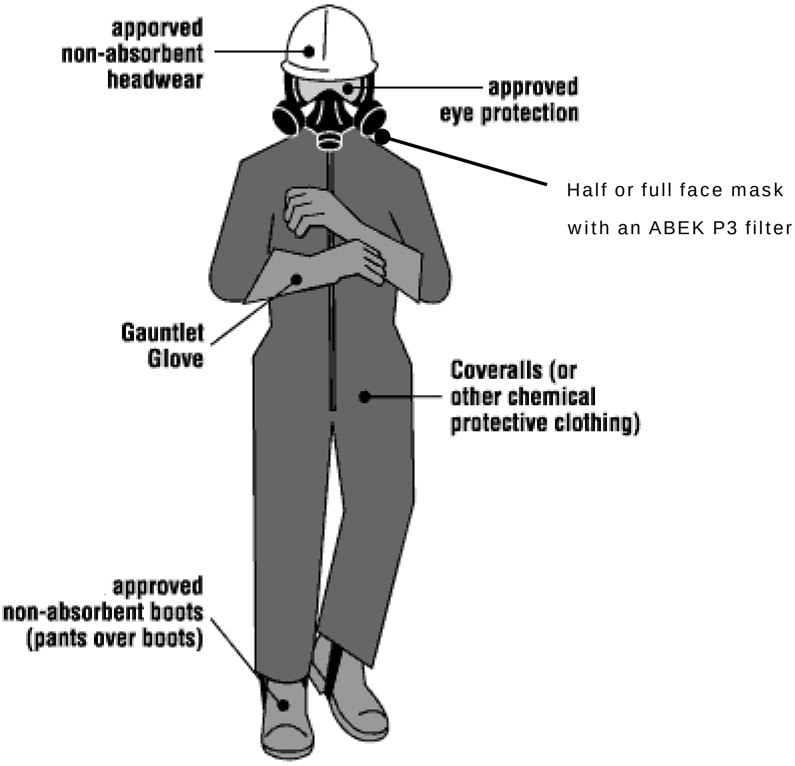
2. The internal emergency plan
This plan deals with the exceptional Measures to be taken when an accident occurs within the ICC. This plan should be written by the responsible party for the storage of the repacked OPs and POPs.

3. The external emergency plan
This plan deals with exceptional measures to be taken when an accident occurs within the ICC but spills over the ICC towards the immediate environment. This plan should be established by the authority with the assistance of the responsible party.

The main entrance gives access to the hall and from the hall you can enter the decontamination unit on the right hand side. The decontamination unit is divided into two parts:
1. The clean part
2. The contaminated part

These parts are separated by a red line painted on the floor. The purpose of dividing this unit is to avoid that the workers and staff members working in the ICC taking contaminated personal belongings to the office and back to their homes.

Personnel who want to inspect, work, off or on-load repacked OPs and POPs in the ICC should enter the clean part of the decontamination unit and change. Lockers in the clean part can be used to store their clothes and personal belongings. With a clean cover overall and clean cover shoes or boots they move towards the contaminated part and take their cleaned Personal Protective Equipment (PPE) out of a special cupboard. After they have the correct PPE and have checked if all is in correct shape they leave the decontamination unit through the exit towards the ICC.

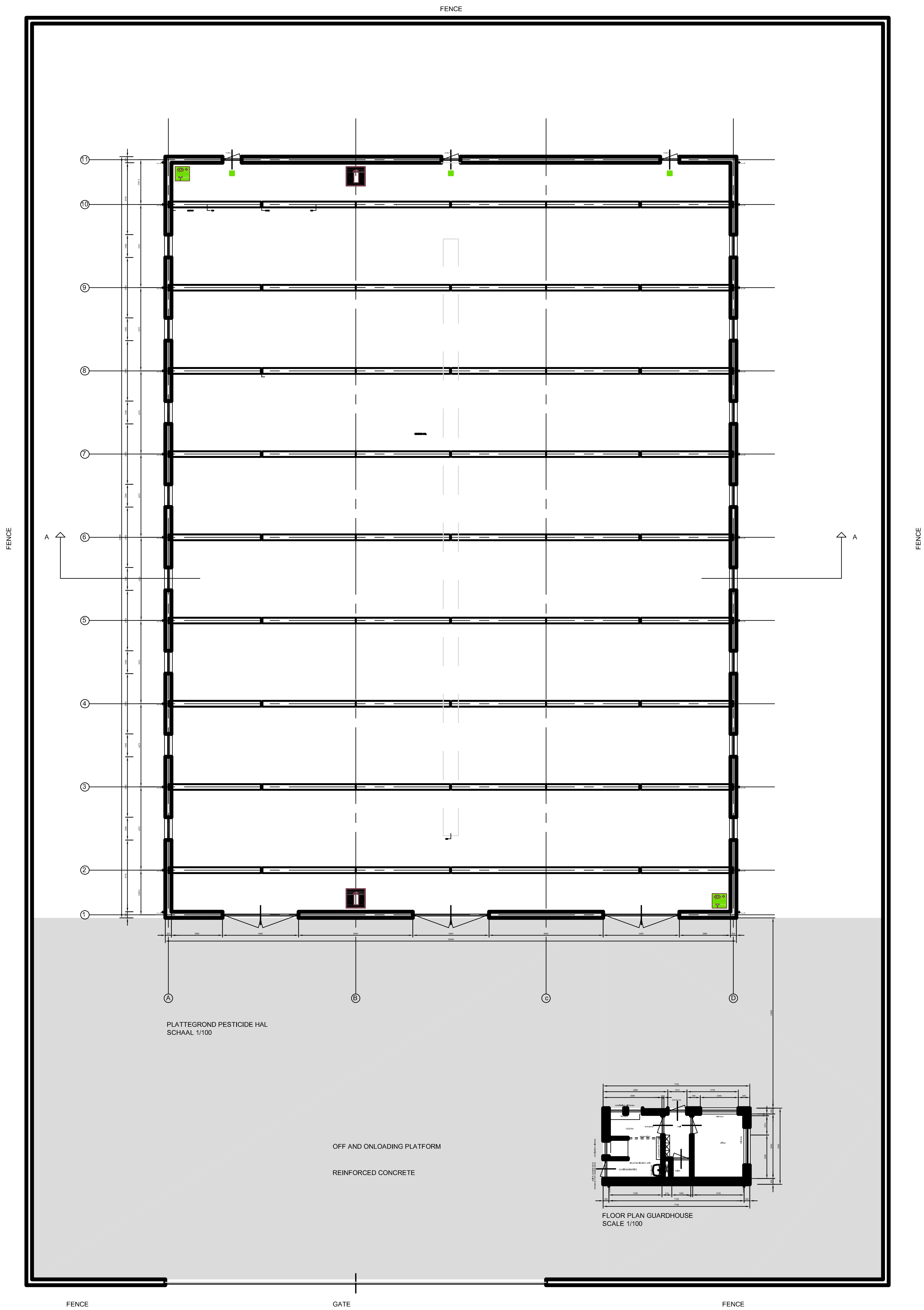


Coming back from the ICC they only enter the decontamination unit through the door of the contaminated part. They clean their PPE, remove the cover overall, their cover shoes or boots and if necessary take a shower. When they are clean they can move to the clean part of the decontamination unit.

The used cover overalls and cover shoes and other disposables should be put in a separate bag and full bags are seen as obsolete pesticides and should be stored in the ICC until they are transported to the destruction facility with the other POPs.

Appendix 1

Plan ICC and Guardhouse



Tauw P.O. 133 7400 AC Deventer Tel. (0570) 69 99 11	Project Site Assessment Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides Nubarashen Armenia	
Client Organisation for Security and Cooperation in Europe (OSCE)	Subject Engineering Requirements ICC repacked POPs and obsolete pesticides	Date 23-10-09 Des. KPA App. MWK

Projectnumber	Drawingnr.	Status	Scale	Format
1210169	104	FINAL	1 : 20	A3

D0902901.DWG

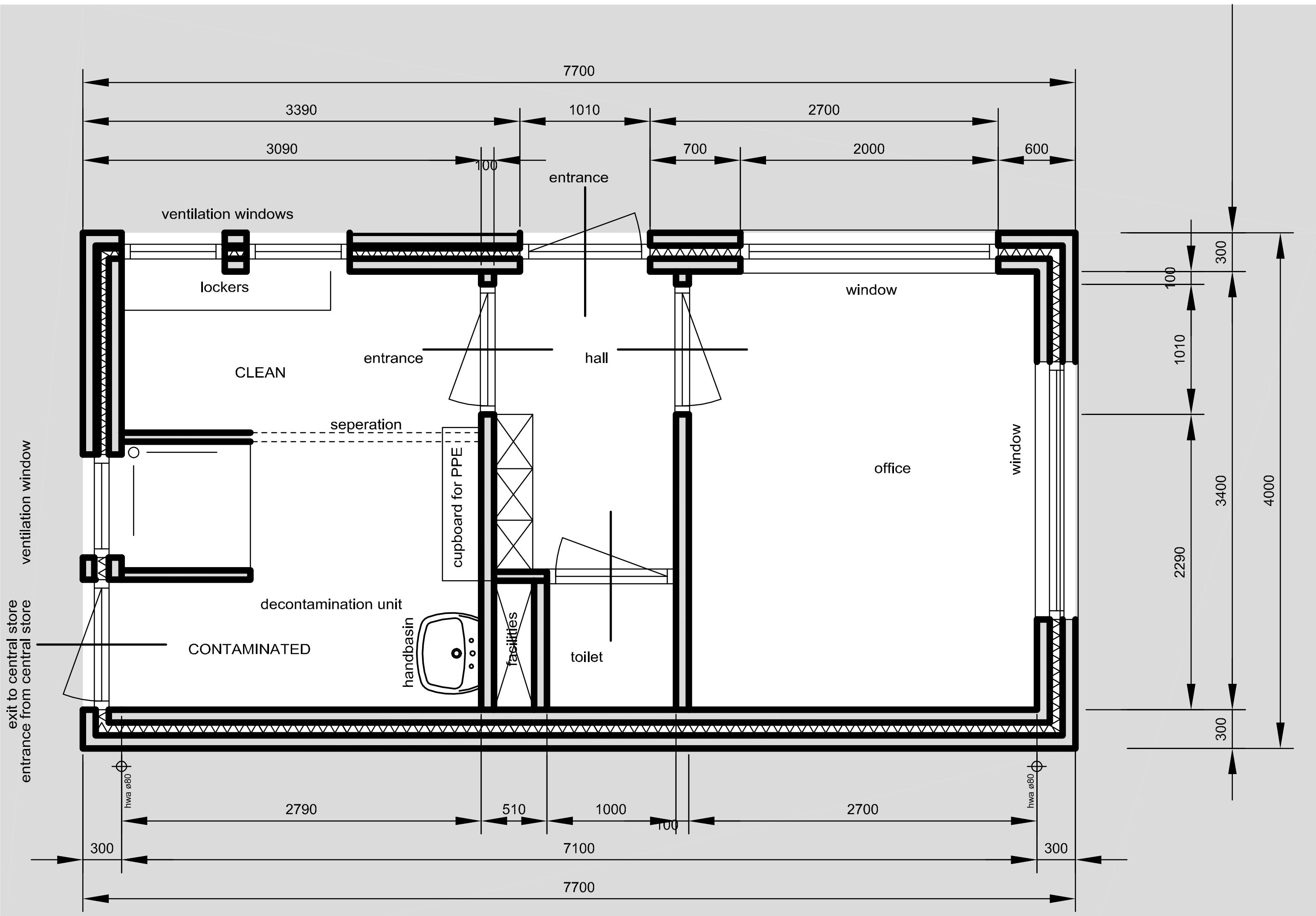
Appendix

2

Floor plan Guardhouse

LEFT FRONT　　FRONT　　RIGHT FRONT　　REAR FRONT

Scale 1:100



FLOOR PLAN GUARDHOUSE

Tauw — P.O. 133, 7400 AC Deventer, Tel. (0570) 69 99 11	Project: Site Assessment Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides Nubarashen Armenia
Client: Organisation for Security and Cooperation in Europe (OSCE)	Subject: Engineering Requirements ICC repacked POPs and obsolete pesticides

Date	Des.	App.
23-10-09	KPA	MWK

Projectnumber	Drawingnr.	Status	Scale	Format
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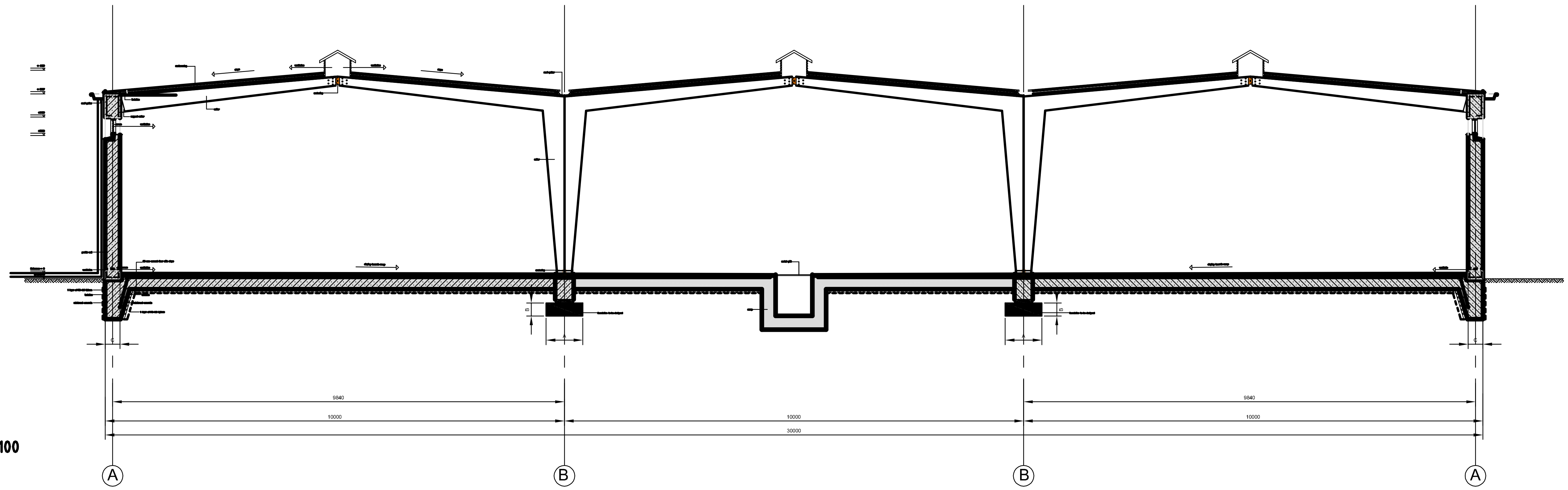
Appendix

3

Detail ICC and cross section



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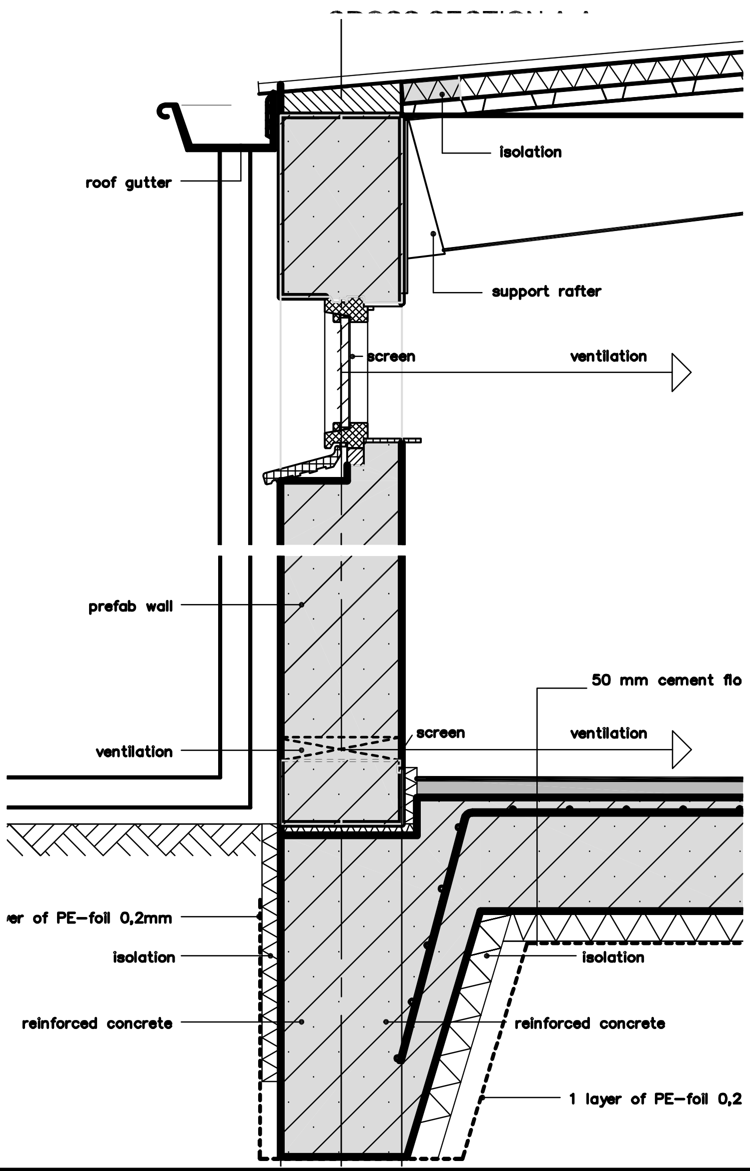
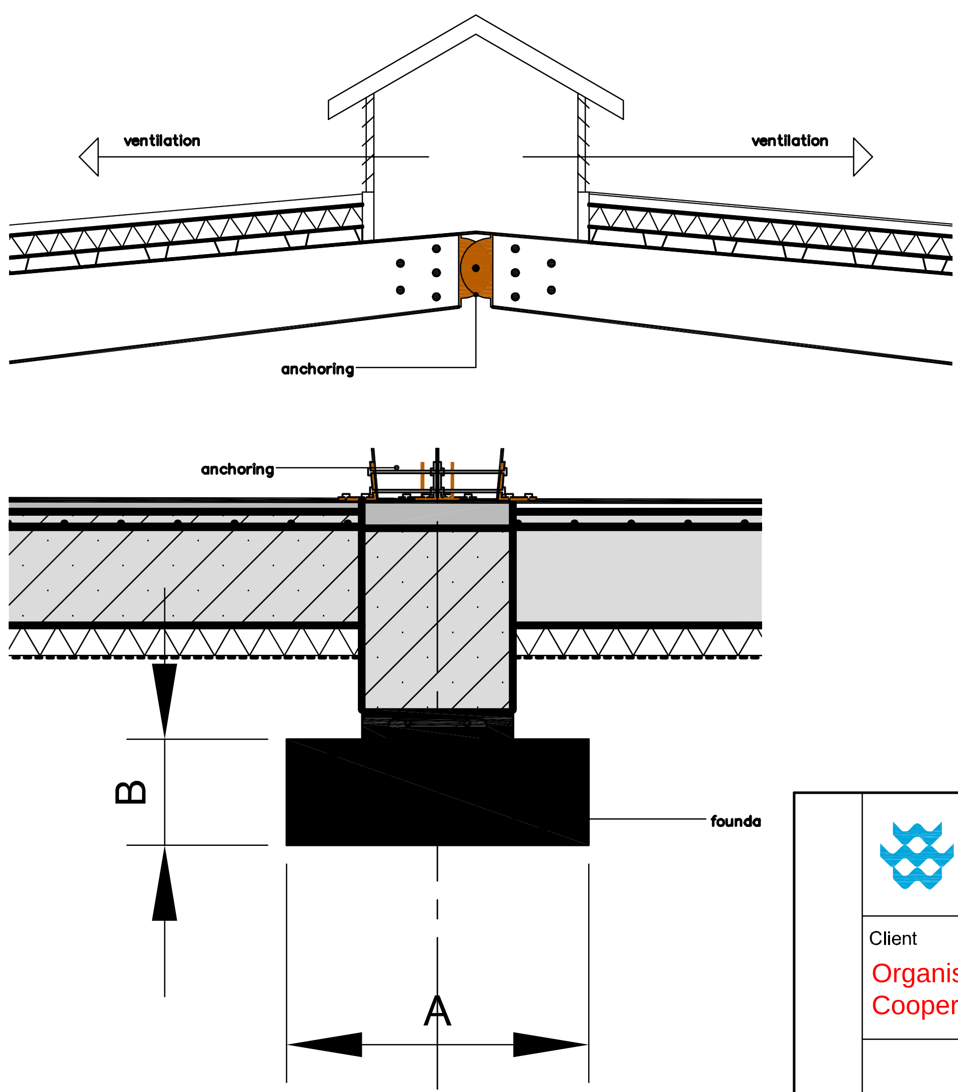
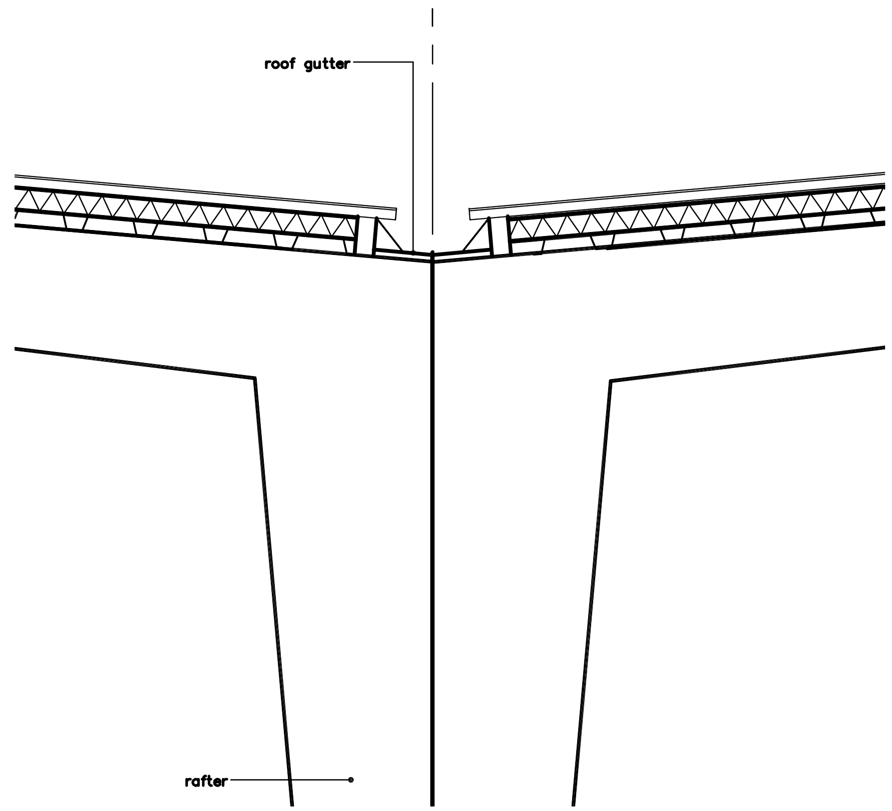






Tauw

P.O. 133
7400 AC Deventer
Tel. (0570) 69 99 11

Project
Site Assessment Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides Nubarashen Armenia

Client
Organisation for Security and Cooperation in Europe (OSCE)

Subject
Engineering Requirements ICC repacked POPs and obsolete pesticides

Date	23-10-09
Des.	KPA
App.	MWK

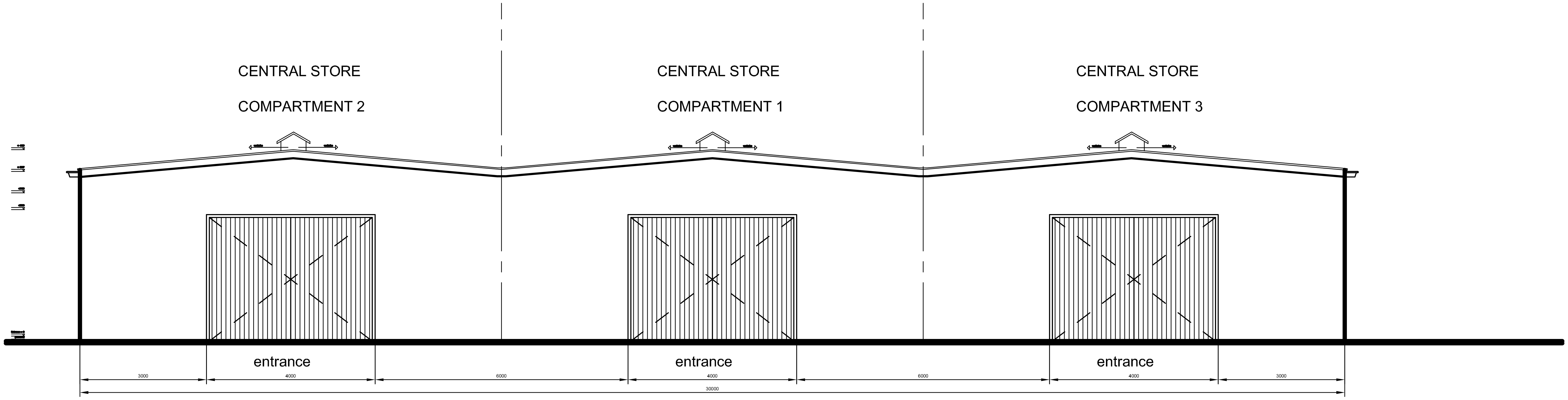
Projectnumber	Drawingnr.	Status	Scale	Format
1210169	103	FINAL	1 : 20	A3

D0902901.DWG

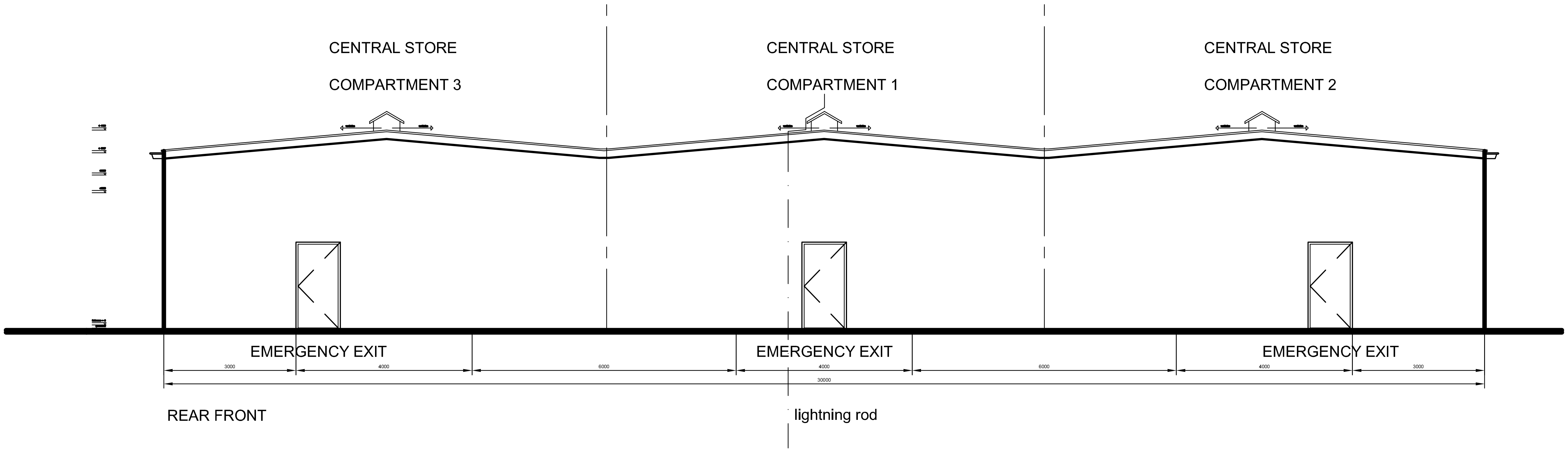
Appendix

4

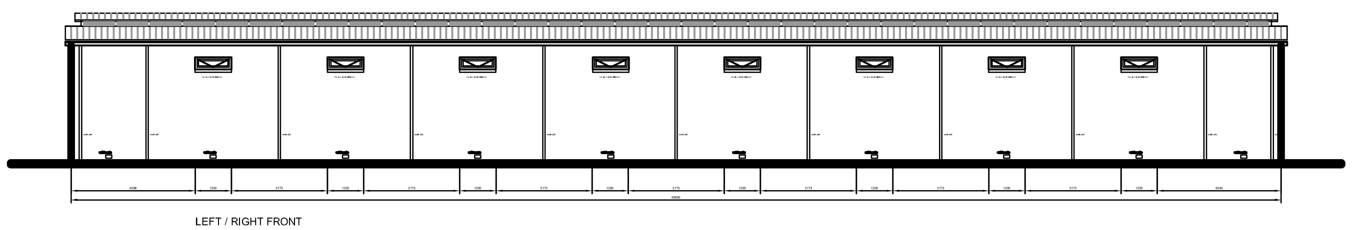
Profiles ICC



FRONT



REAR FRONT



Scale 1:250

Tauw	P.O. 133 7400 AC Deventer Tel. (0570) 69 99 11	Project Site Assessment Feasibility Study of the Nubarashen Burial Site of Obsolete and Banned Pesticides Nubarashen Armenia
Client Organisation for Security and Cooperation in Europe (OSCE)		Subject ineering Requirements ICC ıcked POPs and obsolete pesticides

Date	23-10-09
Des.	KPA
App.	MWK

Projectnumber	Drawingnr.	Status	Scale	Format
1210169	102	FINAL	1 : 100	A3

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Appendix

5

Characterization dumped hazardous waste

	Substances	Amount on the list	Tones	Remarks	Type	POP	Rodenticide	Pesticide	Insecticide	Herbicide	Fungicide	Bactericide	seed disinfectant	Defolian	Acaricideagainst ticks	fumigand	Acute toxic	Toxic	moderate toxicity	low toxic	Volatile	Solubility in water	Appearance	Colour	Smell	Package	Half-life period
1	DDT	192.5 tons	192,50		Organochlorine, C14H9Cl5,	x		x		x								x			low volatility, vapor pressure at 20C: 1.5x10-7 mm Hg	practically insoluble	crystalline	from white to light brown	with a specific fruity smell	paper bag -20 kg	Extremely resistant to environmental factors
2	Entobacterin	33,121 kg	33,12		Biological preparation, Entobacterin-3 contains 30 billion bacterial spores/ kg of *Bacillus cereus var. Galleriae*. Usually applied together with DDT				x														Powder/ the liquid form is a dark brown liquid creamy texture	gray / dark brown			
3	Fenthiuram	6,765 kg	6,77	compound of TMTD 40% и HCH 20% and trichlorophenol copper 10% and kaolin 10 %	Mixture containing organochlorine				x										x				Powder	reddish brown	pungent odor of phenol	multi-ply paper bags with polyethylene liner 20-25 kg	
4	Dalapon	17 tons	17,00		2,2 dichloropropanoic acid (C3H4Cl2O2), liquid. Sodium salt is crystalline solid. Corrosive to iron					x										x		45gram/L at 25C	crystalline powder	white with a yellow tinge		30-40kg drums	decomposes at 174-176C. Aquous solutions hydrolyze above 70C
5	Hexachlorocyclohexane	48,396 kg	48,40	all isomers are reasonably anticipated to be a human carcinogen	Organochlorine, C6H6Cl6	x			x										x		vapor pressure at 20C: 9.4x10-6 mm Hg. (y-HCH)	practically insoluble (7.3mg/L at 25C)	crystalline	yellowish-gray or light gray	smell of mold	multi-ply paper bags - 20-25 kg	At a temperature of 50 ° in 8 days 75% evaporates. It refers to a very persistent preparations: in the soil after a year 76% of the original amount is found.
6	Simazine	18,117 kg	18,12		Organochlorine, C7H12ClN5					x										x	low volatility	practically insoluble	crystalline/ dry powder	white/ gray white		paper bag 20 kg	Can preserve toxicity in the soil up to 2 years
7	Cosan	2,693 kg	2,64	Thiovit	80% sulfur. Trade name Cosan has also been used for phenyl mercury acetate						x				x				x	x		x	powder	yellow		bag 20 kg	
8	Granosan	8,402 kg	8,40		2% ethylmercury						x	x	x				x					x	crystalline	white, dark pink/ purple	specific	steel drums with polyethylene liner - 10 kg	
9	TUR	1,280 kg	1,28							x																	
10	Thiovit	1,810 kg	1,81	Cosan	80% sulfur						x				x				x	x		x	powder	yellow		bag 20 kg	
11	Cytox	0,096 tons	0,10	Methyl cistox, methyl demeton	Organophosphorous, C6H15O3PS2. Demeton (s methyl)				X						x		X	x				practically insoluble	Oily liquid, flammable	colurless	bad, faint odour	30% concentrate in steel capsules - 2 litres	
12	Liquid soap	0,289 tons	0,29																								
13	Hexachlorobenzene	1,265 tons	1,27	resonably anticipated to be a human carcinogen							x		x							x	vapor pressure at 20C: 1.09x10-5 mm Hg. Sublimable.	insoluble	crystalline, needles	gray / white to cream-colored	bad	30% dry powder -multi-ply paper bags with polyethylene liner - 20 kg; 30 kg	resistant to light, acids and alkalis
14	Dichol	0,168 tons	0,17	mixture of ethylene glycol and propylene glycol																			powder	white to light gray		bituminized paper bag with polyethylene liner - 20kg	
15	Pentachlorophenol	8,715 tons	8,72				x			x				x			x				x	slightly soluble in water (80mg/L), soluble in oils	20 % oil solution	white	smell of phenol, very pungent odor only when hot	iron drums of 30-40 kg	
16	Lissapol	1,878 tons	1,88	Polyoxyethylene (10) nonylphenol, NP10	C15H24O. (C2H4O)n an alkylphenol ethoxylate, used as wetting agent, detergent														X			easilly dissolves	colorless liquid				
17	Diamine phosphate	5 tons	5,00		Ethylene diamine acid -o-phosphate EDAP ??																						
18	Chlorophos	1,695 kg	1,70	organochlorophosphorus	C4H8Cl3O4P				x										x			12,30%	7 % granular formulation or 80% dry powder	white-crystal powder	bad	multi-ply paper bags with polyethylene liner- 20-25 kg	when heated to 70 degrees, in an acidic environment (pH 6) - three hours, neutral - 0.7hours, alkaline (pH 6) - 0.6 hours
19	Sevin	1,846 lg	1,85	1-naphthyl methylcarbamate, Carbaryl	C12H11NO2	x			x										x			slightly soluble, soluble in organic solvents	crystal powder/dust/ granules	white	no smell	cardboard boxes with polyethylene liner - 15 kg, 25 kg, 50 kg	
20	Cossan	1,498 kg	1,50		80% sulfur. Trade name Cosan has also been used for phenyl mercury acetate						x				x				x	x		x	powder	yellow		bag 20kg	
21	Cyneb	16,374 kg	16,37	Zinc ethylenebis (dithiocarbamate), Zineb	C4H6N2S4Zn						x									x		insoluble in water and organic solvents, moderately soluble in pyridine	80% dry powder	White slightly yellowish / white light gray	bad	paper bag 30 kg	In the environment is destroyed within a month. Toxic products of its transformation stored for 1,5 - 2 months
22	Colloid sulfur	17,950 kg	17,95		Sulfur				x	x	x				x					x			70 % dry powder, 80% dry powder	yellow		metal or wooden barrels or paper bags 20-25 kg	
23	Metaldehyde	0,1 ton	0,10		Polymer of acetaldehyde (C2H4O)n				x											x		practically insoluble	crystal	colorless		50% dry powder or 5% granules, cardboard drums -20 -25 kg	
24	Calcium arsenate	42,640 kg	42,64		Ca3(AsO4)2				x	x	x			x			x					slightly soluble in water (0.13gr/L), soluble in hydrochloric and nitric acids	powder, density 3.62gr/cm3	from white to light gray	odorless	38-40 % dry powder - steel drums - 25 кг	
25	Tobacco packs			5494 packs	Nicotine											x					sublimes at 112C						
26	BIP Biological insecticide preparation	5,160 kg	5,16																								
27	TMTD Tetramethylthiuramdisulphide	7,205 kg	7,21	Known also as Aatiram, Thiram	Carbamate, C6H12N2S4								x						x			insoluble	crystal	from white to cream-colored		50-80 %dry powder, also in a mixture with insecticides, multy-ply bituminized paper bag placed in plywood drums - 20-25 kg, 30 kg	In water in a neutral medium -46.7 days, in acidic (pH 3.5) -9.4 hours. In a neutral medium still on the 200th day retained 5.2% TMTD. Resistant to high temperatures. In alkaline medium (pH 7) after 2-4 hours of boiling saved 60-30% TMTD introduced.
28	Paris Green	0,239 tons	0,24	copper(II) acetoarsenite, Cu(CH3COO)2·3Cu(AsO2)2 (Mixed copper acetate arsenite (II))			x		x	x							x					practically insoluble	fine crystalline powder	green		In metal containers	
29	Copper vitriol				CuSO4.5h2o						x											highly soluble, 316gr/L at 0C for the pentahydrate	coarsely crystalline powder containing 93-98.2% of the active substance	blue		multi-ply paper bags with polyethylene liner- 20-25 kg	
30	Dendrobacilin	9,815 kg	9,82		Biological preparation																						
31	Rezetopth	17,1 ton	17,10	Rezitoks/Koral/, muskatoks,. Bayer	Is this? Coumaphos: "0,0-diethyl 0-3-chloro-4- methyl-7-coumarinyl thiophosphate"				x						x			x					crystal	белый/ желтоватого цвета		25 %, 30% и 50 % dry powder, 16 % emulsion concentrate, 0.5% и 5 % dust	
32	DNOC Dinitroortocresol	0,890 ton	0,89					x	x	x	x						x				moderately volatile with steam	slightly soluble in water, better in alcohol. Sodium salt is freely soluble in water	crystal	from yellow to orange	no smell	40% soluble powder- iron drums with polyethylene liner or 30-40 kgcardboard drums with polyethylene liner - 10 kg	
33	Sodium trichloroacetate	4,98 tons	4,98							x										x		highly soluble in water	crystal, hygroscopic	yellow or white		87 % powder - drums 30 -40kg	Remains active in the soil for 4-10 months
34	Pesticides containing arsenic, sulfur, phosphor, cyanide and mercury	30 tons	30,00																								
		Total	**504,93**																								

Appendix

6

Nubarashen Stakeholder involvement planning file

Project name:	Stakeholder involvement planning file for the first workshop of the The Nubarashen Working Group (formed by the Steering Group meetings of the OSCE and UNDP projects) This planning file is prepared under the OSCE Project *Site Assessment and Feasibility study of the POP and OP Burial site in Nubarashen, Armenia*	Date:	Fill in

What succes looks like for:	OSCE and Tauw Consortium	The Nubarashen Working Group (formed by the Steering Group meetings of the OSCE and UNDP projects)	The community living close to the site
	Site Assessment and Feasibility Study carried out. Clear perspective on how to lower imidiate risks of the burial site.	Clear perspective on how to lower imidiate risks of the burial site.	No imidiate risks from the burial site.

INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
Promise:	Promise:	Promise:	Promise:	Promise:
We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for direct advice and innovation in formulating solutions and incorporate your advice and recommendations into the dicisions to the maximum extend possible.	We will implement what you decide.
Stakeholders	Stakeholders	Stakeholders	Stakeholders	Stakeholders
MoNP	MoNP			
MoA	MoA			
MoH	MoH			
MoEmerg. Si.	MoEmerg. Si.			
MoEcon.	MoEcon.			
MoFA	MoFA			
MoTeri.Admini.	MoTeri.Admini.			
MoDefence	MoDefence			
State Police Dep.	State Police Dep.			
Nat. Sec.Service	Nat. Sec.Service			
State Revenu Comm.	State Revenu Comm.			

Stakeholders	Stakeholders	Stakeholders	Stakeholders	Stakeholders
Local Authorities	Local Authorities			
OSCE	OSCE			
UNDP	UNDP			
UNIDO	UNIDO			
AWHHE	AWHHE			
Scient.Res.Inst.Gen. Health and Occup. Diseases	Scient.Res.Inst. Gen. Health and Occ. Dis.			
Waste Center MoNP	Waste Center MoNP			
Engineer Geologist LTD	Engineer Geologist LTD			
Other Environmental and Social NGOs	Other Environmental and Social NGOs			
Workers maintaining the site	Workers maintaining the site			
Inspection staff (NGO representative and government officers)	Inspection staff (NGO representative and government officers)			
Police guards	Police guards			
Population living downstream the dumpsite	Popul. living downstream the dumpsite			
Herdsmen	Herdsmen			
Children playing in the neighbourhood	Children playing in the neighbourhood			
Women collecting herbs in the neighbourhood	Women coll. herbs in neighbourhood			
Women using surface water for irrigation	Women using surface water for irrigation			

What tools can we use?	What tools can we use?	What tools can we use?	What tools can we use?	What tools can we use?
When? How?	When? How?	When? How?	When? How	When? How?