BEFORE THE NATIONAL GREEN TRIBUNAL
WESTERN ZONE BENCH, PUNE

THROUGH PHYSICAL HEARING (WITH HYBRID OPTION)

Original Application No. 06/2023 (WZ)

I.A No. 217/2023(WZ)

Mrs. Patrica Pinto & Ors. **....Applicant(s)**

Versus

State of Goa & Ors. **....Respondent(s)**

AFFIDAVIT FOR RESPONDENT NO. 2

MAY IT PLEASE THE TRIBUNAL:

I, Mr. Johnson B. Fernandes, adult, being the Member Secretary of the Goa Coastal Zone Management Authority, having my office at 4th Floor, Dempo Towers, Patto, Panaji, Goa, do hereby solemnly affirm and state as under:

1. I say that the Hon'ble NGT vide order dated 4/12/2023 has directed the Authority to submit an additional affidavit as to whether the activities submitted in tabular form by the GSIDC that is respondent no. 7 in their affidavit which is as follows.

2 I say that on perusal of application submitted by GSIDC vide letter GSIDC/Engg/Works/1485/6054 dated 27 Jan 2022 along with Form 1, EIA report, Project layout superimposed on CRZ map, List of Drawings submitted along with the application. It is submitted as follows:

a. Drawing no. AD-CRZ-1 is between chainage 0.0 to 0.634 which is from Miramar circle to Youth Hostel which pertains to 634mtr.

b. Drawing no. AD-CRZ-2 is between chainage 0.920 to 1.125 and AD-CRZ-3 is between chainage 1.125 to 1.969 which is from Kala academy to ESG pertains to 1049m.

3 I say that the GSIDC in Form I in its para 1.11 has clearly described the proposal as- "*In this proposal there will be a continuous retaining wall along the coast for protection. Wherever the existing one has collapsed, it will be restored, and missing walls will be built. In some stretches the embankment have settled and some areas eroded. In such*

situation, new retaining wall or trough have been proposed respectively. It is proposed to create a promenade that would link Miramar Circle and Mahaveer Garden and ESG with a cycling lane that will be part of the future pedestrian itinerary between Ribandar and Dona Paula. The promenade will be continuous and will be connected to the existing roads and maintaining traditional pedestrian & fishing boat access. Public Washrooms are proposed. One near Light House located near Youth Hostel and second is an existing dilapidated structure located near Mahaveer Garden to be renovated and used as Washroom".

4 I say that the GSIDC as applicant at para 3.3 of Form 1 has submitted as follows- "*The promenade connecting youth hostel and Forest Department's Children's Park is a stretch of a longer pedestrian itinerary proposed in the Holistic masterplan to connect Dona Paula and Ribandar*

After completion the promenade will be accessible by main road and it will attract local people for walking, cycling and leisure".

5 I say that as far as the width of the footpath and cycle track including details of the Washroom, Balcao and Bridge are mentioned in section drawings issued below and Annexed to the Affidavit:

Drawing no.	**Details**
AD-CRZ-4	Miramar to Youth Hostel
AD-CRZ-5	Kala Academy to ESG
AD-CRZ-6	Washroom
AD-CRZ-7	Balcao
AD-CRZ-8	Details of the bridge (chainages mentioned)
AD-CRZ-3	Bridge is indicated in the legend and chainages mentioned

6 I say that the said plans are Annexed herewith in Annexure A along with Form I of the GSIDC that is Respondent No. 7.

7 I say that it is therefore submitted that all the details were considered by the GCZMA and all the drawings have been stamped by the authority with details of the letter number by which the NOC was granted by the Authority.

8 I say that it may also be noted that the construction work from chainage 0.280 to 0.545 in front of the Hotel Marriot has not started yet.

Solemnly affirmed on this
27th day of January, 2024.

Deponent 27/1/24

Executed before me
At Panjim Tiswadi - Goa
Reg. No. 17/01/2024
Dated: 7/02/2024

Gracias

Venefrada C.P.P.B Gracias
Advocate & Notary Goa State

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Protection and Restoration of Mandovi River Coastline from Miramar Circle to Youth Hostel and Kala Academy to ESG.

Project Owner:

GSIDC

January 2022

INDEX

1 SITE DESCRIPTION & LOCATION

The Mandovi river front between Miramar Beach and Forest Department´s Childrens' Park is a beautiful spot of Panaji city. Several city amenities are located along it, like the Senior citizen Park, the indoor stadium, skating rink, baseketball court, Kala academy and the Forest Department Children´s Park.

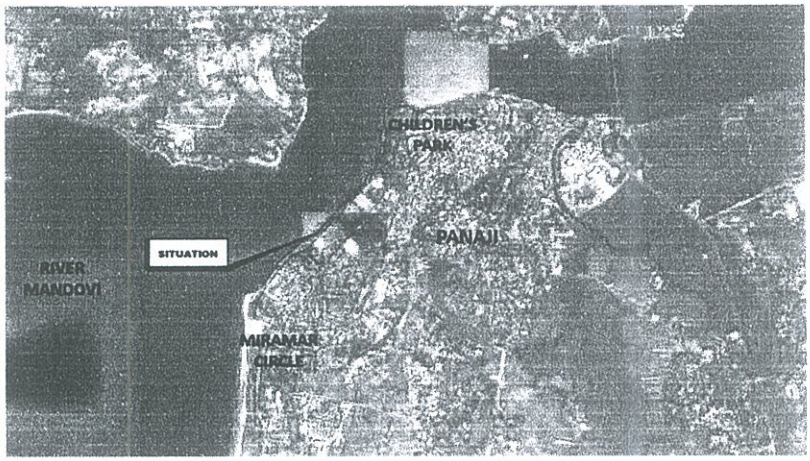
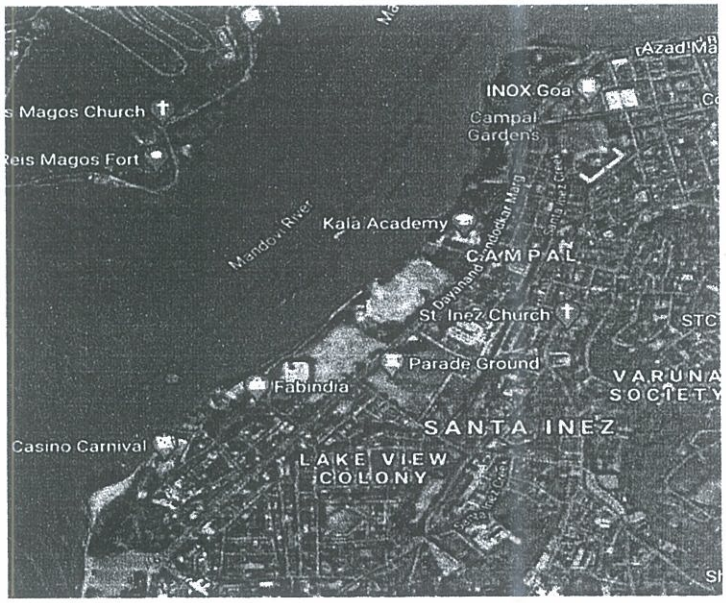


Figure 1: Location plan

The stretch is very pleasant due to the marine breeze, and the amazing river and sea views. Currently, there is a short promenade by the Mandovi River, along Kala academy, which people visit all day long and a well developed promenade with coastline protection in the stretch from Youth Hostel till Kala Academy. Although the rest of the area is not properly developed for pedestrians, people visit on their own risk. It is a spot for fishing, jogging and related activities.

Currently, a main concern in that area arises when surveying and analysing the Coastline morphology evolution, which shows a severe erosion and accretion in the coastline during the latest years.

The main objective of the project is to protect the shoreline from erosion and to restore the river bank and Government land. Another secondary objective of the project is to further open the City to the River, while generating a promenade with cycling lane along the Mandovi River that will allow people to properly enjoy the beauty and connect all the previously said city amenities.



Extension plan view with main surrounding landmarks

2 PROPOSAL

The concept theme of the proposal derives from giving priority to protect the coast and restoration of river bank while place making in order to give own identity to every corner created; providing space for enhancing exiting activities, like fishing, cycling and skating and fostering a safe public space for citizens' leisure and sports for all age groups, while opening the city to the river. The proposal includes the following features:

2.1 PROTECTION OF THE COAST AND RESTORATION OF RIVER BANK

- Continuous protection retaining wall along the coast to arrest erosion and settlement of the existing embankment.
- Rebuilt the protection retaining wall wherever the existing one has collapsed.
- In stretches where there is no retaining walls and the embankments have settled or eroded, in such situation, new retaining wall or trough will be built respectively

2.2 LEISURE & SPORTS

- Enhancing Senior Citizen's park
- Improving and extending the existing Skating area
- Providing safe Fishing spots
- Creating a small Amphitheater to guarantee best river bank views from the promenade
- Equipping the public area with Seating and eating area, along with public facilities of washrooms.

2.3 EDUCATION & CREATIVITY

- Providing area for local artists to develop their creations through a public competition.
- Learning on some Goan architectural features
- Learning on Goan customs and traditions related to fish.

3 DESCRIPTION OF THE ENVIRONMENT

3.1 Socio-economic Environment

Panaji is the capital of Goa and the headquarters of North Goa district. It is the centre of socio- economic and political existence of the state. A city with great heritage values gradually assuming increasing relevance among the cities of the world. The Capital city is located on the banks of Mandovi River and is bound by the Rua de Ourem creek on the East that has been artificially trained to flow along its east side, the Mandovi river on the North, the hillock of Altinho on the south east and the St. Inez Creek and Taleigao village on the west.

The area of the city is approximately 8.12 Sq. Km. with a population of around 70,091 people and floating population of 1,50,000 people.

3.1.1 City Profile Snapshot

1.	**Location**	:	Panaji, Goa
2.	**City Area**	:	8.12 Sq. Km
3.	**Population**	:	70091 (2011 Census – provisional data)
4.	**Population desnsity**	:	8742/km2
5.	**Nearest Railway Station**	:	Karmali (~ 10 km)
6.	**Nearest Airport**	:	Dabolim Airport (~ 30 km)
7.	**Access Roads**	:	NH-4A connects to the NH-17 from Panaji
8.	**Longitude**	:	73° 49′ 40″ E
9.	**Latitude**	:	15° 29′ 56″ N
10.	**Elevation**	:	7 m (23 ft) from sea level
11.	**Temperature**	:	Tropical monsoon climate (Köppen climate classification *Am*), generally hot in summer and equable in winter. During summers (from March to May) the temperature reaches up to 32 °C and in winters (from December to February) it is usually between 31 °C and 23 °C.
12.	**Humidity**		Varies from 67% to 89% through out year, max. during monsoon period.
13.	**Rainfall**	:	The monsoon period is from June to September with heavy rainfall and gusty winds.
14.	**Annual Average Rainfall**	:	2932 mm (115.5 inches).
15.	**Basic wind speed**	:	39 km/hr
16.	**Seismic Zone**	:	Zone III

This report should satisfy the coastal regulation department, unless it cannot be permitted. Since Mandovi River falls under the CRZ II classification in Coastal Regulation Zone, Impact assessment report is more essential to assess. This project encloses the entire details regarding the spot, the projects to be carried out, the assessment part due to each and every project etc. The preliminary investigations are conducted and the datas are prepared. The environmental impact due to every project was analysed and discussed. The required tests to assess the projects are conducted, refered and finalized. The standard values and test results are compared to assess the impact of activies on the environment. Central Water and Power Research Station, Pune has prepared a study for WRD on the impacts of demolition of the retaining wall built by WRD in 1978. The Mathematical model studies on hydrodynamics and sedimentation for demolition of the retaining wall along stretch of Marriot Hotel, Goa has been referred to for preparation of this report.

3.2 Physical Environment-

After a thorought site inspection of the area, and further surveying, there are some straigth forward conclusions, which can be drawn, namely:

- When surveying and analysing the Coastline morphology and the development of the Erosion & Accretion in the latest years there is need to protect the shore line and restore the river bank wherever possible. The existing retaining wall has disappeared, there is settlement in mayor areas of the embarkment earlier executed by WRD. Figure 1 shows the change in Shorline due to erosion /accretion which has been studied by National Center for Sustaiabile Coastal Mangement (MoEF) .

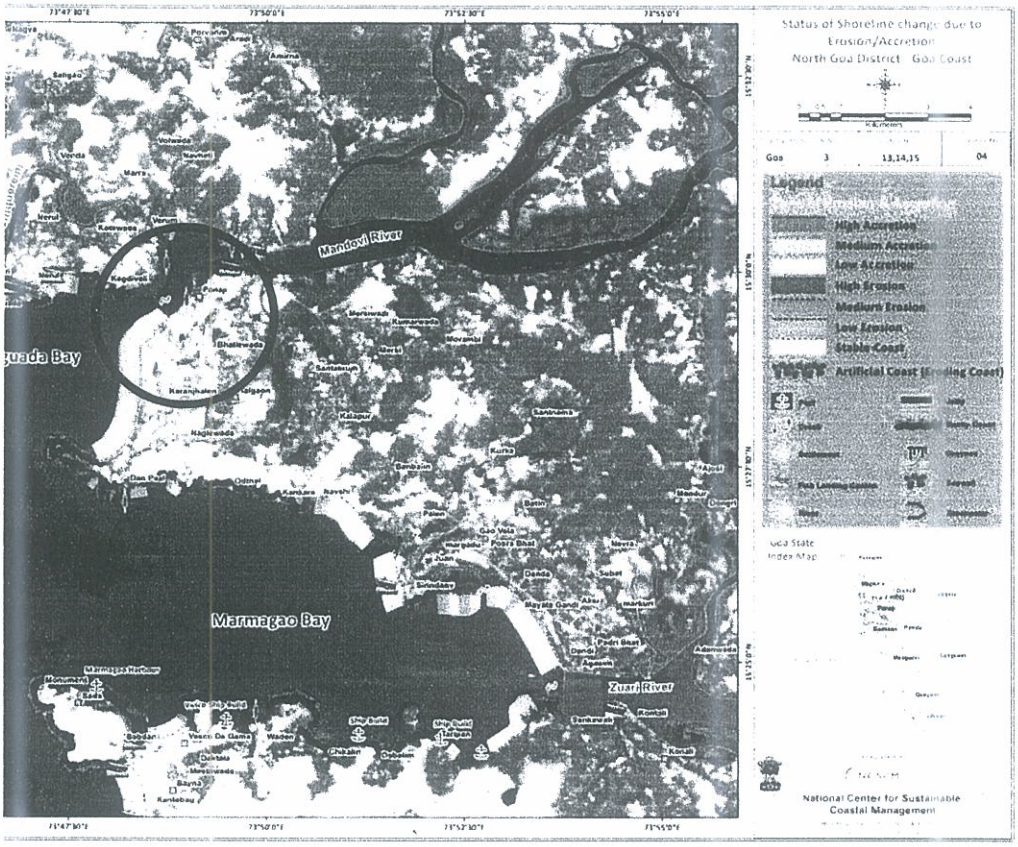


Figure 1: Shoreline change due to Erosion/Accreation.

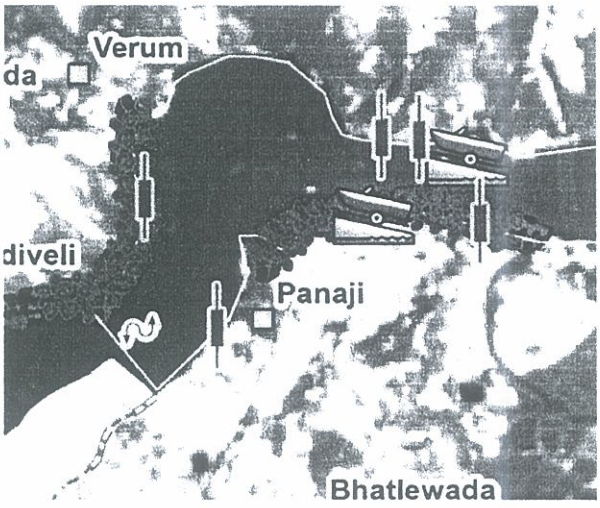


Figure 2: Shoreline change due to Erosion/Accreation along Panaji coastline.

- There is a receding tree line and loss of Government acquired land.

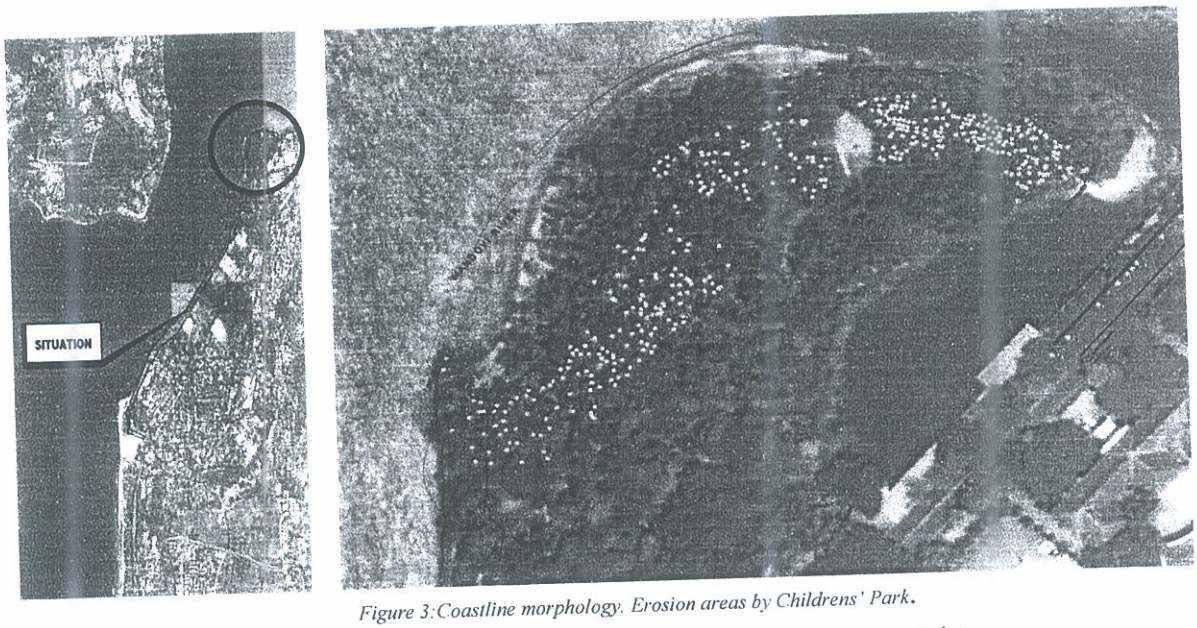


Figure 3:Coastline morphology. Erosion areas by Childrens' Park.

Figure 4: Coastline morphology. Erosion areas by youth Hostel and Marriot Hotel

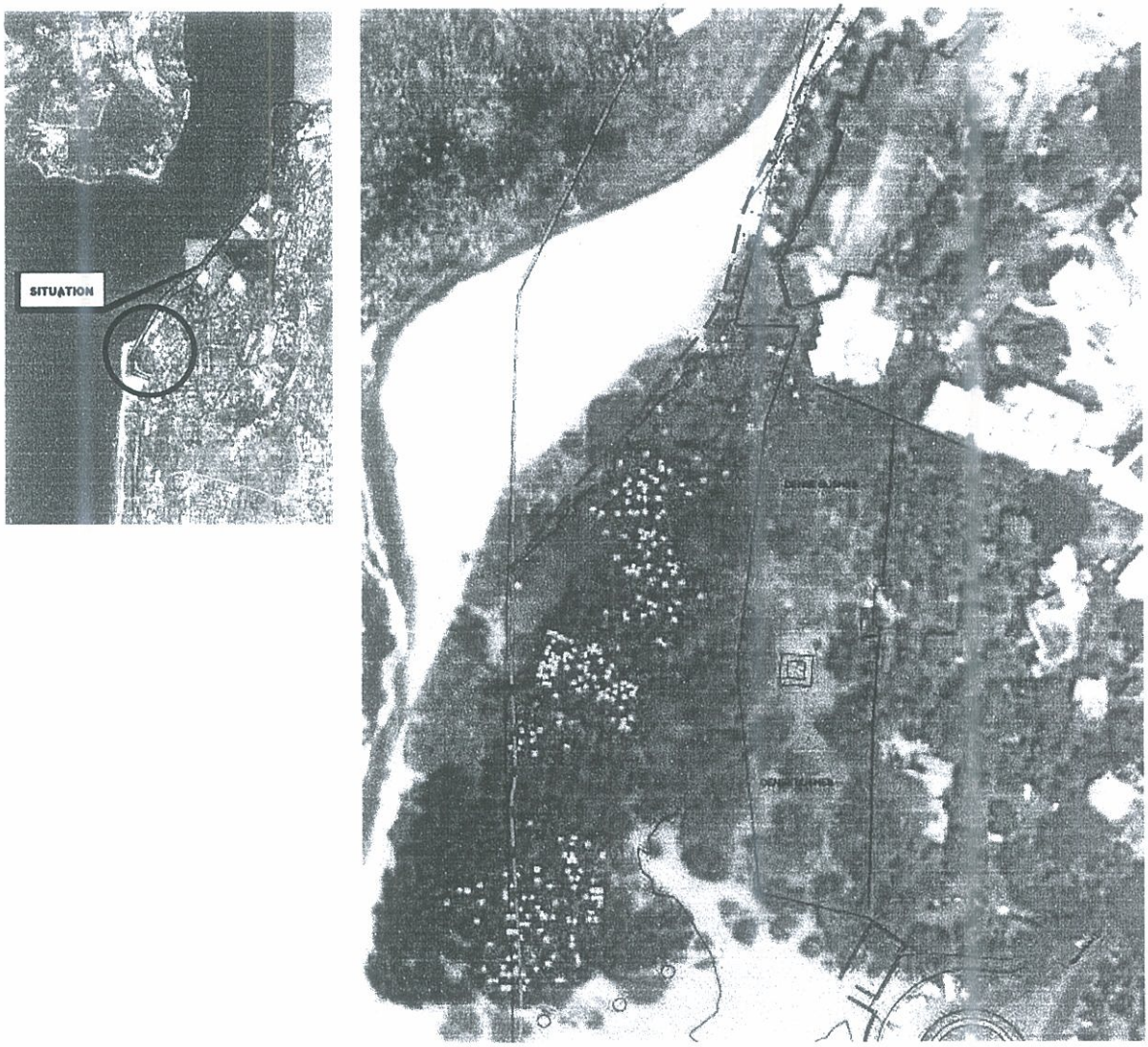


Figure 5: Coastline morphology. Erosion/ Accreation areas by Miramar Beach

- The river bank from near Miramar Beach and Kala Academy to the area near Mahaveer Garden next to Children's Park is not protected with retaining walls or rip rap boulders
- There is a 2m wide sidewalk approximately length of 180 m along the Kala Academy. When comparing the rivershore line along the already protected stretch from Indoor Stadium till Kala Academy with the Kala Acdemy stretch and surroundings, it is observed asevere settlement in the shore , which calls for an urgent need to restore the existing retaining wall, mainly dilapidated and protect the coastline urgently.
- The impact on the Environment should be assessed.
- The full stretch considered for protection, shows few areas accessible for visitors. In some spots many people walk at their own risk.
- In a different note, the river front is unknown for many panjimites and tourists and its used for fishing and other sportive activities, without adequate ligthing and safe access.
- The Forest Department Childrens' Park is located very close to the river, but it is not properly connected to it.

- There is no pedestrian connection between the existing landmarks and the main general road which has got a lot of traffic.

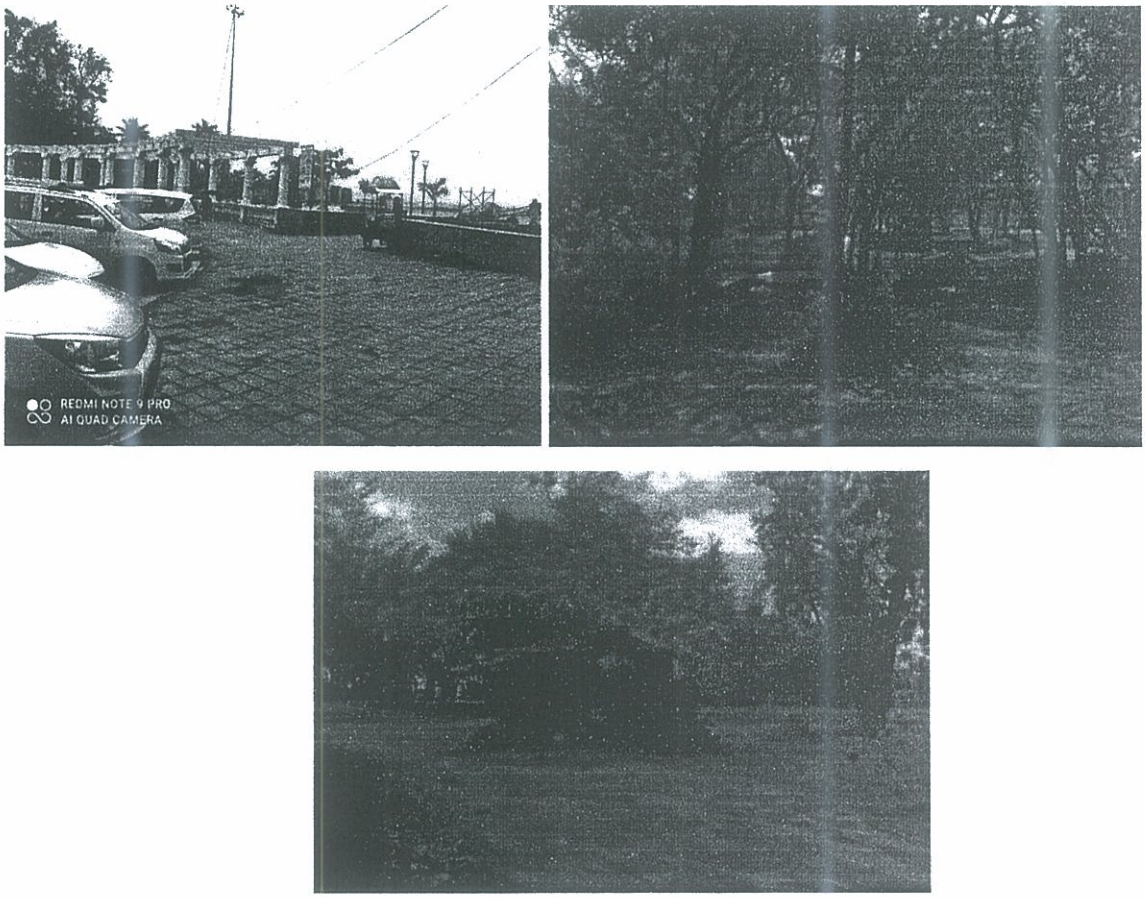


Figure 6: Existing Condition of Stretch 1

Figure 7: Existing Condition of Stretch 2

Figure 8: Existing Condition of Stretch 3

3.3 Physiographic and Hydraulic Conditions

The width of the Mandovi estuary at the entrance is 3300 m and natural depths are about 8 to 9 m below CD (Fig.9) which reduces to about 1km across Hotel Marriott and Youth Hostel and keeps on reducing to 600m width near Panjim Gymkhana in a stretch of 1400 m. A sharp band can also be seen in the estuary 2000m upstream from Hotel Marriott. Estuary flow gets diverted towards left bank due to sharp band making left bank more vulnerable for erosion. It is also evident from the bathymetry of the area which shows that deep channel is very close to left bank. The hydraulic conditions of the area were not available, a large area was modelled which comprises the Mormugao port area for which hydraulic parameters like velocities, hydrographs, wave, tide etc. Hydrographs of both the rivers namely Mandovi and Zuari are shown in Fig. 10. The peak discharge in Mandovi river is about 1600 m3/s for those respective years. In general, the discharges in the Mandovi river are about 4-5 times more than those in Zuari river. The peak discharge in the Manodovi river has been estimated as about 5000 m3/s. The same was used for the model studies by CWPRS.

The peak tidal currents in the offshore region are of the order of 0.25 m/s. Offshore wave data reported in Indian daily weather chart reports published by Indian Metrological Department (IMD) are shown in following rose diagrams (Fig.11) and the same have been used to simulate MIKE-21 SW module by CWPRS. (A. K. Agrawal, 2020)

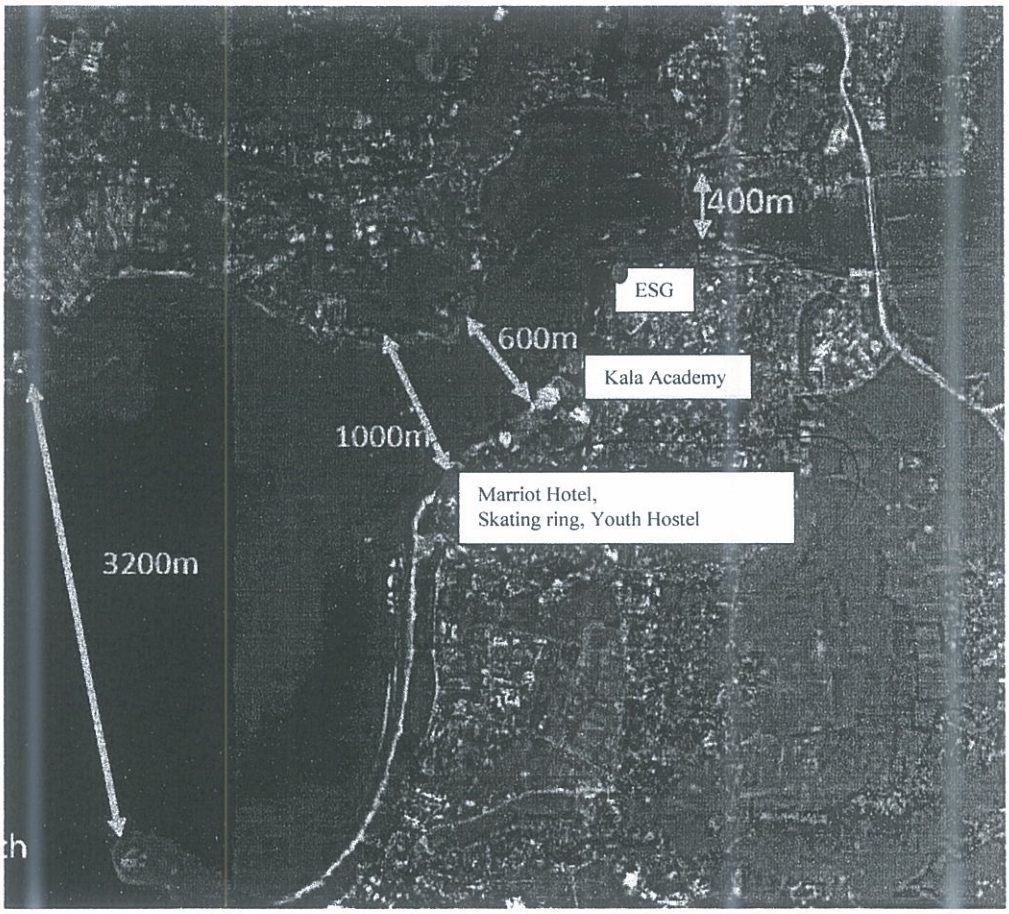


Figure 9: Physiographic of Mandovi estuary

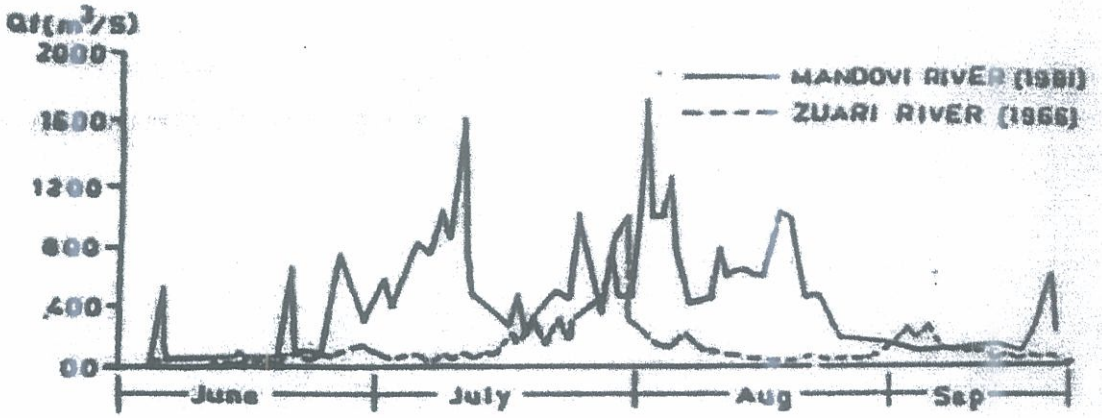


Figure 10: Hydrographs of Mandovi and Zuari River

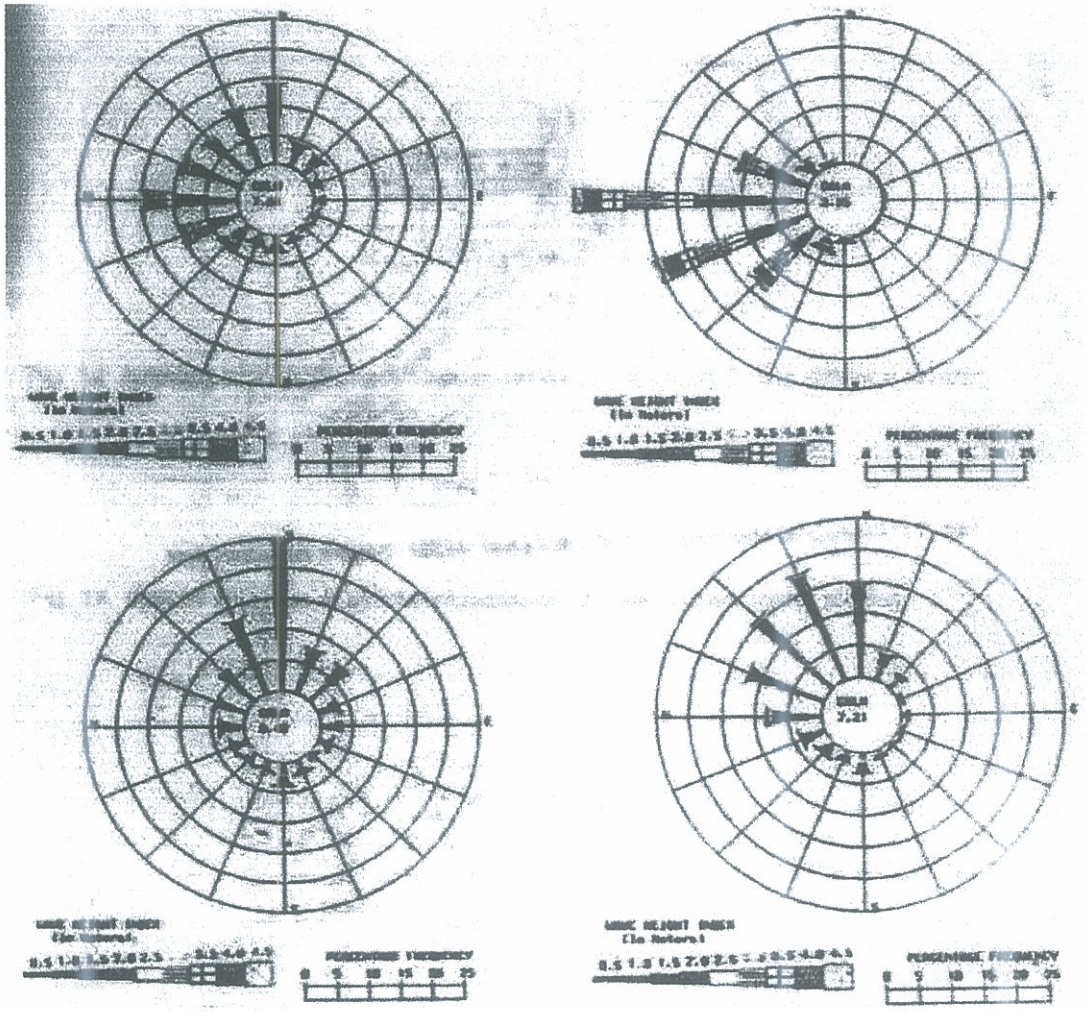


Figure 11: Offshore Wave Data Rose Diagrams

Bathymetry is one of the most important input for the model adopted by CWPRS. Bathymetry was obtained from available hydrographic charts as supplied by the MPT and from MIKE-21 C map data. The bathymetry covers an area of 40kmX40km. The model area includes major stretch of Zuari and Mandovi rivers. Towards sea side, it covers soundings up to(-) 56 m depth contours below CD. Figure 12 shows the 2-D view of the model area and bathymetry while Figure 13 indicates bathymetry in the vicinity of area of study. A deep channel can be observed near the left bank of river. This is caused due to sharp bend of river 1.5 km upstream of river as flow gets deflected towards left bank. The flow velocity increases on the outer curvature of bend causing erosion which in turn creates deep channel near outer curvature bank. Thus, the flow attacks the left bank at an angle making it more vulnerable for erosion. On the other hand near the right bank (opposite to Marriott hotel), the depths are shallow. This can be seen in Fig. 14 which shows cross-section L1-L2 across River Mandovi near Marriott Hotel. It can be observed that deep channel is at a distance of about 900 m from right bank while from left bank it is just about 150 m. Large model area has been considered to incorporate Mormugao port where observed hydraulic data was available which has been used to calibrate hydraulic conditions in the model by CWPRS. (A. K. Agrawal, 2020)

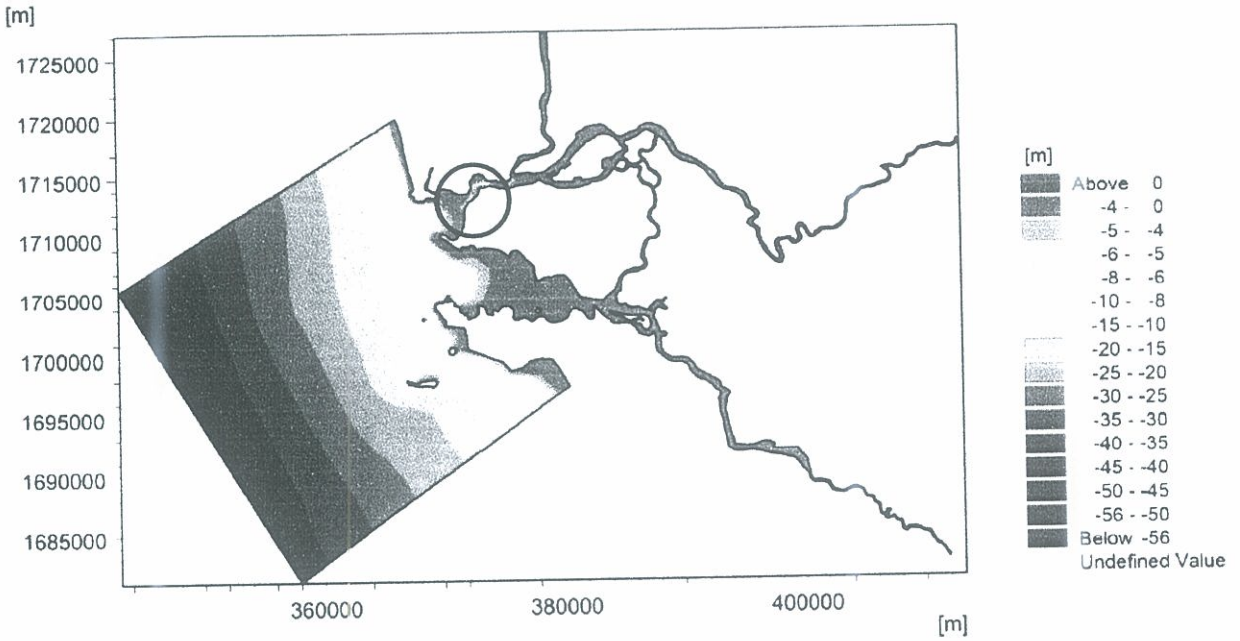


Figure 12: 2-D View of Bathymetry in modelled area

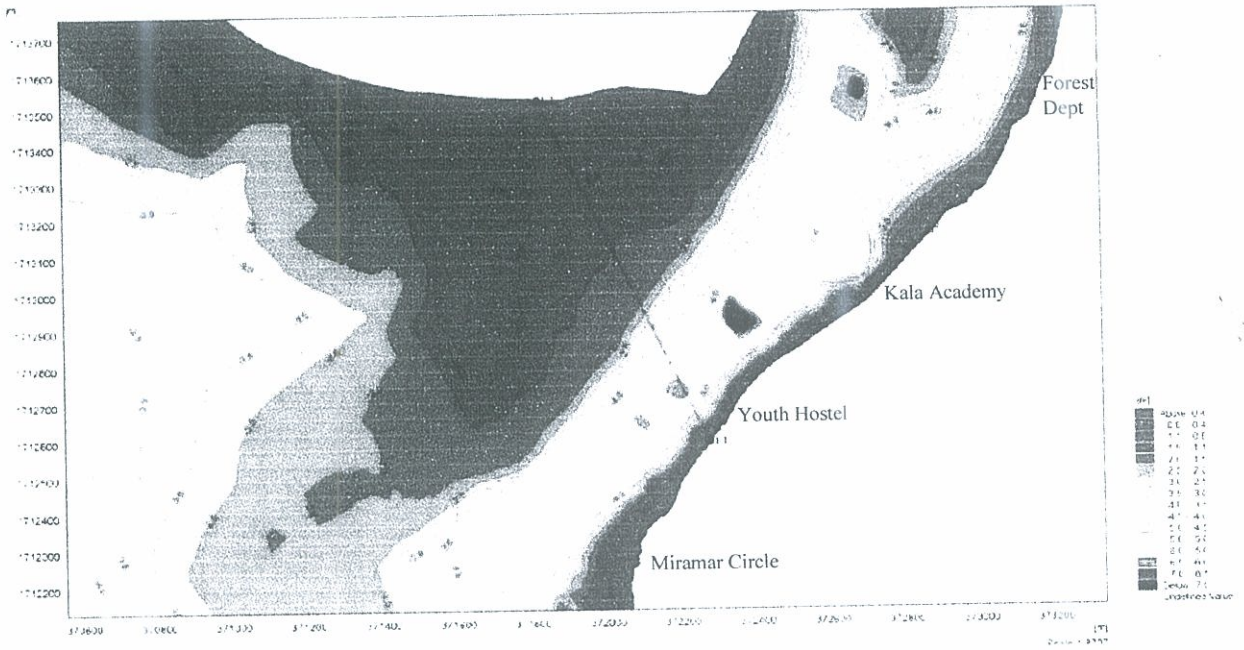


Figure 13: 2-D View of Bathymetry in the vicinity of Miramar beach near Marriot Hotel till Forest Department

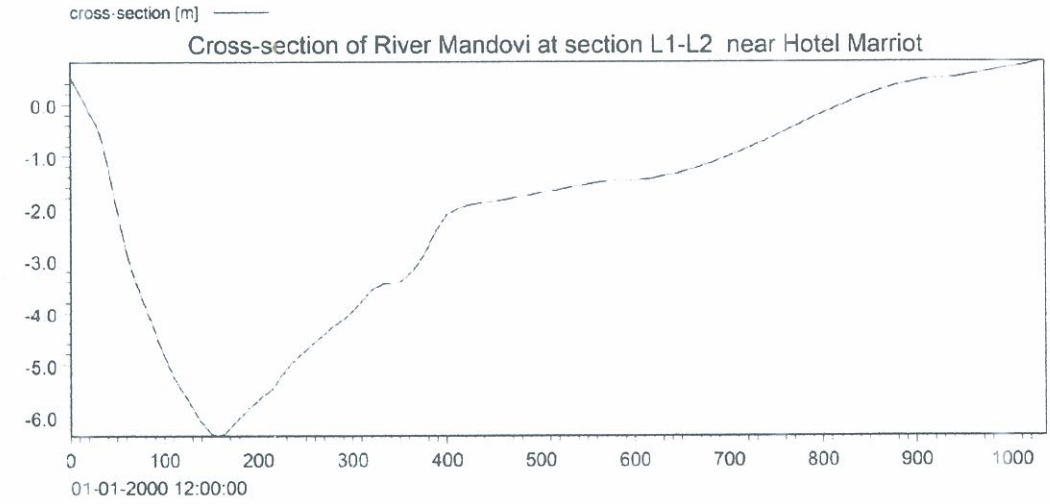


Figure 14: Mandovi River Cross-section near Hotel Marriott

The region is subjected to incident short period waves of significant height of 2.0m from the directions north to northwest during the non-monsoon season (October to May) and from the directions between southwest and west of significant height of about 4.0m during the southwest monsoon season i.e. from June to September. (A. K. Agrawal, 2020)

3.4 Wave Transformation Studies

The computational model considered by CWPRS for wave transformation, covered an area of 40 km x 40 km and the same has been used to for hydrodynamic and sedimentation studies. The model area covers the entire proposed port area upto (-) 56 m depth contour. Mesh and bathymetry files were generated using MIKE-21 tools. Model was simulated for both SW and NE monsoon period. The significant waves are shown in Fig. 15-18. It could be seen from figure that significant wave height during monsoon period is 0.8m at Miramar beach near Miramar Residency and 0.3m at Children's Park while during non-monsoon period it is only 0.2m at Miramar beach near Miramar Residency and 0.05m at Children's Park. (A. K. Agrawal, 2020)

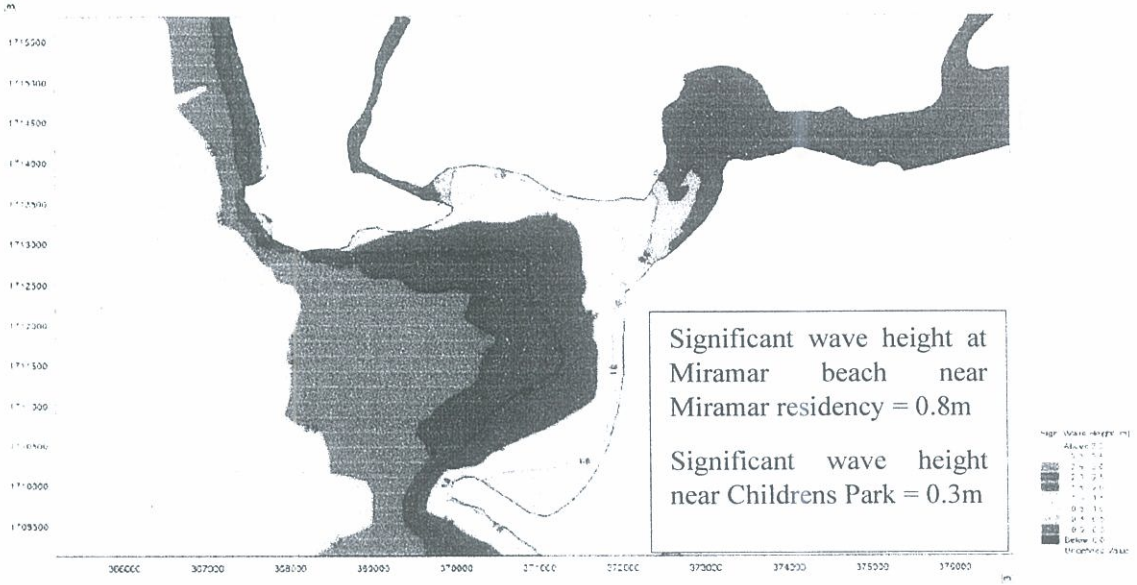


Figure 15: Significant wave Height during SW Monsoon (Wave Direction 2500)

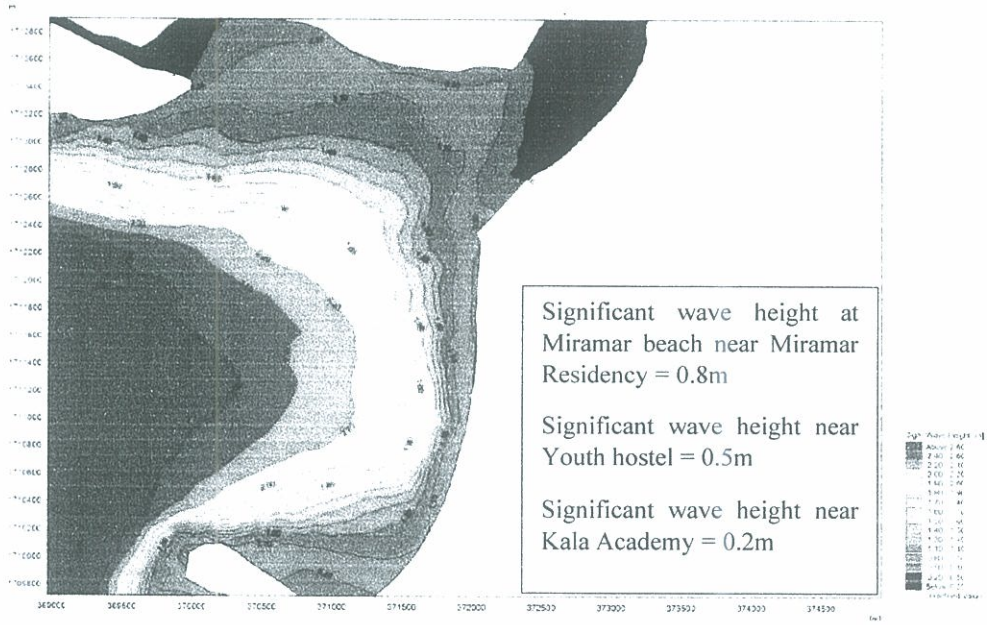


Figure 16: Significant wave Height during SW Monsoon (Wave Direction 2700)

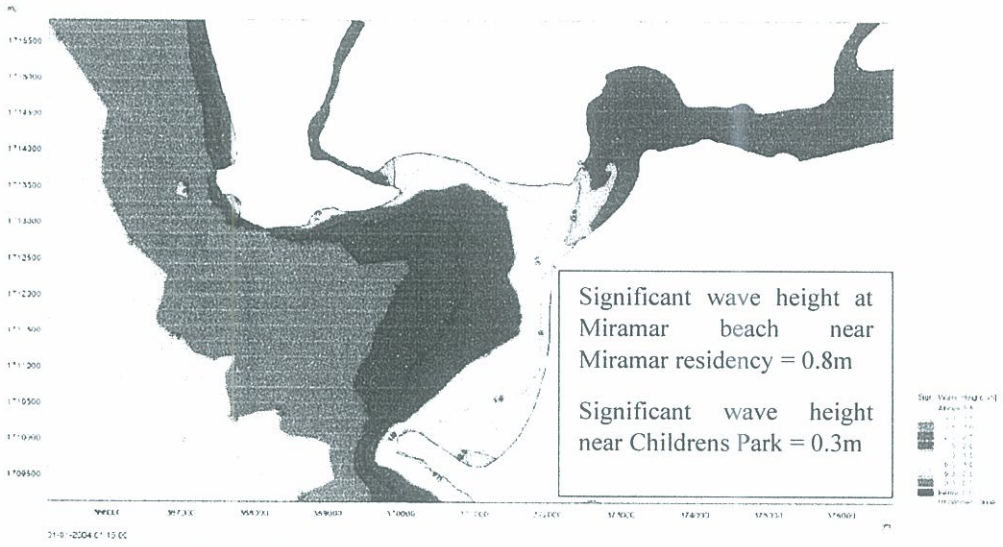


Figure 17: Significant wave Height during SW Monsoon (Wave Direction 2250)

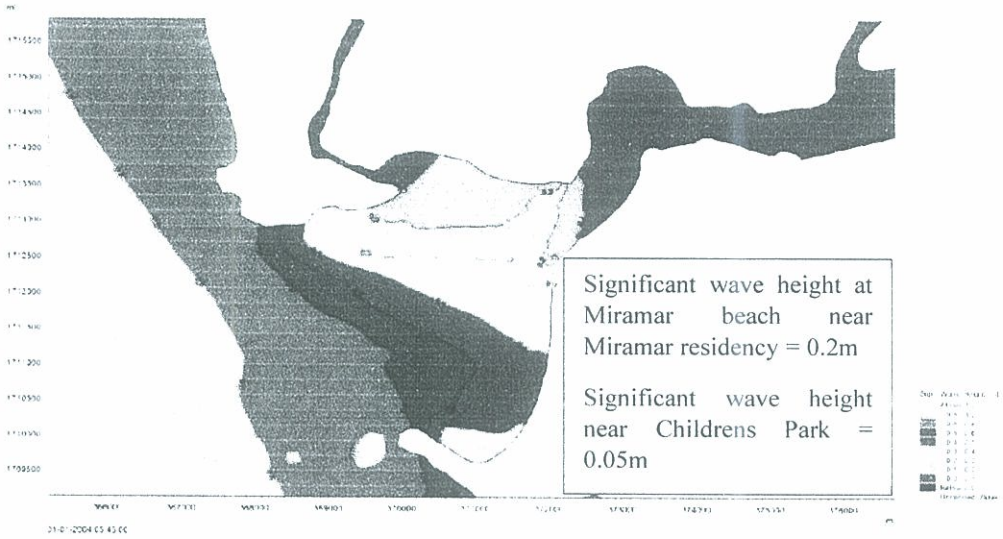


Figure 28: Significant wave Height during NE Monsoon (Wave Direction 3150)

3.5 Hydrodynamic and sedimentation studies

3.5.1 Existing Hydrodynamic Condition

The computational model considered by CWPRS for tidal flow simulation covered an area of 40 km x 40 km. The model area covers the entire proposed port area up to (-) 56 m depth contour. Mesh and bathymetry files were generated using MIKE-21 tools. In the vicinity of Marriott hotel, fine mesh was generated while in remaining model area, coarse mesh was generated to reduce the simulation time. The model area consists of 5 open boundaries: two river boundaries and three sea boundaries. Predicted tidal levels obtained from C-map were supplied at north and south boundaries with appropriate level differences. As the flow is almost parallel to the contours along western boundary, no cross flow condition was provided at this boundary. At remaining two open boundaries, hydrographs of Mandovi and Zuari River were provided. The model parameter like bottom roughness coefficient, surface elevation etc. were adjusted to get the required prototype conditions in the model (available in vicinity Mormugao port). The model was simulated for peak river discharge condition. The simulations were repeated by changing model parameters until the computed values matched with the field observed data. The changes in flow fields were computed every time step of 30 sec and results are recorded at every 30 minutes time interval. The computed values of currents were compared with the field observed data. The studies were repeated by changing model parameters until the computed values matched well with the field observed data. Typical flow behavior is shown in Fig.19. The length of vector shows the magnitude of current and arrowhead of vector indicates the direction of flow. (A. K. Agrawal, 2020)

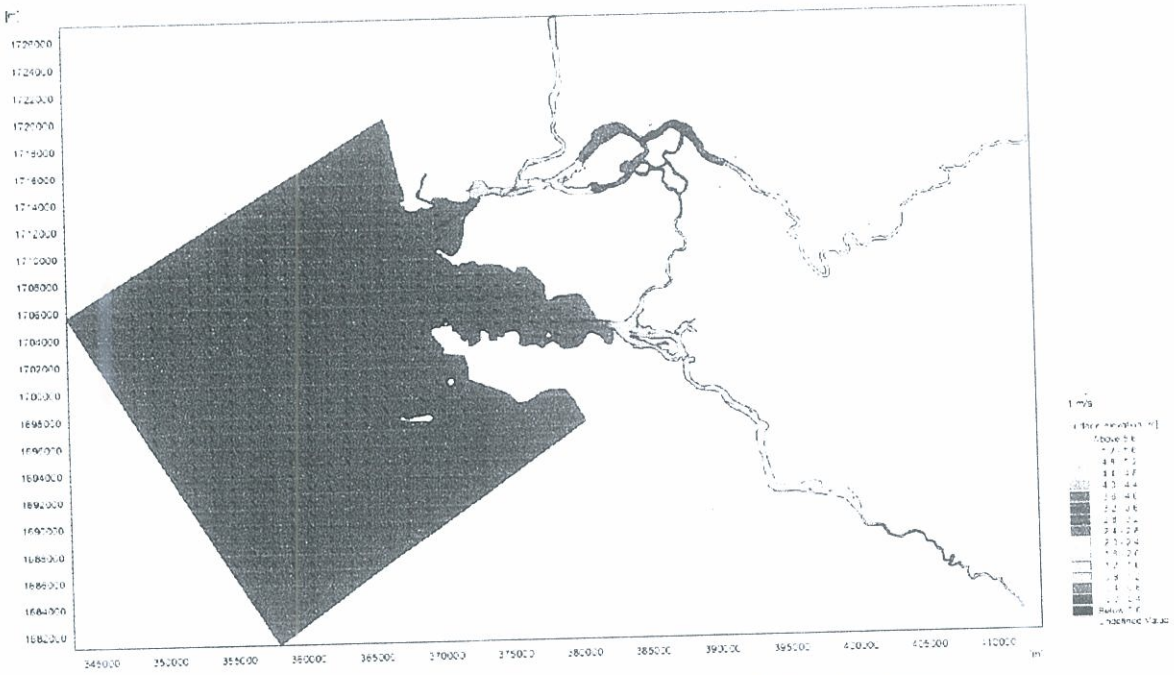


Figure 39: Flow Pattern in Model Area during peak river Discharge

In order to examine flow behavior in the vicinity Mandovi River, this river portion was model zoomed and flow behavior was studied in two conditions namely, high tide and low tide. The typical plots are shown in Fig. 20 to 21 and proposed coast for protection and restoration works has indicated in red. The length of vector shows the magnitude of current and arrowhead of vector indicates the direction of flow. It could be observed that during low tide magnitude of current is higher in river compared to during high tide. This is due to the fact that during low tide, level difference surface water is more. (A. K. Agrawal, 2020)

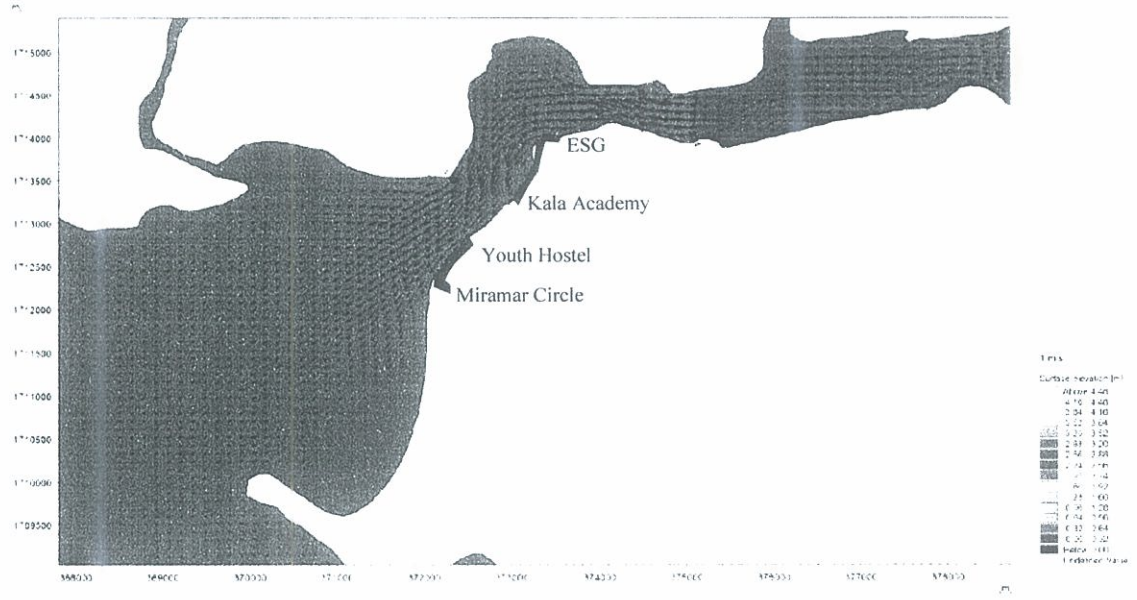


Figure 20: Flow Pattern during High Water

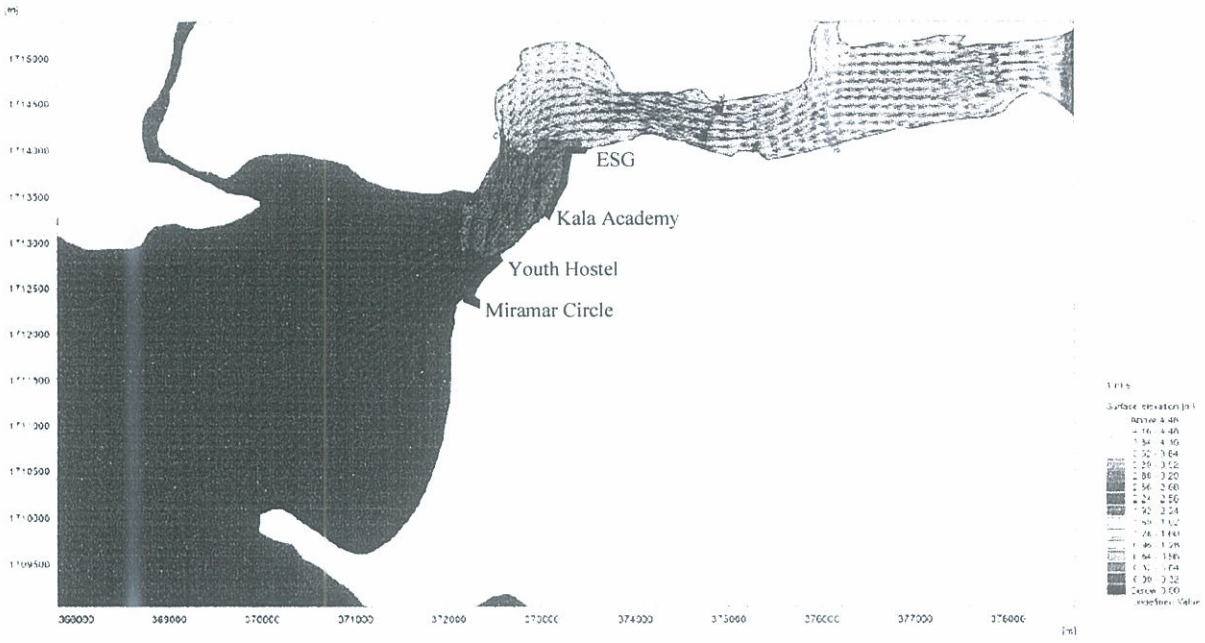


Figure 214: Flow Pattern during Low Water

The typical plots during high tide and low tide are further zoomed to examine current pattern from Miramar beach near Miramar Residency to Children's park are shown in Fig. 22 to 23 and proposed coast for protection and restoration works are indicated in red. It can be observed that the flow is oblique to left bank upstream of Miramar beach. It could cause addition impact on the bank and can cause more erosion in this area. (A. K. Agrawal, 2020)

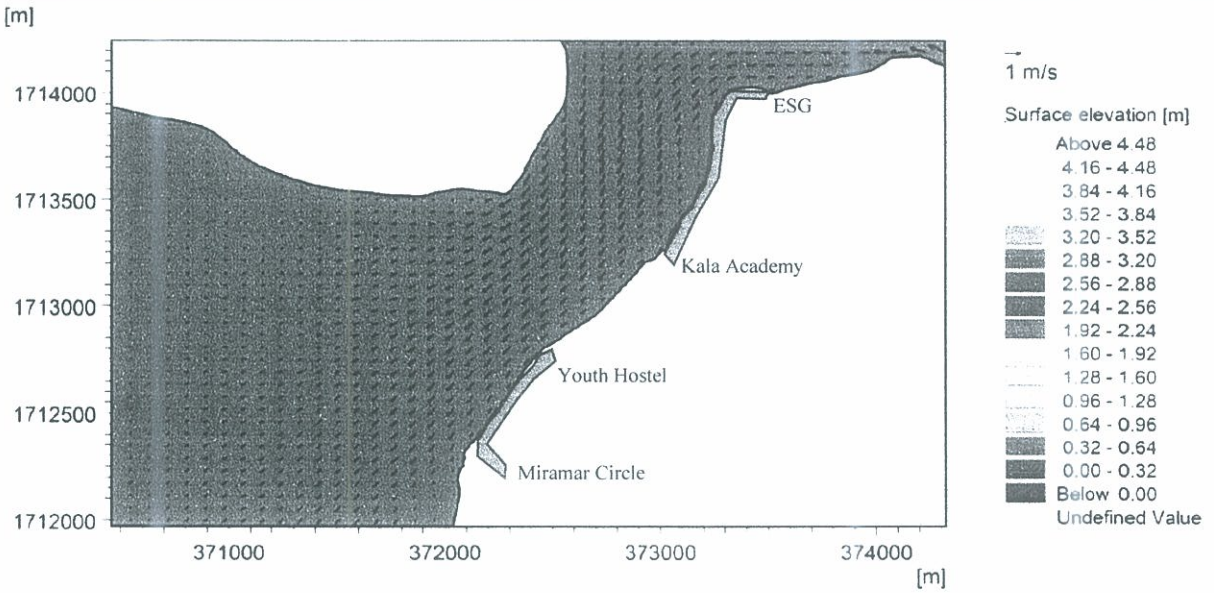


Figure 22: Flow Pattern during High Water

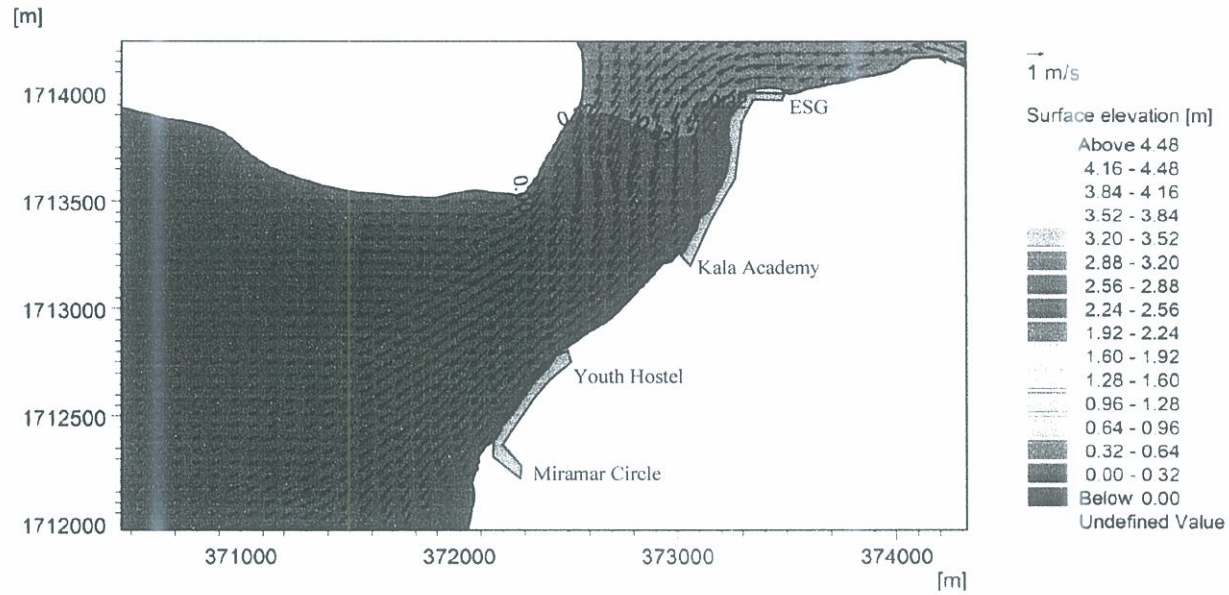


Figure 23: Flow Pattern during Low Water

3.5.2 Existing Condition sedimentation

CWPRS modelled the simulation for the existing condition using MIKE 21 MT software for peak river discharge in the rivers. Model was simulated during monsoon period and suspended sediment concentration values were adopted as per the prototype data available with CWPRS. Typical plot of sedimentation/erosion is shown in Fig. 24. It could be seen from figure that during high river discharge condition erosion takes place in the vicinity of hotel along the retaining wall. The erosion varies from 0.5 m to 1.2 m in the region. (A. K. Agrawal, 2020).

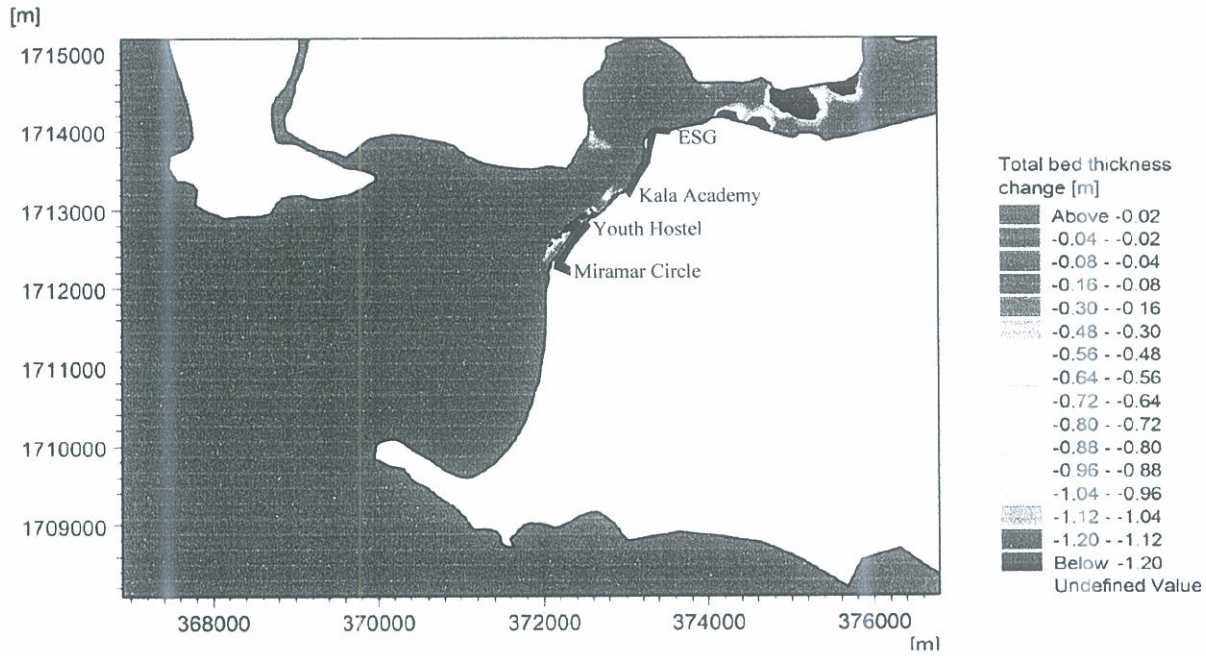


Figure 54: Sedimentation and Erosion

3.6 Inferences and Proposals

As per the studies conducted by CWPRS for WRD, it can be inferred that the high river discharges and waves and oblique flow towards left bank due to land outcrop at Reis Magos fort site (right bank site) play major important roles in erosion of bank. Lesser at ESG, children's park and increasing towards Miramar. Shifting of left bank would increase the curvature of river resulting in more erosion at left bank.

The existing retaining wall arrests the shifting of channel towards left bank, as such reducing the situation of erosion, as angle of oblique current would further increase if the wall is demolished and the wave forces would be borne by bank alone.

Therefore, **providing a continuous retaining wall along the coastline will reinforce and protect this river bank.**

Other observations that can be inferred is that during low tide magnitude of current is higher in river compared to during high tide, which is due to the fact that during low tide, level difference surface water is more. Also during peak river discharge, the existing retaining wall is in some parts are partially submerged due to which this wave does not break and attacks the vertical wall causing huge force on the wall and also overtop it. During low river discharge condition, breaking waves hit the retaining wall. These breaking waves have impact on both bed erosion and retaining wall thrust. Depending upon type of waves; breaking or non breaking, the thrust varies.

Therefore **providing rip rap along the retaining wall will decipate the wave energy or thrust, thus protecting the retaining wall from scour and erosion of coastline.**

3.7 Ecological Environment

Majority casuarina trees planted by Forest department to retain the soil can be found along the coastline. Other trees that found here are acasia, badam and cocunut trees.

Traces of *Ipomoea pes caprae* can be found growing on the surface of the beach stretches.

4 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The relationship between the three project phases (pre-construction, construction and post-construction & operation) and components and the environment established to identify anticipated environmental impacts are given below in table 1. General construction activities typical of a retaining wall and promenade construction have been considered. Each anticipated environmental impact was assessed for significance based in intensity, duration, and scope. Mitigation measures were identified to reduce the significant adverse impacts including residual effects.

Table 1: Stage wise construction activities

I. Pre-construction Stage	
a.	Site mobilization and erection of temporary facilities - land clearing, installation of construction trailers, electricity and other utility connections, perimeter fencing, establishment of storage areas, waste disposal, pre-fabricated components, installation of production equipment (concrete batching, casting), launch and assembly areas, temporary access roads etc.
b.	Relocation and protection of public utility infrastructure
II. Construction Stage	
a	Land clearing which includes grass clearing, surface stripping, topsoil/sand/rubble storage, excavation, earthwork and other land preparation activities.
b.	Construction of infrastructure on land: 1) retaining wall 2) cycle track and pedestrian footpath 3) bridge 4) installation of precast concrete service trench 5) installation of structures etc.
c.	Management of construction wastes, excavated material and hazardous materials
d.	Transportation of construction materials from quarries and borrow areas
e.	Operation of construction camp sites having: batching plants, storage yards, stockpiles
III. Post -construction and Operation Stage	
a	Deconstruction of structures: dismantling of steel and concrete structures, and crushing of debris
b.	Demobilization of work site like dismantling of all temporary facilities, restoration of storage and all other areas
c.	Maintenance works

The scale and scope of impact assessment is limited, it also allows a unique opportunity to integrate mitigation and enhancement principles in the design phase of the project to avoid and reduce adverse environmental impacts. The principle environmental impacts from the protection and restoration of coastline of Mandovi River from Miramar Circle to Youth Hostel and Kala Academy to ESG are as follows:

4.1 Physical Environment

Soil, ground and surface water, and ambient air quality. Soil and ground contamination from oil and lubricant spillage and measures must be implemented to immediately avoid the dispersion in the environment. Most of the construction activities will occur near the coast line along Mandovi River and measures and the control of suspended solid and other contaminants must be implemented. Movement of large volume of equipment; emissions from production equipment like cement batching, casting yard, and stone cutting & polishing, unpaved road travel will cause deterioration of the air quality. Measures must also be implemented to control greenhouse gas emissions from the construction activities in addition to national ambient air quality parameters. An emergency response plan will be prepared and implemented by the

contractor to contain the harmful effects of accidents and malfunctions of construction equipment and machineries.

4.2 Biological Environment

The project site is known to serve as habitat for the common aquatic species such as fish, crabs, shrimps, clams, turtles, etc. and common birds. Tourist are attracted to these waters due to the boat rides for Dolphin site seeing. Fishing activities take place in the project influence area. Measures must be undertaken to ensure that construction activities and infrastructures do not lead to the reduction in their population. During construction and de-commissioning phases, temporary and permanent structures along the coastline, affect fish habitat, and other animals through disruption of normal activities, deterioration and loss of habitat.

4.3 Human Environment

The main impacts are noise. The surrounding sound environment will deteriorate from the construction operation. A noise management program will be implemented to comply with the GoI guideline. Withstanding all these anticipated impacts, the effects to the human environment are considered as not significant if the mitigation measures are implemented.

4.4 Ecological Environment

No trees will be cut for the construction of the retaining wall, the cycle track and pedestrain footpath. The cycling track will be aligned or bifurcated such that no trees are cut.

For trees to be retained within the footpath by ensuring land and root zones are not damaged open planters will be provided.

Natural excavated sand along the beach strecthes will be used for back fill and compaction along with granitic boulders to encourage growth of local vegetation *Ipomoea pes caprae.*

5 SCOPE OF BASELINE STUDIES

For the present EIA study, the attributes of environment considered are:

- Air environment (Meteorology, ambient air quality, noise levels, traffic pattern and traffic density)
- Water environment (Hydrodynamic, sedimentation, etc)
- Land environment (Geology, Geo hydrology, land use, solid waste disposal, etc.,)
- Biological environment (Flora, fauna, vegetation, ecosystem); and
- Socio economic environment (Demography, occupational structure, leisure, revenue generation etc.)

5.1 AMBIENT AIR QUALITY

Air pollution can cause significant effects on human beings, animals, vegetation and materials. Air environment monitoring covers the parameter for which national ambient air quality standards have been defined by the Ministry of Environment and Forests. Accordingly, parameters monitored were Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM), Oxides of Nitrogen (NOx) and Sulphur dioxide (SO2).

Table 2: Results of ambient air quality

Parameters µg/m3	Mean value of the sampling sites	
	Location: Infront of old GSPCB premises, Panaji	Air Quality
PM 10	51	Satisfatory
PM 2.5	13	Satisfatory
SO2	2	Satisfatory
NOX	25	Satisfatory
AQI	51	Satisfatory

5.2 TESTING OF NOISE

Equivalent sound pressure level (Leq) the Leq is the equivalent continuous sound level, which is equivalent to the same sound energy as the actual fluctuating sound measured in the same period. This is necessary because sound from noise source often fluctuates widely during a given period of time.

This is calculated from the following equation:

Leq(hrly)=L50+(L10–L90)2/60

L day: is defined as the equivalent noise level measured over a period of time during day (6am to 10pm).

L night: is defined as the equivalent noise level measured over a period of time during night (10 pm to 6 am).

Table 3: Ambient noise standards

Category of area	Noise level dB(A)	
	Day time	Night time
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

5.2.1 Instrument used for monitoring

Sound Pressure Level (SPL) measurements were automatically recorded with the help of an Integrated Sound Level Meter to give the equivalent noise level for every hour continuously for 24 hours in a day. Industrialization has a direct bearing on the noise level of the environment pertaining to such activities. Noise beyond limits interferes with communication in the work spot form annoyance and health hazard. Impact of noise on the environment depends on various factors such as intensity, distance from source, time of exposure and nature, the type of activities etc. The most common and universally accepted scale is the A weighted Scale which is measured as dB (A). This is more suitable for audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise according to the response of a human ear. The impact of noise sources on surrounding community depends on characteristics of noise sources (instantaneous, intermittent or continuous in nature). It can be observed that steady noise is not as annoying as one, which is continuously varying in loudnessThe time of day at which noise occurs, for example high noise levels at night in residential areas are not acceptable because it acts as a disturbance to sleep; and the location of the noise source, with respect to noise sensitive land use which determines the loudness and period of exposure. The Environmental Impact of noise can have several effects varying from Noise Induced Hearing Loss (NIHL) to annoyance depending on loudness of noise. The impact of noise from the proposed project can be undertaken by considering various factors like potential damage to hearing, physiological responses, annoyance and general community responses. The noise survey has been conducted at the same locations where data on air quality was collected. Noise monitoring has been undertaken for 24 hrs. The main objective of noise monitoring in the study area is to establish the baseline noise levels and assess the impact of the total noise generated by the operation of the proposed project activities around it.

5.3 WATER QUALITY

Water is a vital commodity for the survival of vegetation, animals and human beings and for the proper balance of the eco-system itself. As such, any adverse impact on water quality due to the industrial activity will have serious consequences on the environment. Hence it is imperative to study the water quality of the regime likely to be influenced by public activities. Effects can be represented by quantity and quality changes, these changes can in turn, have aquatic faunal or floral species and aquatic species systems implication.

Table 4: water quality standards

Parameters	Units	S1: River Mandovi Near Hotel Mariott	Standards
pH	-	7.81	6.5-8.5
Dissolved Oxygen	Mg/l	6.4	4
BOD	Mg/l	BDL	3
Fecal Coliform	MPN/100ml	170	100 or less
Total Alkalinity	Mg/l	50	290

Source: NAMP Annual data 2020-21, GSPCB

6 CONCLUSION

The site is influenced by waves, tide and large river discharge conditions. River discharges and waves play an important role in erosion of bank along the site. This stretch is prone to erosion. Other major cause of erosion at the left bank is bending of river which is result of a large land outcrop towards Reis Magos fort site (right bank site) and flow gets deviated towards the left bank, which can also be correlated with the number of protective/anti-erosion works implemented by the state since 1978 all along the left bank.

In light of the technical, institutional measures recommended it is expected that the project will avoid severe, permanent and regional impacts. There will be no net loss in biodiversity. Tremendous social and economic benefits will be generated in Panaji by the development of promenade creating the reliable, sustainable and safe public activties.

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ANNEXURE A

DESCRIPTION OF MODULES OF MODEL MIKE- 21

In the present study, 2-Dimensional hydrodynamic model MIKE 21 HD and mud transport Model, MIKE 21 MT have been used to simulate the flow field and sediment transport in the existing and the proposed scenario under prevailing tidal and wave conditions. Brief description of scientific background of MIKE 21 HD model and MIKE 21 MT model is given in following paragraphs as below.

1.1 MIKE 21HD Module

In order to simulate dynamics of cohesive sediment, it is necessary to initially compute the hydrodynamics of water body in terms of velocity and water level fluctuations. Appropriate governing equations for hydrodynamics in tidal areas are given by the shallow water wave equations. These two dimensional shallow water equations are derived from Navier Stokes equations of motion with the simplified assumptions. MIKE 21 Flow Model FM is based on a flexible mesh approach and it has been developed for applications within oceanographic, coastal and estuarine environments. The modelling system may also be applied for studies of overland flooding. The system is based on the numerical solution of the two- dimensional incompressible Reynolds averaged Navier-Stokes equations invoking the assumptions of Boussinesq and of hydrostatic pressure. The spatial discretization of the primitive equations is performed using a cell-centred finite volume method. The spatial domain is discretized by subdivision of the continuum into non-overlapping elements/cells. In the horizontal plane an unstructured grid is used while in the vertical domain in the 3D model a structured mesh is used. In the 2D model, the elements can be triangles or quadrilateral elements. The spatial discretization of the primitive equations is performed using a cell-centered finite volume method. The basic equations are derived from conservation equation for spectral wave action density, and are represented as under:

$$\frac{\partial(C_{gx} m_o)}{\partial x} + \frac{\partial(C_{gy} m_o)}{\partial y} + \frac{\partial(C_\theta m_o)}{\partial \theta} = S_o \qquad (4)$$

$$\frac{\partial(C_{gx} m_1)}{\partial x} + \frac{\partial(C_{gy} m_1)}{\partial y} + \frac{\partial(C_\theta m_1)}{\partial \theta} = S_1 \qquad (5)$$

Where,

$m_o(x,y,\ )$	:	Zeroth moment of the action spectrum (m^2)
$m_1(x,y,\ )$	:	First moment of the action spectrum (m^2/s)
C_{gy}, c_{gx}	:	Components in the x and y direction of the group velocity (c_g), (m/s)
c	:	propagation speed representing the change of action in the dir. (m/s)
	:	direction of the wave propagation (degree)
S_0, S_1	:	source terms (m^2, m^2/s)

The moments $m_n(\ )$ are defined

$$m_n(\theta) = \int_0^x \omega^n A(\omega, \theta)\, d\omega$$

where, is the absolute frequency (S^{-1}), and A is the spectral wave action density (m^2/s). The propagation speed c_{gx}, c_{gy} and c are obtained using linear wave theory.

The left hand side of the basic equations takes into account the effect of refraction and shoaling. The source terms S_o and S_1 take into account the effect of local wind generation and energy dissipation due to bottom

friction and wave breaking. The effects on current on these phenomena are included.

The spatial discretisation of the basic partial differential equations is performed using Eulerian finite difference technique. The zeroth and the first moment of the action spectrum are calculated on a rectangular grid for a number of discrete directions. In the X-direction, linear forward differencing is applied while in both the Y and □ directions it is possible to choose between linear up-winded differencing, central differencing and quadratic up-winded differencing. The best results are usually obtained using linear up-winded differencing in both the Y and □ directions. The non-linear algebraic equation system resulting from the spatial discretisation is solved using a once-through marching procedure in the X-direction (the predominant direction of wave propagation) restricting the angle between the direction of wavepropagation and the X-axis to be less than 90^0.

The discretization in geographical and spectral space is performed using a cell-centred finite volume method. In the geographical domain, an unstructured mesh is used. The spatial domain is discretized by subdivision of the continuum into non-overlapping elements.

The sediment transport (MIKE-21 MT) formulations are built into the advection-dispersionmodule, MIKE 21 AD, which solves advection-dispersion equation:

$$\frac{\partial c}{\partial t} + u\frac{\partial c}{\partial x} + v\frac{\partial c}{\partial y} = \frac{1}{h}\frac{\partial}{\partial x}\left(hD_x \frac{\partial c}{\partial x} \right) + \frac{1}{h}\frac{\partial}{\partial y}\left(hD_y \frac{\partial c}{\partial y} \right) + Q_L C_L \frac{1}{h} - S \qquad (6)$$

The following symbols are used in the equation:

c	: compound concentration (arbitrary units
u,v	: horizontal velocity components in x, y directions (m/s)
h	: water depth (m)
D_x,D_y	: dispersion coefficients in the x,y directions (m^2/s)
S	: accretion/erosion term ($kg/m^3/s$)
Q_L	:source discharge per unit horizontal area($m^2/s/m^2$)
C_L	: concentration of source discharge (kg/m^3)

The advection-dispersion equation is solved using an explicit, third-order finite differencescheme, known as the ULTIMATE scheme.

1.2 MIKE 21 MT Module

The sediment transport studies were carried out using MIKE 21 MT model. This model simultaneously solves hydrodynamic and sediment transport equations. The calibration of sediment transport model is difficult because morphological changes are too slow and temporalbed changes are too variable to measure anything significant for comparison. The sediment fluxes at various locations may differ and the following factors contribute for these variations:

- Unsteadiness of flow,
- Mixtures of sediment in suspension,
- Variability of supply of mobile sediment on the bed,
  - Presence of sandy (non-cohesive) sediment,
  - Omission of depth variation,

- Effect of wave stirring.

The erosion, transport and deposition of silt, mud and clay particles under action of currents and waves can be best described by the multi-layers mode of the mud transport module of MIKE 21. The sediment transport module is dynamically coupled with the 2-dimensionalhydrodynamic module, MIKE 21 HD. The module solves the primitive equations in two dimensions using finite difference methods by Alternating Direction Implicit technique and the Double Sweep algorithm. Following are the relationships used in the module.

The sediment transport formulations are built into the advection-dispersion module, MIKE 21AD, which solves advection-dispersion equation:

$$\frac{\partial c}{\partial t} + u\frac{\partial c}{\partial x} + v\frac{\partial c}{\partial y} = \frac{1}{h}\frac{\partial}{\partial x}\left(hD_x \frac{\partial c}{\partial x} \right) + \frac{1}{h}\frac{\partial}{\partial y}\left(hD_y \frac{\partial c}{\partial y} \right) + Q_L C_L \frac{1}{h} - S \qquad (6)$$

The following symbols are used in the equation:

c	: compound concentration (arbitrary units)
u,v	: horizontal velocity components in x, y directions (m/s)
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S	: accretion/erosion term ($kg/m^3/s$)
Q_L	: source discharge per unit horizontal area($m^2/s/m^2$)
C_L	: concentration of source discharge (kg/m^3)

The advection-dispersion equation is solved using an explicit, third-order finite difference scheme, and known as the ULTIMATE scheme.

Annexure-IV

Form-I for seeking clearance for project attracting CRZ notification

(I) Basic information:

Name of the Project: -*"Protection and Restoration of Mandovi river Coastline from Miramar Circle to Youth Hostel and from Kala Academy to ESG"*

Location or site alternatives under consideration: - ***Miramar Circle to Youth Hostel and from Kala Academy to ESG***

Size of the project (in terms of total area):- ***Approximate area of 18,434 sq.m.***

CRZ classification of the area: - ***CRZ II***

Expected cost of the project: - ***Rs. 33,68,06,755.11***

Contact Information: - ***Goa State Infrastructure Development Corporation Limited***

(II) Activity

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, and the like)

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	No	
1.2	Details of CRZ classification as per the approved Coastal Zone Management Plan?		CRZ-II
1.3	Whether located in CRZ-I area?	No	
1.4	The distance from the CRZ-I areas.		Not Applicable
1.5	Whether located within the hazard zone as mapped by Ministry of Environment and Forests/National Disaster Management Authority?		Part area of 295 sqm near Miramar circle is located within hazard line.
1.6	Whether the area is prone to cyclone, tsunami, tidal surge, subduction, earthquake etc.?	No	
1.7	Whether the area is prone for saltwater ingress?	Yes	Area from Kala Academy till Children Park is prone to ingress of saltwater. Retaining wall with rip rap is proposed. Refer drawings Annexure A

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.8	Clearance of existing land, vegetation and buildings?	Yes	Overgrown Shrubs, wherever necessary.
1.9	Creation of new land uses?	No	Not Applicable
1.10	Pre-construction investigations e.g. borehole, soil testing?	No	
1.11	Construction works?	Yes	In this proposal there will be a continuous retaining wall along the coast for protection. Wherever the existing one has collapsed, it will be restored, and missing walls will be built. In some stretches the embankment have settled and some areas eroded. In such situation, new retaining wall or trough have been proposed respectively. It is proposed to create a promenade that would link Miramar Circle and Mahaveer Garden and ESG with a cycling lane that will be part of the future pedestrian itinerary between Ribandar and Dona Paula. The promenade will be continuous and will be connected to the existing roads and maintaining traditional pedestrain & fishing boat access. Public Washrooms are proposed. One near Light House located near Youth Hostel and second is an exisitng dilapidated structure located near Mahaveer Garden to be renovated and used as Washroom.
1.12	Demolition works?	Yes	Wherever the existing retaining walls have collapsed, it will be rebuilt.
1.13	Temporary sites used for construction works or housing of construction workers?	Yes	Temporary shed for housing site Office.
1.14	Above ground buildings, structures or Earthworks including linear structures, cut and fill or excavations	Yes	Wherever required earth fill to be done for maintaining uniform leveling above HTL.
1.15	Underground works including mining or tunneling?	No	Not Applicable
1.16	Reclamation works?	Yes	In some parts wherever required reclamation of eroded Government acquired lands to maintain uniform access.
1.17	Dredging/reclamation/land filling/disposal of dredged material etc.?	Yes	Existing lateritic rubble embankments and collapsed retaining walls to be reused.
1.18	Offshore structures?	No	Not Applicable

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.19	Production and manufacturing processes?	No	Not Applicable
1.20	Facilities for storage of goods or materials?	Yes	Temporary sheds will be constructed for necessary storage of materials during construction period. For Logistics 3 locations have been identified. (i) Open area near Forest Department Nursery; (ii) Kala Academy parking area (iii) Govt. of Goa land near Miramar Residency.
1.21	Facilities for treatment or disposal of solid waste or liquid effluents?	No	Solid waste- The construction debris will be transported via closed trucks to avoid fugitive dust emission. Liquid effluent- Portable toilets, will be provided which are cleaned by suction pump
1.22	Facilities for long term housing of operational workers?	No	Not Applicable
1.23	New road, rail or sea traffic during construction or operation?	No	The existing infrastructure facilities will be used during the construction.
1.24	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	No	Not Applicable
1.25	Closure or diversion of existing transport Routes or infrastructure leading to changes in traffic movements?	No	Not Applicable
1.26	New or diverted transmission lines or pipelines?	No	Not Applicable
1.27	Impoundment, damming, culverting, Realignment or other changes to the hydrology of watercourses or aquifers?	No	All existing drainage outlets will be maintained.
1.28	Stream and river crossings?	No	Not Applicable
1.29	Abstraction or transfers of water form ground or surface waters?	No	Not Applicable
1.30	Changes in water bodies or the land surface affecting drainage or run-off?	No	Not Applicable
1.31	Transport of personnel or materials for construction, operation or decommissioning?	Yes	The construction materials shall be brought to construction site in covered vehicles.
1.32	Long-term dismantling or decommissioning or Restoration works?	Yes	Wherever the existing retaining walls have collapsed will be rebuilt.
1.33	Ongoing activity during decommissioning which could have an impact on the environment?	No	Not Applicable

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.34	Influx of people to an area in either temporarily or permanently?	Yes	There will be temporary influx of laborers and site personnel during construction phase. A steady increase in commuters expected during the operation phase of the project. Proposed Promenade purpose is to attract local people for walking, cycling and leisure activity.
1.35	Introduction of alien species?	No	Not Applicable
1.36	Loss of native species or genetic diversity?	No	Natural ground cover/sand will be maintained.
1.37	Any other actions?	No	Not Applicable

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):

S. No.	Information/checklist confirmation	Yes/ No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)	No	Not Applicable
2.2	Water (expected source & competing users) unit: KLD	No	Source –Water requirement for construction activities will be met using tanker water whereas potable water requirement for washrooms will be met through PWD supply.
2.3	Minerals (MT)	No	Not Applicable
2.4	Construction material–stone, aggregates, sand/soil (expected source – MT)	Yes	Granitic/Basaltic boulders for coastline protection & soling-66,750MT (Maharashtra). Laterite stone- 170MT (Pernem) Laterite Rubble- 3000 MT (available at site) Aggregate- 17,000MT (Dodamarg) Crush sand- 2500MT (Dodamarg) Sand- 3000MT (Kudal, Colvale) Granite for flooring - 1800MT (Andhra Pradesh, Karnataka)
2.5	Forests and timber (source – MT)	No	Not Applicable.
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel(MT), energy (MW)	Yes	During Construction Electricity- 5000kWh Fuel for Machinery – 80L/D
2.7	Any other natural resources (use appropriate standard units)	No	Not envisaged

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous(as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	No	Not Applicable
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	No	Not Applicable
3.3	Affect the welfare of people e.g. by changing Living conditions?	Yes	The promenade connecting youth hostel and Forest Department's Children's Park is a stretch of a longer pedestrian itinerary proposed in the Holistic masterplan to connect Dona Paula and Ribandar. After completion the promenade will be accessible by main road and it will attract local people for walking, cycling and leisure.
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	No	Not Applicable
3.5	Any other causes, that would affect local communities, fisherfolk, their livelihood, dwelling units of traditional local communities etc	No	All fishing activities and access will be maintained.

4. Production of solid wastes during construction or operation or decommissioning (MT/month)

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	No	Not Applicable
4.2	Municipal waste (domestic and or commercial wastes)	Yes	Public Washroom waste will be connected to nearest municipal sewer line.
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	No	Not Applicable
4.4	Other industrial process wastes	No	Not Applicable
4.5	Surplus product	No	Not Applicable

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
4.6	Sewage sludge or other sludge from effluent treatment	No	Portable toilets will be provided which will be cleaned by suction pump and Public Washroom waste will be connected to nearest municipal sewer line.
4.7	Construction or demolition wastes	Yes	Construction debris will be disposed off at designated place authorized by the local body. Existing embankment material will be utilized.
4.8	Redundant machinery or equipment	No	Not Applicable
4.9	Contaminated soils or other materials	No	Not Applicable
4.10	Agricultural wastes	No	Not Applicable
4.11	Other solid wastes	No	Not Applicable

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	Yes	The operation of various equipments during construction phase shall require combustion of fuel. Vehicles older than 5 years are not used and 'green tag' labeling will be used to keep vehicular pollution to a bare minimum through proper maintenance and upkeep.
5.2	Emissions from production processes	No	Not Applicable
5.3	Emissions from materials handling including storage or transport	Yes	Speed limits, sprinkling of water for roads, covered transportation, barricading, green belt etc. are practiced for reduction in SPM. Materials are stored in covered areas to prevent fugitive emissions.
5.4	Emissions from construction activities including plant and equipment	No	
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	Yes	Water sprinkling will be carried on site regularly. Within permissible limits.
5.6	Emissions from incineration of waste	No	Not Applicable
5.7	Emissions from burning of waste in open air(e.g. slash materials, construction debris)	No	Not Applicable
5.8	Emissions from any other sources	No	Not Applicable

6. Generation of Noise and Vibration, and Emissions of Light and Heat

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data withsource ofinformation data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	Yes	All construction equipment will be properly maintained so as to minimize noise and vibration levels. Acoustics done, Equipments shall generate noise not greater than 90 dB (A).
6.2	From industrial or similar processes	No	Not Applicable
6.3	From construction or demolition	Yes	No heavy/ loud machinery will be used.
6.4	From blasting or piling	No	Not Applicable
6.5	From construction or operational traffic	Yes	During construction phase, construction material will be brought to the project site mainly by road. This will lead to increase in trucks and other vehicle movements which could increase noise levels. This is minimized as the interstate materials are allowed in night only.
6.6	From lighting or cooling systems	No	Not Applicable
6.7	From any other sources	No	Not Applicable

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	No	Waste oils are stored in covered areas with a concreted base. No manual filling of fuel will be done onsite.
7.2	From discharge of sewage or other effluents to Water or the land(expected mode and place of discharge)	No	Not Applicable
7.3	By deposition of pollutants emitted to air into the land or into water	No	Not applicable
7.4	From any other sources	No	Not Applicable
7.5	Is there a risk of long term buildup of pollutants in the environment from the resources?	No	Not Applicable

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8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	No	Training for effective use and safe handling of diesel and any hazardous material including waste/spent oil will be provided to site staff. First aid facility at site office.
8.2	From any other causes	No	Not Applicable
8.3	Could the project be affected by natural disasters causing environmental damage (e.g., loods, earthquakes, landslides, cloudburst etc)?	No	Not Applicable

9.Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality

S. No.	Information/Checklist confirmation	Yes/ No	Details there of (with approximate quantities/rates, wherever possible) with source of information data
9.1	Lead to development of supporting. facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) housing development extractive industries supply industries other	No	Panaji and its surroundings are already developed. The Mandovi promenade is connected through main road.
9.2	Lead to after-use of the site, which could have an impact on the environment	No	Not Applicable
9.3	Set a precedent for later developments		Not Applicable
9.4	Have cumulative effects due to proximity to other	No	Not Applicable

III. Environmental Sensitivity

S. No.	Areas	Name/ Identity	Aerial distance(within15 km.) Proposed project location boundary
1	Areas protected under international conventions, National or local legislation for their ecological, landscape, cultural or other related value	No	
2	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Yes	The proposed development is along the Mandovi river bank.
3	Areas used by protected, important or sensitive Species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	No	
4	Inland, coastal, marine or underground waters	No	Not Applicable
5	State, National boundaries	No	Not Applicable
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	No	Not Applicable
7	Defense installations	No	Not Applicable
8	Densely populated or built-up area	No	Not Applicable
9	Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)	No	Not Applicable
10	Areas containing important, high quality or scarce resources (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)	No	Not Applicable
11	Areas already subjected to pollution or Environmental d a m a g e . (those where existing legal environmental standards are exceeded)	No	Not Applicable
12	Areas susceptible to natural hazard which could cause the project to present environmental problems (earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions)	No	The Proposal is to protect the coastline from erosion.

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291C

LIST OF DRAWINGS		
SL.NO.	DRAWNG NO.	NAME OF THE DRAWING
1	AD-CRZ-1	PROJECT LAYOUT SUPERIMPOSED ON CRZ PLAN (CHAINAGE 0+00 TO 0+634)
2	AD-CRZ-2	PROJECT LAYOUT SUPERIMPOSED ON CRZ PLAN (CHAINAGE 0+920 TO 1+125)
3	AD-CRZ-3	PROJECT LAYOUT SUPERIMPOSED ON CRZ PLAN (CHAINAGE 1+125 TO 1+969)
4	AD-CRZ-4	TYPICAL SECTION 1 & SECTION 2
5	AD-CRZ-5	TYPICAL SECTION 3 & SECTION 4
6	AD-CRZ-6	TYPICAL WASHROOM DETAILS
7	AD-CRZ-7	TYPICAL BALCAO DETAILS
8	AD-CRZ-8	PEDSTRIAN BRIDGE DETAILS

Legend

Lighthouse/Beacon
Fish Landing Centre/ Ramp
Water Quality Monitoring Location - SW-II
Multi Purpose Cyclone Shelters
Sluice Gate - Prior to 1991
Bund - Prior to 1991
Road
Railway Line
Seawall
High Tide Line
Low Tide Line
Hazard Line
Port Limit
Khazan Land
Boat Parking /Net Mending Area
Rock Outcrop
Jetty or Shipyard
Fishing Ward Boundary
Fish Breeding Area
Fisherman Community Complex
Waterbody
Survey Plots
Village Boundary
Municipal/Other Urban boundary
Taluk Boundary

CRZ Lines

100m CRZ line for Bays
100 m Line in CRZ III Area
200 m Line - NDZ
500 m CRZ Line
CRZ Line for River or Creek

CRZ CATEGORY

CRZ - I

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Intertidal Zone -CRZ IB
Aquaculture / Saltpan - CRZ IB

CRZ - II

CRZ Landward of HTL - CRZ II

CRZ - III

No Development Zone - CRZ III
200 to 500 m from HTL - CRZ III

CRZ - IV

Waterbody - CRZ IVA
Waterbody - CRZ IVB

LEGEND

Existing retaining wall
New retaining wall
New Basaltic Embankment.
R.C.C.Trough
New Footpath- Granite floor/ cycle track -P.Q.C. Floor
Existing tree
Existing structure to be renovated and used as Washroom 01
BALCAO (5.20m x 5.20m)
BRIDGE

NOTE: ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED

PROMOTOR	CLIENT	PROJECT	DATE	TITLE	DRAWING NUMBER	DEALT BY	
GSIDC GOA STATE INFRASTRUCTURE DEVELOPMENT CORPORATION	Smart City IMAGINE PANAJI SMART CITY DEVELOPMENT LIMITED (IPSCDL)	PROTECTION AND RESTORATION OF MANDOVI RIVER COASTLINE FROM MIRAMAR CIRCLE TO YOUTH HOSTEL AND FROM KALA ACADEMY TO ESG	DEC 2021	PROJECT LAYOUT SUPERIMPOSED ON CRZ PLAN (CHAINAGE 1+125 TO 1+969)	AD-CRZ-3		
			SCALE		SHEET	CHKD BY	
			1:1000		03 OF 03	ROGER H.	

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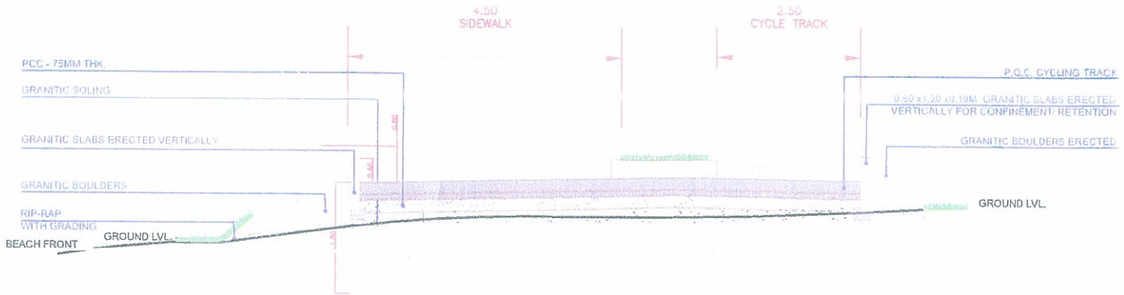
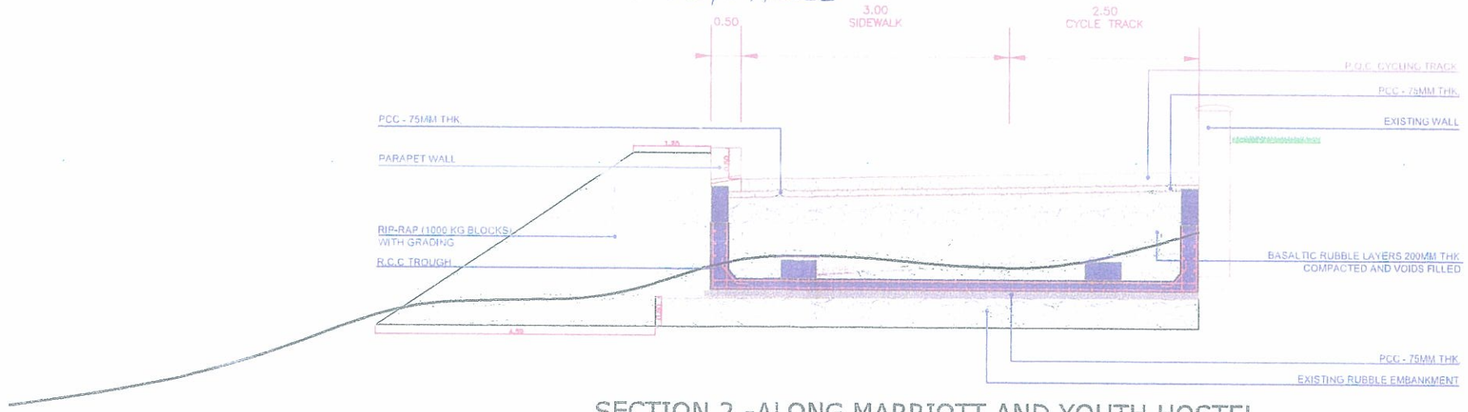


SECTION 1- ALONG MIRAMAR BEACH

COASTAL ZONE MANAGEMENT AUTHORITY
DEPARTMENT OF SCIENCE TECHNOLOGY & ENVIRONMENT
PANAJI - GOA

No. GCZMA/N/21-22/89/199
dt. 28/04/2022



SECTION 2 -ALONG MARRIOTT AND YOUTH HOSTEL

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NOTE: ALL DIMENSIONS ARE IN M UNLESS OTHERWISE SPECIFIED

PROMOTER: GOA STATE INFRASTRUCTURE DEVELOPMENT CORPORATION	CLIENT: IMAGINE PANAJI SMART CITY DEVELOPMENT LIMITED (IPSCDL)	PROJECT: PROTECTION AND RESTORATION OF MANDOVI RIVER COASTLINE FROM MIRAMAR CIRCLE TO YOUTH HOSTEL AND FROM KALA ACADEMY TO ESG	DATE: DEC 2021 SCALE: 1:100	TITLE: TYPICAL SECTION 1 & SECTION 2	DRAWING NUMBER: AD-CRZ-4 SHEET: 01 OF 02	DEALT BY: CHKD BY: ROGER H.

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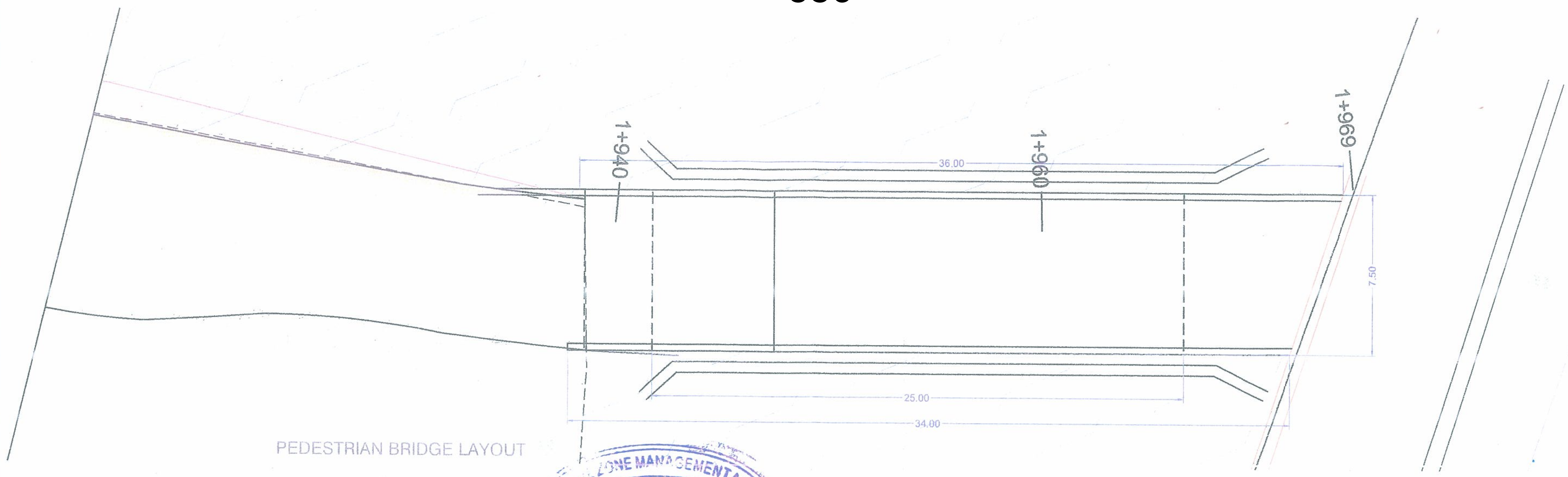
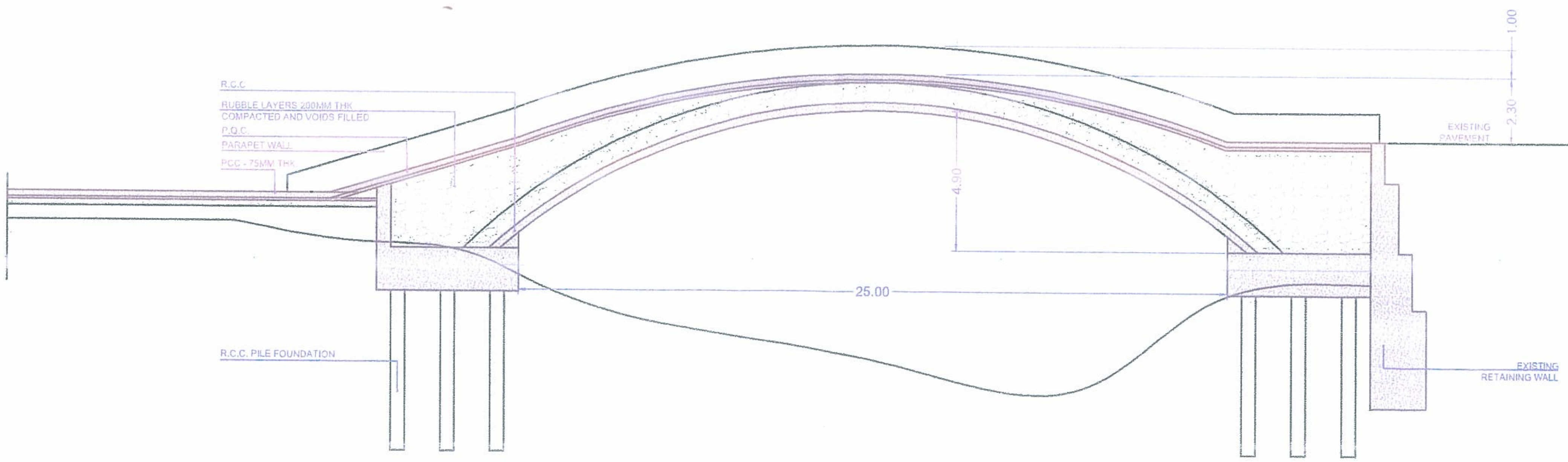


PEDESTRIAN BRIDGE LAYOUT

COASTAL ZONE MANAGEMENT AUTHORITY
DEPARTMENT OF SCIENCE TECHNOLOGY & ENVIRONMENT
PANAJI - GOA

No. GCZMA/N/21-22/89/199
dt. 28/04/2022



SECTION DD'

LKS INDIA PRIVATE LIMITED

NOTE: ALL DIMENSIONS ARE IN M UNLESS OTHERWISE SPECIFIED

PROMOTER	CLIENT	PROJECT	DATE	TITLE	DRAWING NUMBER	DRAWN BY	
GOA STATE INFRASTRUCTURE DEVELOPMENT CORPORATION	IMAGINE PANAJI SMART CITY DEVELOPMENT LIMITED (IPSCDL)	PROTECTION AND RESTORATION OF MANDOVI RIVER COASTLINE FROM MIRAMAR CIRCLE TO YOUTH HOSTEL AND FROM KALA ACADEMY TO ESG	DEC 2021	PEDESTRIAN BRIDGE DETAILS	AD-CRZ-8		Panaji Office C/4, 155/6, Second floor, Block No.3 Neugi Nagar Mala Panaji 403001 Tel; +918378966429
	Smart City		SCALE 1:100		SHEET 01 OF 01	CHKD BY ROGER H.	LKS INDIA Private Ltd. "Vatika Business Center", C-Tower Level 5, Suite No-3 Tech Park-1, Airport Road Yerwada, PUNE - 411006 India www.lks-global.com

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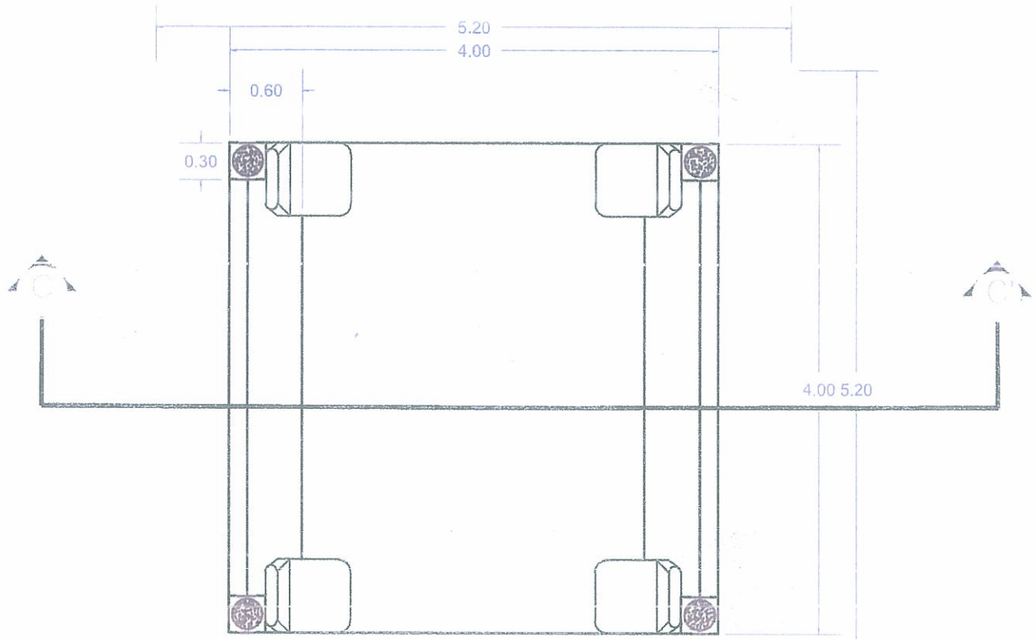
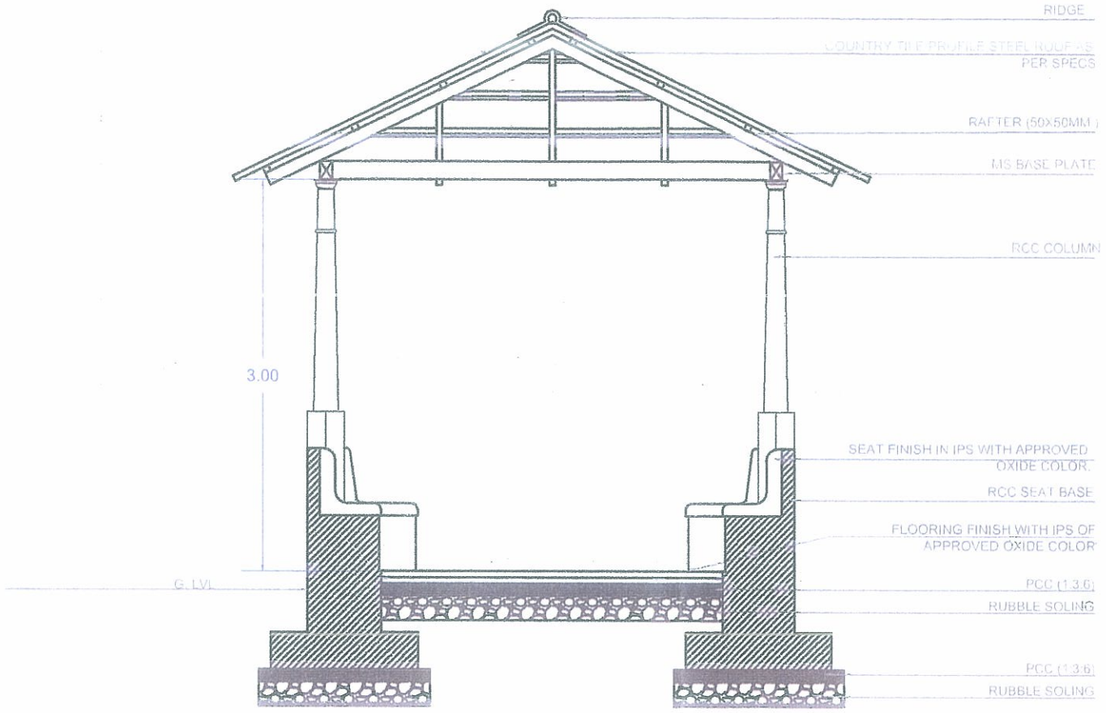


TYPICAL BALCAO LAYOUT



SECTION CC'

COASTAL ZONE MANAGEMENT AUTHORITY
DEPARTMENT OF SCIENCE TECHNOLOGY & ENVIRONMENT
PANAJI - GOA

No. GCZMA/N/21.22/89/199
dt. 28/04/2022

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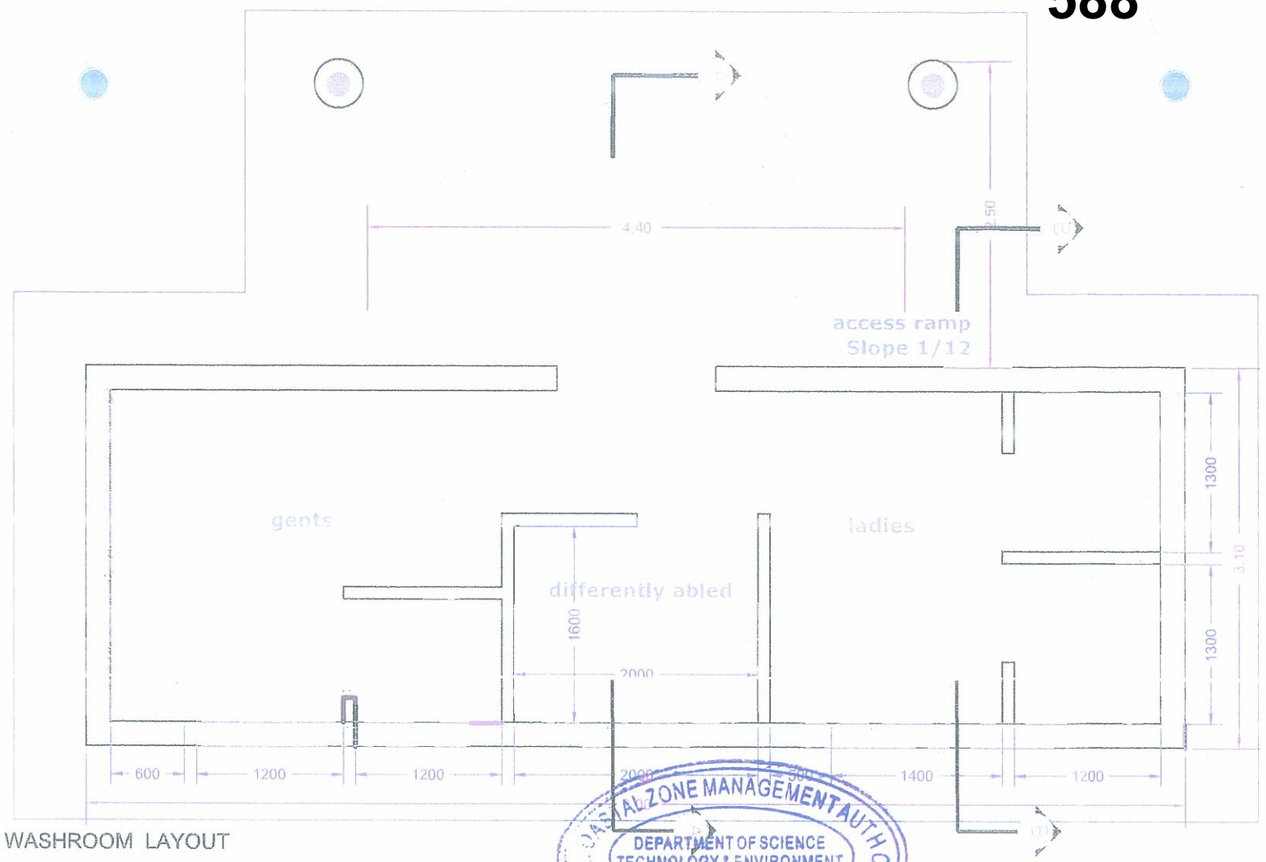
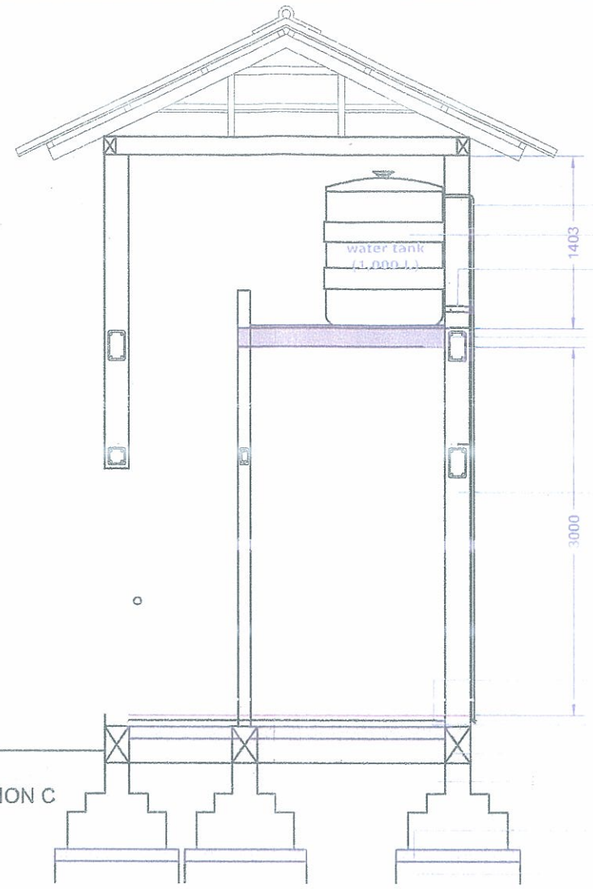
PROMOTER: GOA STATE INFRASTRUCTURE DEVELOPMENT CORPORATION	CLIENT: IMAGINE PANAJI SMART CITY DEVELOPMENT LIMITED (IPSCDL)	PROJECT: PROTECTION AND RESTORATION OF MANDOVI RIVER COASTLINE FROM MIRAMAR CIRCLE TO YOUTH HOSTEL AND FROM KALA ACADEMY TO ESG	DATE: DEC 2021 SCALE: 1:100	TITLE: TYPICAL BALCAO DETAILS	DRAWING NUMBER: AD-CRZ-7 SHEET: 01 of 01	DRAWN BY: NIMISHA CHKD BY: GAYLE	Panaji Office G/4, 2537, Second floor, Block No.3 Nehru Nagar Extn Panaji 403001 Tel: +918378966429 LKS INDIA Private Ltd. "Vatika Business Center", C-Tower Level 5, Suite No-3 Tech Park-1, Airport Road Yerwada, PUNE - 411006 India www.lks-global.com



TYPICAL WASHROOM LAYOUT



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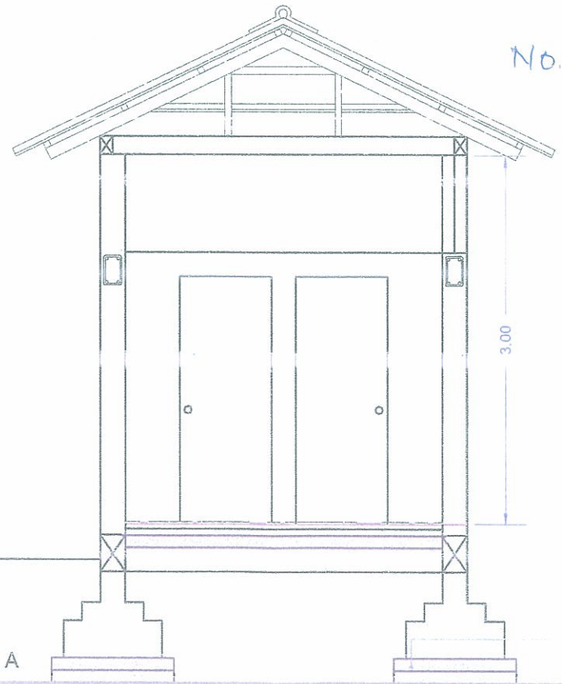
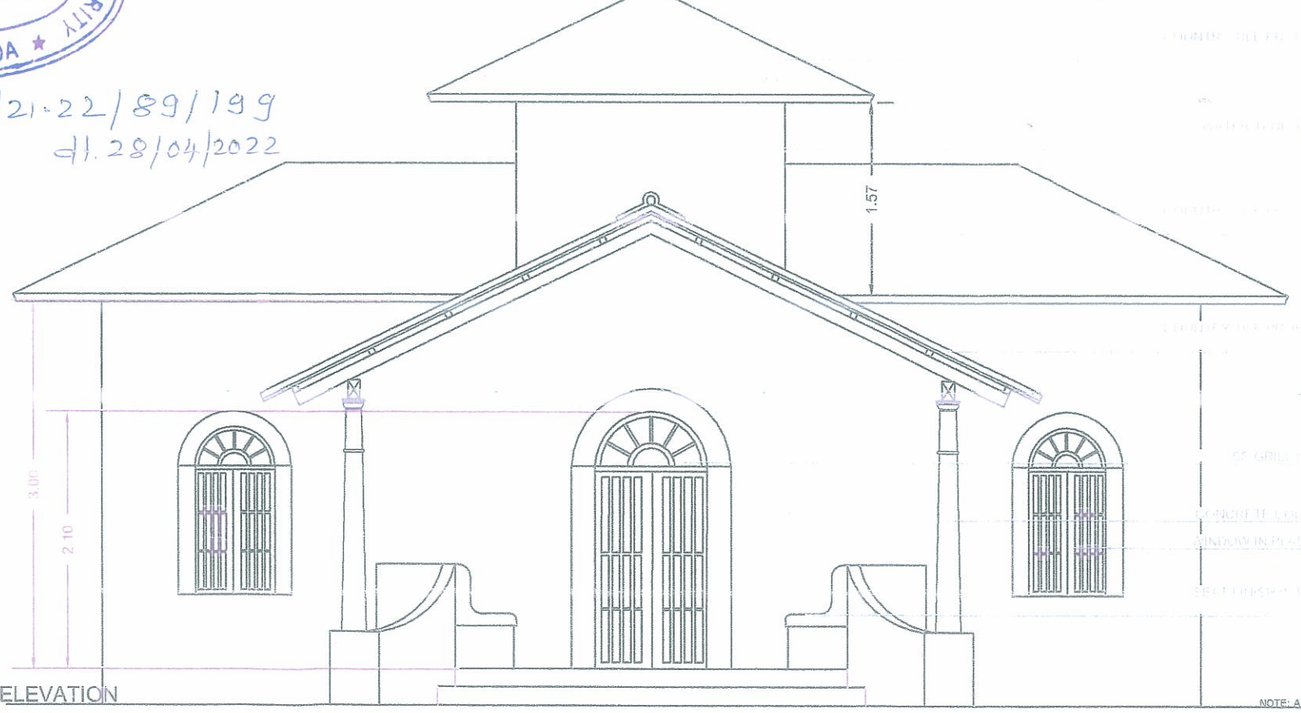


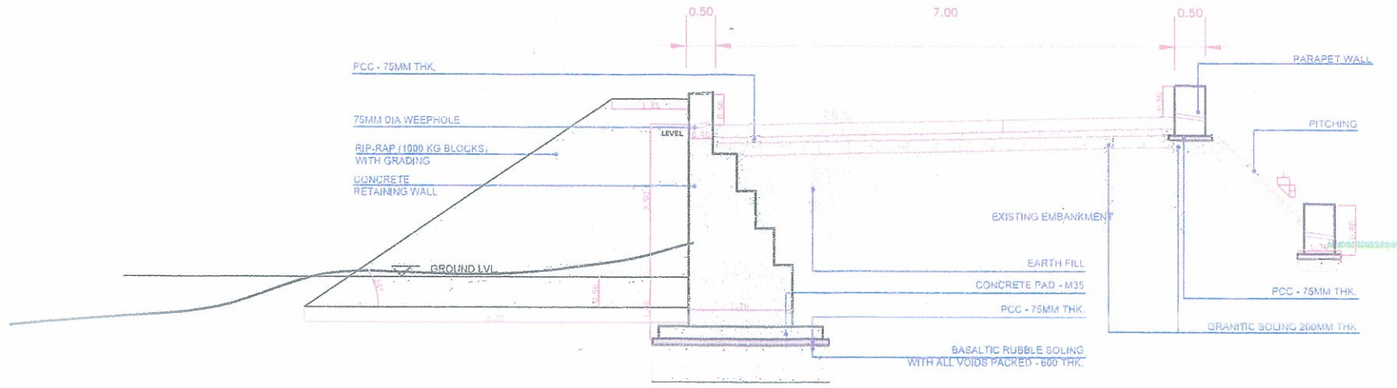
SECTION A



FRONT ELEVATION

NOTE: ALL DIMENSIONS ARE IN M UNLESS OTHERWISE SPECIFIE

PROMOTER: GOA STATE INFRASTRUCTURE DEVELOPMENT CORPORATION	CLIENT: IMAGINE PANAJI SMART CITY DEVELOPMENT LIMITED (IPSCDL)	PROJECT: PROTECTION AND RESTORATION OF MANDOVI RIVER COASTLINE FROM MIRAMAR CIRCLE TO YOUTH HOSTEL AND FROM KALA ACADEMY TO ESG	DATE: DEC 2021 SCALE: 1:100	TITLE: TYPICAL WASHROOM DETAILS	DRAWING NUMBER: AD-CRZ-6 SHEET: 01 OF 01	DEALT BY: SHIPRA CHKD BY: GAYLE	Panaji Office Block No.3 Neugi Nagar Hall Panaji 403001 Tel: +918378966429 LKS INDIA Private Ltd. "Vatika Business Center", C-Tower Level 5, Suite No-3 Tech Park-1, Airport Road Yerwada, PUNE - 411006 India



SECTION 3- ALONG KALA ACADEMY, FOREST DEPARTMENT/ PART CHILDRENS PARK

GOA COASTAL ZONE MANAGEMENT AUTHORITY
DEPARTMENT OF SCIENCE TECHNOLOGY & ENVIRONMENT
★ PANAJI - GOA ★

No. GCZMA/N/21-22/89/199
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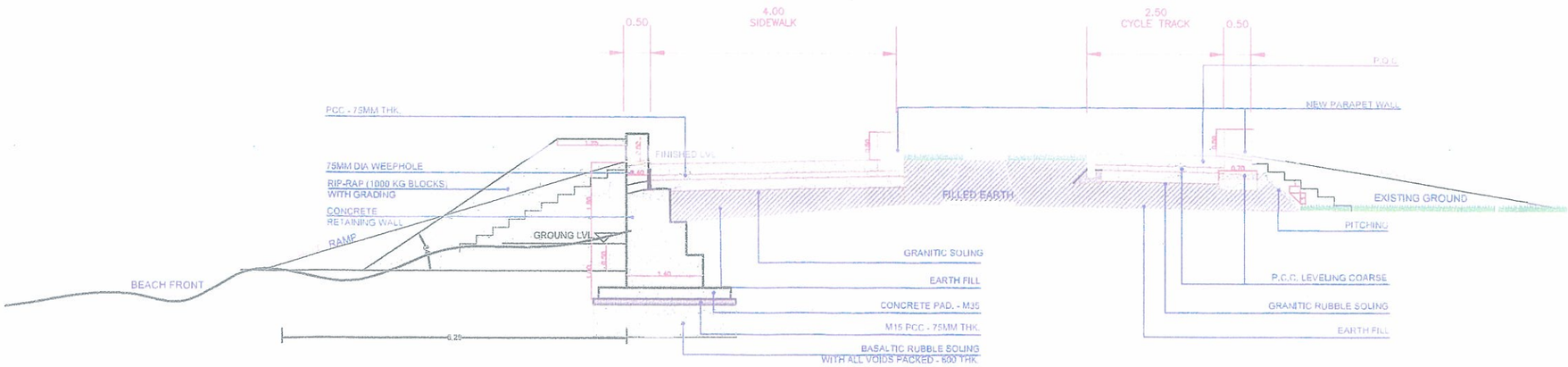

SECTION 4- ALONG CHILDREN PARK TILL ESG

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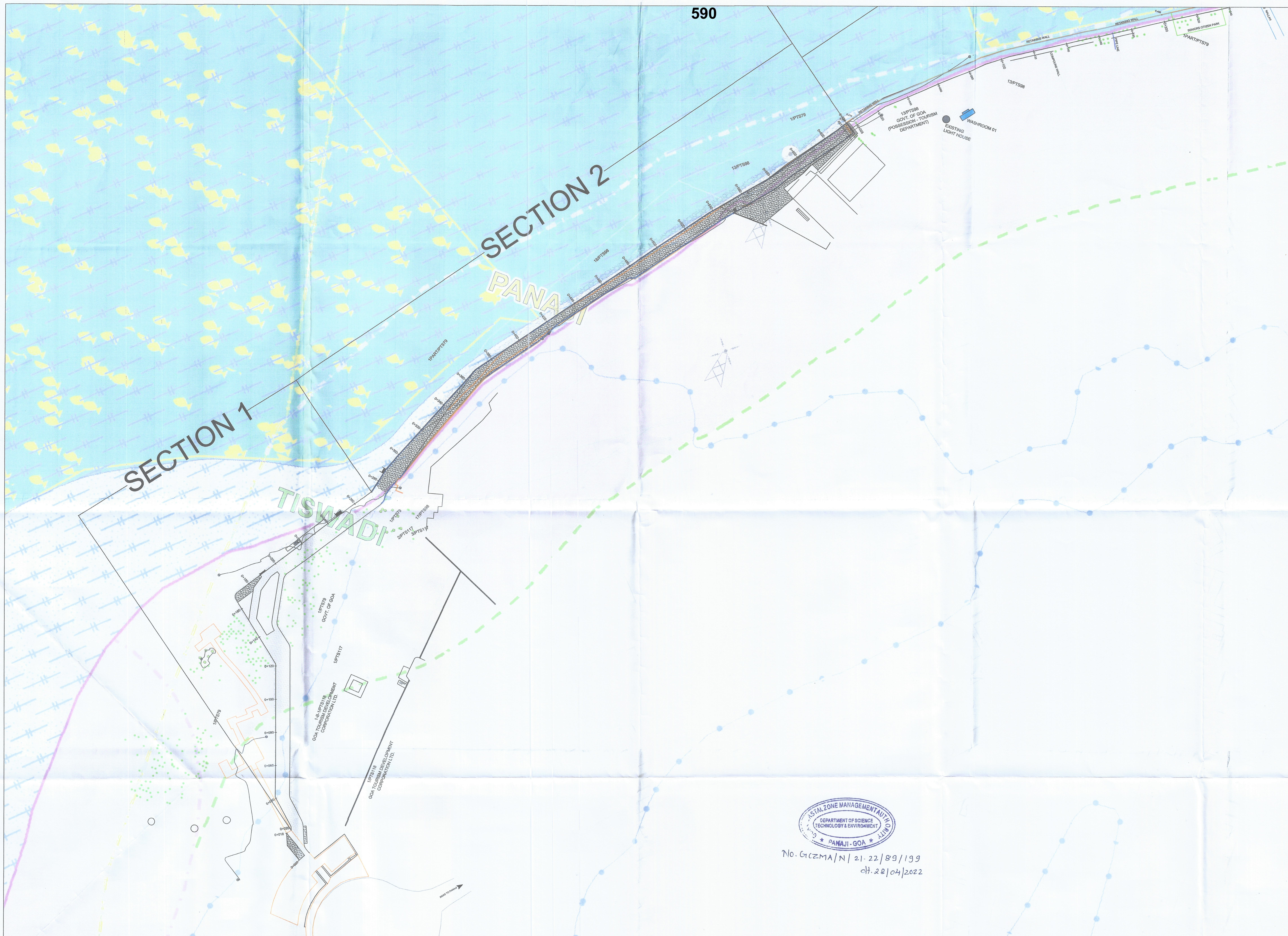
NOTE: ALL DIMENSIONS ARE IN M UNLESS OTHERWISE SPECIFIED

PROMOTER: GOA STATE INFRASTRUCTURE DEVELOPMENT CORPORATION	CLIENT: IMAGINE PANAJI SMART CITY DEVELOPMENT LIMITED (IPSCDL)	PROJECT: PROTECTION AND RESTORATION OF MANDOVI RIVER COASTLINE FROM MIRAMAR CIRCLE TO YOUTH HOSTEL AND FROM KALA ACADEMY TO ESG	DATE: DEC 2021 SCALE: 1:100	TITLE: TYPICAL SECTION 3 & SECTION 4	DRAWING NUMBER: AD-CRZ-5 SHEET: 01 OF 02	DRAWN BY: CHKD BY: ROGER H.	LKS INDIA Private Ltd. "Vatika Business Center", C-Tower Level 5, Suite No-3 Tech Park-1, Airport Road Yerwada, PUNE - 411006 India www.lks-global.com



COASTAL ZONE MANAGEMENT AUTHORITY
DEPARTMENT OF SCIENCE TECHNOLOGY & ENVIRONMENT
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No. GCZMA/N/ 21-22/89/199
dt. 28/04/2022

Legend

- Lighthouse/Beacon
- Fish Landing Centre/ Ramp
- Water Quality Monitoring Location - SW-II
- Multi Purpose Cyclone Shelters
- Sluice Gate - Prior to 1991
- Bund - Prior to 1991
- Road
- Railway Line
- Seawall
- High Tide Line
- Low Tide Line
- Hazard Line
- Port Limit
- Khazan Land
- Boat Parking /Net Mending Area
- Rock Outcrop
- Jetty or Shipyard
- Fishing Ward Boundary
- Fish Breeding Area
- Fisherman Community Complex
- Waterbody
- Survey Plots
- Village Boundary
- Municipal/Other Urban boundary
- Taluk Boundary

CRZ Lines

- 100m CRZ line for Bays
- 100 m Line in CRZ III Area
- 200 m Line - NDZ
- 500 m CRZ Line
- CRZ Line for River or Creek

CRZ CATEGORY

CRZ - I

- Mangroves - CRZ IA
- 50m Mangrove buffer zone - CRZ IA
- Archaeological and heritage sites - CRZ IA
- Reserve Forest - CRZ IA
- Mudflats - CRZ IA
- Salt Marsh - CRZ IA
- Sand Dunes - CRZ IA
- Corals and coral reefs - CRZ IA
- Nesting Grounds of Birds - CRZ IA
- Turtle Nesting Grounds - CRZ IA
- Intertidal Zone -CRZ IB
- Aquaculture / Saltpan - CRZ IB

CRZ - II

- CRZ Landward of HTL - CRZ II

CRZ - III

- No Development Zone - CRZ III
- 200 to 500 m from HTL - CRZ III

CRZ - IV

- Waterbody - CRZ IVA
- Waterbody - CRZ IVB

LEGEND

- Existing retaining wall
- New retaining wall
- New Basaltic Embankment.
- R.C.C.Trough
- New Footpath- Granite floor/ cycle track -P.Q.C. Floor
- Existing tree
- Washroom 02 near Youth Hostel

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NOTE: ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED

PROMOTOR	CLIENT	PROJECT
GSIDC — GOA STATE INFRASTRUCTURE DEVELOPMENT CORPORATION	Smart City — IMAGINE PANAJI SMART CITY DEVELOPMENT LIMITED (IPSCDL)	PROTECTION AND RESTORATION OF MANDOVI RIVER COASTLINE FROM MIRAMAR CIRCLE TO YOUTH HOSTEL AND FROM KALA ACADEMY TO ESG

DATE	TITLE	DRAWING NUMBER	DEALT BY
DEC 2021	PROJECT LAYOUT SUPERIMPOSED ON CRZ PLAN (CHAINAGE 0+00 TO 0+634)	AD-CRZ-1	
SCALE		SHEET	CHKD BY
1:1000		01 OF 03	ROGER H.

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PROMOTOR	CLIENT	PROJECT
GSIDC GOA STATE INFRASTRUCTURE DEVELOPMENT CORPORATION	Smart City IMAGINE PANAJI SMART CITY DEVELOPMENT LIMITED (IPSCDL)	PROTECTION AND RESTORATION OF MANDOVI RIVER COASTLINE FROM MIRAMAR CIRCLE TO YOUTH HOSTEL AND FROM KALA ACADEMY TO ESG

DATE	TITLE	DRAWING NUMBER	DEALT BY
DEC 2021	PROJECT LAYOUT SUPERIMPOSED ON CRZ PLAN (CHAINAGE 0+920 TO 1+125)	AD-CRZ-2	
SCALE		**SHEET**	**CHKD BY**
1:1000		02 OF 03	ROGER H.

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