Terms of Reference (ToR)
Forest Landscape Restoration: implementation of field works

BACKGROUND INFORMATION

Climate change is increasing the frequency, intensity and magnitude of disasters, leading to a higher number of casualties as well as property and economic losses. Nature can provide cost-effective, no-regret solutions, which help increase community resilience beyond their capacity to absorb and recover from a single disaster, such as a flood or drought. IUCN has been at the forefront of developing the concept of Nature-based Solutions and has recently launched a Global Standard for Nature-based Solutions. Evidence shows that beyond the positive impact on societies and improved management of disaster risks, Nature-based Solutions benefit habitats and biodiversity as well as support climate change mitigation and adaptation.

Countries in the Western Balkans are among the most vulnerable with respect to climate change impacts affecting numerous sectors and domains. Yet, while Nature-based Solutions are increasingly used and integrated into climate change policy and action planning globally, in particular, in relation to disaster risk reduction and community resilience, in the Western Balkans, the value derived from deploying Nature-based Solutions in response to societal challenges remains underexplored. The contributions of ecosystems and biodiversity towards climate change adaptation and disaster risk reduction have not been recognised or sufficiently reflected in relevant strategies and policies in the region. Policies and planning approaches are often fragmented or do not consider capacity gaps with regards to their implementation.

On a global scale Nature-based Solutions have been recognised to offer untapped potential to the achievement of the multiple national and international priorities on mitigating climate change, improving livelihoods, reducing desertification and conserving biodiversity. Integrating Nature-based Solutions into national climate change policy and planning is one way to promote and create a more holistic perspective that acknowledges the role of ecosystems and the services they provide. Also, it is critical that investments are mobilized for nature-based solutions through other mechanisms than public sector investments. Additionally, alignment with global and regional policy frameworks, including the Paris Agreement with NDCs as its delivery vehicle, the Sendai Framework, Agenda 2030, CBD and NAPs among others, supports the achievement of international commitments and reporting requirements. Overlaps between these frameworks as well as other activities, such as the work on UNCCD's land degradation neutrality should also be considered. Global post-2020 negotiations in particular offer opportunities for mainstreaming Nature-based Solutions into ongoing policy development and planning processes, such as updating and / or enhancing NDCs (including how to enhance climate resilience (adaptation), setting LDN targets, and defining the pathways to achieve the Post-2020 Global Biodiversity Framework.

In addition to global frameworks, the Western Balkan countries strive to align national policies with EU acquis. The recently adopted EU Green Deal, the EU Biodiversity Strategy, EU Strategy on Adaptation to Climate Change provide new opportunities for Nature-based Solutions actions. The Green Agenda for the Western Balkans currently under development will adapt the EU Green Deal and related strategies to the regional context and align goals with priorities of the Western Balkan countries. ADAPT aims to harness the potential of Nature-based Solutions for climate change adaptation and disaster risk reduction by capitalising on

national, regional and global processes for policymaking and planning that facilitate effective implementation.

ADAPT: Nature-based Solutions for resilient societies in the Western Balkans is a project funded by the Swedish International Development Cooperation Agency (Sida) and implemented by IUCN. It aims to increase ecosystem and community resilience to climate change and environmental degradation in the Western Balkans. The project works at multiple levels and involves government agencies, research institutions and civil society, which offers opportunities for knowledge exchange, wider capacity building and institutional strengthening as well as the potential for scaling up.

The project will be implemented through the following three strategies:

1. Enhance knowledge and awareness of nature-based disaster risk reduction solutions among decision makers, natural resource managers and local communities with a specific focus on gender;
2. Integration of Nature-based Solutions and equitable climate-smart planning into adaptation and disaster reduction policy; and
3. Implementation of Nature-based Solutions for disaster risk reduction and their scale-up.

In order to demonstrate the value and multiple benefits of Nature-based Solutions, the project aims at implementing two pilot NbS field projects, one in Kraljevo municipality in Serbia and one in Elbasan municipality in Albania. Apart from the two pilot sites, the project will help prepare a tender dossier in North Macedonia and pre-feasibility studies for future NbS projects in selected pilot sites locations in the other three Western Balkans economies.

BRIEF OVERVIEW OF THE DEVELOPMENT STAGES OF THE ALBANIAN PILOT SITE

In Albania, field visits and preliminary consultations with partners and stakeholders have led to the selection of the Municipality of Elbasan as a suitable area to implement a pilot NbS project. The municipality is located within the Shkumbini river basin and is particularly vulnerable to flood risk and soil erosion, due to upstream degraded forests and greater occurrence of extreme rainfall, which also increases the risk of pollution being carried by floodwaters, considering Elbasan has several metallurgical production sites. The Shkumbini river basin hosts diverse natural habitats and contains upstream the Shebenik-Jabllanice National Park, middlestream the Kuturman Nature Park and downstream the Divjake–Karavasta National Park. The pilot project is implemented in close cooperation with national and local authorities as well as local interest groups and civil society.

During the first phase of project development, various challenges to be addressed in Elbasan Municipality have initially been identified (solid waste disposal, high industrial pollution, erosion in upstream catchments and along the river banks, etc.) and three potential sites were suggested to implement pilot NbS measures. Following these consultations, the team of experts provided a list of potential NbS measures for three pre-selected sites. Stakeholders prioritised NbS interventions at one of the sites, Gurra stream and its catchment, in Shushica village. In addition, they also refined the set of NbS measures related to erosion control during a validation workshop organised in July 2022.

A team of local and international experts conducted a NbS baseline assessment in Elbasan municipality, to identify local challenges and opportunities and provide recommendations for a NbS pilot intervention. This initial assessment is multidisciplinary, covering the topics of water management, biodiversity, socio-economy and gender inclusiveness and provides three NbS measures, with related Cost-Benefits Analysis (CBA). The NbS Baseline Assessment and background studies were finalised in November 2022 and looked more specifically into

conservation and biodiversity status, they analysed degradation drivers and proposed options to enhance biodiversity net-gains while providing socio-economic benefits. Two of the NbS measures recommended by the team of experts are dedicated to Forest Landscape Restoration (FLR), whereas another NbS measure focuses on Flow and Bedload Transport Regulation (FBTR).

In March 2023, a team of experts has been appointed to review the NbS baseline assessment and provide the final project design, focusing on Forest Landscape Restoration (FLR) measures. The FLR intervention designed by the experts for this NbS pilot project is considered for 9 zones, covering a total of area of 8.2 ha, which are heavily eroded, with visible gullies and steep slopes. FLR actions includes: rehabilitation by planting, gabion and brushwood check dams, planting of grass strips and direct grass throwing. Economic benefits are expected for FLR actions, therefore influencing the selection of tree species and the design of the whole intervention. The final FLR project design report provides further detailed information on the NbS sites and actions to be implemented.

The technical design for the FLR pilot mentioned above was finalised and approved by the ADAPT project partners and donor in November 2023. The Design is accompanied by a Management and Maintenance Guidance Note, management and maintenance plan for the FLR pilot and a Monitoring and Evaluation Framework (MEF) capacity and resources needs assessment for the pilot project in Albania, draft Community Grazing Management Plan and Work Plan, Technical-economic project documents delivered for obtention of afforestation permit (available only in Albanian). These are key documents that offer useful information about proposed restoration measures and complementary actions to be conducted at Shushica pilot site, as well as roles and responsibilities for different stakeholders involved in the process.

The next phase in project implementation consists in performing all the FLR field works according to the project technical design.

SCOPE OF WORK

The Consultant will work closely with the IUCN project management team, relevant IUCN units, project partners and experts and will be responsible for the tasks listed below.

TECHNICAL CHARACTERISTICS

The areas in which interventions are proposed are affected by extreme levels of soil degradation, with almost no vegetation on the ground.

Based on the assessment of the conditions at the site and consultations with local experts, the local community and IUCN, nine intervention areas have been proposed – see figure 1, below.

All nine intervention areas must be covered by the technical and financial proposal submitted by the Consultant. IUCN reserves the right to reduce the scope of field work, including in a number of intervention areas (zones).

The Consultant might propose some adjustments to the intervention design along with justification of the proposed adjustments.

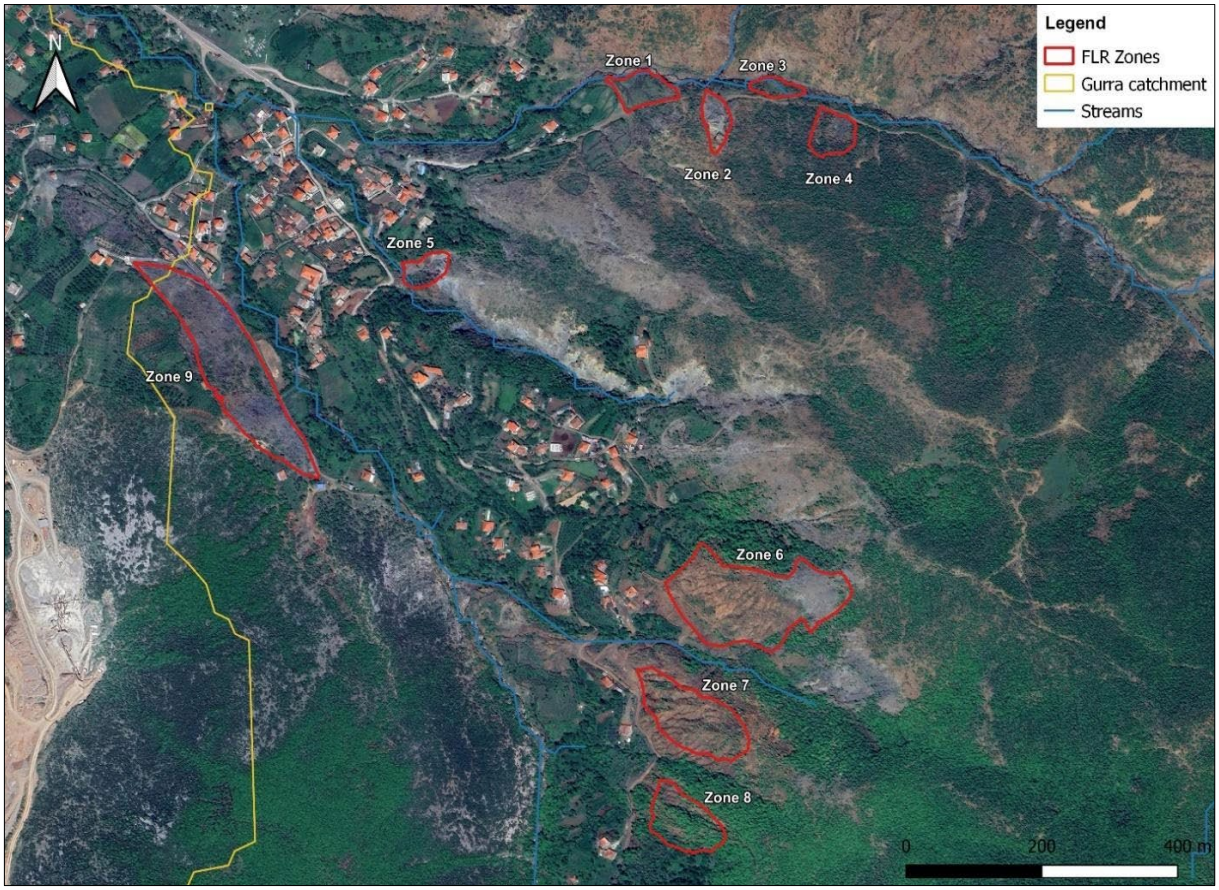

Figure 1 – Proposed intervention zones (zones marked in red)

The proposed zones for FLR interventions range in area from 0.15 ha to 2.43 ha, amounting to 8.20 ha in total (see table below):

Zone	Area(ha)	Perimeter of intervention zones (m)
1	0.34	276
2	0.23	209
3	0.15	185
4	0.30	225
5	0.24	213
6	2.34	729
7	1.47	592
8	0.70	357
9	2.43	807
Total	8.20	3593

Table 1 – Area and perimeter of proposed intervention zones

All of the selected areas are heavily affected by soil erosion; however micro-conditions vary in each zone. A tailored combination measures is therefore proposed for each zone, as shown in the table below. The proposed combinations of measures were determined based on field survey, discussions with local forest experts and the suitability of site conditions. The proposed measures aim to use local resources (stone and wood), reduce soil erosion and add value to local livelihoods.

Types of FLR Interventions	Targeted area	Justification	IUCN global NbS standards
Rehabilitation by planting	Degraded forest lacking suitable species in zone 2, 4, 6, 7, 8, 9.	To restore forest and ecosystem functions on bare land or in very degraded forests/	Criterion 1: Societal challenge; Criterion 2: Design at small scale; Criterion 3: Net gain to biodiversity and ecosystem integrity; Criterion 4: Economic viability Criterion 5: Inclusive, transparent and empowering governance processes. Criterion 6: Equitable balance tradeoffs and continued provision of multiple benefits; Criterion 7: Adaptive management based on evidence; Criterion 8: Sustainable and mainstreamed within an appropriate jurisdictional context.
Natural Forest Rehabilitation (NFR)	Degraded forest lacking normal structure in zone 1, 2, 3, 4, 5, 6, 7, 8, 9.	To increase soil stability and water holding capacity and reduce soil erosion by transition from degraded forest land to artificial forest	
Direct seeding	Heavy eroded sites where topsoil layer exists in zones 4 & 5.	To reduce water flowing on surface and rill soil erosion	
Vegetative sediment trapping measure *Log check dams and Brushwood Check dam*	Heavy eroded sites with gully erosion in zones 3, 4, 5 & 6.	To control flash floods and soil erosion.	
Check dams/gabions	Heavy eroded site in zone 2, 4, 5, 6, 7, 8.	To control flash floods and soil erosion.	
Grass filter strip	Bare land in zone 6 & 9.	To control soil erosion through vegetative strips	

Table 2 - Proposed FLR measures by target areas and relevant IUCN global standards

Zone 1

Z.1.1. Location and description of current conditions

- Coordinates of the central point: 34 UTM 0425026E; 4549903N; Area: 0.34 ha
- Slope: 28.5%, Facing N/W. Elevation: 279 m above sea level.
- Plot ownership: 100% Elbasan municipality

Current conditions: The area is covered by herbaceous, with very rare bushes of red prickle and blackberry, and a considerable presence of *Cistus salvifolius* species. Thesoil is wet due to water flowing on the ground. Soil is Cinnamon mountain, a subtype of reddish or Calcaro-Chromic Cambisols, according to FAO (1974) classification. In the lower part adjacent to this zone, there is a stream with a considerable amount of water, which can be used for irrigation during the summer period. Grazing is one of the main problems in this location and additional measures need to be taken into consideration (e.g. fencing of the zone).

Z.1.2. Objectives

- Reducing the level of soil erosion
- Increasing biodiversity
- Reducing carbon leaking
- New forest stands establishing providing economic benefits for local population
- Harvesting non-wood products from new established forest stand
- Provide valuable wildlife habitat

Z.1.3. FLR Measures

Planting of Zone 1 with relevant species using pits with dimensions 40 x 40 x 40 cm and a planting density of 2500 trees per hectare.

Z.1.4. Expected benefits

Afforestation of this zone is expected to reduce the soil erosion up to 50%. It will have an impact on the soil water holding capacity and nutrients enrichment as well as air cleaning and CO2 sequestration. The opportunity for economic and social benefits derived from firewood and non-wood products where on average at least 4 families will benefit from this activity. In terms of aesthetics, the forested area will have a noticeable improvement and can also serve as a recreation area.

Z.1.5. Planting

For the Zone 1, the following species are recommended for planting:

1. *Prunus* tree 20%
2. *Salix* spp. 20%
3. *Alnus glutinosa* 20%
4. *Populus* sp. 20%
5. *Pyrus amygdaliformis* 10%
6. *Olea europea* 10%

Other species suited with zone 1 site conditions are:

- Tree species: *Pinus pinaster*, *Punica granatum*, *Carpinus orientalis*, *Fraxinus ornus*, *Quercus pubescens*.
- Shrubs: *Crataegus monogyna; Sambucus spp.*

Total number of seedlings: 0.34 ha x 2500 seedlings/ha = 850 pcs.

Z.1.6. Transport and manipulation of seedlings

Handling, loading and transporting trees from nursery to planting site, unloading trees and their storage must be carried out without causing any damage. Trees with a plastic bag or

container should ideally be handled by the container and the seedling stem should not be damaged. Seedlings should be protected from direct sun, wind, frost, drying out and mechanical damage.

In particular, they must be protected from drying, overheating or frost during transport. Stored seedlings must be watered sufficiently (depending on the weather and cover material used) and protected from damage by wild animals (depending on the site). Seedlings grown in containers or plastic bags must be temporarily stored or planted within a maximum of 48 hours after transport.

Z.1.7. Planting technique

The available area should be properly prepared before planting. On most sites, preparation mainly involves the following: (i) removal of persistent weeds, including the parts capable of regeneration, and (ii) removal of undesirable materials. Removal of competing vegetation before planting is advisable. Planting of the seedlings will be with individual pits. The diameter of the planting pit must be at least 1.5 times larger than the width of the root system of a bare-rooted tree or the diameter of the bottom of a container or plastic bag. The bottom of the planting pit must be loosened. A regular planting scheme with a distance of 2x2 meters is suggested. Two-year-old seedlings in plastic bags orcontainers should be used. If the root and especially tap root is too long, it should be reduced to 25-30 cm (according to the planting hole depth) using a sharp tool. During planting, it is recommended to place the tree in the center of the planting pit. Backfill the pit in soil layers and ensure that the tree remains upright. At each stage, the filling must be gently compacted to avoid any open spaces under and around the root system. Before placing the seedling, the planting pit should be filled with the highest quality soil available up to half of the pit depth. The finest soil should be used to fill the hole directly around the seedling. Finally, the lower quality soil is used to fill the upper part of the pit. The level of the root collar must be checked, so that after planting the root collar should be a few cm higher than the level of the surrounding terrain. This is to avoid the root collar sinking with natural soil settling. During planting, it is best to irrigate the open pit to minimize the formation of air pockets. Irrigation must evenly saturate soil volume throughout the planting pit. The expected survival rate of seedlings in Zone 1 is expected to be around 80%, two years after planting. It is advisable the completion of the aftercare works at least for a period of 2 years after planting. Monitoring of the planted area in June and September will be carried out.

Z.1.8. Operation and maintenance

Removal of competing vegetation prior to planting is advisable. The area around planted seedlings should be kept clear of weeds and competitors. After planting, aftercare works including hoeing, fertilizing and watering for a period at least 2 years is suggested.

Replacement of dead trees will also be operated. In the zone 1, it is estimated that 20% of the planted trees would have to be replaced.

Z.1.9. Recapitulation

Z.1.9.1. Planting

Nr	Working process	Area/Pieces
A.1	Area cleaning	0.34 ha
A.2	Pits opening	850 pcs
A.3	Seedling holding and transport into the planting site	850 pcs
A.4	Seedling planting	850 pcs
A.5	Seedling transport from nursery to site	850 pcs
A.6	Seedling purchase	
A.6.1	*Prunus tree*	20% x 850 pcs =170 pcs
A.6.2	*Salix spp*	20% x 850 pcs =170 pcs
A.6.3	*Alnus glutinosa*	20% x 850 pcs =170 pcs
A.6.4	*Populus spp*	20% x 850 pcs =170 pcs
A.6.5	*Pyrus amygdaliformis*	10% x 850 = 85 pcs
A.6.6	*Olea Europea*	10% x 850 = 85 pcs

Table 3 - Zone 1: Recapitulation of planting working processes and material

Z.1.9.2. Dead tree replacement (20%)

Name of activity	Unit	Quantity
Reopening pits with sizes 60 x 60 x 60 cm and below	Pieces	170
Transport of 1-2-year-old conifer seedlings by hand at a distance of 200-500 m	Pieces	170
Planting seedlings in bags, holes 40x40x40 cm	Pieces	170
Purchase of seedlings	Pieces	170
Car transport of seedlings	Pieces	170

Table 4 - Zone 1: Dead tree replacement

Z.1.9.3. Aftercare works (2 years after planting)

Name of activity	Unit	Quantity
Hoeing seedlings in pits less than 50x50x50 cm with a radius of 0.3 m	Pieces	1,700
Spraying chemical fertilizer around the seedling	Pieces	1,700
Irrigation of seedlings in forests with 30 l of water at a distance of up to 100 m	Pieces	1,700
Pruning of seedlings	Pieces	1,700
Cure of seedlings wounds	Pieces	1,700
Weeds cleaning	Pieces	1,700

Table 5 - Zone 1: Aftercare works

Zone 2

Z.2.1. Location and description of current conditions

- Coordinates of the central point: UTM 34 0429293E; 4549813N Area: 0.23 ha
- Slope: max. 76.4%; facing North; Elevation 313 m above sea level.
- Plot ownership: 100% Elbasan municipality

Current conditions: Skeletal terrain, with many stones on the surface, very poor soil, ultra-basic rock, with visible signs of rill and gully erosion.

Z.2.2. Objectives

- Reducing the level of erosion
- Protection of water pipeline from which the village is supplied
- Protection of the pedestrian path used by local people
- Increasing biodiversity through artificial planting
- Reducing stone removing and superficial water.
- Provide valuable wildlife habitat

Z.2.3. FLR Measures

In the zone 2, the following measures are proposed:

- two check dams with gabions with stones locally sourced
- 10 brushwood check dams with poles provided from market or locally sourced from young dense forest areas close to zone 2.
- In total, 240 seedlings of honey locust (Gleditsia triacanthos) will be planted with irregular design for soil erosion controlling instead of Accacia that is widely used for that purpose in Albania.

Z.2.4. Expected benefits

- Several water pipes pass close to the eroded area, from which one neighbourhood from Shushica village is supplied, therefore the remediation of Zone 2 will reduce the possibility of advancing soil erosion to the extent of 60%.
- It will have an impact on the quantity and quality of water and carbon stocked by the trees that will be planted within zone 2.
- Forest composition, structure, and functions will be restored, reducing the disaster risk and increasing the ecological and economic value.

Z.2.5. Design specifications

Below are presented the design specifications for gabion check dams and brushwood barriers:

Nr	Gabion check dam characteristics	Gabion check dam nr.1	Gabion check dam nr.2
1	Length (m)	9.0	7.0
2	Width (m)	2.0	2.0
3	Height (m)	3.5	3.5
4	Foundation depth(m)	0.7-1.1	0.7-1.1

Table 6 - Zone 2: design specifications for gabion check dams

Nr	Brushwood double poles check dams' characteristics	Value
1	Poles length (m)	1.5-2.0
2	Poles diameter (cm)	8.0-12
3	Driven depth to soil	1/3-1/2 length
4	Spacing between poles (m)	0.5
5	Branches number	apart 10-15 cm
6	Species proposed	*Carpinus; Alnus; Pine*
7	Number of brush check dams	~10

Table 7 - Zone 2: design specifications for double brushwood check dams

In case of gabions, the stones are locally sourced but the wire needs to be purchased. The material for brushwood check dams could (a) be provided from forest stands around (e.g. artificial pine stands or local Mediterranean shrubs and oak forest stands) or (b) purchased.

Option (a) is recommended, considering that:

- healthy forest has been identified within the village of Shushica, located on public land;
- Clearing/collection of brushwood material would be conducted according to sustainable forestry management methods, benefiting Shushica forest landscape and adding value to wider impact of the NBS pilot;
- Obtaining wood from surrounding healthy forest will reduce costs (cost-benefit efficiency).
- The Head of Department of Forestry of the Municipality of Elbasan has supported this approach.

NOTE: Formal permission will need to be provided for by the Municipality in order to implement this option. This should be done as part of the overall agreement with the Municipality for the implementation of the project design.

Z.2.6. Layout, physical output, and surveying procedures

Gabion check dams are small barriers constructed of a series of gabion baskets bound together to form a flexible obstacle used to slow down the water flow and water speed. They will be used on the flat parts of zone 2 where slope is less than 10% and positioned in series with spacing of 10-90 m apart. The gabion check dams will be used transversal with slope. Galvanized wire mesh of 2.5 mm diameter is the most commonly used material to build gabions. Gabions basket standard size is 1.0 m x 1.0 m x 1.0 each basket is filled by stones with upper boundary porosity value of 30% and the construction will be commonly by hand.

Z.2.7. Construction procedure

Z.2.7.1. Gabion check dams

The construction work will include the involvement of local communities, organization of the worksite and maintenance planning. Stones will be collected and piled up by farmers. The gabion basket will be purchased or prepared in the worksite from qualified workers and the average cost per square meter is estimated based on the frontal vertical area and estimated to 16.3 Euro/m^3. In calculation are considered: (i) the worksite preparation; (ii) mechanical transport of the stones; (iii) local produced cages made of galvanized iron; (iv) labor cost and (tools used for work construction and maintenance). If the total height (effective height plus foundation depth) of the gabion check dam is three m or less and if the box gabions used are 1 x 1 x 2 m, or 0.85 x 0.85 x 2 m, or 0.75 x 1.5 x 3 m, it is not necessary to compute the dimensions of the dam (thickness of. crest and base) according to hydrostatic principles or empirical formulas. This is because the above-mentioned box gabions stabilize the dams against overturning, collapsing, sliding and breaking. The Figure 2 shows a gabion check dam

constructed by using the box gabions of 0.85 x 0.85 x 2 m in size. The depth of the foundation is equal to one-half of the effective height of the dam, which means that the foundation depth is one-third of the dam's total height. The foundation is longer than the spillway. After digging the foundation, a layer of box gabions are placed vertically. The vertical sides of the box gabions are tied with binding wire of the same diameter.

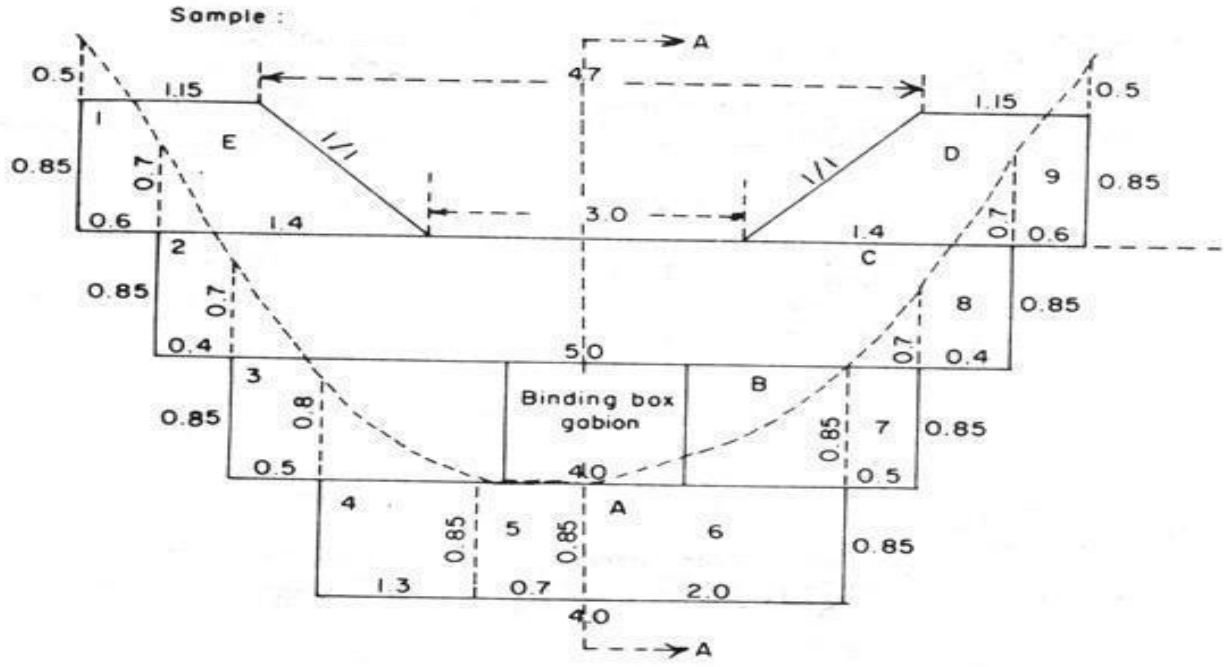

Figure 2 - Front view of gabion check dam

When a gabion check dam has three layers and is no higher than three meters, place a "binding box gabion" in the middle or top layer. The space behind the dam and wing walls should be filled with soil excavated for the foundation and from the gully bed. Wings should enter at least 50 cm into each side of the gully and they should be protected against flash water by wing walls. The angle between the wing and wing wall is 0 to 45 degrees. The height of a wing wall is equal to the depth of the spillway. Box gabions used for check dams can be assembled using ready wire meshes as indicated in *Figure 3*. Box gabions can be prepared directly by netting galvanized wires (diameter three to four mm or eight to 10 gauge). If No. eight gauge (four mm) is used, the size of the mesh should be 15 by 15 cm, If No. 10 (three mm) is used, the mesh should be 10 by 10 cm in size.

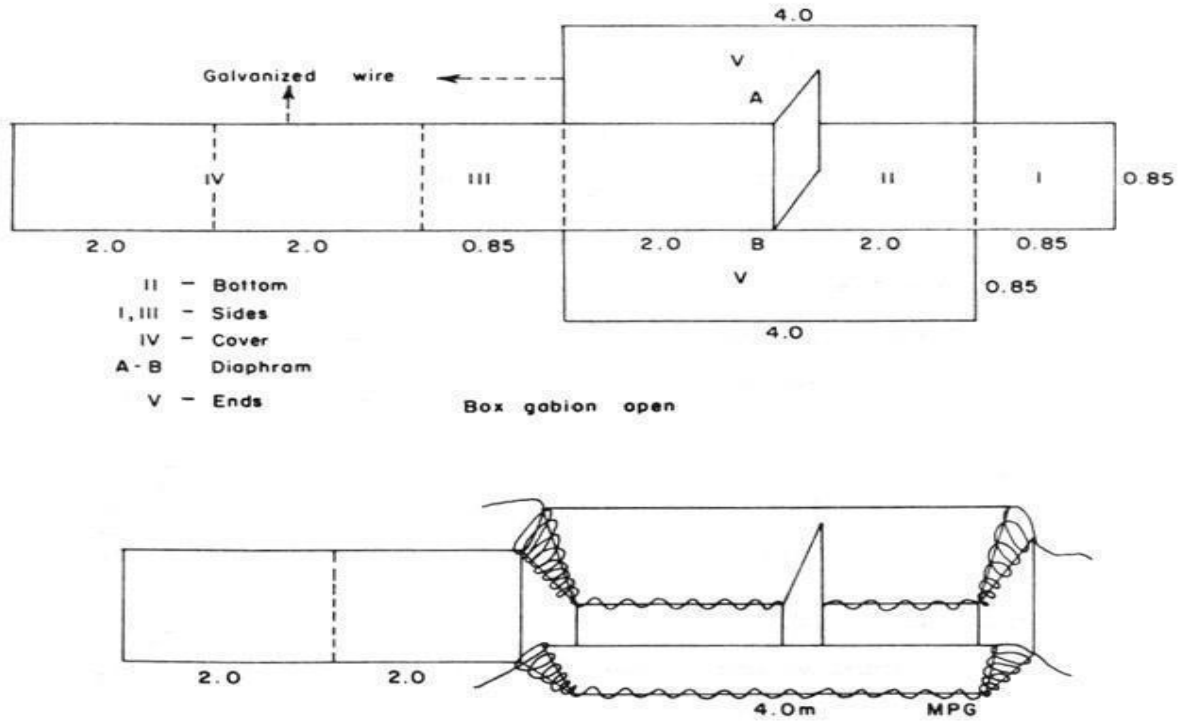

Figure 3 - Assembly of a box gabion with a central diaphragm

If the total height of the gabion check dams is three to five m, the thicknesses of crest and base are calculated by the following formulas: k = 0.4 H and, d = 0.6 H

- where: k: thickness of the dam's crest at spillway level
- d: thickness of the dam's base
- H: total height of the dam including foundation.

These formulas provide stability against overturning, collapsing, sliding and breaking.

Z.2.7.2. Brushwood double poles check dams

The design of Brushwood double poles check dams in the Zone 2 should include:

- The sides of the gully are cut to a slope of 1: 1
- The size of poles is 1.5 to 2 meters in length and 8 to 12 centimetres in diameter
- Any tree or shrub species can be used; however, sprouting poles from *Salix*, Simali (vitex), and poplar are most preferred.
- A trench of about 15 cm. deep is made across the gully, and the wooden poles are driven to a depth of about 1/3 to ½ of the pole length, and at a spacing of about half a meter
- The tops of the poles in the middle are made lower than the sides to form a notch of the required size to accommodate the maximum runoff
- The flexible branches of trees (Salix, poplar, vitex, etc.) and shrubs are woven between wooden poles driven into the ground till a dam of the required height is obtained
- The ends of inter-linked materials should enter at least 30 cm into the sides of the gully
- Brushwood check dams are constructed when the soil in the gully is saturated or during the early rainy season
- The brush used preferably should have been left on
- If non-sprouting species (pine*, Alnus, Carpinusas* poles,) are used, brushwood check dams can be constructed during any season.
- The back of the brushwood check dams must be filled up with soil
- A brushwood apron of about 1.5 times the height of the check dam is necessary to protect the channel from scouring.

Z.2.8. Planting

For the Zone 2 the following species are recommended for planting:

1. *Gleditsia triacanthos* 80%
2. *Pyrus amygdaliformis* 10%
3. *Crataegus monogyna* 10%

The alternative tree species considered for Zone 2 are:

- *Robinia pseudoaccacia*, *Punica granatum*, *Carpinus oriantalis*, *Quercus pubescens*.

Total number of seedlings: 0.23 ha x 2500 seedlings/ha = 575 pcs;

Z.2.9. Transport and manipulation of seedlings

Due to the poor soil we suggest using seedlings in containers or plastic bags, because the soil material around the root system provides seedlings with enough nutrients until they become acclimatized. Trees with a plastic bag or container should ideally be transported without causing any stem damage. Seedlings should be protected from direct sun, wind, frost, drying out and any mechanical damage. In particular, they must be protected from drying, overheating or frost during transport. Stored seedlings must be watered sufficiently (depending on the weather and cover material used) and protected from damage by wild animals (depending on the site). Seedlings grown in containers or plastic bags must be temporarily stored or planted within a maximum of 48 hours after transport.

Z.2.10. Planting technique

Since the terrain is very steep and not suitable for afforestation, due to the lack of quality soil, it is mandatory to plant seedlings in squares where one pit per square will be dug. The pit dimensions will be 40 x 40 x 40 cm maximum and an irregular planting scheme will be applied. Two-year-old seedlings in plastic bags or a container should be used. If the root and especially tap root is too long, it should be reduced to 25-30 cm (according to the planting hole depth) using a sharp tool. During planting, it is recommended to place the tree in the center of the planting pit. Backfill the pit in soil layers and ensure that the tree remains upright. At each stage, the filling must be gently compacted to avoid any open spaces under and around the root system. Before placing the seedling, the planting pit should be filled with the highest quality soil available up to half of the pit depth. The finest soil should be used to fill the hole directly around the seedling. If fine soil cannot be provided in the worksite it must be provided from other locations. Finally, the lower quality soil is used to fill the upper part of the pit. The level of the root collar must be checked, so that after planting the root collar should be a few cm higher than the level of the surrounding terrain. This is to avoid the root collar sinking with natural soil settling. During planting, it is best to irrigate the open pit to minimize the formation of air pockets. Irrigation must evenly saturate soil volume throughout the planting pit. The expected survival rate of seedlings in Zone 2 is expected to be around 70%, two years after planting. It is advisable the completion of the aftercare works at least for a period of 2 years after planting. Monitoring of the planted area in June and September will be carried out.

Z.2.11. Operation and maintenance

Removal of competing vegetation prior to planting is advisable. The area around planted seedlings should be kept clear of weeds and competitors. After planting, aftercare works including hoeing, fertilizing and watering for a period at least 2 years is suggested.

Replacement of dead trees will also be operated. In the zone 2, it is estimated that 30% of the planted trees would have to be replaced.

Z.2.12. Recapitulation

Z.2.12.1. Gabion check dams

In the Zone 2, two check dams with gabions will be built (cf. Z.2.5. Design specifications). It will include the following operations and material:

Nr	Operations	Unit	Quantity
1	Excavation of the foundation with a 0.25 m^3 wheeled excavator with self-unloading	m^3	4
2/1a	Digging soil by hand	m^3	2.5
3	Galvanized wire mesh	m^2	23
4	Preparation of gabion with galvanized wire mesh 1 x 1 x 1 m	m^3	16.1
5	Filling with soil behind the walls	m^3	3.5
6	Estimated volume of stones	m^3	16.1

Table 8 - Zone 2: Operations and material for construction of gabion check dams

Z.2.12.2. Brushwood check dams

In the zone 2,10 double brushwood check dams will be built, with an average length of 4 meters per side, on both sides is 8 meters. It will include the following operations and material:

Nr	Operations	Unit	Quantity
1	Poles production (2 m long & 8-12 cm thick) from hardwoods	pcs	60
2	Rod production (1.5-2 m long and transportation to the collection site till 100 m distance from hardwoods)	pcs	1,200
3	Making poles tips with diameter 8-12 cm	pcs	200
4	Pit openings 8-12 cm wide and 80 cm deep with a pickaxe for poles driving	pcs	60
5	Making brackets in the nails for the placement of bands	pcs	200
6	Nailing of bands to poles	pcs	120
7	Fencing with rods	m^2	8
8	Estimated volume of timber for poles production	m3	1.1

Table 9 - Zone 2: Operations and material for construction of double brushwood check dams

Z.2.12.3. Planting

Nr	Working process	Area/Pieces
A.1	Area cleaning	0.23 ha
A.2	Pits opening	575 pcs
A.3	Seedling holding and transport into the planting site	575 pcs
A.4	Seedling planting	575 pcs
A.5	Seedling transport from nursery to site	575 pcs
A.6	Seedling purchase	
A.6.1	*Gleditsia triacanthos*	80% x 575 pcs = 460 pcs
A.6.2	*Pyrus amygdaliformis*	10% x 575 pcs = 58 pcs
A.6.3	*Crataegus monogyna*	10% x 575 pcs = 58 pcs

Table 10 - Zone 2: Recapitulation of planting working processes and material

Z.2.12.4. Dead tree replacement (30%)

Name of activity	Unit	Quantity
Reopening pits with sizes 60 x 60 x 60 cm and below	Pieces	173
Transport of 1-2-year-old conifer seedlings by hand at a distance of 200-500 m	Pieces	173
Planting seedlings in bags, holes 40x40x40 cm	Pieces	173
Purchase of seedlings	Pieces	173
Car transport of seedlings	Pieces	173

Table 11 - Zone 2: Dead tree replacement

Z.2.12.5. Aftercare works (2 years after planting)

Name of activity	Unit	Quantity
Hoeing seedlings in pits less than 50x50x50 cm with a radius of 0.3 m,	Pieces	1150
Spraying chemical fertilizer around the seedling	Pieces	1150
Irrigation of seedlings in forests with 30 l of water at a distance of up to 100 m	Pieces	1150
Pruning of seedlings	Pieces	1150
Cure of seedlings wounds	Pieces	1150
Weeds cleaning	Pieces	1150

Table 12 - Zone 2: Aftercare works

Zone 3

Z.3.1. Location and description of current conditions

- Coordinates of the central point: UTM 34 0429372E; 4549360N; Area: 0.12 ha
- Slope: max. 35%, facing North, Elevation 313m above sea level.
- Plot ownership: 100% Elbasan Municipality

Current conditions: Land surface occupied mainly by herbaceous plants, with a large presence of ferns. This surface was dominated by *Juniperus* species. Land suitable for afforestation, sufficient presence of quality soil.

Z.3.2. Objectives

- Reducing the level of erosion
- Increasing biodiversity
- Reducing pollution (carbon sequestration)
- Creation of the forest for recreation
- Non-wood forest products
- Increasing the wildlife habitat

Z.3.3. FLR Measures

Planting of Zone 3 with relevant species using pits with dimensions 40 x 40 x 40 cm and a planting density of 2500 trees per hectare.

Z.3.4. Expected benefits

Afforestation of this zone is expected to reduce the soil erosion up to 80%. It will have an impact on the soil water holding capacity and nutrients enrichment as well as air cleaning and

CO_2 sequestration. The opportunity for economic and social benefits derived from firewood and non-wood forest products where on average at least 3 families will benefit from this activity. In terms of aesthetics, the forested area will have a noticeable improvement and can also serve as a recreation area.

Z.3.5. Planting

For the Zone 3 the following species are recommended for planting:

1. Quercus pubescens 50%
2. Coryllus avellana 20%
3. Pyrus amygdaliformis 20%
4. Punica granatum 10%

The alternative species considered for Zone 3 are:

- Tree species: *Pinus pinaster*, *Carpinus orientalis*, *Fraxinus ornus*.
- Shrubs: *Crataegus monogyna; Buxus sempervirens.*

Total number of seedlings: 0.15 ha x 2500 seedlings/ha = 375 pcs.

Z.3.6. Transport and manipulation of seedlings

Handling, loading and transporting trees from nursery to planting site, unloading trees and their storage must be carried out without causing any damage. Trees with a plastic bag or container should ideally be handled by the container and the seedling stem should not be damaged. Seedlings should be protected from direct sun, wind, frost, drying out and mechanical damage.

In particular, they must be protected from drying, overheating or frost during transport. Stored seedlings must be watered sufficiently (depending on the weather and cover material used) and protected from damage by wild animals (depending on the site). Seedlings grown in containers or plastic bags must be temporarily stored or planted within a maximum of 48 hours after transport.

Z.3.7. Planting technique

The available area should be properly prepared before planting. On most sites, preparation mainly involves the following: (i) removal of persistent weeds, including the parts capable of regeneration, and (ii) removal of undesirable materials. Removal of competing vegetation before planting is advisable. Planting of the seedlings will be with individual pits. The diameter of the planting pit must be at least 1.5 times larger than the width of the root system of a bare-rooted tree or the diameter of the bottom of a container or plastic bag. The bottom of the planting pit must be loosened. A regular planting scheme with a distance of 2 x 2 meters is suggested. Two-year-old seedlings in plastic bags or containers should be used. If the root and especially tap root is too long, it should be reduced to 25-30 cm (according to the planting hole depth) using a sharp tool. During planting, it is recommended to place the tree in the center of the planting pit. Backfill the pit in soil layers and ensure that the tree remains upright. At each stage, the filling must be gently compacted to avoid any open spaces under and around the root system. Before placing the seedling, the planting pit should be filled with the highest quality soil available up to half of the pit depth. The finest soil should be used to fill the hole directly around the seedling. Finally, the lower quality soil is used to fill the upper part of the pit. The level of the root collar must be checked, so that after planting the root collar should be a few cm higher than the level of the surrounding terrain. This is to avoid the root collar sinking with natural soil settling. During planting, it is best to irrigate the open pit to minimize the formation of air pockets. Irrigation must evenly saturate soil volume throughout the planting pit. The expected survival rate of seedlings in Zone 3 is expected to be around 80%, two years after planting it is advisable the completion of the aftercare works at least for a period of 2 years after planting.

Z.3.10. Operation and maintenance

Removal of competing vegetation prior to planting is advisable. The area around planted seedlings should be kept clear of weeds and competitors. After planting, aftercare works including hoeing, fertilizing and watering for a period at least 2 years is suggested.

Replacement of dead trees will also be operated. In the zone 3, it is estimated that 30% of the planted trees would have to be replaced.

Z.3.11. Recapitulation

Z.3.11.1. Planting

Nr	Working process	Area/Pieces
A.1	Area cleaning	1,500 m2
A.2	Pits opening	375 pcs
A.3	Seedling holding and transport into the planting site	375 pcs
A.4	Seedling planting	375 pcs
A.5	Seedling transport from nursery to site	375 pcs
A.6	Seedling purchase	
A.6.1	*Quercus pubescens*	50% x 375 pcs = 187 pcs
A.6.2	*Coryllus avellana*	20% x 375 pcs = 75 pcs
A.6.3	*Pyrus amygdaliformis*	20% x 375 pcs = 75pcs
A.6.4	Punica granatum	10% x 375 pcs = 38 pcs

Table 13 - Zone 3: Recapitulation of planting working processes and material

Z.3.11.2. Dead tree replacement (20%)

Name of activity	Unit	Quantity
Reopening pits with sizes 60 x 60 x 60 cm and below	Pieces	75
Transport of 1-2-year-old conifer seedlings by hand at a distance of 200-500 m	Pieces	75
Planting seedlings in bags, holes 40x40x40 cm	Pieces	75
Purchase of seedlings	Pieces	75
Car transport of seedlings	Pieces	75

Table 14 - Zone 3: Dead tree replacement

Z.3.11.3. Aftercare works (2 years after planting)

Name of activity	Unit	Quantity
Hoeing seedlings in pits less than 50x50x50 cm with a radius of 0.3 m	Pieces	750
Spraying chemical fertilizer around the seedling	Pieces	750
Irrigation of seedlings in forests with 30 l of water at a distance of up to 100 m	Pieces	750
Pruning of seedlings	Pieces	750
Cure of seedlings wounds	Pieces	750
Weeds cleaning	Pieces	750

Table 15 - Zone 3: Aftercare works

Zone 4

Z.4.1. Location and description of current conditions

- Coordinates of the central point: 34 UTM 0429471E; 4549908N, Area: 0.30 ha
- Slope: max. 75%, facing North, Elevation 330 m above sea level
- Plot ownership: 100% Municipality of Elbasan.

Current conditions: Skeletal terrain, with presence of stones on the ground, very poor soil, affected by erosion on the surface. Most of the surface is bare of vegetation. There were rarely bushes of *Juniperus oxycedrus*, *Carpinu sorientalis*, *Rubus idaeus* and the type of fern, which at the same time indicates the presence of water in that area.

Z.4.2. Objectives

- Reducing the level of erosion
- Protection of water pipeline from which the village is supplied
- Protection of the pedestrian path used by local people
- Increasing biodiversity through artificial planting
- Reducing stone removing and superficial water
- Increasing wildlife habitat

Z.4.3. FLR Measures

In zone 4 is proposed a combination of soil erosion controlling measures using vegetative barriers (brushwood check dams) and afforestation of bare lands with suitable species. In total will be constructed 8 (eight) double brushwood check dams using locally sourced timber from other forest parcels within the management unit. Planting of suitable species will be in an irregular way due to the specifications of the site conditions.

Z.4.4. Expected benefits

The expected benefits from FLR measures in zone 4 will be:

- in situ soil conservation
- more percolation of surface water into the ground resulting in recharge of ground water
- reducing the siltation of water harvesting structures downstream
- additional benefits of fuel wood, fodder, water quality and quantity, CO2 sequestration etc.
- ensuring tourism and recreation benefits in the coming years.

Z.4.5. Design specifications

In total, eight brushwood check dams will be established in zone 4. The design specification of such barriers should include:

- The sides of the gully are cut to a slope of 1:1
- The size of poles is 1.5 to 2 meters in length and 8 to 12 centimeters in diameter
- Any tree or shrub species can be used; however, sprouting poles from Salix, simali (vitex), and poplar are most preferred.
- A trench of about 15 cm deep is made across the gully, and the wooden poles are driven to a depth of about 1/3 to ½ of the pole length, and at a spacing of about half a meter
- The tops of the poles in the middle are made lower than the sides to form a notch of the required size to accommodate the maximum runoff
- The flexible branches of trees (Salix, poplar, vitex, etc.) and shrubs are woven between wooden poles driven into the ground till a dam of the required height is obtained
- The ends of inter-linked materials should enter at least 30 cm into the sides of the gully
- Brushwood check dams are constructed when the soil in the gully is saturated or during the early rainy season
- The brush used preferably should have been left on
- If non-sprouting species (pine, Alnus, Carpinusas poles,) are used, brushwood check dams can be constructed during any season.

- The back of the brushwood check dams must be filled up with soil
- A brushwood apron of about 1.5 times the height of the check dam is necessary to protect the channel from scouring.

Z.4.6. Layout, physical output, and surveying procedures

Individual brushwood check dams will be constructed perpendicular to rill channels and the distance between brushwood check dams depends on slope and length of the soil eroded channels. For that reason, length and slope of the field should be measured.

- Horizontal (surface) distance between the barriers = $\frac{Lengthofthefield\ (m)}{Slope\ (\%)}$
- Number of barriers = $\frac{Lengthofslopingfield\ (m)}{Distancebetweentwobarriers(m)}$

The main specifications of the brushwood check dam are summarized in table below:

Nr	Brushwood double poles check dams' characteristics	Value
1	Poles length (m)	1.5-2.0
2	Poles diameter (cm)	8.0-12.0
3	Driven depth to soil	1/3-1/2 length
4	Spacing between poles (m)	0.5
5	Branches number	apart 10-15 cm
6	Species proposed	*Carpinus; Alnus; Pine*
7	Number of brush check dams	~8

Table 16 - Zone 4: Brushwood double poles check dams' characteristics

In case of afforestation planting design will be irregular only on these parts where the topsoil layer is rich. Planting of the trees will be with pits if slope is less than 20% and squares if slope is higher than 20% with dimensions 60cm x 60cm x 60cm. Pits will be open in the middle of the squares with the dimensions 40cm x 40 cm x 40 cm closer to the upper side of slope cut at irregular distances.

Z.4.7. Construction procedure

Construction procedure for the brushwood check dams includes the following steps:

- A trench of about 15 cm deep is made across the gully, and the wooden poles are driven to a depth of about 1/3 to ½ of the pole length, and at a spacing of about half a meter.
- The tops of the poles in the middle are made lower than the sides to form a notch of the required size to accommodate the maximum runoff.
- The flexible branches of trees (*Salix, Poplar, Vitex*, etc.) and shrubs are woven between wooden poles driven into the ground till a dam of the required height is obtained
- The ends of inter-linked materials should enter at least 30 cm into the sides of the gully
- Brushwood check dams are constructed when the soil in the gully is saturated or during the early rainy season
- The brush used preferably should have been left on
- If non-sprouting species (pine, Alnus, Carpinusas poles,) are used, brushwood check dams can be constructed during any season.
- The back of the brushwood check dams must be filled up with soil
- A brushwood apron of about 1.5 times the height of the check dam is necessary to protect the channel from scouring.

Z.4.8. Planting

For the Zone 4, the following species are recommended for planting:

1. *Quercus pubescens* 50%
2. *Pinus halepensis* 40%
3. *Punica granatum* 10%

Note: Since the terrain is very steep and not suitable for afforestation, due to the lack of quality soil, it is mandatory to plant seedlings in squares, based on that the number of trees that can be potentially planted is 1250 pcs/ha (approximately 4x4 meters).

The alternative species considered for Zone 4 are:

- Tree species: *Carpinus betulus*, *Fraxinus ornus*, *Coryllus avellana*, *Pyrus amygdaliformis*.
- Shrubs: *Crataegus monogyna*, *Rubus ideaues, Buxus sempervirens*.

Total number of seedlings: 0.30 ha x 1250 seedlings/ha = 375 pcs.

Z.4.9. Transport and manipulation of seedlings

Handling, loading and transporting trees from nursery to planting site, unloading trees and their storage must be carried out without causing any damage. Trees with a plastic bag or container should ideally be handled by the container and the seedling stem should not be damaged. Seedlings should be protected from direct sun, wind, frost, drying out and mechanical damage.

In particular, they must be protected from drying, overheating or frost during transport. Stored seedlings must be watered sufficiently (depending on the weather and cover material used) and protected from damage by wild animals (depending on the site). Seedlings grown in containers or plastic bags must be temporarily stored or planted within a maximum of 48 hours after transport.

Z.4.10. Planting technique

The available area should be properly prepared before planting. On most sites, preparation mainly involves the following: (i) removal of persistent weeds, including the parts capable of regeneration, and (ii) removal of undesirable materials. Removal of competing vegetation before planting is advisable. Planting of the seedlings will be with individual pits. The diameter of the planting pit must be at least 1.5 times larger than the width of the root system of a bare-rooted tree or the diameter of the bottom of a container or plastic bag. The bottom of the planting pit must be loosened. A regular planting scheme with a distance of 2 x 2 meters is not possible to suggested. Two-year-old seedlings in plastic bags or containers should be used. If the root and especially tap root is too long, it should be reduced to 25-30 cm (according to the planting hole depth) using a sharp tool. During planting, it is recommended to place the tree in the center of the planting pit. Backfill the pit in soil layers and ensure that the tree remains upright. At each stage, the filling must be gently compacted to avoid any open spaces under and around the root system. Before placing the seedling, the planting pit should be filled with the highest quality soil available up to half of the pit depth. The finest soil should be used to fill the hole directly around the seedling. Finally, the lower quality soil is used to fill the upper part of the pit. The level of the root collar must be checked, so that after planting the root collar should be a few cm higher than the level of the surrounding terrain. This is to avoid the root collar sinking with natural soil settling. During planting, it is best to irrigate the open pit to minimize the formation of air pockets. Irrigation must evenly saturate soil volume throughout the planting pit. The expected survival rate of seedlings in Zone 4 is expected to be around 70%, two years after planting, it is advisable the completion of the aftercare works at least for a period of 2 years after planting. Monitoring of the planted area in June and September will be carried out.

Z.4.10. Operation and maintenance

Removal of competing vegetation prior to planting is advisable. The area around planted seedlings should be kept clear of weeds and competitors. After planting, aftercare works including hoeing, fertilizing and watering for a period at least 2 years is suggested.

Replacement of dead trees will also be operated. In the zone 4, it is estimated that 30% of the planted trees would have to be replaced.

Z.4.11. Recapitulation

Z.4.11.1. Brushwood check dams

In the Zone 4, 8 double brushwood check dams will be built, with an average length of 3 meters per side, on both sides is 6 meters. It will include the following operations and material:

Nr	Operations	Unit	Quantity
1	Poles production (2 m long & 8-12 cm thick) from hardwoods	pcs	60
2	Rod production (1.5-2 m long and transportation to the collection site till 100 m distance from hardwoods)	pcs	1200
3	Making poles tips with diameter 8-12 cm	pcs	200
4	Pit openings 8-12 cm wide and 80 cm deep with a pickaxe for poles driving	pcs	60
5	Making brackets in the nails for the placement of bands	pcs	200
6	Nailing of bands to poles	pcs	120
7	Fencing with rods	m^2	8
8	Estimated volume of timber for poles production	m^3	1.1

Table 17 - Zone 4: Operations and material for construction of double brushwood check dams

Z.4.11.2. Planting

Nr	Working process	Area/Pieces
A.1	Pits opening	375 pcs
A.2	Seedling holding and transport into the planting site	375 pcs
A.3	Seedling planting	375 pcs
A.4	Seedling transport from nursery to site	375 pcs
A.5	Seedling purchase	
A.5.1	*Quercus pubescens*	50% x 375 pcs =187 pcs
A.5.2	*Pinus halepensis*	40% x 375 pcs = 150 pcs
A.5.3	*Punica granatum*	10% x 375 pcs = 37 pcs

Table 18 - Zone 4: Recapitulation of planting working processes and material

Z.4.11.3. Dead tree replacement (30%)

Name of activity	Unit	Quantity
Reopening pits with sizes 60 x 60 x 60 cm and below	Pieces	113
Transport of 1-2-year-old conifer seedlings by hand at a distance of 200-500 m	Pieces	113
Planting seedlings in bags, holes 40x40x40 cm	Pieces	113
Purchase of seedlings	Pieces	113
Car transport of seedlings	Pieces	113

Table 19 - Zone 4: Dead tree replacement

Z.4.11.4. Aftercare works (2 years after planting)

Name of activity	Unit	Quantity
Hoeing seedlings in pits less than 50x50x50 cm with a radius of 0.3 m,	Pieces	1,500
Spraying chemical fertilizer around the seedling	Pieces	1,500
Irrigation of seedlings in forests with 30 l of water at a distance of up to 100 m	Pieces	1,500
Pruning of seedlings	Pieces	1,500
Cure of seedlings wounds	Pieces	1,500
Weeds cleaning	Pieces	1,500

Table 20 - Zone 4: Aftercare works

Zone 5

Z.5.1. Location and description of current conditions

- Coordinates of the central point: UTM 34 0428824E; 4549590N E, Area: 0.24 ha
- Slope: max. 50%, facing West, Elevation 264 m above sea level.
- Plot ownership: 100% Elbasan Municipality.

Current conditions: This area is located in the middle of the Shushicë village close to the main road and Korodushku stream. The terrain is quite steep and very unstable. There are pronounced signs of rill and gully erosion. In some parts of the plot there are individuals of tree species such as: *Pyrus amygdaliformes*, *Cercis siliquastrum*, *Quercus pubescens*, *Carpinus orientalis* etc. Very rarely any bushes of the red melon and blackberry, with the presence of herbaceous plants of the *Cistus salvifolius* and fern species.

Z.5.2. Objectives

- Reducing the level of soil erosion
- Protection of water pipeline from which the village is supplied
- Protection of the pedestrian path used by local people
- Increasing biodiversity through artificial planting
- Reducing stone removing and superficial water.
- Provide valuable wildlife habitat

Z.5.3. FLR Measures

The main interventions proposed for zones 5 are:

- three gabion check dams
- eight double brushwood check dams
- afforestation of area with irregular planting scheme

Z.5.4. Expected benefits

Combination of bioengineering interventions (check dams and afforestation) will provide many benefits for zone 5 and community:

- in situ soil conservation (decrease of soil erosion up 60%)
- more percolation of surface water into the ground resulting in recharge of ground water
- reducing the siltation of water harvesting structures downstream
- additional benefits of fuel wood, fodder, water quality and quantity, CO_2 sequestration, etc.
- ensuring tourism and recreation benefits in the coming years.
- economic and ecological benefits for at least 4 families leaving around zone 5

Z.5.5. Design specifications

Z.5.5.1. Design specifications for brushwood check dams

The design specifications of brushwood check dams for the Zone 5 are presented in table below:

Nr	**Brushwood double poles check dams' characteristics**	**Values**
1	Poles length (m)	1.5-2.0
2	Poles diameter (cm)	8.0-12
3	Driven depth to soil	1/3-1/2 length
4	Spacing between poles (m)	0.5
5	Branches number	apart 10-15 cm
6	Species proposed	*Carpinus; Alnus; Pine; Salix*
7	Number of brush check dams	~8

Table 21 - Zone 5: Design specifications of double brushwood check dams

Z.5.5.2. Design specification for gabion check dam

The gabion check dam will have a length about 9 m and height 3 m. If the total height (effective height plus foundation depth) of the gabion check dam is three m or less and if the box gabions used are 1 x 1 x 2 m, or 0.85 x 0.85 x 2 m, or 0.75 x 1.5 x 3 m, it is not necessary to compute the dimensions of the dam (thickness of. crest and base) according to hydrostatic principles or empirical formulas. This is because the above-mentioned box gabions stabilize the dams against overturning, collapsing, sliding and breaking. The depth of the foundation is equal to one-half of the effective height of the dam, which means that the foundation depth is one-third of the dam's total height (1 m in this case). The foundation is longer than the spillway. After digging the foundation, a layer of box gabions is placed vertically. The vertical sides of the box gabions are tied with binding wire of the same diameter. When a gabion check dam has three layers and is no higher than three meters, place a "binding box gabion" in the middle or top layer. The space behind the dam and wing walls should be filled with soil excavated for the foundation and from the gully bed. Wings should enter at least 50 cm into each side of the gully and they should be protected against flash water by wing walls. The angle between the wing and wing wall is 0 to 45 degrees. The height of a wing wall is equal to the depth of the spillway. Box gabions used for check dams can be assembled using ready wire meshes. Box gabions can be prepared directly by netting galvanized wires (diameter three to four mm or eight to 10 gauge). If No. eight gauge (four mm) is used, the size of the mesh should be 15 by 15 cm. If No. 10 (three mm) is used, the mesh should be 10 by 10 cm in size.

Z.5.6. Layout, physical output, and surveying procedures

Gabion check dam will form a flexible obstacle used to slow down the water flow and water speed of Korodushku stream. This gabion check dam will be placed transversal with the stream. Galvanized steel wire of 2.5 mm diameter is the most commonly used material used to build gabions. Gabions basket standard size is 1.0 m x 1.0 m x 1.0 m. Each basket is filled by stones with upper boundary porosity value of 30% and the construction will be commonly by hand.

If the total height of the gabion check dams is three to five m, the thicknesses of crest and base are calculated by the following formulas: k = 0.4 H and, d = 0.6 H, where:

- k: thickness of the dam's crest at spillway level
- d: thickness of the dam's base
- H: total height of the dam including foundation.

These formulas provide stability against overturning, collapsing, sliding and breaking.

In total, eight double poles check dams will be constructed perpendicular with eroded channels within zone 5. The number and the distance of the brushwood check dams depends on the slope and length of eroded channels. After the length and slope is measured then distance between barriers is estimated using the following equation:

- Horizontal (surface) distance between the barriers = $\frac{Lengthofthefield\ (m)}{Slope\ (\%)}$
- The total number of barriers is estimated by means of the formula: $\frac{Lengthofslopingfield\ (m)}{Distancebetweentwobarriers(m)}$

Z.5.7. Construction procedure

Z.5.7.1. Brushwood check dams

Construction procedure for the brushwood check dams includes the following steps:

- A trench of about 15 cm deep is made across the gully, and the wooden poles are driven to a depth of about 1/3 to ½ of the pole length, and at a spacing of about half a meter.
- The tops of the poles in the middle are made lower than the sides to form a notch of the required size to accommodate the maximum runoff.
- The flexible branches of trees (Salix, Poplar, Vitex, etc.) and shrubs are woven between wooden poles driven into the ground till a dam of the required height is obtained
- The ends of inter-linked materials should enter at least 30 cm into the sides of the gully
- Brushwood check dams are constructed when the soil in the gully is saturated or during the early rainy season
- The brush used preferably should have been left on
- If non-sprouting species (Pine, Alnus, Carpinus as poles,) are used, brushwood check dams can be constructed during any season.
- The back of the brushwood check dams must be filled up with soil
- A brushwood apron of about 1.5 times the height of the check dam is necessary to protect the channel from scouring.

Z.5.7.2. Gabion check dams

The construction work will include the involvement of local communities, organization of the worksite and maintenance planning. Stones will be collected and piled up by farmers. The gabion basket will be purchased or prepared in the worksite from qualified workers and the average cost per square meter is estimated based on the frontal vertical area and estimated to 16.3 Euro/m^3. The depth of the foundation is equal to one-half of the effective height of the dam, which means that the foundation depth is one-third of the dam's total height. The

foundation is longer than the spillway. After digging the foundation, a layer of box gabions are placed vertically. Galvanized wire mesh of 2.5 mm diameter is the most commonly used material used to build gabions. Gabions basket with size 1.0 m x 1.0 m x 1.0 m is filled by stones with upper boundary porosity value of 30% and the construction will be commonly by hand. The vertical sides of the box gabions are tied with binding wire of the same diameter.

The space behind the dam and wing walls should be filled with soil excavated for the foundation and from the gully bed. Wings should enter at least 50 cm into each side of the gully and they should be protected against flash water by wing walls. The angle between the wing and wing wall is 0 to 45 degrees. The height of a wing wall is equal to the depth of the spillway.

Z.5.8. Planting

For the Zone 5 the following species are recommended for planting:

- *Punica granatum* 50%
- *Pyrus amygdaliformis* 40%
- *Quercus pubescens* 10%

The alternative species considered for Zone 5 are:

- Tree species: *Carpinus betulus*, *Fraxinus ornus*, *Coryllus avellana*,
- Shrubs: *Crataegus monogyna*, *Rubus idaeus*, *Sambucus* spp.

Total number of seedlings: 0.24 ha x 1250 seedlings/ha = 300 pcs.

Z.5.9. Transport and manipulation of seedlings

Handling, loading and transporting trees from nursery to planting site, unloading trees and their storage must be carried out without causing any damage. Trees with a plastic bag or container should ideally be handled by the container and the seedling stem should not be damaged. Seedlings should be protected from direct sun, wind, frost, drying out and mechanical damage.

In particular, they must be protected from drying, overheating or frost during transport. Stored seedlings must be watered sufficiently (depending on the weather and cover material used) and protected from damage by wild animals (depending on the site). Seedlings grown in containers or plastic bags must be temporarily stored or planted within a maximum of 48 hours after transport.

Z.5.9. Planting technique

The available area should be properly prepared before planting. On most sites, preparation mainly involves the following: (i) removal of persistent weeds, including the parts capable of regeneration, and (ii) removal of undesirable materials. Removal of competing vegetation before planting is advisable. Planting of the seedlings will be with individual pits. The diameter of the planting pit must be at least 1.5 times larger than the width of the root system of a bare-rooted tree or the diameter of the bottom of a container or plastic bag. The bottom of the planting pit must be loosened. A regular planting scheme with a distance of 2 x 2 meters is not possible. Two-year-old seedlings in plastic bags or containers should be used. If the root and especially tap root is too long, it should be reduced to 25-30 cm (according to the planting hole depth) using a sharp tool. During planting, it is recommended to place the tree in the center of the planting pit. Backfill the pit in soil layers and ensure that the tree remains upright. At each stage, the filling must be gently compacted to avoid any open spaces under and around the root system. Before placing the seedling, the planting pit should be filled with the highest quality soil available up to half of the pit depth. The finest soil should be used to fill the hole directly around the seedling. Finally, the lower quality soil is used to fill the upper part of the pit. The level of the root collar must be checked, so that after planting the root collar should be a few cm higher than the level of the surrounding terrain. This is to avoid the root collar

sinking with natural soil settling. During planting, it is best to irrigate the open pit to minimize the formation of air pockets. Irrigation must evenly saturate soil volume throughout the planting pit. The expected survival rate of seedlings in Zone 5 is expected to be around 70%, two years after planting. It is advisable the completion of the aftercare works at least for a period of 2 years after planting.

Z.5.10. Operation and maintenance

Removal of competing vegetation prior to planting is advisable. The area around planted seedlings should be kept clear of weeds and competitors. After planting, aftercare works including hoeing, fertilizing and watering for a period at least 2 years is suggested.

Replacement of dead trees will also be operated. In the zone 5, it is estimated that 30% of the planted trees would have to be replaced.

Z.5.11. Recapitulation

Z.5.11.1. Gabion check dams

In the zone 5, three gabion check dams will be built (cf. Z.5.5.2. Design consideration for gabion check dam). It will include the following operations and material:

Nr	Operations	Unit	Quantity
1	Excavation of the foundation with a 0.25 m^3 wheeled excavator with self-unloading	m^3	4
2/1a	Soil dug by hand	m^3	2.5
3	Galvanized wire mesh	m^2	23
4	Preparation of gabion with galvanized wire mesh 1 x 1 x 1 m	m^3	16.1
5	Filling with soil behind the walls	m^3	3.5
6	Estimated volume of stones	m^3	16.1

Table 22 - Zone 5: Operations and material for construction of gabion check dams

Z.5.11.2. Brushwood check dams

In the zone 5, 8 double brushwood check dams will be built, with an average length of 3 meters per side, on both sides is 6 meters. It will include the following operations and material:

Nr	Operations	Unit	Quantity
1	Poles production (2 m long & 8-12 cm thick) from hardwoods	pcs	16
2	Rod production (1.5-2 m long and transportation to the collection site till 100 m distance from hardwoods)	pcs	240
3	Making poles tips with diameter 8-12 cm	pcs	16
4	Pit openings 8-12 cm wide and 80 cm deep with a pickaxe for poles driving	pcs	16
5	Making brackets in the nails for the placement of bands	pcs	16
6	Nailing of bands to poles	pcs	480
7	Fencing with rods	m^2	6
8	Estimated volume of timber for poles production	m^3	1.1

Table 23 - Zone 5: Operations and material for construction of double brushwood check dams

Z.5.11.3. Planting

Nr	Working process	Pieces
A.1	Pits opening	300 pcs
A.2	Seedling holding and transport into the planting site	300 pcs
A.3	Seedling planting	300 pcs
A.4	Seedling transport from nursery to site	300 pcs
A.5	Seedling purchase	
A.5.1	*Punica granatum*	50% x 300 pcs = 150 pcs
A.5.2	*Pyrus amygdaliformis*	40% x 300 pcs = 120 pcs;
A.5.3	*Quercus pubescens*	10% x 300 pcs = 30 pcs;

Table 24 - Zone 5: Recapitulation of planting working processes and material

Z.5.11.4. Dead tree replacement (30%)

Name of activity	Unit	Quantity
Reopening pits with sizes 60 x 60 x 60 cm and below	Pieces	90
Transport of 1-2-year-old conifer seedlings by hand at a distance of 200-500 m	Pieces	90
Planting seedlings in bags, holes 40x40x40 cm	Pieces	90
Purchase of seedlings	Pieces	90
Car transport of seedlings	Pieces	90

Table 25 - Zone 5: Dead tree replacement

Z.5.11.4. Aftercare works (2 years after planting)

Name of activity	Unit	Quantity
Hoeing seedlings in pits less than 50x50x50 cm with a radius of 0.3 m,	Pieces	600
Spraying chemical fertilizer around the seedling	Pieces	600
Irrigation of seedlings in forests with 30 l of water at a distance of up to 100 m	Pieces	600
Pruning of seedlings	Pieces	600
Cure of seedlings wounds	Pieces	600
Weeds cleaning	Pieces	600

Table 26 - Zone 5: Aftercare works

Zone 6

Z.6.1. Location and description of current conditions

- Coordinates of the central point: UTM 34 0429261E; 4549100N, Area: 2.34 ha
- Slope: max. 56%, facing Southwest, Elevation 385 m above sea level.
- Plot ownership: 100% Elbasan municipality.

Current conditions: This area is located in the upper part of the Shushicë village near the main road. The terrain is quite steep and very unstable, is quite bare, with pronounced signs of deep erosion. Within the surface where the works will be carried out, there are numerous channels induced by water erosion. Brown soil in some places is suitable for afforestation. In some parts of the plot there are individuals of tree species such as: *Pyrus amygdaliformis*, *Cercis siliquastrum*, *Quercus pubescens*, *Carpinus orientalis* etc. Very rarely any bushes of the *Juniperus* and Rubus, with the presence of herbaceous plants of the mint flowers. Near this area there are several houses which are at risk from soil erosion. Grazing is the main problem of this area, all the trees that are present in this area have been damaged by grazing. Several water pipes pass through the eroded area. There is a stream with water for irrigation but during the summer it is dried up.

Z.6.2. Objectives

- Reducing the level of erosion
- Protection of water pipeline from which the village is supplied
- Protection of the pedestrian path used by local people
- Increasing biodiversity through artificial planting
- Reducing stone removal and water flow on the ground.
- Provide valuable wildlife habitat

Z.6.3. FLR Measures

The main interventions proposed in the zone 6 are:

- brushwood check dams
- afforestation
- barriers with stones
- grass vegetative filter strip

Z.6.4. Expected benefits

With the afforestation of this zone, the possibility of e soil erosion will decrease by 75%, which would lead to deeper erosion as well. A very important benefit element is the protection of the houses and main road, which are at risk of soil erosion and the collapse of rocks. It will have an impact on the purification of water and air in the surrounding area. The opportunity for economic and social benefits from the collection of fruits and non-wood forest products, where an average of 4 families will benefit from this activity. Given the fact that this surface is near the main road, after covering this surface with forest species, a very beautiful landscape will be created for the residents and visitors of the area. There are beehives in the houses around this area, and the benefits will also be for the beekeepers.

Z.6.5. Design specifications

Z.6.5.1. Brushwood double poles check dams

The design specifications of brushwood check dams for the Zone 6 are presented in table below:

Nr	Brushwood double poles check dams' characteristics	Values
1	Poles length (m)	1.5-2.0
2	Poles diameter (cm)	8.0-12
3	Driven depth to soil	1/3-1/2 length
4	Spacing between poles (m)	0.5
5	Branches number	apart 10-15 cm
6	Species proposed	*Carpinus; Oak*
7	Number of brush check dams	~25

Table 27 - Zone 6: Design specifications of brushwood double poles check dams

The wood required for the construction of brushwood check dams will be provided from forest parcels around zone 6 within the management unit with permission of the forest staff of Elbasan municipality. If this is not possible then timber should be provided from the market and the purchase cost should be considered in the cost estimation.

Z.6.5.2. Grass filter strips/grass barriers

The vegetative barriers will be used in gentle slopes ranging from 2-8% within zone 6. Such barriers are considered effective for erosion and sediment control because grass form erect, stiff and uniformly dense hedges, and so resist overland flow. Grass has roots which bind soil and thus prevent riling and scouring near the barrier. The grasses can survive moisture and nutrient stress and re-establish top-growth quickly after rain. Grass species are planted along the contour with 75 cm paired row distance along with 20 × 20 cm plant-to-plant spacing in a 10 cm wide furrow of 20 cm depth in a staggered fashion on a 1 m vertical interval. This corresponds to 50, 25 and 12.5 m horizontal intervals on 2, 4 and 8 % slopes, respectively, on 100 m length slope segments. The excavated soil of the furrow is kept down slope of grass barriers. Water flow is impeded and so silt carried along with it is deposited near the barrier. Sediment deposition and tillage operations progressively cause benching.

Z.6.6. Layout, physical output, and surveying procedures

In total,25 double poles check dams will be constructed perpendicular with eroded channels within zone 6. The number and distance of the brushwood check dams depends on the slope and length of eroded channels. After the length and slope is measured then distance between barriers is estimated using the following equation:

- Horizontal (surface) distance between the barriers = $\frac{Lengthofthefield\ (m)}{Slope\ (\%)}$
- The total number of barriers is estimated by means of this formula: $\frac{Lengthofslopingfield\ (m)}{Distancebetweentwobarriers(m)}$

Z.6.7. Construction procedure

Z.6.7.1. Brushwood check dams

Construction procedure for the brushwood check dams includes the following steps:

- A trench of about 15 cm deep is made across the gully, and the wooden poles are driven to a depth of about 1/3 to ½ of the pole length, and at a spacing of about half a meter.
- The tops of the poles in the middle are made lower than the sides to form a notch of the required size to accommodate the maximum runoff.
- The flexible branches of trees (Salix, poplar, vitex, etc.) and shrubs are woven between wooden poles driven into the ground till a dam of the required height is obtained
- The ends of inter-linked materials should enter at least 30 cm into the sides of the gully
- Brushwood check dams are constructed when the soil in the gully is saturated or during the early rainy season
- The brush used preferably should have been left on
- If non-sprouting species (pine, Alnus, Carpinusas poles,) are used, brushwood check dams can be constructed during any season.
- The back of the brushwood check dams must be filled up with soil
- A brushwood apron of about 1.5 times the height of the check dam is necessary to protect the channel from scouring.

Z.6.7.2. Grass filter strips

- Demarcation of contour line and slopes.
- Identification of 1 m vertical interval, which is 50, 25 and 12.5 m horizontal distance
- on 2, 4 and 8% slopes, respectively, in a 100 m length plot.
- Opening of furrow (10 cm wide and 20 cm deep) along the contour in a paired row
- at a distance of 75 cm, prepared using a country plough or other small agricultural
- implements in the respective horizontal distance.
- Root slips containing 2-3 tillers are planted in furrows in a paired row. For accommodating a paired row of vegetative barriers, planting is performed in a staggered fashion. Planting could be done during the winter 2023 and spring 2024 for all grasses.
- The soil excavated from contour furrows is heaped on the down-slope side to forma bund.
- Watering may be done with the help of a bucket to promote better soil binding with root slips.

Z.6.8. Planting

For the Zone 6, the following species are recommended for planting:

1. *Punica granatum* 30% x 2,925 pcs = 877 pcs
2. *Pyrus amygdaliformis* 30% x 2,925 pcs = 877 pcs
3. *Quercus pubescens* 20% x 2,925 pcs = 585 pcs
4. *Gleditsia triacanthos* 20% x 2,925 pcs = 585 pcs

NOTE: Due to the relatively large surface area, the terrain conditions, the large number of Brushwood check dams that are planned to be built, and the surface partially covered with vegetation, in this area the number of seedlings per hectare that will be planted is planned to be 1,250 seedlings (distance 4X4 meter).

The alternative species considered for Zone 6 are:

- Tree species: *Carpinus betulus*, *Fraxinus ornus*, *Coryllus avellana*.
- Shrubs: *Crataegus monogyna*, *Rubus idaeus, Buxus sempervirens*

Total number of seedlings: 2.34 ha x 1,250 seedlings/ha = 2925 pcs.

For contour grass barriers, the species proposed are:

- *Lolium perennial;*
- *Poa pratensis;*
- *Medicago Sativa;*
- *Festuca pratensis*.

Z.6.9. Transport and manipulation of seedlings

Handling, loading and transporting trees from nursery to planting site, unloading trees and their storage must be carried out without causing any damage. Trees with a plastic bag or container should ideally be handled by the container and the seedling stem should not be damaged. Seedlings should be protected from direct sun, wind, frost, drying out and mechanical damage.

In particular, they must be protected from drying, overheating or frost during transport. Stored seedlings must be watered sufficiently (depending on the weather and cover material used) and protected from damage by wild animals (depending on the site). Seedlings grown in containers or plastic bags must be temporarily stored or planted within a maximum of 48 hours after transport.

Z.6.10. Planting technique

The available area should be properly prepared before planting. On most sites, preparation mainly involves the following: (i) removal of persistent weeds, including the parts capable of regeneration, and (ii) removal of undesirable materials. Removal of competing vegetation before planting is advisable. Planting of the seedlings will be with individual pits. The diameter of the planting pit must be at least 1.5 times larger than the width of the root system of a bare-rooted tree or the diameter of the bottom of a container or plastic bag. The bottom of the planting pit must be loosened. A regular planting scheme with a distance of 2 x 2 meters is not possible suggested. Two-year-old seedlings in plastic bags or containers should be used. If the root and especially tap root is too long, it should be reduced to 25-30 cm (according to the planting hole depth) using a sharp tool. During planting, it is recommended to place the tree in the center of the planting pit. Backfill the pit in soil layers and ensure that the tree remains upright. At each stage, the filling must be gently compacted to avoid any open spaces under and around the root system. Before placing the seedling, the planting pit should be filled with the highest quality soil available up to half of the pit depth. The finest soil should be used to fill the hole directly around the seedling. Finally, the lower quality soil is used to fill the upper part of the pit. The level of the root collar must be checked, so that after planting the root collar should be a few cm higher than the level of the surrounding terrain. This is to avoid the root collar sinking with natural soil settling. During planting, it is best to irrigate the open pit to minimize the formation of air pockets. Irrigation must evenly saturate soil volume throughout the planting pit. The expected survival rate of seedlings in Zone 6 is expected to be around 80%, two years after planting. It is advisable the completion of the aftercare works at least for a period of 2 years after planting.

Z.6.11. Operation and maintenance

Removal of competing vegetation prior to planting is advisable. The area around planted seedlings should be kept clear of weeds and competitors. After planting, aftercare works including hoeing, fertilizing and watering for a period at least 2 years is suggested.

Replacement of dead trees will also be operated. In the zone 5, it is estimated that 20% of the planted trees would have to be replaced.

Z.6.10.1. Grass strips

In this area, in slopes with inclination less than 10% it is recommended to apply seeding for establishing grass strips. Planting with grass is planned to be carried out in 3 rows above the houses of the village, with the dimensions as below:

1. First row: 20 meters
2. Second row: 15 meters
3. Third row: 15 meters

The seed mix to be used is standard and it is designed according to the Mediterranean climatic context and to the aspect of the slope. The components and the quantities for meter square have to be chosen in accordance with the environment, climate, the need for green and geomorphological formation of ground. The amount of seeds will be 40 g/m^2 and mixture of seeds for such sterile and poor terrains is estimated as follows:

- *Lolium perennial* *45%*
- *Poa pratensis* *20%*
- *Medicago Sativa* *35%*
- *Festuca pratensis* *10%*

The origin and the germination of the seeds and of their mixture with the other components should be certified, the mixing should be done at the work site. The application consists by distribution of the mixture in several layers. The seeding should be applied in the wet seasons and with humidity. Usually the greened surface can be considered as stabilized after one year from the moment of the seeding. Is necessary to check the surfaces to find the areas where can be verified failures and if needed should be re applied within the same season.

Z.6.9. Recapitulation

Z.6.9.1. Double brushwood check dams

In the zone 6, 25 double brushwood check dams will be built, with an average length of 3 meters per side, on both sides is 6 meters. It will include the following operations and material:

Nr	Operations	Unit	Quantity
1	Poles production (2 m long & 8-12 cm thick) from hardwoods	pcs	16
2	Rod production (1.5-2 m long and transportation to the collection site till 100 m distance from hardwoods)	pcs	240
3	Making poles tips with diameter 8-12 cm	pcs	16
4	Pit openings 8-12 cm wide and 80 cm deep with a pickaxe for poles driving	pcs	16
5	Making brackets in the nails for the placement of bands	pcs	16
6	Nailing of bands to poles	pcs	480
7	Fencing with rods	m2	6
8	Estimated volume of timber for poles production	m3	1.1

Table 28 - Zone 6: Operations and material for construction of double brushwood check dams

Z.6.9.2. Planting

Nr	Working process	Pieces
A.1	Pits opening	2,925 pcs
A.2	Seedling holding and transport into the planting site	2,925 pcs
A.3	Seedling planting	2,925 pcs
A.4	Seedling transport from nursery to site	2,925 pcs
A.5	Seedling purchase	
A.5.1	*Punica granatum*	30% x 2,925 pcs = 877 pcs
A.5.2	*Pyrus amygdaliformis*	30% x 2,925 pcs = 877 pcs
A.5.3	*Quercus pubescens*	20% x 2,925 pcs = 585 pcs
A.5.4	*Gleditsia triacanthos*	20% x 2,925 pcs = 585 pcs

Table 29 - Zone 6: Recapitulation of planting working processes and material

Z.6.9.3. Dead tree replacement (20%)

Name of activity	Unit	Quantity
Reopening pits with sizes 60 x 60 x 60 cm and below	Pieces	585
Transport of 1-2-year-old conifer seedlings by hand at a distance of 200-500 m	Pieces	585
Planting seedlings in bags, holes 40x40x40 cm	Pieces	585
Purchase of seedlings	Pieces	585
Car transport of seedlings	Pieces	585

Table 30 - Zone 6: Dead tree replacement

Z.6.9.4. Aftercare works (2 years after planting)

Name of activity	Unit	Quantity
Hoeing seedlings in pits less than 50x50x50 cm with a radius of 0.3 m,	Pieces	5,850
Spraying chemical fertilizer around the seedling	Pieces	5,850
Irrigation of seedlings in forests with 30 l of water at a distance of up to 100 m	Pieces	5,850
Pruning of seedlings	Pieces	5,850
Cure of seedlings wounds	Pieces	5,850
Weeds cleaning	Pieces	5,850

Table 31 - Zone 6: Aftercare works

Z.6.9.5. Grass strips

Operations	Area
Planting (40g/m^2)	543 m^2
Opening furrow and planting	543 m^2
Gap filling and maintenance	543 m^2

Table 32 - Zone 6: Direct seeding operations and area

Zone 7

Z.7.1. Location and description of current conditions

- Coordinates of the central point: UTM 340429199E; 4549026N, Area: 1.47 ha
- Slope: max. 63%, facing Southwest, Elevation 400 m above sea level
- Plot ownership: 100% Elbasani municipality

Current conditions: This area is located in the upper part of the Shushicë village near the main road. Eroded on the entire surface (the depth of the canals is more than 3 m), with very deep channels, which were mainly created by the erosion of the soil and the flow of water. The terrain is quite steep, very unstable and is quite bare. Soil, in some places, is suitable for afforestation. In some parts of Zone 7, there are individuals of tree species such as: *Pyrus amygdaliformis*, *Cercis siliquastrum*, *Quercus pubescens*, *Carpinus orientalis* etc. Very rarely any bushes of *Juniperus* and rubus genus are present in the area. Near this area there are several houses which are at risk of erosion. Grazing is the main problem of this area. Most of the trees that are growing in this area have been damaged by grazing (especially oak and hornbeam).

Z.7.2. Objectives

- Reducing the level of erosion
- Road and house protection from erosion
- Soil enrichment.
- Increasing site biodiversity
- Increasing carbon sequestration
- Esthetical aspect
- Creation of the forest for beekeeping
- Harvesting fruits from fruit trees and secondary forest products

Z.7.3. FLR Measures

In zone 7, two interventions are proposed:

- erosion control through brushwood check dams
- afforestation

Z.7.4. Expected benefits

- in situ soil conservation
- more percolation of surface water into the ground resulting in recharge of ground water
- reducing the siltation of water harvesting structures downstream
- additional benefits of fuel wood, fodder, water quality and quantity, CO_2 sequestration, etc.
- ensuring tourism and recreation benefits in the coming years.

Z.7.5. Design specifications

The design specifications of double brushwood check dams are presented in the table below:

Nr	Brushwood double poles check dams' characteristics	Values
1	Poles length (m)	1.5-2.0
2	Poles diameter (cm)	8.0-12
3	Driven depth to soil	1/3-1/2 length
4	Spacing between poles (m)	0.5
5	Branches number	apart 10-15 cm
6	Species proposed	*Carpinus; Alnus; Pine; Salix*
7	Number of brush check dams	~ 18

Table 33 - Zone 7: design specifications of double brushwood check

Timber should be provided from the market and the purchase cost should be considered in the cost estimation.

Z.7.6. Layout, physical output, and surveying procedures

In total, eighteen double wooden poles check dams will be constructed perpendicular with eroded channels within zone 7. The number and the distance of the brushwood check dams depends on the slope and length of eroded channels. After the length and slope is measured then distance between barriers is estimated using the following equation:

- Horizontal (surface) distance between the barriers = $\frac{Lengthofthefield\ (m)}{Slope\ (\%)}$
- The total number of barriers is estimated by means of this formula: $\frac{Lengthofslopingfield\ (m)}{Distancebetweentwobarriers(m)}$

Z.7.7. Construction procedure

Construction procedure for the brushwood check dams includes the following steps:

- A trench of about 15 cm deep is made across the gully, and the wooden poles are driven to a depth of about ⅓ to ½ of the pole length, and at a spacing of about half a meter.
- The tops of the poles in the middle are made lower than the sides to form a notch of the required size to accommodate the maximum runoff.
- The flexible branches of trees (Salix, poplar, vitex, etc.) and shrubs are woven between wooden poles driven into the ground till a dam of the required height is obtained
- The ends of inter-linked materials should enter at least 30 cm into the sides of the gully
- Brushwood check dams are constructed when the soil in the gully is saturated or during the early rainy season
- The brush used preferably should have been left on
- If non-sprouting species (pine, Alnus, Carpinusas poles,) are used, brushwood check dams can be constructed during any season.
- The back of the brushwood check dams must be filled up with soil
- A brushwood apron of about 1.5 times the height of the check dam is necessary to protect the channel from scouring.

Z.7.8. Planting

For the Zone 7, the following species are recommended for planting:

1. *Gleditsia triacanthos* 50%
2. *Quercus pubescens* 30%
3. *Pyrus amygdaliformis* 10%
4. *Punica granatum* 10%

The alternative species considered for Zone 7 are:

- Tree species: *Carpinus betulus, Fraxinus ornus, Coryllus avellana*
- Shrubs: *Crataegus monogyna, Buxus sempervirens.*

Total number of seedlings: 1.47 ha x 1,250 seedlings/ha = 1837 pcs.

Z.7.9. Transport and manipulation of seedlings

Handling, loading and transporting trees from nursery to planting site, unloading trees and their storage must be carried out without causing any damage. Trees with a plastic bag or container should ideally be handled by the container and the seedling stem should not be damaged. Seedlings should be protected from direct sun, wind, frost, drying out and mechanical damage.

In particular, they must be protected from drying, overheating or frost during transport. Stored seedlings must be watered sufficiently (depending on the weather and cover material used)

and protected from damage by wild animals (depending on the site). Seedlings grown in containers or plastic bags must be temporarily stored or planted within a maximum of 48 hours after transport.

Z.7.10. Planting technique

The available area should be properly prepared before planting. On most sites, preparation mainly involves the following: (i) removal of persistent weeds, including the parts capable of regeneration, and (ii) removal of undesirable materials. Removal of competing vegetation before planting is advisable. Planting of the seedlings will be with individual pits. The diameter of the planting pit must be at least 1.5 times larger than the width of the root system of a bare-rooted tree or the diameter of the bottom of a container or plastic bag. The bottom of the planting pit must be loosened. A regular planting scheme with a distance of 2 x 2 meters is not possible. Two-year-old seedlings in plastic bags or containers should be used. If the root and especially tap root is too long, it should be reduced to 25-30 cm (according to the planting hole depth) using a sharp tool. During planting, it is recommended to place the tree in the center of the planting pit. Backfill the pit in soil layers and ensure that the tree remains upright. At each stage, the filling must be gently compacted to avoid any open spaces under and around the root system. Before placing the seedling, the planting pit should be filled with the highest quality soil available up to half of the pit depth. The finest soil should be used to fill the hole directly around the seedling. Finally, the lower quality soil is used to fill the upper part of the pit. The level of the root collar must be checked, so that after planting the root collar should be a few cm higher than the level of the surrounding terrain. This is to avoid the root collar sinking with natural soil settling. During planting, it is best to irrigate the open pit to minimize the formation of air pockets. Irrigation must evenly saturate soil volume throughout the planting pit. The expected survival rate of seedlings in Zone 7 is expected to be around 70%, two years after planting.it is advisable the completion of the aftercare works at least for a period of 2 years after planting.

Z.7.12. Operation and maintenance

Removal of competing vegetation prior to planting is advisable. The area around planted seedlings should be kept clear of weeds and competitors. After planting, aftercare works including hoeing, fertilizing and watering for a period at least 2 years is suggested.

Replacement of dead trees will also be operated. In the zone 7, it is estimated that 30% of the planted trees would have to be replaced.

Z.7.12. Recapitulation

Z.7.12.1. Brushwood check dams

In the Zone 7,18 double brushwood check dams will be built, with an average length of 3 meters per side, on both sides is 6 meters. It will include the following operations and material:

Nr	Operations	Unit	Quantity
1	Poles production (2 m long & 8-12 cm thick) from hardwoods	Pcs	16
2	Rod production (1.5-2 m long and transportation to the collection site till 100 m distance from hardwoods)	Pcs	240
3	Making poles tips with diameter 8-12 cm	Pcs	16
4	Pit openings 8-12 cm wide and 80 cm deep with a pickaxe for poles driving	Pcs	16
5	Making brackets in the nails for the placement of bands	Pcs	16
6	Nailing of bands to poles	Pcs	480
7	Fencing with rods	m2	6
8	Estimated volume of timber for poles production	m3	1.1

Table 34 - Zone 7: Operations and material for construction of double brushwood check dams

Z.7.12.2. Planting

Nr	Working process	Pieces
A.1	Pits opening	1,837 pcs
A.2	Seedling holding and transport into the planting site	1,837 pcs
A.3	Seedling planting	1,837 pcs
A.4	Seedling transport from nursery to site	1,837 pcs
A.5	Seedling purchase	
A.5.1	*Gleditsia triacanthos*	50% x 1,837 pcs = 920 pcs
A.5.2	*Quercus pubescens*	30% x 1,837 pcs = 551 pcs
A.5.3	*Pyrus amygdaliformis*	10% x 1,837 pcs = 187 pcs
A.5.4	*Punicagranatum*	10% x 1,837 pcs = 187 pcs

Table 35 - Zone 7: Recapitulation of planting working processes and material

Z.7.12.3. Dead tree replacement (30%)

Name of activity	Unit	Quantity
Reopening pits with sizes 60 x 60 x 60 cm and below	Pieces	551
Transport of 1-2-year-old conifer seedlings by hand at a distance of 200-500 m	Pieces	551
Planting seedlings in bags, holes 40x40x40 cm	Pieces	551
Purchase of seedlings	Pieces	551
Car transport of seedlings	Pieces	551

Table 36 - Zone 7: Dead tree replacement

Z.7.12.4. Aftercare works (2 years after planting)

Name of activity	Unit	Quantity
Hoeing seedlings in pits less than 50x50x50 cm with a radius of 0.3 m	cope	3,674
Spraying chemical fertilizer around the seedling	cope	3,674
Irrigation of seedlings in forests with 30 l of water at a distance of up to 100 m	cope	3,674
Pruning of seedlings	cope	3,674
Cure of seedlings wounds	cope	3,674
Weeds cleaning	cope	3,674

Table 37 - Zone 7: Aftercare works

Zone 8

Z.8.1. Location and description of current conditions

- Coordinates of the central point: UTM 34 0429241E; 4548948N, Area: 0.7 ha
- Slope: max. 49%, facing Northwest, Elevation390 m above sea level.
- Plot ownership: 100% Elbasan municipality

Current conditions: This area is the highest part of forest parcels which needed to be treated in the Shushicë village. There is a big difference with the other areas that will be treated, due to the fact that in this area there is a high percentage of forest trees (approximately 50% of the surface is covered), and they are less damaged by grazing. Inside the surface there are several parts of bare land, mostly eroded, with deep channels 1.5 to 2 meters. Due to the fact that it is a surface covered with trees, the land also looks quite high-quality, and suitable for afforestation and planting grasses. The main species of trees are *Quercus pubescens*, *Carpinus orientalis*, *Alnus glutinosa*. Other species in zone 8 are *Juniperus oxycedrus* and *Pyrus amygdaliformis*.The diameter at breast height of the trees vary from 2 to 7 cm and tree height up to 6 meters.

Z.8.2. Objectives

- Reducing the level of soil erosion
- Restoring degraded forest land.
- Road protection from erosion
- Increasing biodiversity
- Increasing carbon sequestration
- Esthetical aspect
- Increasing incomes for local community through wood and non-wood products

Z.8.3. FLR Measures

In zone 8, two measures will be applied:

- brushwood check dams
- afforestation of degraded forest land

Z.8.4. Expected benefits

- in situ soil conservation
- more percolation of surface water into the ground resulting in recharge of ground water
- reducing the siltation of water harvesting structures downstream
- additional benefits of fuel wood, fodder, water quality and quantity, CO_2 sequestration, etc.
- ensuring tourism and recreation benefits in the coming years.

Z.8.5. Design specifications

The design specifications of brushwood check dams for the Zone 8 are presented below:

Nr	Brushwood double poles check dams' characteristics	Values
1	Poles length (m)	1.5-2.0
2	Poles diameter (cm)	8.0-12
3	Driven depth to soil	1/3-1/2 length
4	Spacing between poles (m)	0.5
5	Branches number	apart 10-15 cm
6	Species proposed	*Carpinus; Alnus; Pine; Salix*
7	Number of brush check dams	~10

Table 38 - Zone 8: Design specifications of double brushwood check dams

The wood required for the construction of brushwood check dams will be provided from forest parcels around Zone 8 within the management unit with permission of the forest staff of Elbasan municipality. If this is not possible then timber should be provided from the market and the purchase cost should be considered in the cost estimation.

Z.8.6. Layout, physical output, and surveying procedures

In total, ten double brushwood check dams will be constructed perpendicular with eroded channels within zone 8. The number and the distance of the brushwood check dams depends on the slope and length of eroded channels. After the length and slope is measured then distance between barriers is estimated using the following equation:

- Horizontal (surface) distance between the barriers = $\frac{Lengthofthefield\ (m)}{Slope\ (\%)}$
- The total number of barriers is estimated by means of this formula: $\frac{Lengthofslopingfield\ (m)}{Distancebetweentwobarriers(m)}$

Z.8.7. Construction procedure

Construction procedure for the brushwood check dams includes the following steps:

- A trench of about 15 cm deep is made across the gully, and the wooden poles are driven to a depth of about 1/3 to ½ of the pole length, and at a spacing of about half a meter.
- The tops of the poles in the middle are made lower than the sides to form a notch of the required size to accommodate the maximum runoff.
- The flexible branches of trees (Salix, poplar, vitex, etc.) and shrubs are woven between wooden poles driven into the ground till a dam of the required height is obtained
- The ends of inter-linked materials should enter at least 30 cm into the sides of the gully
- Brushwood check dams are constructed when the soil in the gully is saturated or during the early rainy season
- The brush used preferably should have been left on
- If non-sprouting species (pine, Alnus, Carpinusas poles,) are used, brushwood check dams can be constructed during any season.
- The back of the brushwood check dams must be filled up with soil
- A brushwood apron of about 1.5 times the height of the check dam is necessary to protect the channel from scouring.

Z.8.8. Planting

For the Zone 8, the following species are recommended for planting:

1. *Quercus pubescens* 40%
2. *Pyracantha coccínea* 30%
3. *Pyrus amygdaliformis* 30%

Note: This area is more than 50% covered by forest trees and bushes. For this reason, the number of seedlings for planting are 600 pcs/ha (approximately in a distance of 8 x 8 meter).

The alternative species considered for Zone 8 are:

- Tree species: *Fraxinus ornus*,
- Shrubs: *Crataegus monogyna*, *Buxus sempervirens*

Total number of seedlings: 0.70 ha x 600 seedlings/ha = 420 pcs.

Z.8.9. Transport and manipulation of seedlings

Handling, loading and transporting trees from nursery to planting site, unloading trees and their storage must be carried out without causing any damage. Trees with a plastic bag or container should ideally be handled by the container and the seedling stem should not be damaged. Seedlings should be protected from direct sun, wind, frost, drying out and mechanical damage.

In particular, they must be protected from drying, overheating or frost during transport. Stored seedlings must be watered sufficiently (depending on the weather and cover material used) and protected from damage by wild animals (depending on the site). Seedlings grown in containers or plastic bags must be temporarily stored or planted within a maximum of 48 hours after transport.

Z.8.10. Planting technique

The available area should be properly prepared before planting. On most sites, preparation mainly involves the following: (i) removal of persistent weeds, including the parts capable of regeneration, and (ii) removal of undesirable materials. Removal of competing vegetation before planting is advisable. Planting of the seedlings will be with individual pits. The diameter of the planting pit must be at least 1.5 times larger than the width of the root system of a bare-rooted tree or the diameter of the bottom of a container or plastic bag. The bottom of the planting pit must be loosened. A regular planting scheme with a distance of 2 x 2 meters is not possible. Two-year-old seedlings in plastic bags or containers should be used. If the root and especially tap root is too long, it should be reduced to 25-30 cm (according to the planting hole depth) using a sharp tool. During planting, it is recommended to place the tree in the center of the planting pit. Backfill the pit in soil layers and ensure that the tree remains upright. At each stage, the filling must be gently compacted to avoid any open spaces under and around the root system. Before placing the seedling, the planting pit should be filled with the highest quality soil available up to half of the pit depth. The finest soil should be used to fill the hole directly around the seedling. Finally, the lower quality soil is used to fill the upper part of the pit. The level of the root collar must be checked, so that after planting the root collar should be a few cm higher than the level of the surrounding terrain. This is to avoid the root collar sinking with natural soil settling. During planting, it is best to irrigate the open pit to minimize the formation of air pockets. Irrigation must evenly saturate soil volume throughout the planting pit. The expected survival rate of seedlings in Zone 8 is expected to be around 80%, two years after planting. It is advisable the completion of the aftercare works at least for a period of 2 years after planting.

Z.8.11. Operation and maintenance

Removal of competing vegetation prior to planting is advisable. The area around planted seedlings should be kept clear of weeds and competitors. After planting, aftercare works including hoeing, fertilizing and watering for a period at least 2 years is suggested.

Replacement of dead trees will also be operated. In the zone 8, it is estimated that 20% of the planted trees would have to be replaced.

Z.8.12. Recapitulation

Z.8.12.1. Brushwood check dams

In the Zone 8, 10 double brushwood check dams will be built, with an average length of 3 meters per side, on both sides is 6 meters. It will include the following operations and material:

Nr	Operations	Unit	Quantity
1	Poles production (2 m long & 8-12 cm thick) from hardwoods	pcs	16
2	Rod production (1.5-2 m long and transportation to the collection site till 100 m distance from hardwoods)	pcs	240
3	Making poles tips with diameter 8-12 cm	pcs	16
4	Pit openings 8-12 cm wide and 80 cm deep with a pickaxe for poles driving	pcs	16
5	Making brackets in the nails for the placement of bands	pcs	16
6	Nailing of bands to poles	pcs	480
7	Fencing with rods	m2	6
8	Estimated volume of timber for poles production	m3	1.1

Table 39 - Zone 8: Operations for construction of double brushwood check dams

Z.8.12.2. Planting

Nr	Working process	Pieces
A.1	Pits opening	420 pcs
A.2	Seedling holding and transport into the planting site	420 pcs
A.3	Seedling planting	420 pcs
A.4	Seedling transport from nursery to site	420 pcs
A.5	Seedling purchase	
A.5.1	*Quercus pubescens*	40% x 420 pcs = 168 pcs
A.5.2	*Pyracantha coccinea*	30% x 420 pcs = 126pcs
A.5.3	*Pyrus amygdaliformis*	30% x 420 pcs = 126 pcs

Table 40 - Zone 8: Recapitulation of planting working processes and material

Z.8.12.3. Dead tree replacement (20%)

Name of activity	Unit	Quantity
Reopening pits with sizes 60 x 60 x 60 cm and below	Pieces	84
Transport of 1-2-year-old conifer seedlings by hand at a distance of 200-500 m	Pieces	84
Planting seedlings in bags, holes 40x40x40 cm	Pieces	84
Purchase of seedlings	Pieces	84
Car transport of seedlings	Pieces	84

Table 41 - Zone 8: Dead tree replacement

Z.8.12.4. Aftercare works (2 years after planting)

Name of activity	Unit	Quantity
Hoeing seedlings in pits less than 50x50x50 cm with a radius of 0.3 m,	Pieces	840
Spraying chemical fertilizer around the seedling	Pieces	840
Irrigation of seedlings in forests with 30 l of water at a distance of up to 100 m	Pieces	840
Pruning of seedlings	Pieces	840
Cure of seedlings wounds	Pieces	840
Weeds cleaning	Pieces	840

Table 42 - Zone 8: Aftercare works

Zone 9

Z.9.1. Location and description of current conditions

- Coordinates of the central point: UTM 34 0428545 E; 4549529 N, Area: 2.43 ha
- Slope: max. 41%, facing Northeast, Elevation 253 m above sea level
- Plot ownership: 100% Elbasan municipality.

Current conditions: This area is located in the middle part of the Shushicë village. The terrain is almost completely bare, skeletal with ultra-basic formations. In some parts there are signs of rill erosion. Woody vegetation is almost completely missing, except in some parts there are some trees of *Pyrus amygdaliformis* and bushes of *Juniperus oxycedrus* and *Rubus idaeus*.

Z.9.2. Objectives

- Reducing the level of soil erosion
- Restoration of degraded forest land
- Increasing biodiversity
- Increasing carbon sequestration
- Esthetical aspect

Z.9.3. FLR Measures

The FLR measures proposed for zone 9 are:

- partly afforestation of the area
- grass barriers/strips
- direct seeding

Z.9.4. Expected benefits

With the afforestation of this area, the possibility of surface soil erosion will decrease by 80%. If there is no intervention in this area, this would lead to even deeper erosion. The opportunity for economic and social benefits from the collection of fruits and secondary forest products, where an average of 4 families will benefit from this activity. A very beautiful landscape will be created for the residents and visitors of the area. It will have an impact on the water quality and quantity, carbon sequestration and habitat for wildlife.

Z.9.5. Design specifications of grass barriers

The vegetative barriers will be used in gentle slopes with an inclination less than 10% within zone 9. Such barriers are considered effective for erosion and sediment control because grass form erect, stiff and uniformly dense hedges, and so resist overland flow. Grass has roots which bind soil and thus prevent riling and scouring near the barrier. The grasses can survive moisture and nutrient stress and re-establish top-growth quickly after rain. Grass species are planted along the contour with 75 cm paired row distance along with 20 × 20 cm plant-to-plant spacing in a 10 cm wide furrow of 20 cm depth in a staggered fashion on a 1 m vertical interval. This corresponds to 50, 25 and 12.5 m horizontal intervals on 2, 4 and 8 % slopes,

respectively, on 100 m length slope segments. The excavated soil of the furrow is kept downslope of grass barriers. Water flow is impeded and so silt carried along with it is deposited near the barrier. Sediment deposition and tillage operations progressively cause benching.

Z.9.6. Layout, physical output, and surveying procedures

In this zone, it is recommended to apply direct seeding associated with Jute mat. Grassing is planned to be carried out in 5 rows perpendicular to the slope, with the dimensions as below:

1. First row 30 meters
2. Second row 20 meters
3. Third row 20 meters
4. Fourth row 30 meters
5. Fifth row 20 meters

- The distance between each row depends from slope (%) and length of slope: $\frac{Lengthofthefield\ (m)}{Slope\ (\%)}$
- The total number of barriers is estimated by means of this formula: $\frac{Lengthofslopingfield\ (m)}{Distancebetweentworows(m)}$

Z.9.7. Construction procedure

The vegetative barriers will be used in gentle slopes ranging from 2-8% within zone 6. Such barriers are considered effective for erosion and sediment control because grass form erect, stiff and uniformly dense hedges, and so resist overland flow. Grass has roots which bind soil and thus prevent riling and scouring near the barrier. The grasses can survive moisture and nutrient stress and re-establish top-growth quickly after rain. Grass species are planted along the contour with 75 cm paired row distance along with 20 × 20 cm plant-to-plant spacing in a 10 cm wide furrow of 20 cm depth in a staggered fashion on a 1 m vertical interval. This corresponds to 50, 25 and 12.5 m horizontal intervals on 2, 4 and 8 % slopes, respectively, on 100 m length slope segments. The excavated soil of the furrow is kept downslope of grass barriers. Water flow is impeded and so silt carried along with it is deposited near the barrier. Sediment deposition and tillage operations progressively cause benching.

Z.9.8. Planting

For the Zone 9, the following species are considered for planting:

1. *Quercus pubescens* 40%
2. *Pyracantha coccinea* 30%
3. *Pyrus amygdaliformis* 30%

Note: Almost all of this area is going to be treated by grassing, just a small number of trees can be planted 400 pcs/ha (approximate distance 13 x 13 meters).

The alternative species considered for Zone 9 are:

- Tree species: *Fraxinus ornus*.
- Shrubs: *Crataegus monogyna, Buxus sempervirens.*

Total number of seedlings: 2.43 ha x 400 seedlings/ha = 972 pcs.

Z.9.9. Transport and manipulation of seedlings

Handling, loading and transporting trees from nursery to planting site, unloading trees and their storage must be carried out without causing any damage. Trees with a plastic bag or container should ideally be handled by the container and the seedling stem should not be

damaged. Seedlings should be protected from direct sun, wind, frost, drying out and mechanical damage.

In particular, they must be protected from drying, overheating or frost during transport. Stored seedlings must be watered sufficiently (depending on the weather and cover material used) and protected from damage by wild animals (depending on the site). Seedlings grown in containers or plastic bags must be temporarily stored or planted within a maximum of 48 hours after transport.

Z.9.10. Planting technique

The available area should be properly prepared before planting. On most sites, preparation mainly involves the following: (i) removal of persistent weeds, including the parts capable of regeneration, and (ii) removal of undesirable materials. Removal of competing vegetation before planting is advisable. Planting of the seedlings will be with individual pits. The diameter of the planting pit must be at least 1.5 times larger than the width of the root system of a bare-rooted tree or the diameter of the bottom of a container or plastic bag. The bottom of the planting pit must be loosened. A regular planting scheme with a distance of 2 x 2 meters is not possible. Two-year-old seedlings in plastic bags or containers should be used. If the root and especially tap root is too long, it should be reduced to 25-30 cm (according to the planting hole depth) using a sharp tool. During planting, it is recommended to place the tree in the center of the planting pit. Backfill the pit in soil layers and ensure that the tree remains upright. At each stage, the filling must be gently compacted to avoid any open spaces under and around the root system. Before placing the seedling, the planting pit should be filled with the highest quality soil available up to half of the pit depth. The finest soil should be used to fill the hole directly around the seedling. Finally, the lower quality soil is used to fill the upper part of the pit. The level of the root collar must be checked, so that after planting the root collar should be a few cm higher than the level of the surrounding terrain. This is to avoid the root collar sinking with natural soil settling. During planting, it is best to irrigate the open pit to minimize the formation of air pockets. Irrigation must evenly saturate soil volume throughout the planting pit. The expected survival rate of seedlings in Zone 9 is expected to be around 70%, two years after planting.

Z.9.11. Operation and maintenance

Removal of competing vegetation prior to planting is advisable. The area around planted seedlings should be kept clear of weeds and competitors. After planting, aftercare works including hoeing, fertilizing and watering for a period at least 2 years is suggested.

Replacement of dead trees will also be operated. In the zone 9, it is estimated that 30% of the planted trees would have to be replaced.

Z.9.12. Direct seeding

The seed mix to be used is standard and it is designed according to the Mediterranean climatic context and to the aspect of the slope. The components and the quantities for meter square have to be chosen in accordance with the environment, climate, the need for green and geomorphological formation of ground.

The amount of seeds will be 40 gr/m^2 and the mixture of seeds for sterile and poor terrains will be:

- *Lolium perennial* 45%
- *Poa pratensis* *20%*
- *Medicago Sativa* *35%*
- *Festuca pratensis.* *10%*

The origin and the germination of the seeds and of their mixture with the other components should be certified, the mixing should be done at the work site. The application consists by distribution of the mixture in several layers.

The seeding should be applied in the wet seasons and with humidity. Usually the greened surface can be considered as stabilized after one year from the moment of the seeding. Is necessary to check the surfaces to find the areas where can be verified failures and if needed should be re applied within the same season.

Z.9.13. Recapitulation

Z.9.13.1. Planting

Nr	Working process	Pieces
A.1	Pits opening	972 pcs
A.2	Seedling holding and transport into the planting site	972 pcs
A.3	Seedling planting	972 pcs
A.4	Seedling transport from nursery to site	972 pcs
A.5	Seedling purchase	
A.5.1	*Quercus pubescens*	40% x 972 pcs = 389 pcs
A.5.2	*Pyracantha coccinea*	30% x 972 pcs = 291 pcs
A.5.3	*Pyrus amygdaliformis*	30% x 972 pcs = 291 pcs

Table 43 - Zone 9: Recapitulation of planting working processes and material

Z.9.13.2. Dead tree replacement (30%)

Name of activity	Unit	Quantity
Reopening pits with sizes 60 x 60 x 60 cm and below	Pieces	292
Transport of 1-2-year-old conifer seedlings by hand at a distance of 200-500 m	Pieces	292
Planting seedlings in bags, holes 40x40x40 cm	Pieces	292
Purchase of seedlings	Pieces	292
Car transport of seedlings	Pieces	292

Table 44 - Zone 9: Dead tree replacement

Z.9.13.3. Aftercare works (2 years after planting)

Name of activity	Unit	Quantity
Hoeing seedlings in pits less than 50x50x50 cm with a radius of 0.3 m	Pieces	1,944
Spraying chemical fertilizer around the seedling	Pieces	1,944
Irrigation of seedlings in forests with 30 l of water at a distance of up to 100 m	Pieces	1,944
Pruning of seedlings	Pieces	1,944
Cure of seedlings wounds	Pieces	1,944
Weeds cleaning	Pieces	1,944

Table 45 - Zone 9: Aftercare works

Z.9.13.1. Grass strips

Operations	Area
Planting (40g/m^2)	1500 m^2
Opening furrow and planting	1500 m^2
Gap filling and maintenance	1500 m^2

Table 46 - Zone 9: Direct seeding operations and area

Z.10. Direct grass seeding in some of the intervention zones

Direct grass seeding is will be applied for a total area of 4 ha in zones 6,7,8 and 9. The grass planting activity will be by throwing, almost in all the areas where the conditions will be most suitable for germination.

It is estimated for this activity that up to 400 kg of grass seeds will be necessary, considering that 1 kg of seeds enables to plant **25 to 40 m^2.**

Recapitulation of measures for all FLR intervention zones

Zone	Working process	Ha/zone
1	Rehabilitation by planting	0.34
2	Gabion check dams	0.23
	Brushwood check dams	
	Rehabilitation by planting	
3	Rehabilitation by planting	0.15
4	Rehabilitation by planting	0.30
	Brushwood check dams	
5	Gabion check dams	0.24
	Brushwood check dams	
	Rehabilitation by planting	
6	Rehabilitation by planting	2.34
	Brushwood check dams	
	Grass strips	
7	Rehabilitation by planting	1.47
	Brushwood check dams	
8	Rehabilitation by planting	0.80
	Brushwood check dams	
9	Rehabilitation by planting	2.43
	Grass strips	
All zones	Direct grass throwing	N/A
TOTAL		**8.20**

Table 47 - Recapitulation of FLR working processes and areas for each considered zone.

METHOD OF IMPLEMENTING CONTROL AND ENSURING THE QUALITY OF SERVICES

Determination of performed services

After the completed works (herewith “services”), the quantity and quality of the completed works is checked by the person(s) appointed by the Client. Determining the performed services will be done by counting, measuring or other appropriate methods, with the presence of the Service Provider (Contractor) or an authorized person of the Service Provider (whom the contractor is obliged to appoint in writing before the start of the services), in accordance with the rules of the forestry profession, valid standards and the objectives of the ADAPT project, which "Records" of performed services are created.

All communication between the Client and the Service Provider will be done in English, as per protocol established after contract signature.

The service provider or the authorized person of the Service Provider is obliged to notify IUCN and the private landowners on whose land they will implement forestry measures at least 3 calendar days in advance whenever they plan to perform such works and therefore access their land.

The service provider or the authorized person of the Service Provider is obliged to sign the "record" of the performed services in terms of confirmation of the type, quantity and quality of the performed services, on a monthly basis.

On the part of the Client, the "record" of the performed services in terms of confirmation of the type, quantity and quality of the performed services is signed by an Independent Supervisor appointed by the Client and the ADAPT project coordinator.

The selected contractor is obliged to keep the business documentation related to the implementation of the Contract resulting from this Public Procurement and make it available in the event of a possible audit. The selected contractor is obliged to keep this documentation for NO LESS THAN 5 YEARS after the end of this Agreement.

Record of performed services

The minutes are compiled by type of services and/or by area on the last working day of the month, based on all daily records of performed services for the month in which the Minutes are compiled.

The record contains the type of service, area, quantity and value of services performed, and is signed by:
- Independent superviser (forestry expert) appointed by the Client
- ADAPT project coordinator
- Authorized person of the Service Provider

About the authorized person of the Service Provider: the record should be drawn up and signed in 3 copies, of which 1 copy is retained by the Client, and two copies are retained by the Service Provider. The Minutes represent a recapitulation of all completed works for a certain type of service for the month for which the Minutes are drawn up.

Based on the record, the Service Provider issues an invoice, where the Record is an attachment to the invoice.

Dynamics of providing services

The monthly dynamics of the provision of services is determined by the Client in accordance with the rules of the forestry profession, the applicable standards and the goals of the ADAPT project at the beginning of each current month for the following month, in writing in three copies, one copy of which is handed over to the Service Provider, i.e. to a person authorized by the contractor; with the Contractor's signature the service provider confirms that it is familiar with the place of work and the established dynamics by the Client, and two copies are kept by the Client.

The Service Provider is obliged to act in accordance with the monthly dynamics established by the Client.

In case of objective circumstances that could not be foreseen (weather, organizational, technical or other circumstances), the Client reserves the right to change the established monthly dynamics of the performance of services, about which he is obliged to inform the Service Provider no later than the day before the day on which they are performing services.

START DATE OF CONTRACT APPLICATION, DURATION OF CONTRACT AND POSSIBILITY OF EXTENSION, PLACE OF PERFORMANCE OF SERVICES

START DATE OF THE CONTRACT which will be concluded on the basis of this Public Procurement, cannot be before the completion of the selection of the most favourable bidder on the basis of this Public Procurement.

In accordance with the goals and dynamics of the implementation of the ADAPT project, the aforementioned works, which are the subject of this Public Procurement, must be started in April 2024. Ideally, the Service Provider will execute the majority of foreseen activities during the spring-summer season (April to end of June). Planting should take place in the planting season which secures the highest possible survival rate for seedlings.

Note: The designated representative designated by the Client has the obligation to state in writing the date of commencement of services under the Contract concluded in this Public Procurement, together with the representative of the selected bidder.

DURATION OF CONTRACT, the duration of this assignment will last over the period from the signing of the contract to 30th June 2024, with possibility to extend in case it is required for successful implementation of FLR measures and to secure a high survival rate of the seedling to allow for enough time for all steps in the execution of the pilot project to take place.

EXTENSION OF THE AGREEMENT - the duration of the Agreement may be extended longer than the specified period, due to the occurrence of objective circumstances that could not be foreseen or force majeure, in the case when the contracted quantities of services have not been fully performed, without changing the total value of the Agreement in accordance with the Law on Public procurements.

PERFORMANCE OF SERVICES

NAME AND PLACE OF PERFORMANCE OF THE SERVICE	Tentative timeframe[1]
Tree planting	April - May
Grass strip planting	April - May
Brushwood check dams	April to June

[1] The modification of the tentative timeframe should be justified (e.g. planting season, survival rate, etc.)

Gabion check dams	April to June
Aftercare work	TBD
Dead-tree replacement	TBD

A detailed timeframe for each zone and each type of work must be submitted as part of the technical proposal, according to the following template:

Zone	**Measure**	**Working process / operation**	**Time (Year, Month Week)**						
			Month 1			**Month 2**			
			W1	W2	W3	….	….	….	….
1	Tree Planting	Area cleaning							
		Pits opening							
		Purchasing of seedlings							
	Grass strips	Etc.							
	Brushwood check dams								
2	Gabion check dams								
	Direct grass seeding								
	Etc.								
	.								

AVAILABLE RESOURCES

1. Management and Maintenance Guidance Note (internal report, available at request)
2. Monitoring and Evaluation Framework (MEF) capacity and resources needs assessment for the pilot project in Albania (internal report, available at request)
3. Nature-based Solutions baseline assessment for pilot project in Elbasan municipality (internal report, available at request)
4. Technical-economic project documents delivered for obtention of afforestation permit (available only in Albanian):
    a. Projekt Pyllezimi-Ngastra 82a
    b. Projekt Pyllezimi- Ngastra 88b
    c. Projekt Pyllezimi- Ngastra 88a
    d. Projekt Pyllezimi- Ngastra 89b
    e. Projekt Pyllezimi- Ngastra 95a
5. IUCN Global Standard for Nature-based Solutions
6. ADAPT project
7. Environmental and Social Management System | IUCN
8. IUCN Monitoring and Evaluation Policy