

**National Institute of Ocean Technology,  
Ministry of Earth Sciences, Government of India**

**Prefeasibility Report**

**for**

**Seafront Facility**

**Ministry of Environment, Forest and Climate change  
Indira Paryavaran Bhavan, Jorbagh Road  
New Delhi.**

**August 2015**

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## **1.0 Background**

NIOT has been functioning since November 1993 as the technical arm of the Ministry of Earth Sciences, Govt. of India (previously Department of Ocean Development) to work on the development of ocean technology. Since its inception, this Institute had functioned in IIT, Chennai campus till February 2000. As NIOT grew in terms of manpower and projects, a 50 acres campus was set up in Pallikaranai, Chennai accommodating different laboratories, administrative offices and other facilities. Presently activities of NIOT are expanding with significant number of large scale projects. Several of these developmental activities require testing in actual sea conditions before the prototype is taken out offshore for actual testing. With increasing work requirements, conducting laboratory tests alone is insufficient, thereby requiring testing to be undertaken onsite. The proposed sea front research facility at Nellore, Andhra Pradesh has been conceived with the aim to serve such purposes.

## **2.0 Organization of Prefeasibility Report**

The prefeasibility report contains the details of the three components which describes the details of activities to be undertaken in the next four years from 2015 to 2019. The details of facilities, time schedule, budget and methodology of implementation are presented in detail from Sections 7.0 to 9.0.

## **3.0 Objective**

Objective of this project is to create world class Seafront Research Facility (SRF) to enable activities in development and testing of prototype systems, validation of indigenously developed marine systems in the ocean environment and also to undertake programs connected with NIOT such as Deep Sea Technology & Ocean Mining, Submersibles and Gas Hydrates, Offshore Numerical studies, Marine Sensor Systems, Desalination Research, Coastal Engineering Research, Ocean Acoustics, Marine Biotechnology, Ocean Observation System and Ocean Electronics.

## **4.0 Justification of proposal**

The Seafront Research Facility (SRF) is required to be undertaken in order to enable the activities in development of proto type systems, testing and calibration of indigenous developed systems. The present NIOT campus at Pallikaranai was established in stages from 1998 and has limitations for further expansion due to recent State Government guidelines.

As the institute contributes to knowledge of the oceans and their resources, to monitoring of marine and coastal environments and to sustainable development of marine activities there is a necessity for additional facilities. Facilities like numerical tank, ballast water treatment tank etc with basic amenities are needed to carry out world class research in the field of ocean technology in India.

The quantum of projects being handled by the NIOT is comparable to any other R&D Institution in the world. However, present constraints faced by the institute would be solved only by developing such a seafront facility in order to stand at par with reputed global giants in the field of ocean technology such as Institut français de recherche pour l'exploitation de la mer (IFREMER) in France, Japanese Agency for Marine-Earth Science and Technology (JAMSTEC) in Japan, National Research Council (NRC) in Canada.

## **5.0 Built up area**

The block layout of the three component facilities have been superimposed in the CRZ map to ensure that the space requirements are met and keeping the CRZ regulations. Based on the present research requirement, among the overall research facilities, it is proposed to establish three components of the facilities during the years 2015 -2019.

## **6.0 Development Proposal**

It is envisaged to create research facilities at the Seafront, it is proposed to undertake three components which are the present requirement. It is noted that statutory approvals like Environmental Clearance are valid for a fixed period (like 5 years) and therefore it is planned to establish the seafront facility from 2015 to 2019. The following sections describe in detail activities that are proposed to be undertaken between the years 2015 to 2019.

Component 1: Development of basic amenities for establishment of ESSO-NIOT at Seafront Research Facility (SRF) and Facilities for Administration, Computation and Training (FACT).

Component 2: Establishment of Offshore Numerical Tank facility.

Component 3: Establishment of Ballast Water Treatment Technologies – Test Facility.

## **7.0 Development of basic amenities for establishment of ESSO-NIOT at SRF and FACT.**

During the years 2015-19 it is proposed to establish basic amenities and ancillary facilities at SRF site in Pamanji and Vagarru villages. It is also proposed to establish another Facility for Administration, Computation and Training (FACT) and its allied ancillary facilities at

Chittedu village. The methodology, schedule and projected cost are mentioned in following sections.

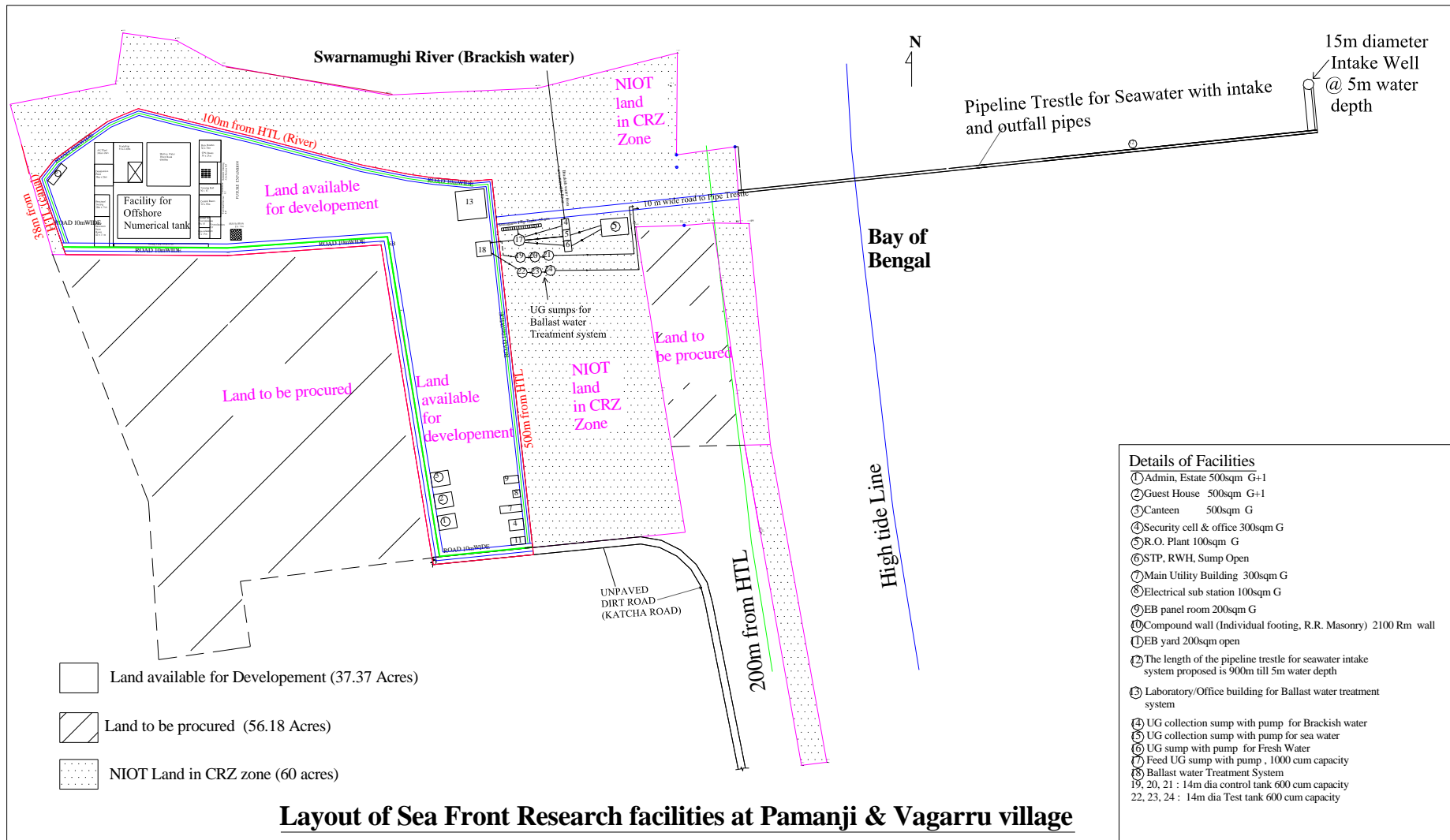
### **7.1. Proposed basic amenities & infrastructure for establishment of SRF site in Pamanji and Vagarru**

It is proposed to create an energy efficient campus comprising of administrative block, guest house, pipeline trestle for seawater intake system and other related infrastructure for research Components II & III. The details of facilities proposed for development are mentioned in Table 1

**Table 1: Research Facilities in Pamanji and Vagarru.**

<b>Sl.No</b>	<b>Type of Facility</b>	<b>Facility</b>	<b>Approximate built up area in m<sup>2</sup> / Length in m</b>
1	Research	Numerical tank test facility (Component II)	60,600 m <sup>2</sup>
2	Research	Ballast Water Treatment Technologies (Component III)	21,400 m <sup>2</sup>
3	Basic amenities	Administrative block, Estate section, Guest House, Canteen, Security block, Utility Building, Compound Wall, Road & External / Internal services, Pipeline Trestle for seawater intake (Component I)	3,700 m <sup>2</sup>
4	External	Last mile approach road work, and HT line Extension to both sites (Component I)	900 m

The conceptual layout of facilities indicating Administrative block, Infrastructure for Component II & III and Pipeline Trestle are shown in Fig. 5, and this layout has been superimposed on the Coastal Regulatory Zone (CRZ) map provided by IRS, Anna University, Chennai which is shown in Figure 1



**Figure 1: Tentative layout of facilities for SRF site at Pamanji and Vagarru**

The proposed SRF site in Pamanji and Vagarru villages falls adjacent to the Buckingham canal, Swarnamukhi River and Bay of Bengal. Hence it is necessary to determine whether the proposed project falls under regulations of CRZ notifications, 2011. Keeping in view the requirements, NIOT had requested Institute of Remote Sensing, (IRS) Anna University to carry out the Coastal Regulated Mapping of the SRF site, which is the base document for obtaining environmental clearance.

It is proposed to strengthen and widen the 9 km stretch of approach road to SRF site from the Gudur-Durgarajapatnam Link road. The work on widening and strengthening of 9 km stretch is being allocated to Andhra Pradesh Local Government Road work bodies such as Panchayat Raj section & Road / Bridges section. Rs 5 Lakhs has been transferred to R&B section of AP to obtain detailed estimate by conducting a pre survey of the road condition and accordingly submit the estimate. Based on their preliminary estimate it is expected that 25 crores including HT line transfer will be the total estimated cost, which will be included in the activities. The breakup of the built up area of basic amenities in component I is shown in Table 2.

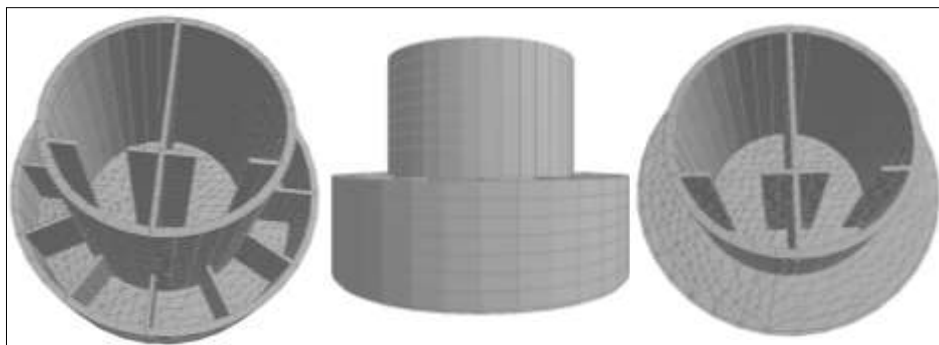
**Table 2: Proposed Plinth areas of building facilities at Pamanji and Vagarru in Phase I.**

<b>Building</b>	<b>Plinth Area in sqm / Length in m</b>	<b>Story of building</b>	<b>Built up Area in m<sup>2</sup></b>
Admn , Estate,	500	G+1	1000
Guest House	500	G+1	1000
Canteen	500	G	500
Security cell & office	300	G	300
R.O Plant	100	G	100
STP, RWH, Sump	LS	Open	
Main Utility Building	300	G	300
Electrical sub station	100	G	100
EB panel room	200	G	200
Compound wall (Individual footing, R.R Masonry)	2100 Rm	wall	
EB Yard	200	open	200
The length of the pipeline trestle for seawater intake system proposed is 900 m till 5m water depth.			
Total built up area in m <sup>2</sup> in Phase I of Component I at Pamanji and Vagarru in m <sup>2</sup>			3700

## 7.2. Seawater Intake System

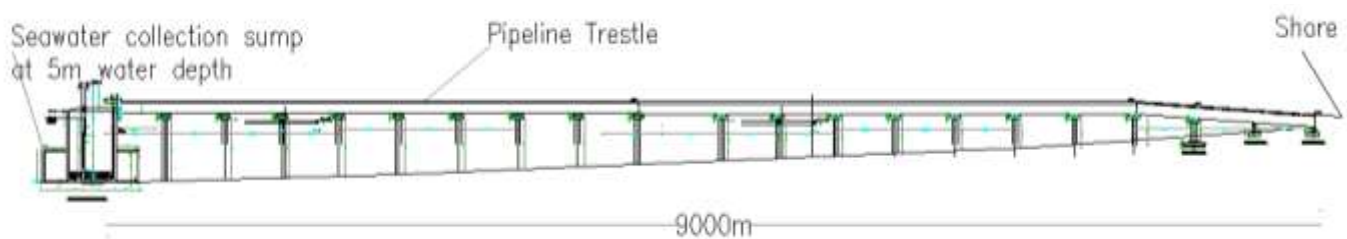
Most of the seafront research facilities require seawater as a main input for laboratories. Hence an Intake Sump to house the pumps that draw seawater water with approach trestle to connect intake sump to shore and to carry sea water pipelines up to research facilities is proposed. These structures are designed to satisfy in place stability and to ease the construction procedure. The design considerations include environmental loads, availability of equipment for construction, logistics and uncertainties.

A concrete sump structure is to be installed at about 5m water depth (with respect to Chart Datum) to house the sea water pumps. The construction methodology of sump will be decided after conducting route survey. The sump size of 8 m diameter and 9 m height is proposed, as shown in Figure 2.

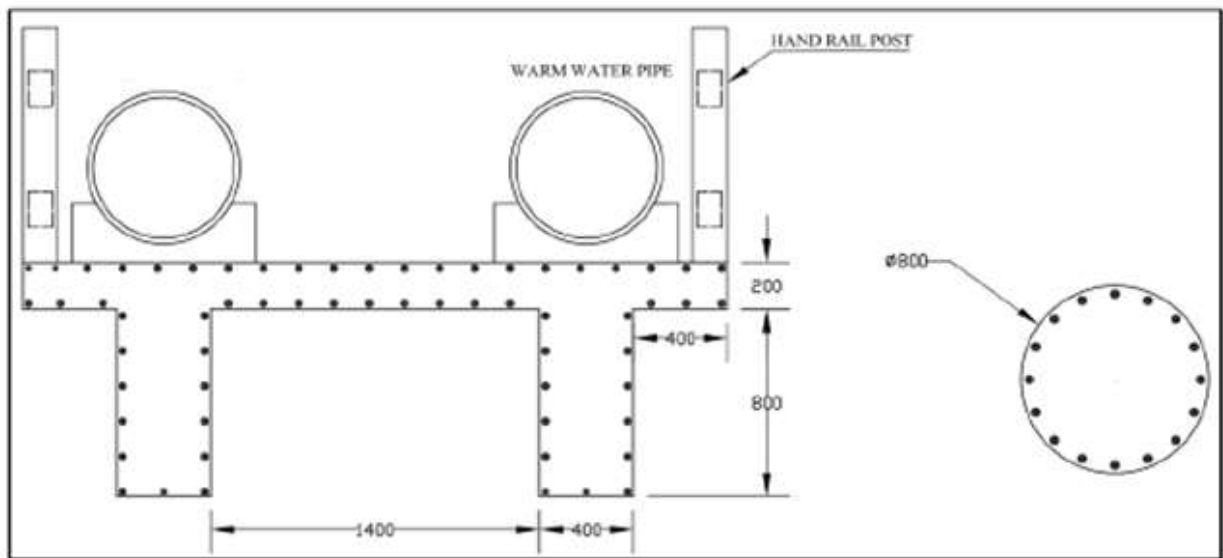


**Figure 2: Isometric views of circular sump**

The typical side elevation of the approach trestle and section of the approach trestle carrying the pipelines are shown in Figure 3 & Figure 4 respectively.



**Figure 3: Sectional Elevation of Pipeline Trestle with seawater Intake system**



### 7.3.Methodology of execution

The CRZ maps have been prepared by IRS Anna University. Conceptual block layout also has been prepared based on user requirement for SRF site. The various steps involved in establishing facilities at SRF site are

- Tender for bore hole/ marine soil investigation and carrying out soil investigations
- Approach road strengthening & widening by transfer of funds through A.P Govt. agencies.
- Extension of HT line
- Appointing an EIA Consultant
- Submission of "Terms Of Reference" (TOR) for EIA application, with Ministry of Environmental & Forests (MoEF) to be undertaken by EIA consultant
- Appointment of "Consultancy firm" for preparing master layout for the entire campus
- Preparation of Finalized Master plan by Consultancy firm
- Detailed engineering including preparation of Bill of Quantities (BoQ) and execution drawings for Phase-I Components of the project
- TOR Clearance from MoEF and EIA studies
- Application to District level / State level CRZ Committee for obtaining Environment clearance from MoEF
- Tendering and appointment of Project Management Consultant (PMC) for contract supervision of civil/electrical works
- Tendering and appointment of construction company - contractor
- Construction and creation of basic facilities, pipeline trestle for seawater intake system, and civil infrastructure required for component II & III.

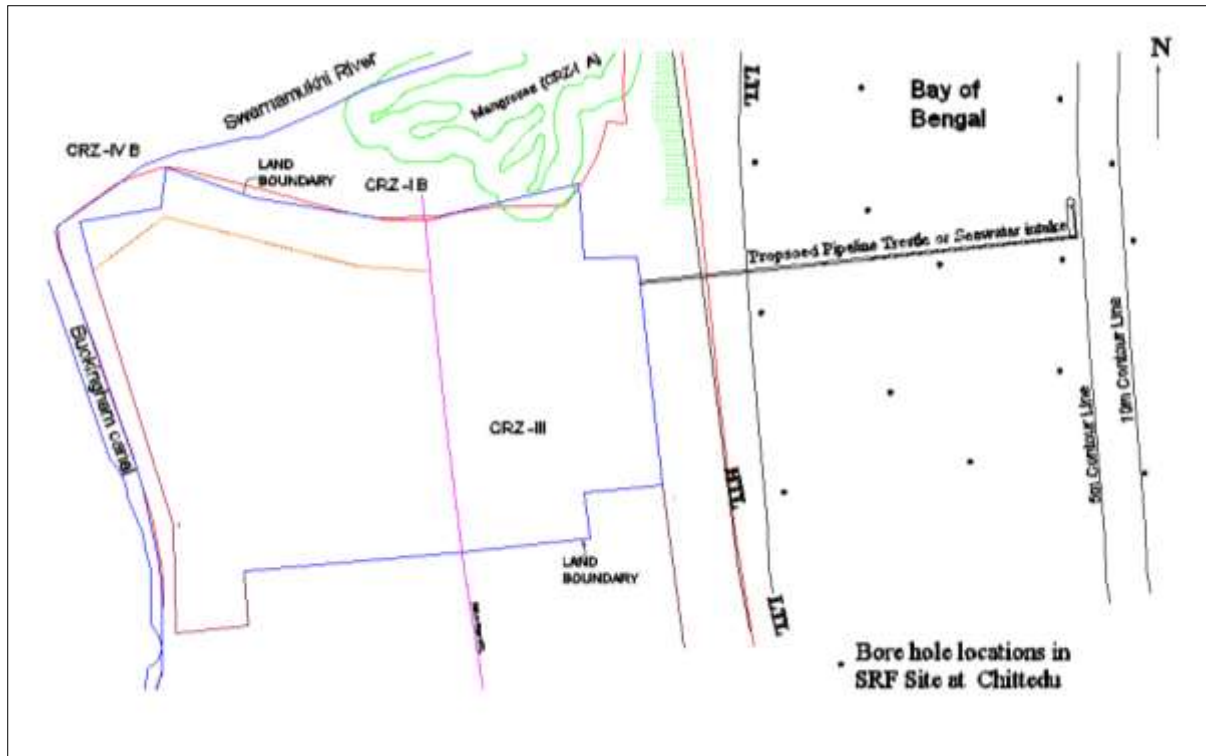
#### **7.4. Soil investigation – Marine and Land Bore profiles and testing**

The Soil investigation work needs to be carried out to identify the soil profile and soil parameters required for the foundation design of various structures and for the construction of compound wall. The deliverables of soil investigation are bearing capacity for shallow footings, Pile capacity for piles, type of pile, suitable founding strata for the pile, estimated length of pile for various capacities, suitability of the soil for construction of roads and pavements, dynamic soil properties such as dynamic shear modulus based on seismic refraction test data, chemical nature of soil and ground water, co-efficient of permeability of sub-soil.

The methodology of soil investigation consists of following:

- Drilling of Boreholes and collection of soil and rock samples at various depths.
- Performing In-situ Tests like Standard penetration test, Static and dynamic cone penetration test.
- Performing field permeability tests.
- Performing geophysical tests like Electrical resistivity and Seismic refraction tests.
- Performing plate load tests and cyclic plate load tests to confirm the load carrying capacity of soil under static and dynamic loading conditions.
- Conducting laboratory tests on the soil and rock samples collected for classification and determination of strength parameters.

The bore locations are shown in Figure 5



**Figure 5: Proposed borehole location at SRF Site.**

### **7.5.EIA Consultant to obtain Environmental clearance**

The SRF site requires Environmental clearance, based on the CRZ map submitted by IRS, Anna University Chennai. Hence it is necessary to have an external EIA Consultant to apply and present to MoEF to obtain Environmental Clearance for Pamanji and Vaggaru site development works.

There are two major steps involved, the first is TOR clearance which allows NIOT to undertake studies / measurements at the site & the second is EIA clearance which is the approval for undertaking construction activities. The objective of study is to assess the positive and negative impacts likely to accrue as a result of the construction and operation of the development activity.

General Scope of work involves, (i) filing of TOR (Form I & Form IA) based on Prefeasibility Report, CRZ map, other required information related to Phase 1 activities of Seafront Research Project at Pamanji, Nellore (ii) EIA studies involves field ecological studies, field physico-chemical studies like rainfall, Temperature, Humidity, water quality, ground water, soil. Marine Ecology studies like Physico-chemical studies & Biological parameters on marine water, sediments, and studies on Socio-economic and Environment Management plan. The approximate duration of EIA studies will be 4 months if ToR is approved for Rapid EIA studies.

## 7.6. Execution of basic amenity Facilities and pipeline trestle for seawater intake system

The civil construction for campus development, roads, electricity, store yard, sewage treatment plant / RO Plant including last mile facility will be executed based on the CPWD guidelines and meeting the Green building concept. Figure 6 shows the last mile approach route to SRF site. The Figure 7 shows the road and service layouts at SRF site.



Figure 6: Proposed route by last mile approach to SRF site

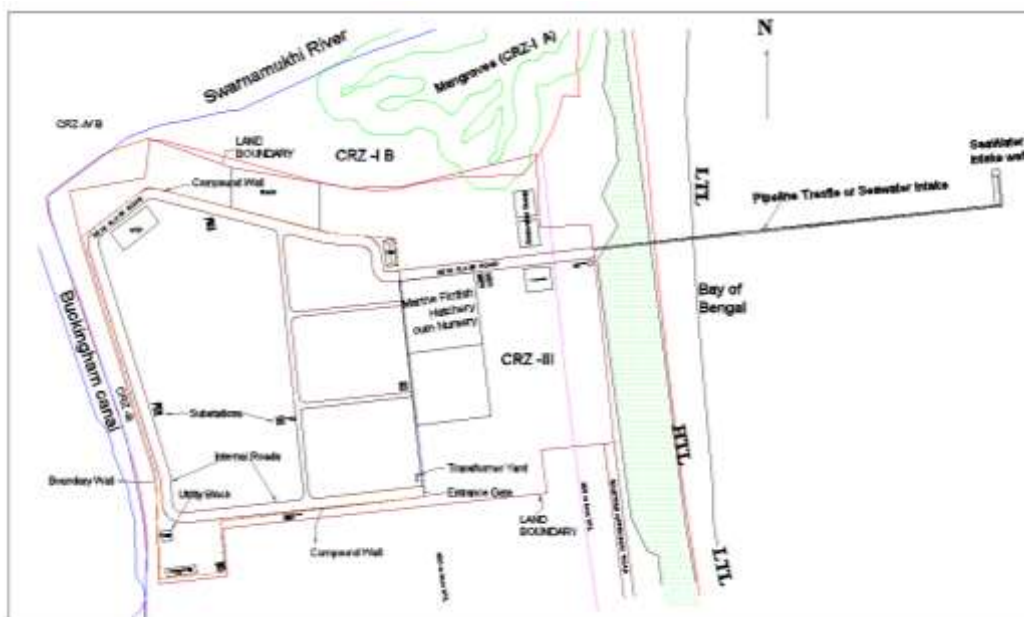
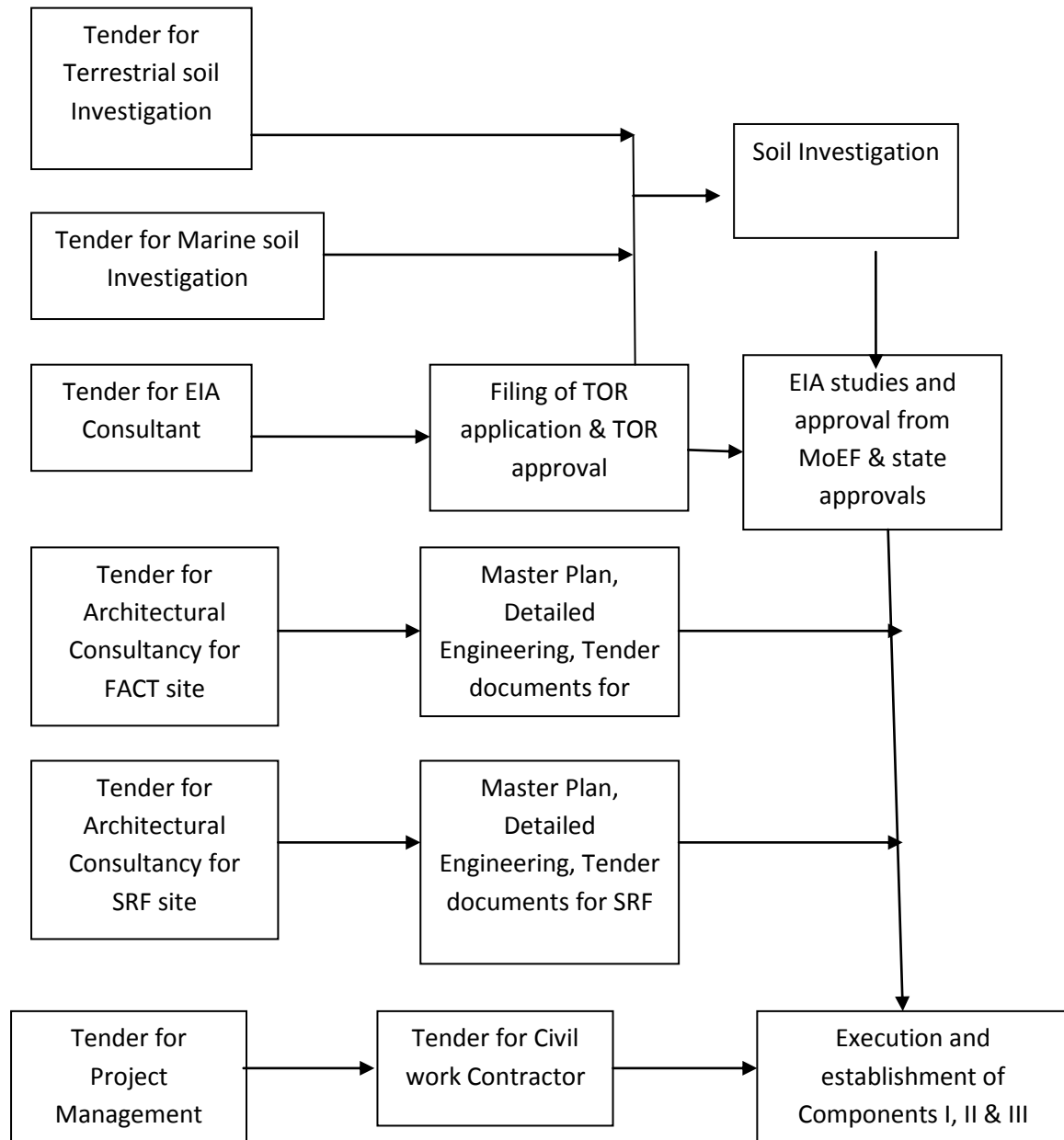


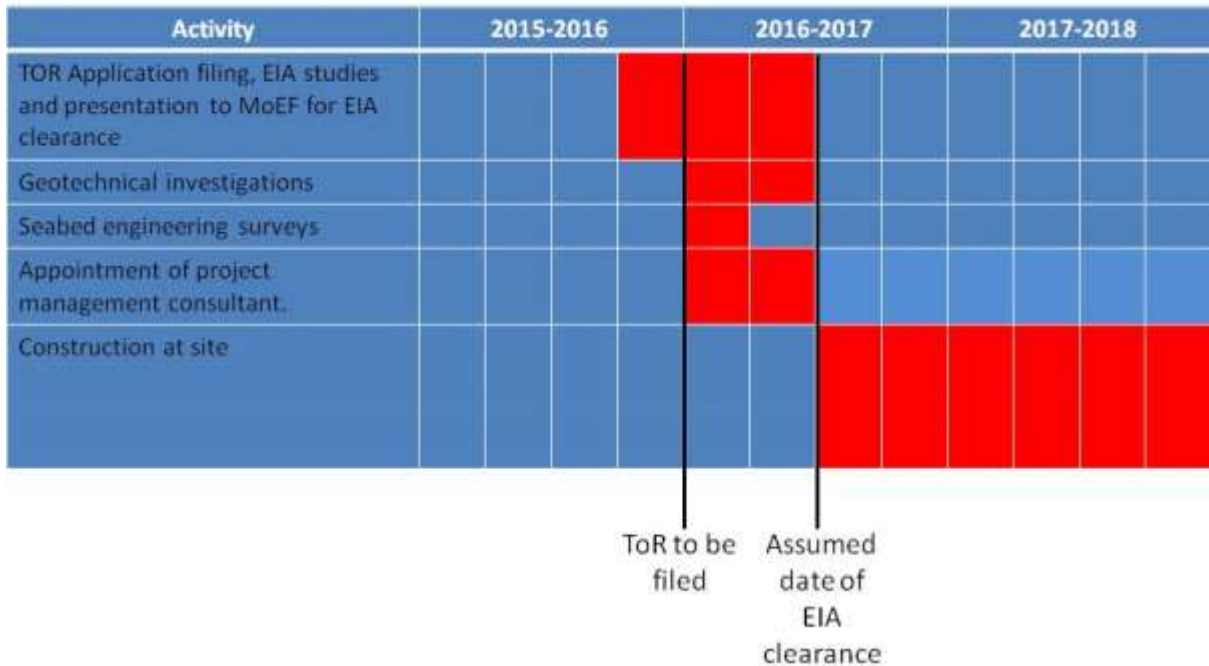
Figure 7: Proposed layout of road and services at SRF site

### 7.7. Programme schedule

The time schedule for establishing the SRF and FACT between the years 2015 to 2019 is shown in the bar chart mentioned below. The infrastructure required for the Component II and III are included in the time schedule. Figure 8 and Figure 9 show the flow chart and Programme chart of various activities involved in Component 1



**Figure 8: Flow Chart for activities for Component I**



**Figure 9: Programme Chart for various components.**

### 7.8.Desalination

A Sea Water Reverse Osmosis (SWRO) plant, that uses osmotic pressure to desalinate the sea water, is proposed for the Sea Front Facility of ESSO-NIOT at Pamanji / Vagarru, Nellore, AP. With a capacity to produce about 100 m<sup>3</sup>/day of potable water, and a recovery ratio of about 30%, the subsystems of the plant include Intake, Pre-treatment, Membrane assembly, post treatment and Remineralisation facilities and settlement tanks. The following are the broad specifications of the system:

Product water flow rate : 4.2 m<sup>3</sup>/hr

Total Dissolved Solids in Product water: below 500 ppm

Feed water flow rate: 20 m<sup>3</sup>/hr

Brine water flow rate: 14 m<sup>3</sup>/hr

Recovery ratio: 30%

Total Dissolved Solids in Feed water: 28000 -30000 ppm (approx)

Total Dissolved Solids in Brine discharge: 40000 ppm (approx)

Nominal diameter of Intake pipe: 100 mm

Nominal diameter of discharge pipe: 100 mm

## 8.0 Budget Estimate

The estimated cost of the development of SRF and FACT together has been provided in Table 3.

**Table 3: Budget Estimate for establishment of Sea Front Research Facility**

Activity / deliverables	Cost (Rs. In crores)
Construction of Utility Buildings, Estate Common amenities and services (internal roadwork, electrical, water& sewage systems)	42.00
Sea water Intake System, Infrastructure and facilities such as Admin Office, Guest House etc.	87.00
Numerical Offshore facility	600.00
Ballast water treatment facility	43.00
<b>Total</b>	<b>772.00</b>