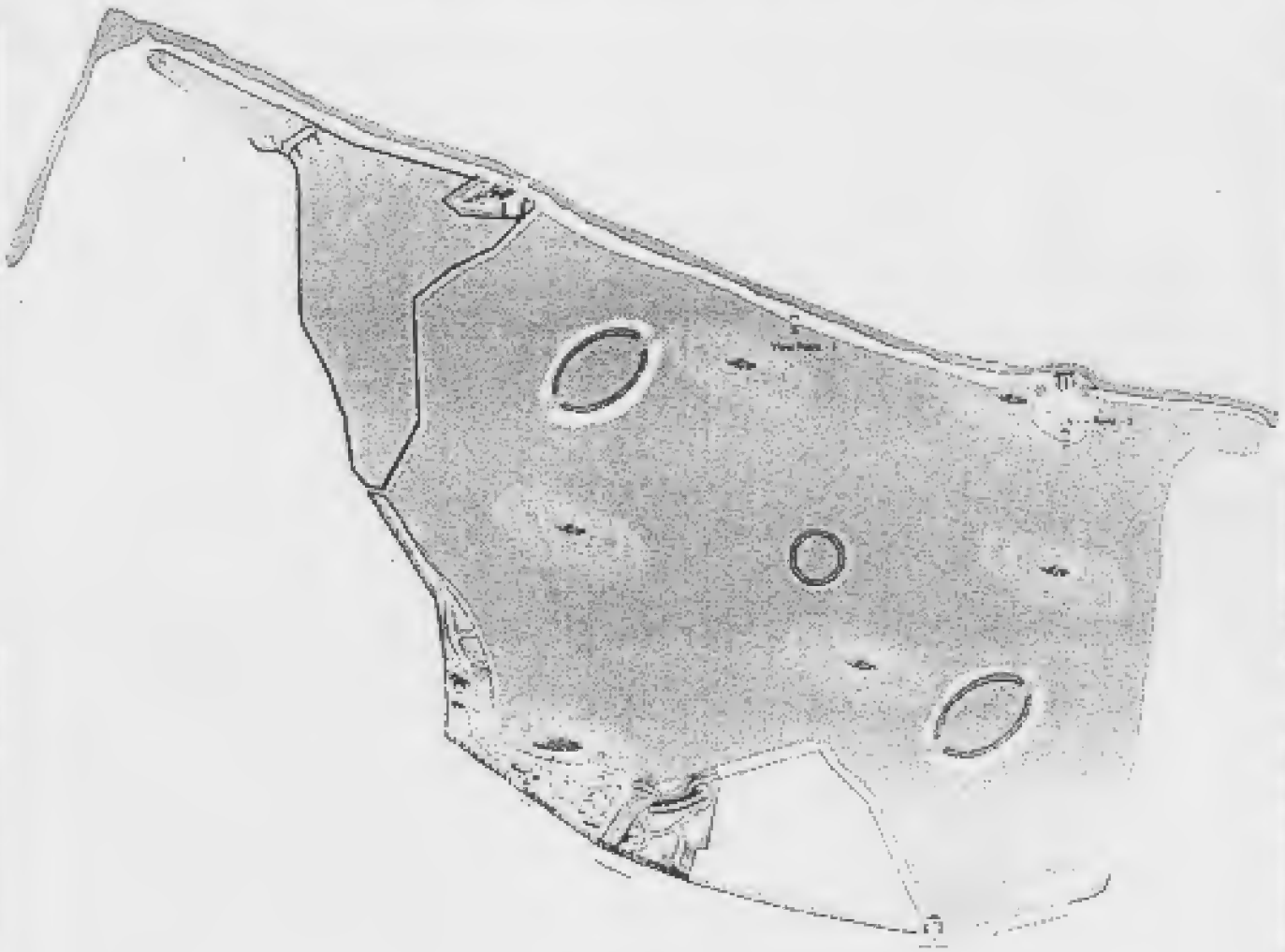
Project Report for

HEBBAL LAKE

in Bangalore on DOT Basis



CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBRIVATIONS

BWSSB	Bangalore water supply and Sewerage board
CC	Cement Concrete
CEO	Chief Executive Officer, LDA, Bangalore.
CM	Cement Mortar
CUM	Cubic Meter
EOI	Expression of interest
DOT	Develop/Operate/Transfer Basis
DPR	Detailed Project Report.
HELPA	Hebbal Lake Parks Association
INEP	Indo-Norwegian Environment Programme.
KFD	Karnataka forest department
LDA	Lake Development Authority, Bangalore
mg/l	Milligrams per liter
mld	Million liters per day
mm	millimeter
NH	National Highway
O&M	Operation and Maintenance
RCC	Reinforced Cement Concrete
RS	Rupees
SOI	Survey of India.
sqm	Square Meter
SSM	Size Stone Masonry
SSWD	Sewage storm water drain
STP	Sewage Treatment Plant
SWD	Storm water drain
UGD	Under Ground Drainage
ULBS	Urban local bodys.

Executive Summary

1.1 Background

Lakes are often seen as main targets for development particularly in urban areas due to pressure of human activities like urbanization, industrialization etc., As a result of this, most of the urban lakes are getting degraded beyond the point of recovery. Encroachments, siltation, discharge of domestic sewage, industrial effluents, weed infestation are the main causes for degradations of these lakes.

Considering the above factors the Department of Forest, Ecology & Environment, Government of Karnataka has made efforts to rejuvenate the Hebbal Lake under INEP in 2001-02. However, due to lack of proper maintenance and want of some technical corrections, the lake has deteriorated within two years of it rejuvenation. Taking note of this fact and the necessity of a sustained maintenance of the lake for its upkeep, the Karnataka Government as a novel initiative under the aegis of Lake Development Authority put on invitation for Expressing of Interest for the maintenance of the restored and to be restored lakes on Develop, Operate and Transfer basis.

M/s E.I.H. Ltd., No.39, M.G. Road, Bangalore – 01, which is a pioneer in the field of hospitality and tourism, were eager not to let go of the novel initiative of the Government of Karnataka to sustain water bodies for the benefit of ecology and environment. Hebbal Lake was chosen for taking up on DOT basis due its strategic location in the city of Bangalore. M/s.EIH, Bangalore, short-listed amongst the various agencies, M/s VIMOS Technocrats & Associates, of Bangalore to prepare a DPR for the Hebbal lake. M/s VIMOS Technocrats & Associates were found to have the requisite qualification and resources for bringing out the desired output within the short time frame stipulated for carrying out the evaluation of the present status of the lake and formulating a scheme of activities required for its revival, improvement and its sustained maintenance as per the guidelines issued by Lake development authority. In right earnestness a study was taken up to evaluate the following aspects

- The present status of the lake.
- The causes for its deteriorations.
- The social impact and its concern.
- The necessary overall plan for lake revival and upkeep.
- The methodology to be adopted to improve the environs of the lake and its upkeep.
- Formulating the essential components required for revival and maintenance and upkeep.
- The financial implications for the revival and its maintenance.

This section presents a summary of recommendations made in the project report of the study.

1.2. Profile of Bangalore and Hebbal Lake

Bangalore city is very old city founded by Kempe Gowda and is situated in the South Deccan Peninsular India to the South-Eastern corner of Karnataka State between the parallels of 12°39' N and 13°18' N and meridians of 77°22' E and 77°52' E at an average elevation of about 900 meters covering on area of 451 Sq.Km having a population of 69 lakhs in the year 2001. Bangalore is the capital state of Karnataka and is variously known as the Air-conditioned city, Garden city, Pensioner's paradise and Pub city. Today, it sports a new label as the Silicon Valley of India, having the unique distinction of producing the largest number of software professionals in the world. Throbbing with life and buzzing with industrial activity, Bangalore's salubrious climate and industrial-conducive environment has made it the destination of most prestigious MNCs in the world.

Hebbal is the most elevated part of Bangalore and the apex point being Hebbal area for the three major valleys of Bangalore. The Lake is located in the North of Bangalore, abutting Ring Road on its South and Bellary Road on its east, it is 9 Kms away from Vidhana Soudha. The Hebbal Lake receives water inflow from its catchments that covers localities of Yeshwanthpura, Mathikere, RMV, BEL and HMT colonies, Nagavara, Narsipura and other layouts. The water of Hebbal Lake had earlier been used for drinking purposes. Due to the change in the urban setup and the piped water supply by BWSSB, currently the lake is locally used for cattle/cloth washing, bathing, for pusiculture by fisheries department and agriculture lands in the adjacent areas. It is currently used for limited boating and garden maintained by HELPA. Most of catchments area is covered by buildings and industries. The catchments area has a good tree cover in plantations, parks and factory colonies. The lake was revived under the funding of INEP by KFD. The details furnished by INEP after the lake's revival is as under.

Table 1. Details of Hebbal Lake after its revival Under INEP

Sl. no.	Item	
1	Basin	Cauvery
2	Area of the lake	64.50 ha
3	Water spread area	64.00 ha
4	Catchments area	2393.75 ha
5	Live capacity of lake (Before desilting)	722707 m^3
6	Live capacity of lake (After desilting)	867756 m^3
7	Net increase in Volume	145049 m^3
8	Shore length	3800 m
9	Wetland area	15.00 ha
10	Areas of islands	
	Island – 1	355 m^2
	Island – 2	355 m^2
	Island – 3	1965 m^2
	Island – 4	240 m^2
	Park area	64143 m^2
11	Total budget provision that was made for development	Rs.27028000

The details of the lake after its revival under the current plan proposed on DOT basis

Sl. no.	Item	
1	Basin	Cauvery
2	Area of the lake	150 acres
3	Water spread area	127 acres
4	Catchments area	2393.75 ha
5	Live capacity of lake (Before desilting)	849 million litres
6	Live capacity of lake (After desilting)	1298 million litres
7	Shore length	3800 m

- The detailed topographical survey of the lake carried out by using electronic total station indicated that the average depth of water in the lake is about 1.05 mt. About ¾ extent of lake is covered with weeds, grass and water hyacinth etc,. The water in the lake is also polluted. Floating solids, Sludge/Silt has accumulated again there by reducing the water holding capacity of the lake again.

1.3 Investigation for lake Rejuvenation

On the reconnaissance survey carried out the following aspects were noticed,

- The lake water is darkish in colour due to decomposition of organic matter and entry of wastewater through the storm water inlets; it leads to depleting the dissolved oxygen content in the water and also the water will become turbid.
- The foul smell is coming due decomposition of organic matter.
- The weeds are growing on surface of water body rampantly due to the entry of wastewater into the lake, spoiling the appearance of lake beauty and drastically reducing the water spread of the lake.
- Due to the existence of floating body on the surface of water body, the area available for boating activity is currently limited.
- Due to bathing activities of the cattle in the lake leads to the pollution of lake water and also which spoils the lake eco-system.
- Bathing and cloth washing involves detergents / soap usage, dirt removal from the cloth fabrics. The detergents, soap and dirt, which will leads to pollute the lake water.
- The surface water flow from the south western corner of the agricultural fields can contain toxic chemical pesticides, weedicides and chemical fertilizer being used in the fields of the catchments area led to pollution of the lake water.
- The pollution of the lake water will lead to adverse affect on flora and fauna of the eco-system of the lake.
- Due to pollution of lake water, it will indirectly affect the groundwater quality.

1.4 Design of engineering measures.

Based on the above surveys, the components designed for Lake Rejuvenation include,

- Deweeding and Desilting the lake.
- Providing of Storm water catch drain with silt traps and screen barriers, this is to avoid floating solids/wastes entry into the lake and for prevention of lake silting up.
- Catchments improvement by deweeding, desilting, removal of obstacles for easy flow of storm water into the lake.
- Strengthening of bunds by revetment.
- Improvements to the wetland.
- Construction of STP to treat the wastewater for augmenting the loss of lake water due to evaporation and percolation.
- Improvements to existing components such as Jogging track, Parking area, etc.,
- Development of recreational facilities around the Lake.
- Providing of Kalyani for Idols immersions to avoid the lake from the toxic paints and sludge.
- Sanitary facilities.
- Fencing the inner and outer boundary of water body and lake area for protecting the lake area and water body respectively.
- Suitable means of garbage and waste disposal generated from various units/components.
- Solar lighting at various points of the lake.
- Medical care center
- Administrative office cum reception center
- Handicraft and Curio gift shops.
- Operation and maintenance of the Proposed Project

It is estimated at Rs.16.75 Crores of investment, as the amount required for executing the Project successfully and the details of the same are presented in table - 2.

Table 2. Project Cost Summary

Name of the Work: Development of Hebbal Lake on DOT Basis

Sl. No.	Description	Cost Rs. In lakhs
1	De-silting, De-weeding and Strengthening	772.00
2	Eco-friendly children park, lightings, rescue watch towers, parking bay, view points, kiosks, boundary protection, arch bridges, solar lighting, floating restaurant and provision for recreational facilities like bumper boats, electric boats, peddle boats, aqua-scooters etc.,	245.00
3	Silt traps and screen barriers – 2 Nos	33.10
4	Storm water drain and catchments area improvement	59.00
5	Sewage treatment plant- 3 mld and wet land improvement.	201.00
6	Toilet block (rectangular)	4.00
7	Toilet block (circular -2 units)	9.00
8	Kalyani for idols immersion	32.00
9	Security/ Ticket issue counter (2 units)	4.00
10	Lake view open air restaurant	21.20
11	Medical care center	13.70
12	Administrative office cum reception center	10.80
13	Handicrafts and Curio gift center	70.00
14	Boating jetty (Southern side)	41.50
15	Boating jetty (Northern side)	2.00
16	Generator set and furniture	80.00
17	Supervision, consultancy and miscellaneous charges	76.70
	Total cost of Project	**1675.00**

(Rupees One Thousand Six Hundred Seventy Five Lakhs Only)

EIH LTD.

Authorised Signatories

EIH LTD.

19/5/2006

Authorised Signatories

CHIEF EXECUTIVE OFFICER 19.5.06
Lake Development Authority
BANGALORE

Table 2. Project Cost Summary

Name of the Work: Development of Hebbal Lake on DOT Basis

Sl. No.	Description	Cost Rs. In lakhs
1	De-silting, De-weeding and Strengthening	772.00
2	Eco-friendly children park, lightings, rescue watch towers, parking bay, view points, kiosks, boundary protection, arch bridges, solar lighting, floating restaurant and provision for recreational facilities like bumper boats, electric boats, peddle boats, aqua-scooters etc.,	245.00
3	Silt traps and screen barriers – 2 Nos	33.10
4	Storm water drain and catchments area improvement	59.00
5	Sewage treatment plant- 3 mld and wet land improvement.	201.00
6	Toilet block (rectangular)	4.00
7	Toilet block (circular -2 units)	9.00
8	Kalyani for idols immersion	32.00
9	Security/ Ticket issue counter (2 units)	4.00
10	Lake view open air restaurant	21.20
11	Medical care center	13.70
12	Administrative office cum reception center	10.80
13	Handicrafts and Curio gift center	70.00
14	Boating jetty (Southern side)	41.50
15	Boating jetty (Northern side)	2.00
16	Generator set and furniture	80.00
17	Supervision, consultancy and miscellaneous charges	76.70
	Total cost of Project	**1675.00**

(Rupees One Thousand Six Hundred Seventy Five Lakhs Only)

1.5 Operation and Maintenance System

In order to ensure proper maintenance of the proposed improvements, the following will have to be taken care of:

- Daily operation of the lighting and fountains in and around the lake
- Collection and disposal of all the solid wastes from restaurants, boat house, food courts, decks, parks and other open spaces including the jogging track around the lake.
- Maintenance and watering of the plants and other landscapes in and around the lake
- Clearing rags, papers etc., (If any) from the lake surface. Regular disinfection of the lake surroundings.
- Life guards for the boating area
- Security persons for watch and ward
- Cleanliness in the toilet unit etc.,
- Fire fighting measures and Cleanliness in Administrative office cum reception center
- Fire fighting measures and Cleanliness in Store building
- Fire fighting measures and Cleanliness in Medical care center
- Advertisements boards
- Landscaped parks, Maze blocks, and Musical fountains.
- Fire fighting measures and Cleanliness in Floating restaurant
- Maintenance and Cleanliness of Boats etc.,
- Fire fighting measures, Maintenance and Cleanliness of Boathouses
- Fire fighting measures, Maintenance and Cleanliness of Food courts
- Maintenance of the Kalyani
- Maintenance of internal fence and the boundary fence of the lake
- Maintenance and cleanliness of the parking bays

The estimated manpower of 55 personnel has been recommended to maintain and carry out the above activities.

1.6 Financing and implementation Plan

The implication of the project is proposed to be financed by M/s E.I.H. Ltd., No.39, M.G. Road, Bangalore - 01 from its internal resources.

1.7 Project Management

Effective management and co-ordination of the project activities is very essential for development successful implementation of the complex projects such as Lake conservation its operation and maintenance. This is due to the complexity and multiplicity of the activities and agencies involved in the implementation and also during its operation and maintenance. Considering those aspects the preparation of DPR for Hebbal Lake and its successful implementation is intended to be implementation completely carried through M/s VIMOS Technocrats & Associates, Bangalore.

The implementation of the development of Hebbal Lake on DOT Basis will take about 12 month`s duration, including monsoon season from the date of issue of work order.

1.8 Conclusion: -

The project is intended to be taken up on the DOT basis more as a fulfillment of social obligation than as a source of revenue generation. The project is formulated a break-even basis and the activities are so projected taking the eco-ethos of the water body and lake at large.

The Oberoi, Lombok Indonesia

"All of your staff are outstanding. All exceeded expectations. The best beach resort in the world and most definitely our favorite. Keep up the excellent work. Thank you"

Ms Lisa Choegyal
Tourism Specialist, New Zealand

CHAPTER-1

INTRODUCTION

By renovating an old irrigation tank, it provides a valuable set of services to the communities, which extend beyond irrigation. The only successful tank rehabilitation strategy is one that looks at all the current socio-ecological activities and their values. Not just irrigation.

Approaching the rehabilitation of the 50-100 year-old irrigation tanks-spread across Bangalore solely from an irrigation perspective, runs the risk of depriving communities of valuable socio-ecological services and functions that these structures provide today.

These tanks may have become' inefficient' in their original function of providing flow irrigation, but as they have degraded over time, they have evolved into valuable systems that support people's livelihoods in number of ways. In addition to storing water for crop irrigation, tanks provide services such as recharge of ground water used by adjacent communities, fishing and aquaculture, water for raising livestock, and recreational use.

So, to define tank rehabilitation as returning tanks to their original state as irrigation structures' runs the risk of not using the available resource to the full potential for the benefit of the public.

By favouring'classical' approaches to tank rehabilitation- renovating the tanks (at high cost) by de-silting the tank-beds or raising the bunds, repairing the outlets and lining the community and the new services that it provides. Rehabilitation of a tank should not be done before a profile of the current user base of the tank and its ecological functions is established.

'Modernization is a process of upgrading (as opposed to mere rehabilitation) of irrigation schemes, combined with institutional reforms if required, with the objective to improve resource utilization (labour, water, economic, environment). The approach is sound, but to date little has been done to apply this knowledge more broadly or communicate the importance of rethinking tank rehabilitation to irrigation or development circles.

Ministry of Water Resources Govt. of India on April 1, 2002 brought out a National Water Policy have started that water, as a resource is one and indivisible: rainfall, river waters, surface ponds and lakes and ground water are all part of one system. Water is part of a larger ecological system. Realising the importance and managed as such, and on an integrated and environmentally sound basis, keeping in view the socio-economic aspects and needs pf the states. As the country has entered the 21 st century, efforts to develop, conserve, utilize and manage this important resource in a sustainable manner, have to be guided by the national perspective.

As per the latest assessment (1993), out of the total precipitation, including snowfall, of around 4000 billion cubic meter in the country, the availability from surface water and replenishable ground water is put at 1869 billion cubic meter. Because of topographical and other constraints, about 60 % of this i.e. 690 billion cubic meter from surface water and 432 billion cubic meter from ground water, can be put to beneficial use. Availability of water is highly uneven in both space and time.

The development and overexploitation of groundwater resources in certain parts of the country have raised the concern and need for judicious and scientific management and conservation.

Ministry of Water Resources, Govt. Of India in its water policy 2002 have given importance to the Private Sector Participation by incorporating that Private sector participation should be encouraged in planning, development and management of water resources projects for diverse uses, wherever feasible. Private sector participation may help in introducing innovative ideas, generating financial resources and introducing corporate management and improving service efficiency and accountability to users. Depending upon the specific situations, various combinations of private sector participation, in building, owning, operating, leasing and transferring of water resources facilities, may be considered.

Under the Conservation of Water statement of National Water Policy 2002 it is stated that

Efficiency of utilization in all the diverse uses of water should be optimized and an awareness of water as a scarce resource should be fostered. Conservation consciousness should be promoted through education, regulation, incentives and disincentives.

The resources should be conserved and the availability augmented by maximizing retention, eliminating pollution and minimizing losses. For this, measures like selective modernization and rehabilitation of existing systems including tanks, recycling and re-use of treated effluents may be promoted, wherever feasible.

Under the Performance Improvement and Maintenance and Modernization statement of National Water Policy 2002 it is stated that

There is an urgent need of paradigm shift in the emphasis in the management of water resources sector. From the present emphasis on the creation and expansion of water resources infrastructures for diverse uses, there is now a need to give greater emphasis on the improvement of the performance of the existing water resources facilities. Therefore, allocation of funds under the water resources sector should be re-prioritized to ensure that the needs for development as well as operation and maintenance of the facilities are met.

Structures and systems created through massive investments should be properly maintained in good health.

In the Conclusion statement of National Water Policy it is stated that in view of the vital importance of water for human and animal life, for maintaining ecological balance and for economic and development activities of all kinds, and considering its increasing scarcity, the planning and management of this resource and its optimal, economical and equitable use has become a matter of the utmost urgency Concerns of the community need to be taken into account for water resources development and management. The success of the National Water Policy will depend entirely on evolving and maintaining a national consensus and commitment to its underlying principles and objectives. To achieve the desired objectives, State Water Policy backed with an operational action plan shall be formulated in a time bound manner say in two years.

On the basis the Govt. of Karnataka has come up with a formulation, which is the first of its kind in the country on the lines of private sector participation on the lines envisaged under the water policy 2002.

Lakes constitute an important component of fresh water resources in the global perspective. They serve as an aquifer and regulating hydrological regimes, besides providing habitats and breeding grounds for the variety of birds, fish and other aquatic life. In the urban areas, lakes assume special importance in providing drinking water, recreation, and fishing. However, these lakes are often seen as main targets for development particularly in urban areas due to pressure of human activities like urbanization, industrialization, etc, As a result of these activities most of the urban lakes are getting degraded beyond the point of recovery. Encroachments, siltation, weed infestation, discharge of domestic sewage, industrial effluents, surface run off carrying pesticides and other chemicals used in agriculture are the main causes for degradation of these lakes. The overall impact of these activities have resulted in

- Deterioration of lake water quality
- Sedimentation and shrinkage of water body
- Decrease in productivity to support flora and fauna.
- Loss of aesthetic values.

In view of the various issues mentioned above and considering the above factors the Department of Forest, Ecology & Environment, Government of Karnataka has made efforts to rejuvenate the Hebbal Lake under INEP in 2001-02. Now for the maintenance of the restored Hebbal Lake, EOI on DOT basis is invited from the Lake Development Authority, Bangalore for further development, beautification and maintenance of the Lake. The development, beautification and maintenance depends upon lake conditions such as,

- Formulation of perspective plans for conservation based on resource surveys.
- Prevention of pollution from point and non-point sources
- Other activities depending on location specific conditions such as an integrated development approach, including interface with human population.

With the above objective in view, it is imperative to survey and study various aspects of these water bodies in order to understand the ecological processes of the lake so as to formulate management action plans.

1.1 Present Study: -

Considering the above factors the objectives of the study will be to formulate plans for development of Hebbal Lake, so as to improve the urban environmental quality of the city and to develop the area around the lake for recreational purposes.

The scope of the work and the approach adopted by the technical consultants to accomplish the above objectives are detailed out in the following sections.

1.2 Scope of Work: -

The major components of the study as identified after the detailed survey work are broadly enumerated as under:

- Deweeding
- Desilting
- Prevention of pollution from point and non-point sources entering
- Construction of STP and wetland for water purification and weed control.
- Providing of Storm water catch drain with silt traps and screen barriers, to avoid wastes load entry into the lake for prevention of lake silting up.
- Improvements to existing components such as Jogging track, Parking area, Landscaping etc.,
- Development of recreational facilities around the Lake.
- Providing of Kalyani for Idols immersion
- Sanitary facilities.
- Administrative office cum reception center
- Medical care center
- Handicraft and Curio gift shops.
- Operation and maintenance of the Proposed Project

Detailed investigations and necessary engineering surveys have been carried out to draw plans for all the above components inline with the guidelines of Lake Development Authority, Bangalore as mentioned in the ROP document.

1.3 Methodology: -

For effective and economical management of our water resources, inputs various areas have to be gathered and analysed. The following are the key parameter, which have to be considered,

- Hydrometeorology
- Lake hydrology
- Surface and ground water hydrology
- Assessment of water resources
- Water harvesting and ground water recharge
- Water quality
- Water conservation
- Evaporation and seepage losses
- Recycling and re-use
- Better water management practices and improvements in operational technology
- Soils and material research
- The safety and longevity of water-related structure
- Economical designs for water resource projects
- Use of remote sensing techniques in development and management
- Use of static ground water resource as a crises management measure
- Sedimentation of lakes
- Environmental impact
- Regional equity

All bogus claims

The methodology adopted is broadly organized into three major aspects comprising of urban environment and ecological improvement as under:

1. Assessment of current pollution status of the Lake.
2. Assessment of water inflows
3. Recommendation of engineering measures.

The aspect of assessing the Lake characteristics involved, carrying out the tasks such as preparation of profile of the Hebbal Lake, present condition of lake, sources of wastewater inflow and development trends around the Lake etc. In order to frame the project proposal, the nature and characteristics of the catchments were assessed in terms of its nature and potential to contribute to the pollution of the Lake. The assessment survey comprised of reconnaissance surveys and topographic surveys as elaborated in the following sections.

1.3.1. Assessment of current pollution status of the Lake: -

The objective of this task was to identify the nature and type of sources contributing to the pollution of the lake, pollution load in terms of domestic, industrial and storm water inflows into the lakes and its seasonal fluctuations. The task also involved the following activities.

Task 1: Reconnaissance survey of development pattern and pollution sources, around the Lake.

Prior to the commencement of the engineering surveys, detailed reconnaissance survey of the lake and its surroundings were carried out to assess the exact requirements of the surveys, secondary information pertaining to the lake and its surroundings such as

- Details of the existing sewerage system.
- Details of the existing storm water drainage system.
- Details of natural drainage pattern of the area.
- Meteorological and hydrological data of the region
- Base map of the Lake etc., were collected for further analysis.

Task 2: Assessment of pollution levels in the lake

For the purposes of assessing the pollution levels in the lake during the reconnaissance survey of the lake and its surroundings it was found that there are two storm water inlets existing. One is from the southern side of lake from ring road side and other one is from the western side from Bhadrappa layout. The sewage diversion has been formulated from western side to eastern side by constructing a separate drain on the periphery of the lake but at the time of the heavy rains the existence sewage diversion drain is filled and over flows into the lake along with the floating solid wastes. The existing sluice gate constructed across the sewage diversion drain is damaged. So currently from both the storm water inlets it was found that the huge quantity of floating bodies entered into the lake. Currently as per the electronic total station survey carried out the weeds cover is 62% of the surface of the water body. From both of the storm water inlets area, foul smell is being generated due to decomposing of organic floating matter and stagnation of sewage. Towards southeastern corner at the junction of ring road and National highway and also towards Northeastern corner at waste weir side immersed idols were found, so due to it the decomposition of organic matters is found and a foul smell is being emitted. Inside the lake water body activities like washing the cloths, Cattle bathing, sanitary activities (Toilets) were seen. These activities have lead to the current deterioration of the lake even though the lake has been revived in the recent past.

Task 3: Preparation of Base map.

The objective of this task was to prepare a detailed base map of the Hebbal Lake indicating the exact boundries of the lake along with surrounding details such as roads, surrounding permanent structures, land use, etc.

The essential features of the base map was to identify the exact location of all the water inlets into the lake and indicate them on the base map

Task 4: Profile survey of the lake.

Along with the base map preparation, topographic surveys were carried out to assess the following basic features of the lake.

- Area of the lake
- Bank levels of the lake
- Water level
- Invert levels of the lake so as to indicate the bottom profile
- Bottom level of lake.
- Location and level of all the inlets contributing storm water.
- Details of present utilization of the lake.

Task 5: Estimation of Silt/ Sludge quantity

Based on the profile of the lake developed from the topographic survey, the quantity and thickness of silt accumulated in the lake has been estimated. The profile of the lake was arrived at, by carrying out survey by using the electronic total station surveying equipment with prisms. The levels to obtained were then used to estimate, the total quantity of silt accumulated in the lake.

1.3.2 Assessment of wastewater inflows

Task 6: Assessment of existing wastewater system.

In order to avoid the pollution of lake, the following studies were carried out such as,

- Sewage disposal system adopted for the urban area around this Lake.
- Storm water inflows into the lake carrying silt and solid wastes
- Other wastewater inflows due to
    1. Domestic animal bathing in the lake
    2. Cloths washing in the lake.

In order to arrest the inflow of wastewater into the lake it is required to study the existing sewerage diversion system provided for the Lake.

1.3.3 Recommendation of Engineering measures: -

Task 7: Identification of Lake Remedial measures.

The objective of this task is to formulate remedial measures based on the analysis of pollution sources analyses in the earlier sections. This will broadly comprise of

- De-weeding the weeds and De-silting the bed of the lake
- Prevention of waste water inflow into the lake
- Improvement to harvest storm water into the lake
- Prevent silt and floating solid wastes from entering the lake
- Structural protections.

De-silting of the Lake: -

Options of manual removal or removal through mechanical means such as excavators have been evaluated. The options are influenced by the characteristics of the sludge and its present condition. Presence of toxics and large quantity of sludge will discourage manual removal of sludge. Similarly, liquid and semi-solid status of the sludge will require conditioning measures such as pumping of excess water so as to initiate the process of dredging. The depth of lake and the condition of sludge (septic, dry or liquid) will also influence the options of sludge removal. All these parameters are analyzed and appropriate removal method have been suggested.

Structural protection and surplus flow arrangements: -

Further to ensure that no wastewater enters into the lake and excess storm water is drained safely, appropriate structural protection measures and surplus flow arrangements are recommended based on the assessment of structural condition of the lake. The measures shall also consider rainfall pattern, upstream and downstream characteristics of the area.

Task 8: Recommendation of pollution prevention measures: -

While the earlier task focuses on the measures to renovate the lake by way of de-silting, the objective of the task will be prevent future pollution of the lake by way of taking measures for inflow and silt accumulation.

This will comprise of

- Construction of silt traps and screen barriers.
- Suitable modification for sewage diversion.
- Measures for floating solid waste and silt collection and disposed from the screens and the silt trap.
- Construction of Kalyani for Idols immersion.
- Construction of STP.
- Implementing environmental education programs. Etc.,

Prevention of Wastewater inlets of the lake: - The sewage diversion line helps in avoiding of the entry of wastewater from the unplanned rapidly growing urban extension seen around the lake. By this, the eutrophication of lake and growth of water hyacinth in the lake is avoided completely. The destruction of aquatic flora and fauna is avoided. It helps in the overall maintenance of the condition of lake as also it helps avoid recurring expenditure for the lake maintenance.

Construction of silt traps: - Normally it can be seen silting up of lakes is due to the carrying of silt from the catchments area during the monsoon, which is deposited into the lake along with the surface water flow. The floating solids are also carried by the wastewater and rainwater flowing into the lake. This has to be avoided to upkeep the lake and retain the storage capacity of the lake. The floating solids pollute and choke up the lake, as also spoils the beauty and the aesthetic view of the lake. To cleanup the lake of this silt and floating solids would be expensive and more time consuming as the vastness of the area of the lake is to be considered as well as the watery situation.

It is very essential to avoid silt and floating solids entering the lake. By providing silt traps, the silt flowing through the sewage storm water drain can be totally eliminated from entering the lake. However, the silt collected has to be periodically removed from the silt traps, which can be carried out at regular intervals, which will be easy and economically viable. The same is the case also with floating solids flowing through the storm water drain. This helps in maintaining the lake for a longer period with minimum expenditure.

The silt traps and screen barriers will be put up to the drain width prevalent at the site, to accommodate the storm water flow into the lake

Sanitary facilities: - Public Toilets are essential for use of public visiting the lake as also for upkeep of the cleanliness and hygiene of the lake and surroundings.

Solid waste collection and disposed arrangements: - In order to avoid indiscriminate disposal of solid waste into the lake adequate solid waste collection and disposal arrangements will be recommended to provided screen barriers at storm water inlets.

Chain link fencing around the Lake: - The lake will be secured by providing and constructing a Chain link fencing all around the lake to inhibit the activities like washing, Ares passing into the lake area etc.,

Kalyani for Idols immersion: - At the time of the festival after their pujas the idols are immersed into their nearest water body. As such the public residing in the surrounding of Hebbal Lake area are using the lake for this purpose. After the restoration if again the same process is continued the water body may get affected (such as by decomposing of thrown matters into the lake and dissolved idols immersed into the tank, metals concentration such as lead etc., may increase). It leads to increasing the concentration of pollution of lake water.

Sewage Treatment plant: - During the non monsoon period the depth of the water in the lake depletes due to evaporation and under percolation loss, so to maintain the water level perennially for beautification as well as for recreational facilities and to facilitates flora and fauna, the waste water flow on the upstream side of diversion drain can be treated and allowed to the lake through the wet land to maintain full depth of water in the lake. So a three MLD sewage water treatment plant is proposed.

Environmental education: - This is the most important aspect of improving the status of urban waterways. In order to ensure this, an environmental education program will be designed that could be implemented with the involvement of locals.

The objective of the program will be to apprise the residents of the importance of the lakes and water bodies in the urban ecosystem and the impacts due to polluting the same.

Task 10: - Development of recreational and entertainment facilities.

The areas around the lakes and water bodies will provide excellent environment for the development of recreational and entertainment facilities.

The proposals could include.

- Improvement to existing Park
- Improvement to existing Play spaces
- Improvement to existing Landscape
- Mounds
- Ornamental fountains and water jets.
- Sitting spaces
- Improvement to existing Island
- Boating Jetty
- Improvement to existing Jogging track
- Entrance Arch, litter bins.
- Security office
- Ticket counter
- Open Air restaurant
- Kiosks/food courts
- Watch towers
- Medical care center
- Administrative office cum reception center
- Handicraft and curio gift shop
- Arch bridge
- Boats and Boat house
- Floating restaurant
- Solar lighting

A quick assessment of the entertainment requirements of Bangalore city will be carried out and necessary further Improvements will be recommended.

Task 11: - Project Costing.

Detailed cost estimates will be provided for all the recommended measures as discussed in the earlier tasks. The capital cost of the project will be estimated based on the market prices.

It is proposed to provide one bore well for water supply to maintain the cleanliness of administrative building, medical care center, restaurants, food courts, toilets etc.,

Task 12: - Project Implementation: -

The implementing agency of Hebbal Lake is M/s E.I.H. Ltd., No.39, M.G. Road, Bangalore - 01 with Consultants - M/s VIMOS technocrats & Associates, Bangalore.

1.4 Ownership: -

The lake is situated in Tank Registration No.353, having an area of 60.09 hectare; under the ownership of the government of Karnataka, Extract of Topo sheet is enclosed in Figure1.1.

1.5 Organization of the Report: -

The presentation of this report is organized into the following Eight Sections. The present Section, the first of the report, discusses the scope of the study and the approach adopted for carrying out various tasks to accomplish the same.

The second section of the report presents a brief profile of Bangalore city and Hebbal Lake in terms of its physical and hydrological features.

The Third Section, on the engineering and environmental surveys carried out and discusses the pollution status of the lake.

The fourth chapter based on the information presented in chapters 2 and 3 evaluates various options of engineering measures of Lake Rejuvenation and design the most appropriate option for the lake improvement.

The design of systems and components for lake improvement are discussed in the fifth chapter of the report and the sixth chapter presents operation and maintenance aspects of the project.

The Seventh and Eighth chapters of the report, deals with the project financing, management and monitoring evaluation aspects of the project.

EIH LTD.
19/5/2006
Authorised Signatories

19.5.06
CHIEF EXECUTIVE OFFICER
Lake Development Authority
BANGALORE

Task 11: - Project Costing.

Detailed cost estimates will be provided for all the recommended measures as discussed in the earlier tasks. The capital cost of the project will be estimated based on the market prices.

It is proposed to provide one bore well for water supply to maintain the cleanliness of administrative building, medical care center, restaurants, food courts, toilets etc.,

Task 12: - Project Implementation: -

The implementing agency of Hebbal Lake is M/s E.I.H. Ltd., No.39, M.G. Road, Bangalore - 01 with Consultants - M/s VIMOS technocrats & Associates, Bangalore.

1.4 Ownership: -

The lake is situated in Tank Registration No.353, having an area of 60.09 hectare; under the ownership of the government of Karnataka. Extract of Topo sheet is enclosed in Figure1.1.

1.5 Organization of the Report: -

The presentation of this report is organized into the following Eight Sections. The present Section, the first of the report, discusses the scope of the study and the approach adopted for carrying out various tasks to accomplish the same.

The second section of the report presents a brief profile of Bangalore city and Hebbal Lake in terms of its physical and hydrological features.

The Third Section, on the engineering and environmental surveys carried out and discusses the pollution status of the lake.

The fourth chapter based on the information presented in chapters 2 and 3 evaluates various options of engineering measures of Lake Rejuvenation and design the most appropriate option for the lake improvement.

The design of systems and components for lake improvement are discussed in the fifth chapter of the report and the sixth chapter presents operation and maintenance aspects of the project.

The Seventh and Eighth chapters of the report, deals with the project financing, management and monitoring evaluation aspects of the project.

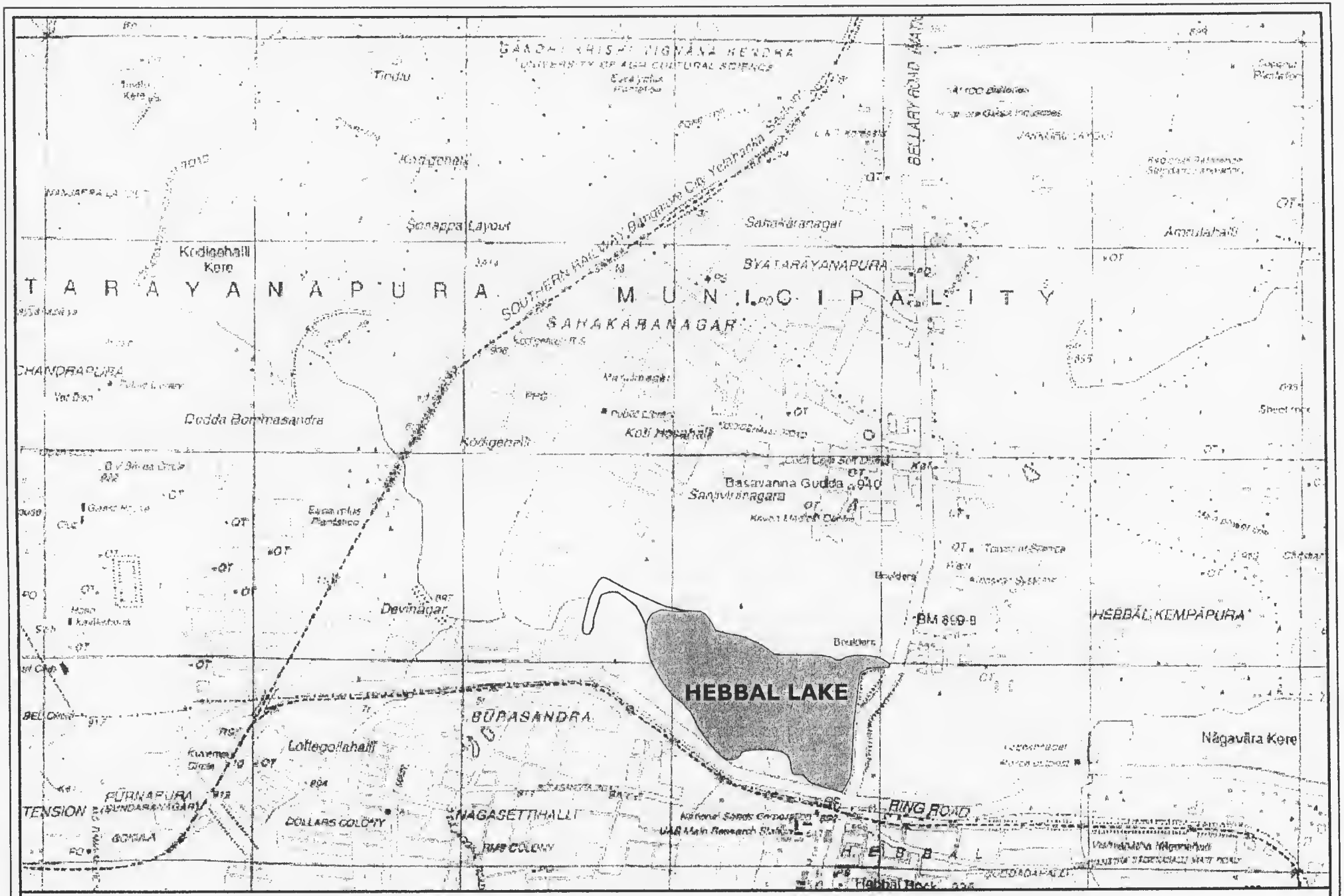


FIGURE NO. 1.1 EXTRACT OF S.O.I. TOPOSHEET INDICATING THE HEBBAL LAKE, BANGALORE.

CHAPTER –2

STATUS OF THE LAKE SYSTEM

2.1 Introduction: -

Understanding the functioning of the lake system and its present pollution status is very important for identifying measures for rejuvenation. The present section based on detailed profile surveys reviews the status of the lake system; it's functioning and utility to the urban ecology of Bangalore. For the purposes of better understanding of the local conditions, a general profile of Bangalore and Socio-economic conditions is also discussed in this section.

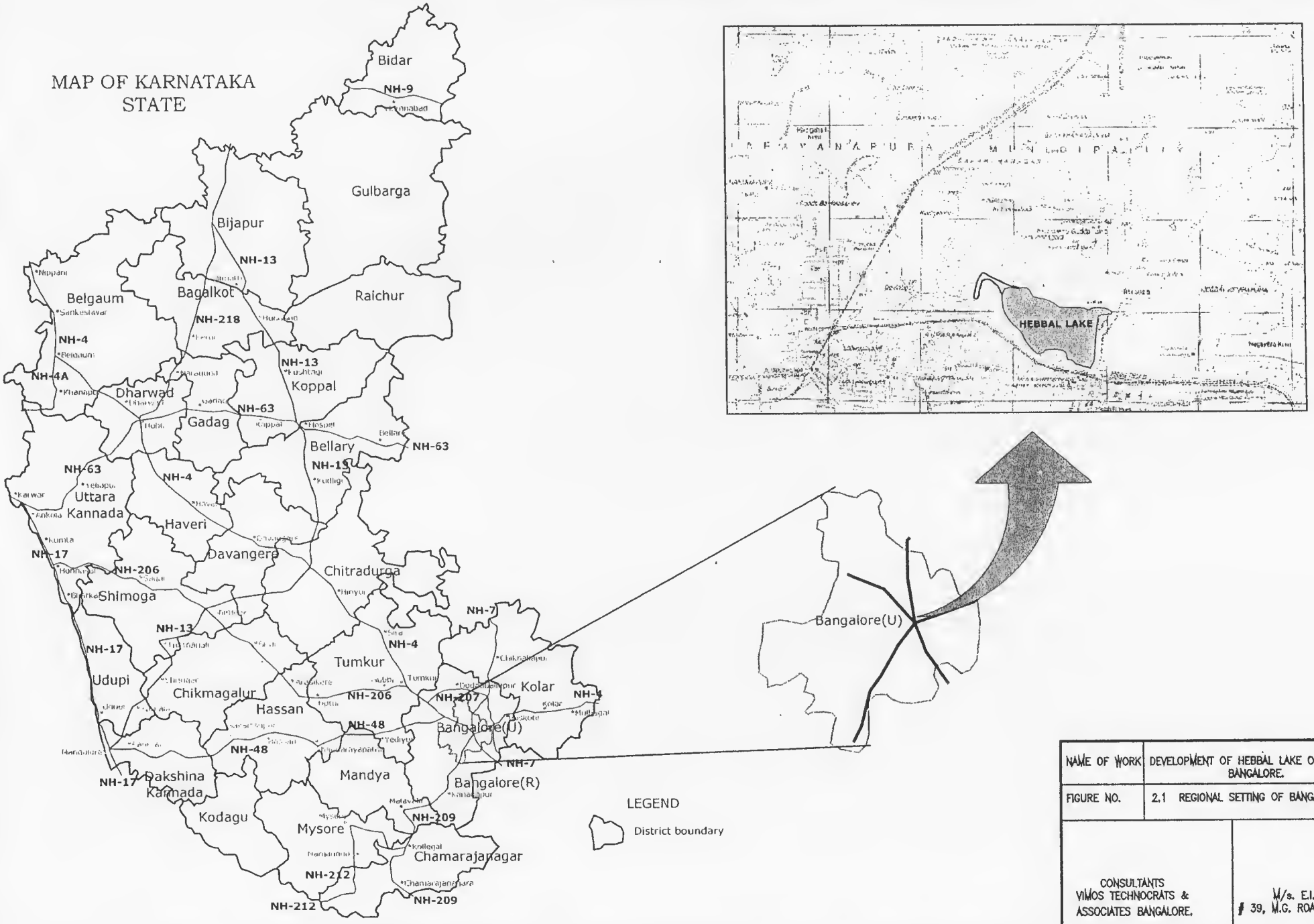
2.2 Profile of Bangalore City: -

Banalore city is very old founded by Kempe Gowda by designating Bendakaluru is situated in the South Deccan Peninsular India to the South-Eastern corner of Karnataka State between the latitudinal parallels of 12°39' N and 13°18' N and Longitudinal meridians of 77°22' E and 77°52' E at an average elevation of about 900 meters covering on area of 451 Sq.Km having a population of 69 lakhs in the year 2001.The map of the Regional setting is shown in figure 2.1. The Bangalore is the capital of Karnataka is variously known as the Air-conditioned city, Garden city, Pensioner's paradise and Pub city. Today, Bangalore sports a new label as the Silicon Valley of India, having the unique distinction of producing the largest number of software professionals in the world. Throbbing with life and buzzing with industrial activity, Bang lore's salubrious climate and industrial-conducive environment has made it the destination of choice for some of the most prestigious MNCs in the world.

The climate of Bangalore are ranging from 32 ° C - 36 ° C in the hottest month of April to 14 ° C - 19 ° C in the winter months and the lowest minimum of 14 ° C in January. The average rainfall is 976 mm per year. There are 1.2 lakhs of bore wells are established in the city.

2.3 Profile of Hebbal Lake: -

A large tank, Hebbal Lake is located in the North of Bangalore, abutting Ring Road on its South and Bellary Road on its east, it is 9 Kms away from Vidhana Soudha.The very fact that the lake's water was used for drinking purposes, earlier clearly contrasted its present condition. Moreover, the lake occupies a special place, as it is a vital habitat for migratory birds. With the growth of greater Bangalore, the Hebbal Lake came under strain due to continuous inflow of untreated sewage and effluents entering the lake from the catchments area as also the vehicular pollution on the Bangalore-Hyderbad highway. This led to the alteration in the nature of the habitat for fish, birds and other aquatic plants with the growth of dangerous weeds like water hyacinth etc., The problem was further complicated by the fact that gradual siltation over the years had created deep layer of artificial subsoil on the lakebed. While reducing the water holding capacity of the lake, this completely stopped the recharge of ground water. As the lake was



NAME OF WORK	DEVELOPMENT OF HEBBAL LAKE ON D.O.T. BASIS AT BANGALORE.
FIGURE NO.	2.1 REGIONAL SETTING OF BANGALORE.

CONSULTANTS
VIMOS TECHNOCRATS & ASSOCIATES BANGALORE.

M/s. E.I.H. LTD,
39, M.G. ROAD, BANGALORE-01

hydrologically inter-connected to the other lakes in the chain, it received and in turn transferred the pollutants to lakes in the downstream.

The Hebbal Lake receives water inflow from its catchments that covers localities of Yeshwanthpura, Matthikere, RMV, BEL and HMT colonies, Nagavara, Narsipura and other layouts. The water of Hebbal Lake had earlier been used for drinking purposes by the local residents, in addition for use by the forest nursery, fisheries department and agriculture lands in the adjacent areas. Most of catchments area is covered by buildings and industries while some portion is used for agriculture. The catchments area has a good tree cover in plantations, parks and factory colonies.

Ecologically, the tank had a special place in the chain of Bangalore tanks, as it was a vital habitat for migratory birds. Prior to 1984, in a district seasonal cycle, most of the area in the lakebed used to dry during summer with sporadic small pools of water. As these small pools were the only support systems for fish and aquatic fauna, they exhibited a concentration of the fish and hence attracted several migratory birds who came to Hebbal in search of food and for nesting.

Over the last few decades, the Hebbal valley has been seriously affected by the continuous inflow of untreated sewage and effluents entering the lake from the catchments area and vehicular pollution of the traffic on national highway (NH-7) and Ring road. The pollution not only disturbed the seasonal cycle but also filled the lake with eutrophic water throughout the year. It is turn, altered the nature of the habitat for fish, birds and other aquatic plants with dangerous aquatic weed like water hyacinth, Eichhornia Crassipes, Cyperaceae etc. infesting the lake severely. However, as important was the change in the content of the lake. Gradual siltation over the years created a deep layer of artificial subsoil on the lakebed. This had an adverse impact in two ways: it reduced the water holding capacity of the lake itself, and two, recharge of the ground water was completely arrested.

The Department of Forest, Ecology & Environment and Government of Karnataka has made efforts to rejuvenate the Hebbal Lake under INEP in 2001-02.The Aerial photograph of Hebbal Lake after restoration under INEP as shown in figure 2.2. Presently due to heavy rains the existence sewage diversion drain is filled and over flow into the lake along with the floating bodies. The existing sluice gate constructed across the sewage diversion drain is damaged. So from both the storm water inlets found that the huge quantity of floating bodies entered into lake. Weeds covered 62% of the water body. From both the storm water inlet areas foul smell is emitted due to decomposing of organic floating matters. Towards southeastern corner at the junction of ring road and National highway and also towards Northeastern corner at waste weir side the immersed idols were found, due to it the decomposition of organic matters is found and a foul smell is being emitted. Also inside the lake water body activities like washing the cloths, Cattle bathing, sanitary (Toilets) activities were going.

Some of the articles published in the daily newspaper during the year 2003 & 2004 about pollution of Hebbal lake after restoration under INEP are as mentioned below and also Pictorial views of the same are shown in figure 2.3.

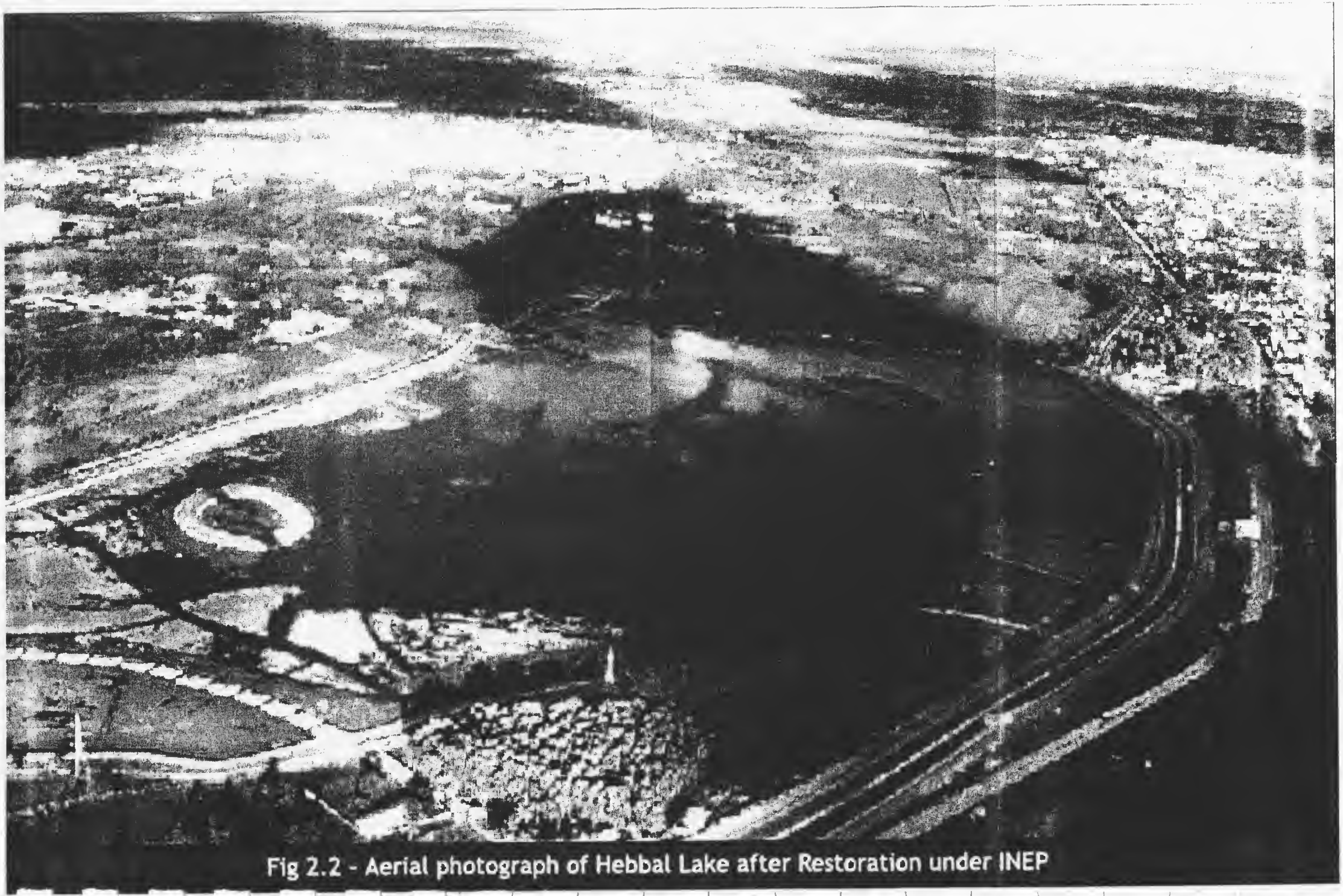


Fig 2.2 - Aerial photograph of Hebbal Lake after Restoration under INEP

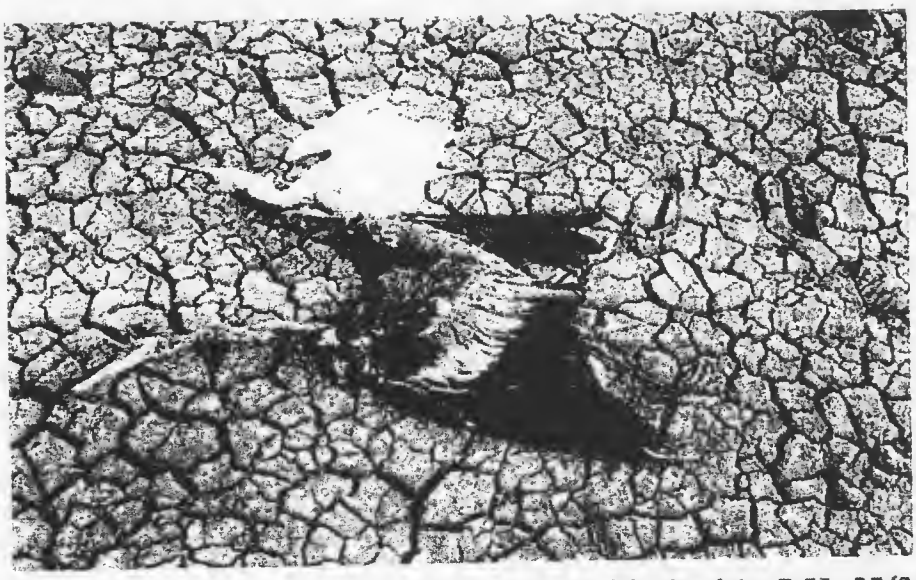


Photo of Dead Birds seen at Hebbal Lake, published in DH, 05/06/2003

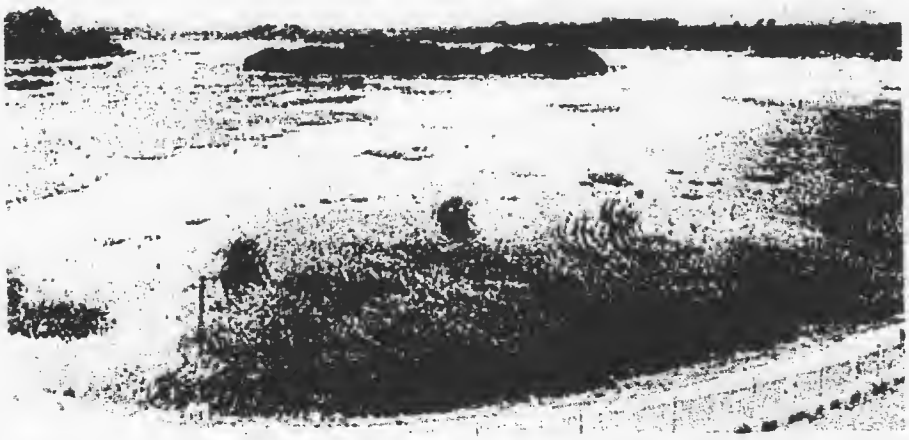


Photo of Hebbal Lake covered with Weeds, published in DH, 17/06/2004

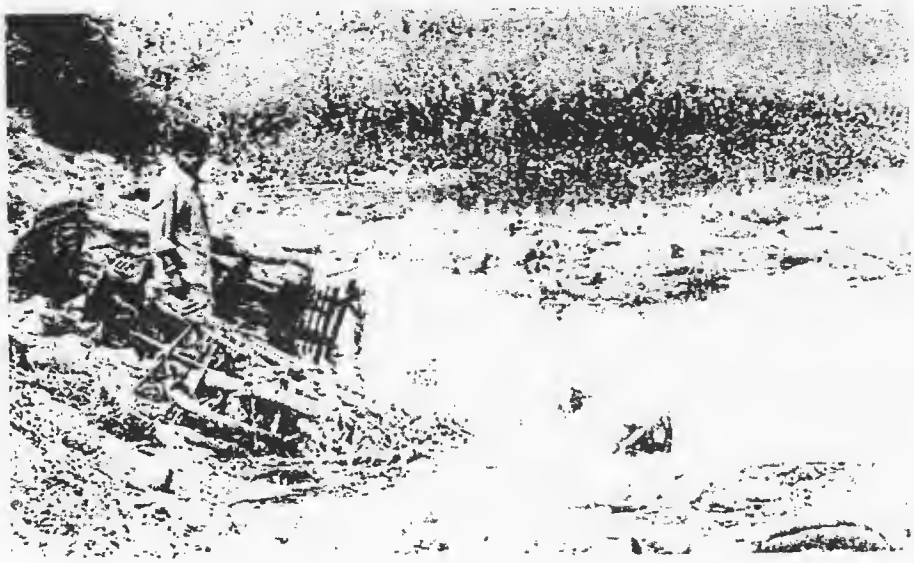


Photo of Hebbal Lake showing residue of the Idols immersed, published in Prajavani 15/10/2004

Fig. 2.3

- Article Published in DECCAN HEARLED English daily newspaper on June 5, 2003 in front page under heading " An egret and a cormorant died in Hebbal Lake, Bangalore probably due to dehydration".

  - It happens due to the storm water diverted into the wastewater flow drain instead off taking into the lake.
  - It affects on the population of Migratory birds life.

- Article Published in DECCAN HEARLED English daily newspaper on June 17, 2004 under heading "Killer weed Hebbal Lake", that was de-silted recently is partially filled with water after rains, But weeds seem to be spreading rapidly and if not checked, might rob the lake of its new life.

  - It may have happened due to the entry of wastewater into the lake.
  - It affects on the flora, fauna, beauty of lake and recreational facilities.

- Article Published in PRAJAVANI Kannada daily newspaper on October 10, 2004. The pictorial view shows "About polluted Hebbal Lake water" showing the floating solids (due to the activities of idols immersion) and weeds grown inside the lake and also states about the importance of maintenance for conservation of Hebbal Lake.

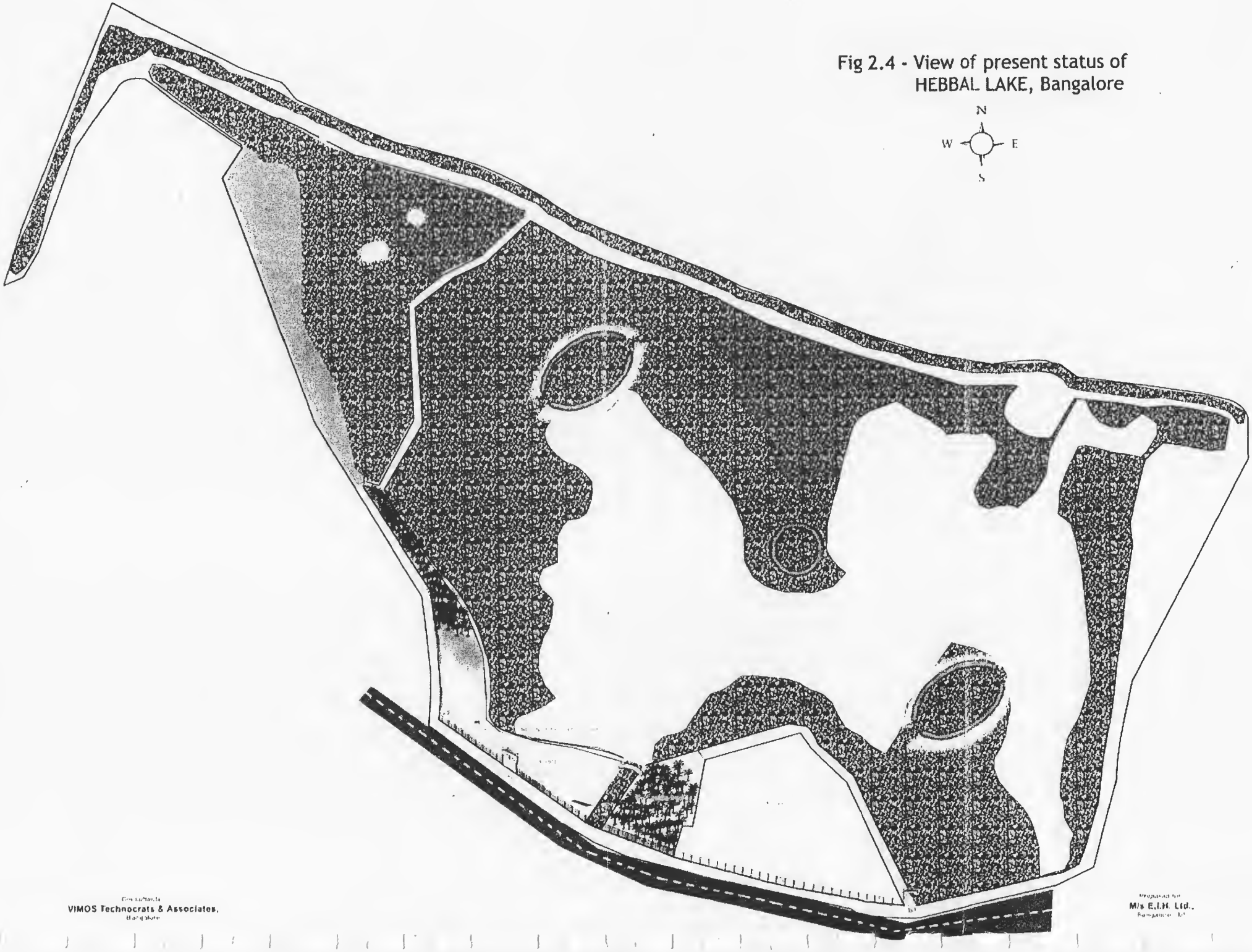
From the above articles it implies that there is a necessity of Conservation of Hebbal Lake, even though Restoration and Conservation of the Hebbal Lake had been taken up during 2001-02 under INEP where in mechanism for diversion of waste water, collection and removal of silt and floating wastes entering into the lake have not been properly implemented, improvements to storm water intake, boundary protection and providing of separate idols immersion arrangement have not been envisaged.

Table 2.1 Details of Hebbal Lake

Sl.no.	Item	Details
1	Basin	Cauvery
2	Area of the lake	150 acres
3	Water spread area	127 acres
4	Catchments area	2393.75 ha
5	Live capacity of lake (Before desilting)	849 million litres
6	Live capacity of lake (After desilting)	1298 million litres
7	Shore length	3800 mt

With regards to the details of lake as shown in table 2.1 and the present status of lake as shown in figure 2.4 the lake has one outlet which discharges the surplus water to the down stream, towards Northeastern side.

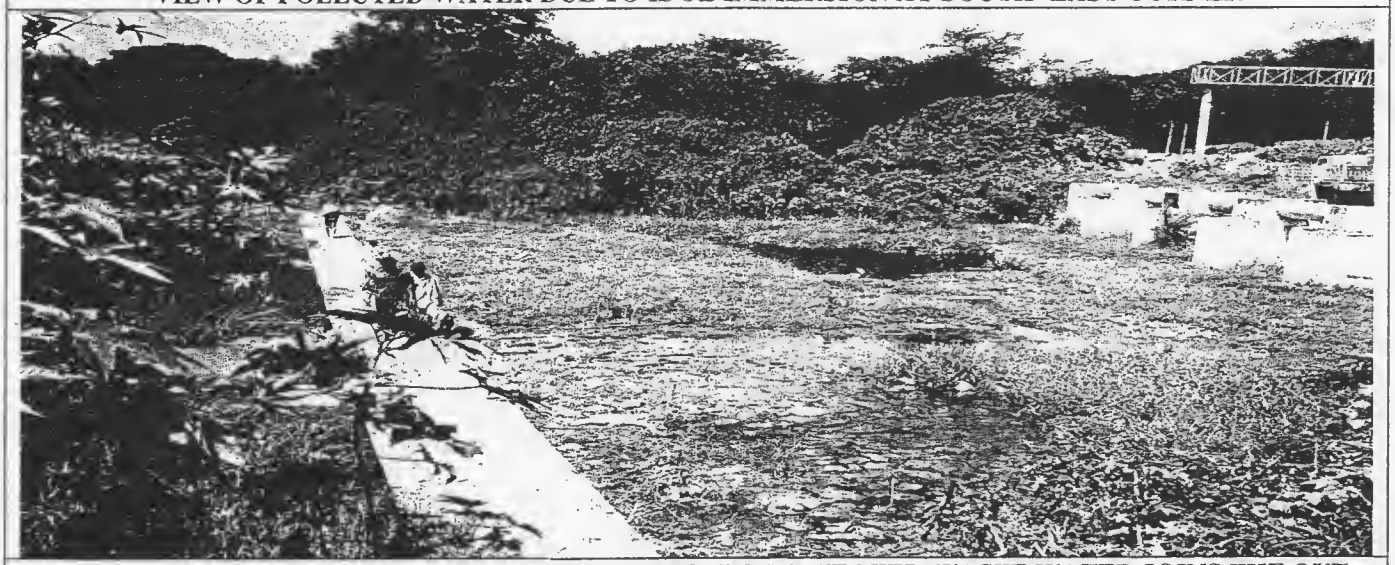
Fig 2.4 - View of present status of
HEBBAL LAKE, Bangalore



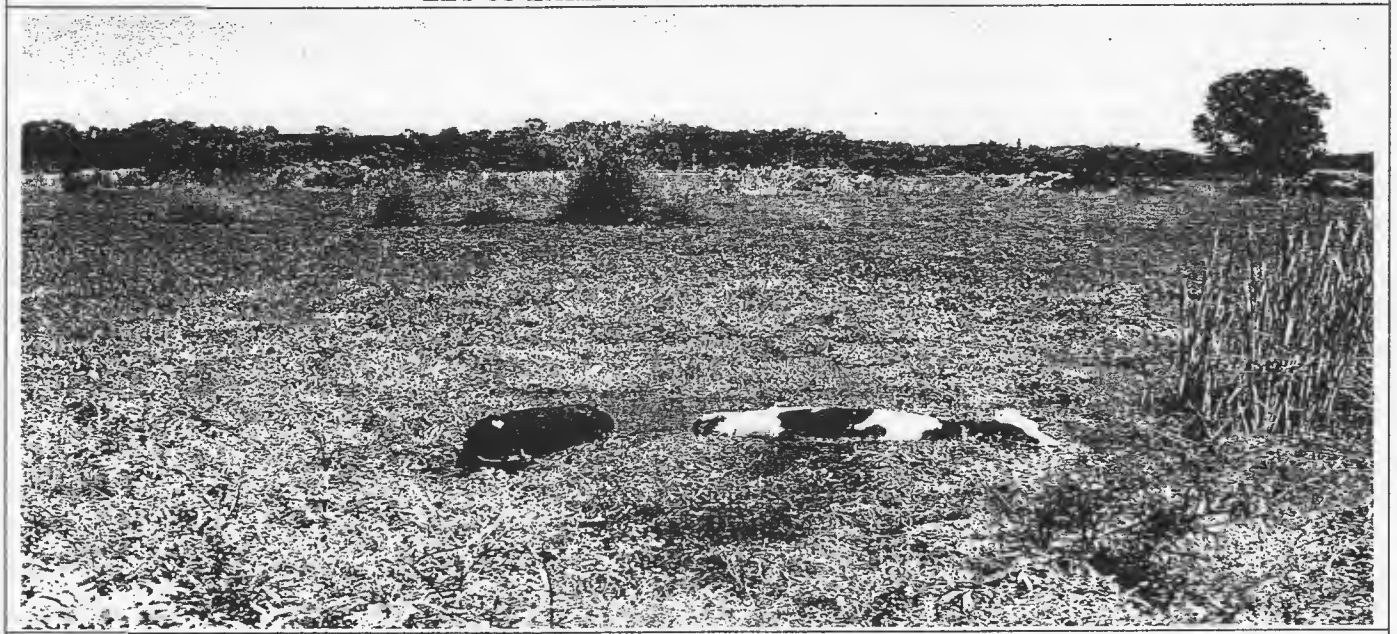
Prepared by
VIMOS Technocrats & Associates,

Prepared for
M/s E.I.H. Ltd.,

VIEW OF POLLUTED WATER DUE TO IDOL IMMERSION AT SOUTH- EAST CORNER



VIEWS OF IDOL IMMERSION, WASTE WEIR & FLOW OF DIVERTED WASTE WATER JOINS THE OUT LET OF LAKE AT NORTH-EAST CORNEER



CATTLES BATHING AT SOUTHERN SIDE

FIGURE NO 2.5: DIFFERENT PICTORIAL VIEWS OF PRESENT HEBBAL LAKE

Topographic survey of the Lake: -

While some preliminary idea of the lake is available from secondary sources, authentic information on depth of the lake, level of sludge accumulated etc., were not available from any of the agencies involved in the lake operations. This information is critical to judge the necessity of de-silting the lake and its regular operations.

With this objective and to get the further physical details of the lake, a detailed topographic survey of the lake and its surroundings was carried out in the month of October 2004. The objective of the Survey was to find out exactly, the characteristics such as,

- Area of the lake
- Depth of the lake
- Water spread
- Sludge/sediment accumulated
- Invert levels of the inlets and outlets to the lake and
- Weeds covered area.

To get accurate information on the terrain elevation detailed topographic survey was conducted using electronic total station instrument. The temporary benchmarks were fixed on the Wall of waste weir of lake. Different Pictorial views of present Hebbal Lake are shown in figure 2.5

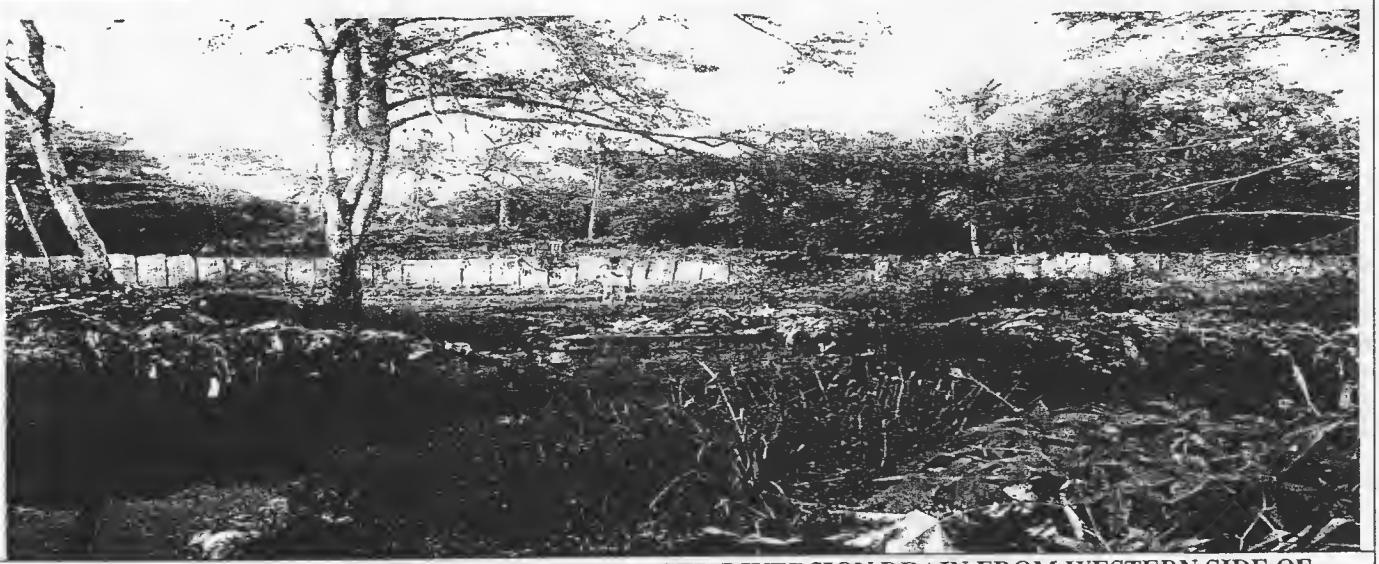
The deepest point of the lake being RL 96.69. At present the average depth of water in the lake is about 1.05 mt. To increasing the water holding capacity of lake, the desilting for Hebbal Lake is proposed for the area of 111 acres (Tank 1) average depth of 1 mt. To maintain the lake being always full as water should be available through out the year for recreational activities etc., desilting of the lake is very essential to increase the water holding capacity of lake. The total quantity of silt to be excavated is estimated as 450000 cum. After desilting the water holding capacity of lake increases by 35%. The excavated silt is proposed to be utilized for improvements of slope correction of bund, Landscaping area, Garden area, island etc.

2.4 Pollution Sources: -

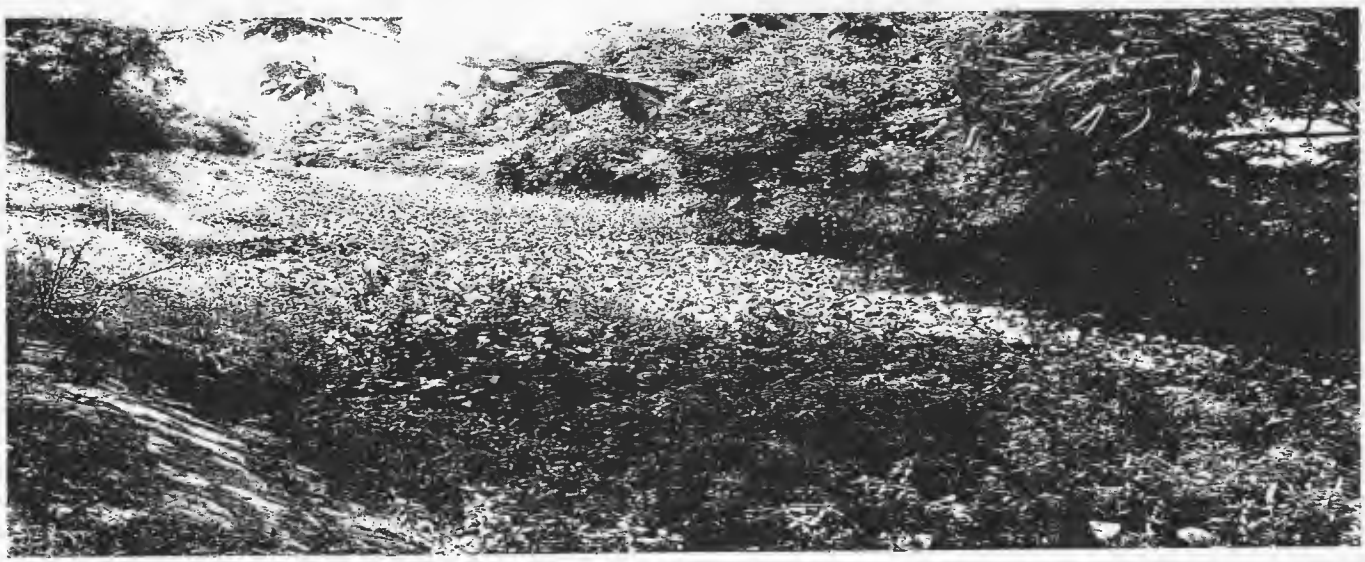
The major sources of pollution of the Hebbal Lake are

- Use of lake surroundings, for number of public uses such as community toilet, idol immersion, cloth washing, cattle bathing etc.,
- Indiscriminate arrangement for wastewater flow discharge.
- Intense residential activities.

VIEW OF STORMWATER INLET FROM WESTERN SIDE AT BHADRAPPA LAYOUT



VIEW OF THE WASTEWATER FLOW IN DAMAGED DIVERSION DRAIN FROM WESTERN SIDE OF BHADRAPPA LAYOUT

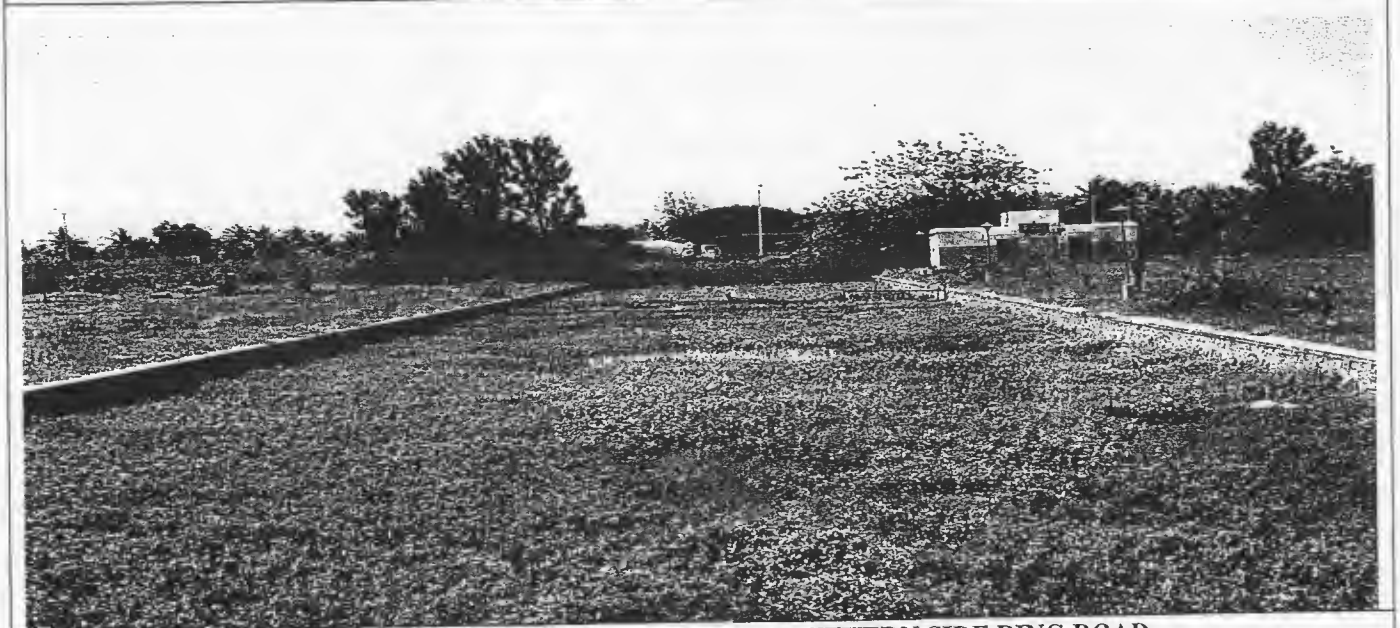


VIEW OF THE GROWTH OF WEEDS IN WASTEWATER FLOW DRAIN AT NORTHERN SIDE

FIGURE NO 2.5: DIFFERENT PICTORIAL VIEWS OF PRESENT HEBBAL LAKE

VIEW OF BATHING AT NORTHWESTERN SIDE

VIEW OF WASHING ACTIVITIES AT NORTHEASTERN SIDE

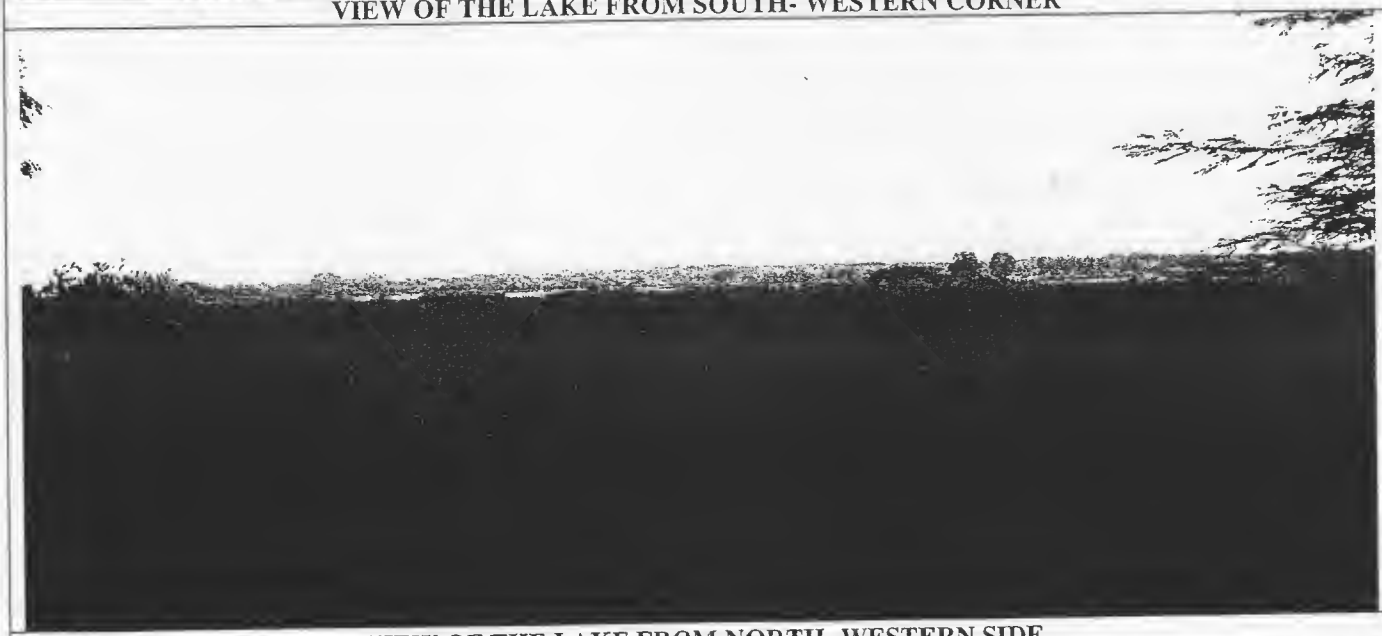


VIEW OF STORMWATER INLET FROM SOUTHERN SIDE RING ROAD

FIGURE NO 2.5: DIFFERENT PICTORIAL VIEWS OF PRESENT HEBBAL LAKE

VIEW OF WEEDS INSIDE THE LAKE TOWARDS SOUTH-WESTERN SIDE

VIEW OF THE LAKE FROM SOUTH- WESTERN CORNER

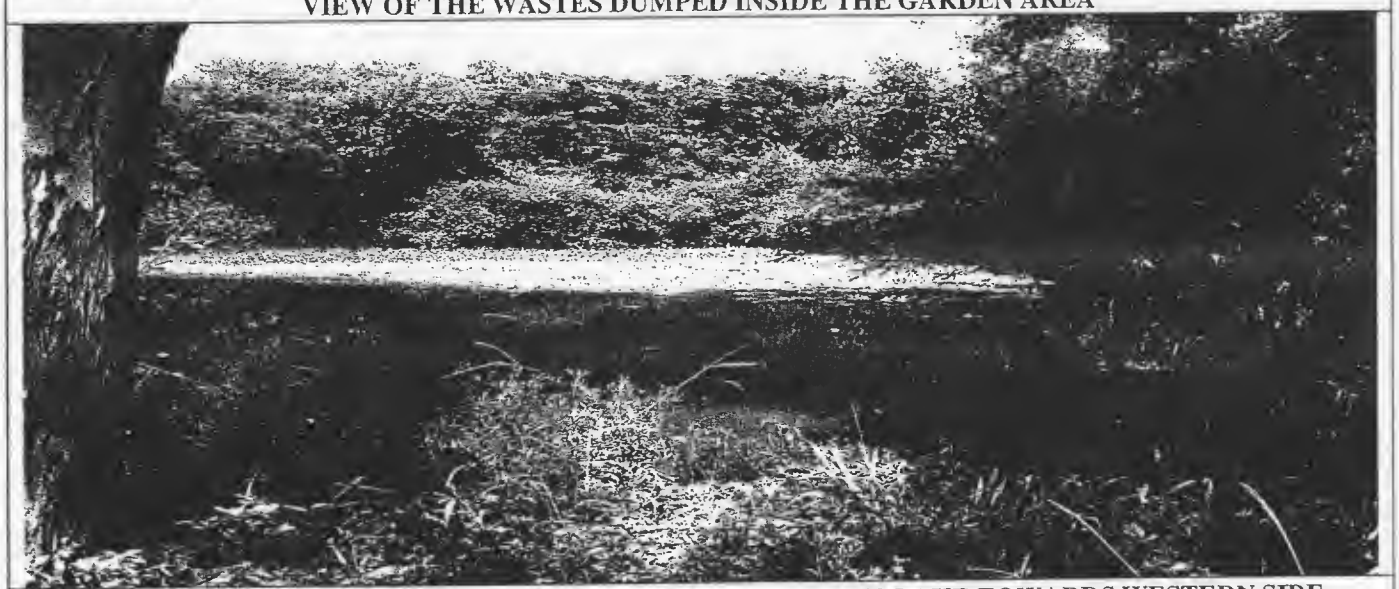


VIEW OF THE LAKE FROM NORTH- WESTERN SIDE

FIGURE NO 2.5: DIFFERENT PICTORIAL VIEWS OF PRESENT HEBBAL LAKE

VIEW OF THE JOGGING TRACK TOWARDS NORTHERN SIDE OF LAKE

VIEW OF THE WASTES DUMPED INSIDE THE GARDEN AREA

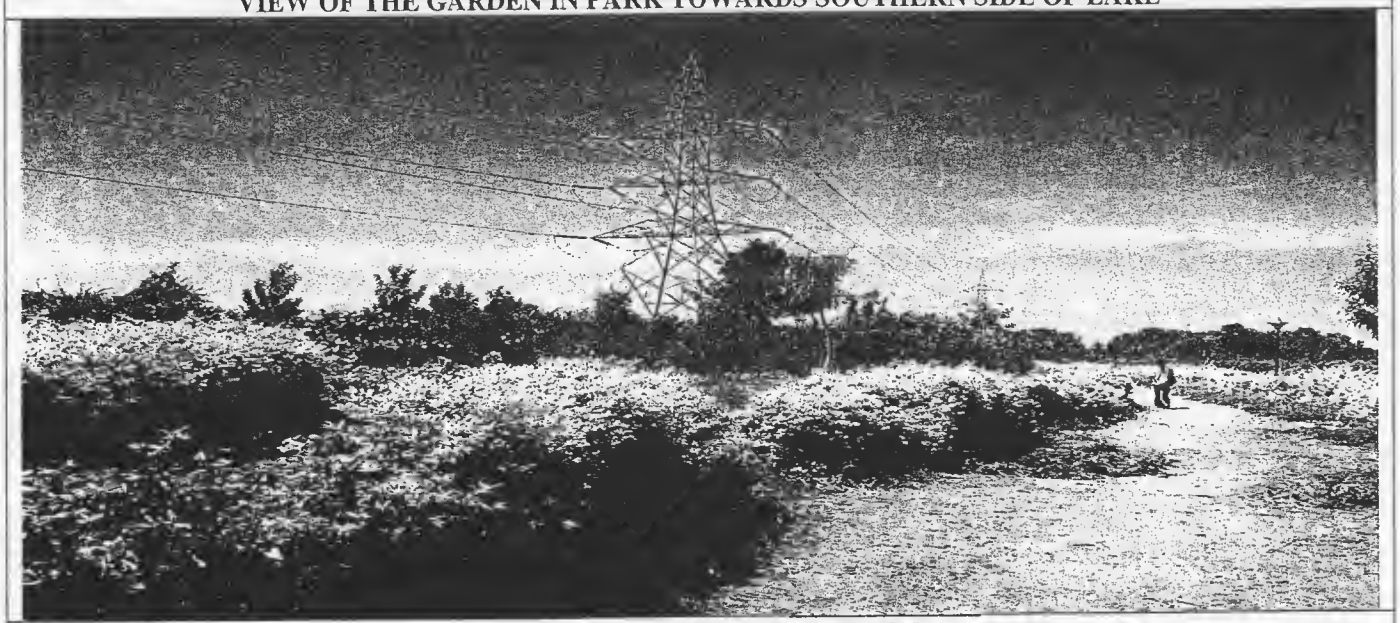


VIEW OF THE FLOATING BODYS ARE STACKING INSIDE THE LAKE TOWARDS WESTERN SIDE

FIGURE NO 2.5: DIFFERENT PICTORIAL VIEWS OF PRESENT HEBBAL LAKE

VIEW OF BOATING JETTY

VIEW OF THE GARDEN IN PARK TOWARDS SOUTHERN SIDE OF LAKE



VIEW OF PATH WAY IN GARDEN

FIGURE NO 2.5: DIFFERENT PICTORIAL VIEWS OF PRESENT HEBBAL LAKE

2.5 Past and current uses of the Lake: -

In the Past the Lake water was used for drinking water supply purposes. Current (present) and In future used for,

- Recharge of ground water as it indirectly helps to increase the ground water table.
- It will help in improving the quality of ground water.
- Directly it will benefit the people of Bangalore for their regular activities such as,
  - → Water supply due to increase in water level of bore wells in the effective surrounding area.
  - → Recreational facilities.
  - → Fishing
- To encourage eco-tourism
- To support lake for bio-diversity.
- To maintain the eco-balance

EIH LTD.
19/5/2006
Authorised Signatories

CHIEF EXECUTIVE OFFICER 19.5.06
Lake Development Authority
BANGALORE

Exactly what does this sign endorse ?!

representative claimed to be a relative of a "famous" "conservationist" —

2.5 Past and current uses of the Lake: -

In the Past the Lake water was used for drinking water supply purposes. Current (present) and In future used for,

- Recharge of ground water as it indirectly helps to increase the ground water table.
- It will help in improving the quality of ground water.
- Directly it will benefit the people of Bangalore for their regular activities such as,
  - → Water supply due to increase in water level of bore wells in the effective surrounding area.
  - → Recreational facilities.
  - → Fishing
- To encourage eco-tourism
- To support lake for bio-diversity.
- To maintain the eco-balance

CHAPTER – 3

INVESTIGATIONS FOR LAKE REJUVENATION

As discussed in the earlier sections, the major sources of pollution to the lake are domestic wastewater inflows and indiscriminate disposal of solid waste in the lake by the intense human activity around the lake. In the absence of any earlier technical studies and in order to frame the engineering measures for Lake Rejuvenation, detailed reconnaissance surveys are carried out.

For the purposes of assessing the pollution levels in the lake by reconnaissance survey of the lake and its surroundings found that there are two storm water inlets are existing one is towards from the southern side from ring road and other one is towards the western side from Bhadrappa layout. The waste water diversion was formulated from western side to eastern side by constructing a separate drain by the side of the lake but at the time of the heavy rains the existence waste water diversion drain is filled and over flow into the lake along with the floating bodies and also found that the existing waste water carrying drain is damaged at several places. The existing sluice gate constructed across the wastewater diversion drain is damaged. So from both the storm water inlets found that the huge quantity of floating body exists. Weeds cover the 62 % of surface area of water body. From both the side of the storm water inlet areas foul smell is coming due to decomposing of organic floating matters presence. Towards southeastern corner at the junction of ring road and National highway and also towards Northeastern corner at waste weir side the immersed of idols are found, so due to it the decomposition of organic matters is found and a foul smell is coming up. Also inside the lake found that the activities of washing the cloths, Cattle washing, sanitary activities (Toilets) are going.

From the reconnaissance survey, concluded that from the above mentioned points,

- The lake water is darkish in colour due to decomposition of organic matter and entry of wastewater through the storm water inlets; it leads to deplete the dissolved oxygen content in the lake and also the water will become turbid.
- The foul smell is coming due decomposition of organic matter.
- The weeds are grown on surface of water body due to the entry of wastewater into the lake, they lost the appearance of lake beauty
- Due to the existence of floating body on the surface of water body found that, they lost the appearance of beauty.
- Due to, bathing activities of the cattle in the lake, they can pass the urine and dung; the lake floor will be affected badly. The cattle are also fed on the floating larvae and other macrophyes. Which spoils the lake eco-system. Because of cattle washing in the lake, not only leads to the pollution of lake, it leads to the out break of contagious diseases like Foot and Mouth, Hemorrhagic septicemia, Black quarter from one animal to another animal within no time by ingestion of contaminated water, which

in turn leads severe economic loss to the owner and country also. The parasitic infection is also one of the severe economic losses in the milk animals. This spreads from one animal to another animal by ingestion of Dung contaminated water.

- Bathing and cloth washing involves detergents / soap usage, dirt removal from the cloth fabrics. The detergents, soap and dirt, which will leads to pollute the lake water.
- The surface water flow from the south western corner of the agricultural fields, they contain toxic chemical pesticides, weedicides and chemical fertilizer being used in the fields of the catchments area leads to pollute the lake water.
- The pollution of the lake water will lead to affect on flora and fauna of the eco-system of the lake.
- Due to pollution of lake water it will indirectly affect on to the groundwater quality.

CHAPTER –4

DESIGN OF ENGINEERING MEASURES FOR LAKE REJUVENATION

4.1 Introduction

Information generated in the previous sections indicates that the sediment accumulated in the lake with seeds of weed. The preventive measure for the rejuvenation of Hebbal Lake will broadly comprise of

- Deweeding (Control of eutrophication)
- Dredging and de-silting the accumulated sludge.
- To provide silt trap and screen barriers, in future to prevent the silting up of lake and also to avoid floating matters enters into the lake.

4.2 Control of eutrophication: -

The method of controlling eutrophication, permanently by prevention of wastewater inflows into the lake is adopted for rejuvenation of Lake. For this, an improvement to existing wastewater drain is adopted to avoid the entry of wastewater into the lake. By adopting this method the quality of the lake water will not be disturbed and also the destruction of aquatic flora and fauna is avoided. The maintenance expenditure can be also reduced.

Prevention of wastewater from entering the lake by adopting an improvement to existing wastewater carrying open drain by diverting it into the outlet waterway nalla will help in preventing the pollution of the lake. Diverting the pollution load entirely is thus extremely beneficial. The diverted flow must only contain the domestic wastewater and it should be ensured that the diversion does not carry the storm water flow that is the source of fresh water inflow into the lake.

4.3 Removal of Bottom sediments: -

Removal of bottom sediments becomes essential when the lake reacts in hypereutrophic stage. Where in the internal nutrient recycling, is often the major portion of annual nutrient loading, so that the reduction or complete removal of the external loading is really inactive in reducing the total nutrients available for bio mass production.

In case of Hebbal Lake, the internal recycle of nutrients is substantially high and the contribution from the wastewater flow and accumulated in the bottom of lake is substantial. Also the lake's wash out time is less than one year and some of the organics that has occurred in the bottom sediments over the years will diminish through gradual natural out process, once the wastewater inflows are curbed.

However, in view of the proposed recreational and boating facilities and use of a portion of the lake area for development of recreational facilities, it is recommended to desludge/desilt the accumulated 4,50,000 Cum, of sludge as a

permanent option of lake rejuvenation and provide silt traps to avoid silting of the lake in future.

4.4 Control of Solid waste disposal: -

The other major contributor of contamination of Hebbal Lake is indiscriminate disposal of solid waste. This is primarily due to

- Intense human and commercial activity around the lake.

The change of activity pattern can be done by way of proposed development of recreational facilities in and around the lake and imposing restricting on indiscriminate waste disposal.

Dramatic changes in the public perception could be expected soon after the rejuvenation of the lake and commencement of the recreational facilities.

4.5 Control of waste floating bodies: -

The other major contributor of contamination of Hebbal Lake is entry of waste floating bodies into the lake through the storm water inlets. It will leads to foul smell, after decomposition of organic floating bodies and also the surface of the water body will loss its beautification and looks ugly and also it will affect on flora and fauna. The change of activity pattern can be done by way of proposing a construction of screen barriers at storm water inlets

19.5.06

CHIEF EXECUTIVE OFFICER
Lake Development Authority
BANGALORE

EIH LTD.

19/5/2006

Authorised Signatories

permanent option of lake rejuvenation and provide silt traps to avoid silting of the lake in future.

4.4 Control of Solid waste disposal: -

The other major contributor of contamination of Hebbal Lake is indiscriminate disposal of solid waste. This is primarily due to

- Intense human and commercial activity around the lake.

The change of activity pattern can be done by way of proposed development of recreational facilities in and around the lake and imposing restricting on indiscriminate waste disposal

Dramatic changes in the public perception could be expected soon after the rejuvenation of the lake and commencement of the recreational facilities.

4.5 Control of waste floating bodies: -

The other major contributor of contamination of Hebbal Lake is entry of waste floating bodies into the lake through the storm water inlets. It will leads to foul smell, after decomposition of organic floating bodies and also the surface of the water body will loss its beautification and looks ugly and also it will affect on flora and fauna. The change of activity pattern can be done by way of proposing a construction of screen barriers at storm water inlets.

CHAPTER-5

DETAILS OF DESIGN AND COST ESTIMATION

5.1 Introduction

As discussed in the earlier sections, it can be summarized that the final composition of lake rejuvenation will involve dredging the sediments from the Lake Bottom, improvements to lake area bund strengthening, deweeding, improvements to existing waste water diversion drain, sewage treatment plant, Silt traps and screen barriers, landscaping, beautifying the lake surroundings for recreational purposes and educating the community on various environmental aspects of Hebbal Lake conservation.

The present section will elaborate on the design and cost estimation of the all the above components.

5.2 De-silting, De-weeding and improvements to bund strengthening of the Hebbal Lake

As identified in chapter 4, it has been concluded that the dredging of the lake sediments is unavoidable to rejuvenate Hebbal Lake. Since the lake can be emptied during the summer periods, it will also not very difficult to dredge the same by means of mechanical equipment during the lean period

The design criteria for the sludge extraction and removal primarily constituted of the following components,

- Volume of sediments to be extracted
- Method of extraction and
- Re-use of sediments

Volume of sediments to be extracted from the lake bottom has been estimated through a detailed survey of the tank and its bottom profile. Based on the bottom profile, the de-sludging quantity is calculated and a detail of cost estimation is done as shown in table 5.1. However for the purpose of project execution a uniform bottom level is being considered.

The existing bottom of the lake is consists off sediments, de-silting is being proposed to increase the water holding capacity of the lake and also to reduce the effect of weed seeds present in the bottom of lake along with sediments, as the tank gets reduces the water in the lake during the summer season. Since soil/earth is required for the improvements of existing children park, correction of bund, pathways, Island etc., is found feasible to remove the soil from the bed of the lake and use the same for the above proposed activity instead of conveying it from large distances from outside which neither decreases the cost nor increase the water holding capacity of the lake

Proposed for de-weeding it is covered by Nearly about 62% of the water body of the lake area and also to provide revetment towards newly developed bund towards the NH side and improvements to existing damaged revetment on sides of bund and island.

The detailed estimate includes de-silting, de-weeding, strengthening the bund by revetment and turfing as show in Table 5.1 The fig.5.1 shows a typical cross-section of the bund proposed to be formed for the pathway

5.3 Lake area development, Land scapping, beautifying the lake surroundings for recreational purposes.

As discussed in the earlier chapters, a **pathway** is essential for strolling, walking by the side of the lake on bund. (The natural beauty and the pleasant environment around the lake area offer an excellent spot for morning walkers and joggers). There is a necessity of improvements to existing pathway, where it is located towards Northern and Southern side of bund at present about 80% of pathway is covered by unwanted plants, it should be cleared and paved by using interlocking blocks.

For the **protection of the Lake Boundary** and **aesthetics**, chain link fencing is proposed to be provided all round the boundary of lake where it is not fenced and also a necessity of improvement to existing chain link fencing towards park boundary towards ring road side. For the periphery of the water body all round a railing is proposed for the aesthetical improvement.

It is proposed to development of the existing bund to use for jogging track. In the estimate provision is also made for for edges of the jogging track. **benches** are proposed around the promenade for the elderly and the aged persons to relax and enjoy the view the lake. This helps as a relaxation zone for aged and unhealthy person to rejuvenate by getting good air for refresh ness The outer edge of the promenade, provisions are made for planting the trees, inner edge for shrubs and in-between open spaces for developing of Lawn, ornamental planting, crotons, forest species, aquatic plants etc. It increases the beautification of lake as well as fresh air. For security of the lake property, **gate** is provided for Entry and Exit towards the southern side park area facing to ring road side. Also provision is made for putting up arches for the entrances of the lake (having the logo, Welcome sign, Name of lake etc) it will enhance the appearance of the lake and attract the public to entry into the lake. All along the promenade and at important points of public use in the lake is being proposed to be illuminated through street lights and path lights etc,. Provisions are also made for **plantations all around** the lake from the end of southern side edge of forest department nursery to Northern side weir position. It will increase the beautification of lake as well as fresh air. Provision are also made for **view points** along the jogging track towards the Southern side of lake, it will helps the visitors to view, sit, enjoy by seeing the eco-system environ This is shown in figure 5.2 and is cost estimated in the Table 5.2

5.3.1 Gardening and Eco-friendly Children's Park: -

As discussed in the earlier chapter, for the beautification, excellent environment for recreation and entertainment etc., inside the premises of the lake area, the following provisions are made for improvements in the existing garden area such as shrubs on both sides of pathways inside the garden, the open space of the garden is utilized for formation of Lawn, Rockery, Mounds and for planting the ornamental plants, crotons, forest species, aquatic plants etc. Provision is also made for colour illumination arrangement on either side of the pathways between the shrubs. **Sprinklers** are provided for spraying the water to maintain the Lawns etc. **Benches** are also provided inside the garden for use of relaxation, viewing of the environs, to take fresh air, refreshment etc. In the garden there is a provision for **Eco-friendly children's park**, where a sand bed flooring is provided with **children playing equipment** for the children to play joyfully, get good exercise to their body and also refreshes the children, helps to get new friends, etc. There is also provision made for internal pathways inside the gardening (park) to facilitate children play, Fountains, Boat jetty, etc., resting and relaxing around the garden. There is also a provision for railing inside the garden for protection and aesthetic appearance. **Rescue watchtowers** are provided to watch and ward the activities in the lake area and also it will helps to save the life of pupils from endangers at the time of boating etc., it will helps the visitors to view, sit, enjoy by seeing the eco-system environ. Provision is also made for construction of to Boating jetty were it is presently located at southern side towards ring road opposite to entrance to the garden area and also another boating jetty is proposed to provide at northeastern corner of lake towards rocky out crop edge, it is essential for creating recreational facilities to the visitors of lake. In order to avoid pollution of lake water, **Motorboats, Powerboats, water scooter, Bumper boats, Aqua cycles, Battery operated pleasure boats, Floating jetty, Angling boats, Peddle boats** and **Rowboats**, shall be used for this purpose. Provision is also made for **Boathouses**. There is also a provision is made for providing **Drinking water fountains** which are near garden, boating jetty, jogging track etc., as required. For recreational purposes in the estimate provision is also made for **Floating restaurant.**

Provision for **liter bins** to be located at various places inside the gardening is made which is very essential because it is very useful for putting the unwanted things, wastes etc., in to it. This helps to maintain the cleanliness of the premises of the lake as well as in garden. There is also a provision made for **sign boards** at the entrance of the lake, it will really help the users of the lake to know what are the things and facilities available for their use. Provision is made for **bore well** and pump set inside the garden for giving good water service to the users, to maintain greenery of garden, for fountain, etc. There is also a provision for **fountain** in the garden is really increases the beautification of the garden aesthetically and also it gives refreshing enjoyment to the visitors etc, Provision is also made for **Solar lighting** around the lake is as shown in figures 5.2 its cost estimated in the table 5.2.

5.4 Silt trap and Screen Barrier:

As discussed in the earlier chapter, it is essential to avoid silt and floating solids entering into the lake. By providing silt traps and screen barriers, we can totally eliminate this from entering the lake. Other wise the clean up of the lake would be expensive and more time consuming. There are two silt trap and screen barriers are provided, one is towards southern side storm water inlet and other one is towards western side storm water inlet to the lake and also a provision is made for covering the top of storm water inlet open drain which is located towards near park area is shown in the figure 5.3 and 5.4 and its cost estimate shown in the Table 5.3

5.5 Storm water catch drain and Catchments area improvement

As discussed in the earlier chapter, the existing storm water inlet drain of western side is damaged and is flowing not in a proper manner, so there is a necessity of improvement to existing storm water drain. There is also a need of drain to sewage treatment plant to divert for treat the wastewater, then allow into the lake to maintain the lake always perennial because in the summer season the depth of the water in the lake is reduced to minimal. The up streamside of lake is fully developed by urban scenario, so there is a necessity of improvement to existing catchments area to bring the storm water into the lake. Its cost estimate shown in the Table 5.4.

5.6 Sewage treatment plant

As discussed in the earlier chapter there is a necessity of treating the wastewater, to treat a Three million liter per day capacity of sewage treatment plant is proposed to locate towards northeastern corner of tank 2. Its cost estimate shown in the Table 5.5.

5.7 Sanitary Facilities.

As discussed in the earlier chapter Public Toilet Block is essential for use of visiting public, for keeping the lake premises clean and maintain good environment. For this separate toilet blocks for gents and women are provided, also provision is made for urinals, wash basin, electrification, water supply, for the utility provisions are made to locate near by open air restaurant (circular type), near southwestern corner where the garden ends (circular type) and another one of rectangular type is located at northern side of lake towards jogging tack as shown in the figure 5.5 & 5.6 and its detailed cost estimate is tabulated in Table 5.6 and Table 5.7.

5.8 Island:

The location of an Island in a lake is ideal for recreation and ecological improvements. There is also a provision is made for improvements to existing island to encourage development of bird sanctuary.

5.9 Kalyani for idols Immersion:

As discusses in the earlier chapter, this item of work is very essential to be provided as a **social cause**. Now the surrounding residents are using the lake for their Domestic animal bathing and immersion of ganapathis' at the time of festival into the tank. In future it is very inconvenient to the present users and also for maintaining cleanliness in the lake. For good environ and for avoiding the pollution of the lake water in future there is a need of kalyani for Domestic animal bathing/Idols immersion, with provision of water service. It is located in the Southeastern cornet junction as shown in the Drawing 5.7 and the cost estimate is shown in the Table 5.8.

5.10 Security

For watch and ward of the premises of the lake area, a security office is absolutely required. It is located in the Southern side towards entrance to the park area of lake as shown in the drawing 5.8 and its cost estimate as shown in the Table 5.9

5.11 Ticket Issue counter:

It is essential for maintaining the lake after restoration for which revenue is required. This revenue can be generated by collecting a nominal fee from the users of the recreational facilities provided in the lake. For collecting this fee and regulating the entry, it is necessary to provide for a Ticket Issue counter. As such this is located in the Southern side towards entrance of the lake near to the Right side of the entrance of garden, which is the strategic point for the lake. This is shown in the drawing 5.9 and its cost estimate is as shown in the Table 5.9

5.12 Lake view open air Restaurants:

It is located towards the southern side of lake between the garden and Govt. nursery. It is essential for the visitors to have some refreshments as they may wish to spend some time in the lake with their family and friends. These sorts of environment give not only refreshment but also enjoyment for the users in pleasant environs. This is shown in the drawing 5.10 and its estimate cost is shown in the Table 5.10. In the estimate there is a provision of water supply, electrification, washbasins etc. for maintaining cleanliness and good environ. There is also a provision made for one **floating restaurant**.

5.13 Medical care center

It is located towards southern side of lake in the premises of park area to treat the pupils when they are accidentally illness occur at the time of boating, playing etc., is essential for the visitors to facilitate. This is shown in the drawing 5.11 and its estimate cost is shown in the Table 5.11. In the estimate there is a provision of water supply, electrification, toilet, washbasins etc. for maintaining cleanliness and good environ.

5.14 Administrative office cum reception center

It is located towards southern side of lake in the premises of park area to maintain the different activities of lake area such as security, ticket issue, boating jetty, STP, toilets, lake view open air restaurants, medical care center, parking bay, garden, handicraft and curio gift shop, eco-friendly children park, silt traps, screen barriers, jogging track, kalyani, kiosks etc., and also to give information to query's of the visitors. This is shown in the drawing 5.12 and its estimate cost is shown in the Table 5.12. In the estimate there is a provision of water supply, electrification, toilet, washbasins etc. for maintaining cleanliness and good environ

5.15 Handicraft and Curio gift center

It is located towards southern side of lake in the premises of park area to promote Handicraft activities and its product to exhibit and sale to the pupils visit to the lake as shown in the figure 5.13 and its cost estimate shown in the Table 5.13.

5.16 Boating jetties

Provision is also made for construction of Boating jetty were it is presently located at southern side towards ring road opposite to entrance to the garden area and also another boating jetty is proposed to provide at northeastern corner of lake near by existing rocky out crop edge, it is essential for creating recreational facilities to the visitors of lake, is very essennal. As shown in the figure 5.14 and 5.15 and it's cost estimate shown in the Table 5.14 & 5.15.

5.17 Kiosks / Food courts

Are located towards Northern and Southern side of the lake pathways were ever necessary. It is essential for visitors to the lake. The Food Kiosks are very useful for non-peak hours/days and also it is very useful for the people those who want only coffee, tea, dry snack, chats, soft drinks and ice creams.

5.18 Arch Bridges

Essential for creating accessibility around the lake. One is located to connect the park area and open-air restaurant and another is to connect the pathways between Northern to southern side. It will also improve the aesthetical appearance of lake area.

5.19 Advertisement boards.

Provisions are made for putting the advertising boards with logo towards ring road side, national highway side and places were ever required as per the approval to be obtained from the competent authority regarding the numbers of boards and size of the boards etc.

5.20 Environmental Education: -

Environmental education is very essential as a **social cause** about awareness of the conserve the Hebbal Lake is very important for achieving the objectives of the lake conservation program as discussed in the earlier sections

For the conservation of Hebbal Lake the awareness may be required at different levels for administrators, media persons, neighborhood communities etc. This helps them to know their responsibility and the importance of their necessity, for the role of conservation of lake

Awareness may be given in the areas about the conservation of lake and what are the future and present benefits from such activities,

- Increase of ground water table
- Preserve good quality of ground water.
- Discharge of sewage only through sewer systems
- Dispose of solid wastes in a designated locality
- Preserve the good quality of lake water throughout
- By maintaining cleanliness, what are the future benefit can we get - such as avoiding the growth of mosquitoes, fly's, rats etc
- What are the facilities available to the public (visitors)
- Protection of flora and fauna in the lake water
- About the growth of Bird Sanctuary
- Avoid Air pollution by tree plantation around the lake
- Economical benefit such as promoting of fisheries.

In the light of these factors, it is recommended to educate the community residing near the Hebbal Lake catchments on the importance of lake conservation and its implications on environmental health. For his purpose it's recommended to;

- Form neighborhood committees in the Hebbal Lake catchments and carryout intense education campaigns by conduct rallies, street plays, competitions and cultural activities concerning environmental sanitation and try to educate the community.
- Carryout mass media campaigns on environmental implications of sanitary conditions through electronic media, print media, mass media and other means of environmental sanitation and
- Ensure active participation of community in conserving Hebbal Lake

5.21 Project Cost: -

As summarized in table 5.16 the cost of the project is estimated at Rs.16.75 crore (Rupees Sixteen Crores Seventy five Lakhs only)

Name of the Work: Development of Hebbal Lake in Bangalore On DOT Basis.

Table 5.16: Details of Project Cost Summary

Sl. No.	Description	Cost Rs. In lakhs
1	De-silting, De-weeding and Strengthening	772.00
2	Eco-friendly children park, lightings, rescue watch towers, parking bay, view points, kiosks, boundary protection, arch bridges, solar lighting, floating restaurant and provision for recreational facilities like bumper boats, electric boats, peddle boats, aqua-scooters etc.,	245.00
3	Silt traps and screen barriers – 2 Nos	33.10
4	Storm water drain and catchments area improvement	59.00
5	Sewage treatment plant- 3 mld and wet land improvement.	201.00
6	Toilet block (rectangular)	4.00
7	Toilet block (circular -2 units)	9.00
8	Kalyani for idols immersion	32.00
9	Security/ Ticket issue counter (2 units)	4.00
10	Lake view open air restaurant	21.20
11	Medical care center	13.70
12	Administrative office cum reception center	10.80
13	Handicrafts and Curio gift center	70.00
14	Boating jetty (Southern side)	41.50
15	Boating jetty (Northern side)	2.00
16	Generator set and furniture	80.00
17	Supervision, consultancy and miscellaneous charges	76.70
	Total cost of Project	**1,675.00**

(Rupees One Thousand Six Hundred Seventy Five Lakhs Only)

EIH LTD.

Authorised Signatories

For EIH Ltd.,
Bangalore-01

VIMOS Technocrats & Associates
Bangalore

EIH LTD.

19/5/2006

Authorised Signatories

CHIEF EXECUTIVE OFFICER
Lake Development Authority
BANGALORE

19.5.06

5.21 Project Cost: -

As summarized in table 5.16 the cost of the project is estimated at Rs.16.75 crore (Rupees Sixteen Crores Seventy five Lakhs only)

Name of the Work: Development of Hebbal Lake in Bangalore On DOT Basis.

Table 5.16: Details of Project Cost Summary

Sl. No.	Description	Cost Rs. In lakhs
1	De-silting, De-weeding and Strengthening	772.00
2	Eco-friendly children park, lightings, rescue watch towers, parking bay, view points, kiosks, boundary protection, arch bridges, solar lighting, floating restaurant and provision for recreational facilities like bumper boats, electric boats, peddle boats, aqua-scooters etc.,	245.00
3	Silt traps and screen barriers – 2 Nos	33.10
4	Storm water drain and catchments area improvement	59.00
5	Sewage treatment plant- 3 mld and wet land improvement.	201.00
6	Toilet block (rectangular)	4.00
7	Toilet block (circular -2 units)	9.00
8	Kalyani for idols immersion	32.00
9	Security/ Ticket issue counter (2 units)	4.00
10	Lake view open air restaurant	21.20
11	Medical care center	13.70
12	Administrative office cum reception center	10.80
13	Handicrafts and Curio gift center	70.00
14	Boating jetty (Southern side)	41.50
15	Boating jetty (Northern side)	2.00
16	Generator set and furniture	80.00
17	Supervision, consultancy and miscellaneous charges	76.70
	Total cost of Project	**1,675.00**

(Rupees One Thousand Six Hundred Seventy Five Lakhs Only)

NAME OF WORK:		Integrated Development of Hebbal lake in Bangalore on DOT Basis							
TABLE 5.1:		Detailed estimate for Deweeding, Desilting & Strenghething.							
SL. NO	SPECIFICATION	No	L	B	D	QUAN TITY	UNIT		AMOUNT (in Rupees)

1	Excavation for desilting 450000 cum @ Rs.60 00 / cum		Cum	Rs.	27000000 00
2	Disposal of Desilted earth with a lead of 15 kms 450000 cum @ Rs 105/cum		Cum	Rs.	47250000 00
3	Rough stone revetment 45 cm thick For NHside(new) & damaged portion of lake bund peripery & island surrounding. 2000 X 3 = 6000 sqm @ Rs.450.00 /Sqm		Sqm	Rs.	2700000.00
4	Turfing to slope of embankment 5000 0.60	3000.00	sqm		
	3000 sqm @ Rs.80 / sqm			Rs.	240000.00
5	Miscellaneous			Rs	10000.00
		Total		Rs.	77200000.00

(Seven hundred seventy two lakhs only)

NAME OF WORK:	Integrated Development of Hebbal lake in Bangalore on DOT Basis
TABLE 5.2:	Detailed estimate for Eco-friendly children park,Lightings,Resue watch tower,Parking bay, view points,Kiosks, Boundary protection, Arch bridges & Provision for Recreational facilities.

SL NO	SPECIFICATION	No	L	B	D	QUAN TITY	UNIT		AMOUNT (In Rupees)
1	Improvements to existing Landscaping						LS	Rs.	500000.00
2	Improvenents to existing Jogging track and path ways in garden by providing inter locking blocks for 3000 sqm @ Rs.650.00/sqm						Sqm	Rs.	1950000.00
3	Improvements to existing Island land scapping						LS	Rs	200000.00
4	Improvements to existing chain link fencing towards park area boundry and providing new chain link fencing towards not protected area (except park area) for Boundary protection for 6000 sqm @ Rs.360.00/sqm.						Sqm	Rs.	2160000.00
5	Sitting benches for jogging track, Children park & Garden @ Rs. 2500.00 each for 50 Nos.						No	Rs.	200000.00
6	Railing for park, Garden area & peripery of water body @ Rs. 1200.00/ Rmt for 1650 sqm						Rmt	Rs.	2500000.00
7	Sand filling to children game area						LS	Rs.	50000.00
8	Children playing equipment (provide & construct)						LS	Rs.	500000.00
9	Improvements to existing Path way either sides shurbs, garden lawn, ornamental plants, croton, forest species, aquatic plans etc.,						LS	Rs	200000.00
10	Improvements to existing colour lights on either sides of pathways and street lights for lake area surrounding.						LS	Rs.	3000000.00
11	Providing & fixing the Sprinklers for watering arrangements						LS	Rs.	200000.00
12	Formation of rockery, mounts etc., complete						LS	Rs.	100000.00
13	Litter bins 50 Nos @ Rs.5000/- each						No	Rs.	250000.00
14	Sign boards 2 Nos						LS	Rs.	50000.00
15	Providing one borewell, pumpset, electrification, plumbing works etc.,						LS	Rs	200000.00
16	Entrance Arch						LS	Rs.	200000.00
17	Fountain						LS	Rs.	500000.00
18	Boathouse with Boats such as Motorboats, Powerboats, peddleboats & Row boats						LS	Rs.	5000000.00
19	Rescue Watch towers 2Nos						LS	Rs.	800000.00
20	Kiosks 4 Nos						LS	Rs	800000.00
21	Advertisement boards 10 Nos						LS	Rs.	500000.00
22	View points 2 Nos						LS	Rs.	100000.00
23	Drinking water fountains 8 Nos						LS	Rs.	200000.00
24	Parking Bay						LS	Rs	500000.00
25	Floating restuarent						LS	Rs	3000000.00
26	Arch bridges 2 Nos						LS	Rs.	800000.00
27	Miscellaneous & round off							Rs	40000.00
							Grand Total	Rs.	24500000.00

(Rupees Two hundred forty five lakhs only)

VIMOS Technocrats and Associates,
Bangalore

M/s E.I.H. Ltd.,
Bangalore

NAME OF WORK:		Integrated Development of Hebbal lake in Bangalore on DOT Basis							
TABLE 5.3:		Detailed estimation for Silt trap & Screen barrier.							
SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)

Towards western side

1 Earth work excavation for levelling and lowering the ground (other than foundation work) in Ordinary Soil

1 x 1200 x 0.6 720 cum @ Rs.60.00/Cum Cum Rs 43200.00

2 Earth work excavation for foundation in Hard soil

1 x 1200 x 2.6 3120 cum @ Rs.90.00/Cum Cum Rs. 280800.00

3 Earth work filling to the foundation & basement (available)

500 cum @ Rs.35.00/Cum Cum Rs. 17500.00

4 Sand & Boulders filling for foundation

1200 x 0.3 =360.00

At Silt Chamber

0.3 x 0.3 x 22.75 = 2.05

0.3 x 0.3 x 32.13 = 2.90

Total Qty = 364.95 say 365 cum @ Rs.635.00/ cum Cum Rs. 231775.00

5 Providing and laying the bed Cement Concrete in 1:4:8

1200 x 0.15 =180.00

At Silt Chamber

0.3 x 0.15 x 22.75 = 1.02

0.3 x 0.15 x 32.13 = 1.45

At side walls

30.3 x 0.9 x 0.15 = 4.10

At upstream side screen

(0.3 + 0.3) x 0.15 x 33.9 = 5.69

1.2 x 0.15 x 33.96 = 6.12

At Silt Chamber

0.3 x 0.15 x 22.75 = 1.02

0.3 x 0.15 x 32.13 = 1.45

Total Qty = 200.85 say 205 cum @ Rs.1700.00/ cum Cum Rs. 348500.00

6 Providing Coffer dams for water diversion during construction

1200 x 2 =2400.00 cum @ Rs.610.00/ Cum Cum Rs. 1464000.00

7 Providing and laying the Coping Cement Concrete in 1:2:4

At Silt Chamber entrance and exit

For foundation = 0.3 x 0.9 (22.75 + 32.13 + 33.9 = 23.97

For walls @ D/S side = 0.3 x 2.25 + 33.9 = 22.69

Deduction for screen = 20 x 1.5 + 0.3 = 9.00

For side walls, 92.20 x 2.70 x 0.3 = 74.68

Length = 33 + 11.90 +35.4 +11.9 = 92.20 mts

Height = 2.25 + 0.3 + 0.15 = 2.70 mts

For Foundation, 92.20 x 0.90 x 0.3 = 24.90

For Silt Spillways, 0.3 x 2.25 x 32.13 = 21.69

Total Qty = 159.13 say 160 cum @ Rs.2450.00/ cum Cum Rs. 392000.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
8	Providing and constructing the SSM, chistle dressed in CM 1:4								
	At enrance & exit toewalls and Trash rocks								
	0.3 x 0.3 x 34.5 =3.10								
	0.3 x 0.75 x 32 =7.20								
	0.3 x 0.75 x 22 =4.95								
	0.3 x 0.75 x 22 =1.35								
	Total Qty = 16.60 say 20 cum @ Rs.1700.00/ cum						Cum	Rs.	34000.00
9	Providing and laying the Pointing for exposed surfaces of SSM in CM 1:3								
	0.3 x 4 (32 + 22) = 55.2 say60 sqm @ Rs 34.00/Sqm						Sqm	Rs.	2040.00
10	Trash rack on either side of silt chamber								
	1.75 x (15 + 20) = 61.25 say 70 sqm @ Rs.3000.00/Sqm						Sqm	Rs.	210000.00
	Trash rack towards **southern side**								
	14.00 x 1.5 = 21.00 sqm @ Rs.3000.00/Sqm						Sqm	Rs.	63000.00
11	RCC 1:11/2:3 slab for **southern side** inlet chamber								
		1	50		15	0.15	112.5		
	say 15.00 cum @ Rs.5250.00/ cum						Cum	Rs.	78750.00
12	Supplying of HYSD steel bar & labour charges for fabrication for RCC work (**southern side**)								
	15.00 cum @ 1.5 % of concrete area = 2250 say 2.25MT @ Rs.37500.00/MT						MT	Rs.	84375.00
13	Construction of Silt chamber (**southern side**)						L.S	Rs.	50000.00
14	Miscellaneous & round off							Rs.	10060.00
							Total	Rs.	**3310000.00**

(Rupees Thirty three lakhs ten thousand only)

NAME OF WORK:	Integrated Development of Hebbal lake in Bangalore on DOT Basis
TABLE 5.4:	Detailed estimation for storm water catch drain & Catchment area improvement.

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
1	Earth work excavation for levelling and lowering the ground (other than foundation work)								
	1 x 400 x 5.20 x 2.15	4472					Cum		
	40 % in Ordinary soil	1789 cum @ Rs.50.00/Cum						Rs.	89450.00
	40 % in Hard soil	1789 cum @ Rs.65.00/Cum						Rs.	116285.00
	20 % in Ordinary Rock without Blasting	894 cum @ Rs.135.00/Cum						Rs.	120690.00
2	Earth work excavation for foundation in Hard soil								
	2 x 400 x 1.25 x 1.15	1150 cum @ Rs.90.00/Cum					Cum	Rs.	103500.00
3	Providing and laying the bed Cement Concrete in 1:4:8								
	2 x 400 x 1.25 x 0.15	150 cum @ Rs.1700.00/Cum					Cum	Rs.	255000.00
4	Providing and constructing the SSM, hammer dressed in CM 1:6								
		2x 400 x 0.45 x 3.0= 1080.00							
		1/2x 2x400 x 0.50 x 3.0= 600.00							
						1680			
		@ Rs. 1170.00/ Cum					Cum	Rs	1965600.00
5	Providing and laying the Coping Cement Concrete in 1:2:4								
	2 x 400 x 0.45 x 0.15	54 cum @ Rs.2450.00/Cum					Cum	Rs	132300.00
6	Providing and laying the Pointing for exposed surfaces of SSM in CM 1:3								
	2 x 400 x 2.00	1600 sqm @ Rs.34.00/Sqm					Sqm	Rs.	54400.00
7	Desilting for drains								
	West & North side	1	1800	4.5	1	12150			
	Southern side	1	500	5	1	3750			
		1	50	14	1	1050			
		@ Rs. 60.00/ Cum				16950			
					or say	17000	Cum	Rs.	1020000.00
8	Deweeding for drains								
	West & North side	1	1800	6		10800			
	Southern side	1	500	5		2500			
		1	50	14		700			
		@ Rs. 10.00/ Sqm				11300	Sqm	Rs.	113000.00
9	Construction of head wall to divert the waste water						LS	Rs.	100000.00
10	Disposal of Desilted Earth from drain								
		17,000 cum @ Rs.105/cum							1785000.00
11	Miscellaneous & round off							Rs	44775.00
							Total	Rs.	5900000.00

(Rupees Fifty Nine Lakhs only)

NAME OF WORK:		Integrated Development of Hebbal lake in Bangalore on DOT Basis							
TABLE 5.5:		Estimation for 3 MLd Sewage Treatment Plant (All units).							
SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
1	Earth work excation for foundation in ordinary soil					450 @ Rs.65.00/ cum	Cum		29250.00
2	CC Bed 1:3:6					210 @ Rs.1870.00/ cum	Cum		392700.00
3	SSM for foundation in CM 1:6					360 @ Rs.1170.00/ cum	Cum		421200.00
4	SSM for basement in CM 1:6					105 @ Rs.1430.00/ cum	Cum		150150.00
5	CC 1:2:4					42 @ Rs.2450.00/ cum	Cum		102900.00
6	BBM in CM 1:6					202 @ Rs.2160.00/ cum	Cum		436320.00
7	RCC lintels & beams in 1:11/2:3					6 @ Rs.4160.00/ cum	Cum		24960.00
8	RCC Chejja in 1:2:4					38 @ Rs.600.00/ sqm	Sqm		22800.00
9	RCC for STP side walls in 1:1:2					480 @ Rs.5775.00/ cum	Cum		2772000.00
10	Teak wood windows/doors					38 @ Rs.4500.00/ sqm	Sqm		171000.00
11	RCC roof slab in 1:11/2:3					38 @ Rs.5250.00/ cum	Cum		1023750.00
12	CC flooring					195 @ Rs.375.00/ sqm	Sqm		73125.00
13	Plastering to BBM wall in CM 1:4,20mm th.					2700 @ Rs.74.00/ sqm	Sqm		199800.00
14	Plastering to Celling in CM 1:3,12mm th.					195 @ Rs.74.00/ sqm	Sqm		14430.00
15	Water proof course painting to out side					2400 @ Rs.42.00/ sqm	Sqm		100800.00
16	Oil bound distemper painting to out side					780 @ Rs.34.00/ sqm	Sqm		26520.00
17	Pointing to SSm in C:M 1:3					360 @ Rs.34.00/ sqm	Sqm		12240.00
18	Synthethic enamel painting for wood work					75 @ Rs.52.00/ sqm	Sqm		3900.00
19	Earth filling to basement					150 @ Rs.35.00/ cum	Cum		5250.00
20	CC 1:3:6 for cills					2 @ Rs.2115.00/ cum	Cum		4230.00
21	Steel & fabrication for RCC works					98 @ Rs.37500.00/ MT	MT		3675000.00
22	Steel & fabrication for Frame works					7 @ Rs.80000.00/ MT	MT		560000.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
23	Asbestos cement rain water pipe 7.5 cms dia.					165 @ Rs.95.00/ RM	RM	Rs.	15675.00
24	NP2 450 mm dia RCC pipe					40 @ Rs.1500.00/ RM	RM	Rs.	60000.00
25	Sand & Boulder filling					40 @ Rs.635.00/ cum	Cum	Rs.	25400.00
26	Rollong shutter					36 @ Rs.2500.00/ sqm	Sqm	Rs.	90000.00
27	Rollong shutter top cover					18 @ Rs.600.00/ sqm	Sqm	Rs.	10800.00
28	MS Ladder					4No	LS	Rs.	400000.00
29	Air blower & its internal arrangements					2No	LS	Rs.	300000.00
30	Bar Screens					2No	LS	Rs.	600000.00
31	Gas hood					1No	LS	Rs.	200000.00
32	Puddle pipes					2No	LS	Rs.	200000.00
33	Raw sewage pump					3No	LS	Rs.	300000.00
34	Sludge recycling pump					2No	LS	Rs.	250000.00
35	Pressure feed pump					2No	LS	Rs.	200000.00
36	Compressors					2No	LS	Rs.	200000.00
37	Filter press					1No	LS	Rs.	2000000.00
38	V- notch					1No	LS	Rs.	150000.00
						Total		Rs.	15224200.00
39	10 % for water supply arrangements for cleaning purpose							Rs.	1522420.00
40	15% for Electrification works							Rs.	2283630.00
41	Wet land improvement							Rs.	1000000.00
42	Miscellaneous & round off							Rs.	69750.00
								Grand Total Rs.	20100000.00

(Rupees Two hundred one lakhs only)

NAME OF WORK:		Integrated Development of Hebbal lake in Bangalore on DOT Basis							
TABLE 5.8:		Detailed estimation for Toilet Block (Rectangular Type).							
SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
1	Earth work excavation for foundation in Ordinary soil								
	Toilet : Allround	1	15.96	1.05	1.05	17.60			
	Center horizontal	1	4.67	0.60	0.90	2.52			
	Partition vertical	1	0.61	0.60	0.90	0.33			
	Urinal: Allround	1	8.41	0.60	0.90	4.54			
						24.99	cum		
	Say 25.00 cum @ Rs.65.00 / cum							Rs.	1625.00
2	Providing and laying the bed Cement Concrete in 1:4:8								
	Toilet : Allround	1	15.96	1.05	0.15	2.51			
	Center horizontal	1	4.67	0.60	0.15	0.42			
	Partition vertical	1	0.61	0.60	0.15	0.05			
	Urinal: Allround	1	8.41	0.60	0.15	0.76			
						3.75	cum		
	Say 4.00 cum @ Rs.1700.00 / cum							Rs.	6800.00
3	Providing and constructing the SSM, hammer dressed in CM 1:6 for foundation								
	1st course : Allround	1	15.96	0.75	0.45	5.39			
	Center horizontal	1	5.12	0.60	0.45	1.38			
	Partition vertical	1	1.06	0.60	0.45	0.29			
	2nd course: Allround	1	15.96	0.60	0.45	4.31			
	Urinal: Allround	1	8.56	0.60	0.45	2.31			
						13.68	cum		
	Say 14.00 cum @ Rs.1170.00 / cum							Rs.	16380.00
4	Providing and constructing the SSM, Chistle dressed in CM 1:6 for basement								
	Toilet : Allround	1	15.96	0.45	0.45	3.23			
	Center horizontal	1	5.27	0.45	0.45	1.07			
	Partition vertical	1	1.36	0.45	0.45	0.28			
	Urinal: Allround	1	8.71	0.45	0.22	0.86			
						5.44	cum		
	Say 6.00 cum @ Rs.1430.00/ cu m							Rs	8580.00
5	Providing and laying the Coping Cement Concrete in 1:2:4								
	Toilet : Allround	1	15.96	0.45	0.10	0.72			
	Center horizontal	1	5.27	0.45	0.10	0.24			
	Partition vertical	1	1.36	0.45	0.10	0.06			
	Urinal: Allround	1	8.71	0.45	0.10	0.39			
	(Below caddapa slab)	1	2.03	0.70	0.10	0.14			
						1.55	cum		
	Say 2.00 cum @ Rs.2450.00 / cum							Rs	4900.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
6	Earth work filling to the foundation & basement (available)								
	Toilet	1	5.00	1.59	0.45	3.58			
	Urinal	1	2.78	1.81	0.22	1.11			
						4.69	cum		
	Say 5.00 cum @ Rs.35 00/cum							Rs.	175 00
7	Providing and laying the BBM wall in CM 1 6								
	Toilet : Allround	1	15.96	3.60	0.23	13.21			
	Center horizontal	1	5.49	3.00	0.23	3.79			
	Partition vertical	1	1.80	3.00	0.23	1.24			
	Urinal: Allround	1	8.49	1.50	0.23	2.93			
						21.17	cum		
	Deductions:								
	Door	6	0.75	2.10	0.23	2.17			
	Ventilator	8	0.60	0.30	0.23	0.33			
	Lintel (l)	8	1.00	0.15	0.23	0.28			
	Lintel (d)	6	1.35	0.15	0.23	0.28			
	Toilet entrance opening	1	0.90	1.50	0.23	0.31			
						3.37	cum		
	Net Quantity: 21.17 - 3.37 = 17.80 cum								
	Say 18.00 cum @ Rs 2160 00 / cum							Rs	38880.00
8	RCC Lintels in 1:1 1/2 :3								
	Quantity as item No.7			(V)		0.28			
				(D)		0.28			
	Urinals top of wall allround	1	8.19	0.23	0.15	0.28			
						0.84	cum		
	Say 1 00 cum @ Rs.4160.00 / cum							Rs.	4160 00
9	RCC drop Chejja in 1:1 1/2 :3, 7.5 cm thick								
	D	2	1.20	0.45		**1.08**	Sq.m		
	Say 1.2 Sq.m @ Rs.600.00 / sqm							Rs.	720 00
10	RCC roof slab in (1:11/2:3) finishing exposed faces in CM (1:3) (exclusive of cost of steel & fabrication charges)								
		1	5.95	2.49	0.15	**2.22**	cum		
	Say 2.50cum @ Rs.4160.00 / cum							Rs	10400.00
11	Supplying of steel for RCC works.								
	Item No. (8)					1.00			
	Item No. (9)					2.00			
	Item No. (10)					3.00			
						6.00	cum		
	1.5% concrete area, 6x150-900 kg = 0.9 MT								
	Say 1.00 MT @ Rs.35000.00 / MT							Rs.	35000.00
12	Labour charges for fabrication of MILD/HYSD steel								
	Quantity as in item No. (11)					1.00	MT		
	1.00 MT @ Rs.2500.00 / MT							Rs	2500 00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
13	Flooring with Ceramic tiles								
		1	5.26	2.03		10.68	Sq.m		
	Say 11.00 Sq.m @ Rs.975.00 / sqm							Rs	10725.00
14	Providing Plastering to BBM walls CM 1:4 (20 mm th)								
	External					100.00	sq.m		
	Say 100.00 sqm @ Rs.74.00/sq m							Rs.	7400.00
15	Providing glazed tiles for walls - inside								
	Say 120.00 sqm @ Rs.750.00/sq.m							Rs.	90000.00
16	Providing Plastering to ceiling in CM 1:3 (12 mm th)								
		1	5.26	2.03		10.68	Sq.m		
	Say 12.00 Sq.m @ Rs.74.00 / sqm							Rs	888.00
17	Providing and laying the Pointing for exposed surfaces of SSM in CM 1:3								
	Allround	1	17.76	0.45		7.99	Sq.m		
	Say 8.00 Sq.m @ Rs.34.00 / sqm							Rs.	272.00
18	Water proof cement painting out side								
	Quantity as item No.14					108.60	Sq.m		
	Say 120.00 Sq.m @ Rs..42.00 / sqm							Rs.	5040.00
19	Oil bound distemper painting to inside walls								
	Internal wall Quantity as in item. No.14					101.04			
	ceiling Quantity item					10.68			
						111.72	Sq.m		
	Say 120.00 Sq.m @ Rs..34.00 / sqm							Rs	4080.00
20	Teak wood Doors, Windows & Ventilators with wood polish								
	D	6	0.75	2.10		9.45			
	Ventilator	8	0.60	0.30		1.44			
	Say 11.00 Sq.m @ Rs.4500.00/ sqm						Sq.m	Rs.	49500.00
21	Flooring of paving with 10 cms thick B.S slabs on a sand bed of 7.5 to 3 cms thick, fixing and pointing in CM (1:3) curing								
	Urinal floor	1	3.00	1.26		3.78	Sq.m		
	Say 4.00 Sq.m @ Rs.300.00/ sqm							Rs.	1200.00
22	Providing & fixing pre cast or cast in situ 5 cms thick fretwork, reinforced with 6 mm rods, perforated as per design and specification cast with cement mortar 1:3 including finishing & curing etc., complete								
	Allround	1	7.59	0.60		4.55	Sq.m		
	Say 5.00 Sq.m @ Rs.600.00/ sqm							Rs.	3000.00
23	2.50 cm to 4 cms thick polished cudappa slabs with machine cut sides, including fixing & pointing with cm (1:3) curing polishing etc., complete for urinals.								
	wall lining	1	3.57	1.50		5.36			
	Flooring	1	2.03	0.60		1.22			
	Separators	3	1.00	1.20		3.60			
						10.17	Sq.m		
	Say 12.00 Sq.m @ Rs.525/ sqm							Rs	6300.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
24	Providing and laying white vitreous china clay Indian type water closet flush type of approved make with 'P' trap or "S" trap etc , complete as per directions								
	4 Nos @ Rs.1200.00/ each						No	Rs.	4800.00
25	Providing & fixing white vitreous china clay urinals								
	4 Nos @ Rs.700/ each						No	Rs.	2800.00
26	Providing vitreous china clay hand wash basin								
	3 Nos @ Rs.2500/ each						No	Rs.	7500.00
27	Providing & laying weather proof course 10 cms th. Av.								
		1	5.49	2.03		11.14	Sq.m		
	Say 12.00 Sq.m @ Rs.215.00/ sqm							Rs.	2580.00
28	Providing asbestos cement rain water pipes 7.50 cms dia.								
		3	3.60			10.80	Rmt		
	Say 12.00 MT @ Rs.95.00/ Rmt							Rs.	1140.00
						Total		Rs.	327345.00
29	10 % for Electrification works							Rs.	32734.00
30	10% Water supply & sanitory works							Rs.	32734.00
31	Miscellaneous & round off							Rs	7187.00
							Total	Rs.	400000.00

(Rupees Four lakh only)

NAME OF WORK:	Integrated Development of Hebbal lake in Bangalore on DOT Basis
TABLE 5.7:	Detailed estimation for Toilet Block (Circular Type).

SL. NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
1	Earth work excavation for foundation in Ordinary soil Say 15.00 cum @ Rs.65.00 / cum						cum	Rs	975.00
2	Providing and laying the bed Cement Concrete in 1:4:8 Say 5.00 cum @ Rs.1700.00 / cum								8500.00
3	Providing and constructing the SSM, hammer dressed in CM 1:6 for foundation Say 15.00 cum @ Rs.1170.00 / cum						cum	Rs.	17550.00
4	Providing and constructing the SSM, Chistle dressed in CM 1:6 for basement Say 8.5.00 cum @ Rs.1430.00/ cu.m						cum	Rs.	12155.00
5	Providing and laying the Coping Cement Concrete in 1:2:4 Say 2.00 cum @ Rs.2450.00 / cum						cum	Rs.	4900.00
6	Earth work filling to the foundation & basement (available) Say 300.00 cum @ Rs.35.00/cum						cum	Rs.	10500.00
7	Providing and laying the BBM wall in CM 1:6 Say 18.00 cum @ Rs.2160.00 / cum						cum	Rs	38880.00
8	RCC Lintels in 1:1 1/2 :3 Say 1.50cum @ Rs.4160.00 / cum						cum	Rs.	6240.00
9	Partion wall by using Table moulded bicks in CM 1:4 Say 20 Sq.m @ Rs.400.00 / sqm						sq.m	Rs.	8000.00
10	RCC roof slab in (1:11/2:3) finishing exposed faces in CM (1:3) (exclusive of cost of steel & fabrication charges) Say 4.50cum @ Rs.4160.00 / cum						cum	Rs	18720.00
11	Supplying of steel for RCC works. Item No. (8) Item No. (10)					1.50 4.50 **6.00**	cum		
	1.5% concrete area, 6x150=900 kg = 0.9 MT Say 1.00 MT @ Rs.35000.00 / MT						MT	Rs.	35000.00
12	Labour charges for fabrication of MILD/HYSD steel Quantity as in item No. (11) 1.00 MT @ Rs.2500.00 / MT					1.00	MT	Rs	2500.00
13	Flooring with Ceramic tiles Say 35.00 Sq.m @ Rs.975.00 / sqm						Sq.m	Rs.	34125.00
14	Providing Plastering to BBM walls CM 1:4 (20 mm th) External Say 80.00 sqm @ Rs 74.00/sq.m					80.00	Sq.m	Rs	5920.00
15	Providing glazed tiles for walls - Inside Say 80.00 sqm @ Rs.750.00/sq.m						Sq.m	Rs.	60000.00
16	Providing Plastering to ceiling in CM 1:3 (12 mm th) Say 26.00 Sq.m @ Rs.74.00 / sqm						Sq.m	Rs	1924.00
17	Providing and laying the Pointing for exposed surfaces of SSM in CM 1:3 Say 8.00 Sq.m @ Rs.34.00 / sqm						Sq.m	Rs.	272.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
18	Water proof cement painting out side Quantity as item No.14 Say 80.00 Sq m @ Rs..42.00 / sqm						Sq.m	Rs.	3360.00
19	Oil bound distemper painting to inside walls Celling Quantity as in the It. No 16 26.00 Sq.m @ Rs. 34.00 / sqm						Sq.m	Rs	884.00
20	Teak wood Doors & Ventilators with wood polish Say 18.00 Sq.m @ Rs.4500.00/ sqm						Sq.m	Rs.	81000.00
21	Providing and laying white vitreous china clay Indian type 4 Nos @ Rs.1200.00/ each						No	Rs.	4800.00
22	Providing & fixing white vitreous china clay urinals 4 Nos @ Rs.700/ each						No	Rs	2800.00
23	Providing vitreous china clay hand wash basin 2 Nos @ Rs.2500/ each						No	Rs.	5000.00
24	Providing & laying weather proof course 10 cms th. Av. Say 35.00 Sq.m @ Rs.215.00/ sqm						Sq.m	Rs	7525.00
						Total		Rs.	371530.00
25	10 % for Electrification works							Rs.	37154.00
26	10% Water supply & sanitory works							Rs	37154.00
27	Miscellaneous & round off							Rs.	4162.00
							Total	Rs.	450000.00

Grand total = Two units reqd. = 2 x 450000 = Rs. 900000.00

(Rupees Nine lakhs only)

NAME OF WORK:	Integrated Development of Hebbal lake in Bangalore on DOT Basis
TABLE 5.8:	Detailed estimation of kalyani for idols immersion.

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)

I. For Immersion tank

1 Earth work excavation for levelling and lowering the ground (other than foundation work) in Ordinary Soil

	1 x (10+32/2) x (10+32/2) x 3.1				1367.1	
	4	28	2	1	224	
Qty = 1591.1 say 1600 cum @ Rs.50 00/ cum					Cum	Rs 80000 00

2 Earth work to hearting of bund (imperious)

For bund around	4	32.1	12+4/2	3.5	3595	
For seating	1	36.1	12.3	0.5	222	
					3817	Cum
Consider 35 % as hearting soil						
Qty = 1136 cum @ Rs.130.00/ cum					Cum	Rs. 147680.00
Consider 65 % as casing soil						
Qty = 2481cum @ Rs.260.00/ cum					Cum	Rs. 694680.00

3 Rough stone revetment 45 cm thick

Inside tank	4	19	10.8	0.45	369.36	
Out side embankment	1	40.8	5.25	0 45	96.39	
	2	32.7	4 3	0 45	126 55	
					592.3	
Qty = 592.3 say 600 cum @ Rs.450.00/ cum					Cum	Rs 270000 00

4 CC 1:2 4 for tank bed

1	36.11	4	0.075	10.83	
1	22.5	22 5	0.075	37.97	
1	10	20	0.15	15	
3	28	4	0.075	25.2	
				89	
Qty = 89 say 90 cum @ Rs.2450.00/ cum				Cum	Rs. 220500.00

5 Granite slab 15 cms th. with two line dressed& fixed in CM 1:6

For tread & rise	80 (28+10)/2		0.6	912	
For bed of kalyani	1	10	10	100	
For embankment	2	36.1	4	288.8	
	2	28	4	224	
				1525	
Qty = 1525 say 1550 Sqm @ Rs.640 00/ sqm				Sqm	Rs. 992000.00

6 Chain link fencing

1	160		1 8	228	
Qty = 228 say 300 Sqm @ Rs.1750.00/ sqm				Sqm	Rs 525000 00

7 Turfing to slope of embankment

1	36.1	0.6	21.66	
2	32.05	0.6	38.46	
			61.12	
Qty = 61.12 say 65 Sqm @ Rs 95.00/ sqm			Sqm	Rs 6175.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
8	Coffer dam for water course diversion	2	36	0.9	1.2	80			
	Qty = 80 cum @ Rs.610.00/ cum						Cum	Rs.	48800.00
	II. Sluice								
9	Earth work excavation for levelling and lowering the ground								
	Forbodywall circular	1	3.14	2.5	1.2	9.43			
	Splayed wingwalls	2	7.5	1.2	1	18			
	Apron portion	1	5	1.7+0.5	0.75	6.01			
	Intake pipe	1	14	1	1.2	16.8			
	Qty = 50.24 say 55 cum @ Rs.50.00/ cum						Cum	Rs.	2750.00
10	Sand & Boulder filling								
	Forbodywall circular	1	3.14	2.5	0.3	2.36			
	Splayed wingwalls	2	7.5	1.2	0.3	5.4			
	Apron portion	1	5	1.7+0.5	0.3	5.41			
	Intake pipe	1	14	1	0.3	4.2			
	Qty = 17.37say 18 cum @ Rs.635.00/ cum						Cum	Rs.	11430.00
11	CC 1:4:8 for foundation								
	Forbodywall circular	1	3.14	2.5	0.3	2.36			
	Splayed wingwalls	2	7.5	1.2	0.3	5.4			
	Apron portion	1	5	1.7+0.5	0.3	5.41			
	Intake pipe	1	14	1	0.3	4.2			
	D/S apron	1	15	0.75	0.15	1.69			
	Qty = 19.05say 20 cum @ Rs 1700.00/ cum						Cum	Rs.	34000.00
12	Providing and constructing the SSM, Chistle dressed in CM 1:6								
	For body wall of sluice circular Portion								
	1 x 3.14 x 1.85 x 3.0 x (0.6 + 0.45) / 2					9.16			
	2 x 7.5 x (0.75 + 0.45) / 2 x (0.9 + 1.6) / 2					11.25			
	Qty = 20.41 say 22 cum @ Rs.1430.00/ cum						Cum	Rs.	31460.00
13	CC 1:2:4 for tank bed								
	For body wall of sluice circular Portion								
	1 x 3.14 x 1.85 x 3.0 x 0.1					1.74			
	2 x 7.5 x (0.75 + 0.45) / 2 x 0.1					0.9			
	Qty = 2.64 say 3 cum @ Rs.2450.00/ cum						Cum	Rs.	7350.00
14	Providing and laying the Pointing for exposed surfaces of SSM in CM 1:3								
	Forbodywall circular	1	3.142	3		9.43			
	Splayed wingwalls	1	3.142	3		9.43			
	50% Out side wall	2	7.5	0.9		13.5			
	Qty = 32.35 say 35 sqm @ Rs.34.00/Sqm						Sqm	Rs.	1190.00
15	Providing & fixing of MS sluice gate					1No	LS	Rs.	25000.00
16	Providing & fixing 3 HP pump set with Plumbing woks for inlet & outletarrangements, Including electrification charge.						LS	Rs.	100000.00
17	Miscellaneous & round off							Rs	1985.00
								Total Rs.	3200000.00

(Rupees Thirty two lakh only)

NAME OF WORK:	Integrated Development of Hebbal lake in Bangalore on DOT Basis
TABLE 5.9:	Detailed estimation for Security office / Ticket issue counter.

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
1	Earth work excavation for foundation in Ordinary soil								
	All round	1	12.92	1.05	1.05	14.24			
	Qty = 14.24 say 15 cum @ Rs.65.00/ cum						Cum	Rs	975.00
2	Providing and laying the bed Cement Concrete in 1 4 8								
	All round	1	12.92	1.05	0.15	2.03			
	Qty = 2.03 say 2.5 cum @ Rs.1700.00/ cum						Cum	Rs	4250.00
3	Providing and constructing the SSM, hammer dressed in CM 1:6 for foundation								
	All round	1	12.92	0.75	0.45	4.36			
		1	12.92	0.6	0.45	3.49			
	Qty = 7.85 say 8 cum @ Rs.1170.00/ cum						Cum	Rs.	9360.00
4	Providing and constructing the SSM, Chistle dressed in CM 1:6 for basement								
	All round	1	12.92	0.45	0.45	2.62			
	Qty = 2.62 say 3 cum @ Rs.1430.00/ cum						Cum	Rs.	4290.00
5	Providing and laying the Coping Cement Concrete in 1:2:4								
	All round	1	12.92	0.45	0.15	0.87			
	Qty = 0.87say 1 cum @ Rs.2450.00/ cum						Cum	Rs.	2450.00
6	Providing and laying the BBM wall in CM 1:6								
	All round	1	12.92	0.23	2.4	7.13			
	Deductions:								
	Lintel-All openings		7.7	0.23	0.15	0.26			
	Door- D	1	0.9	0.23	2.1	0.43			
	Window - W	3	1.5	0.23	1.2	1.24			
	Net Qty=7.13- 1.93=5.2 say 6 cum @ Rs.2160.00/cum						Cum	Rs.	12960.00
7	Earth work filling to the foundation & basement (available)								
		1	2.78	2.78	0.45	3.48			
	3.48 say	4	cum @ Rs 35.00/Cum				Cum	Rs.	140.00
8	RCC Lintels in 1:1 1/2 :3								
	Lintel-All openings	1	36	0.23	0.15	1.24			
	Qty. as in It.No.6	0.26	cum @ Rs.4160.00/Cum				Cum	Rs.	1082.00
9	CC Cill in 1:3 :6								
	Windows	3	2.1	0.23	0.1	0.19			
	Qty = 0.19 say 0.2cum @ Rs.2115.00/ cum						Cum	Rs.	423.00
10	Teak wood Doors, Windows & Ventilators with wood polish								
	Door	1	0.9		2.1	1.89			
	Window	3	1.5		1.2	5.4			
	Qty = 7.29 say 8 sqm @ Rs 4500.00/ sqm						Sqm	Rs.	36000.00
11	Supplying of HYSD steel bar & labour charges for fabrication 0.26 cum @ 1.5 % of concrete area = 0.039 say 0.05MT @ Rs 37500.00/MT						MT	Rs.	1875.00
12	Tubular trusses & Iron angle purlines for roof								
	Say about 1 MT @ Rs. 80000.00/ MT						MT	Rs.	80000.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
13	Supplying & fixing new Mangalore tiles								
	25 sqm / 0.0675 = 371 say 400 Nos @ Rs. 12.00/ each						Each	Rs	4800.00
14	Supplying & fixing Mangalore ridge tiles								
	15 mts length at Rs. 91.00/ RM						RM	Rs	1365.00
15	Providing and laying the Pointing for exposed surfaces of SSM in CM 1:3								
	All round	4	3.9		0.45	7.02			
	Say 8 sqm @ Rs.34.00/Sqm						Sqm	Rs	272.00
16	Providing Plastering to BBM walls CM 1:4 (20 mm th)								
	55 sqm @ Rs.74.00/Sqm						Sqm	Rs.	4070.00
17	Bed CC in 1:3:6 for flooring, 15 cm th.								
	Qty =1.2 cum @ Rs.2115.00/ cum						Cum	Rs.	2538.00
18	Adanga marble tiles with veins for flooring including wall skirting								
		1	3		3	9			
	Qty = 9 sqm @ Rs.1215.00/ sqm						Sqm	Rs.	10925.00
19	Water proof cement painting out side								
	Say 35 sqm @ Rs.42.00/ sqm						Sqm	Rs.	1470.00
20	Oil bound distemper painting to inside walls								
	Say 30 sqm @ Rs.34.00/ sqm						Sqm	Rs.	1020.00
						Total		Rs	180265.00
21	10 % for Electrification works							Rs.	18026.00
22	Miscellaneous & round off							Rs	1709.00
							Total	Rs.	200000.00

Grand total = Two units reqd. = 2 x 200000 = Rs. 400000

(Rupees Four lakhs only)

NAME OF WORK:		Integrated Development of Hebbal lake in Bangalore on DOT Basis							
TABLE 5.10:		Detailed estimation for Lake view Open air restaurant.							
SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
1	Earth work excavation for foundation in Hard soil								
	Colums	27	1.5	1.5	1.8	109.35			
	walls	1	41.23	0.9	1 2	44 52			
	Qty = 153.87 say 160 cum @ Rs.85.00/ cum						Cum	Rs	13600 00
2	Sand & Boulders filling for foundation								
	Colums	27	1.5	1.5	0 6	36 45			
	walls	1	81.73	0.9	0 3	22.06			
	Total Qty = 58.51 say 60 cum @ Rs 635.00/ cum						Cum	Rs	38100 00
3	Providing and laying the bed Cement Concrete in 1:4:8								
	Colums	27	1.5	1.5	0 15	9.11			
	walls	1	81.73	0.9	0.15	11.03			
	Qty = 20.14say22 cum @ Rs.1700.00/ cum						Cum	Rs.	37400.00
4	Providing & laying RCC column footing in 1: 11/2 :3 (RMC)								
	Rectangular	27	1.2	1.2	0.3	11.66			
	Trapezodial 0.5	27	1.2	1.2	0.45	7.29			
	Qty = 18.95 say 20 cum @ Rs.3750.00/ cum						Cum	Rs.	75000 00
5	Providing & laying RCC column in 1: 11/2 :3 (RMC)								
		3	0 23	0 45	3.7	1.14			
		11	0 23	0 45	4 3	4.89			
		13	0.23	0.45	5.5	7.4			
	Qty = 16.43 say 18 cum @ Rs 5475.00/ cum						Cum	Rs.	98550 00
6	Providing and constructing the SSM, hammer dressed in CM 1:6 for foundation								
	Walls	1	80	0.9	0.45	32.4			
		1	80	0.6	0.45	21.6			
	Qty = 54 cum @ Rs.1170.00/ cum						Cum	Rs.	63180 00
7	Providing and constructing the SSM, Chistle dressed in CM 1:6 for basement								
	walls	1	80	0.45	0.45	16.2			
	Qty = 16.2 say 18 cum @ Rs.1430.00/ cum						Cum	Rs.	25740.00
8	Earth work filling to the foundation & basement (available)								
		1	22.63	6	0.45	61.1			
		1	13.37	2.8	0.45	16.84			
		1	6.18	2.8	0.45	7.78			
	Qty = 85.72 say 90 cum @ Rs.35.00/Cum						Cum	Rs.	3150.00
9	Providing & laying RCC Plinth beams in 1: 11/2 :3 (RMC)								
		1	80	0.45	0.3	10.8			
	Qty = 10 8 say 12 cum @ Rs.3750.00/ cum						Cum	Rs	45000 00
10	Teak wood Doors & Ventilators with wood polish								
	Door- D	1	1.2		2.1	2.52			
	D1	1	1.05		2.1	2.21			
	Ventilators - V	4	1.8		0.75	1.35			
	Qty = 6 08 say 7 sqm @ Rs.4500.00/ sqm						Sqm	Rs.	31500 00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
11	Providing and laying the BBM wall in CM 1:6								
	Store	1	3.5	0.23	4.5	3.62			
		1	8.86	0.23	4.1	8.35			
	Service hall	2	1.43	0.23	3.75	2.48			
	- plat form	1	13.89	0.23	0.75	2.39			
	- plat form partation	18	0.75	0.23	0.75	2.32			
	Side wall	2	5.6	0.23	4.1	10.56			
	Deductions								
	Door- D	1	1.2	0.23	2.1	0.58			
	D1	1	1.05	0.23	2.1	0.5			
	Ventilators - V	4	1.8	0.23	0.75	1.24			
	Lintel-for openings		14	0.23	0.15	0.48			
	Net Qty=29.7- 2.80= 26.9 say 28 cum @ Rs.2160.00/ cum						Cum	Rs.	60480.00
12	Providing and laying Polished caddapa slab for service hall platform								
		1	16	0.75		12			
	Qty = 12 sqm @ Rs.700.00 / sqm						Sqm	Rs.	8400.00
13	RCC Lintels in 1:1 1/2 :3								
	Door- D	1	1.8	0.23	0.15	0.06			
	D1	1	1.7	0.23	0.15	0.06			
	Ventilators - V	4	2.4	0.23	0.15	0.33			
	0.45 cum say 0.48 cum @ Rs.4160.00/Cum						Cum	Rs.	1997.00
14	RCC drop Chejja in 1:1 1/2 :3, 7.5 cm thick								
	Door- D	1	1.8		0.6	1.08			
	Ventilators - V	4	2.4		0.6	5.76			
	6.84 Sqm say 8 Sqm @ Rs.600.00/Sqm						Sqm	Rs.	4800.00
15	Providing & laying RCC Roof beams in 1: 11/2 :3 (RMC)								
	Ring beam- Store	2	2.37	0.23	0.32	0.35			
		3	3.22	0.23	0.32	0.71			
		4	2.7	0.23	0.25	0.62			
	Service hall	6	2.95	0.23	0.32	1.3			
		6	4.08	0.23	0.32	1.8			
	Dinning hall	12	2.51	0.23	0.45	3.12			
		13	4.9	0.23	0.32	4.69			
	Qty = 9.61 say 10 cum @ Rs.5325.00/ cum						Cum	Rs.	53250.00
16	Iron angle purlines for roof								
	Say about 6.0 MT @ Rs.80000.00/ MT						MT	Rs.	480000.00
17	Supplying & fixing new Mangalore tiles								
	300 / 0.0675 = 4445 say 5000 Nos @ Rs. 12.00/ each						Each	Rs.	60000.00
18	Providing masonary with modular bricks band on roof in CM 1:6								
	10 x 12 = 120 Rm @ Rs 60.00/ Rm						Rm	Rs.	7200.00
19	Providing and laying the Pointing for exposed surfaces of SSM in CM 1:3								
		1	60		0.45	27			
	27 sqm @ Rs.34.00/Sqm						Sqm	Rs.	918.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT	.	AMOUNT (in Rupees)
20	Providing Plastering to BBM walls CM 1:4 (20 mm th)								
	Inside & Outside	1	60		4.1	246			
			250 sqm @ Rs.74.00/Sqm				Sqm	Rs.	18500.00
21	Bed CC in 1:3:6 for flooring to store, service & dinning								
	Qty = 6.5 cum @ Rs.2115.00/ cum						Cum	Rs.	13748.00
22	Adanga marble tiles with veins for dinning hall flooring								
			160 Sqm @ Rs.1215.00 / Sqm				Sqm	Rs.	194400.00
23	Rough Shahabad slabs for store & service flooring								
			100 Sqm @ Rs.300.00 / Sqm				Sqm	Rs.	30000.00
24	Providing and fixing MS hand railing for steps & dinning.								
		1	50		0.75	37.5			
		say	40 sqm @ Rs.900.00/Sqm				Sqm	Rs.	36000.00
25	Water proof cement painting out side								
	Say 90sqm @ Rs.42.00/ sqm						Sqm	Rs.	3780.00
26	Oil bound distemper painting to inside walls								
	Say 150 sqm @ Rs.34.00/ sqm						Sqm	Rs.	5100.00
27	Supplying of HYSD steel bar & labour charges for fabrication for RCC work								
	62 cum @ 1.5 % of concrete area = 9.3 MT @ Rs.37500.00/MT						MT	Rs	348750.00
						Total		Rs.	**1758543.00**
28	10 % for water supply & Sanitary facilities							Rs.	175854.00
29	10 % for Electrification works							Rs	175854.00
30	Miscellaneous & round off							Rs.	9749.00
							Grand Total	Rs.	**2120000.00**

(Rupees Twenty one lakhs twenty thousand only)

NAME OF WORK:	Integrated Development of Hebbal lake in Bangalore on DOT Basis
TABLE 5.11:	Detailed estimation for Medical Care Centre.

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
1	Earth work excavation for foundation in Ordinary soil								
	All round	1	32	1.05	1.05	35.28			
	Central walls	1	12	1.05	1.05	13.23			
	Qty = 48.51 say 50 cum @ Rs.65.00/ cum						Cum	Rs.	3250.00
2	Providing and laying the bed Cement Concrete in 1:4:8								
	All round	1	32	1.05	0.15	5.04			
	Central walls	1	12	1.05	0.15	1.89			
	Qty = 6.93 say 7 cum @ Rs.1700.00/ cum						Cum	Rs.	11900.00
3	Providing and constructing the SSM, hammer dressed in CM 1:6 for foundation								
	All round	1	32	0.75	0.45	10.8			
		1	32	0.6	0.45	8.64			
	Central walls	1	12.75	0.75	0.45	4.3			
		1	13.12	0.6	0.45	3.54			
	Qty = 27.28 say 30 cum @ Rs.1170.00/ cum						Cum	Rs	35100.00
4	Providing and constructing the SSM, Chistle dressed in CM 1:6 for basement								
	All round	1	32	0.45	0.45	6.48			
	Central walls	1	13.5	0.45	0.45	2.73			
	Qty = 9.21 say 10 cum @ Rs 1430.00/ cum						Cum	Rs.	14300.00
5	Providing and laying the Coping Cement Concrete in 1:2:4								
	All round	1	32	0.45	0.15	2.16			
	Central walls	1	13.5	0.45	0.15	0.91			
	Qty = 3.07 say 3.5 cum @ Rs.2450.00/ cum						Cum	Rs.	8575.00
6	Providing and laying the BBM wall in CM 1:6								
	All round	1	32	0.23	3	22.08			
	Central walls	1	13.5	0.23	3	9.32			
	Deductions:								
	Lintel-All round	1	45.5	0.23	0.15	1.56			
	Door- D	2	1.2	0.23	2.1	1.16			
	D1	1	1.05	0.23	2.1	0.51			
	D2	1	0.75	0.23	2.1	0.36			
	Front entrnce door	1	4	0.23	2.1	1.93			
	Window - W	2	1.5	0.23	1.5	1.04			
	W1	4	0.9	0.23	1..35	1.12			
	Ventilators - V	2	0.75	0.23	0.75	0.26			
	Net Qty=31.4 - 7.94= 23.46 say 25 cum @ Rs 2160.00/ cum						Cum	Rs.	54000.00
7	Earth work filling to the foundation & basement (available)								
		1	12	4	0.45	21.6			
		say	22 cum @ Rs 35.00/Cum				Cum	Rs	770.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
8	RCC Lintels in 1:1 1/2 :3								
	Lintel-All round	1	45.5	0.23	0.15	1.56			
	Cantilever beam for canopy	1	12.6	0.23	0.45	1.3			
	Canopy slab	1	5.5	1.8	0.125	1.24			
	4.1 cum say 4.5 cum @ Rs 4160.00/Cum						Cum	Rs	18720.00
9	Supplying of HYSD steel bar & labour charges for fabrication for RCC work								
	4.5 cum @ 1.5 % of concrete area = 0.675 say 0.7 MT @ Rs.37500.00/MT						MT	Rs.	26250.00
10	CC Cill in 1:3 :6								
	Window - W	2	2	0.23	0.1	0.92			
	W1	4	1.4	0.23	0.1	0.13			
	Ventilators - V	2	1.25	0.23	0.1	0.06			
	Qty = 1.11 say 1.5 cum @ Rs.2115.00/ cum						Cum	Rs.	3173.00
11	Teak wood Doors, Windows & Ventilators with wood polish								
	Door- D	2	1.2		2.1	5.04			
	D1	1	1.05		2.1	2.2			
	D2	1	0.75		2.1	1.58			
	Front entrnce door	1	4		2.1	8.4			
	Window - W	2	1.5		1.5	4.5			
	W1	4	0.9		1..35	4.86			
	Ventilators - V	2	0.75		0.75	1.13			
	Qty = 27.71 say 30 sqm @ Rs.4500.00/ sqm						Sqm	Rs.	135000.00
12	Tubular trusses & Iron angle purlines for roof								
	Say about 3.0 MT @ Rs. 80000.00/ MT						MT	Rs.	240000.00
13	Supplying & fixing new Mangalore tiles								
		1	14		7	98			
	98 / 0.0675 = 1452 say 1500 Nos @ Rs. 12.00/ each						Each	Rs.	18000.00
14	Supplying & fixing Mangalore ridge tiles								
	39 mts length at Rs. 91.00/ RM						RM	Rs.	3549.00
15	Providing Pointing for exposed surfaces of SSM in CM 1:3								
		1	32		0.45	14.4			
	15 sqm @ Rs.34.00/Sqm						Sqm	Rs.	510.00
16	Providing Plastering to BBM walls CM 1:4 (20 mm th)								
	Inside & Outside	1	95		3	285			
	300 sqm @ Rs.74.00/Sqm						Sqm	Rs.	22200.00
17	Bed CC in 1:3:6 for flooring								
		1	13	5	0.1				
	Qty = 6.5 cum @ Rs.2115.00/ cum						Cum	Rs.	13748.00
18	Adanga marble tiles with veins for flooring including wall skirting								
		1	13	5					
	Qty = 65 sqm say 80 sqm @ Rs.1215.00/ sqm						Sqm	Rs	97200.00
19	Water proof cement painting out side								
	Say 110 sqm @ Rs.42.00/ sqm						Sqm	Rs.	4620.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
20	Oil bound distemper painting to inside walls								
	Say 180 sqm @ Rs.34.00/ sqm						Sqm	Rs	6120.00
						Total		Rs	716785.00
21	Procurement of medical equipments						LS	Rs	500000.00
22	10 % for water supply & Sanitary facilities							Rs	71678.00
23	10 % for Electrification works							Rs	71678.00
24	Miscellaneous & round off							Rs	9859.00
							Grand Total	Rs.	1370000.00

(Rupees Thirteen lakhs seventy thousand only)

NAME OF WORK:	Integrated Development of Hebbal lake in Bangalore on DOT Basis
TABLE 5.12:	Detailed estimation for Administrative office cum Reception centre.

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
1	Earth work excavation for foundation in Ordinary soil								
	All round	1	41.56	1.05	1.05	45.82			
	Central walls	1	22.45	1.05	1.05	24.75			
	Colums	2	0.9	0.9	1.05	1.7			
	Qty = 72.27 say 75 cum @ Rs.65.00/ cum						Cum	Rs.	4875.00
2	Providing and laying the bed Cement Concrete in 1:4:8								
	All round	1	41.56	1.05	0.15	6.54			
	Central walls	1	22.45	1.05	0.15	3.53			
	Colums	2	0.9	0.9	0.15	0.25			
	Qty = 10.32 say 12 cum @ Rs.1700.00/ cum						Cum	Rs.	20400.00
3	Providing and constructing the SSM, hammer dressed in CM 1:6 for foundation								
	All round	1	41.56	0.75	0.45	14.02			
		1	41.56	0.6	0.45	11.22			
	Central walls	1	22.45	0.75	0.45	7.58			
		1	22.45	0.6	0.45	6.06			
	Qty = 38.88 say 40 cum @ Rs.1170.00/ cum						Cum	Rs.	46800.00
4	Providing and constructing the SSM, Chistle dressed in CM 1:6 for basement								
	All round	1	41.56	0.45	0.45	8.41			
	Central walls	1	22.45	0.45	0.45	4.54			
	Qty = 12.95 say 14 cum @ Rs.1430.00/ cum						Cum	Rs.	20020.00
5	Providing and laying the Coping Cement Concrete in 1:2:4								
	All round	1	41.56	0.45	0.15	2.8			
	Central walls	1	22.45	0.45	0.15	1.51			
	Qty = 4.31 say 5 cum @ Rs.2450.00/ cum						Cum	Rs.	12250.00
6	Providing & laying RCC column footing in 1: 11/2 :3 (RMC)								
		2	0.6	0.6	0.45	0.32			
	Qty = say 0.4 cum @ Rs.3750.00/ cum						Cum	Rs.	1500.00
7	Providing & laying RCC column in 1: 11/2 :3 (RMC)								
	3.14 x 0.3 x 0.3	2			3.15	1.78			
	Qty = Say 1.8 cum @ Rs.5475.00/ cum						Cum	Rs.	9855.00
8	Providing and laying the BBM wall in CM 1:6								
	All round	1	41.56	0.23	3	28.67			
	Central walls	1	22.45	0.23	3	15.49			
	Gable walls	0.5	6.06	0.23	1.5	1.05			
	0.5	2	11.12	0.23	1.5	3.84			
	0.5	2	2.26	0.23	0.6	0.32			
	0.5	2	2.96	0.23	0.6	0.4			
	Deductions.								
	Lintel-All openings	1	36	0.23	0.15	1.24			
	Door- D	3	1.2	0.23	2.1	1.74			
	D1	4	1.05	0.23	2.1	2.02			
	Window - W	4	1.5	0.23	1.5	2.07			
	W1	6	1.2	0.23	1.5	2.48			

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
	Ventilators - V	4	0.75	0.23	0.75	0.52			
	Net Qty=49.7- 10.07=39.63 say 40 cum @ Rs.2160.00/cum						Cum	Rs.	86400.00
9	Earth work filling to the foundation & basement (available)								
		1	10.2	5.4	0.45	24.78			
		1	5.6	4.23	0.45	10.65			
	35.43 say		36 cum @ Rs.35.00/Cum				Cum	Rs	1260.00
10	RCC Lintels in 1:1 1/2 :3								
	Lintel-All openings	1	36	0.23	0.15	1.24			
		say	1.5 cum @ Rs.4160.00/Cum				Cum	Rs.	6240.00
11	CC Cill in 1:3 :6								
	Window - W	4	2.1	0.23	0.1	0.19			
	W1	6	1.8	0.23	0.1	0.25			
	Ventilators - V	4	1.25	0.23	0.1	0.12			
	Qty = 0.56 say 0.6cum @ Rs.2115.00/ cum						Cum	Rs.	1269.00
12	Teak wood Doors, Windows & Ventilators with wood polish								
	Door- D	3	1.2		2.1	7.56			
	D1	4	1.05		2.1	8.82			
	Window - W	4	1.5		1.5	9			
	W1	6	1.2		1.5	10.8			
	Ventilators - V	4	0.75		0.75	2.25			
	Qty = 38.43 say 40 sqm @ Rs.4500.00/ sqm						Sqm	Rs.	180000.00
13	Providing & laying RCC beams for canopy at lintel level in 1: 1 1/2 :3 (RMC)								
	All round	1	9.3	0.3	0.45	1.25			
	Qty = say 1.50 cum @ Rs.5325.00/ cum						Cum	Rs.	7988.00
14	Supplying of HYSD steel bar & labour charges for fabrication for RCC work								
	6.5 cum @ 1.5 % of concrete area = 0.975 say 1MT @ Rs.37500.00/MT						MT	Rs.	37500.00
15	RCC drop Chejja in 1:1 1/2 :3, 7.5 cm thick								
	Window - W	4	2.1		0.6	5.04			
	W1	6	1.8		0.6	6.48			
	Ventilators - V	4	1.2		0.6	2.88			
	14.4 Sqm say		15 Sqm @ Rs.600.00/Sqm				Sqm	Rs.	9000.00
16	Tubular trusses & Iron angle purlines for roof								
	Say about 3.5 MT @ Rs. 80000.00/ MT						MT	Rs	280000.00
17	Supplying & fixing new Mangalore tiles								
		1	14		7	98			
	72 / 0.0675 = 1067 say 1100 Nos @ Rs. 12.00/ each						Each	Rs	13200.00
18	Supplying & fixing Mangalore ridge tiles								
	25 mts length at Rs. 91.00/ RM						RM	Rs.	2275.00
19	Providing masonary with modular bricks band on roof in CM								
	60 Rm @ Rs 60.00/ Rm						Rm	Rs.	3600.00
20	Providing and laying the Pointing for exposed surfaces of SSM in CM 1:3								
		1	42		0.45	18.9			
		20 sqm @ Rs.34.00/Sqm					Sqm	Rs	680.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
21	Providing Plastering to BBM walls CM 1:4 (20 mm th)								
						430 sqm @ Rs 74.00/Sqm	Sqm	Rs.	31820.00
22	Bed CC in 1:3:6 for flooring								
	Qty = 7 0 cum @ Rs 2115.00/ cum						Cum	Rs.	14805.00
23	Adanga marble tiles with veins for flooring including wall								
			1	13	5				
	Qty = 70 sqm @ Rs.1215.00/ sqm						Sqm	Rs.	85050.00
24	Water proof cement painting out side								
	Say 130 sqm @ Rs.42.00/ sqm						Sqm	Rs.	5460.00
25	Oil bound distemper painting to inside walls								
	Say 310 sqm @ Rs.34.00/ sqm						Sqm	Rs.	10540.00
						Total		Rs.	892787.00
26	10 % for water supply & Sanitary facilities							Rs.	89279.00
27	10 % for Electrification works							Rs.	89279.00
28	Miscellaneous & round off							Rs.	8655.00
							Grand Total	Rs.	1080000.00

(Rupees Ten lakh eighty thousand only)

NAME OF WORK:	Integrated Development of Hebbal lake in Bangalore on DOT Basis
TABLE 5.13:	Detailed estimation for Handicraft & Curio gift shops.

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
1	Earth work excavation for foundation in Ordinary soil Qty = 300 cum @ Rs.65.00/ cum						Cum	Rs	19500.00
2	Providing and laying the bed Cement Concrete in 1:4:8 Qty =45 cum @ Rs.1700.00/ cum						Cum	Rs	76500.00
3	Providing and constructing the SSM, hammer dressed in CM Qty = 170 cum @ Rs.1170.00/ cum						Cum	Rs	198900.00
4	Providing and constructing the SSM, Chistle dressed in CM Qty = 60 cum @ Rs.1430.00/ cum						Cum	Rs.	85800.00
5	Providing and laying the Coping Cement Concrete in 1:2:4 Qty = 20 cum @ Rs.2450.00/ cum						Cum	Rs.	49000.00
6	Providing and laying the BBM wall in CM 1:6 Qty=85 cum @ Rs.2160.00/ cum						Cum	Rs.	183600.00
7	Earth work filling to the foundation & basement (available) 150 cum @ Rs.35.00/Cum						Cum	Rs.	5250.00
8	RCC Lintels in 1:1 1/2 :3 for ventilator 2 cum @ Rs 4160.00/Cum						Cum	Rs.	8320.00
9	Supplying of HYSD steel bar & labour charges for fabrication 2.0 cum @ 1.5 % of concrete area = 0.300 say 0.3 MT @ Rs.37500.00/MT						MT	Rs	11250.00
10	Teak wood Ventilators with wood polish Qty = 20 sqm @ Rs.4500.00/ sqm						Sqm	Rs.	90000.00
12	Iron angle beams & purlines for roof Say about 20.0 MT @ Rs.80000.00/ MT						MT	Rs.	1600000.00
13	Supplying & fixing new Mangalore tiles 10000 Nos @ Rs. 12.00/ each						Each	Rs.	120000.00
14	Supplying & fixing Mangalore ridge tiles 120 mts length at Rs. 91.00/ RM						RM	Rs.	10920.00
15	Providing Pointing for exposed surfaces of SSM in CM 1:3 55 sqm @ Rs.34.00/Sqm						Sqm	Rs.	1870.00
16	Providing Plastering to BBM walls CM 1:4 (20 mm th) 960 sqm @ Rs.74.00/Sqm						Sqm	Rs.	71040.00
17	Bed CC in 1:3:6 for flooring Qty = 60 cum @ Rs.2115.00/ cum						Cum	Rs.	126900.00
18	Adanga marble tiles with veins for flooring including wall Qty = 600 sqm @ Rs.1215.00/ sqm						Sqm	Rs.	729000.00
19	Laying of Vitrified tiles for flooring 600 sqms @ Rs. 1000.00/sqm						Sqm	Rs	600000.00
20	Water proof cement painting out side Say 360 sqm @ Rs.42.00/ sqm						Sqm	Rs.	15120.00
21	Oil bound distemper painting to inside walls Say 600 sqm @ Rs.34.00/ sqm						Sqm	Rs.	20400.00
22	Providing and fixing MS hand railing for corridor. say 300 sqm @ Rs.2000.00/Sqm						Sqm	Rs.	600000.00

SL NO	SPECIFICATION	No	L	B	D	Quantity	UNIT		AMOUNT (in Rupees)
23	Providing and fixing Aluminium partation with doors. say 900 sqm @ Rs.3000.00/Sqm						Sqm	Rs.	2700000.00
24	Providing masonary with modular bricks band on roof in CM 1:6 220 Rm @ Rs.60.00/ Rm						Rm	Rs.	13200.00
						Total		Rs.	5812570.00
25	10 % for Electrification works							Rs.	581257.00
26	Miscellaneous & round off							Rs	606173.00
							Grand Total	Rs.	7000000.00

(Rupees Seventy lakhs only)

NAME OF WORK:	Integrated Development of Hebbal lake in Bangalore on DOT Basis							
TABLE 5.14:	Detailed estimate for Boatting jetty (Southern side)							
SL NO	SPECIFICATION	No	L	B	D	QUAN TITY	UNIT	AMOUNT (in Rupees)

1	Earth work excavation for foundation in Ordinary soil Qty = 560 cum @ Rs.65.00/ cum	Cum	Rs	36400.00
2	Providing and laying the bed Cement Concrete in 1:4:8 Qty =75 cum @ Rs.1700.00/ cum	Cum	Rs.	127500.00
3	Providing and constructing the SSM, hammer dressed in CM 1:6 for foundation Qty = 500 cum @ Rs.1170.00/ cum	Cum	Rs	585000.00
4	Providing and laying the Coping Cement Concrete in 1:2:4 Qty = 85 cum @ Rs.2450.00/ cum	Cum	Rs.	208250.00
5	Providing and laying the Wire cut modular brick masonary wall in CM 1:6 Qty = 2 cum @ Rs.3000.00/ cum	Cum	Rs.	6000.00
6	Earth work filling to the foundation & basement (available) 110 cum @ Rs.35.00/Cum	Cum	Rs.	3850.00
7	Providing Pointing for exposed surfaces of SSM in CM 1:3 150 sqm @ Rs 34.00/Sqm	Sqm	Rs.	5100.00
8	Providing Pointing brick masonary in CM 1:3 30 sqm @ Rs 34.00/Sqm	Sqm	Rs.	1020.00
9	Tubular post columns for rainy shutter roof 80 Rmt @ Rs.3000.00/Rmt	Rmt	Rs	240000.00
10	Tubular trusses & iron angle purlines for rainy shutter roof 350 sqm @ Rs.6000.00/Sqm	Sqm	Rs.	2100000.00
11	FRP sheet for rainy shutter roof 350 sqm @ Rs.400.00/Sqm	Sqm	Rs.	140000.00
12	Chain guard at peripery of steps, 58 Rmt	LS	Rs.	80000.00
13	Inter locking blocks paving for 350 sqm @ Rs.650.00/sqm	Sqm	Rs.	227500.00
14	10% Electrical works		Rs.	376062.00
15	Miscellaneous & round off		Rs.	13938.00
			Grand Total Rs.	4150000.00

(Rupees Forty one lakhs fifty thousand only)

NAME OF WORK:		Integrated Development of Hebbal lake in Bangalore on DOT Basis							
TABLE 5.15:		Detailed estimate for Boating jetty (Northeastern side)							
SL NO	SPECIFICATION	No	L	B	D	QUAN TITY	UNIT		AMOUNT (in Rupees)
1	Earth work excavation for foundation in Ordinary soil Qty = 120 cum @ Rs.65.00/ cum						Cum	Rs	7800.00
2	Sand & Boulder filling Qty =13 cum @ Rs.635.00/ cum						Cum	Rs.	8255.00
3	Providing and laying the bed Cement Concrete in 1:4:8 Qty =8 cum @ Rs.1700.00/ cum						Cum	Rs	13600.00
4	Providing and constructing the SSM, Chistle dressed in CM Say 60.00 cum @ Rs.1430.00/ cu m						cum	Rs	85800.00
5	Earth work filling to the foundation & basement (available) 50 cum @ Rs.35.00/Cum						Cum	Rs.	1750.00
6	Providing Pointing for exposed surfaces of SSM in CM 1:3 45 sqm @ Rs.34.00/Sqm						Sqm	Rs.	1530.00
7	Providing and laying the Coping Cement Concrete in 1:2:4 Qty = 7cum @ Rs.2450.00/ cum						Cum	Rs.	17150.00
8	Chain guard at peripery of steps, 32 Rmt						LS	Rs	32000.00
9	10% Electrical works							Rs.	16788.00
10	Miscellaneous & round off							Rs	15327.00
							Grand Total	Rs.	200000.00

(Rupees Two lakhs only)

CHAPTER – 6

OPERATION AND MAINTENANCE SYSTEM

6.1 Operation and maintenance of and Recreational facilities: -

Maintenance of the recreational facilities designed in the earlier section is most important for preserving the ecological balance, good environment and for keeping clean of Hebbal Lake. The activities that will have to be performed by the maintenance team shall comprise of the following

- Daily operation of the lighting and fountains in and around the lake
- Collection and disposal of all the solid wastes from restaurants, boat house, food courts, decks, parks and other open spaces including the jogging track around the lake.
- Maintenance and watering of the plants and other landscapes in and around the lake
- Clearing rags, papers etc., (If any) from the lake surface. Regular disinfection of the lake surroundings.
- Life guards for the boating area
- Security persons for watch and ward
- For maintain cleanliness in the toilet unit etc ,
- Administrative office cum reception center
- Store building
- Medical care center
- Administrative office cum reception center
- Advertisements boards
- Landscaped parks, Maze blocks, and Musical fountains
- Floating restaurant – 1no.
- Boating etc.,
- Boathouses – 2 nos.
- Food courts 5 no.

With the fact in mind a detailed operational and maintenance plan has been worked out, so as to ensure that the facilities developed as part of the project, are maintained

6.2 Operation and Maintenance of silt trap and screen barriers: -

The essentiality of construction of silt trap and screen barriers is explained in the earlier section. The maintenance of these units is another task for implication of the project in good environmental condition to give good service to the visitors of Hebbal Lake.

The activities that will have to be performed by the maintenance team shall comprise of the following:

- Removing of the collected floating solid wastes in the screen barrier
- The collected silt should be removed from the silt trap

For the maintenance of a silt trap and screen barrier, the labour required is very low may take the assistance from the staff of the Land scapping and recreational facilities.

6.3 Requirement of man power and maintenance

The total estimated manpower required to maintain the different activities of Hebbal Lake annually is 55 personnel has been proposed

Skilled	:	15 persons
Semi Skilled		10 persons
Unskilled (Labour)		30 persons

To annual operate, maintain and other expenses incurred are detailed out in the financial bid for the items of pump, generator, house keeping, advertisement, machinery etc , are worked out by increase in expenditure for corresponding next years is assumed as follows

Salaries	5.0%
Power	5.0%
Advertisement	5.0%
Food	10.0%
House keeping	2.5%
Machine maintenance	5.0%
Maintenance	2.5%
Misc expenses	5.0%

EIH LTD
19/5/2006
Authorised Signatories

CHIEF EXECUTIVE OFFICER
Lake Development Authority
BANGALORE
19.5.06

6.2 Operation and Maintenance of silt trap and screen barriers: -

The essentiality of construction of silt trap and screen barriers is explained in the earlier section. The maintenance of these units is another task for implication of the project in good environmental condition to give good service to the visitors of Hebbal Lake.

The activities that will have to be performed by the maintenance team shall comprise of the following.

- Removing of the collected floating solid wastes in the screen barrier.
- The collected silt should be removed from the silt trap

For the maintenance of a silt trap and screen barrier. the labour required is very low. may take the assistance from the staff of the Land scapping and recreational facilities.

6.3 Requirement of man power and maintenance

The total estimated manpower required to maintain the different activities of Hebbal Lake annually is 55 personnel has been proposed.

Skilled	:	15 persons
Semi Skilled	:	10 persons
Unskilled (Labour)	:	30 persons

To annual operate, maintain and other expenses incurred are detailed out in the financial bid for the items of pump, generator, house keeping, advertisement, machinery etc., are worked out by increase in expenditure for corresponding next years is assumed as follows:

Salaries	5.0%
Power	5.0%
Advertisement	5.0%
Food	10.0%
House keeping	2.5%
Machine maintenance	5.0%
Maintenance	2.5%
Misc.expenses	5.0%

CHAPTER – 7

FINANCING AND SCHEME FOR IMPLIMENTATION

7.1. Introduction: -

The proposed Hebbal Lake conservation program has been appraised for its financial sustainability in the present section. Based on the financial appraisal various options financing and appropriate scheme for implementation is recommended.

7.2 Project Appraisal and Financing: -

It has been observed that in India, most projects fail after successful implementation due to the lake of proper maintenance. This lack of maintenance is direct fallout of financial constraints being faced by most of the urban local bodies (ULBs), wherein available financial resources are spread thinly across a wide spectrum of new projects, leaving meager resources for maintenance of existing assets

I Suggests that some Single waste this!!

In order to ensure that adequate financial resources are available to maintain each of the project components to pre-specified standard, it is essential to identify project-related revenues that could be clearly earmarked for the same.

Revenue sources: -

The possible sources of revenue generation potential from the Hebbal Lake conservation project from the Commercial Activities are as summarized below and are detailed out in the financial bid.

1 Entry fee

An estimated arrival into the park is assumed in the first year as 5 lakh people (it excludes the children's below 5 years of age for them free entry) the rate of increase for next years is assumed as follows.

2 to 5 year - 20%; 6 to 10 year - 15%; 11 to 15 year - 10%

Entry ticket into the park is estimated at,

Rs. 20/- per person in the first 3 years
Rs. 25/- per person in the second 3 years
Rs. 30/- per person in the third 3 years
Rs. 35/- per person in the fourth 3 years
Rs. 40/- per person in the fifth 3 years.

2 Boating

Varieties of boating activities such as pedal boats, bumper boats, battery operated pleasure boats, aqua cycles etc., will be introduced The No. of rounds operating per day, capacity per round and cost of ticket per person are estimated.

3 Floating restaurant

The No. of cycles operating per day, capacity per cycle and cost of ticket per person in floating restaurant are estimated.

4 Lake view Open-air restaurant

In a year, the expected population that can utilize the Lake view open air restaurants is 3 lakhs, on an average the percentage expenditure incurred by persons visiting the restaurant is as mentioned below,

10 %	Rs. 500.00/head
10 %	Rs. 300.00/head
15 %	Rs. 200.00/head
15 %	Rs. 100.00/head
20 %	Rs. 50.00/head
30 %	Rs. 20.00/head.

The profit expected is 5 % of the turn over after excluding all the expenditure incurred.

5 Handicraft and Curio gift center

Annual rent expected from Handicraft curio gift center per year at rate Rs. 5/- per Sq.ft. (Profit excludes all the expenditure power etc.,)

6 Entry for Eco- friendly children park and immersion of idols in the Kalyani, no fee is charged as they are considered as a **service for social cause.**

The project is intended to be taken up more as a fulfillment of social obligation than as a source of revenue generation. The project is formulated on a break-even basis and the activities are so projected taking the eco-ethos of the water body and lake at large

7.3 Scheme for Implementation: -

As discussed in the earlier chapter's for the implication of the project has to be financed by M/s E.I.H. Ltd., No.39, M.G. Road, Bangalore - 01 from his own investment.

CHAPTER – 8

PROJECT EXECUTION, MANAGEMENT AND MONITORING

8.1 Project Implementation Schedule

The execution of the proposed project is expected to be 12 months duration, including monsoon seasons (from May 2005 to April 2006) It excludes the period required for awarding the Hebbal lake from Lake Development Authority on DOT basis, it may take about six months say (from November 2004 to April 2005) accordingly the PERT Chart is prepared as shown in table 8.1.

8.2 Institutional Aspects

As discussed in the earlier chapter's for the implication of the project has to be financed by M/s E.I.H. Ltd., No.39, M.G. Road, Bangalore - 01 from his own investment.

Project Management

Effective management and co-ordination of the project activities is very essential for development successful implementation of the complex projects such as Lake conservation its operation and maintenance. This is due to the multiplicity of the activities and agencies involved in the implementation and also during its operation and maintenance. Its successful implementation is intended to be implementation completely carried through M/s VIMOS Technocrats & Associates, Bangalore

D. Construction of Medical care center, Administrative office cum reception, Handicraft & curio shops, Toilets, Ticket issue counter, Security and Lake view open-air restaurant													
1	Civil works						----------						
2	Electrical Installation										----------		
II. LANDSCAPING & RECREATIONAL FACILITIES.													
E. Development of Children park, Lightings, Rescue watchtower, Parking bay, Viewpoints, Kiosks, Arch bridges, and Beautification													
1	Civil works							----------					
2	Landscaping									----			
3	Plantation										----		
4	Equipments for boating, floating restaurant, Children playing & others										----------		
5	Electrical installation											----	
6	Trial												---

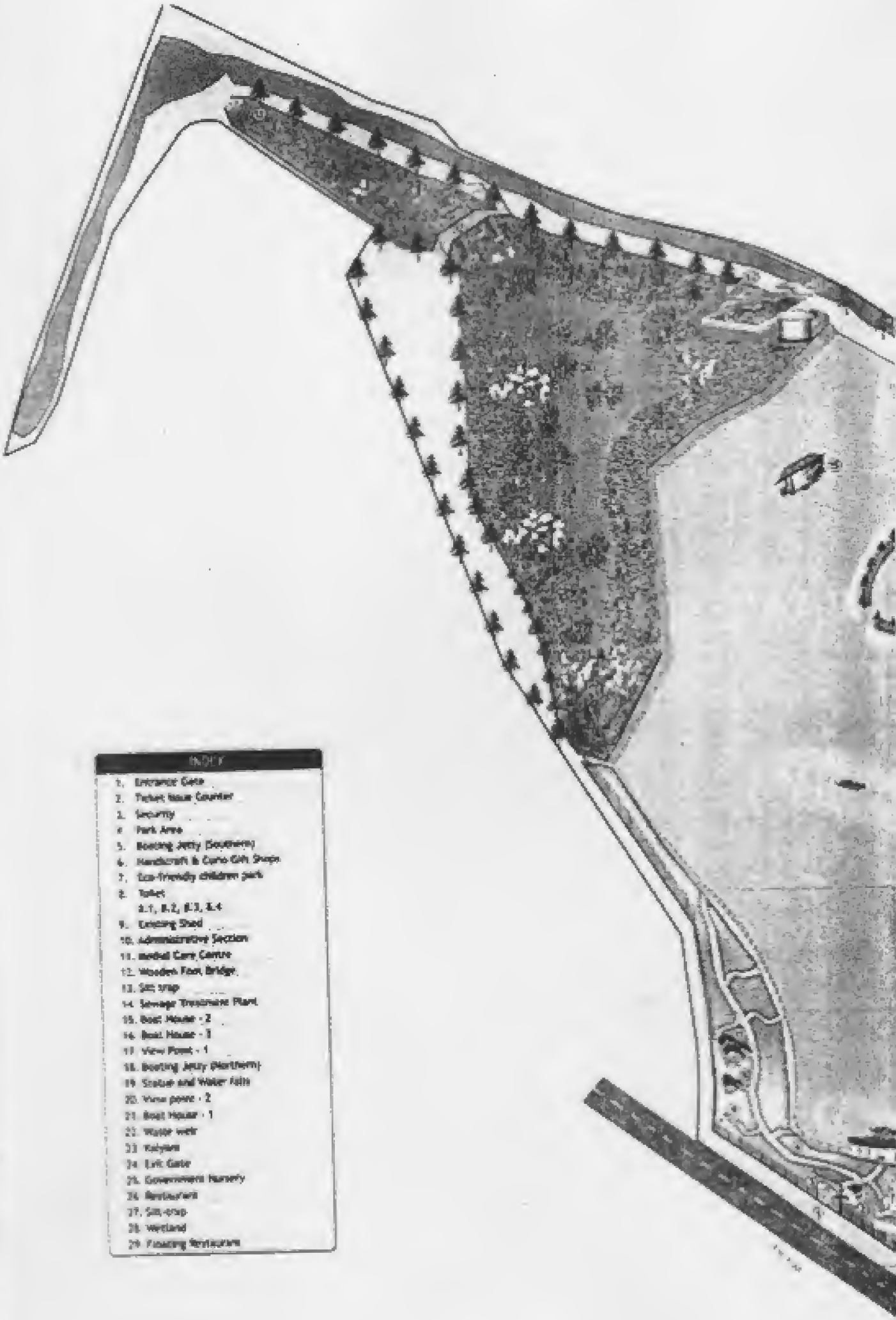
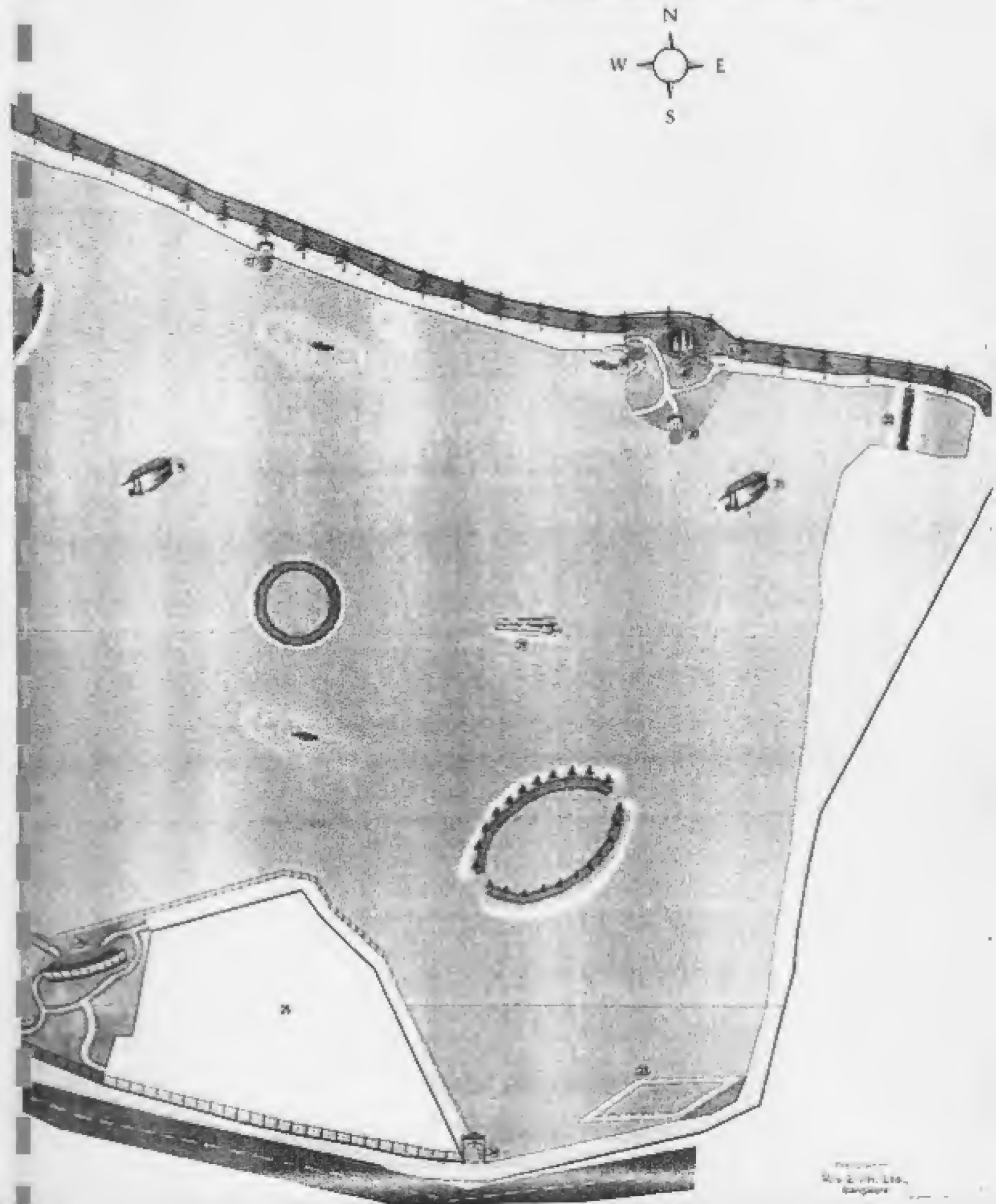
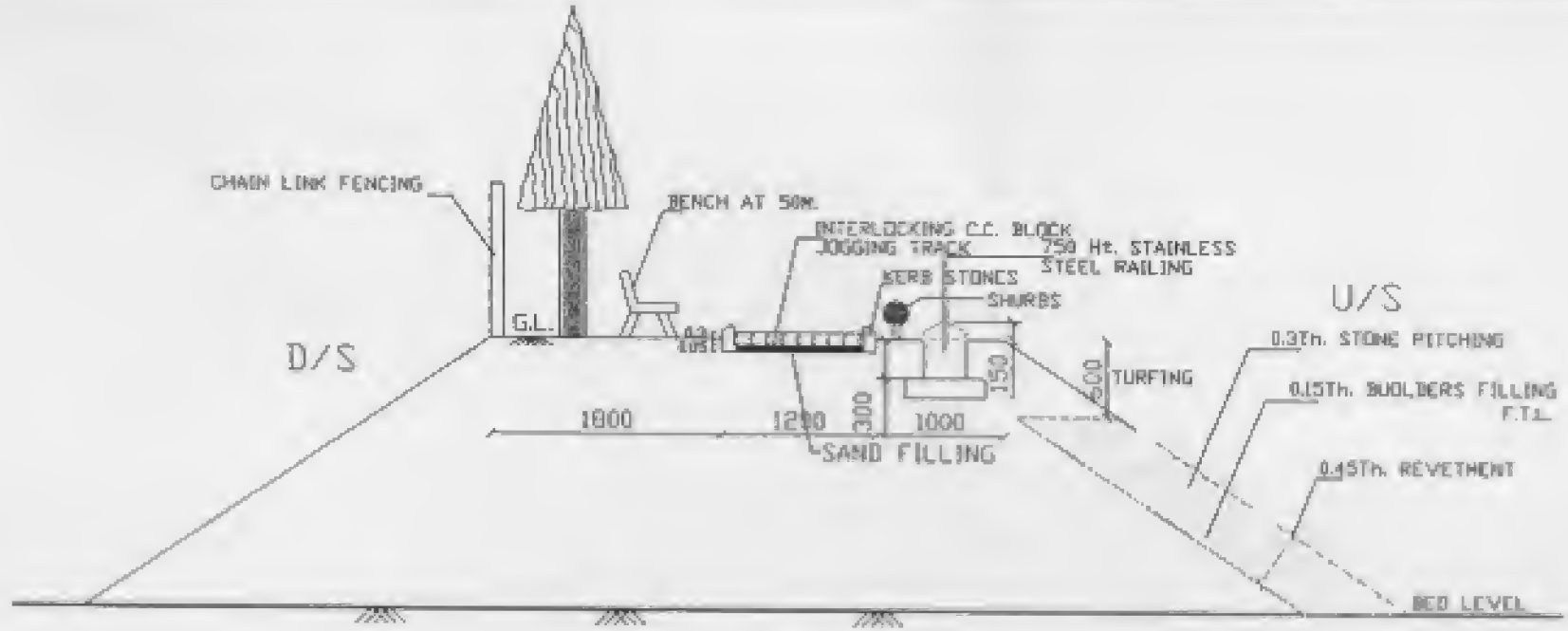

INDEX
1. Entrance Gate
2. Ticket Issue Counter
3. Security
4. Park Area
5. Boating Jetty (Southern)
6. Handicraft & Curio Gift Shops
7. Eco-friendly children park
8. Toilet
8.1, 8.2, 8.3, 8.4
9. Changing Shed
10. Administrative Section
11. Medical Care Centre
12. Wooden Foot Bridge
13. Silt trap
14. Sewage Treatment Plant
15. Boat House - 2
16. Boat House - 1
17. View Point - 1
18. Boating Jetty (Northern)
19. Statue and Water falls
20. View point - 2
21. Boat House - 1
22. Water weir
23. Kalyani
24. Exit Gate
25. Government Nursery
26. Restaurant
27. Silt-trap
28. Wetland
29. Floating Restaurant

Fig. 5.2 - Panoramic view of the HEBBAL LAKE after Restoration



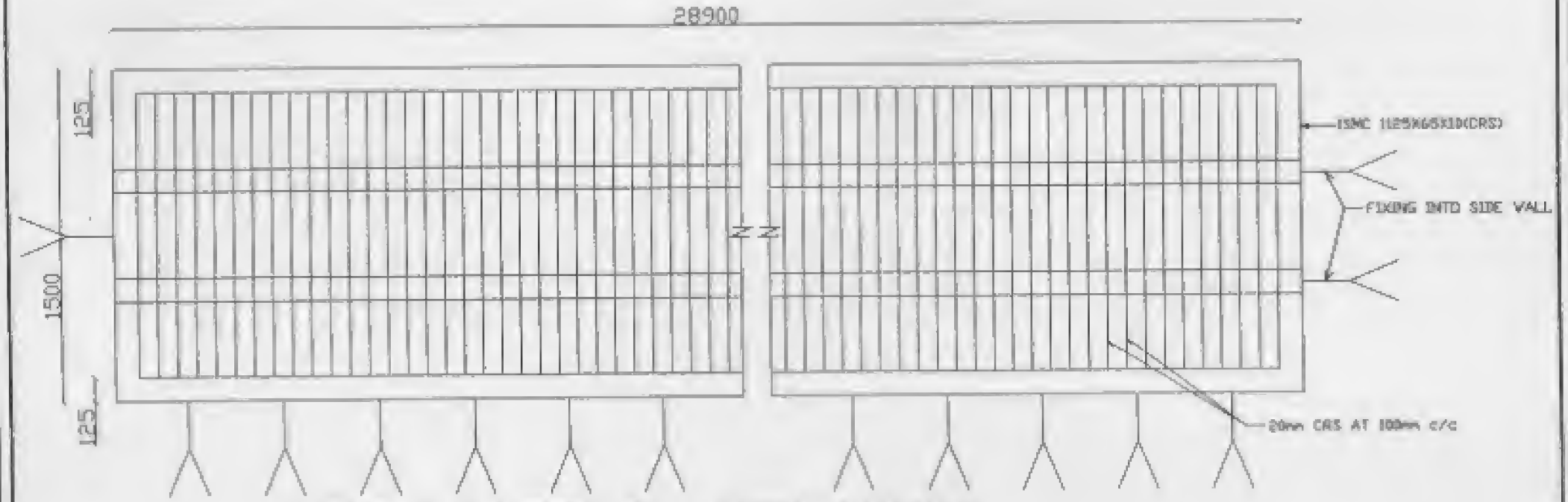


SECTIONAL DETAILS OF PERIPHERY BUND

NAME OF WORK	DEVELOPMENT OF HERBAL LAKE ON D.D.T. BASIS AT BANGALORE.
FIGURE NO.	5.1 TYPICAL SECTION OF BUND

CONSULTANTS
VIMOS TECHNOCRATS & ASSOCIATES BANGALORE.

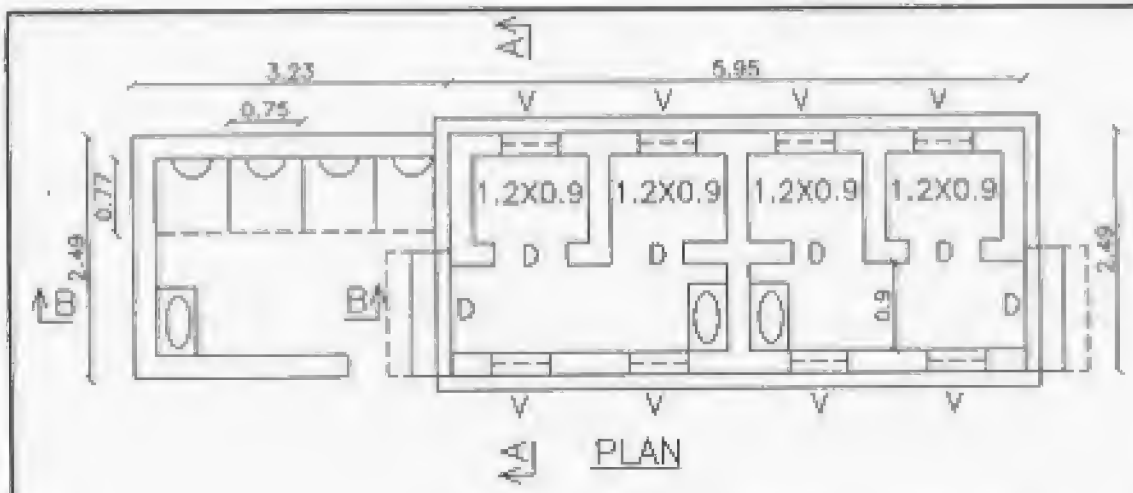
M/s. E.I.H. LTD,
39, M.G. ROAD, BANGALORE-01

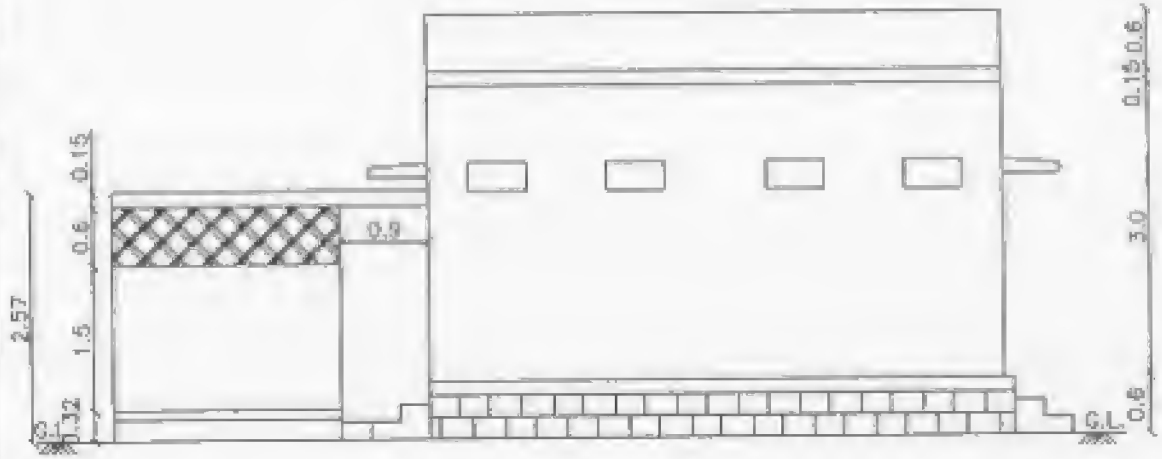


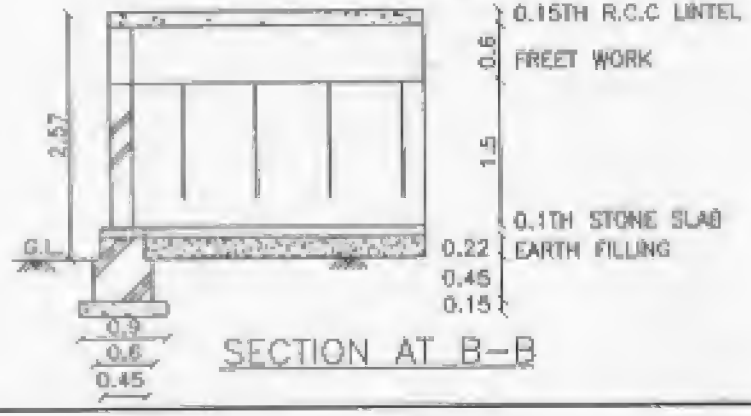
FRONT ELEVATION OF SCREEN BARRIER.

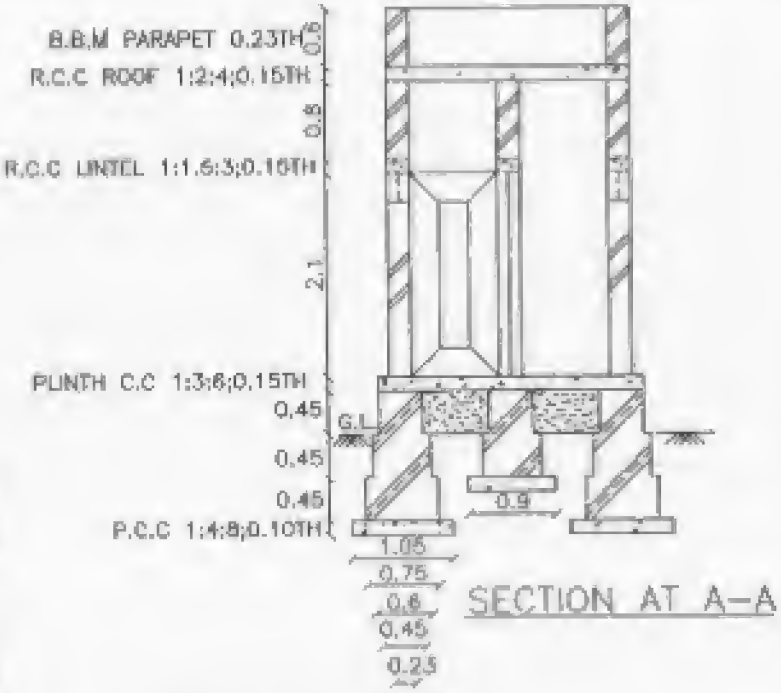
NAME OF WORK	DEVELOPMENT OF HEBBAL LAKE ON D.O.T. BASIS AT BANGALORE.
FIGURE NO.	5.4 DETAILS OF SCREEN BARRIER.

CONSULTANTS VIMOS TECHNOCRATS & ASSOCIATES BANGALORE.	M/s. E.I.H. LTD, # 39, M.G. ROAD, BANGALORE-01









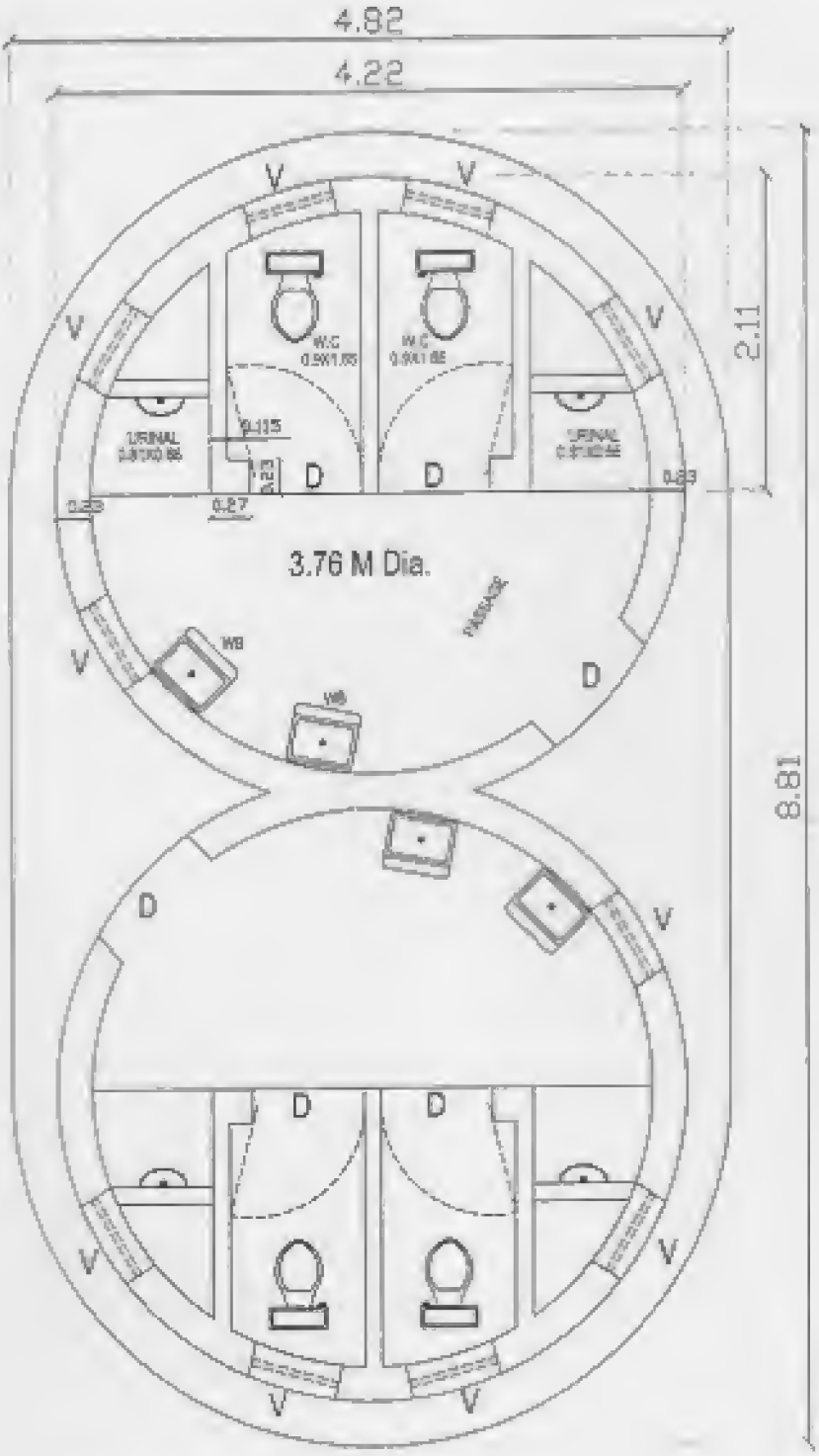
SCHEDULE OF OPENINGS

SL. NO.	PARTICULARS	NO.S	SIZES
01.	D-DOOR	6	0.75X2.1
02.	V-VENTILATORS	8	0.6X0.3

NAME OF WORK	DEVELOPMENT OF HEBBAL LAKE ON D.D.T. BASIS AT BANGALORE.
FIGURE NO.	5.5 TOILET BLOCK (RECTANGULAR SHAPE).

CONSULTANTS
VINOS TECHNOCRATS & ASSOCIATES BANGALORE.

M/s. E.I.P. LTD,
39, M.G. ROAD, BANGALORE-01



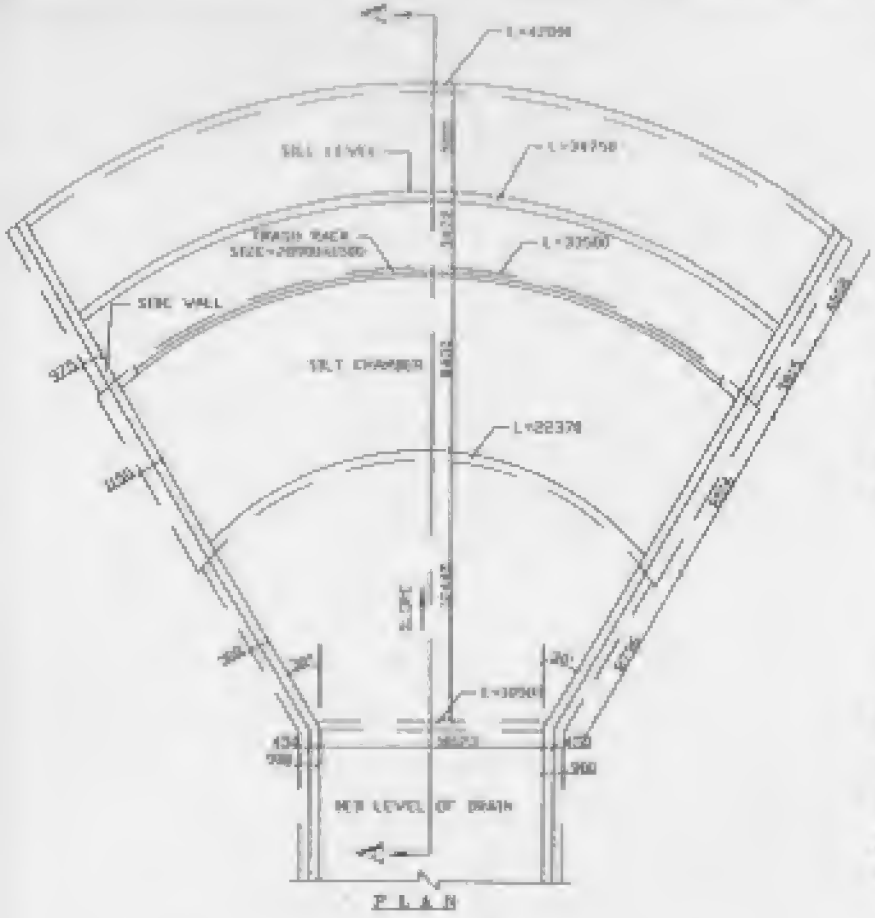
SCHEDULE OF OPENINGS

SL. NO.	PARTICULARS	NO.S	SIZES
01	D-DOOR	6	0.75X2.1
02.	V-VENTILATORS	10	0.6X0.3

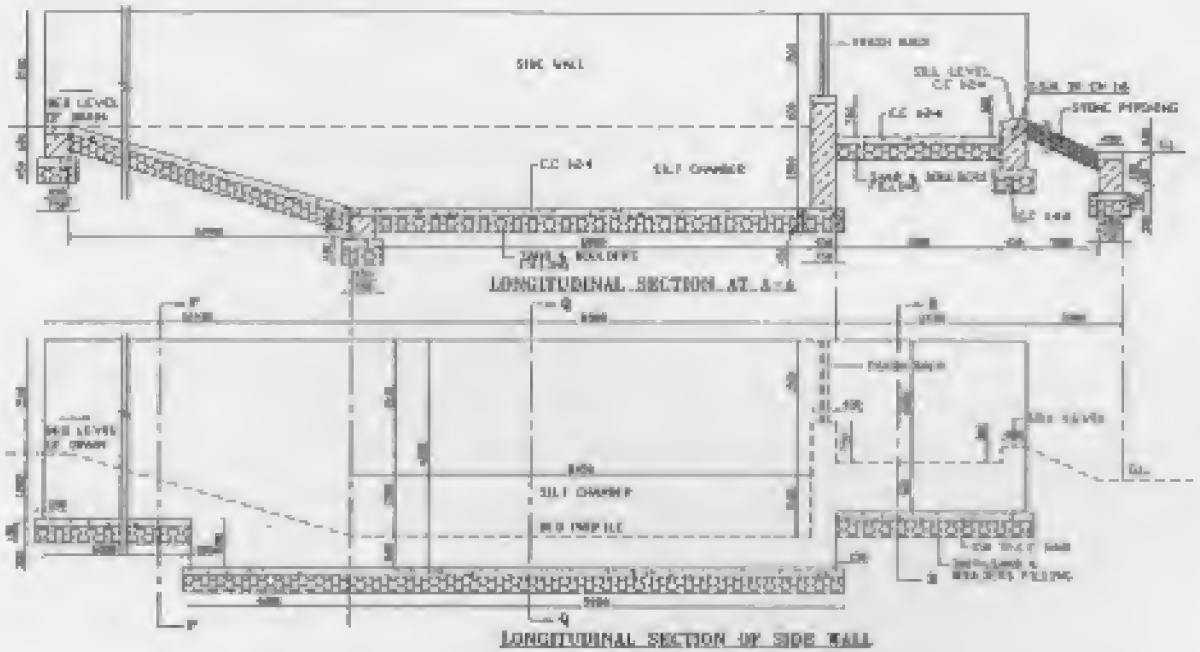
NAME OF WORK	DEVELOPMENT OF HERBAL LAKE ON D.O.T. LAND AT BANGALORE.
FIGURE NO.	8.8 TOILET BLOCK (CIRCULAR SHAPE).

CONSULTANTS
VINOS TECHNOCRATS & ASSOCIATES BANGALORE.

M/s. E.I.H. LTD.
36, M.G. ROAD, BANGALORE-01

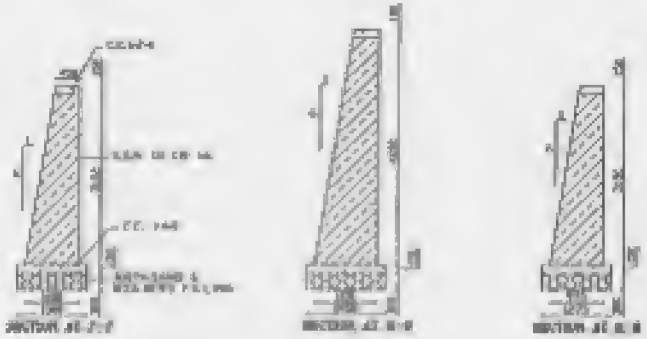


PLAN



LONGITUDINAL SECTION AT A-A

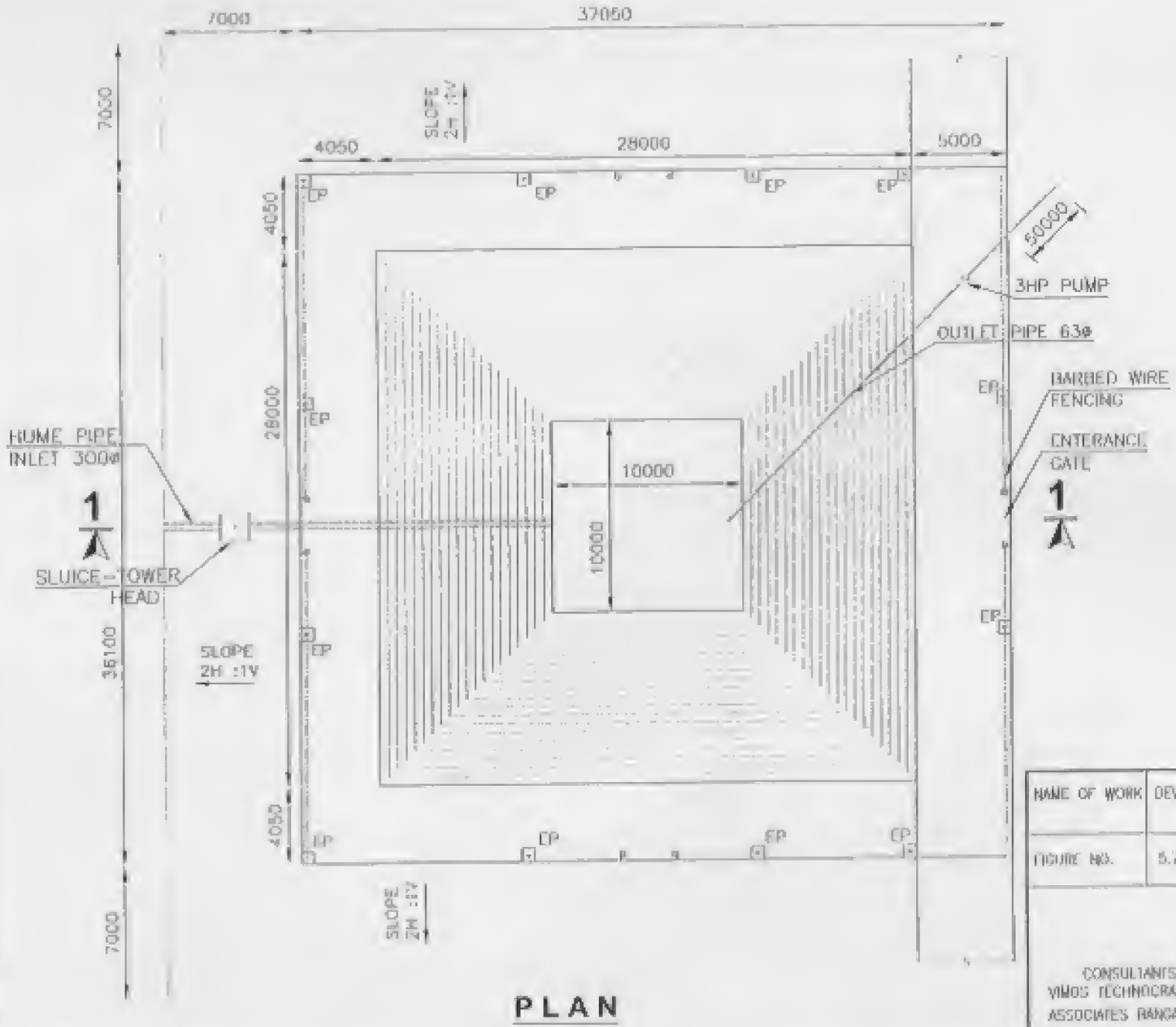
LONGITUDINAL SECTION OF SIDE WALL



NAME OF WORK	DEVELOPMENT OF HEBBAL LAKE ON D.O.I BASIS AT BANGALORE.
FIGURE NO	5.5 DETAILS OF SILT TRAP

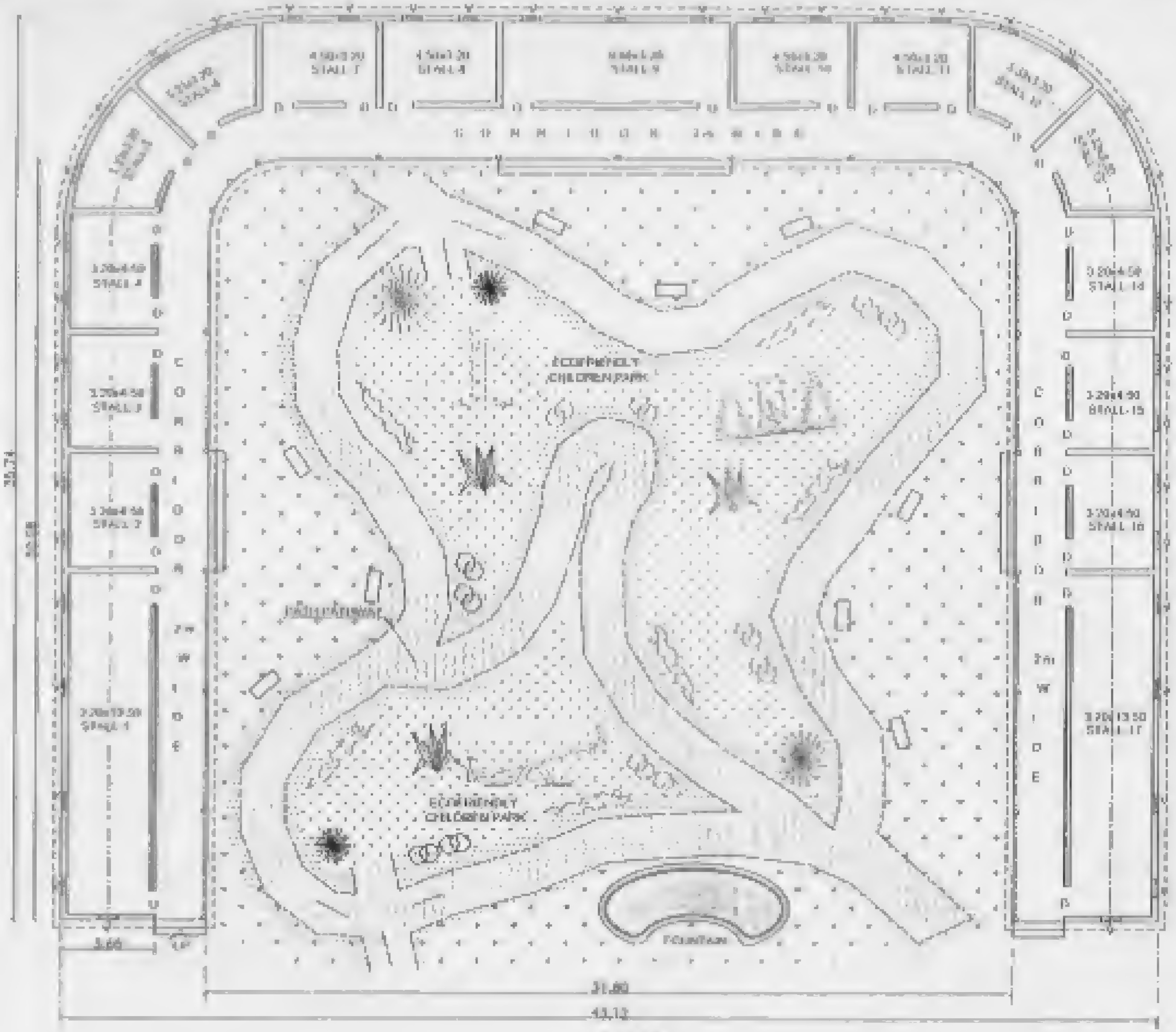
CONSULTANTS
VIMOS TECHNOCRATS &
ASSOCIATES BANGALORE.

M/s. D.J.H. LTD,
39, M.G. ROAD, BANGALORE-01



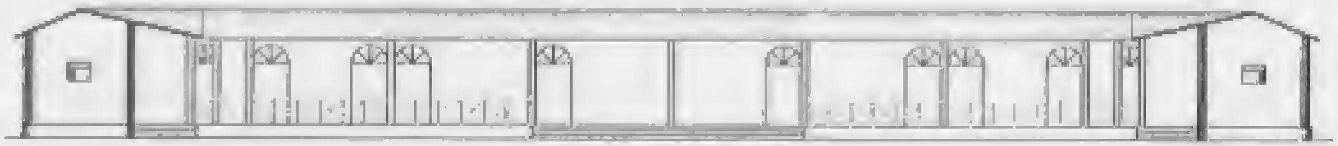
PLAN

NAME OF WORK	DEVELOPMENT OF HEBBAL LAKE ON D.O.T. BASIS AT BANGALORE.
FIGURE NO.	5.7 PLAN OF KALYANI FOR IDOL IMMERSION TANK.
CONSULTANTS VIMOS TECHNOCRATS & ASSOCIATES BANGALORE.	M/s. E.I.H. LTD. # 39, M.G. ROAD, BANGALORE-01



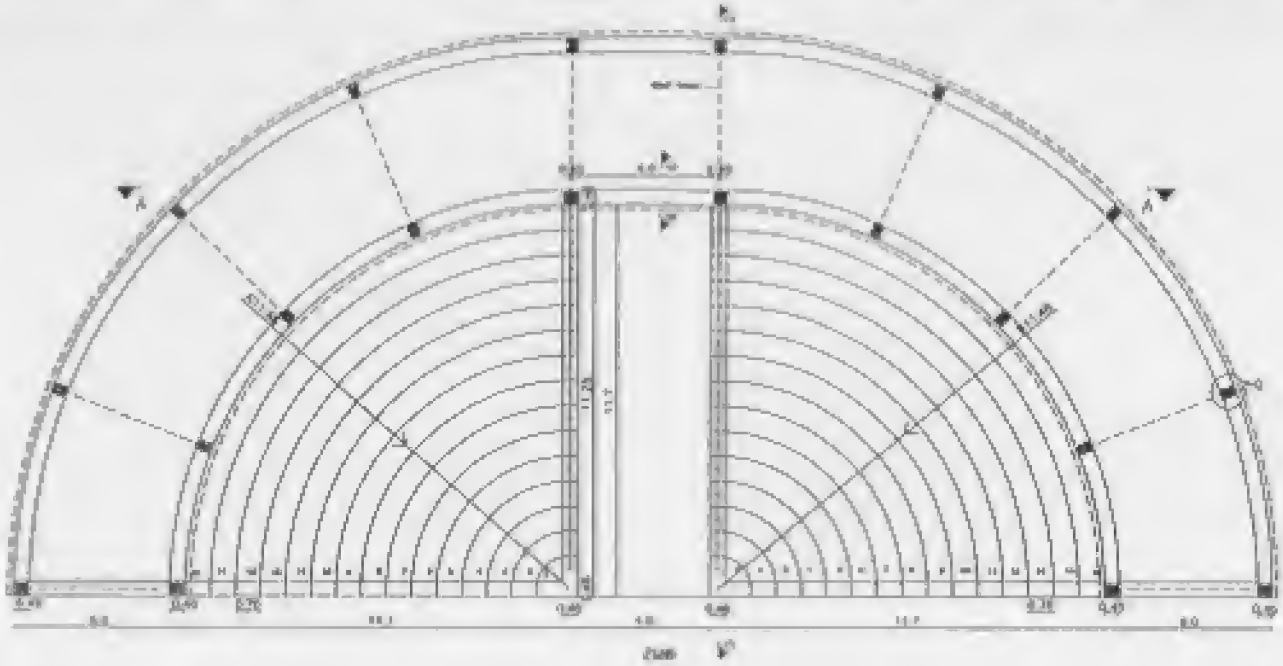
PLAN

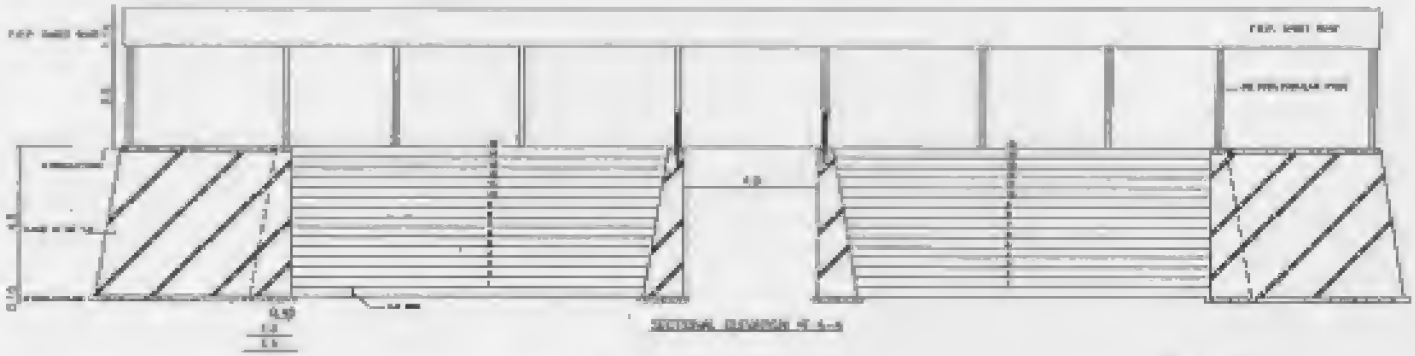
SCHEDULE OF OPENINGS	
D	1.20x2.10
V	0.75x0.60

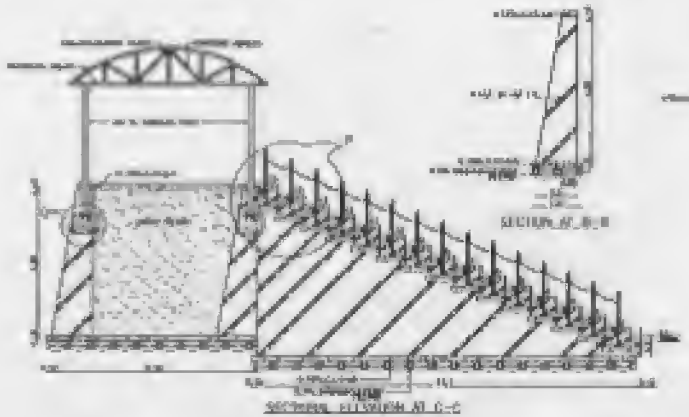


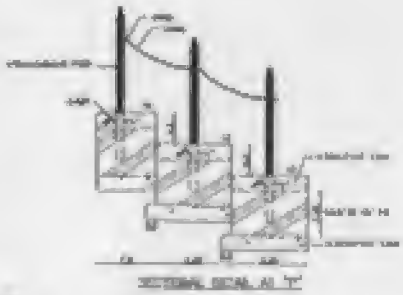
FRONT ELEVATION

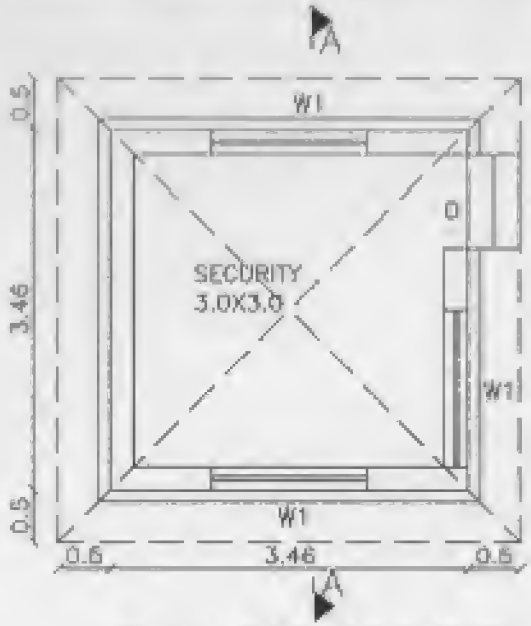
NAME OF WORK	DEVELOPMENT OF MOBILE CAFE ON D.O.T. TAXIS AT BANGALORE.
FIGURE NO.	5.13 HANDICRAFT & CURIO GIFT SHOPS CUM ECO-FRIENDLY CHILDREN PARK.
CONSULTANTS VINTO TECHNOCRATS & ASSOCIATES BANGALORE.	M/s. C.I.H. LTD. # 38, M.G. ROAD, BANGALORE-01





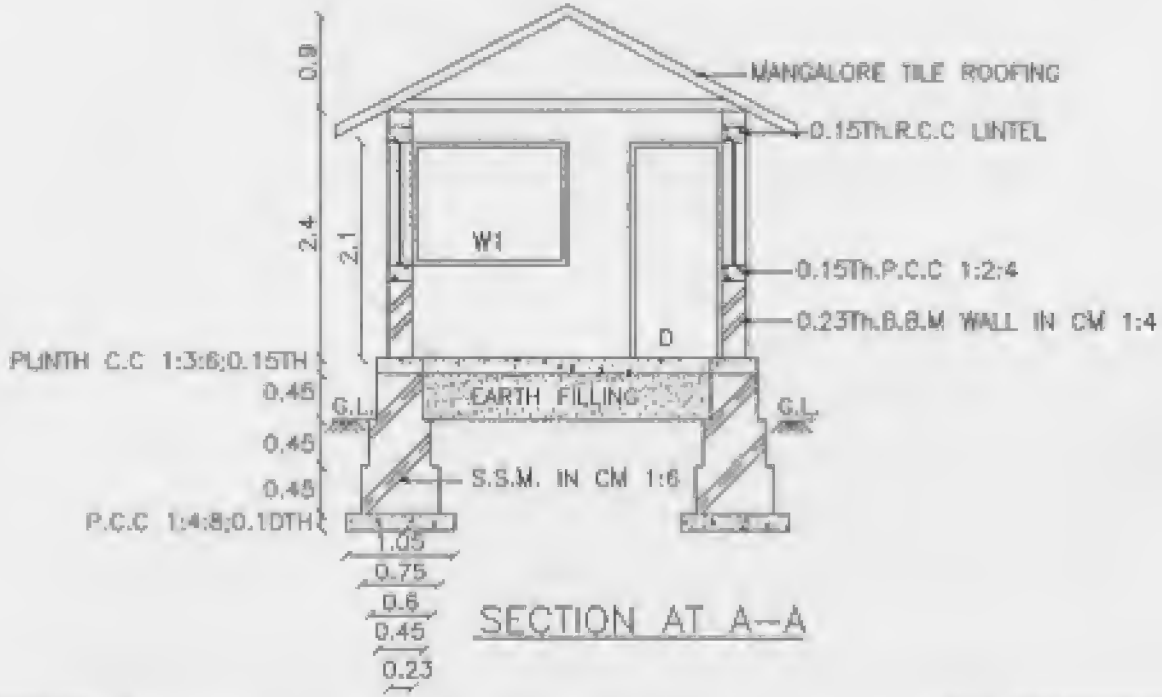






PLAN FOR SECURITY

SCHEDULE OF OPENINGS	
DOOR D	0.9X2.1
WINDOW W1	1.5X1.2

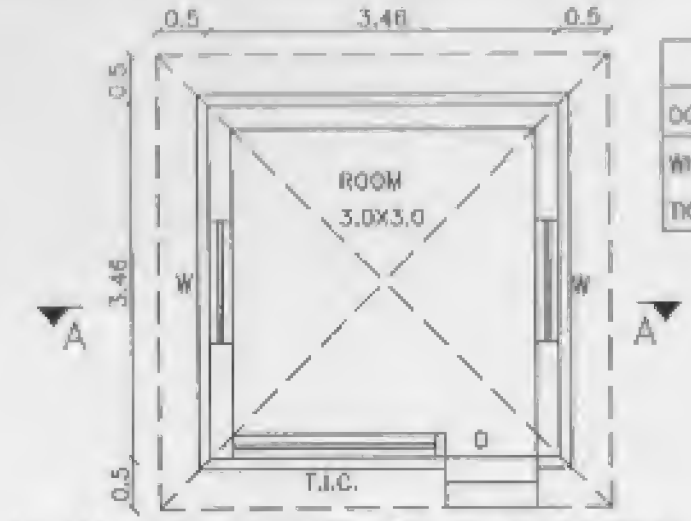


SECTION AT A–A

NAME OF WORK	DEVELOPMENT OF HERBAL LAKE ON B.O.T. BASIS AT BANGALORE.
FIGURE NO.	5.8 SECURITY OFFICE.

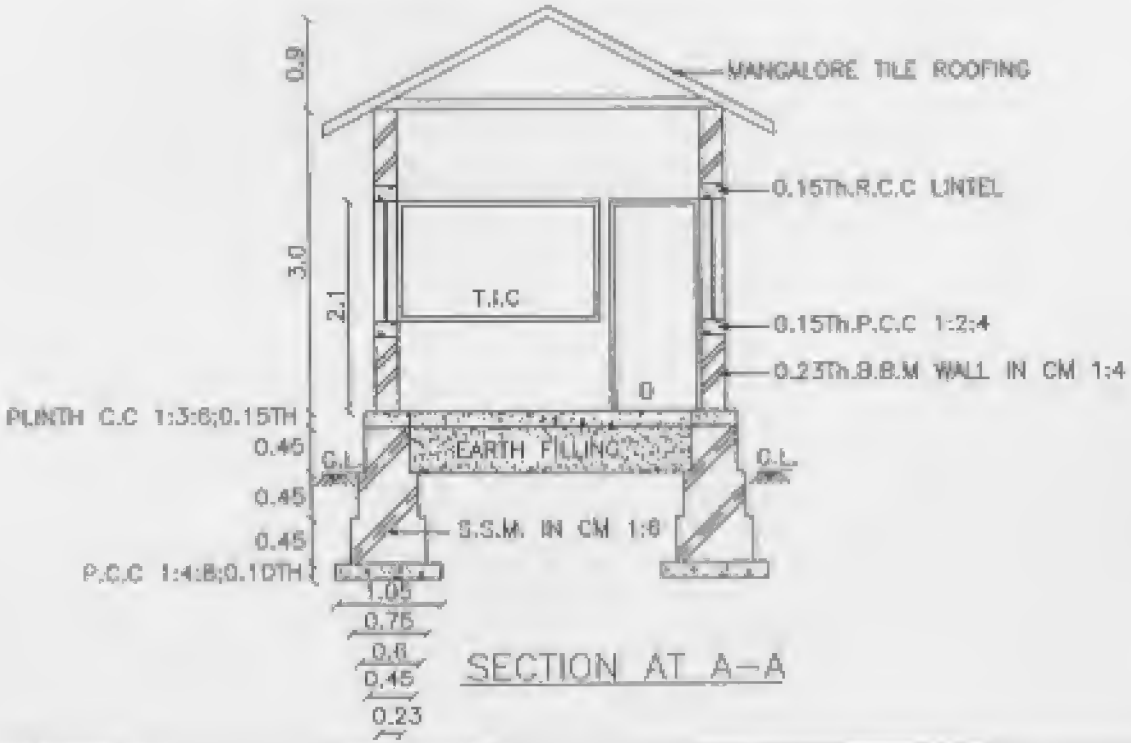
CONSULTANTS
VIMDS TECHNOCRATS &
ASSOCIATES BANGALORE.

M/s. E.I.H. LTD,
39, M.G. ROAD, BANGALORE-01



PLAN FOR TICKET ISSUE COUNTER

SCHEDULE OF OPENINGS	
DOOR D	0.9X2.1
WINDOW W	1.5X1.2
TICKET ISSUE COUNTER(T.I.C)	2.0X1.2

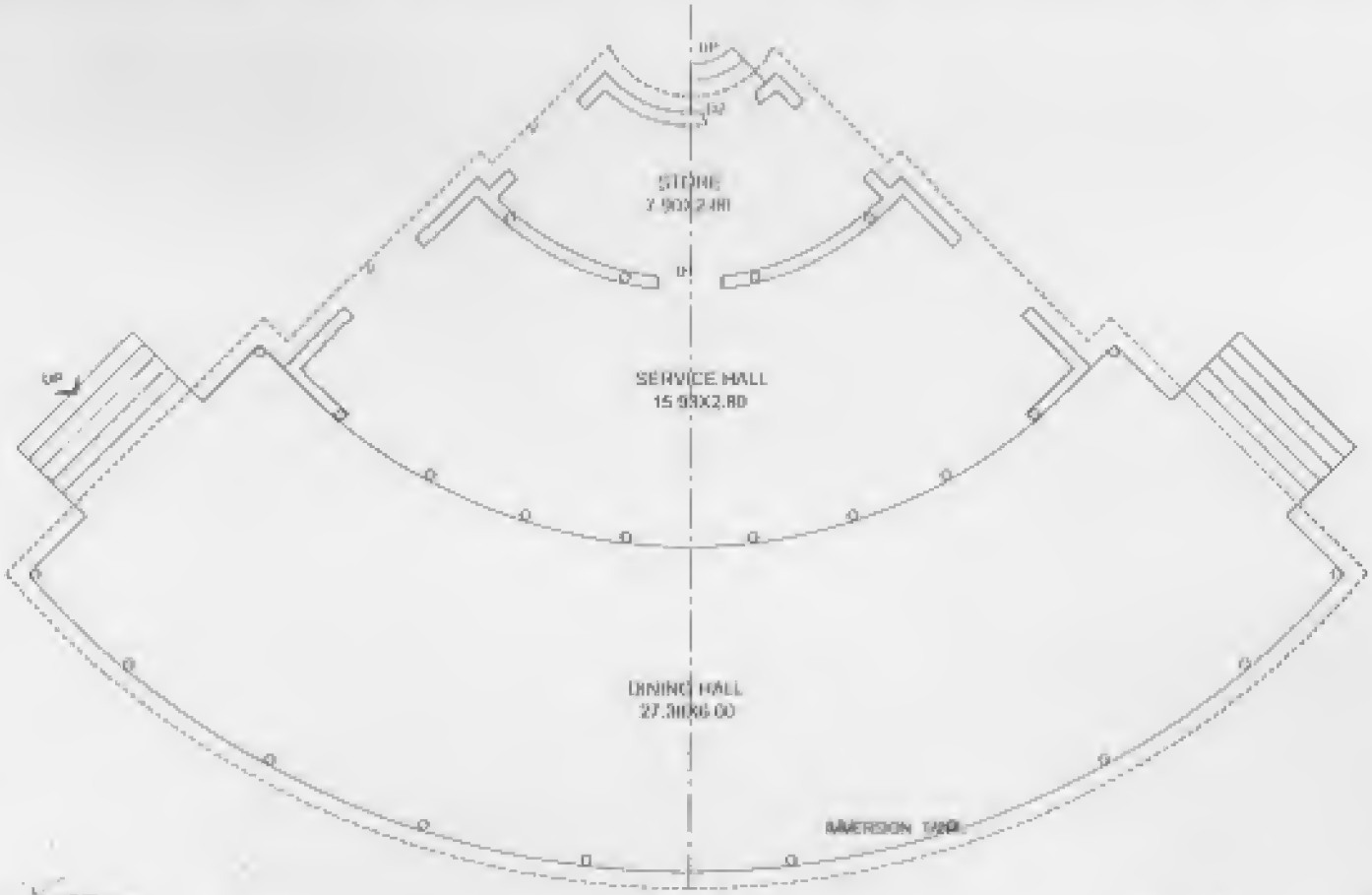


SECTION AT A-A

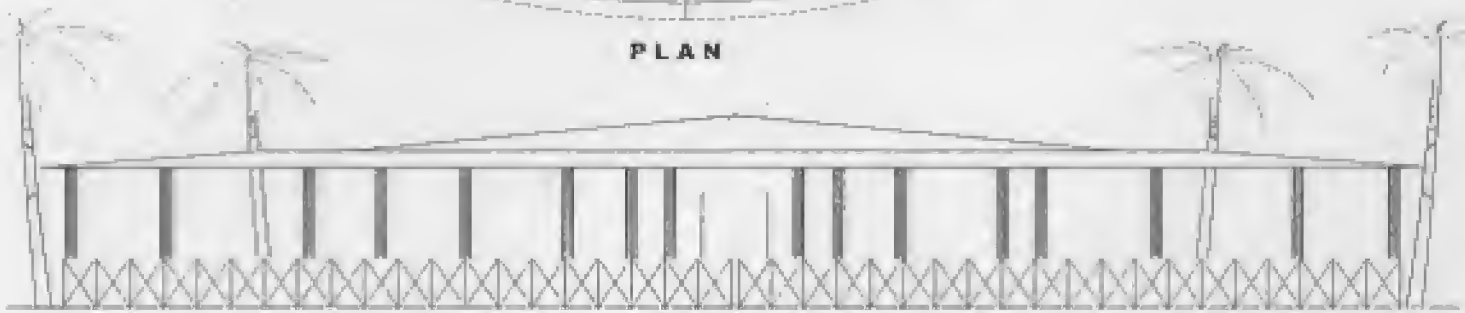
NAME OF WORK	DEVELOPMENT OF HERBAL LAKE ON B.O.T. BASIS AT BANGALORE.
FIGURE NO.	5.9 TICKET ISSUE COUNTER

CONSULTANTS
VINOS TECHNOCRATS & ASSOCIATES BANGALORE.

M/s. E.I.H. LTD.
39, M.G. ROAD, BANGALORE-01



PLAN

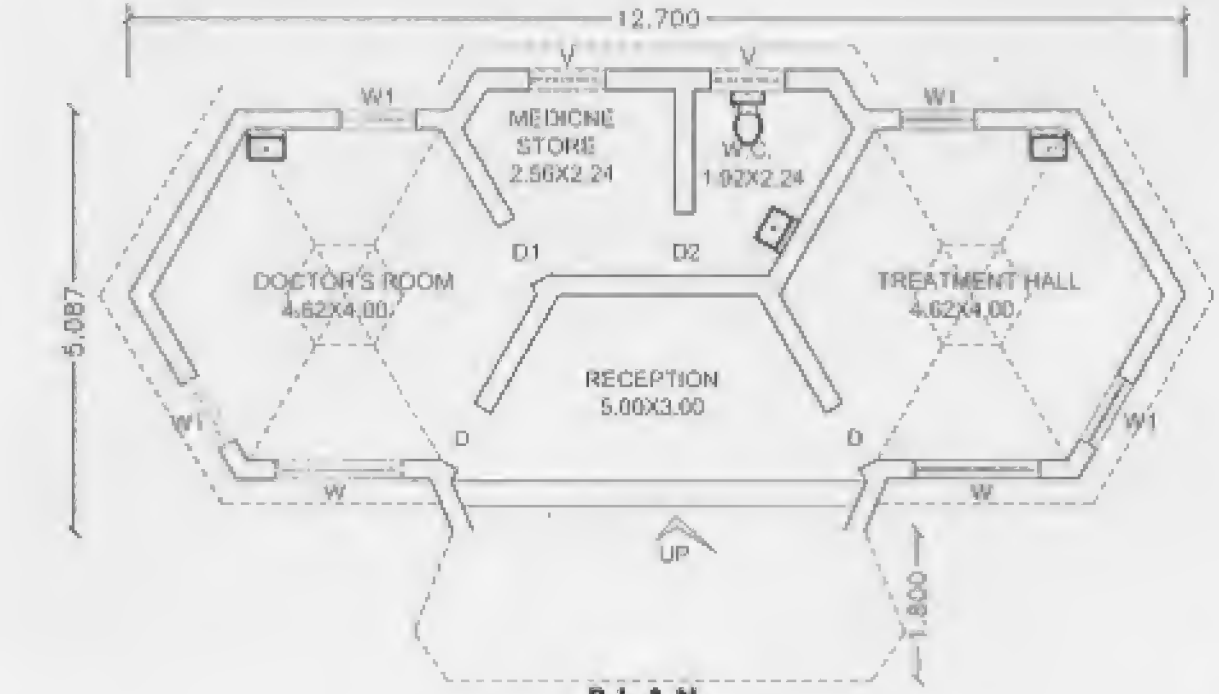


ELEVATION

NAME OF WORK	DEVELOPMENT OF VEERAL LAKE ON D.O.T. LANDS AT BANGALORE.
DRAWING NO	S.10 OPEN AIR RESTAURANT

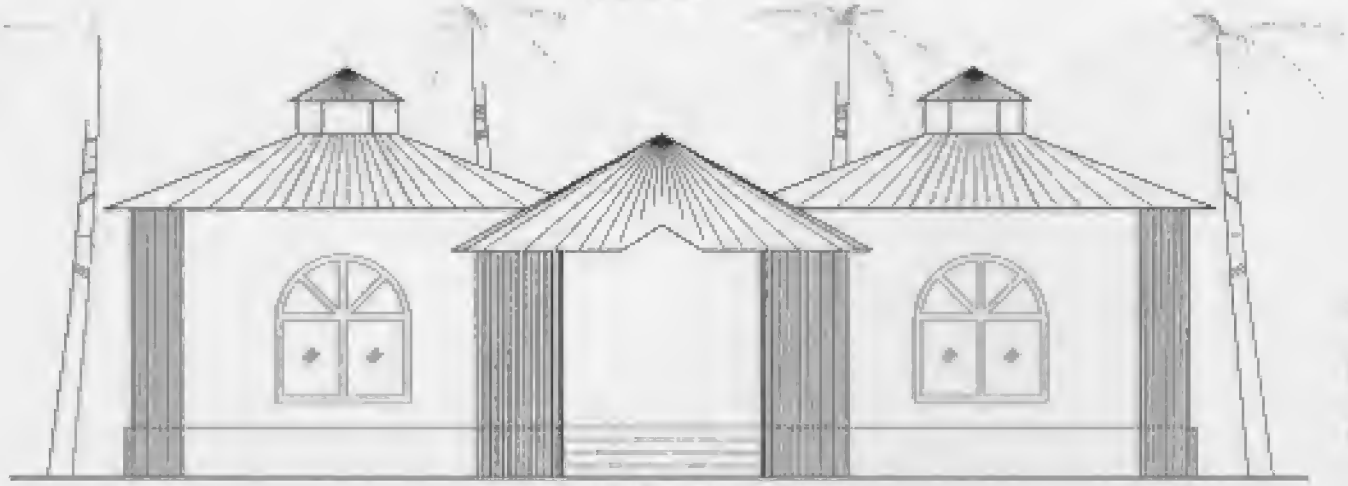
CONSULTANTS
VIKAS TECHNOCRATS &
ASSOCIATES, BANGALORE

M/s. C.I.H. LTD.,
29, M.G. ROAD, BANGALORE-01



PLAN

SCHEDULE OF OPENINGS	
D	1.20X2.10
D1	1.05X2.10
D2	0.75X2.10
V	0.75X0.75



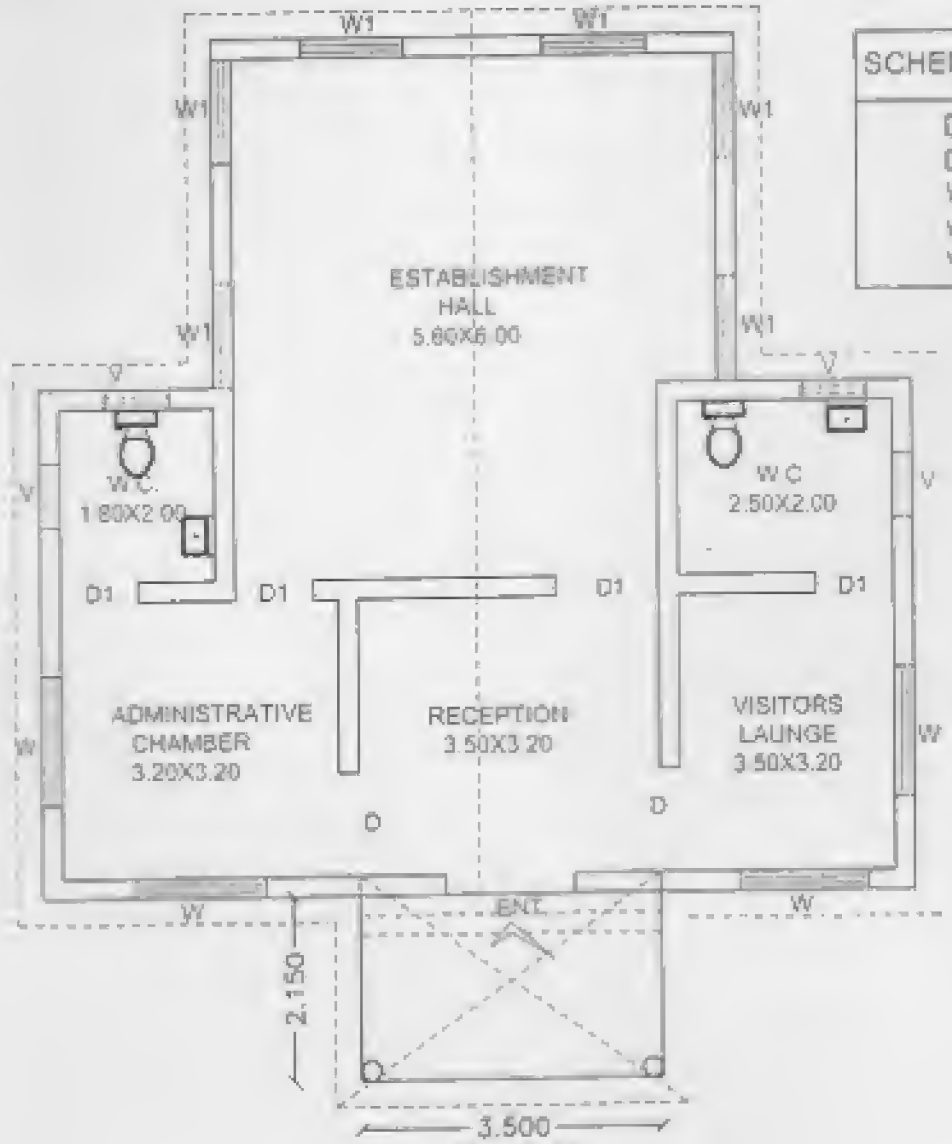
ELEVATION

NAME OF WORK	DEVELOPMENT OF HERBAL LAKE ON D.O.T. BASIS AT BANGALORE.
FIGURE NO.	5.11 MEDICAL CARE CENTRE.

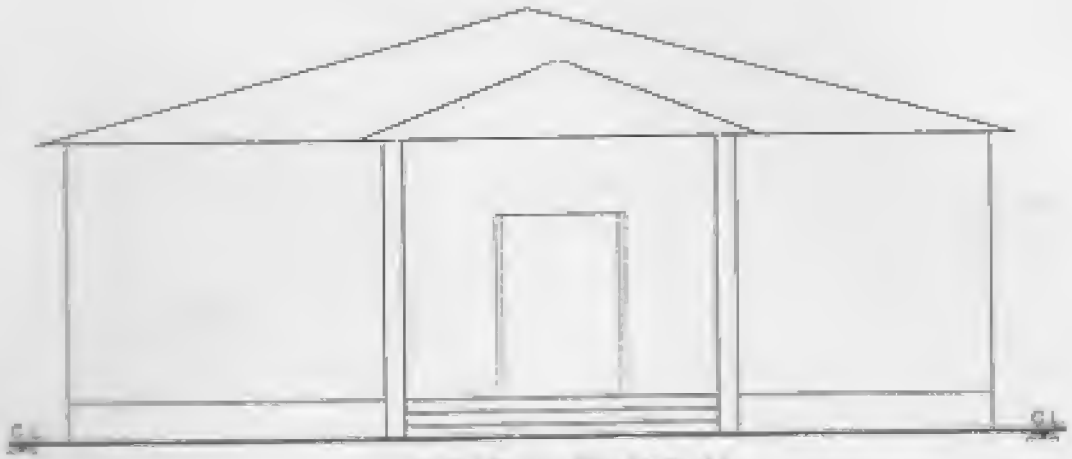
CONSULTANTS
VIMOS TECHNOCRATS & ASSOCIATES BANGALORE.

M/s. E.I.H. LTD,
30, M.G. ROAD, BANGALORE-01

SCHEDULE OF OPENINGS	
D	1.20X2.10
D1	1.05X2.10
W	1.50X1.50
W1	1.20X1.50
V	0.75X0.75

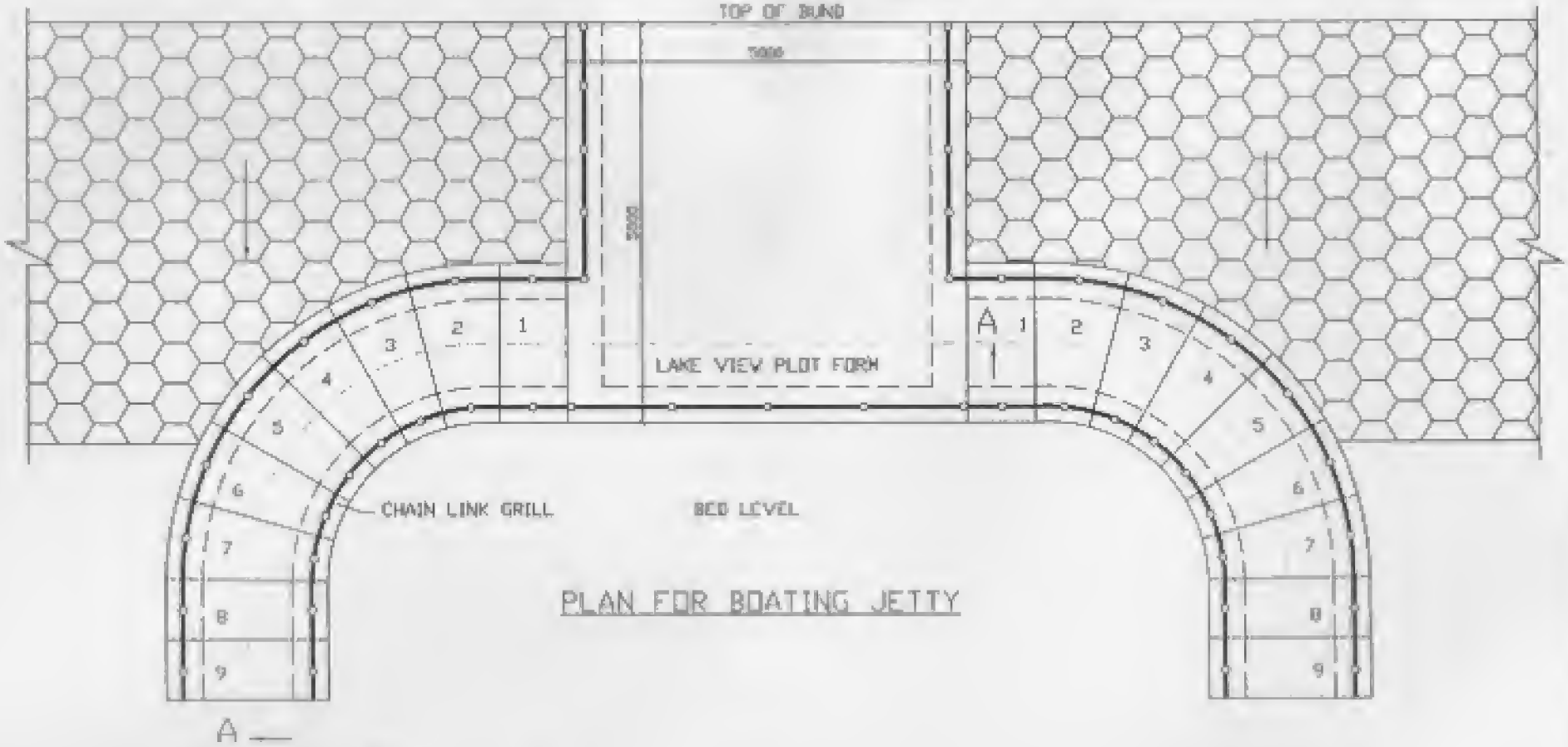


PLAN

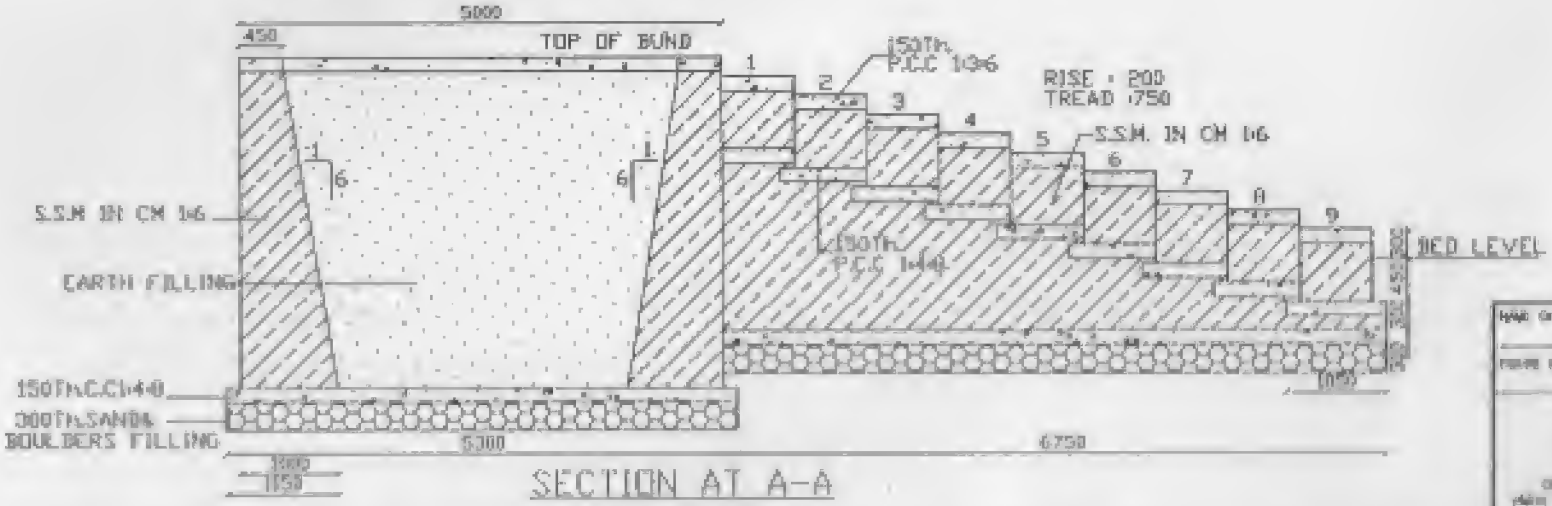


FRONT ELEVATION

NAME OF WORK	DEVELOPMENT OF HERBAL LAKE ON D.O.T. BASIS AT BANGALORE.
FIGURE NO.	8.12 ADMINISTRATIVE OFFICE CUM RECEPTION CENTRE.
CONSULTANTS VIMOS TECHNOCRATS & ASSOCIATES BANGALORE.	M/s. E.I.H. LTD. # 59, M.G. ROAD, BANGALORE-01



PLAN FOR BOATING JETTY



SECTION AT A-A