PN-ABY-879

INITIAL ENVIRONMENTAL EXAMINATION

of the

PROPOSED INDUSTRIAL ESTATE

at

MANAWERIYA

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by

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The findings and recommendations contained herein represent the best professional judgement of the study team only.

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MANAWERIYA
PROPOSED INDUSTRIAL ESTATE
INITIAL ENVIRONMENTAL EVALUATION

I. GENERAL SITE DESCRIPTION

This proposed industrial site is situated in the Puttalam District, within the Arachchikattuwa Divisional Secretary Division. It is part of a larger tract of government coconut land known as the St. Martin's Estate. This site is approximately 21 hectares (52 acres), and is adjacent to the Chilaw-Puttalam (A3) main road. See Annex A for regional and site maps. The terrain of the proposed site and adjacent lands is nearly flat, with shallow drainage to the west under the road to the Maha Manaweriya tank. The only building on the site is a partly-completed garment factory. Construction of the building was begun in 1992, but the site is now abandoned.

II. PHYSICAL ENVIRONMENT

A. Weather

The site is at the boundary of the wet and Intermediate zones of Sri Lanka. The average temperature varies between 22-37°C within the year. Chilaw, which is approximately 8.5 km from the site, receives about 1850mm of rainfall annually. Most rainfall (an average of 1210mm/yr) is received from October to March which is the Maha season. Average rainfall during the Yala season from April to September is 640mm. Wind direction is predominately SW or S during the southwest monsoon (May to September); the prevailing direction is NE during December to February, which is the Northeast Monsoon period. Average wind speed in this region is about 11.5 km/hr.

B. Topography, Soils, Groundwater

A 1992 perimeter survey map of the proposed site shows the site as a rectangular tract of 21.091 hectares bordering the A3 main road to the east. The site is flat lowland at an elevation of approximately 20m above msl with slopes of no more than 1.3%. The land drains via a shallow valley to a culvert under the road at the southwest edge of the site and thence to the Maha Manaweriya Tank. The topsoil of the site is predominately sandy, underlain by clay. Some clay mining has been done for brick making on the site close to the SE boundary. The hydraulic conductivity tests done by the team indicate that the soil at the site has excellent permeability. See Annex B for more detailed soil analysis.

No specific measurements were made of the water table, nor was any quantitative assessment made of the availability of ground water resources. However, since the Maha Manaweriya Tank is at close proximity, the ground water should be present at a shallow depth. There are some indications that the soil is frequently saturated, and that the land surface is occasionally subjected to saturation and possibly flooding.

C. Surface Water Hydrology

A clearly visible but shallow valley through the site drains the surface runoff from the proposed site to the Manaweriya tank. There is no flowing stream or permanent surface water body within the site. The two reservoirs at close proximity to the site are Manaweriya Tank (less than 0.5 km) and Karukkuliya Maha Wewa (approximately 1.0 km), which have approximate capacities of 150,000 and 240,000 cubic meters respectively. The paddy cultivation under these tanks is done only during one (Yala) season due to a lack of water in the tanks during the dry season. The water uses of the reservoirs are mainly for irrigation and domestic purposes.

Deduru Oya flows within about 3.0 km of the site. The average annual flow of Deduru Oya at Chilaw is 3022 MCM (Hydrological Annuals, Irrigation Department 1992/93, 1993/94). The river's average annual maximum and minimum flows at this point range from 460 MCM (November) to 168 MCM (March). In Deduru Oya sand mining operations are ongoing.

Lunu Oya is another surface water body which flows at a distance of approximately 3.0 km from the site, along the main road due South. During the site visit, the flow rate at the bridge over the main road was measured to be $8.4m^3/s$ (21.8 MCM/month). The Lunu Oya originates approximately 2-3 km upstream of the bridge at which the flow rate was measured. It is linked with Deduru Oya during the high flow period, indicating that the flow rate must be much higher than that registered during the site visit.

Battulu Oya flows approximately 11 km from the proposed site. The flow rate of this water body is quite insignificant. The maximum flow rate at the entrance to Mundel lagoon is approximately $9m^3/s$ (NARA). There have been periods of 'no-flow' during January-March and June-September. Diversion at an anicut upstream of the NARA measurement point -- the point of inflow to the Mundel lake -- is cited as the cause for the no-flow periods. Topographic maps indicate numerous insignificant streams and reservoirs in the area around Battulu Oya.

D. Water Quality

Samples from the undermentioned water bodies in and around the Manaweriya division of St. Martins Estate were obtained in order to determine their water quality. The detailed water quality results are given in Annex C.

The measurement points were the bridges over the Lunu Oya and Deduru Oya on the Chilaw Puttalam (A3) highway, and the sluice gate of the Karukkuliya Maha Wewa.

Water quality measurements indicate the presence of very high salinity in the Lunu Oya and Deduru Oya river water, and to a lesser extent in the other surface water bodies. This high salinity may be due to a combination of the following contributing factors:

(a) Rate of ground water extraction exceeding the ground water recharge rate;
(b) Significant sand mining taking place in the river bed;
(c) Large-scale ponding of saline water for prawn cultivation.

Further, the fluoride concentration in both the surface and ground water is at a level causing concern, and the BOD/COD ratio pertaining to waters of Deduru Oya and Karukkuliya Maha Wewa indicates that these water mostly contain refractory (non-biodegradable) elements. The nutrient level of these waters is also significant, indicating the likely input of agro-chemicals in runoff water from nearby farmland.

E. Air Quality and Noise

No site-specific air quality data are available. There are no current on-site emission sources; nearby off-site sources include an adjacent tile factory with two chimneys, and three other brick and tile factories in the vicinity within 3 km down the road towards Chilaw.

No significant noise emission sources are present. The school adjacent to the site may be adversely affected by any significant new noise generation activity.

III. CURRENT AND PLANNED FACILITIES AND SERVICES

A. Water Supply and Wastewater Disposal Options

Possible sources for water supply for industrial uses are given below for the proposed site at Manaweriya:

1. Deduru Oya - Observed water quality values for Deduru Oya water are given in Annex C. From these data it is apparent that a water treatment process has to be instituted to obtain water of sufficient quality for industrial use. NOTE: Discussion and approval of the Irrigation Department and the National Water Supply and Drainage Board should be sought to ascertain whether sufficient quantity of water could be extracted from the river for an industrial estate at this site without adversely affecting other water uses of the river. It should be noted that Deduru Oya provides potable water to the towns of Kurunegala and Chilaw (partially).

2. Battulu Oya - Water quality measurements were not conducted for water from this river. As per the discussion of Deduru Oya, views of the Irrigation Department should be sought on the availability of sufficient waters for industrial use.

3. Karukkuliya Maha Wewa - Water from this tank is mainly used for irrigation purposes. Due to lack of adequate water, irrigation is carried out only during one season. It may be possible to augment (if the need arises) the

water supply to the industrial estate from this source, but competing uses should be considered.

3. Ground water - Detailed pumping tests to estimate the ground water yield should be carried out with the assistance of either National Water Supply and Drainage Board (NWSDB) or Water Resources Board (WRB). The high salinity observed in the nearby Chilaw water supply (obtained from tube wells) indicates that ground water extracted at this site might have high salt content.

Possible liquid waste disposal locations (after the necessary treatment) for the industries are given below:

- Ocean: Discharge could be made via a deep-sea outfall (approximately 6km long), which would be relatively costly to construct but might allow a lower level of treatment.

- Karukkuliya Maha Wewa: Industrial effluent treated up to an inland surface water quality level may be discharged to this tank, which would in fact increase the yield of the tank and help the farmers in the process. But a strict quality control and monitoring and remedial program should be set in place if this option is pursued, particularly since adjacent villages use the tank as a source of drinking water.

- Dutch Canal: this canal, which connects Negombo lagoon and Puttalam lagoon, is extensively used for prawn culturing. Hence any toxic elements in the industrial effluent would have a serious consequence. If the industries generate only the biodegradable waste, discharge to either Dutch canal or Lunu Oya would become feasible.

- Lunu Oya: This river, which has water of very high salinity, is widely used for prawn farming and domestic recreational use (the latter mainly in the upstream area). If compatible industries that generate biodegradable effluent are located at this site (such as food processing, prawn packaging, ice production or the proposed industrial estate), then the possibility exists for disposing of the effluent into this river, if it is first treated up to inland water disposal quality standards as established by the Central Environmental Authority.

B. Infrastructure

1. Power: Two 33 kv lines are running along the estate. (One line goes over the estate while the other is along the boundary.) The closest sub-stations are 8.5 km, to Chilaw sub-station, and 45 km to Puttalam sub-station.

According to a local industrialist, the power supply in this area is unreliable at the present time due to frequent interruptions.

2. Telecommunications: Telephone lines go by the estate. There is a secondary exchange station in Chilaw connected with Colombo by a 400 MHz UHF radio transmission system with a capacity of 1750 lines; an augmentation project is under study. Cellular telephone facilities are also available.

3. Transportation: The estate borders the main (A3) road. This road is the principal access to Chilaw and the estate site. The existing road is narrow and congested in many sections; it usually takes 2-2.5 hours to reach the site by vehicle from Colombo. Planned road improvements that would positively benefit the site include:
   - New or upgraded Colombo-Katunayake highway
   - Expansion of the road beyond Katunayake by the Road Development Authority (RDA)

   The nearest rail access to the site is the Bangadeniya Rail Station (at ≈ 1.0 km southward on A3). During the rainy season rail access to the site may be affected due to flooding of the railway line. The Katunayake International Airport is about 50 km Southwards from the site on the main road towards Colombo.

   Currently there is no direct water transport access to the site, but with proper development, the Hamilton Dutch canal might be a feasible means of transport.

4. Other public services: Chilaw town is well developed with all basic public facilities such as Post Office, hospital system (intensive care, maternity etc.). The area falls under the Puttalam Health Region. There is no local fire brigade or other organized fire fighting capability. The closest facilities available are those at the Katunayake airport and Free Trade Zone.

C. Existing Structures and Industrial Activities

As mentioned above, there is a partially constructed facility intended to be a garment factory spread over 3 acres of the northwest corner of the site. The building framework is completed up to the roof level. There is a partial structure to support a water tank. The soakage pit and toilets for the facility are also partly done. One house behind the unit serves as the estate watcher's hut; there are also a few squatter families living on the site near this building. Adjacent to the site along the road to the northwest is a tile factory. At the northeast corner of the site is the Chilaw/Jayapala Maha Vidyalaya, which is the Karukkuliya Government School.

The St. Martins industrial estate is located at the 79 km post of the Colombo-Puttalam road, approximately 5 km from the site. The estate occupies an area of 17 ha, but only a part of it has been developed. It was developed by the Industrial Services Bureau of the North Western Province. At present several industries function at the site, including: a prawn processing factory, a hume pipe construction plant, a white fibre mill, a charcoal briquetting plant, and a fibre glass production plant. A tannery using vegetable dye had operated at the estate, but was requested to shut down due to polllution related objections. Although it is referred to as an industrial estate, industries are not provided any facilities for waste disposal, or tretment. Industries have simply been allocated land, and are required to take necessary measures to dispose of thier waste, themselves. Utilities such as water and electricity are not provided either. The estate is also prone to flooding, and experienced flooding in 1995. Adjacent to the St. Martens estate there is also an ice factory and a livestock farm.

D. Proposed Industrial Activities at or Near the Site

At this time no specific industrial applications for this site are under consideration. There are no known approved or planned industrial facilities under development within 1 km of this site.

IV. BIOLOGICAL ENVIRONMENT AND RESOURCES

The proposed site is situated in the dry and arid lowland floristic region or Sri Lanka in close proximity of northern and intermediate lowlands.

A. Significant Flora

No significant natural vegetation exists within the site, which is a partly cleared coconut plantation. Principal plant species present consist of grasses and weeds typical of cleared areas. This land is bordered by two tanks. The Manaweriya tank is located on the west side of the site; Karukkuliya Maha Wewa is to the east and up-slope from the site. Manaweriya Wewa is connected with the Chilaw Estuary near the coast about 4 km away from the site. Both tanks contain fresh-water vegetation; *Nymphae* spp., *Nelumbo* spp. and *Salvinia* are the predominant aquatic plants found in those two tanks. Mangroves are also present in Lunu Oya near this site.

B. Significant Fauna

Numerous commonly-occurring waterfowl have been recorded at Manaweriya and Karukkuliya Maha Wewa; these include the Pheasant-tailed Jakana, Little Cormorant, Large Egret, Median Egret, Little Egret,White-breasted Water Hen, Common Kingfisher, Indian Pied Kingfisher, and Indian Pond Herons. No species of migratory waterfowl were observed; however the team's site visit was not conducted during the migratory season.

Five species of fish were reported by two local fishermen as being present in these two tanks: Butter catfish (*Ompok bimaculatus*), Murrel (*Channa striata*), Orange Chromide (*Etroplus maculatus*), Pearl spot (*E. testudineus*), and Climbing perch (*Anabas testudineus*).

There are no known terrestrial endemic or endangered species present on the site or in the immediate vicinity.

V. SOCIAL AND CULTURAL ENVIRONMENT

A. Human Settlements

The Estate is situated in the Karukkuliya GSD (Grama Sevake Division) which is associated with the old (Purana) village of Karukkuliya and with Tanabima, a village recently created by giving legal status to encroachers. The total population recorded in 1989 for the Karukkuliya GSD was 856 persons with a nearly equal sex ratio (M/F) living in 192 houses. The population recorded for Rajakadaluwa (the GSD to the east) was 1180, living in 351 houses whilst Kottapitiya to the south accounted for 953, living in 220 houses. Rajakadaluwa and Kottapitiya stand out as having more temporary and partly-built houses, respectively, than Kurukkuliya.

Health care for the populace is available at Bangadeniya and Arachchikattuwa area clinics within 4-5 km of the site; there is a rural hospital at Anawilundawa.

The Central Jayapala Maha Vidyalaya School at Karukkuliya (at the border of the site) has approximately 1500 children and 18 teachers, while the Junior school at Bangadeniya (approx. 1 km away) has about 1000 children and 22 teachers.

B. Labour Force

The labour force in all three GSDs does not exceed 45% of the population. Even though the population in the Kurukkuliya GSD has increased at an approximate annual rate of 2% from 1989, this industrial estate will most likely have to draw workers from more densely populated GSDs lying further to the south, including Weerakumandaluwa and Mukkandaluwa, which collectively accounted for 3356 people in 1989. Kurukkuliya employment dispersion reveals a relatively equal emphasis on government/private employment and agriculture, whilst in Rajakadaluwa the focus is on trading and government employment. In Kottapitiya more people are employed in the private sector and fisheries whilst in Weerakumandaluwa great diversity is recorded with many involved in technical activities as well. In all these GSDs at least half the work force is under-employed.

C. Local Economic Activity

Fishing is an important local activity, particularly in the coastal GSDs where many have taken to prawn farming as well. Agriculture and forestry are unlikely to be adversely affected by local industrial development, as there is no local forestry and most agricultural areas are to the north of the site.

D. Religious and Cultural Features

Karukkuliya Buddhist temple is located on the southern boundary of the Karukkuliya tank; a Hindu kovil to the left of the main road and a Christian church to the right at Rajakadaluwa in the vicinity of the site are currently functioning. There are no archaeological sites in the immediate vicinity of the site. but Vairankattuwa and Arachchikattuwa, about 4 km distant, are acclaimed historical sites.

E. Aesthetic and Recreational Features

The ancient tanks of Karukkuliya and the gently sloping terrain to the Dutch Canal harbor abundant bird life; these areas serve as local recreational resources of high aesthetic value. The area lacks any organised recreation activities or facilities.

F. Local Customs, Aspirations, and Attitudes

The existence of several local places of worship help to satisfy the local residents' religious needs. Some local farmers complain of seasonal inadequacy of water; young people are concerned about the lack of employment opportunities.

VI. MAJOR ENVIRONMENTAL AND REGULATORY ISSUES

A. Sensitivity of the Affected Environment

The environment at the site itself is highly altered from the natural state and contains no significant wildlife habitat. The nearby tanks, however, do provide significant habitat for aquatic species and a variety of birds. Care should be taken to ensure that development and operation of industrial facilities at this site should not degrade the water quality in these tanks, either through removal of water during dry periods or through discharge of sediments or other water pollutants.

According to local fishermen, local fishery resources in the Lunu Oya have recently been deteriorating. Aqua Marine Ltd., which manages several hundred acres of aquaculture ponds on the opposite bank of the Lunu Oya from the site, releases its effluents directly to the Lunu Oya. As an apparent consequence of this pollution (organic fertilizer and supplementary feed), the receiving waters frequently turn eutrophic or even hypertrophic, resulting in blooms of (often toxic) algae, severe oxygen depletion, and high

mortality of fish and shrimp populations. Given these circumstances, any effluents generated by the proposed Manaweriya industrial estate should be treated to meet standards established for protection of fish and aquatic life before being released to the Lunu Oya.

Since the area is at low elevation and apparently prone to soil saturation and possible flooding, care should be taken in constructing roads and buildings on the site, in order not to make this situation worse, and to assure proper drainage around all structures. This site is probably not suitable for a solid waste landfill due to the high seasonal water table; arrangements for proper disposal elsewhere of solid waste from the site should be made.

Noise and air pollutants from construction and operation of industrial facilities at this site could present a possible conflict with the nearby school. Care should be taken in the design of facilities to provide proper buffers and emission controls to avoid or minimize this potential problem.

B. Regional Water Resource Limitations

Both the adequacy and reliability of water resources for this site are questionable. Before approval is given to industries to develop this site, the potential demand of each industry for water supply should be assessed relative to other existing and planned water uses in the same region. If ground-water withdrawal is to be permitted for industrial use, further on-site analysis of ground-water quality and sustainable quantity should be undertaken to ensure that such withdrawals are feasible, particularly during the dry season.

C. Regulatory Issues

Approval of plans for either surface or ground-water use for this estate should be coordinated with the Irrigation Department, the Water Supply and Drainage Board, the C.E.A., and local authorities. Plans for discharge of treated effluent into nearby water bodies should be approved by the C.E.A. prior to commencement of site development to assure that appropriate standards will be met and monitoring for compliance will be conducted.

VII. GENERAL CONCLUSIONS AND RECOMMENDATIONS

This site was rated by the study team as having medium to low pollution assimilative capacity and medium to high local resource availability. The site is considered to be generally suitable for industries of medium to low pollution potential and resource needs The site has good access to transportation, utilities, and labour, and would probably be most suitable for a variety of labour-insensitive manufacturing activities. The principal environmental constraints on the development of this site for heavier industries are:

- The lack of good drainage with potential flooding and soils, with consequent limitations for on-site solid waste disposal;

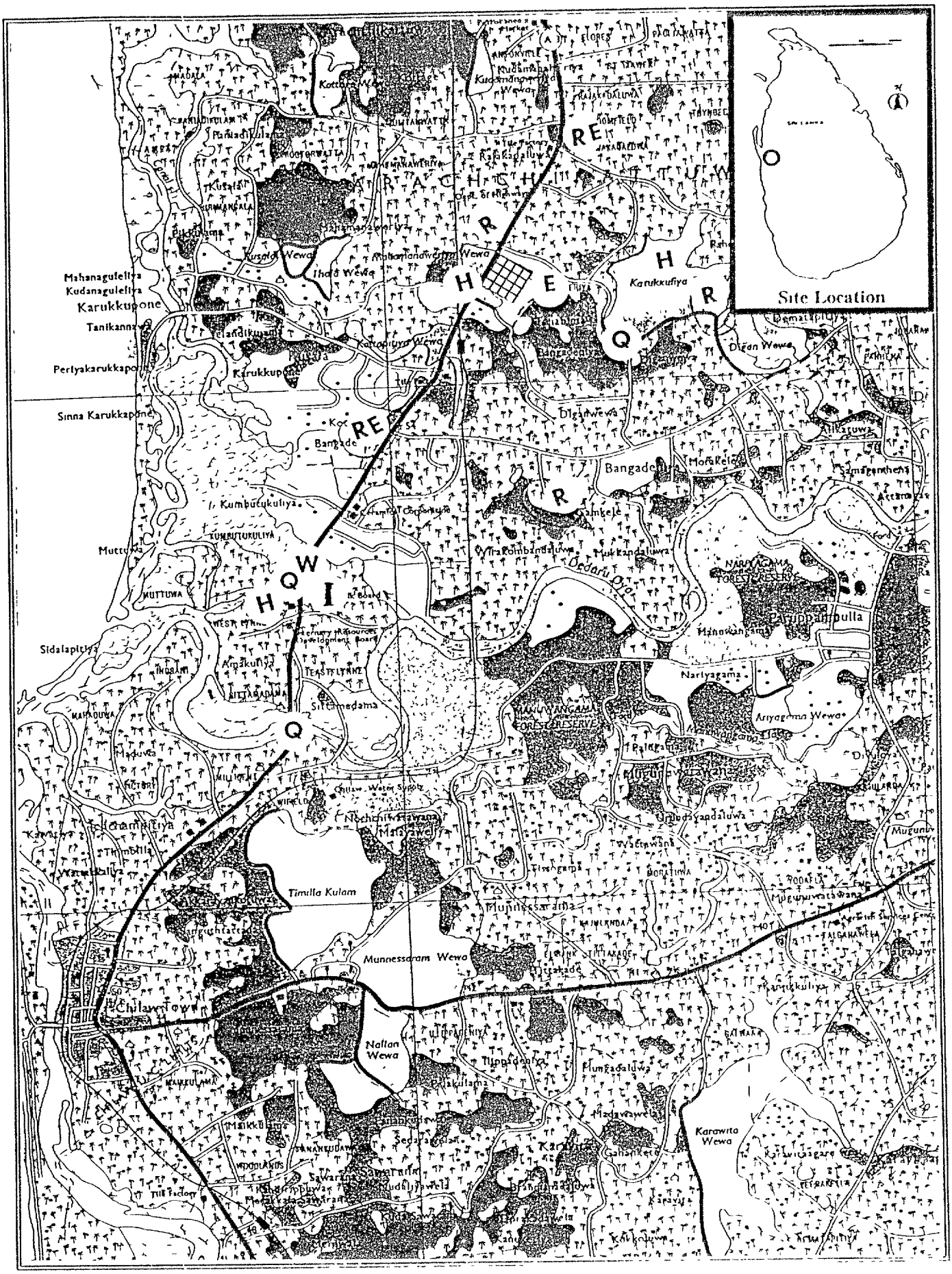
- Limitations on site expandability due to existing adjacent land uses and water bodies.

Although surface and ground-water resources appear to be available, pre-treatment may be necessary due to the high salinity and other dissolved solids. For the same reason, water discharged from any treatment facility at this site will have to meet standards that protect existing tank and downstream river users from further pollution.

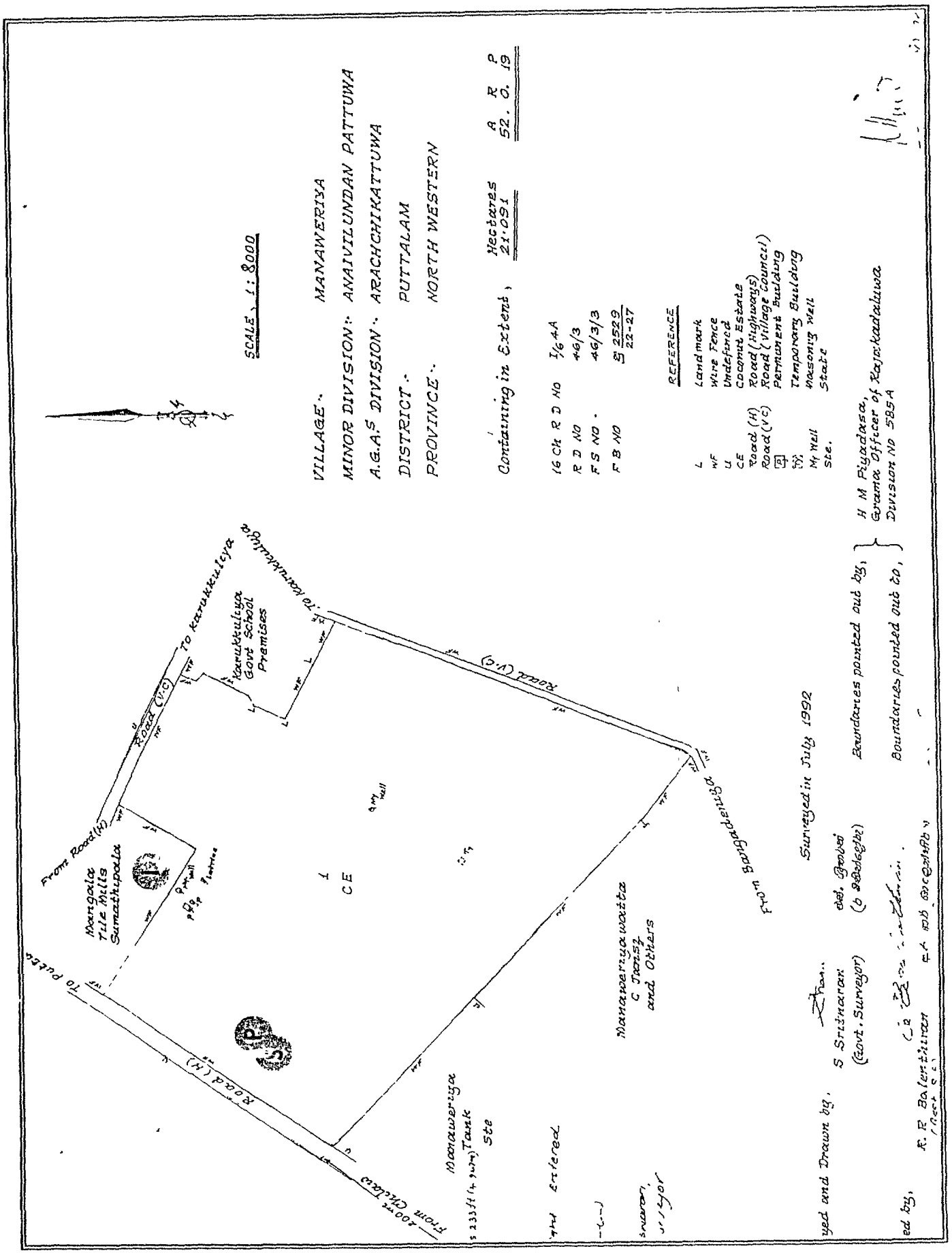
REFERENCES

National Aquatic Resources Agency. "Water Exchange in Mundel Lake - Dutch Canal System Relative to Puttalam Lagoon - Sri Lanka". A report by the Oceanographic Division.

A A-1 :


Site Location
Mahanaguleliya
Kudanaguleliya
Karukkupone
Tanikanna
Periyakarukkapone
Sinna Karukkapone
Karukkupone
Bangade
Kumbutukuliya
Muttuwa
Sidalapitiya
Karukkuliya
Bangadeniya
Mokarela
Dikan Wewa
Narayagama
Paruppanpulla
Nariyagama
Ariyagama Wewa
Timilla Kulam
Munnessaram Wewa
Nallan Wewa
Karawita Wewa
Chilaw Town
Mahaweli
Dedaru Oya
Kudamadu Wewa
Kotabe Wewa
Ihala Wewa
Kusala Wewa
Kotapitiya Wewa
Mukkandaluwa
Mutkandaluwa
Nochchikattawana
Malagawela
Munnessaramba
Sedarawela
Sawarna
Samatana
Karawita
Galhakete
Madawela
Kalkuluwa
Mankulama
Mankulama
Kottaramtiya
Thimbulla
Karukkuliya
Karukkuliya
Kalkuluwa
Kalkuluwa
Kalkuluwa

A-II : E MAP - MANA A

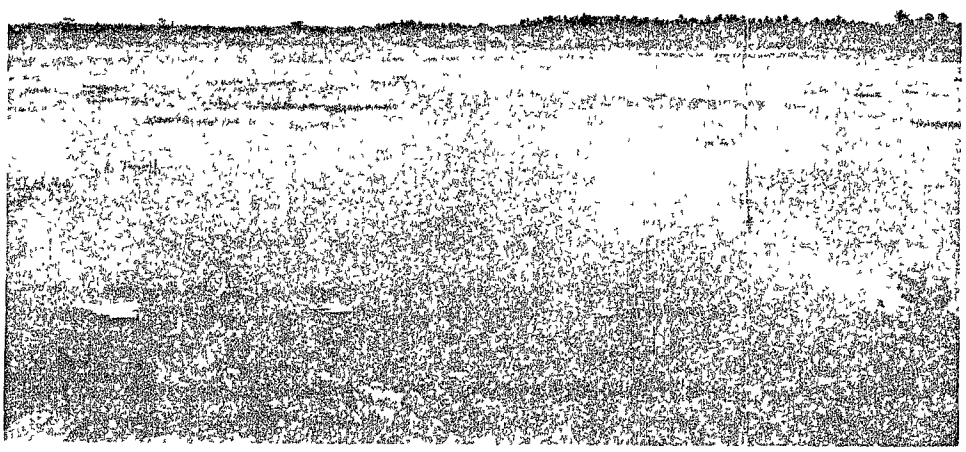


Perimeter Survey Map - Proposed Industrial Estate - Manaweriya

A - Archeological
E - Schools
H - Important Habitats
I - Industries
M-

P - Percolation Measurement Point
Q - Water Quality Sampling Point
R - Religious(Temple, Church, Kovil/Mosque)
S - Soil Sam Poir

A. Proposed Industrial Estate site at Manaweriya in Aranchikattuwe.



B. A view of Karukkuliya Maha Wewa, a major surface water tank adjoining the proposed site.

SOIL AND SURFACE WATER : METHODS OF COMPUTATION

- Site Elevations in MSL are based on Survey Department Topographic Maps or available contour maps for the respective site.
- Maximum slope values are based on physical measurements during study.
- Reservoir capacity estimates other than from irrigation department are based on the average depths observed during site visits.
- Rainfall values are based on data collected from regional institutions during site visits and the historical data from hydrological annuals and Ceylon Electricity Board Water Resources Data Base (July 1987).
- Maximum, Minimum and Average river flows are based on the historical flow data. In cases where streamflow data were absent, representative runoff ratios from hydrological annuals were used with rainfall in respective regions and watersheds identified using topographic maps.
- Hydraulic Conductivity Data and Sorptivity data are based on Infiltrometer Tests done at each site fitted to infiltration curve by Philip (1957).
- Soil moisture contents and the organic matter contents by Gravimetry.
- Soil quality by liquid (water) extraction and relevant water quality methods.
- Wind and temperature estimates are based on the information in the National Atlas of Sri Lanka.
- Soil classification is according to the unified system.

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Soil Data for Proposed Industrial Estate at Manaweriya

Description	Unit	Value
Sampling Depth	mm	250
Moisture Content	%	0.10
Organic Matter	%	2.10
Classification	mg/gr	SP
Chloride Cl^-	mg/gr	0.10
Nitrates No^-_3 -N	mg/gr	0.0015
Fluoride Fl^-	mg/gr	0.05
Phosphate PO^3_4 - P		N/D
pH		5.82
Hydraulic Conductivity (saturated)	cm/hr	2.66
Sorptivity	cm/(hr $^{1/2}$)	12.1

N/D = Not detected

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ANNEX C: DETAILED WATER QUALITY ANALYSIS

INDUSTRIAL ESTATES SITING STUDY, 1995

SUMMARY OF ANALYTICAL METHODS

PARAMETER	UNITS	METHOD	DETECTION LEVEL
TSS	mg/l	Gravimetry	-
TDS	mg/l	Gravimetry	-
DO	mg/l	Titrimetry	-
BOD	mg/l	Titrimetry	-
COD	mg/l	Open - Reflux, Titrimetry	-
pH	-log H^+	Selective ion electrode	0.01
Cl^-	mg/l	Titrimetry	-
SO_4^{2}	mg/l	Gravimetry	-
F^-	mg/l	Colorimetry	0.1
NH_4^+ - N	mg/l	Colourization/Spectrophotometer	0.01
NO_3^- - N	mg/l	Colourization/Spectrophotometer	0.01
PO_4^3 - P	mg/l	Colorimetry	2.0
Alkalinity	mg $CaCO_3$/l	Titrimetry	-
Hardness	mg $CaCO_3$/l	Titrimetry	-

WATER QUALITY ANALYSIS : PUTTALAM DISTRICT

PROPOSED SITE AT MANAWERIYA

Location	Date of Sample	TSS	TDS	DO	BOD_5	COD	BOD/COD	pH	Temp.	Cl^-	SO_4^{2-}	F^-	NH_3-N	NO_3^--N	PO_4^{3-} - P	Carb. Alk.	Bicarb. Alk.	Carb. Hard.	Non-Carb. Hard.	Flow rate
Deduru Oya	Aug. 2, 1995	6.0	2930	5.8	7.0	92	0.08	7.6	29	670	163	1.5	0.28	0.05	ND	Nil	280	130	Nil	-
Lunu Oya	-do-	45	9700	6.5	185	680	0.27	7.5	29	4215	1227	3 5	2.0	0.09	3.3	Nil	160	160	>1350	8.4 m^3/S
Karukkuliya Maha Wewa	-do-	15	210	8.5	3.5	60	0 06	8.4	32.2	74	5.7	1.6	0.02	0.08	ND	Nil	60	60	40	-
Proposed minimum ambient quality	-do-	-	-	3.0	4.0	-	-	5-8.5	-	1200	440	1.5	4.0	5 0	0.7	-	-	600		

ND = Not Detected