

PN-ABY-877

**INITIAL ENVIRONMENTAL EXAMINATION**

**of the**

**PROPOSED INDUSTRIAL ESTATE**

**at**

**GEMUNUPURA**

**December 1995**

**Prepared for the Ministry of Industrial Development**

**by**

**NAREPP/IRG**

**Colombo, Sri Lanka**

A

This report was prepared by : Dr. Ajith De Alwis (University of Moratuwa); Dr. S. Bhuvendralingam (University of Moratuwa); Mr. John Butler (Consultant to NAREPP); Mr. M. H. Gunaratne (Consultant to NAREPP); Mr. Sanath Ranawana (NAREPP); Dr. Robert Smythe (Consultant to NAREPP); Mr. H. D. V. S. Vattala (Consultant to NAREPP); and Dr. Sohan Wijesekere (University of Moratuwa).

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

B

## TABLE OF CONTENTS

I.	GENERAL SITE DESCRIPTION	1
II.	PHYSICAL ENVIRONMENT	1
	Weather	1
	Topography, Soils, Groundwater	1
	Surface Water Hydrology	2
	Water Quality	2
	Air Quality and Noise	3
III.	CURRENT AND PLANNED FACILITIES AND SERVICES	
	Water Supply and Wastewater Disposal for Industries	3
	Infrastructure	4
	Existing Structures and Industrial Activities	5
IV.	BIOLOGICAL ENVIRONMENT AND NATURAL RESOURCES	
	Significant Flora	5
	Significant Fauna	5
	Sensitive Habitat	5
V.	SOCIAL AND CULTURAL ENVIRONMENT	
	Human Settlements	6
	Labour Force	6
	Local Economic Activity	6
	Religious and Cultural Features	6
	Aesthetic and Recreational Features	7
	Local Customs, Aspirations, and Attitudes	7
VI.	MAJOR ENVIRONMENTAL AND REGULATORY ISSUES	
	Sensitivity of the Affected Environment	7
	Regional Water Resource Limitations	7
	Regulatory Issues	7
VII.	GENERAL CONCLUSIONS AND RECOMMENDATIONS	8
	REFERENCES	
	ANNEX A-1: Regional Map	
	ANNEX A-II: Site Map	
	ANNEX A-III: Site Photographs	
	ANNEX B: Detailed Soil Analysis	
	ANNEX C: Detailed Water Quality Analysis	

**GEMUNUPURA  
PROPOSED INDUSTRIAL ESTATE  
INITIAL ENVIRONMENTAL EXAMINATION**

**I. GENERAL SITE DESCRIPTION**

This site is located in the Redimaliyadda Divisional Secretary Division of the Badulla District, on an access road approximately 5 km from the B46 road and 5 km from the proposed Mapakada industrial estate. The area of this proposed industrial estate is approximately 34 hectares (85 acres). It is on the slope of a hill draining to the southeast. A part of the site that is nearly flat and close to the main road has paddy storage facilities. The rest of the land is covered with disturbed secondary vegetation and scattered large trees. See Annex A for regional and site maps of the area.

**II. PHYSICAL ENVIRONMENT**

**A. Weather**

The site is situated in the intermediate zone of Sri Lanka. Meteorological observations made at Batticaloa, which is approximately, 100 km from the site is considered representative of the region encompassing this site. Average temperatures in the region vary from 22-34°C during the year. Mean annual rainfall at Mapakada Wewa (within 4 km) is 2096.7mm/yr (1992-1995 June). Most of this rainfall, averaging 1706.1mm, is received during the Maha Season from October to March. The Yala season rainfall (from April to September) averages 390.6mm. Average wind velocity in the region within a year is 9.5 km/hr. Wind direction is predominantly SE from May to September and N or NE from December to February.

**B. Topography, Soils, Groundwater**

The proposed site has an area of 34.4 ha (85 ac). The entire tract of land drains towards the southeast in the direction of Dambarawa Wewa. Surface runoff from land to the north and northeast of the site also drains through this land. The site is approximately 120 meters above msl and has slopes up to 9.5%. There are valleys through the center of the land indicating storm water drainage paths.

The soils are predominantly clay and are gravelly close to the ridges. See Annex B for more detailed analysis of soil samples. A cemetery for the adjacent settlement is located at the northern edge of the proposed site.

A well at the northern boundary of the site had ground water at a depth of 3 meters. No other on-site quantitative ground water measurements were done during this study.

### C. Surface Water Hydrology

The principal surface water bodies close to the site are:

- (1) Stream draining Nagadeepa Tract 5 to Dambarawa Wewa
- (2) Minipe Right Bank Transbasin Canal
- (3) Dambarawa Wewa
- (4) Arawatta Wewa
- (5) Mirisgewatta Wewa

The stream draining Nagadeepa Tract 5 crosses the access road from B46 about 1 km south of the site. This stream also receives the surface drainage from the site. The stream is said to be perennial; it had a flow of 0.12 m<sup>3</sup>/s (0.01 MCM/day) during the site visit.

Minipe Right Bank Transbasin Canal passes about 200 m to the west of the site. The full flow in the canal is 64 m<sup>3</sup>/s; this water flows to Ulhitiya Rathkinda Reservoir. The Mahaweli Authority does not permit the tapping of water at intermittent points which have not been preplanned; however, subsequent approval for certain cases has been granted.

Dambarawa Wewa is within 1 km of the site; it has an approximate capacity of 15.9 MCM. The Minipe Transbasin Canal releases 0.216 MCM/day to this tank. At maximum capacity the water depth at sluice is 7.3m; during this study this depth was measured at 2.44 m. This water is used for irrigation, fishing, and domestic purposes.

Arawatta Wewa, about 1 km from the proposed site, has a level crossing of the Nagadeepa Irrigation Scheme. Though this tank has an approximate storage of about 200,000 m<sup>3</sup>, it may not be possible to use it as an industrial water source since this storage tank is a built-in component of an established irrigation network.

Miriswaga Wewa is approximately 2 km to the south of the proposed site (it is not indicated on the 1:50,000 Topography map). This tank collects drainage water from the Nagadeepa Irrigation Scheme and was built with the intention of commissioning a lift irrigation scheme. The tank is said to be close to its spill level most of the year. The stored water is being used by a few farmers for gravity irrigation. Other main uses are for domestic purposes and bathing. Approximate capacity of the tank is 275,000 m<sup>3</sup>.

### D. Water Quality

Samples from water bodies near the site were collected and analyzed. The sampling sites were at the following locations:

- (1) Dambarawa Wewa, at the inlet to the sluice;

(2) Arawatta Wewa;

(3) Well at the Northern periphery of the proposed site, East of the Gemunupura junction.

Waters of the irrigation tanks show a higher level of ammonia than is usually found in surface water bodies. Fluorides were found at a level that is in excess of CEA's proposed list of minimum ambient water quality levels. According to Dissanayake and Weerasooriya, the composition of rocks of the area coupled with climate conditions are the key factors for the abundance of fluoride in the dry zone (Eastern and north-central region) of the country (Dissanayake and Weerasooriya, 1985). A more detailed water quality analysis of these samples is presented in Annex C.

#### **E. Air Quality and Noise**

No site-specific air quality data were available for this site. No major sources of air pollution were observed. Some emissions are generated from the burning of solid waste by the nearby garment factory and by burning of vegetation during chena cultivation. No significant noise sources were identified.

### **III. CURRENT AND PLANNED FACILITIES AND SERVICES**

#### **A. Water Supply and Wastewater Disposal Options**

Shadeline Garments, a garment factory situated near the proposed site at Gemunupura junction, obtains its water from the Minipe Right Bank Transbasin Canal. The options of extracting water from either the canal or canal-seepage release exist in principle, although the Mahaweli Authority has so far opposed releasing water from the canal to the proposed industrial estate. The distance between the proposed site and these potential water sources is relatively large (approx. 5-6 km). The quality and seasonal reliability of available water from the canal-seepage release also remains to be considered.

Given the above situation, the possibility of obtaining an adequate amount of ground water to supply the proposed industrial estate should be explored. A detailed hydro-geological study of the site is needed, and could be based on the information already provided by the pumping test commissioned by Shadeline Garments. This test showed a ground-water yield of 120 liters/minute for a period of 10 hours/day. More detailed measurements of ground water quality and quantity, especially during the dry season, are needed to determine the suitability of ground water at this site.

Potential disposal locations to receive treated industrial effluent are:

(1) Arawatta Wewa -- already a recipient of drainage water from the Nagadeepa Irrigation Scheme;

- (2) Dambarawa Wewa -- via under-crossings of the Transbasin Canal.

Any industrial effluent discharged to these water bodies should be treated such that complete removal of toxic and refractory substances as well as removal of excess salinity and hardness (to satisfy irrigation water quality standards) takes place before the final discharge. An ongoing water quality monitoring program will be needed to ensure that these conditions are met if the site is developed.

## **B. Infrastructure**

1. Power: There is an existing 33 KV line along the Arawatte-Gemunupura main road. A supply of 1 MVA could be provided using the existing 33 KV system with a 0.25 km 33 KV line. This site is located approximately 40 km away from the Badulla grid substation. Alternatively, power could be provided from the Randenigala switch yard. The estimated cost for a requested 400 KVA supply (i.e. a 0.25 km 33 KV HT line, 400 KVA sub. and a 1 km 3 phase LT line) is approximately Rs. 998,000 (1993 costs).

The Shadeline garment factory has a back-up diesel generator. A 500 litre diesel storage tank is available [where? for the factory?] and diesel is transported from Mahiyangana. On the day of the site visit, the garment factory experienced six power interruptions. Stability [or reliance?] on the grid is very low.

2. Telecommunications: The current telephone service to the site is via radio link. The garment factory uses this method quite successfully. Even the Redimaliyadda Divisional Secretary's office has only a radio link telecommunication connection. According to the Badulla Telecom Engineer, it is possible to supply radio link telecommunication facilities to the site.
3. Transportation: The site for this proposed industrial estate is on the Arawatte-Gemunupura main road, which is narrow and not suitable for heavy transport. In fact, the garment factory next to the site is very small -- 13' x 13' trucks are used for their goods transport. Public bus service is available but not frequent. The garment factory has arranged their own transport for the workers from nearby settlements. The nearest railway connection is 40 km away at Badulla.
4. Other public services: Nearby health care facilities include the Mahiyangana District Hospital (12 km from the site), the Uraniya Rural Hospital (7 km), and the Tissapura Grameeya Hospital (closest at 3 km from the site).

Local schools include Gemunupura Maha Vidyalaya (up to A-Level), 0.2 km from the site, and Abyapura Model School, 2 km away.

The nearest police station is 12 km away in the town of Mahiyangana. All petroleum fuels for the local area must be obtained from the Ceylon Petroleum Corporation depot at Mahiyangana. There are no local fire-fighting or emergency services.

### **C. Existing Structures and Industrial Activities**

The site is not yet developed, and has not received any industry inquiries. There are a few local houses, and a UDA housing site has been proposed nearby. The garment factory adjacent to the site (Shadeline) is operating quite satisfactorily. They get their water from a well on-site and by tapping the Transbasin canal; their electricity is supplied via an on-site transformer. They have requested a second transformer to meet their power demand. A Buddhist temple is also situated at one end of the site. There is a paddy storage facility on the Northern side of the site.

## **IV. BIOLOGICAL ENVIRONMENT AND RESOURCES**

### **A. Significant Flora**

Most of the area of the proposed site is covered with jungle vegetation typical of disturbed forest land. Major species observed at the site are -Mee (*Madhuca longifolia*), Eraminiya (*Zizyphus sp.*), Myla (*Bauhinia racemosa*), Kanda (*Macaranga peltrata*), Milla (*Vitex altissima*), Palu (*Manilkara hexandra*), and Weli Venna (*Dimorphocalyx sp.*). This is the only existing forest patch in the area except for a few scrubs present several km from this site.

### **B. Significant Fauna**

Local people state that a large number of wild boar (*Sus scrofa*) live in this small jungle. One snake was observed at the site, namely Tura Haldanda (*Dendrelaphis tristis*). According to nearby villagers, cobra (*Naja naja*), Russel's Viper (*Vipera russelli*) are also present within or near the site. The Common Garden Lizard (*Calotes versicolor*) and Green Garden Lizard (*Calotes calotes*) were observed at the site during the team's visit.

Several forest birds, including the Black-fronted babbler, Azure Blue fly catcher, White backed Munia, and Green Imperial Pigeon were observed at the site in addition to other common bird species. This forest appears to provide suitable nesting ground for several bird species.

### **C. Sensitive Habitat**

Clearance of this forested tract of land could adversely affect some birds and other fauna. Two streams within the site could be further dried up by site clearing and development. The forest within and adjacent to the site is a principal source of fuel wood

for nearby villagers, which would be eliminated by clearing and development of the proposed industrial site.

## **V. SOCIAL AND CULTURAL ENVIRONMENT**

### **A. Human Settlements**

The Gemunupura site was formerly part of a settlement to be irrigated by water from the Nagadeepa tank/canal system built towards the latter part of the 1960s. The site itself is located within the Colony -- titled Tract No. 5 with a total irrigable area of 185.4 acres. The total number of acres intended to be irrigated by the entire Nagadeepa Project was 1465.1; the number of families resettled amounted to nearly 700 (inclusive of the families of the area relocated in Tracts 1, 2, and 3). Because Gemunupura is at the tail-end of the irrigation system, this land remained unsettled due to a lack of sufficient irrigation water.

The total population of the Redeemaliyadda Divisional Secretariat (DS) is 41,086, of which 21,318 are male and 19,768 are female. Of the total population, 27,503 have had an education up to Grade 10, 3442 have G.C.E. OL/AL, and 206 have a higher qualification. There are 8336 housing units that house 8371 families.

Basic local health care is provided by the Tissapura (3 km) and Uraniya (7 km) Rural hospitals; Mahiyangana (12 km) has a well-equipped district hospital. Of the local schools, Gemunupura Maha Vidyalaya (1110 children), Mapakada Maha Vidyalaya (1085 children), and Abyapura Junior School (600 children) have reached the regional standard in education.

### **B. Labour Force**

The local labor force of the Redeemaliyadda DS is approximately 20,858 of which over 20,435 are employed. The majority of the labour force is in agriculture whilst teaching and other minor types of employment attract a much smaller number.

### **C. Local Economic Activity**

Agriculture, especially paddy cultivation, is the principal local economic activity. There are several cottage type industries, including brick making.

### **D. Religious and Cultural Features**

Nagadeepa (7 km from the site) is an important religious and cultural feature that includes two pagodas and a columnar stone (2nd Century BC) inscription which has still not been deciphered. Local Buddhist temples currently in use are the Gemunupura temple adjoining the site and the forest meditation centre between Mapakada and Uraniya.

## **E. Aesthetic and Recreational Features**

Limited local recreational facilities will be available upon completion of efforts taken by the Shadeline Garment factory to develop a playground on four acres adjacent to [?] the proposed site. The area contains diverse natural aesthetic features of dry forest vegetation and wildlife as well as the flowing waters of irrigation canals and tanks. A forested stretch of vegetation is maintained along the Mahaweli transbasin canal as a wildlife sanctuary and buffer.

## **F. Local Customs, Aspirations, and Attitudes**

The third generation-colonists who are more articulate indicate that they prefer to see improved local employment, while maintaining a sanctified Buddhist environment.

# **VI. MAJOR ENVIRONMENTAL AND REGULATORY ISSUES**

## **A. Sensitivity of the Affected Environment**

Although this site has been substantially altered from its natural state, it still provides significant forest habitat for a variety of birds and other native fauna; the vegetative cover serves to stabilize the soil and prevent siltation of the local streams. If it is further disturbed by clearing and construction the result would likely be loss of wildlife and increased soil erosion and stream sedimentation. Nearby canals and paddy fields are susceptible to industrial pollution; special care has to be taken to prevent contaminants from entering the labyrinthine irrigation system. A central wastewater treatment plant and an ongoing environmental monitoring program are probably the most effective way to assure that this objective is met.

## **B. Regional Water Resource Limitations**

As was indicated in Sections II and III above, potential local sources of surface water for industrial use are limited and to a large extent are committed to irrigation uses. The long-term availability and quality of local ground water is uncertain, and will require further analysis to determine. Although the Minipe Right Bank Transbasin Canal is a potential water source, its availability is dependent on approval by the Mahaweli Authority, which must consider a number of competing seasonal and long-term needs for this water.

## **C. Regulatory Issues**

Plans for either surface or ground-water withdrawals to supply water to this site for industrial uses should be developed only after further on-site analysis and discussions with the Mahaweli Authority, the Irrigation Department, the C.E.A, and local government authorities.

To avoid significant adverse secondary impacts on adjacent land and water resources from unplanned development, M/ID should involve local and regional authorities in preparing and administering an area land-use plan to determine where local housing, utilities, roads, and commercial facilities would be located if the site is developed as an industrial estate.

## **VII. GENERAL CONCLUSIONS AND RECOMMENDATIONS**

**This site was rated by the study team as having medium to low pollution assimilative capacity and low to medium local resource availability.** The proposed site is considered to be most suitable for industrial activities that do not require a large amount of water for industrial processes or a large skilled work force, and do not generate or discharge toxic pollutants.

The principal constraints on the use of this site as an industrial estate are:

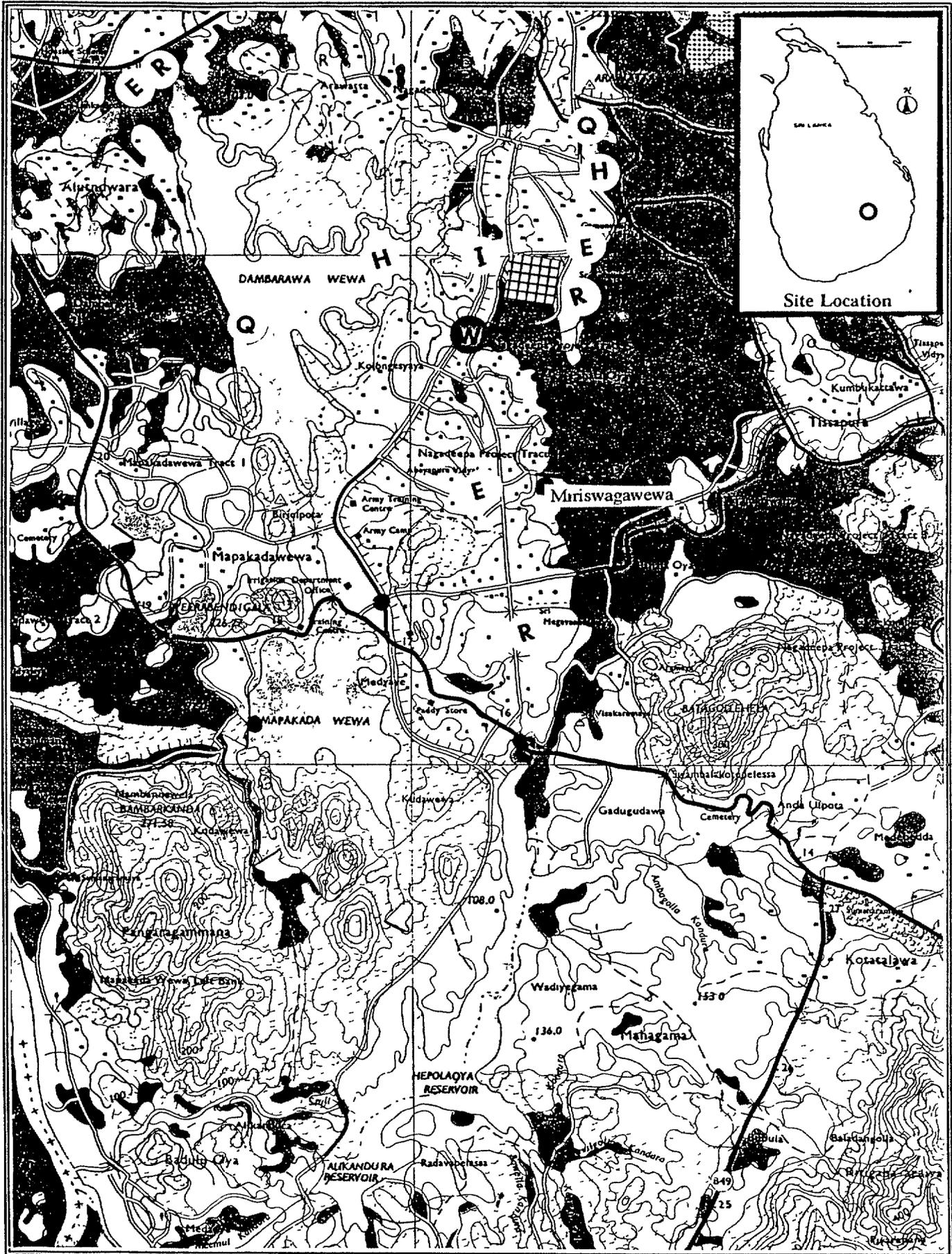
- Uncertainty about the availability and reliability of potential sources of surface and ground water;
- Lack of public utilities and community infrastructure and low-quality transportation access;
- Limited availability of local skilled labour.

If further studies and/or inter-agency negotiations determine that either ground water or Mahaweli project water can be supplied to the site on a long-term sustainable basis, then the site may be suitable for a wider variety of industrial activities, provided that adequate measures are taken to minimize the discharge of toxic substances into the local environment.

## **REFERENCES**

Dissanayake, C. B. And S.V. R. Weerasooriya, The Hydrogeochemical Atlas of Sri Lanka, Natural Resources Energy and Science Authority (NARESA) of Sri Lanka, 1985.

# A - A-1 : REGIONAL MAP - GEMUNUPURA

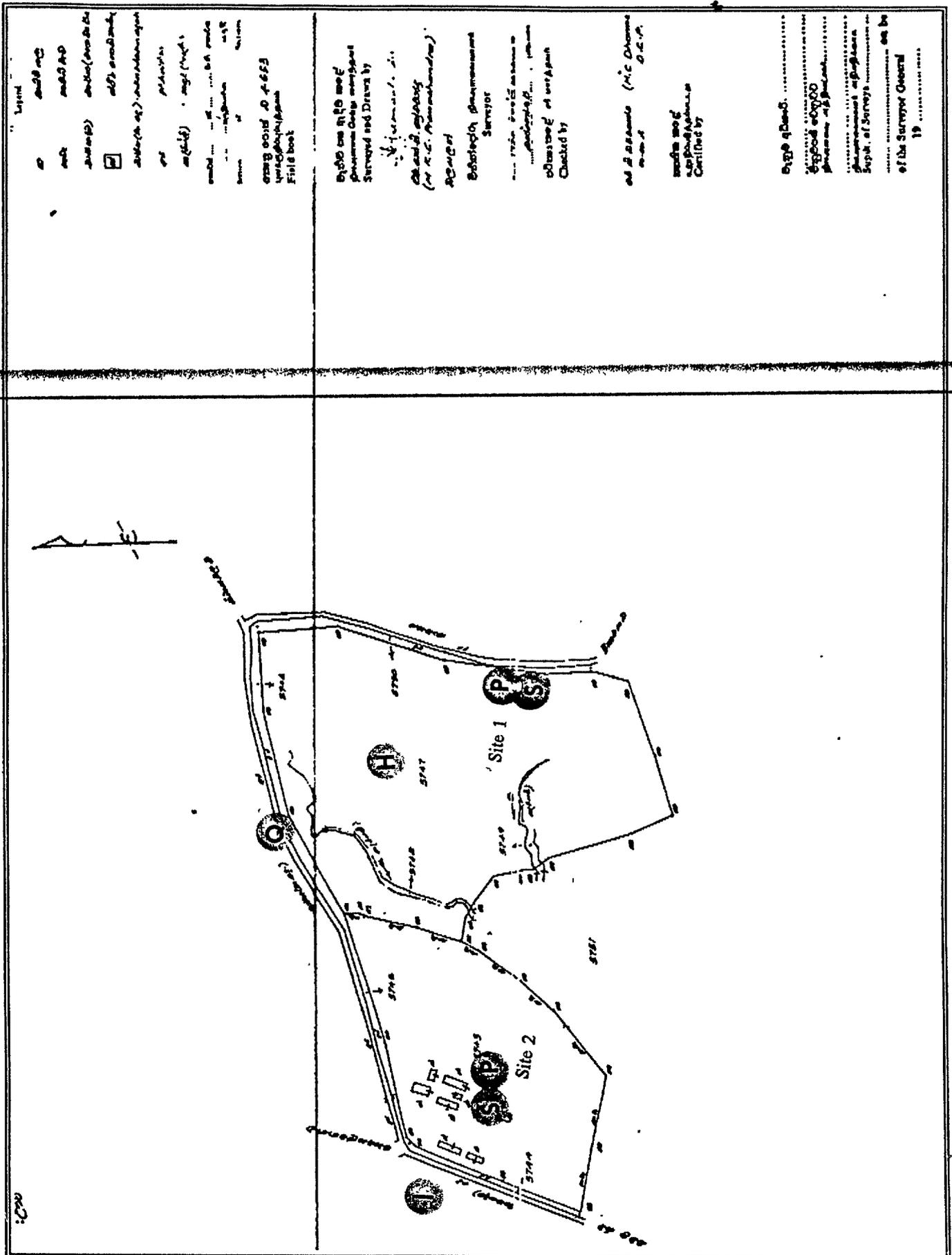


**Location Map of Proposed Industrial Estate - Gemunupura**

Scale . Produced using 1:50,000  
Topographic Map

- |                        |  |
|------------------------|--|
| A - Archeological      | P - Percolation Measurement Point            |
| E - Schools            | Q - Water Quality Sampling Point             |
| H - Important Habitats | R - Religious (Temple, Church, Kovil/Mosque) |
| I -                    | S -  |
| M -                    | u -  |

A



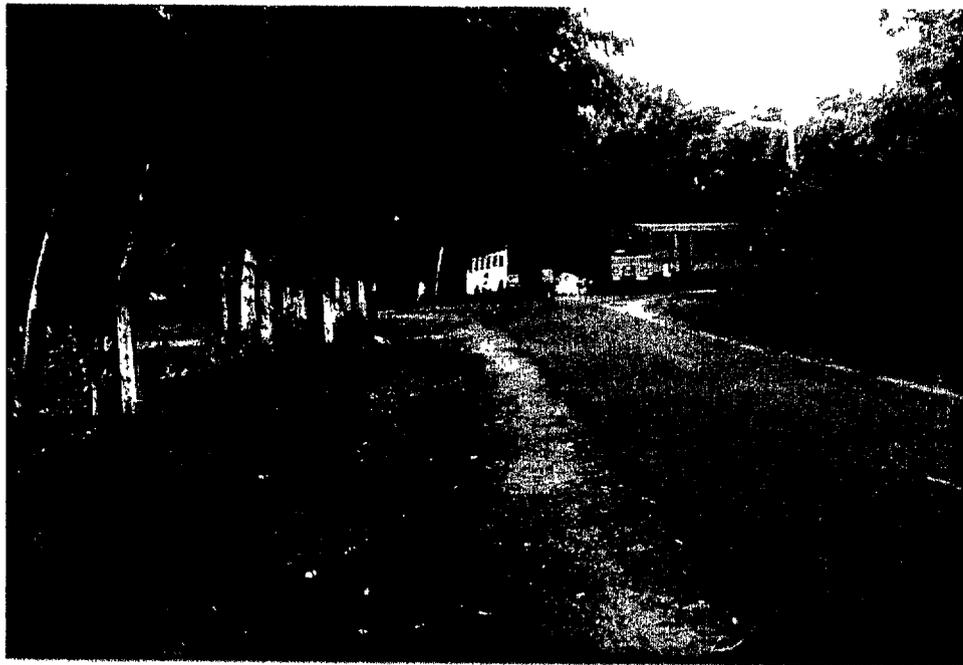
Perimeter Survey Map - Proposed Industrial Estate - Gemunupura

- |                        |  |
|------------------------|--|
| A - Archeological      | P - Percolation Measurement Point            |
| E - Schools            | Q - Water Quality Sampling Point             |
| H - Important Habitats | R - Religious (Temple, Church, Kovil/Mosque) |
| I - Industries         | S - Soil Sampling Point                      |

**ANNEX A-III: SITE PHOTOGRAPHS - GEMUNUPURA**



**A. Buddhist temple situated in the high ground at SW corner of the proposed Industrial Estate at Gemunupura in Ridimaliyadde.**



**B. Turn-off to the Industrial Estate Site - from the base of the Shadeline Garment Industry.**

## ANNEX B: DETAILED SOIL ANALYSIS

### 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.

**Soil Data for Proposed Industrial Estate at Gemunupura**

Description	Unit	Site 1	Site 2
Sampling Depth	mm	250	250
Moisture Content	%	3.75	5.43
Organic Matter	%	6.17	4.47
Classification		SW	SP
Chloride Cl <sup>-</sup>	mg/gr	0.20	0.30
Nitrates NO <sub>3</sub> <sup>-</sup> -N	mg/gr	0.001	0.001
Fluoride F <sup>-</sup>	mg/gr	0.050	0.050
Phosphate PO <sub>4</sub> <sup>3-</sup> - P	mg/gr	N/D	N/D
pH		6.50	6.32
Hydraulic Conductivity (saturated)	cm/hr	4.35	3.85
Sorptivity	cm/(hr <sup>1/2</sup> )	4.10	4.32

N/D = Not detected

## 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 <sup>+</sup>	Selective ion electrode	0.01
Cl <sup>-</sup>	mg/l	Titrimetry	-
SO <sub>4</sub> <sup>2-</sup>	mg/l	Gravimetry	-
F <sup>-</sup>	mg/l	Colorimetry	0.1
NH <sub>4</sub> <sup>+</sup> - N	mg/l	Colourization/Spectrophotometer	0.01
NO <sub>3</sub> <sup>-</sup> - N	mg/l	Colourization/Spectrophotometer	0.01
PO <sub>4</sub> <sup>3-</sup> - P	mg/l	Colorimetry	2.0
Alkalinity	mg CaCO <sub>3</sub> /l	Titrimetry	-
Hardness	mg CaCO <sub>3</sub> /l	Titrimetry	-

**WATER QUALITY ANALYSIS :**

**PROPOSED SITE AT GEMUNUPURA**

**BADULLA DISTRICT**

Location	Date of Sample	TSS	TDS	DO	BOD <sub>5</sub>	COD	<u>BOD</u> COD	pH	Temp.	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	F <sup>-</sup>	NH <sub>3</sub> -N	NO <sub>3</sub> <sup>-</sup> -N	PO <sub>4</sub> <sup>3-</sup> - P	Carb. Alk.	Bicarb. Alk.	Carb. Hard.	Non-Carb. Hard.	Flow rate
Dambarawa Wewa	-do-	5.0	120	9.3	1.0	32	0.03	7.5	28	15.5	20.57	3.2	0.24	0.02	ND	Nil	110	90	Nil	-
Arawatta Wewa	-do-	4.0	60	7.8	1.0	36	0.03	7.0	28	14.0	12.34	3.0	0.24	0.02	ND	Nil	120	90	Nil	-
Gemunupura Well	-do-	13.0	90	6.8	1.4	36	0.04	6.5	28	16.0	10.69	1.4	0.36	0.05	ND	Nil	110	100	Nil	-
Proposed Minimum Ambient Quality	-do-	-	-	3.0	4.0	-	-	5-8.5	-	1200	400	1.5	4.0	5.0	0.7	-	-	600		-

ND = Not Detected