The Proposed Hotel Complex at Kandalama and the Environment

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INTRODUCTION

The proposed hotel complex in the catchment of the Kandalama Tank has become a controversial issue because of its possible harmful effects on the environment. Harmful effects of industrialization, urbanization, and agricultural development, especially on the immediate environment of the developed area, are quite evident in many instances. We also know that the present changes in global weather are caused by greenhouse gases emitted from industries and unplanned clearing of vegetation all over the world. However, the effects of a multistoried five star hotel complex on its immediate environment h ave not been documented yet. Nevertheless, there is plenty of evidence of the deterioration of the water quality of streams and rivers, lakes and reservoirs throughout the world resulting from point source and nonpoint source pollution.

Today, most of the lakes and reservoirs in the world have been eutrophicated and are also becoming sinks for pollutants due to human interference in their watersheds. Eutrophication means overfertilization or the excessive nutrient enrichment of water. One of the biggest sources of eutrophication is the direct discharge of untreated human waste into waterways. Eutrophication could also result from the application of inorganic fertilizers to the soil and the discharge of dairy effluent and other wastes such as those from hospitals, restaurants, and households into waterways. A classic example for hypereutrophication in Sri Lanka is the Beira Lake in the heart of the capital.

Eutrophication is not the only potential environmental hazard in natural watersheds resulting from new developments and their infrastructure. Development projects can also have harmful effects on other environmental aspects such as vegetation, wildlife, water quality and quantity, climate, and also health. Therefore, it is important to examine such effects of developmental projects on these environmental aspects as well. At present, most development projects have been identified as economically beneficial but ecologically wasteful. However, there is a prime need for development in order to provide essential commodities for the increasing population. Therefore the concept of sustainable development has been recognized as minimizing the damage to the environment.

KANDALAMA

Kandalama is a small village, situated 6.5 km east of the Kandy-Dambulla main road before the road passes the Rangiri Dambulu Vihara. The presence of a beautiful man-made lake, the Kandalama Tank, and its catchment area, which is confined to the North Central Dry Zone of the country, has made this village one of the most attractive villages in the area. The Kandalama Tank is also an important irrigation source with its huge command area which extends up to Kekirawa. The catchment area of the tank is about 37.7 km^2 and has different types of land-use patterns indigenous to the dry zone. The vegetation of the watershed consists of scrub jungle and secondary or tertiary dry zone forests. There are also some patches of reforesta tion with exotic *Eucalyptus* species and paddy lands. The watershed of the Kandalama Tank is bordered by a series of rolling rocks in the Kala Oya Basin including the Erawalagal-Weligala Massif. A tributary of the Mirisgoni Oya, which has a flow that lasts through all seasons of the year (a perennial flow), feeds the Kandalama Tank, and through it the Dambulla Town and the Pelwehera Agricultural Station.

The Kandalama Tank was formed by damming two branches of the Mirisgoni Oya called the Maha Oya and the Nagolla Oya in 1957. Restoration work on the tank was begun in 1952 and lasted till 1957. The tank was reconstructed to aid the development of the area around Dambulla Town. The tank is situated 50.5 m above mean sea level and its catchment area is 92.6 km^2. The tank receives water from its own catchment and the storage capacity at full supply level (FSL) is 279 million cubic meters. The waterspread at FSL is 668 ha and the maximum depth is 6.3 m. There are two sluice gates, each about one metre in diameter, at the right and left banks of the tank bund. The tank bund is about 1 km long and an 80-metre masonry spill has been constructed on the rockbed near the left bank sluice entrance. The right bank channel provides water to 840 ha of paddy fields including 140 ha of government farmland through which the channel passes. This channel crosses the Trincomalee road to Randeniya Wewa and later runs parallel to the Habarana-Anuradhapura road.

With the completion of Phase I of the Mahaweli Diversion Project (i.e., the Mahaweli Ganga and the Kala Oya Trans Basin Diversion), water from the Mahaweli River is diverted to the Bowatenna hydropower reservoir through the Sudu Ganga and the Amban Ganga. The water from the Bowatenna Reservoir is now released to feed the Dambulu Oya Reservoir, the Kandalama Tank, and the Hurulu Wewa. Therefore, the bund of the Kandalama Tank was raised by about one meter to accommodate the water from the Bowatenna Reservoir. The Bowatenna Reservoir regularly releases about 150-300 cusecs of water to the Kandalama Tank, except in May and December during the harvesting time of *yala* and *maha* crops. Today, the Mahaweli water received by the Kandalama Tank is conveyed to the Randeniya Wewa and subsequently feeds about 14,400 ha of paddy fields in the command area of the Kandalama Tank, which now extends up to Kekirawa.

NATURAL ENVIRONMENT

The watershed of the Kandalama Tank will undoubtedly consist of rare and woody species of trees such as *palu*, *burutha*, and *halmilla* (Table 1). However, no information is available on the population densities and distribution patterns of these species of trees. A huge patch of *Eucaliptus* plantation, which is located in the western border of the proposed hotel site, may have replaced the natural forest or scrub jungle. Although not indicated in the land-use map, it is certain that an extensive area of the Kandalama watershed has been subjected to *chena* cultivation. Small patches of paddy fields in the watershed are associated with human settlements in several small villages such as Ereula, Pallegama, Korakahagolla, and Kalundawa. The highest population is concentrated in the Kandalama Village (Figure 1) and the downstream command area of the tank.

Table 1. Important species of trees found in the North Central Dry Zone.

Species	Sinhala name
Chloroxylon swietenia	Burutha
Manilkara hexandra	Palu
Chukrasia tabularis velutina	Hulang-hik
Diospyros ebenum	Kaluwara
Vitex pinnata	Milla
Bauhinia racemosa	Mayila
Alstonia scholaris	Rukattana
Drypetes sepiaria	Wera
Mitragyna parvifolia	Helamba
Azadirachta indica	Kohomba
Schleichera oleosa	Kone
Pterospermum canescens	Welang

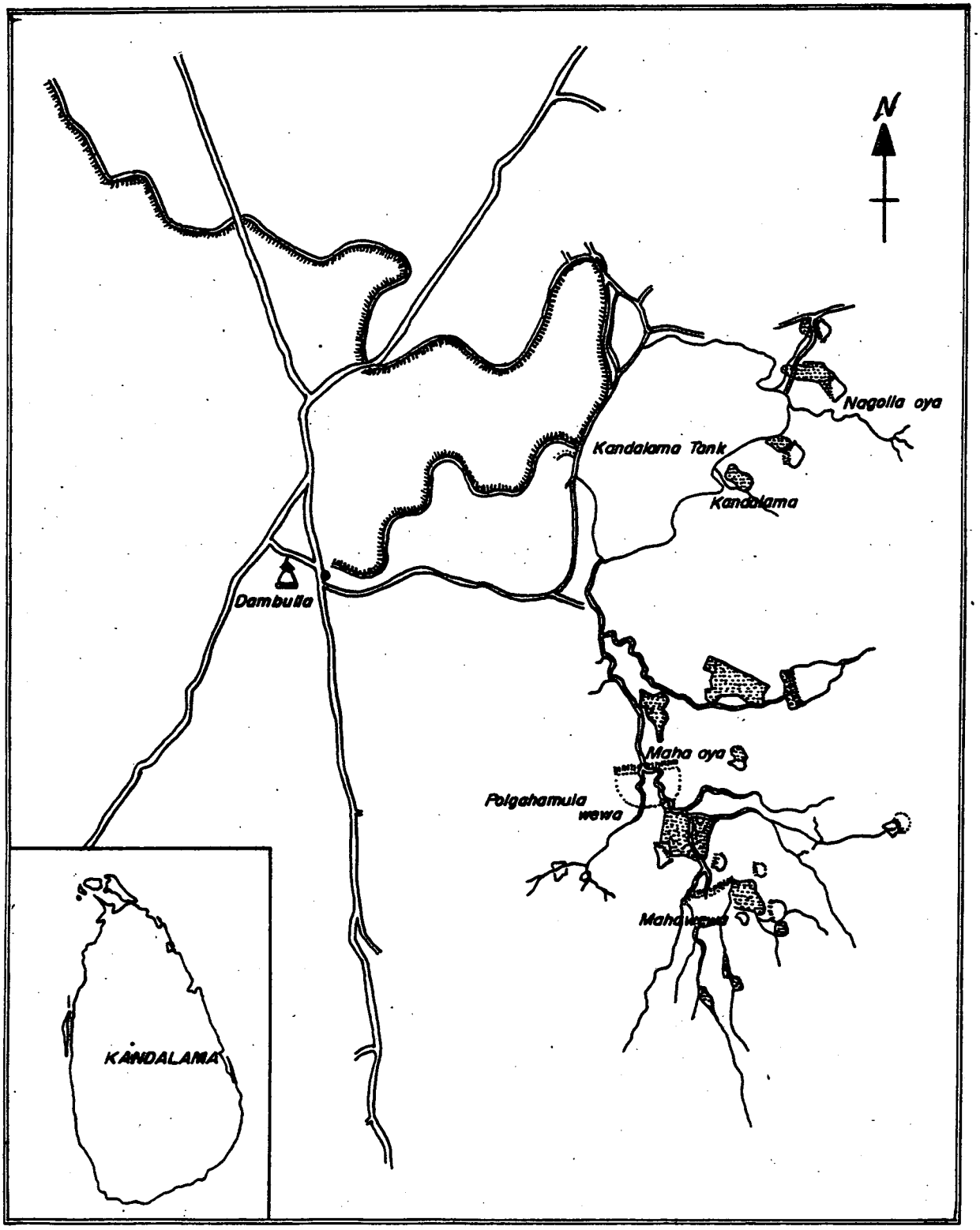

Figure 1. Map of Kandalama Tank and its watershed.

ENVIRONMENTAL IMPACT

The potential impact of the proposed hotel complex on the Kandalama environment can be assessed in three phases.

1. The status of the natural environment before the construction of the hotel.

2. Possible harmful effects on the environment during construction.

3. Anticipated effects with the functioning of the hotel.

Present Status

As I mentioned before, little is known about the natural environment of the Kandalama watershed. No systematic studies have been conducted on its vegetation, wildlife, climate, and hydrogeology. Rainfall data of the area for the last 10 years are available at the Agricultural Research Station at Dambulla. The water levels of the Kandalama Tank have been recorded since 1987 by the Mahaweli Authority. However, the vegetation (also the wildlife) of the Kandalama area may consist of typical dry zone species as given in Table 1. A recent investigation of the area made by the Institute of Fundamental Studies found a scarce distribution of tree species, and that the proposed hotel site was mainly covered in scrub jungle. The seasonal rainfall pattern of the area and the water level fluctuation of the tank are shown in Figure 2. Though there is a more or less consistent supply of water from the Bowatenna Reservoir, the water level of the tank is mainly determined by irrigation demand and the annual rainfall pattern. The irrigation demand is lowest in May and December and the rainfall is highest from October to January, the second intermonsoon period. It is also assumed that the level of groundwater decreases during the dry seasons (February to March and July to August). It is not clear whether the groundwater supply, especially during the dry seasons, is sufficient for the daily requirements of the hotel.

The Kandalama Tank's water quality and its aquatic communities are more or less similar to those of a typical dry zone tank in the North Central Dry Zone (Table 2). However, it is very unlikely to find fish species endemic to Sri Lanka in dry zone reservoirs. Avifauna associated with the Kandalama Tank must also resemble those in adjoining waterbodies. Perhaps there may be some endemic species listed as threatened or endangered, but their niches are not confined only to the Kandalama Tank.

Table 2. Some limnological features of five dry zone reservoirs.

Parameter	Parakrama Samudraya	Minneriya	Giritale	Kaudulla	Kandalama
Year of restoration	1958	1903	1905	1958	1957
Altitude (m)	59.5	96.5	94.5	65.0	50.5
Area (ha)	2265	1876	325	2940	668
Shoreline (km)	46.7	46.9	9.85	29.4	19.5
Catchment (ha)	7250	2398	2430	8160	9760
Maximum depth(m)	3.2	1.3	7.5	4.6	8.6
Temperature °C	29.2	29.8	30.2	29.6	28.8
Conductivity m°S	352	245	189	297	260
pH	8.01	7.54	7.67	7.62	7.80
Secchi depth (m)	0.75	0.88	0.88	0.90	0.80
Chlorophyll a (gl^{-1})	38.6	33.4	25.4	39.5	28.5
t-phosphorus (mgl^{-1})	34.0	-	-	-	-
Nitrate (mgl^{-1})	4.2	-	-	-	4.1

Impact During Construction

It is inevitable that most of the scrub jungle will be cleared and trees felled during the construction period of the proposed hotel for infrastructural development. The removal of the ground vegetation cover may aggravate the erosion of top soil and the silt will wash off to the tank during the rainy season. Sediment

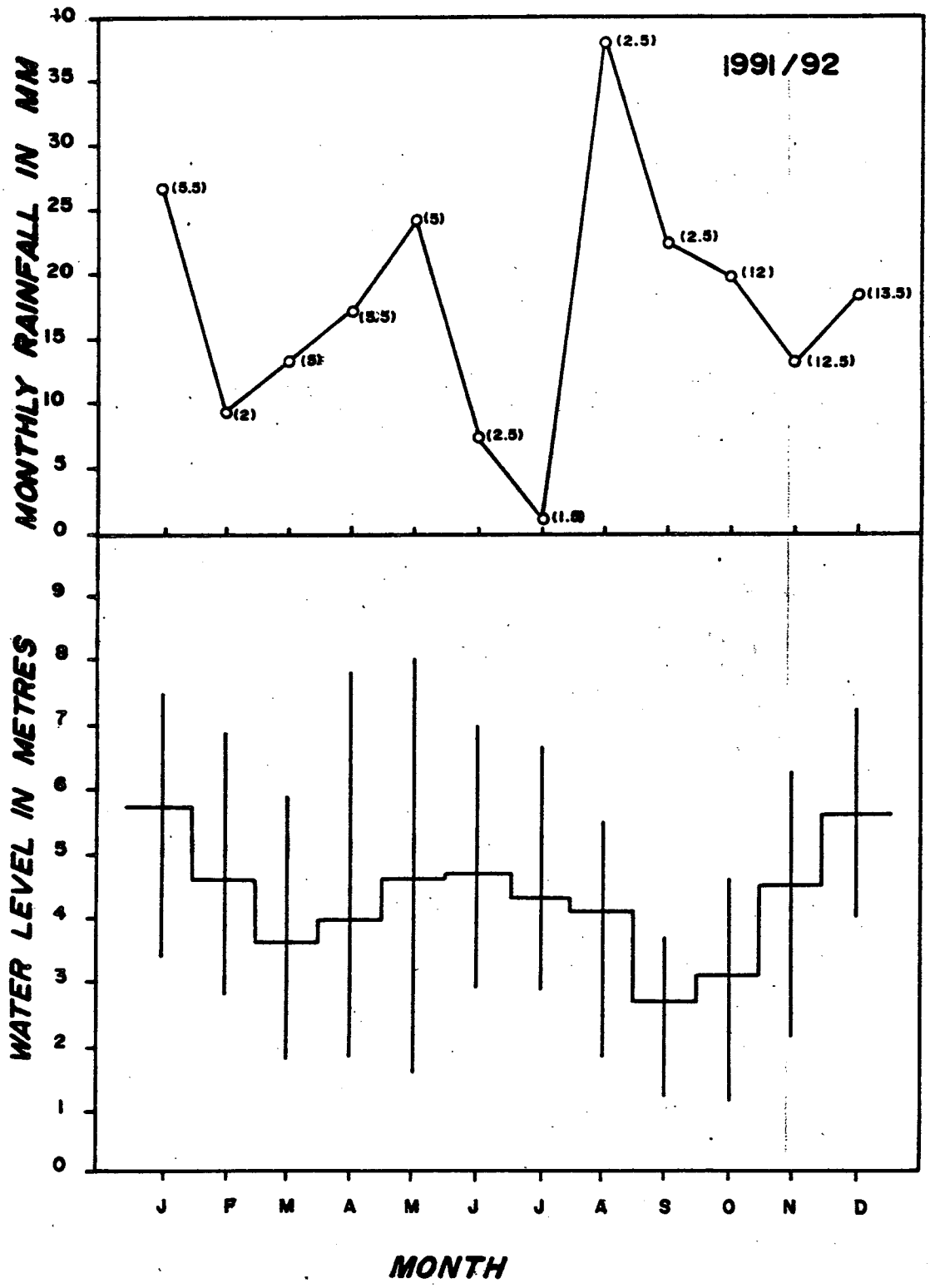

Figure 2. Monthly rainfall pattern and water level fluctuation of the Kandalama Tank (vertical lines represent the monthly range).

loading will certainly increase the turbidity of the water, subsequently affecting the metabolic processes of the tank. However, it is unlikely to anticipate a countable siltation of the tank as a result of sediment loading during the construction period. More importantly, care should be taken to avoid the following illicit activities which are common in our country during the implementation period of such development projects:

1. Felling of rare and valuable timber species in the watershed. If this occurs, it may lead to the extinction of rare and endemic species from the Kandalama catchment.

2. Blasting of natural rocks to be used for the construction of the hotel. This may also have some irreversible effects on specific habitat types.

3. Tapping the tank water or its inflows for the construction of the hotel which can affect the irrigation needs of the command area.

Postconstruction Impact

The functioning of a five star hotel on the shoreline of a reservoir may have both positive and negative effects on its immediate environment. Landscaped and well-maintained gardens favor the surrounding environment because these ensure minimum erosion of the soil. The negative effects are mainly associated with waste disposal. Direct dumping of any waste products from the hotel such as garbage, kitchen and laundry waste, and sewage into the tank or its inflows will lead to significant changes in the ecosy stem of the tank over time. The waste water released from hotels contain large quantities.of phosphorus and nitrogen compounds. The waste water from the proposed hotels can easily reach the tank through seepage, if the septic tanks are not properly sealed. If this happens, nitrogen- and phosphorus-containing organic material will convert into inorganic forms under microbial activity and subsequently enrich the tank water du e to the addition of extra nutrients to its nutrient pool. Therefore, one aspect of anticipated water pollution in the Kandalama Tank is hypereutrophication as a result of overfertilization.

Eutrophication ranks as one of the most pervasive water-quality problems around the world. Eutrophication results in a series of undesirable symptomatic changes in waterbodies including nuisance production of algae and other aquatic plants, the deterioration of water quality, taste and odour problems, and fish kills. Water-treatment processes can become very expensive and time consuming when large reservoirs are hypereutrophicated. However, it should be noted that most of the dry zone reservoirs in our country are considered to be eutrophicated. As algal populations die and sink to the bottom of a reservoir, their decay by bacteria can reduce the oxygen concentration in bottom waters to levels that are too low to support fish life. This results in fish kills. Such oxygen-deficient conditions can also result in excessive levels of iron and manganese in water, which is harmful for human health. There are also potential negative health effects related to vector-borne diseases such as malaria and filariasis. By providing suitable habitats for the disease-causing vectors and parasites to thrive, these diseases can easily reach epidemic proportions.

RECOMMENDATIONS

1. A systematic survey should be launched to determine the present status of the vegetation in the watershed, the tank's water quality, and its water budget. This study should be continued to determine the future trends of these environmental aspects following the construction of the hotel.

2. The present water budget of the tank should be maintained. Permission to tap water from the tank or its inflows should not be given either during the construction period or after the construction of the hotel.

3. Waste-disposal methods of the hotels should be thoroughly examined and the status of the septic tanks should be regularly examined.