TECHNICAL FEASIBILITY AND IMPLEMENTATION PLAN

Nature-based Restoration of the Buna River

Secondary Channel Reconnection, Riverbank Stabilisation and Riparian Habitat Restoration

Project: Restoration of Buna River Banks with Plant Engineering
Lead Implementing Organisation: EcoAlbania
Location: Buna River, Shkodër County, Albania
Priority Intervention Reach: 450 m
Approach: Nature-based Solutions, River Restoration and Plant Engineering

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Executive summary

EcoAlbania is implementing a Nature-based river restoration intervention along a priority 450 m reach of the Buna River in Shkodër County. The site is characterised by active erosion of the right riverbank, progressive disconnection of an adjacent natural secondary branch, fragmented riparian vegetation and a combination of ecological and local land-use sensitivities. Historical imagery and field observations undertaken during project preparation indicate that the secondary branch has become increasingly disconnected from the main river and that the space available for lateral river movement at the site has decreased. The working technical diagnosis is that this change may be contributing to increased concentration of flow against the right bank and to the erosion observed within the project reach.

The proposed intervention therefore addresses the problem at the scale of the river corridor rather than treating the eroding bank as an isolated engineering failure. It combines the low-impact reconnection of the existing secondary branch with selective bioengineering of the vulnerable right bank and restoration of native riparian vegetation. The project does not propose construction of a new channel, continuous bank armouring or uniform stabilisation of the entire 450 m reach. Instead, it seeks to re-establish the possibility for water to enter an existing lateral channel, reinforce only those bank sections where intervention is justified, and allow natural hydromorphological and vegetation processes to provide an increasing proportion of the long-term restoration function.

The secondary-channel intervention will focus principally on the sediment and alluvial material currently restricting the upstream inlet. Excavation will be limited and progressive. The first entry of water into the branch will constitute an operational hold point at which the technical team will assess the response before authorising further excavation. The intention is to establish functional connectivity rather than a predetermined engineered channel geometry. The downstream part of the branch should therefore remain largely under passive restoration, with additional excavation undertaken only where an actual obstruction prevents the intended connectivity.

Bank treatment will also be selective. Earlier site observations describe the affected bank as approximately 5–6 m high in relevant sections and include a preliminary 2H:1V reprofiling concept. In this Plan, that geometry is retained only as a reference for locations where reshaping is technically required. Existing stable bank sections, mature native vegetation, areas of functioning natural regeneration and ecologically valuable exposed banks should remain undisturbed wherever possible. The principal bioengineering techniques will include vegetated toe protection, willow fascines, brush layering, live cuttings and whips, wooden posts and stakes generated from suitable local woody material, and limited rock-block reinforcement at locations where initial protection against undermining or bypass is necessary. SISMAE's earlier technical input specifically emphasised the importance of protecting the toe and upstream end of living bank-protection structures during their establishment period.

Riparian restoration will rely primarily on native material of local genetic origin. Willow will provide the main living material in the lower and wetter part of the bank, while alder, suitable

native poplar, Tamarix and other confirmed local riparian species can occupy progressively higher positions according to moisture and inundation conditions. Platanus and other species less closely associated with the active water edge should only be used where their local occurrence and ecological suitability are confirmed. Planting will not follow regular plantation-style rows. Existing vegetation and natural regeneration will be integrated into an irregular riparian mosaic, and active planting will be concentrated where it provides a clear stabilisation or ecological benefit.

Biodiversity protection is an integral constraint on the physical design. Parts of the eroded bank may provide nesting habitat for Sand Martins and potentially European Bee-eaters. The intervention must therefore distinguish between erosion that needs to be managed and exposed bank dynamics that should be retained for ecological reasons. The current source documentation refers to ornithological requirements but does not provide a detailed site-specific assessment containing definitive buffer distances or breeding-period dates. This Plan therefore does not invent such parameters. Where EcoAlbania has or subsequently adopts a site-specific ornithological assessment, its recommendations must be incorporated into the final intervention zoning and shall prevail where they are more restrictive than the general engineering concept.

EcoAlbania will remain the sole implementing organisation. SISMAE is no longer an implementing partner under the revised project arrangement, although technical experts identified through SISMAE may be contracted by EcoAlbania for defined specialist assignments. EcoAlbania will coordinate technical experts, the local supervising engineer, specialised contractors, RAPA Shkodër, Shkodër Municipality, the Forestry Technical School in Shkodër and users of the riparian area. The Forestry Technical School can contribute to safe activities such as preparation of plant material, planting, practical demonstrations and vegetation monitoring, while hazardous works involving machinery, unstable bank faces or deep flowing water remain the responsibility of qualified contractors and technical personnel.

The works are considered technically and operationally feasible, subject to final validation of the 450 m treatment zoning, inlet geometry, ecological restrictions, plant-material availability, access, permit conditions and final quantities. Implementation should remain condition-based. Earlier planning envisages site preparation during October and installation of willow-based living structures during November, when willow is dormant and river conditions are expected to be more compatible with the works. These dates should remain indicative rather than absolute. Hydrology, ecological clearance and plant condition should determine when individual operations proceed.

The project should ultimately be judged by whether it establishes a more connected and resilient river corridor rather than by whether the post-construction site remains unchanged. Sediment movement, vegetation succession, local erosion and morphological adjustment will continue. Maintenance should therefore address genuine loss of function rather than natural irregularity. The desired outcome is a secondary channel that can function under appropriate river stages, a more resilient but still dynamic main bank, a recovering native riparian corridor and continued availability of important exposed-bank habitat.

1. Introduction and project context

1.1. Project background and restoration rationale

The Buna River is a dynamic lowland river connecting Lake Shkodra with the Adriatic Sea and forming part of a wider transboundary river, wetland and delta system shared by Albania and Montenegro. Its ecological value is associated not only with the main watercourse but with the interaction between the channel, floodplain, side channels, alluvial vegetation, wetlands and exposed sediment features. The project site in Shkodër County represents one small but technically important part of this wider corridor.

EcoAlbania identified a priority 450 m reach on the right bank where erosion has become particularly visible. Immediately adjacent to this bank is a natural secondary branch whose upstream connection with the Buna has become increasingly restricted. Comparison of imagery from 2016 and 2024 and field observations undertaken during project preparation suggest that the side branch is less functionally connected than previously and that lateral river space at the site has become more constrained. The project has consequently developed the working hypothesis that a greater proportion of flow is now concentrated in the main channel and that this may be contributing to the erosion pressure affecting the right bank. The available information supports this as a credible restoration hypothesis, but it does not provide a detailed hydraulic model capable of quantifying the change in velocity, shear stress or discharge distribution. The intervention should therefore not claim that reopening the branch will produce a predetermined numerical reduction in hydraulic stress. Its rationale is instead hydromorphological: restoring an existing lateral flow path is expected to increase the space available to the river and may redistribute part of the flow during suitable water levels. The actual response will be observed during implementation and subsequent monitoring.

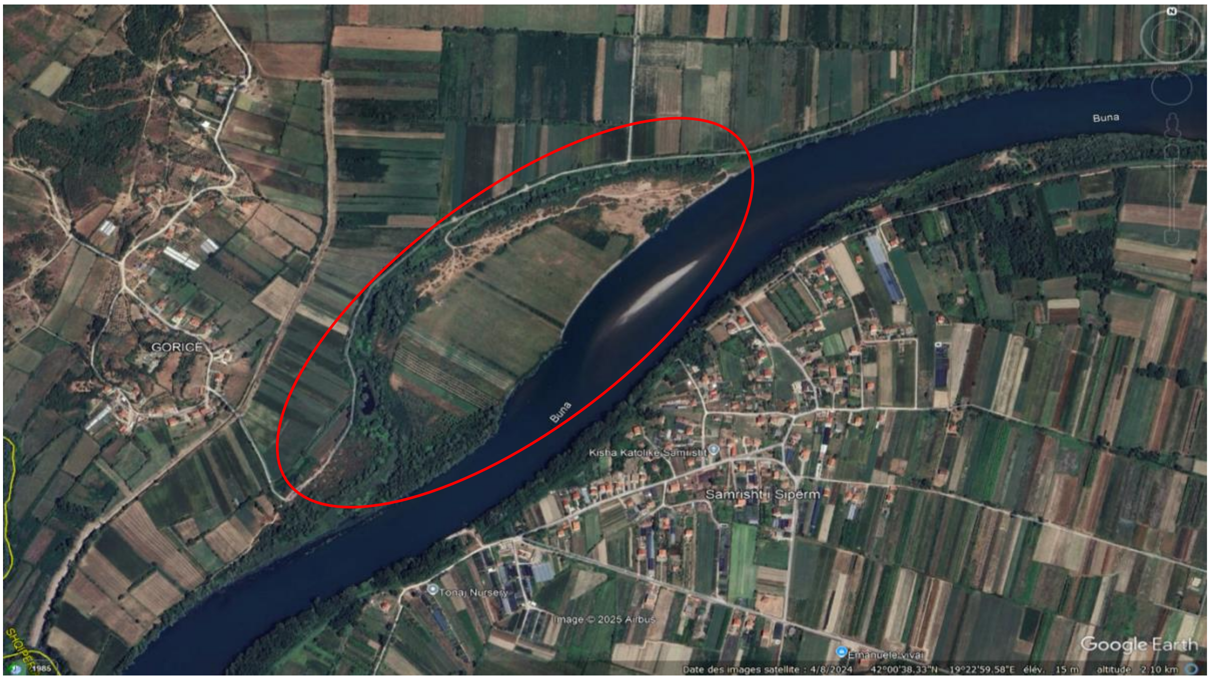

Figure 1: The project area selected for the intervention

This distinction determines the character of the project. Rather than beginning with a conventional solution such as continuous rock armouring of the eroded bank, EcoAlbania proposes to address part of the underlying river-process problem by restoring lateral connectivity. Local bank protection is then used where needed to support vulnerable sections while vegetation establishes. In this way, engineering is used to initiate and support ecological recovery rather than to replace river processes.

The project should not attempt to return the Buna to an exact historical configuration. Rivers evolve continuously, and the historical imagery is used to identify the loss of connectivity rather than to define a fixed geometry that must be reconstructed. The objective is to remove or lower the principal local constraint at the secondary-channel inlet and then provide the river with the opportunity to use that pathway again.

1.2. Scope and objectives of the plan

This Technical Feasibility and Implementation Plan covers the confirmed 450 m priority reach of the right bank, the immediately adjacent secondary branch, the blocked upstream inlet, the riparian areas directly associated with the works and the access required for implementation. The 450 m dimension defines the project reach but does not define the length of bank that must receive active treatment. A central requirement of the final design is that the reach be divided into treatment and no-treatment areas according to bank condition, ecological value and vegetation.

The intervention has three principal physical components. The first is the **selective reopening of the existing secondary branch** through limited lowering or removal of the alluvial obstruction at its upstream connection. The second is the **selective restoration and stabilisation of vulnerable sections** of the right bank using bioengineering and limited supporting civil works. The third is **reinforcement of the riparian vegetation** using locally derived native material and natural regeneration.

These components pursue a common objective: to improve the hydromorphological and ecological resilience of the site while reducing excessive local erosion. Hydrological reconnection should provide additional lateral space for flow. Bioengineering should improve resistance where bank instability needs to be managed. Riparian restoration should reinforce the treated areas progressively through root development while increasing ecological connectivity and habitat structure.

The Plan also defines important limits to the intervention. It does not propose continuous stabilisation of all exposed bank surfaces. It does not assume that the secondary channel must carry water permanently. It does not require every planted cutting to survive. It does not treat sediment movement after implementation as an automatic failure. Most importantly, it recognises that some exposed bank sections may have biodiversity value and may therefore need to remain deliberately untreated.

The document serves as the implementation reference for EcoAlbania, technical experts, the local supervising engineer and specialised contractors. It should also support coordination with Shkodër Municipality, RAPA Shkodër, the Forestry Technical School in Shkodër and riparian users. It does not replace protected-area authorisations, final technical drawings, the applicable ornithological requirements or other formal approvals required before physical works begin.

1.3. Institutional setting and restoration principles

EcoAlbania will have overall responsibility for management and delivery. Under the revised implementation arrangement, SISMAE will no longer act as an implementing partner. Specialist technical cooperation may nevertheless continue where EcoAlbania contracts individual experts for defined design, supervision or training tasks. This distinction should remain clear in all project documentation: technical contributions previously developed through SISMAE remain part of the project knowledge base, but responsibility for current implementation rests with EcoAlbania.

Shkodër Municipality is relevant both because of the municipal/public-land context described in the project documents and because changes in secondary-channel connectivity may influence access and local use. RAPA Shkodër and other competent authorities will define the applicable protected-area conditions. Users of adjacent agricultural and pastoral land should be consulted before works because the restoration may alter local wetness or inundation patterns. The Forestry Technical School in Shkodër can provide an important capacity-building and practical-restoration role but should not be assigned responsibilities that require engineering authority or hazardous construction work.

Implementation should follow three practical principles. The first is minimum intervention. Excavation, bank reshaping and mineral material should be limited to what is necessary to restore function or provide initial stability. The second is full use of appropriate local material. Earlier technical planning proposes reusing trunks as posts, medium branches as cuttings and whips, and finer branches for fascines and brush layering. The third is adaptive management. The project should respond to actual site and river conditions rather than reproduce a preliminary drawing regardless of what is observed in the field.

These principles are particularly important in the protected Buna landscape. A technically successful intervention should gradually become less dependent on installed structures and increasingly dependent on the functioning of the river and riparian vegetation. The project should therefore create initial conditions for recovery rather than establish a permanently controlled riverbank.

2. Site description, baseline and problem diagnosis

2.1. Site setting, protected-area context and local use

The project site lies along the Albanian part of the Buna River in Shkodër County. The restoration area includes the eroding right bank, the adjacent secondary channel, the blocked inlet area, existing riparian vegetation and nearby land used for pasture, grazing and cultivation. The site therefore functions simultaneously as part of a protected river corridor and as a locally used landscape.

The project documentation places the intervention within a protected/Ramsar context and identifies RAPA Shkodër among the relevant institutional actors. This status directly affects implementation. Machinery movement, vegetation removal, handling of excavated material, sourcing of plants and seasonal timing cannot be considered only from a construction perspective. The method must remain compatible with protected-area requirements and with any conditions attached to the final permits.

Local use is equally relevant. The project documents refer to municipal ownership while recognising continued use of the riparian area by farmers and herders. The restoration of water movement through the side branch may therefore alter the condition of areas that have become accessible or drier during the period of reduced connectivity. Consultation should occur before excavation so that EcoAlbania and Shkodër Municipality understand the practical implications for access and land use and can communicate clearly that renewed inundation is an intended restoration outcome.

This social consideration should not result in the ecological purpose of the reconnection being compromised unnecessarily. If an existing informal crossing becomes less reliable after the branch is restored, the first response should be to examine alternative access arrangements with Shkodër Municipality and users rather than to reduce channel connectivity solely to preserve the present dry condition. Earlier SISMAE input similarly recommends coordination with the municipality, forestry school and riparian users for both access and longer-term maintenance.

2.2. Existing morphology and hydromorphological problem

The main morphological feature relevant to the intervention is the relationship between the Buna main channel and the natural secondary branch. The branch remains visible and physically present but is restricted at its upstream connection by sediment and alluvial deposition. The available project material considers this inlet obstruction sufficiently localised for reconnection through relatively limited excavation rather than reconstruction of the full channel.

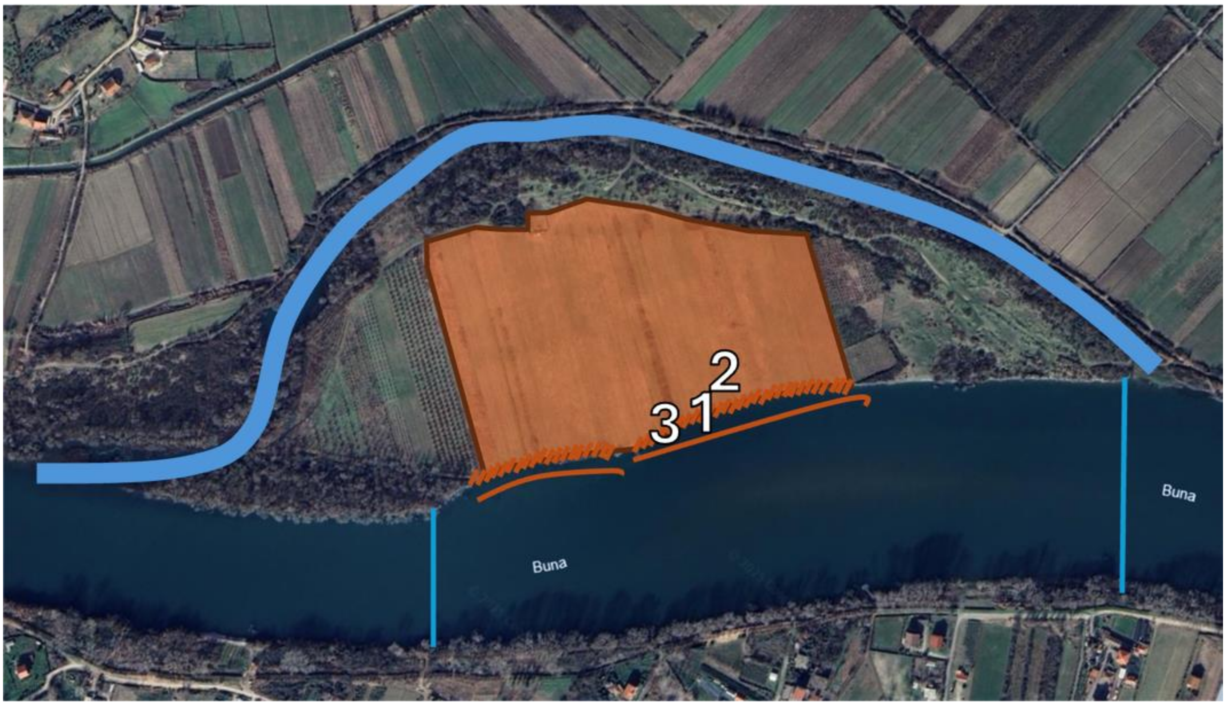

Figure 2: Morphology of the project intervention site

The loss of connectivity matters because side channels provide additional space for the river to distribute water and sediment. Historical imagery indicates that the site had greater lateral openness previously.

Figure 3: Illustration pictures of riverbank and river terrace at the proposed intervention site

The present working diagnosis is that the reduction of this lateral flow path has contributed to concentration of hydraulic action in the main channel and therefore to increased pressure on the right bank. The project presentation and the longer Technical Plan both rely on this interpretation. The right bank has consequently experienced active erosion. Earlier field observations describe the bank as broadly 5–6 m high in relevant sections.

The process appears to include attack at the lower bank and subsequent instability or retreat of the upper bank. This is important for the design because planting only the upper slope would not address the vulnerability of the toe. Where active stabilisation is required, lower-bank protection and anchoring must therefore be integrated with vegetation higher on the slope.

At the same time, erosion should not be treated as inherently undesirable. The Buna is an alluvial river, and bank erosion, deposition and sediment redistribution are part of its natural behaviour. The project is concerned with excessive or locally problematic erosion, not with elimination of channel dynamics. This is one of the principal reasons why continuous bank protection is inappropriate.

2.3. Vegetation, habitat and ecological constraints

Existing alluvial and riparian vegetation already performs important restoration functions at the site. Mature trees and shrubs provide developed root systems, shade, habitat and connectivity. Natural regeneration is also present in parts of the river corridor and represents locally adapted vegetation that has established without intervention. These existing assets should be retained wherever they are compatible with the essential works.

Areas requiring active restoration are therefore likely to occur as gaps within a wider vegetation mosaic rather than as one continuous planting strip. Willow is particularly relevant because it can provide living material for fascines, cuttings, whips and potentially living posts. Other native riparian species can be used according to their natural position in the moisture gradient. The final selection, however, should depend on what is actually confirmed locally.

The exposed eroded bank introduces an important ecological constraint. The project documentation recognises Sand Martins and European Bee-eaters as relevant species and acknowledges that exposed erosion cliffs can provide future nesting habitat. This means that the same bank face may simultaneously be considered unstable from an engineering perspective and valuable from an ornithological perspective.

The final site zoning must resolve this issue spatially rather than attempting to treat both objectives uniformly. Sections identified for nesting-habitat retention should remain open and free from unnecessary reprofiling or dense vegetation. Sections where erosion threatens the restoration objective can receive treatment. A successful final site may therefore contain visibly untreated exposed banks immediately beside restored vegetated sections. That contrast is intentional and should not be interpreted as incomplete construction.

2.4. Baseline information to be closed before construction

The existing baseline is sufficient to support a positive feasibility conclusion, but several parameters need final site confirmation before mobilisation. These relate principally to the exact implementation layout rather than to the validity of the overall concept.

EcoAlbania and the technical team should mark the 450 m project reach and identify its internal treatment zones. The upstream inlet of the secondary channel should be surveyed sufficiently to establish the current obstruction geometry and the level to which sediment can initially be lowered. Downstream continuity of the branch should be checked to ensure that reconnecting the inlet will provide meaningful lateral function rather than simply fill an isolated depression.

The bank should be walked section by section to identify locations requiring reprofiling, locations where direct bioengineering is possible without extensive reshaping, areas of mature vegetation to be retained and no-intervention ecological sections. Local donor vegetation should be inspected at the same stage so that the actual quantity of appropriate willow and other native material can be estimated without placing excessive pressure on donor stands.

The access route, machinery working position and temporary material-storage area should also be fixed before mobilisation. Finally, the permit conditions and any definitive ornithological requirements should be transferred onto the same site plan used by the contractor. Once these elements are confirmed, the project can move from feasibility planning into implementation without requiring another broad conceptual review.

3. Technical feasibility and restoration strategy

3.1. Overall feasibility and limits of the available evidence

The proposed intervention is technically feasible in principle because it works primarily with existing site features and established bioengineering methods. The secondary channel already exists and does not require construction as a new watercourse. The inlet obstruction appears localised enough for limited excavator work. The bank can be treated selectively using conventional earthmoving equipment together with plant-engineering methods that have already been considered during project preparation.

The main uncertainty concerns the hydraulic response after reconnection. No detailed model in the current source set establishes a numerical reduction in main-channel velocity or shear stress. Consequently, the intervention should not be justified through unsupported hydraulic values. Its technical basis is the restoration of lateral connectivity, combined with observation of the response during staged excavation.

Bank bioengineering is similarly feasible, but its performance will depend on execution quality and hydraulic exposure. SISMAE's technical response refers to documented experience showing that vegetated bank-protection techniques can perform effectively but that destructive floods and poor construction details remain important failure mechanisms. The literature values cited in that response provide context but cannot be treated as Buna-specific design thresholds without corresponding hydraulic calculations.

Feasibility is therefore conditional rather than uncertain in a way that prevents implementation. The appropriate response is to use hold points, site supervision and adaptive construction. This is more appropriate than attempting to eliminate every uncertainty through a much larger engineering design that would itself be inconsistent with the ecological character of the site.

3.2. Spatial restoration strategy

The 450 m reach should be treated as a sequence of different functional areas rather than as one continuous engineering section. The plan identifies the secondary-channel inlet zone, active bank-stabilisation zones, lower-bank bioengineering areas, riparian restoration areas, existing vegetation and natural-regeneration areas, and bird-habitat no-intervention zones.

This zoning reduces both construction intensity and ecological impact. It also allows resources to be concentrated where they are most useful. A recently collapsed section with active toe erosion may justify local reprofiling, anchoring and dense willow treatment. A nearby section already occupied by stable native vegetation may require no physical intervention. A steep exposed nesting face may need to remain untouched even if its geometry would normally be considered unsuitable for planting.

The same differentiated approach should apply to planting. The objective is not to achieve a uniform density across the entire project reach. Lower wet areas requiring rapid root reinforcement should receive more intensive living material. Higher areas can support a more diverse and less dense riparian structure. Areas with strong natural regeneration can be protected rather than replanted.

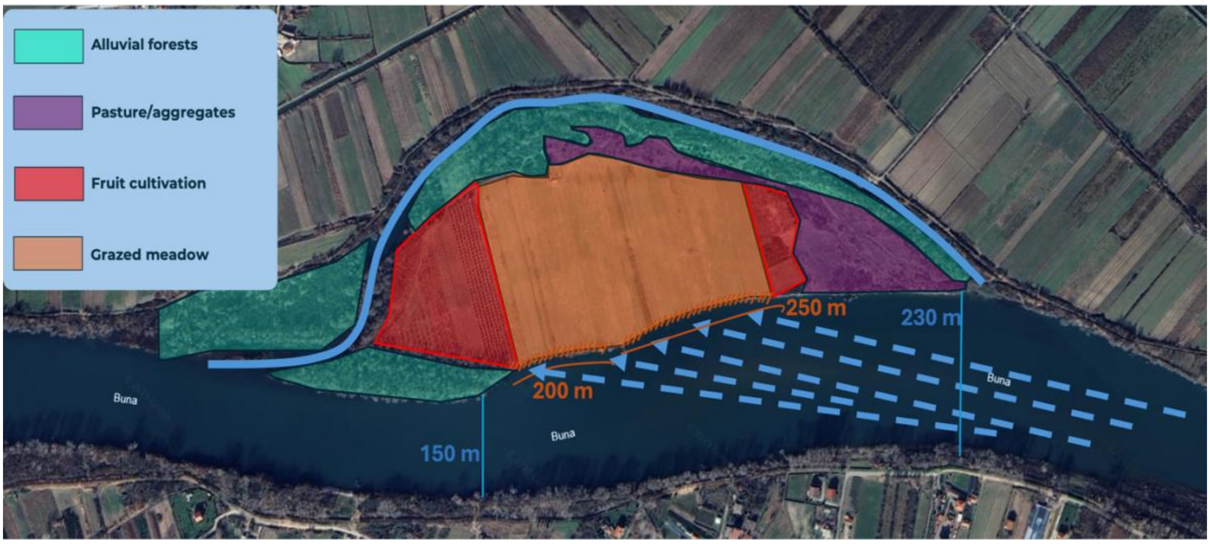

Figure 4: State of landuse and vegettion cover at the site

This spatial strategy is the principal mechanism through which the project reconciles erosion management, biodiversity conservation and minimum intervention. It also means that the final quantities cannot be calculated reliably simply by multiplying the earlier 200 m design by 1.25.

3.3. Conditions governing implementation

The intervention should proceed only when technical, ecological and operational readiness coincide. Final zoning and drawings must be available. Protected-area authorisations must be obtained. The inlet and bank condition must still support the proposed method. The ecological work area must be cleared. Suitable local plant material must be available. The river must be at a level that allows controlled and safe work.

Seasonality is particularly important because earthworks, bird sensitivity and plant biology create overlapping constraints. The works shall be implemented in four consecutive phases.

Phase 1 – Site Preparation and Pre-Implementation Works: October 2026

During October 2026, the Contractor shall establish the approved access arrangements and working areas within Zone 1 and complete all preparatory activities required for the subsequent riverbank and inlet interventions. This phase shall include setting out of the approved work limits, installation of temporary environmental protection measures, preparation of access routes, establishment of material handling areas, and ecological clearance of the authorised work footprint.

Before works proceed into Zones 2 and 3, the final condition of the inlet and riverbank shall be verified against the approved design. This verification shall confirm that no material change in bank geometry, erosion condition, sediment configuration or hydraulic behaviour has occurred that would prevent implementation of the specified method.

All plant material, including willow required for living structures, shall be identified and secured during this phase so that suitable locally sourced material is available within the required biological window.

Phase 2 – Main Riverbank and Bioengineering Works: November 2026

November 2026 shall constitute the principal implementation period for the living restoration and bioengineering works.

Works in Zone 3 shall include installation of the specified living willow structures, associated bank preparation, planting and all related bioengineering measures shown on the approved drawings. Willow material shall be harvested, handled and installed only while it is in a suitable dormant condition and shall be installed promptly following harvesting in accordance with the technical specifications.

Works within Zone 2 shall be undertaken during the same implementation period where river level, flow conditions and site access allow controlled and safe execution. Near-water earthworks and inlet works shall only proceed when river conditions permit the defined intervention to be carried out without unacceptable risk of erosion, uncontrolled sediment mobilisation, damage to completed works or unsafe working conditions.

The sequence of works within Zones 2 and 3 shall be coordinated so that earthworks and bank preparation are completed immediately before the associated stabilisation and planting measures, thereby minimising the period during which exposed bank surfaces remain untreated.

Phase 3 – Completion, Reinstatement and Corrective Works: December 2026

During December 2026, all remaining construction and restoration activities shall be completed. This phase shall include completion of outstanding works within Zones 2 and 3, correction of local defects identified during implementation, completion of planting where biologically appropriate, removal of temporary construction measures that are no longer required, and progressive reinstatement of disturbed areas within Zones 1 and 4.

By the end of December 2026, the principal intervention works shall be substantially complete, with the site stabilised and all permanent erosion-control and bioengineering measures installed.

Phase 4 – Final Completion and Demobilisation: January 2027

January 2027 shall be reserved for final inspection, completion of any minor outstanding or corrective works, reinstatement of temporary access and working areas, removal of temporary facilities and surplus materials, ecological reinstatement, and final demobilisation.

No new major intervention activity shall be initiated during this phase. All physical works, reinstatement and demobilisation shall be fully completed by **31 January 2027**.

If river levels are too high, near-water works should wait. If living willow material is not in suitable dormant condition, harvesting and installation should wait. If the ecological work window has closed, the relevant activity should be postponed. The project should not compensate for administrative or procurement delays by carrying out living restoration under unsuitable conditions.

This conditional approach should be incorporated into the contractor's programme so that pauses at technical hold points are treated as part of the method rather than as construction delays.

4. Nature-based restoration design

4.1. Site zoning and minimum-intervention design

The detailed design for the Buna riverbank shall be implemented through a practical site-zoning approach rather than by applying a uniform treatment along the full approximately 450 m reach. The purpose of the zoning is to clearly define where intervention is required, what type of intervention is permitted, and where works are to be avoided. This reflects the variable condition of the riverbank, where some sections require active stabilisation while others are already stable, naturally vegetated or of particular ecological value.

The zoning plan shall therefore act as a principal construction-control tool and shall be read together with the detailed design drawings. The overall project boundary shall not be interpreted as an unrestricted working area. The Contractor shall limit activities to the specific zones and intervention footprints identified on the drawings, with the general principle that physical disturbance should be kept to the minimum necessary to achieve the design objectives.

Zone 1 shall comprise the approved access routes, temporary working areas, material handling areas and other locations required for site establishment and construction logistics. These areas shall be kept as compact as practicable and positioned so as to minimise disturbance to existing riparian vegetation. Mature trees, naturally regenerating vegetation and stable bank areas outside the defined working limits shall not be cleared, tracked over or used for material storage. Following completion of the works, all temporary access and working areas shall be reinstated and, where necessary, revegetated.

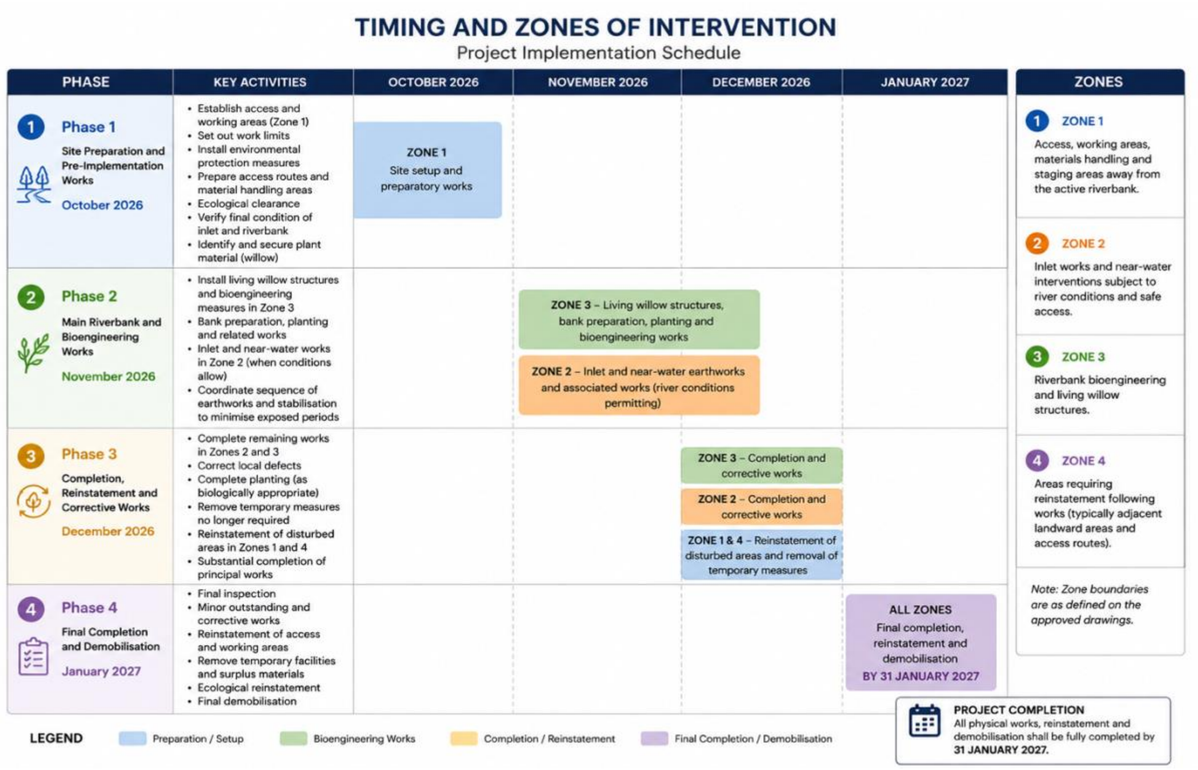

Figure 5: The zonning and time-table of intervention matrix

Zone 2 shall comprise the secondary-channel inlet and the immediately associated near-water work area. This shall be treated as a discrete hydromorphological intervention zone because its condition is directly influenced by river level, flow, sediment deposition and local erosion processes. Works may include local excavation, sediment adjustment, bank reprofiling, toe treatment, erosion-control measures and associated bioengineering where shown on the approved design. Intervention shall remain strictly within the defined footprint and shall not involve general widening, excavation or modification of the inlet beyond the design requirements. Before construction begins in this zone, the actual condition of the inlet, bank geometry and sediment configuration shall be checked against the detailed design. If material changes have occurred, the proposed treatment shall be reviewed before works proceed. Near-water works shall only be undertaken when river and access conditions allow safe execution without unacceptable erosion or sediment mobilisation.

Zone 3 shall comprise the sections of the main right bank where active restoration is required due to erosion, local instability, degraded vegetation or insufficient bank protection. These areas shall occur as discrete intervention sections rather than as one continuous treatment corridor. Within Zone 3, works may include local reprofiling, toe stabilisation, living willow structures, other bioengineering measures, biodegradable erosion-control materials and riparian planting, depending on the condition and requirements of each section. Reprofiling shall be limited to locations where it is necessary for stability or for the effective installation of the specified treatment. Stable bank features, mature trees and established vegetation shall be retained wherever practicable and incorporated into the restoration approach.

Within Zone 3, a distinction should be maintained between areas requiring active bank stabilisation and areas requiring principally riparian restoration. Where the bank is structurally stable but vegetation is fragmented, intervention should be limited mainly to planting, enrichment and improvement of vegetation continuity rather than earthworks. Existing successful natural regeneration shall be retained and considered part of the restoration treatment. At the ends of active treatment sections, the works shall transition gradually into the existing bank so that abrupt changes in slope, elevation or bank form are avoided.

Zone 4 shall comprise ecological protection and no-intervention areas. These shall include mature woodland, stable naturally vegetated bank sections, successful natural regeneration and any exposed-bank habitats identified as important for Sand Martin or other nesting species. Within these areas, the existing bank form and vegetation shall be retained and physical intervention shall generally not be permitted. In particular, protected exposed-bank habitat shall be designated as a no-reprofiling and no-planting area. Construction access, excavation, storage of materials and unnecessary vegetation clearance shall also be excluded from these sections unless specifically authorised.

This approach intentionally allows the completed riverbank to remain irregular and spatially varied. The final condition may therefore include stabilised sections, bioengineered areas, planted riparian zones, naturally regenerating vegetation and exposed-bank habitat occurring alongside one another. Such variation shall be regarded as an intended design outcome. The objective is to achieve hydraulic stability, ecological continuity and habitat diversity rather than a visually uniform bank profile. Prior to the start of the principal works, the zone boundaries shall be verified and marked on site using chainages, coordinates, stakes or other suitable visible references. The drawings should clearly identify the limits of Zone 1 access and working areas, the Zone 2 inlet intervention, the individual Zone 3 treatment sections and all Zone 4 protection areas. Where appropriate, the start and end of each intervention section should be identified by chainage so that the Contractor can readily relate the design requirements to the physical site.

A pre-construction inspection shall also be undertaken to confirm that the observed bank condition remains consistent with the design. If a section identified for treatment has naturally stabilised or successfully regenerated, the extent of intervention may be reduced. Conversely, works shall not be extended into previously untreated or protected areas without technical justification and prior approval. The governing principle shall therefore be that intervention may be reduced where site conditions allow, but shall not be expanded beyond the approved limits without confirmation.

The zoning plan shall consequently provide a clear and practical basis for construction, allowing the Contractor to understand where works are permitted, where only limited restoration measures are appropriate and where the existing riverbank and habitat must remain undisturbed. This targeted approach is considered more suitable for the Buna site than the application of a uniform typical section along the full reach and will help ensure that engineering works remain proportionate to actual erosion and stability needs while protecting the ecological functions already present on site.

4.2. Integration of channel reconnection, bank treatment and vegetation

The restoration components should be implemented as a sequence. The secondary-channel inlet should normally be addressed first because its hydraulic response may influence the final intensity of treatment required along the main bank. After initial reconnection, the technical team should reassess the planned bank sections before substantial reprofiling begins.

Where active bank treatment remains justified, the structural logic should proceed from the toe upward. Localised anchoring protects the most exposed lower section during the establishment phase. Willow fascines and other living material create immediate roughness and sediment-retention capacity. Brush layers and cuttings higher in the profile extend root reinforcement through a greater part of the bank. Broader riparian planting then links the treated structure to the surrounding vegetation corridor.

Over time, these separate installed elements should become less visually and functionally distinct. Successful willow should root and develop shoots. Brush layers should integrate into the slope. Naturally regenerating plants should colonise gaps. The bank should gradually function as a vegetated riparian system rather than as a recognisable engineered structure. This progressive transfer of function from installation to vegetation is fundamental to the Nature-based design.

4.3. Final design outputs

Before construction, the technical package should contain one coordinated site plan rather than multiple overlapping conceptual plans. That plan should show the 450 m reference reach, the secondary-channel inlet, active bank-treatment areas, planting zones, natural-regeneration areas, mature vegetation to be protected, ecological exclusions, machinery access and temporary working space.

Representative cross-sections should be prepared for the principal bank-treatment types. These do not need to describe every metre of bank. They should show the relationship between the existing bank, any proposed reprofiling, toe protection, fascines, brush layers and upper-bank planting. The 2H:1V concept can be shown where relevant but should be clearly described as conditional on local morphology.

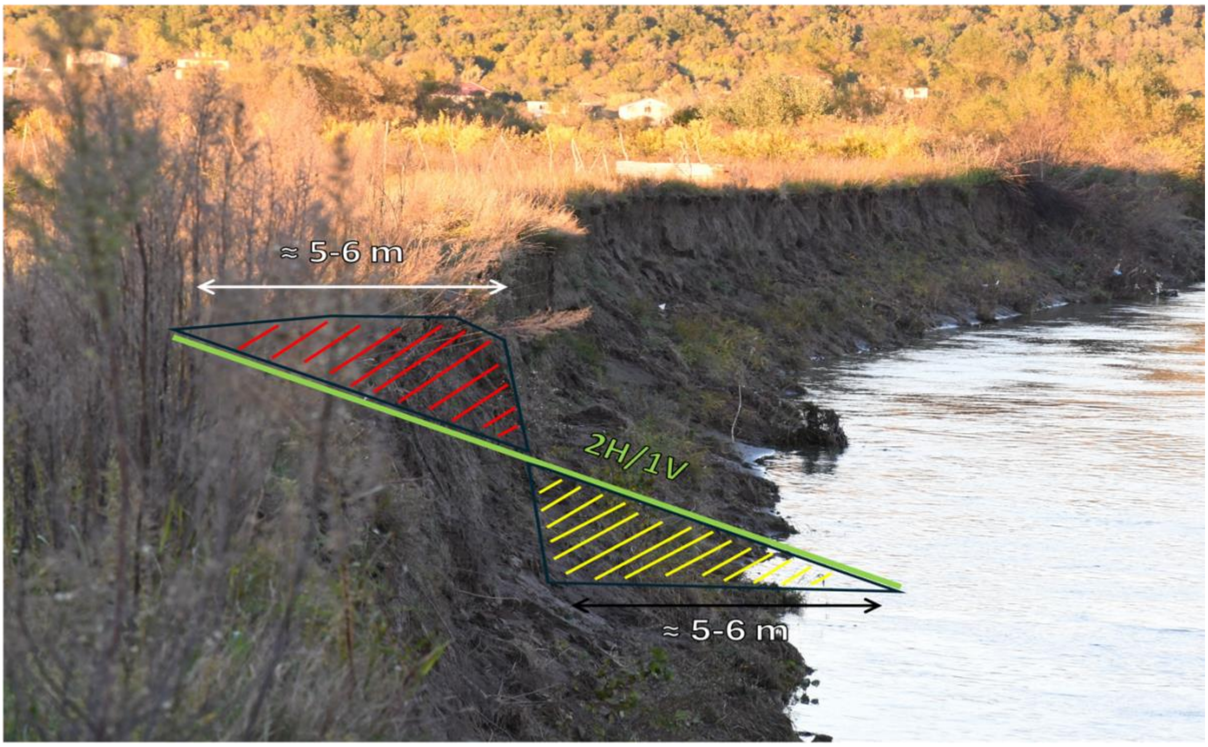

Figure 6: Illustration picture of the 2H:1V concept from the site

A separate inlet detail should show the extent of initial sediment lowering and the staged excavation logic. Bioengineering details should illustrate the intended relationships between posts, fascines, living branches and soil rather than prescribing unsupported dimensions that have not yet been validated.

The final drawings should be sufficiently clear that EcoAlbania, the supervising engineer and the machine operator can all identify the permitted intervention directly in the field.

5. Secondary-channel reconnection

5.1. Reconnection objective and pre-work verification

The secondary-channel intervention aims to restore functional lateral connectivity between the Buna main channel and the existing branch. It does not aim to establish continuous year-round flow or a fixed share of river discharge. The branch may naturally operate intermittently or seasonally depending on the level of the Buna.

Immediately before excavation, the technical team should verify the inlet condition. The current elevation of the obstruction, its approximate thickness and composition, the difference between the main river and branch bed, and the downstream continuity of the branch should be checked. The work limits should then be marked visibly.

The branch itself should be inspected but not automatically cleared. Natural woody debris, irregular banks, vegetation and local sediment features may contribute to habitat complexity. They should only be removed where they create an actual barrier to the intended connection or another demonstrable technical problem.

The access and excavator working position should be chosen so that the machine can reach the inlet without unnecessary travel through riparian vegetation or flowing water.

5.2. Staged excavation and Sediment management

Excavation should begin from the dry or least hydraulically active part of the inlet wherever the site configuration allows. Sediment should be removed incrementally rather than through immediate excavation to a predetermined large cross-section.

The critical moment occurs when water first begins entering the side branch. Excavation should stop at that point. The technical supervisor should observe the direction, intensity and stability of the flow before deciding whether additional lowering is necessary. This pause is not optional; it is the principal control mechanism for avoiding excessive opening.

If additional excavation is required, it should proceed in small stages. The contractor should not be assessed on the volume of sediment removed. Over-excavation would represent poor performance even if it increased the measured earthwork quantity.

Excavated clean sediment can be reused locally where technically appropriate, for example in approved bank shaping. Material not required should be placed outside the branch, active flow paths and sensitive habitat, in a stable position from which it is unlikely to be washed directly back into the river.

5.3. Hydraulic observation, hold points and stop conditions

The first hydraulic connection should be assessed qualitatively because the project does not currently possess the detailed modelling needed to predict the exact response. The team should look for a controlled entry of water and continued downstream movement through the existing branch.

A weak initial connection does not automatically mean that the inlet must be enlarged substantially. If the river stage is relatively low, the branch may be functioning as expected even with only limited flow. The intervention should be judged in relation to the river level at the time.

Conversely, if water enters strongly and begins eroding the inlet rapidly, further excavation should stop. The technical expert or local supervising engineer should assess whether the connection is already sufficient or whether local stabilisation is required.

Work should also stop if the river level rises unexpectedly, if the working platform becomes unstable, if excessive sediment release occurs, if a fuel or hydraulic leak develops, or if an ecological issue is identified within the work area.

5.4. Post-opening adjustment and maintenance

Immediately after the opening, the inlet and accessible part of the side channel should be photographed and documented. The technical team should also inspect the site after the first significant high-flow event once safe access is possible.

Sediment deposition after reconnection should not automatically trigger new excavation. Reworking of the inlet is part of the natural behaviour of an alluvial river. Maintenance becomes justified when deposition results in a meaningful loss of the restored function, not simply because the inlet no longer resembles its post-construction form.

Likewise, the side channel should not become subject to routine mechanical clearing. The project is intended to restore a natural branch, not create a maintained drainage ditch. Vegetation, local sediment bars and woody features should generally be accepted unless they prevent the branch from functioning.

6. Riverbank stabilisation and bioengineering

6.1. Selective bank preparation and reprofiling

Bank works should begin only after the secondary-channel response has been reviewed and the active treatment sections reconfirmed. The entire 450 m reach must not be reprofiled.

Where a bank section is excessively steep, freshly collapsed or otherwise unsuitable for installation of living structures, limited reshaping may be undertaken. Earlier project work uses approximately 2H:1V as a preliminary reference for treated areas. That geometry may be useful in some locations but should not be imposed where a different profile can remain stable with less excavation.

The final bank surface does not need to be perfectly smooth. Small irregularities support microhabitat and can help integrate the intervention into the surrounding riverbank. Existing mature roots and vegetation should be protected, and the reprofiling should adapt around them where technically possible. No reprofiling should take place within confirmed bird-nesting conservation sections unless the applicable ecological requirements specifically allow it.

6.2. Toe protection and localised rock anchoring

The lower bank requires particular attention because undermining at the toe can lead to failure of otherwise well-established upper-bank vegetation. The project therefore includes vegetated toe protection together with limited mineral reinforcement at critical locations.

The plan proposes reinforced rock-block anchoring immediately upstream of the living bank-protection structure to reduce the risk that the first floods undermine the toe or pass behind the treatment. This is an appropriate supporting measure provided that it remains localised.

The project should not develop a continuous riprap revetment. Rock is intended to protect vulnerable transition and anchoring points while vegetation develops. Where it is used, the living bank treatment should connect closely to the mineral element so that the finished bank remains predominantly vegetated. The final dimensions and quantity of rock should be established from the actual treatment zones and local hydraulic exposure rather than from a fixed amount per metre of the 450 m project reach.

6.3. Fascines, brush layering, live cuttings and local woody material

Willow fascines will form one of the principal lower-bank bioengineering measures.

Figure 7: Demonstration of the Willow fascines concept that could potentially be implented on site

They should be prepared from healthy, flexible, locally derived willow material collected during a suitable dormant period and installed promptly to avoid drying. The bundles should remain in close contact with moist soil and should be firmly secured with appropriate stakes or posts.

Brush layering can be used higher on reprofiled sections to extend living reinforcement through the bank. Where possible, it should be installed progressively during bank shaping so that branches are incorporated into the soil rather than inserted after the slope has been fully completed.

Live willow cuttings and whips should supplement these structures across treated areas. Their exact spacing should be determined through the final technical specification and should not create a plantation-style grid. The objective is sufficient living density for reinforcement while maintaining a natural appearance and allowing spontaneous vegetation to develop.

The project should maximise appropriate reuse of woody material generated during necessary preparation. Trunks can provide posts and structural pieces, medium branches can supply whips and cuttings, and smaller flexible branches can be incorporated into fascines and brush layers. This full-material-use approach is already embedded in the revised implementation arrangement.

6.4. Construction sequence and early performance

The bank should be treated from the lower structural elements towards the upper ecological restoration. Toe anchoring is installed first, followed by fascines, brush layers and live cuttings as the bank profile is completed. Broader riparian planting follows after the structural living measures are secure.

The first representative bioengineering section should be inspected before the same detail is repeated elsewhere. The supervising engineer should confirm that posts and anchoring are stable, living material is fresh, fascines remain in contact with suitable soil and brush layers have been incorporated properly.

The first significant high-flow event will provide an important test. Movement of small amounts of sediment or partial burial of living structures may be acceptable. More serious warning signs include undermining, movement of the entire fascine line, erosion behind the treated area or failure at the transition between treated and untreated bank.

Corrective work should respond to the cause. A repeatedly failing structure should not simply be rebuilt identically without reassessing hydraulic exposure and installation details.

7. Riparian vegetation restoration and local plant material

7.1. Local genetic material and donor vegetation

The restoration should rely primarily on native plant material collected from the site or another immediately local and approved source. This reflects both the ecological logic of the project and the protected-area constraints identified during preparation.

Before harvesting, donor vegetation should be mapped sufficiently to confirm species, condition and sustainable availability. Willow stands will be particularly important because they can supply several types of living material. Collection should be distributed among appropriate donor plants and should not substantially degrade one tree or stand.

Material should be harvested in coordination with installation. Large quantities should not be cut simply because labour is available if the receiving bank is not yet ready. Freshness and viability are more important than achieving a preliminary quantity. Plant origin should be recorded in a simple field system showing the species or material type, donor area, collection date and receiving treatment area.

7.2. Vegetation zonation along the riverbank

Planting should follow the site's hydrological gradient. Willow should dominate the lowest and wettest part of the restored bank because it tolerates frequent inundation and can root effectively from living branches and cuttings.

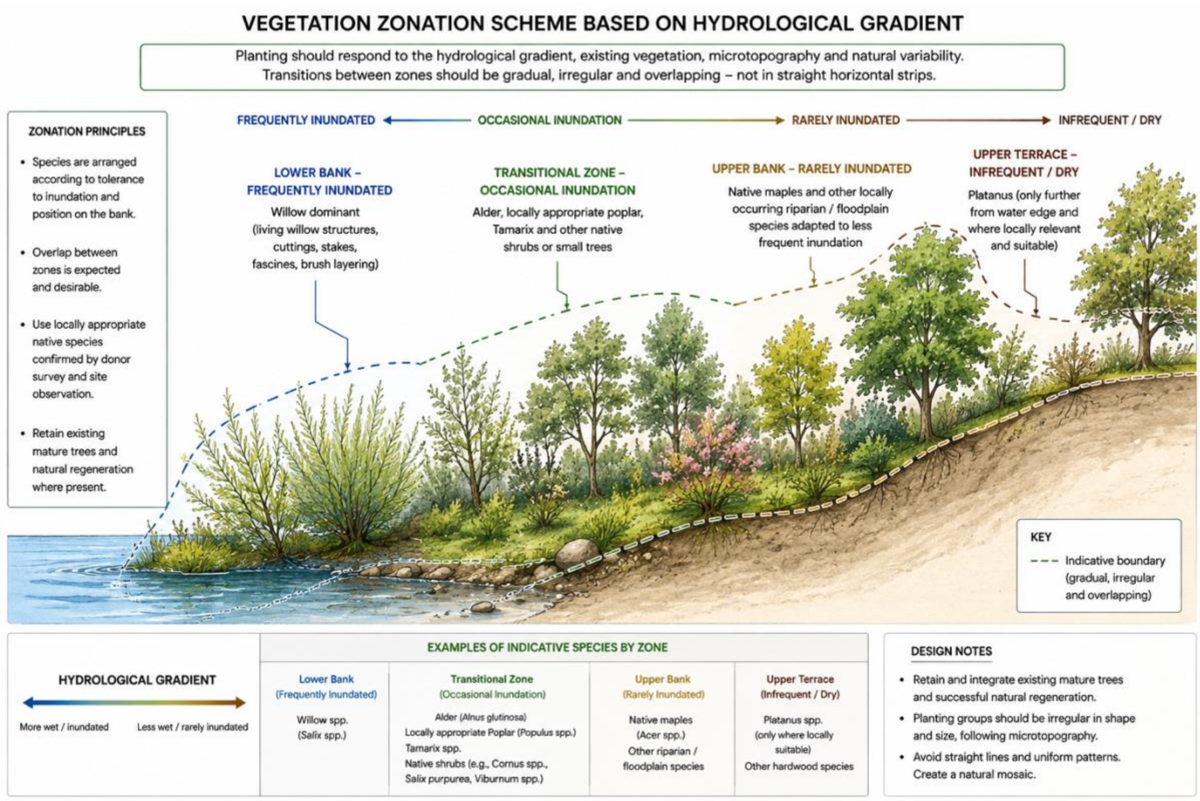

Figure 8: Schematic explaination of the vegetation zonation to be recovered on site

Moving higher, alder and locally appropriate poplar can contribute to the developing riparian woodland where these species are confirmed in the local vegetation. Tamarix and other native shrubs or small trees may be incorporated where site observation confirms their natural relevance.

Upper parts of the bank should transition towards species adapted to less frequent inundation. Appropriate native maples or other locally occurring riparian/floodplain species can be used where supported by the donor survey. Platanus should be positioned further from the active water edge and only where its local occurrence and suitability are confirmed.

This zonation should not appear as straight horizontal strips. Local depressions, terraces, existing vegetation and microtopography should create gradual overlap and irregularity.

7.3. Natural regeneration and planting method

Natural regeneration should be treated as a central restoration mechanism rather than an unplanned addition. Where native seedlings, shoots or young shrubs are already establishing, the project should protect them and reduce active planting accordingly.

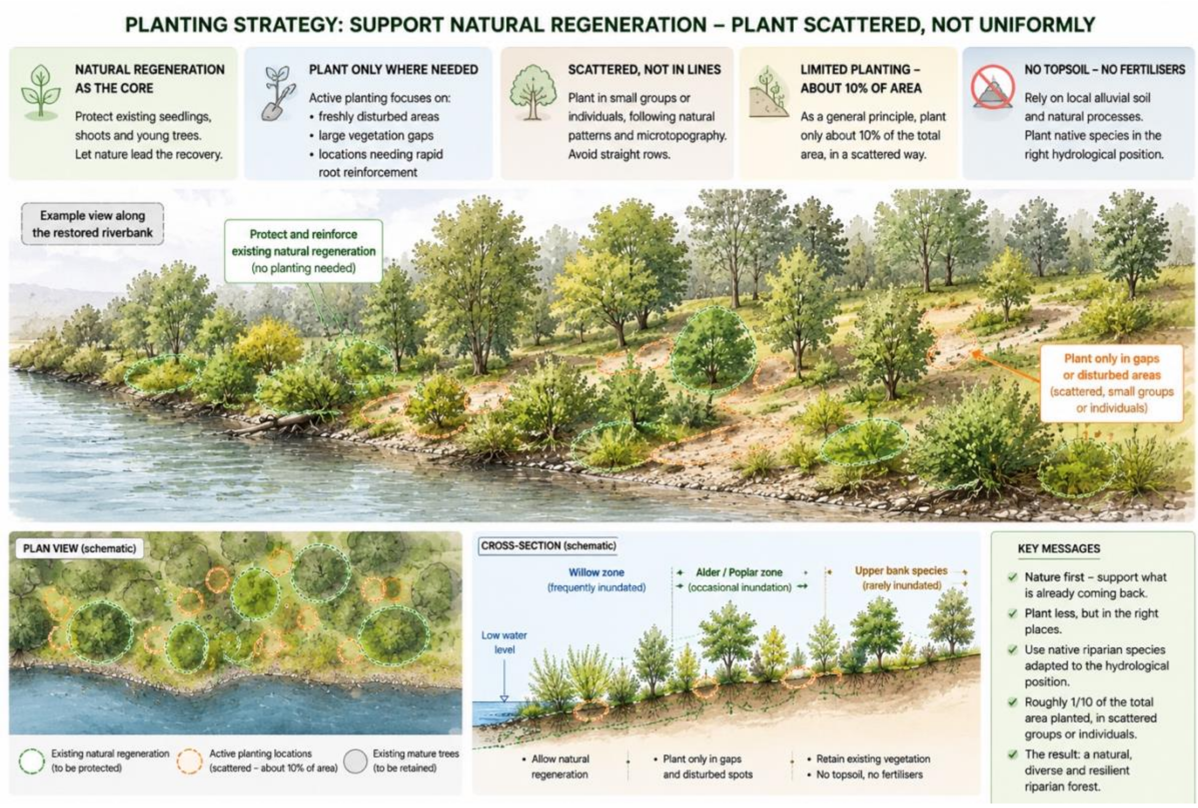

Figure 9: Scheme of planting method for riparian forest restoration on site

This approach improves ecological authenticity and reduces demand on donor material. It also provides information about which species are naturally responding to the site's hydrological conditions.

Active planting should focus on freshly disturbed bioengineering areas, large vegetation gaps and locations where rapid root reinforcement is required. The project should avoid importing topsoil or routinely applying fertilisers. Native riparian vegetation should be expected to establish in the local alluvial substrate when planted in the appropriate hydrological position.

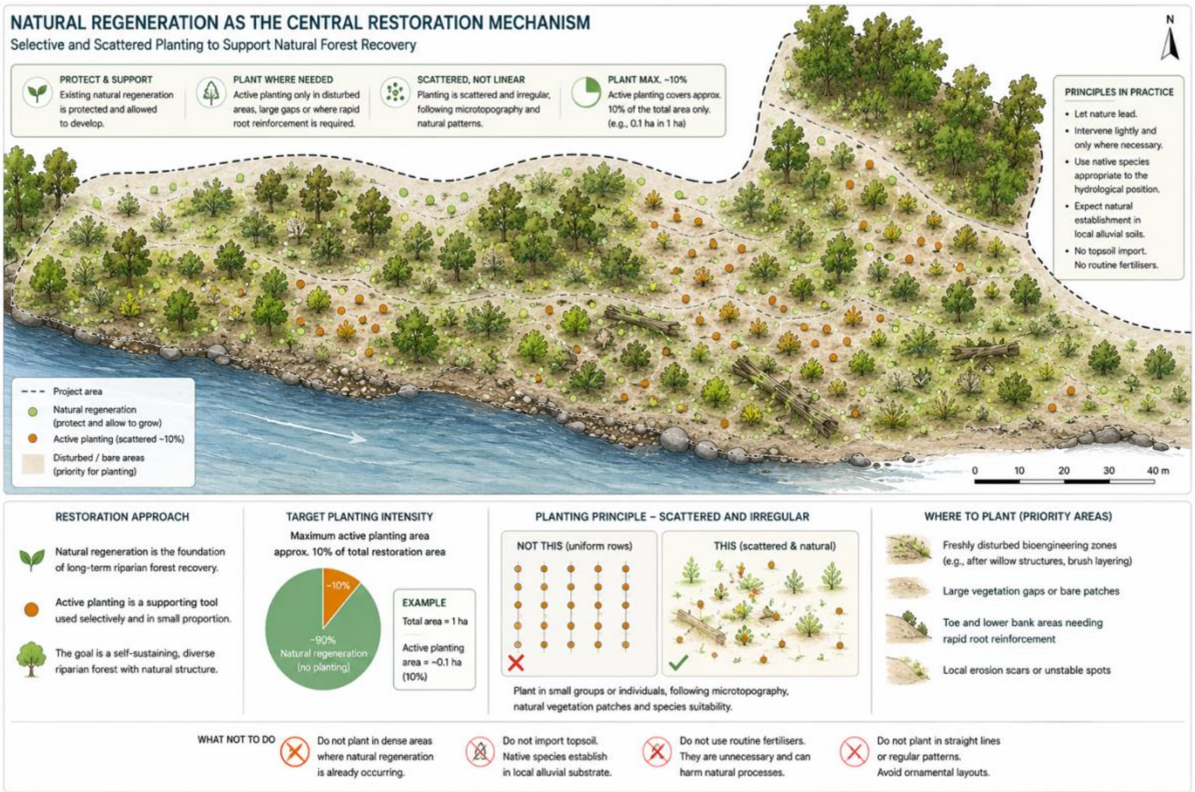

Figure 10: The scattered planting method model, appropriate for forest restoration on Protected Areas

Where initial mortality occurs, replacement should be based on function. If natural regeneration is successfully filling the same ecological role, numerical replacement of every dead cutting is unnecessary.

7.4. Forestry technical school participation and establishment care

The Forestry Technical School in Shkodër can play a useful practical and educational role during vegetation preparation, planting and monitoring. The revised work plan already provides for technical training and field demonstrations involving EcoAlbania staff, students, youth and local stakeholders.

Students can assist with identification of donor vegetation, preparation of cuttings, fascine bundling, planting, recording plant origin and later vegetation observations. They should not participate in excavator operations, rock placement, unstable-bank work or activities immediately adjacent to hazardous flowing water.

During the establishment period, vegetation should be observed for drought stress, grazing and mechanical damage. Long-term artificial irrigation is not intended, but limited emergency watering may be appropriate in exceptional dry conditions for higher-bank planting. Cooperation with local users should be used to reduce grazing damage where possible rather than defaulting to extensive permanent fencing.

8. Biodiversity, protected-area and environmental safeguards

8.1. Protected-Area compliance

The protected/Ramsar context is a design and implementation condition, not simply an administrative reference. EcoAlbania will obtain the required approvals before physical works and translate all permit conditions into the contractor's field instructions.

RAPA Shkodër will be consulted as required regarding machinery, vegetation removal, plant sourcing, habitat protection and other protected-area conditions. If a permit or competent authority establishes a requirement more restrictive than this Plan, that requirement should prevail.

Machinery will use existing or previously disturbed access wherever possible. Temporary storage should remain outside sensitive vegetation, active flow paths and areas likely to be inundated. Vegetation should only be removed where it directly conflicts with the approved works.

The intervention should leave no conventional construction waste within the river corridor.

8.2. Sand Martin and European bee-eater habitat

Exposed erosion faces must be assessed as habitat before they are considered for stabilisation. Sand Martins and European Bee-eaters are recognised in the project documentation as species relevant to the intervention, and the source material acknowledges that works outside the active breeding period can still modify habitat available for future nesting.

The final intervention plan should therefore show protected exposed-bank sections clearly. Within these areas, reprofiling, dense planting, storage of material and machinery movement should be excluded unless specifically allowed by the applicable ecological requirements.

Immediately before work, EcoAlbania should verify that the ecological assumptions remain valid. River erosion can create new suitable faces between design and implementation. If an active nest or other sensitive feature is discovered unexpectedly, work in the immediate area should stop pending ecological assessment.

The current source set does not contain a detailed ornithological assessment establishing definitive buffers or breeding dates. These should therefore not be invented in this Plan.

8.3. Water, sediment, pollution and biosecurity

Excavation close to the Buna will inevitably create some short-term sediment disturbance, but this should be kept proportionate. The staged opening of the side channel reduces the likelihood of releasing a large quantity of sediment at once.

Fuel and hydraulic fluids present a greater environmental risk. Machinery should be checked for obvious leaks, refuelling should occur away from the active water edge where practical, and spill-response materials should be available. A significant leak should result in immediate suspension of the affected operation.

Equipment arriving from other sites should also be reasonably clean so that foreign soil and vegetative material are not introduced unnecessarily into the protected river corridor. Unknown or invasive plants should not be incorporated into fascines or planting material.

Excavated material should be reused or placed only in approved stable areas and should never be dumped into the side channel as waste.

8.4. Environmental supervision and acceptance

Environmental safeguards should be incorporated into day-to-day supervision. Sensitive areas should be marked on site and explained directly to machinery operators. The ecological supervisor or appropriately designated EcoAlbania representative should have authority to stop work where an exclusion zone is breached, an active nest is found or significant pollution occurs.

After the works, the site should receive an environmental inspection in addition to the engineering inspection. Protected nesting faces should remain intact, mature vegetation retained where required, donor areas should not show excessive harvesting damage, and waste or unnecessary spoil should have been removed.

Environmental compliance should therefore form part of final acceptance. Completion of the excavation and bioengineering alone is not sufficient where avoidable damage remains unresolved.

9. Implementation methodology, responsibilities and site supervision

9.1. Sequence of implementation

Implementation begins with final technical validation, permits, site zoning, ecological clearance and mobilisation planning. The secondary-channel inlet should normally be addressed first under suitable river conditions.

Following the initial connection and hydraulic observation, the planned bank-treatment sections should be reviewed. Selective vegetation removal and reprofiling can then proceed only where confirmed necessary. Toe anchoring and fascines should follow, after which brush layering, live cuttings and broader planting are installed.

Living material should be harvested in coordination with these activities rather than far in advance. Once physical works are completed, temporary areas should be reinstated and the final as-built condition documented.

Monitoring begins immediately rather than after a separate "construction phase" has ended.

9.2. Roles of EcoAlbania and project partners

EcoAlbania remains responsible for overall project delivery, procurement, coordination, institutional communication, stakeholder engagement, monitoring and reporting. The Project Manager should function as the main operational link between the technical team, contractor and external institutions.

A contracted specialist in river restoration or bioengineering should provide technical validation and support during critical operations. A locally based engineer should provide more regular field supervision, quality control and contractor coordination.

SISMAE should be referred to accurately as the source of earlier technical input and, where applicable, a channel through which individual technical specialists may be identified. SISMAE is not the current implementing organisation under the revised arrangement.

RAPA Shkodër provides protected-area oversight. Shkodër Municipality provides the municipal land-use and institutional interface. The Forestry Technical School in Shkodër contributes mainly to training, plant preparation, planting and monitoring. Local users contribute site knowledge and should be consulted on access, inundation and longer-term site stewardship.

9.3. Supervision, decisions and hold points

The local engineer should be the contractor's main technical contact during active field operations. The external expert should be involved where specialist judgement is required, particularly for the inlet opening, the first bioengineering section and significant post-flood issues.

Minor adaptations that remain within the approved design can be made in the field. Moving a fascine around a mature tree or reducing planting where natural regeneration is strong are appropriate examples.

Changes that significantly enlarge excavation, extend the treated bank, alter protected habitat or introduce a different bank-protection method require higher-level technical and institutional approval.

Formal hold points should occur before mobilisation, at first water entry into the side branch, before broad repetition of the first bioengineering detail and before final acceptance. A stop-work instruction from the responsible technical or environmental supervisor must be followed immediately.

9.4. Local engagement and capacity building

Consultation should remain practical and focused on issues that influence implementation. Users of riparian plots should understand the purpose of the side-channel reconnection and the potential change in inundation. Shkodër Municipality should be involved where access arrangements require institutional support.

The Forestry Technical School should participate in a way that creates real technical learning. Practical demonstrations should cover preparation of willow material, fascine construction, planting according to moisture zones, plant-origin records and monitoring.

EcoAlbania should also use the site to build its own internal implementation capacity. The project has value not only as a single restoration intervention but as a demonstration of how low-impact river bioengineering can be planned, supervised and monitored in Albania.

10. Quality assurance, health and safety, and site control

10.1. Quality control and technical hold points

Quality assurance should focus on whether the restoration function is achieved, not simply on whether planned quantities have been installed. The secondary-channel opening should be accepted because it establishes controlled functional connectivity, not because a target excavation volume has been reached.

Bank reprofiling should be accepted where a suitable treatment surface has been created with minimum necessary disturbance. Fascines should be checked for anchoring, living-material condition and soil contact. Brush layers should be inspected before they are covered. Cuttings should be fresh and installed in an appropriate hydrological position.

The first representative section is particularly important because installation errors can otherwise be repeated across the site.

Technical records should remain simple but sufficient to demonstrate what was implemented.

10.2. Health and safety at the Buna site

The principal site risks arise from heavy machinery, unstable eroded banks, work near flowing water, large woody materials and changing river levels.

Only competent personnel should operate the excavator and powered cutting equipment. Manual crews should remain outside the machine's operating radius. Workers should not stand beneath unstable bank faces or enter flowing water unless a specifically assessed task requires it.

River and weather conditions should be reviewed daily during critical operations. A rising river, deteriorating access route or unstable working platform is sufficient reason to suspend work.

Forestry-school students and other non-construction participants should work only after major machinery activities have been completed in the relevant area and should remain within clearly defined safe zones.

10.3. Non-Conformities and site documentation

A non-conformity may be technical or environmental. Examples include excavation beyond the approved inlet, weak fascine anchoring, use of dried plant material, unnecessary vegetation clearance or machinery entering an exclusion area.

Minor problems should be corrected immediately. More significant deviations should be recorded and reviewed before the relevant activity continues.

Daily or near-daily site records should identify work undertaken, river conditions, significant technical decisions, quantities where relevant and environmental or safety issues. Photographs should record hidden construction details before they are covered.

The objective is not excessive paperwork but traceability.

10.4. Completion and demobilisation

Before machinery leaves the site, EcoAlbania and the supervising team should inspect the secondary-channel inlet, treated bank, planting, access areas and protected habitat.

Temporary materials, packaging, fuel containers and waste should be removed. Any unnecessary disturbance to access or storage areas should be corrected.

As-built information should show what was actually constructed, including any differences from the pre-work plan. Monitoring viewpoints should be established before demobilisation so that subsequent change can be compared with a reliable post-construction baseline.

11. Estimated Implementation Budget

The estimated budget for implementation of the proposed riverbank restoration measures is EUR 12,612.00. The estimate has been structured around the principal activities required to prepare, safeguard and implement the intervention, namely ecological verification of Sand Martin nesting habitat, implementation of planting and bioengineering techniques, mechanised earthworks associated with local bank treatment and reopening of the secondary channel, and harvesting of locally available plant material. The budget is intended as a practical implementation estimate and should be confirmed through contractor quotations and final mobilisation arrangements prior to commencement of the works.

An indicative breakdown of the estimated costs is presented below.

No.	Activity / Cost Component	Estimated Cost (€)
1	**Ornithologist – Sand Martin Nest Assessment**	**1,000.00**
1.1	Qualified ornithological expert – 5 working days × €200/day	1,000.00
2	**Implementation of Planting and Bioengineering Techniques**	**3,842.00**
2.1	Transport of participating students / field team from Tirana or Shkodër to the site	900.00
2.2	Meals and basic field support during implementation activities	600.00
2.3	Hand tools and small equipment, including pruning shears, shovels, pickaxes and sledgehammers	650.00
2.4	Wooden stakes/posts and fixing materials required for bioengineering works	550.00
2.5	Biodegradable geotextile and related erosion-control materials	500.00
2.6	Seed, wire and other minor planting and installation consumables	642.00
3	**Mechanised Earthworks and Reopening of the Oxbow / Secondary Channel**	**5,720.00**
3.1	Mobilisation and demobilisation of excavation and earthmoving machinery	900.00
3.2	Excavator / earthmoving equipment hire	1,800.00
3.3	Machinery operators and associated site services	1,350.00
3.4	Limited bank reprofiling and local earthwork operations	850.00
3.5	Controlled lowering/removal of the inlet obstruction and local channel reopening works	820.00
4	**On-site Harvesting of Local Plant Material**	**2,050.00**
4.1	Identification and selection of suitable local donor material	300.00
4.2	Cutting and harvesting of willow and other approved local plant material	800.00
4.3	Preparation, sorting and bundling of harvested material for installation	500.00
4.4	Local handling and transport of harvested material to the intervention areas	450.00
	TOTAL ESTIMATED COST	**12,612.00**

The ornithological assessment represents a specific environmental safeguard required before works are undertaken in or adjacent to exposed-bank habitats potentially used by Sand Martin. A qualified ornithological expert is expected to undertake approximately five days of field assessment and related site advice at a daily rate of EUR 200. The purpose of this input is to confirm the presence, absence and extent of active or potentially suitable nesting habitat, verify the limits of any ecological exclusion areas and, where necessary, advise on minor adjustments to the intervention footprint before construction begins. This cost is therefore directly linked to ensuring that the proposed physical works remain compatible with the ecological protection measures established in the design.

The planting and bioengineering component, estimated at EUR 3,842, covers the practical requirements for installing the proposed nature-based restoration measures. This includes transportation and field support for participating students or implementation teams travelling from Tirana or Shkodër, together with the hand tools and consumable materials required for planting and construction of living structures. Typical materials include pruning shears, shovels, pickaxes, sledgehammers, stakes or posts, biodegradable geotextile, seed, wire and other minor fixing materials. The estimate assumes that planting will remain targeted and scattered rather than being undertaken uniformly across the restoration area.

In accordance with the restoration approach, existing natural regeneration will be retained wherever possible, thereby reducing both the amount of imported planting material and the overall cost of active planting.

A further EUR 2,050 is allocated specifically to the on-site harvesting and preparation of locally available plant material. This is intended primarily to support the use of willow and other suitable native species collected from approved local donor areas. The allowance covers the identification and selection of appropriate donor material, cutting, preparation, bundling and local transport to the areas where installation is required. The use of locally sourced material is expected to improve ecological compatibility with the site while reducing dependence on nursery-grown stock. Harvesting should be undertaken within the appropriate biological period and coordinated closely with installation so that living material is used promptly and retains good establishment potential.

The largest budget component, EUR 5,720, relates to mechanised earthworks and the controlled reopening of the existing oxbow or secondary-channel inlet. These works are expected to be carried out by a specialised public works contractor and include machinery mobilisation, excavator or equivalent equipment, operators and the limited earthworks required for local bank reprofiling and adjustment of the inlet obstruction. The estimate assumes a targeted intervention rather than continuous modification of the riverbank. Earthworks should therefore remain confined to the approved Zone 2 inlet area and the individual Zone 3 bank sections where physical stabilisation is necessary. Final quantities and machinery requirements should be verified against actual river, sediment and bank conditions immediately prior to implementation, and the above values should consequently be treated as planning estimates subject to confirmation through final contractor pricing.

12. Risk and contingency management

12.1. Hydrological and technical risks

The most important technical uncertainty is the response of the secondary channel when the inlet is lowered. Staged excavation is the principal mitigation measure. A stronger-than-expected response requires immediate suspension and review rather than further enlargement.

The opposite condition is also possible: the branch may carry little water during the implementation period. This does not necessarily indicate failure if the main river is at a relatively low stage. The team should avoid excessive excavation simply to create visible flow. High flows shortly after installation could damage living structures before rooting is established. Toe protection, upstream anchoring, correct construction and post-event inspection are therefore important.

Repeated failure of the same structure should trigger reassessment of the design rather than repeated replacement.

12.2. Ecological and regulatory risks

The principal ecological risk is inappropriate treatment of exposed bird-nesting habitat. This is addressed through final zoning, pre-work ecological verification and exclusion from treatment where required.

Another risk is overharvesting local donor vegetation. The project should reduce treatment intensity or use more natural regeneration where local material is insufficient rather than degrading donor stands.

Permit delays can also affect the ecological work window. Physical works must not begin before the required approvals are obtained. Where delay causes the suitable season to be missed, postponement is preferable to implementation under inappropriate conditions.

12.3. Operational, seasonal and financial risks

Contractor availability, machinery access and procurement should be resolved before the preferred implementation window. The revised work plan already identifies early procurement and alternative providers as mitigation measures.

Budget uncertainty is especially relevant to the secondary-channel reconnection because the exact excavation requirement is not yet measured. Final costing should therefore follow inlet verification rather than rely on a speculative volume.

If resources are insufficient for all envisaged works, technical and ecological quality should not be reduced. Priority should be given to the core hydromorphological intervention, critical bank sections, supervision and safeguards. Broader planting can be reduced more readily where natural regeneration can provide part of the intended function.

12.4. Contingency principle

The overall contingency rule is that unexpected conditions should result first in observation and reassessment, not immediate expansion of construction. Sediment redeposition, vegetation mortality, local bank movement and changes in the side-channel morphology are expected to some degree.

Corrective intervention is justified where these changes cause a meaningful loss of function, create an unacceptable safety issue or undermine a protected ecological objective.

This distinction between natural adjustment and genuine failure is essential to maintaining the Nature-based character of the project.

13. Monitoring, maintenance and adaptive management

13.1. Monitoring baseline and indicators

Monitoring should begin with repeatable photographs and simple field observations established before and immediately after construction.

Key observation locations should include the secondary-channel inlet, representative bioengineered bank sections, the toe, principal planting zones and retained exposed nesting habitat. The project does not require a complex permanent monitoring system. Consistent observations are more valuable than sophisticated methods that cannot be maintained after project funding.

The revised project arrangement already identifies secondary-channel connectivity, bank condition, vegetation establishment and habitat condition as the principal monitoring themes.

13.2. Hydromorphological and bank monitoring

The side channel should be observed under different river stages to determine whether it continues to receive water when appropriate. The presence of sediment at the inlet should be recorded, but corrective excavation is only necessary where connectivity is effectively lost. The main bank should be inspected for toe erosion, displacement of structures, new cracking or significant retreat behind treated areas.

Post-high-flow inspection is especially important. It should occur after conditions become safe and should distinguish between normal adjustment and structural failure.

Photographic comparison will be particularly useful in understanding whether changes are progressive or stabilising naturally.

13.3. Vegetation and biodiversity monitoring

During the first growing season, the project should record shoot development in willow fascines and cuttings, general condition of planted vegetation, natural regeneration and areas of concentrated mortality.

Success should not be expressed only as a survival percentage. A section where planted material has partly failed but natural native vegetation is establishing strongly may still be functioning successfully.

Retained nesting banks should also be monitored for physical condition and excessive vegetation encroachment where relevant. Bird observations should be undertaken in a manner that avoids disturbance and should follow any more detailed ecological requirements subsequently adopted.

The aim is a diverse habitat mosaic rather than maximum vegetation cover.

13.4. Maintenance and corrective intervention

Maintenance should remain limited. A displaced fascine may require re-anchoring. Major vegetation gaps in an important stabilisation section may require replacement during the next suitable dormant period. Complete re-blockage of the side-channel inlet may justify local reopening.

Routine clearing, pruning or reshaping should not occur simply because the site looks irregular. Natural sediment deposition, local erosion, vegetation succession and channel adjustment are expected processes.

Where repeated failure occurs, the project should identify the cause before further intervention.

13.5. Long-term responsibilities

EcoAlbania should lead formal monitoring during the funded project period, supported by the local engineer and specialist technical input when required.

The Forestry Technical School in Shkodër can contribute to vegetation follow-up and provide continuity through practical educational activities. Local users can report significant changes because of their regular presence at the site. Shkodër Municipality can provide longer-term institutional continuity.

Earlier SISMAE recommendations propose a scoping arrangement between the municipality, forestry school and riparian users to clarify who monitors, who responds to damage and how longer-term maintenance should be organised.

This arrangement should be formalised before project closure and should remain proportionate to the limited maintenance philosophy of the restoration.

14. Implementation schedule, resources & feasibility

14.1. Implementation schedule

The preferred programme follows the revised EcoAlbania work plan. Technical review, final zoning, specifications, permits, procurement and access planning should be completed before physical mobilisation. Site preparation is expected principally in October, including only the necessary cutting and preparation of local woody material. Living willow structures and planting are expected principally in November, during the dormant period and under suitable river conditions.

The sequence within the field period is more important than the precise calendar dates. The side-channel inlet is addressed first. The bank treatment is then reconfirmed. Selective reprofiling and toe work follow, then fascines, brush layers and cuttings, and finally broader riparian planting.

Site reinstatement, as-built documentation and immediate inspection occur before contractor demobilisation. Vegetation and post-high-flow monitoring continue after the physical works. A delay in one preparatory activity should not automatically compress the subsequent ecological work into an unsuitable period.

14.2. Resources and bill of quantities

The earlier project design contains preliminary quantities for a 200 m treatment concept. These include large and smaller stakes, fascine branches, fine brush-layer material, large trunks and live cuttings. The uploaded Technical Plan correctly notes that these values should not simply be increased by 25% to produce a 450 m BOQ.

The final quantities should be calculated from the actual treatment zoning. Secondary-channel excavation should be measured from the inlet geometry. Bank earthworks should be calculated only for sections requiring reprofiling. Rock should be quantified only at defined anchoring points. Fascine material should derive from the actual installed length. Brush-layer material should reflect the treated surface, and planting quantities should account for existing vegetation and natural regeneration.

The final BOQ should also distinguish the total material requirement from the proportion expected to be obtained locally. This is especially important for woody material because full reuse of appropriate trees and branches generated during site preparation can reduce external procurement substantially.

Technical supervision, ecological support, machinery, safety provisions, monitoring and minor corrective works should be treated as genuine project resources rather than incidental costs.

14.3. Final feasibility determination and Go/No-Go conditions

The Buna River restoration is considered technically, ecologically and operationally feasible, subject to completion of the final site-specific conditions identified in this Plan.

The secondary-channel reconnection can proceed where the branch remains physically continuous, the inlet obstruction can be lowered through limited intervention, the necessary approvals have been obtained, local access implications have been considered and the initial hydraulic response can be controlled.

Bank reprofiling and bioengineering can proceed where active instability justifies intervention, living material is available, the river condition allows safe installation and no ecological exclusion applies.

Riparian planting can proceed where appropriate local genetic material is confirmed and the planting location corresponds to the species' ecological requirements.

The project should not proceed with a particular component where these conditions cannot be met. A no-go decision for one local treatment does not necessarily invalidate the entire project. The design should be adjusted rather than forcing implementation.

The final technical conclusion is therefore that EcoAlbania should proceed with the project as a selective, staged and adaptive restoration of the confirmed 450 m Buna River reach, not as continuous bank construction.

The strongest intervention should remain concentrated where it is necessary to restore function and initial stability. Elsewhere, existing vegetation, natural regeneration, exposed habitat and natural river adjustment should be allowed to perform their own roles.

15. References

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