

# **URBAN ENVIRONMENT RESTORATION AND ECOTOURISM IN ADUPPUKUTTAN PARA (QUARRY), PEROORKADA**

Submitted by



**KERALA STATE BIODIVERSITY BOARD**  
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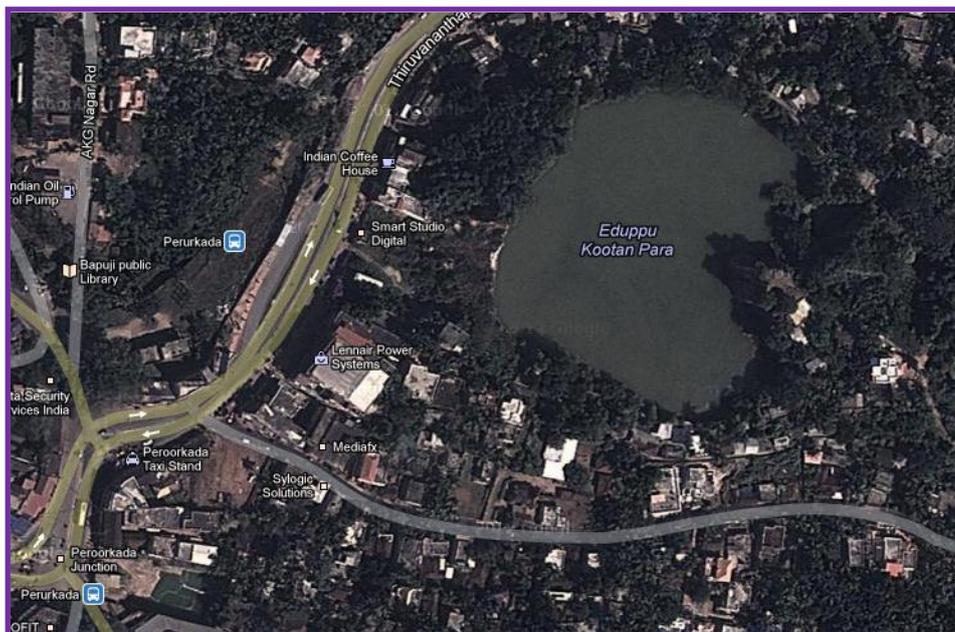
## URBAN ENVIRONMENT RESTORATION

### Eco restoration of quarries in Urban areas Rs 50 Lakhs

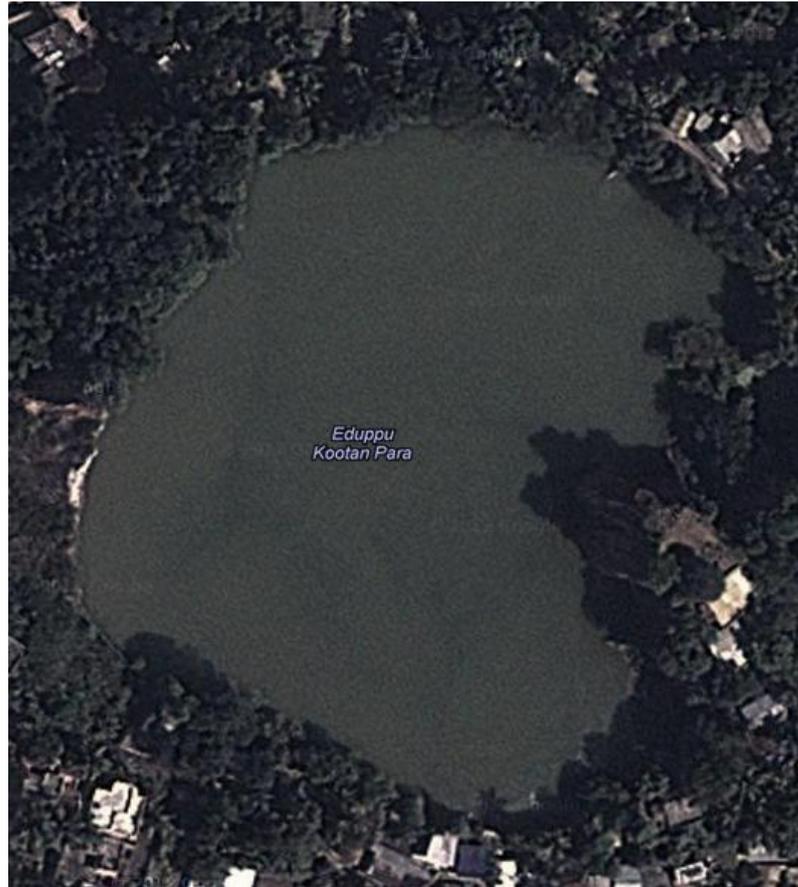
The state of Kerala is physiographically divided into low land, midland and high land. At present nearly 10,000 quarries are there in the State of Kerala, primarily used for the extraction of rubble and its value added products or brick and tile clays. The capital city, Thiruvananthapuram contributes to a total of 822 quarries including granite, brick/tile clay, laterite, dimension stone, ordinary sand and ordinary clay for the extraction of resources from four taluk of the district namely Chirayinkeezhu, Nedumangad, Neyyattinkara and Thiruvananthapuram. Most of these quarries after the extraction of resources, are left abandoned thereby making these quarries an eyesore. These abandoned quarries remained flooded for most part of the year.

Quarrying results in irreversible ecological fall outs and scars on the environment. Disfigurations of the land scape, degradation of the ecosystem, scaring of the areas which may have been areas of ecological significance are some of the direct negative implications of quarrying activities. Eco restoration of abandoned quarries near Urban areas will lead to regeneration of degraded land which is being left neglected, to areas of recreational purposes

**Location: Peroorkada, Aduppukuttan Para Quarry (Figure 1).**



**Figure 1: Ariel view of Aduppukuttan para and adjoining areas of Peroorkada.**



**Apx. Area: 3.52 Ares/1.42 Hector**

**Major Planned activities:**

- Biofencing with vetiver grass along with other locally available flora.
- Planning of hydraulic revitalization according to the maximum depth foreseen for the quarry.
- Planting of riparian vegetation along the banks.
- Construction of nature trails.
- Develop Flagship quarry sites for conservation and educational value.
- Reshaping the quarry to harvest the rainwater for drinking water purposes.
- Develop the abandoned area into areas of recreational purposes with ecotourism potential and environment friendly boating facility.
- Enhancing faunal diversity.
- Enhancing and enriching ecosystem services and value and biodiversity conservation.

**Type of ecosystem being restored:** Degraded ecosystem and polluted water in the abandoned quarry.

**Habitat protected by the project:** Water bodies, Shrubs, Grasses, Riparian vegetation

**Species protected by the project:** Plants, fishes, Amphibians, Butterflies, Birds etc. The quarry is a perennial source of water and standing water provides an important habitat for a range of amphibians, odanata and other invertebrates such as snails and crustaceans.

The area surrounding the quarry and the banks will be developed into a nature trail by planting with recommended native species of grasses, shrubs, trees and riparian vegetation. Abandoned quarry will be utilized for rain water. Phytoremediation techniques that intercept the flow of polluted waters to the quarry will be implemented. The large water body is proposed to attract many birds, butterflies and serve as an important habitat for a range of amphibians, and other invertebrates.

**Anticipated benefits:** Development of this area is expected to enrich the biodiversity of this area and generate public awareness. The project will help in recharging the underlying aquifer, raising the water table which increases the vegetation in the surrounding area. The area can be used for recreational purposes and can be developed into a nature park with solar boating facility and is expected to improve the urban environment.

## **QUARRY RESTORATION MANAGEMENT PLAN FOR ADUPPUKUTTAN QUARRY**

**Criteria for selection of study site for eco restoration:**

### **Geographical factors**

1. All quarries larger than 1.0 acre in area
2. All quarries located in poramboke land
3. All quarries posing hazards and located within 500 m of population centres
4. All quarries with perennial source of water
5. Quarries, with good access, abutting on the right of way of state roads, national highways and rail roads
6. Quarries near the banks of rivers

The largest part of the area supports only sporadically growing thorny bushes and shrubs. A nature trail around the quarry will be established with information sites located at strategic points. The area adjacent to the quarry will be restored with soil and planted with recommended native species, based on the results of a biodiversity study. The first step in any restoration programme is to adopt physical methods to reclaim the area like easing of slopes, terracing, levelling, construction of retaining walls etc to make it conducive to interventions for restoration. Identification of constraints in seed germination, species establishment, screening of suitable legumes, forage trees for nitrogen enrichment, will be done. Reclamation of erosion prone and steep areas, and biological stabilization methods will be undertaken. Plantations will stress on multi species and bird attracting trees. The presence of the highest predator birds like kingfisher on the water-body will be taken as indicator of good health.

#### ***Module 1: Base line data collection***

The first step in the restoration process was determining the base-line data; these included studies of

- 1) **Substrate conditions in the excavated areas**– pH, substrate hardness etc., to determine the thickness of soil to be re-spread and water analysis to suggest appropriate water treatment systems.
- 2) **Local land-use patterns** – typical crops, fodder requirements, availability of water for irrigation; and detailed land use patterns.
- 3) **Vegetation planning** i.e. the vegetation best suited to the local environmental conditions. The inventory should be as wide as possible, encompassing all – or at least the most sensitive – habitats and species present on site, as well as actual and potential impacts upon them.

#### ***Module 2: Cleaning and desilting the quarry***

The large water body will be desilted and cleaned to attract many birds from other areas, including ducks, cranes, hornbills and sometimes kingfishers. One of the key aspects of the quarry restoration scheme will be the creation of rain water holding reservoirs. The water bodies will also act as focal points of the re-establishment of biodiversity.

### ***Module 3: Afforestation***

This module aims to re-establish key local, and possibly rare, species – by designing habitat restoration. The species composition and the layout of the plants to be planted are based on: Riparian vegetation for reconstruction and enhancement of the general ecosystem; Flowering plants for creation of suitable conditions for the settlement of Birds, butterflies, and other pollinator species. Planting of appropriate local native species – to make the rehabilitation as self-sufficient and natural as possible, as well as to help preserve particular rare local plants will be done in as natural and as diverse a way as possible – to mimic the pre-site habitat (for restoration), maximise the biodiversity benefit (for rehabilitation), minimise erosion and increase nitrogen fixation.

<b>Life form</b>	<b>Common name</b>	<b>Scientific name</b>	<b>Density</b>	
			<b>Max</b>	<b>Min</b>
Overstorey (trees) plants	Annexure	Annexure	750	400
Shrub, > 5m tall			1500	500
Medium Shrub, 1-5 m tall			1500	500
Grasses				

### ***Selection Criteria for Plant Species and suggested species***

Seed mixture should be composed of:

1. Species naturally present in the direct surroundings of the degraded site and species that naturally develop in comparable sites adding such species in the seed mixture helps reinforcing the chances of their establishment and further on-site colonization.
2. Species absent from the direct surroundings of the site but whose ability to colonize in comparable environments is indicated by their presence in similar degraded sites.
3. Broad spectrum species that have the ability to colonize various types of ecosystems, described as “all purpose” species. Those species will ensure rapid vegetation development.
4. Seed Mixtures of Grass and Legume. Grasses are more tolerant to adverse pH and moisture conditions than legumes. Nitrogen fixing species are preferred as it enriches soil nitrogen. Grass and legume mixtures of native vegetation can be used. Grass should be a local perennial with fibrous roots preferably a forage.

5. Vetiver Eco-restoration: Vetiver (*Vetiveria zizanioides*; local name: *Ramacham*) grows well in landfills and quarries. It resists prolonged dry spells or waterlogged situations and is an ideal species for quarry restoration programmes. Vetiver grows up to 1.5–2.5 m high, its crown stays in clumps and its stems are erect, strong and hard; therefore the plant can easily form hedgerows when it is planted densely along the contour. Vetiver has deep, massive and rapid-growing roots, which can grow down to 2–3 m in one year and at most, down to 5 m or so 2–3 years later. Moreover, the roots have great tensile strength and keep soil stable even under the condition of heavy downpours or flood, toxicity of heavy metals or organic pollutants. It can resist long-term dry or water-logged or flooding, adverse conditions and can grow permanently under the condition of partial submergence and resist at least 100-day complete submergence.

Vetiver can be combined with some local plant species, including trees, shrubs, grasses and climbers with characteristics of strong resistance and widespread adaptation. It not only rapidly covers barren lands and produces good afforestation efficiency, but also beautifies the environment. Vetiver also forms a permanent “bio-dam” that can effectively holdup runoff, sand, litter, and prevent landslide. Thus the layer upon layer holdup from underground to earth’s surface firmly fix soil and water, and offer a relatively good habitat to the growth of other species

6. In order to develop an appropriate revegetation species list for the site consideration should also be given to the relevant floristic community, local environmental and site conditions, ease of propagation and likely availability of species from regional nurseries. Leguminous herbs will also be planted to form a stable soil nutrition system through the mutual effects of vetiver, legumes and defoliating species. Select trees and shrubs with the characteristics of ornamental value and strong resistance, some defoliate and some evergreen, to be used as the main species. After finishing the planting of vetiver, other covering plants and creepers can be planted. Apart from these, small shrubs will also be planted at a distance of about 2 m and trees at the spacing of 1–3 m. Flowering trees will be preferred to attract more birds – which also help in dispersal of the seeds. They support a large number of insects that come to feed on the fruit as well as birds that come to feed on these insects and fruits. Thus these trees provide habitats for a very large diversity of organisms – almost as a complete ecosystem

## **Methods of Replanting**

***Sowing seeds in-situ:*** Planting nursery raised seedlings using microbial inoculums like VAM/bacteria for easy seedling establishment. Transplanting of individual species of natural vegetation from surrounding areas will be adopted.

***Use of Organic Wastes and Compost for Remediation and Restoration:*** Biodegradable organic town waste can be utilized. It provides a balance of nutrients, organic matter, high water retention capacity, aeration, and an ideal condition for establishment of plant species.

***Actively remove and control invasive exotic species:*** To ensure that the rehabilitation project does not inadvertently encourage the spread of such species, and also because any invasive exotics already present may otherwise undermine the project.

***Local fauna:*** The vegetation of quarry sites will be modelled to provide a suitable environment for a rich and diverse assemblage of insects, invertebrates and amphibians. Native fishes will be introduced to the water body. Bird feeders, birdhouses, shallow water baths will be installed to lure native species back to the area that were impacted by mining activity. The various birdhouses will include eco-friendly structures. Restored fauna will include several different species of dragonflies that are especially indicators for gauging the health of the water body. The restored quarry will function as a sanctuary for dragonflies, and other species like butterflies and grasshoppers. It will also serve as an oasis for native birds providing them with fresh water, food and nesting materials. Sign boards will be set up displaying images of birds for public awareness.

***Butterfly garden:*** Butterfly gardens can be set up in any location by introducing butterfly host plants and by recreating suitable habitats. Citrus, Albizia, Cassia, Cinnamom, Aristolochia, Milk weeds, Tylophora, Wattakakka and Mussaenda are the common larval host plants that can be introduced for attracting various butterflies found in Kerala. Ixora, Lantana, Mussaenda, Marigold, Cuphea, Zinnia and Clerodendron are some common nectar plants favoured by many species of butterflies. Common Mime, Common Rose, Crimson Rose, Lime Butterfly, Blue Mormon, Southern Birdwing, Glassy Blue Tiger, Blue Tiger, dark Blue Tiger, Emigrants and Grass Yellows are some butterflies that can be easily sustained. As the butterfly population increases, a variety of organisms including Preying mantis, spiders, lizards and birds also colonise the area leading to a stabilization of habitats and better functioning of ecosystems. Habitats having bright sunshine, shade, bushes, streams and ponds, lianas and tall trees are preferred by specific groups of butterflies.

## **Ecotourism potential**

Ecotourism has become a popular developmental tool for biodiversity conservation and planning, by maintaining attractive natural landscapes and a rich flora and fauna; at the same time helping communities earn money from ecotourism thus providing an incentive for conservation. Ecotourism **should** take care not to disturb the integrity of the ecosystem, while creating economic opportunities that make conservation and protection of natural resources advantageous to the local people. Ecotourism will contribute to environmental and cultural heritage preservation, while ensuring the participation of the local communities and other stakeholders in the process. On the other hand, tourist visitation interrupts nesting of birds, requires clearing for the construction of amenities, expands the need for more waste disposal facilities, and generates noise pollution that affects wildlife.

Ecotourism should be

- a) Nature based,
- b) Ecologically sustainable,
- c) Where education and interpretation is a major component and
- d) Where local people are benefited

## **Ecotourism Activities**

Water-based activities mainly refer to boating, canoeing, kayaking, rafting, diving, fishing. The principles of zoning in ecotourism can be adopted here to create various zones, featuring Adventure and leisure activities for nature enthusiasts.

## **Leisure Zone**

Trekking

Resting Points

Pathways - Winding trails leading tourists to various sites.

Sway Bridge/ Winch - An unsupported bridge, made of wooden planks and hung from ropes across the rocks or winch to cross the quarry.

Fishing

Landscaped Garden

Boating/ Canoeing

**Environment Education Centre:** This Centre facilitates various activities using the potential features of the site to educate the visitors.

Educate local residents, visitors and staff – to ensure wide understanding of, and involvement in, the planning and implementation of rehabilitation/restoration projects. The BMC will provide residents of the basin with accessible local watershed information and ongoing information about watershed management through community workshops. The BMC will identify priority locations for the installation of interpretive signs and other infrastructure that educates the public and attracts tourists to the area

## **IMPLEMENTATION AND MONITORING**

- ➔ Formation of an advisory body.
- ➔ A State Level Advisory Body should be constituted with the participation of concerned departments
- ➔ Stake holder Participation.: Stakeholders include local land owners, government agencies, NGOs,, community based organisations, users of the land or other nearby natural resources, interested private companies etc.
- ➔ The quarry restoration schemes offer a number of opportunities to the public in its various stages such as planning and management, nursery management and plant rising, fish cultivation, planting and maintenance, utilisation and harvesting, monitoring and evaluation.

### **Implementation.**

- ➔ The Kerala State Biodiversity Board will co ordinate the activities of BMC and also ensure the assistance and expertise they need from various departments. The project will be implemented under the overall supervision of Kerala State Biodiversity Board.
- ➔ The BMCs will be responsible for the designing of restoration plan including design, estimate, implementation and future maintenance of the site. The master plan prepared will be approved by the State Level Advisory Board . The economic benefit if any obtained from the restoration programme may be deposited to Biodiversity Fund.
- ➔ Cleaning and desilting of the quarry will be undertaken with the help of LSG and through Mahatma Gandhi Rural Employment Guarantee Scheme.

## **Monitoring and Evaluation.**

- ➔ A joint monitoring committee under the Chairmanship of KSBB will be constituted to evaluate the implementation of the proposed project. The chairman of the committee will have the power to assign various activities to the members of the monitoring and evaluation committee for the proper functioning of the result oriented programmes.

## **BUDGETARY REQUIREMENT: Annexure**

### **EXPECTED OUTCOME**

It is expected that the following outputs will be observed following the above interventions to ensure the successful implementation of the restoration programs.

- ✓ Improvement in biodiversity status, restoration of degraded ecosystems and utilization of abandoned area.
- ✓ Improvement in water storage and recharge mechanisms.
- ✓ Conservation and promotion of native fishery resource through restoration of degraded systems.
- ✓ Eco tourism - Development of a recreational area for urban population with boating facilities and other amenities.
- ✓ Increased local Biodiversity fund for conservation activities
- ✓ Urban environment improvement

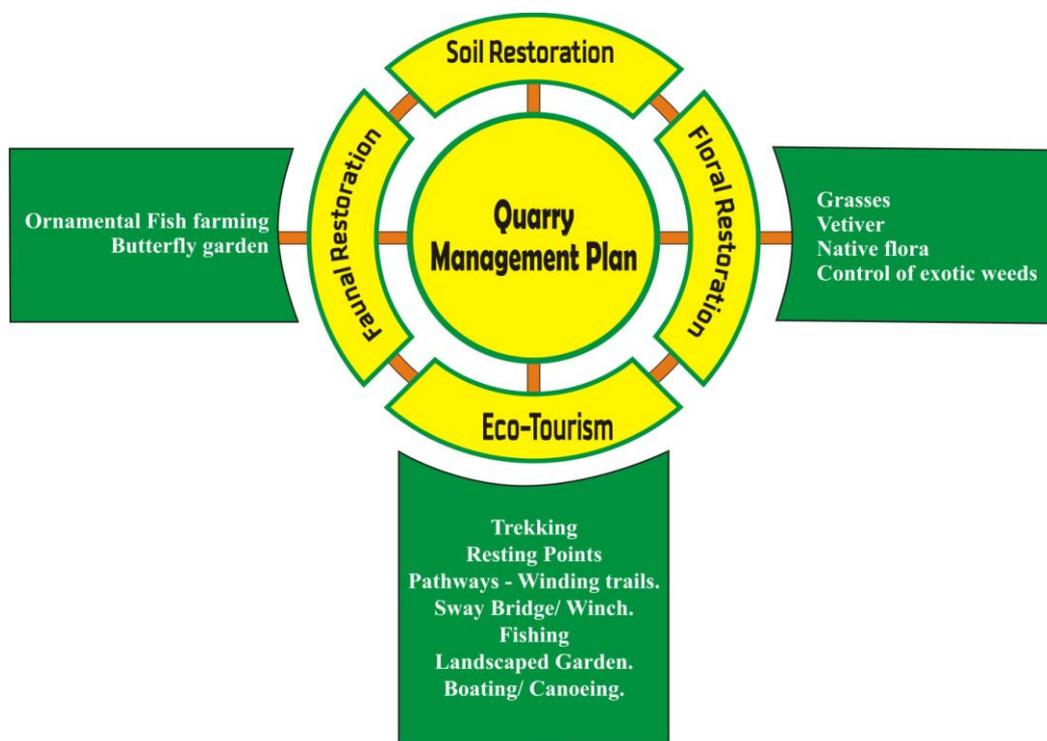
### **RECOMMENDATIONS**

- i. Awareness programmes to be conducted through the supervision of BMCs.
- ii. Govt. should frame suitable legislations for restoration of quarries which is left abandoned for more than a fixed period of time after the mineral extraction. The restoration programmes for such quarries will be proposed after assessing the priority analysis.
- iii. There should be strict regulatory framework for quarry operators. Licence should be given to those quarries which already included necessary steps for restoration after mineral extraction; this should be planned and done simultaneously with the resource extraction process.
- iv. A fixed amount of revenue obtained from various rehabilitation programmes should be deposited to State Biodiversity fund to promote various conservation programmes.

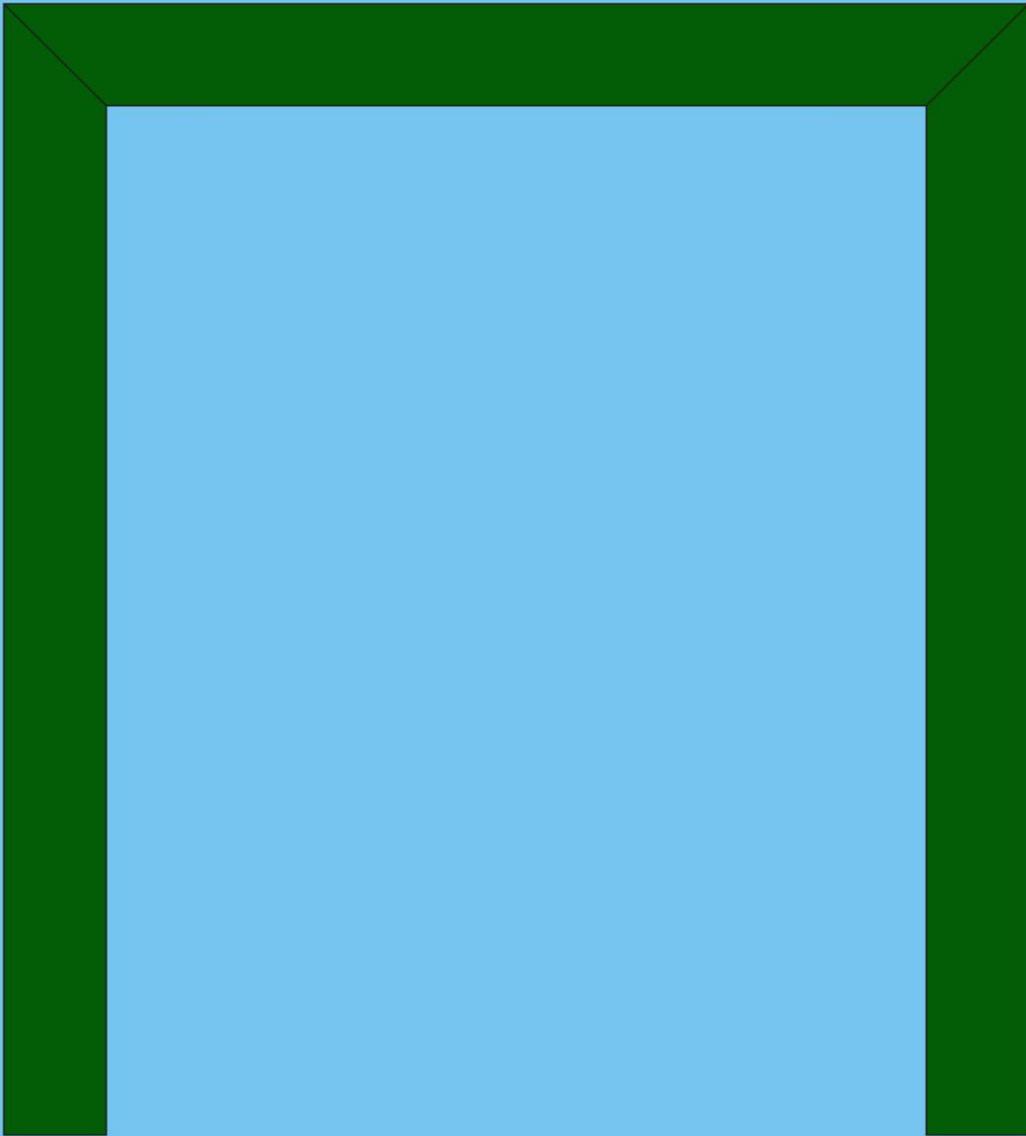
## Budget

S No	Item	Amount (Rs)
1	De silting/ Cleaning of quarry	1,00,000
2	Planting of Vetiver grasses	5,00,000
3	Planting of surface covering vegetation (Grasses and legumes)	5,00,000
4	Planting of trees and riparian vegetation	5,00,000
5	Construction of nature trails around the quarry	10,00,000
6	Construction of eco friendly bird houses	1,00,000
7	Establishment of butterfly garden, Tourist amenities, Solar boats etc	20,00,000
8	Bioremediation/ promotion of aquatic plants for bio filtration	2,00,000
9	Awareness Programmes	50,000
10	Contingency expenses	50,000
<b>Total</b>		<b>50,00,000</b>

**Total Budget : Rs. 50 Lakhs**



## Quarry Management Plan for Aduppukuttanpara



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