

Annex A1

Conservation Management Plan

**Pilot Project for
Public-Private Conservation Scheme
Sha Lo Tung Valley, Tai Po**

Conservation Management Plan

(February 2012)

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List of Abbreviations

CA	Conservation Area
ETWB	Environment, Transport & Works Bureau
GB	Green Belt
PPP	Public- Private-Partnership
SLTDC	Sha Lo Tung Development Co. Ltd.
SSSI	Site of Special Scientific Interest
V	Village

1 Introduction

1.1 *Scope of the Management Plan*

1.1.1 This management plan covers the first 5-year period, beginning at the start of implementation, of the Pilot Project for Public-Private Conservation Scheme at Sha Lo Tung Valley, Tai Po (hereafter, the “Project”). This plan covers the area of the statutory plan, or around 56.6 hectares (ha). Of these, 52.5 ha are targeted for Ecological Reserve serving conservation and associated educational purposes. The remaining 4.1 ha is named the “Development Site, of which about 1.27 ha are earmarked for building footprint of a Nature Interpretation Centre and Multi-Cultural Education Retreat cum Columbarium”. While the 52.5 ha of Ecological Reserve covers the core area of Sha Lo Tung Valley with high ecological value, the proposed Nature Interpretation Centre will be located at the entrance immediately outside the Nature Reserve. It is an area of low ecological concern and of the least ecological impact due to the development. Locating the Nature Interpretation Centre at the entrance of the SLT Valley would also assist the management of the Ecological Reserve which will ensure the long-term conservation of its rich biodiversity and promote nature education of the SLT Valley to the public. Green Power (conservation partner of the project) would be entrusted with the responsibility of managing the Ecological Reserve and Nature Interpretation Centre.

1.1.2 This plan aims to:

- provide information for Project managers and other stakeholders;
- identify the key resources of the protected area and focus management attention upon them;
- assess those natural and anthropogenic trends and factors that have implications for these key resources;
- define management objectives to neutralize threats to the key resources;
- prescribe actions to be implemented that will lead to achievement of the management objectives;
- outline a monitoring program to ensure that management does indeed achieve its objectives, and to alert stakeholders to unforeseen developments.

1.1.3 Conservation management plans are often considered blueprints or recipes for management actions that allow little flexibility for change. That interpretation has been analyzed in recent years and found to be less effective than an adaptive or process approach where the management plan is a guideline for action but evolves as time passes and experience is gained (Barrow & Murphree 2001). This management plan is based upon the process approach: It should be regarded as a first step in a process of management evolution over the 5-year period it covers, and should be reviewed and adjusted as needed.

1.1.4 The plan will be implemented by the Conservation Agent, Green Power.

1.1.5 This CMP outlines the framework for the management of the Ecological Reserve. Upon the endorsement and approval of the proposed PPP development, further details including guidelines for specific habitat management/enhancement works, ecological monitoring methodologies, reporting requirements and implementation schedules will be provided for the operation of the reserve.

1.2 Core versus Added-Value Management

1.2.1 The activities prescribed under this plan fall into two categories, core and added-value activities. Biodiversity conservation is the core focus of the Public- Private-Partnership (PPP) programme under which Sha Lo Tung Valley is to be managed. Value-added activities include conservation education, preservation of cultural heritage and any other activities not directly related to biodiversity conservation.

1.3 Justification and Purpose of the Management Plan

1.3.1 This conservation management plan prescribes management to safeguard the ecological value of the area in perpetuity for the people of Hong Kong. The plan is to be implemented by a partnership between SLTDC, Hong Kong Government, and Green Power.

1.3.2 The statutory zoning serves to protect the site from development, but makes no provision for conservation management of its habitats or species of conservation interest. In the absence of management during prior years, ecological resources have been degraded. Although this has not been quantified, it is highly probable that wildlife exploitation, off-road vehicle use and vegetation removal have damaged the SSSI zone.

1.3.3 The PPP proposal distinguishes three inter-related components under the “pilot project”, as shown in Figure 3.1 of the main proposal document (Environmental Impact Assessment Report). These areas are described separately as they differ in their context, conservation management and treatment of later land use approvals under different statutory procedures and arrangements. First are the lands designated for conservation management, the **Ecological Reserve**. Land use zones covered by this area are “SSSI”, “CA”, “GB” and “V” zones.

1.3.4 Second are lands developed and managed for religious and institutional uses, the **Development Site**. Land use zones covered by this area are the “GB” zone to the south of the Ecological Reserve. This area includes a small area for a public facility which will serve visitors to the Ecological Reserve, patrons of the religious/institutional development concession and Country Park users. This land is located at the development site and will comprise parking, bus/taxi drop off and the Interpretation Center.

1.3.5 Third is the improvement of the Sha Lo Tung Road. The purpose of the proposed improvement is to upgrade the existing roadway to the standard required of a Single Track Access Road that would enable emergency access for fire-fighting equipment. The detailed project description and environmental consideration of the proposed development and the road improvement are included in

Volume 1 and Volume 3, respectively, of the main proposal document.

1.4 Structure of the Plan

1.4.1 This plan is presented in the following sections:

Section 1 discusses the scope, justification and purpose of the conservation management plan

Section 2 describes the physical and ecological resources in the Ecological Reserve

Section 3 describes and assesses existing threats to ecological resources

Section 4 outlines conservation objectives to overcome these threats

Section 5 describes management constraints and potential impacts of conservation

Section 6 outlines the zoning and layout of the Ecological Reserve

Section 7 prescribes an action plan to remove threats

Section 8 discusses sustainability and prescribes research and monitoring projects

Section 9 outlines management structure and financial arrangements

Section 10 lists references cited in this plan

2 Physical Description & Ecological Resources

2.1 Site Description

2.1.1 Sha Lo Tung is a scenic valley surrounded by Pat Sin Leng Country Park. The landscape undulates over grassy hillsides, patches of woodland and abandoned paddy fields. Two narrow streams traverse the valley floor and provide habitats for dragonflies and other aquatic animals. The streams drain Sha Lo Tung Valley northward to Hok Tau Reservoir and downstream to become Tan Shan River, which then flows into Ng Tung River, Shenzhen River and Shenzhen Bay (Deep Bay). Elevations range from around 180 m on the Valley floor to 440 m at the peak of Cloudy Hill (Kau Lung Hang Shan) on the west rim of the Valley.

2.1.2 The remnants of three villages, Cheung Uk, Lei Uk and Lo Wai, which were settled over 300 years ago, now lie abandoned and surrounded by woodland and abandoned farmlands. A recognised village burial ground exists on the eastern knoll at the entrance to the Valley. While the villagers have left, their traditional rights to New Territories Exempt Housing (NTEH) in the Sha Lo Tung Valley, are still valid. In 1996, the District Officer/Tai Po advised ACE that these rights would require some 160 NTEH sites.

2.1.3 Following abandonment of the indigenous villages, the primary landowner in the Valley proposed to the Administration to re-use most of the private lands and intervening Government Lands within the statutory plan area for recreational and residential purposes. The proposals included mitigation measures in recognition of the ecological sensitivity of the stream habitats but were rejected largely on the grounds that construction and occupation of the valley would adversely affect these habitats.

2.2 Habitats

2.2.1 The Project site mainly comprises of a variety of habitats including natural streams, woodlands, grassland-shrubland mosaic and abandoned agricultural lands. The woodlands support mostly native species and an expected suite of fauna use them for shelter and food. In a Hong Kong context, the woodlands are of average quality and are not the best examples of this habitat type. Nevertheless, most of the plant species recorded in Sha Lo Tung were found in woodland habitat, which also harbours many plant species of conservation interest. The abandoned agricultural lands have been colonized by grass communities following the cessation of agricultural activities. These lands have low ecological value and are subject to continuing human disturbance, although some wet abandoned agricultural lands in the valley support rare fish species. The SSSI zones along the streams protect more than 9 ha of abandoned paddy. This large area abuts the stream courses and provides continuity with the stream habitats. The stream courses are largely natural and are renowned for supporting a diverse community of dragonflies and terrapins of conservation interest. Chapter 9 of the EIA provides a detailed description of habitats in Sha Lo Tung.

2.3 Animals and Plants

2.3.1 Sha Lo Tung is of recognized importance for conservation of flora, dragonflies, fish, and terrapins that are of conservation interest. Survival of some of those species of conservation interest is threatened by human activities, some of which continue to date (e.g., hillfire). For this reason some of these species were not recorded during the most recent surveys. The conservation management plan focuses on the rare or endemic species/taxa groups that are of conservation interest highlighted in the New Nature Conservation Policy, some of which are simultaneously under threat from human activities. These species/groups are as follows and described below:

- Dragonfly (*Macromidia ellenae*, *Lamelligomphus hainanensis* and *Sieboldius alexanderi*)
- Freshwater fish (*Macropodus hongkongensis*)
- Plants (*Viburnum hanceanum*, *Carex phacota*)
- Mammal (Chinese Pangolin)
- Birds (Bonelli's Eagle, Crested Goshawk, Lesser Coucal, Greater Coucal and Emerald Dove)
- Reptile (Three Banded Box Terrapin)
- Butterflies (*Catochrysops strabo* and *Caltoris bromus*).

2.3.2 The flagship species group for the site is dragonflies. The wider Sha Lo Tung area, including the stream course down to Hok Tau Reservoir, is a very important site for breeding and development of an extremely diverse community of dragonflies. Currently, about 72 species of dragonflies have been recorded in the general area out of a total of 116 known in Hong Kong. At this percentage (62%), the

Valley is the most species-rich dragonfly habitat in Hong Kong. Many of the recorded species are stream specialists and include the Hainan Hooktail *Lamelligomphus hainanensis* and Small Dragonhunter *Sieboldius alexanderi*, both considered rare. The Clubtailed Cruiser *Macromia urania* (“Least Concern” in IUCN Red List) and the endemic Spangled Shadow-emerald *Macromidia ellenae* have also been recorded. The stream courses and associated riparian habitat have been designated as SSSI zone to afford protection to the dragonfly fauna.

2.3.3 Similar to other rural, isolated sites in Hong Kong, Sha Lo Tung supports a considerable diversity of additional fauna including butterflies, fish, amphibians, reptiles, birds and mammals. Species of conservation interest observed at the site over the past 14 years include the Chinese Pangolin *Manis pentadactyla* and the Three Banded Box Terrapin *Cuora trifasciata*. These species have international and China-wide vulnerability ratings due to their widespread consumption and use by local peoples. The fish, *Macropodus hongkongensis* also occurs within the marsh and stream habitats at Sha Lo Tung, and while this fish occurs at several other sites in Hong Kong, it is currently treated as potentially endemic. Bird species of conservation interest include Bonelli’s Eagle, Crested Goshawk, Lesser Coucal, Greater Coucal and Emerald Dove. These are woodland dependent species.

2.3.4 Plant species of local interest include Hance’s Viburnum, *Viburnum hanceanum* (an endemic to China) and Convex Utricle Sedge *Carex phacota*. These are forest-edge species and wetland species respectively, testifying to the diversity of habitats present in Sha Lo Tung.

2.3.5 The cumulative species list of flora and fauna recorded in Sha Lo Tung is shown in Annex F of the EIA, while species of conservation interest recorded during the most recent surveys are listed in Section 9 of the EIA. While the Conservation Management Plan takes a habitat approach and designates the above mentioned species/taxa groups as conservation targets for the initial five years of Project implementation, ecological monitoring of the Nature Reserve would reveal new information about the diversity and rarity of the taxa on and near the Project site. Based on this information and on the adaptive approach (Section 1.3.3), the conservation objectives and target species would also be reviewed and adjusted as needed after first five years of operation.

3 Threats to Ecological Resources

3.1 Village Development

3.1.1 Villages at Sha Lo Tung have been progressively abandoned over the last several decades, and lands have been sold to SLTDC. No one currently resides permanently in the Valley. SLTDC has acquired over 96% of the private lands in the Valley, leaving only small, isolated plots in the ownership of others. Basically, all uses within the remit of the Sha Lo Tung Outline Zoning Plan are prescribed in detail under the Notes to the various zones. Any proposed land use is not permissible unless it is listed as one of the permitted uses under that zone and does not require excavation, filling, or other earth works. If these conditions are not met, the proposed activity or land use requires approval from

the Town Planning Board. Thus village development or expansion are anticipated to cause only minimal impacts if any to the natural resources in the Valley.

3.1.2 Any potential management issues that might arise from the remaining private lands in Sha Lo Tung Valley not currently held by SLTDC will be addressed in the long-term by purchasing the remaining private lots in the Valley, which now comprise about 4 percent of the total land area. This can be achieved by setting aside a portion of the total project capital investment purchase of the remaining private lots or by other means that will be further explored as implementation proceeds.

3.2 Hillfire

3.2.1 Hillfire is not natural in Hong Kong, yet fire plagues the Valley because of the many grave sites where fire is carelessly used during ceremonies. Some areas of the Valley are burned once or twice per year and have been for many decades. On such sites vegetation cover is sparse and species richness limited. The absence of mature forest on the valley floor and the surrounding slopes is explained by the high frequency of hill fire, which maintains the vegetation as a shrub-grass community and precludes natural succession to forest.

3.2.2 The biodiversity implications of frequent hillfire have seldom been quantified in Hong Kong but it is beyond doubt that species richness of both flora and fauna communities declines where hillfires are frequent. Streams are also subjected to greater loads of eroded sediments, which degrade water quality and stream-bed habitats. This would be expected to degrade habitat conditions for dragonflies during larval and adult life stages.

3.2.3 The only existing controls on hillfire are fire suppression responses from the relevant government departments. Because there are no permanent residents in the Valley, there is no one to report small fires or extinguish them. In the absence of the proposed PPP pilot project, hillfire would remain one of the most serious threats to natural resources in the Valley.

3.3 Off-road Vehicles and Siltation

3.3.1 Sha Lo Tung Road provides vehicle access to the Valley. This has attracted off-road vehicle enthusiasts during recent decades. The result has been damage to streams, soils and vegetation by vehicles operated on natural habitats. The direct damage is obvious and severe. The indirect damage caused by stream sedimentation due to increased soil erosion is less obvious but possibly more severe from the perspective of biodiversity conservation. This is because the water quality in the streams and the condition of the stream-beds is critically important to the survival of dragonflies.

3.3.2 The only means of excluding off-road vehicles from the natural habitats in the Valley is to construct the road terminus to include barricades that would control vehicle passage. There are no known government plans for such a project. In the absence of the proposed PPP pilot project, use of off-road vehicles would remain a serious threat to natural resources in the Valley.

3.4 Visitors and War Games

3.4.1 Although the streams in the Valley are known to support wildlife that is of high conservation interest, there is no control over visitor access to and activities in/around these streams. There are trails to guide hikers through the valley to and from the surrounding Pat Sin Leng Country Park. However, there are no personnel, boundary markers, barricades, or other features to ensure that visitors stay on the trails in the interest of protecting habitats and wildlife in the natural habitats.

3.4.2 Conspicuous among visitors that use off-trail habitats are the “war-game” players. The ecological impacts of their activities have not been quantified, and may, indeed be minor. However, in combination with hillfire and off-road vehicle use, their activities could lead to declines in habitat quality and wildlife species richness or population abundance. Repeated presence of people in natural habitats in the Valley potentially fragments habitats even when there is no evidence of physical damage. This is because of the sensitivity of some wildlife species to human presence.

3.4.3 In the absence of the proposed PPP pilot project, visitor access to off-trail areas would remain a threat to natural resources in the Valley.

3.5 Exotic Species

3.5.1 The primary threat caused by exotic species is the spread of *Mikania micrantha*, an introduced climbing vine. Sha Lo Tung has not been overwhelmed by Mikania, but there is potential for this species to become more problematic.

3.5.2 Currently only volunteers are available to address the threat of exotic species at Sha Lo Tung. In the absence of the proposed PPP pilot project, exotic species would remain an unquantified threat to natural resources in the Valley.

3.6 Exploitation of Wildlife

3.6.1 In prior decades hunters were probably active in the Sha Lo Tung area. They probably used a variety of capture methods including firearms, snares, traps, nets, poisons, and others. In recent years this has diminished as a threat to wildlife because there are fewer residents in such remote areas and fewer people interested to hunt wild animals. The only species thought to be taken from the Valley in recent years is the Three Banded Box Terrapin *Cuora trifasciata*. It is a target of poachers because of its high market price due to its reputed medicinal value as a treatment for cancer.

3.6.2 The result of over-exploitation has been elimination of the species from much of its former range in south China and Hong Kong. The local population of the terrapin would be protected through more effective control of illegal capture.

4 Conservation Objectives

4.1 Objective 1: Conserve Dragonfly Biodiversity by Protecting and Enhancing Habitats

4.1.1 Dragonfly species are conservation targets of the PPP project. Dragonfly habitats, including marshes, streams and riparian vegetation, are to be protected, conserved, and enhanced in accordance with the stated purpose of the SSSI zoning. This will also benefit other aquatic and terrestrial target species, as described under Objective 7. Management tasks including baseline surveys will be used along with other information to plan and agree details of the enhancement strategy. Continuous monitoring of the dragonfly community and their habitats will also be implemented during operation of the Ecological Reserve. Baseline maps of stream-corridors (Cheung Uk, Lei Uk Streams, Northeast Marsh and Stream) and stream/marsh features (e.g. pool and riffle areas) will be compiled and updated annually. Management strategies will be developed, implemented, and adapted based on information provided by baseline surveys and monitoring. This is a core objective.

4.2 Objective 2: Enhance Upland Habitats by Removal of Exotic Vegetation

4.2.1 Invasion of exotic plant species (climbers, shrubs, and trees) is considered a threat to biodiversity in the Valley. The primary threat is *Mikania micrantha*, but others are present as well. The exotic plant species will be manually removed from the Valley prior their flowering seasons. Annual survey of exotic plants will be performed, and monitoring reports that will include maps showing the locations of removal operations and changes in spatial distribution will be provided each year. This is a core objective.

4.3 Objective 3: Enhance Quality and Area of Woodland Habitat

4.3.1 Woodlands including secondary woodland and fung shui woodland that occur outside the riparian SSSI zones form the Woodland Conservation Zone. Although these woodlands have been degraded by a long history of exploitation and hillfire, woodlands are locally important as reservoirs of genetic biodiversity. In particular, fung shui woodlands also demonstrate important cultural practices relating to nature conservation. Woodlands are designated a conservation target for the PPP project in the interest of maintaining and enhancing their biodiversity and habitat values. The Woodland Conservation Zone will be kept as existing and enhanced where appropriate through interplanting and manual removal of exotic species of vegetation (Objective 2) that competes with woodlands for light, nutrients and other resources. Use of trails for passive recreation and conservation education would also be allowed. This will also support Objective 1 (dragonfly conservation) and benefit butterflies by increasing the extent that adult dragonflies perch on woody vegetation and increases in diversity or availability of flowers, pollen, and nectar respectively.

4.3.2 The upland grassland and shrubland areas are included in the Woodland Enhancement Zone where woodland cover could be enhanced by planting of native tree species and by transplantation of

trees from the Sha Lo Tung Road Improvement works, if any. This will increase the species richness and cover of secondary woodlands, accelerate succession of shrub-grassland to woodland, which is also less fire-prone.

4.3.3 The newly planted or transplanted trees in both Woodland Conservation and Woodland Enhancement Zones will be maintained for 24 months after planting under the landscape contract and any dead trees found during the maintenance period will be replaced by healthy plants of the same species and similar size. Upon completion of the landscape contract, the woodland planting will be maintained and monitored by the ecological reserve staff. A detailed baseline map of secondary woodland will be compiled. This is a core objective.

4.4 Objective 4: Restore and Rehabilitate Abandoned Agricultural Lands

4.4.1 Wet abandoned agricultural lands are located in lowlands alongside streams, and they will be restored to wetlands by restoration of the irrigation system. Some lots of wet abandoned agricultural lands near Cheung Uk will be converted to a paddy farming demonstration site. Dry abandoned agricultural lands will be rehabilitated and converted to a butterfly floral garden and a plant nursery. Debris, terraces, and other hydrological modifications, if any, will be removed. This is a core objective.

4.5 Objective 5: Sustainably Manage Visitors

4.5.1 Visitors to the Valley include hikers, wildlife watchers, nature lovers and others. The PPP pilot project will maintain existing trails and control access such that most of these users can enjoy outdoor experiences without degrading the natural resources of the Valley. This can be achieved by designing the main access (for hikers) and provision of signage to divert visitors away from the ecologically sensitive areas. Guided tours will be provided to educate the public. Off-road vehicles will be excluded from the Valley by fencing and patrol by Ecological Reserve staff. This is a core objective.

4.6 Objective 6: Conserve Target Species/Taxa

4.6.1 The overall conservation focus is preservation and enhancement of the intrinsic ecological values of Sha Lo Tung SSSI and surrounding habitats. One objective is enhanced conservation of species and habitats of conservation interest that are native to the area. The taxa/species of conservation interest highlighted in the New Nature Conservation Policy for the Sha Lo Tung PPP site are selected as primary targets for conservation. These are described below:

Freshwater Fishes

4.6.2 Sha Lo Tung supports 14 native fish species in the two streams and various perennial and seasonal wetlands. One of these is the potentially endemic Hong Kong Paradise fish *Macropodus hongkongensis* (香港鬥魚, formerly considered to be *M. concolor*), which is a designated a target species of the PPP project. Actions taken to achieve Objective 1 (dragonfly conservation) will also

benefit conservation of *M. hongkongensis* by ensuring protection and enhancement of freshwater habitats through removal of rubbish and man-made barriers, integrated catchment management of water supply and monitoring studies. This is a core objective.

Three Banded Box Terrapin

4.6.3 Three Banded Box Terrapin is designated a target conservation species. It mainly occupies the stream courses in Sha Lo Tung Valley and in other remote locations with clean upland freshwater streams. The population at Sha Lo Tung is known to be exploited by trapping and appears to be declining. Secondary woodland enhancement, stream and riparian zone protection, and patrol/enforcement actions will aid conservation of freshwater terrapins. A species recovery plan will also be developed. This is a core objective.

Butterflies

4.6.4 Ninety-three butterfly species occupy the Valley, including two rare species, Forget-me-not *Catochrysops strabo* and Colon Swift *Caltoris bromus*. While little information is available on the ecology of these two species, planting of larval foodplants of the two rare butterfly species (including *Bambusa tuldooides*, *Bambusa multiplex* for *Caltoris bromus* and *Desmodium heterocarpon* for *Catochrysops strabo*) would benefit these butterfly species. Woodland dependant butterflies will also be enhanced by improving secondary woodland cover in the Valley (Objective 3). Improving the species diversity and cover of the Valley woodlands will have the added advantage of enhancing the corridor between two butterfly hotspots at Hok Tau and Fung Yuen. This is a core objective.

Chinese Pangolin

4.6.5 Chinese Pangolin *Manis pentadactyla* is listed as lower-risk, near-threatened in the IUCN Redlist. It is protected in mainland China at national level 2 but is not protected in Guangdong Province. It is exploited mainly for food and for use of its body parts in traditional medicines. Sha Lo Tung supports Chinese Pangolin in unknown numbers. It is designated a target species and the management objective is to increase local Chinese Pangolin abundance. Objectives 3 and 5 will support conservation of Chinese Pangolin by enhancing upland habitat quality through native tree planting in secondary and fung shui woods, and extending corridors through the valley (Objective 3), and removing agents of habitat degradation such as off-road vehicles (Objective 5). Levels of human disturbance will be reduced through visitor control and education. This is a core objective.

4.7 Objective 7: Enhance Conservation Education Opportunities

4.7.1 The PPP project will construct an Interpretation Centre on the Development Site to provide interactive educational exhibits related to the unique site values of Sha Lo Tung and provide facilities for school workshops. The Centre will have the facilities needed for public access and enjoyment, and safe and efficient passage through the Centre and the rest of the site (e.g. parking, toilets). The Centre will provide linked and guided access to key sites, and will offer guided tours to educate the public. It

will provide support facilities such as storeroom, workshop, and administrative areas. Increased human activities and disturbance during special Festivals, i.e. Ching Ming or Chung Yeung, may be a potential impact to the Sha Lo Tung Valley. With the provision of sufficient Conservation Ambassadors (i.e. 30 people, organised by Green Power), who will serve as reserve guards to control, advise and educate visitors of the regulations in the Ecological Reserve, human activities and disturbance will be largely controlled. The Nature Interpretation Centre will also be closed during those days to avoid attracting excessive numbers of people to the Ecological Reserve. This is a value-added objective.

5 Management Constraints & Potential Impacts

5.1 Management Constraints

5.1.1 Financial Sustainability: The pilot project will be funded by an one-off capital outlay by SLTDC. Costs of operations will be funded by income generated by funds placed in a Government statutory fund by SLTDC. The sum to be injected to the Government statutory fund should be adequate to generate steady income to meet recurrent costs for carrying out measures to conserve the SLT Ecological Reserve. Thus the project would be financially sustainable.

5.1.2 Villager-Owned Lands: As noted above under threats (Section 3), villager land ownership does not constrain the effectiveness of the PPP project because less than 4% of the Project site land area is owned by private holders other than SLTDC.

5.1.3 Hillfire Suppression: Under the Sha Lo Tung pilot project, an aggressive fire-suppression programme will be implemented to prevent hill fires or minimize their impacts. While no burning of incense and effigies will be allowed at the columbarium, the fire suppression programme will also include:

- Removal of grave sites in the proposed ER. Agreement had been reached with descendents of the graves inside the ER, and about 80% of the graves had already been relocated to designated burial grounds outside the Valley. Only four graves remain within the ER, thus significantly reducing the threat of hillfire caused by grave sweeping inside the ER. During operational phase, overgrown weeds around the graves would also be regularly removed by the ER staff as a vegetation management measure to further reduce chance of hillfire.
- Creation of firebreaks and planting of native fire-resistant plant species. Firebreak is a gap in vegetation that act as a barrier to slow or stop the spread of hillfires. While the existing streams serve as a natural firebreak, well-maintained trails inside the ecological reserve through regular clearance of weeds can also serve as firebreaks. In addition, selection of fire-resistant plant species for woodland enhancement and barrier planting can also reduce the spread and damage of hillfires. Examples of native fire-resistant tree species include *Schima superba*, *Bischofia javanica*,

Liquidambar formosana, *Cylcobalanopsis glauca*, *Castanopsis fordii*, and *Camellia* spp.

- Intensive patrolling and fire watching by ecological reserve personnel and volunteers during festival periods. During festival periods, sufficient Conservation Ambassadors will be provided by the Ecological Reserve to patrol the ecological reserve and the surrounding hillside. Water as well as containers would be provided to sweepers to the four grave sites for burning of effigies and paper offerings. Conservation education materials including flyers, providing the information regarding the damage effect of hillfires and fire-free grave sweeping methods (such as bringing fresh flowers), will also be distributed to sweepers to graves in the surrounding hillside and country park visitors.
- Closely coordination with Columbarium management unit, Fire Services Department, Hong Kong Police Force, and other NGOs for public education, law enforcement and fire control. In case of hillfires, an emergency system would be triggered where the Ecological Reserve staff would immediately notify the Police and Fire Service Department for assistance. The Columbarium management unit will also be contacted immediately for traffic regulation, especially during festival period, to facilitate the access of fire trucks to the scene. With experience accumulated during festival periods, liaison to Fire Services Department through the Fire Services Department Public Liaison Group would be made for better coordination of fire control. When necessary, the Ecological Reserve Staff or Conservation Ambassadors would also assist Hong Kong Police Force for prosecution of arsonists caught on site. Liaison, discussion and possibly cooperation would be made with other NGOs experiencing in implementation of hillfire prevention programme.

However, the risk of hillfire cannot be entirely eliminated by the PPP pilot project because fires might start outside the pilot project area. Although outbreak of hillfire could constrain the effectiveness of woodland restoration under the pilot project, this is not considered an overwhelming constraint on the overall effectiveness of the pilot project. The risk of hillfire is considered to be greater in the absence of the pilot project.

5.1.4 Scientific Learning Curve: The proposed management authority, Green Power (GP), is a non-government organisation focused on environmental protection and conservation education. As nature reserve manager GP will assume new roles as supervisor for land management, patrol enforcement and fire-fighting as well as the roles of scientist and conservation biologist. Each of these roles, and particularly the latter two, will require accumulation of scientific knowledge and field experience before useful results can be expected. This process of accumulating knowledge and experience must be allowed for in programming interventions and expectations. For issues other than off-road vehicles and obvious agents of resource degradation (e.g. poaching, hillfire) it may be appropriate to strive to maintain the ecological status quo for the initial several years of operation. Each component of the action plan and enhancement works will be carefully designed and preferably will be tried before full implementation. During this time period scientific information and field experience would be accumulated that would enable more effective planning and implementing of any conservation interventions.

5.1.5 Country Park Access: Sha Lo Tung Valley has several access points to the surrounding Pat Sin Leng Country Park. These points must be maintained to enable uninterrupted Park access for visitors. Activities of Park visitors within the PPP project management area can be controlled to a large extent through the provision of marked trails, fencing and guided tours. The authority for access control, trail maintenance, and relevant ordinances or guidelines will be subject to the land grant conditions, which is to be further discussed between the Government and Project Proponent.

5.2 Potential Ecological Impacts

5.2.1 The potential ecological impacts of the proposed PPP project were fully assessed in Section 9.9 of the EIA. The impacts of construction and associated management work in relation to the Ecological Reserve were highlighted below.

5.2.2 The PPP pilot scheme will not only avoid and minimise ecological impacts but will enhance the conservation value of Sha Lo Tung Valley through the following actions:

- It removes large scale village expansion as a threat to the ecological integrity and conservation value of the valley.
- It protects the area by a controlled site access and enhances the ecological values by active management
- Management work including removal of weeds and woodland enhancement would have positive impacts to the habitats on site.

5.2.3 Major activities within the Ecological Reserves would include:

- Installation of a drop bar at the road entrance to Sha Lo Tung Valley
- Temporary footbridge across the Sha Lo Tung Stream SSSI to Lei Uk for transporting materials to fencing site
- Permanent fencing at Lei Uk
- Other minor works including trail design and improvement and placement of signage and education display
- Compensatory planting and transplantation of species of conservation importance
- Ecological surveys, research and monitoring

5.2.4 The drop bar would be installed in developed area where SSSIs and CA will be avoided. The footprint is of minimal size and no major excavation works /machinery required. The construction period would also be very short. Therefore, no adverse impact is anticipated with good site practices and mitigation measures proposed in the EIA.

5.2.5 The temporary footbridge would be installed on abandoned agricultural land and of small size footprint. The footbridge will mainly be made of wooden materials with small concrete footings, which will be sitted away from stream as far as possible. Prefabricated timber sections and

construction materials would also be carried by hand to the proposed site for in-situ assembling on site. It will be installed during dry season for a short period of time with the use of hand tools only. The footbridge will also be removed and the site reinstated upon construction of fencing. Only buggies will be used where necessary for transportation of materials. Similar construction method would be adopted for permanent fencing installation at Lei Uk. The footings will be located inside the village area where minimal soil excavation is required for the posts and fence installation.

5.2.6 The trails are designed and improved to keep visitors on track and deter off-track activities. Trail and education sign posts along trails would also occupy limited footprint within the ecological reserve. Hand tools would be used or by small scale machines where necessary. Sensitive habitats and vegetated areas would be avoided as much as possible. Upon trail improvement the impacts are anticipated to be positive.

5.2.7 Compensatory planting will increase the woodland coverage of the valley and hence enhance the ecological value of the site in the long run. Ecological monitoring and research will be carried out by experienced ecologists and will provide long term data for management actions beneficial to wildlife, therefore constitute positive impact to the reserve.

5.2.8 Major activities during operation of the Ecological Reserves would include:

- conservation management measures including vegetation management including weed removal, enhancement planting, woodland planting, butterfly garden planting, plant nursery, trail maintenance, and ecological surveys, research and monitoring
- active control of destruction activities including use of four wheel drive vehicles, hill fires, war games, illegal trapping and vegetation removal
- organic farming at the demonstration site
- visitors in terms of country park hikers and ecological reserve visitors
- Villager activities at the unpurchased lot

5.2.9 Implementation of the conservation measures and enforcement of site security by the conservation management staffs will protect the flora and fauna especially the target species and enhance the ecological value of the ecological reserve as a whole.

5.2.10 The organic paddy farm demonstration site occupies a small footprint behind Cheung Uk. The location is carefully selected to avoid areas within Stream SSSI and areas with sightings of species of conservation species. No pesticides or insecticides would be allowed and where necessary only organic products would be applied. The wet organic farm would attract certain wetland dependent fauna to the site and therefore the overall impact would be positive.

5.2.11 The potential increase in number of visitors may constitute secondary impact such as disturbance to wildlife and vegetation. Several measures will be adopted to minimise the impact, including

- Restrict general visitors access to public trails and guided tours' access to education trails
- Restrict access to sensitive areas by gate, signage, planting
- Restrict size of guided tours (40 people each group) and number of tours (2 per day)
- Staff patrolling (e.g. for vandalism) and monitoring
- Provision of sufficient Conservation Ambassadors during festival days (served as reserve guards to control, advise and educate visitors)
- Closure of Nature Interpretation Centre during festival days to discourage visitors to Ecological Reserve
- Maintain records of visitor numbers to evaluate potential impact
- Provide guidance on code of behaviour.

5.2.12 There are 4 unpurchased lots (where only 2 lots are village houses) at V zone, which constitute to <1% of total area within the Ecological Reserve. Indirect impact due to disturbance to wildlife and vegetation is possible should the landowners revive activities in their lots. However, considering that no electrical/water supply and no vehicular access will be re-provided in the V zone, chances of resuming village activities would be minimal. With enforcement of regulation/code and regular patrol of the Ecological Reserve to prevent unlawful and improper activities, the potential impact due to village activities would be minimal.

5.2.13 In summary, there will be no adverse environmental impacts arising from implementation of the proposed conservation management plan during construction and operational phase. Positive impacts are anticipated through protection and enhancement of important habitats and species diversity.

6 Conservation Layout Plan

Management zones

6.1.1 The zoning map shown as Figure A1 outlines areas where the conservation measures will be implemented. Its main purpose is to distinguish those areas that will be closed to public access in the interest of conservation (core use areas) from those that will be open to public access for visitation and education programmes (added-value use areas). Table 1 lists the habitats and the management strategies that will be applied to each of them.

Dragonfly Habitat Conservation Area - Streams and Riparian Habitat

6.1.2 This area encompasses the most valued parts of the site and includes all of the SSSI zones and those CA zones in the north-east that adjoin the NE SSSI Zone. These will be managed together as the Stream and Dragonfly Conservation Zone and designated for the preservation and enhancement of dragonflies and other aquatic fauna and flora.

Woodland

6.1.3 Woodland areas include fung shui and secondary woodlands that occur outside the riparian SSSI zones and form the Woodland Conservation Zone. These will be kept as existing and enhanced where appropriate through interplanting and weed removal. Use of trails for passive recreation and conservation education would also be allowed.

Grassland and Shrubland

6.1.4 Green Belt hillside and grassland-shrubland areas largely comprise a number of local ridges that straddle the northern, eastern and southern boundaries of the OZP adjacent to the Country Park boundary. These areas are included in the Woodland Enhancement Zone where woodland cover will be enhanced at these locations by planting using native woodland species.

Abandoned Agricultural Land

6.1.5 Dry abandoned agricultural lands are mostly flat and located some distance from and at elevations above the stream courses. These lands provide excellent opportunities for sustainable re-use and will be successfully reallocated to flower gardens, orchards and plant nursery and managed to generate additional funding for conservation activities. A passive recreation area for the Public is also planned for this zone. This area would be designated as Butterfly Enhancement Area and Plant Nursery. Wet abandoned agricultural lands are mostly in the vicinity of stream courses. Most of these lands are included in Marsh Restoration Zone and would be restored to marshes, while areas previous recorded with Hong Kong Paradise Fish and of good conditions will be included under Paradise Fish and Marsh Preservation Zone. Some lots behind Cheung Uk village and away from stream courses will be restored to organic paddy farming demonstration site.

Village Areas

6.1.6 The villages are abandoned and the houses will be retained but not managed. Some unstable structures of old village houses at Lei Uk will be fenced for public safety reasons. Trails in the Valley will be retained for Country Park access. These are designated as Village Preservation Zone.

Table A1 Management Strategies for Habitats and Features

Habitats	Existing Structures	OZP Status	Proposed Feature	Purpose	Management Strategy
Streams, riparian, wetland	Paths	SSSI, CA	Dragonfly Habitat Conservation Area – keep as existing and enhance Use trails for education	Conservation, education,	Low-intervention management until scientific knowledge and experience are accumulated
Abandoned agricultural land	Abandoned school building	CA, GB	flower & butterfly garden, plant nursery, marsh restoration and organic paddy farm	Conservation; passive recreational use	Active use and management
Grassland and shrubland	Trails	GB	enhancement planting at woodland fringe to woodland, use trails for conservation education	Biodiversity conservation and enhancement	Restoration management moderate intensity management (planting rare, endangered species, removing exotics)
Secondary woodland and/or fung shui woodland	Trails	SSSI, CA, GB	Keep as existing, enhance through plantation, weed removal Use trails for passive recreation, conservation education	Conservation; passive recreation and education	Low-intervention management
Village areas	3 indigenous villages	V	None other than fencing of broken village houses at Lei Uk due to public safety concern	preservation in-situ	no management

6.2 Infrastructure and facilities

Access

6.2.1 Visitors (Hong Kong students, public as well as tourists) are to be encouraged to enjoy the natural environment at SLT without degrading the natural resources. The site will be accessible to visitors but they will be encouraged to join guided tours arranged by the Nature Interpretation Centre when visiting the ecologically sensitive areas, and will be discouraged from entering these areas unguided. For example, only two groups guided tours/day, each group of 40 people will be organised. Visitors to the Multi-Cultural Education Retreat cum Columbarium may visit the site, and will generally visit the interpretation centre of the site. The site will still provide access to the country park for hikers. Access of only major trails will be maintained for public to other parts of the country side via the Ecological Reserve, while other paths to streams, woodland and sensitive area would be of restricted access (by gate, signage, planting).

6.2.2 Public access (Figure A1) will be provided through the valley to Pat Sin Leng Country Park as in the existing situation. The general public will not, however, have unrestricted access to the sensitive areas within the Ecological Reserve. A drop bar will be installed at the entrance of the Ecological Reserve to control off-road vehicles from entering the natural habitats in the Valley. Other than the public access, other footpaths will be reserved as education trails. Wooden gates and signs will be installed between public trails and education trails, while native trees, shrubs and/or vines will be planted along the boundary of the Ecological Reserve to discourage public entering the sensitive areas.

6.2.3 To protect habitats in the Valley, the existing trails and footpaths will be maintained. This will enable some control of visitor access while ensuring access for the handicapped.

Public awareness / education

6.2.4 The educational component consists of the interpretation centre, guided tours, information signs and volunteer work. It is important to raise public awareness of the environmental value of this site and of nature in general. Environmental education leads people through the stages of ignorance→ awareness→ appreciation→ understanding→ concern→ action. Educating school children and students is particularly important, as this is when environmental attitudes are formed. Instilling a sense of pride in the environmental and teaching ethical approaches to the natural world can change attitudes and lifestyles.

6.2.5 Education programs for schools and the general public will be formulated to raise public awareness of local biodiversity and nature conservation values. Guided tours will be provided for students and the general public to enhance their understanding of the ecological importance of Sha Lo Tung Valley. Educational materials will be provided in the Interpretation Center.

7 Action Plan

7.1 Actions to Achieve Objective 1: Enhance Dragonfly Habitat (Core actions)

7.1.1 Dragonflies at Sha Lo Tung have survived deforestation, human settlement, conversion of natural habitats to croplands, hill fire, farming and animal husbandry, building construction, and environmental vandalism. The result is a hotspot of dragonfly biodiversity in Hong Kong and the south China region. However, the local biology and ecology of Valley dragonflies is poorly understood. Only basic habitat preferences are known. Given our limited scientific knowledge of this group and the high probability that any unscientific intervention would do more harm than good, no specific measures other than stream and general catchment protection are proposed for dragonfly conservation during the 5-year term of this management plan. Species management or recovery plans could, however, be developed at a later date when the ecology of dragonflies and their habitats are better understood.

7.1.2 Dragonfly use of the Valley is concentrated along the two streams that are wooded and have perennial flow. Northeast Stream lacks these characteristics and lacks the dragonfly species richness of the other two Valley streams. A study of the biology, hydrology, and substrates of Northeast Stream could lead to recommendations for stream restoration. If so, this could increase the availability of habitat for dragonfly species that prefer wooded streams.

7.1.3 The endemic dragonfly species Spangled Shadowed-emerald *Macromidia ellenae* prefers forested ravine streams. At least 30% of the local dragonfly species inhabit forested streams. Detailed studies on habitat requirements of the dragonfly species of concern will be implemented before management recommendations for dragonflies will be made. Restoration and enhancement of stream habitats might also benefit Three Banded Box Terrapin while discouraging the spread of *Mikania* along stream bank habitats.

7.1.4 Management tasks will include:

1. Compile baseline maps of stream and marsh features such as pool and riffle areas. Maps should be compiled for both the wet (April to September) and dry seasons (November to March) and update the maps annually.
2. Compile baseline stream-corridor maps for Cheung Uk, Lei Uk Streams, Northeast Marsh and Stream. Update the maps annually to track changes in riparian vegetation.
3. Analyse substratum composition and conduct water quality monitoring of the streams and marshes to determine the breeding habitat features.
4. Trial management based on results of studies on habitat requirements of the target dragonfly species.
5. Remove accumulated refuse from streams and marshes.

7.1.5 Performance indicators and monitoring tasks will be as follows:

1. Design and implement systematic baseline surveys of dragonfly communities.
2. Initiate annual quantitative monitoring of dragonfly species richness and abundance for both adult and larval forms.

7.1.6 Remedial actions will include conducting a specialist review and where appropriate, improving the monitoring programme, adjusting vegetation management including invasive weed control, reviewing and adjusting refuse maintenance efforts, habitat enhancement measures and visitor levels.

7.2 Actions to Achieve Objective 2: Removal of Exotic Species (Core Actions)

7.2.1 All exotic flora species will be manually removed from the Valley. Annual removal projects will be carried out prior to the flowering season for each target species. If free of seed, all removed vegetation will be composted for use in landscaping. Removal and disposal will be carried out by contractors and volunteers.

7.2.2 Annual monitoring will require field survey to locate and plot on maps all exotic species detected in the Valley. Monitoring reports will include maps showing locations of removal operations each year.

7.3 Actions to Achieve Objective 3: Enhance Quality and Area of Woodland Habitat (Core Actions)

7.3.1 Trees will be planted or transplanted in the woodland restoration and enhancement zones at Sha Lo Tung Valley to mitigate losses of trees due to improvement of Sha Lo Tung Road. Compensatory tree planting will achieve a ratio of more than 1:1. Woodland plantation will include only native species that are considered ecologically appropriate to plant in the valley (those known to occur here, and those whose abundance or geographic distribution in the Valley or throughout Hong Kong has declined). Some trees will be transplanted from the works areas of the road improvement project. Others will be purchased from local nurseries. Fruit-bearing and nectar-producing trees will be priorities in species selection. Planted trees will be monitored for survival.

7.3.2 Invasive exotic species of vegetation will be removed from fung shui woods as a first priority. A monitoring project will then be implemented to track the presence of invasive exotic species and plan further removal programs.

7.3.3 No tree or shrub planting is prescribed for the fung shui woods in this plan. Should monitoring projects identify an opportunity to enhance the biodiversity of the fung shui woodland through planting of indigenous species, this could be planned and implemented at a later date.

7.3.4 Management and monitoring tasks will include the following:

1. Compile detailed baseline maps of secondary woodland boundaries using aerial photography supplemented by field survey.
2. List and describe tree species in a tree survey report.

3. Update woodland maps annually.
4. Monitor transplanted trees for survival and replace dead trees as needed.

7.4 Actions to Achieve Objective 4: Restore Abandoned Farmlands (Core Actions)

7.4.1 Some of the dry abandoned farmlands will be converted to a themed butterfly/floral garden. Designing and creating the garden will require selection of vegetation species for planting based upon their utility to adult and/or larval butterflies. The garden will be planned and landscaped to ensure it does not have a deleterious impact on the fauna and flora in the surrounding habitats. Management will require periodic review of activities and proposed uses to ensure that these are compatible with the overall conservation objectives of the site. Management tasks will include:

1. A suitable area will be identified and allocated for use as the butterfly garden for the purpose of providing a safe and protected habitat for native flowering plants and a safe environment for passive recreation such as butterfly watching.
2. Maintain the grounds of the park/garden on a regular schedule. This will include rubbish removal, fire safety control, gardening, and safety checks of equipment and paths.
3. Maintain existing hiking trails and relevant signage on a regular schedule.

7.4.2 Some of the wet abandoned agricultural lands will be restored to marsh or wet riparian habitat. Any debris will be removed. Ginger lilies will also be removed because they were cultivated. Basic recontouring of soils will be undertaken to achieve the most appropriate hydrology for aquatic fauna. Any needed hydrological modifications will be described in a plan together with any proposals for planting of indigenous wetland vegetation.

7.4.3 Some wet abandoned agricultural lands near Cheung Uk would be reverted to organic paddy farming demonstration site. This would restore some cultural value of the old village while also enhance the diversity of habitats for wetland dependent wildlife.

7.4.4 Performance indicators and monitoring will include:

1. Monitoring and maintenance of a database recording species planted and survival date.
2. Review visitor statistics for the park/garden on an annual basis and compare to targets.
3. Analyse maintenance records and compare to targets.
4. Monitor wetland restoration using fixed-point photography and quantitative assessment of vegetation cover by species and area.

7.5 Actions to Achieve Objective 5: Sustainably Manage Visitors (Core Actions)

7.5.1 The guided trails are planned to provide logical access and good circulation around the site, and,

where possible, to link with existing trails and footpaths in order to avoid impact on the fauna and flora of site value.

7.5.2 Signage will be installed to advise that operation of off-road vehicles is prohibited at all locations in the Valley. Signage will be required to advise visitors of the regulations in the Valley prohibiting war-games and other off-trail activities.

7.6 Actions to Achieve Objective 6: Conserve Target Species (Core Actions)

Stream Fauna (Dragonflies and Freshwater Fishes)

7.6.1 Cheung Uk and Lei Uk streams are known to support high dragonfly species numbers and the potentially endemic Hong Kong Paradise Fish. These streams will be unmanaged except for removal of rubbish, weeds including *Mikania micrantha* and any obvious man-made barriers to movement of aquatic organisms.

7.6.2 Northeast Stream is similar in gradient and gross physical appearance to Lei Uk Stream. However, Northeast Stream lacks permanent stream flow and supports lower biodiversity than Lei Uk Stream. Northeast Stream supports the Hong Kong Paradise Fish and is hydrologically connected to Northeast Marsh, which lies between the two streams. It is hypothesized that Northeast Stream was converted from a stream to paddy farming by the early settlers in the Valley. A period of monitoring is needed to determine a useful and appropriate stream restoration strategy for Northeast Stream. This will include monitoring of substrate, hydrology, flora, and fauna, and details will be specified in the monitoring plan. Should it prove desirable to attempt restoration of Northeast Stream, the objective would be increase in habitat availability for dragonflies and freshwater fishes. Planning consideration will be given to the hydrological and ecological relationship between Northeast Stream and the adjacent marsh. Should marsh restoration be indicated by monitoring studies, plans will be developed accordingly.

7.6.3 Based on the existing topography, it is unlikely that Sha Lo Tung Valley ever had ponds. Therefore the focus of habitat restoration will be on streams, marshes, and woodlands. There are, however, some pond dragonfly species that might be attracted to Sha Lo Tung if suitable habitat were available. This will be investigated through a species management and feasibility study.

7.6.4 The marsh between Lei Uk and Northeast Streams is inadequately known at this point to prescribe management. It supports Hong Kong Paradise Fish in addition to at least one species of sedge (*Carex phacota*) that is known in Hong Kong only from Sha Lo Tung Valley. The marsh will be addressed by monitoring of flora, fauna, and hydrology. Should focused management or restoration be required, they will be addressed in a habitat management or restoration plan to be developed later.

7.6.5 Water supply will be managed by adopting an integrated catchment management approach. Tree plantation and fire suppression will be key activities to (i) compensate for prior deforestation; (ii) increase forest cover; (iii) increase infiltration of precipitation; and (iv) increase groundwater and surface water supplies and extend the period of availability to approach predicted pre-human levels.

7.6.6 No new water control infrastructure, facilities, or any type of mechanical device will be installed without general approval of the management organisation and any technical oversight committee.

7.6.7 Monitoring studies will be carried out to describe the ecology of selected species of dragonfly and the Hong Kong Paradise Fish. Based on the outcomes of these studies, plans will be developed for habitat restoration or management. Prospective target dragonfly species include *Macromia urania* (IUCN least concern), *Macromidia ellenae* (endemic), *Lamelligomphus hainanensis* (rare), and *Sieboldius alexanderi* (possibly limited in distribution).

Three-banded Box Terrapin

7.6.8 The species is threatened by illegal taking for the traditional medicine trade as a cure for cancer. The Valley is considered a HKSAR black-spot for taking of turtles, although the population is thought to be surviving. The species is at risk of local extinction and has been extirpated from most of its former range in mainland China. Habitat is both available and suitable at Sha Lo Tung.

7.6.9 The ecology of the species is unknown at Sha Lo Tung. Study is required to describe its distribution, habitat use, abundance, breeding ecology, and degree of exploitation. Mark-recapture studies are recommended and will be detailed in a species recovery plan.

7.6.10 Kadoorie Farm and Botanical Garden (KFBG) and Agriculture, Fisheries and Conservation Department (AFCD) has a joint conservation breeding programme that includes the Three-banded Box Terrapin. Communication will be initiated with KFBG and AFCD to determine, after effective control of illegal trapping and hunting, whether turtles from captive breeding would be available for release at Sha Lo Tung to increase local numbers. This could also enhance the genetic diversity of the population at Sha Lo Tung since this species may be rare in the wild.

7.6.11 Three-banded Box Terrapin favors streams in the vicinity of broadleaf forest. Study of Northeast Stream could lead to inclusion of this stream in the species recovery plan for turtles. Details will be elaborated in the species recovery plan to be developed.

7.6.12 Patrol will be undertaken as part of the species recovery plan to (i) remove traps; (ii) identify and report violators of the law; and (iii) reduce or eliminate illegal taking. Patrol must be more intensive in wet season when most trapping occurs. More effort will be spent to patrol in streams and marsh, which are turtle habitats.

7.6.13 While these actions will focus on the Three-banded Box Terrapin, they will benefit other turtle species that could potentially occupy Sha Lo Tung. Monitoring of species and population numbers and trends will cover all turtles, if any, in the interest of developing conservation projects for the entire species group.

Butterflies

7.6.14 Butterfly biodiversity is among the distinguishing features of Sha Lo Tung Valley. Planting larval foodplants of uncommon/rare species will be incorporated into the tree plantation project in the

interest of butterfly conservation.

Chinese Pangolin

7.6.15 Chinese Pangolin is an anteater. It forages nocturnally on ants, wasps and termites, and occupies burrows during the day. Pangolin habitat requirements are met by existing conditions at Sha Lo Tung. However, these could be improved by enhancement of secondary and fung shui woods, and reduced levels of human disturbance and exploitation. Knowledge of the basic ecology of Chinese Pangolin is limited. Before implementing interventions other than habitat protection, it is advisable to investigate the local ecology of the Chinese Pangolin. This could be accomplished by camera-trapping to identify use areas and locate burrows and mark-recapture studies (using cameras) to estimate population numbers and trends.

7.7 Actions to Achieve Objective 7: Enhance Conservation Education Opportunities (Value-Added Actions)

7.7.1 Regular updating and maintenance will be required to maintain the quality and safety of the Interpretation Centre facilities. Management tasks will include:

1. Production and display of new materials and exhibits for the Interpretation Centre;
2. Periodic change of the exhibit display programme;
3. Organize workshops including field visits to the dragonfly habitat;
4. Maintain guided trails and relevant signage on a regular schedule.
5. Maintain records of visitor numbers and satisfaction;
6. Provide guidance on code of behaviour and ensure numbers are controlled to levels that do not cause adverse impacts;
7. Manage and maintain the support facilities.

7.7.2 Performance indicators and monitoring will include:

1. Review visitor statistics on an annual basis and compare to Objectives.
2. Analyse maintenance records and compare to Objectives.

7.7.3 If performance indications are poor, then a specialist review will be undertaken and changes in management will be made according to recommendations received.

7.8 Infrastructure

Abandoned School and Villages

7.8.1 All abandoned village homes and the abandoned school will be retained but will not be managed in any way other than to remove exotic/invasive vegetation.

Graves and Urns

7.8.2 Hill fire is considered to be the greatest remaining threat to biodiversity in Sha Lo Tung Valley. In the interest of fire suppression, grave sites will be mown twice annually before each grave visitation

period such that no flammable vegetation remains within 1 m of any grave site. In addition, special enforcement patrols will be on-site during the grave-sweeping periods to ensure that laws prohibiting use of open fire are respected. Managers will assist grave visitors to control fire by providing appropriate metal containers for containment of fire and will advise the grave worshippers to follow a precautionary guideline for the prevention of hill fires in countryside. Additional manpower will be deployed to patrol the Sha Lo Tung area during annual worshipping days. Fire management is a core action directly related to habitat improvement.

8 Sustainability, Monitoring and Research

8.1 Habitat

8.1.1 Habitat monitoring will be carried out using a combination of remote sensing and field work. Projects will include:

- annual estimation and mapping of habitat coverage by type; and
- annual description of fire location, area, frequency.

8.2 Flora

8.2.1 Monitoring of vegetation will be carried out using field study. Permanent staff will be supplemented by consulting specialists as required. Monitoring projects will include:

- tree plantation survival rate;
- tree plantation replacement requirements;
- presence and coverage of exotic species.

8.2.2 Vegetation specialists will investigate the potential for implementation of a recovery plan for rare or locally threatened or extinct species.

8.2.3 The rare sedge (*Carex phacota*) will be monitored to learn more of its local ecology for use in conservation management. A monitoring project will be developed to describe its:

- distribution
- abundance
- site characteristics
- need and potential for conservation management

8.2.4 The rare shrub (*Viburnum hanceanum*) is also poorly known in terms of its ecology and potential for conservation management. A monitoring project will be developed to describe its:

- distribution
- abundance
- site characteristics

- need and potential for conservation management

8.3 Fauna

8.3.1 Butterfly species richness and numbers will be sampled at target habitats on a seasonal basis. Monitoring efforts will be coordinated with the monitoring team of Fung Yuen Butterfly Reserve, so that a comprehensive conservation and monitoring project can be implemented to address butterfly biodiversity at both Sha Lo Tung and Fung Yuen SSSI.

8.3.2 Hong Kong Paradise Fish and the other 13 species of freshwater fishes at Sha Lo Tung are not well known in terms of their ecology or conservation needs. To address this knowledge gap monitoring studies will be implemented to focus primarily on the Hong Kong Paradise Fish while investigating other species when appropriate. The monitoring project will accumulate data to describe:

- habitat use;
- distribution; and
- abundance and population trend
- interaction between exotic fish species and native fish species, which would contribute to derive control measures on the exotic fish species.

8.3.3 The Sha Lo Tung dragonfly community has been well studied in terms of species numbers and basic ecology of a few prominent species. However, this level of knowledge is not adequate to make habitat management recommendations to target a single species or even a group of species. The reason for this is that a given intervention may have unintended consequences that adversely affect the overall ecosystem yet do not even achieve the intended conservation objective for the target species. In short, when manipulating nature, it is best to build a vast resource of scientific knowledge and then proceed with great caution. To accumulate knowledge of stream and dragonfly ecology it will be necessary to carry out monitoring and research studies. At a minimum these will include quantification of the following:

- species richness by habitat
- habitat use
- distribution
- abundance

8.3.4 Three-banded Box Terrapin is not well studied at Sha Lo Tung. For this reason it is appropriate to initiate basic ecology studies to describe the existing situation including threats to the Valley population. Monitoring studies are needed to:

- estimate the local population using mark-recapture methods;
- count and remove traps/snares;
- assess threats;

- quantify habitat use; and

8.3.5 Map geographic distribution. Mammals at Sha Lo Tung are poorly studied. This includes the Chinese Pangolin. A monitoring project will be implemented using camera-trapping to collect basic information on mammal presence and relative abundance. Cameras will be set at vandal-proof locations around the Valley and operated on a long-term basis. Presence and relative abundance will be quantified based on the resulting photographs of species including:

- Leopard Cat;
- Chinese Pangolin;
- Muntjac;
- Small Indian Civet;
- Ferret Badger;
- Wild Boar; and
- feral dog.

8.3.6 Hydrology and water quality have been studied on short-term bases over a 20 year period. However, there has never been a long-term quantitative study of water quality or hydrology. Such a project will be implemented in the Valley and in cooperation with the Water Supply Department monitoring works at Hok Tau Reservoir fed by several streams including those in the Valley. Studies will quantify:

- Flow rates
- Water levels in streams and marshes
- Water quality

8.3.7 A work plan summarizing the implementation of the conservation management work at Sha Lo Tung Ecological Reserve is summarised in Figure A2.

9 Management and Finance

9.1 Administration and organization

9.1.1 The conservation agent (Green Power) will implement the CMP. In addition, Eco-Education & Resources Centre, Hong Kong would serve as a partner of Green Power for organic paddy farming in the reserve, while Shantou Institute of Agricultural Science, China would also be an advisory consultant for managing the paddy farm.

9.1.2 The long term management of the SLT Ecological Reserve will be undertaken by the nominated conservation agent, Green Power, with funding to be granted by the Government statutory fund. In the long term, SLTDC is willing and prepared to donate the ecological sensitive land to a dedicated conservation body ultimately for conservation with prior approval of the Director of Lands.

9.1.3 Staff budget plan, structure and responsibilities are described in Appendices 1 and 2 respectively.

9.2 Financial arrangements

9.2.1 A capital budget is shown in Appendix 3. This includes the first-year salary costs because the conservation agent will have staff costs during year 1 when construction is in process.

9.2.2 Year 2 recurrent costs are budgeted in Appendix 4.

9.2.3 Capital costs of establishing the pilot project would be funded by an initial capital injection by SLTDC. Costs of operations would be funded by income generated by funds placed in a Government statutory fund by SLTDC. The adequacy and practicability of the funding will be advised by the Government. It would be an agreeable upfront capital sufficient to ensure an annual yield adequate to meet the annual staff salary cost (Appendix 1) and operating costs (Appendix 4) of the pilot project (together estimated at HK\$4-5 million).

9.2.4 Contingency is estimated at 10% on the capital budget sub-total.

10 Reporting

10.1 Annual Report

10.1.1 Annual habitat management and ecological monitoring reports will be prepared to document the findings of the ecological baselines, evaluation of effectiveness of the action plan and enhancement works undertaken, and recommendations on management measures or trials. The annual report will also include a financial report documenting the annual revenue and operational expenses and a budget report for the coming year. The report will be submitted to the Government statutory fund and concerned parties for review during the operation of the Ecological Reserve so that proper adaptive management could be carried out in the reserve to achieve the conservation objectives.

10.2 Quarterly Report

10.2.1 To facilitate adaptive management, quarterly reports will also be prepared to document the interim findings and exceedance of action/limit levels or anomalies, if any, occurring within the reserve so that proper remedial actions/responses can be taken in time.

11 References

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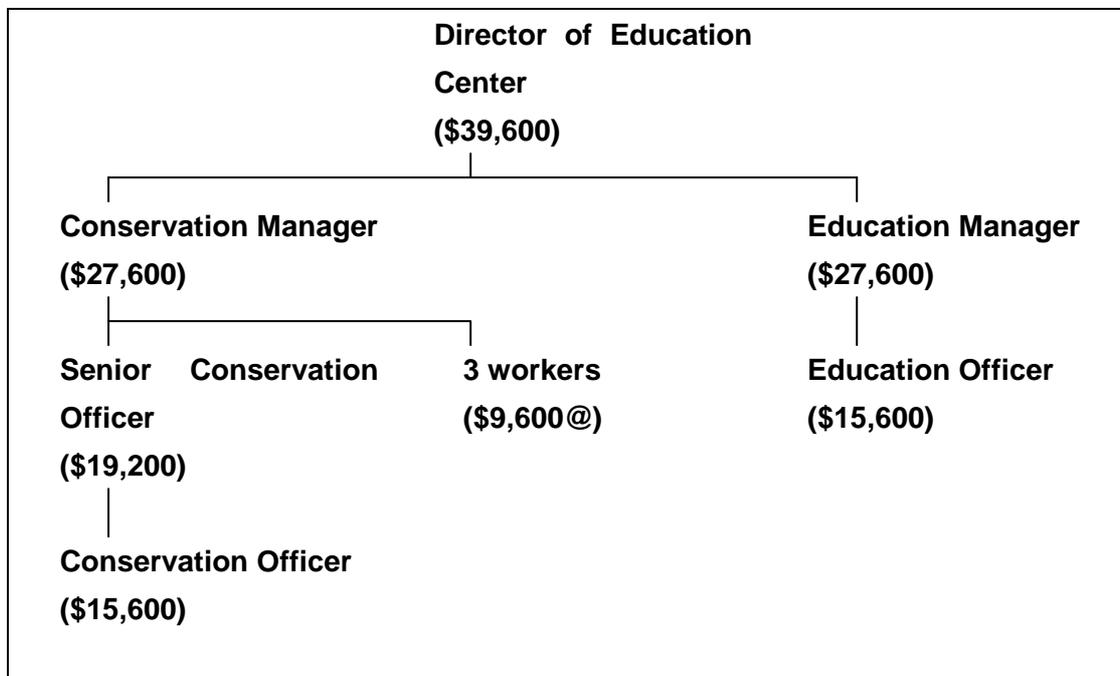
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<http://www.china-landscape.net/wz/25804.htm>

Appendix 1 Proposed Staff Budget Plan for Sha Lo Tung Conservation Management

First Year



No. of staff = 9

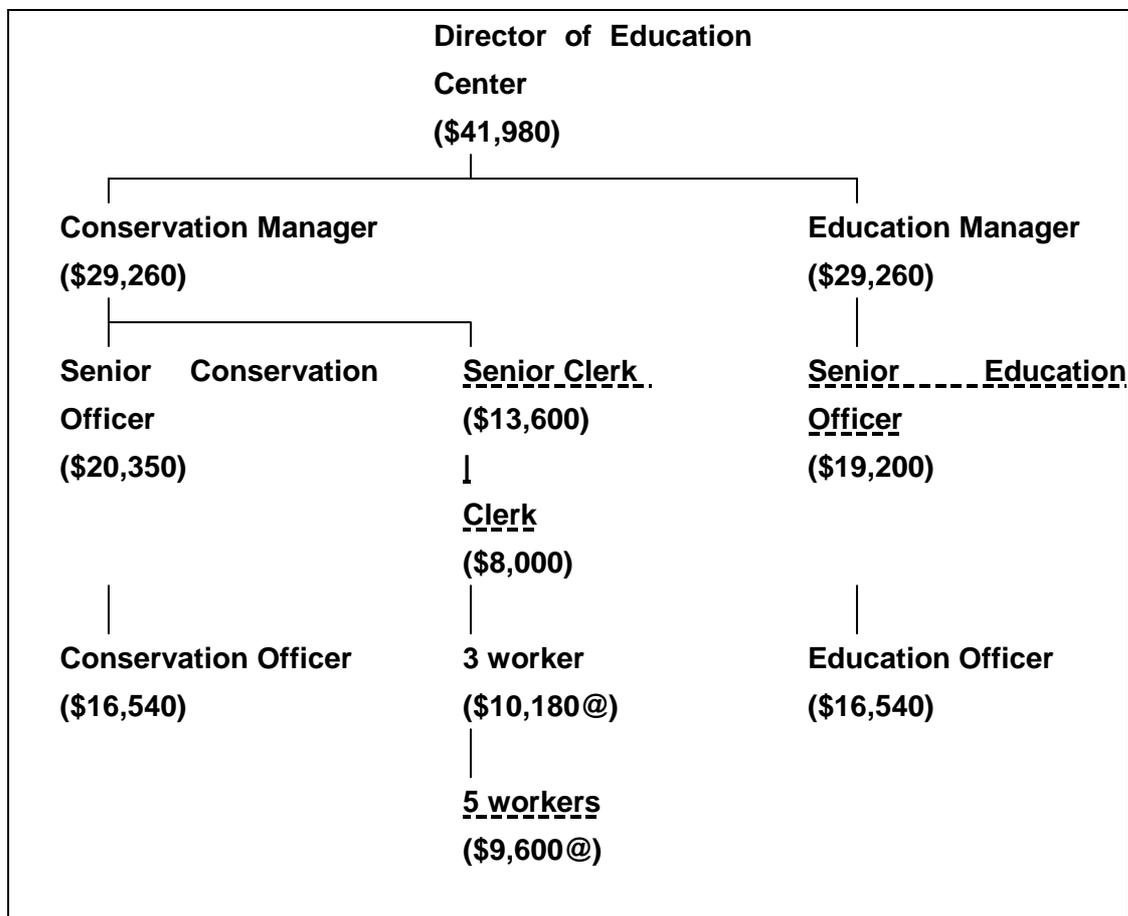
Salary & MPF:

Monthly= \$174,000

Yearly= \$2,088,000

(to be continued)

Second Year



No. of staff = 16

Salary & MPF:

Monthly=\$273,270

Yearly=\$3,279,240

Note:

- (1) Staff newly recruited are underlined for that particular year.**
- (2) It is assumed an annual increase of 3-5% in salary for the staff employed in the previous year.**

Appendix 2 Staff qualification and duty list:

	Post	Qualification	Duty
1.	Director of Education Center	(1) B.Sc./ Master degree in subject related to natural science or nature conservation (2) >5 yrs. experience of in-charging an environmental education center and experienced in field and staff management	(1) Implementation of the Sha Lo Tung Conservation Management Plan and supervising the daily operation of the Interpretation Center (2) Reporting the Sha Lo Tung conservation management related matters to the Government statutory fund.
2.	Conservation Manager	(1) B.Sc./ Master degree in subject related to natural science or nature conservation (2) >5 yrs. relevant working experience in conservation and habitat management	Day-to-day conservation management, species conservation planning and implementation (including the species management plans for dragonfly, butterfly, fishes and the Three Banded Box Terrapin) and ecological monitoring at Sha Lo Tung to achieve the agreed objectives and management goals listed in the conservation management plan
3.	Senior Conservation Officer	(1) B.Sc./ Master degree in subject related to natural science or nature conservation (2) >2 yrs. relevant working experience in conservation and habitat management	Assist to carry out the conservation management practices, species conservation plan and ecological monitoring at Sha Lo Tung
4.	Conservation Officer	(1) B.Sc. degree in subject related to natural science or nature conservation (2) >2 yrs. relevant working experience in nature conservation	Assist to carry out the conservation management at Sha Lo Tung
5.	Senior Clerk	(1) Degree or diploma holder in accountancy or equivalent (2) Good command of English and	Provide administrative, accounting support for the centre

	Post	Qualification	Duty
		<p>Chinese, proficiency in computer application</p> <p>(3) >5 yrs. relevant working experience</p>	
6.	Clerk	<p>(1) F. 5 or above, Good command of English and Chinese, Computer literate</p> <p>(2) >2 yrs. relevant working experience</p>	Assist Senior Clerk to carry out administrative and office work
7.	Education Manager	<p>(1) B.Sc./ Master degree in subject related to natural science or nature conservation</p> <p>(2) >5 yrs. relevant working experience in conservation education</p>	<p>Design and organise nature conservation education programme, guided tours</p> <p>Supervise senior education officer and education officers to carry out the duty.</p>
8.	Senior Education Officer	<p>(1) B.Sc./ Master degree in subject related to natural science, nature conservation or environmental education related subject</p> <p>(2) >2 yrs. relevant working experience in environmental education</p>	Assist to carry out the education program at Sha Lo Tung
9.	Education Officer	<p>(1) B.Sc. degree in subject related to natural science, nature conservation or environmental education</p> <p>(2) >2 yrs. relevant working experience in environmental education</p>	Assist to carry out the education program e.g., guided visit at Sha Lo Tung
10.	Worker(s)	>5 yrs. experience in agriculture, horticulture and other related experience in habitat management as well as other relevant experience (e.g., driving)	Conduct field conservation works as directed by Conservation Manager

Appendix 3 Estimated Capital Costs

Item	Description	Unit Name	No. Units	Unit Cost	Subtotal
1	Interpretation Centre (excluding Public Car Park)*				\$8,000,000.00
2	IT/Education Equipment				\$3,700,000.00
	Office furniture, computers hardwares and softwares				
	CCTV				
	Display design and set up (specimen collection, intranet games, display board, etc.)				
	Pamphlet, brochures, education kits				
	Outdoor signage and display boards				
3	Public Utilities				\$4,000,000.00
	Reconnection of power, water supply				
	Phone and broadband				
4	Conservation Work				
	Phase 1				\$11,830,000.00
	Boundary delineation by soft type fencing/planting	metres	4,800	500	\$2,400,000.00
	Maintenance of existing footpaths	metres	2,000	1,000	\$2,000,000.00
	Site clearance (rubbish and weeds)	contract	1	500,000	\$500,000.00
	Plant nursery establishment & nursery stock	ha	1.72	250,000	\$430,000.00
	Woodland planting	m2	30,000	100	\$3,000,000.00
	Butterfly garden	m2	10,000	200	\$2,000,000.00
	Others (e.g. habitat enhancement works or land purchase in SSSIs)				\$1,500,000.00
	Phase 2				\$9,950,000.00
	Restoration of marsh for Hong Kong Paradise Fish	m2	5,000	150	\$750,000.00
	Stream modification for dragonflies/amphibians	metres	1,000	300	\$300,000.00
	Tree planting (replacement and new)	trees	10,000	100	\$1,000,000.00

Item	Description	Unit Name	No. Units	Unit Cost	Subtotal
	Maintenance of existing footpaths	metres	2,000	200	\$400,000.00
	Site clearance (rubbish and weeds)	contract	1	500,000	\$500,000.00
	Others (e.g. habitat enhancement works or land purchase in SSSIs)				\$7,000,000.00
5	Company Car				\$600,000.00
6	Staff Cost				\$2,088,000.00
7	Others (including temporary office rent, hydrological and soil study, ecological baseline study, conservation management plan, contracted ecologists for site supervision)				\$5,000,000.00
	Subtotal				\$45,168,000.00
	10% Contingency				\$4,516,800.00
	Total				\$49,684,800.00

Appendix 4 Estimated annual recurrent cost during operation (Year 2)

Item	Description	Unit	No.	Unit	Subtotal
		name	Units	Cost	
1	Habitat Management				\$814,800
a	Maintenance of Woodland Planting Area	m2	3000	24	\$72,000
b	Maintenance of Butterfly Garden	m2	10,000	18	\$180,000
c	Maintenance of marsh	m2	3,000	24	\$72,000
d	Maintenance of on-site nursery	ha	1.72	30,000	\$51,600
e	Maintenance of stream	metre	2,400	12	\$28,800
f	Exotic species control	ha	57	2,400	\$136,800
g	Erosion control	ha	57	2,400	\$136,800
h	Fire prevention including vegetation control at grave sites	ha	57	2,400	\$136,800
2	Facilities Maintenance/Upgrade				\$900,000
a	Basic maintenance/worker equipment - tools, uniforms, etc.	month	12	9,000	\$108,000
b	Office Equipment and Supply	month	12	6,000	\$72,000
c	Computing Equipment	month	12	6,000	\$72,000
d	AV Equipment	month	12	9,600	\$115,200
e	Utilities (gas, electricity, water supplies, sewage charges)	month	12	7,200	\$86,400
f	Buildings	month	12	12,000	\$144,000
g	Trails	month	12	6,000	\$72,000
h	Rubbish	month	12	3,600	\$43,200
i	Fencing/gate	month	12	6,000	\$72,000
j	Vehicle	month	12	9,600	\$115,200
3	Conservation & Education				\$1,096,800
a	Signs	sign	100	240	\$24,000
b	Displays	month	12	6,000	\$72,000
c	Brochure/pamphlets	month	12	4,800	\$57,600
d	Scientific Equipment	month	12	9,600	\$115,200
e	Research & Monitoring	contract	5	120,000	\$600,000
f	Subsidy for volunteer (if required)	month	12	6,000	\$72,000

Item	Description	Unit	No.	Unit	Subtotal
		name	Units	Cost	
g	Web site update and maintenance	month	12	6,000	\$72,000
h	Visiting speakers/lecturers	month	12	7,000	\$84,000
	Subtotal				\$2,811,600
	less personnel items listed above (i.e. tasks which can be covered by on-site staff and therefore expenses covered by staffing cost and excluded from recurrent cost)				\$1,825,200
	Adjusted Total Recurrent Cost				\$986,400

*** Cost excludes:**

Staffing cost

Slope stabilisation works, if required

Revenue generated from admission fee

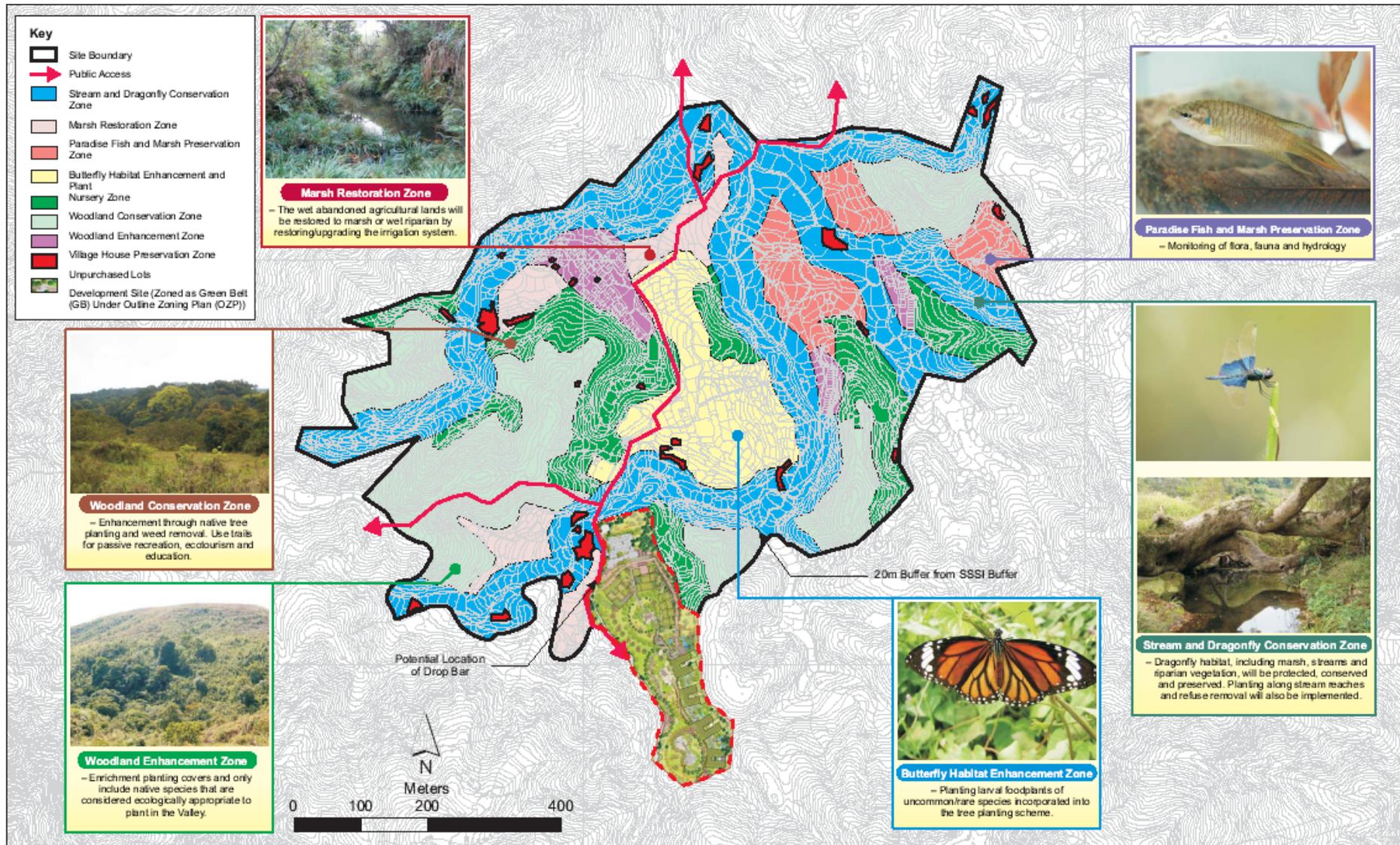


Figure A1 Management Zones at Sha Lo Tung Valley

ITEM	Year									
	Preparation phase				Operational Phase					
	-3	-2	-1	0	1	2	3	4	5	
Plant butterfly garden				■						
Monitor of the butterfly populations				■	■	■	■	■	■	■
Draft restoration plan for wet abandoned agricultural lands and paddy farming demonstration site				■						
Implement and monitor wetland restoration using fixed-point photography and quantitative assessment				■	■	■	■	■	■	■
Draft organic paddy farming plan				■						
Implement and monitor paddy farm in terms of harvest and use by wildlife				■	■	■	■	■	■	■
ACTIONS TO ACHIEVE OBJECTIVE 5: SUSTAINABLY MANAGE TOURISM (CORE ACTIONS)										
Trail design				■						
Installation of signage to detain off-site visitors				■						
Visitor management				■	■	■	■	■	■	■
ACTIONS TO ACHIEVE OBJECTIVE 6: CONSERVE TARGET SPECIES (CORE ACTIONS)										
Define target species of plants, dragonflies, freshwater fishes and freshwater turtles for conservation			■							
Ecological baseline study of stream and marshes (see objective 1)				■	■	■	■	■	■	■
Quantitative monitoring of freshwater fish species richness and abundance				■	■	■	■	■	■	■
Prepare species management or recovery plans				■		■		■		■
Trial management based on results of studies on habitat requirements of the target species				■			■	■	■	■
ACTIONS TO ACHIEVE OBJECTIVE 7: ENHANCE CONSERVATION EDUCATION OPPORTUNITIES (VALUE-ADDED ACTIONS)										
Periodic change of the exhibit display programme				■	■		■	■	■	■
Organize workshops				■	■	■	■	■	■	■
Maintain guided trails and relevant signage on a regular schedule				■	■	■	■	■	■	■
Maintain records of visitor numbers and satisfaction				■	■	■	■	■	■	■

